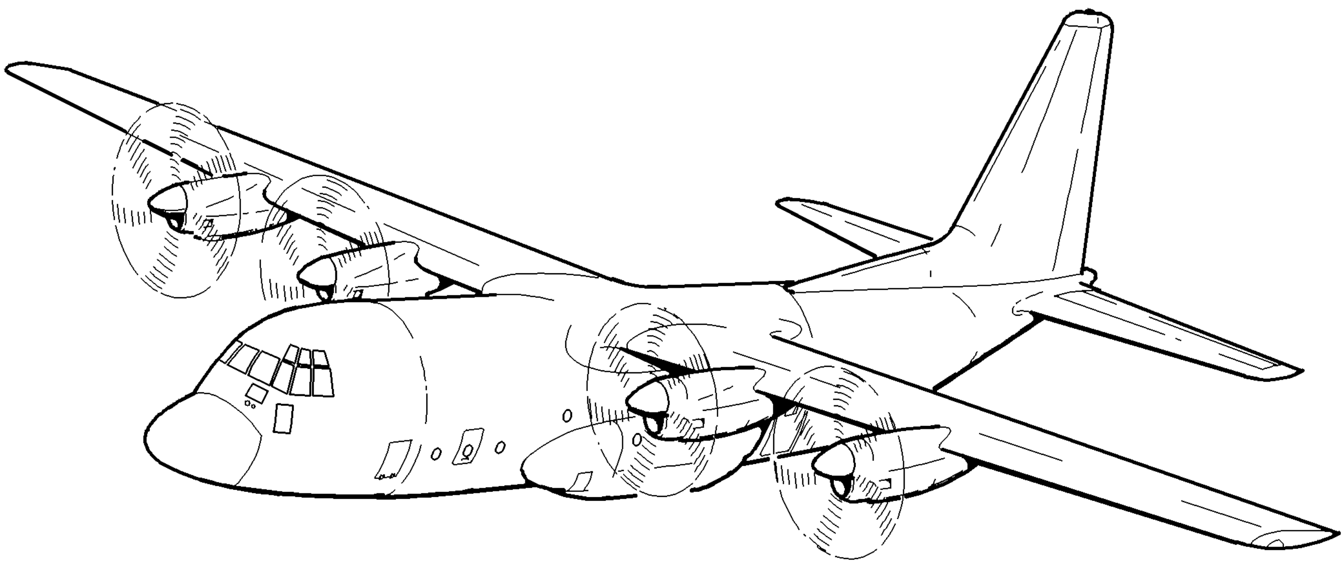
FLIGHT MANUAL

PERFORMANCE DATA MANUAL FOR AERONAUTICA MILITARE ITALIANA SERIES C-130J AND KC-130J AIRPLANES MODEL 382U AIRPLANES



THIS MANUAL SUPERSEDES CMM.1C-130J-1-1 DATED 1 DECEMBER 2002.

THIS MANUAL IS INCOMPLETE WITHOUT CMM.1C-130J-1 FLIGHT MANUAL AND CMM.1C-130J-1-4 CNI-MS OPERATOR MANUAL.

Lockheed Martin Aeronautics Company

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SUMMARY OF LOCKHEED SAFETY AND OPERATIONAL SUPPLEMENT STATUS

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL SECTIONS AFFECTED
None			

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION
CMM.1C-130J-1-1S-2	15 Nov 03	Rescinded

SUPPLEMENTS INCORPORATED IN THIS MANUAL

NUMBER	DATE	DISPOSITION
C-130J-55	1 Jul 02	Incorporated
CMM.1C-130J-1-1S-1	15 Apr 03	Incorporated
CMM.1C-130J-1-1SS-4	1 Nov 06	Incorporated

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SECTION 1
GENERAL INFORMATION

TABLE OF CONTENTS

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LIST OF CHARTS

PURPOSE OF PERFORMANCE CHARTS.

The performance charts are provided to plan complete missions, from takeoff to landing, for normally encountered operating conditions. The performance is based on operating procedures and conditions which are explained in the text or shown on the charts. These procedures and conditions must be followed in order to realize the charted performance for the airplane. The operating procedures are consistent with the normal, emergency, and all-weather procedures in the applicable flight manual.

The C-130J performance data presented in this document reflects the latest Lockheed Martin flight test based aerodynamic and propulsive data base representing flight with Allison AE2100D3 turboprop engines and Dowty R391 propellers and assumes JP-5/8 fuel at a heating value of 18,300 BTU per pound.

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AIRPLANE CONFIGURATION.

The baseline performance data in this document is computed for the C-130J configuration which is based on the following external contour definition (defined as drag index = 0):

- Standard fuselage length
- Wing external fuel tanks and pylons removed
- Flush UHF antenna
- No gloss paint
- Walkway paint
- TCAS antenna
- SATCOM antenna
- AAR-47 defensive system
- ALR-56M defensive system
- ALE-47 defensive system without external wing tanks installed

NOTE

> The data presented in Section 7 (Aerial Refueling Data) are computed for the KC-130J configuration, which consists of the baseline configuration plus refueling pods and external fuel tanks installed.

Except where noted differently, all performance data assumes normal AE2100D3 engine bleed and R391 propeller operation. Simple straight line interpolation can be used on all charts.

DRAG INDEX.

Changes in configuration generally result in different levels of performance. These performance levels are related to the magnitude of drag added to or subtracted from the baseline drag level.

Basic performance is presented for a drag index of zero. Drag correction grids are then provided to allow for external configuration changes due to the addition of other equipment. Drag index values for selected additional configurations are defined as follows:

A listing of individual equipment items and configurations is defined below:

Item	Drag Index
(2) external wing fuel tanks and pylons	18
Inflight refueling probe	3
(2) refueling pods and pylons (drogues stowed)	19
(2) helicopter drogues and hoses	150
(2) fighter drogues and hoses	58
(2) extended hoses (no drogues)	20
Defensive systems	8
ALQ-157 defensive system	6
ALE-47 defensive system with external wing tanks installed	7
SKE 2000 antenna	2
No paint	– 3
No walkways	– 5.5
Cargo door open, ramp closed	50
Cargo door and ramp open	160
Crew entrance door removed	10
Landing gear extended	158
Main landing gear doors removed, gear up - side left or right	52
Nose landing gear doors removed (gear up)	35
Paratroop doors open, air deflectors extended	74

These values are additive. Performance charts are provided within this manual for a drag index range from 0 to + 300.

Example.

GIVEN:

KC-130J configuration incorporating external wing fuel tanks, refueling pods, and SKE 2000 antenna.

FIND:

- Drag index

PROCEDURE:

The baseline drag index of the C-130J is zero. Add to that the incremental drag index of 18 for the external fuel tanks, 19 for refueling pods and pylons, and 2 for the SKE 2000 antenna. Drag index of 0 + 18 + 19 + 2 = 39.

CHART EXPLANATION.

Descriptive explanations and example problems are included in the text of each part of the manual to illustrate the use of the performance charts. On each chart miniature illustrations are provided to show the path to follow when using the chart.

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ABBREVIATIONS AND SYMBOLS

ATCS	Automatic Thrust Control System
BTU	British Thermal Unit
°C	Temperature in degrees Celsius
CAS or V_c	Calibrated Airspeed; indicated airspeed corrected for installation (position error)
CFL	Critical Field Length
COF	Climb-out factor
EAS or V_e	Equivalent Airspeed; calibrated airspeed corrected for compressibility
°F	Temperature in degrees Fahrenheit
FPM	Feet Per Minute
FUSS	Flaps Up Safety Speed
g	Acceleration of Gravity
GS	Ground Speed; true airspeed corrected for wind effect
GW	Gross Weight
H_d	Density altitude
HP	Engine shaft horsepower
H_p	Pressure altitude
HSGI	High Speed Ground Idle (NP at 100%)
IAS	Indicated Airspeed; the airspeed indicator reading corrected for instrument error
ICAO	International Civil Aviation Organization
in. Hg	Inches of mercury
IOAT	Indicated Outside Air Temperature
ISA	International Standard Atmosphere
K	Knots; nautical miles per hour
MFLMETO	Minimum Field Length for Maximum Effort Takeoff
MGT	Measured Gas Temperature
NG	Gas generator speed
NM	Nautical Miles
OAT	Outside Air Temperature (actual)
OWE	Operating Weight Empty
PLA	Power Lever Angle
PSI	Pressure in pounds per square inch
PSIG	Gage pressure, pounds per square inch
ROC	Rate of climb
RCR	Runway Condition Reading
ROD	Rate of descent
RPM	Engine speed (Revolutions Per Minute)
RSC	Runway Surface Condition
SHP	Engine Shaft Horsepower
SMOE factor	1 over the square root of sigma
TAS or V_t	True Airspeed; equivalent airspeed corrected for density
TAT	Total Air Temperature
TD	Touchdown speed
TOF	Takeoff factor
V_{CEF}	Critical engine failure speed
V_D	Maximum airspeed (dive)
V_{GO}	Speed used to commit the airplane to takeoff (V_{REF})
V_H	Maximum level flight recommended airspeed
$V_{HSGI/LDG}$	Indicated airspeed corresponding to 145 KTAS which is the maximum speed on landing for transition from flight idle to High Speed Ground Idle (HSGI)
$V_{HSGI/TO}$	Indicated airspeed corresponding to 139 KTAS which is the maximum speed on takeoff for transition from takeoff power to High Speed Ground Idle (HSGI)
V_{MBE}	Maximum brake energy speed
V_{MCA}	Air minimum control speed
V_{MCA2}	Two engine inoperative air minimum control speed
V_{MCG}	Ground minimum control speed
V_{MPR}	Minimum power restoration speed
V_{OBS}	Obstacle clearance speed

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ABBREVIATIONS AND SYMBOLS

V_R	Rotation speed
V_{REF}	Refusal speed (V_{GO})
V_s	Power-off stall speed
V T/O	Takeoff speed
V_t/W_f	Air nautical miles per pound of fuel (NMPP)
W_f	Total fuel flow in Pounds Per Hour (PPH)
Δ	Indicates an increment (delta)
ΔV_c	Compressibility correction applied to calibrated airspeed (KCAS) to arrive at equivalent airspeed (KEAS)
ΔV_{pc}	Position correction applied to indicated airspeed (KIAS) to arrive at calibrated airspeed (KCAS)
ρ	Atmospheric density in slugs per cubic foot (rho)
ρ_o	Standard sea level atmospheric density; 0.002378 slugs per cubic foot (rho zero)
σ	Atmospheric density ratio (sigma)
$1/\sqrt{\sigma}$	Correction for air density applied to EAS (SMOE factor, 1 over the square root of sigma)
μ	Friction coefficient

AIRSPEED CALIBRATION.

Airspeed readings are affected by the airflow around the airplane fuselage. Changes in the airplane attitude, configuration (wing flap and landing gear position), and proximity to the ground vary this airflow. Variations in airflow affect the pressure sensed at the static ports of the pitot-static system, thus causing the airspeed indicator to read incorrectly. This error, which varies for different series airplanes, is called position error.

The calibration of the primary airspeed indicating system is shown in figure 1-1. This table provides for easy conversion from either calibrated to indicated or indicated to calibrated airspeed and is based upon flight test data. For the flaps up configuration, the correction provided by the air data computer results in the indicated airspeed displayed to the aircrew being equal to calibrated airspeed. When the flaps are lowered however, a further correction (not processed by the air data computer) must be applied to obtain the correct calibrated airspeed. Calibration of the standby system is shown in figure 1-2.

NOTE

> A momentary excursion of airspeed, altitude, and rate of climb indications may be observed during landing gear retraction or extension.

Example.

GIVEN:

Gross weight:	140,000 pounds
Cruise altitude:	Sea Level
Indicated airspeed for rotation	116 KIAS

FIND:

- Calibrated airspeed for rotation

PROCEDURE:

Figure 1-1 reveals that there is a 1 knot correction at this condition. Therefore, the calibrated airspeed for rotation is 116 + 1 = 117 KCAS.

TEMPERATURE CORRECTION.

The temperature read from the indicator during flight will show higher values due to friction of the air across the pickup. The correct value for the outside air temperature must be obtained from figure 1-4. The figure also has a scale from which the deviation from standard temperature can be read.

Example.

GIVEN:

Airspeed:	200 KIAS
Pressure altitude:	20,000 feet
Indicated outside air temperature	– 20 °C

FIND:

- True outside air temperature

PROCEDURE:

Enter figure 1-4 sheet 1 with 200 KIAS and move horizontally to the right to the given pressure altitude. From this point, move vertically to – 20 °C indicated outside air temperature. Move horizontally to the right and read a true outside air temperature of – 29°C. Enter sheet 2 at the left side with the true OAT of –29°C and move to the right, intersecting the given pressure altitude of 20,000 feet, then move down and find a deviation from standard temperature of – 4°C

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COMPRESSIBILITY CORRECTION TO CALIBRATED AIRSPEED.

The relationship between Equivalent Airspeed (EAS) and Calibrated Airspeed (CAS) is shown in figure 1-3. This figure provides the speed increments for changing CAS to EAS. The Density Altitude Chart, figure 1-5, or the Density Altitude Table, figure 1-6, supplies the SMOE ($1/\sqrt{\sigma}$) values required to convert EAS to TAS or vice versa. In addition, the density altitude can be found, although density altitude is normally not required for performance calculations. The relationships of the various speeds are expressed by the following equations:

CAS = IAS + ΔV_{pc} (figure 1-1 and figure 1-2)

EAS = CAS − ΔV_{c} (figure 1-3)

TAS = EAS × $1/\sqrt{\sigma}$ (figure 1-5 and figure 1-6)

Example.

GIVEN:

Pressure altitude:	25,000 feet
True temperature:	– 54.5 °C
Indicated airspeed	188 KIAS

FIND:

- True airspeed

PROCEDURE:

Figure 1-1, reveals no difference between IAS and CAS at this flight condition. Therefore, the speed of the airplane is 188 KCAS. To convert KCAS to KEAS, enter figure 1-3 with 188 KCAS. Move up to the 25,000 foot altitude line, then left and read a ΔV_{c} of 3.0 knots. The equivalent airspeed is then 188 – 3 = 185 knots. The SMOE ($1/\sqrt{\sigma}$) factor is found by entering figure 1-5, sheet 2, with the true temperature of – 54.5 °C and moving vertically to the pressure altitude of 25,000 feet. From this point of intersection, move horizontally to the right and read a (σ) factor of 1.43 and move left to read the corresponding density altitude of 22,500. The SMOE factor is verified by using the Density Altitude Table, figure 1-6, and reading 1.43 opposite the density altitude of 22,500 feet. The true airspeed (TAS) is then determined by multiplying the equivalent airspeed by SMOE factor, then 185 × 1.43 = 264 knots (TAS).

STANDARD ATMOSPHERE.

The ICAO Standard Atmosphere Table, figure 1-7, is provided to show standard values of the atmosphere as defined by the International Civil Aviation Organization (ICAO). The ICAO assumes a temperature of + 15 °C (59 °F) and an atmospheric pressure of 29.92 inches Hg as standard sea level conditions. The temperature variation (lapse rate) with altitude is approximately constant at – 2 °C per 1,000 feet from sea level to 36,089 feet. At 36,089 feet, the stratosphere is assumed to begin and the temperature remains constant, for all practical purposes, with increases in altitude.

The standard atmosphere table shows values for every 1,000-foot increment in altitude and includes temperatures in both degrees Fahrenheit and degrees Celsius. In addition, a Temperature Conversion chart, figure 1-8, is provided.

ALTITUDE PRESSURE CORRECTION.

The Altitude Pressure Correction Table, figure 1-9, provides the correction necessary to determine pressure altitude when field elevation and altimeter setting (in. Hg) are known.

Example.

GIVEN:

Actual field elevation is 700 feet, altimeter setting is 30.02 in. Hg.

FIND:

- Field pressure altitude

PROCEDURE:

Enter figure 1-9 with 30.02 inches Hg and find the correction (Δ ALT) of – 91 feet. Add the actual field elevation of 700 feet and the correction of – 91 feet to obtain a field pressure altitude of 609 feet (700 – 91 = 609).

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C-130J

AIRSPEED CALIBRATION

Information based upon Flight Test results

Flap Setting	In Ground Effect	Out of Ground Effect
Flaps Up (0%)	KIAS = KCAS (estimated)	KIAS = KCAS
Take-Off (50%)	KIAS = KCAS	Below 140 KCAS, KIAS = KCAS Above 140 KCAS, KIAS = KCAS - 1
Landing (100%)	KIAS = KCAS - 3.5	KIAS = KCAS - 1

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Figure 1-1.

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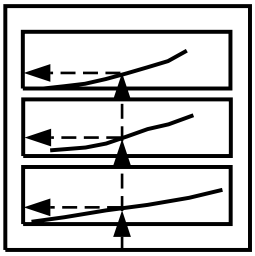
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

AIRSPEED CALIBRATION STANDBY SYSTEM

OUT OF GROUND EFFECT



GEAR UP OR DOWN — ALL WEIGHTS

NOTE: ADD CORRECTION TO INDICATED AIRSPEED TO DETERMINE CALIBRATED AIRSPEED

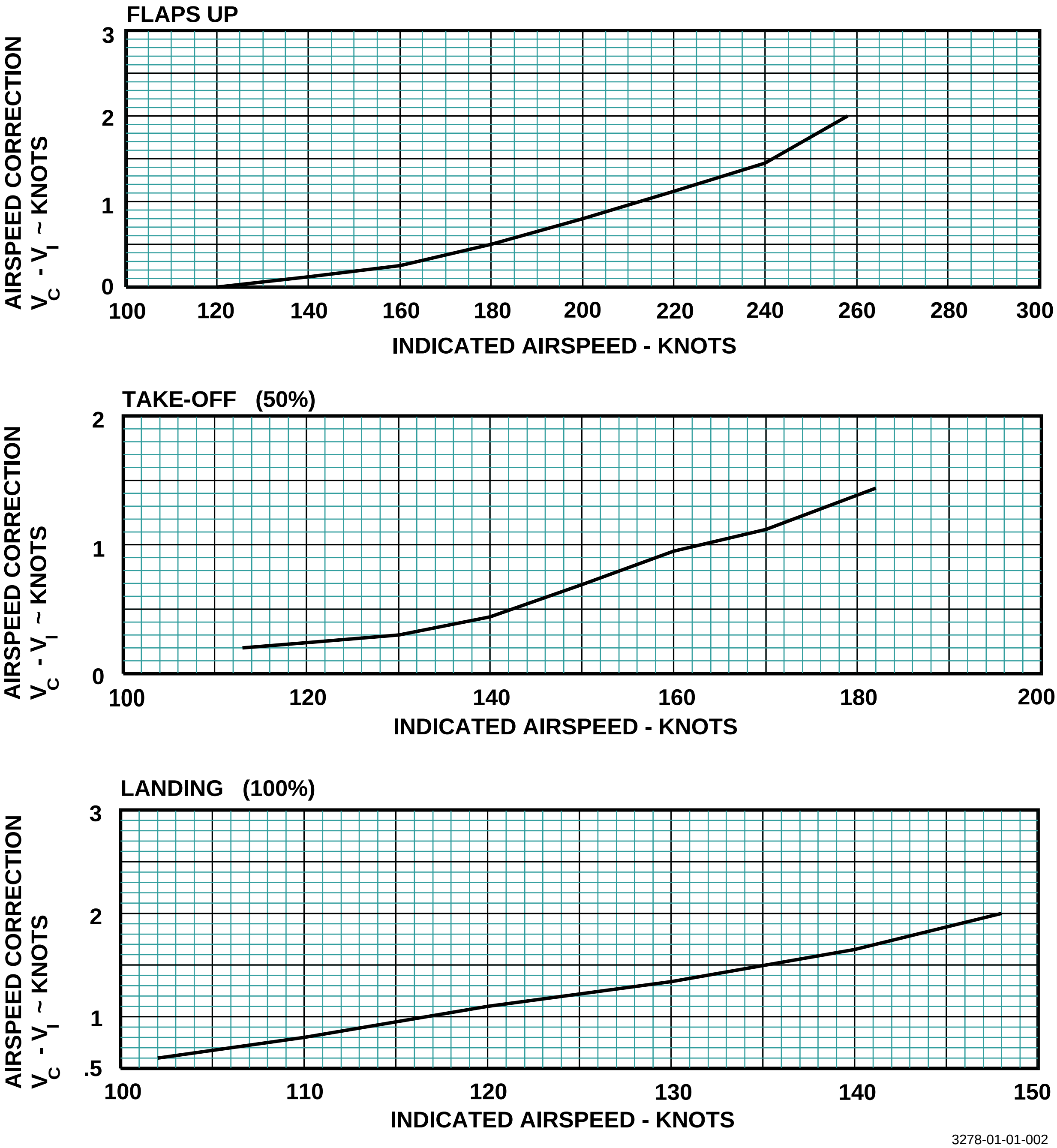


Figure 1-2.

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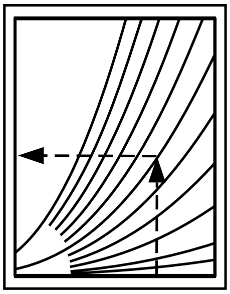
COMPRESSIBILITY CORRECTION TO CALIBRATED AIRSPEED



MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : ESTIMATED

NOTE

SUBTRACT CORRECTION FROM CALIBRATED AIRSPEED TO OBTAIN EQUIVALENT AIRSPEED.
$V_e = V_c - \Delta V_c$

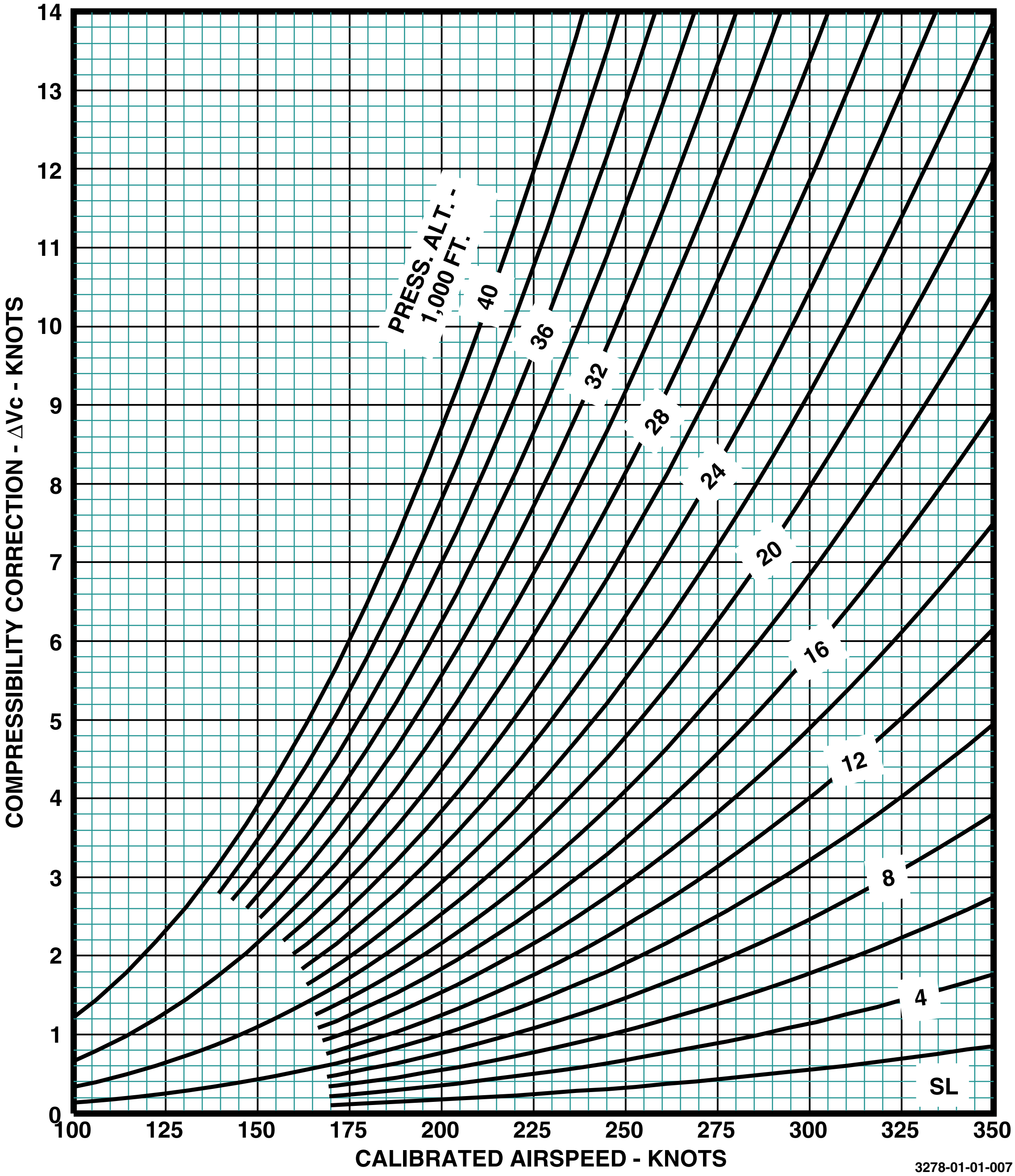


Figure 1-3.

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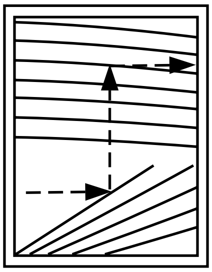
TEMPERATURE CORRECTION

RECOVERY FACTOR = 1.00



MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : ESTIMATED

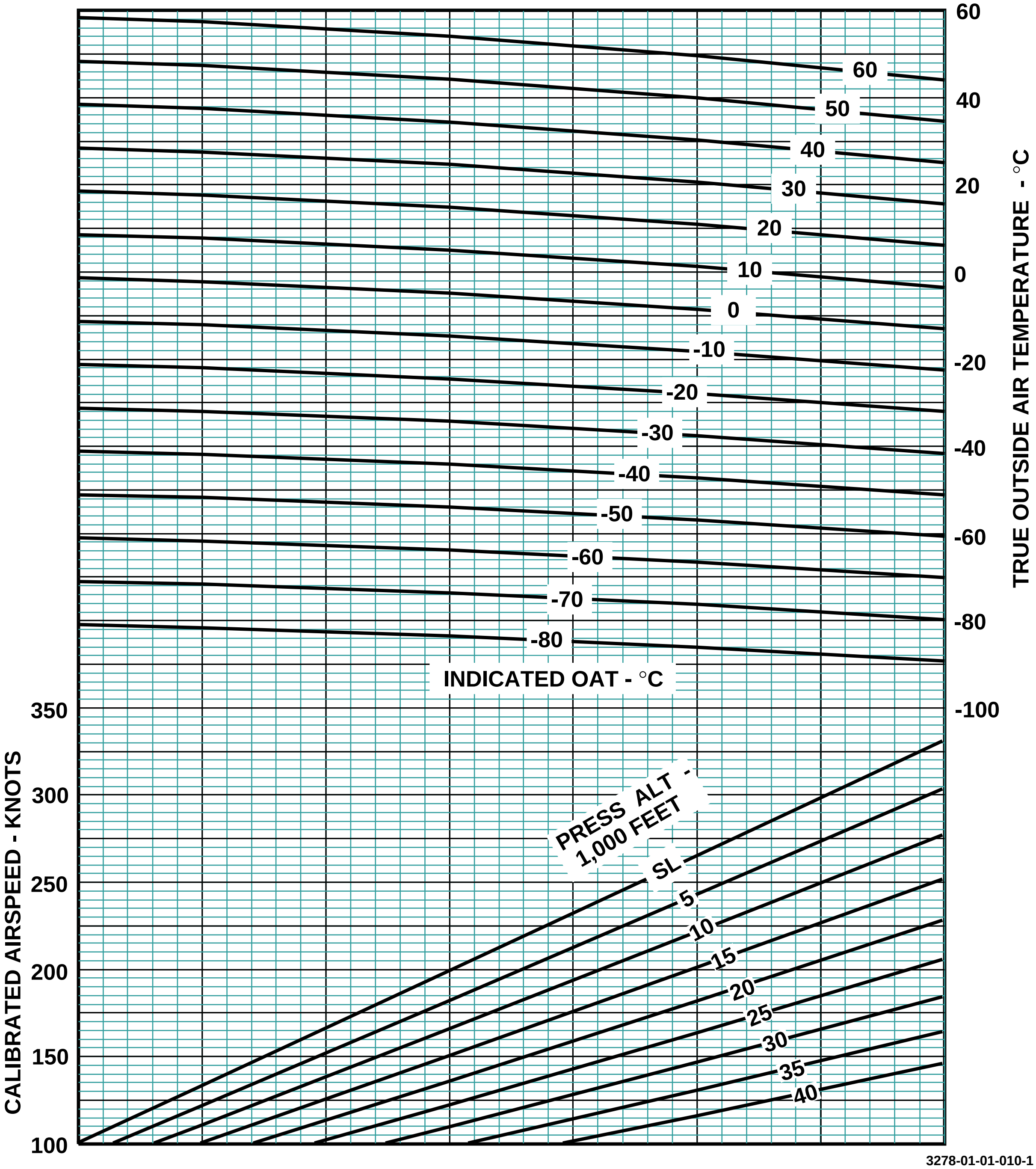
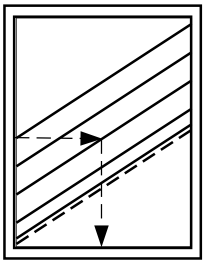


Figure 1-4. (Sheet 1 of 2)

TEMPERATURE CORRECTION

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : ESTIMATED



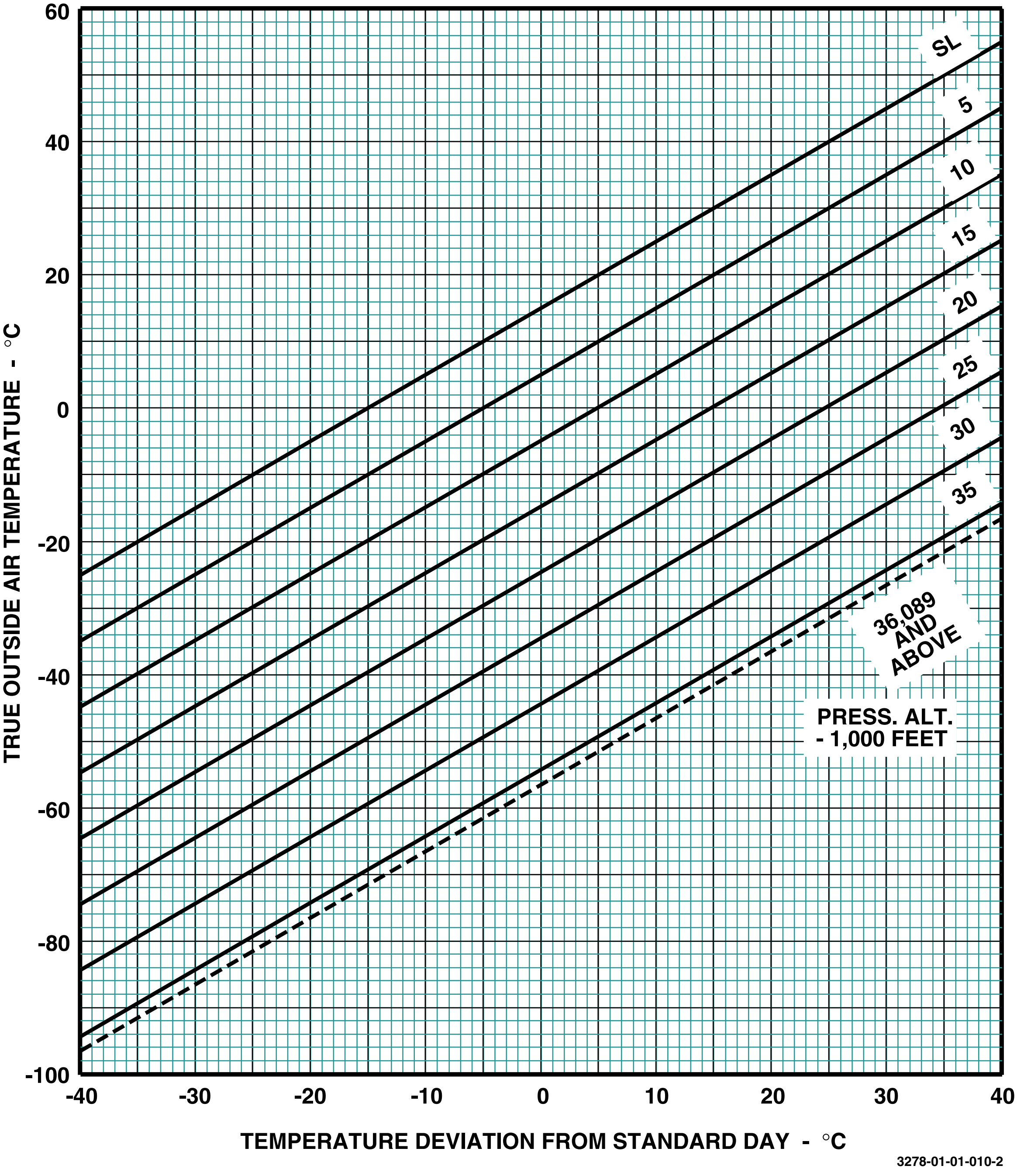


Figure 1-4. (Sheet 2 of 2)

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DENSITY ALTITUDE CHART

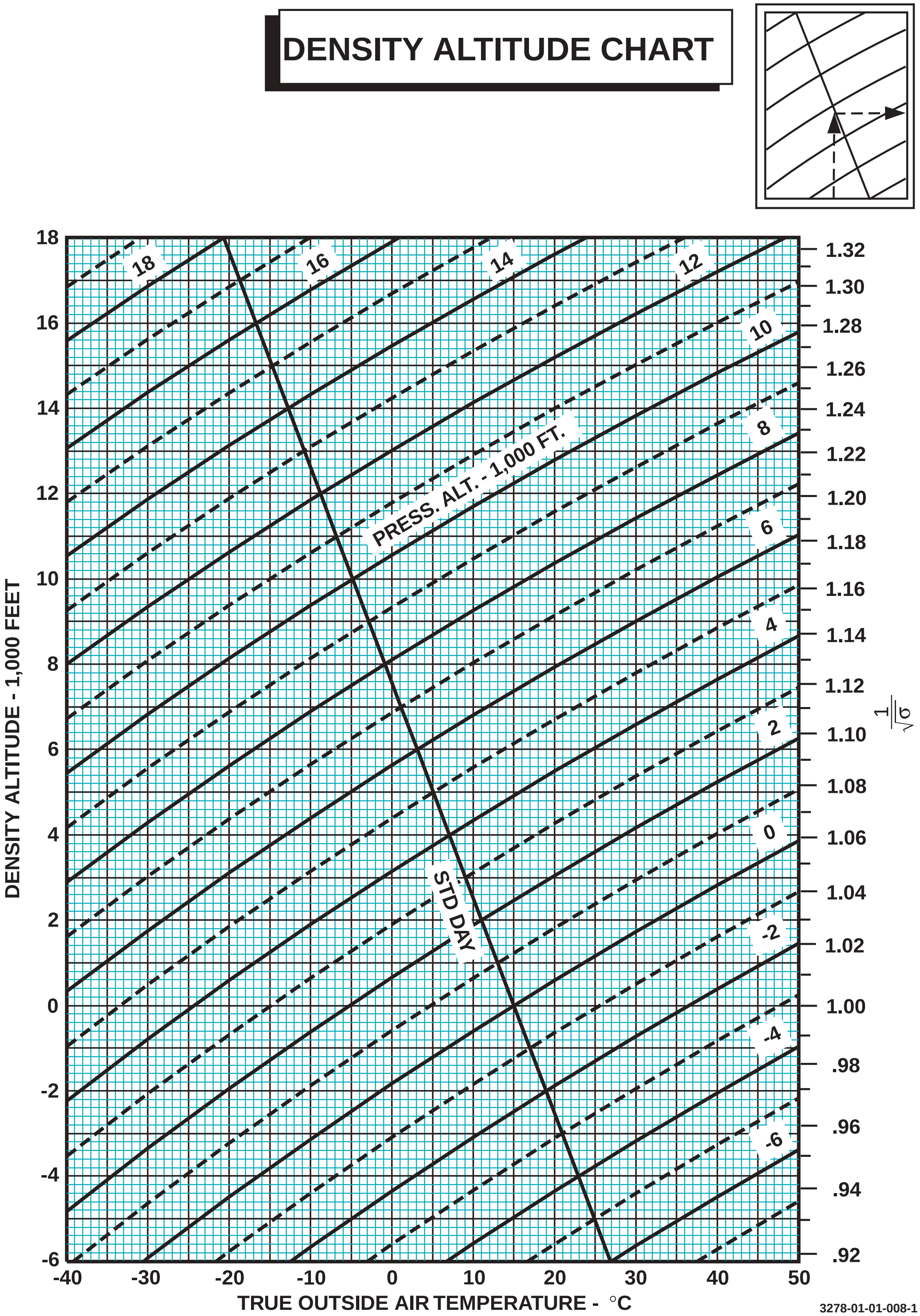

Figure 1-5. (Sheet 1 of 2)

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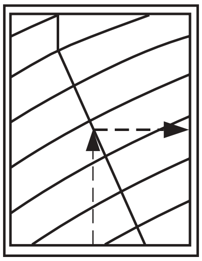
DENSITY ALTITUDE CHART



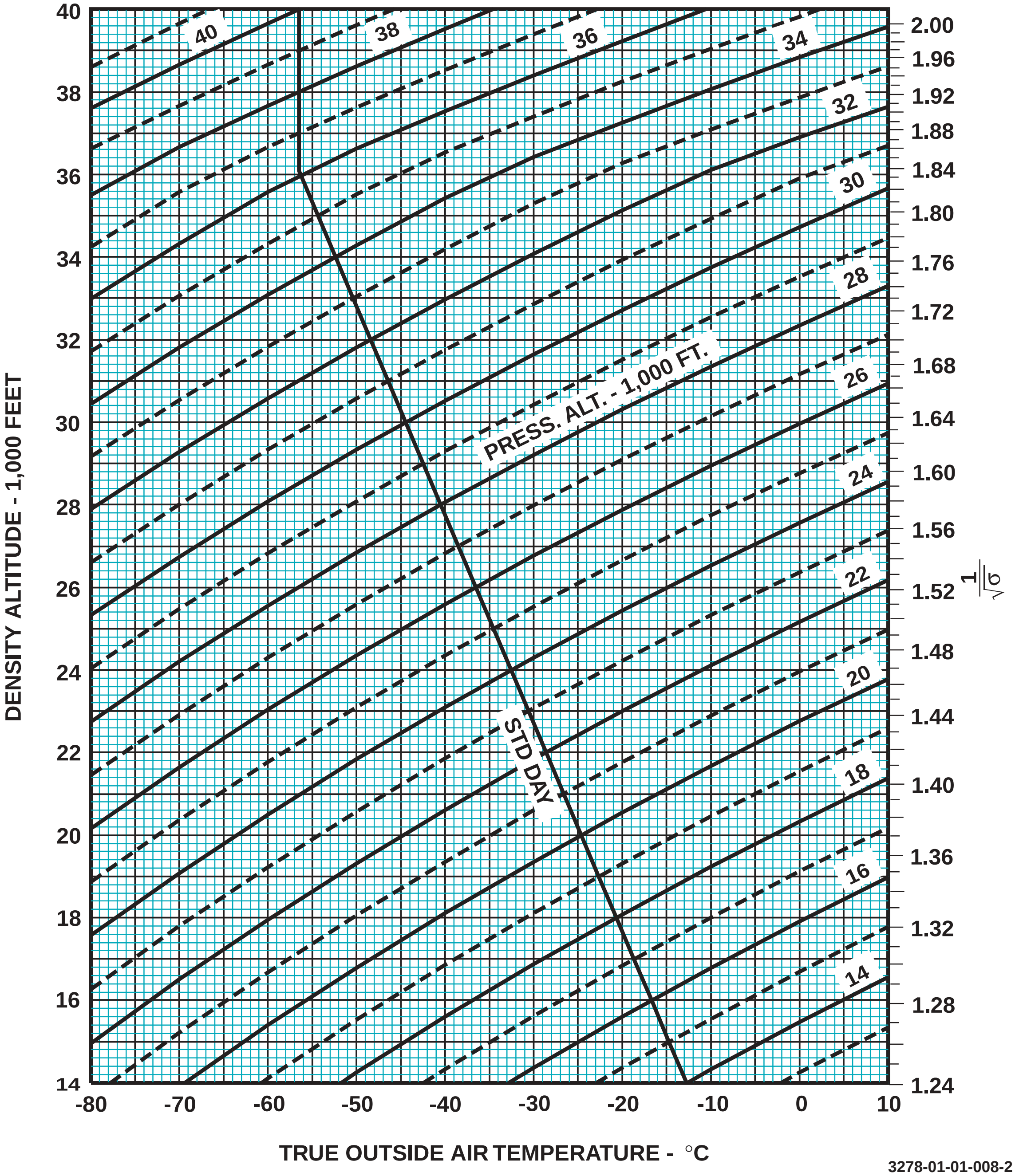


Figure 1-5. (Sheet 2 of 2)

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DENSITY ALTITUDE TABLE

$$\text{TRUE AIRSPEED} = \text{EQUIVALENT AIRSPEED} \times \frac{1}{\sqrt{\sigma}}$$

DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$
100	1.0015	3300	1.0501	6500	1.1022	9700	1.1582	12900	1.2185	16100	1.2335
200	1.0029	3400	1.0516	6600	1.1039	9800	1.1600	13000	1.2204	16200	1.2857
300	1.0044	3500	1.0532	6700	1.1056	9900	1.1618	13100	1.2225	16300	1.2878
400	1.0058	3600	1.0547	6800	1.1073	10000	1.1637	13200	1.2244	16400	1.2900
500	1.0074	3700	1.0564	6900	1.1090	10100	1.1655	13300	1.2264	16500	1.2920
600	1.0089	3800	1.0580	7000	1.1106	10200	1.1674	13400	1.2284	16600	1.2942
700	1.0103	3900	1.0595	7100	1.1123	10300	1.1692	13500	1.2303	16700	1.2963
800	1.0118	4000	1.0611	7200	1.1141	10400	1.1710	13600	1.2323	16800	1.2985
900	1.0138	4100	1.0627	7300	1.1158	10500	1.1729	13700	1.2343	16900	1.3006
1000	1.0148	4200	1.0644	7400	1.1176	10600	1.1747	13800	1.2362	17000	1.3028
1100	1.0163	4300	1.0660	7500	1.1192	10700	1.1766	13900	1.2382	17100	1.3050
1200	1.0178	4400	1.0676	7600	1.1210	10800	1.1784	14000	1.2404	17200	1.3070
1300	1.0193	4500	1.0692	7700	1.1227	10900	1.1804	14100	1.2424	17300	1.3092
1400	1.0208	4600	1.0708	7800	1.1245	11000	1.1822	14200	1.2444	17400	1.3115
1500	1.0223	4700	1.0724	7900	1.1261	11100	1.1840	14300	1.2464	17500	1.3137
1600	1.0239	4800	1.0740	8000	1.1279	11200	1.1860	14400	1.2484	17600	1.3158
1700	1.0253	4900	1.0756	8100	1.1297	11300	1.1878	14500	1.2505	17700	1.3180
1800	1.0268	5000	1.0772	8200	1.1315	11400	1.1896	14600	1.2525	17800	1.3201
1900	1.0284	5100	1.0789	8300	1.1331	11500	1.1916	14700	1.2545	17900	1.3224
2000	1.0299	5200	1.0805	8400	1.1349	11600	1.1935	14800	1.2566	18000	1.3247
2100	1.0315	5300	1.0821	8500	1.1368	11700	1.1953	14900	1.2587	18100	1.3268
2200	1.0330	5400	1.0839	8600	1.1384	11800	1.1973	15000	1.2607	18200	1.3291
2300	1.0330	5500	1.0839	8700	1.1403	11900	1.1992	15100	1.2626	18300	1.3314
2400	1.0361	5600	1.0855	8800	1.1421	12000	1.2011	15200	1.2647	18400	1.3335
2500	1.0376	5700	1.0872	8900	1.1438	12100	1.2031	15300	1.2668	18500	1.3358
2600	1.0392	5800	1.0889	9000	1.1456	12200	1.2050	15400	1.2689	18600	1.3380
2700	1.0407	5900	1.0922	9100	1.1474	12300	1.2069	15500	1.2710	18700	1.3403
2800	1.0422	6000	1.0937	9200	1.1492	12400	1.2088	15600	1.2731	18800	1.3425
2900	1.0437	6100	1.0954	9300	1.1510	12500	1.2108	15700	1.2752	18900	1.3448
3000	1.0454	6200	1.0971	9400	1.1527	12600	1.2127	15800	1.2773	19000	1.3470
3100	1.0469	6300	1.0988	9500	1.1546	12700	1.2146	15900	1.2794	19100	1.3493
3200	1.0484	6400	1.1005	9600	1.1563	12800	1.2165	16000	1.2814	19200	1.3515

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Figure 1-6. (Sheet 1 of 2)

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DENSITY ALTITUDE TABLE

$$\text{TRUE AIRSPEED} = \text{EQUIVALENT AIRSPEED} \times \frac{1}{\sqrt{\sigma}}$$

DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$
19300	1.3539	22400	1.4276	25500	1.5072	28600	1.5934	31700	1.6875	34800	1.7895
19400	1.3561	22500	1.4300	25600	1.5099	28700	1.5964	31800	1.6903	34900	1.7931
19500	1.3585	22600	1.4325	25700	1.5124	28800	1.5992	31900	1.6938	35000	1.7963
19600	1.3607	22700	1.4349	25800	1.5179	28900	1.6023	32000	1.6969	35100	1.7999
19700	1.3630	22800	1.4374	25900	1.5207	29000	1.6051	32100	1.7001	35200	1.8034
19800	1.3654	22900	1.4399	26000	1.5232	29100	1.6080	32200	1.7033	35300	1.8070
19900	1.3676	23000	1.4424	26100	1.5260	29200	1.6111	32300	1.7065	35400	1.8103
20000	1.3701	23100	1.4443	26200	1.5260	29300	1.6139	32400	1.7097	35500	1.8139
20100	1.3723	23200	1.4474	26300	1.5288	29400	1.6171	32500	1.7129	35600	1.8175
20200	1.3746	23300	1.4499	26400	1.5314	29500	1.6200	32600	1.7161	35700	1.8208
20300	1.3770	23400	1.4524	26500	1.5342	29600	1.6228	32700	1.7194	35800	1.8245
20400	1.3793	23500	1.4550	26600	1.5370	29700	1.6260	32800	1.7227	35900	1.8278
20500	1.3816	23600	1.4575	26700	1.5396	29800	1.6289	32900	1.7259	36000	1.8315
20600	1.3841	23700	1.4601	26800	1.5425	29900	1.6319	33000	1.7292	36089	1.8350
20700	1.3864	23800	1.4626	26900	1.5451	30000	1.6348	33100	1.7325	36100	1.8352
20800	1.3887	23900	1.4652	27000	1.5480	30100	1.6380	33200	1.7355	36200	1.8396
20900	1.3912	24000	1.4678	27100	1.5509	30200	1.6410	33300	1.7388	36400	1.8485
21000	1.3935	24100	1.4704	27200	1.5535	30300	1.6439	33400	1.7422	36600	1.8574
21100	1.3959	24200	1.4730	27300	1.5564	30400	1.6469	33500	1.7455	36800	1.8664
21200	1.3982	24300	1.4756	27400	1.5593	30500	1.6502	33600	1.7489	37000	1.8753
21300	1.4008	24400	1.4782	27500	1.5620	30600	1.6532	33700	1.7522	37200	1.8844
21400	1.4031	24500	1.4808	27600	1.5649	30700	1.6562	33800	1.7556	37400	1.8935
21500	1.4055	24600	1.4832	27700	1.5676	30800	1.6592	33900	1.7590	37600	1.9026
21600	1.4079	24700	1.4859	27800	1.5706	30900	1.6622	34000	1.7624	37800	1.9117
21700	1.4104	24800	1.4885	27900	1.5733	31000	1.6656	34100	1.7655	38000	1.9210
21800	1.4128	24900	1.4912	28000	1.5763	31100	1.6686	34200	1.7690	38100	1.9302
21900	1.4152	25000	1.4939	28100	1.5790	31200	1.6717	34300	1.7724	38200	1.9395
22000	1.4176	25100	1.4966	28200	1.5820	31300	1.6748	34400	1.7759	38400	1.9488
22100	1.4201	25200	1.4990	28300	1.5848	31400	1.6779	34500	1.7794	38800	1.9583
22200	1.4225	25300	1.5017	28400	1.5878	31500	1.6810	34600	1.7825	39000	1.9677
22300	1.4251	25400	1.5044	28500	1.5906	31600	1.6841	34700	1.7860	39200	1.9772

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Figure 1-6. (Sheet 2 of 2)

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ICAO STANDARD ATMOSPHERE TABLE

PRESSURE ALTITUDE (FEET)	DENSITY RATIO $(\rho/\rho_o=\sigma)$	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE		SPEED OF SOUND RATIO $(\alpha/\alpha_o=\sqrt{\theta})$	SPEED OF SOUND (KNOTS)	PRESSURE	
			DEG C	DEG F			IN. HG	RATIO $(P/P_o=\delta)$
0	1.0000	1.0000	15.000	59.0	1.0000	661.7	29.92	1.0000
1,000	.9711	1.0148	13.019	55.4	.9966	659.5	28.86	.9644
2,000	.9428	1.0299	11.037	51.9	.9931	657.2	27.82	.9298
3,000	.9151	1.0454	9.056	48.3	.9896	654.2	26.82	.8962
4,000	.8881	1.0611	7.075	44.7	.9862	652.6	25.84	.8637
5,000	.8617	1.0772	5.094	41.2	.9827	650.3	24.90	.8320
6,000	.8359	1.0937	3.113	37.6	.9792	647.9	23.98	.8014
7,000	.8106	1.1106	1.132	34.0	.9756	645.6	23.09	.7716
8,000	.7860	1.1279	-.850	30.5	.9721	643.3	22.22	.7428
9,000	.7620	1.1456	-2.831	26.9	.9686	640.9	21.39	.7148
10,000	.7385	1.1637	-4.812	23.3	.9650	638.6	20.58	.6877
11,000	.7156	1.1822	-6.794	19.8	.9614	636.2	19.79	.6614
12,000	.6932	1.2011	-8.775	16.2	.9579	633.9	19.03	.6360
13,000	.6713	1.2204	-10.756	12.6	.9543	631.5	18.29	.6113
14,000	.6500	1.2404	-12.737	9.1	.9506	629.1	17.58	.5874
15,000	.6292	1.2607	-14.718	5.5	.9470	626.7	16.89	.5643
16,000	.6090	1.2814	-16.700	1.9	.9434	624.3	16.22	.5420
17,000	.5892	1.3028	-18.681	-1.6	.9397	621.9	15.57	.5203
18,000	.5699	1.3247	-20.662	-5.2	.9361	619.4	14.94	.4994
19,000	.5511	1.3470	-22.643	-8.8	.9324	617.0	14.34	.4791
20,000	.5328	1.3701	-24.624	-12.3	.9287	614.6	13.75	.4595
21,000	.5150	1.3935	-26.605	-15.9	.9250	612.1	13.18	.4406
22,000	.4976	1.4176	-28.587	-19.5	.9213	609.6	12.64	.4223
23,000	.4806	1.4424	-30.568	-23.0	.9175	607.2	12.11	.4046
24,000	.4642	1.4678	-32.549	-26.6	.9138	604.7	11.60	.3876
25,000	.4481	1.4939	-34.530	-30.2	.9100	602.2	11.10	.3711
26,000	.4325	1.5207	-36.511	-33.7	.9062	599.7	10.63	.3552
27,000	.4173	1.5480	-38.492	-37.3	.9024	597.2	10.17	.3398
28,000	.4025	1.5763	-40.473	-40.9	.8986	594.7	9.72	.3250
29,000	.3881	1.6051	-42.455	-44.4	.8948	592.1	9.30	.3107
30,000	.3741	1.6348	-44.436	-48.0	.8909	589.5	8.89	.2970
31,000	.3605	1.6656	-46.417	-51.6	.8870	587.0	8.49	.2837
32,000	.3473	1.6969	-48.398	-55.1	.8832	584.4	8.11	.2709
33,000	.3345	1.7292	-50.380	-58.7	.8793	581.8	7.74	.2586
34,000	.3220	1.7624	-52.361	-62.2	.8754	579.2	7.38	.2467
35,000	.3099	1.7963	-54.342	-65.8	.8714	576.7	7.04	.2353
36,000	.2981	1.8315	-56.324	-69.4	.8675	574.0	6.71	.2243
37,000	.2844	1.8753	-56.500	-69.7	.8671	573.8	6.40	.2138
38,000	.2710	1.9210	-56.500	-69.7	.8671	573.8	6.10	.2038
39,000	.2583	1.9677	-56.500	-69.7	.8671	573.8	5.81	.1942
40,000	.2462	2.0155	-56.500	-69.7	.8671	573.8	5.54	.1851
41,000	.2346	2.0645	-56.500	-69.7	.8671	573.8	5.28	.1764
42,000	.2236	2.1148	-56.500	-69.7	.8671	573.8	5.03	.1681
43,000	.2131	2.1662	-56.500	-69.7	.8671	573.8	4.79	.1602
44,000	.2031	2.2189	-56.500	-69.7	.8671	573.8	4.57	.1527
45,000	.1936	2.2728	-56.500	-69.7	.8671	573.8	4.35	.1455

PROPERTIES OF STANDARD DAY, SEA LEVEL AIR

TEMPERATURE (T_o) = 15°C = 59°F
PRESSURE (P_o) = 14.70 LB/SQ.IN. = 29.921 IN. OF Hg
DENSITY (ρ_o) = 0.002378 SLUGS/CU FT
SPEED OF SOUND (α_o) = 661.7407 KNOTS = 1116.89 FT/SEC
SPECIFIC WEIGHT (ω) = 0.07651 LB/CU FT
1 INCH OF Hg = 70.727 LB/SQ FT = 0.49116 LB/SQ IN.

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Figure 1-7.

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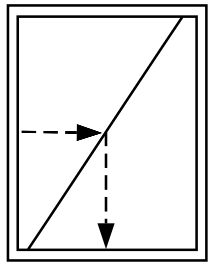
TEMPERATURE CONVERSION CELSIUS/FAHRENHEIT



NOTE: °F = (9/5 °C) + 32
°C = 5/9 (°F - 32)

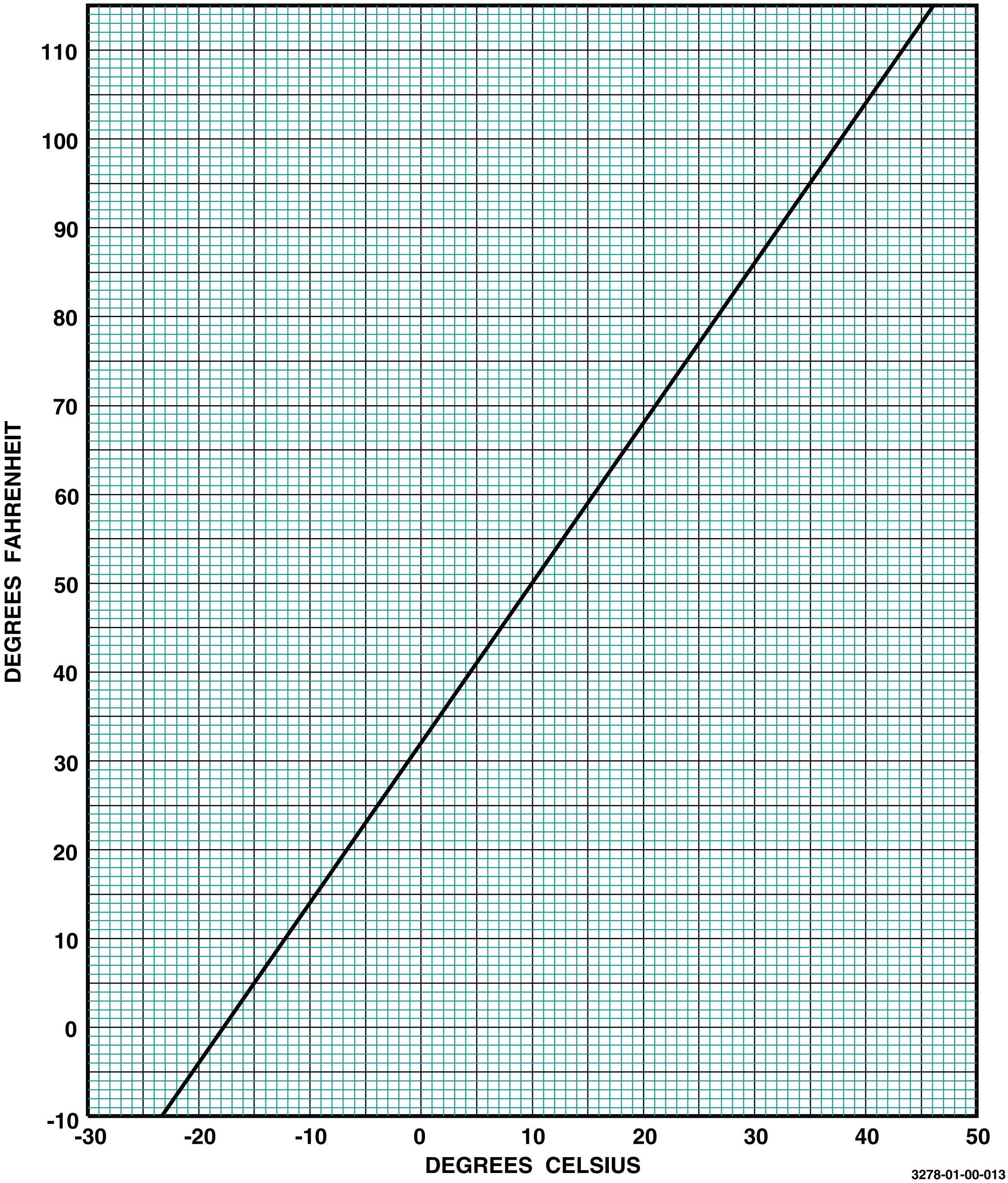


Figure 1-8.

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ALTITUDE PRESSURE CORRECTION TABLE
(INCHES OF Hg VS Δ FEET)

PRESSURE ALTITUDE = FIELD ELEVATION + Δ ALTITUDE

IN. Hg	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	Δ ALTITUDE - FEET									
28.0	1824	1814	1805	1795	1785	1776	1766	1756	1746	1737
28.1	1727	1717	1707	1698	1688	1678	1668	1659	1649	1639
28.2	1630	1620	1610	1601	1591	1581	1572	1562	1552	1542
28.3	1533	1523	1513	1504	1494	1484	1475	1465	1456	1446
28.4	1436	1427	1417	1407	1398	1388	1378	1369	1359	1350
28.5	1340	1330	1321	1311	1302	1292	1282	1273	1263	1254
28.6	1244	1234	1225	1215	1206	1196	1186	1177	1167	1158
28.7	1148	1139	1129	1120	1110	1100	1091	1081	1072	1062
28.8	1053	1043	1034	1024	1015	1005	995	986	976	967
28.9	957	948	938	929	919	910	900	891	881	872
29.0	863	853	844	834	825	815	806	796	787	777
29.1	768	758	749	739	730	721	711	702	692	683
29.2	673	664	655	645	636	626	617	607	598	589
29.3	579	570	560	551	542	532	523	514	504	495
29.4	485	476	467	457	448	439	429	420	410	401
29.5	392	382	373	364	354	345	336	326	318	308
29.6	298	289	280	270	261	252	242	233	224	215
29.7	205	196	187	177	168	159	149	140	131	122
29.8	112	103	94	85	75	66	57	47	38	29
29.9	20	10	+1	-8	-17	-26	-36	-45	-54	-63
30.0	-73	-82	-91	-100	-110	-119	-128	-137	-146	-156
30.1	-165	-174	-183	-192	-202	-211	-220	-229	-238	-248
30.2	-257	-266	-275	-284	-293	-303	-312	-321	-330	-339
30.3	-348	-358	-367	-376	-385	-394	-403	-412	-421	-431
30.4	-440	-449	-458	-467	-476	-485	-494	-504	-513	-522
30.5	-531	-540	-549	-558	-567	-576	-585	-594	-604	-613
30.6	-622	-631	-640	-649	-658	-667	-676	-685	-694	-703
30.7	-712	-721	-730	-740	-749	-758	-767	-776	-785	-794
30.8	-803	-812	-821	-830	-839	-848	-857	-866	-875	-884
30.9	-893	-902	-911	-920	-929	-938	-947	-956	-965	-974
31.0	-983	-992	-1001	-1010	-1019	-1028	-1037	-1046	-1055	-1064

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Figure 1-9.

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SECTION 2
INFLIGHT ENGINE POWER AND FUEL FLOW

TABLE OF CONTENTS

Contents **Page**

LIST OF CHARTS

INTRODUCTION.

Engine operating data consisting of charts for horsepower and fuel flow for both normal and all bleed conditions are presented in this section. These installed engine data were derived from Allison Specification Engine Deck No. EDR 16812, dated 21 July 1997, and include the effects of ram recovery, normal power extraction, pressurization, air conditioning, and anti-icing bleed and represent the minimum power indication displayed on cockpit instruments for the given condition. The charts are valid for all C-130J series airplanes operating with AE2100D3 engines and R391 propellers. Normal bleed includes pressurization, air conditioning packs, and cargo compartment underfloor heating. All bleed includes the above plus engine, wing, and empennage ice protection.

NOTE

For all performance given, fuel flow is increased by four percent as a service allowance (this value is incorporated into all charts throughout this manual).

CHART DESCRIPTION.

Figure 2-1 and figure 2-2 show engine horsepower and fuel flow for any combination of altitude, airspeed, outside air temperature, and Power Lever Angle (PLA) setting when all engines are operating with normal bleed conditions. For convenience, reference numbers have been included to facilitate movement between charts with multiple pages. Similarly, figure 2-3 and figure 2-4 show similar information when all bleed is required for anti-icing purposes.

Example.

GIVEN:

Pressure altitude	8,000 feet
Cruise speed	186 KIAS
OAT	– 26 ºC
PLA	65 degrees
4-engine operation	
Normal bleed	

FIND:

- Horsepower per engine
- Fuel flow per engine

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PROCEDURE:

To find the horsepower per engine, enter figure 2-1, sheet 1, with 8,000 feet pressure altitude and move right to intersect the 186 KIAS line. From this point, move vertically to the – 26 °C OAT line, then move right to the second altitude grid. Move down the page and read a power reference number of 23.5. Note that the point of intersection of 8,000 feet occurs on the vertical portion of the curve. This portion represents the limit horsepower.

Enter figure 2-1, sheet 2, with this power reference number of 23.5 and move up the page to intersect the 65 degree PLA line. Move left to the horsepower axis to read a value of 3,350 horsepower per engine. This limited horsepower represents the true performance of the engine.

To find the fuel flow per engine, enter figure 2-2, sheet 1, with 8,000 feet pressure altitude and move right to intersect the 186 KIAS line. From this point, move up to the – 26 °C OAT line, then right to intersect 8,000 foot pressure altitude line. Next move down to read a fuel reference number of 19.8.

Enter figure 2-2, sheet 2, with this fuel reference number of 19.8, and move up to intersect the 65-degree PLA line. Read to the left a fuel flow of 1,510 pounds per hour per engine.

ENGINE POWER SETTINGS.

The power lever is the primary control for setting engine power. For each flight condition, a particular PLA setting will generate a specific horsepower and corresponding thrust and fuel flow values. The airplane performance computed from this manual can be attained only if engine power is set to the torquemeter horsepower corresponding to the correct PLA setting. Additionally, the charts in this section can be used with data computed from other sections to cross check aircraft performance as well as engine performance and condition.

Example.

GIVEN:

Pressure altitude	10,000 feet
Cruise speed	200 KIAS
OAT	– 15 °C
4-engine operation	
All bleed	

FIND:

- The PLA setting that corresponds to a horsepower value of 2,500 horsepower per engine for the given conditions.
- The PLA setting that corresponds to a fuel flow value of 1,250 pounds per hour per engine for the given conditions.

PROCEDURE:

Enter figure 2-3, sheet 1, with the pressure altitude of 10,000 feet and move right to intersect the 200 KIAS line. From this point, move up to intersect the – 15 °C OAT line. Next move to the right to intersect the 10,000 foot line in the second altitude grid. At this point, read a power reference number of 19.5.

Next, enter figure 2-3, sheet 2, with 2,500 horsepower and establish a horizontal line. Now enter the bottom scale of the figure with the power reference number of 19.5 and establish a vertical line. At the intersection of these two lines, read a PLA required of 61.5 degrees.

To find the PLA setting that corresponds to a fuel flow value of 1,250 pounds per hour per engine, enter figure 2-4, sheet 1, with 10,000 feet pressure altitude and move right to intersect the 200 KIAS line. At this point, move up to intersect the – 15 °C line and across to the 10,000 foot line on the second altitude grid. Read below a fuel reference number of 19.2.

Next, enter figure 2-4, sheet 2, with 1,250 pounds per hour per engine and establish a horizontal line. Then enter the bottom axis of the figure with the fuel reference number of 19.2 and establish a vertical line. At the intersection of these two lines, read a value of required PLA setting of 57 degrees.

NUMBER OF OPERATING ENGINES.

With one or more engines shut down, the air conditioning, pressurization, and deicing systems require more bleed air from operating engines, so corrections to the basic chart are required. Three-engine operation for a given PLA will result in a fuel flow decrease of 8.5 pounds per hour per engine for all altitudes based on normal bleed requirements for all operating engines. Shaft horsepower and thrust remain essentially unchanged from four-engine values. Two-engine operation will result in an average power loss of 50 HP per engine and a fuel flow decrease at altitude as listed below:

Altitude (feet)	∆Fuel Flow (pph per engine)
Sea Level	– 35
5,000	– 31
10,000	– 28
15,000	– 26
20,000	– 24
25,000	– 24
30,000	– 23
35,000	– 20
39,000	– 19

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

POWER AVAILABLE INFLIGHT

4 ENGINES — NORMAL BLEED

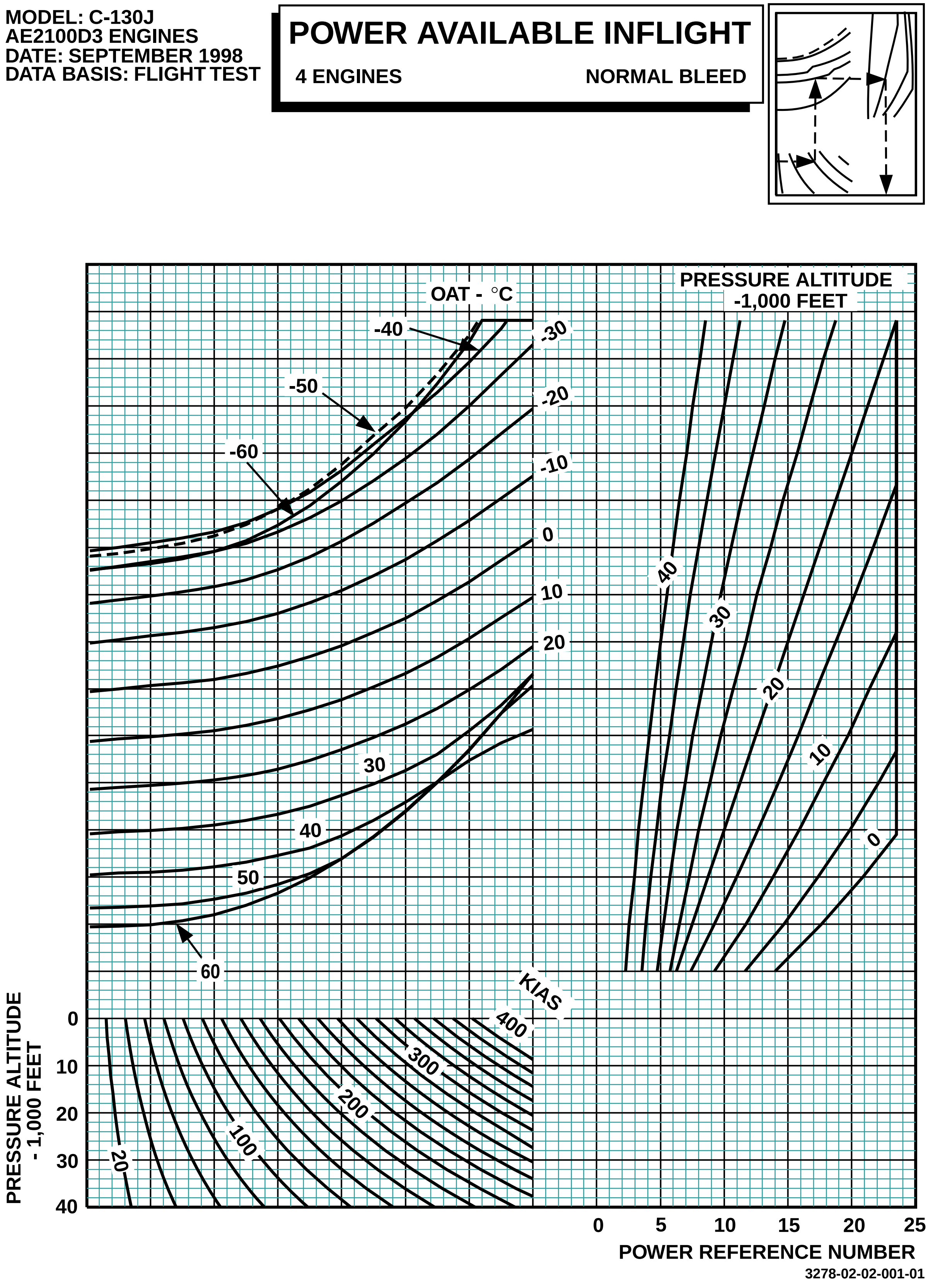

Figure 2-1. (Sheet 1 of 2)

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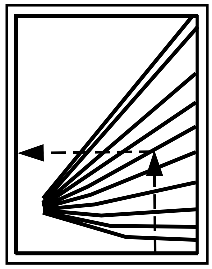
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

POWER AVAILABLE INFLIGHT

4 ENGINES NORMAL BLEED



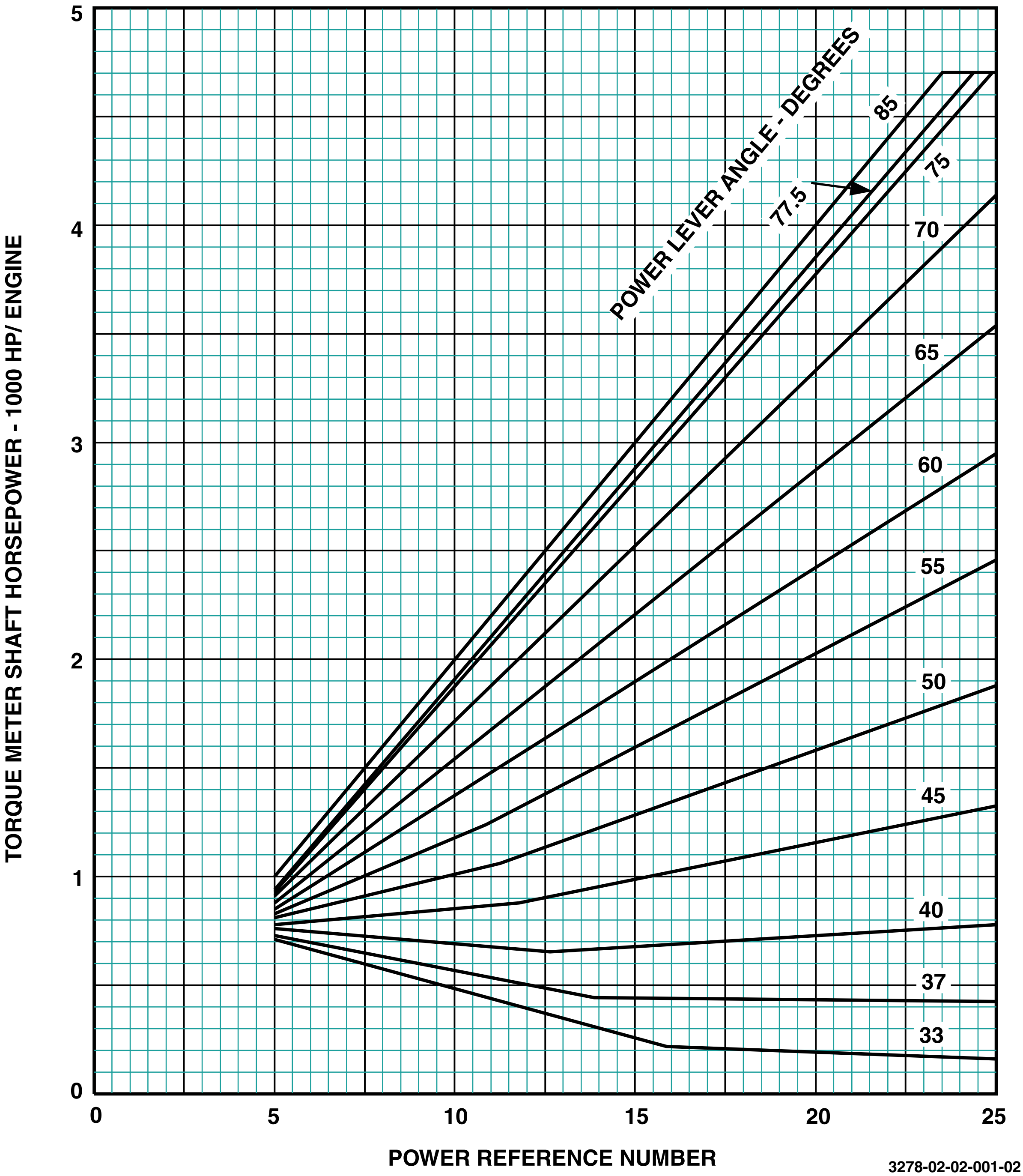


Figure 2-1. (Sheet 2 of 2)

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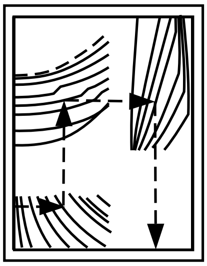
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

FUEL FLOW INFLIGHT

4 ENGINES NORMAL BLEED



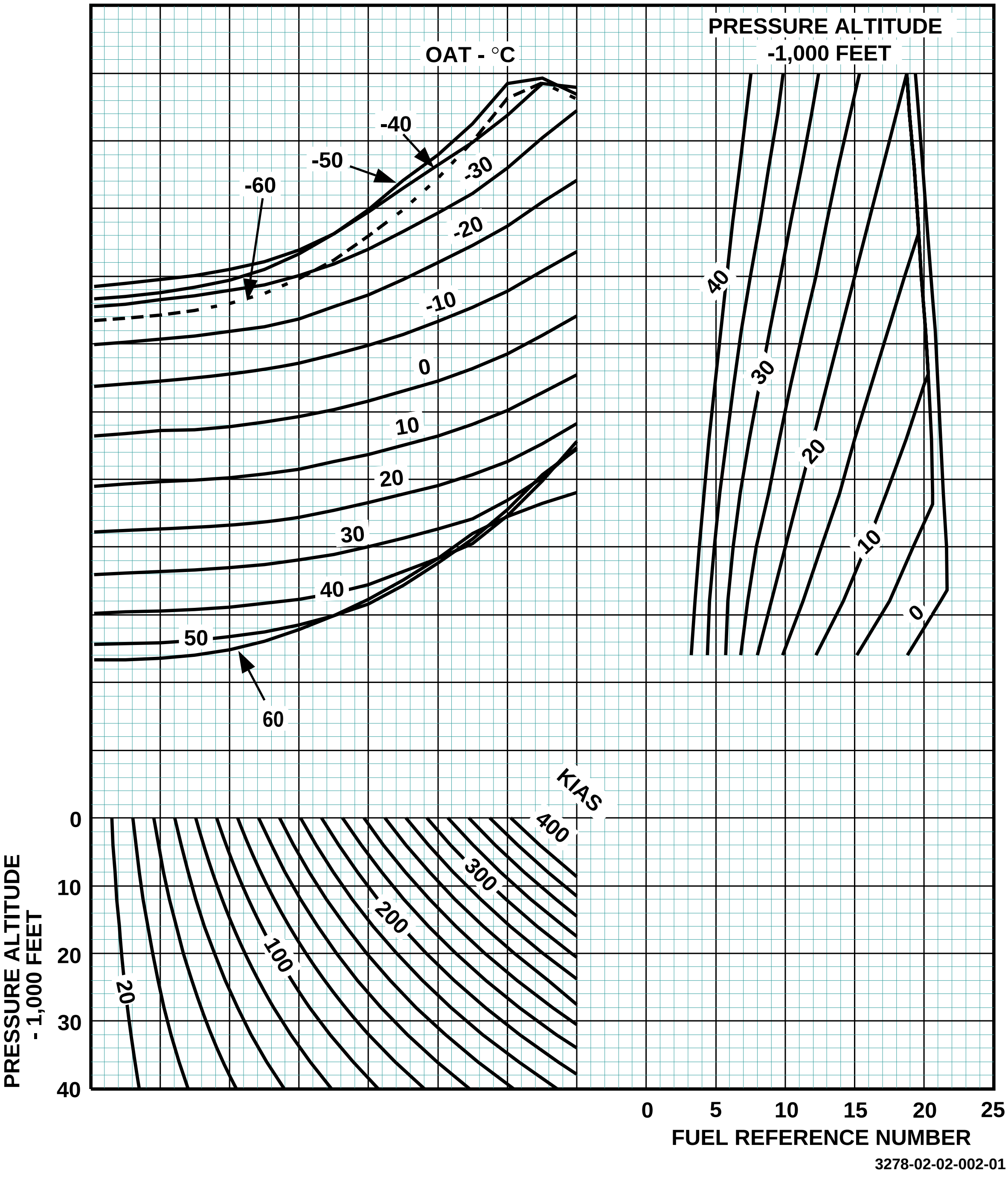


Figure 2-2. (Sheet 1 of 2)

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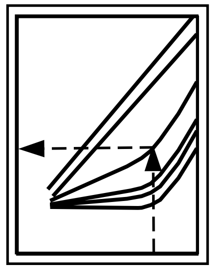
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

FUEL FLOW INFLIGHT

4 ENGINES NORMAL BLEED



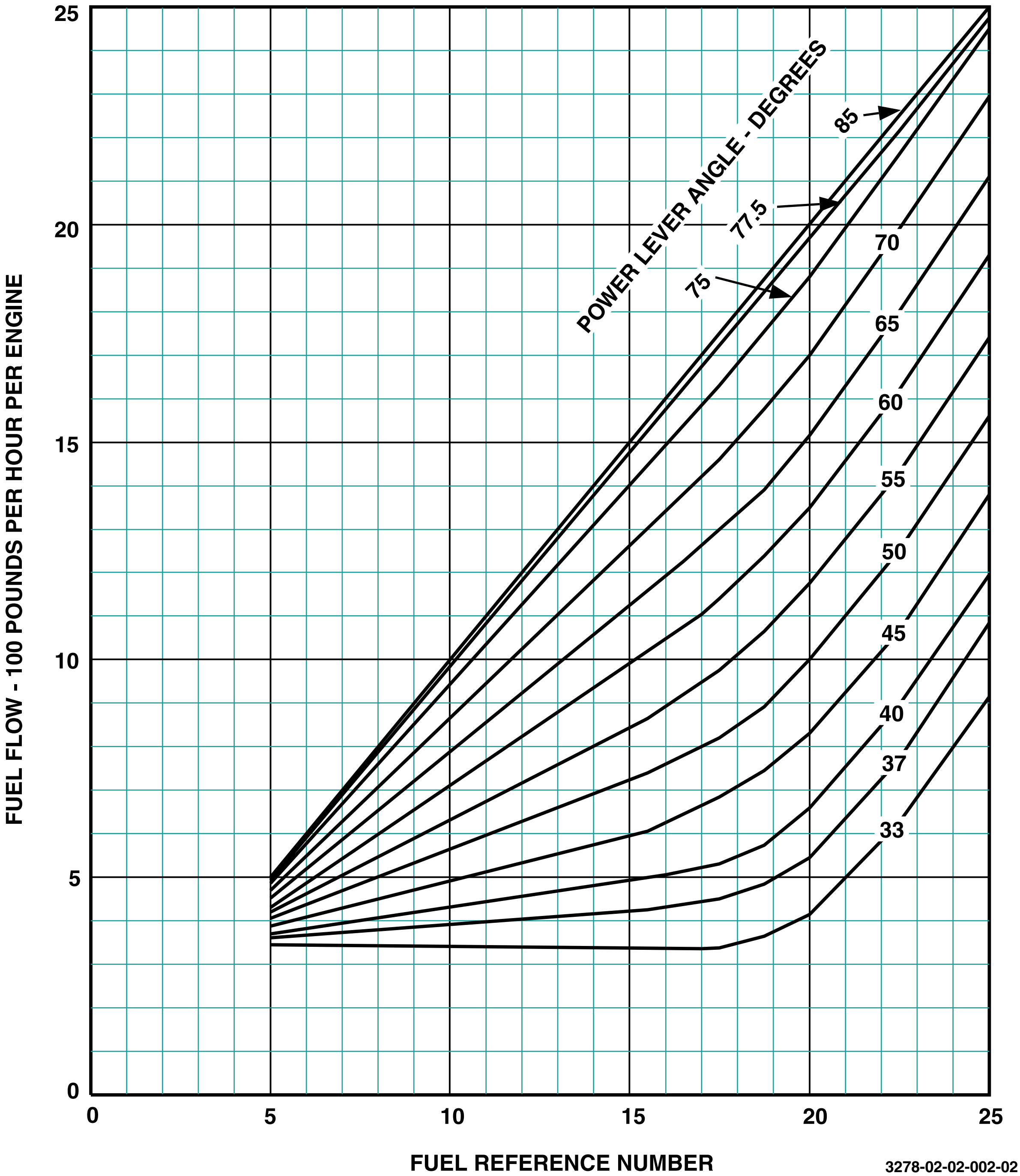


Figure 2-2. (Sheet 2 of 2)

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

POWER AVAILABLE INFLIGHT

4 ENGINES ALL BLEED

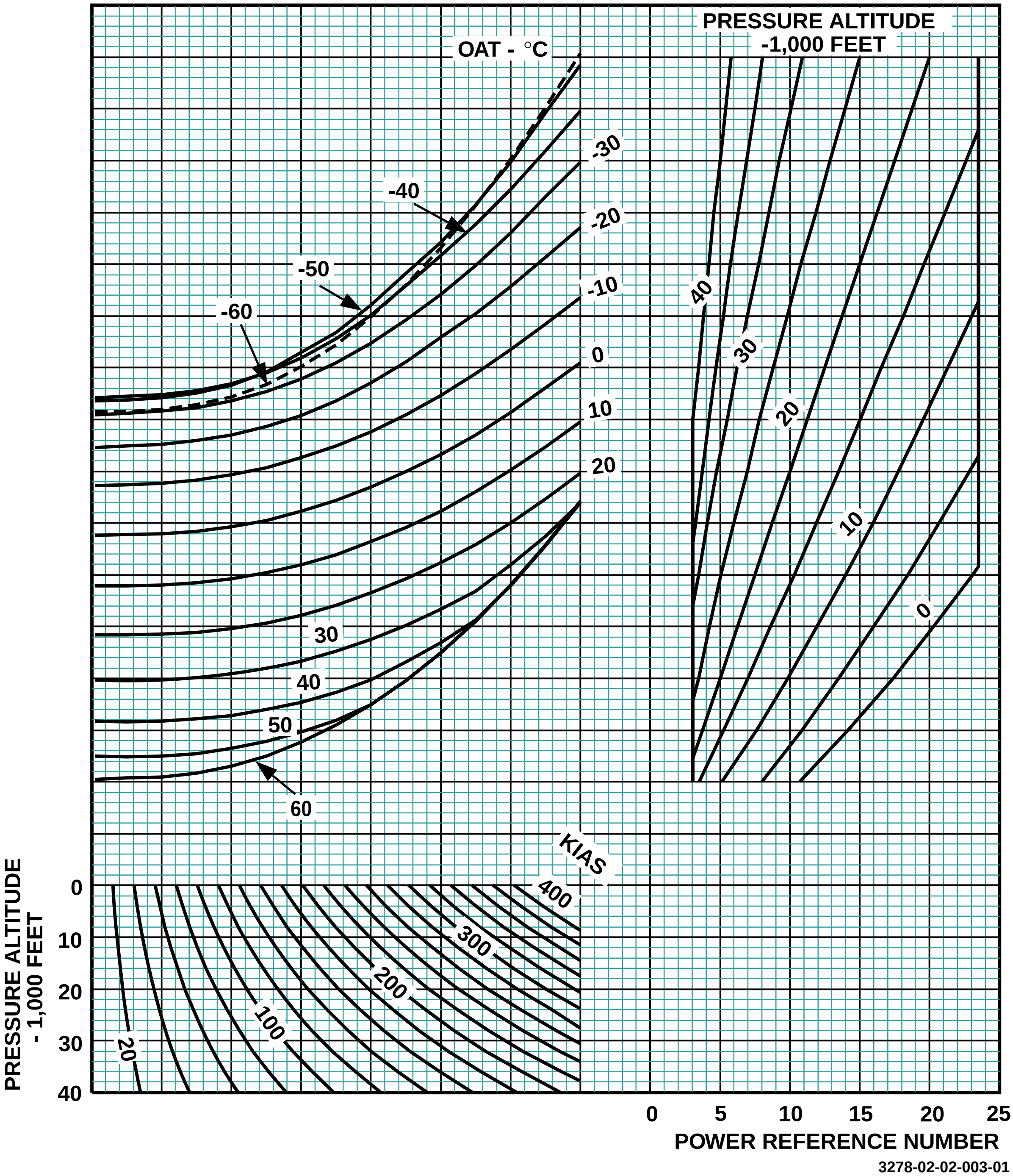

Figure 2-3. (Sheet 1 of 2)

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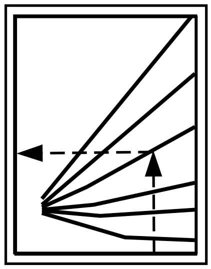
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

POWER AVAILABLE INFLIGHT

4 ENGINES ALL BLEED



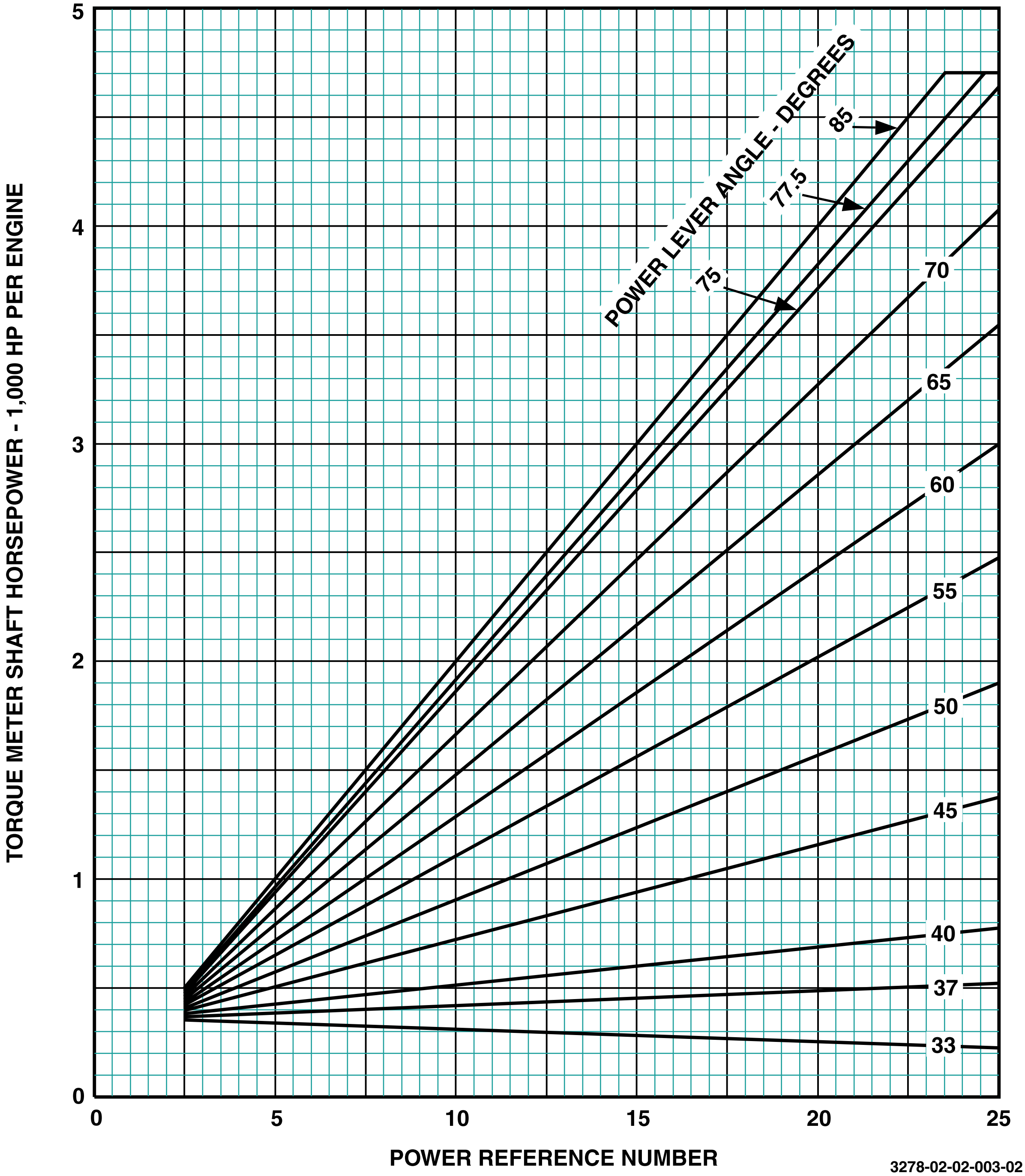


Figure 2-3. (Sheet 2 of 2)

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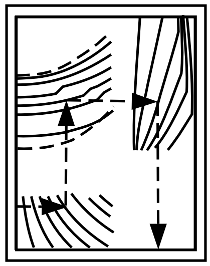
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

FUEL FLOW INFLIGHT

4 ENGINES ALL BLEED



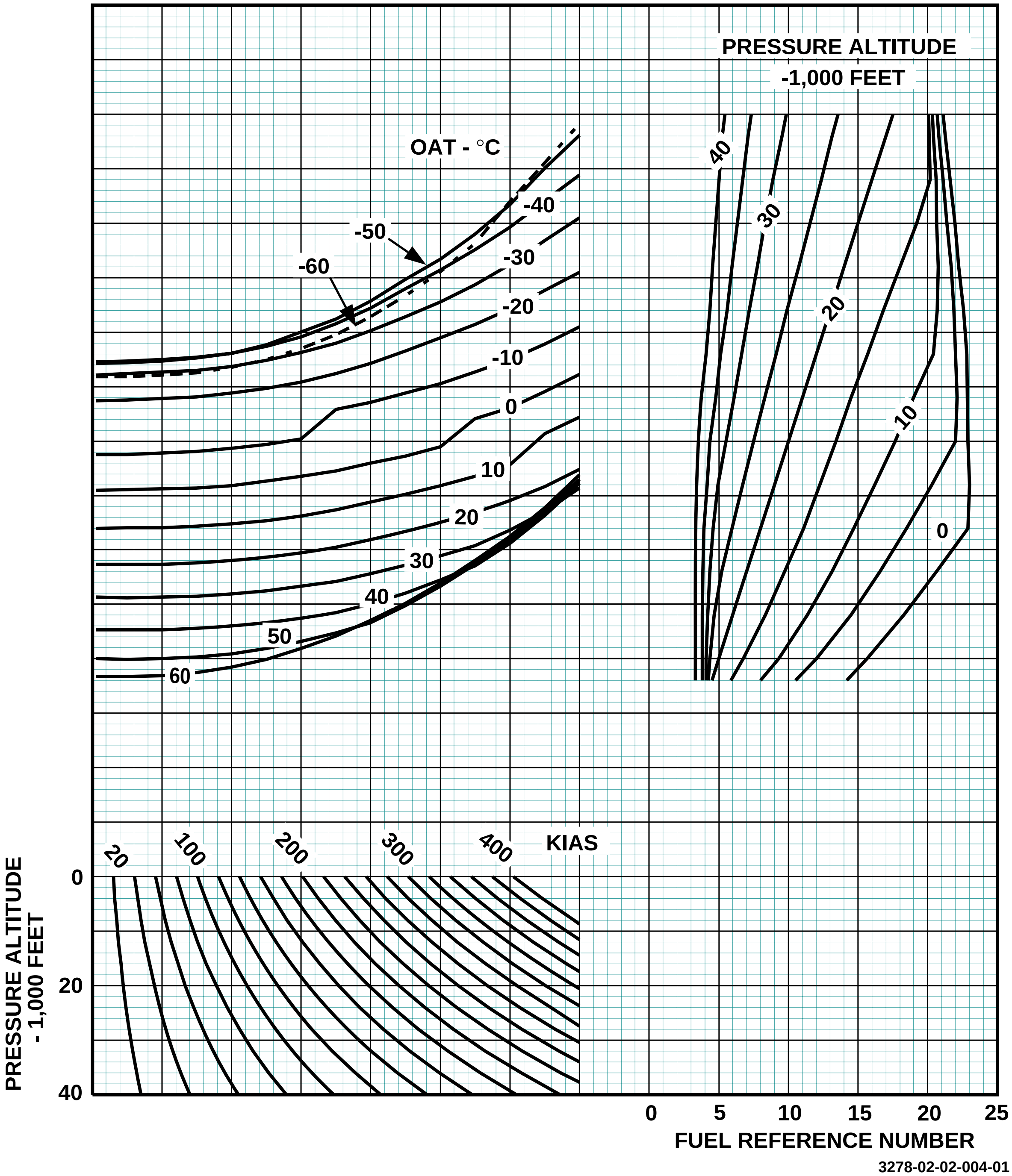


Figure 2-4. (Sheet 1 of 2)

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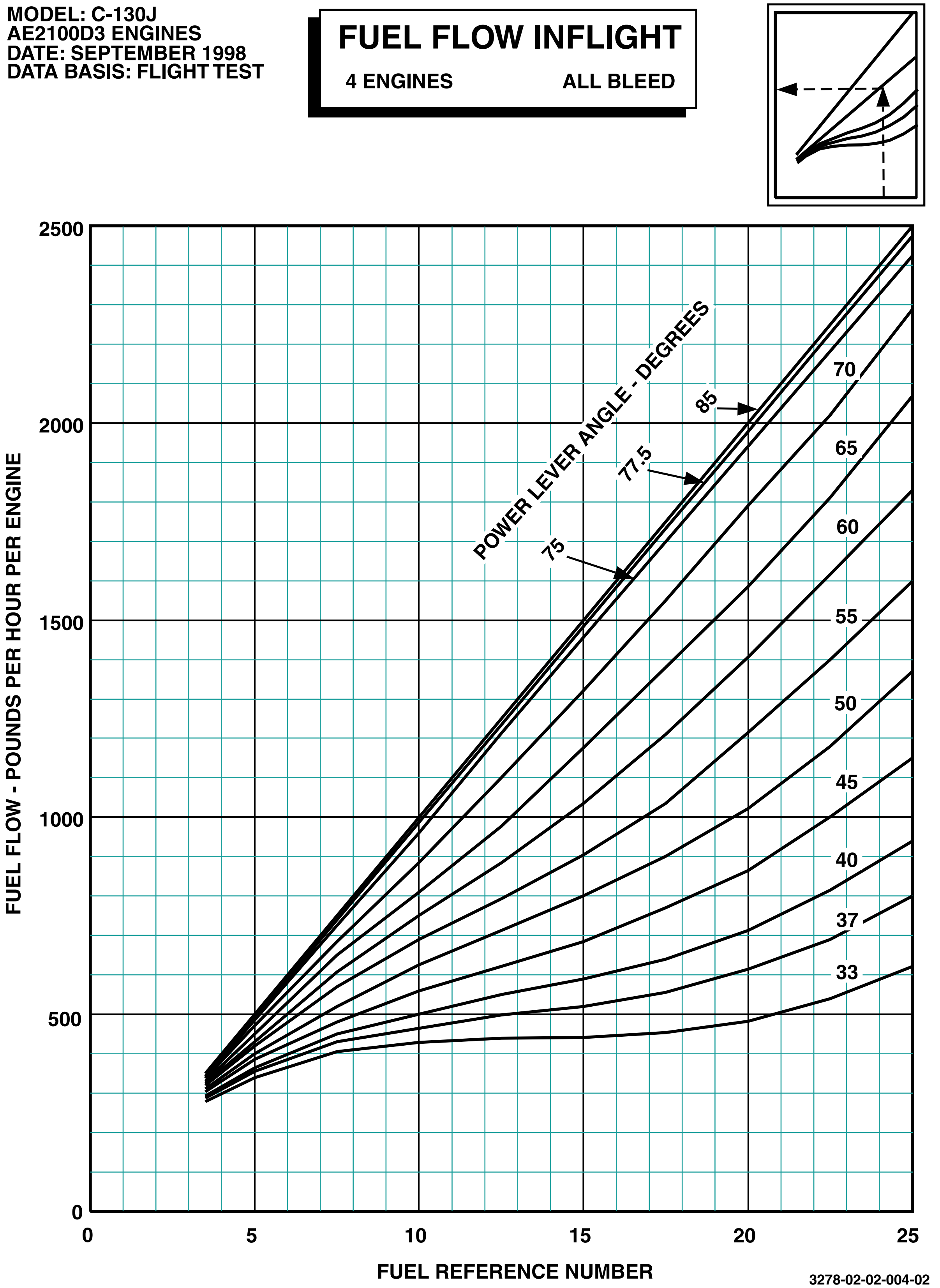

Figure 2-4. (Sheet 2 of 2)

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SECTION 3
TAKEOFF PERFORMANCE

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LIST OF CHARTS

Figure Number Title Page

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INTRODUCTION.

Takeoff performance is important in the operation of the airplane because payload and range may be seriously reduced by the maximum weight limitations imposed by takeoff conditions. Generally, the runway length available imposes the most stringent limits on takeoff weight. Obstacle clearance and climb performance, however, may also limit the gross weight. In addition to the airplane configuration, other factors affecting the takeoff and climb-out performance include pressure altitude, outside air temperature, wind velocity, runway slope, runway condition, surface covering, and power setting. In this section, data are presented for determining the takeoff performance and applicable limitations for both four- and three-engine operation. The normal takeoff configuration is all engines operating at maximum power with air conditioning and pressurization bleed (normal bleed) on, and 50 percent flaps. Nosewheel steering is always assumed to be inoperative as a measure of conservatism.

GROUND EFFECT.

The takeoff performance data consider ground effect where applicable. Ground effect, in general, refers to a reduction in the drag of an airplane when operated close to the ground. The degree of drag reduction will vary with distance of the wing from the ground, being greatest when the wing is at ground level, and becoming negligible when the wing is one-half of the wing span above the ground.

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GRAPHIC ILLUSTRATIONS FOR NORMAL TAKEOFF.

Figure 3-1, figure 3-2, and figure 3-3 provide graphic illustrations of the various conditions and factors which are encountered during takeoff. The normal four-engine acceleration curve depicts the speed-distance acceleration characteristics of the airplane. The acceleration is computed from the point of brake release to takeoff speed at the end of a four-engine ground run. The three-engine acceleration curve shows the speed-distance relationship from the point of assumed engine failure to the takeoff point. The braking roll curve is computed from the refusal point to a complete stop at the end of the runway. Reaction times based on flight test results and specification requirements allow time for the pilot to recognize the situation, make a decision to stop, reduce power lever, and apply brakes in accordance with CMM.1C-130J-1, Section 3, Abort procedure.

NOTE

> If critical field length is longer than the runway available, for normal operation, the takeoff gross weight must be reduced until critical field length is equal to or less than runway available or permission must be obtained to use maximum effort takeoff procedures.

RUNWAY AVAILABLE LONGER THAN CRITICAL FIELD LENGTH (RECOMMENDED).

This condition is illustrated in figure 3-1. With this condition, refusal speed (V_{REF}) is always higher than critical engine failure speed (V_{CEF}). This is because refusal speed is based on runway available, while critical engine failure speed is based on required critical field length.

RUNWAY AVAILABLE EQUAL TO CRITICAL FIELD LENGTH (MINIMUM RECOMMENDED).

This condition is illustrated in figure 3-2. When the runway available is equal to the critical field length and an engine failure occurs at the refusal point, the distance to continue on three engines just equals the distance to stop. Therefore, for this condition the critical engine failure speed and refusal speed are coincident.

RUNWAY AVAILABLE LESS THAN CRITICAL FIELD LENGTH (NOT RECOMMENDED).

This condition is illustrated in figure 3-3. In this condition there is a region above the refusal speed where, if an engine fails, it is not possible to either stop or continue the takeoff within the remaining runway. It is impossible to select a speed for decision speed. If the runway available is less than the critical field length, the airplane should be downloaded for a safe takeoff.

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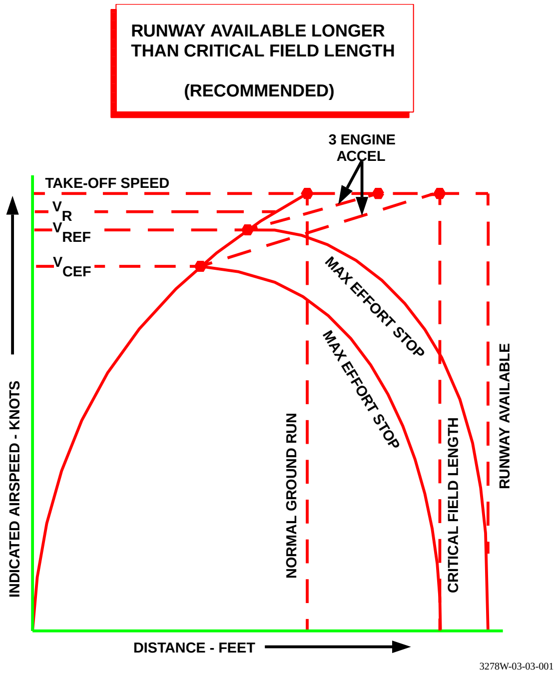

Figure 3-1.

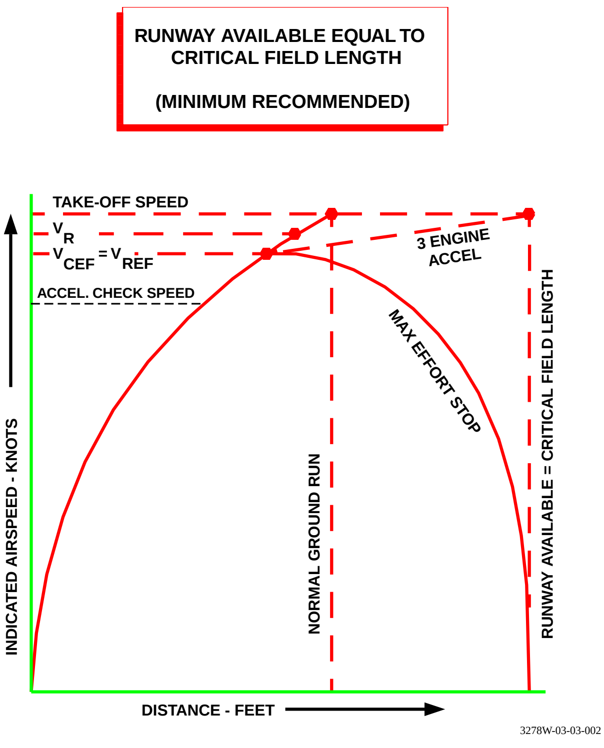

Figure 3-2.

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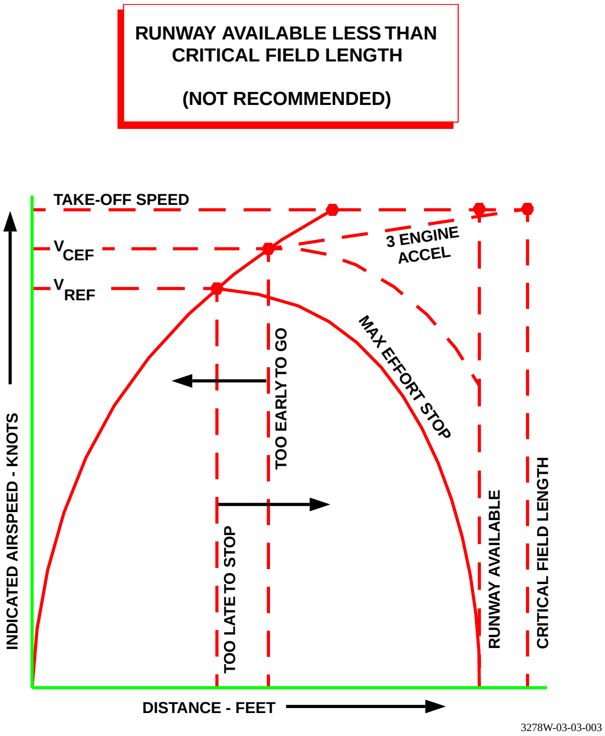

Figure 3-3.

TAKEOFF HORSEPOWER SETTING.

Takeoff power is established by moving the power levers to the TAKEOFF detent. Engine horsepower may then be checked from indicators in the cockpit. Horsepower required for takeoff is determined from figure 3-6 for normal bleed and figure 3-7 for all bleed. When charted performance is desired, takeoff HP should be displayed before the brakes are released. A rolling takeoff is permitted provided takeoff power is displayed (within 200 HP) within 5 seconds after either brake release or the aircraft is turned onto the runway cleared for takeoff.

Example.

GIVEN:

OAT	20 ºC
Field pressure altitude	5,000 feet
Normal bleed	

FIND:

- Takeoff horsepower

PROCEDURE:

Enter figure 3-6 at the given ambient temperature, proceed vertically to the given field pressure altitude, move horizontally to the baseline and read the static horsepower of 4,420 per engine.

PERFORMANCE WITH ANTI-ICING SYSTEM ON.

Ice protection for the wing/empennage leading edges, engine inlet lip, and the oil cooler scoops is provided by engine bleed air. Performance with the anti-icing system operating is given throughout this manual. If engine and wing/empennage ice protection is on, ALL BLEED charts must be used for performance computations. With only engine ice protection on, normal bleed performance can be used for conditions in the shaded area of figure 3-8; otherwise, use ALL BLEED charts for engine ice protection on performance.

TAKEOFF FACTOR.

To simplify the computation of takeoff performance, a takeoff factor is used. This takeoff factor combines the parameters of field pressure altitude and runway temperature. The Take-off Factor Normal Bleed chart (figure 3-8) is based on normal bleed condition. When takeoff is performed with all bleed, the takeoff factor must be computed from figure 3-9.

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Example 1.

GIVEN:

OAT	27 °C
Field pressure altitude	4,000 feet
Normal bleed	

FIND:

- Takeoff factor for normal bleed

PROCEDURE:

Enter figure 3-8 with 27 °C, move horizontally to the 4,000-foot pressure altitude curve, then down to the takeoff factor index to read a normal bleed takeoff factor of 2.8.

Example 2.

GIVEN:

OAT	27 °C
Field pressure altitude	4,000 feet
All bleed on	

FIND:

- Takeoff factor with all bleed on

PROCEDURE:

Enter figure 3-9 with 27 °C and move horizontally to the 4,000 foot pressure altitude, then down to the takeoff index to read a takeoff factor (all bleed on) of 3.12.

THREE-ENGINE CLIMB LIMITATION.

Takeoff gross weight, limited by three-engine climb performance, is presented in figure 3-10 for various rates of climb in the climb-out configuration. The climb-out configuration is defined as follows:

- 50 percent flaps
- Gear up
- ATCS operating
- Maximum power on all available engines
- Inoperative engine with propeller feathered
- Normal obstacle clearance speed (figure 3-17)

NOTE

The capability of the airplane to climb prior to reaching obstacle clearance speed is seriously reduced while the landing gear is retracting (19 seconds) and the propeller is being feathered.

Criteria for minimum rates of climb after takeoff are specified by the airplane operators. When such a criterion has been selected, figure 3-10 can be used to determine the maximum permissible takeoff weight.

Example.

GIVEN:

Field pressure altitude	4,000 feet
Takeoff factor	2.8
OAT	27 °C (Standard day +20 °C)
Gross weight	130,000 pounds
Required rate of climb	500 feet per minute
Drag index	18

FIND:

- Will three-engine climb capability limit the takeoff gross weight of 130,000 pounds?

PROCEDURE:

To find the takeoff gross weight permitted by three-engine climb capability, enter figure 3-10 with the takeoff factor of 2.8, move horizontally to the temperature line of Standard Day +20 °C, and then vertically to the intersection of this line with the 500 feet per minute rate of climb line and obtain the maximum permissible takeoff gross weight of 162,000 pounds. The airplane gross weight of 130,000 pounds is less than the three-engine climb gross weight limit of 162,000 pounds and, therefore, is not limited by the climb capability.

To find the takeoff gross weight limit for three-engine climb capability with external tanks on, use figure 3-10. Enter the chart from the right with a drag index of 18 (from Section 1) and proceed vertically to the 500 feet per minute rate of climb line. Next proceed to the left, following the guidelines to intersect the baseline. Then move horizontally to the left to intersect the vertical line extending up from the point of intersection of takeoff factor 2.8 and Standard Day +20 °C. The three-engine climb limited gross weight is then read as 160,000 pounds.

RUNWAY CONDITION READING AND RUNWAY SURFACE CONDITION.

Runway Condition Reading (RCR) is a value which relates the average braking effectiveness of the particular runway surface to the braking capability of the airplane when the depth of the

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runway contaminant is less than 3 mm. The measured RCR, therefore, becomes a factor in determining any performance which involves braking, such as critical field length and refusal speed.

RUNWAY CONDITION	ICAO REPORT	RCR
Dry	Good	23
Wet	Medium	12
Icy	Poor	05

Runway Surface Condition (RSC) is a value which relates to depth and type of runway covering such as water or slush, and is reported in tenths of an inch in depth (one inch is the equivalent of an RSC of 10). The surface covering affects both the acceleration and stopping performance of the airplane.

NOTE

For operation in loose, dry snow (snow that will drift in a 10-knot wind), enter charts with a depth of RSC equal to 1/3 actual depth. This factor is applicable only for depths of loose, dry snow up to 3 inches.

Note that only RCR corrections are used for runway contaminants less than 3 mm in depth, and only RSC corrections are used for contaminants greater than 3 mm in depth. Under average conditions the depth of the surface covering would vary widely in different locations on the runway, and it is preferable to plan the takeoff such that the lift-off point should have the least depth reported. The retarding force is a function of many variables such as tire pressure, density of covering, groundspeed, weight, and tread and spray pattern of the tire. Extreme care should be exercised in any slush takeoff.

APPLICATION OF WINDS TO TAKEOFF AND LANDING

TYPE OF WIND	HOW TO OBTAIN RUNWAY COMPONENTS	USE OF WIND COMPONENTS
HEADWIND (Effective wind parallel to the runway)	Enter crosswind chart with steady wind value	Always apply 100 percent of wind component when computing acceleration check time, or tire limit speed
		Apply 50 percent of component to brake limits and takeoff and landing distances
		Do not apply headwinds for climb-out flight path calculations.
TAILWIND (Effective wind parallel to the runway)	Enter crosswind chart with steady wind value plus the gust increment	Always apply 100 percent of wind component when computing acceleration check time or tire speed
		Apply 150 percent of component to brake limits, takeoff and landing distances
CROSSWIND (Effective wind across the runway)	Enter crosswind chart with steady wind value plus the gust increment	Check necessity of increased rotation and landing (threshold and touchdown) speeds
GUSTS	Gust increment equals reported wind in excess of steady wind value	Always increase rotation speed, obstacle clearance speed, approach speed, threshold speed, and touchdown speed by the full gust increment not to exceed 10 knots

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CROSSWIND CHART.

The Crosswind Chart (figure 3-11) presents runway (headwind or tailwind) and crosswind components in knots for wind directions of 0 to 90 degrees from the runway heading and for wind speeds up to 60 knots. Use the Crosswind Chart to determine the headwind or tailwind component value and the crosswind component value. Refer to the Application Of Winds To Takeoff And Landing table in this section for a discussion of wind corrections to performance data.

After determining the crosswind component value, establish whether the scheduled value for rotation speed (figure 3-17) falls within the caution area of the Crosswind Chart. This is accomplished by first locating the crosswind component value on the horizontal axis, then (referencing the right side vertical scale) proceeding vertically upward to the value for the scheduled rotation speed.

When the value for the rotation speed falls within the caution area, the rotation speed shall be increased until the recommended area of the chart is reached, or until the airspeed has been increased by a maximum of 10 knots. (Airspeed increases cannot exceed 10 knots.) After increasing the scheduled rotation speed, proceed horizontally to the right vertical axis and read the value for minimum rotation speed.

If rotation speed is to be increased for a wind gust increment (up to 10 knots), this increase may be sufficient to reach the recommended area of the chart. In this case locate the crosswind component on the horizontal axis then (referencing the right side vertical scale) proceed vertically upward to the value for the scheduled rotation speed plus the gust increment. If the speed has not been increased a full 10 knots and it falls in the caution area, increase the speed the remainder of the 10 knots allowed or until the recommended area is reached, then proceed horizontally to the right vertical axis and read the value for minimum rotation speed.

The takeoff charts provide corrections for the increased distance for the corresponding increase in rotation speed.

Refer to Propeller Crosswind Limitation in this section for limits with wind angles between 45 degrees and 315 degrees, and crosswind components greater than 15 knots.

Example.

GIVEN:

Takeoff runway	12
Wind	180 degrees at 32 knots
Rotation speed	107 KIAS

FIND:

- Crosswind component
- Runway component
- Whether takeoff is in the recommended zone at scheduled rotation speed

PROCEDURE:

Note the difference between runway heading and wind direction, and determine the runway wind angle to be 60 degrees (180 degrees – 120 degrees = 60 degrees). Find the intersection of the 60 degrees runway wind angle line and the 32 knot wind velocity line on the Crosswind chart, figure 3-11. Descend vertically from the point of intersection to the crosswind component scale and determine the crosswind component to be 27.5 knots. Move vertically to intersect the 107 knot rotation speed horizontal line, and determine that the takeoff will be in the CAUTION zone. Increase the rotation speed by moving vertically until out of the caution zone, not to exceed 10 knots. The new rotation speed is 110 KIAS. To find the increased takeoff distance due to increased rotation speed, see the paragraph titled Speed and Distance During Ground Run in this section.

PROPELLER CROSSWIND LIMITATION.

The propeller crosswind limitation is invoked when the crosswind component is between 15 and 35 knots and the wind direction is between 45 and 315 degrees relative to the runway. Takeoff is prohibited when the crosswind component is in excess of 35 knots in the above sector. Landings are not affected by this limitation.

The crosswind limited takeoff run must be initiated with a maximum indicated power level of 2500 horsepower until 35 knots airspeed is reached. At 35 knots airspeed the power levers

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are advanced to full takeoff power. This procedure results in a 200 feet penalty to all takeoff distance requirements. The 200 feet should be added to the distance obtained from all takeoff distance computations from this Flight Manual. The 200 feet should be subtracted from the runway distance available for computation of refusal speed.

MAXIMUM RECOMMENDED CROSSWIND FOR TAKEOFF.

Figure 3-12 presents the maximum recommended crosswind that the airplane can be subjected to on the ground with 50 percent flaps and maximum thrust on all four engines and still maintain directional control. Figure 3-12 presents maximum crosswind as a function of gross weight and RCR. The chart is based on the use of nosewheel steering, rudder control, a 5-degree crab angle, and a 3-degree bank into the crosswind with neither brakes nor asymmetric power applied.

Plots for actual wind angle/velocity in the Crosswind Chart, figure 3-11, that fall in the Prohibited For Take-Off area, always remain prohibited for takeoff. An actual wind angle/velocity plotted in the Crosswind Chart, figure 3-11, that does not fall in the prohibited area, and has a crosswind component greater than the maximum crosswind component value determined from figure 3-12, is not recommended for flight and is regarded the same as the Not Recommended area of the Crosswind Chart.

Example.

GIVEN:

Gross weight: 120,000 pounds

Rotation speed: 105 KIAS

Runway heading: 360 degrees

Reported wind: 050 degrees at 30 knots

RCR: 12

FIND:

- Maximum recommended crosswind component for takeoff
- Whether the airplane can take off in existing conditions

PROCEDURE:

Enter figure 3-12 at the bottom with the gross weight of 120,000 pounds, move up to intersect the RCR of 12, then left and read a maximum recommended crosswind component of 24.75 knots. Next, enter figure 3-11 at the intersection of the wind angle of 50 degrees and the wind speed of 30 knots. From this point move down and read the actual crosswind component of 23.0 knots. Since the actual crosswind component of 23.0 knots is less than the maximum crosswind component of 24.75 knots, the airplane may takeoff under these conditions.

CRITICAL FIELD LENGTH.

The critical field length is the total runway distance required to accelerate on all engines to critical engine failure speed, experience an engine failure, then continue the takeoff or stop within the same distance. It is used during takeoff planning, together with the climb-out data, to determine the maximum gross weight for a safe takeoff and climb-out. For a safe takeoff, the critical field length must be no greater than the length of runway available. Critical field length is determined from figure 3-13 by using takeoff factor, takeoff weight, and applying the corrections as required for wind, runway slope, anti-skid, drag, and increased rotation speed.

NOTE

> CNI software versions 8522921-314 and prior do not correct the critical field length for increased rotation speed. Use figure 3-13, sheet 4, to correct critical field length for increased rotation speed.

The critical field length can be adjusted to account for stopping without using reverse thrust, with three engines in ground idle and one propeller feathered, by increasing the charted critical field length by 5.0 percent.

Example.

GIVEN:

Desired gross weight	136,000 pounds
Reported wind	12 knots headwind
Runway length	5,000 feet
OAT	18 °C
Field pressure altitude	Sea level
Slope	0.4 percent uphill
Normal bleed	

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FIND:

- Critical field length
- Maximum takeoff weight as limited by critical field length

PROCEDURE:

Determine takeoff factor for 18 °C and sea level pressure altitude from figure 3-8 to be 1.1. Determine (uncorrected) critical field length for 136,000 pounds gross weight with a takeoff factor of 1.1 from figure 3-13, sheet 1, to be 3,500 feet. Correct the available field length of 3,500 feet for 6 knots of headwind (50 percent of reported wind), and 0.4 percent uphill slope in figure 3-13, sheet 2, to obtain a critical field length of 3,300 feet.

To find the maximum takeoff gross weight as limited by critical field length, enter figure 3-13, sheet 2, with the corrected runway length of 5,000 feet and work back through the chart applying corrections, slope, and wind to obtain an uncorrected field length of 5,200 feet. Next, enter sheet 1 at the right with 5,200 feet and move left to a point that intersects with a takeoff factor of 1.1 and determine that the maximum takeoff weight as limited by critical field length for the stated initial conditions is 164,000 pounds.

REFUSAL SPEED.

Refusal speed is based on runway available and is defined as the maximum speed to which the airplane can accelerate with engines at maximum power and then stop within the remainder of the runway available, with two engines (symmetrical power) in reverse, one engine in ground idle, one propeller feathered, and maximum anti-skid braking in a three-point attitude. Refusal speeds are presented in figure 3-14.

Refusal distance may be calculated based on a given refusal speed. The refusal distance is defined as the distance required to accelerate with engines at maximum power to the selected refusal speed and then stop with two engines (symmetrical) in reverse, one engine in ground idle, one propeller feathered, and maximum anti-skid braking. The refusal distance calculation also assumes that the aircraft is in the three-point ground attitude throughout the maneuver. Refusal distance may be determined from figure 3-14 as described in Example 2.

In the event of a critical engine failure, the options available are based on ground minimum control speed (V_{MCG}), refusal speed (V_{REF}), and critical engine failure speed (V_{CEF}). The following table can be used to determine the available option in the event of critical engine failure. The data is based on a critical engine failure occurring at critical engine failure speed.

If the refusal speed is greater than the brake energy limit speed, set refusal speed equal to brake energy limit speed.

ENGINE FAILURE AT CRITICAL ENGINE FAILURE SPEED AND:	TAKEOFF OR STOP PERMITTED	MAX EFFORT: TAKE-OFF COMMITTED IN REMAINING RUNWAY LENGTH	CANNOT TAKEOFF: MUST STOP IN RE-MAINING RUNWAY LENGTH
$V_{MCG} < V_{CEF} < V_{REF}$	X		
$V_{MCG} < V_{REF} < V_{CEF}$		x △1	
$V_{CEF} < V_{REF} = V_{MCG}$			X

Note
△1 Adequate obstruction clearance may not be available. See figure 3-1, figure 3-2, and figure 3-3.

As shown by the next example, the various corrections can reduce the refusal speed by significant amounts. It is therefore possible that an uncorrected refusal speed might be greater than rotation speed, but that corrections could reduce the refusal speed to a value less than rotation speed. It is imperative that all applicable corrections be applied to refusal speed prior to comparing the corrected refusal and rotation speeds to determine which will be used for refusal speed.

To calculate refusal speed without using reverse thrust, based on three engines in ground idle and one propeller feathered, enter the refusal speed chart (figure 3-14) with runway available less 5.0 percent.

Example 1.

GIVEN:

Gross weight: 145,000 pounds

Flaps: 50 percent

Normal bleed

Anti-skid: Operating

Takeoff factor: 2.7

Reported wind: 20 knots headwind

Runway length: 6,000 feet

RCR: 12

Slope: 0.4 percent uphill

FIND:

- Refusal speed

PROCEDURE:

Enter figure 3-14, sheet 1, with the takeoff factor of 2.7. Move right to the 6,000 foot runway available line, up to the 145,000 pound gross weight line, then right to read an uncorrected refusal speed of 111 KIAS. Enter sheet 2 with the uncorrected refusal speed of 111 KIAS. Move right to the baseline of the runway slope correction grid. Follow the guidelines to a runway slope of + 0.4 percent. Move right to the baseline of the refusal speed wind correction grid. Follow the guidelines to the + 10 knot (50 percent of reported wind) line, then move horizontally to the right to read a partially corrected refusal speed of 120 KIAS. Enter sheet 3 with a partially corrected refusal speed of 120 KIAS. Move right to the RCR baseline and follow the guidelines to the RCR of 12 and read the corrected refusal speed of 108 KIAS.

Example 2.

GIVEN:

Takeoff gross weight: 150,000 pounds

Flaps: 50 percent

Normal bleed

ATCS: Operating

Anti-Skid: Operating

Takeoff factor: 2.0

Reported wind: 10 knots headwind

Refusal speed: 120 KIAS (rotation speed)

RCR: 12

Slope: 1 percent uphill

FIND:

- Refusal Distance

PROCEDURE:

Enter figure 3-14, sheet 4, on the Corrected Indicated Airspeed axis (right side) with the refusal speed of 120 KIAS. There are no corrections for anti-skid or ATCS, so move left to a partially corrected indicated airspeed of 120 KIAS. Enter sheet 3 on the right side with a partially corrected indicated airspeed of 120 KIAS. Move horizontally to the left until intersecting the RCR of 12. Follow the guidelines to the RCR baseline and read a partially corrected indicated airspeed of 133 KIAS. Enter sheet 2 on the right side with a partially corrected indicated airspeed of 133 KIAS. Move horizontally to left until intersecting the +5 knot (50 percent of reported wind) line. Follow the guidelines to the wind baseline (128 KIAS). Move horizontally to the left until intersecting the +1 runway slope line. Follow the guidelines to the runway slope baseline and read an uncorrected indicated airspeed of 129 KIAS. Enter sheet 1 with an uncorrected indicated airspeed of 129 KIAS. Move horizontally to the left until intersecting a gross weight of 150,000 pounds. Move vertically until intersecting a takeoff factor of 2.0 and interpolate a refusal distance of 7,500 feet.

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CRITICAL ENGINE FAILURE SPEED.

Critical engine failure speed is based on critical field length and is obtained from figure 3-14. It is defined as that speed to which the airplane can accelerate, lose an engine, and then either continue the takeoff with the remaining engines or stop in the same total runway distance. The acceleration distance is based on all engines set on computed takeoff power with ATCS operative. Stopping distances are based on two engines (symmetrical power) in reverse thrust, one engine in ground idle, one propeller feathered, and maximum braking with anti-skid operative or inoperative.

The critical engine failure speed for stopping without using reverse thrust, with three engines in ground idle and one propeller feathered, is obtained by entering figure 3-14 with runway available less 5.0 percent.

Example.

GIVEN:

Takeoff gross weight: 140,000 pounds

Runway length: 6,000 feet

Reported wind: 20 knots headwind

OAT: 28 °C

Field pressure altitude: 2,000 feet

Runway slope: 1 percent uphill

Normal bleed

FIND:

- Critical engine failure speed

PROCEDURE:

Obtain a takeoff factor of 2.12 from figure 3-8. Now obtain a critical field length of 4,200 feet from figure 3-13 for the above conditions using the procedures outlined in the previous section. Enter the lower portion of figure 3-14, sheet 1, with the 2.12 takeoff factor, and, now using the field length guidelines as critical field lengths, move to the right to intercept the 4,200 foot line. Move upward to intersect the 140,000 pound takeoff gross weight line and read an uncorrected airspeed of 100 KIAS. Enter sheet 2 with 100 KIAS and correct for runway slope and wind. Ensure to use the wind correction grid identified for critical engine failure speed. Since there are no more corrections to be made, read a corrected critical engine failure speed of 100.5 KIAS.

BRAKE ENERGY LIMIT SPEED.

Takeoff brake energy limit speeds are shown in figure 3-15. Brake energy limit speed is defined as the maximum speed at which maximum anti-skid braking can be applied without exceeding the energy absorption limit of the brake system. Brake energy limit speeds are based on two engines (symmetrical power) in reverse thrust, one engine in ground idle, one propeller feathered, and maximum braking with anti-skid operative.

NOTE

The brake energy limit speeds are based on the brake temperature prior to taxi being equal to the ambient temperature.

NOTE

If critical engine failure speed is higher than brake energy limit speed, the takeoff gross weight must be reduced by the amount shown in figure 3-15 and the planned takeoff recomputed at the lower weight. If refusal speed is greater than brake energy limit speed, set refusal speed equal to brake energy limit speed.

Example.

GIVEN:

Gross weight: 155,000 pounds

Flaps: 50%

Normal bleed

Runway length: 9,000 feet

Field pressure altitude: 4,000 feet

OAT: 27 °C

Runway slope: – 1 percent (downhill)

Reported wind: – 5 knots (tailwind)

Critical engine failure speed (from figure 3-14): 112 KIAS

Refusal speed (from figure 3-14): 125 KIAS

FIND:

- Brake energy limit speed
- Correction to takeoff weight
- Corrected refusal speed

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PROCEDURE:

Enter figure 3-15 with the weight of 155,000 pounds and move vertically to intersect the 4,000 foot pressure altitude line. Move horizontally to the right to the temperature baseline. Follow the guidelines to correct for a temperature deviation of 20 °C. Read an uncorrected value of brake energy limit speed of 123.5 KIAS. Enter sheet 2 with this value and correct for slope and tailwind (use 150 percent of the reported wind). The corrected brake energy limit speed is 109 KIAS. The corrected brake energy limit speed is 3 KIAS less than the critical engine failure speed, therefore sheet 3 must be used to determine the weight reduction required. Enter sheet 3 with a ΔV of 3 KIAS. Move vertically to intersect the curve and read a weight reduction of 2,200 pounds. The planned takeoff weight should be reduced by 2,200 pounds and the performance data recomputed at the lower weight. Also note that the refusal speed for this example is greater than the brake energy limit speed. Therefore, the refusal speed should be reduced to the brake energy limit speed even if no reduction in takeoff weight is required for the planned takeoff conditions.

POWER LEVER TRANSITION LIMITATIONS.

If the power lever is moved from TAKEOFF to GND IDLE at an airspeed greater than 139 KTAS, there is the likelihood of producing propeller overspeeds which fall outside the generator frequency envelope. This will cause the generators to drop offline and result in a loss of the anti-skid system. This speed limit is presented in figure 3-16 in knots indicated airspeed (KIAS) as a function of pressure altitude and ambient temperature.

If the speed from figure 3-16 is less than the refusal speed, then this speed limitation becomes the refusal speed.

Example.

GIVEN:

Ambient temperature: 15 °C

Airfield pressure altitude: Sea level

FIND:

Maximum speed for throttle transition from takeoff power to ground idle

PROCEDURE:

Enter the lower axis of figure 3-16 at 15 °C, move up to the sea level pressure altitude line, and then left to obtain a throttle transition limit speed of 138 KIAS.

TAKEOFF SPEEDS.

All operational speeds used during takeoff and climb-out have been established to provide adequate margins above stall speed, to guarantee comfortable flight characteristics, and to provide tolerance for gusts and for the maneuvering which may be required to follow the takeoff flight path.

All normal takeoff performance data have been computed using the scheduled rotation and obstacle clearance speeds presented in figure 3-17. Maximum effort performance data has been computed using the scheduled rotation and obstacle clearance speeds presented in figure 3-18.

ROTATION AND OBSTACLE CLEARANCE SPEEDS.

The flaps setting for normal and maximum effort takeoff is 50 percent. Normal rotation and obstacle clearance speeds are presented in figure 3-17. The normal rotation speed is scheduled to ensure that the takeoff (liftoff) speed is greater than the air minimum control speed and the obstacle clearance speed is at least 1.2 times the power off stall speed. The flap retraction speeds for normal and maximum effort takeoffs with 50% flaps are presented in figure 3-47.

Maximum effort rotation and obstacle clearance speeds are presented in figure 3-18. Minimum control speeds are not considered for maximum effort takeoff speed schedules.

NOTE

> The airspeed at which flap retraction is initiated should never be less than the minimum flap retraction speed defined in figure 3-47.

The airplane must be rotated to the proper attitude in order to capture the correct obstacle clearance speed and attain the charted takeoff distance. Takeoff pitch attitude schedules for normal and maximum effort operations are presented in figure 3-19. Use the normal pitch attitude schedule for a 0% flaps takeoff.

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Zero flaps rotation and obstacle clearance speeds are presented in figure 3-20. The zero flaps rotation speed is scheduled to ensure that the takeoff (liftoff) speed is greater than the air minimum control speed and the obstacle clearance speed is at least 1.2 times the power off stall speed.

Example.

GIVEN:

Gross weight: 155,000 pounds

Runway altitude: 4,000 feet

Takeoff (50 percent) flaps

Standard day

FIND:

- Normal rotation speed
- Obstacle clearance speed
- Target takeoff pitch attitude

PROCEDURE:

From figure 3-8, obtain a takeoff factor of 2.0, then enter the bottom of figure 3-17 at takeoff factor of 2.0 and proceed upward, intersecting the 155,000 pound guide lines. At the intersection of the appropriate line, read across to obtain a rotation speed of 122.5 KIAS and an obstacle speed of 137.5 KIAS.

Enter figure 3-19 at 155,000 pounds and move vertically until you intersect the normal takeoff line. Read a required pitch attitude of 7 degrees.

MINIMUM CONTROL SPEEDS.

GROUND MINIMUM CONTROL SPEEDS.

Ground minimum control speed (V_{MCG}) is the minimum airspeed during the takeoff ground run at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane using the rudder control alone and take off safely using normal piloting skill while maintaining takeoff power on the remaining engines.

The ground minimum control speeds are based on the following conditions and restrictions:

- No. 1 engine failed with the propeller auto-feathered.
- Maximum takeoff power on all remaining engines.
- ATCS operating.
- Maximum rudder deflection limited by 150 pounds of rudder pedal force or maximum rudder control surface deflection.
- Flaps set at 50 percent.
- Minimum takeoff weight.
- No nosewheel steering required.
- Maximum lateral deviation from initial runway track of 30 feet.

One-engine-inoperative ground minimum control speeds are shown in figure 3-21.

The most critical condition for directional control is with the No. 1 engine failed at light gross weight. An ATCS DEGRADED ACAWS message means that ATCS protection may not be provided, and the takeoff planning is no longer accurate.

NOTE

> Refer to the table under the Refusal Speed paragraph for ground minimum control speed, refusal speed, and critical engine failure speed relationships.

Example.

OAT	18 ºC
Airfield pressure altitude	Sea level

FIND:

- Ground minimum control speed

PROCEDURE:

Enter the lower axis of figure 3-21 at 18 ºC, move up to sea level field pressure altitude, and then move left to obtain a ground minimum control speed value of 88 KIAS.

AUTOMATIC THRUST CONTROL SYSTEM.

The airplane is equipped with an Automatic Thrust Control System (ATCS) to reduce the asymmetric thrust moment in the event of an outboard engine failure. The ATCS senses the failure through the FADEC system and reduces the shaft horsepower on the opposite outboard engine to 50 percent of that at maximum takeoff power if airspeed is below a scheduled value. This permits lower minimum control speeds than those achievable with the opposite engine continuing to operate at maximum takeoff thrust. The ATCS linearly restores the thrust over a 40-knot range from 50% to 100% of the maximum takeoff thrust as airspeed is increased.

The speed below which ATCS will reduce is the minimum power restoration speed V_{MPR} (see figure 3-22). V_{MPR} is a function of temperature and pressure altitude.

AUTOMATIC THRUST CONTROL SYSTEM INOPERATIVE.

If the ATCS is inoperative or degraded, do not operate the outboard engines above 50 percent of the takeoff power as defined in figure 3-6 below the minimum power restoration speed (refer to Minimum Power Restoration Speed in this section) as defined in figure 3-22.

WARNING

It is imperative that the limitations and procedures for ATCS inoperative listed in the Nonstandard Operations section of the basic flight manual be observed and followed. Takeoffs with ATCS inoperative should only be performed when authorized by the appropriate authority.

NOTE

Engine out performance assumes the additional drag of the inoperable engine, feathered propeller, and additional trim are included in the baseline drag level.

MINIMUM POWER RESTORATION SPEED.

In the event of an outboard engine failure, the ATCS senses the loss of the engine and rapidly retards the torque on the opposing outboard engine. This reduces the rudder control requirement by reducing the thrust asymmetry on the airplane. ATCS reduces the opposing engine's torque to 50 percent of the maximum takeoff torque. The ATCS torque schedule is a function of airspeed, altitude and air temperature.

As the airspeed increases, the rudder effectiveness increases and engine power is gradually and automatically restored on the operating outboard engine by the ATCS. The airspeed at which the engine is restored to full power is known as the minimum power restoration speed. These speeds are given in figure 3-22. These speeds represent the minimum airspeeds at which full power may be restored to the opposing outboard engine and the pilot still maintain control of the airplane.

WARNING

If the ATCS is degraded or inoperative, do not operate the outboard engines above 50 percent of the maximum takeoff power at airspeeds below the minimum power restoration speed.

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Example.

OAT	15 °C
Airfield pressure altitude	4,000 feet

FIND:

- V_{MPR}

PROCEDURE:

Enter the bottom of figure 3-22 at 15 °C and move vertically to intersect the 4,000 foot pressure altitude line. Read to the left to obtain the minimum power restoration speed of 139 KIAS.

AIR MINIMUM CONTROL SPEEDS.

The yawing moment with a failed engine increases with decreasing airspeed. Similarly, the rolling moment caused by the asymmetric propeller slip stream also increases with decreasing airspeed. The aerodynamic controls that must balance these asymmetries, however, become less effective with decreasing airspeed. There is therefore a minimum speed at which rudder and aileron control inputs can balance the yawing and rolling moments caused by the engine-out condition and the aircraft still maintain a straight course.

One-Engine-Inoperative Air Minimum Control Speeds.

The air minimum control speed is defined as the minimum airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative and maintain straight flight with an angle of bank not to exceed 5 degrees. The conditions that determine air minimum control speed are as follows:

- ATCS operational
- No. 1 engine failed with the propeller auto-feathered.
- Takeoff power commanded on all remaining engines.
- Maximum rudder deflection limited by 150 pounds of rudder pedal force or maximum rudder control surface deflection.
- Zero rudder trim.
- Minimum flying weight.
- A bank angle ≤5 degrees away from the failed engine. (As required to maintain heading.)

One-engine-inoperative air minimum control speeds are shown in figure 3-23 for 50 percent flaps and figure 3-24 for flaps up.

The air minimum control speeds with the No. 1 engine inoperative, are defined by the directional control limits and are higher than the lateral-control-limited air minimum control speeds achieved with the No. 4 engine inoperative.

Bank angle has a powerful influence on the air minimum control speed. The importance of maintaining bank away from the failed engine is illustrated in figure 3-4. Attempting to maintain a wings-level attitude at light gross weights with one engine inoperative increases V_{MCA} by 23 KIAS with the flaps up and by 43 KIAS with the flaps set at 50 percent. For example, at Sea Level, Standard Day conditions, the flaps up V_{MCA} would increase from 136 KIAS to 159 KIAS and the 50% flaps V_{MCA} would increase from 94 KIAS to 137 KIAS. The increase in V_{MCA} with the wings level is much larger for 50 percent flaps because the power restoration on the operating outboard engine scheduled by the ATCS has a larger effect at the lower airspeeds.

Rudder hydraulic boost pressure directly affects the amount of rudder deflection available for a given airspeed and rudder pedal force and thus has a powerful influence on the minimum control speeds. The rudder boost assembly is powered by both the boost and utility hydraulic systems at pressures determined by the flap lever position. As shown in the table below, a change in the flap lever position or a loss in pressure of either of these two systems can significantly affect the air minimum control speeds.

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EFFECT OF RUDDER BOOST PRESSURE AND FLAP LEVER POSITION ON ONE-ENGINE INOPERATIVE MINIMUM CONTROL SPEED V_{MCA}

Flap Deflection	Flap Lever Position ⚠1	Hydraulic System Status	Cockpit Rudder Boost Pressure Reading ⚠2 Utility	Booster	Air Minimum Control Speed Increase (KIAS)
Flaps Up	Less than 10%	Both Systems Operational	1,300	1,300	0
		One Boost System Inoperative	1,300 or 0	0 or 1,300	+36
	20% - 100%	Both Boost System Operational	3,000	3,000	−16
		One Boost System Inoperative	3,000 or 0	0 or 3,000	−7
Flaps 50%	20 - 100%	Both Systems Operational	3,000	3,000	0
		One Boost System Inoperative	3,000 or 0	0 or 3,000	+20

Note
⚠1 10 to 20 percent represents tolerance band within which pressure reading is indeterminate.
⚠2 Nominal, refer to the Limitations Section of the applicable Flight Manual for limitations.

With the flaps retracted and the flap lever handle in the normal operating position, the utility and booster hydraulic systems each provide 1,300 pounds of hydraulic pressure to power the rudder. Loss of either of these systems results in a 36 KIAS increase in the flaps up V_{MCA}. With the flaps deflected 50 percent and the flap lever handle in the normal operating position, each hydraulic system provides 3,000 pounds of hydraulic pressure to power the rudder. Loss of a hydraulic system results in a 20 KIAS increase in the V_{MCA} speeds.

To obtain high rudder boost with the flaps in the retracted position, the appropriate circuit breaker is pulled to disengage the flaps from the flap lever and the flap lever is then repositioned to correspond to a flap deflection of higher than 20 percent. The increased rudder boost pressure which results from this action yields lower V_{MCA} speeds than those of figure 3-24, even with one hydraulic system inoperative.

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BANK ANGLE EFFECT ON THREE OR TWO ENGINE AIR MINIMUM CONTROL SPEED

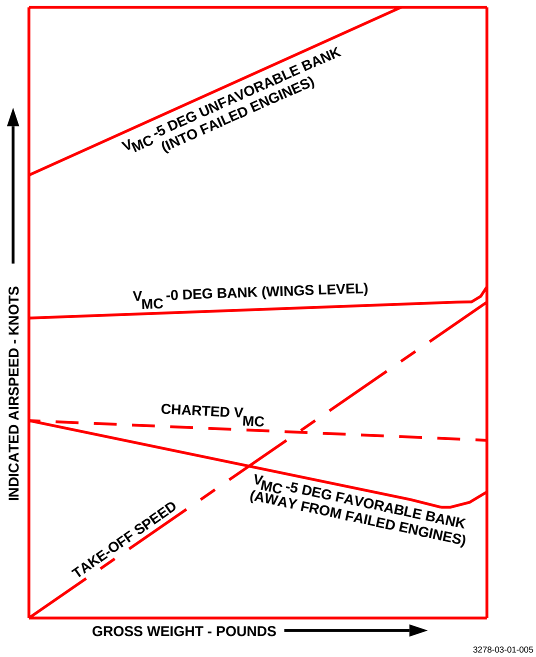

Figure 3-4.

Two-Engine Inoperative Air Minimum Control Speed.

The two-engine-inoperative air minimum control speed (V_{MCA2}) is defined as the minimum airspeed at which, when the second critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with the two critical engines still inoperative and maintain straight flight with an angle of bank not to exceed 5 degrees. The conditions which determine V_{MCA2} are as follows:

- No. 1 and No. 2 engines failed and feathered.
- Takeoff power on the remaining engines.
- Maximum rudder deflection limited by 150 pounds of rudder pedal force or maximum rudder surface deflection.
- Flaps set at 50 percent.
- Minimum flying weight.
- A bank angle of 5 degrees away from failed engine.
- Rudder trim required for a 3-degree approach with three engines operating.
- Gear down.

Two-engine-inoperative air minimum control speeds are shown in figure 3-25.

Directional control is most critical with the No. 1 and No. 2 engines inoperative. The speeds presented in figure 3-25 reflect this configuration and must be used in mission planning.

Bank angle has a powerful influence on the two-engine-inoperative air minimum control speeds. The importance of maintaining 5 degrees of bank away from the failed engines is shown in figure 3-4. Attempting to maintain a wings-level attitude with the flaps set at 50 percent and two engines inoperative increases V_{MCA2} by 24 KIAS at light gross weights.

As stated above, the V_{MCA2} speeds presented in figure 3-25 represent engines No. 1 and No. 2 failed and feathered. This is the critical condition for two engines inoperative because of the reduced hydraulic pressure available to the rudder. If an inboard propeller is windmilling at 100 percent, the hydraulic pressure provided

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by the associated pump more than compensates for the increased asymmetric drag.

STALL SPEED.

Power off stall calibrated airspeeds (KCAS) for 0, 50, and 100% flaps and bank angles of 0, 15, 30, and 45 degrees are shown in figure 3-26, figure 3-27, and figure 3-28. Figure 3-26 provides a means of computing flaps up power off stall speeds at a 60 degree bank angle. Maximum lift and stall speed are defined by stick pusher activation.

NOTE

> The charted stall airspeeds are defined as the calibrated airspeeds at which the stick pusher activates and are derived from flight test data. These data are based on test boom calibrated airspeeds, a 1 knot/second entry rate, flight idle power, the center of gravity at the forward limit, and the worst case system and installation tolerances of the stick pusher system. The indicated airspeed at which the stick pusher activates should not be higher than the charted calibrated stall speed but may be as much as 12 knots lower due to variations in entry rate, power setting, center of gravity, stick pusher system installation, and airspeed system accuracy near stall speed.

Example.

GIVEN:

Drag index	Zero
Gross weight	125,000 pounds
Bank angle	45 degrees
Flaps	50 percent

FIND:

- Airplane stall speed in KCAS

PROCEDURE:

Enter figure 3-27 with the gross weight of 125,000 pounds. Move vertically to the 45 degree bank angle line, then left to read a stall airspeed of 123 KCAS.

TAKEOFF DISTANCE.

TAKEOFF PITCH ATTITUDE SCHEDULE.

In order to achieve the charted performance, it is required to attain the pitch attitude given in figure 3-19. Use the normal pitch attitude schedule for a 0% flaps takeoff.

NORMAL FOUR-ENGINE TAKEOFF DISTANCE.

Takeoff distance is defined as the total distance required to accelerate from brake release to the takeoff speed, liftoff and climb to a 50-foot obstacle. Takeoff ground run is defined as the distance required to accelerate from brake release to liftoff. The normal four-engine takeoff distance and ground run with 50 percent flaps is presented in figure 3-29. The takeoff distances in figure 3-29 are based on the scheduled rotation and obstacle clearance speeds.

When computing the four-engine takeoff distance over a 50-foot obstacle, use sheets 1, 2, 3, and 4 for 50 percent flaps and sheets 1, 2, 3, and 5 for a flaps up takeoff. Note that sheets 2, 4, and 5 each include a wind velocity correction grid and sheets 3, 4, and 5 each include drag index and ATCS correction grids. When computing the takeoff distance over a 50-foot obstacle, only apply the wind, drag index, and ATCS corrections from sheet 4 or 5 as required.

Example.

GIVEN:

Takeoff factor: 2.0

Flaps: 50 percent

Gross weight: 140,000 pounds

Runway slope: 1 percent uphill

Reported wind: 5 knots headwind

RSC and drag index: 0

FIND:

- Ground roll
- Total distance to a 50-foot obstacle

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PROCEDURE:

Enter figure 3-29, sheet 1, at a takeoff factor of 2 and proceed upward to intersect the 140,000 pound gross weight line. Read across to obtain an uncorrected ground roll distance of 3,600 feet. Enter sheet 2 at this value and follow the guide lines to correct for slope and wind (use 50 percent of reported wind). The corrected ground run is 3,700 feet.

Enter sheet 4 with a ground run of 3,850 feet (corrected for runway slope only) and follow the guidelines to correct for obstacle height and wind. The corrected takeoff distance over a 50-foot obstacle is 5,400 feet.

FLAPS UP TAKEOFF DISTANCE.

Flaps up takeoff distances are computed from figure 3-29, sheets 3 and 5, which correct the 50 percent flap data determined from sheets 1 and 2 of figure 3-29. Flaps up rotation and obstacle speeds are obtained from figure 3-20.

NOTE

Refer to the Nonstandard Operations section of the basic flight manual for 0% flap takeoff procedures.

THREE-ENGINE TAKEOFF.

WARNING

It is imperative that the limitations and procedures for three-engine ferry operations listed in the Non-Standard Operations section of the basic flight manual be observed and followed, since the loss of an additional engine after liftoff and prior to reaching two-engine inoperative air minimum control speed results in a hazardous situation. Three-engine takeoffs should only be performed when authorized by the appropriate authority.

MINIMUM FIELD LENGTH FOR THREE-ENGINE TAKEOFF.

The Minimum Field Length for Three-Engine Takeoff chart (figure 3-30) is provided for use during three-engine ferry operations.

Minimum field length for three-engine takeoff as shown in figure 3-30 is defined as the greater of:

a. Distance required to accelerate from brake release on three engines to rotation speed, become airborne, and climb to 50 feet, times a factor of 1.15.

b. Distance to accelerate on three engines to rotation speed, then execute an abort, and stop based on two engines in reverse, one propeller windmilling, and maximum anti-skid braking.

The rotation speed for either of the preceding cases is the charted speed given in figure 3-17 or the one engine inoperative minimum air control speed in figure 3-23, whichever is greater.

Example.

GIVEN:

Takeoff factor: 1.50

Gross weight: 110,000 pounds

Runway slope: 2 percent uphill

Reported wind: 20 knots headwind

Drag index: 0

FIND:

- Minimum field length for three-engine takeoff

PROCEDURE:

From figure 3-30, sheet 1, obtain an uncorrected field length of 5,100 feet. Enter figure 3-30, sheet 2, with this value and correct for the + 2 percent runway slope and + 10 knot wind (50 percent of the reported value). The corrected minimum field length is 5,300 feet.

THREE-ENGINE TAKEOFF DISTANCE.

The three-engine takeoff distance chart (figure 3-31) is provided for use during three-engine operations. The three-engine takeoff distances are based upon takeoff factors obtained from figure 3-8 for normal bleed.

No correction grids for RSC, RCR, flap settings, or ATCS inoperative are provided, since three-engine takeoffs are restricted to dry hard surface runways with a 50 percent flap setting and ATCS operable. Note that sheets 2 and 3 of figure 3-31 each include a wind velocity and drag index correction grid. When computing

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the takeoff distance over a 50-foot obstacle, only apply the wind and drag index corrections from sheet 3.

Example.

GIVEN:

Takeoff factor: 1.50 000

Gross weight: 110,000 pounds

Runway slope: 2 percent uphill

Reported winds: 20 knots headwind

Drag index: 50

FIND:

- Three-engine takeoff ground run
- Total distance from brake release to a height of 50 feet

PROCEDURE:

Enter figure 3-31, sheet 1, with the takeoff factor of 1.50 and move vertically to the 110,000 pound line. Read an uncorrected ground roll of 3,100 feet. Enter figure 3-31, sheet 2, with the 3,100 feet and correct for the + 2 percent slope, 10 knots headwind (50 percent of the reported value), and drag index. The corrected ground run is 3,100 feet.

Enter sheet 3 with a ground run of 3,550 feet (corrected for runway slope only) and follow the guidelines to correct for obstacle height, a 10-knot headwind (50 percent of the reported value), and a drag index of 50. The corrected three-engine takeoff distance over a 50-foot obstacle is 4,500 feet.

MAXIMUM EFFORT TAKEOFF.

WARNING

Maximum effort operations result in takeoff speeds which may be less than air minimum control speed and should be performed only when authorized by appropriate authority.

The maximum effort takeoff utilizes the maximum takeoff performance available. The maximum effort takeoff performance in this manual is based on the following criteria:

- 50 percent flap setting.
- Engine stabilized at maximum power prior to brake release.
- A hard-surfaced, paved runway.
- Rotate at the specific maximum effort rotation speed given in figure 3-18.
- Takeoff pitch attitude from figure 3-19.
- Capture obstacle clearance speed as given in figure 3-18.
- Disregarding minimum control speeds.

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKEOFF.

Minimum field length for maximum effort takeoff, shown in figure 3-32, is defined as that length of runway which is required to accelerate to decision (refusal) speed, experience an engine failure, and stop or continue acceleration to maximum effort takeoff speed in the remaining runway. If an engine failure occurs at or above refusal speed, the airplane can accelerate to the computed maximum effort takeoff speed, but this speed does not ensure adequate stall margin with only three engines operating and the resulting reduced lift on one wing. This reduced lift, the relationship at this point to air minimum control speed, and the probable necessity for retarding power on the symmetrically operating engine to maintain control combine to make it highly unlikely that a successful takeoff can be made. The probability of a successful takeoff depends on where in the takeoff run an engine failure occurs. If rotation speed is below V_{MCA} and runway length is available, increase rotation speed to V_{MCA}. The charted MFLMETO distance can be adjusted for increased rotation speed using figure 3-32, sheet 4.

WARNING

If an engine failure occurs at or below refusal speed, the takeoff must be aborted.

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WARNING

If an engine failure occurs immediately after rotation speed, immediate action is required to lower the nose to control airspeed. If below V_{MCA}, the opposite outboard power lever may have to be reduced below the ATCS scheduled HP. Serious consideration should be given to executing a stop based on terrain, overrun, obstacle, etc. Because of the many variables, the decision to abort or to attempt a takeoff must remain with the pilot.

WARNING

If an engine failure occurs after rotation speed, do not attempt a maximum effort lift-off. Reduce pitch attitude and increase airspeed as much as possible, obtaining air minimum control speed if possible, before a lift-off is attempted.

NOTE

CNI software versions 8522921-314 and prior do not correct the minimum field length for maximum effort takeoff for increased rotation speed. Use figure 3-32, sheet 4, to correct critical field length for increased rotation speed.

Example.

GIVEN:

Takeoff factor: 1.15

Gross weight: 130,000 pounds

Runway slope: + 2 percent uphill

Reported wind: – 5 knots tailwind

RCR: 12

FIND:

- Minimum field length for maximum effort takeoff

PROCEDURE:

Enter figure 3-32, sheet 1, at a takeoff factor of 1.15 and proceed upward to intersect the 130,000 pound gross weight line. Read across to obtain an uncorrected minimum field length of 1,960 feet. Enter figure 3-32, sheet 2, at this value and follow the guide lines to correct for slope and wind 7.5 knots (150 percent of reported wind), to obtain a semi-corrected minimum field length of 2,317 feet. Enter figure 3-32, sheet 3, with this value and follow guide lines to read a corrected minimum field length of 2,900 feet.

MAXIMUM EFFORT TAKEOFF DISTANCE.

The maximum effort takeoff distance shown in figure 3-33 is defined as the distance required to accelerate from brake release to the takeoff speed, liftoff and climb to a 50 foot height. Note that sheets 2 and 3 include a wind velocity and drag index correction grid. When computing the takeoff distance over a 50-foot obstacle, only apply the wind and drag index corrections from sheet 3.

Example.

GIVEN:

Takeoff factor: 2.00

Gross weight: 140,000 pounds

Runway slope: + 1 percent uphill

Reported wind: + 5 knots headwind

RSC and drag index: 0

FIND:

- Maximum effort takeoff ground run
- Maximum effort takeoff distance over a 50-foot obstacle

PROCEDURE:

Enter figure 3-33, sheet 1, at a takeoff factor of 2.0 and proceed upward to intersect the 140,000 pound gross weight line. Read across to obtain an uncorrected ground roll distance of 2,190 feet. Enter figure 3-33, sheet 2, at this value and follow the guide lines to correct for slope and wind (50 percent of reported wind) to obtain the corrected ground run of 2,250 feet.

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Enter sheet 3 with a ground run of 2,350 feet (corrected for runway slope only) and follow the guidelines to correct for obstacle height and a 2.5 knot headwind (50 percent of the reported value). The corrected maximum effort takeoff distance over a 50-foot obstacle is 3,650 feet.

ACCELERATION CHECK TIME DURING TAKEOFF GROUND RUN.

The takeoff performance as shown on the charts can be realized only if normal acceleration is attained. Dragging brakes, excess flap deflection, runway contamination, low power output, and similar factors will reduce the rate of acceleration. The Acceleration Check Time charts (figure 3-34) provide the time normally required to accelerate on four or three-engines, respectively, to a given indicated airspeed. The acceleration check should be made between brake release and either 120, 110, 100, 90, 80, 70, or 60 knots. Use the highest of these speeds which will not exceed refusal speed – 10 knots rounded down to the nearest 10 knot. A 3-knot tolerance is applied to the check speed to determine the minimum acceptable airspeed. The charts also show the effects of power setting, wind, runway slope, and drag index on acceleration time. To obtain the true time, a correction grid for altitude (SMOE) is provided in figure 1-6.

Four-engine takeoff acceleration check time is shown in figure 3-34. Three-engine takeoff acceleration check time is given in figure 3-35.

Example.

GIVEN:

4 engines operating

Takeoff factor: 2.0

Gross weight: 140,000 pounds

Runway slope: 1 percent uphill

Winds: 5 knots headwind

$1/\sqrt{\sigma}$: 1.10

Drag Index: 0

Refusal speed: 112 KIAS

Check speed: 100 KIAS

FIND:

- True acceleration time to 100 KIAS

PROCEDURE:

Enter figure 3-34, sheet 1, at a takeoff factor of 2 and proceed across to intersect the 140,000 pound gross weight line. Proceed down to intersect the 100 KIAS line. Read across to obtain an uncorrected check time of 21.5 seconds. Enter figure 3-34, sheet 2, at this value and follow the guide lines to correct for wind, runway slope, $1/\sqrt{\sigma}$, and drag index. The corrected check time is 24.0 seconds.

SPEED AND DISTANCE DURING GROUND RUN.

The four-engine speed and distance during takeoff ground run chart (figure 3-36), provides a means for determining the speed at any point along the four-engine takeoff ground run. Similar three-engine data are given in figure 3-37. Enter these charts with the no wind ground run and rotation speed. Draw a line parallel to the acceleration guide lines through the point at which the ground run and rotation speed intersect.

This line now represents the speed and distance at any point along the takeoff roll.

Example.

GIVEN:

4 engines operating

Rotation speed: 110 KIAS

No wind takeoff ground run: 3,500 feet

FIND:

- Indicated airspeed at a ground distance of 2,000 feet
- Increase in ground run distance if rotation speed is increased by 10 KIAS

PROCEDURE:

Enter figure 3-36 with 3,500 feet and move horizontally to intersect with the vertical 110 KIAS line. At this point, draw a line parallel to the acceleration guide line. Enter the chart with 2,000 feet and move horizontally to the line drawn parallel to the acceleration guide line, then vertically down and read 87 KIAS.

To find the increase in ground run for a 10 KIAS increase in takeoff speed, enter figure 3-36 with the new takeoff speed of 120 KIAS (110 + 10). Move up to the line drawn parallel to the guide lines, then left to read a total ground run distance of 4,350 feet. The

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increased ground run due to the 10 KIAS increase in takeoff speed is found to be 850 feet (4,350 – 3,500 feet).

CLIMB-OUT FLIGHT PATH.

The climb-out flight path charts provide a means of determining the distance required from brake release to clear a given obstacle height. The climb-out flight path charts should not be used with a tailwind. Winds have a strong effect on climb gradient. In order to have predictive value, the wind component along the climb-out flight path must be a headwind or zero. Figure 3-39 and figure 3-42 provide climb-out flight path data for 4-engine 50 percent flap normal and maximum effort operations, respectively. Climb-out flight path data for 3-engine, 50 percent flap operation is provided by figure 3-45. These charts show distance and height from brake release as a function of the climb-out flight path profile (figure 3-5) and a given climb-out factor. Climb-out factor, which is based on takeoff factor, temperature deviation from standard day, and airplane gross weight, is provided in figure 3-38 and figure 3-41 for 4-engine normal and maximum effort operation and figure 3-44 for 3-engine operation.

NOTE

> For normal operations, planning a takeoff and climb-out over an obstacle should be done on the basis of 3-engine performance to allow for engine failure.

The 4-engine climb-out flight path is based on 4-engine acceleration to lift off at the normal takeoff speed and acceleration to the obstacle clearance speed at or prior to the 50 foot obstacle height. Landing gear retraction is initiated 3 seconds after lift off. Takeoff pitch attitude is maintained while the airplane accelerates to the flap retraction speed (figure 3-47). Initiate flap retraction at the flap retraction speed while reducing pitch attitude as required to facilitate acceleration to the best climb speed. (Figure 3-47.)

The 4-engine maximum effort climb-out flight path is based on 4-engine acceleration to lift off at the maximum effort takeoff speed and acceleration to the maximum effort obstacle clearance speed at or prior to the 50 foot obstacle height. Landing gear retraction is initiated 3 seconds after lift off. Takeoff pitch attitude is maintained while the airplane accelerates to the flap retraction speed (figure 3-47). Initiate flap retraction at the flap retraction speed while reducing pitch attitude as required to facilitate acceleration to the best climb speed. (Figure 3-47.)

The 3-engine climb-out flight path is based on 4-engine acceleration to the critical engine failure speed and 3-engine acceleration thereafter. Rotation occurs at the scheduled normal rotation speed and the normal obstacle clearance speed is captured at or prior to the 50-foot obstacle height. Landing gear retraction is initiated 3 seconds after lift off. Reduce the pitch attitude/rate of climb to allow the airplane to accelerate to the flap retraction speed (figure 3-47). Initiate flap retraction at the flap retraction speed while reducing pitch attitude as required to facilitate acceleration to the flaps up safety speed. (Figure 3-47.) Continue to accelerate to best climb speed (figure 3-47), and hold the best climb speed until obstacles are cleared. Once the obstacles are cleared, accelerate to the enroute climb speed (figure 4-5).

NOTE

> Refer to the basic flight manual for flap retraction procedures.

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CLIMB OUT FLIGHT PATH PROFILE

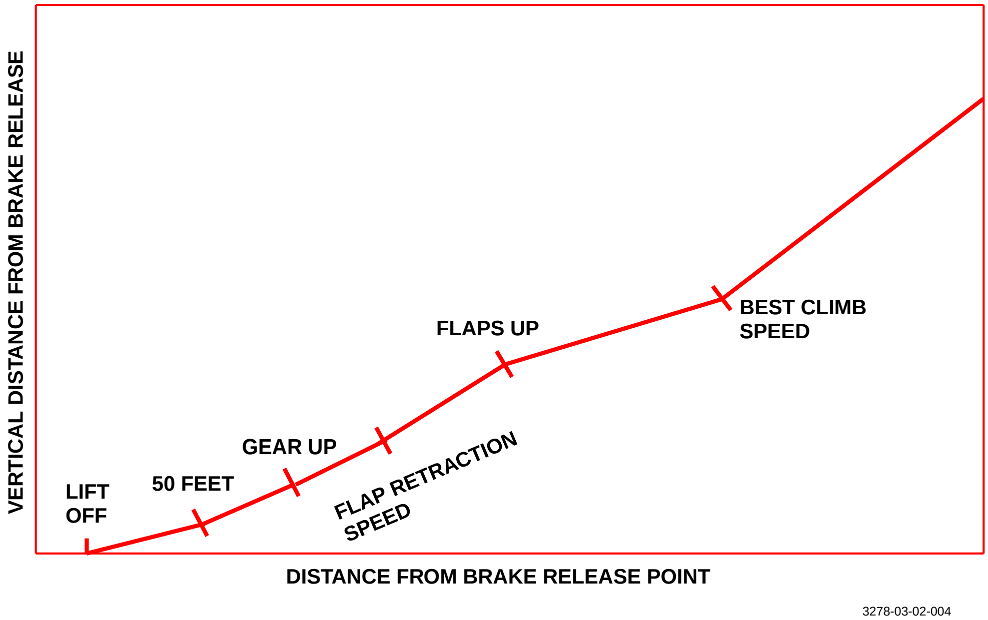

Figure 3-5.

CORRECTIONS TO CLIMB-OUT FLIGHT PATH DATA.

The effect drag has on climb-out performance is defined by the variant configuration charts (figure 3-40, 3-43, and 3-46). These charts may be used in two ways. First, the charts may be entered at the bottom with the horizontal distance to the obstacle, move vertically to the given drag index, and then move horizontally to the left to determine the actual horizontal distance an airplane with the given drag index must travel to attain the same height as an airplane with zero drag index.

The charts may also be used to determine the effective obstacle distance for a given drag index. Enter on the variant scale (vertical axis) with the actual obstacle distance, move horizontally to the right to the given drag index, then down to the zero drag index scale and read the effective horizontal distance to the obstacle. This effective horizontal distance should be used to evaluate the obstacle clearance capability with a drag index.

Corrections to the climb-out flight path due to runway slope, RSC, or RCR must also be considered. For other than dry runway conditions or with an uphill slope, ground roll is extended, resulting in reduced inflight distance to the obstacle. For this case it is necessary, before entering the chart, to decrease the known distance from brake release to the obstacle by the difference between the actual ground roll (corrected for existing RSC, RCR, and slope) and the ground roll for dry, level runway. This distance is the critical field length in the 3-engine case, and the normal takeoff ground roll in the 4-engine case. The RCR factor does not affect the 4-engine climb-out, but does affect the 3-engine climb-out. In determining corrected takeoff distance for climb-out flight path, do not apply a headwind correction but always apply tailwind.

FOUR-ENGINE CLIMB-OUT.

Example 1.

GIVEN:

Takeoff factor: 2.50

Temperature deviation: 0 °C

Gross weight: 155,000 pounds

Obstacle: 1,600 feet high, 3.62 nautical miles from brake release

Flaps: 50 percent

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Drag index: 100

FIND:

- Climb-out factor
- Height of airplane at the obstacle distance of 3.62 nautical miles
- Maximum of gross weight at which the airplane can clear an obstacle

PROCEDURE:

Enter figure 3-38 with the takeoff factor of 2.50 and a temperature deviation of 0 °C, move right to the gross weight of 155,000 pounds, then down and read a climb-out factor of 169.

To find airplane height at the obstacle distance, the effective obstacle distance for the drag index of + 100 must first be determined. To do this, enter figure 3-40, sheet 2, on the variant scale with 21,995 feet (3.62 × 6,076 = 21,995), move right to the + 100 drag index line, then down to read an effective distance to the obstacle of 20,000 feet. Enter figure 3-39, sheet 2, with the effective obstacle distance of 20,000 feet, move up to the climb-out factor of 169, then left and find the airplane height at the obstacle to be 890 feet. The airplane will not clear the obstacle at the given gross weight.

To find the maximum gross weight at which the airplane will clear the obstacle, enter figure 3-39, sheet 2, with the effective obstacle distance of 20,000 feet. Move up to the obstacle height of 1,600 feet and interpolate a climb-out factor of 148. Now enter figure 3-38 with that climb-out factor of 148, and the takeoff factor of 2.50, and a temperature deviation of 0 °C. At the intersection of these lines, interpolate a gross weight of 136,000 pounds.

Example 2.

GIVEN:

Maximum effort takeoff

Takeoff factor: 1.50

Temperature deviation: +30 °C

Gross weight: 125,000 pounds

Obstacle: 200 feet high, 5,500 feet from brake release

Dry level runway

FIND:

- Height of airplane 5,500 feet from brake release

PROCEDURE:

First find the 4-engine climb-out factor by entering figure 3-41 with the takeoff factor of 1.50. Move right and up the temperature correction curve to +30 °C. Continue moving right to the 125,000-pound gross weight line, then down and read the climb-out factor of 132. Now enter figure 3-42, sheet 2, with the obstacle distance of 5,500 feet, move up to intersect the climb-out factor of 132, then left and read a height of 525 feet. The airplane will clear the obstacle at the given gross weight.

THREE-ENGINE CLIMB-OUT.

The 3-Engine Climb-Out Factor (figure 3-44) and the 3-Engine Climb-Out Flight Path (figure 3-45) charts are used in the same manner as the four-engine data.

GIVEN:

Takeoff factor: 1.0

Gross weight: 140,000 pounds

Climb-out factor: 140

Flaps: 50 percent

Runway slope: 2 percent uphill

RCR: 12

Engine failure at critical engine failure speed

FIND:

- Height at 15,000 feet from brake release

PROCEDURE:

Determine the critical field length corrected for runway slope and RCR to be 4,550 feet from figure 3-13. Determine the uncorrected critical field length portion from figure 3-13 to be 3,660 feet. The increase in takeoff ground run for the given conditions is 4,550 - 3,660 or 890 feet. The obstacle distance must be reduced by the increase in takeoff ground run when using the climb-out flight path chart. Enter the 3-engine climb-out flight path chart (figure 3-45) with the adjusted obstacle distance of 14,110 feet (15,000 - 890). Move vertically to a climb-out factor of 140 then move horizontally to the left and read a vertical distance (airplane height) of 475 feet.

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER REQUIRED FOR TAKE-OFF

4 ENGINES NORMAL BLEED

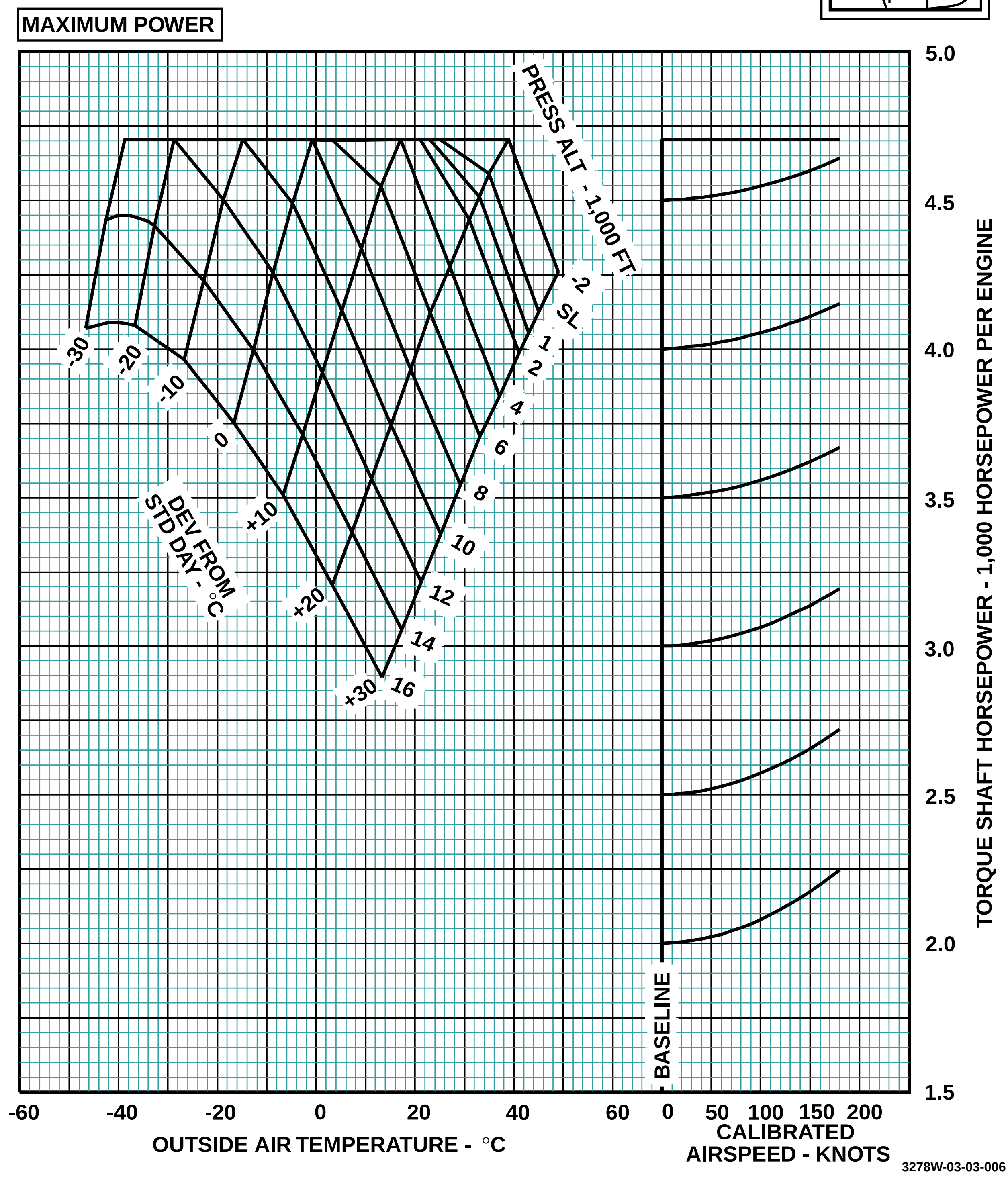


Figure 3-6.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER REQUIRED FOR TAKE-OFF

4 ENGINES ALL BLEED

MAXIMUM POWER

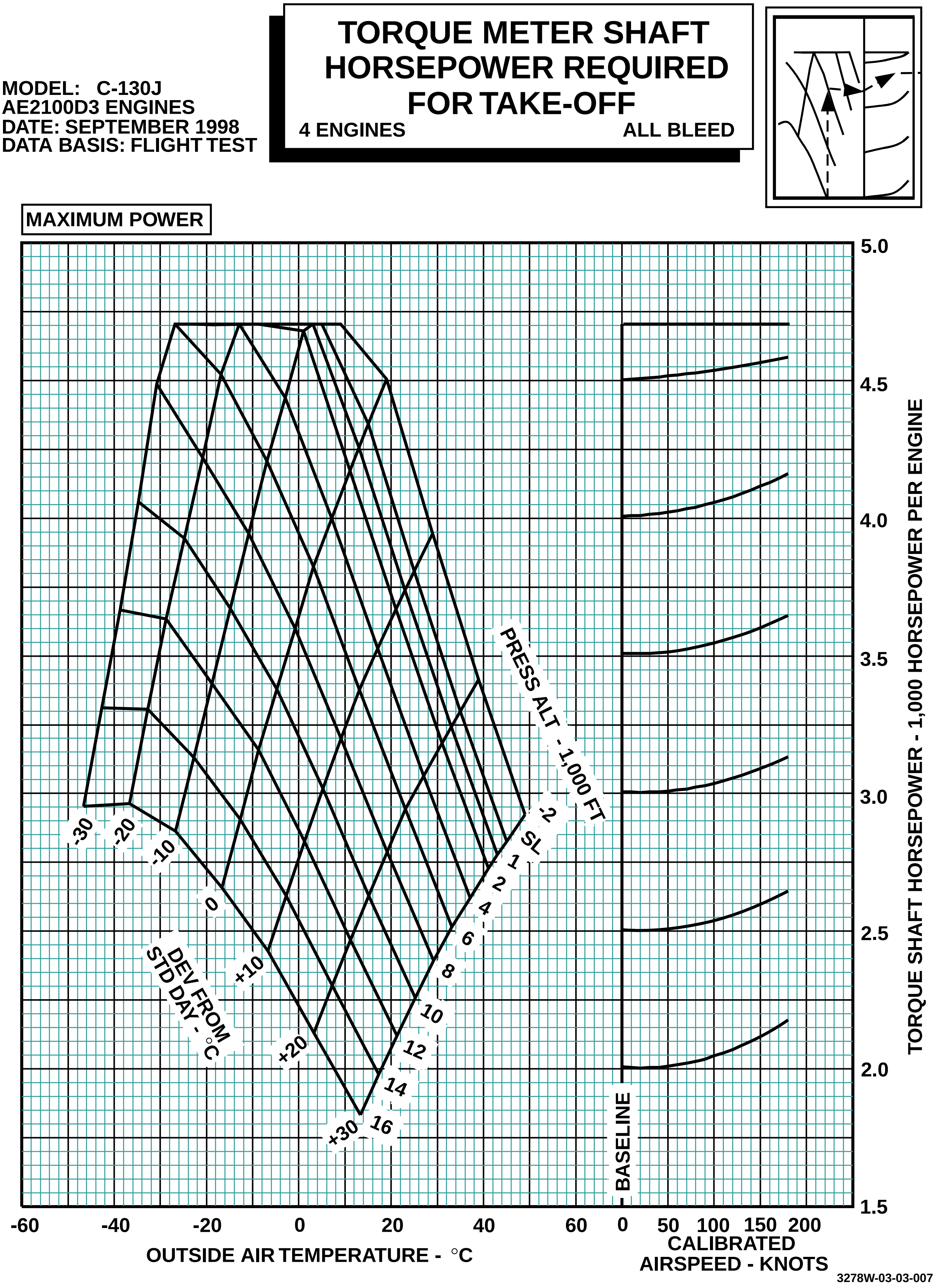


Figure 3-7.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF FACTOR

NORMAL BLEED

NOTE: FOR TAKE-OFF WITH ENGINE ANTI-ICE ON, USE NORMAL BLEED TAKE-OFF FACTOR IN SHADED AREA, OTHERWISE USE ALL BLEED CHART

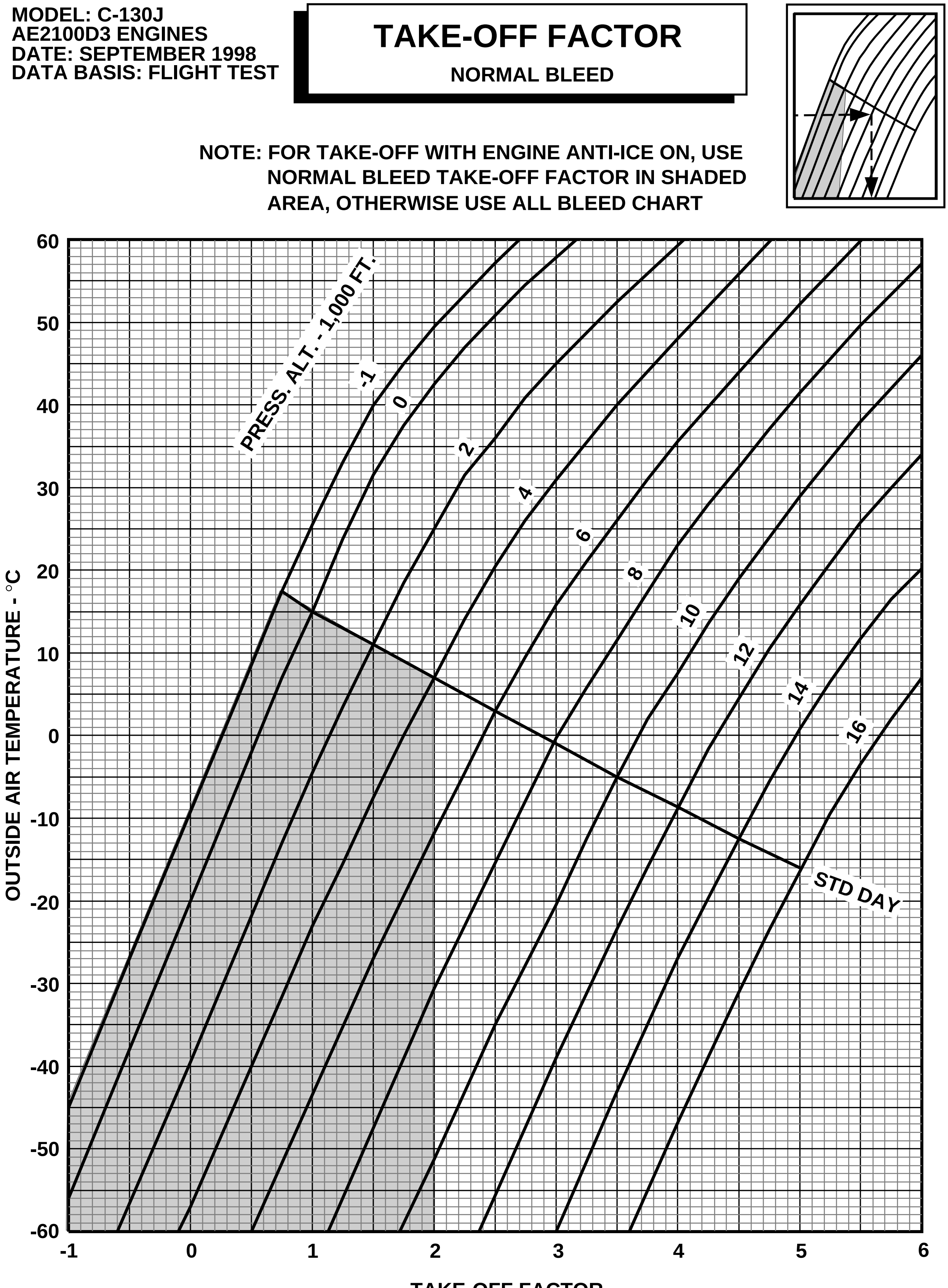


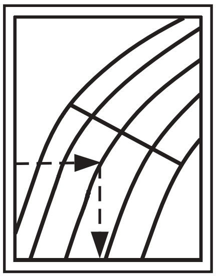
Figure 3-8.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF FACTOR

ALL BLEED



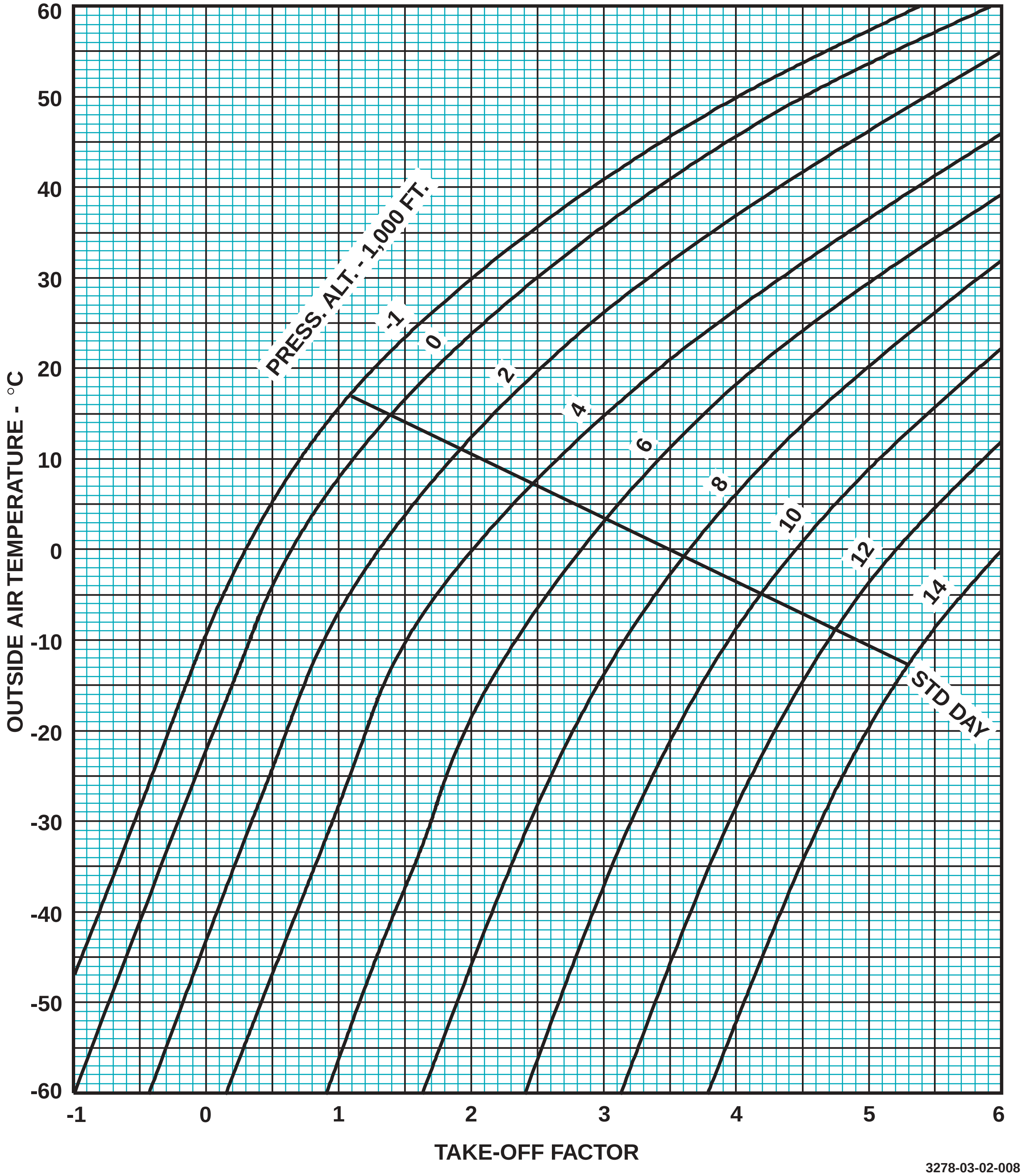


Figure 3-9.

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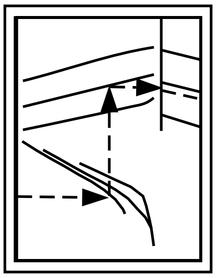
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF GROSS WEIGHT LIMITED BY THREE ENGINE CLIMB PERFORMANCE

GEAR UP 50 PERCENT FLAPS



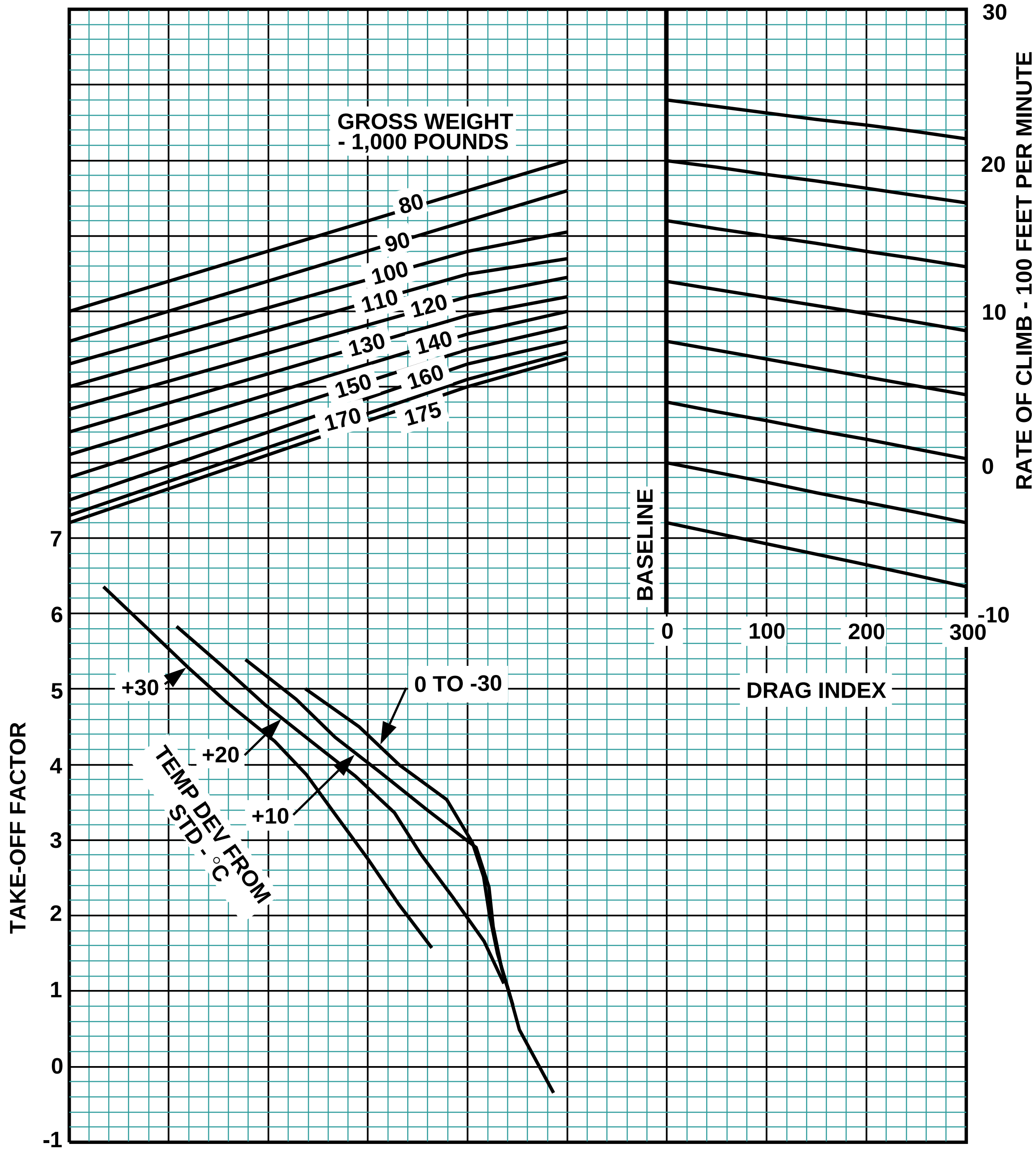
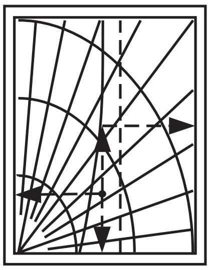


Figure 3-10.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

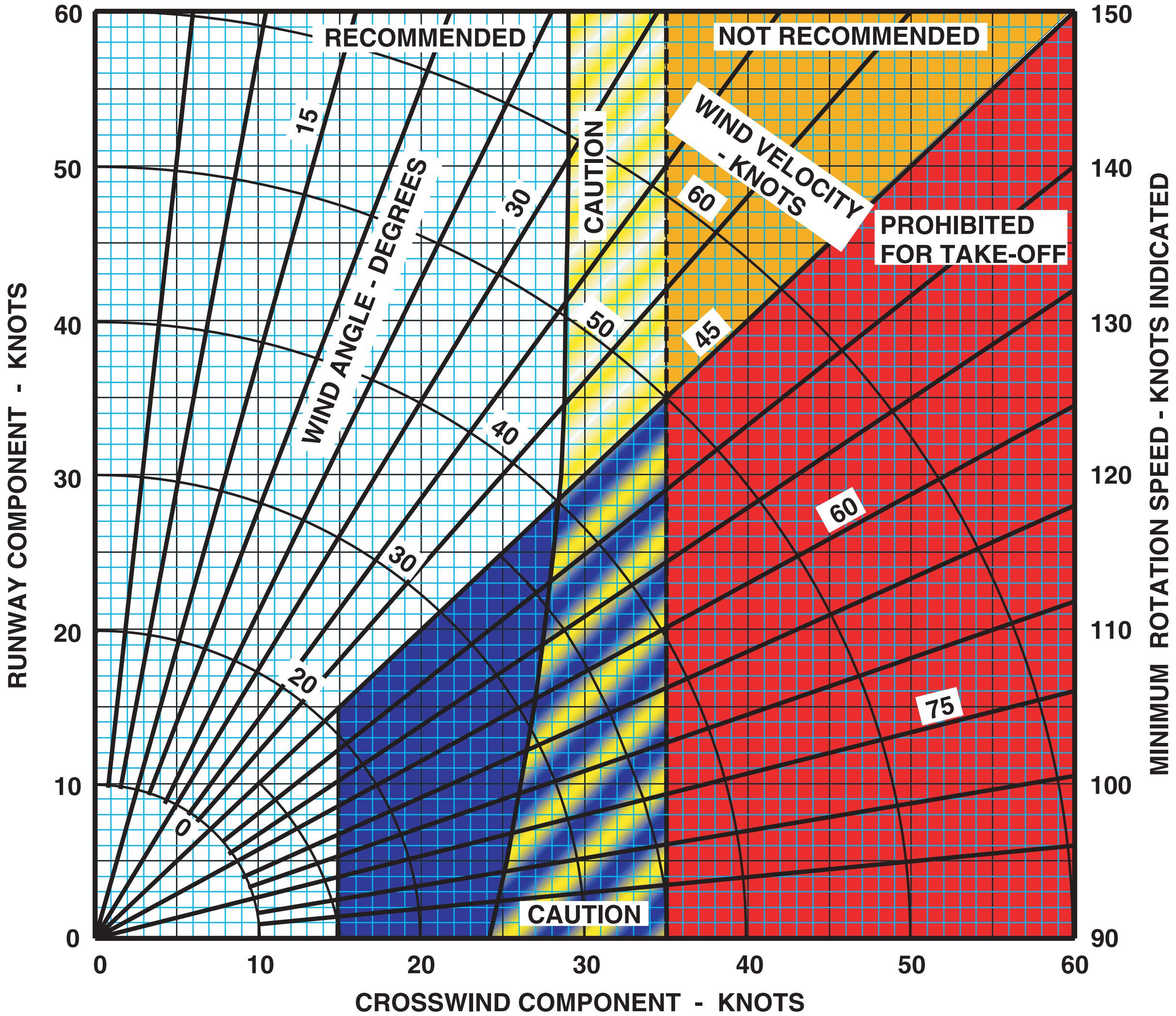
MODEL: C-130J
AE2100D3 ENGINES
DATE: MARCH 1998
DATA BASIS: FLIGHT TEST

CROSSWIND CHART
TAKEOFF



NOTE

THE MAXIMUM ALLOWABLE INCREASE IN ROTATION SPEED IS 10 KNOTS. RECOMPUTE TAKEOFF GROUND RUN WHEN ROTATION SPEED IS INCREASED.



POWER RESTRICTED TO 2500 HORSEPOWER WHEN LESS THAN 35 KNOTS AIRSPEED FOR WIND ANGLES BETWEEN 45° AND 315° AND CROSSWIND COMPONENTS BETWEEN 15 AND 35 KNOTS. SEE PARAGRAPH TITLED "PROPELLER CROSSWIND LIMITATION" IN THIS SECTION FOR THE EFFECT ON TAKEOFF DISTANCE.

3278-03-07-011

Figure 3-11.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MAXIMUM RECOMMENDED CROSSWIND FOR TAKE-OFF

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

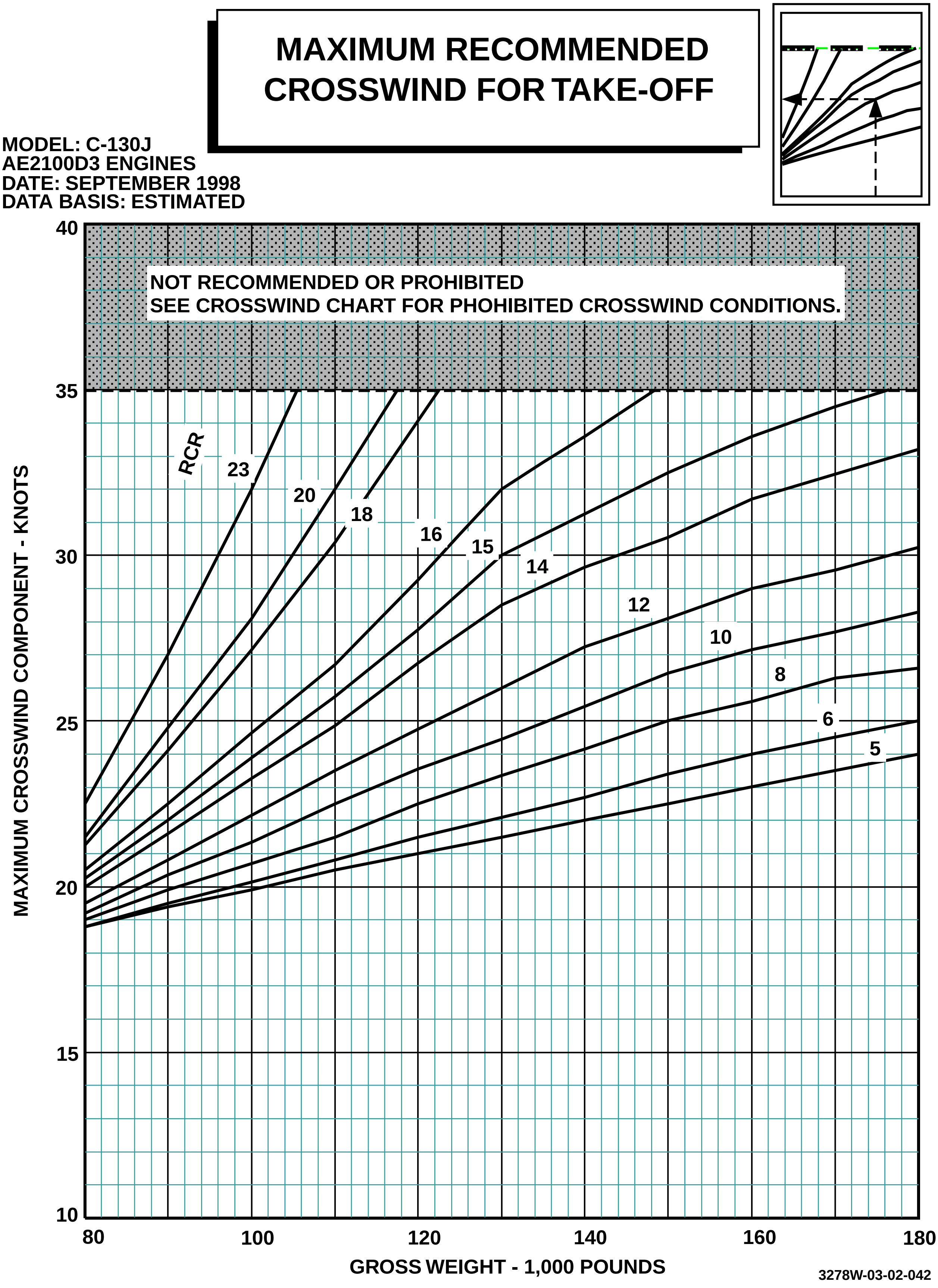


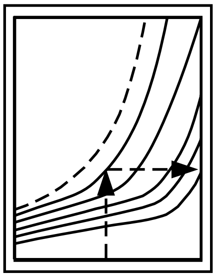
Figure 3-12.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

CRITICAL FIELD LENGTH

4 ENGINES



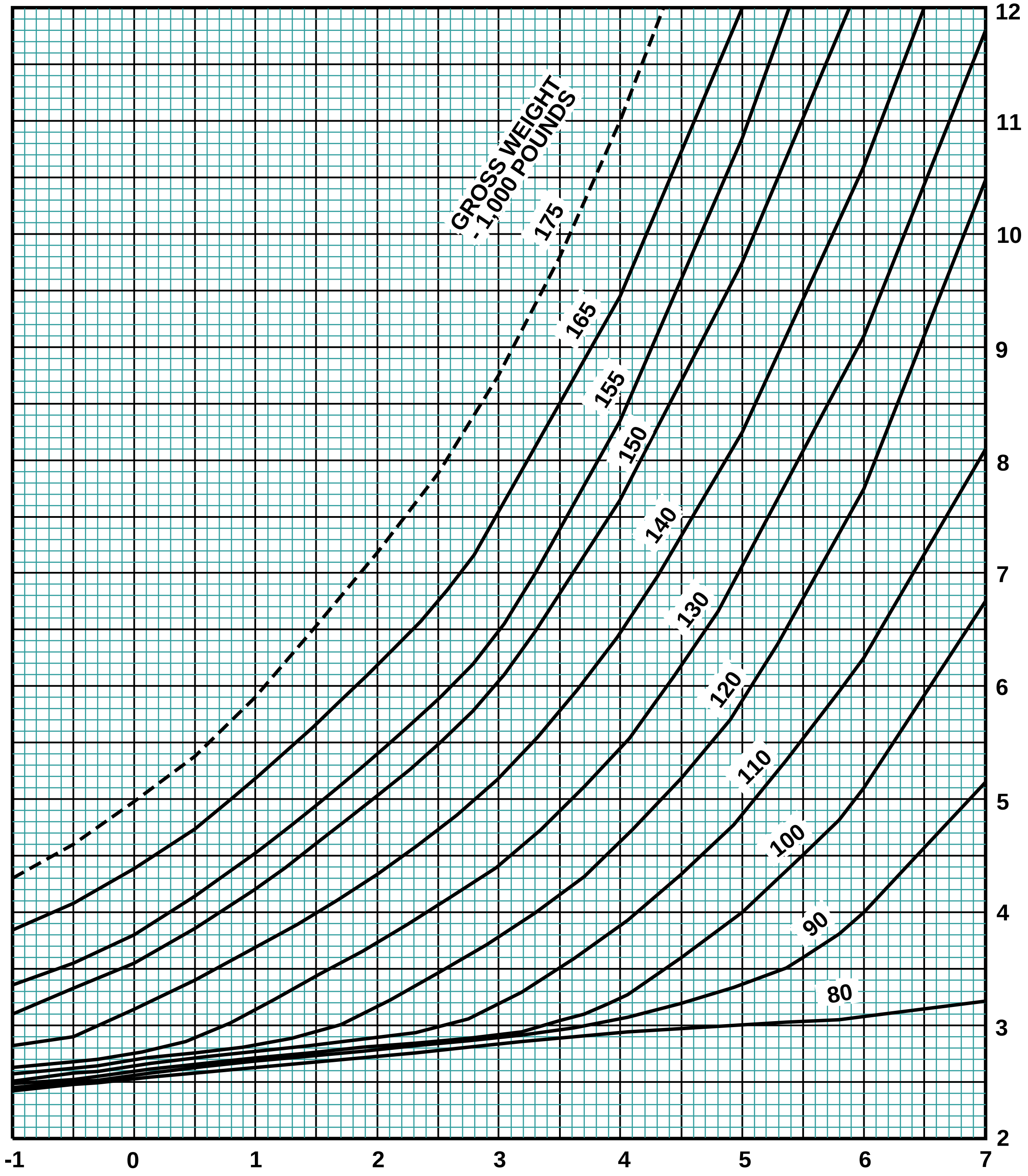


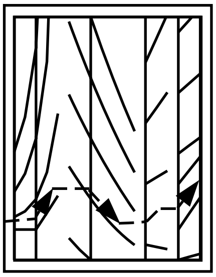
Figure 3-13. (Sheet 1 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL-C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRITICAL FIELD LENGTH

4 ENGINES



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

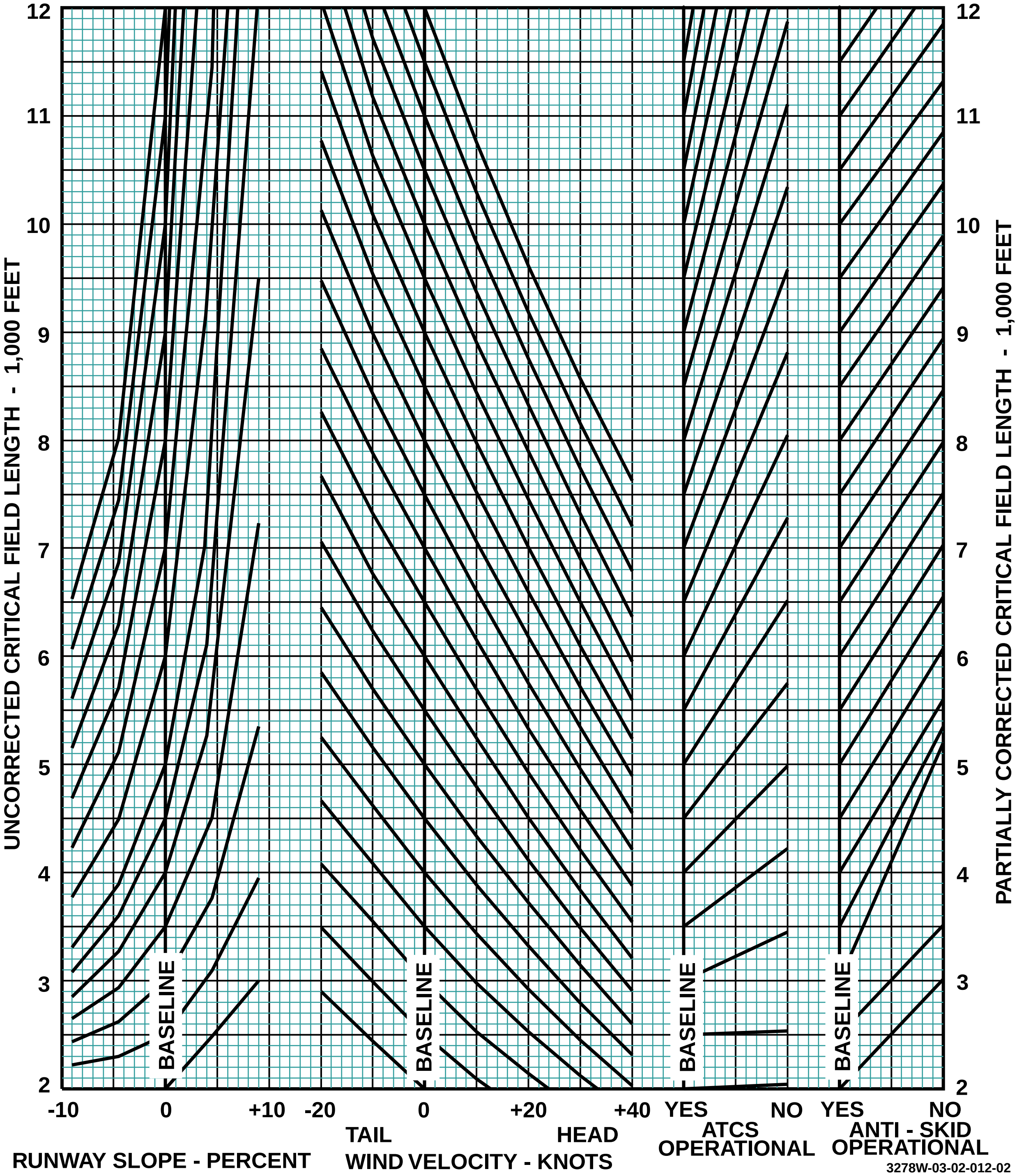


Figure 3-13. (Sheet 2 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL-C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRITICAL FIELD LENGTH

4 ENGINES

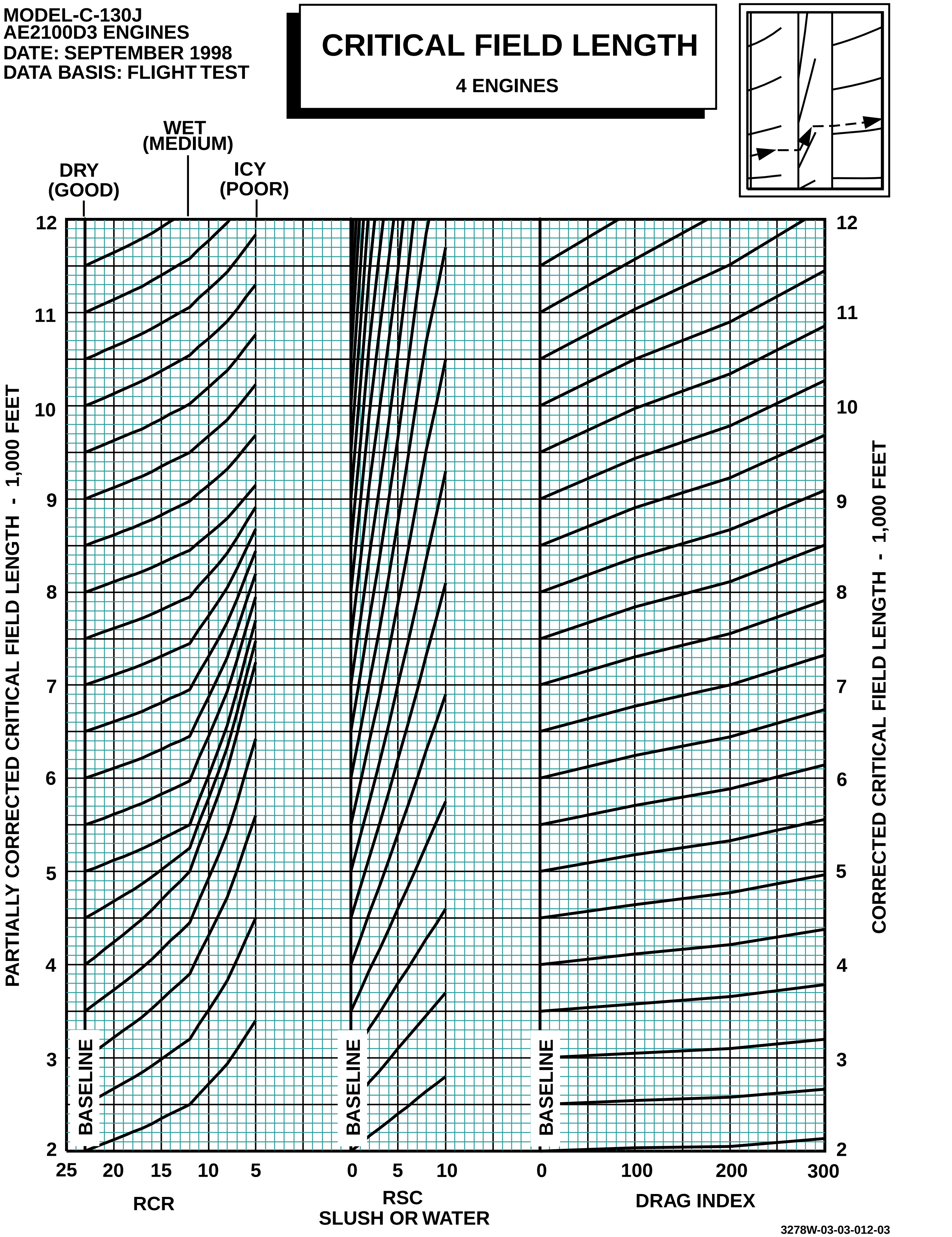


Figure 3-13. (Sheet 3 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

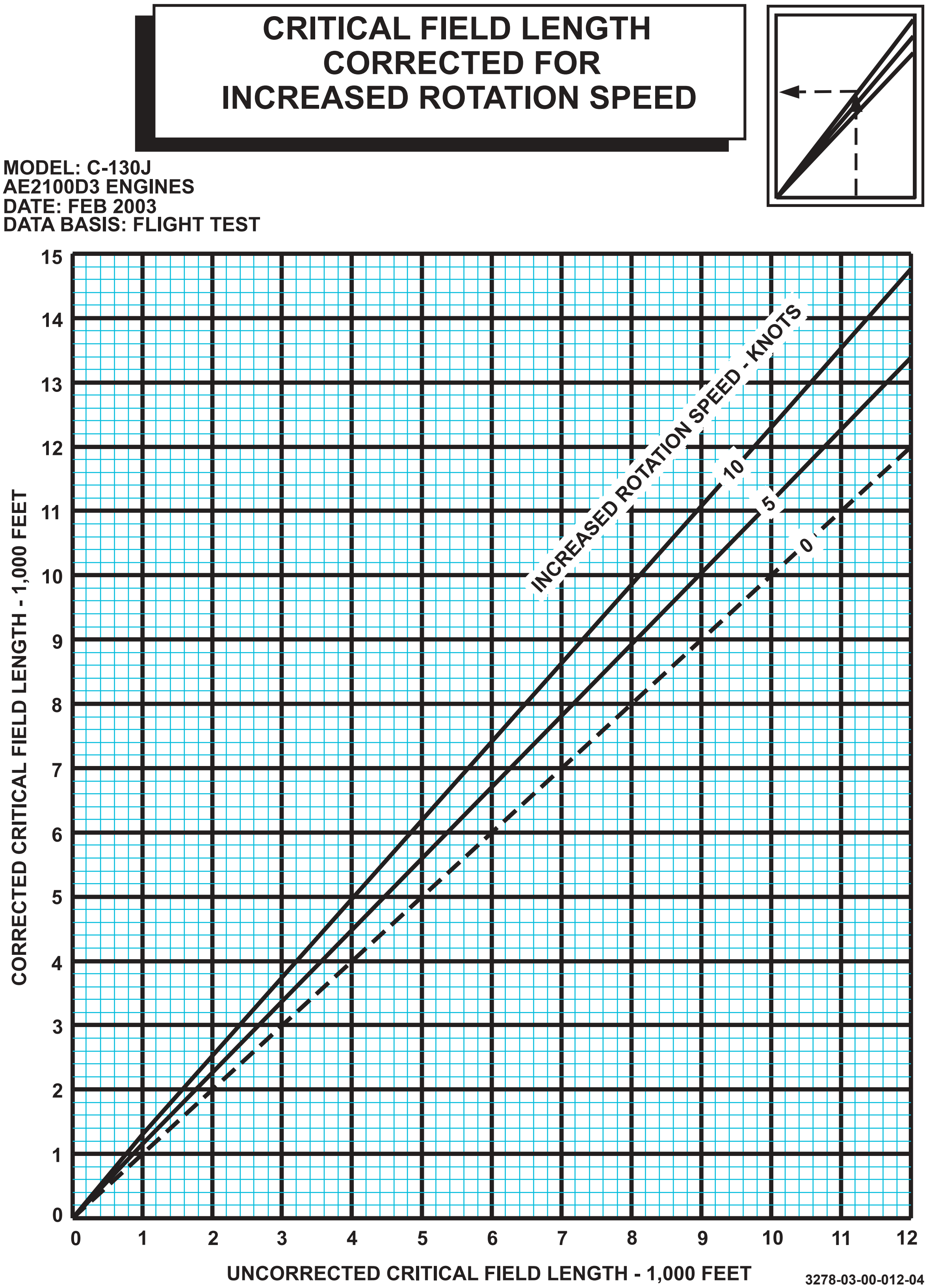


Figure 3-13. (Sheet 4 of 4)

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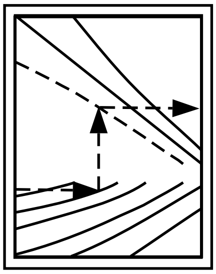
REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

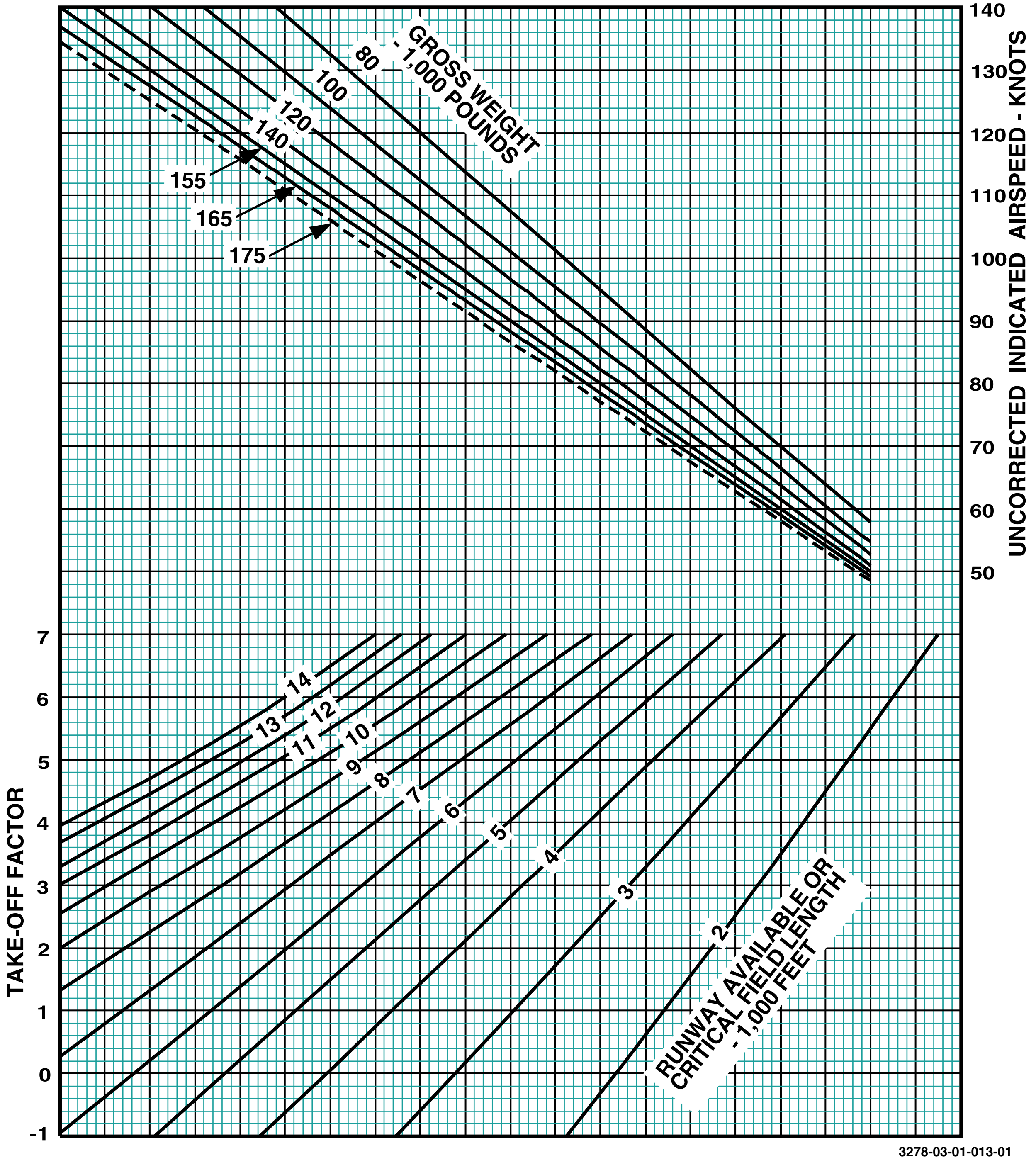


Figure 3-14. (Sheet 1 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

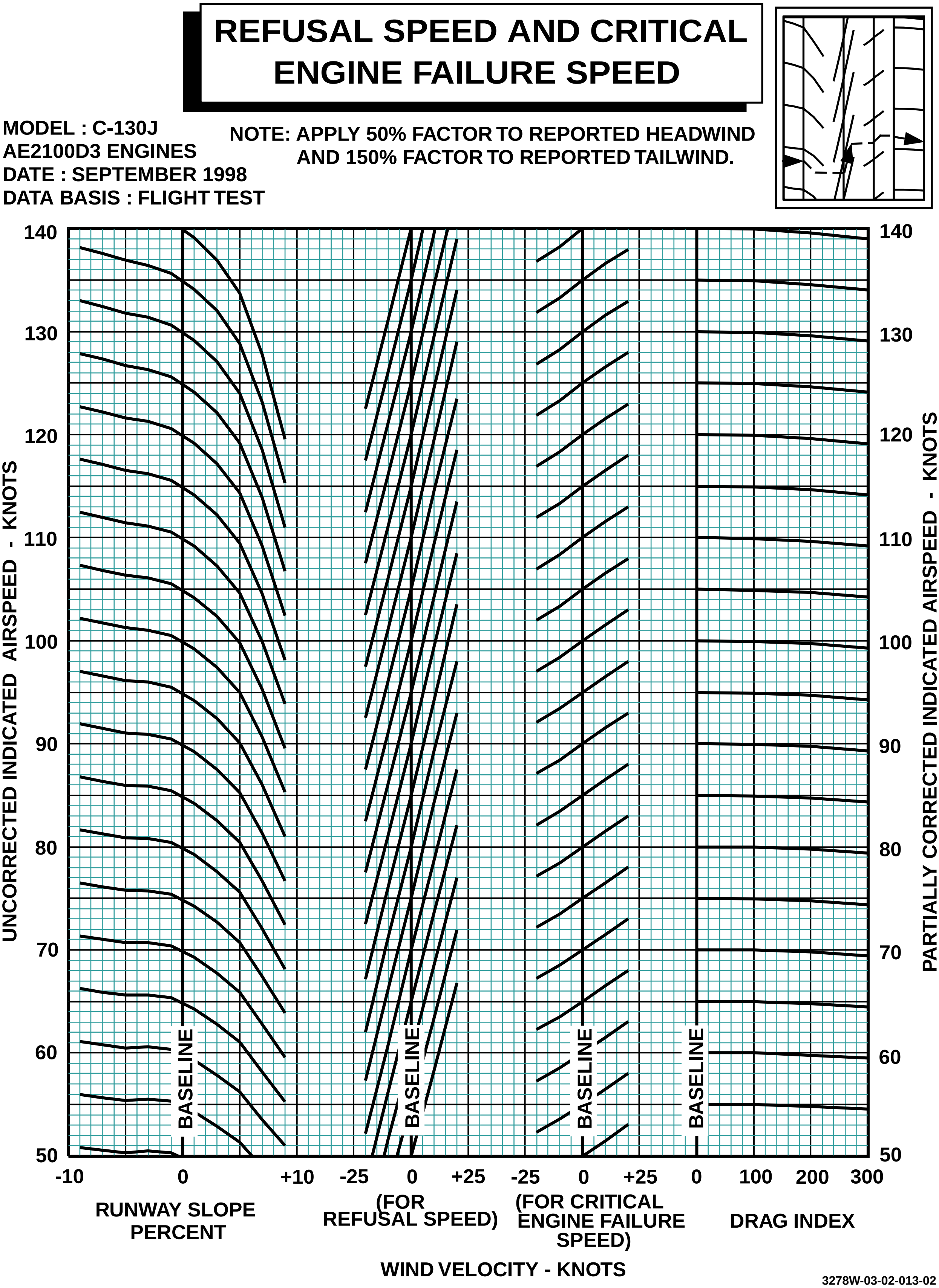
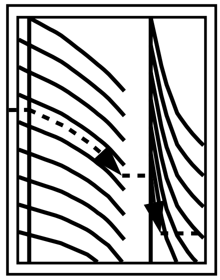


Figure 3-14. (Sheet 2 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED



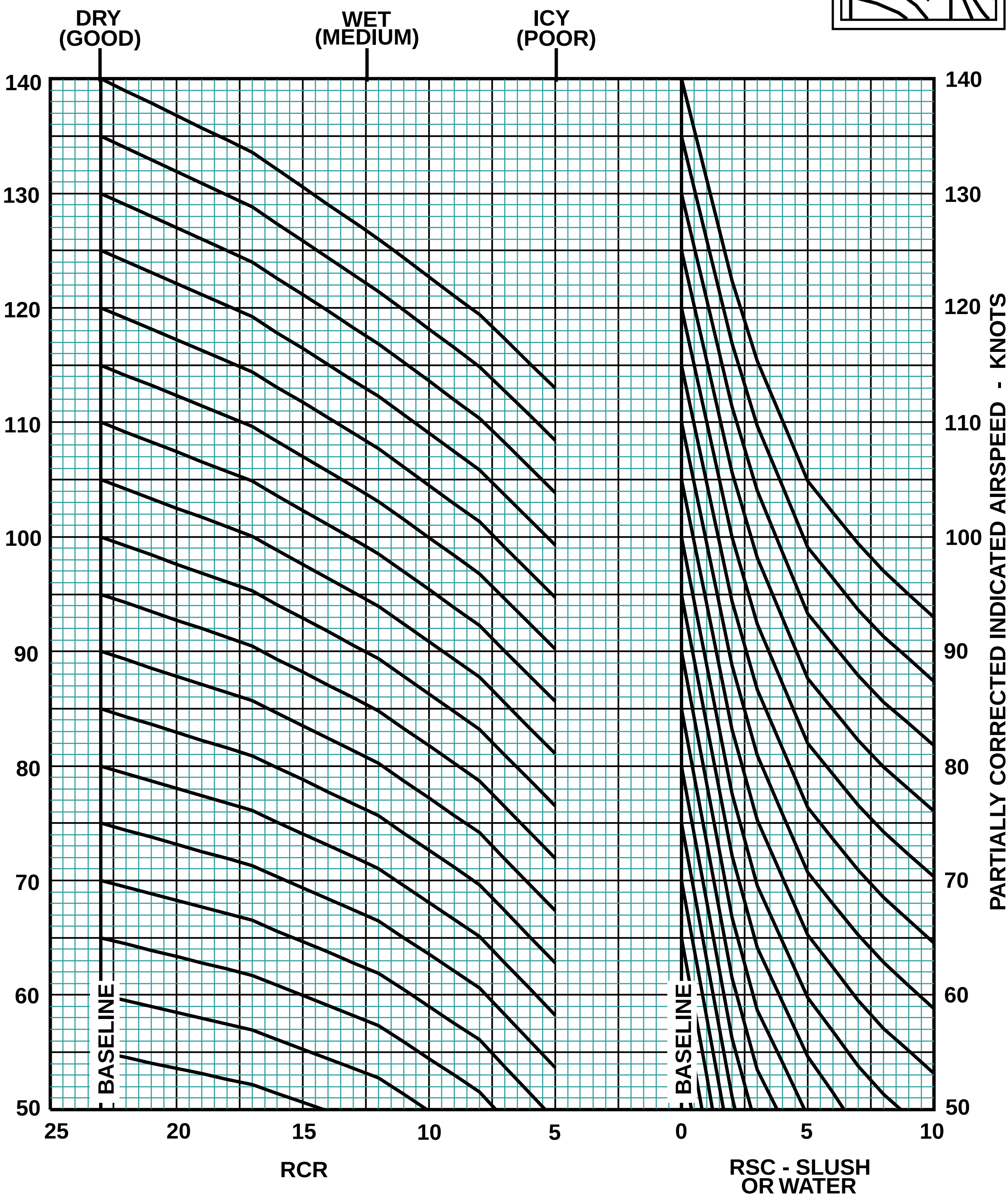


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Figure 3-14. (Sheet 3 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED

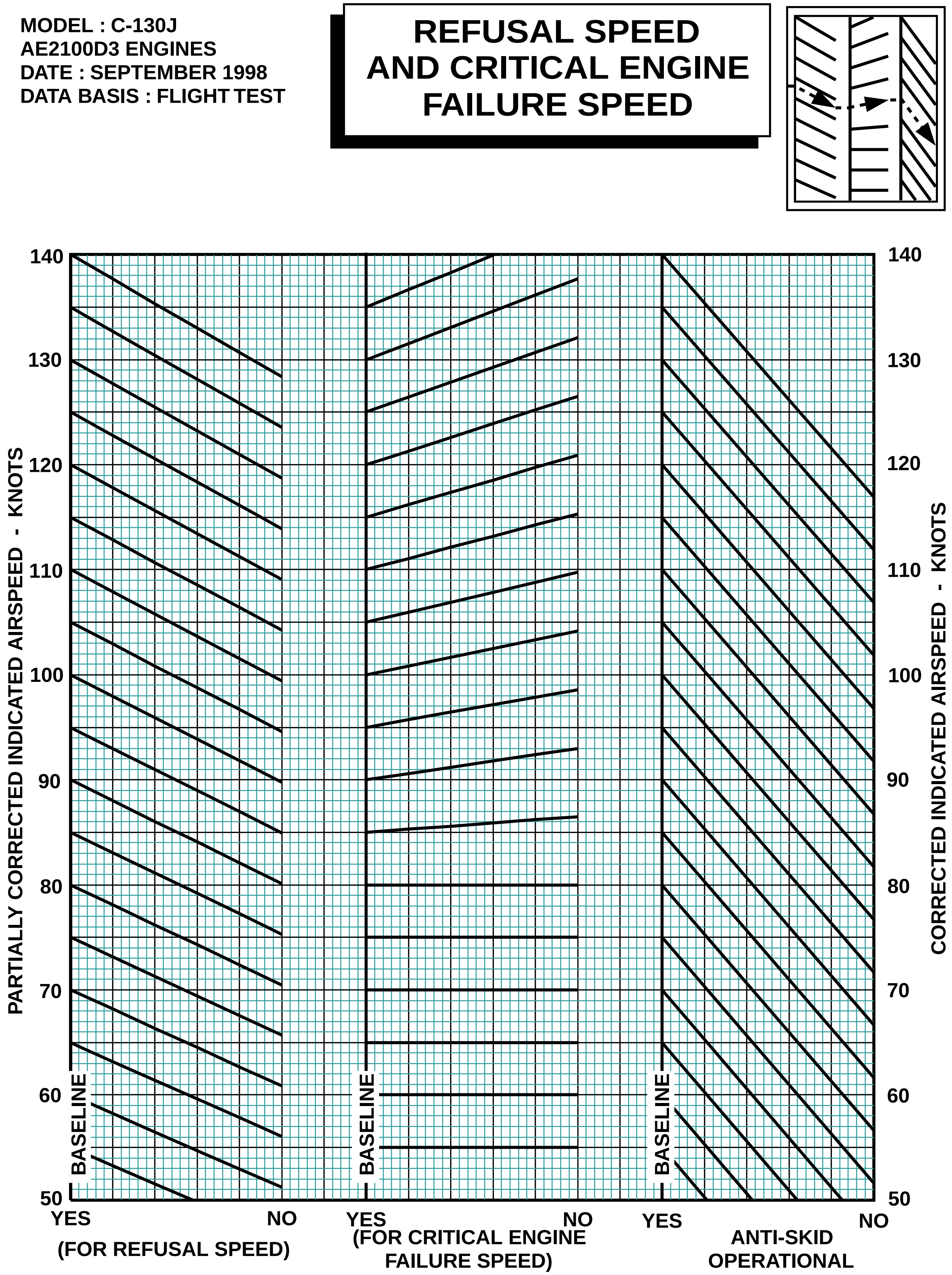

Figure 3-14. (Sheet 4 of 4)

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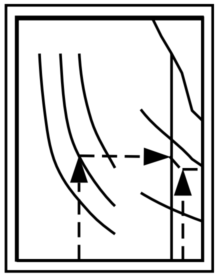
TAKE-OFF BRAKE ENERGY LIMIT SPEED

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



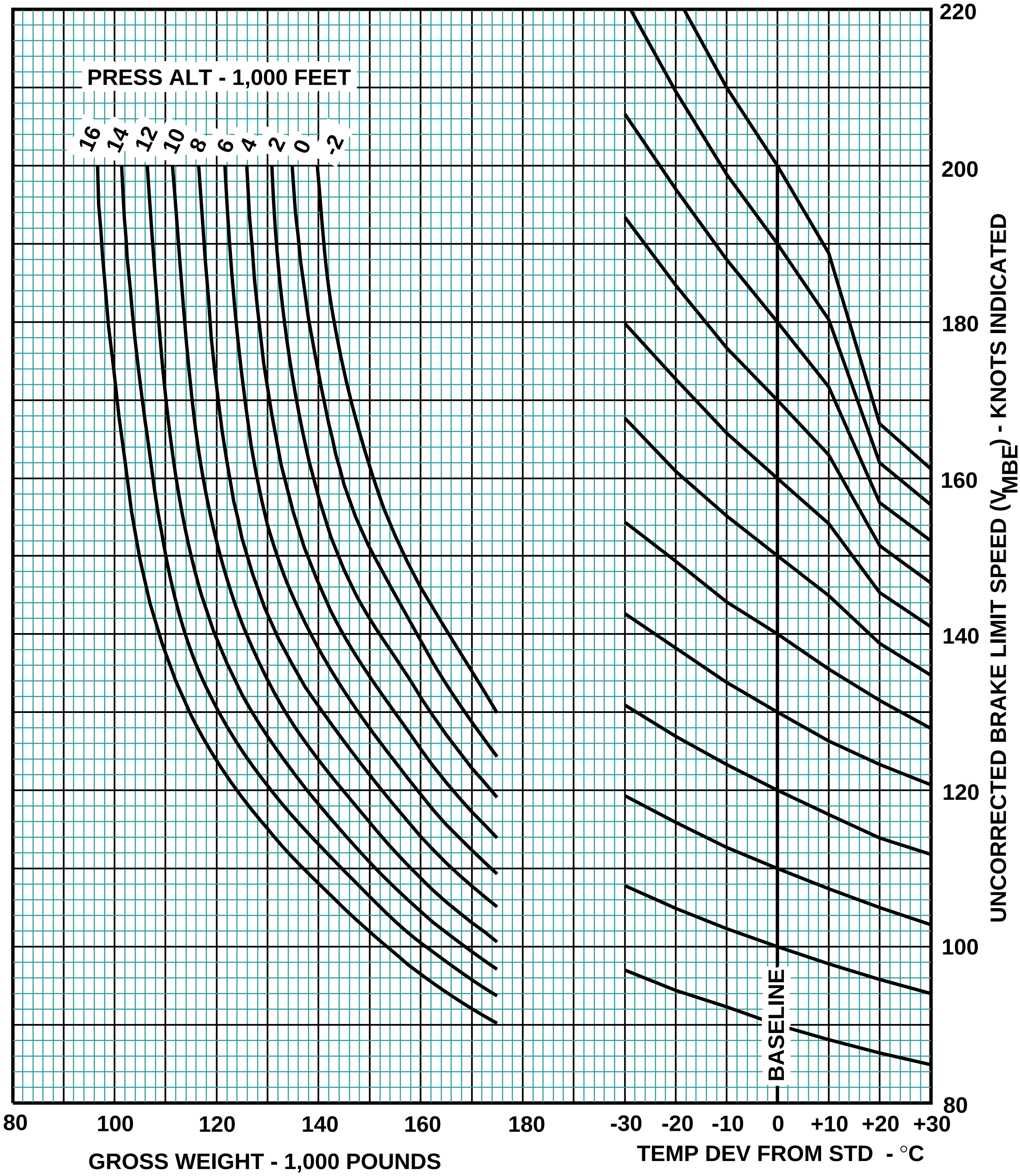
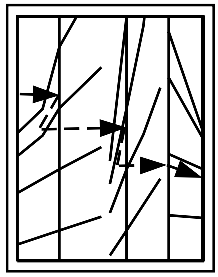


Figure 3-15. (Sheet 1 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TAKE-OFF BRAKE ENERGY LIMIT SPEED



MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

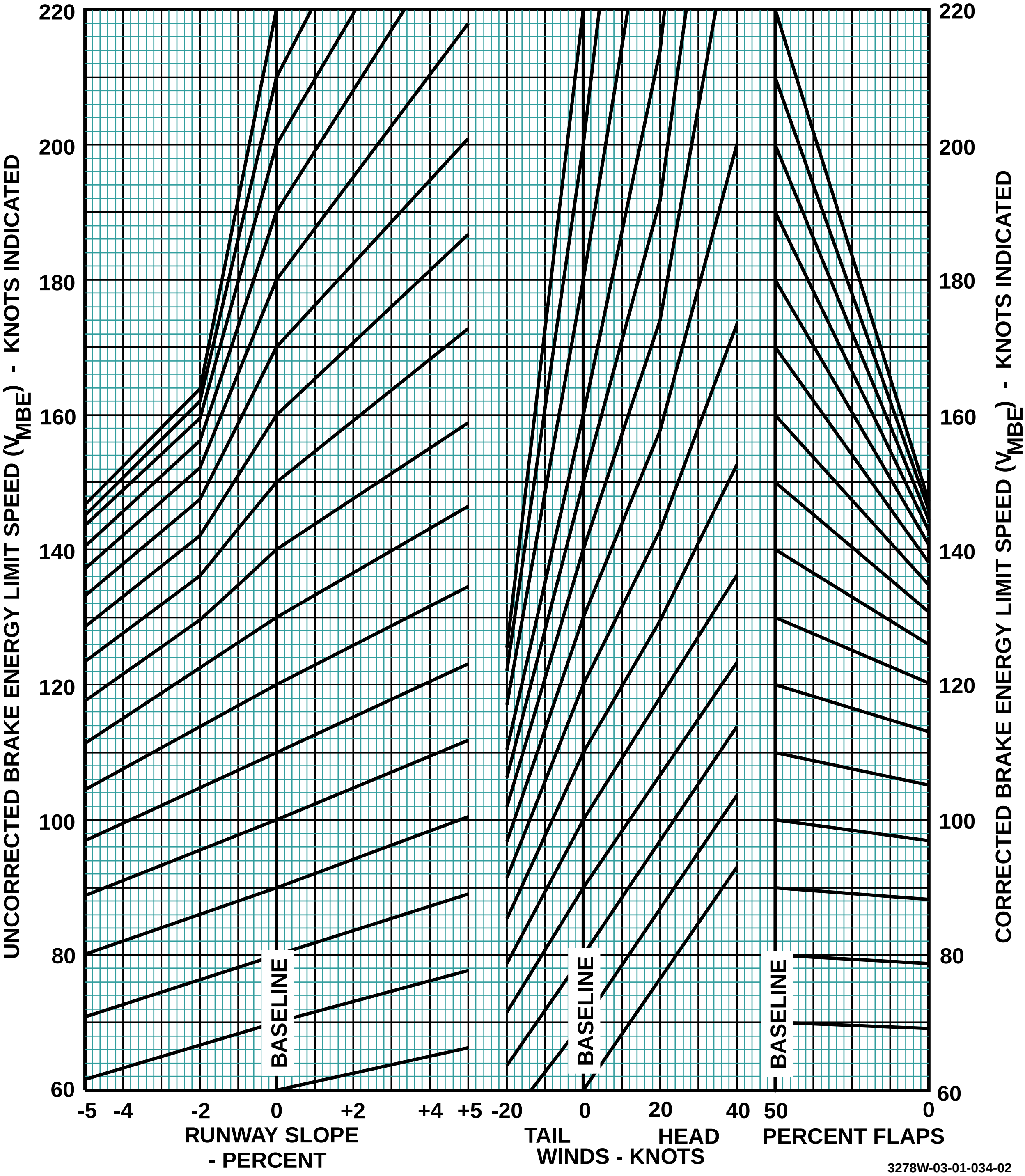
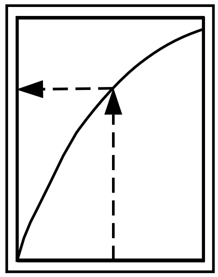


Figure 3-15. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TAKE-OFF BRAKE ENERGY LIMIT SPEED

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPEMBER 1998
DATA BASIS: FLIGHT TEST



WEIGHT REDUCTION

NOTE: IF V_{CEF} IS GREATER THAN V_{MBE}, THE TAKE-OFF WEIGHT MUST BE REDUCED BY THE INCREMENT SHOWN ON THIS CHART AND PERFORMANCE RECOMPUTED AT THE REDUCED WEIGHT. IF V_{REF} IS GREATER THAN V_{MBE}, SET V_{REF} EQUAL TO V_{MBE}.

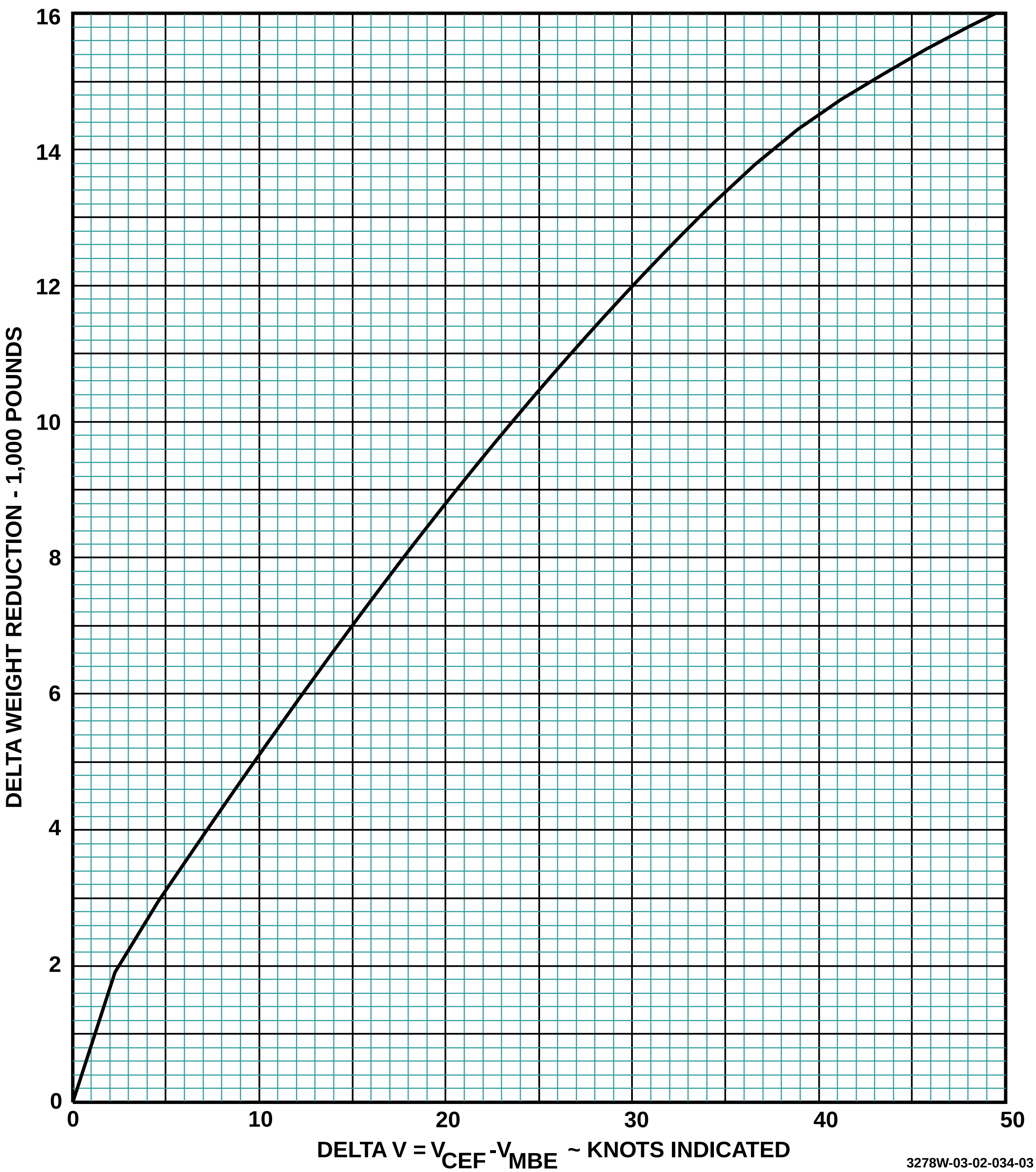


Figure 3-15. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MAXIMUM SPEED FOR TRANSITION FROM TAKEOFF POWER TO HIGH SPEED GROUND IDLE

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

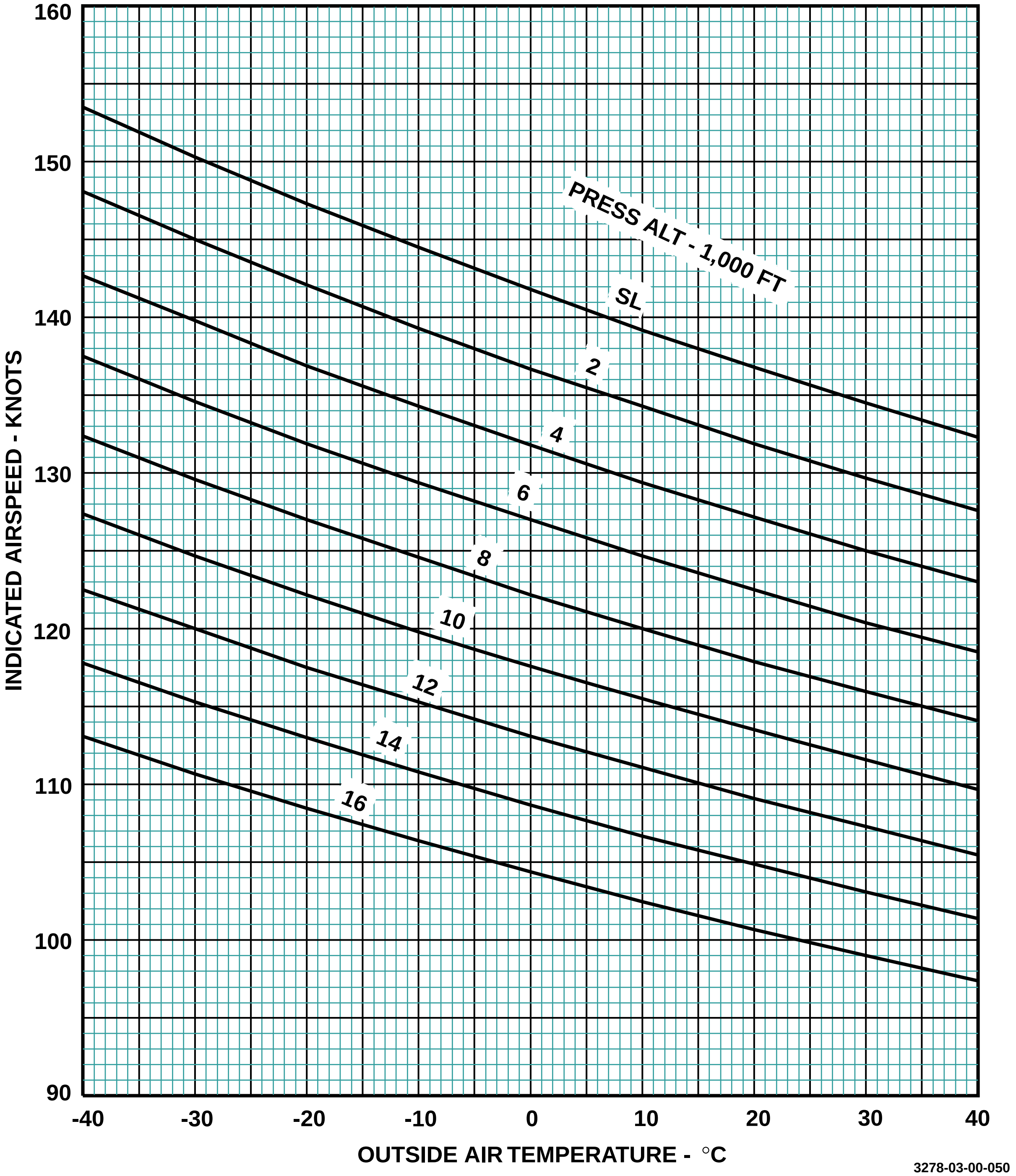
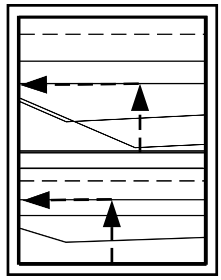


Figure 3-16.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

ROTATION AND OBSTACLE CLEARANCE SPEEDS

50 PERCENT FLAPS



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

NORMAL OPERATION

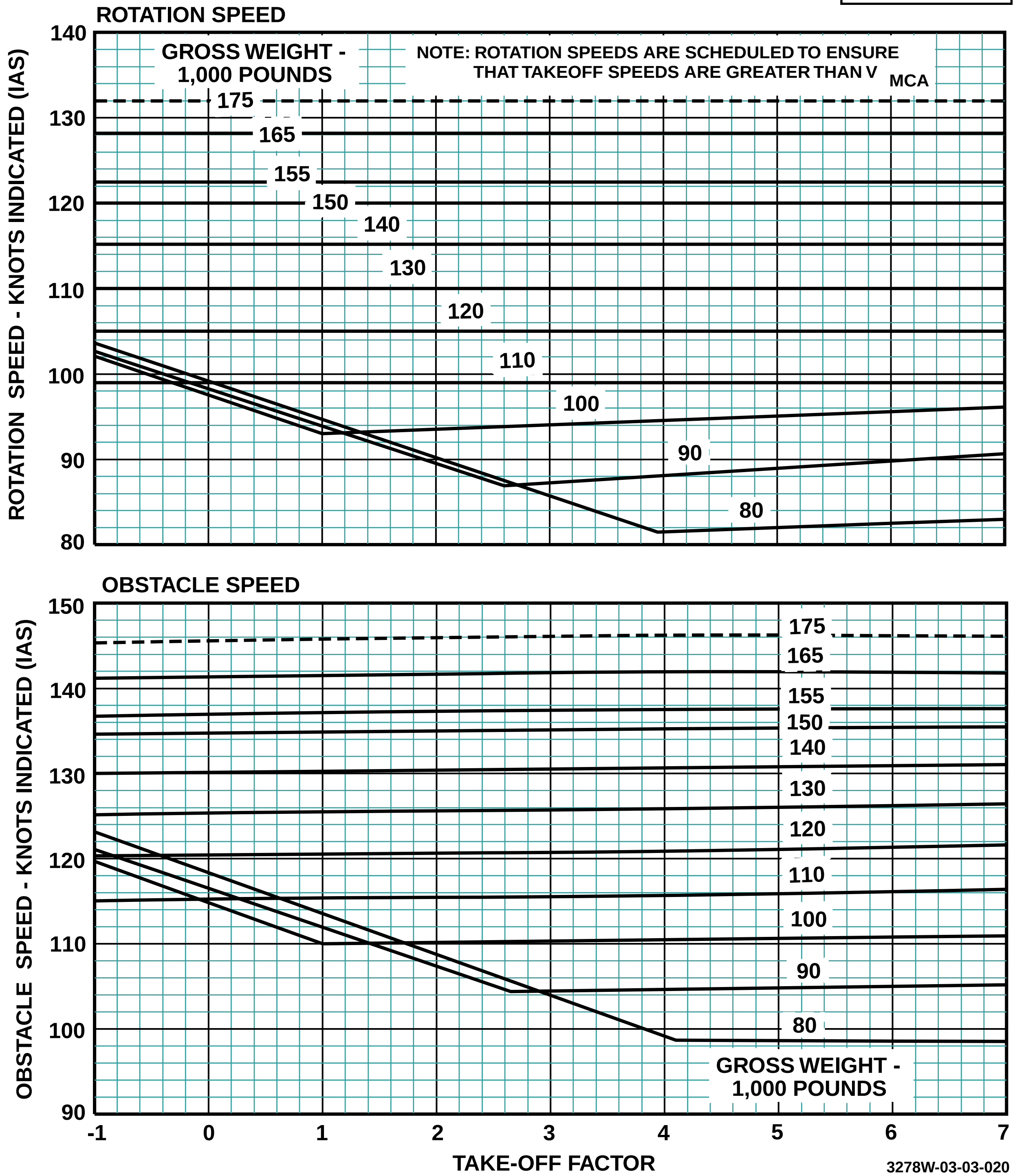


Figure 3-17.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

ROTATION AND OBSTACLE CLEARANCE SPEEDS

50 PERCENT FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAXIMUM EFFORT

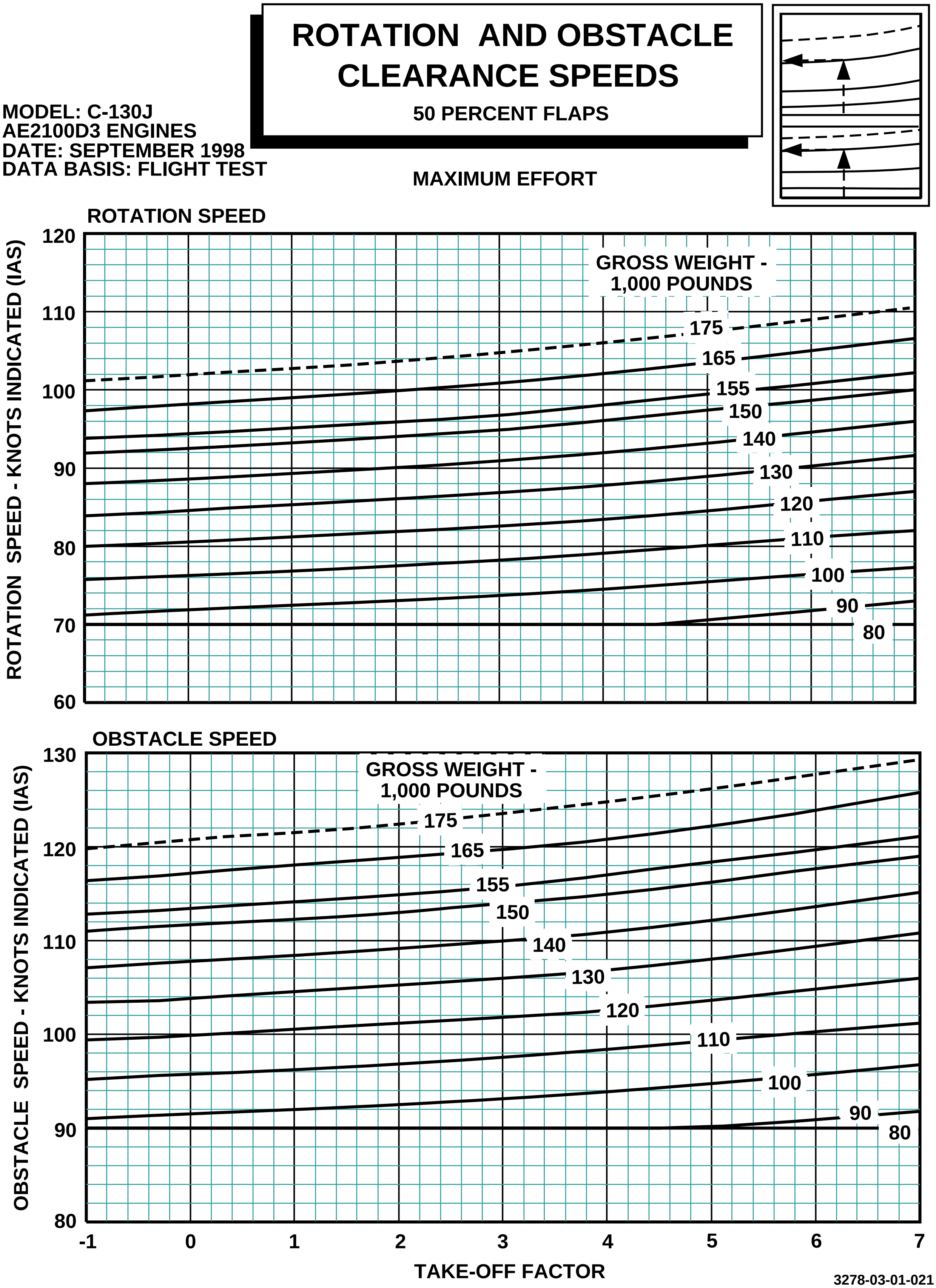


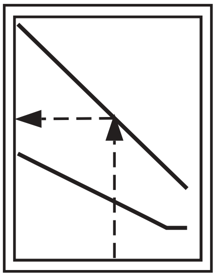
Figure 3-18.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TAKE-OFF PITCH ATTITUDE SCHEDULE

50 PERCENT FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



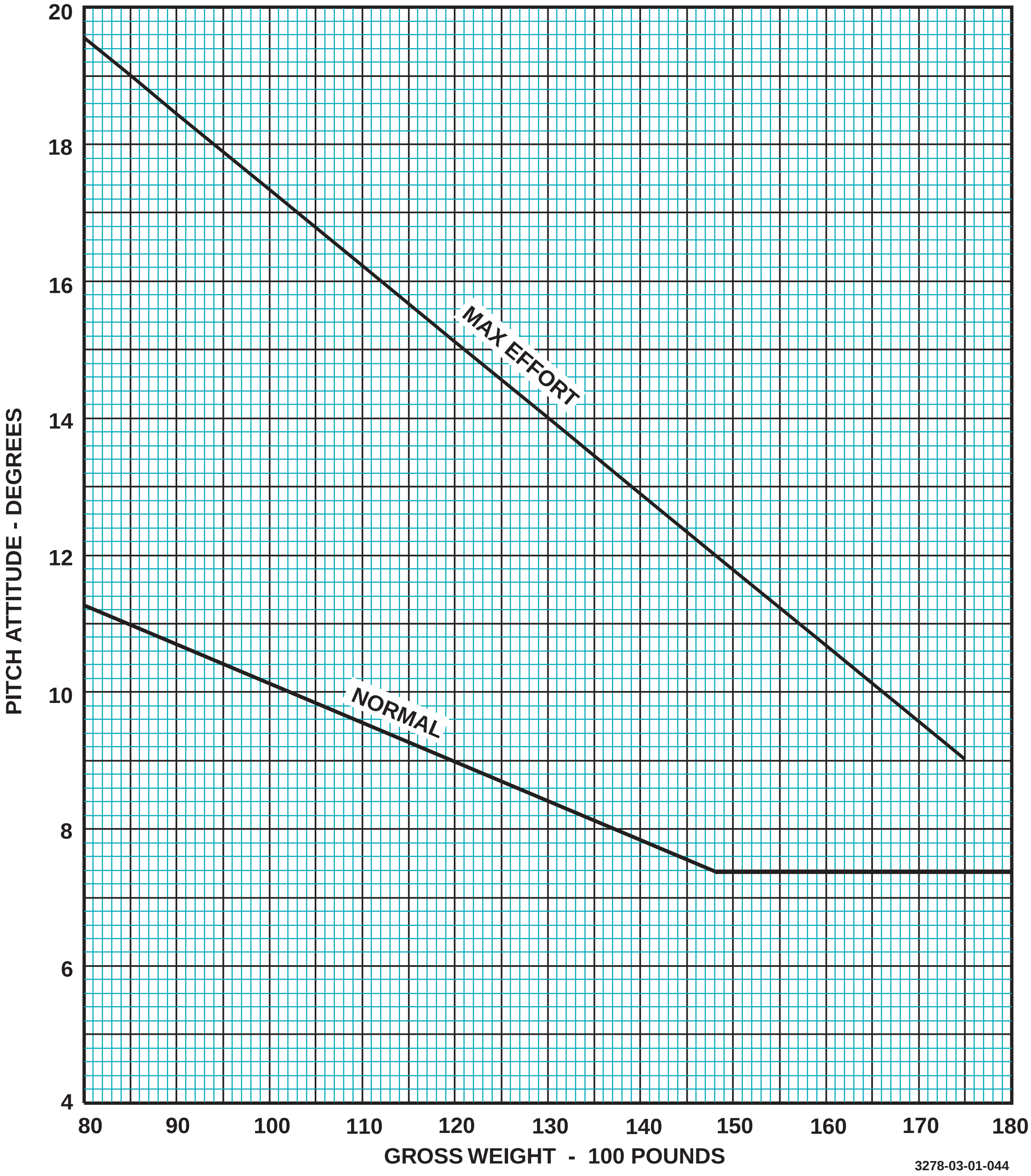


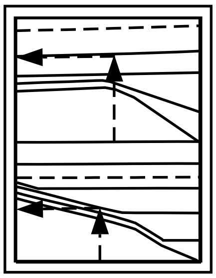
Figure 3-19.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

ROTATION AND OBSTACLE CLEARANCE SPEEDS

FLAPS UP

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



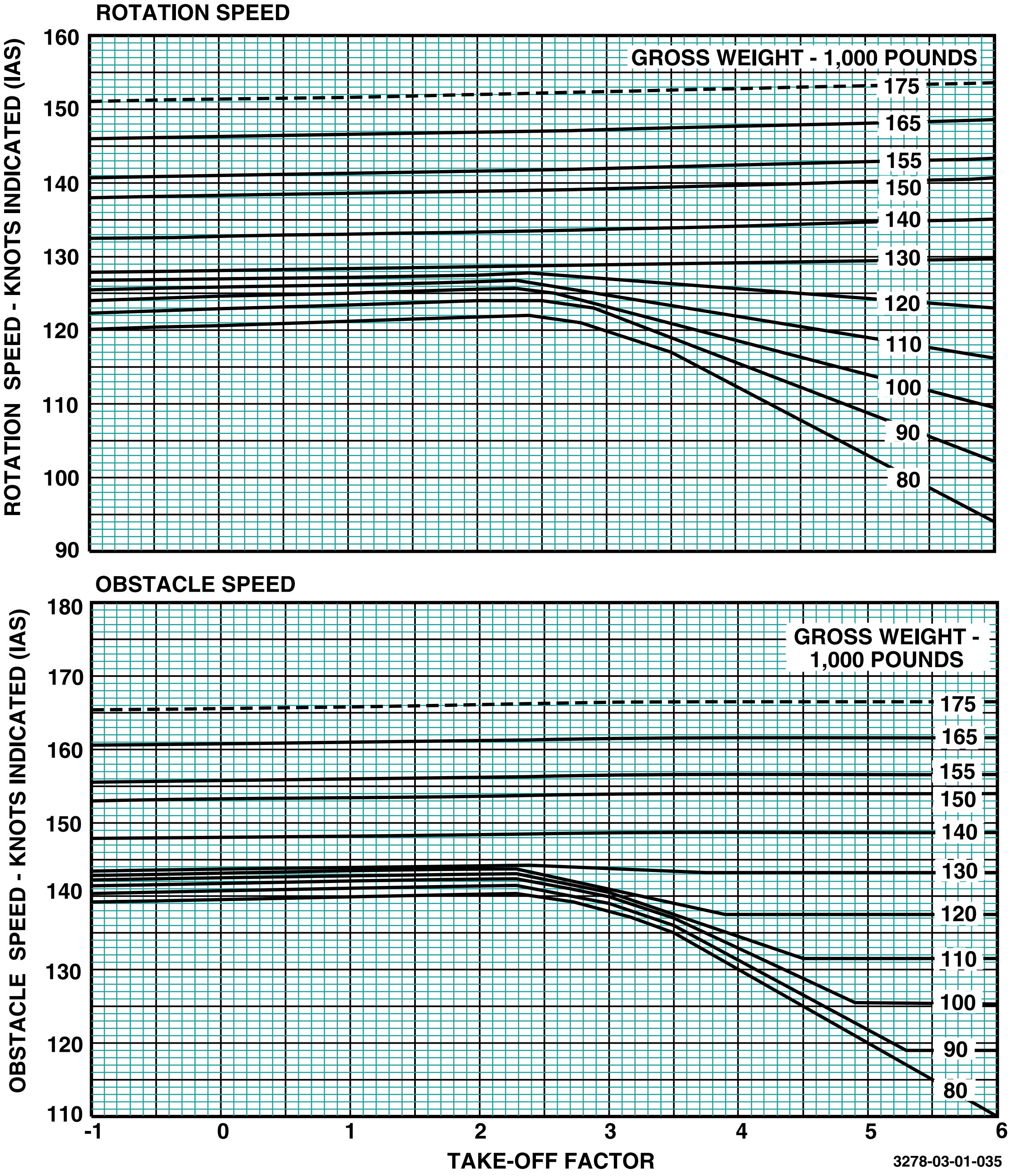
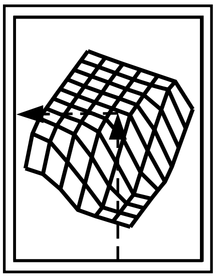


Figure 3-20.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

GROUND MINIMUM CONTROL SPEED ONE ENGINE INOPERATIVE

GEAR DOWN **50% FLAPS** **NORMAL BLEED**



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

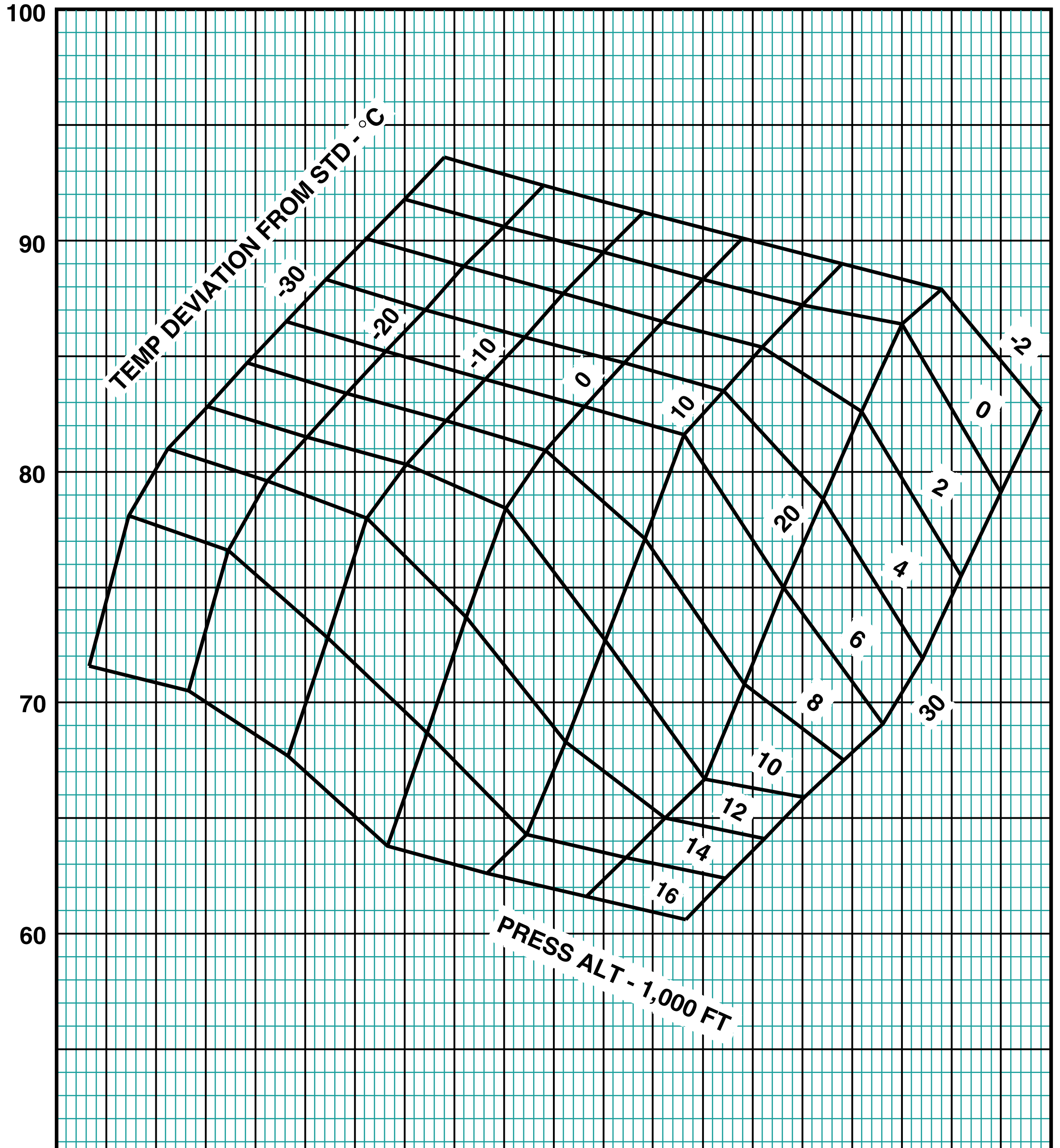
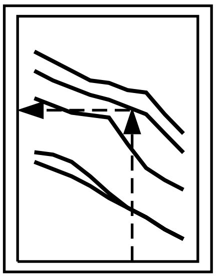


Figure 3-21.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MINIMUM POWER RESTORATION SPEED - V_{MPR}

ATCS NOT OPERATING



MODEL:C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

WARNING IF THE ATCS IS DEGRADED OR INOPERATIVE, DO NOT OPERATE THE OUTBOARD ENGINES ABOVE 50% MAX TAKEOFF POWER BELOW THE AIRSPEEDS DEFINED IN THIS CHART.

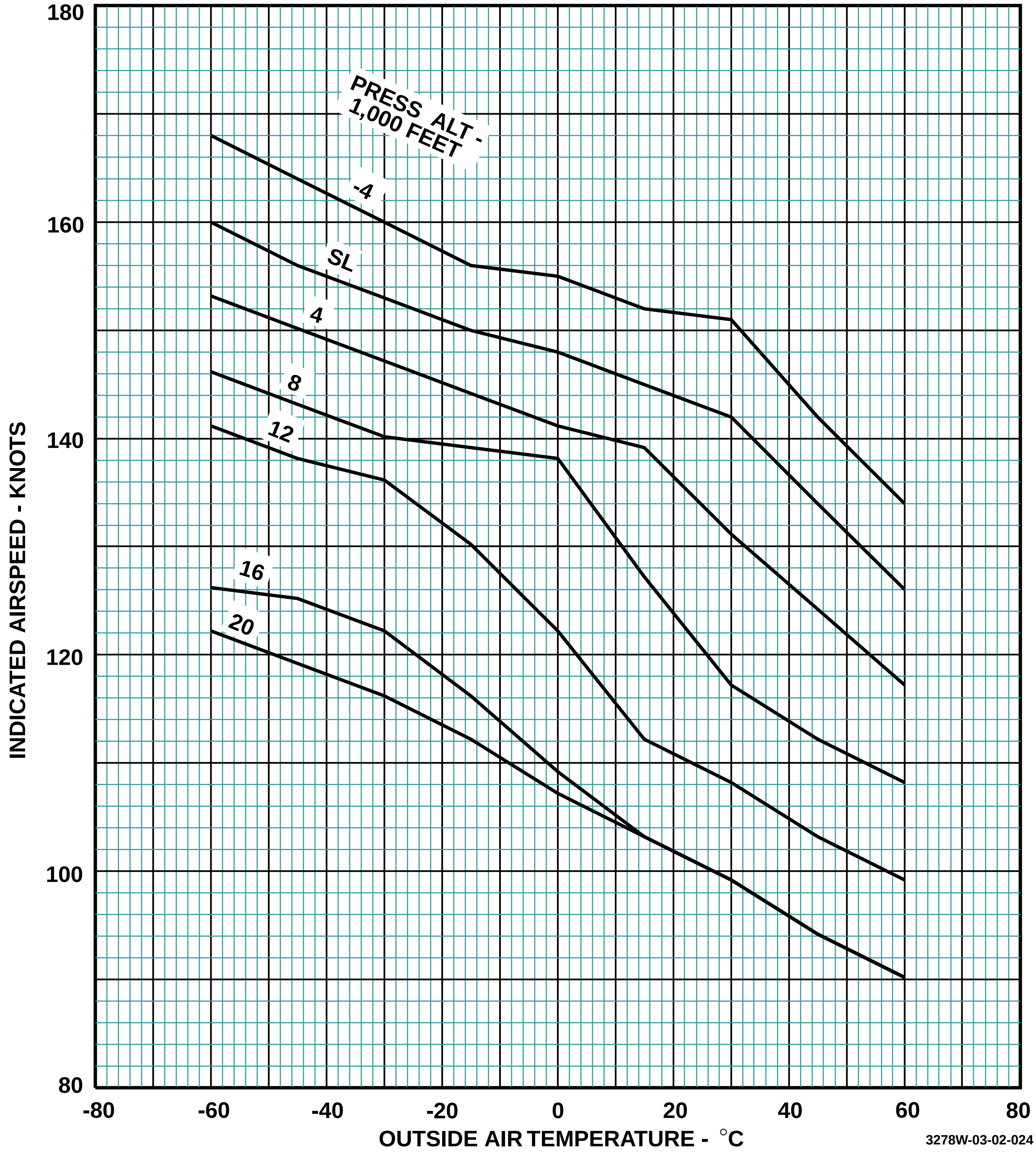
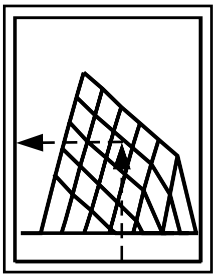


Figure 3-22.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

AIR MINIMUM CONTROL SPEED
ONE ENGINE INOPERATIVE

GEAR UP OR DOWN 50% FLAPS NORMAL BLEED
OUT OF GROUND EFFECT



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

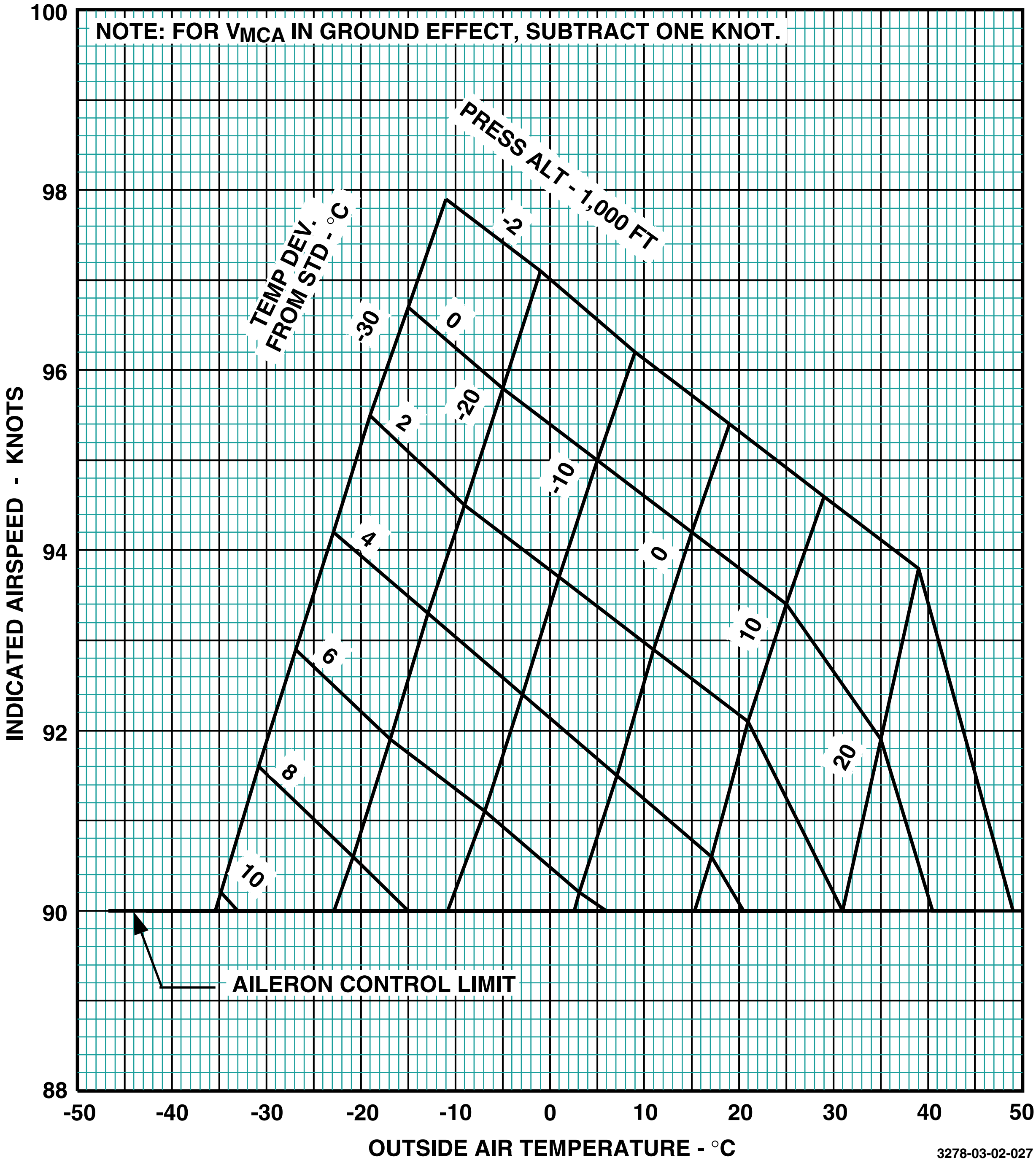
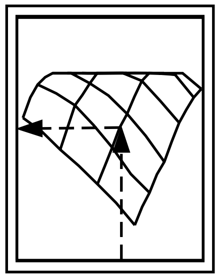


Figure 3-23.

AIR MINIMUM CONTROL SPEED
ONE ENGINE INOPERATIVE

GEAR UP OR DOWN FLAPS UP NORMAL BLEED
IN OR OUT OF GROUND EFFECT



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

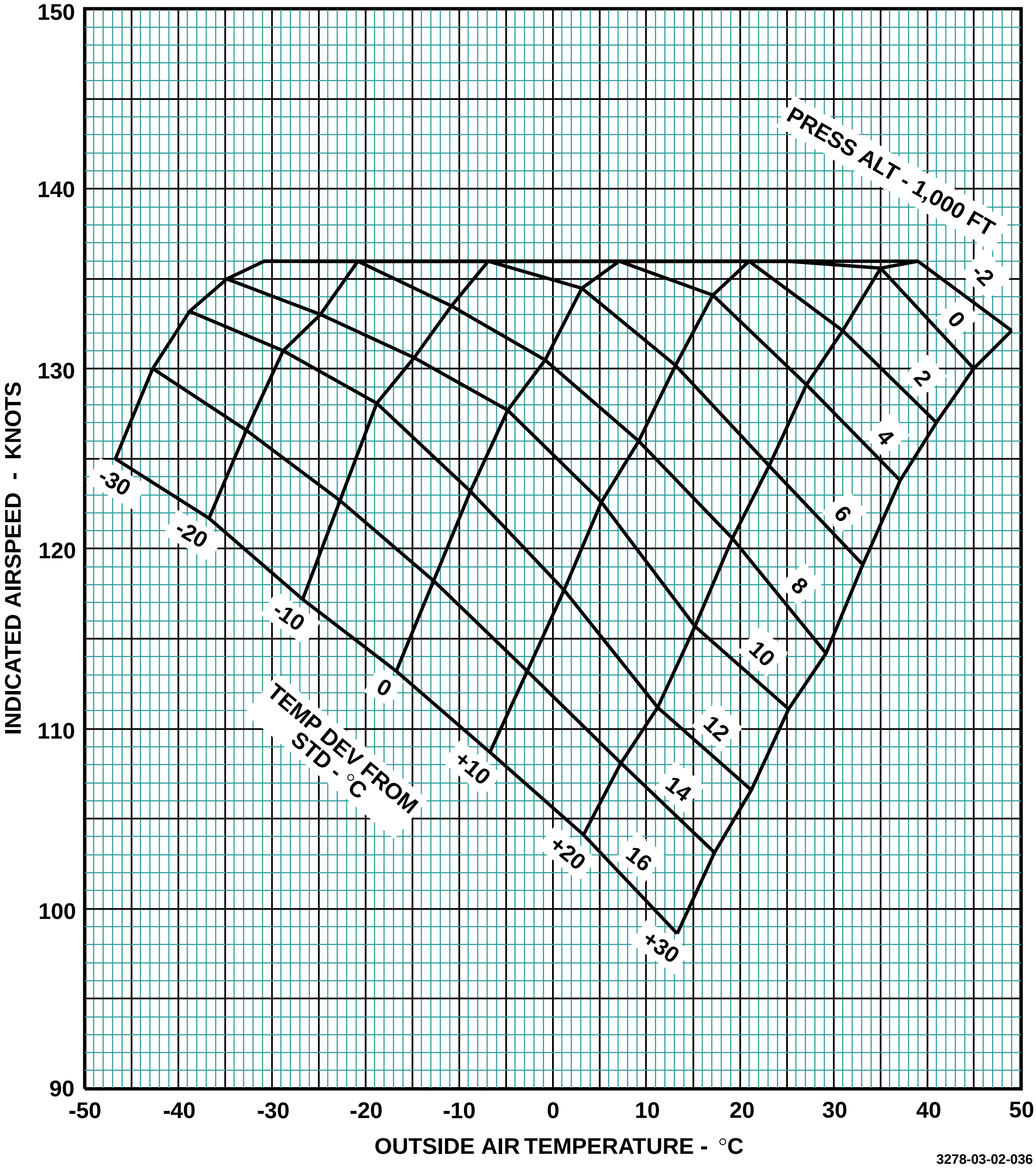
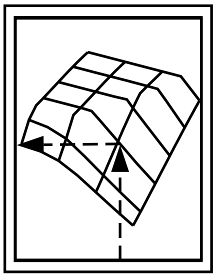


Figure 3-24.

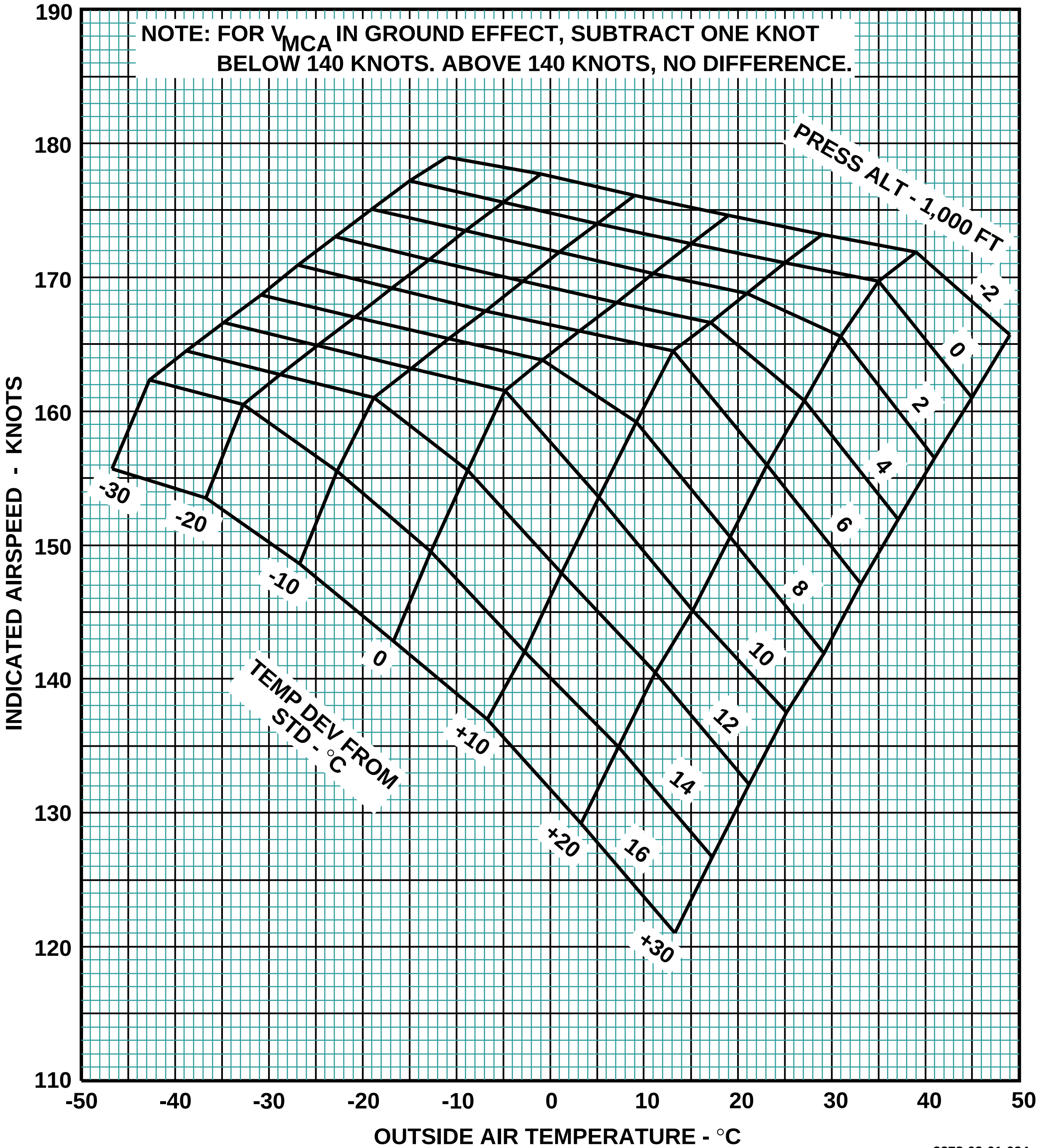
Use, copying and/or disclosure is governed by the statement on the title page of this document.

AIR MINIMUM CONTROL SPEED TWO ENGINES INOPERATIVE

GEAR UP OR DOWN 50% FLAPS NORMAL BLEED
OUT OF GROUND EFFECT



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



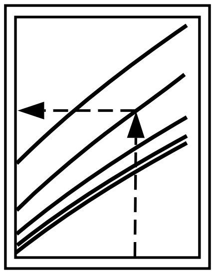
3278-03-01-034

Figure 3-25.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

POWER-OFF STALL SPEEDS

ENROUTE



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

GEAR UP OR DOWN
FLAPS UP

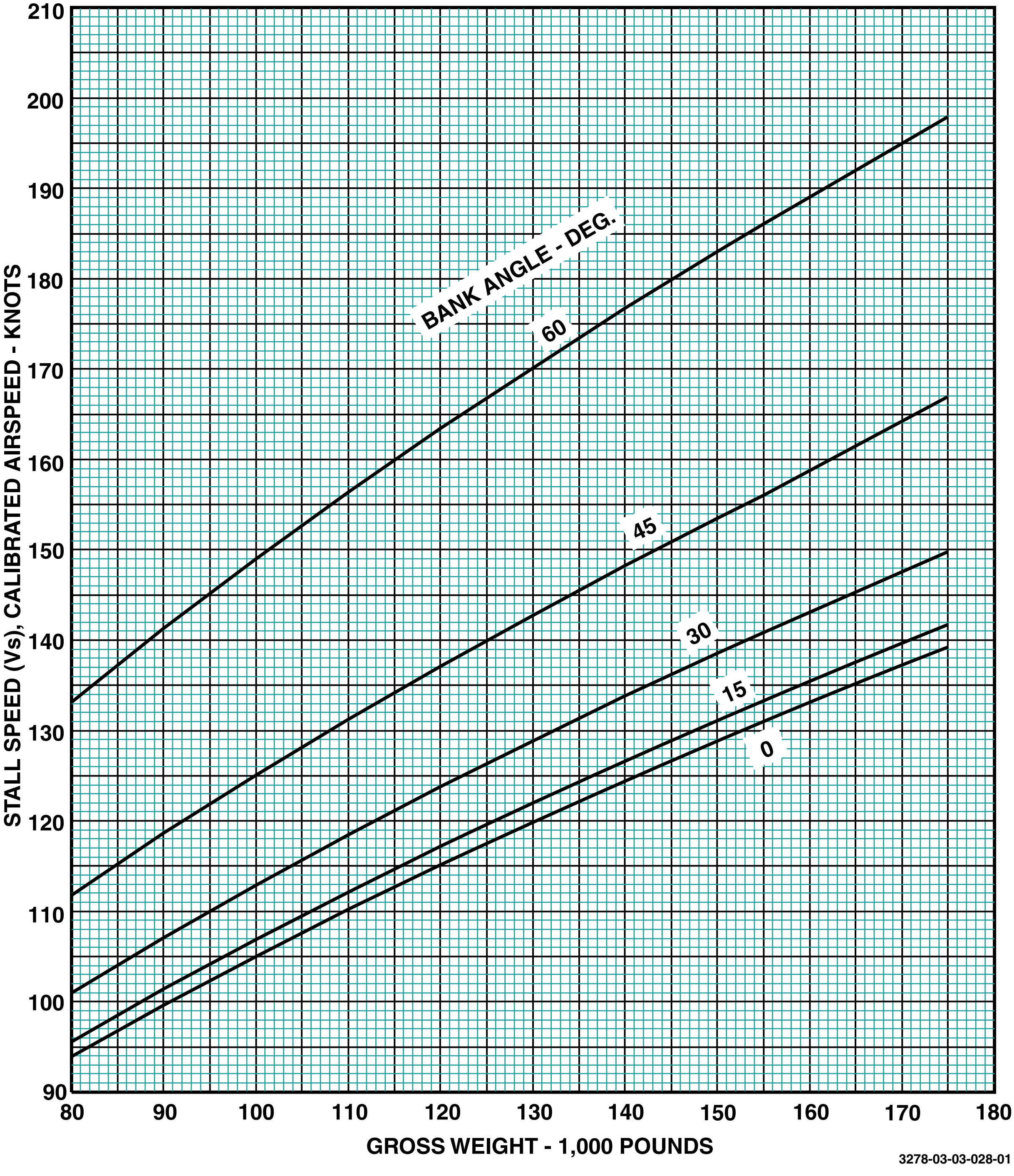
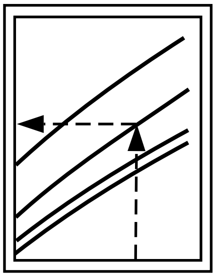


Figure 3-26.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

POWER-OFF STALL SPEEDS

TAKE-OFF OR APPROACH



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

GEAR UP OR DOWN
50% FLAPS

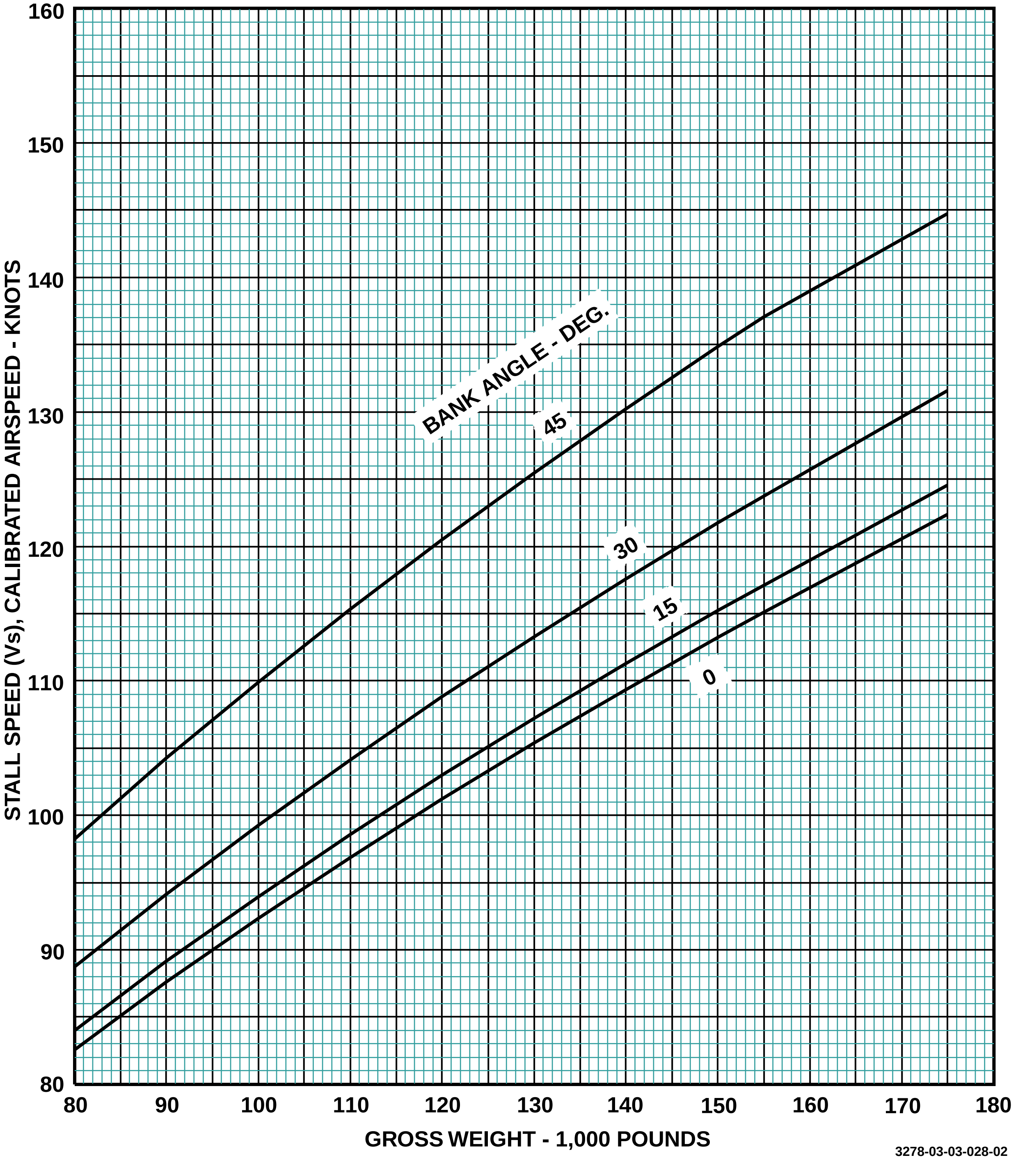


Figure 3-27.

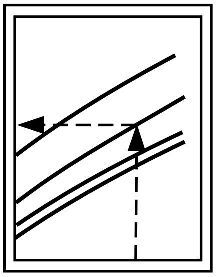
Use, copying and/or disclosure is governed by the statement on the title page of this document.

POWER-OFF STALL SPEEDS

LANDING

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

GEAR UP OR DOWN
100% FLAPS



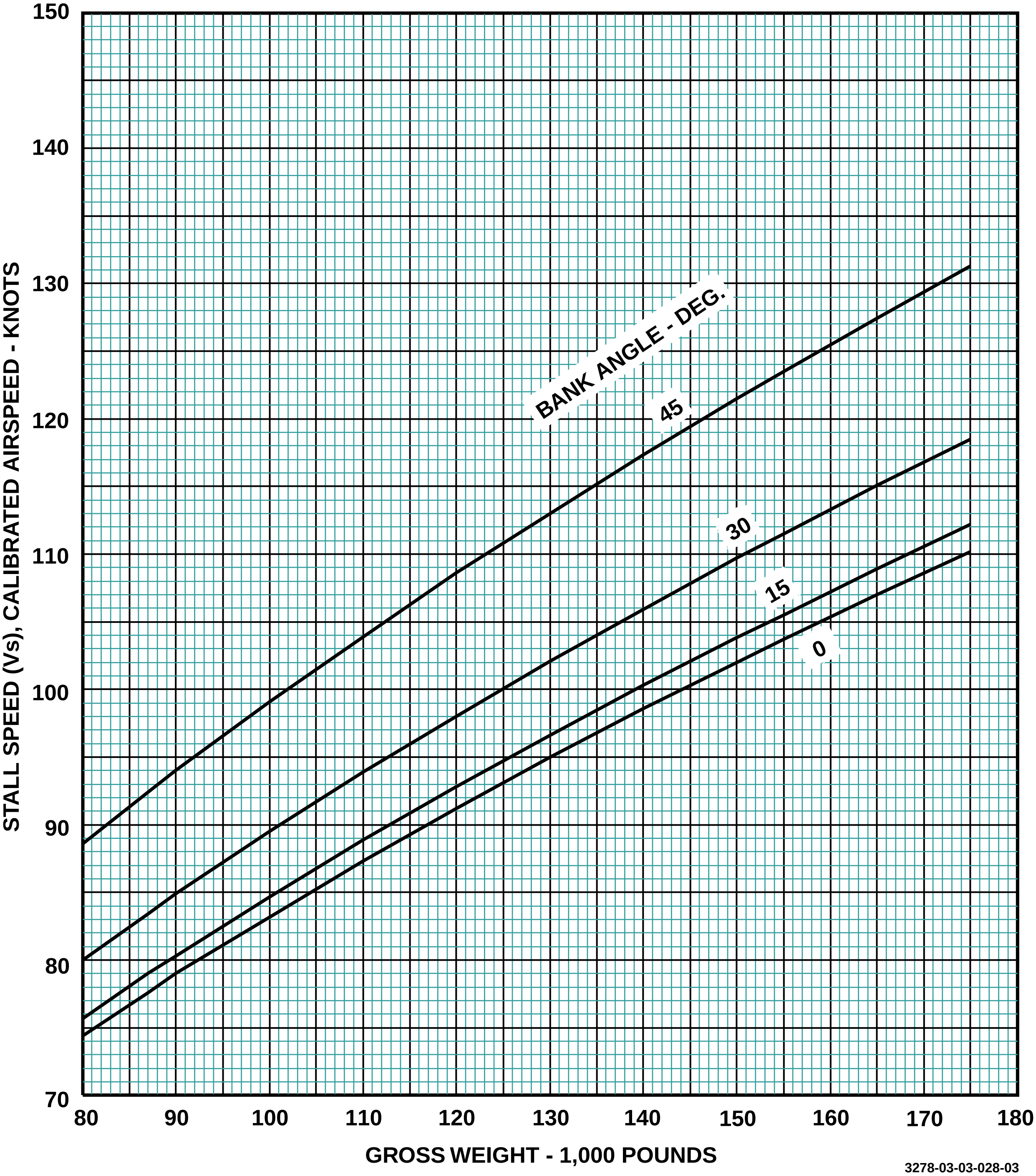


Figure 3-28.

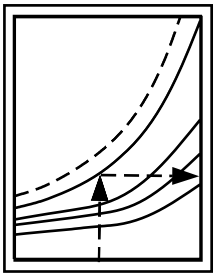
Use, copying and/or disclosure is governed by the statement on the title page of this document.

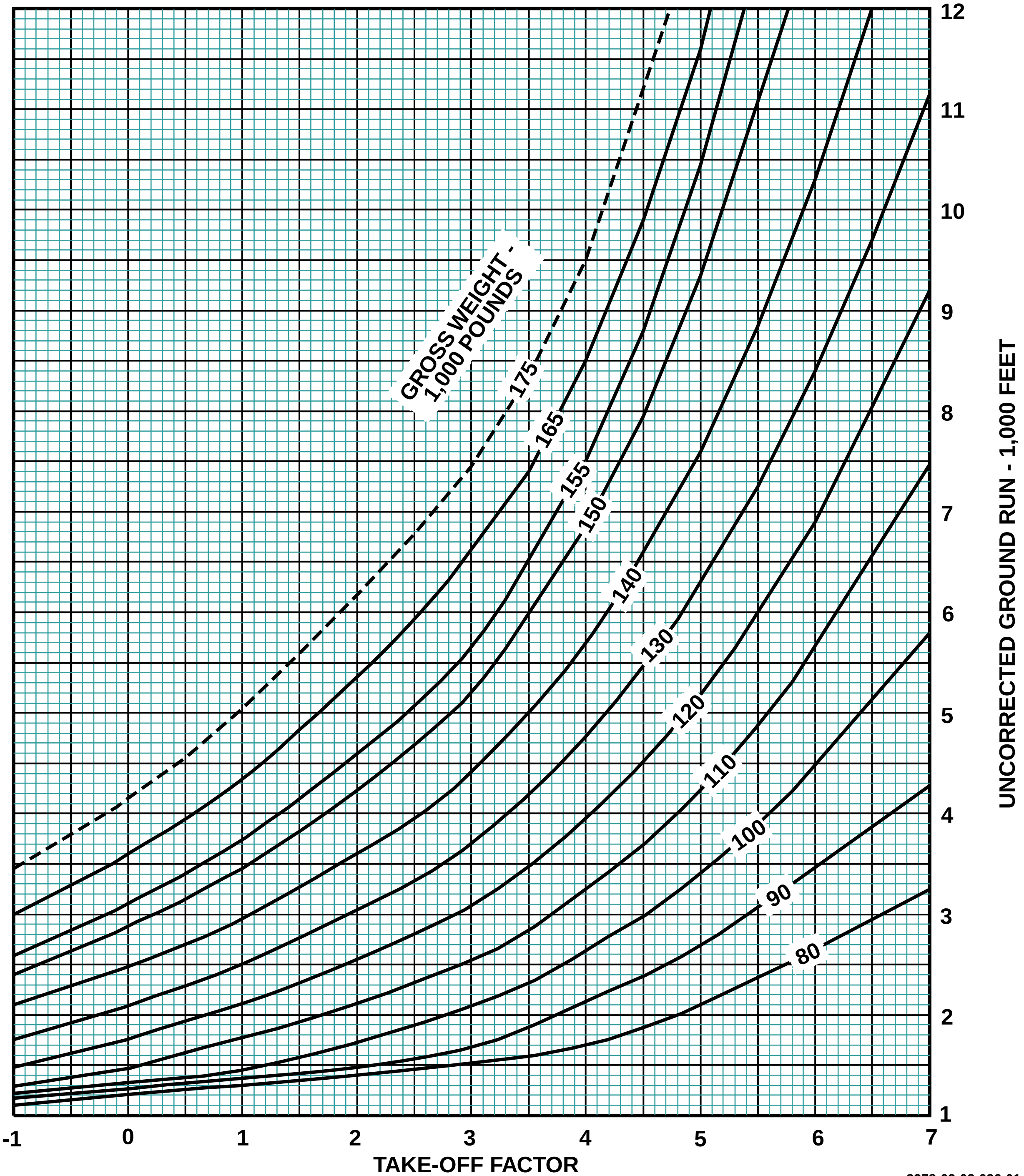
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE

4 ENGINES

50 PERCENT FLAPS





3278-03-02-026-01

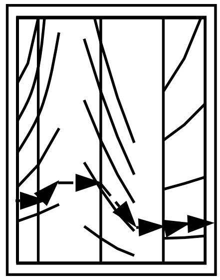
Figure 3-29. (Sheet 1 of 5)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE

4 ENGINES
50 PERCENT FLAPS



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

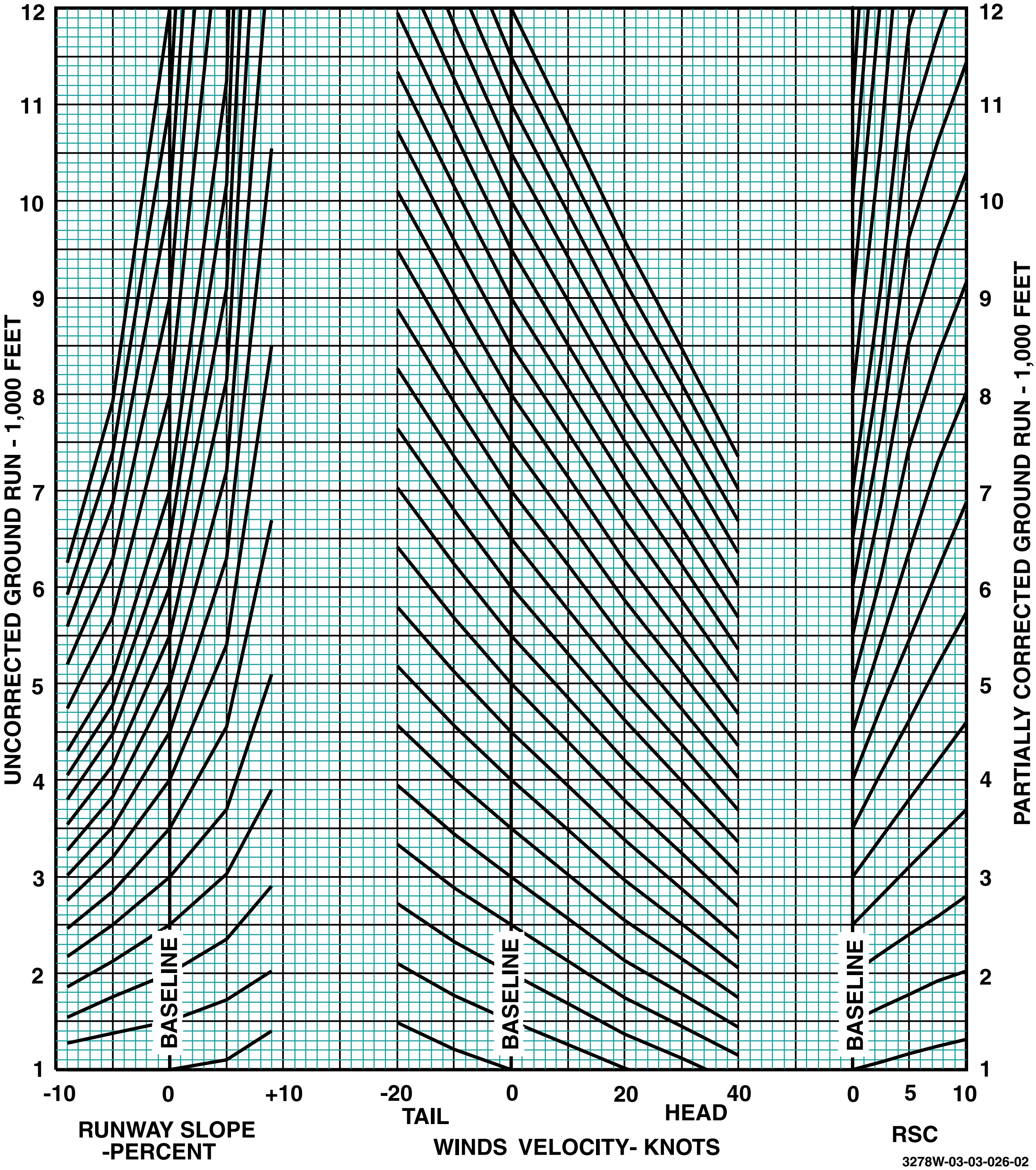


Figure 3-29. (Sheet 2 of 5)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE

4 ENGINES

50 PERCENT FLAPS

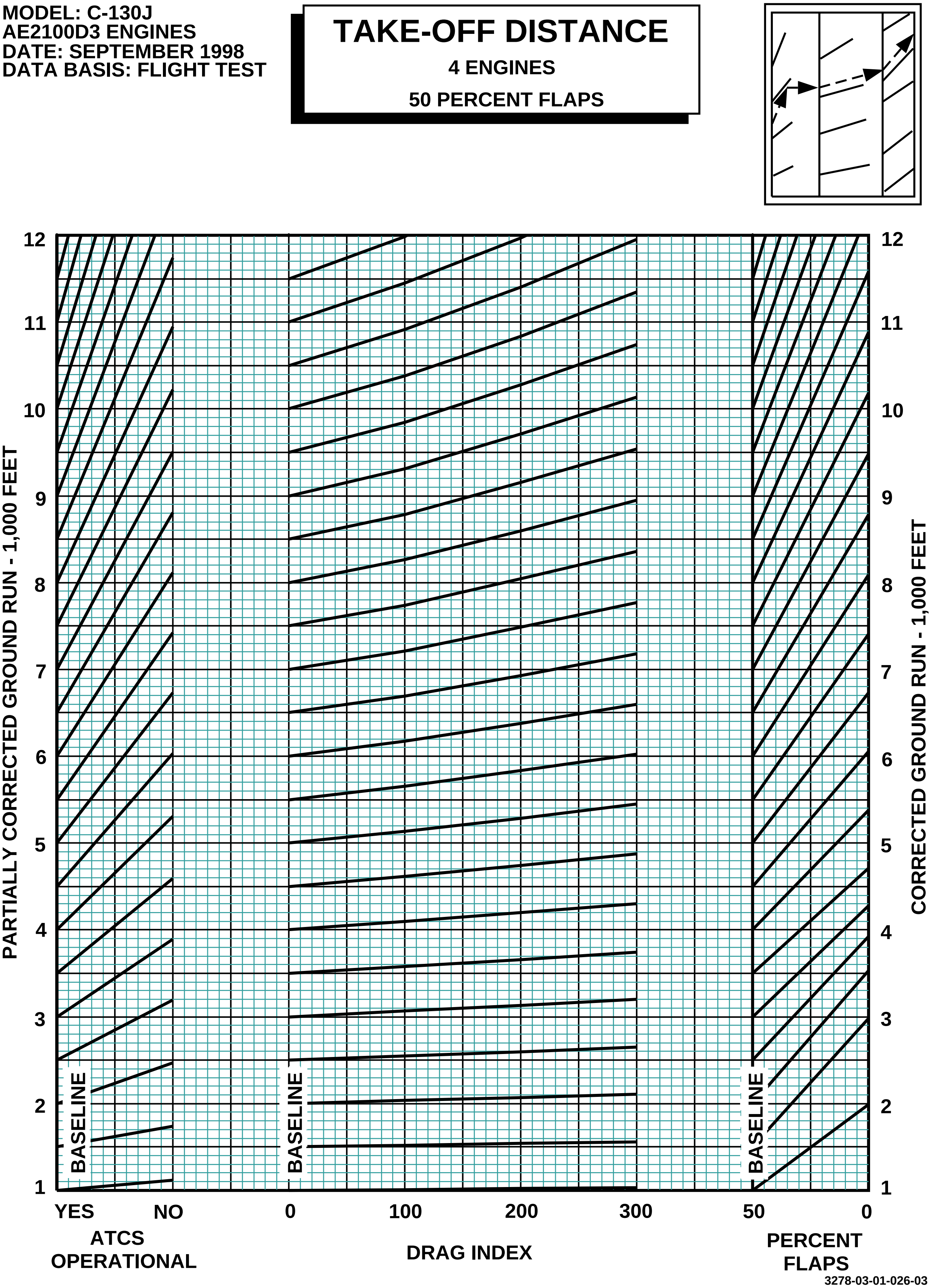


Figure 3-29. (Sheet 3 of 5)

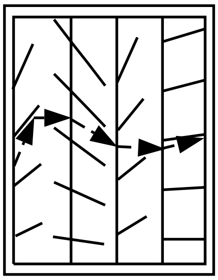
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE

4 ENGINES

50 PERCENT FLAPS



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

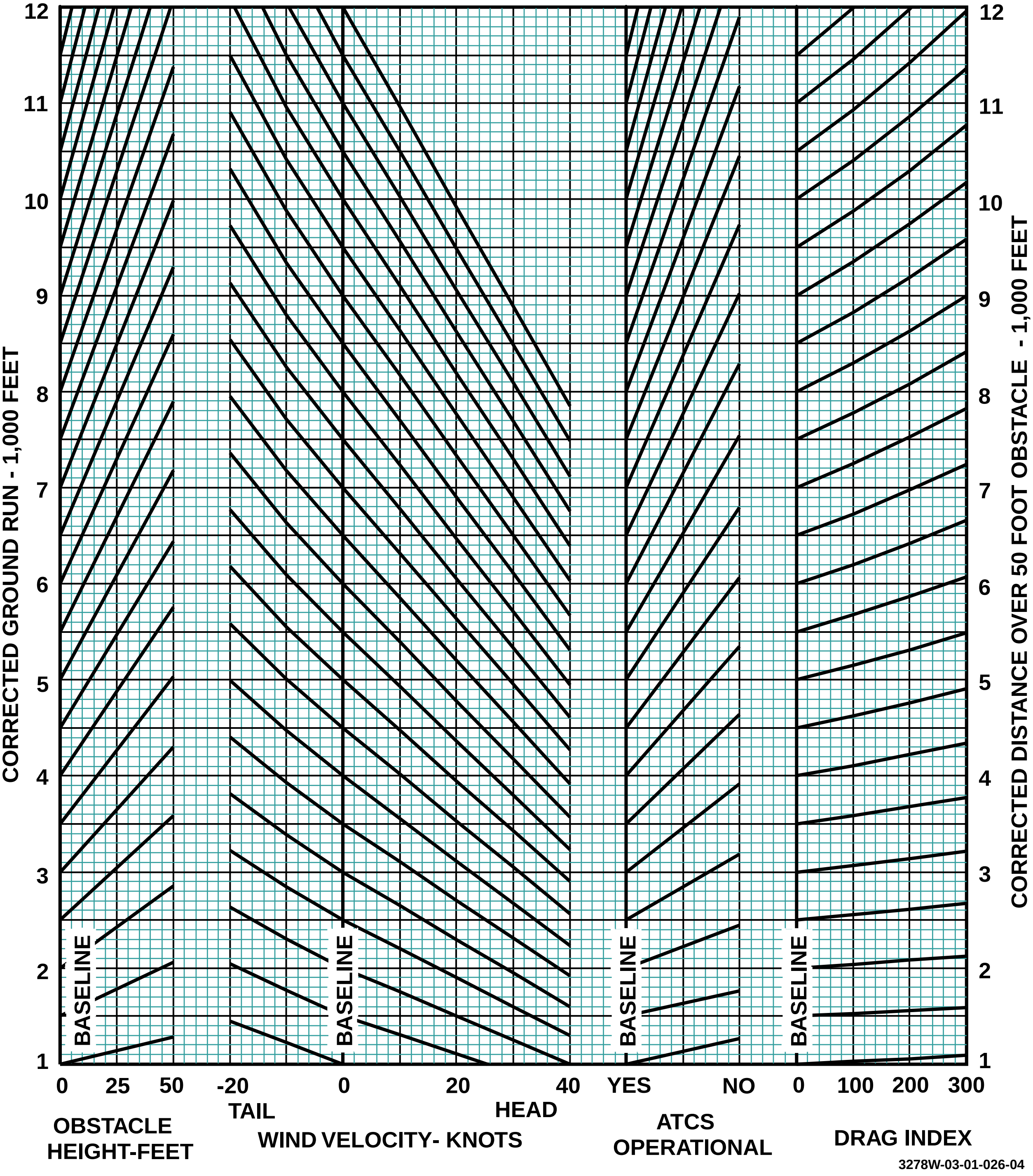
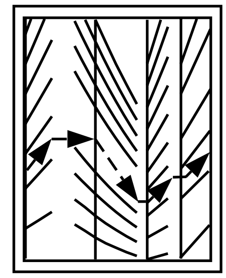


Figure 3-29. (Sheet 4 of 5)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

TAKE-OFF DISTANCE
4 ENGINES
FLAPS UP



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

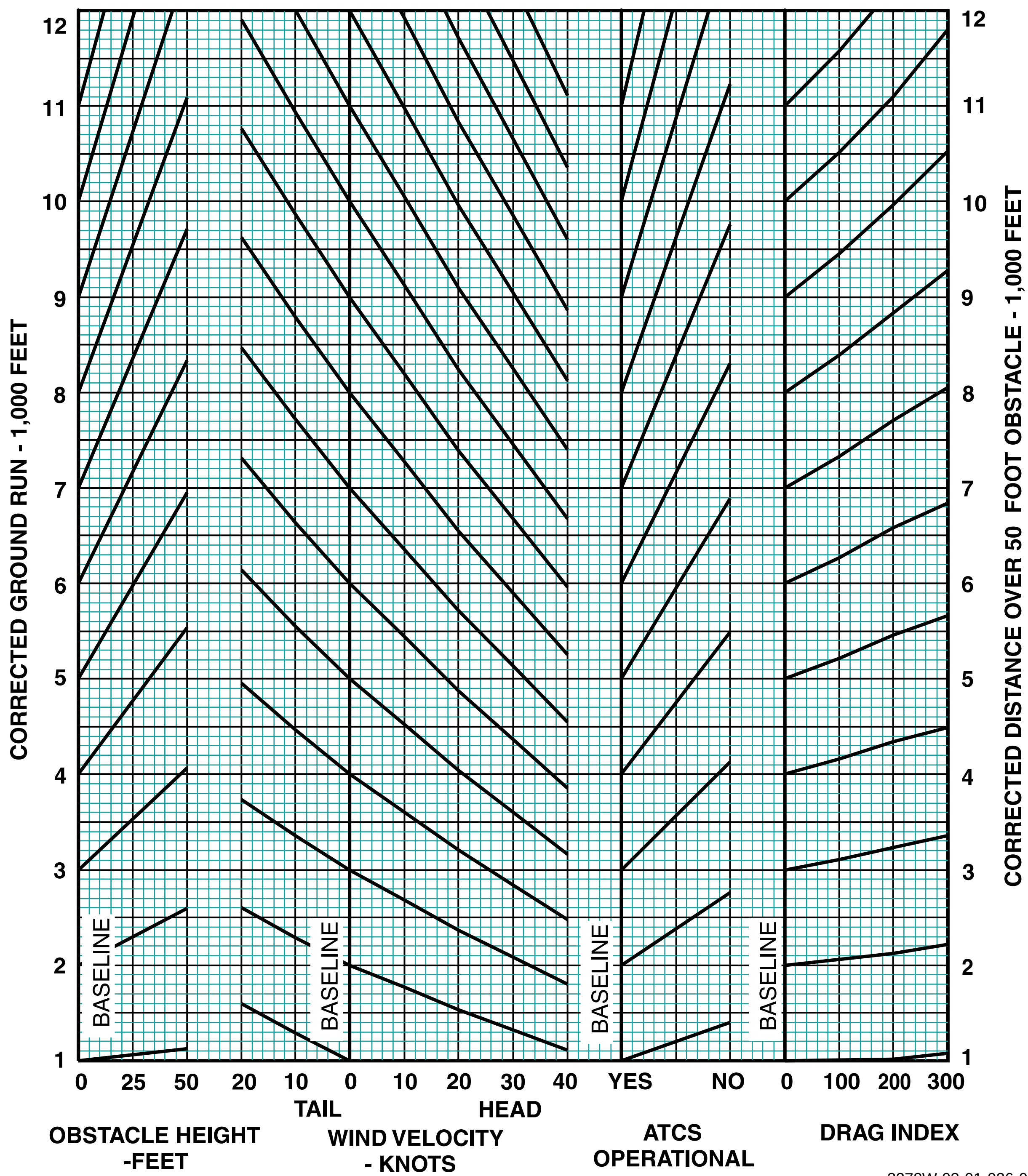


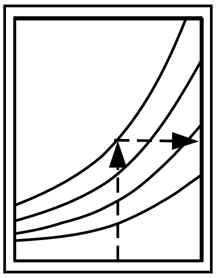
Figure 3-29. (Sheet 5 of 5)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MINIMUM FIELD LENGTH FOR THREE ENGINE TAKE-OFF

50 PERCENT FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



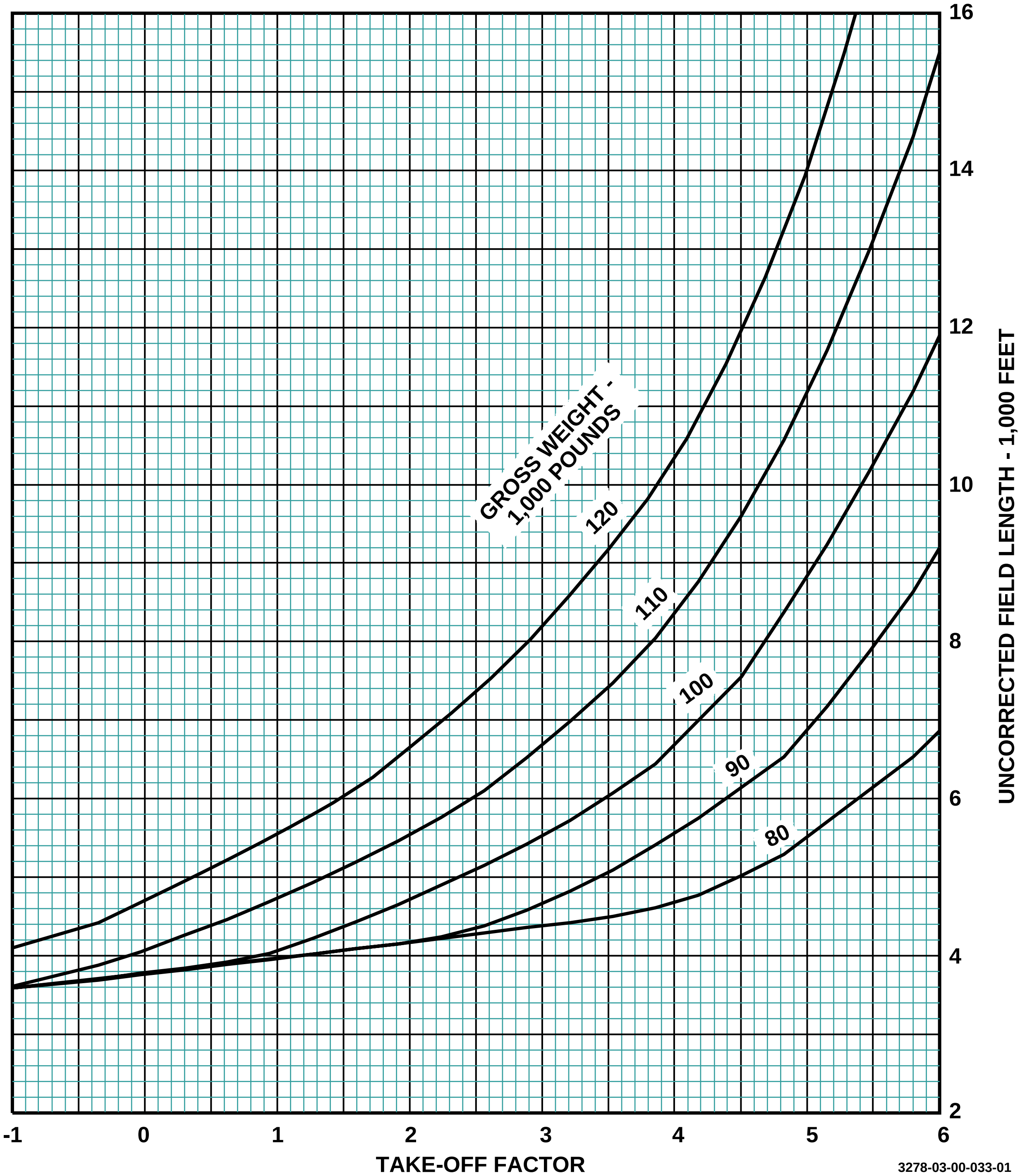


Figure 3-30. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MINIMUM FIELD LENGTH FOR THREE ENGINE TAKE-OFF

50 PERCENT FLAPS

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

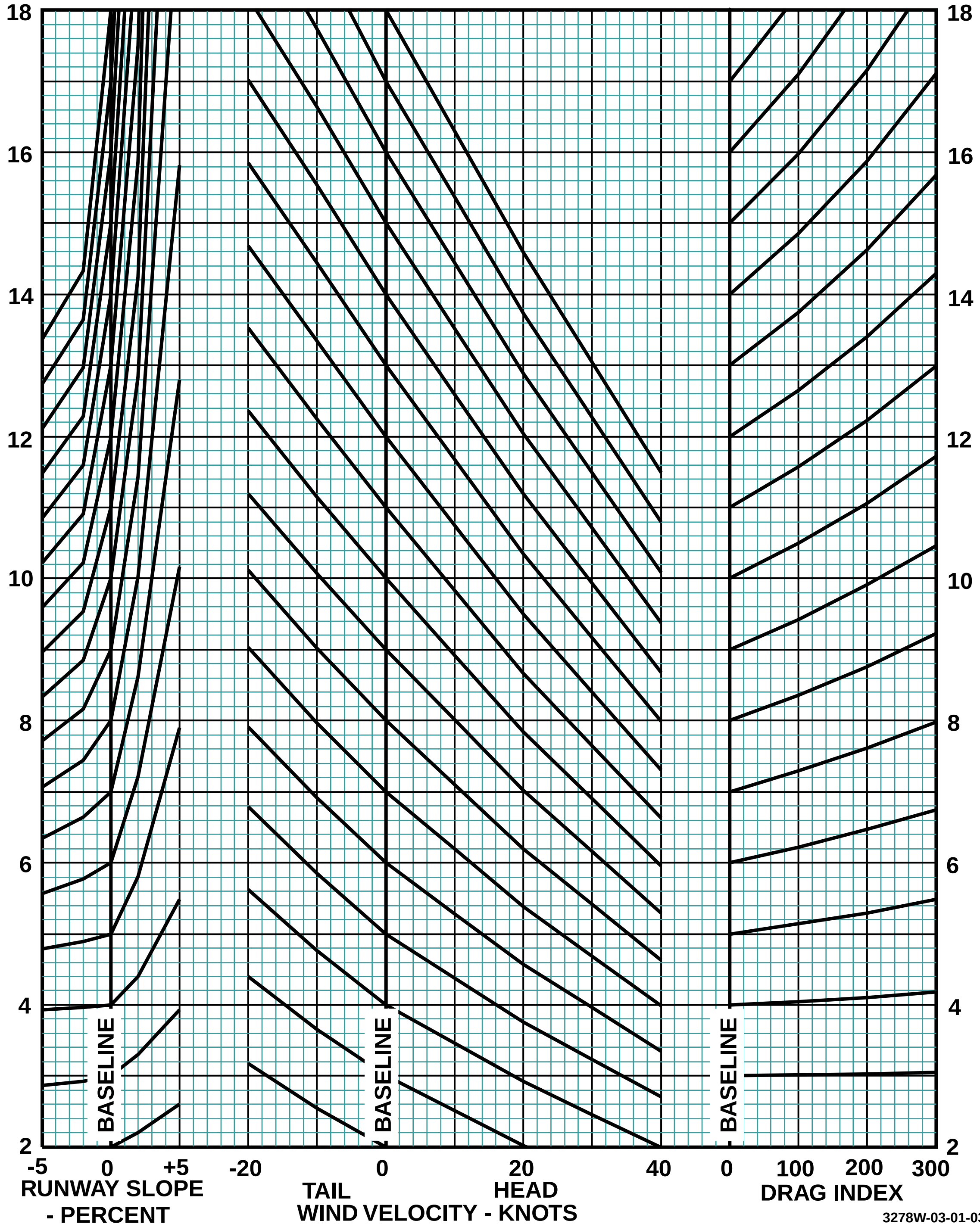
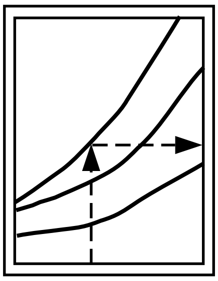


Figure 3-30. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER1998
DATA BASIS : FLIGHT TEST

TAKE-OFF DISTANCE
3 ENGINES
50 PERCENT FLAPS



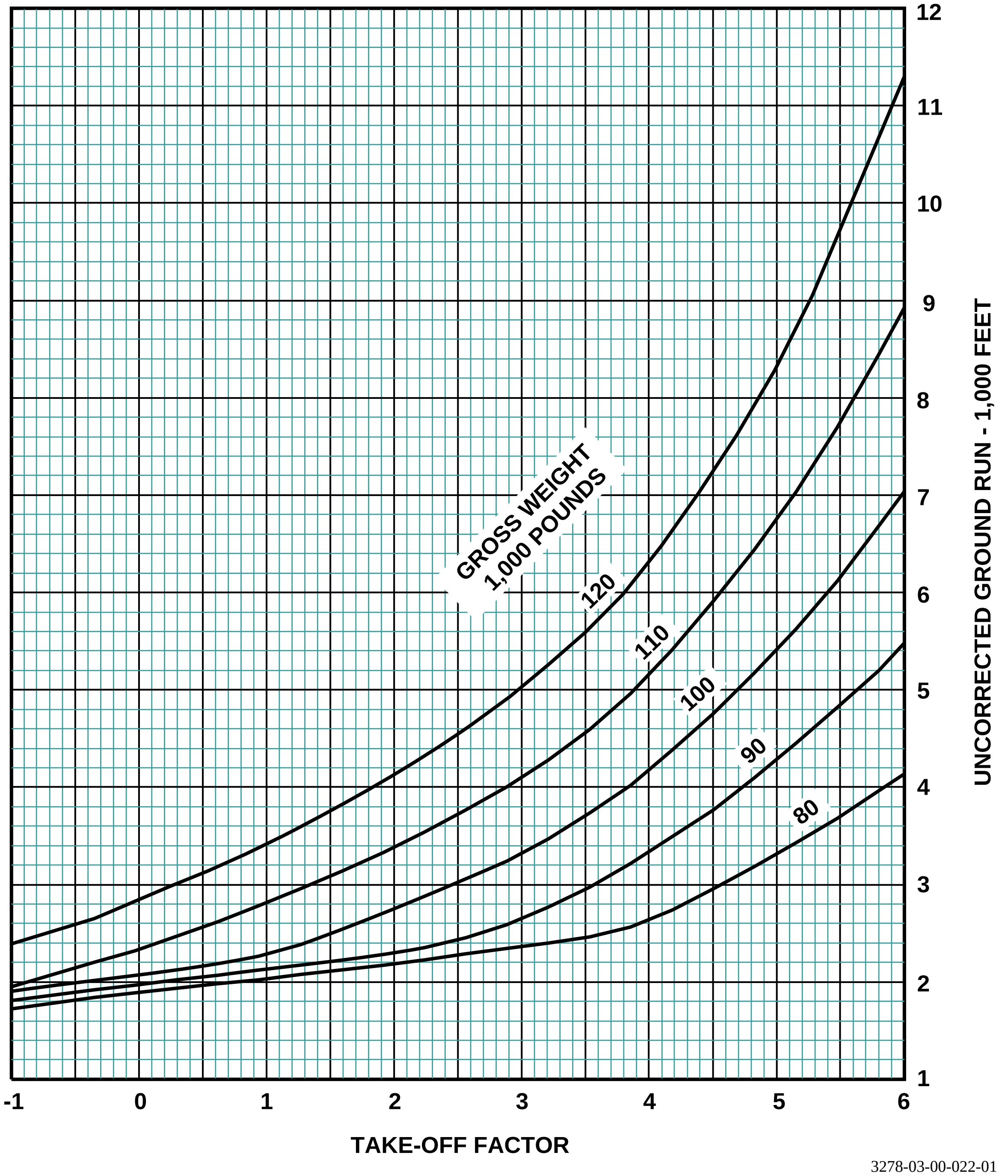
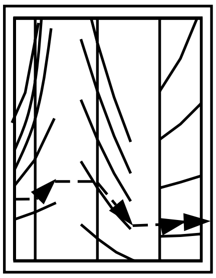


Figure 3-31. (Sheet 1 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE
3 ENGINES
50 PERCENT FLAPS



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

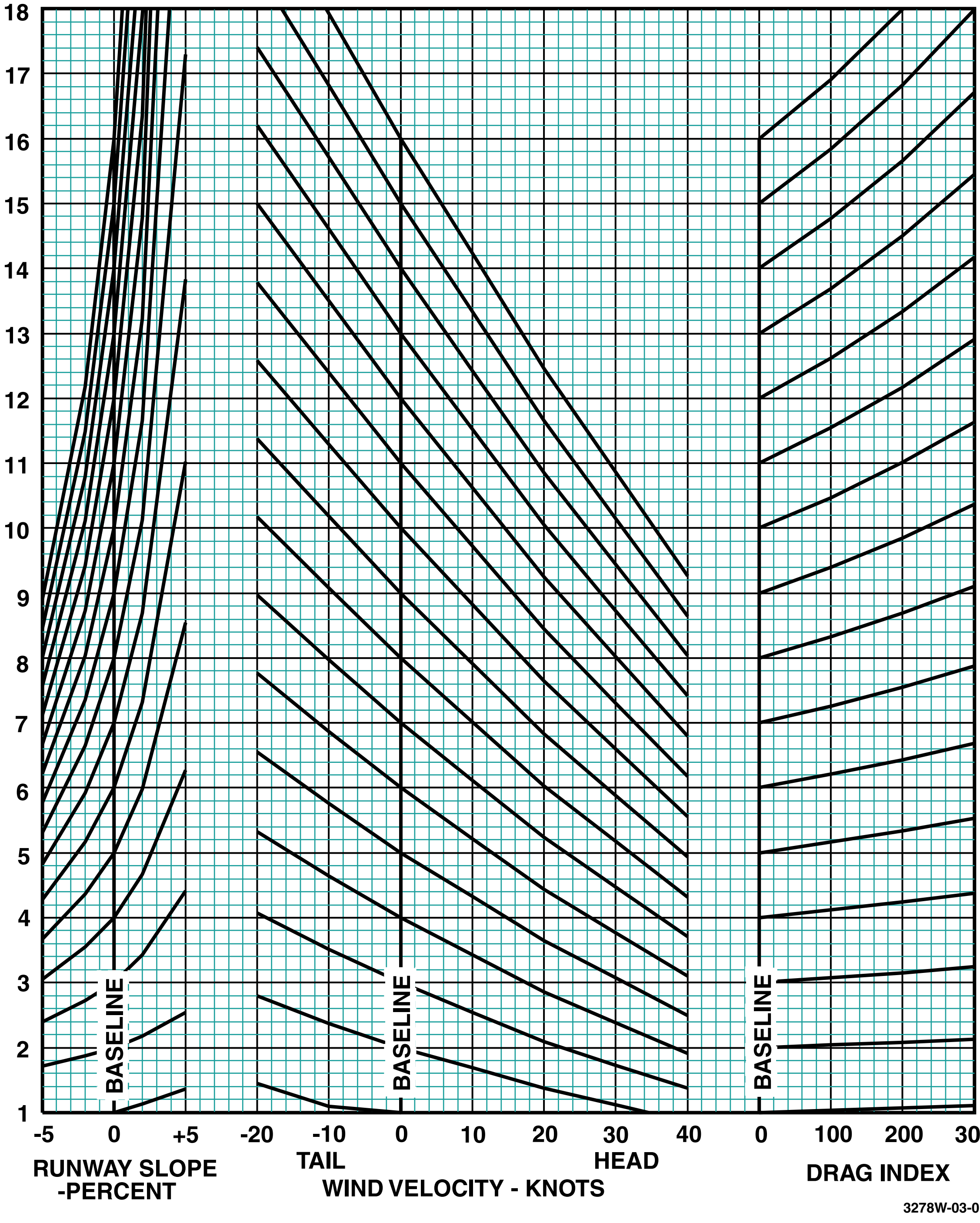


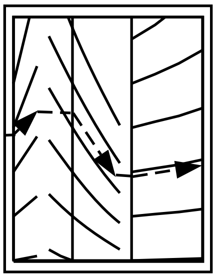
Figure 3-31. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE

3 ENGINES
50 PERCENT FLAPS



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

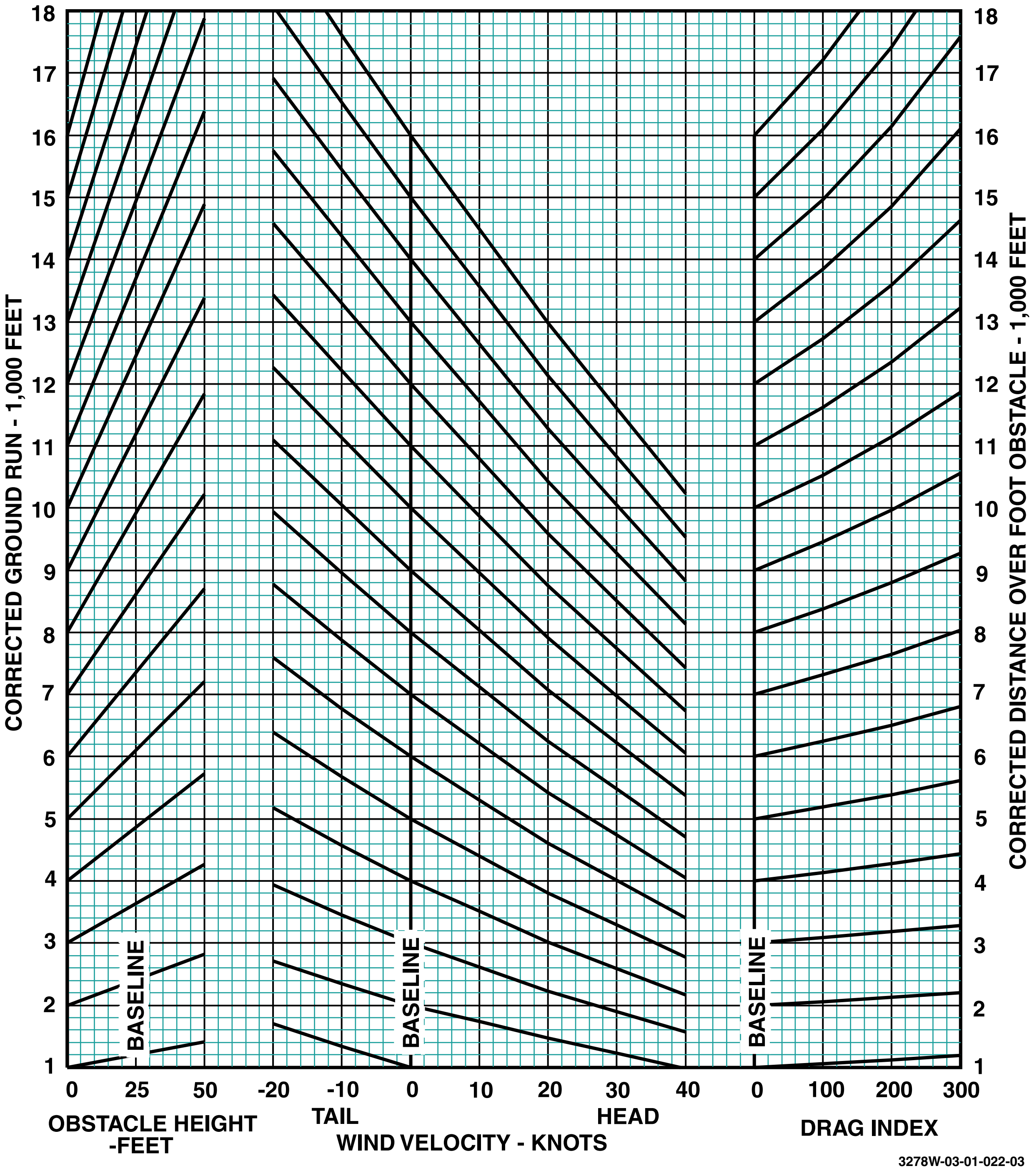


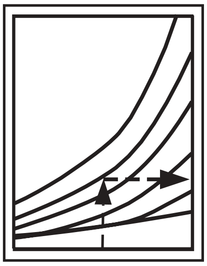
Figure 3-31. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKE-OFF

50 PERCENT FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



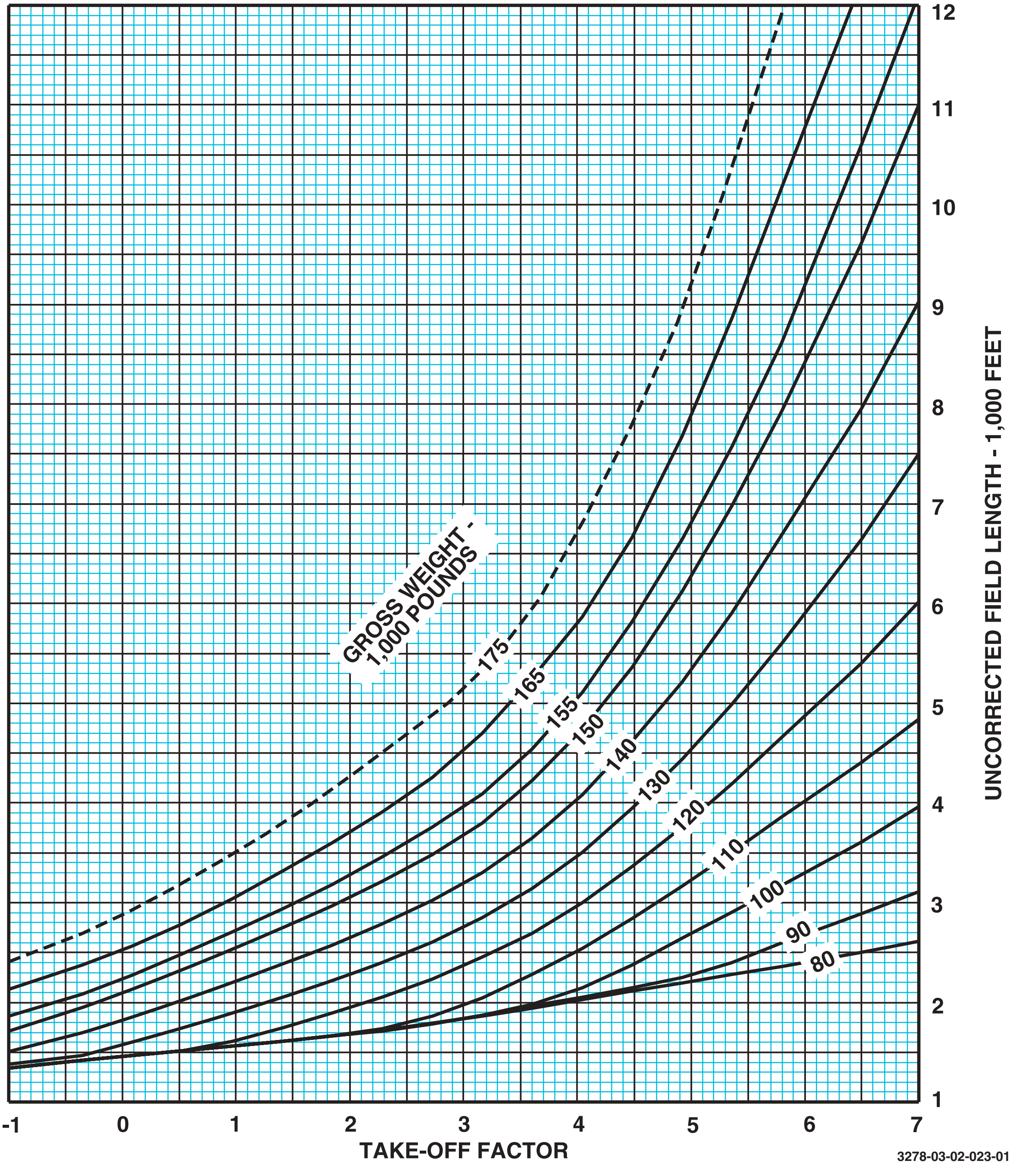


Figure 3-32. (Sheet 1 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKE-OFF

50 PERCENT FLAPS

NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

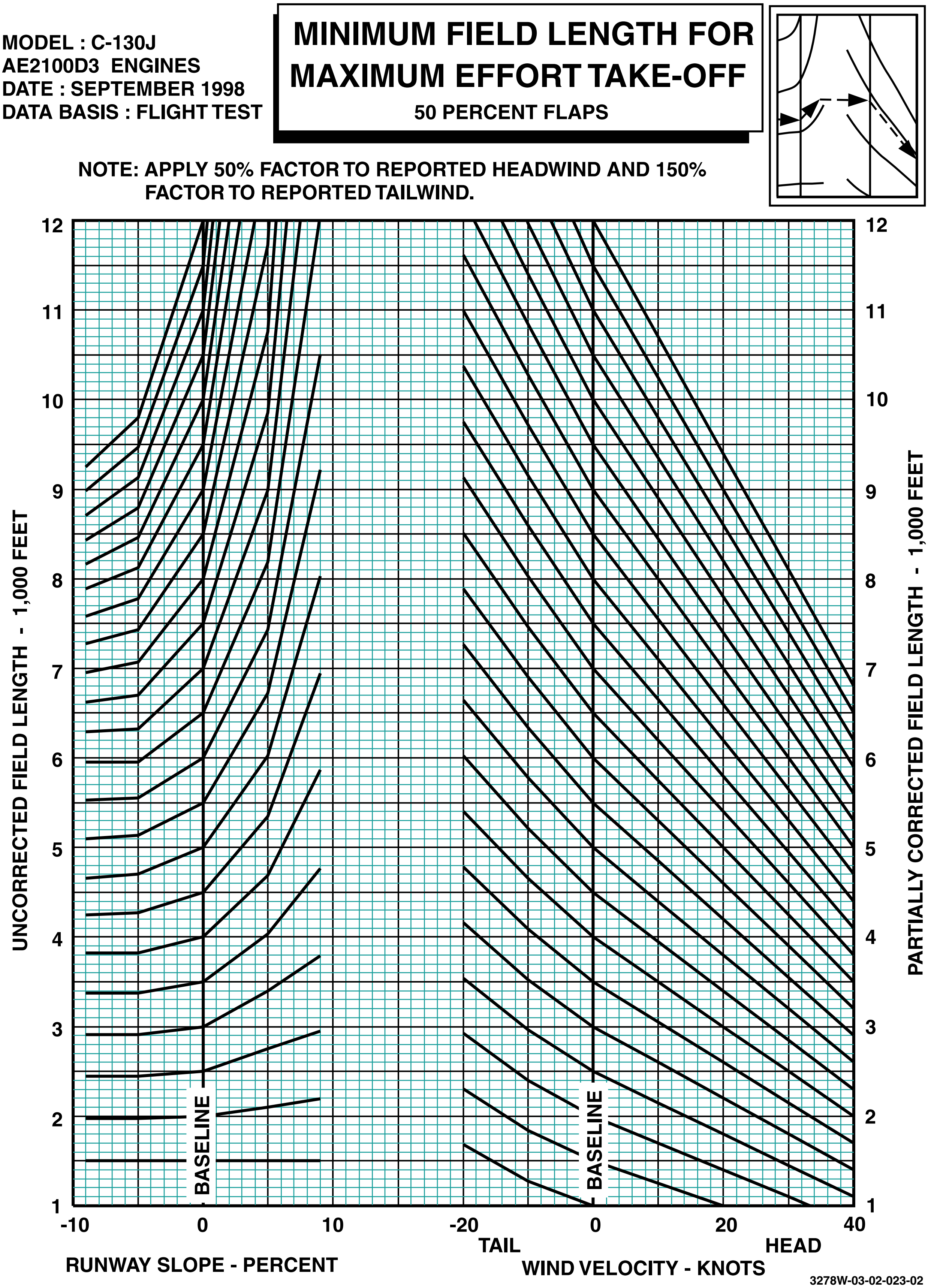


Figure 3-32. (Sheet 2 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS :FLIGHT TEST

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKE-OFF

50 PERCENT FLAPS

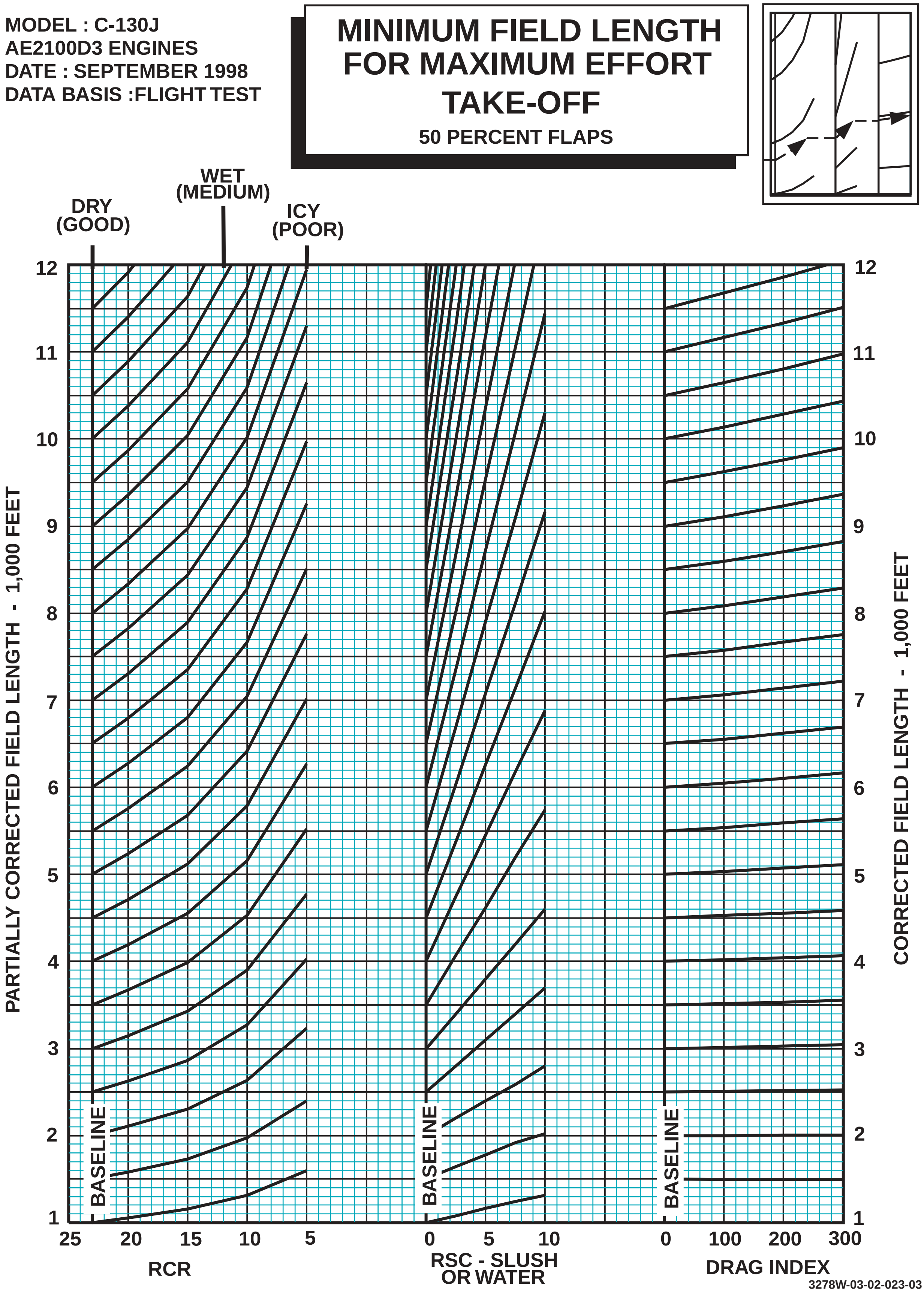


Figure 3-32. (Sheet 3 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

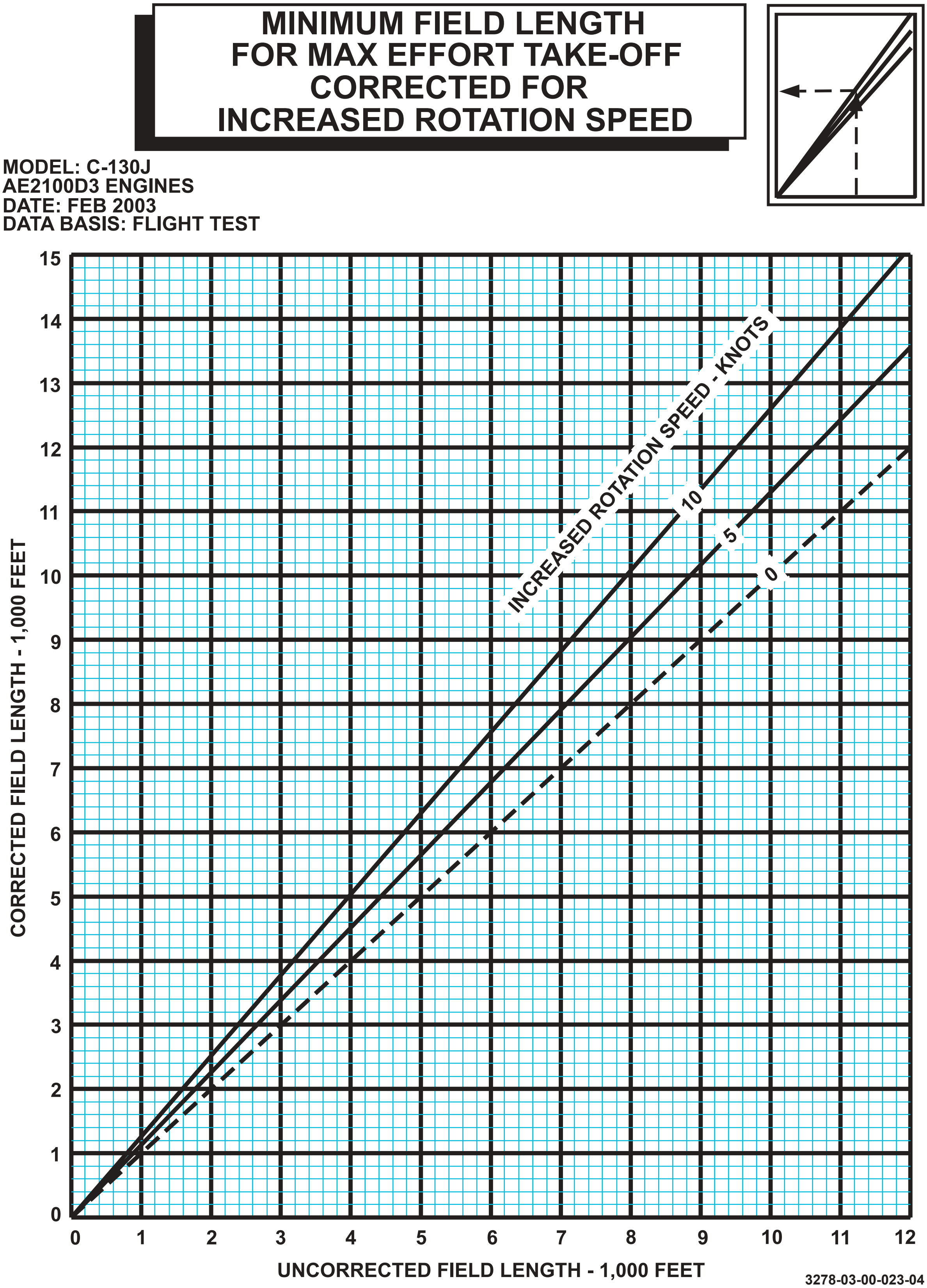


Figure 3-32. (Sheet 4 of 4)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE MAXIMUM EFFORT

4 ENGINES
50 PERCENT FLAPS

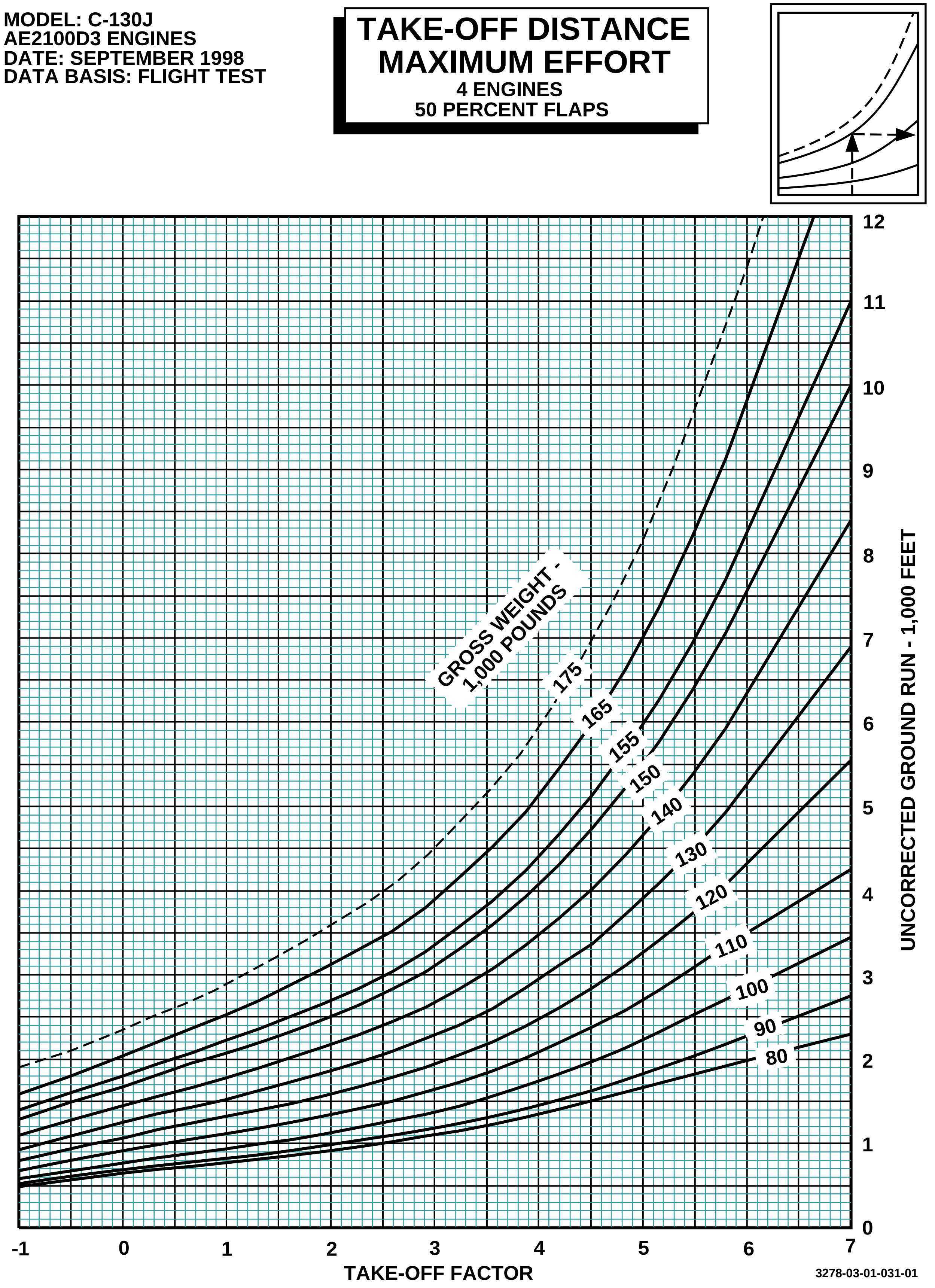


Figure 3-33. (Sheet 1 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE MAXIMUM EFFORT

4 ENGINES
50 PERCENT FLAPS

NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

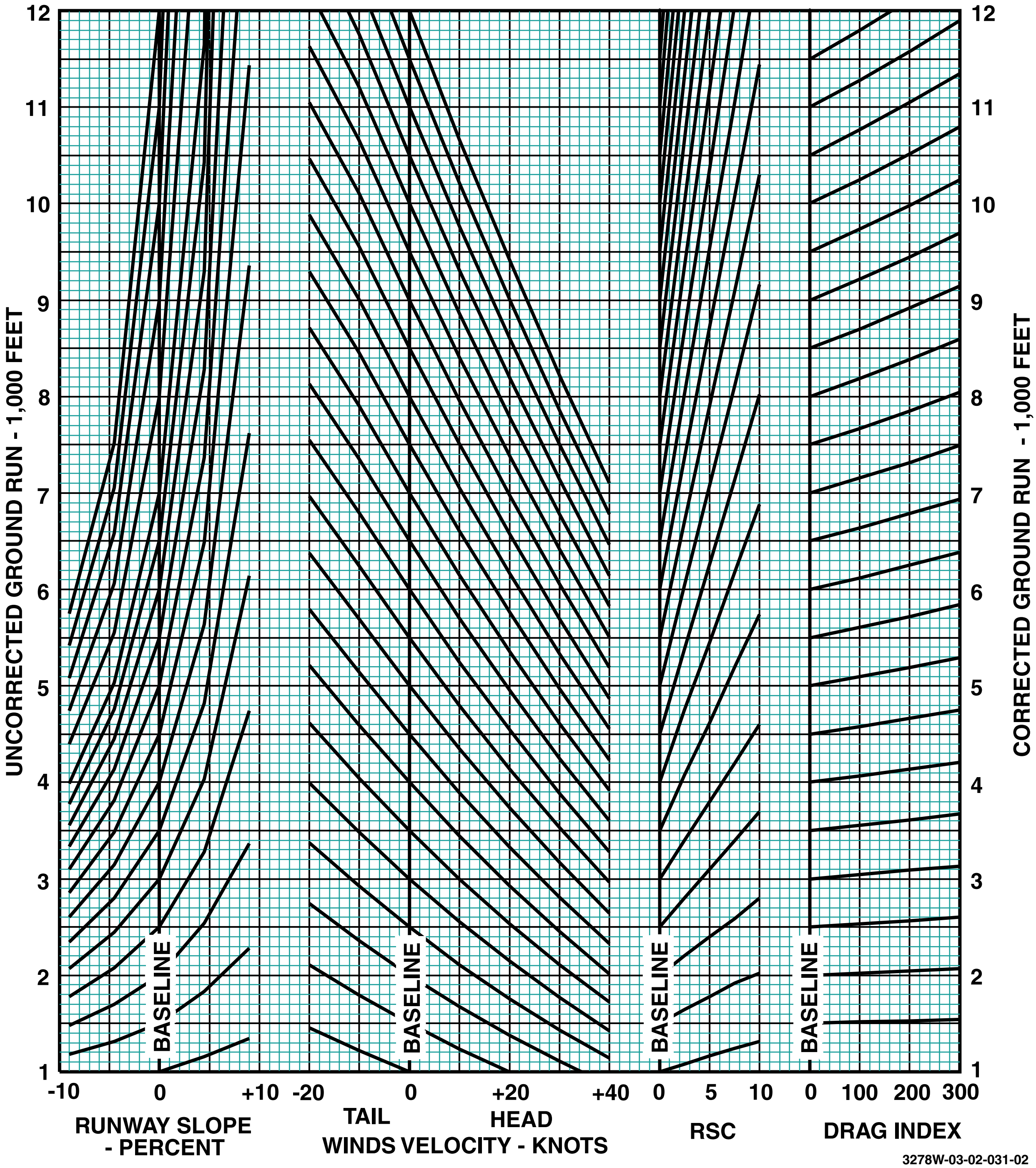


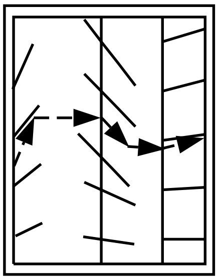
Figure 3-33. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TAKE-OFF DISTANCE MAXIMUM EFFORT

4 ENGINES
50 PERCENT FLAPS



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

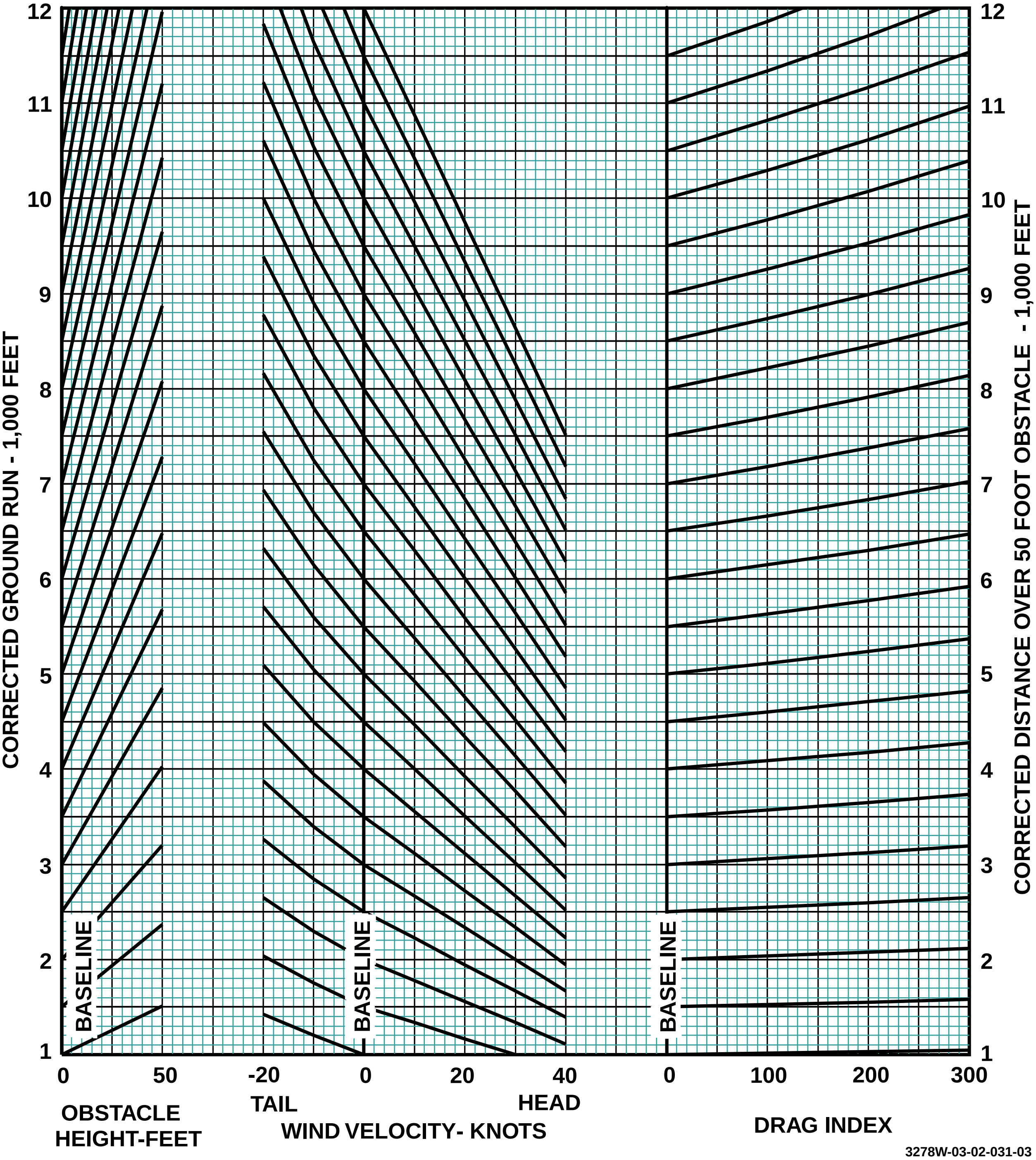


Figure 3-33. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

ACCELERATION CHECK TIME
4 ENGINES

NOTE: USE REFUSAL SPEED -10 KNOTS ROUNDED DOWN TO THE NEAREST 10 KNOTS FOR THE ACCELERATION CHECK TIME SPEED.

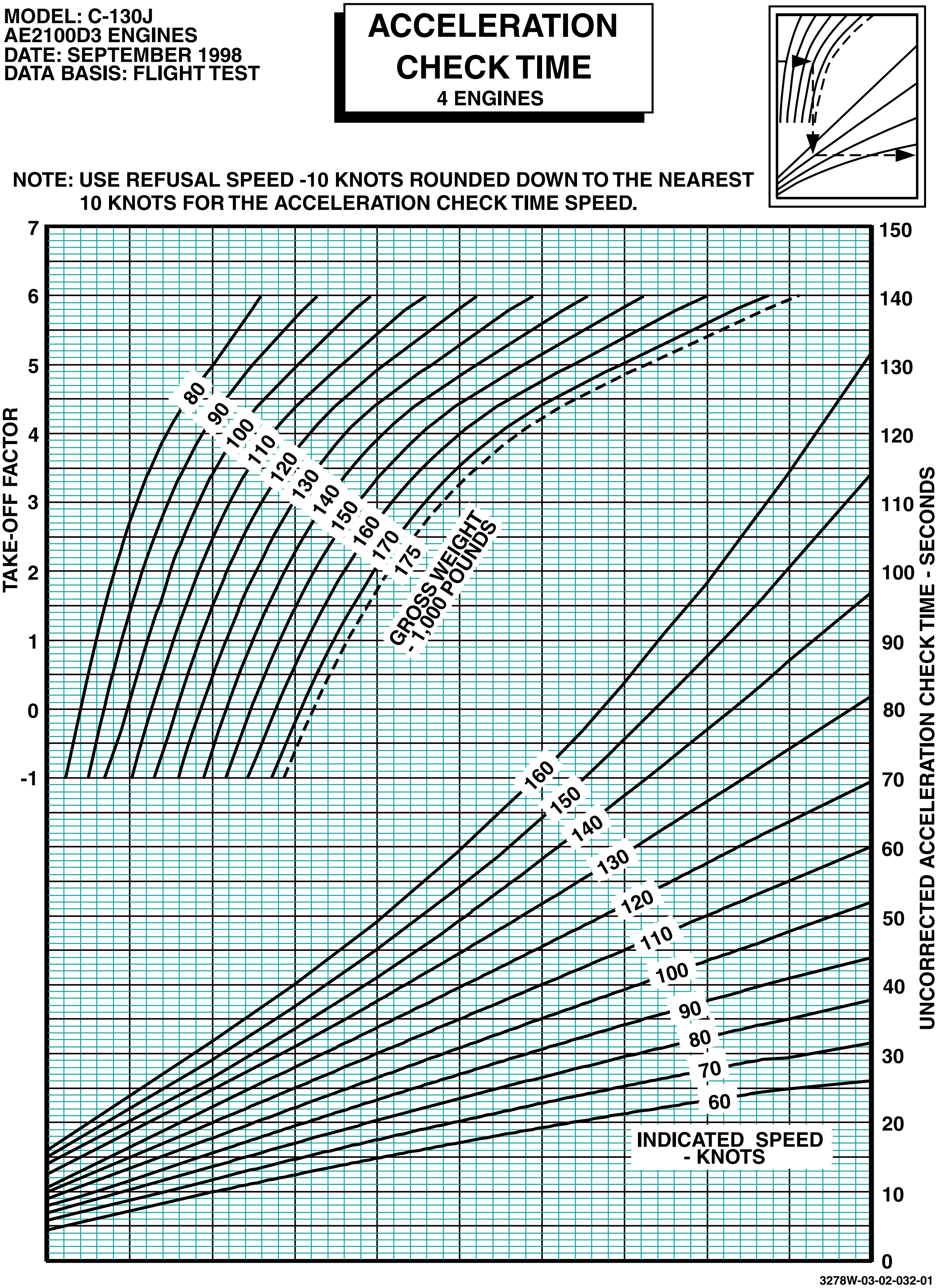


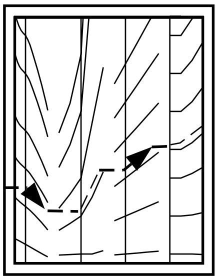
Figure 3-34. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

ACCELERATION CHECK TIME

4 ENGINES



NOTE: USE REPORTED HEADWIND OR TAILWIND.

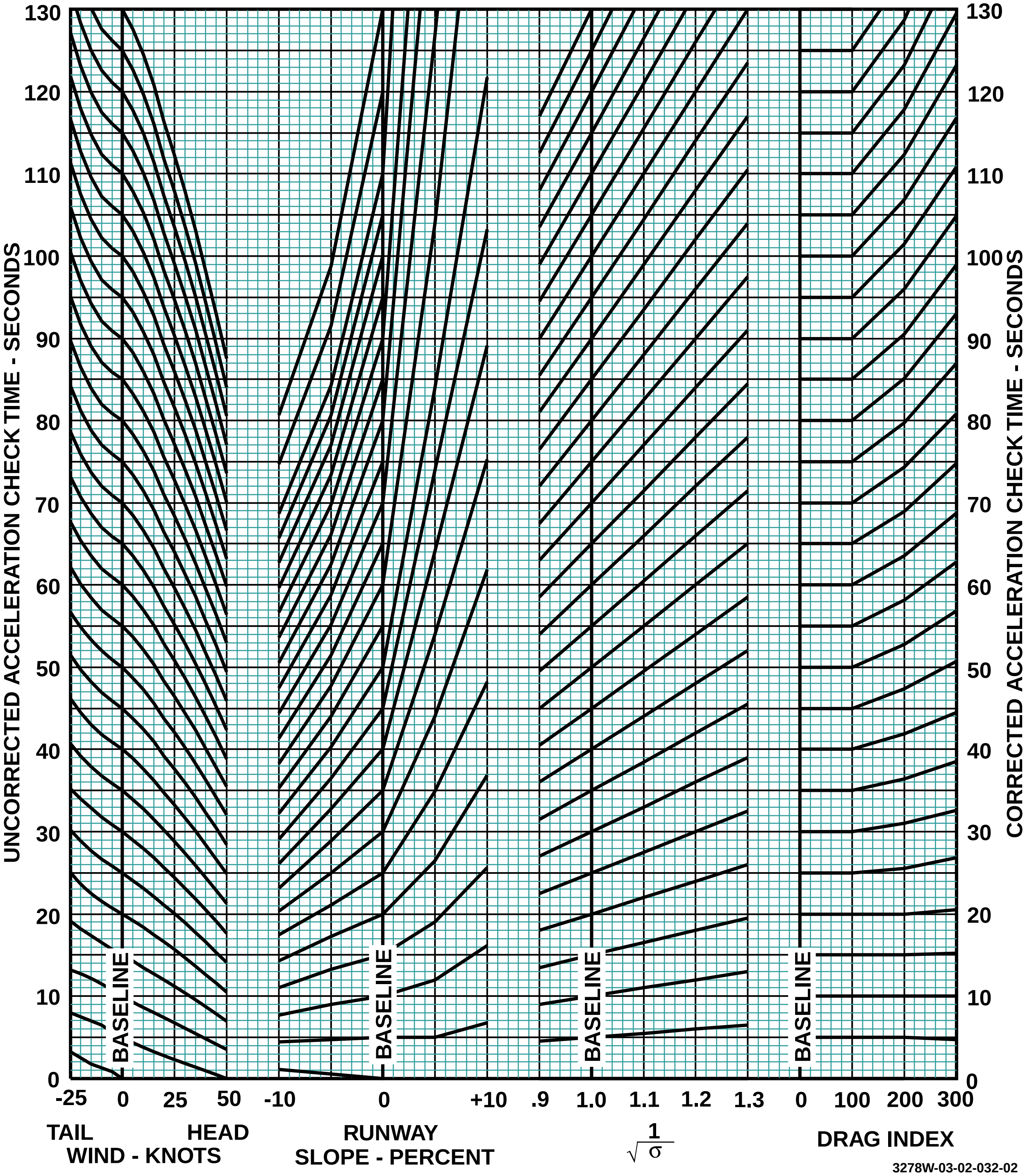


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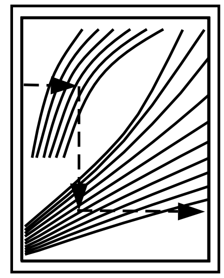
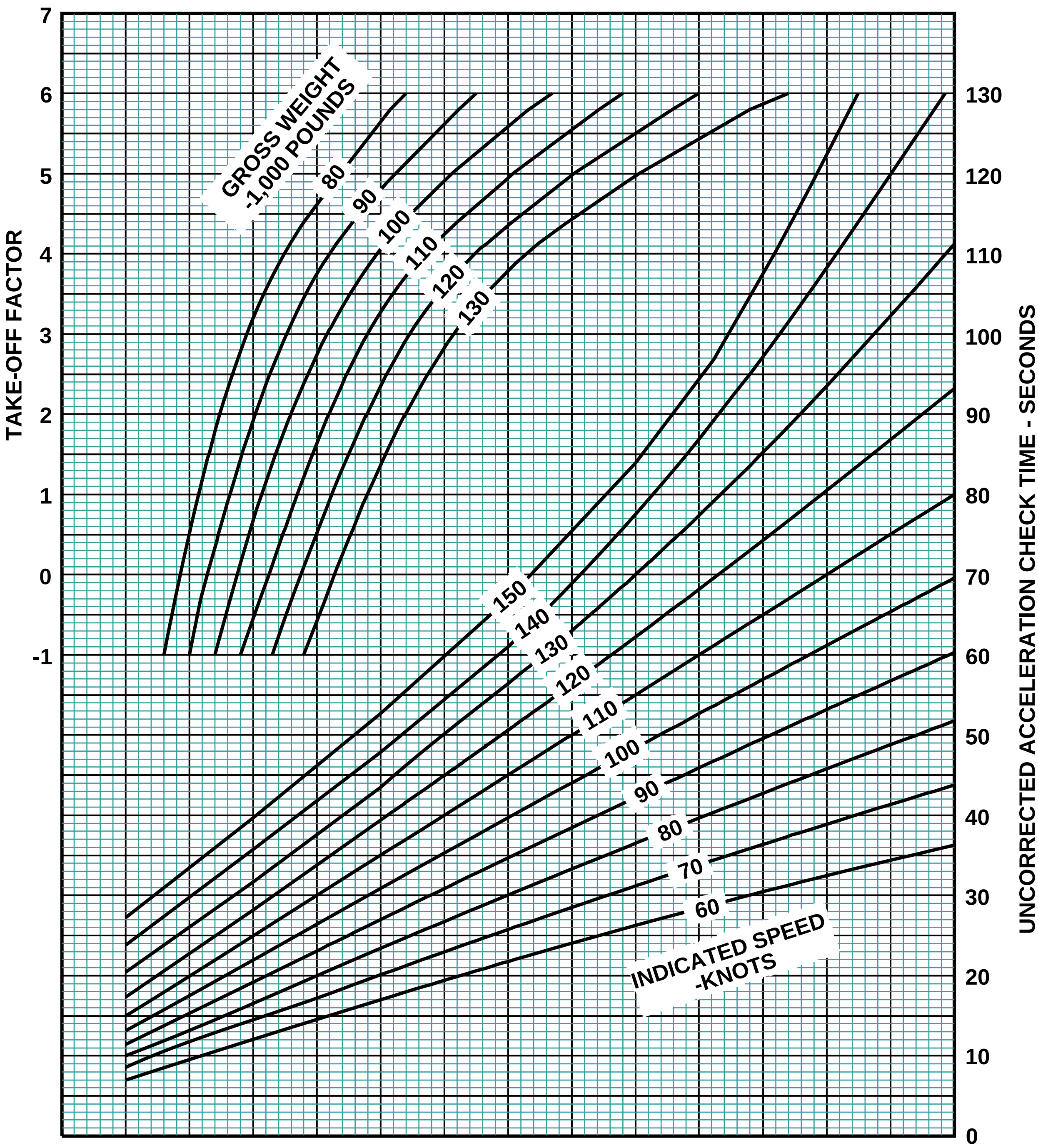
Figure 3-34. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

ACCELERATION CHECK TIME
3 ENGINES





3278-03-00-037-01

Figure 3-35. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

ACCELERATION CHECK TIME
3 ENGINES

NOTE: USE REPORTED HEADWIND OR TAILWIND.

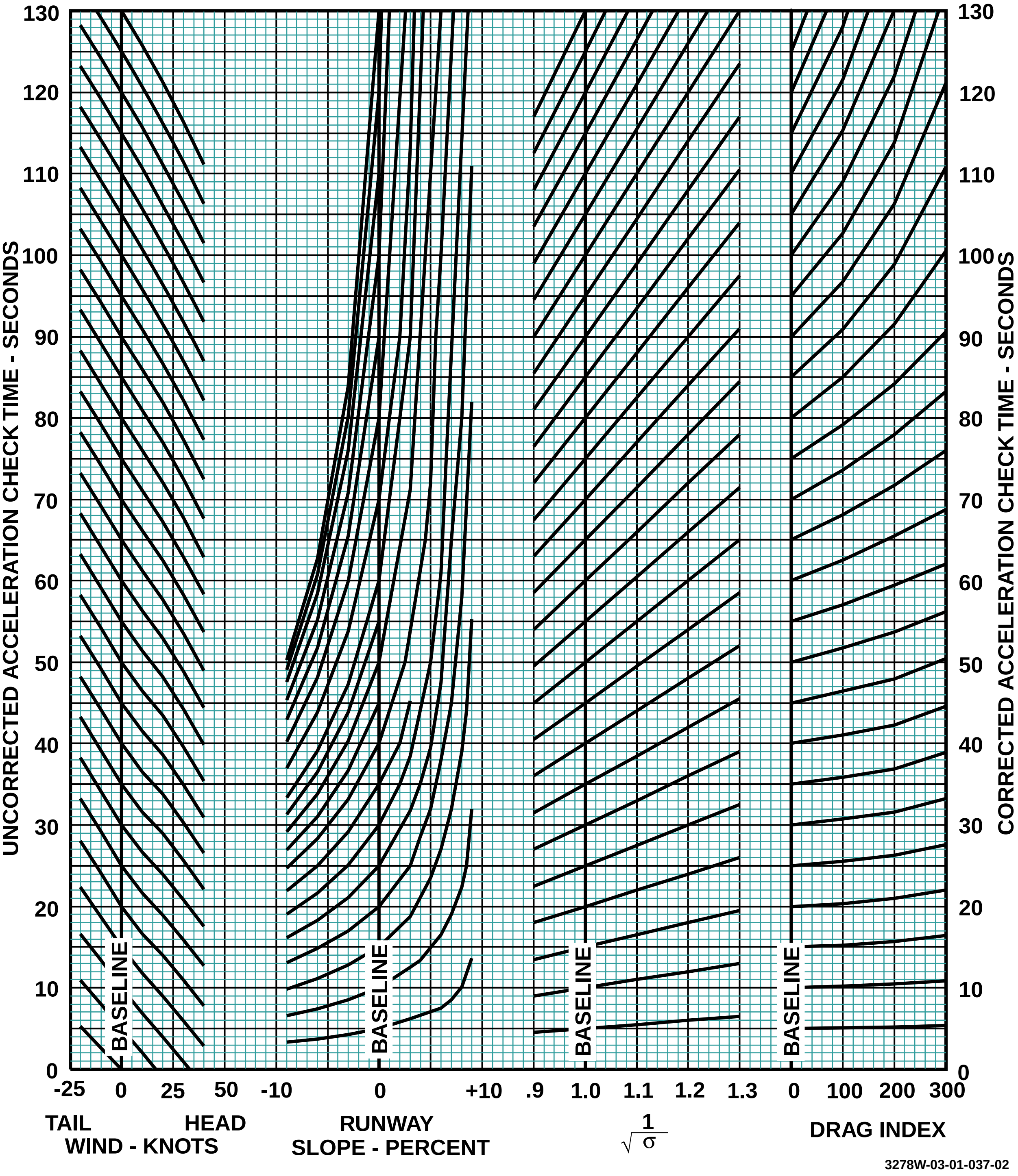


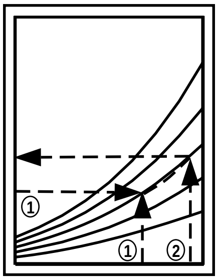
Figure 3-35. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPEED AND DISTANCE DURING TAKE-OFF GROUND RUN

4 ENGINES ZERO WIND



NOTE: ① ENTER WITH COMPUTED TAKEOFF GROUND ROLL AND CHARTED ROTATION SPEED TO DETERMINE THE APPROPRIATE ACCELERATION GUIDELINE FOR THE GIVEN CONDITIONS.

② ENTER WITH THE INCREASED ROTATION SPEED AND USE THE ACCELERATION GUIDELINE DETERMINED IN ① TO FIND THE INCREASED GROUND ROLL DUE TO INCREASED ROTATION SPEED.

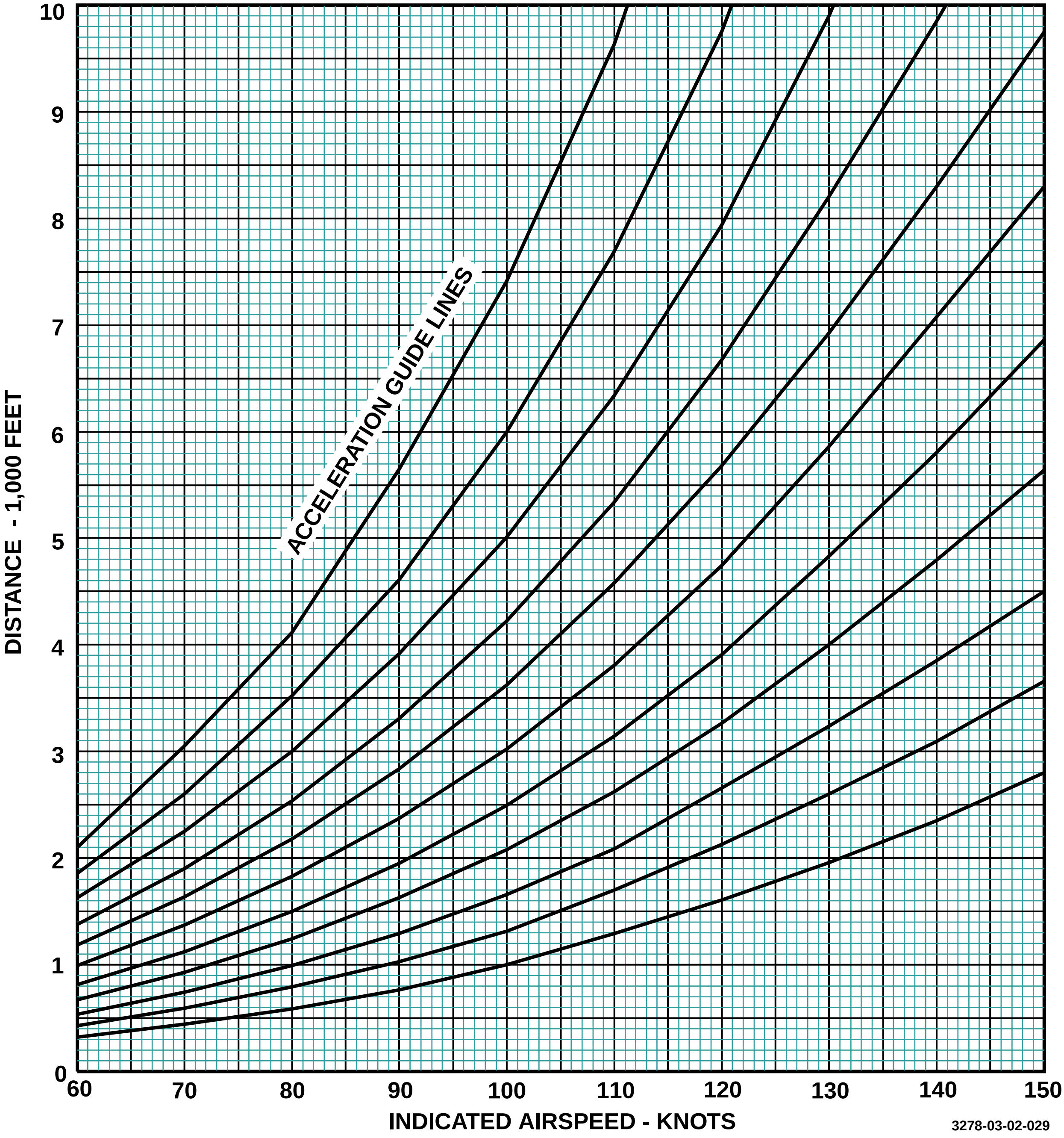


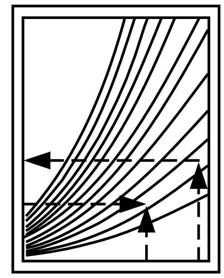
Figure 3-36.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPEED AND DISTANCE DURING TAKE-OFF GROUND RUN

3 ENGINES ZERO WIND



NOTE: ① ENTER WITH COMPUTED TAKEOFF GROUND ROLL AND CHARTED ROTATION SPEED TO DETERMINE THE APPROPRIATE ACCELERATION GUIDELINE FOR THE GIVEN CONDITIONS.

② ENTER WITH THE INCREASED ROTATION SPEED AND USE THE ACCELERATION GUIDELINE DETERMINED IN ① TO FIND THE INCREASED GROUND ROLL DUE TO INCREASED ROTATION SPEED.

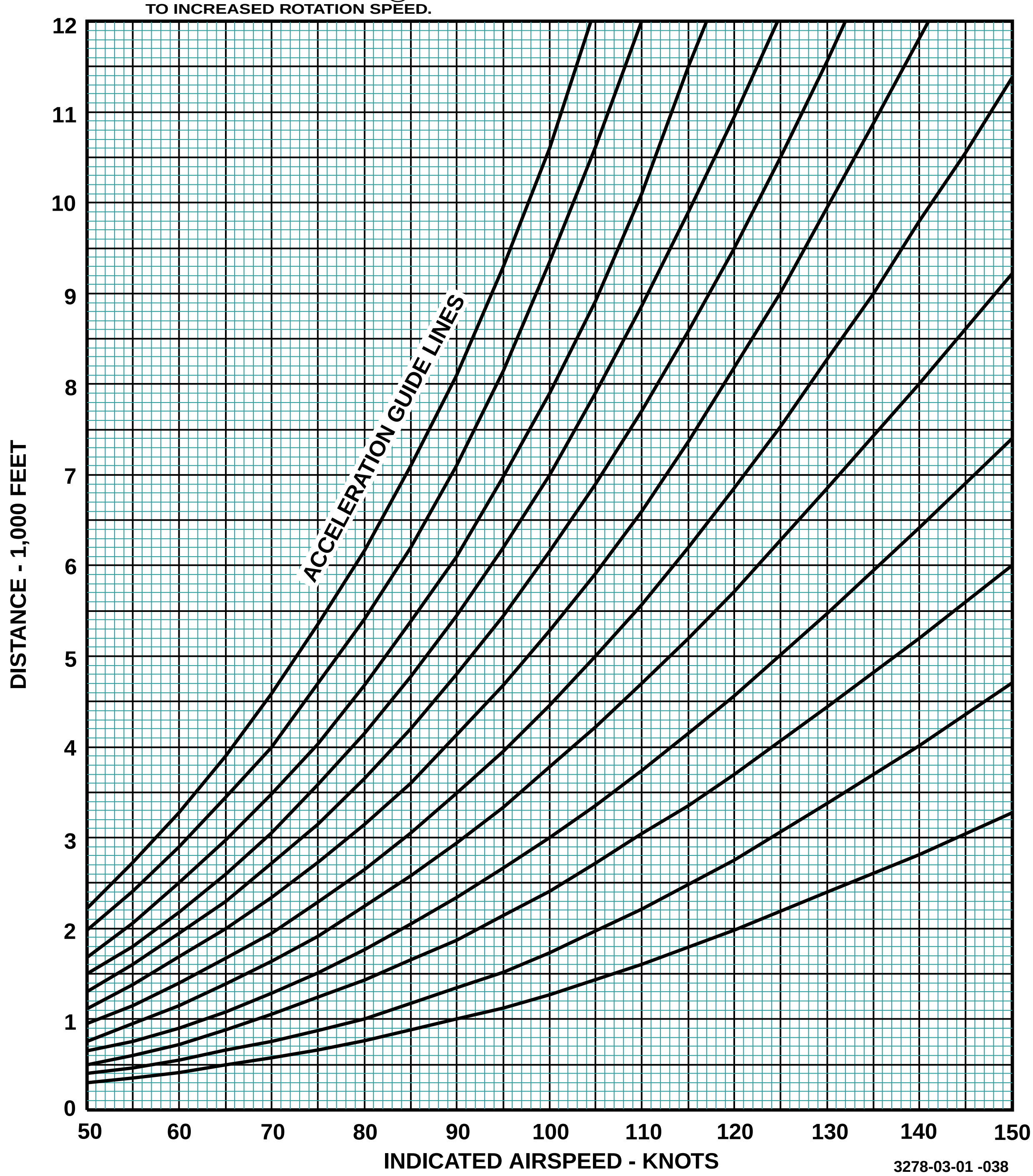


Figure 3-37.

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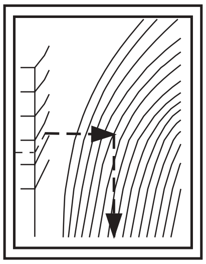
CLIMB-OUT FACTOR

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

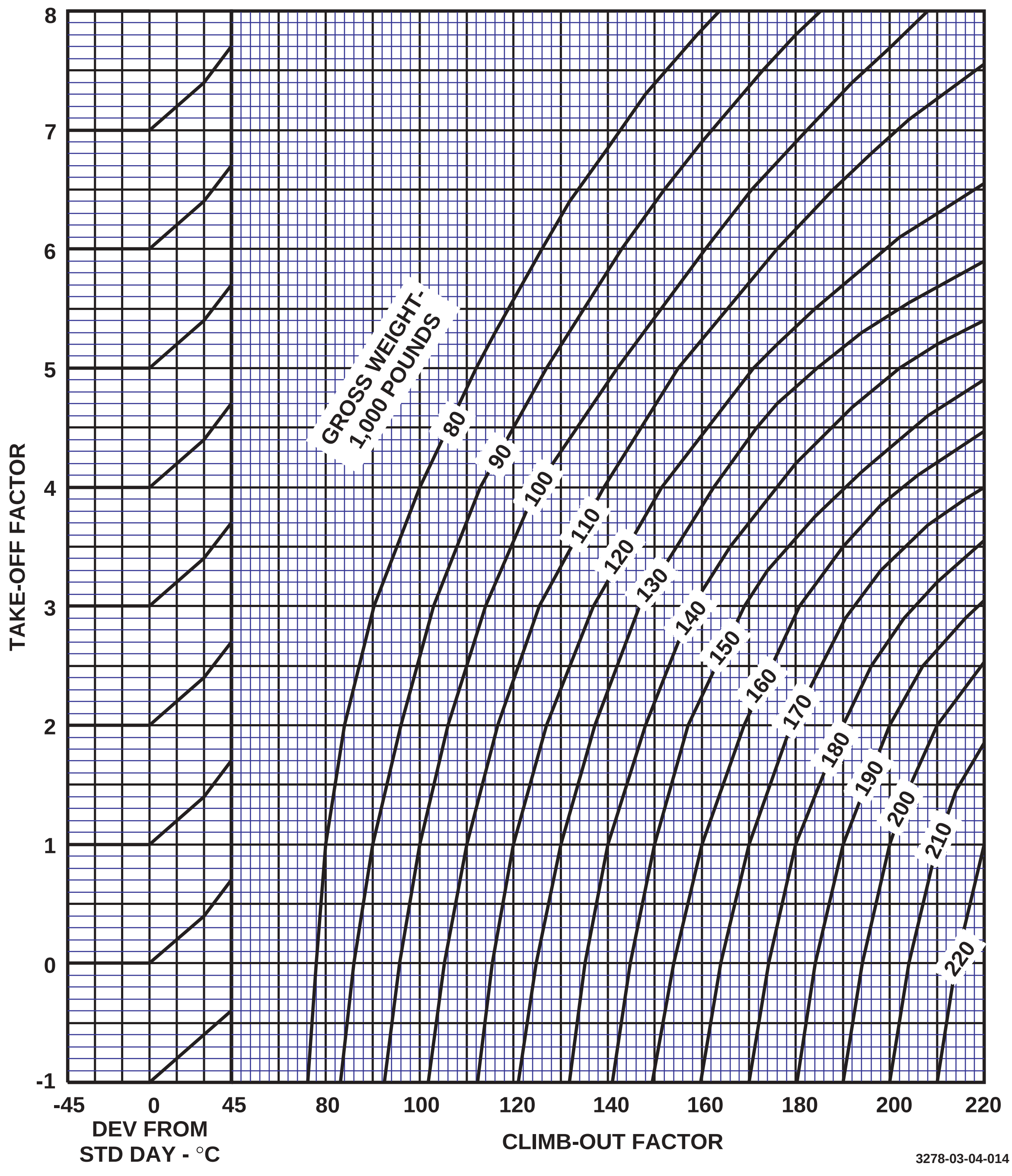


Figure 3-38.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

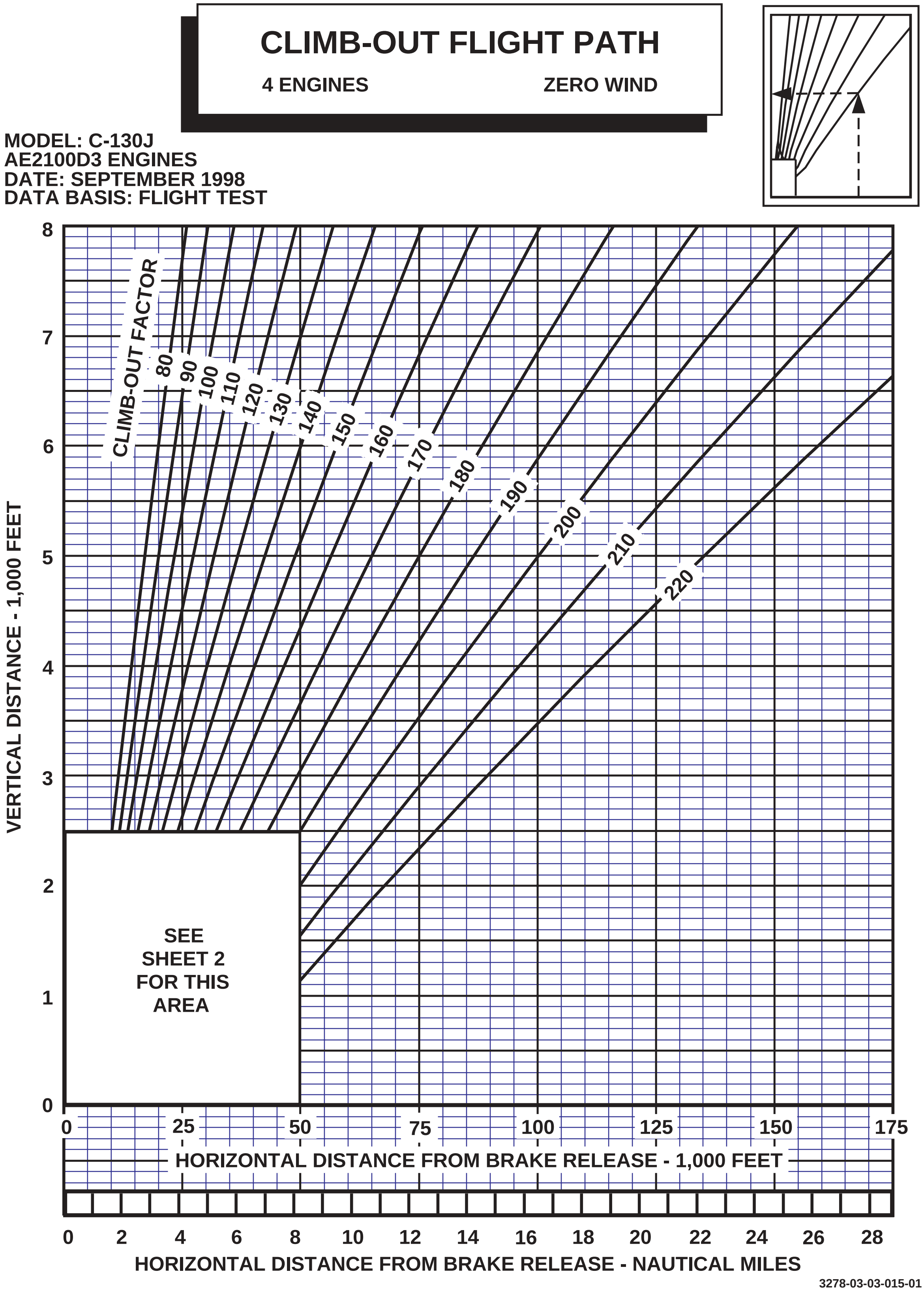


Figure 3-39. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the
statement on the title page of this document.

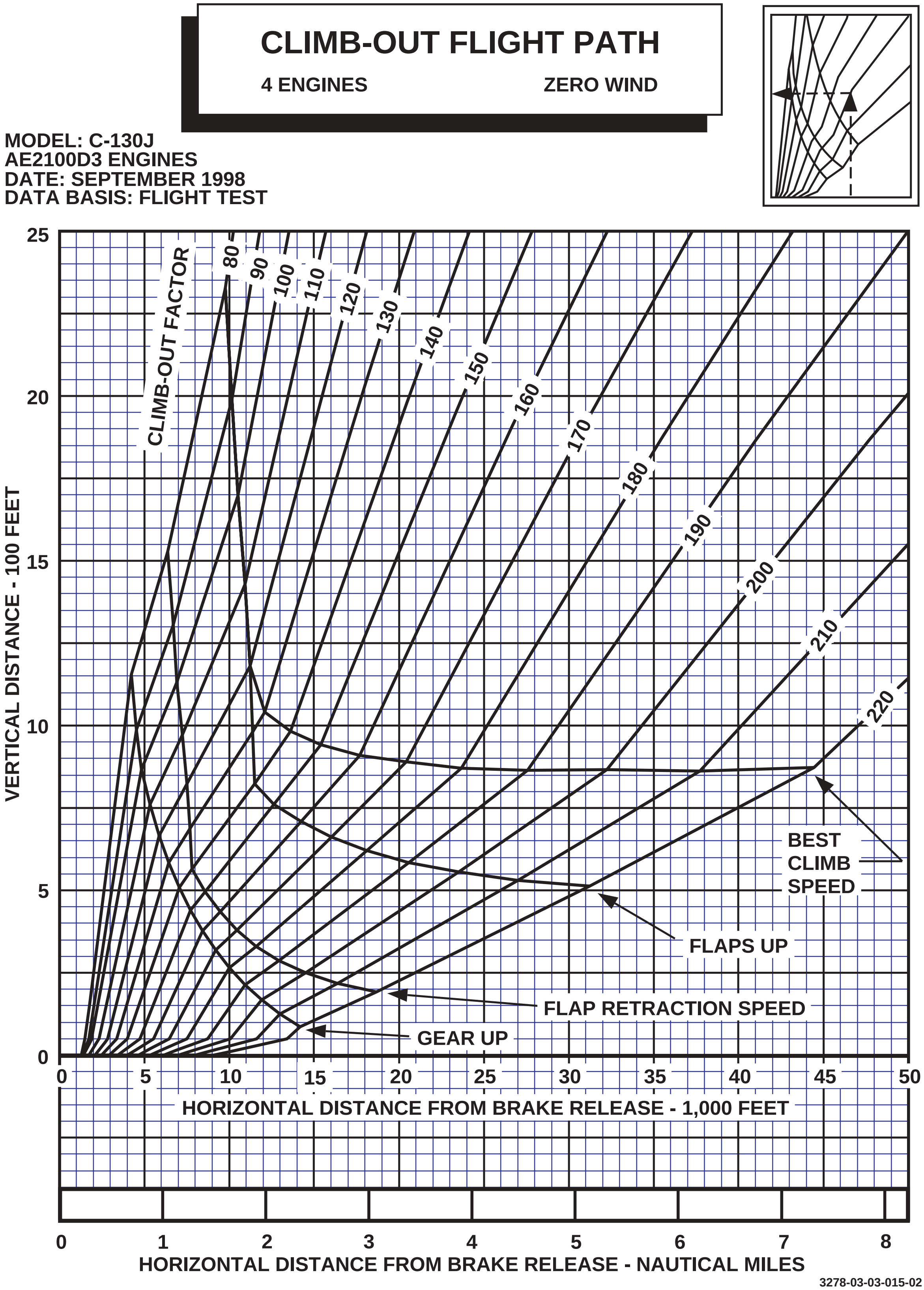


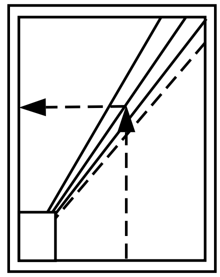
Figure 3-39. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CLIMB-OUT FLIGHT PATH EFFECT OF VARIANT CONFIGURATION

4 ENGINES



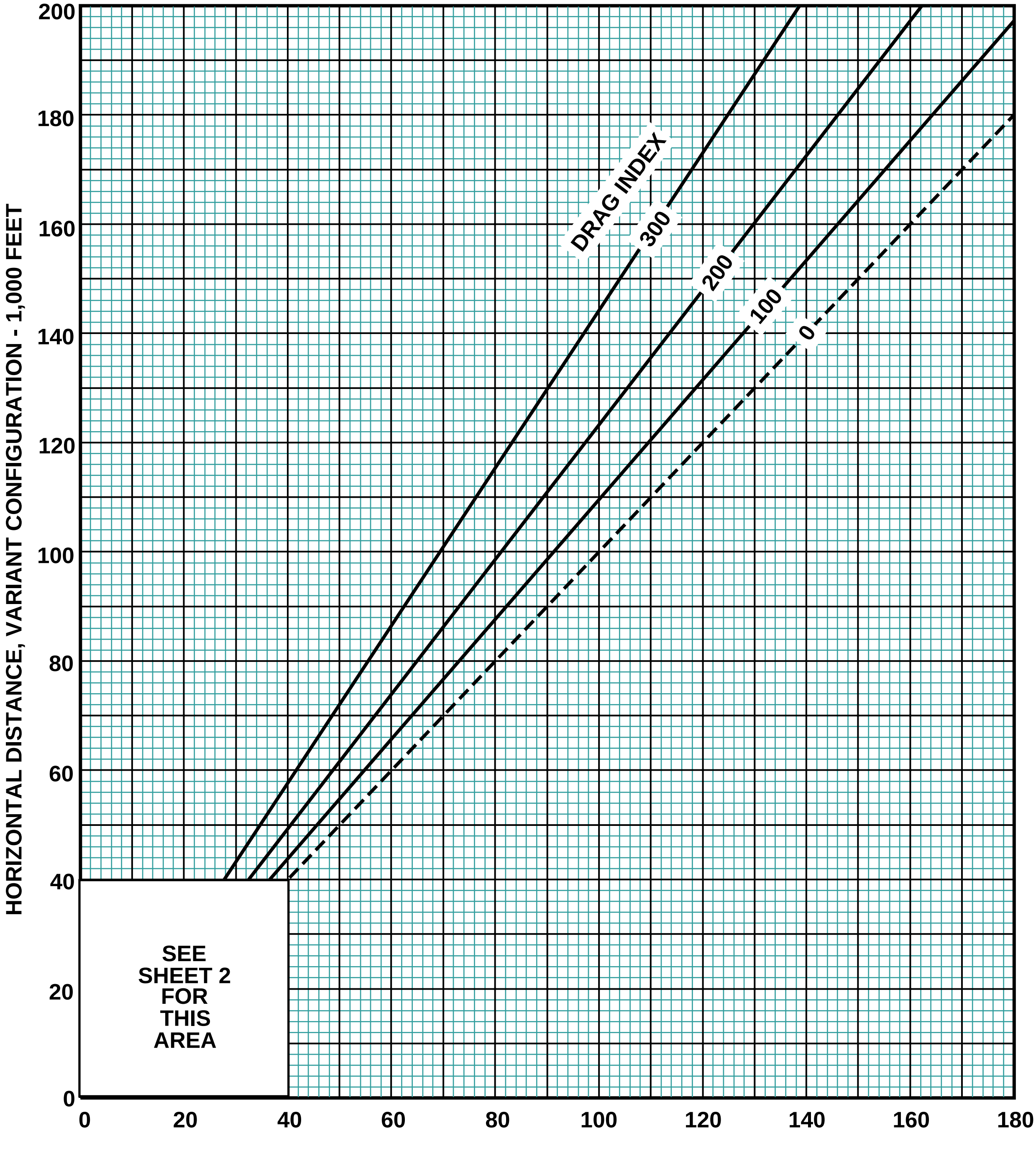


Figure 3-40. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CLIMB-OUT FLIGHT PATH EFFECT OF VARIANT CONFIGURATION

4 ENGINES

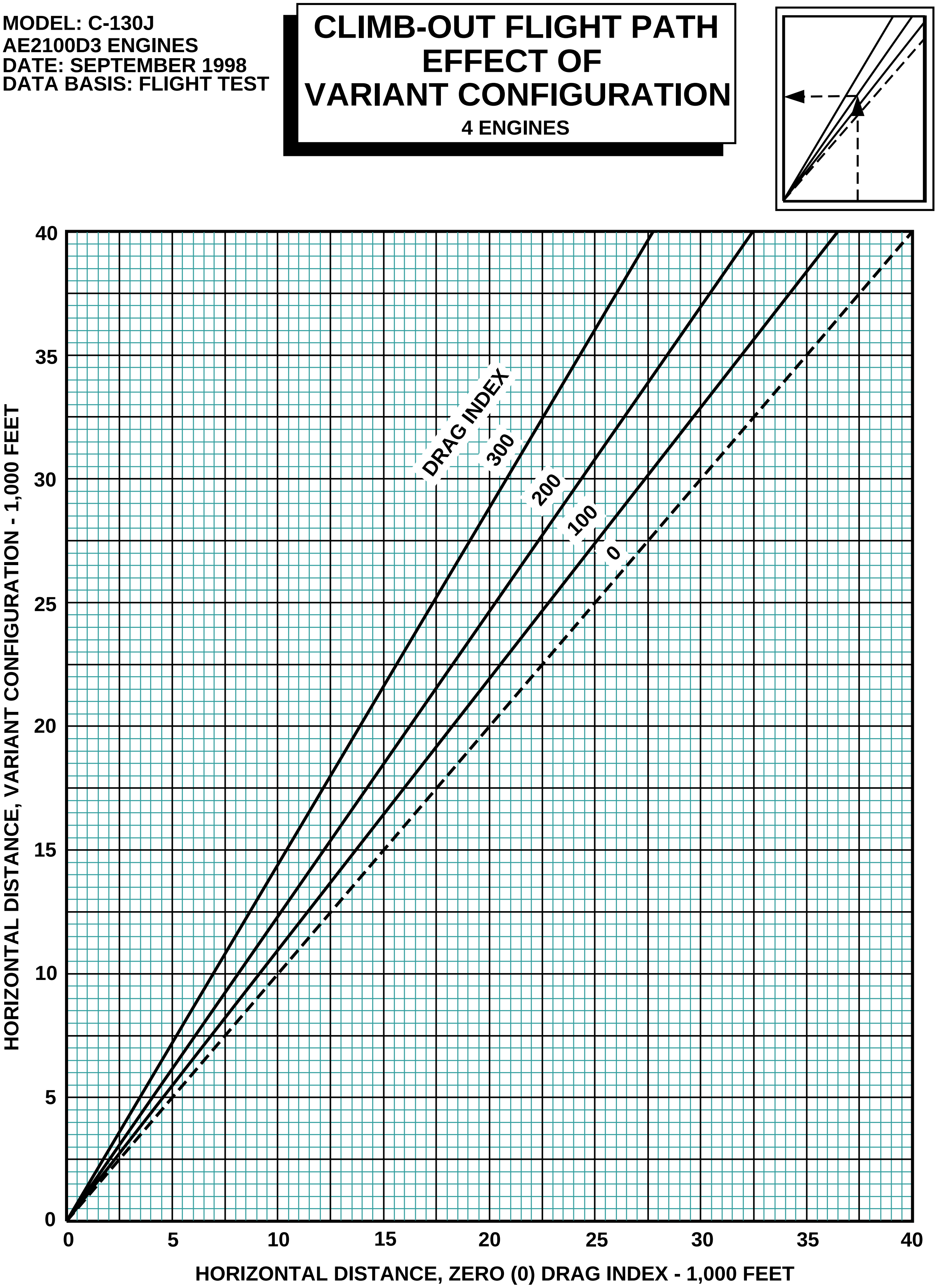


Figure 3-40. (Sheet 2 of 2)

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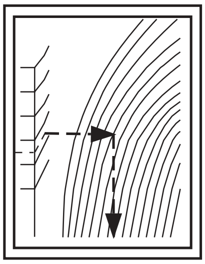
CLIMB-OUT FACTOR

4 ENGINES

MAXIMUM EFFORT

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



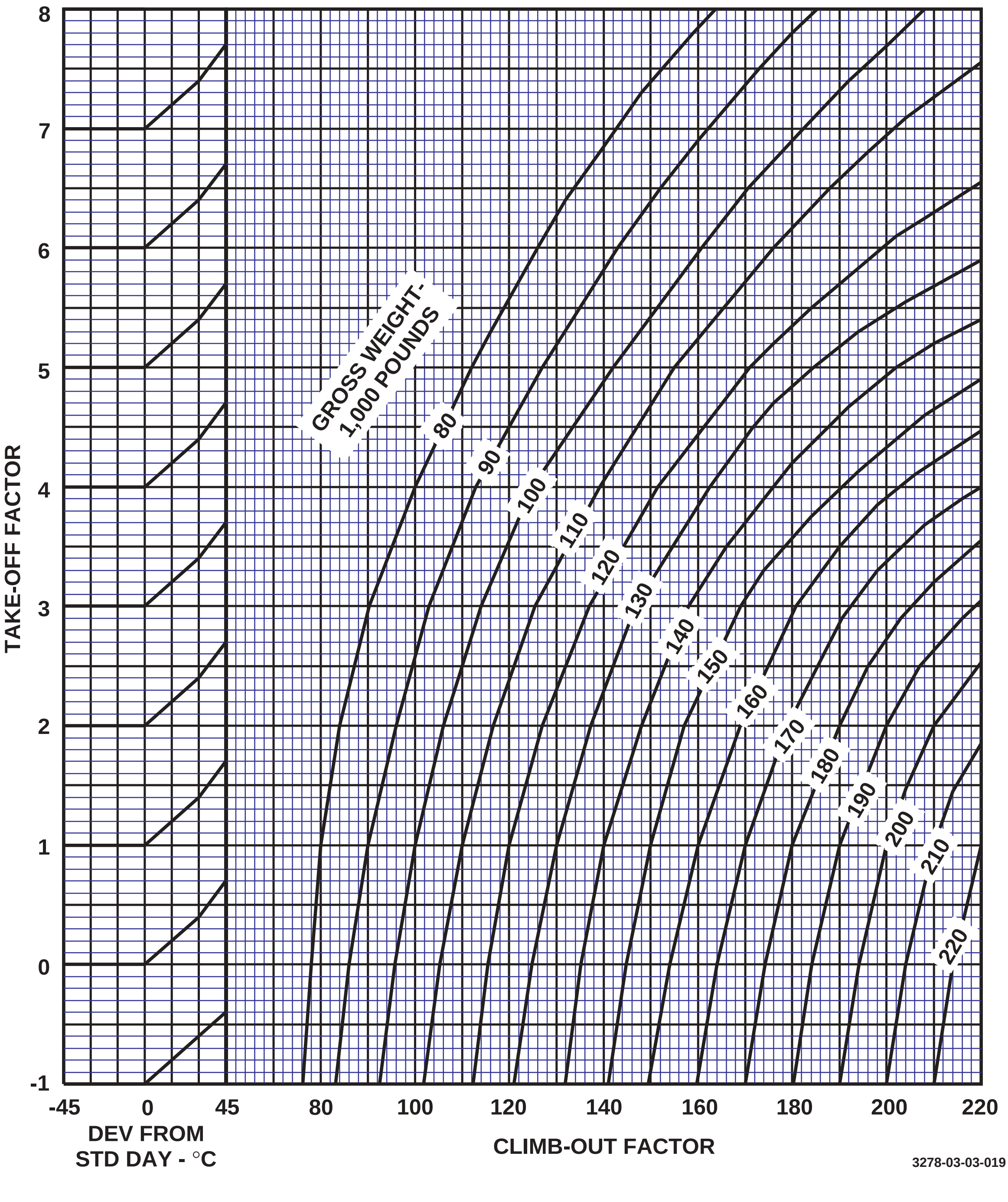


Figure 3-41.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

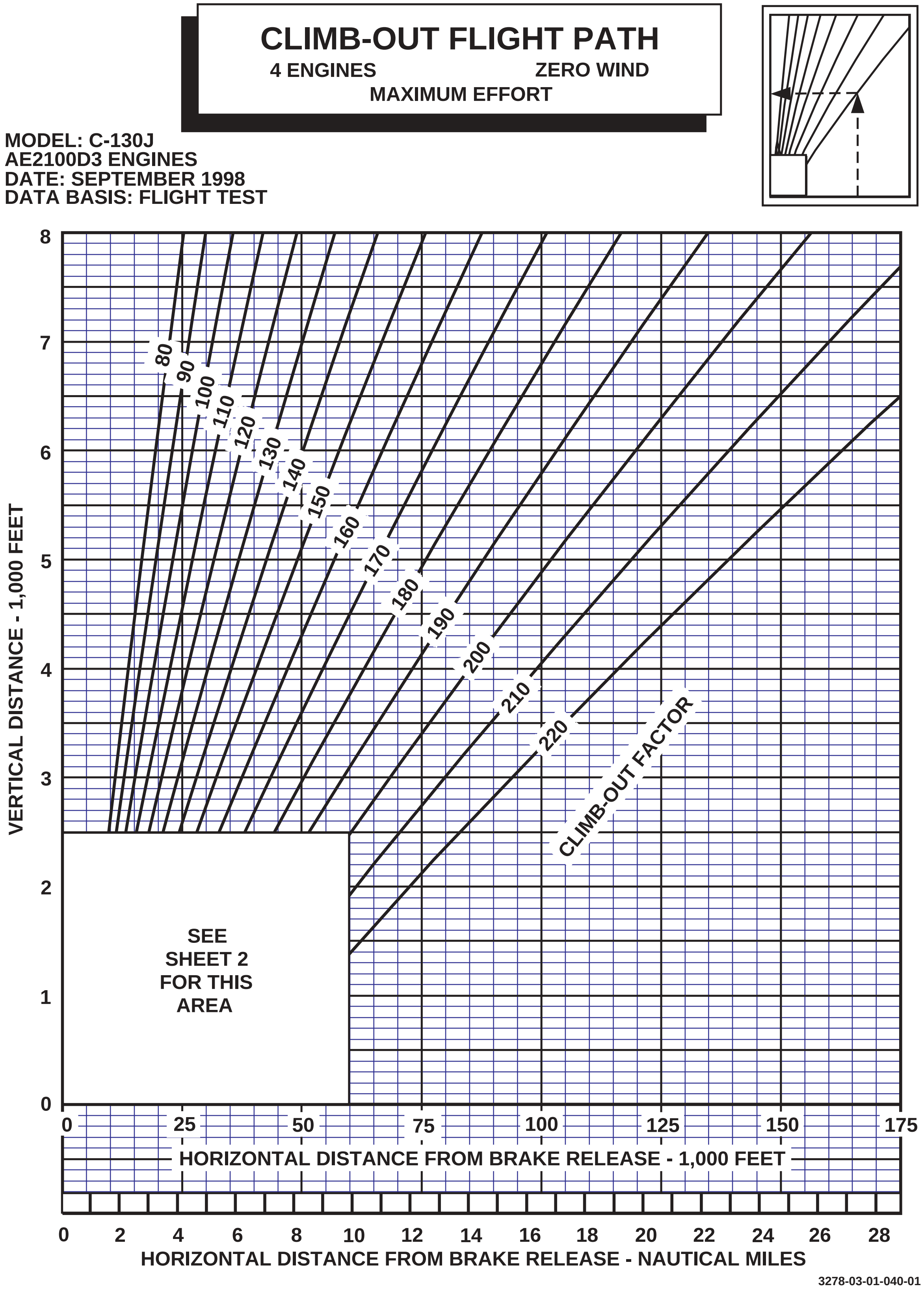


Figure 3-42. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

CLIMB-OUT FLIGHT PATH

4 ENGINES ZERO WIND

MAXIMUM EFFORT

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

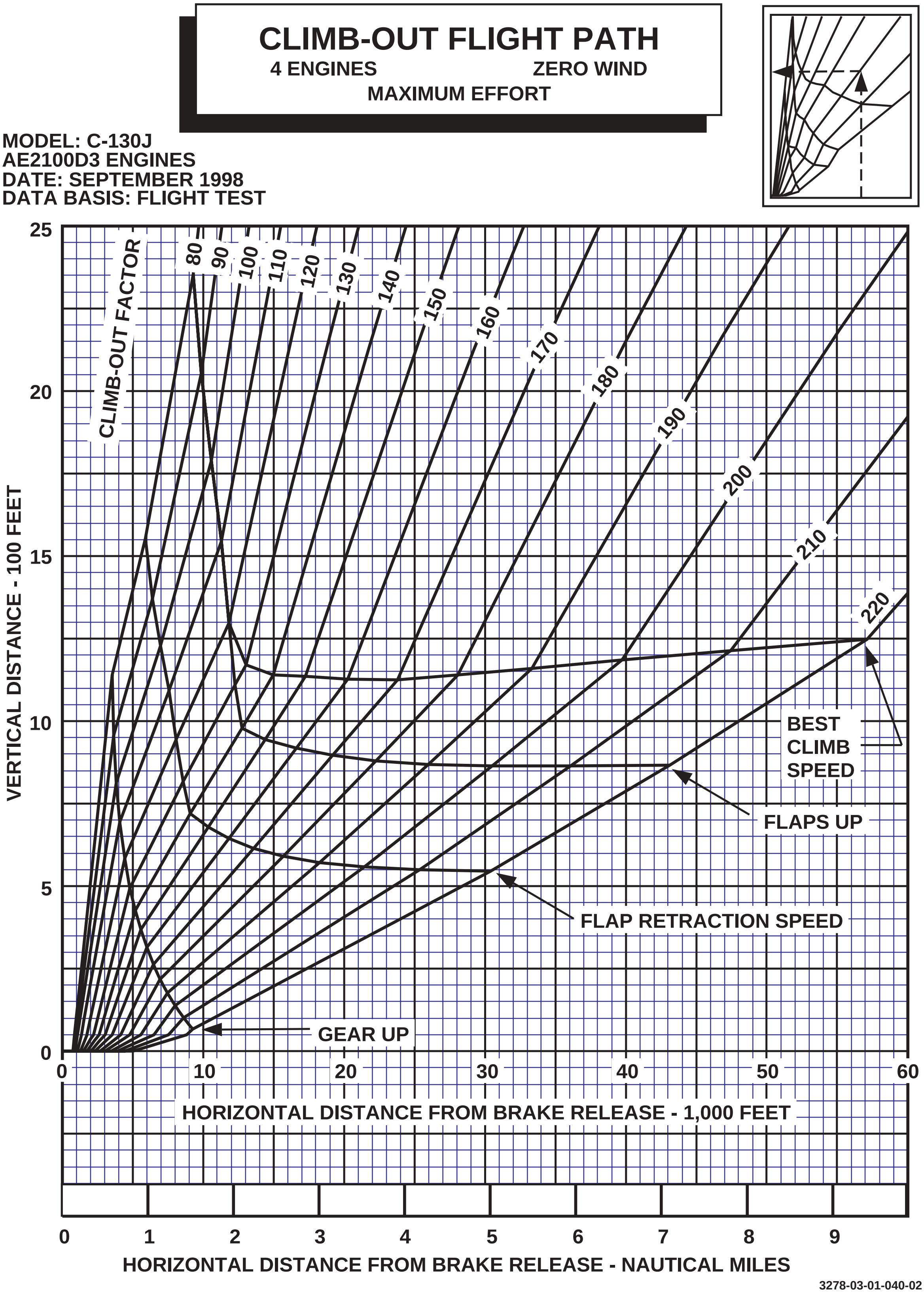


Figure 3-42. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CLIMB-OUT FLIGHT PATH EFFECT OF VARIANT CONFIGURATION

4 ENGINES

MAXIMUM EFFORT

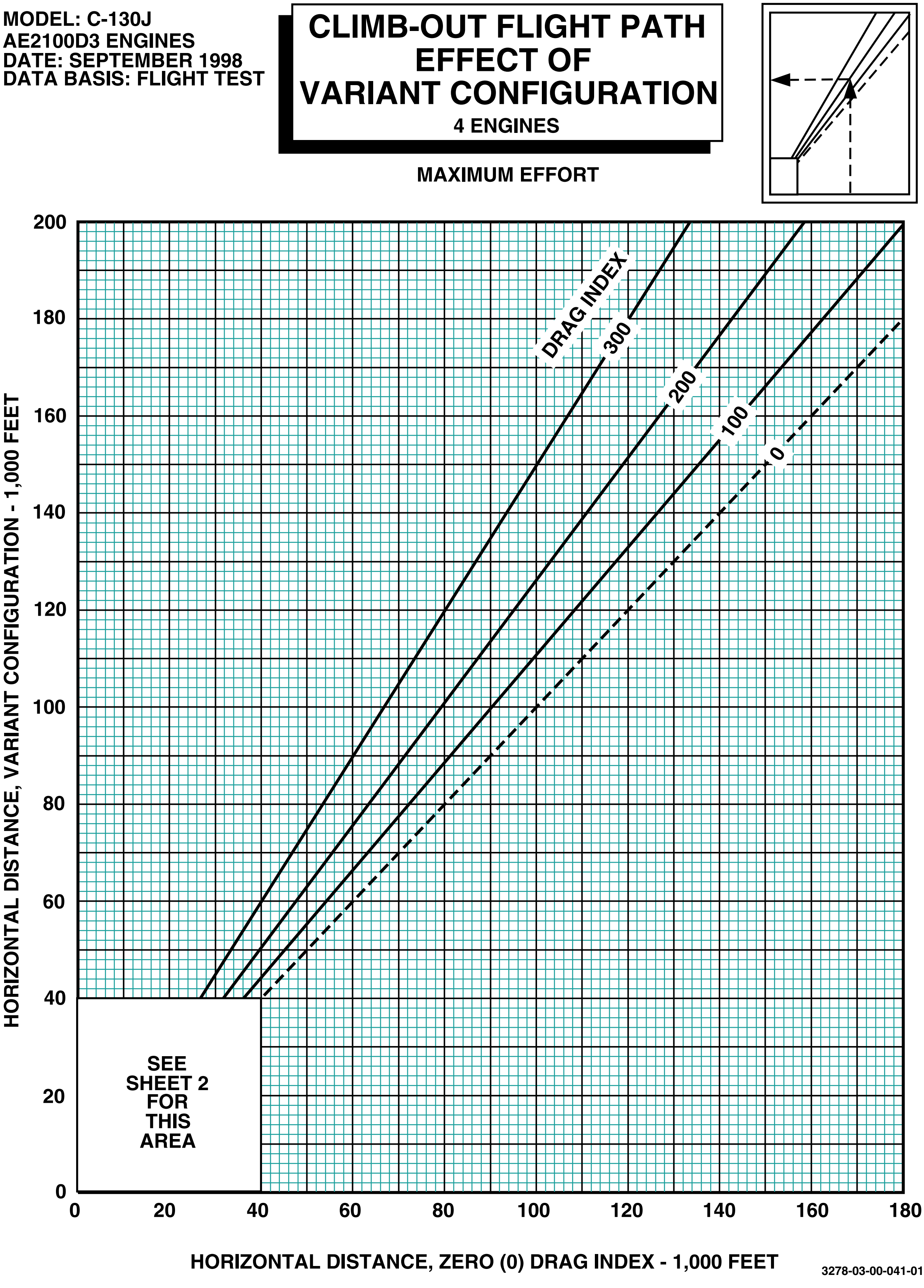


Figure 3-43. (Sheet 1 of 2)

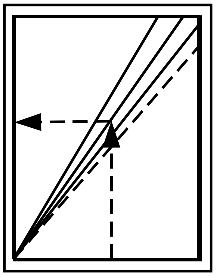
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CLIMB-OUT FLIGHT PATH EFFECT OF VARIANT CONFIGURATION

4 ENGINES

MAXIMUM EFFORT



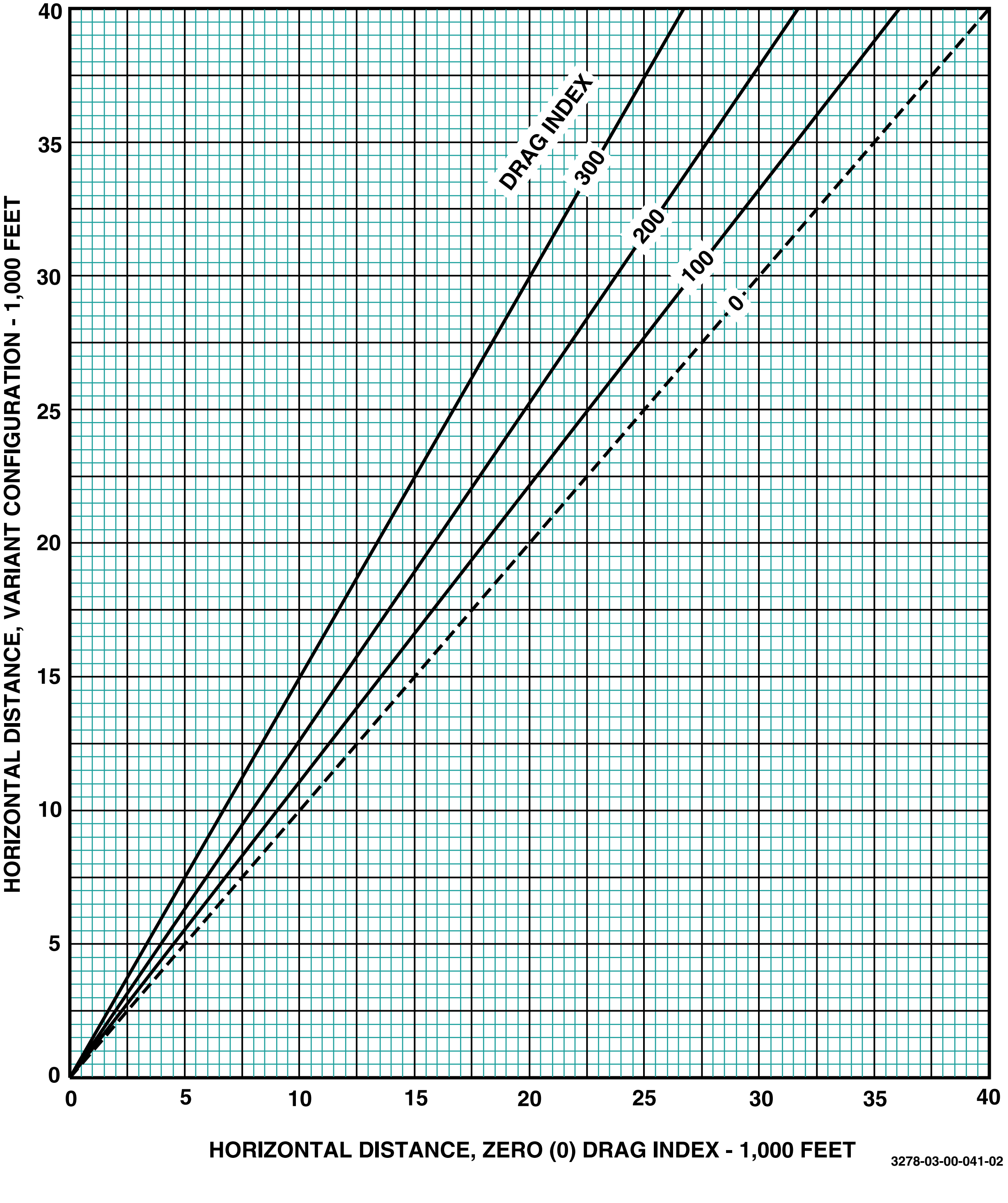
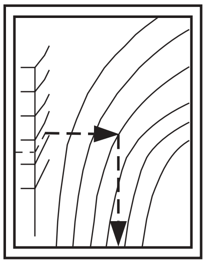


Figure 3-43. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

CLIMB-OUT FACTOR

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

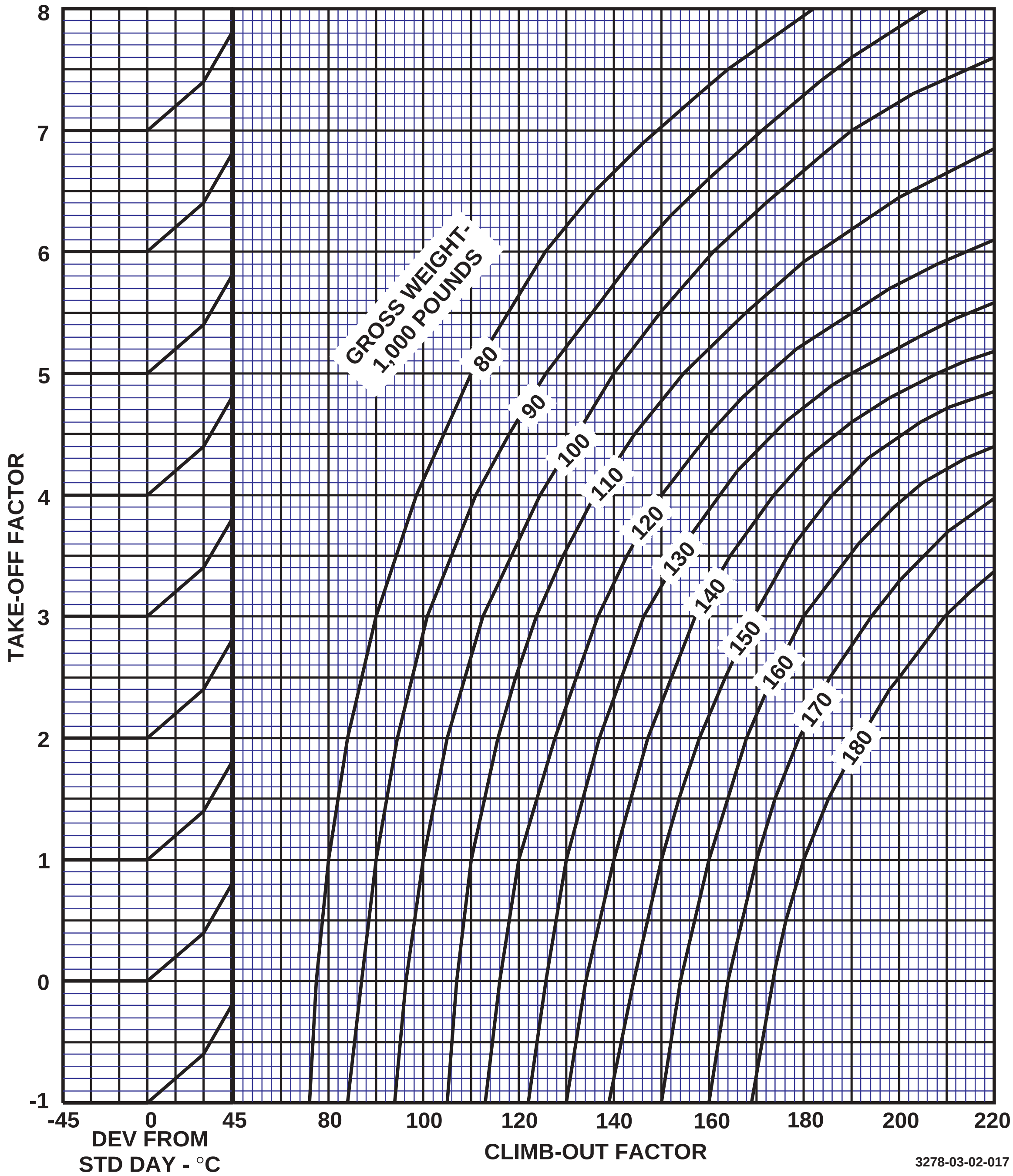


Figure 3-44.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

CLIMB-OUT FLIGHT PATH

3 ENGINES ZERO WIND

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

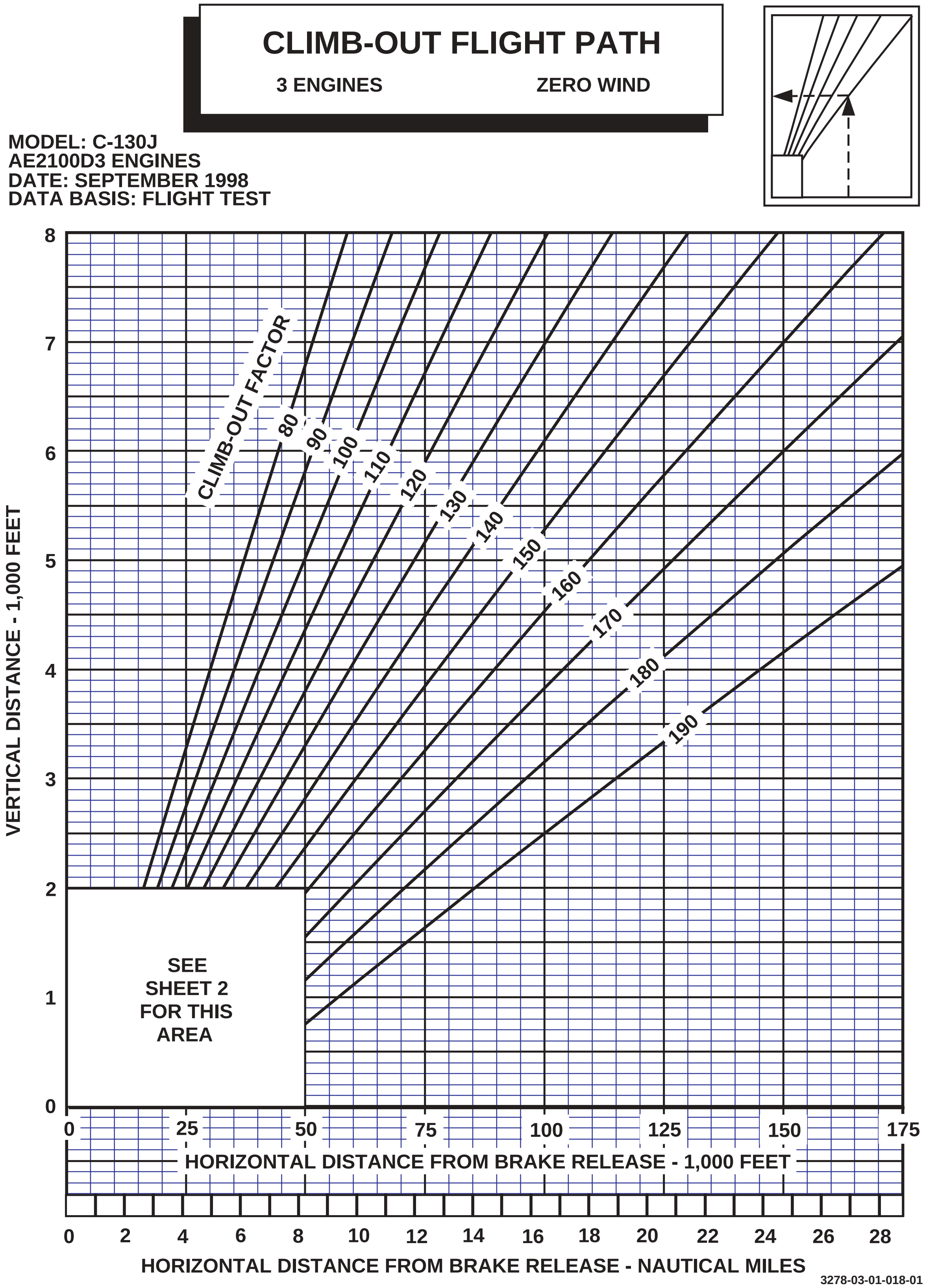


Figure 3-45. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

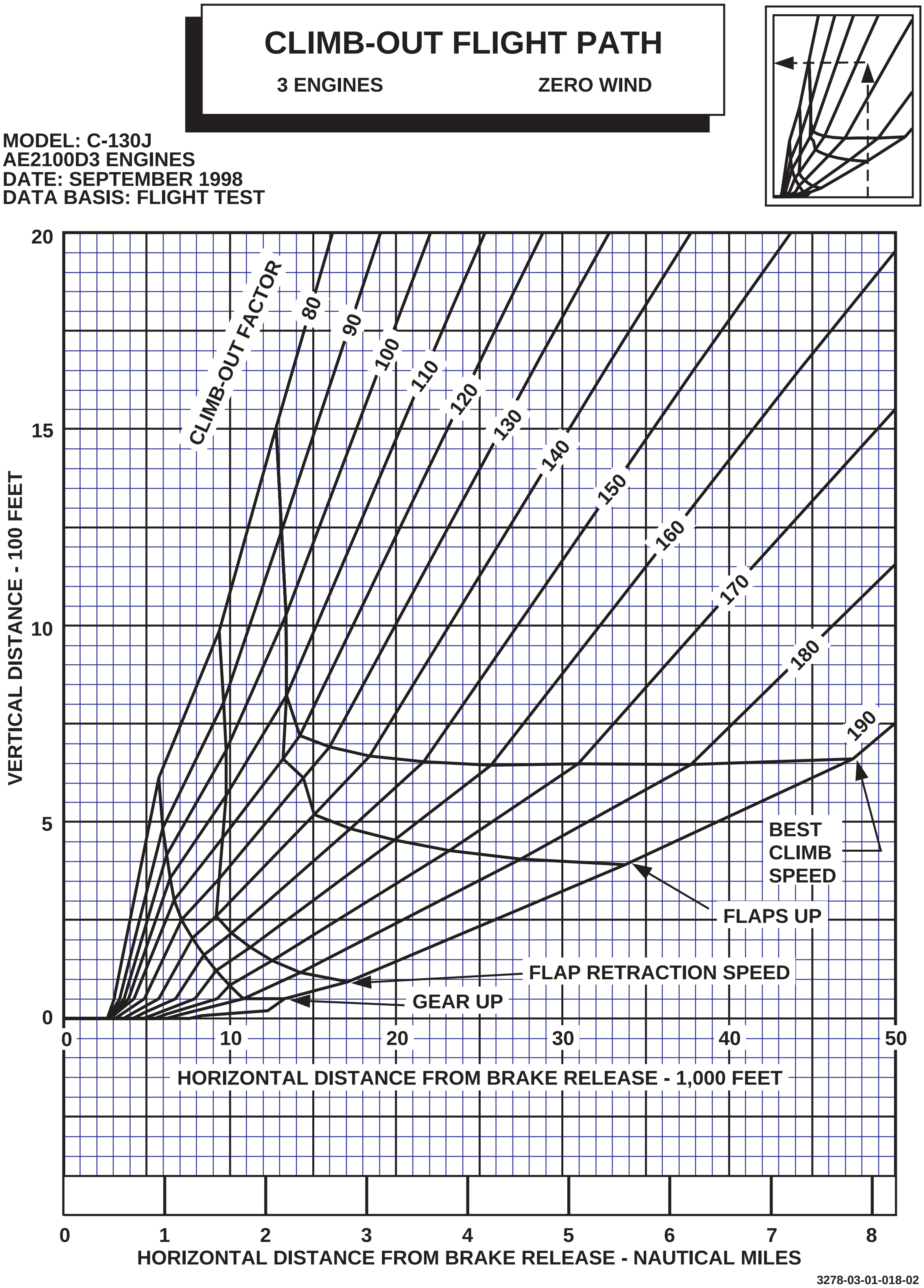


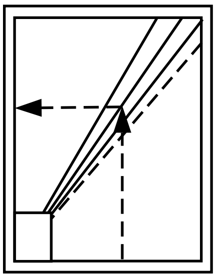
Figure 3-45. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CLIMB-OUT FLIGHT PATH EFFECT OF VARIANT CONFIGURATION

3 ENGINES



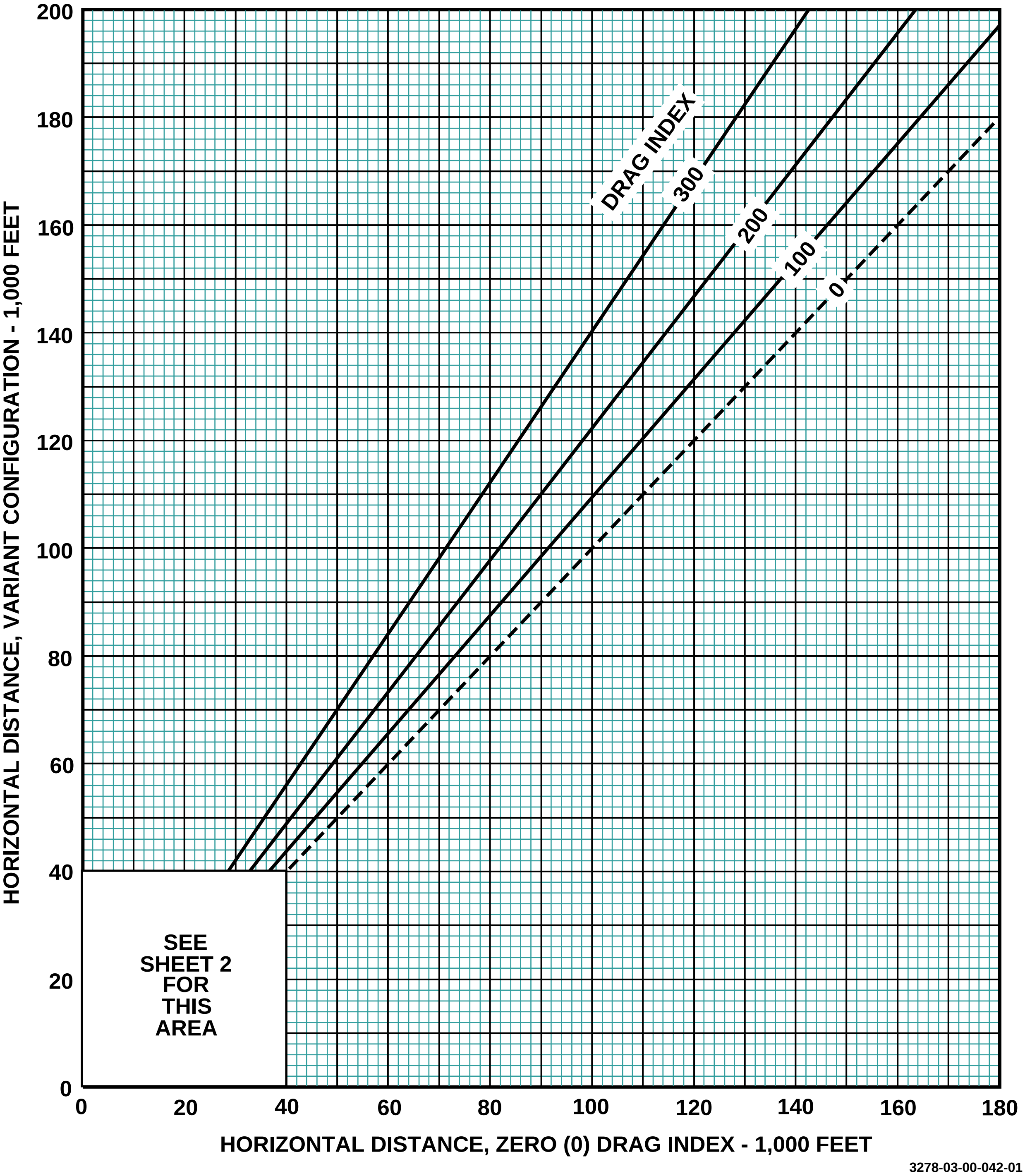


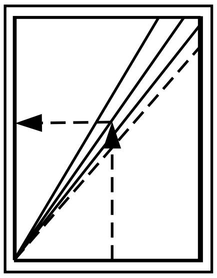
Figure 3-46. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CLIMB-OUT FLIGHT PATH EFFECT OF VARIANT CONFIGURATION

3 ENGINES



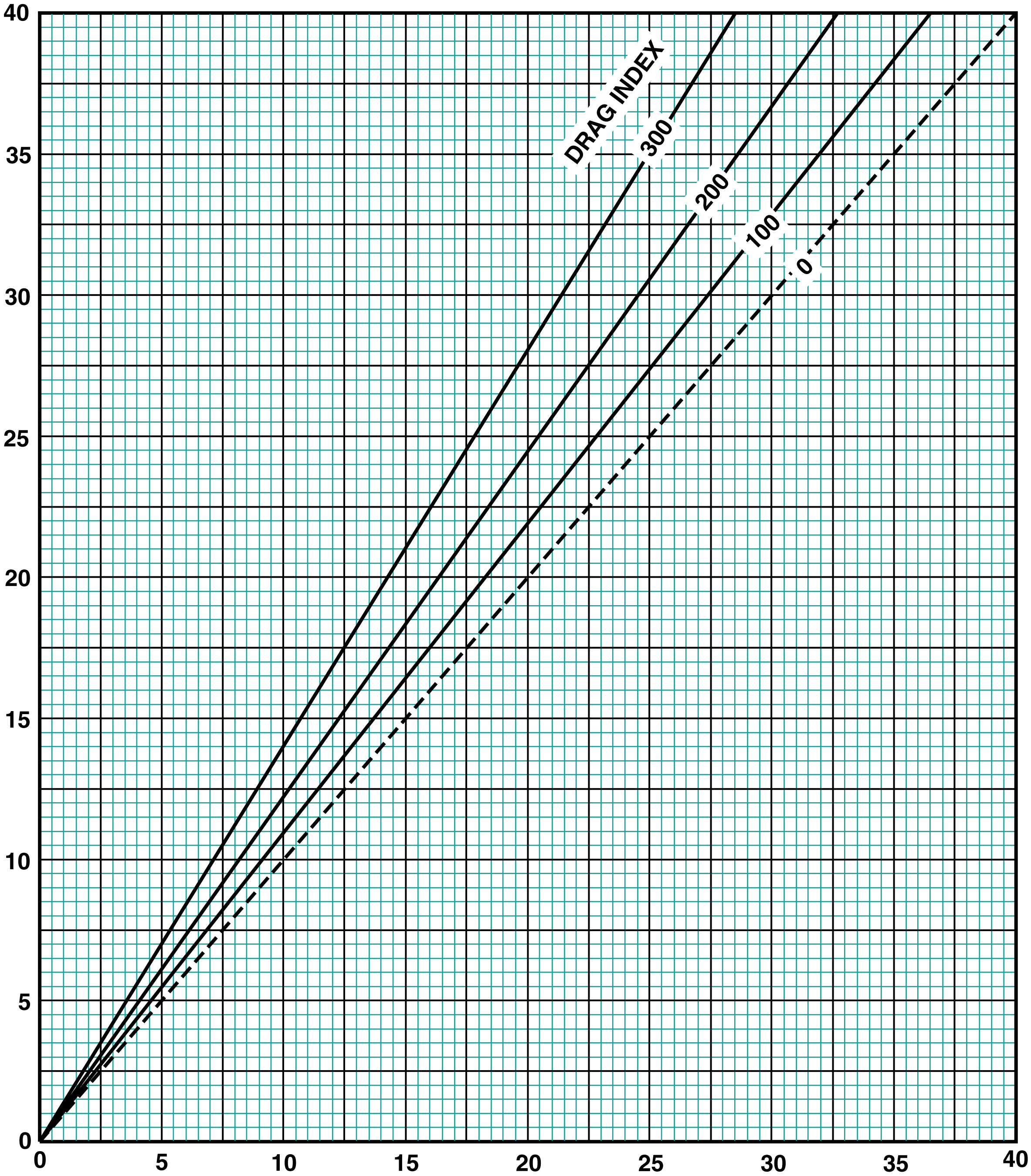


Figure 3-46. (Sheet 2 of 2)

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CLIMB-OUT FLIGHT PATH MINIMUM FLAP RETRACTION AND FLAPS UP SAFETY SPEED

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

3 OR 4 ENGINES

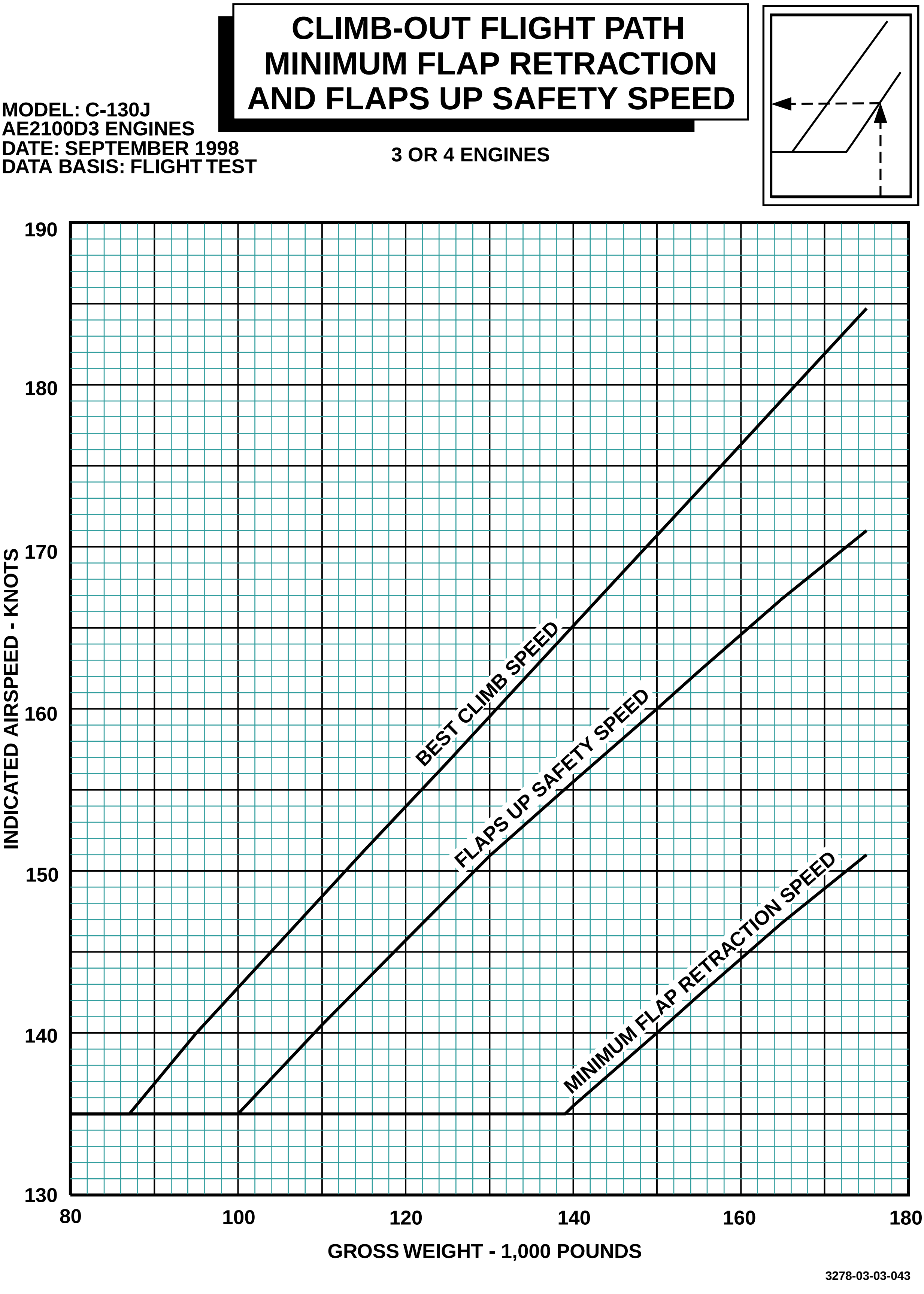

Figure 3-47.

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SECTION 4
CLIMB PERFORMANCE

TABLE OF CONTENTS

CONTENTS Page

LIST OF CHARTS

Figure Number Title Page

INTRODUCTION.

This section contains performance charts giving the recommended indicated airspeed for climbing plus the time, fuel, and distance required to climb from any altitude to another altitude up to the cruise or service ceiling.

NOTE

It is recommended that the maximum continuous power cruise ceiling not be exceeded for cruise operation because the range capability is decreased above this altitude.

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DEFINITIONS:

ATC Ceiling - The Air Traffic Control (ATC) cruise ceiling is that altitude at which the maximum rate of climb capability at maximum continuous power and best climb speed is 500 FPM.

Best Climb Speed - The larger of the speed for MAX ROC or the flaps up air minimum control speed.

Cruise Ceiling - The altitude at which the maximum rate of climb capability at maximum continuous power and best climb speed is 300 FPM.

Flaps Up Safety Speed (FUSS) - The minimum speed recommended for normal operation with the flaps retracted. FUSS is the larger of 1.25 times the flaps up power off stall speed or the flaps up air minimum control speed. Operation at FUSS provides 1.7g of maneuvering capability with all engines operating or 1.3g of maneuvering capability with one engine inoperative.

Minimum Flap Retraction Speed - The minimum recommended airspeed to begin flap retraction.

Service Ceiling - The altitude at which the maximum rate of climb at maximum continuous power and best climb speed is 100 Feet Per Minute (FPM).

Cruise, service, and ATC ceilings are shown along with variant effects, in Section 5 of this manual.

FOUR-ENGINE CLIMB.

The four-engine standard day climb performance is presented for the baseline configuration in figure 4-1, through figure 4-4.

The recommended climb speed schedule is given as a function of gross weight in figure 4-1. Time, fuel, and distance to climb are presented as a function of gross weight in figure 4-2, figure 4-3, and figure 4-4.

NOTE

> Climb speed must not fall below FUSS.

Example 1.

GIVEN:

Drag index: + 25

Initial climb weight: 148,000 pounds

Four-engine operation

Normal bleed

Initial pressure altitude: Sea level

Temp Dev: – 20 °C

Initial cruise altitude: 20,000 feet pressure altitude

FIND:

- Initial climb speed
- Time, distance, and fuel to climb to 20,000 feet with normal bleed
- Time, distance, and fuel to climb to 20,000 feet with all bleed conditions

PROCEDURE:

Enter the x-axis of figure 4-1, sheet 1, at the initial weight of 148,000 pounds and move vertically to intersect the normal speed line. Read an initial climb speed of 169.5 KIAS. Now enter the x-axis of figure 4-1, sheet 2, with this value and move vertically to intersect a 25 drag index guideline. Read a corrected climb speed of 167 KIAS.

Enter figure 4-2, sheet 1, at the initial weight of 148,000 pounds and follow the guideline to the altitude of 20,000 feet. Read to the right an uncorrected climb time of 11.5 minutes. Enter the left axis of figure 4-2, sheet 2, with this value and move horizontally to the temperature baseline and then follow the guideline to a temperature increment of standard day minus 20 °C and read a temperature corrected time of 10.5 minutes. Move horizontally to the drag index baseline and follow the guideline to a drag index of 25. Read the final corrected climb time of 11 minutes for normal bleed conditions. In a similar manner, a normal bleed climb fuel of 1,400 pounds is obtained from figure 4-3 and a climb distance of 36 nautical miles from figure 4-4.

To find the time, fuel, and distance under all bleed conditions, enter the x-axis of figure 4-2, sheet 3, with the 11 minutes computed for normal bleed and move vertically to intersect the all bleed line. Read to the left an all bleed corrected climb time of 22.4 minutes. In a similar manner, a climb fuel of 2,320 pounds and distance of 78 nautical miles are obtained from figure 4-3, sheet 3, and from figure 4-4, sheet 3.

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Example 2.

GIVEN:

Drag index: Zero

Initial climb weight: 155,000 pounds

Four-engine operation

Initial pressure altitude: Sea level

Temp Dev: 0

Initial cruise altitude: Cruise ceiling

All bleed

FIND:

- Time, distance, and fuel to climb to cruise ceiling

PROCEDURE:

From figure 5-2, sheet 2, the cruise ceiling for a weight of 155,000 pounds under all bleed conditions is 19,300 feet. Enter figure 4-3, sheet 1, at 155,000 pounds and follow the guidelines to 19,300 feet. Read a normal bleed fuel value of 1,550 pounds. There is no correction to be made since temperature is standard and the drag index is zero. Now enter figure 4-3, sheet 3, with the 1,550 pounds and move up to intersect the all bleed line. Read an all bleed fuel value of 2,750 pounds.

Revisit figure 5-2, sheet 2, with a weight of 152,250 pounds (155,000 - 2,750). The all bleed cruise ceiling is now read as 19,700 feet. Enter figure 4-2, sheet 1, with 155,000 pounds and follow the guidelines to the 19,700 feet. Read a normal bleed climb time of 12.5 minutes. Enter figure 4-2, sheet 3, with 12.5 minutes and move vertically to intersect the bleed line. Read an all bleed time of 28.5 minutes. In a similar manner, obtain a climb fuel of 2,800 pounds from figure 4-3 and a distance of 117 nautical miles from figure 4-4.

THREE-ENGINE CLIMB.

Three-engine climb speed, time, fuel, and distances are presented in figures 4-5 through figure 4-8. For these presentations it is assumed that the failed engine has been feathered and proper trim applied.

NOTE

Climb speed must not fall below FUSS.

Example.

GIVEN:

Drag index: Zero

Initial climb weight: 150,000 pounds

Three-engine operation

FIND:

- Three-engine climb speed at 10,000 feet
- Three-engine climb speed at 20,000 feet

PROCEDURE:

Enter figure 4-5, sheet 1, at 10,000 feet. Move horizontally to the left to intercept the climb speed curve and read a three-engine climb speed of 185 KIAS.

Enter figure 4-5, sheet 1, at 20,000 feet. Move horizontally to the left to intercept the 150,000 pound climb speed curve and read a three-engine climb speed of 167 KIAS.

TWO-ENGINE CLIMB.

SYMMETRICAL.

Two-engine climb speed, time, fuel, and distance are presented in figures 4-9 through figure 4-12. For these presentations it is assumed that the two failed engines are located symmetrically and have been feathered with proper aircraft trim applied. These figures are used in the same manner as the four and three-engine climb charts.

ASYMMETRICAL.

Climb capability is greatly reduced with asymmetrically failed engines (two engines inoperative on one side of the airplane). The recommended speed for all asymmetric, two engine operation, except for the landing pattern, is 175 KIAS. This speed was selected to provide acceptable controllability with two asymmetrically failed engines and is independent of weight, altitude, and temperature. The recommended speed is based on the following conditions:

- Flaps = 20 percent (high rudder boost).
- Full rudder trim applied.
- Rudder pedal force ≤ 150 pounds (as required to maintain heading).

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- Bank angle ≤ 5 degrees away from the failed engines (as required to maintain heading).

Figure 4-13 presents the climb gradient with two asymmetrically failed engines. Figure 4-13, sheet 1, presents the climb gradient as a function of altitude and temperature for an airplane weight of 120,000 pounds. Figure 4-13, sheet 2, presents correction grids for weight and drag index. Figure 4-13 may be used to determine the maximum altitude at which level flight can be maintained and the corresponding climb or descent gradient.

Example 1.

GIVEN:

Drag index: Zero

Airplane weight: 140,000 pounds

Initial pressure altitude: 30,000 feet

Temp Dev: + 10 °C

FIND:

- Maximum altitude for level flight with two asymmetrically failed engines

PROCEDURE:

Enter figure 4-13, sheet 2, on the correction climb gradient axis (the right vertical axis) at 0 percent. Proceed horizontally to the left into the weight correction grid until intersecting a vertical line at 140,000 pounds. Move parallel to the weight correction guidelines to the baseline and read an uncorrected climb gradient of 0.9 percent. Enter figure 4-13, sheet 1, on the right vertical axis at 0.9 percent. Move horizontally to the left until intersecting the standard + 10 °C temperature line and interpolate a pressure altitude for level flight of 8,000 feet.

NOTE

If a climb profile is being computed, it is suggested that a climb gradient of +1 percent be used to determine the maximum altitude for level flight.

Example 2.

GIVEN:

Drag index: Zero

Airplane weight: 140,000 pounds

Initial pressure altitude: 30,000 feet

Temp Dev: + 10 °C

FIND:

- The climb (or descent) gradient at the initial pressure altitude

PROCEDURE:

Enter figure 4-13, sheet 1, on the standard + 10 °C line and read an uncorrected climb gradient of –3.8 percent at a pressure altitude of 30,000 feet. Enter figure 4-13, sheet 2, at an uncorrected climb gradient of –3.8 percent. Move horizontally to the weight baseline and then move parallel to the weight guidelines until intersecting a vertical line from 140,000 pounds. Since there is no drag index correction, read a corrected climb gradient of – 4.1 percent.

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CLIMB SPEED

4 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

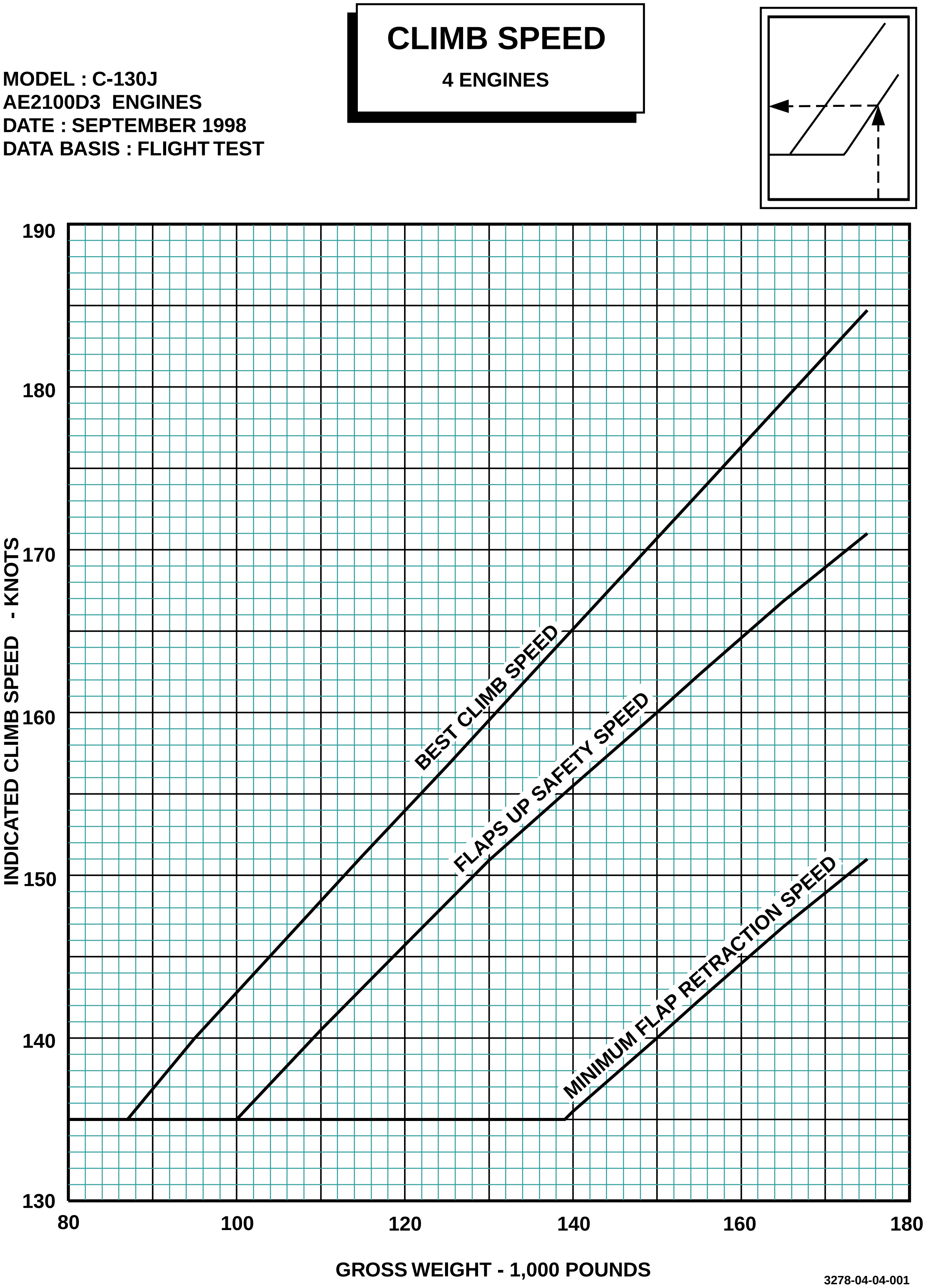

Figure 4-1. (Sheet 1 of 2)

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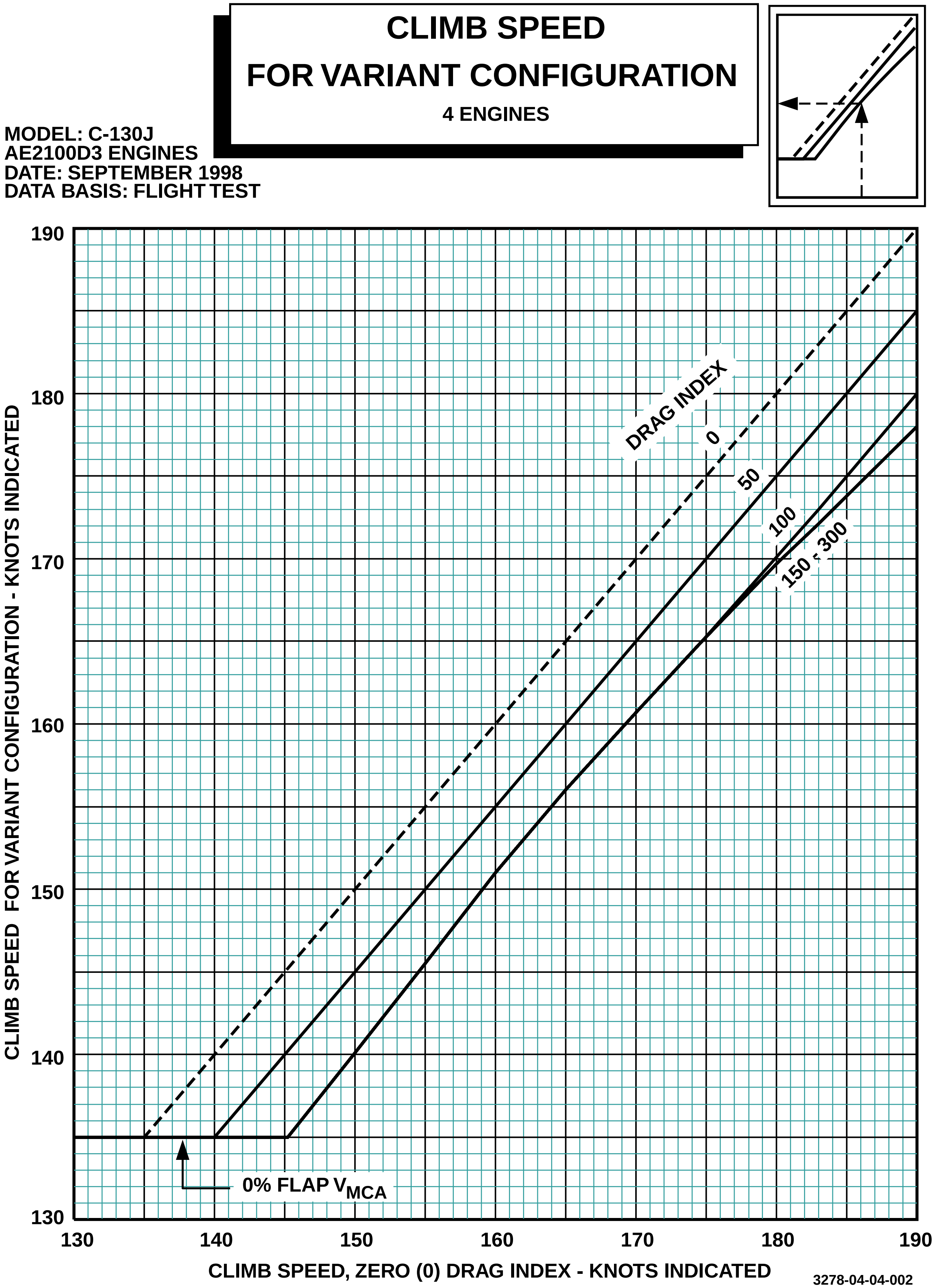

Figure 4-1. (Sheet 2 of 2)

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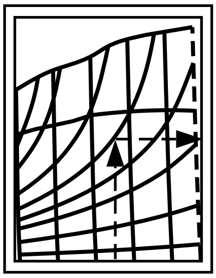
TIME TO CLIMB

4 ENGINES

MAX CONTINUOUS POWER

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST



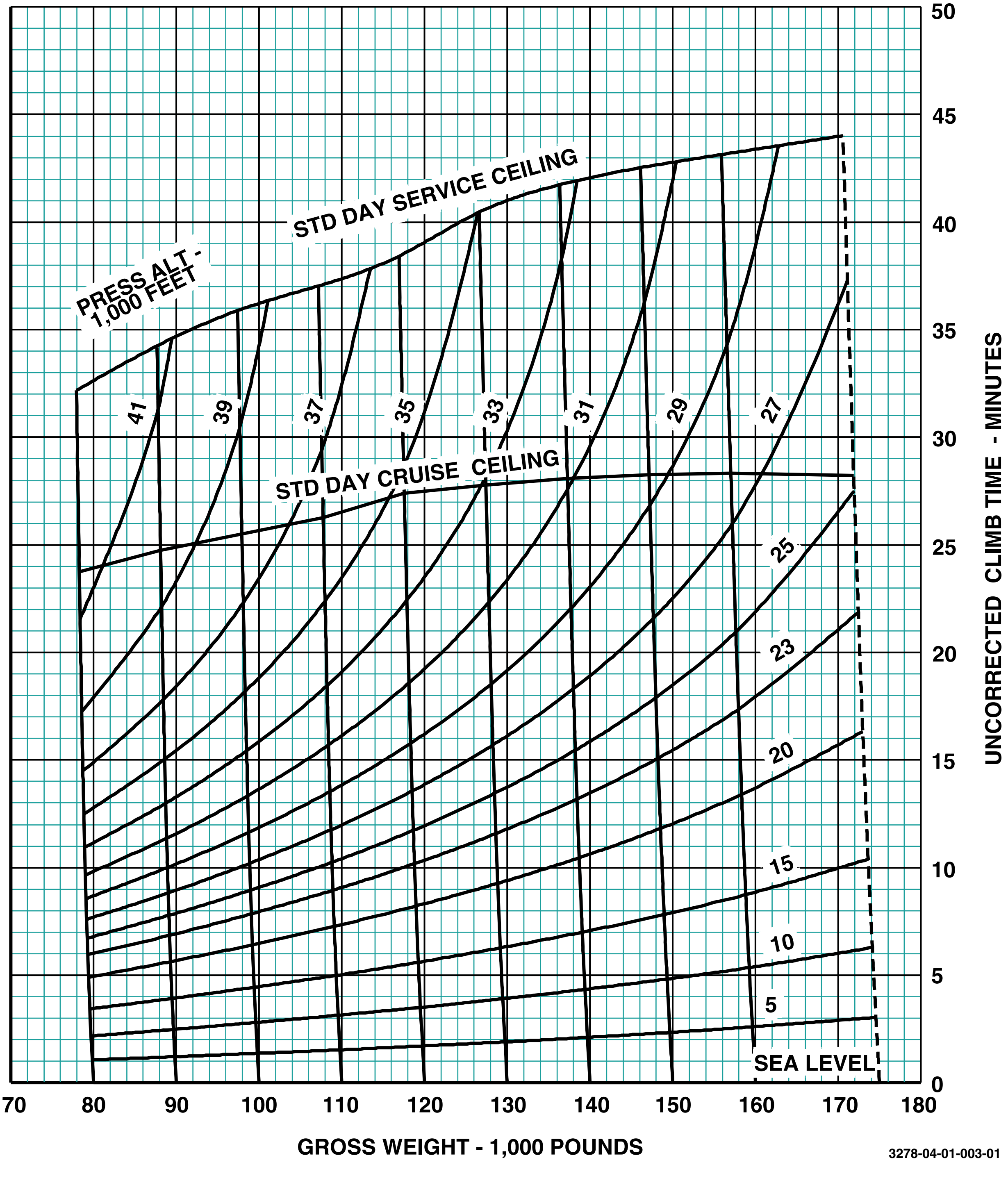


Figure 4-2. (Sheet 1 of 3)

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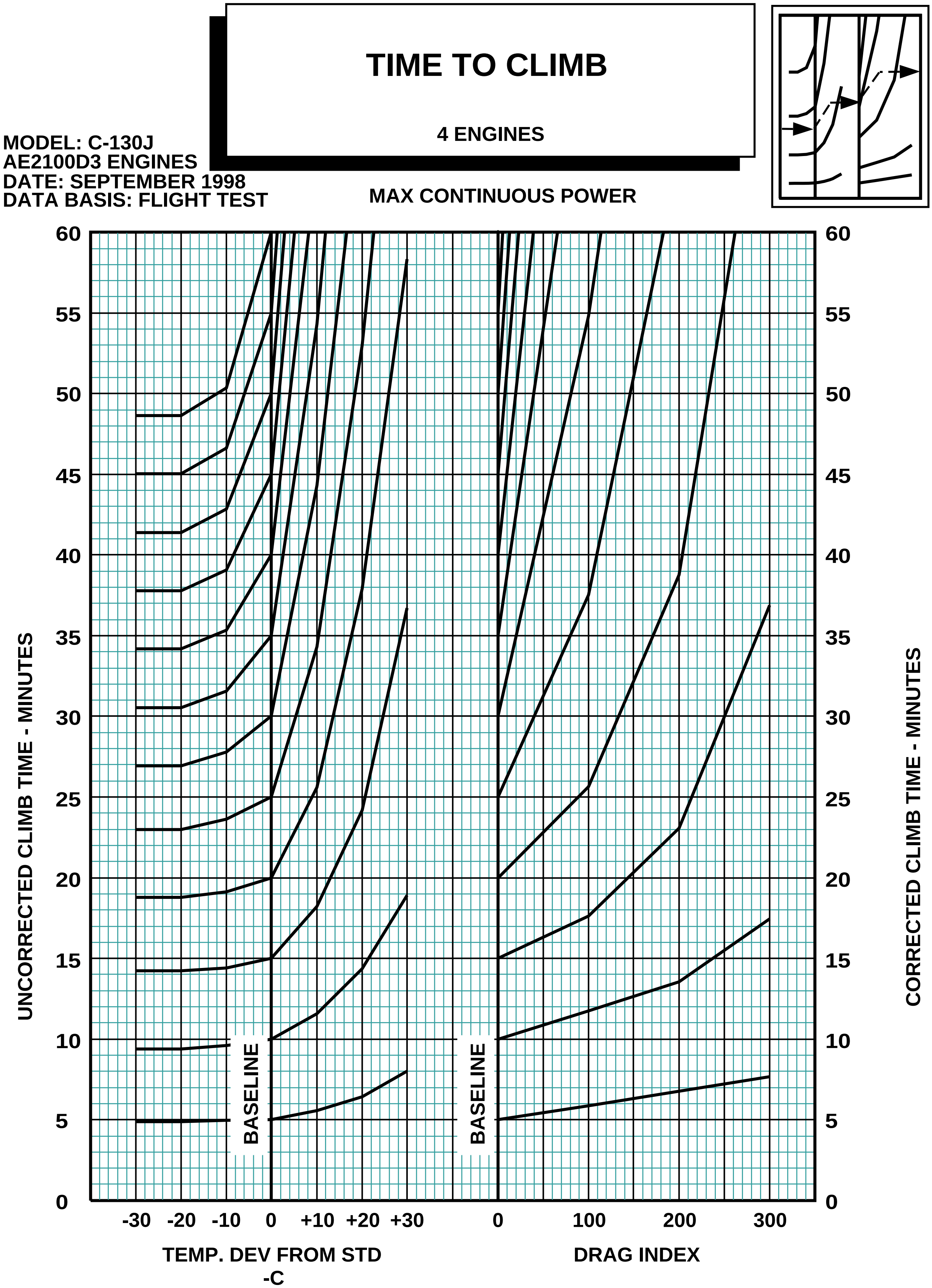

Figure 4-2. (Sheet 2 of 3)

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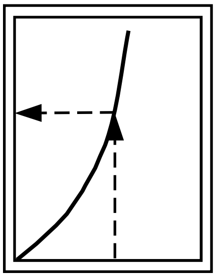
TIME TO CLIMB
BLEED CORRECTION

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

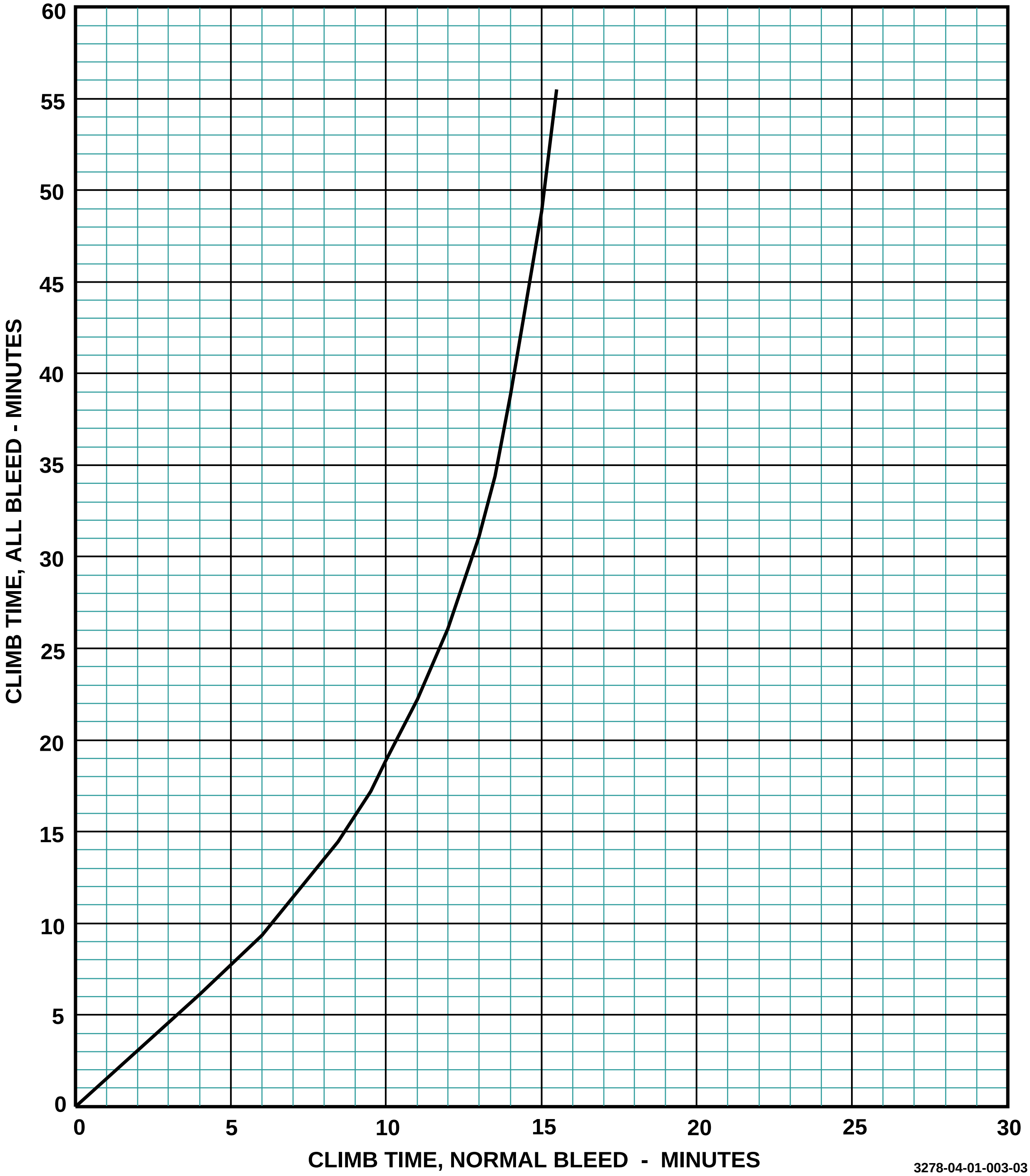


Figure 4-2. (Sheet 3 of 3)

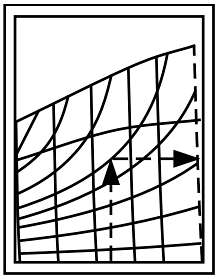
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

FUEL TO CLIMB

4 ENGINES

MAX CONTINUOUS POWER



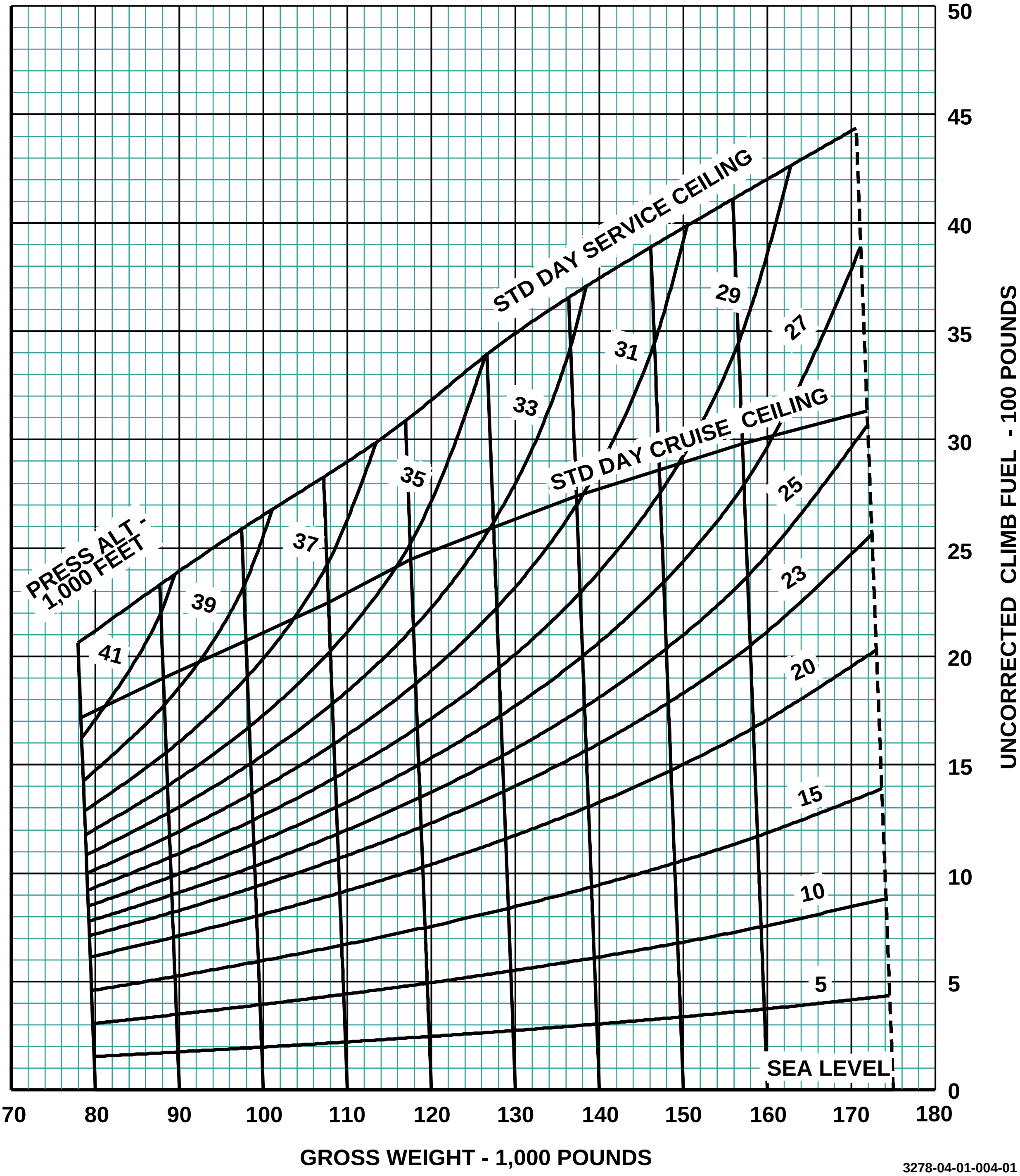
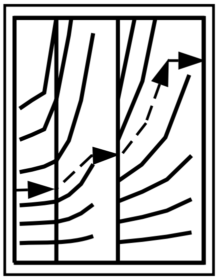


Figure 4-3. (Sheet 1 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

FUEL TO CLIMB

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAX CONTINUOUS POWER

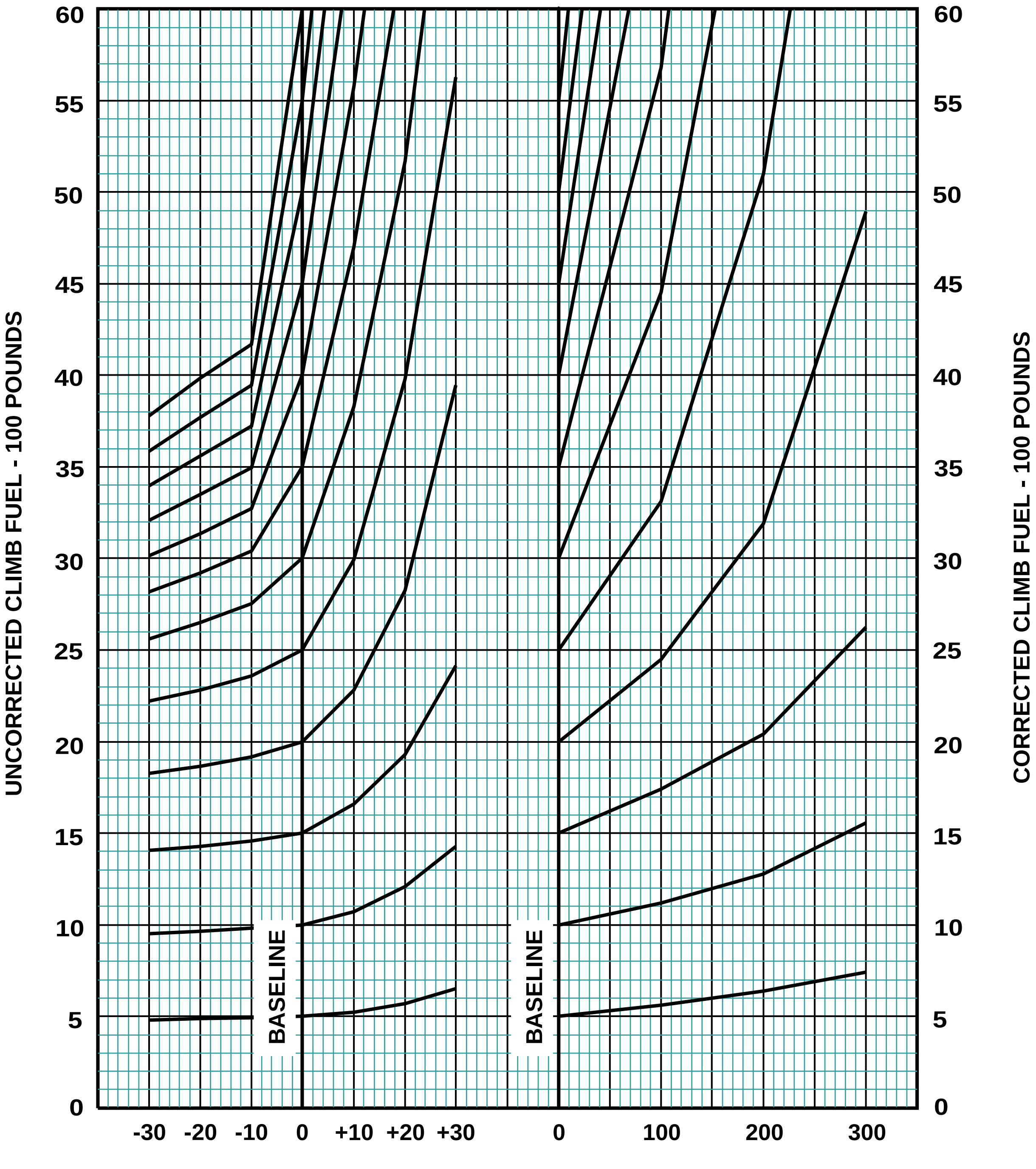


Figure 4-3. (Sheet 2 of 3)

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FUEL TO CLIMB BLEED CORRECTION

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

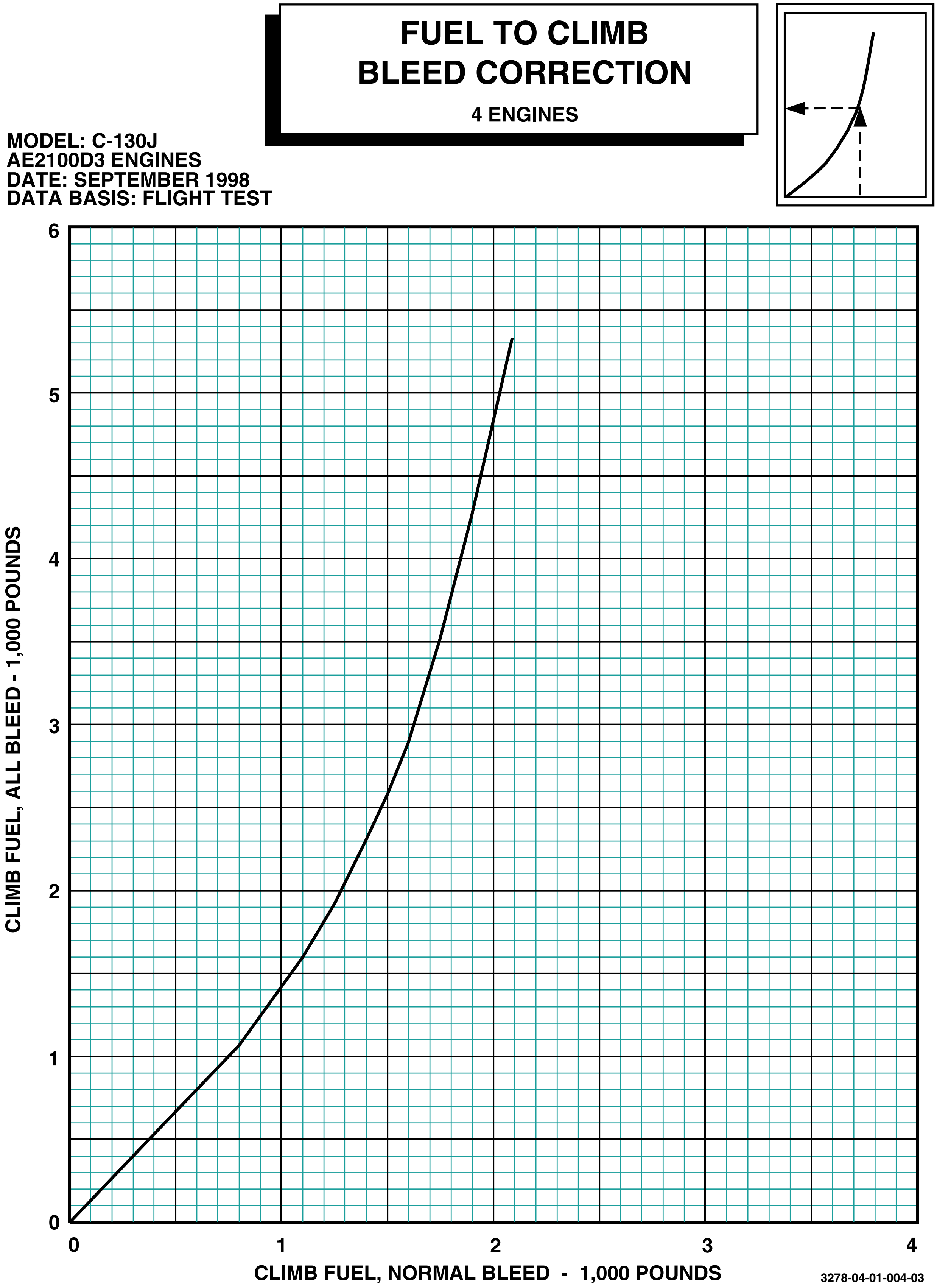

Figure 4-3. (Sheet 3 of 3)

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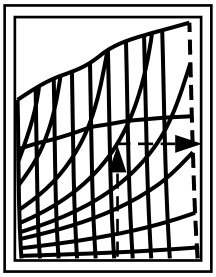
DISTANCE TO CLIMB

4 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



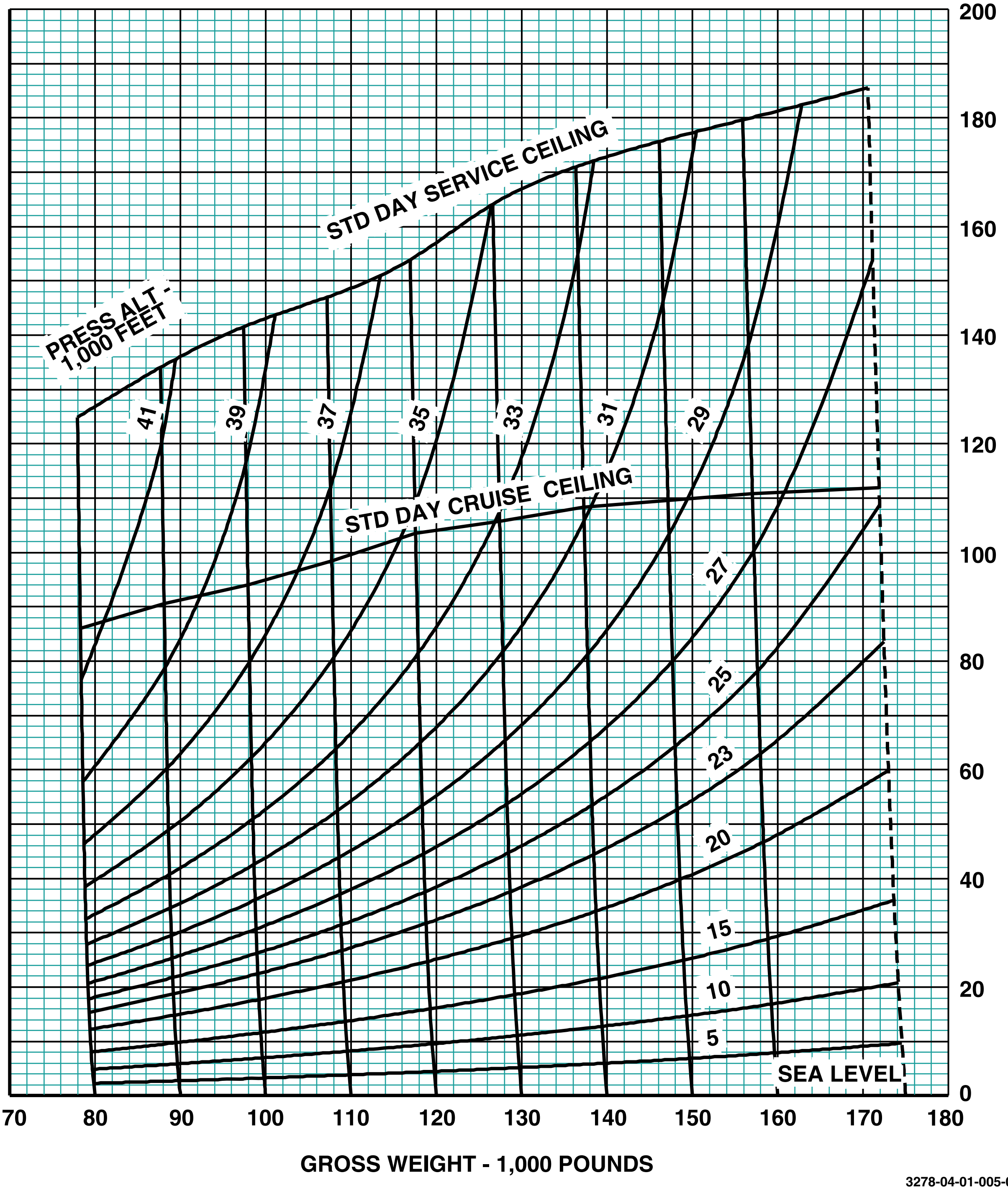


Figure 4-4. (Sheet 1 of 3)

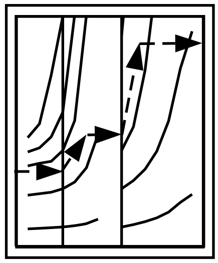
Use, copying and/or disclosure is governed by the statement on the title page of this document.

DISTANCE TO CLIMB

4 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



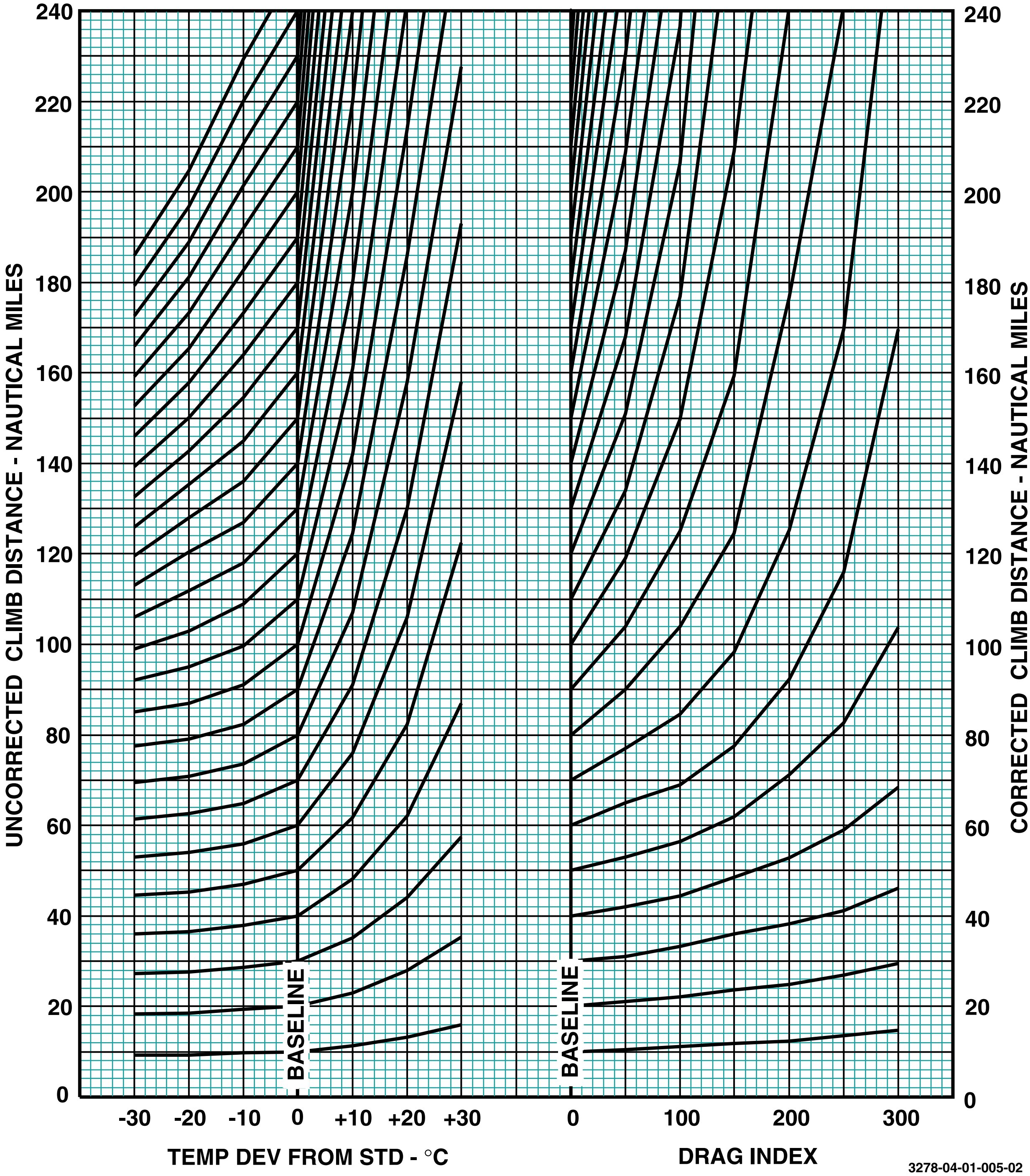
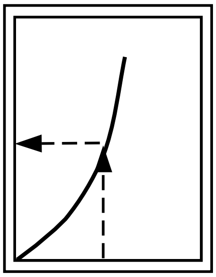


Figure 4-4. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

DISTANCE TO CLIMB BLEED CORRECTION

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

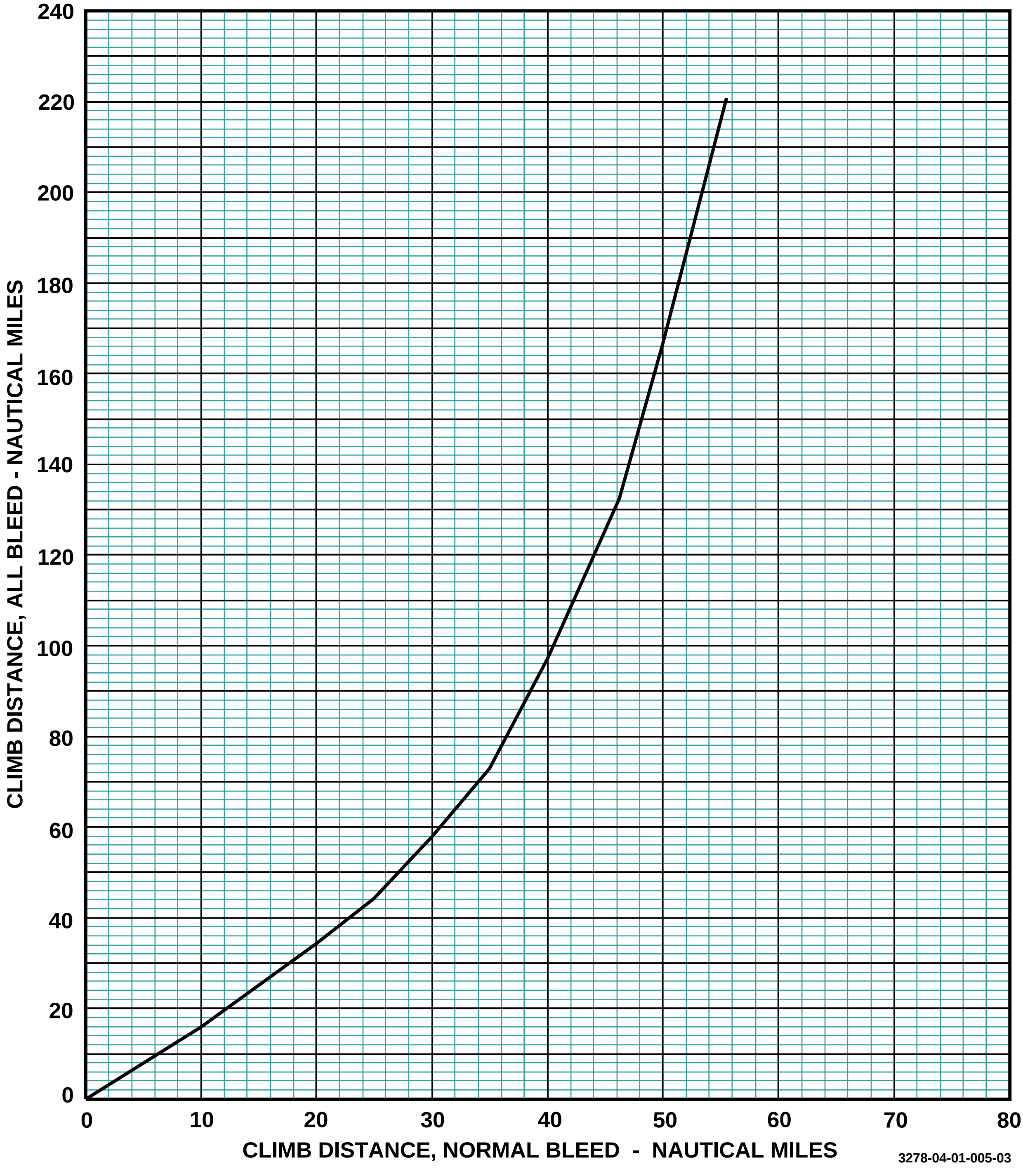


Figure 4-4. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

CLIMB SPEED

3 ENGINES

MAX CONTINUOUS POWER

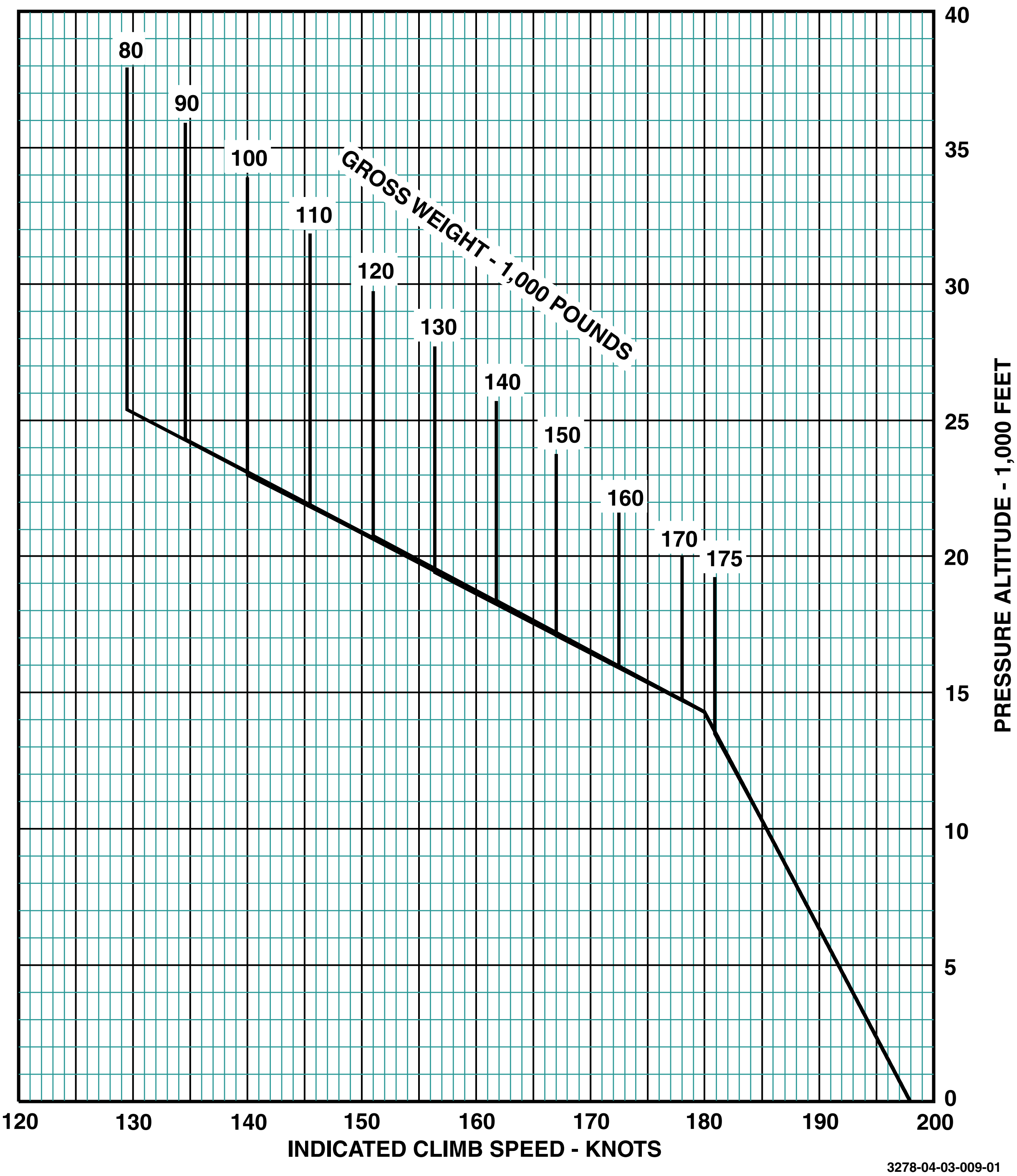


Figure 4-5. (Sheet 1 of 2)

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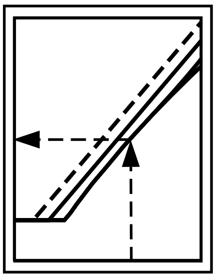
CLIMB SPEED FOR VARIANT CONFIGURATION

3 ENGINES



MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

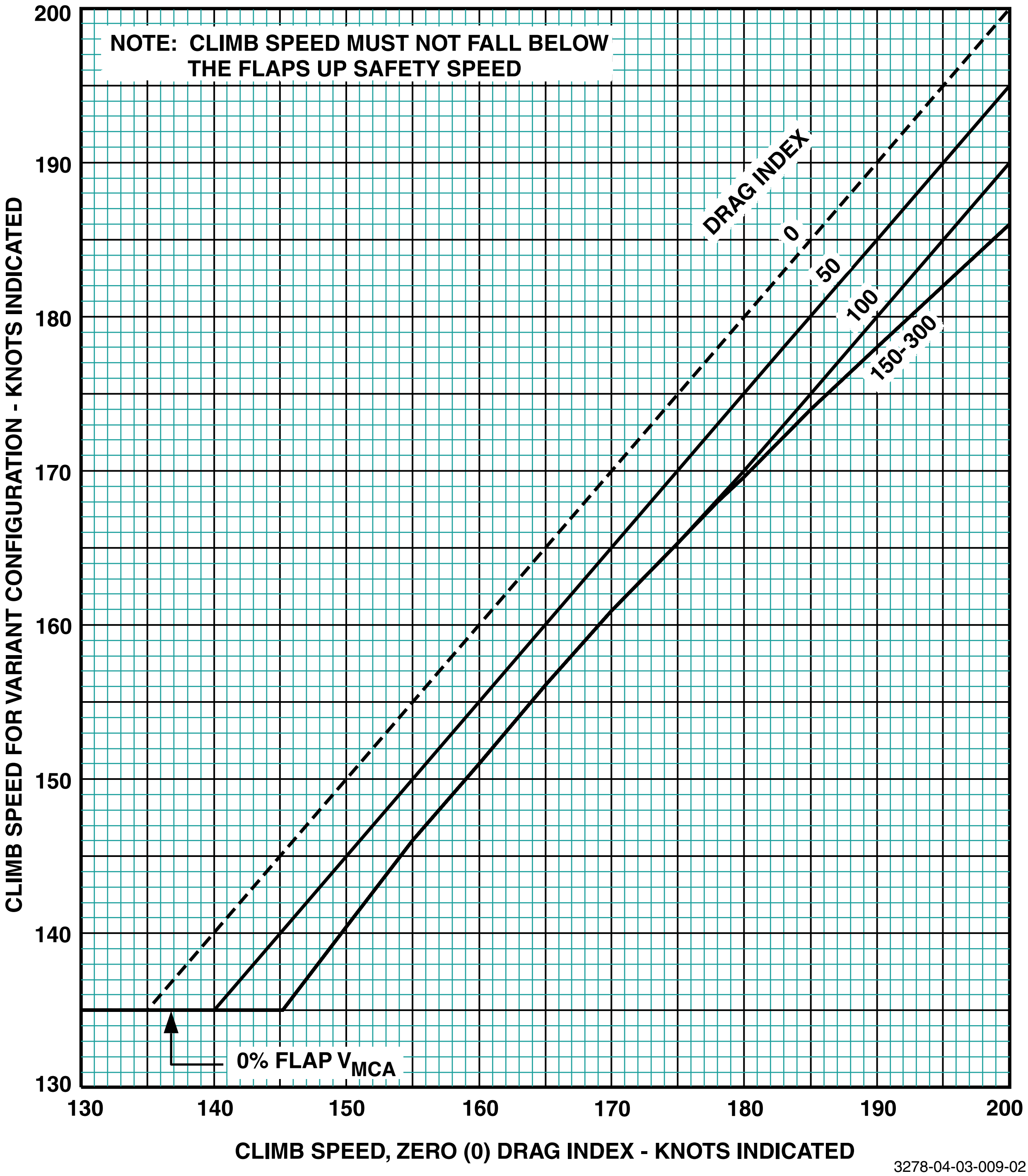


Figure 4-5. (Sheet 2 of 2)

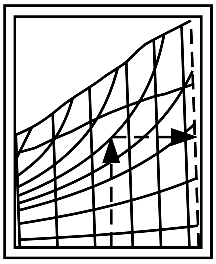
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

TIME TO CLIMB

3 ENGINES

MAX CONTINUOUS POWER



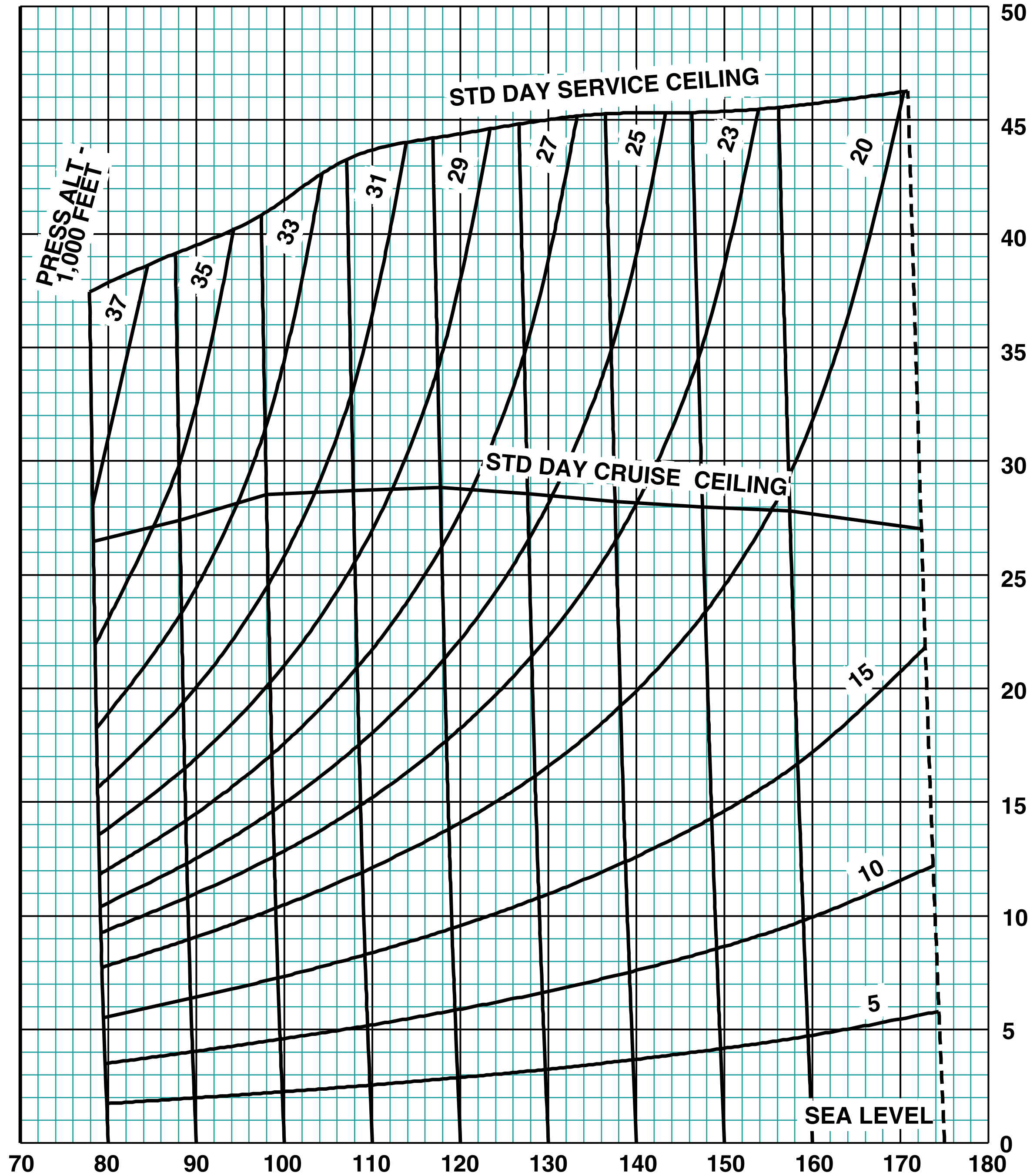


Figure 4-6. (Sheet 1 of 3)

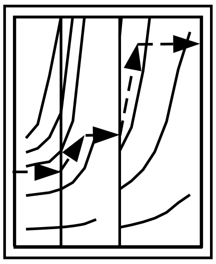
Use, copying and/or disclosure is governed by the statement on the title page of this document.

TIME TO CLIMB

3 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



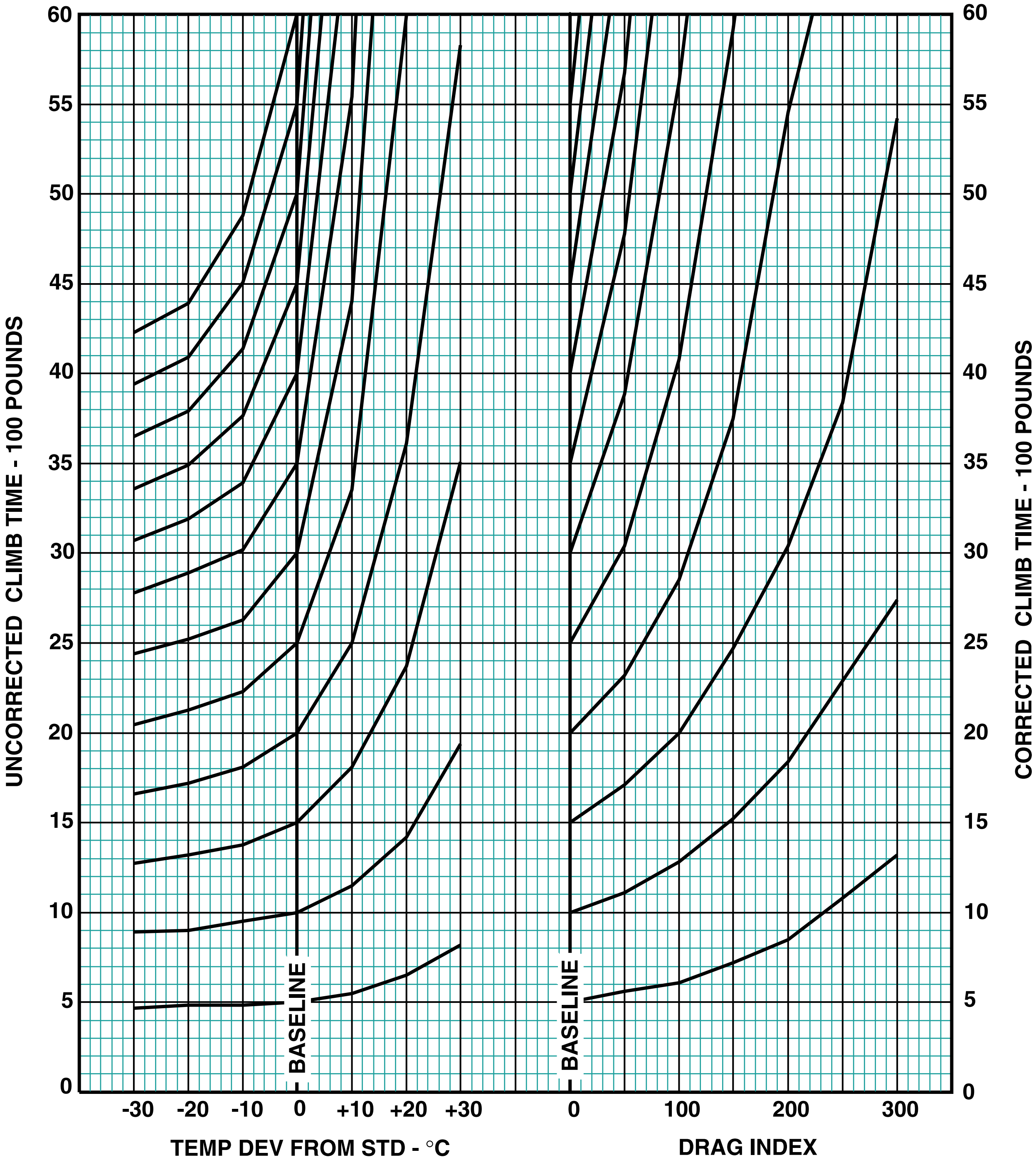
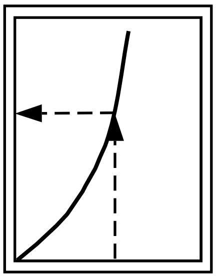


Figure 4-6. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TIME TO CLIMB BLEED CORRECTION

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

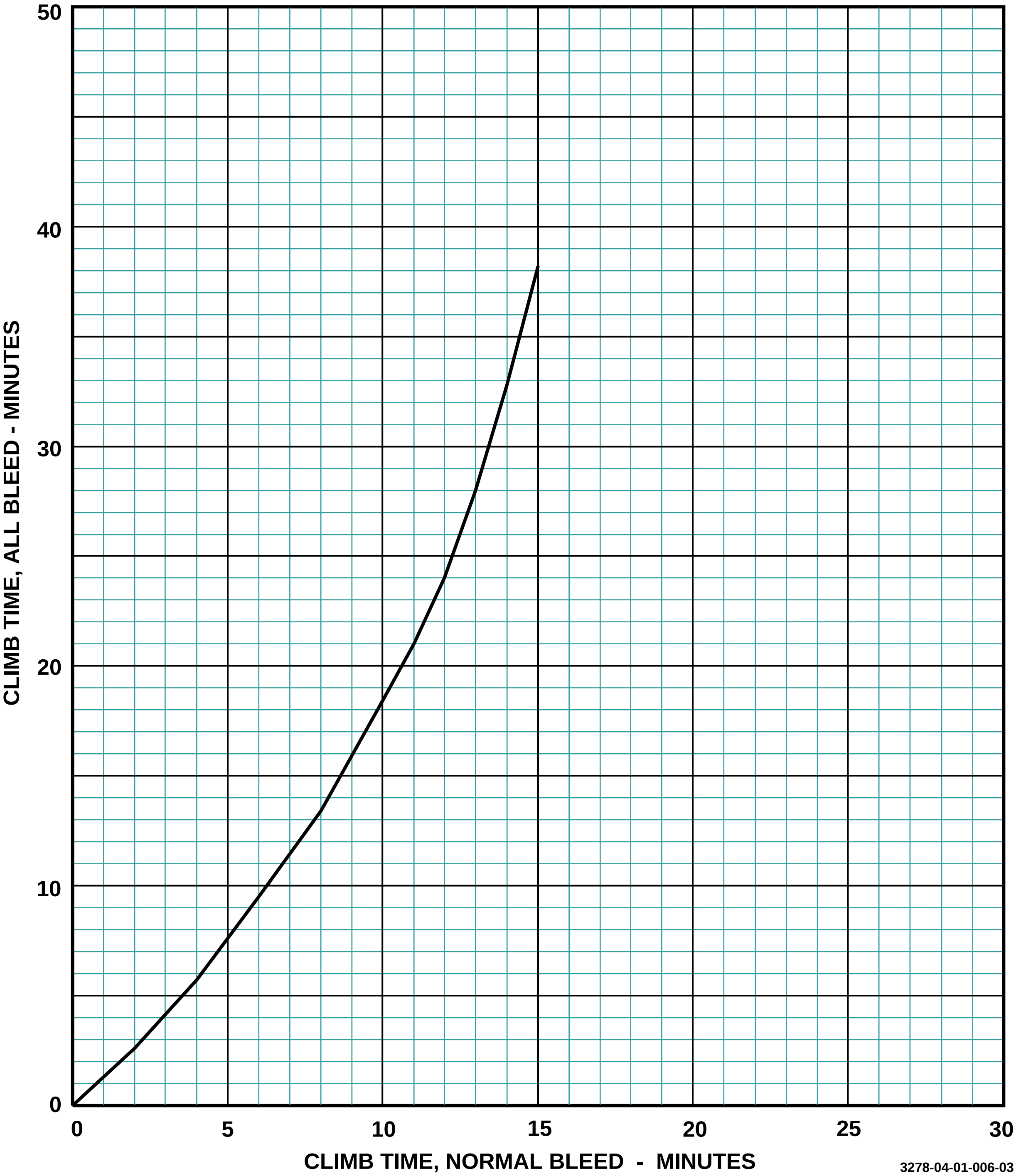


Figure 4-6. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

FUEL TO CLIMB

3 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER

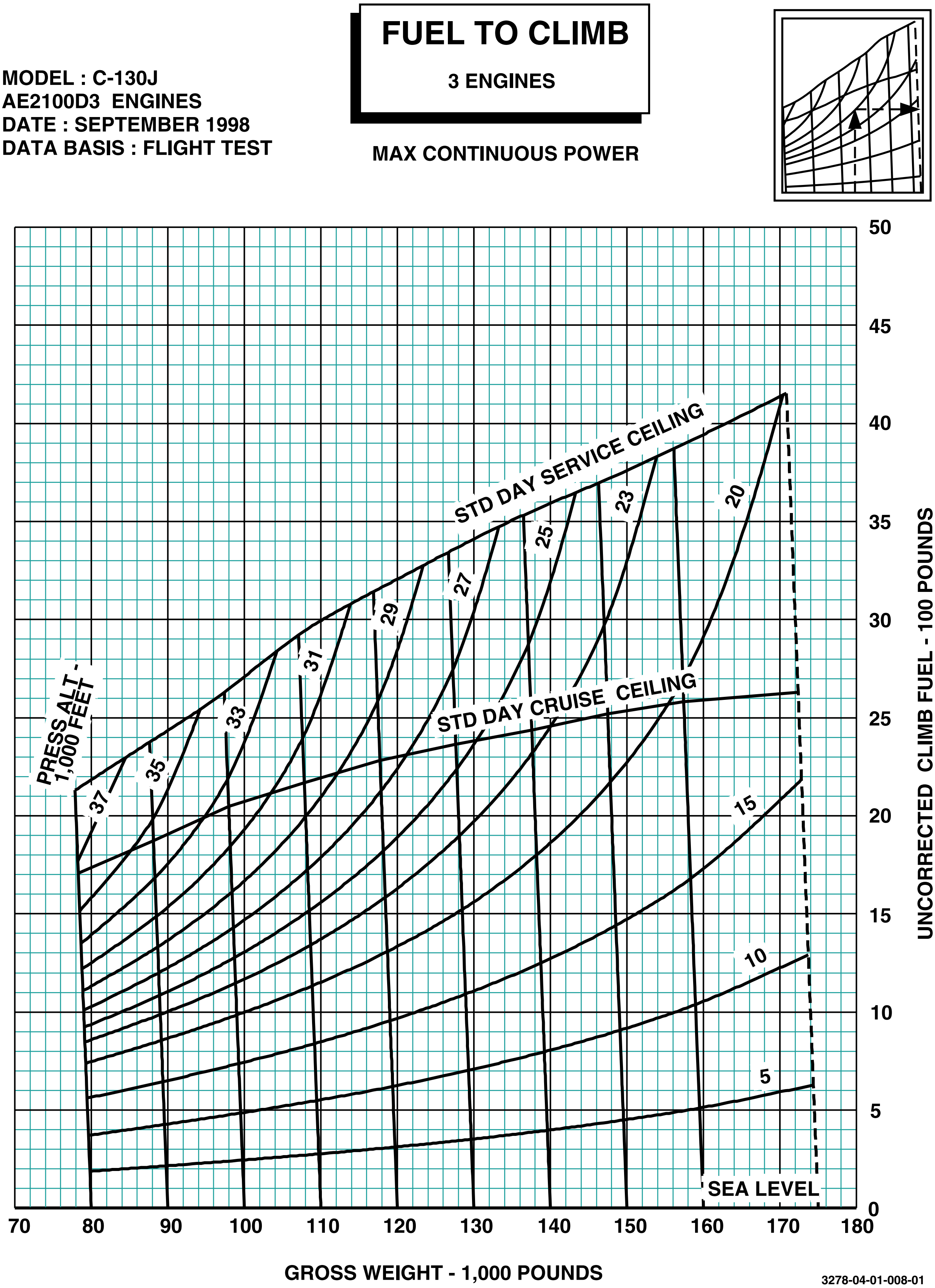


Figure 4-7. (Sheet 1 of 3)

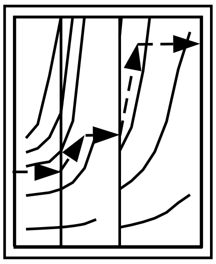
Use, copying and/or disclosure is governed by the statement on the title page of this document.

FUEL TO CLIMB

3 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



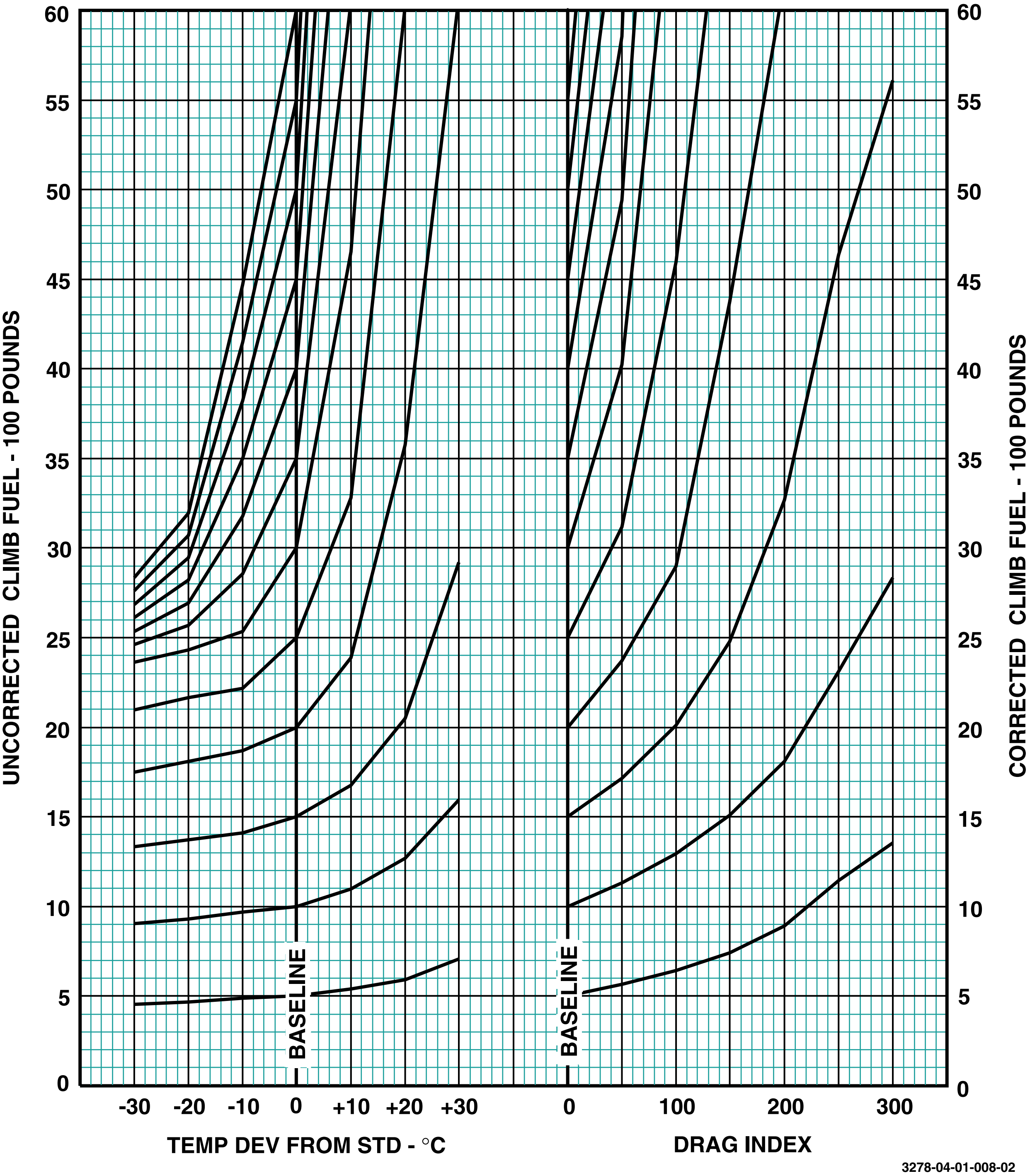


Figure 4-7. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

FUEL TO CLIMB
BLEED CORRECTION

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

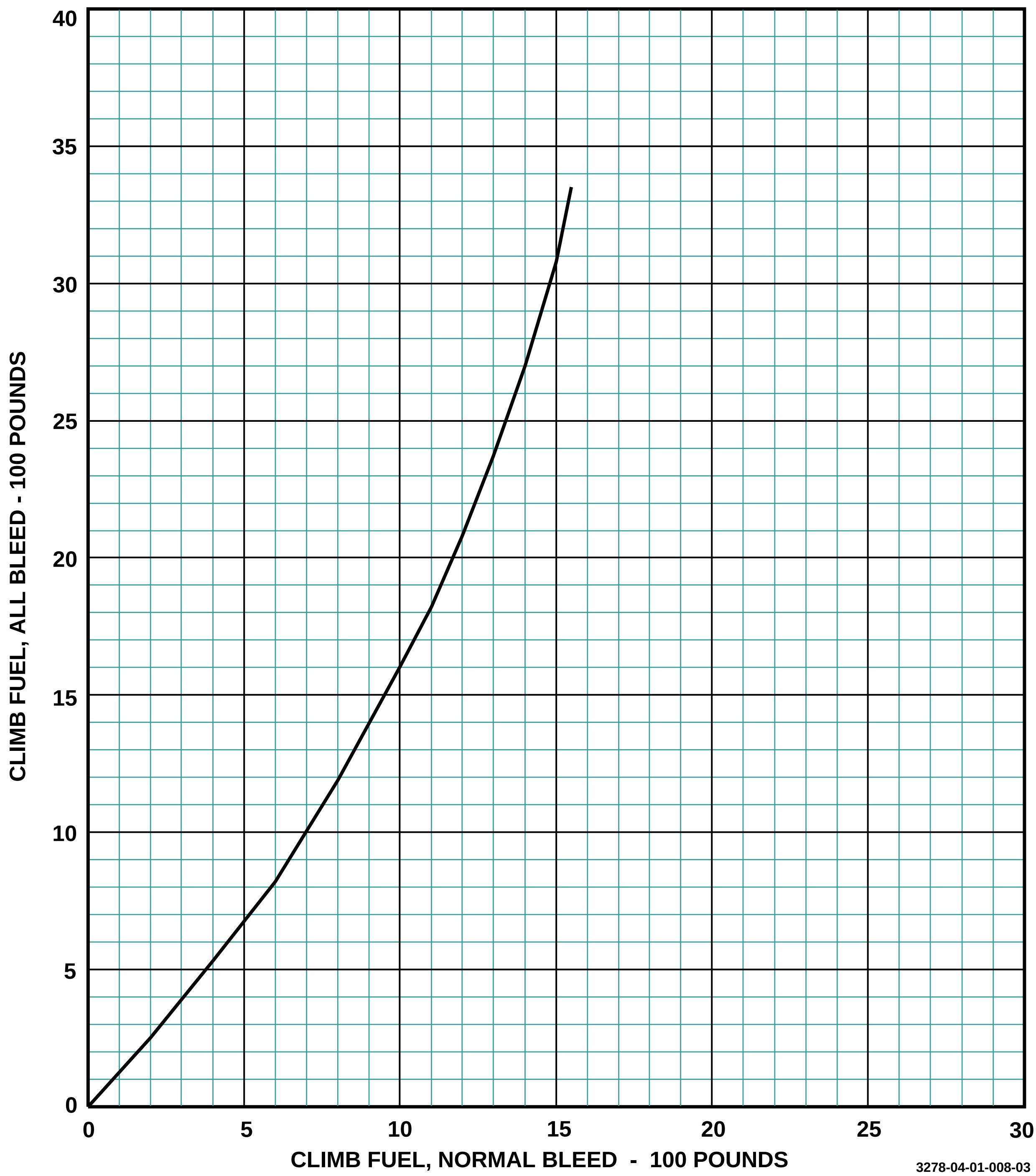


Figure 4-7. (Sheet 3 of 3)

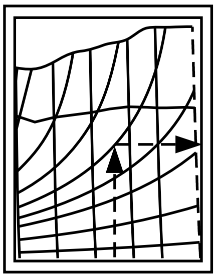
Use, copying and/or disclosure is governed by the statement on the title page of this document.

DISTANCE TO CLIMB

3 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



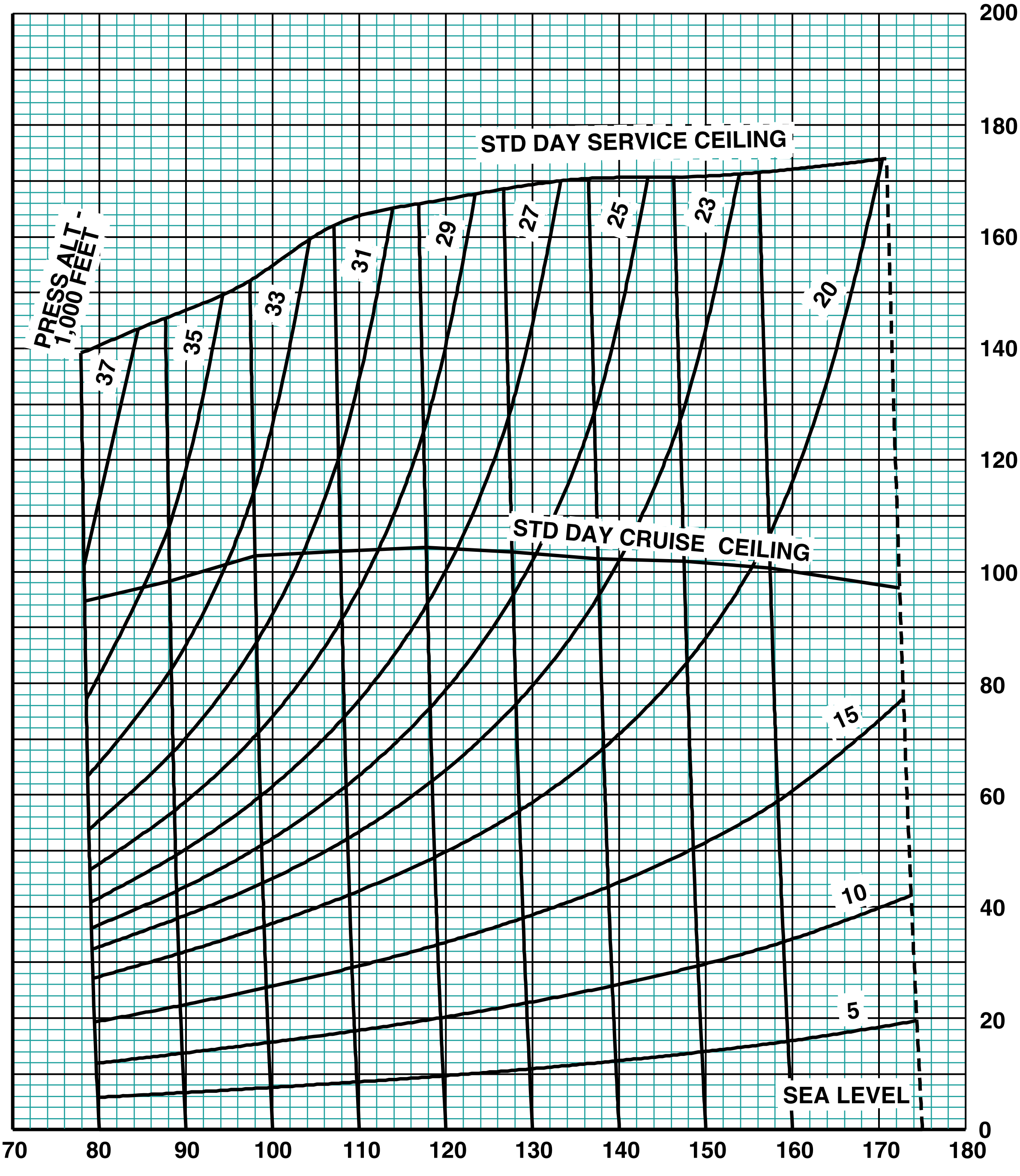


Figure 4-8. (Sheet 1 of 3)

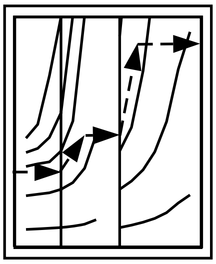
Use, copying and/or disclosure is governed by the statement on the title page of this document.

DISTANCE TO CLIMB

3 ENGINES

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



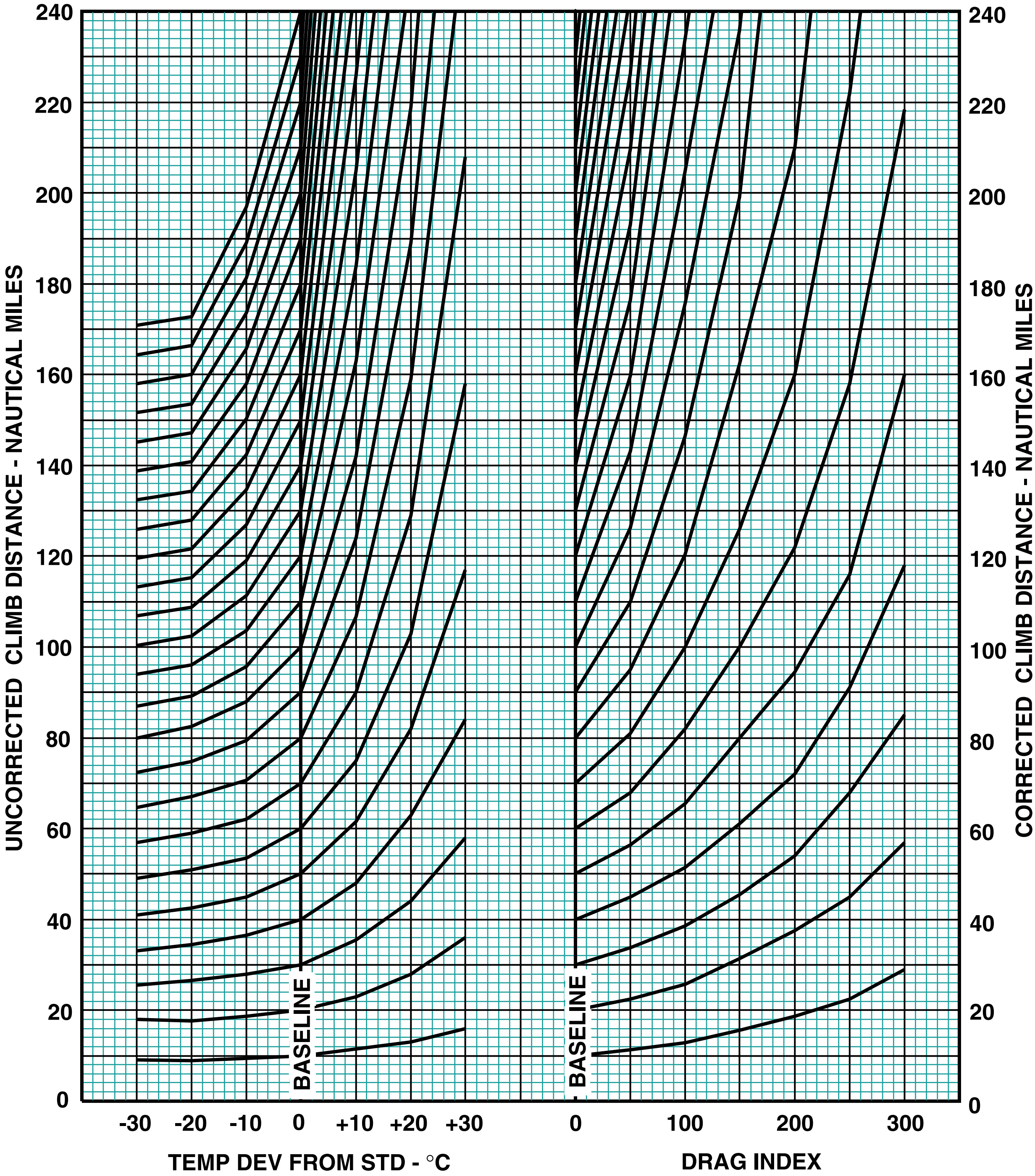


Figure 4-8. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

DISTANCE TO CLIMB BLEED CORRECTION

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

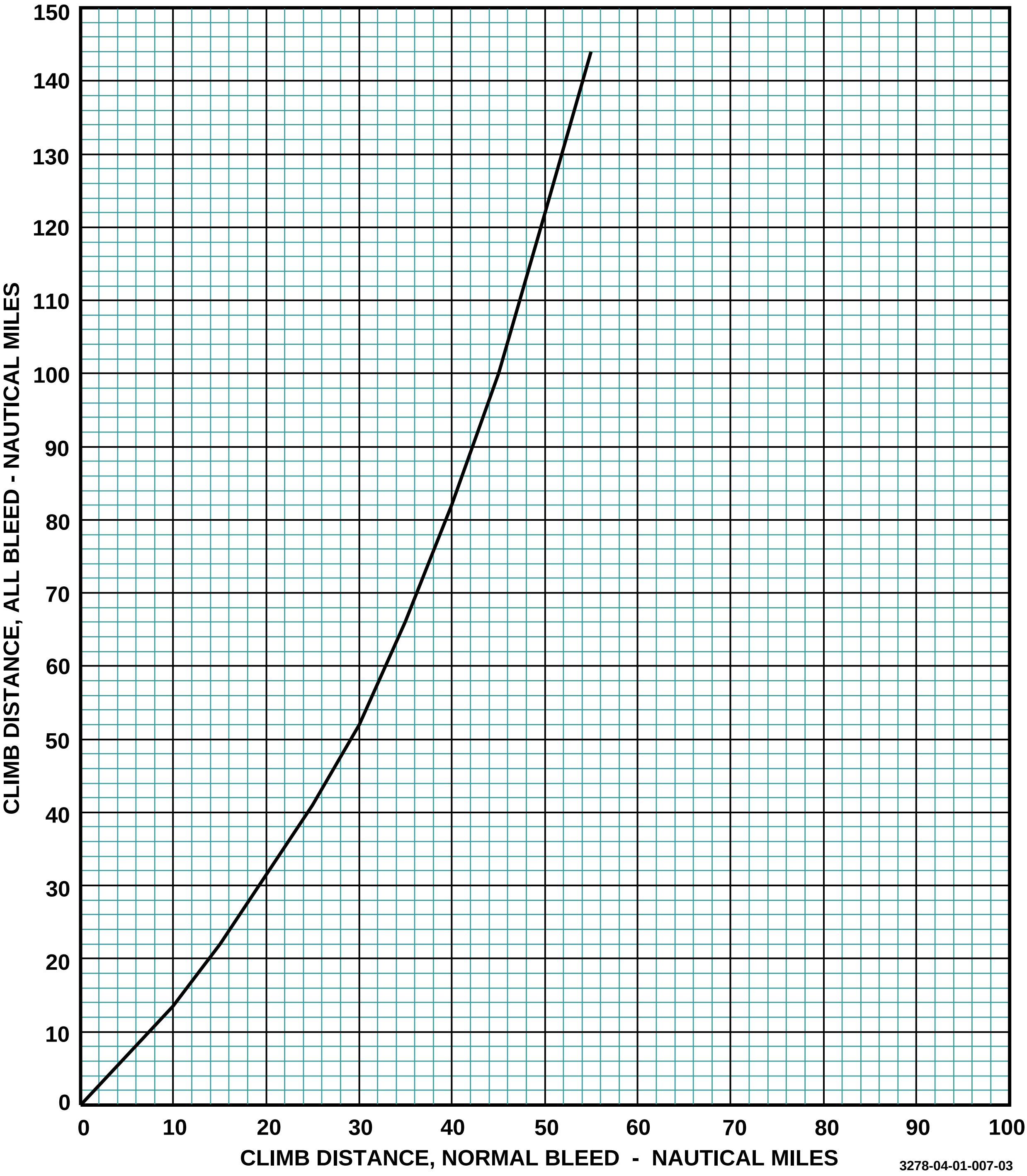


Figure 4-8. (Sheet 3 of 3)

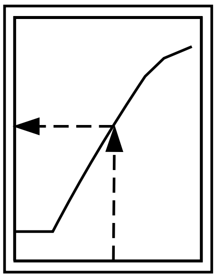
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

CLIMB SPEED

2 ENGINES

SYMMETRIC POWER



MAX CONTINUOUS POWER

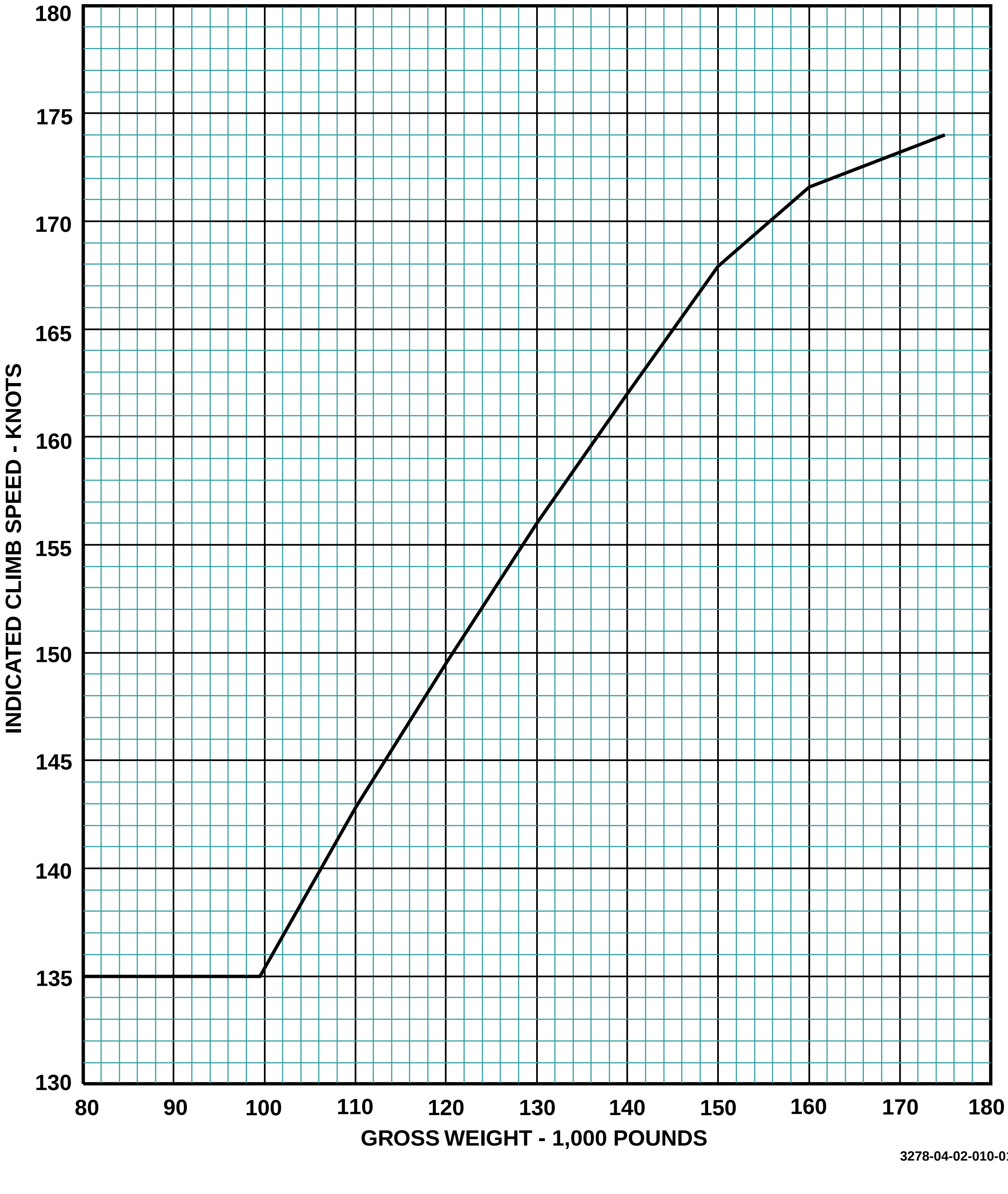


Figure 4-9. (Sheet 1 of 2)

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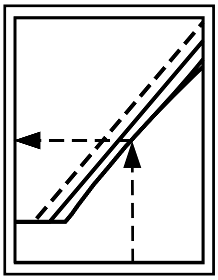
CLIMB SPEED FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST



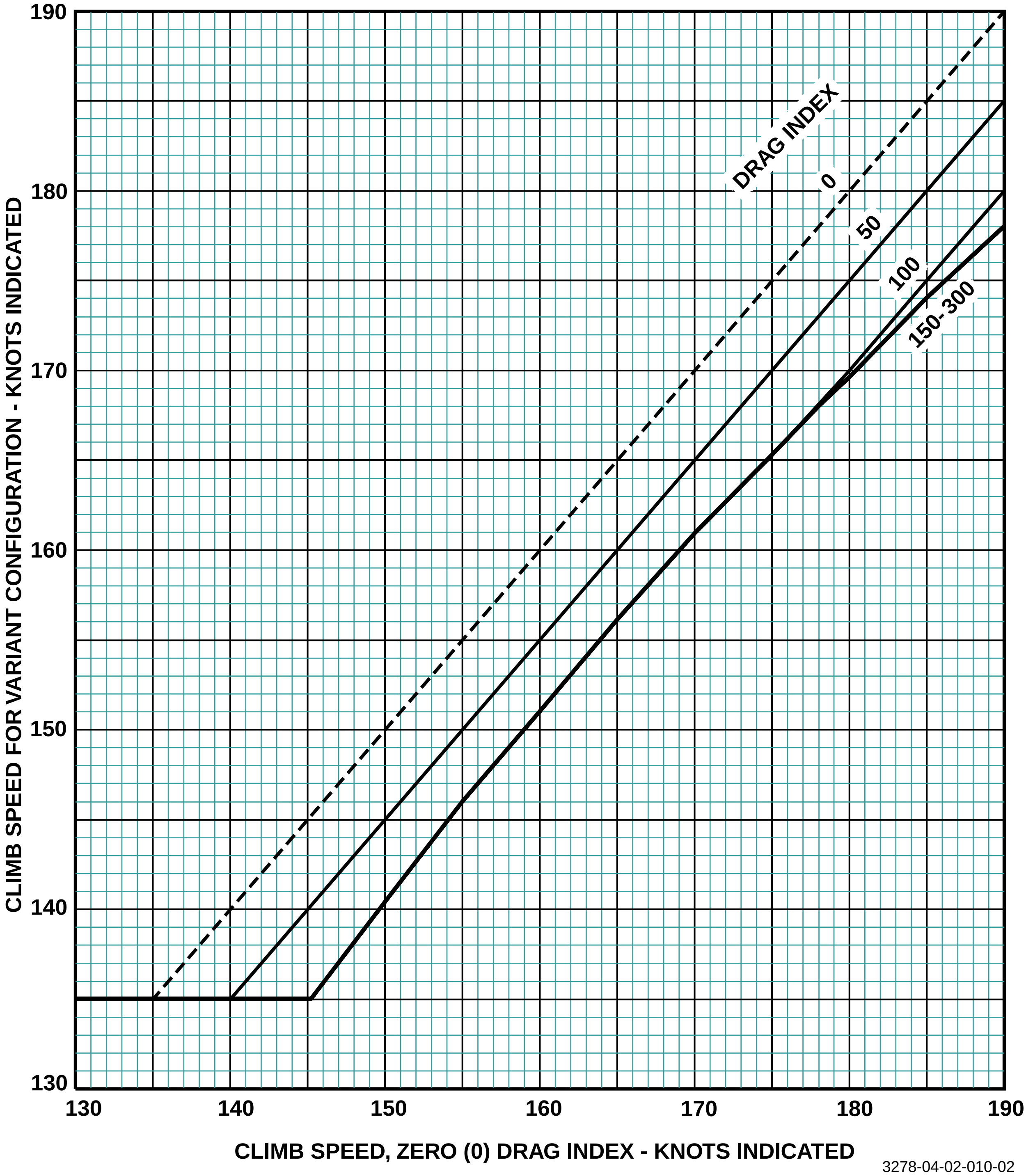


Figure 4-9. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

TIME TO CLIMB
2 ENGINES
SYMMETRICAL POWER

MAX CONTINUOUS POWER

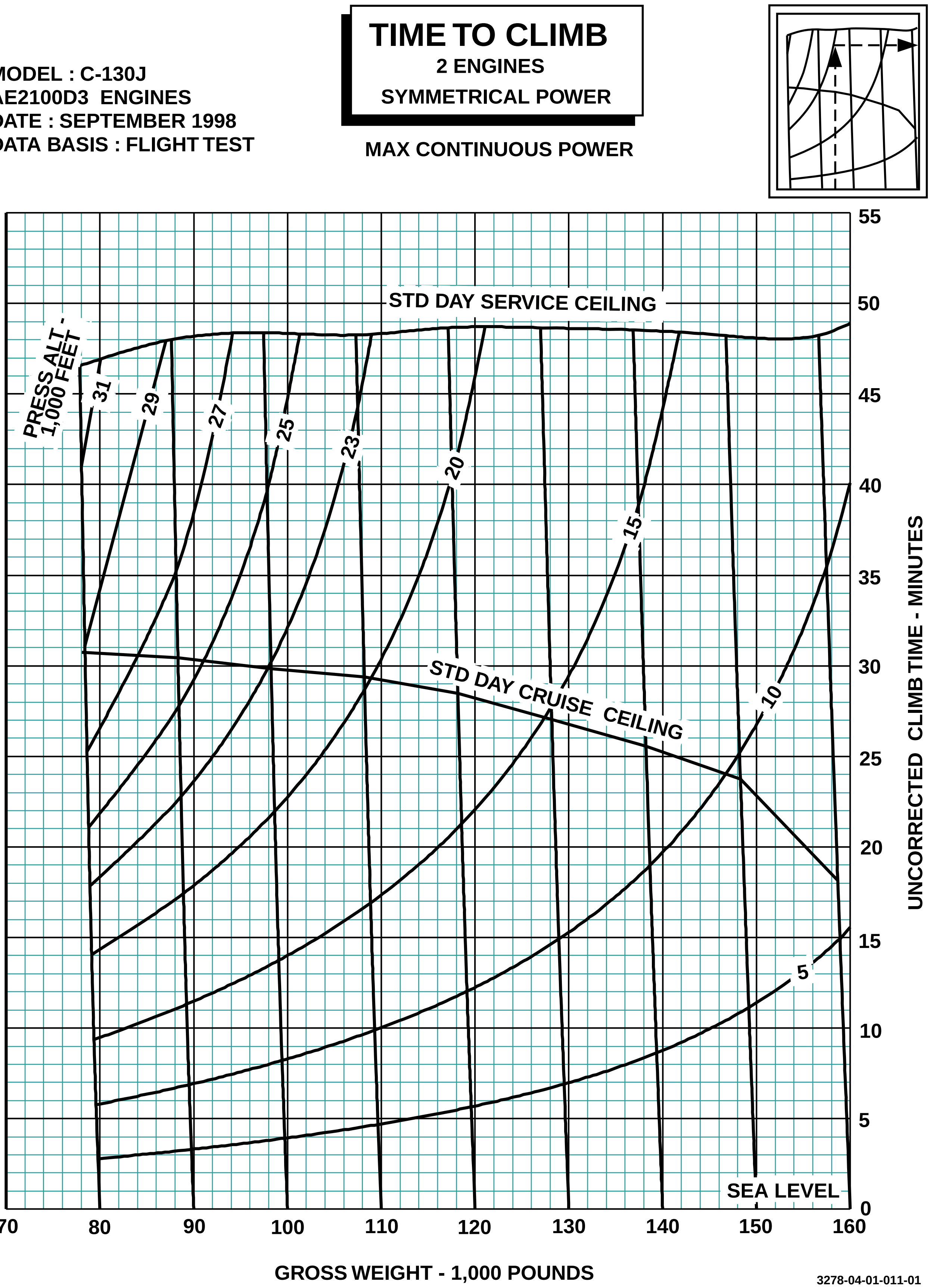


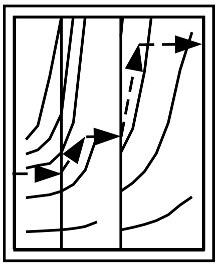
Figure 4-10. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TIME TO CLIMB
2 ENGINES
SYMMETRICAL POWER

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



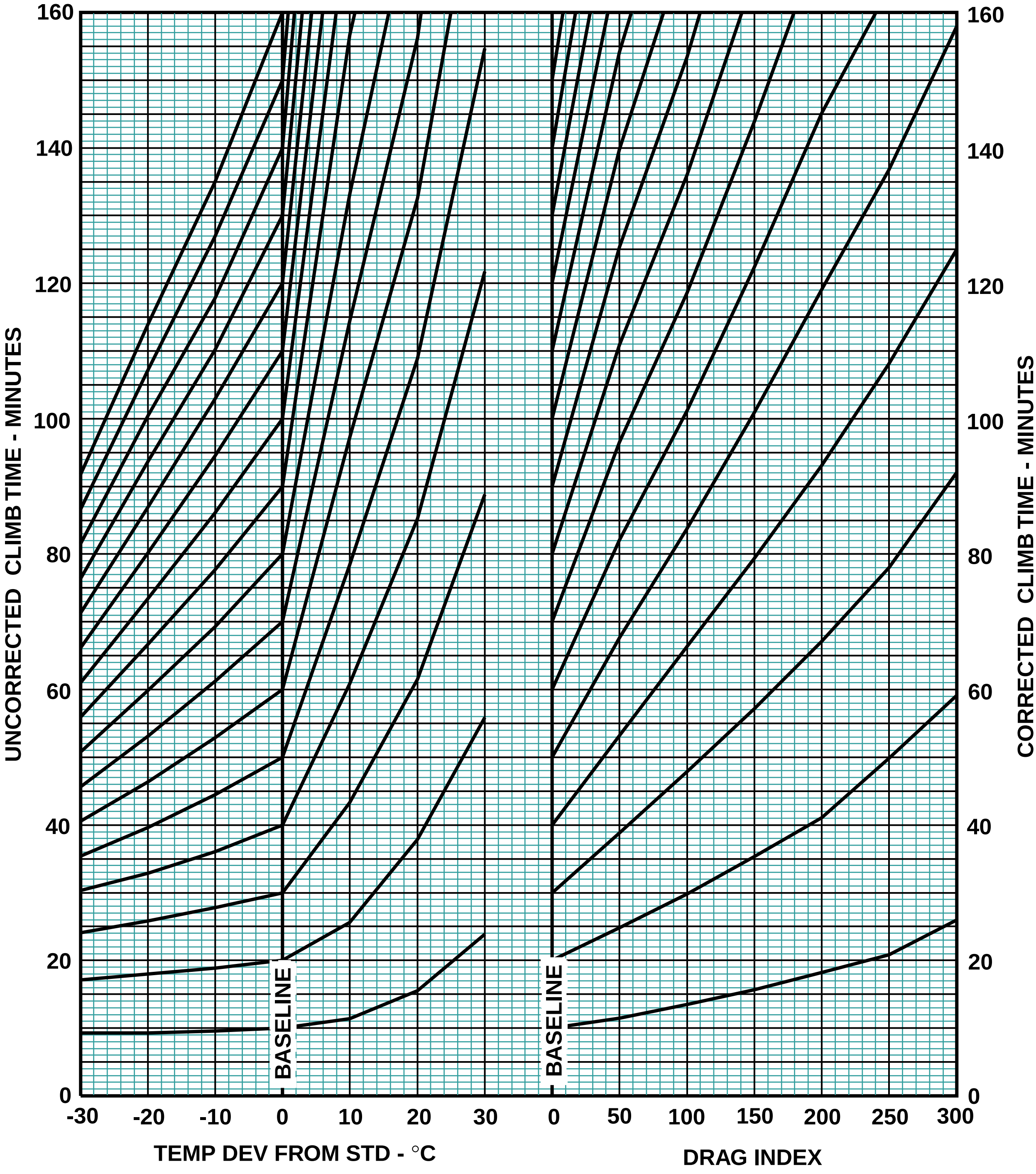


Figure 4-10. (Sheet 2 of 2)

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MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

FUEL TO CLIMB

2 ENGINES

SYMMETRICAL POWER

MAX CONTINUOUS POWER

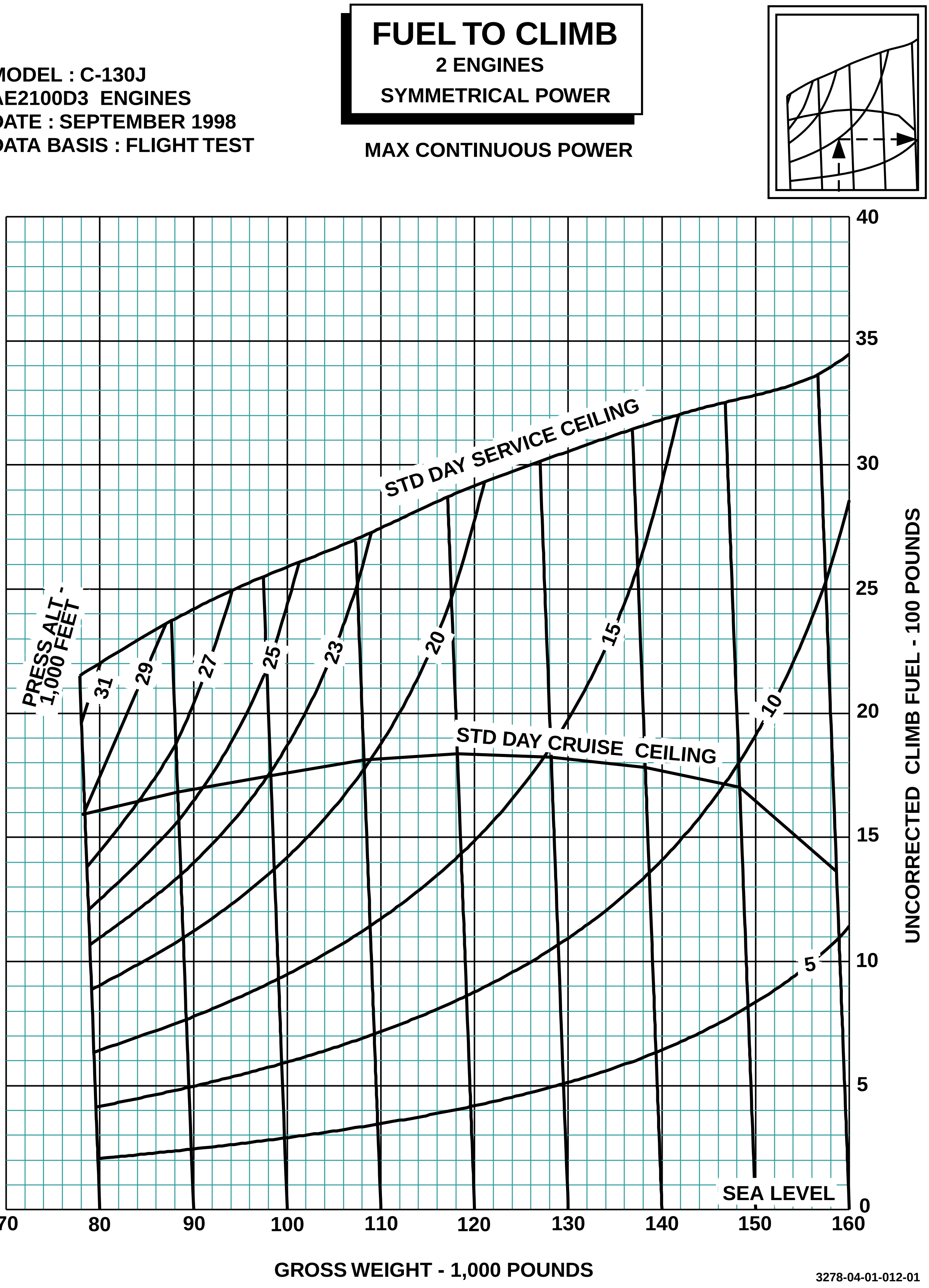

Figure 4-11. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

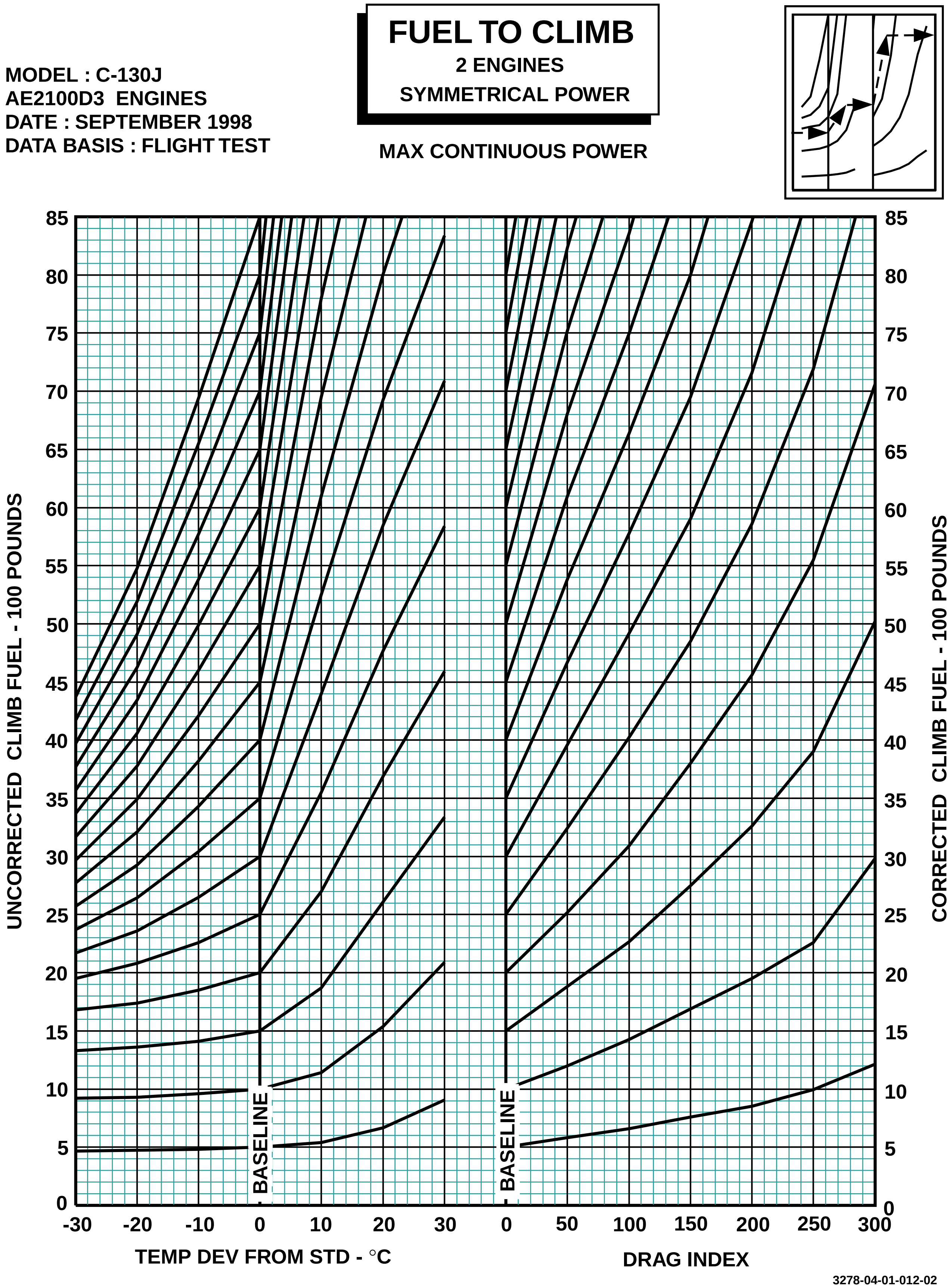

Figure 4-11. (Sheet 2 of 2)

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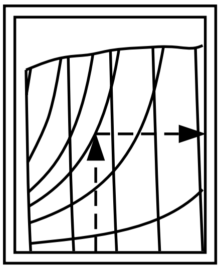
DISTANCE TO CLIMB

2 ENGINES

SYMMETRICAL POWER

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAX CONTINUOUS POWER



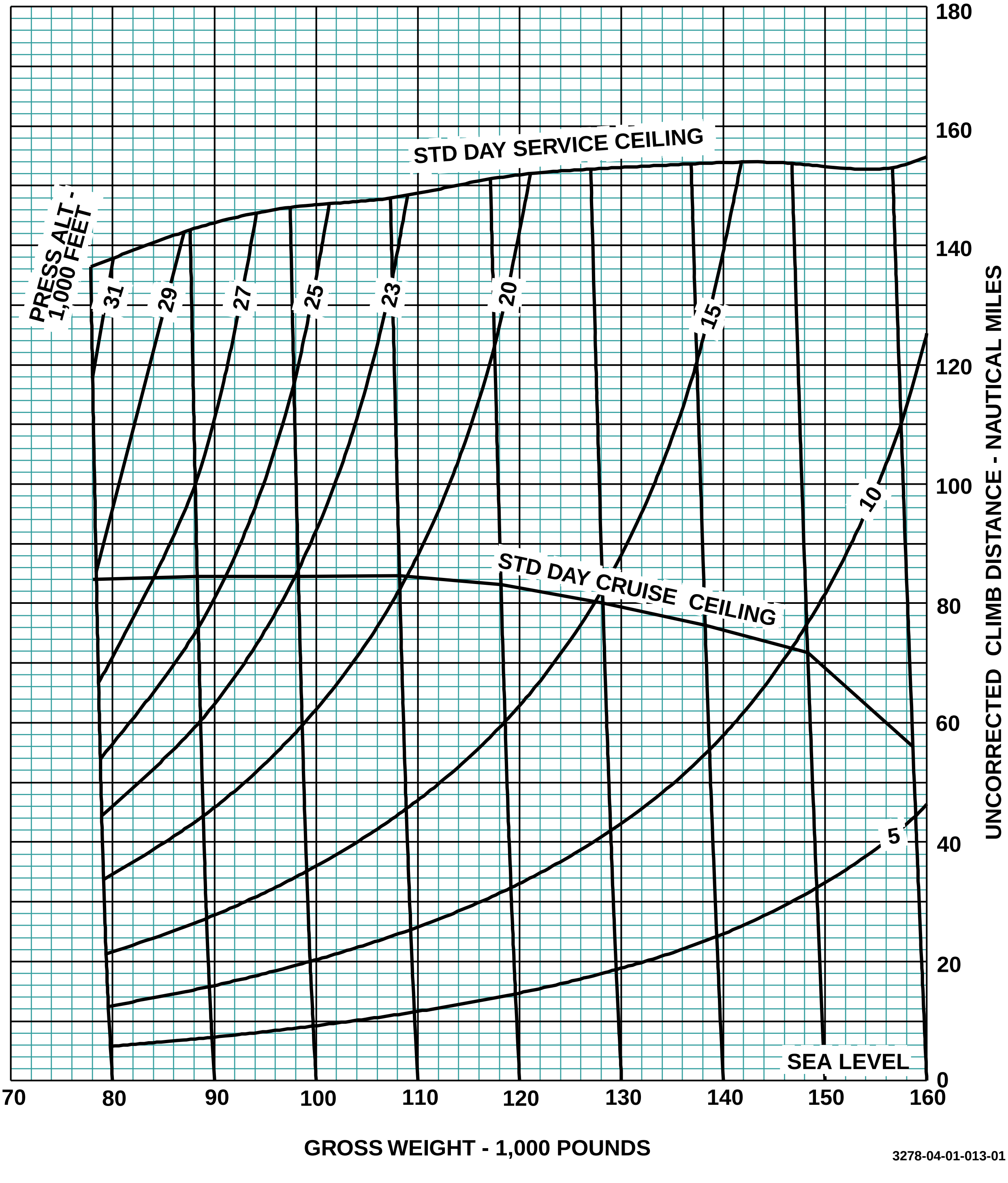


Figure 4-12. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

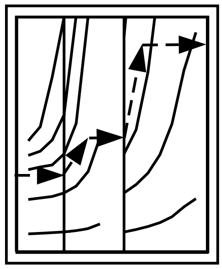
MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

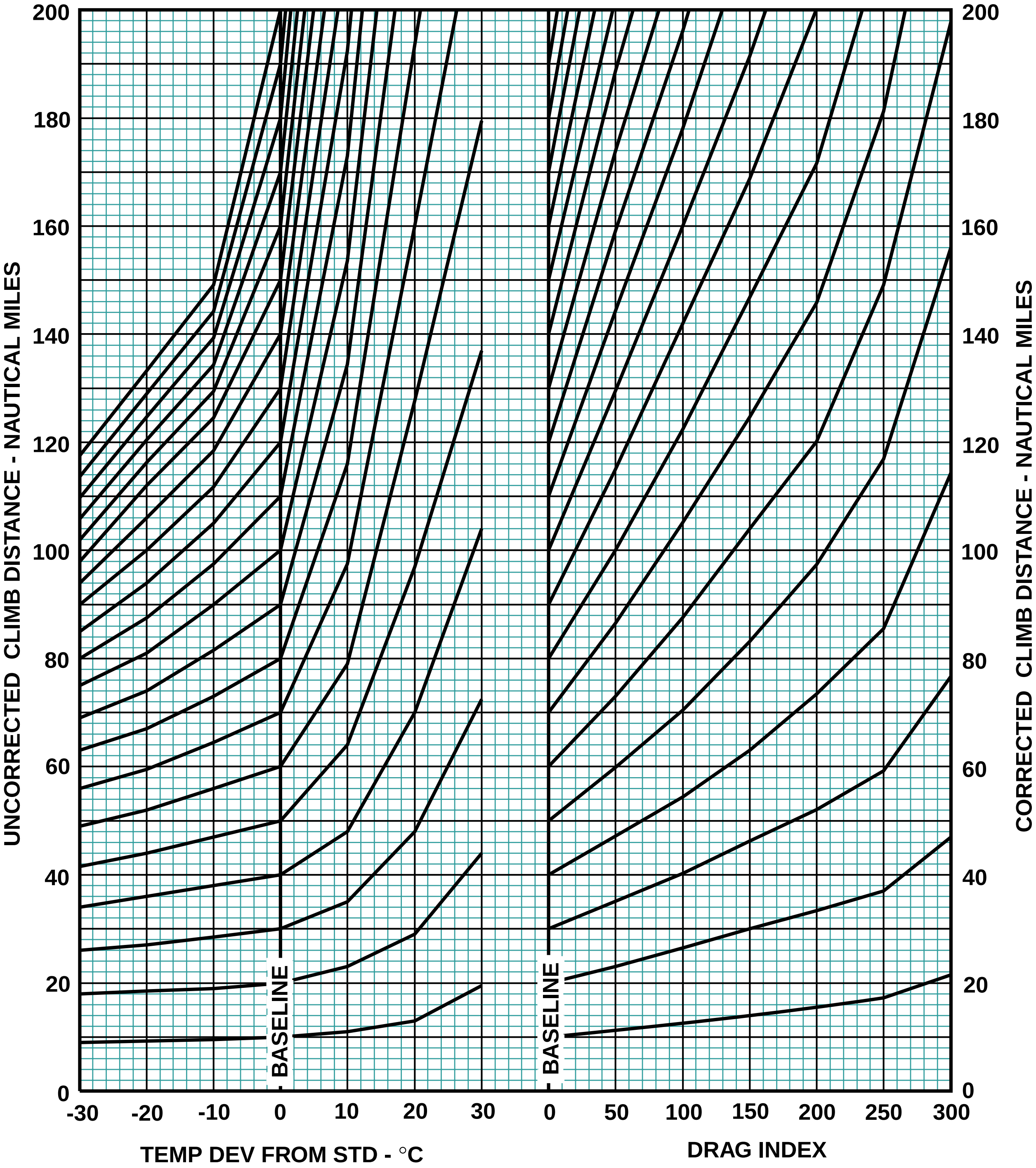
DISTANCE TO CLIMB

2 ENGINES

SYMMETRICAL POWER

MAX CONTINUOUS POWER





3278-04-01-013-02

Figure 4-12. (Sheet 2 of 2)

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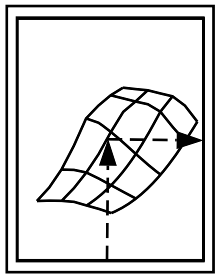
CLIMB GRADIENT

ASYMMETRICAL POWER 2 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAX CONTINUOUS POWER
FLAPS = 20 PERCENT
CLIMB SPEED = 175 KIAS FOR ALL WEIGHTS
WEIGHT = 120,000 POUNDS



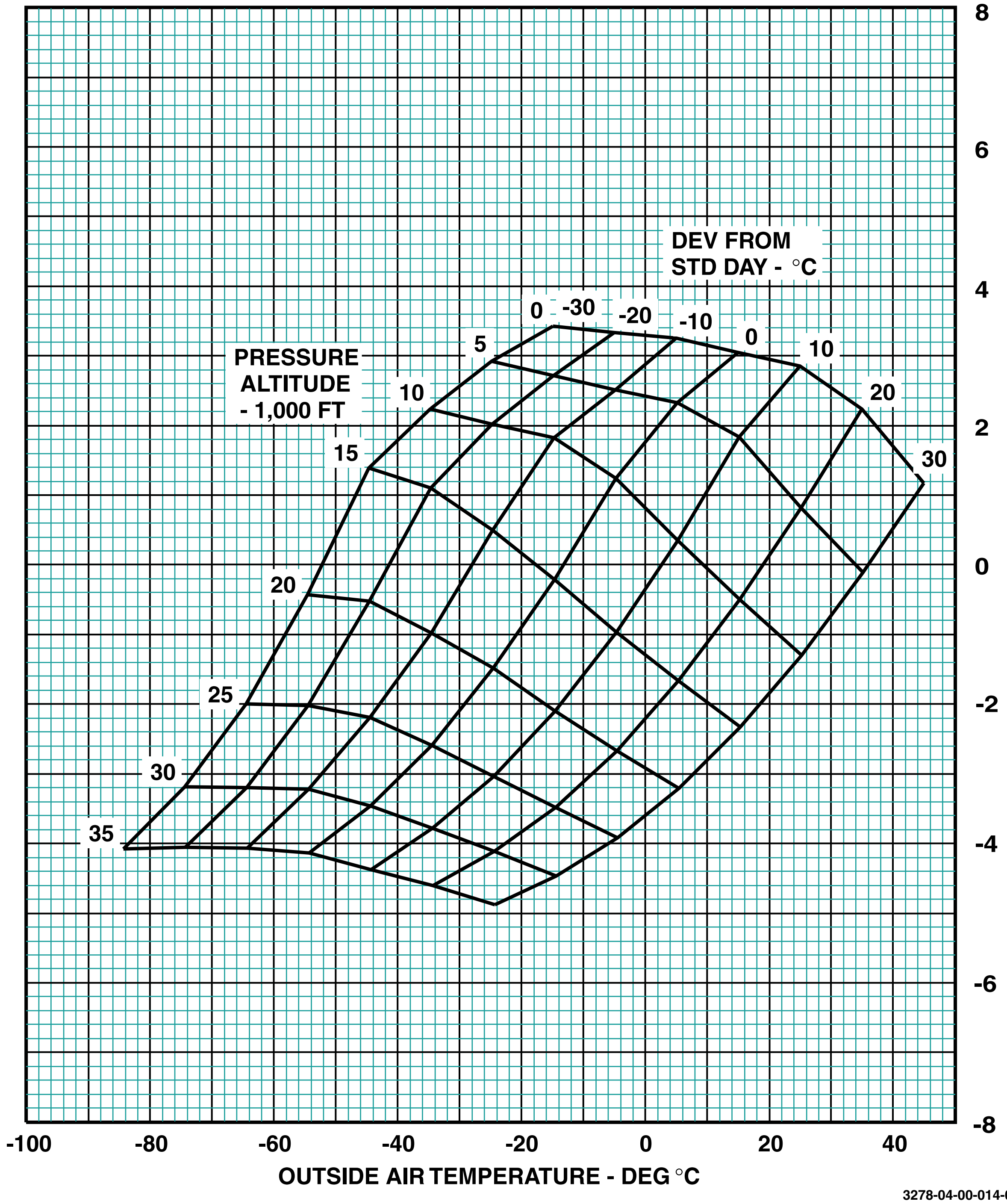


Figure 4-13. (Sheet 1 of 3)

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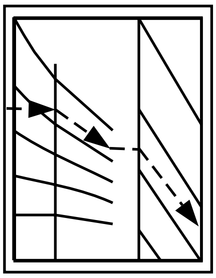
CLIMB GRADIENT

ASYMMETRICAL POWER 2 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAX CONTINUOUS POWER
FLAPS = 20 PERCENT
CLIMB SPEED = 175 KIAS FOR ALL WEIGHTS

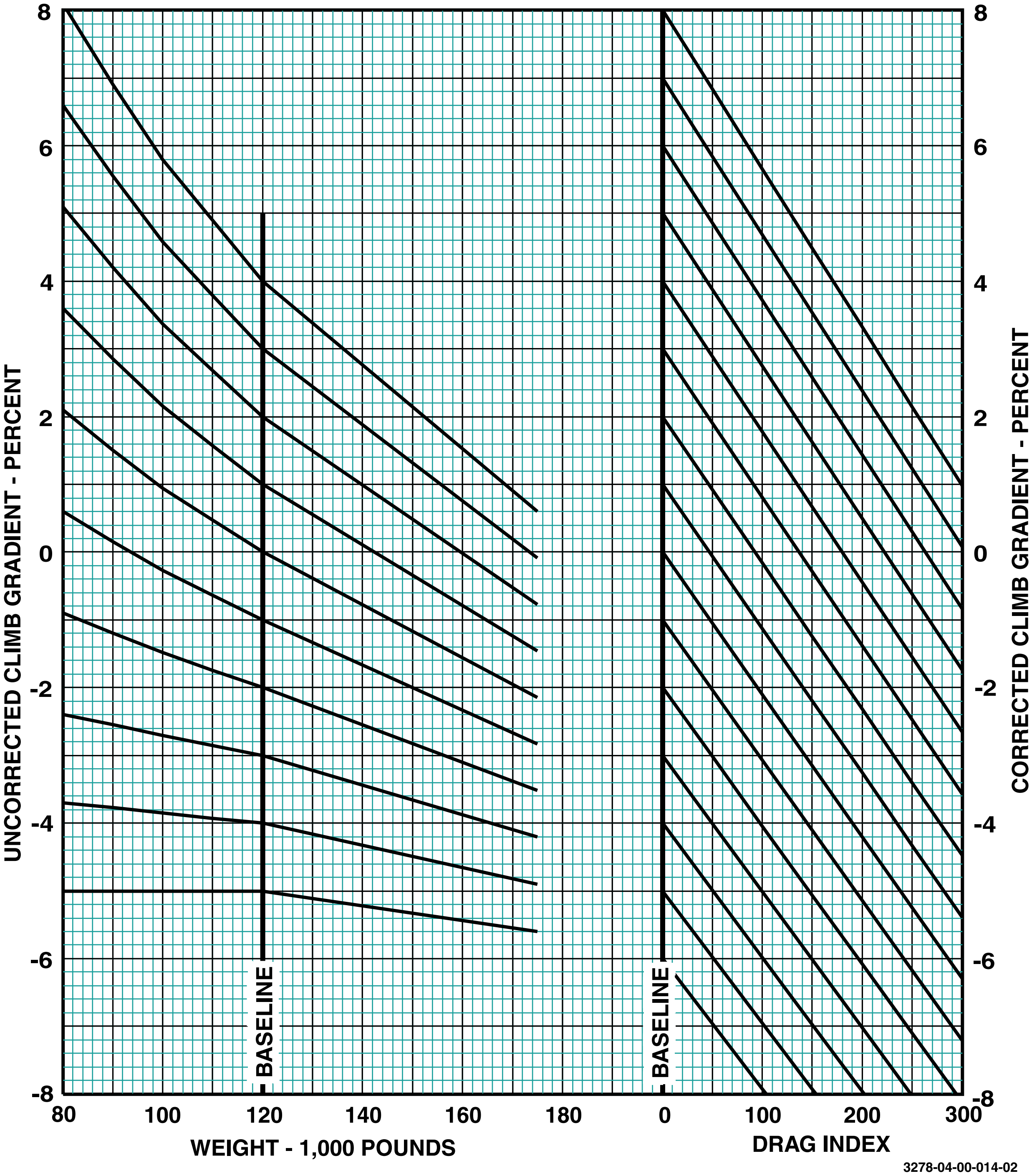


Figure 4-13. (Sheet 2 of 3)

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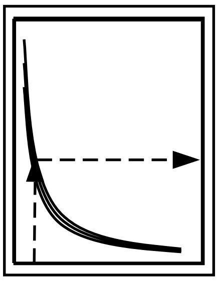
HORIZIONTAL DISTANCE

5000 FOOT PRESSURE ALTITUDE CHANGE



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

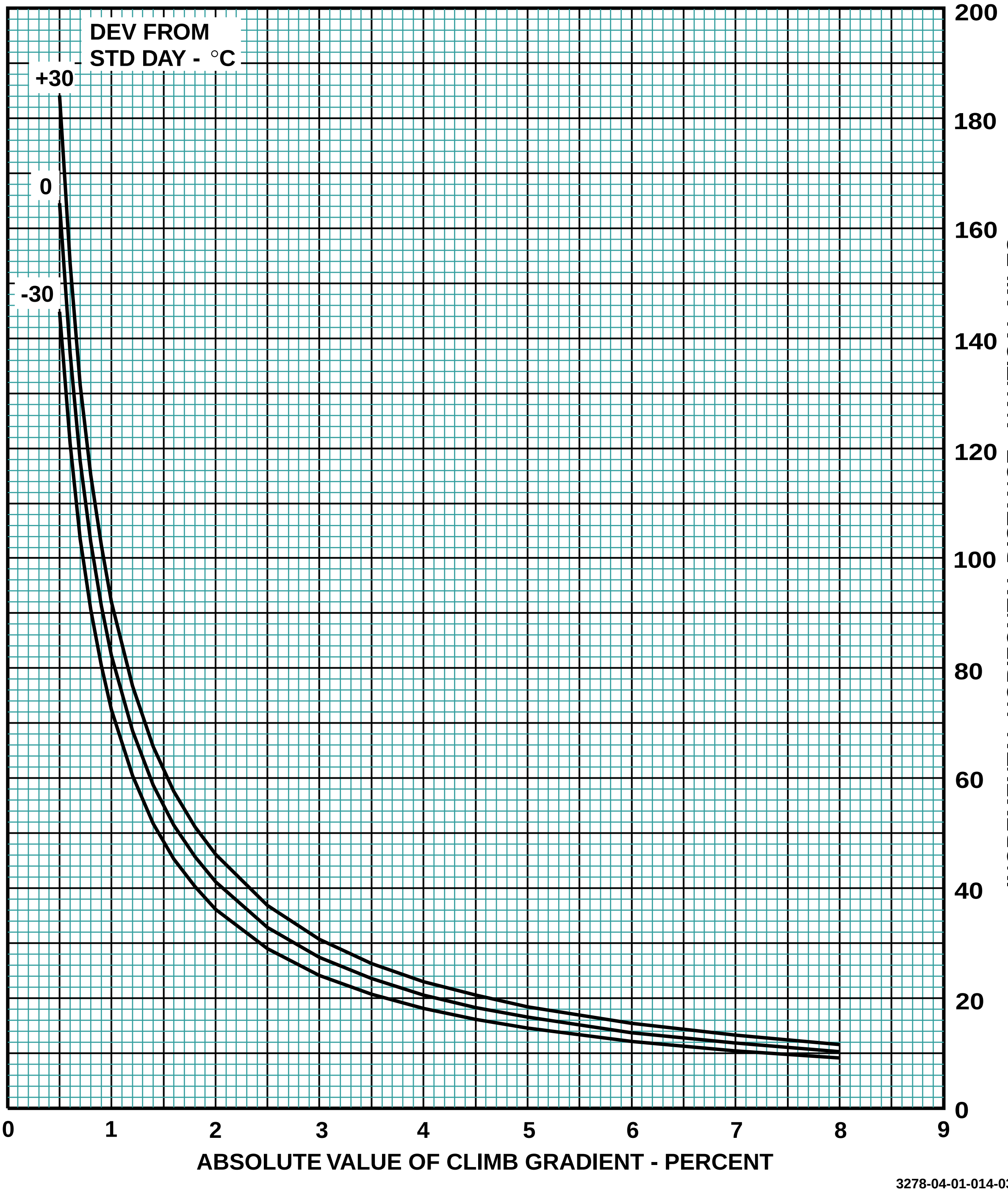


Figure 4-13. (Sheet 3 of 3)

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SECTION 5
RANGE

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LIST OF CHARTS

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INTRODUCTION.

Range capability is a function of fuel consumed and ground speed. Since fuel consumption increases with an increase in power (at a given airplane gross weight and cruise altitude), maximum range capability does not normally occur at maximum speed. For a given mission where fuel economy is more important than speed, the best results will be obtained by flying at reduced power settings. The information contained in Section 5 enables a pilot to choose a cruise option which best suits the particular mission. Charts and tables are included for the basic airplane configuration and for the variant airplane configuration. In addition, data is provided to account for temperature deviation from standard day. Flight limit speeds are shown in figure 5-1.

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The charts contained herein are corrected for normal bleed. When conditions are encountered which require the operation of anti-icing equipment, the procedures outlined in the paragraph entitled Range Correction Due to All Bleed On should be consulted.

Unless otherwise noted, range performance as computed from this part can only be attained if engine power is set to the computed Horsepower (HP) values. Refer to the Engine Power Settings paragraph in Section 2.

CAUTION

> Observe the airplane structural limit speeds shown in the Limitations Section of the applicable flight manual.

DEFINITIONS.

The following is a list of expressions and terms used in describing cruise procedures. Some of these terms are essentially synonymous and may be used interchangeably.

Service Ceiling - The altitude at which the maximum rate of climb at maximum continuous power and best climb speed is 100 Feet Per Minute (FPM).

Cruise Ceiling - The altitude at which the maximum rate of climb capability at maximum continuous power and best climb speed is 300 FPM.

ATC Ceiling - The Air Traffic Control (ATC) cruise ceiling is that altitude at which the maximum rate of climb capability at maximum continuous power and best climb speed is 500 FPM.

V_t/W_f - Specific range. True airspeed divided by total fuel flow, or air nautical miles per pound of fuel.

(V_t/W_f) MAX - The maximum value of specific range for a given weight and altitude.

99% (V_t/W_f) MAX - The value of specific range resulting from increasing true airspeed from the speed at (V_t/W_f) MAX to give a value of specific range which is one percent less than (V_t/W_f) MAX.

Long range cruise - The term which identifies flight of the airplane at the speed for 99% (V_t/W_f) MAX.

V_H - Structurally limited maximum level flight speed (recommended limit speed). See the Limitations Section of the applicable flight manual for a complete definition.

Normal Bleed - The engine bleed condition when compressor bleed air is used to operate the air conditioning and pressurization system.

All Bleed On - The engine bleed condition when compressor bleed air is used to operate the engine anti-icing system and the wing and tail surface anti-icing system in addition to the normal bleed.

Drag Index - A number which is proportional to the drag change associated with a change in the airplane configuration. See Section 1 for a listing of drag index.

RANGE PERFORMANCE.

Range performance is determined by the cruise schedule flown in the cruise portion of a mission. The type of mission determines the type of cruise schedule. Therefore, to accomplish a desired mission, the particular cruise schedule must be selected to maximize or minimize the parameter that will assure the most efficient accomplishment of the mission.

Outside air temperature has a significant effect on airplane performance. Data in this section are presented as a function of ambient temperature for a wide variation from standard temperature in degrees Celsius. Figure 1-4 may be used to determine the variation from standard-day temperature for given conditions of pressure altitude, indicated airspeed, and indicated outside air temperature.

The effect of drag variation from the baseline airplane configuration is shown for levels of drag index ranging from 0 to + 300. The variant drag effects apply for all gross weights and altitudes at each cruise speed. The range summary charts for the variant configurations have been constructed to yield conservative values for the complete range of gross weights and altitudes.

The maximum altitudes recommended for cruise at these constant airspeeds are either the cruise ceilings (at which 300 feet per minute rate of climb can be attained at the best climb speed) or the maximum altitude at which the appropriate true airspeed can be attained at maximum continuous power.

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Cruise at maximum continuous power can be used when required by the mission. However, if this power setting is used for all cruise operations, turbine wear will be accelerated and the turbine life will be reduced. Cruise at constant true airspeed provides an operationally convenient schedule at fast speeds and cruise at long range cruise provides the greatest range available and overall the most economical use of the airplane. Both of these cruise profiles result in average power less than maximum continuous power, thus improving turbine life. Follow the Recommended Cruise Ceiling At Constant True Airspeed chart, and 4-Engine Range Summary (constant true airspeed) or the Long Range Cruise charts for cruise operations whenever mission constraints allow.

STEP-CLIMB CRUISE PROFILE.

The recommended step for a step-climb cruise profile is 2,000 feet. To obtain maximum cruise performance for this condition, the following procedures are recommended.

1. Determine the initial airplane gross weight.
2. Determine the cruise ceiling.
3. Select the desired altitude below cruise ceiling.
4. Enter the Range Summary charts to determine cruise speed, fuel flow, and horsepower setting.
5. Set the recommended power and adjust periodically as necessary to maintain target airspeed as weight decreases due to fuel burnoff. Maintain the constant altitude until the gross weight has been reduced to a value which gives a cruise ceiling 2,000 feet above the altitude being maintained.
6. At this point, advance power to maximum continuous, climb 2,000 feet, and repeat the procedure in 4 and 5 above.

EFFECT OF WIND ON RANGE.

The direct effect of winds on airplane range is to increase or decrease the distance flown in proportion to the tailwind or headwind component. For stronger headwinds (headwind component greater than 70 knots), TAS should be increased to attain best ground nautical miles per pound of fuel. If the headwind component exceeds 70 knots, increasing TAS by 4 knots for every 10 knots of wind above 70 knots will result in obtaining near the maximum ground nautical miles per pound of fuel. True airspeed should be increased only up to the point at which maximum continuous power is required.

CRUISE CEILING CHARTS.

Four-engine ceiling information is obtained from figure 5-2 and figure 5-3. Information for the Air Traffic Control (ATC) ceiling is given in figure 5-4 and figure 5-5. The Recommended Cruise Ceiling At Constant True Airspeed information is given in figure 5-6. To correct the Recommended Cruise Ceiling At Constant True Airspeed chart for drag index, use the Cruise Ceiling for Variant Configuration chart, figure 5-3.

Similar ceiling data for three-engine operation is presented in figure 5-28 through figure 5-31 and for two-engine operation in figure 5-50 through figure 5-53.

Example.

GIVEN:

Drag index: + 50

Initial climb weight: 120,000 pounds

Temp Dev: – 20 °C

Four-engine operation

FIND:

- Four-engine cruise ceiling for normal bleed condition
- Four-engine cruise ceiling for all bleed condition

PROCEDURE:

Enter the bottom of figure 5-2, sheet 1, at 120,000 pounds and proceed vertically until the ISA – 20 °C line is intersected. Read to the left a cruise ceiling of 34,500 feet for a drag index of zero. Enter the bottom of figure 5-3 with 34,500 feet and move vertically to the drag index equal to 50. Read to the left a modified cruise ceiling of 33,400 feet for a drag index of 50. Figure 5-2, sheet 2, and figure 5-3 are used in a similar manner to obtain a cruise ceiling of 25,200 feet for all bleed and drag index equal to 50.

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SPECIFIC RANGE CHARTS.

Four-engine specific range cruise data for the basic configuration are given in figure 5-7 through figure 5-22 from sea level to 39,000 feet. The charts show specific range at constant weights as a function of both true and indicated airspeed for a given altitude. Reference lines are included for recommended long range cruise speeds, maximum endurance speeds, and horsepower required per engine. Variations in speed and specific range with temperature and drag index are given in figure 5-23 through figure 5-26. Variations in specific range with all bleed on are given in figure 5-27.

Similar information for three-engine operation is given in figure 5-32 through figure 5-49 and for two-engine operation, from figure 5-54 through 5-67.

Two-engine operation is based upon the assumption of symmetrically failed engines.

Example.

GIVEN:

Drag index: + 50

Cruise altitude: 16,000 feet

Cruise weight: 140,000 pounds

Temp Dev: + 20 °C

Long range cruise conditions

Four-engine operation

FIND:

- Initial cruise airspeed
- Horsepower per engine
- Specific range

PROCEDURE:

Enter figure 5-11 and locate the intersection of the long range cruise and 140,000 pound lines. Read the baseline configuration conditions of:

KTAS = 277 (KIAS = 218)
HP = 2350 Hp/engine
SFC = 64.8 NM/1,000 lb fuel

To find the corrected specific range, enter figure 5-23 with 64.8 and follow the guidelines for temperature and drag index. The corrected value is read as 59 air nautical miles per 1,000 pounds of fuel. The corrected true airspeed is obtained from figure 5-24 as 272 KTAS.

RANGE SUMMARY CHARTS.

Range summary charts for four-engine cruise at constant true airspeeds ranging from 180 to 320 KTAS are presented in figures 5-68 through 5-91. The data provided is in terms of indicated airspeed versus altitude, and fuel flow, horsepower versus gross weight for the baseline configuration. Variations in fuel flow and horsepower with temperature and drag index are also presented.

Example.

GIVEN:

Drag index: 0

Cruise speed: 280 KTAS

Gross weight: 140,000 pounds

Cruise Altitude: 20,000 feet

Temp Dev: + 10 °C

FIND:

- Indicated airspeed
- Fuel flow
- Horsepower

PROCEDURE:

Enter figure 5-83 at 20,000 feet and move to the right to intersect the airspeed line. Move down to the temperature baseline and follow the guidelines to ISA + 10 °C. The corrected indicated airspeed is read as 203 KIAS.

Enter the bottom of figure 5-84, sheet 1, with 140,000 pounds and move up to the 20,000 foot altitude line. Read to the right an uncorrected fuel flow value of 1,000 pounds per hour per engine. Enter figure 5-84, sheet 2, with the 1,000 and move to the right to the temperature baseline. Follow the guidelines to ISA + 10 °C. Since there is no drag index correction to be made, read the corrected fuel flow value of 990 pounds per hour per engine. In a similar manner, the corrected horsepower is obtained from figure 5-85 as 2,190 horsepower.

RANGE CORRECTION DUE TO ALL BLEED ON.

The charts in this section have been corrected to take into account the losses due to normal bleed. Additional charts are provided to correct for all bleed usage.

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Four-engine range corrections due to all bleed on are presented in figure 5-27 in terms of cruise specific range with normal bleed versus specific range with all bleed on. Three-engine corrections are given in figure 5-49. These corrections are based on the assumption that the power setting is increased to maintain a given flight condition (airspeed and altitude) after the anti-icing system is activated. This requires a torquemeter horsepower setting equal to that required for normal bleed at the same flight condition provided maximum continuous power is not exceeded. It should be noted that no range correction for bleed is given for two-engine operation.

Example.

GIVEN:

Drag index: Zero

Long range cruise altitude: 20,000 feet

Gross weight: 120,000 pounds

Temp Dev: 0

Four-engine operation

FIND:

- Specific range
- Corrected fuel flow per engine

PROCEDURE:

Enter figure 5-13 with the above information and determine the normal bleed long range cruise characteristics of:

Airspeed	202 KIAS/273 KTAS
Specific range	74.6 NM per 1,000 pounds of fuel

The corrected specific range with all bleed on is determined from figure 5-27 by entering with a normal bleed specific range of 74.6 nautical miles per thousand pounds of fuel and reading the corrected value of 67.5 nautical miles per thousand pounds of fuel with all bleed on.

The corrected fuel flow is determined by dividing the true airspeed by the corrected specific range per pound of fuel.

$$273/0.0675 = 4044 \text{ lb/hr}$$

This value is then divided by the number of engines operating, to obtain the fuel flow per engine.

$$4{,}044/4 = 1{,}011 \text{ lb/hr/engine}$$

SERVICE CEILING.

Three- and two-engine service ceilings are shown in figures 5-92 through 5-95. Symmetrical power is assumed for two-engine service ceiling.

Example.

GIVEN:

Drag index: 25

Gross weight: 135,000 pounds

Temp Dev: + 25 °C

Three-engine operating conditions

FIND:

- Three-engine service ceiling for normal bleed
- Three-engine service ceiling for all bleed and drag index = 0

PROCEDURE:

Enter figure 5-92, sheet 1, at the weight of 135,000 pounds and move upward to a guide line corresponding to + 25 °C. Read to the left the uncorrected service ceiling of 20,500 feet pressure altitude. Now enter the bottom axis of figure 5-93 with this value and proceed vertically to the drag index = 25 guideline. The corrected three-engine service ceiling with normal bleed is read as 19,500 feet pressure altitude. The three-engine service ceiling with all bleed and a drag index of zero is read from figure 5-92, sheet 2, as 7,500 feet pressure altitude.

DRIFTDOWN.

If failure of one or two engines should occur during four-engine cruise operation, it may be necessary, due to loss of power, for the aircraft to descend to a lower altitude. This forced descent is called driftdown. When terrain clearance is a factor, driftdown speed is used to ensure the minimum loss of altitude.

The three- and two-engine driftdown data, including the fuel consumed, cover descent down to the standard day service ceiling. The data are based on the assumption that the propellers are feathered on the inoperative engines and that the operative engines are set to maximum continuous power. To obtain driftdown speed, altitude loss, time, fuel, and distance from four-engine cruise ceiling to

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three-engine service ceiling, use figure 5-96 through figure 5-104. Figure 5-105 through figure 5-109 is used for driftdowns from three-engine cruise ceiling to two-engine service ceiling.

The procedure for driftdown is to maintain the recommended driftdown speed until reaching the service ceiling. When terrain clearance is no longer a factor, for best long range cruise, descend to the cruise ceiling at 100 feet per minute and accelerate to long range cruise speed for the conditions. For extended long range cruise, when the gross weight allows (approximately 10,000-pound fuel burn off), use the respective three or two-engine climb speed (see figure 4-5 or figure 4-9) to climb to the next cruise ceiling for the reduced gross weight and resume long range cruise. Otherwise, use descent and cruise to optimize the phase of flight.

To simplify the determination of data for driftdown at nonstandard day conditions, it is assumed that the altitude lost is the same as the amount lost on a standard day; therefore time, distance, and speed during driftdown remain the same. When cruising at a nonstandard day cruise ceiling, deduct from that altitude the amount of height lost on a standard day. This gives the three-engine and two-engine service ceiling, respectively, at the same temperature deviation from standard day.

Example 1.

GIVEN:

Drag index: 25

Initial cruise altitude: 30,000 feet

Gross weight: 132,000 pounds

Four-engine operation (initial)

Assume loss of one engine and driftdown at the recommended airspeed

FIND:

- Distance during driftdown
- Altitude loss
- Time during driftdown
- Driftdown speed
- Fuel during driftdown

PROCEDURE:

Enter figure 5-96 with a gross weight of 132,000 pounds and move horizontally to the 30,000 foot altitude representation. Read the altitude loss as 2,300 feet for a drag index of zero. Enter the bottom axis of figure 5-97 with 2,300 feet and move vertically to intersect a drag index equal to 25 guideline. Read a corrected altitude loss of 2,400 feet. In a similar procedure, read a driftdown time of 22.5 minutes for zero drag index from figure 5-98, which corrects to 23.0 minutes using figure 5-99 with a drag index of 25. In a like manner, obtain a driftdown fuel of 1,330 pounds and a distance of 98 nautical miles from figures 5-100 through 5-103. Initial descent speed is read as 151 KIAS from figure 5-104.

Example 2.

GIVEN:

Drag index: Zero

Cruise ceiling at ISA + 10 °C: 28,900 feet

Gross weight: 140,000 pounds

Normal bleed conditions

Assume loss of one engine and driftdown at the recommended airspeed

FIND:

- Loss in altitude during driftdown to the three-engine service ceiling
- Distance traveled during the driftdown
- Fuel to driftdown
- Time to driftdown

PROCEDURE:

Enter figure 5-96 with a gross weight of 140,000 pounds. Move to the right to intercept the four-engine cruise ceiling guideline and read an altitude loss of 4,520 feet. Deduct this amount from the given cruise ceiling of 28,900 feet to obtain the three-engine service ceiling of 24,380 feet.

Driftdown fuel is determined to be 2,180 pounds from figure 5-100, time of 37 minutes from figure 5-98, and a distance of 159 nautical miles from figure 5-102. To verify the three-engine service ceiling of 24,380 feet, enter figure 5-92, sheet 1, with a weight of 137,820 pounds (140,000 - fuel burned), and on the standard + 10 °C line, read a three-engine

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service ceiling of 24,100 feet (the 280 feet difference being within the allowable tolerances).

Example 3.

GIVEN:

Drag index: + 25

Gross weight: 130,000 pounds

Temp Dev: + 10 °C

Normal bleed conditions

3-engine cruise ceiling

Assume loss of a second engine and driftdown at the recommended airspeed on two engines

Symmetrically failed engines

FIND:

- Altitude loss, time, fuel, and distance to driftdown

PROCEDURE:

Two-engine driftdown data is quite different from that with three engines. This is due primarily to the effects of temperature and drag index on two-engine ceilings. For this reason some of the information and calculation procedure is presented in a slightly revised format than for three-engine operation.

Enter figure 5-28, sheet 1, at 130,000 pounds and move upwards to the standard temperature line. Read a three-engine cruise ceiling of 25,200 feet. Also read the ceiling for plus 10 degrees as 22,900 feet. Using figure 5-29, correct the plus 10 degree ceiling for drag index to be 22,100 feet. Now, enter figure 5-94 at 130,000 pounds and using the same procedure, obtain a two-engine standard day service ceiling of 17,900 feet and a plus 10 degree service ceiling of 15,200 feet. Using figure 5-95, correct the plus 10 degree service ceiling for drag index to be 14,500 feet.

Now calculate a standard day altitude differential of 7,300 feet (25,200 - 17,900). Likewise, calculate the fully corrected altitude differential of 7,600 feet (22,100 - 14,500). The standard day correction factor is now determined as:

Factor = corrected altitude Δ/standard day altitude Δ
Factor = 7,600/7,300
Factor = 1.04

Enter figure 5-105 with 130,000 pounds and read a standard day altitude loss of 7,600 feet. The true altitude loss will now be 7,600 × 1.04 or 7,904. From figure 5-106 obtain a standard day driftdown time of 53 minutes. The true time will now be 53 × 1.04 or 55 minutes. Likewise, the true driftdown fuel obtained from figure 5-107 will be 2,750 pounds and the distance obtained from figure 5-108 will be 204 nautical miles.

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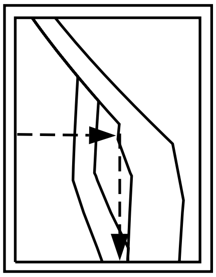
FLIGHT LIMIT SPEEDS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



CAUTION OBSERVE THE AIRPLANE STRUCTURAL LIMIT SPEEDS SHOWN IN THE LIMITATIONS SECTION OF THE APPLICABLE FLIGHT MANUAL.

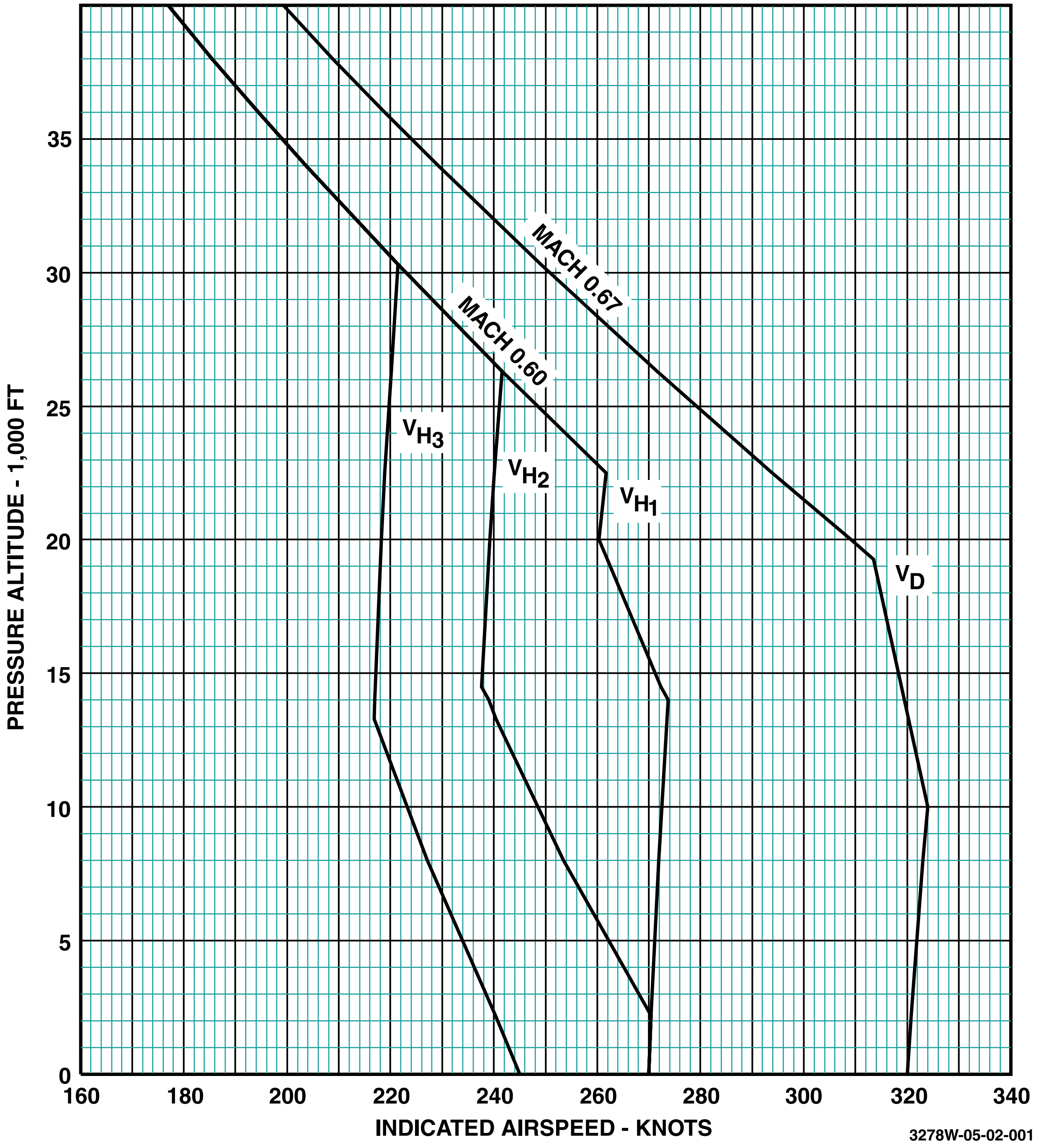


Figure 5-1.

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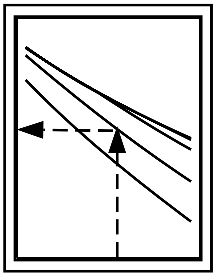
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRUISE CEILING

4 ENGINES NORMAL BLEED



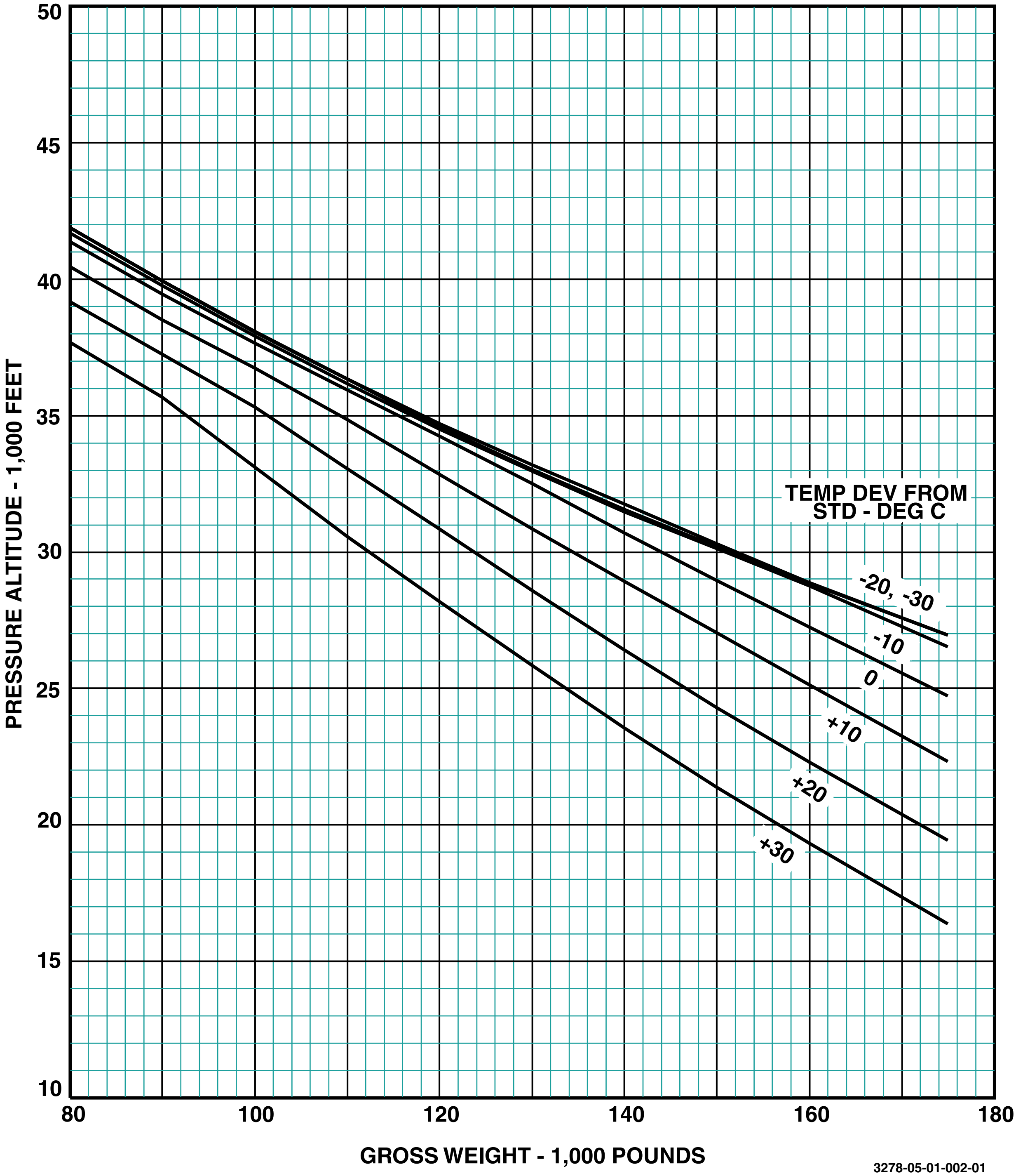


Figure 5-2. (Sheet 1 of 2)

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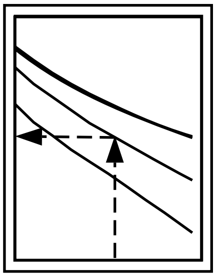
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRUISE CEILING

4 ENGINES ALL BLEED



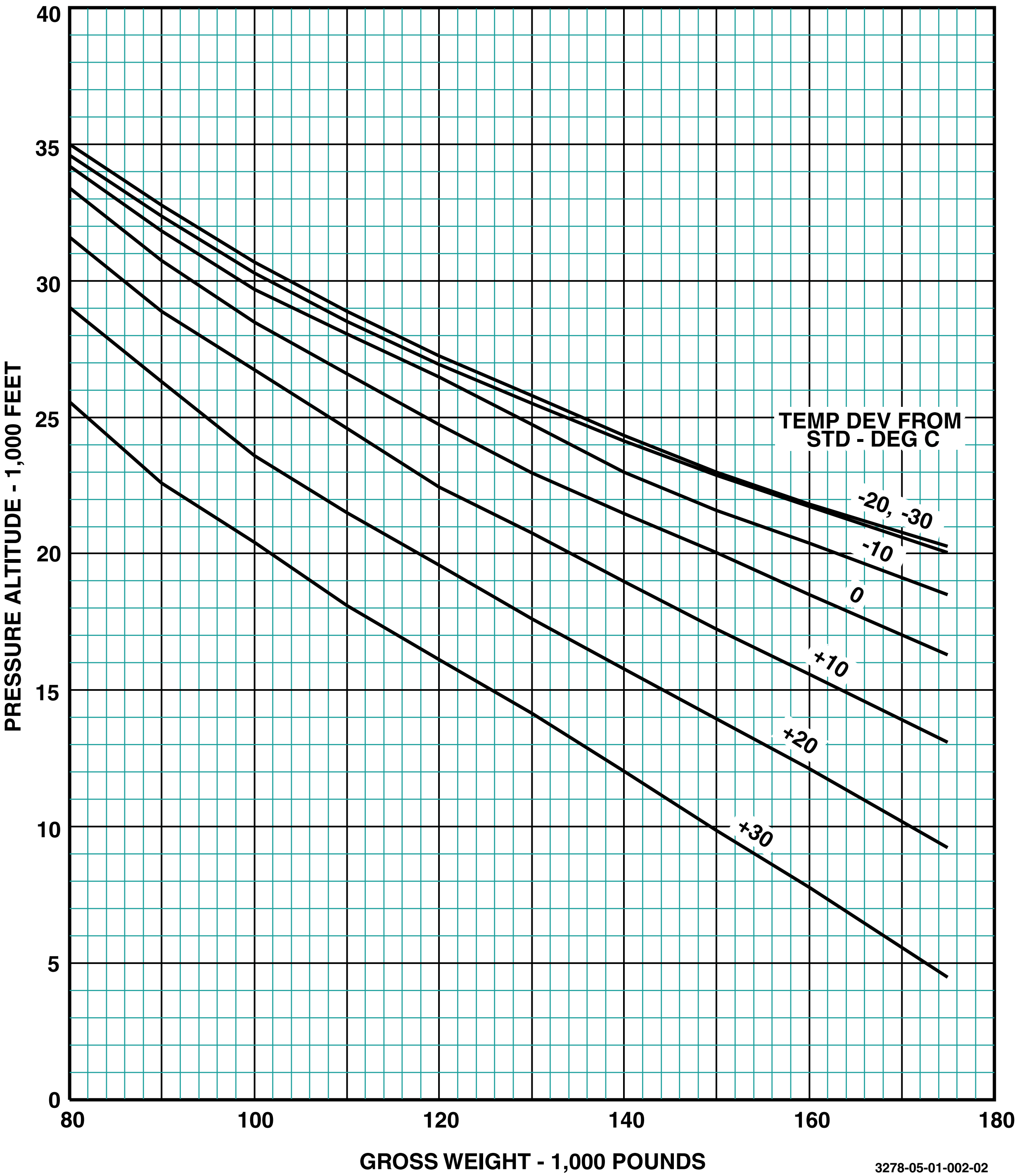


Figure 5-2. (Sheet 2 of 2)

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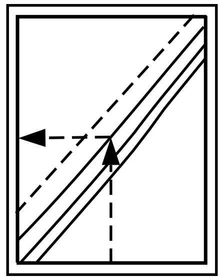
CRUISE CEILING
FOR VARIANT CONFIGURATION

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

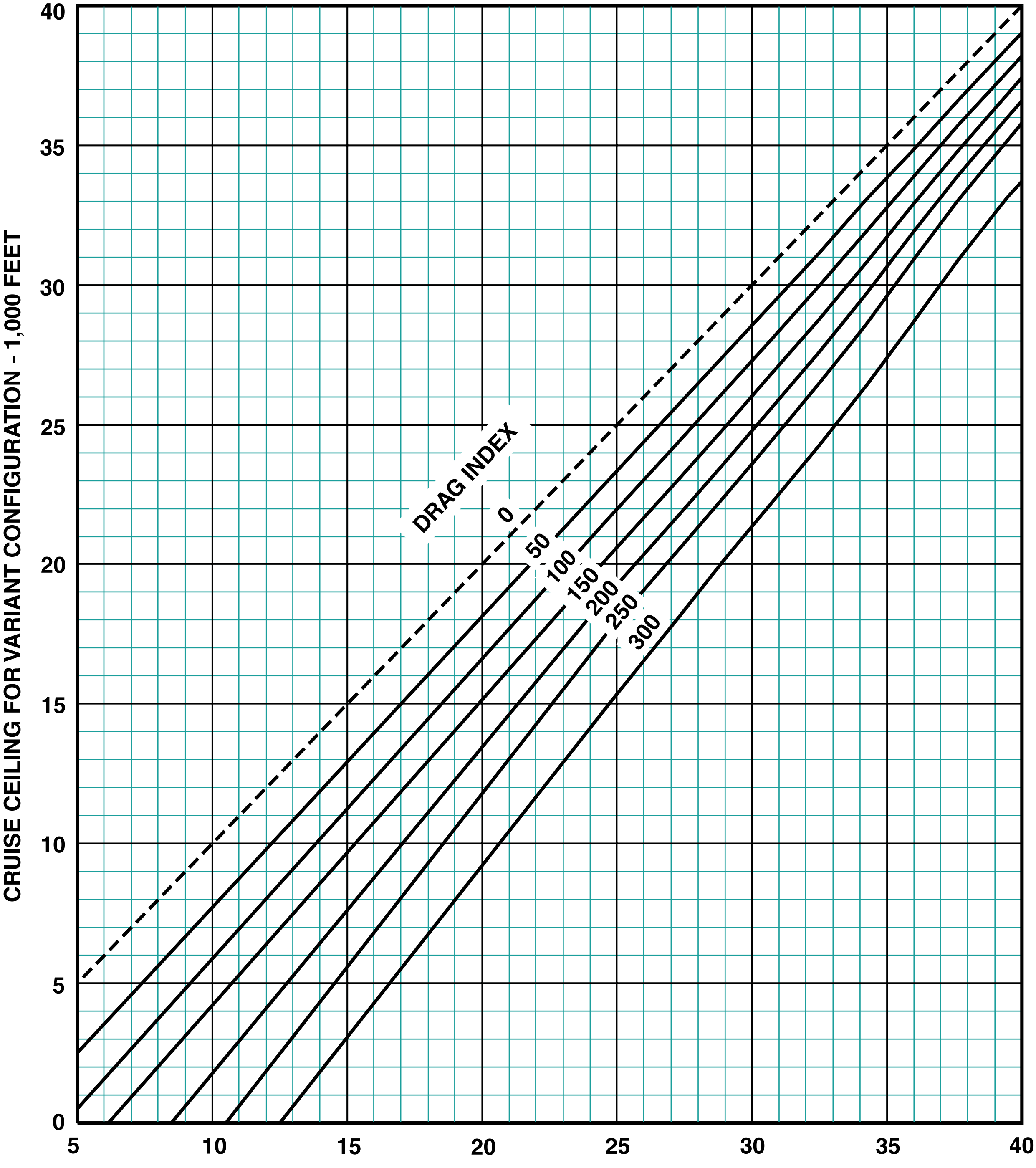


Figure 5-3.

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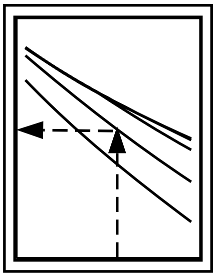
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

AIR TRAFFIC CONTROL CRUISE CEILING

4 ENGINES NORMAL BLEED



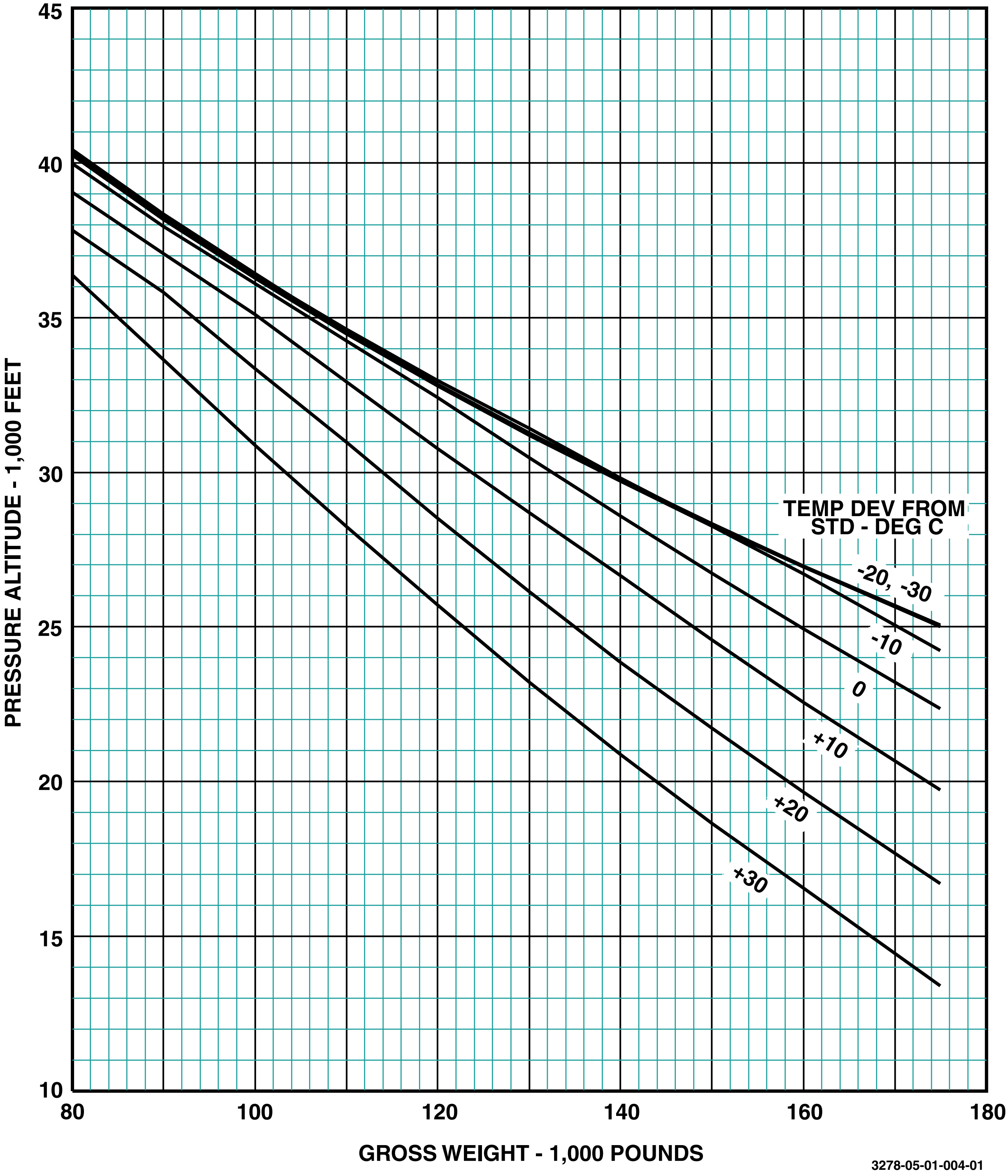


Figure 5-4. (Sheet 1 of 2)

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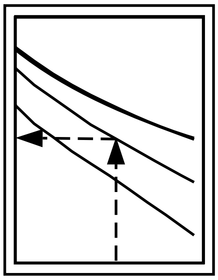
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

AIR TRAFFIC CONTROL CRUISE CEILING

4 ENGINES **ALL BLEED**



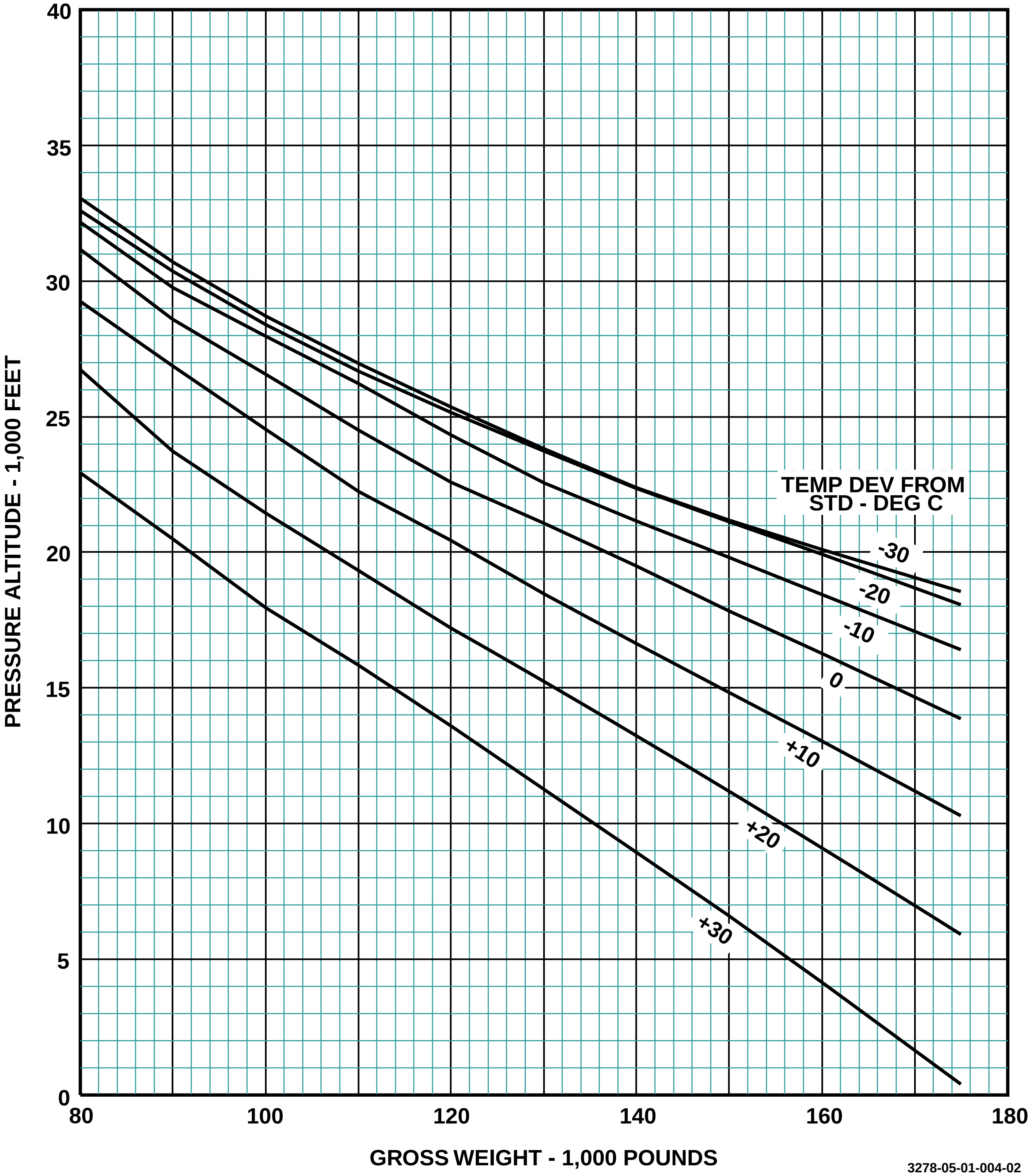


Figure 5-4. (Sheet 2 of 2)

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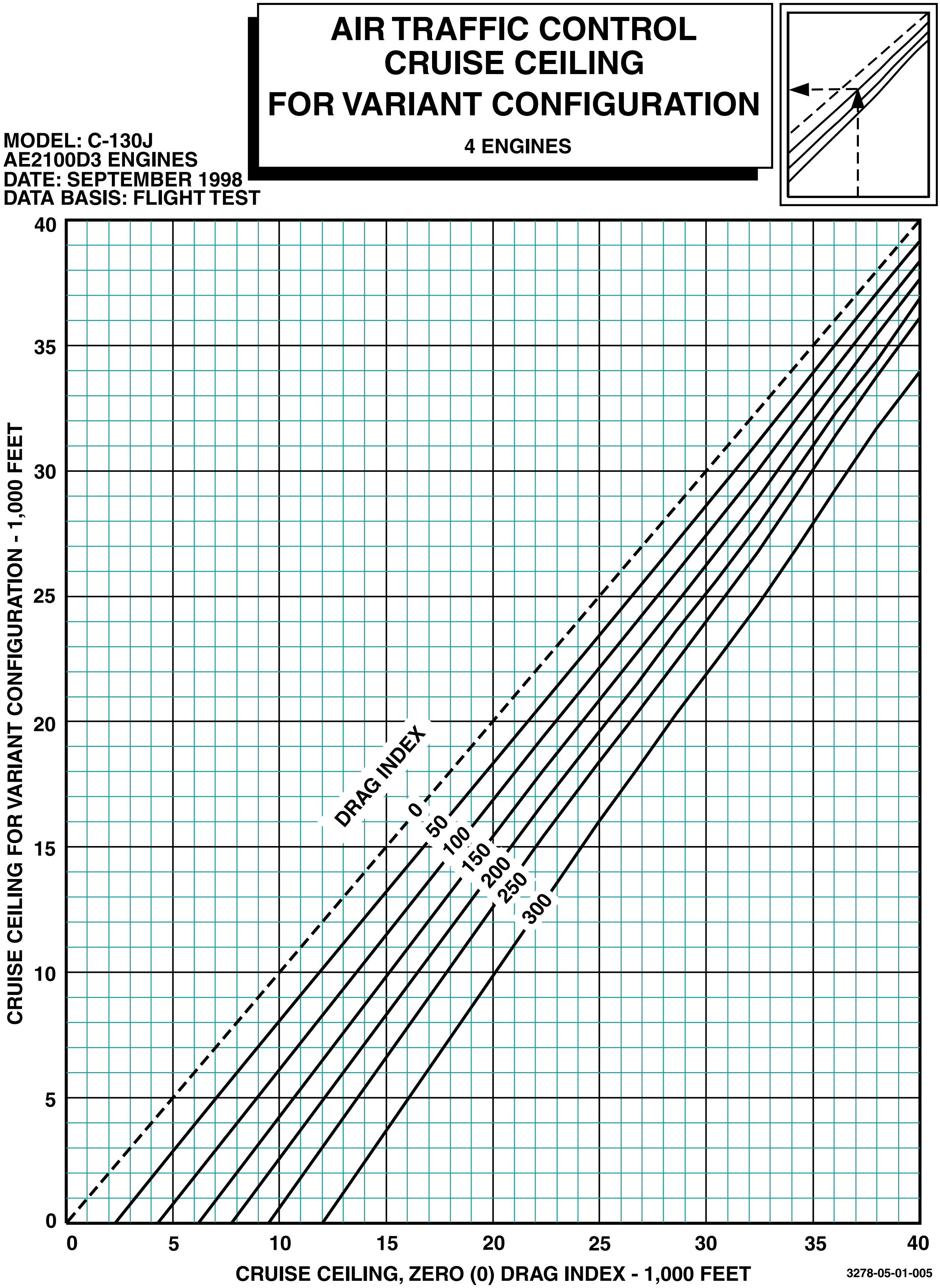

Figure 5-5.

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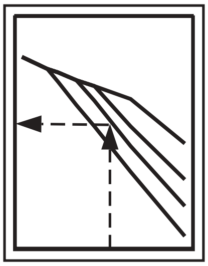
RECOMMENDED CRUISE CEILING AT CONSTANT TRUE AIRSPEED

4 ENGINES **NORMAL BLEED**



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AE2100D3 ENGINES
DATE: MAY 1998
DATA BASIS: FLIGHT TEST

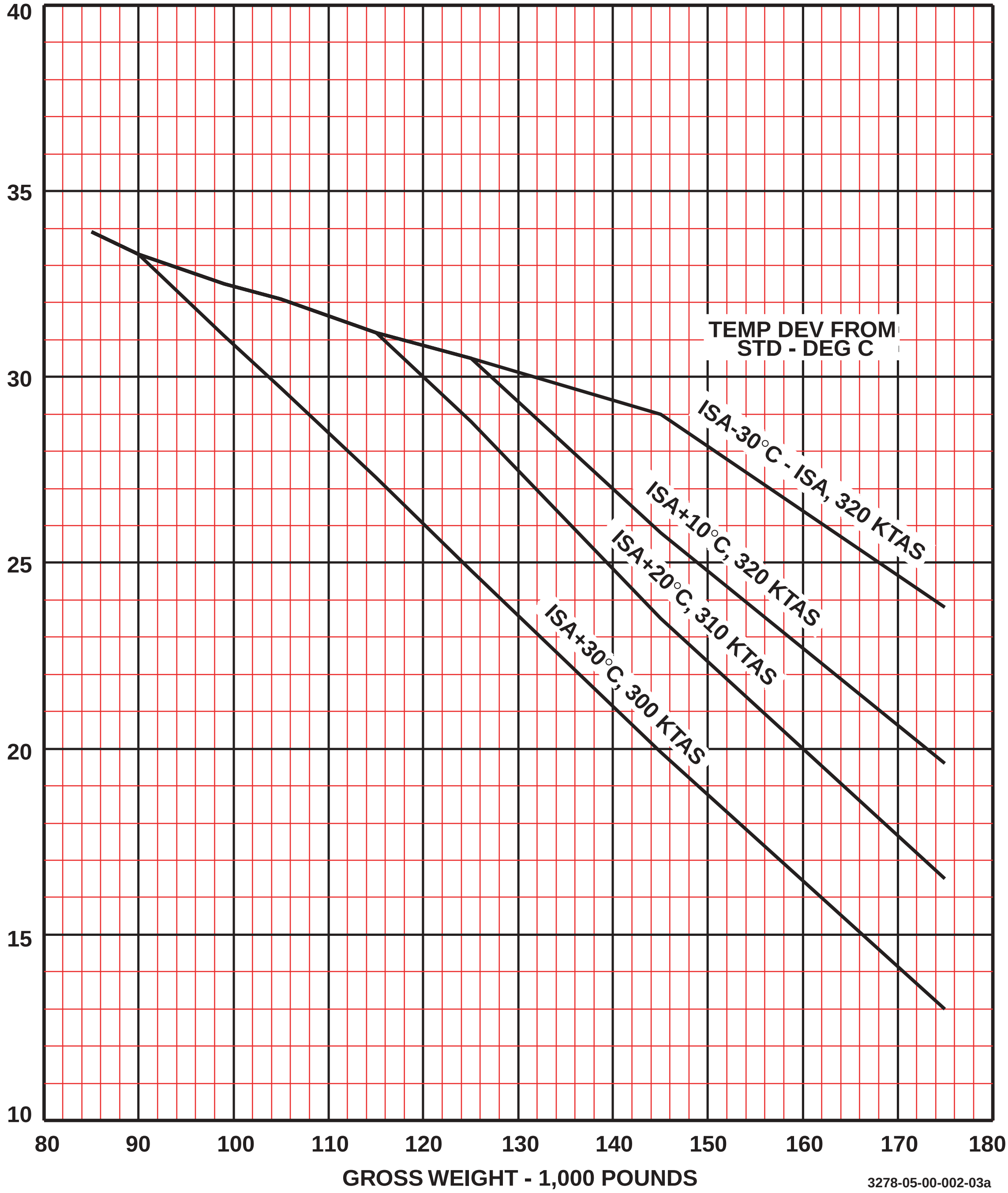

Figure 5-6.

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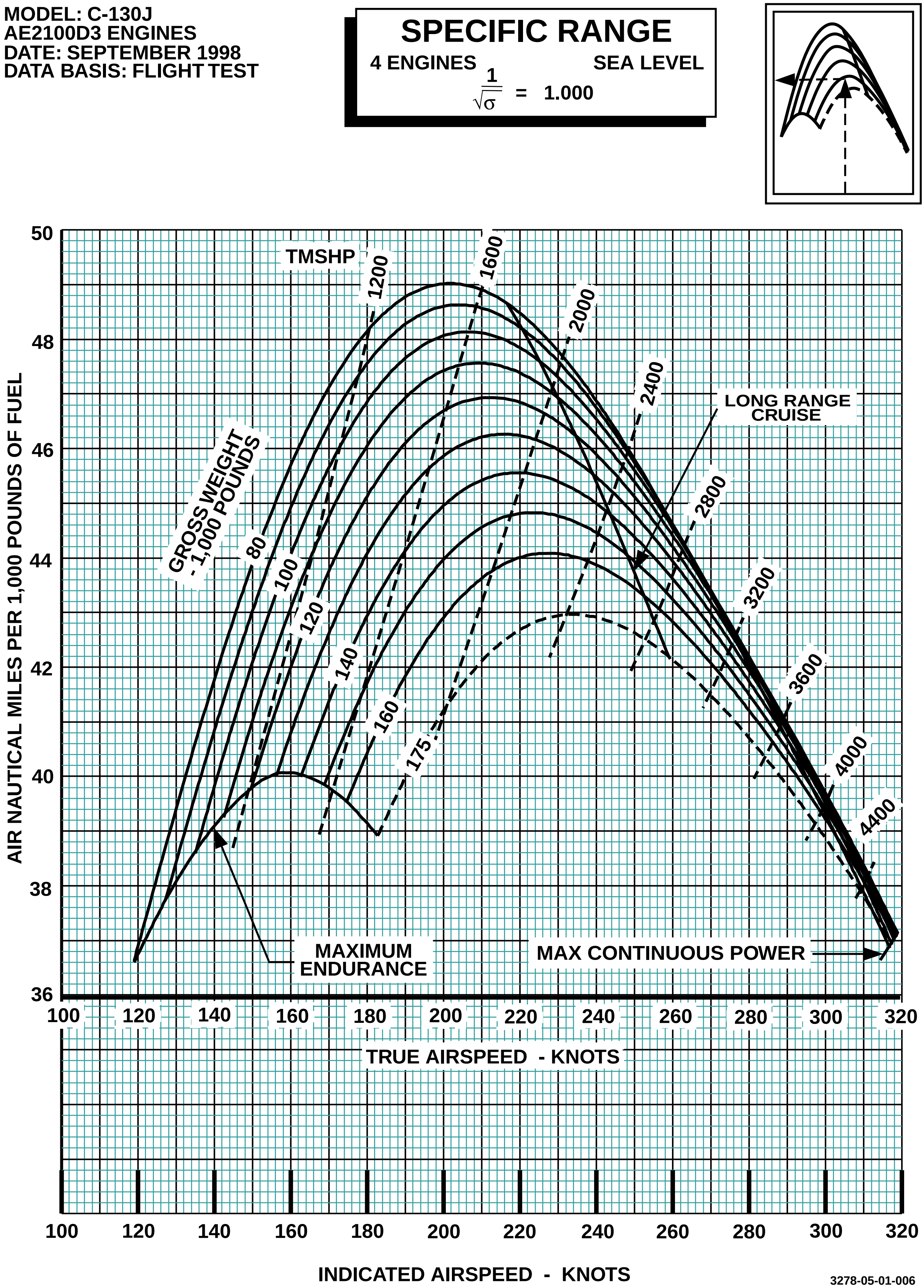

Figure 5-7.

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AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

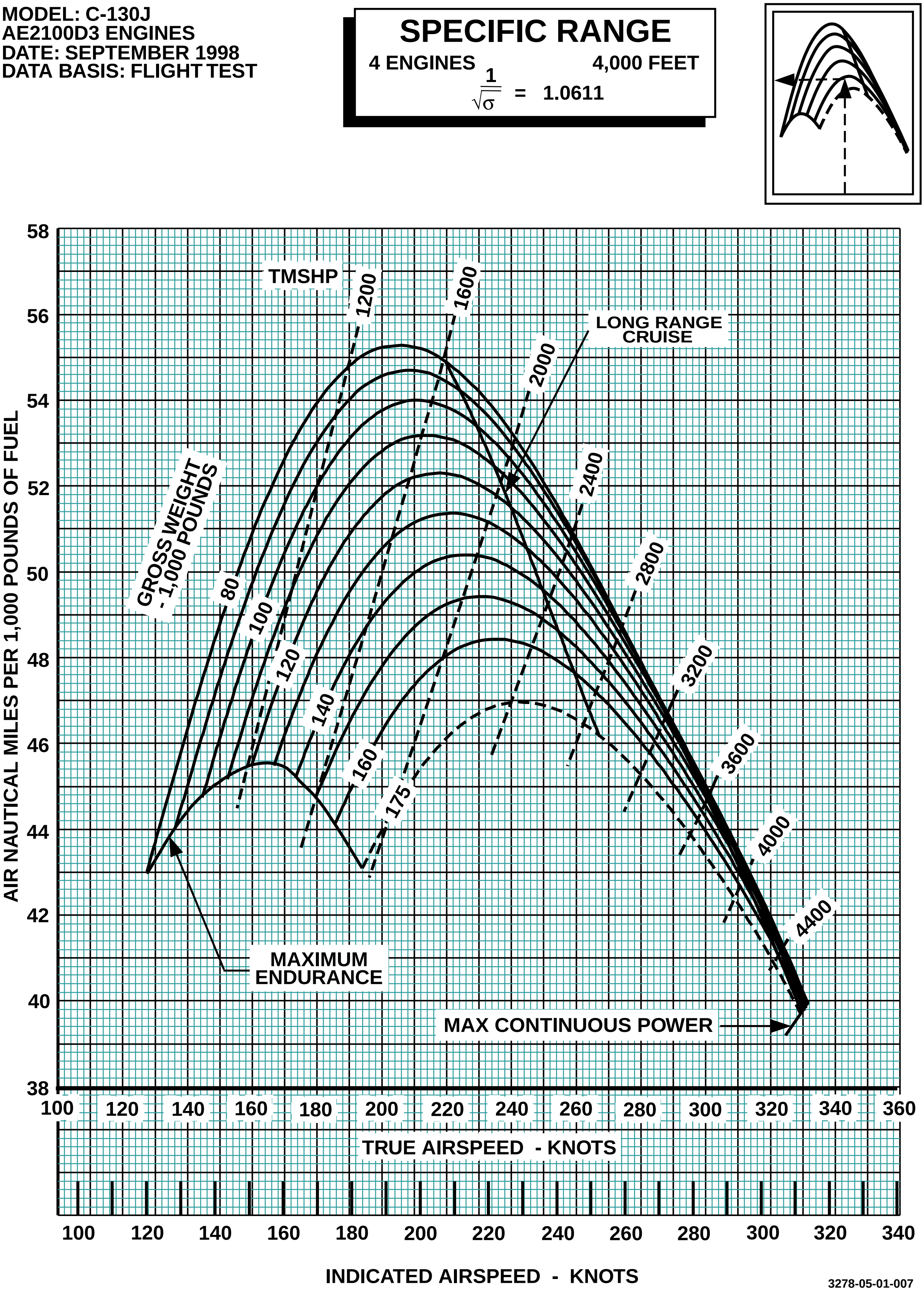

Figure 5-8.

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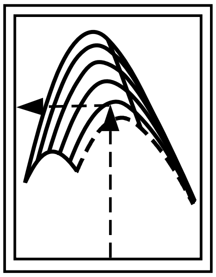
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 8,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.1279$



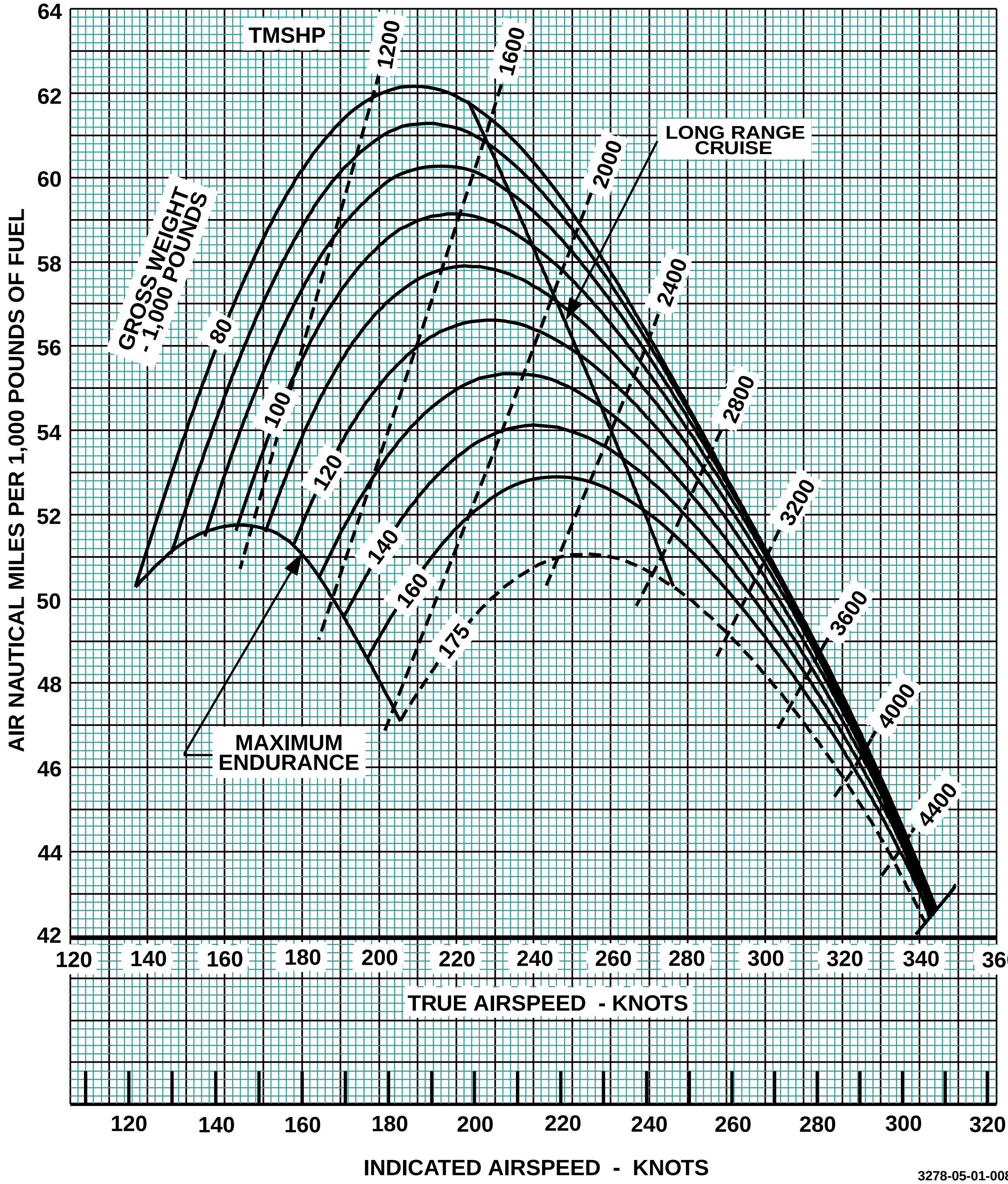


Figure 5-9.

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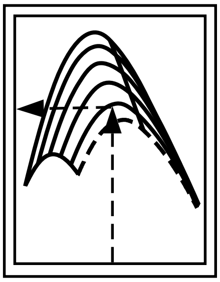
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE
4 ENGINES 12,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.2010$



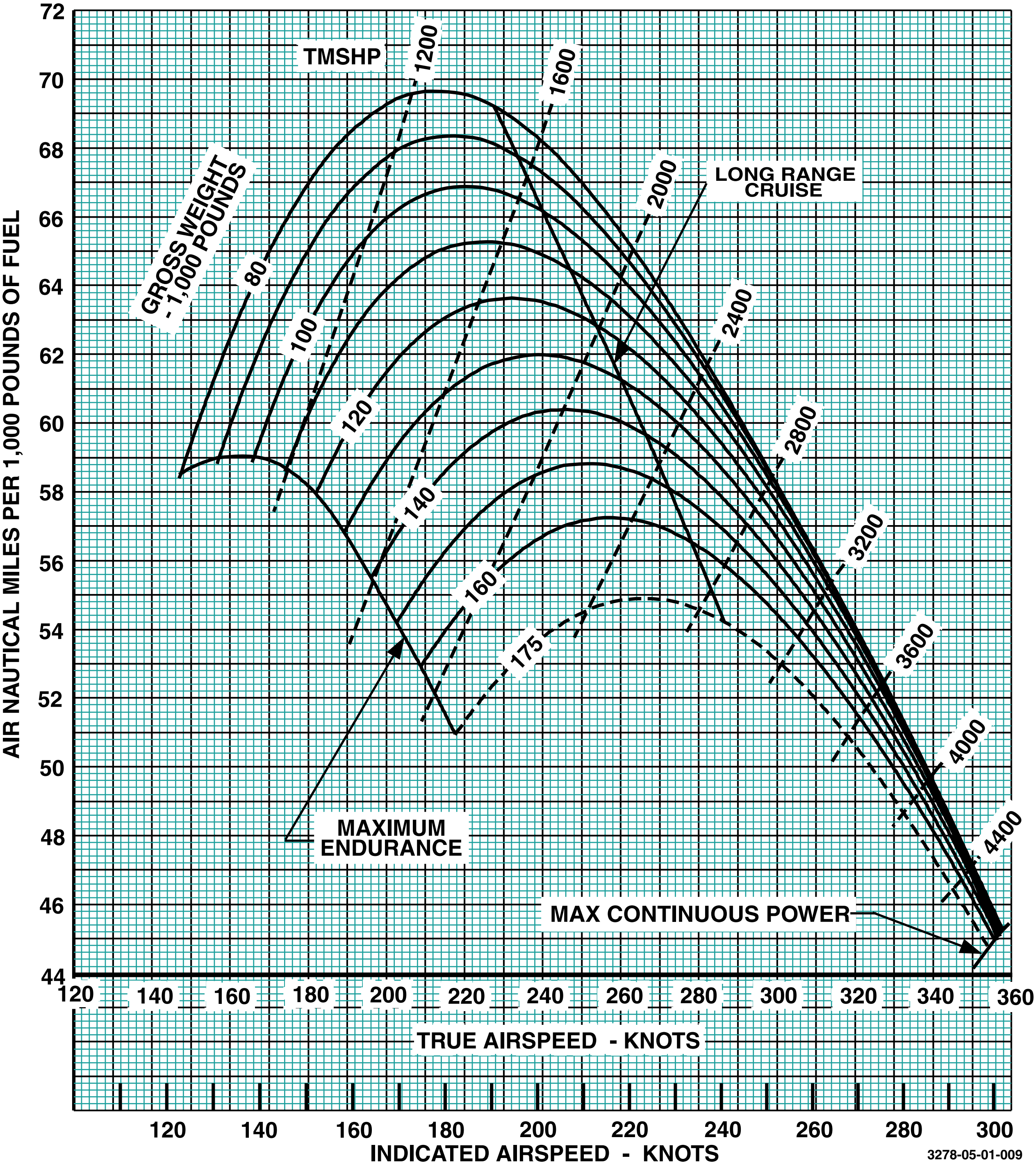


Figure 5-10.

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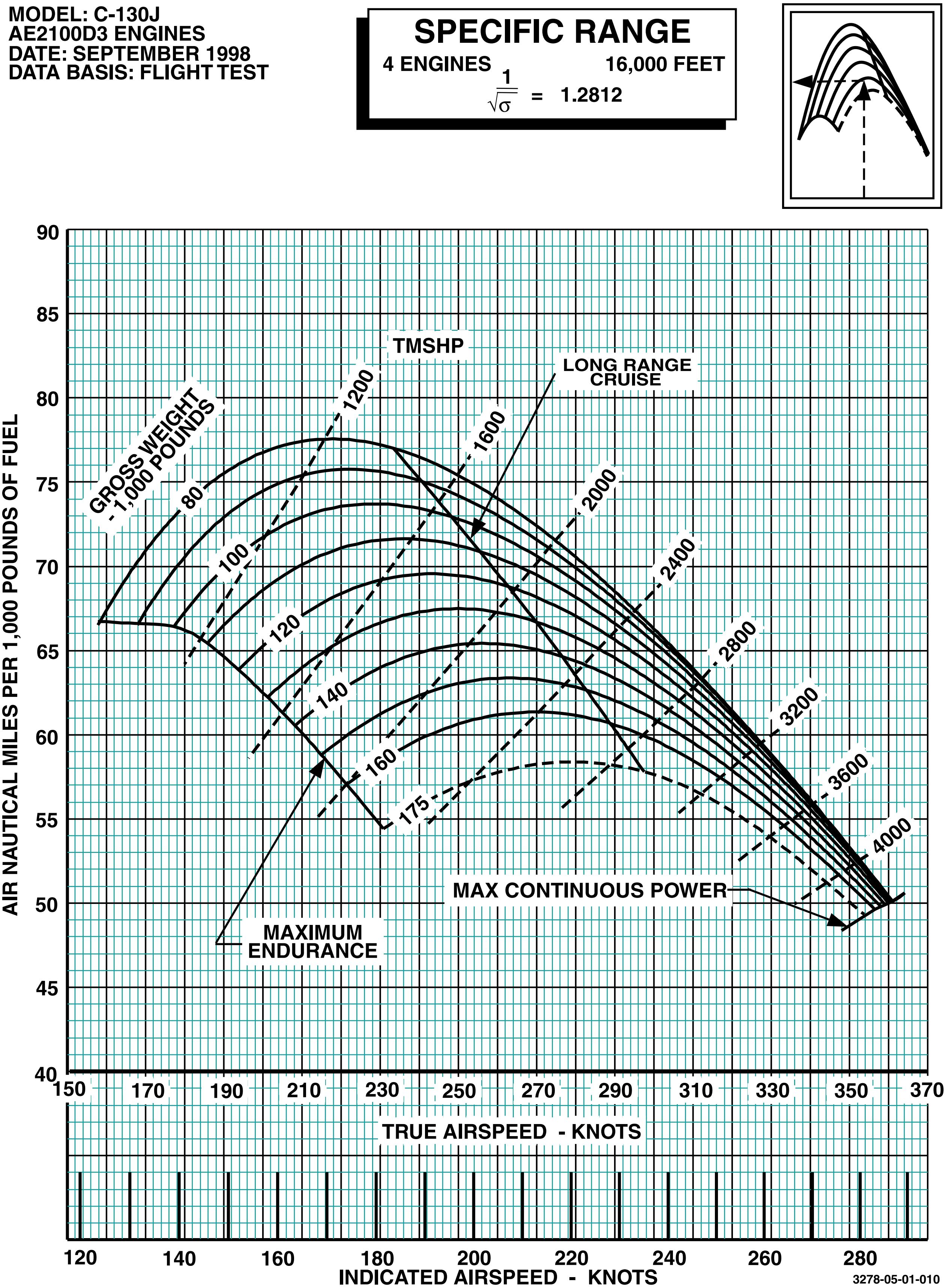


Figure 5-11.

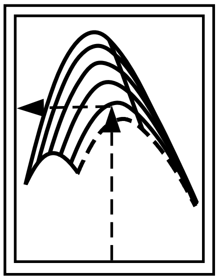
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 18,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.3243$



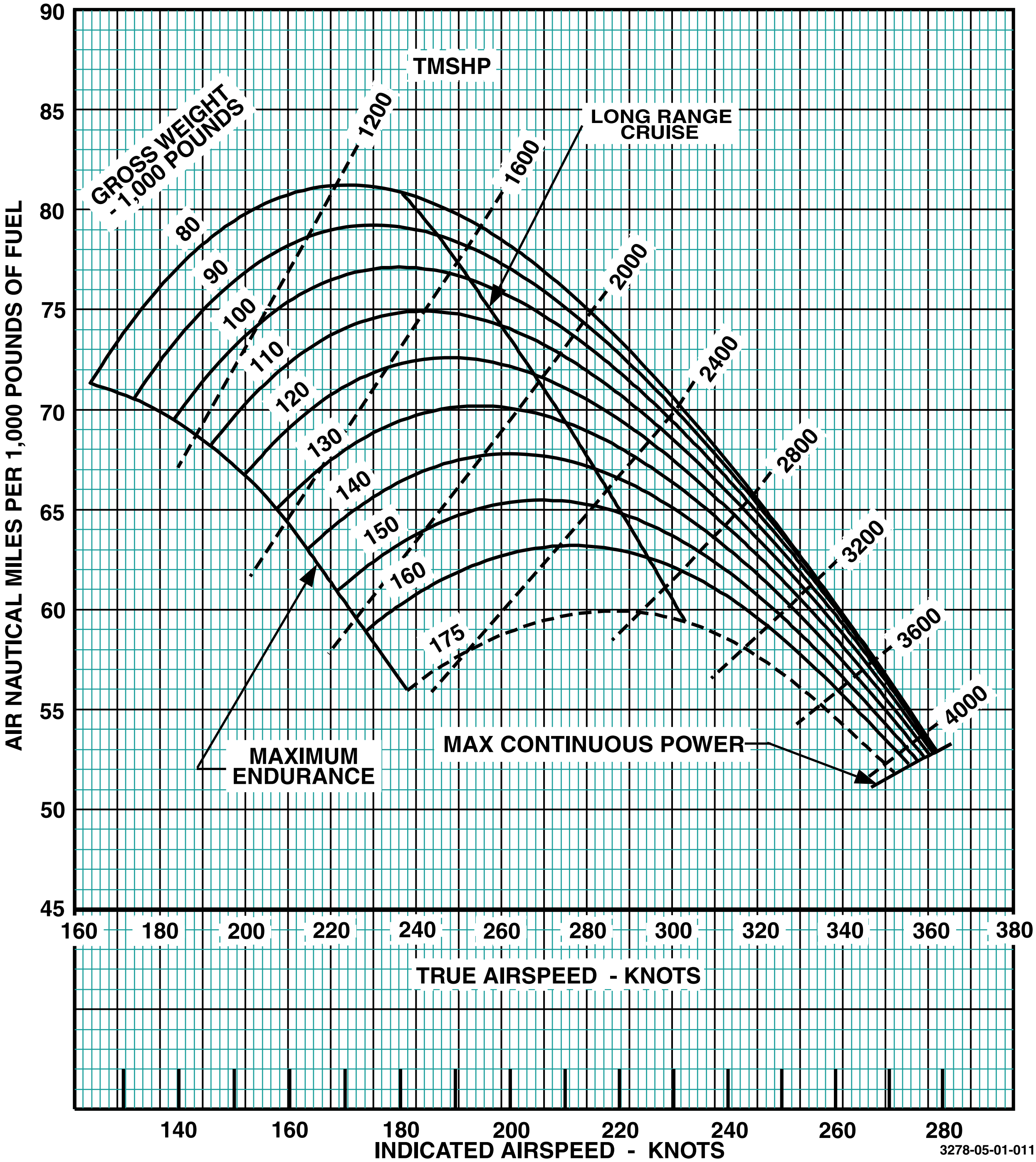


Figure 5-12.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

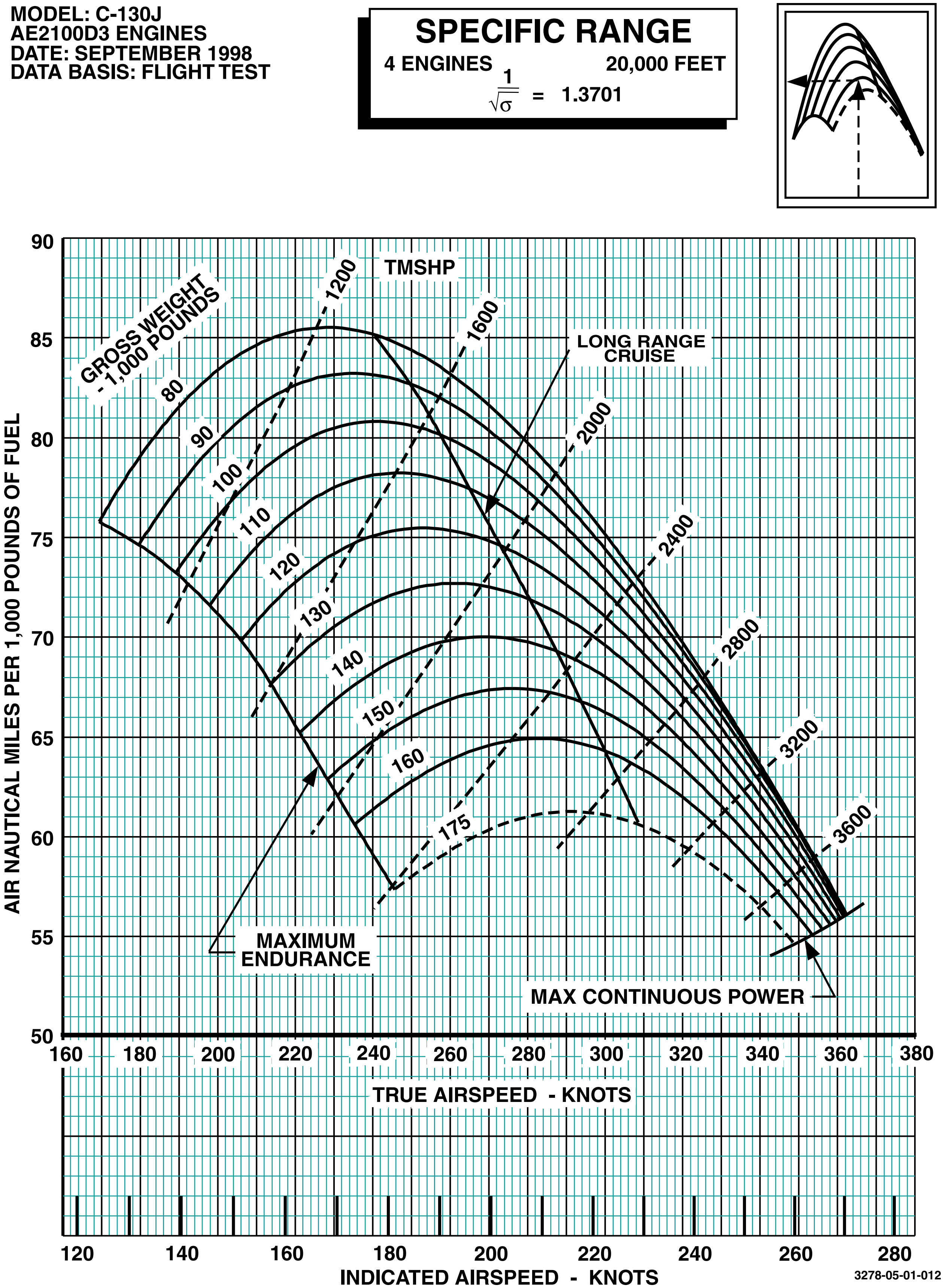


Figure 5-13.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 22,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.4171$

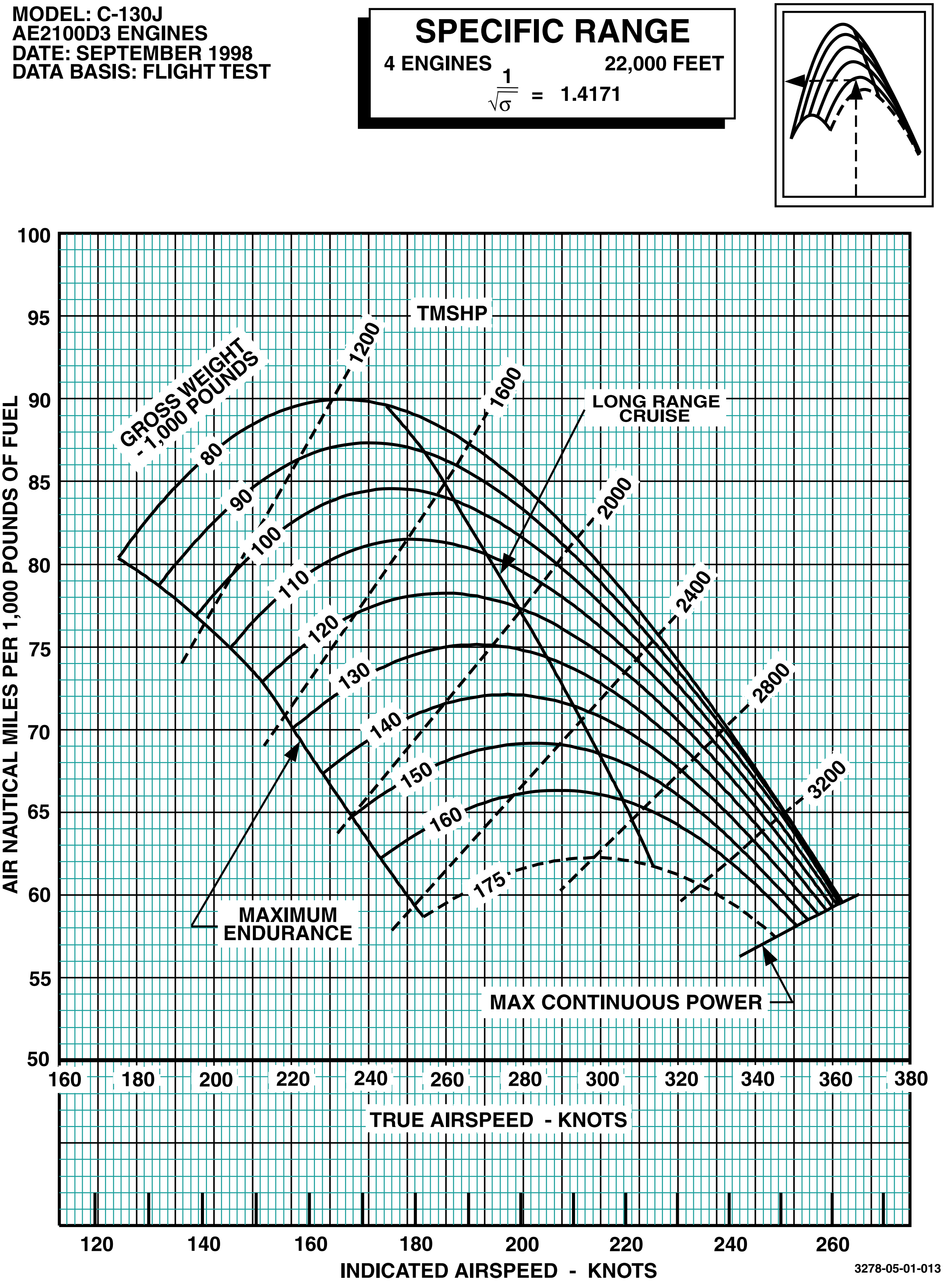


Figure 5-14.

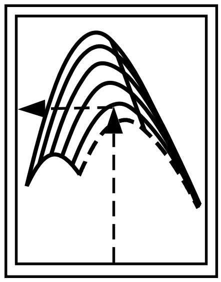
Use, copying and/or disclosure is governed by the
statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 24,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.4671$



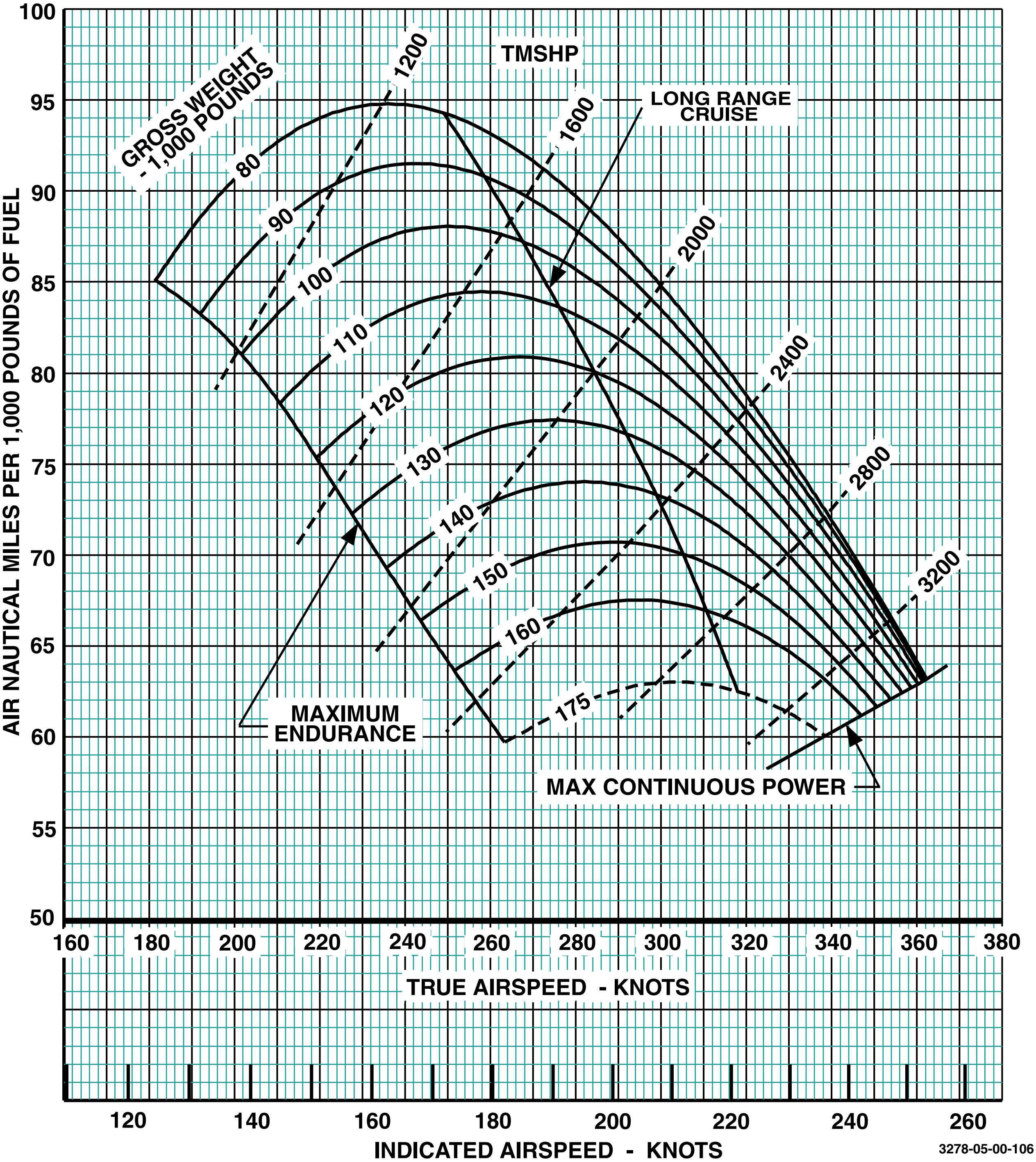


Figure 5-15.

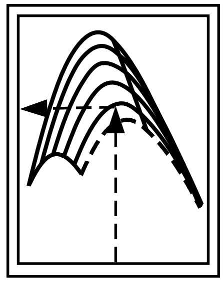
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 26,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.5197$



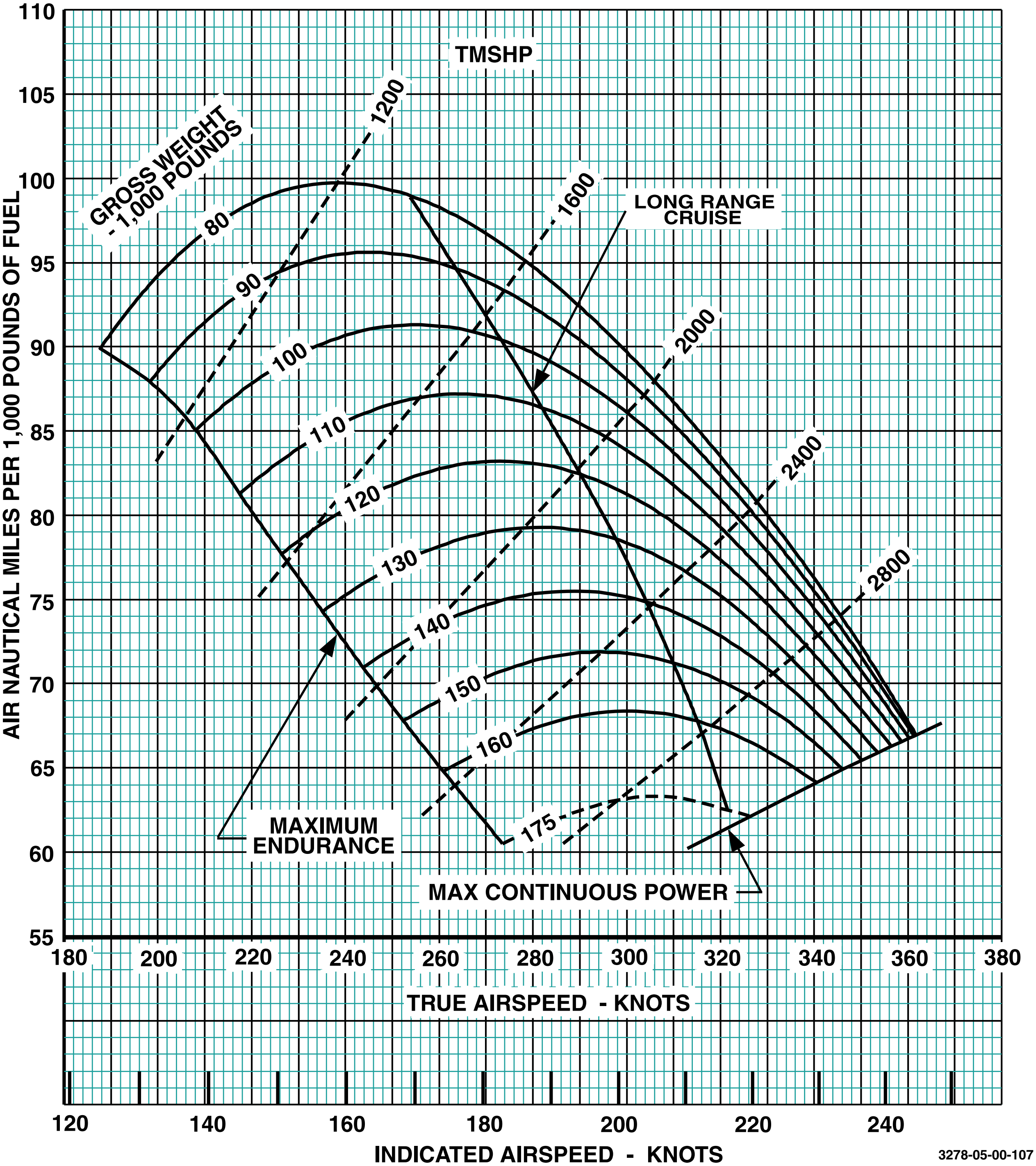


Figure 5-16.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 28,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.5751$

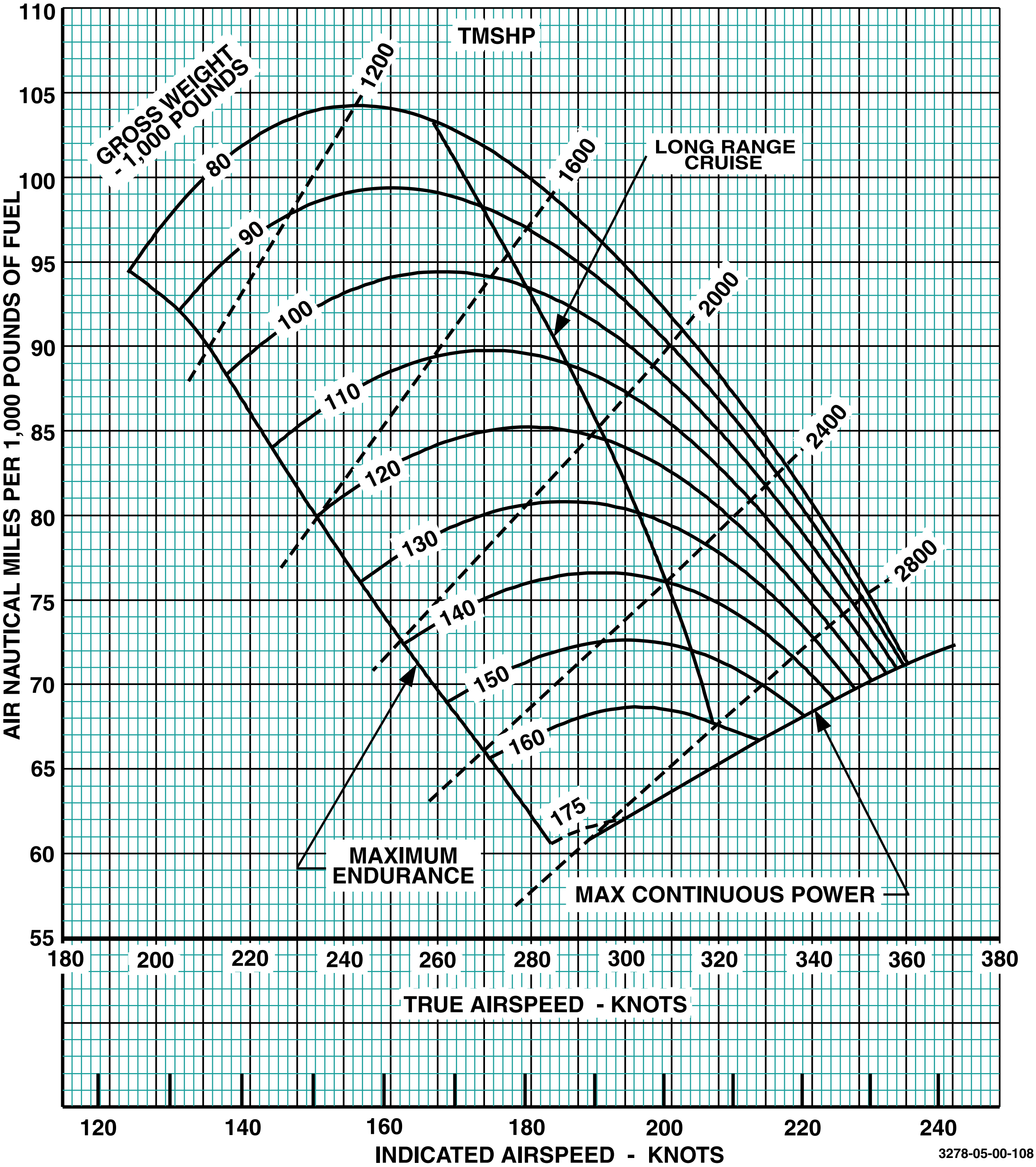


Figure 5-17.

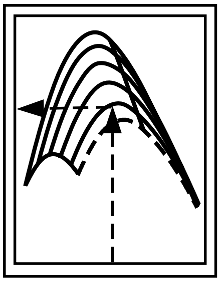
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 31,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.6640$



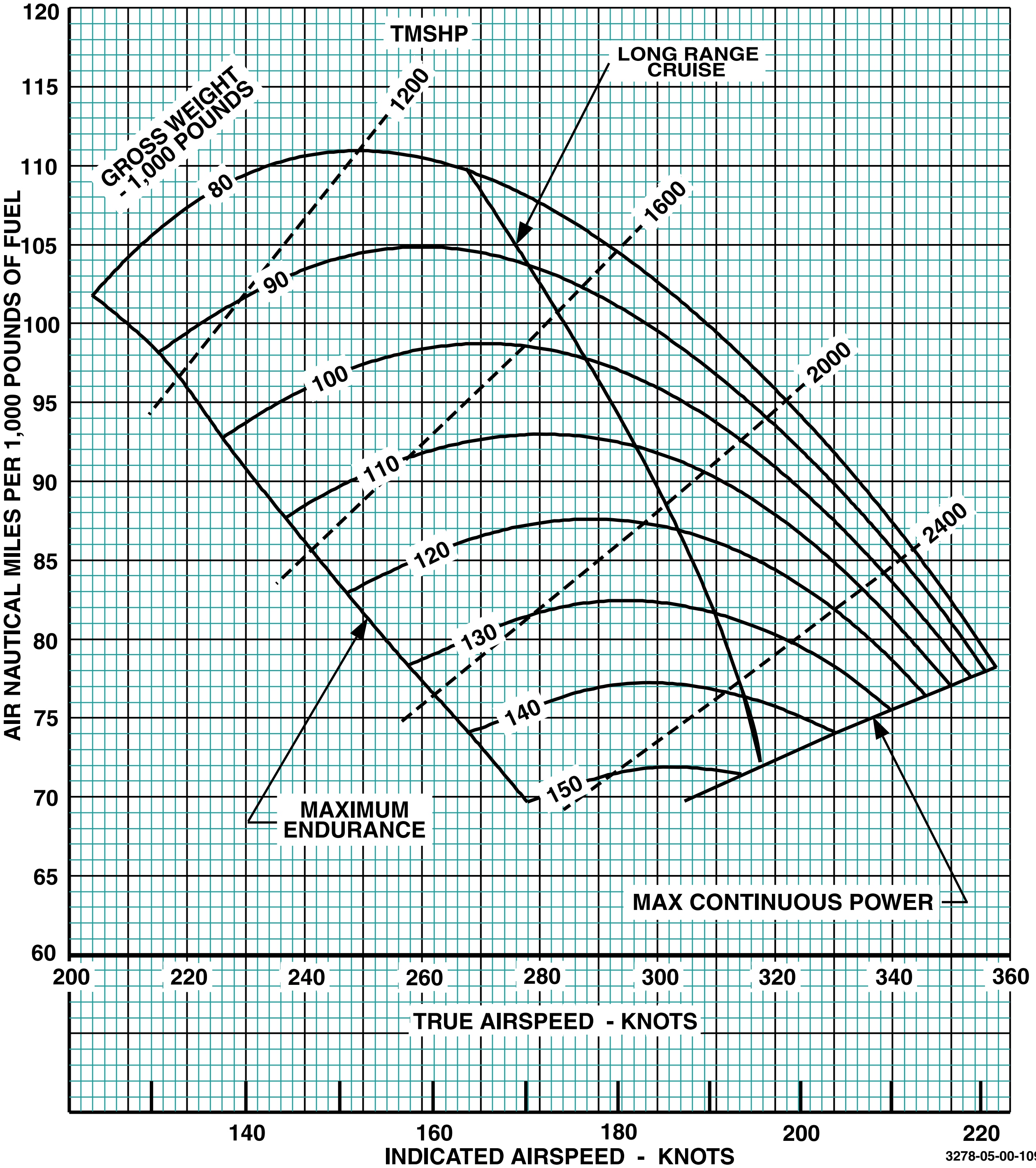


Figure 5-18.

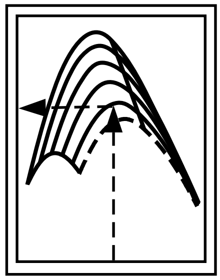
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 33,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.7274$



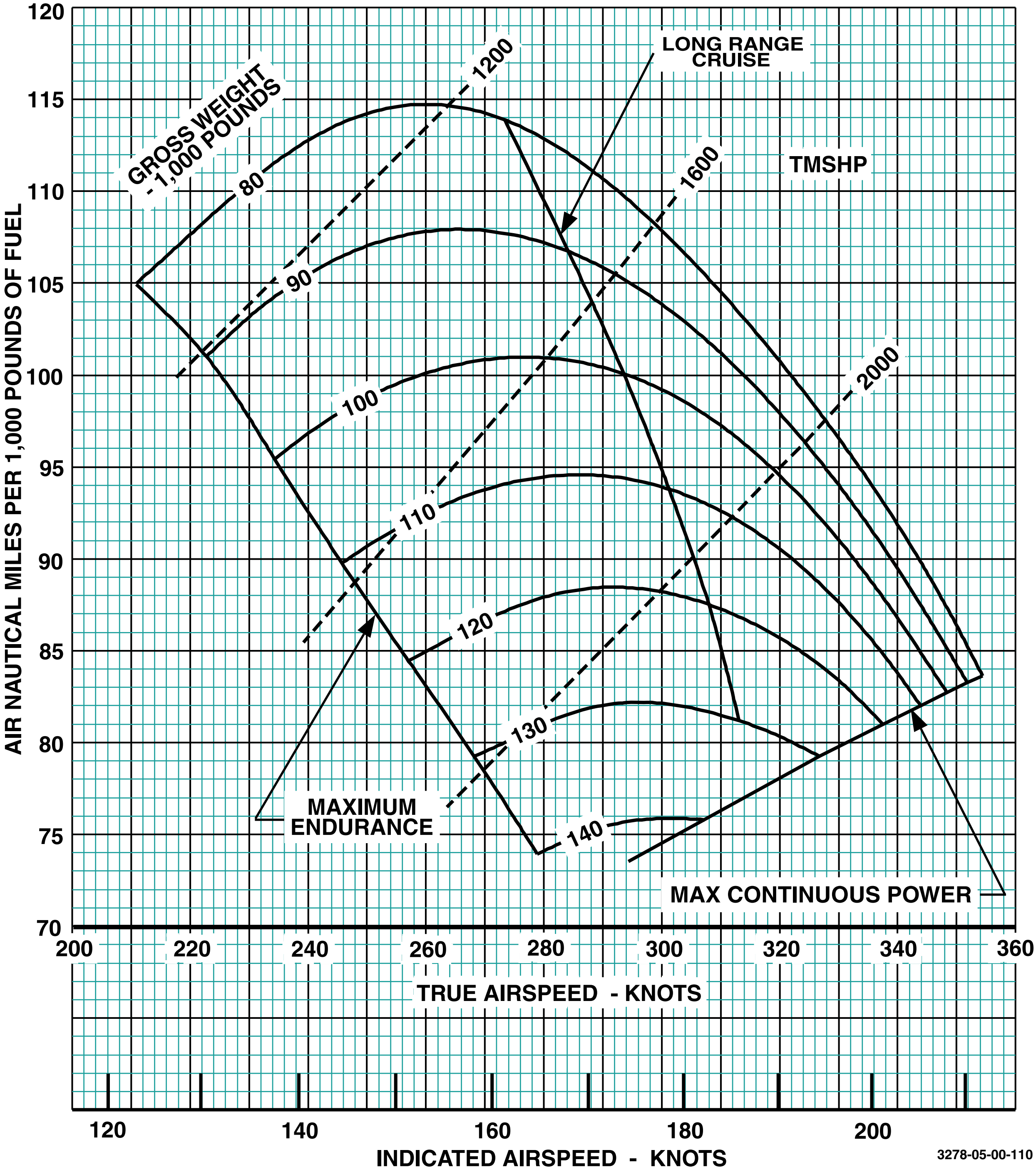


Figure 5-19.

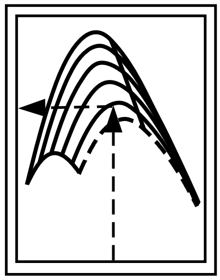
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 35,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.7963$



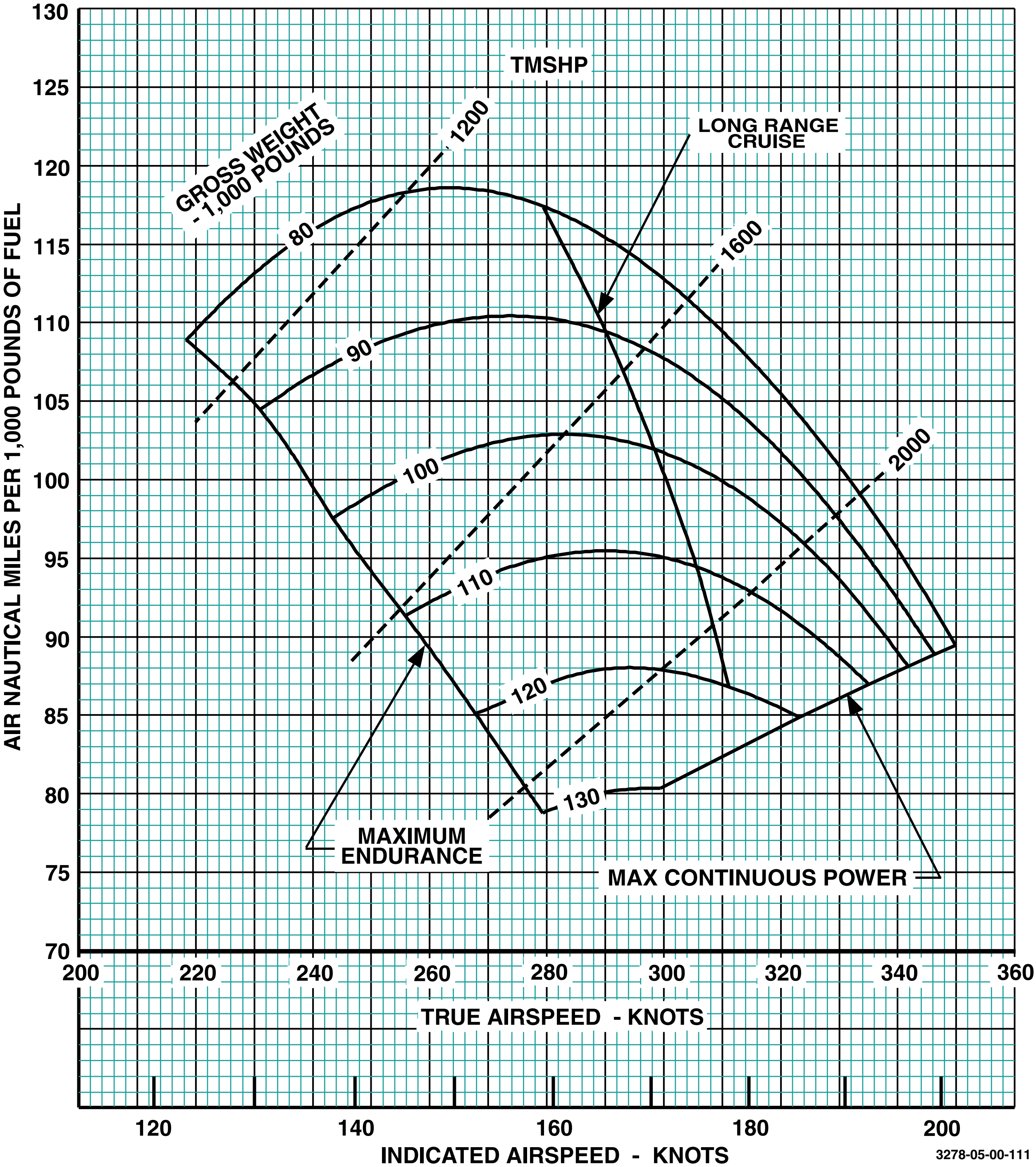


Figure 5-20.

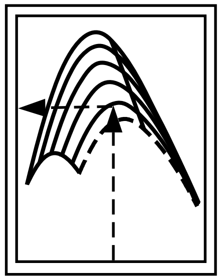
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 37,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.8723$



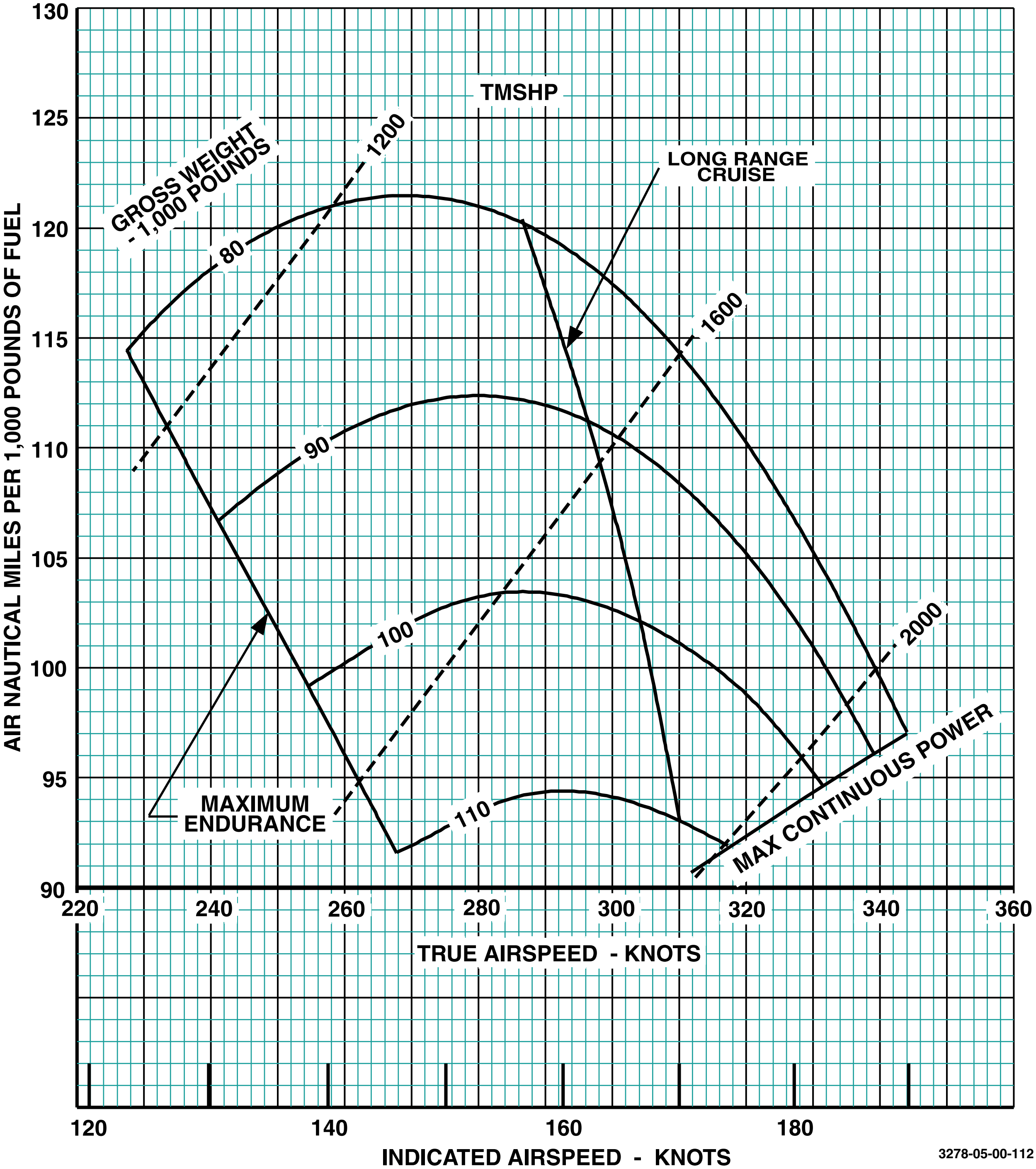


Figure 5-21.

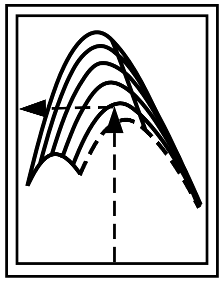
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

4 ENGINES 39,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.9642$



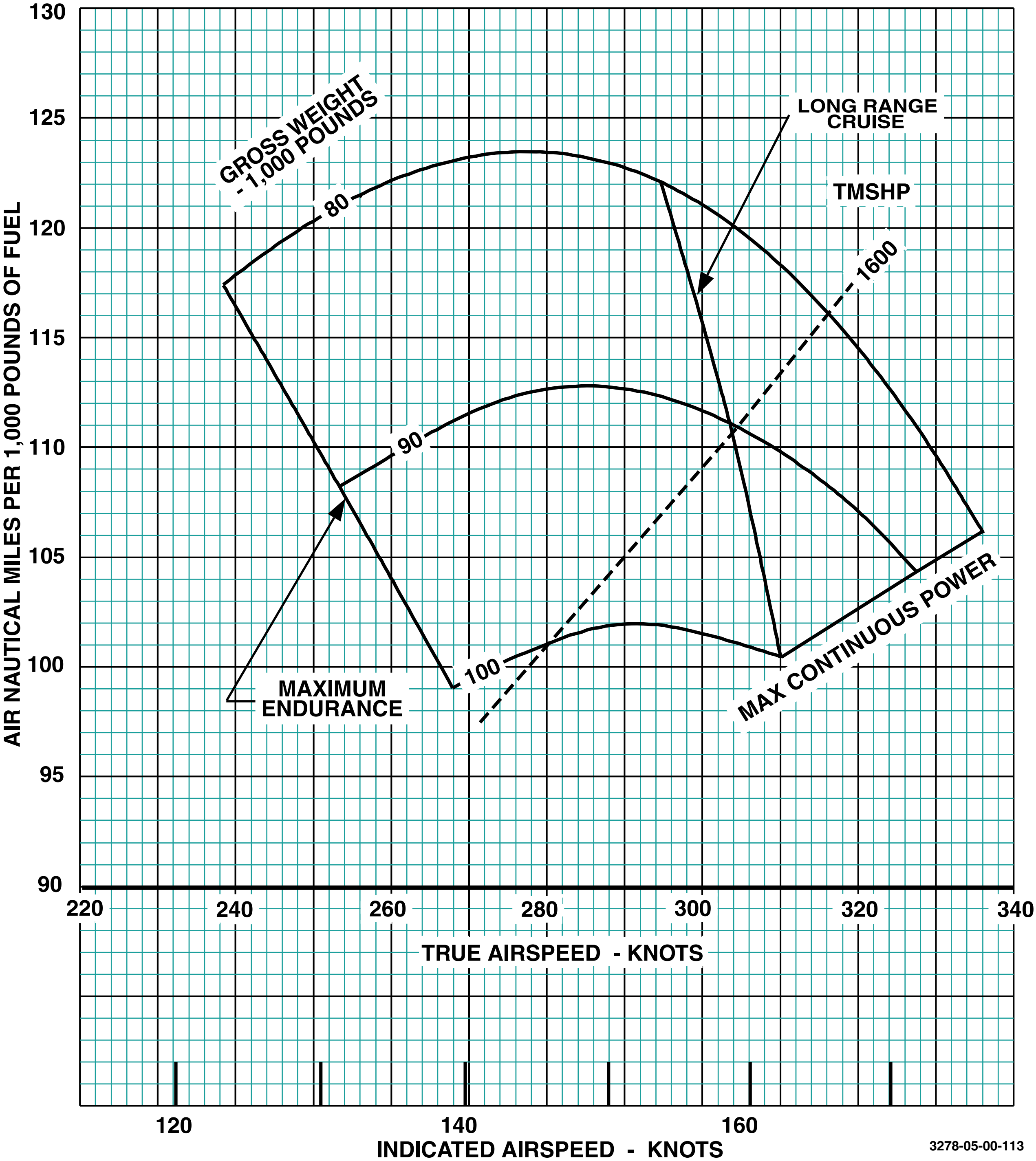


Figure 5-22.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

4 ENGINES

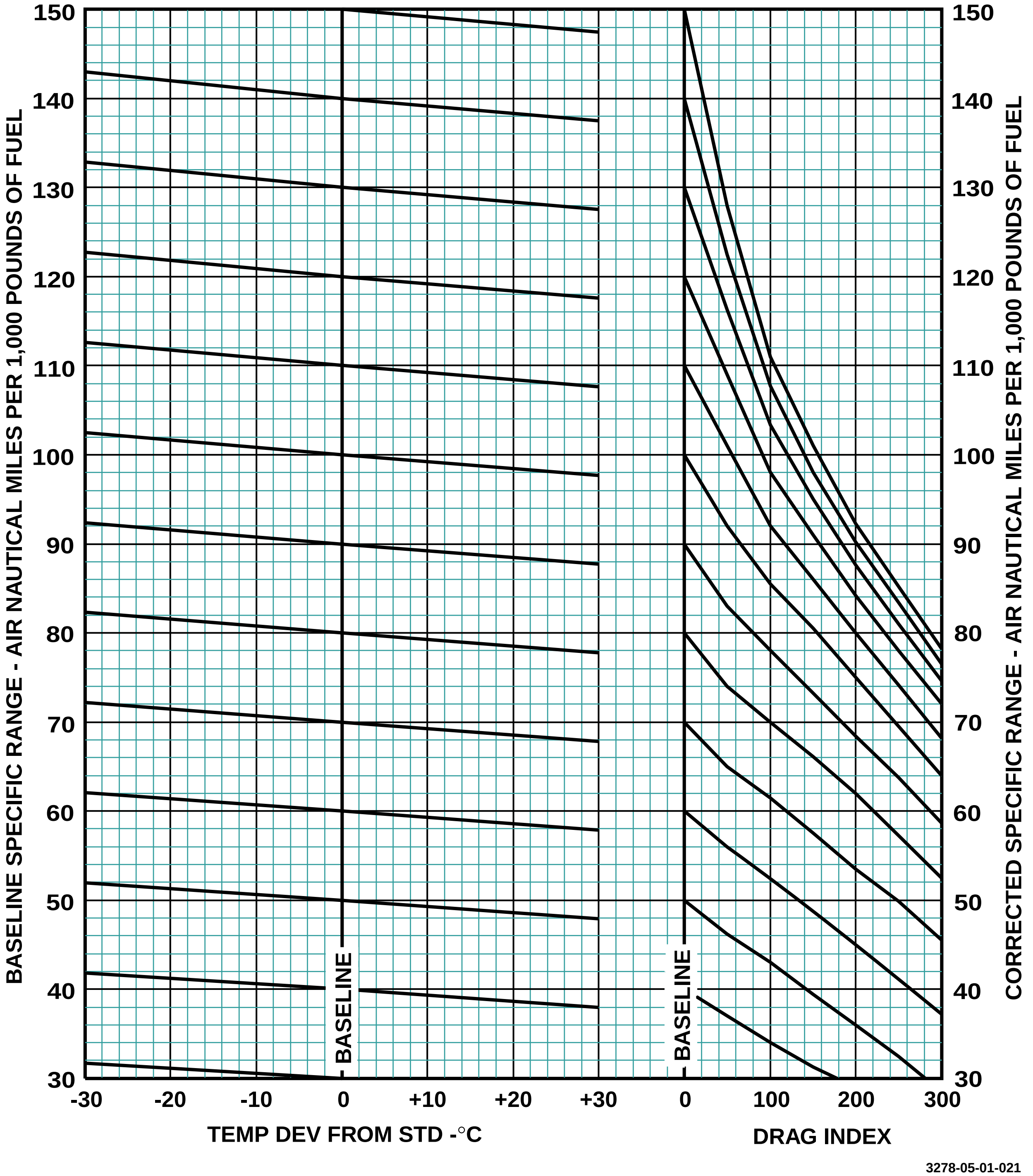
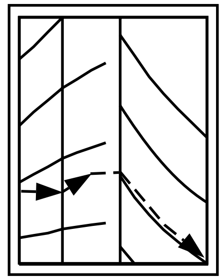


Figure 5-23.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TRUE AIRSPEED AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

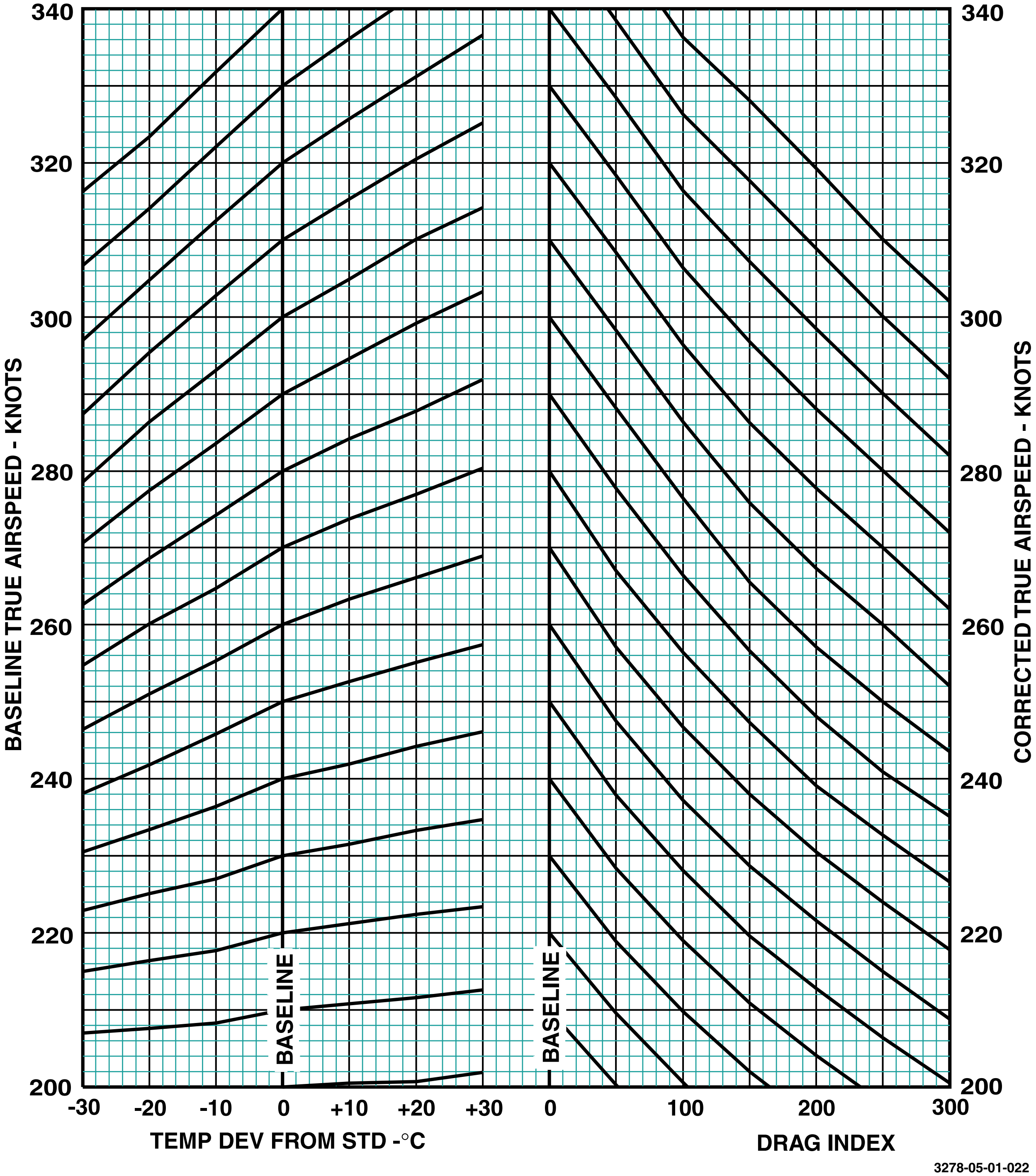


Figure 5-24.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

SPECIFIC RANGE AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

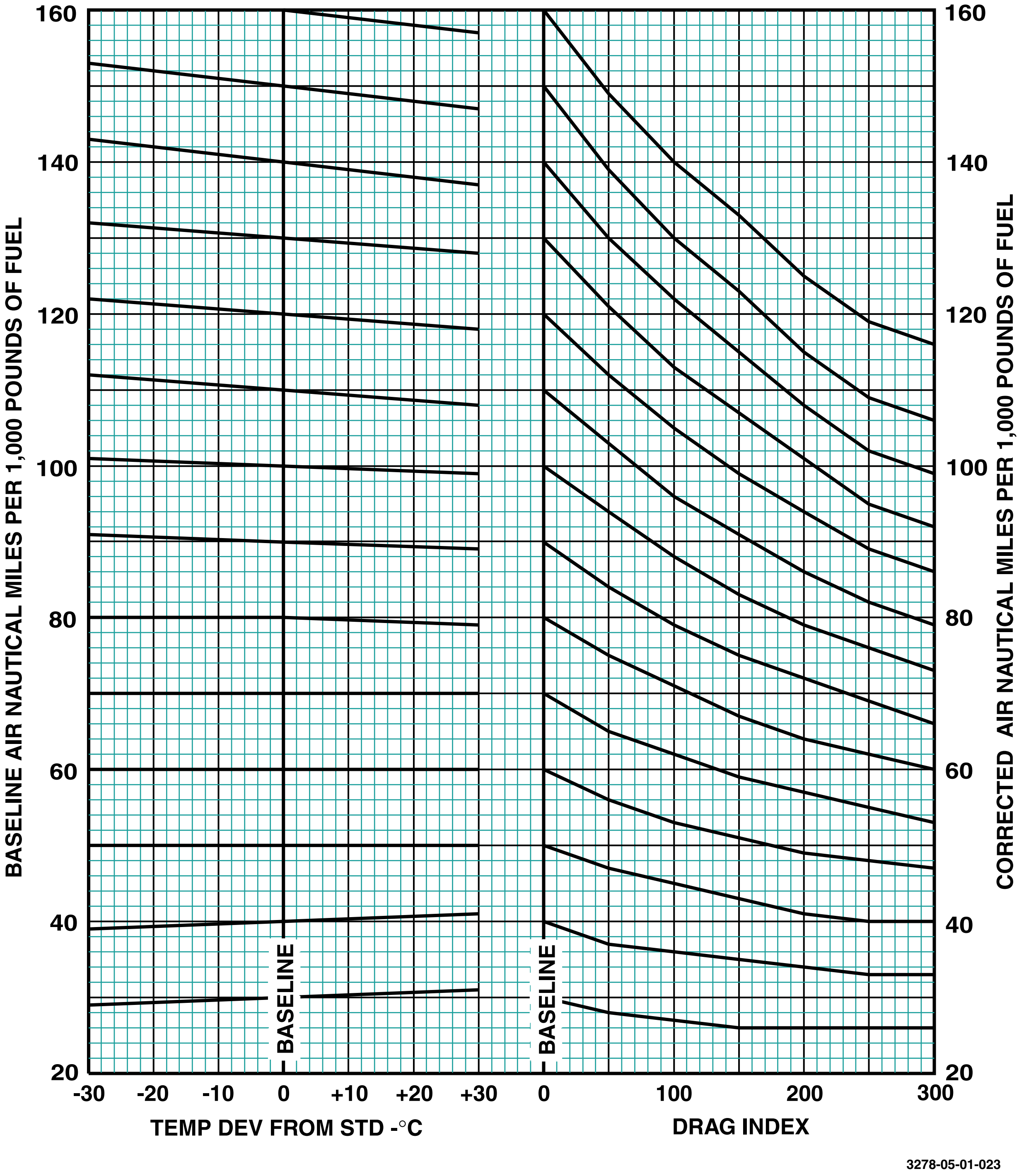


Figure 5-25.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

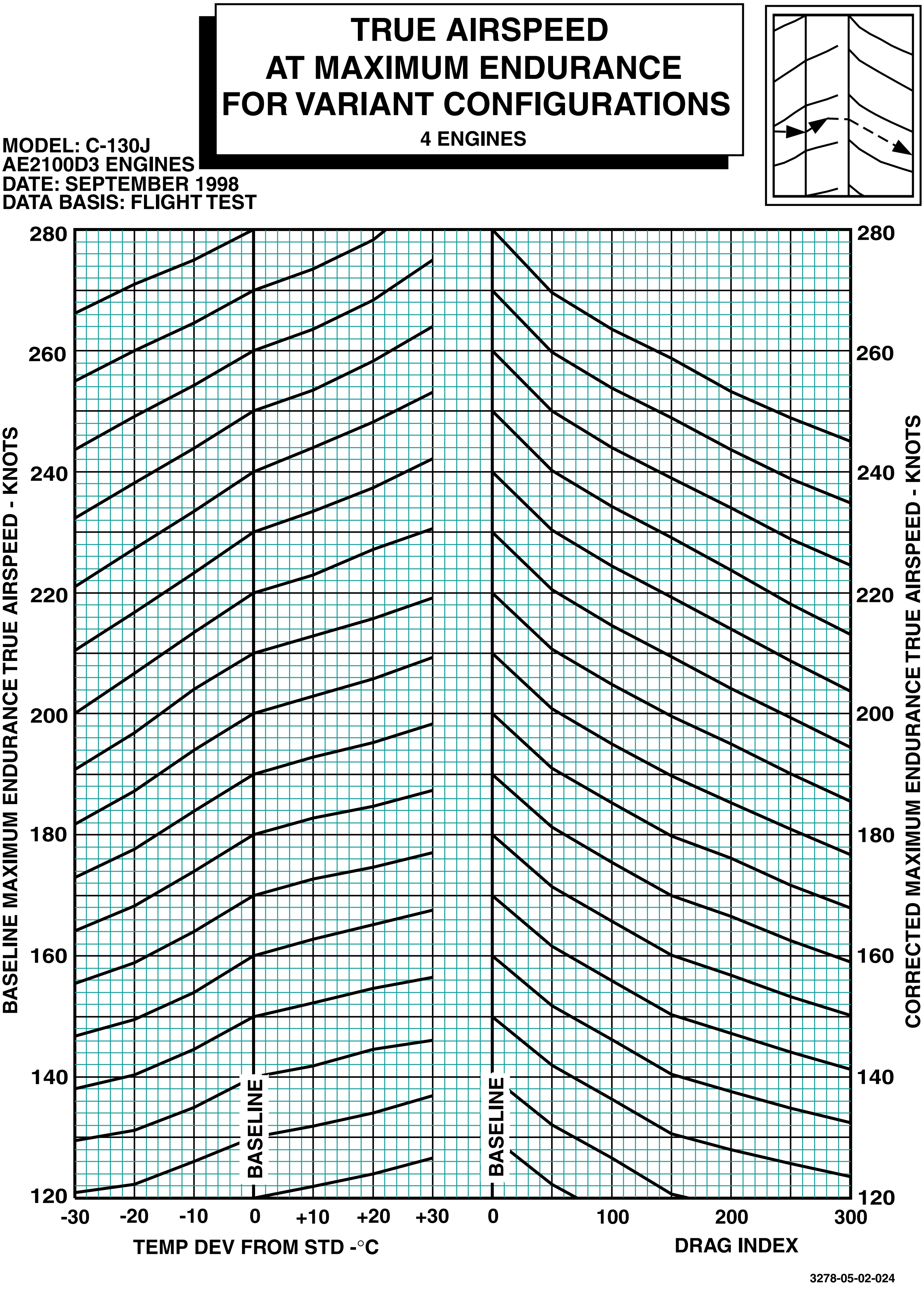


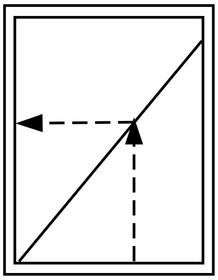
Figure 5-26.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LONG RANGE CRUISE RANGE CORRECTION DUE TO ALL BLEED ON

4 ENGINES



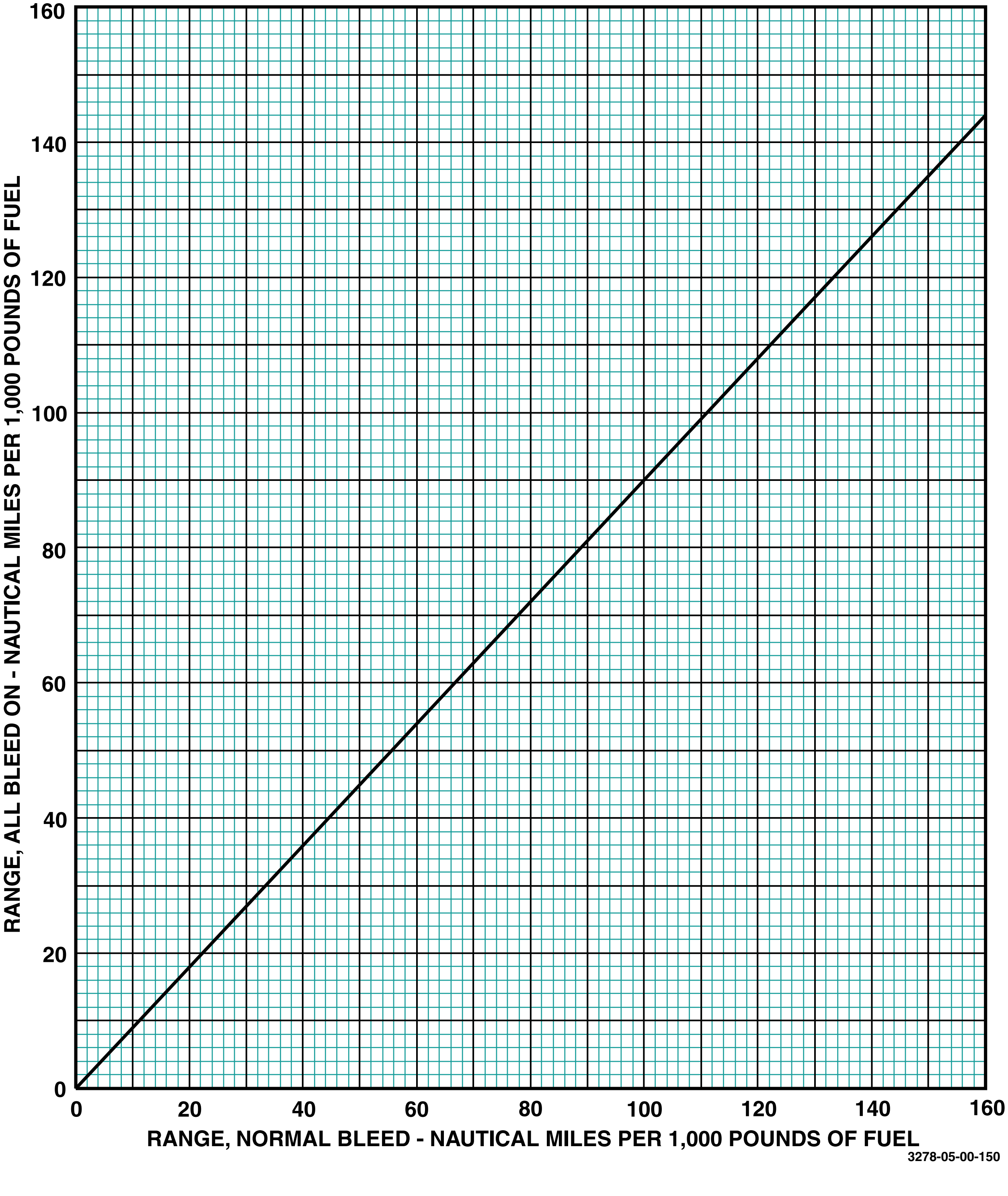


Figure 5-27.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRUISE CEILING

3 ENGINES NORMAL BLEED

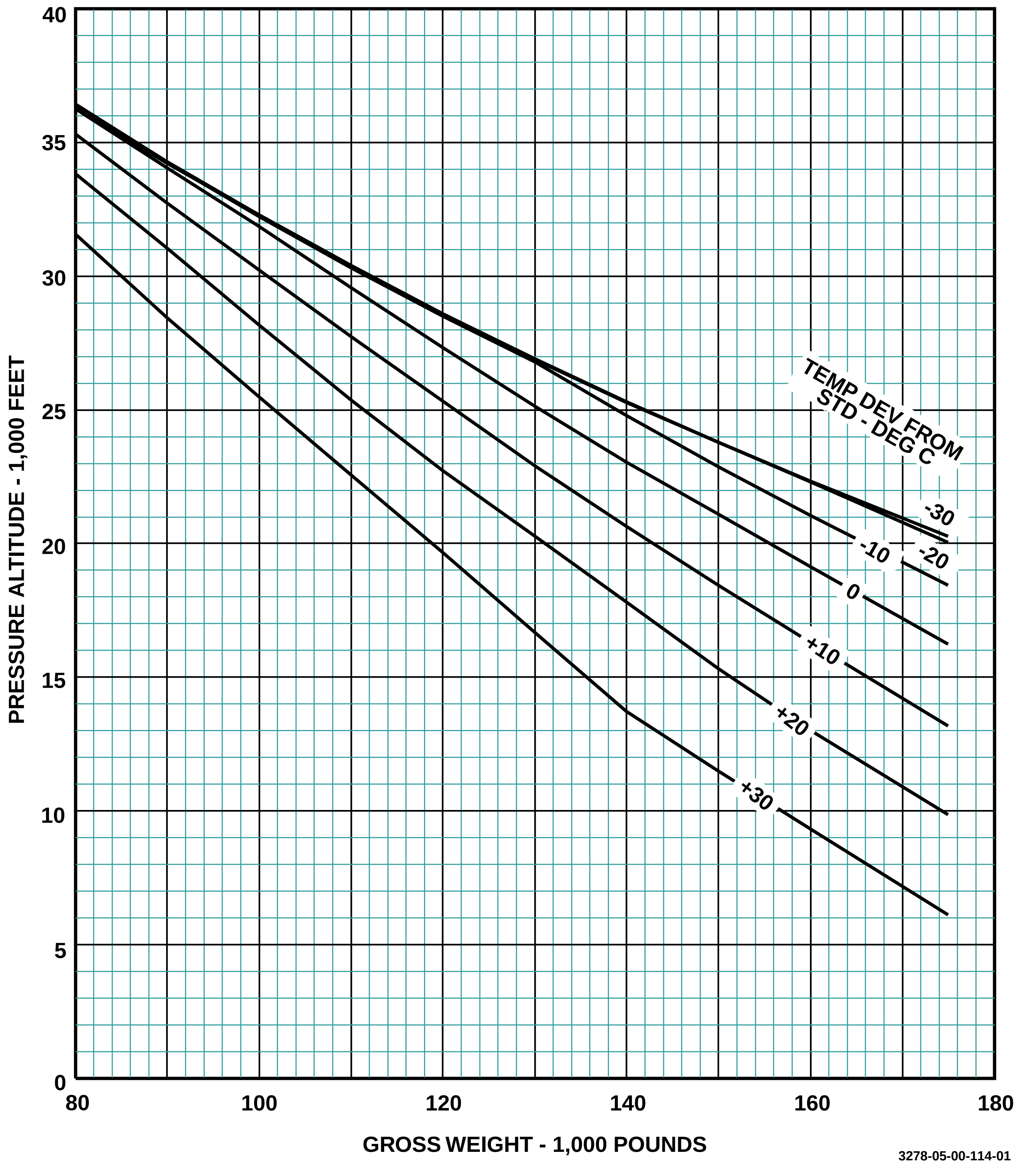


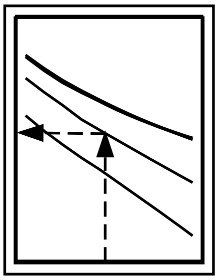
Figure 5-28. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRUISE CEILING

3 ENGINES ALL BLEED



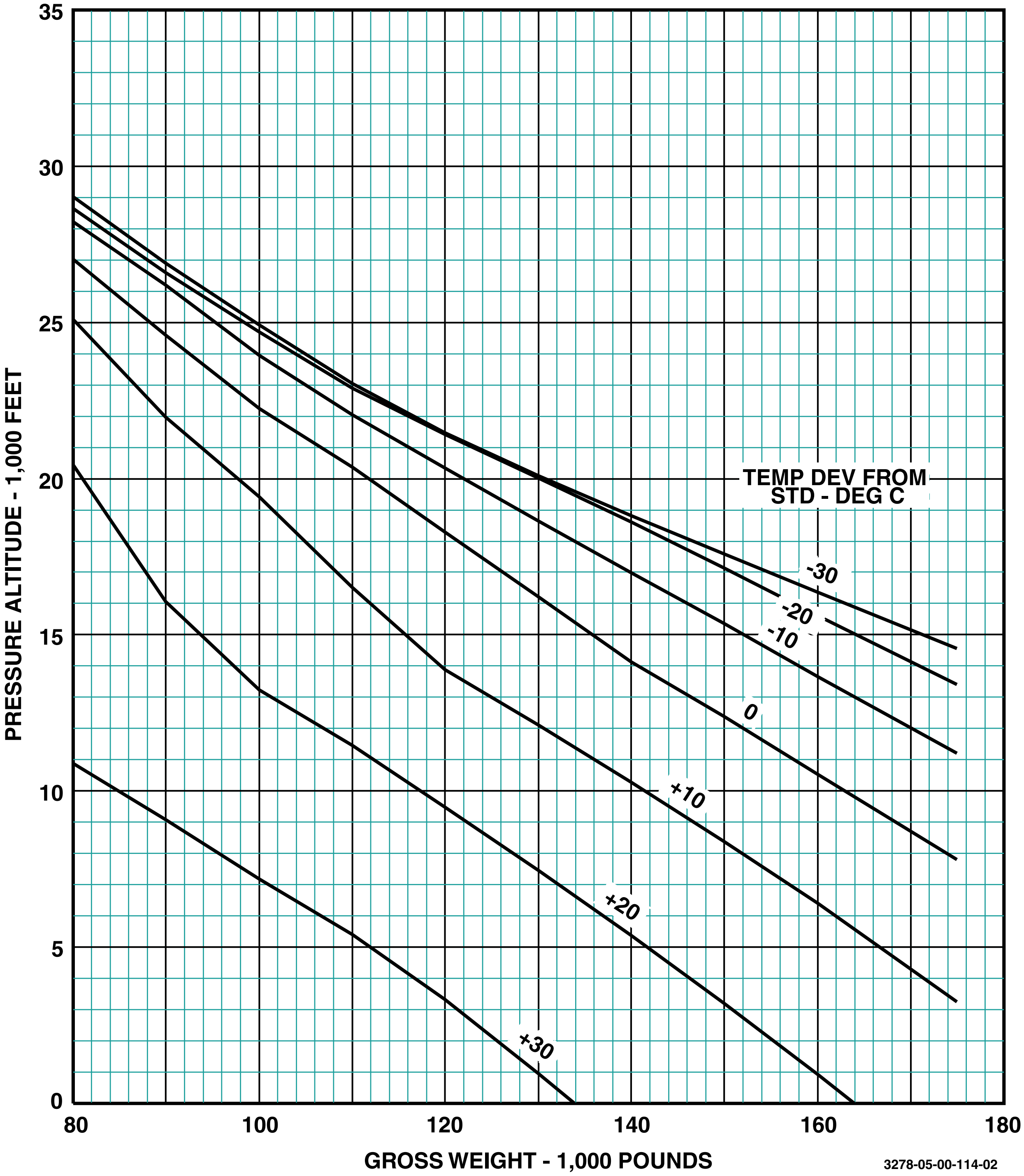
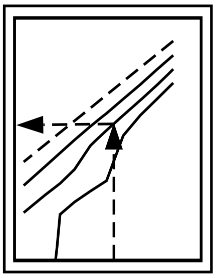


Figure 5-28. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

CRUISE CEILING FOR VARIANT CONFIGURATION

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

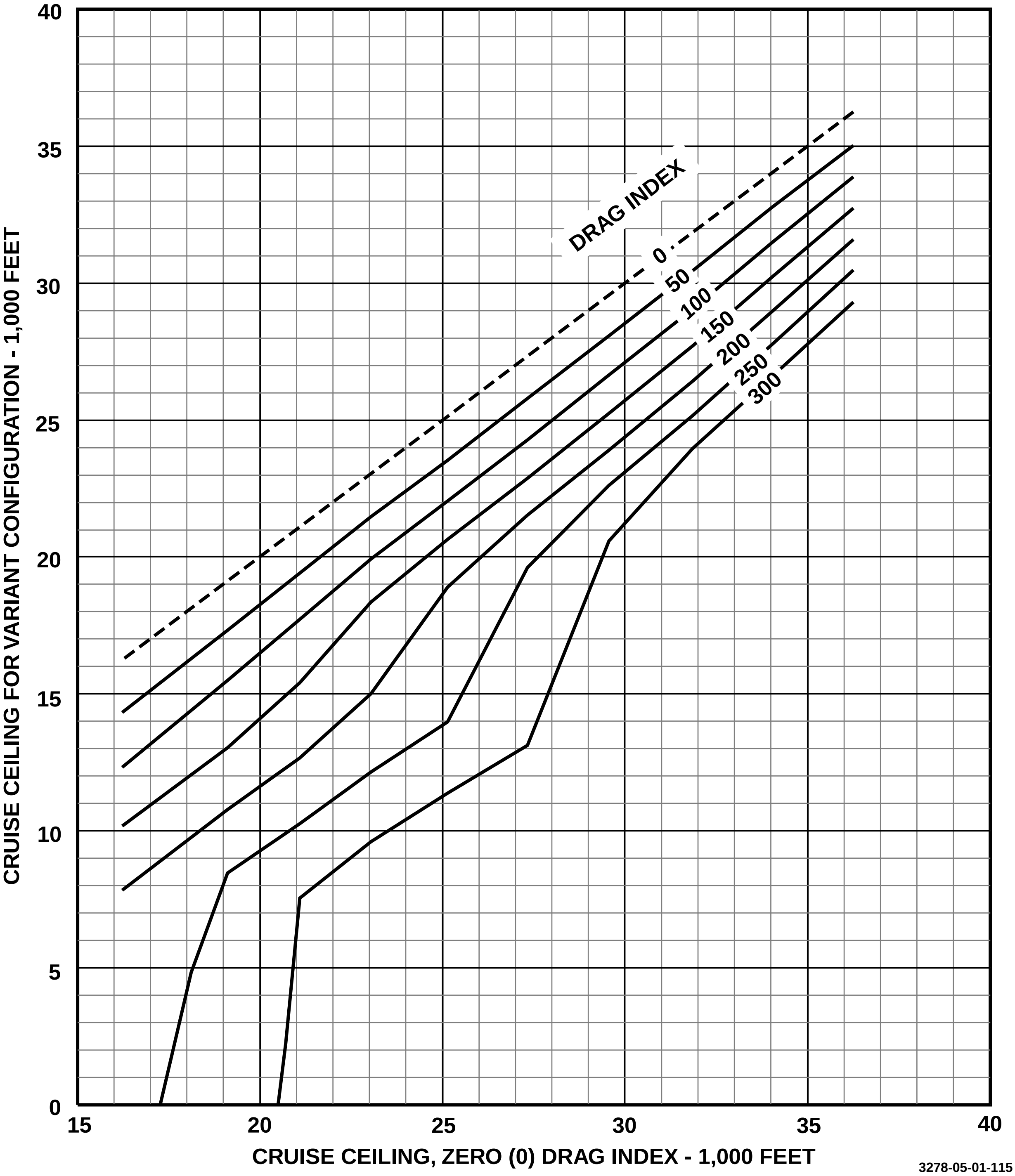


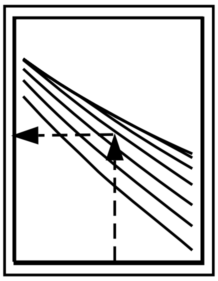
Figure 5-29.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

AIR TRAFFIC CONTROL CRUISE CEILING

3 ENGINES NORMAL BLEED



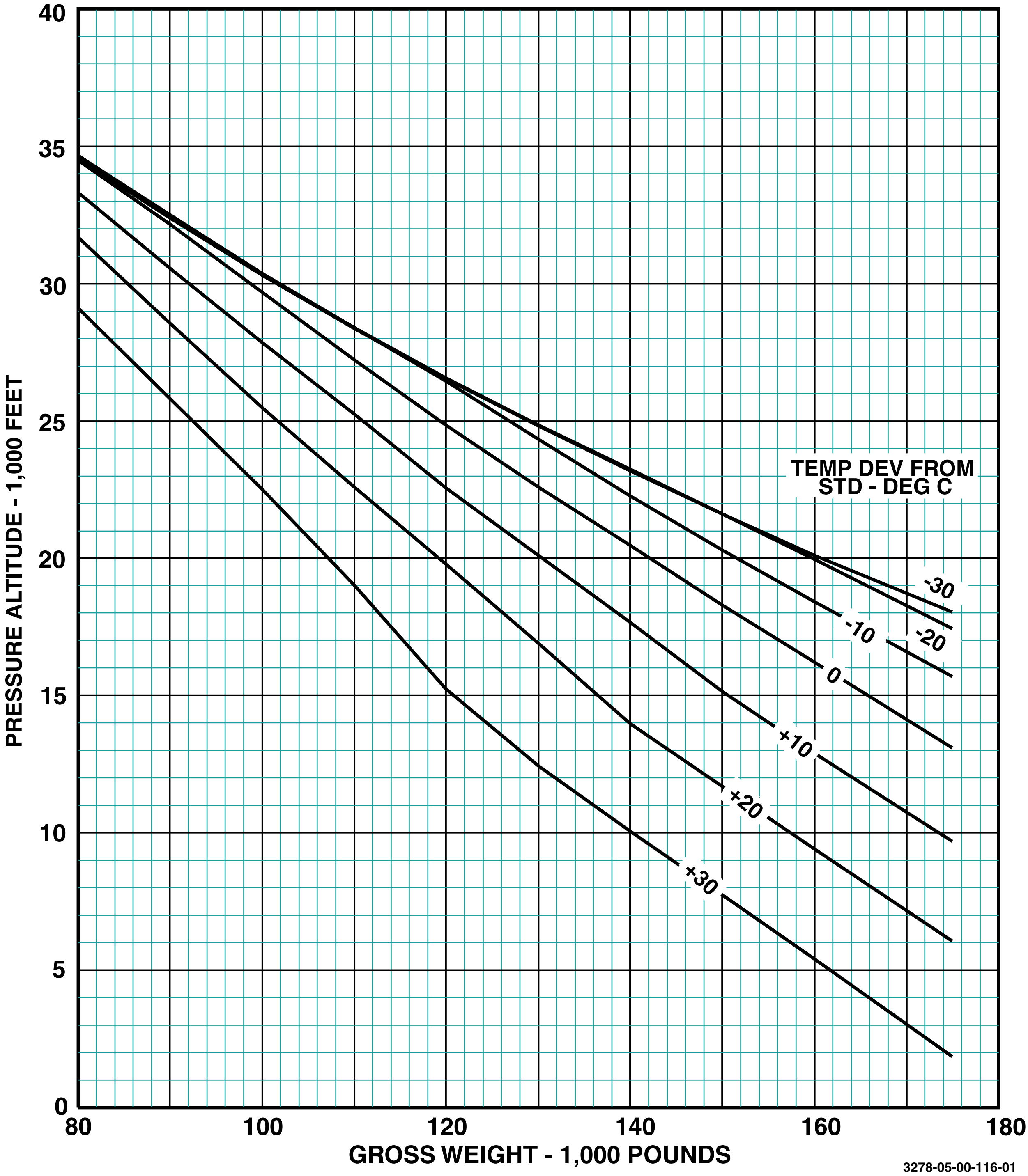


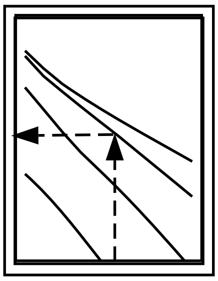
Figure 5-30. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

AIR TRAFFIC CONTROL CRUISE CEILING

3 ENGINES ALL BLEED



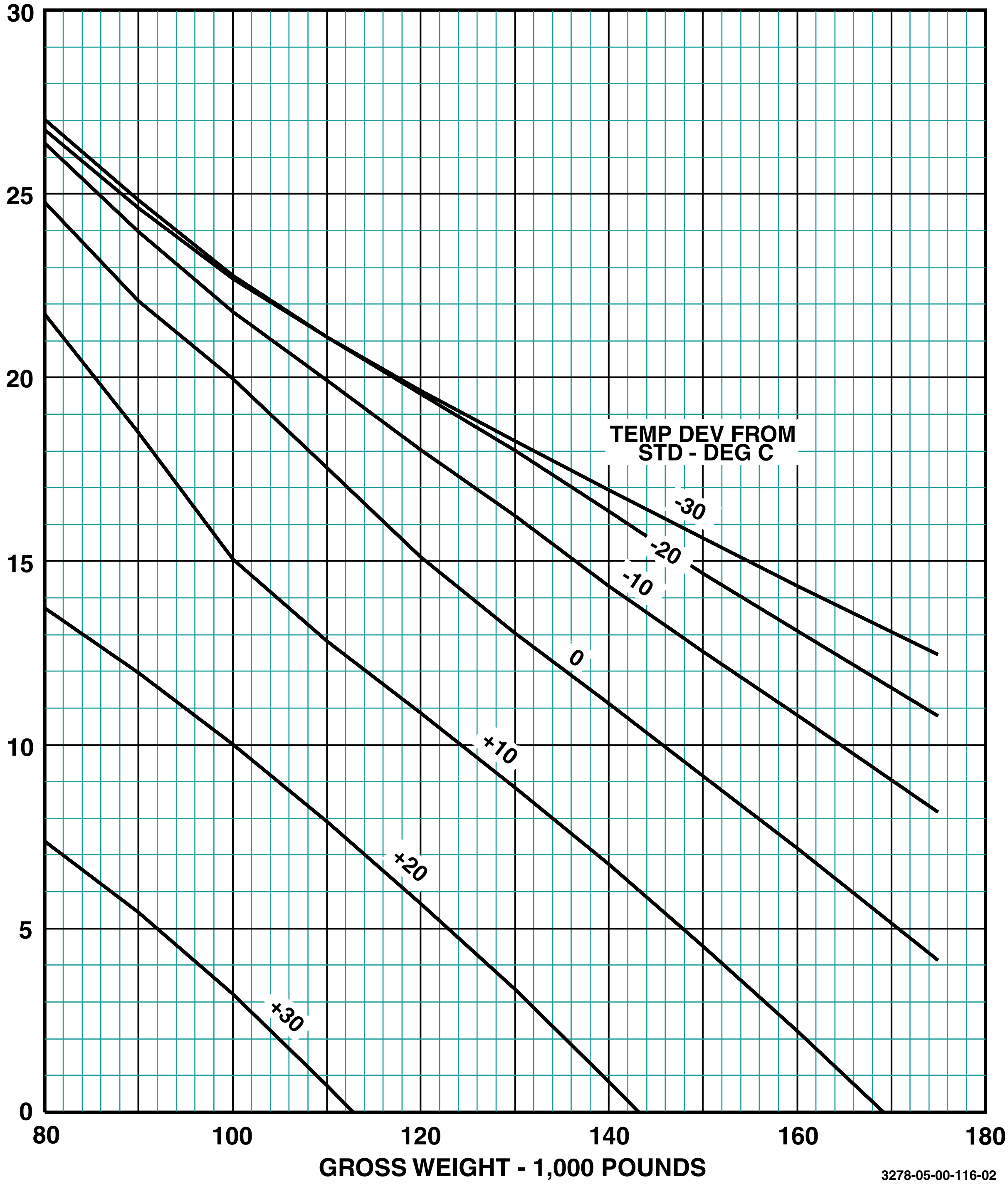


Figure 5-30. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

AIR TRAFFIC CONTROL CRUISE CEILING FOR VARIANT CONFIGURATION

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

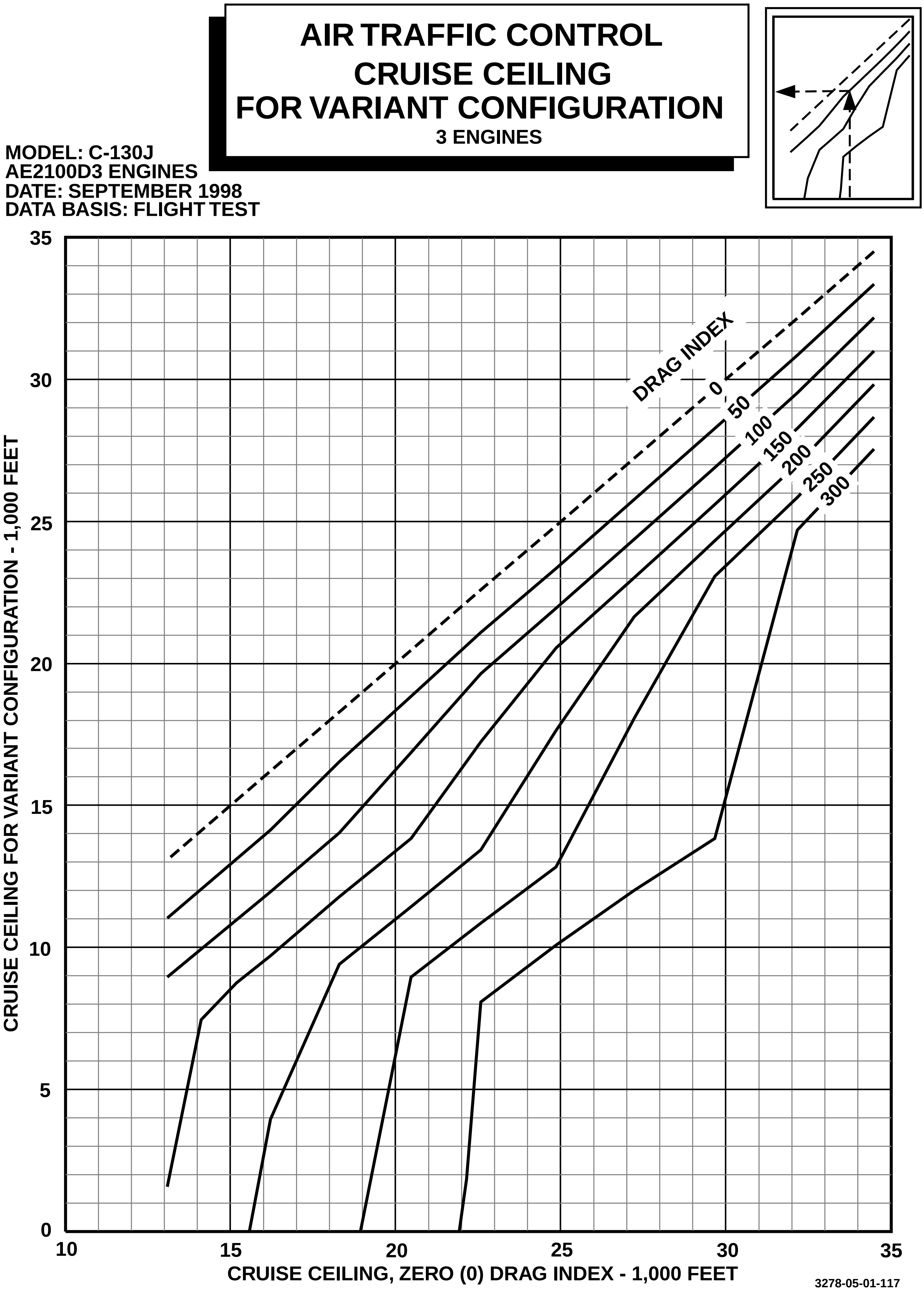


Figure 5-31.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

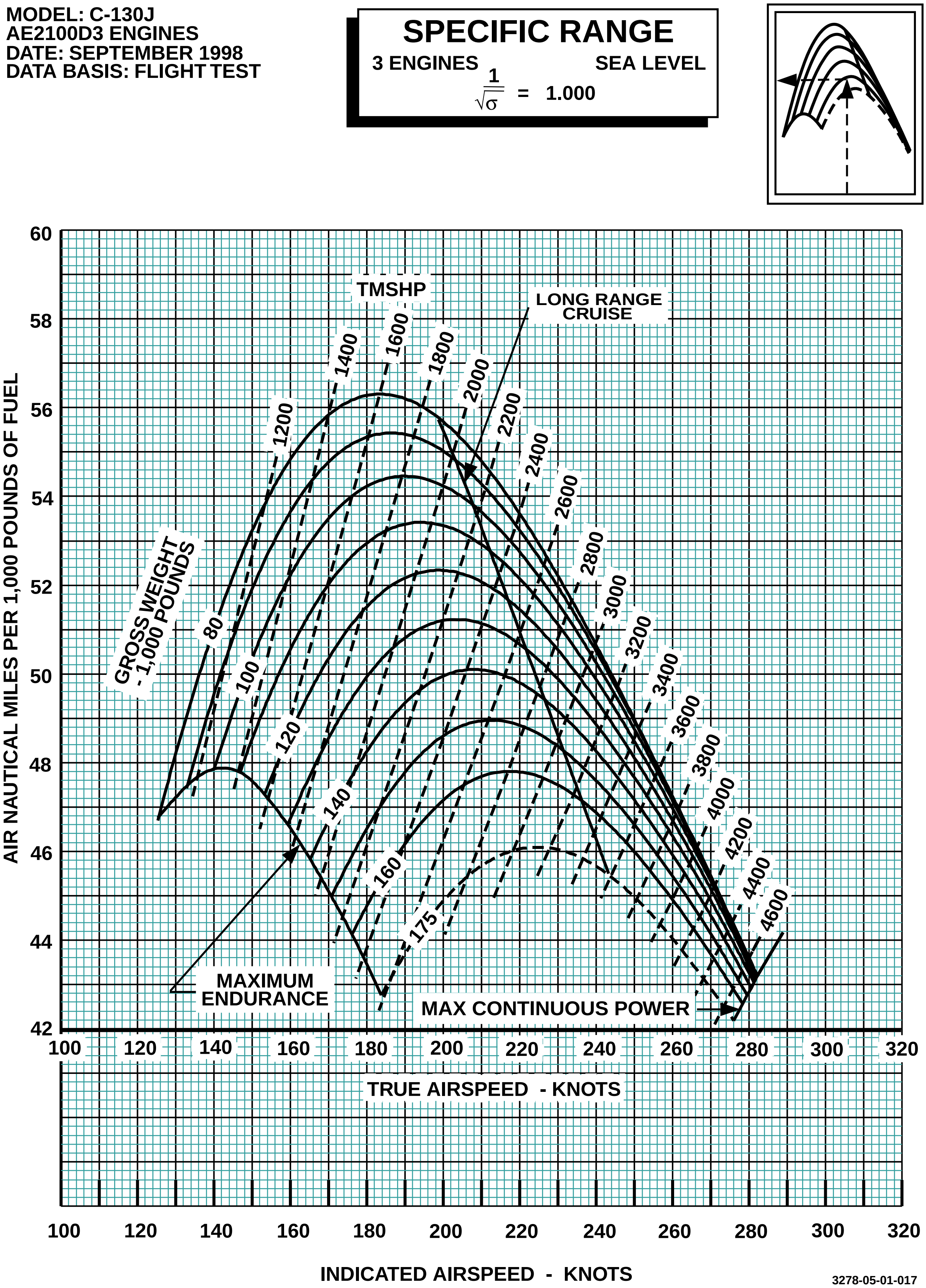
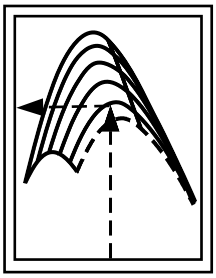


Figure 5-32.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE
3 ENGINES 4,000 FEET
$\frac{1}{\sqrt{\sigma}} = 1.0611$



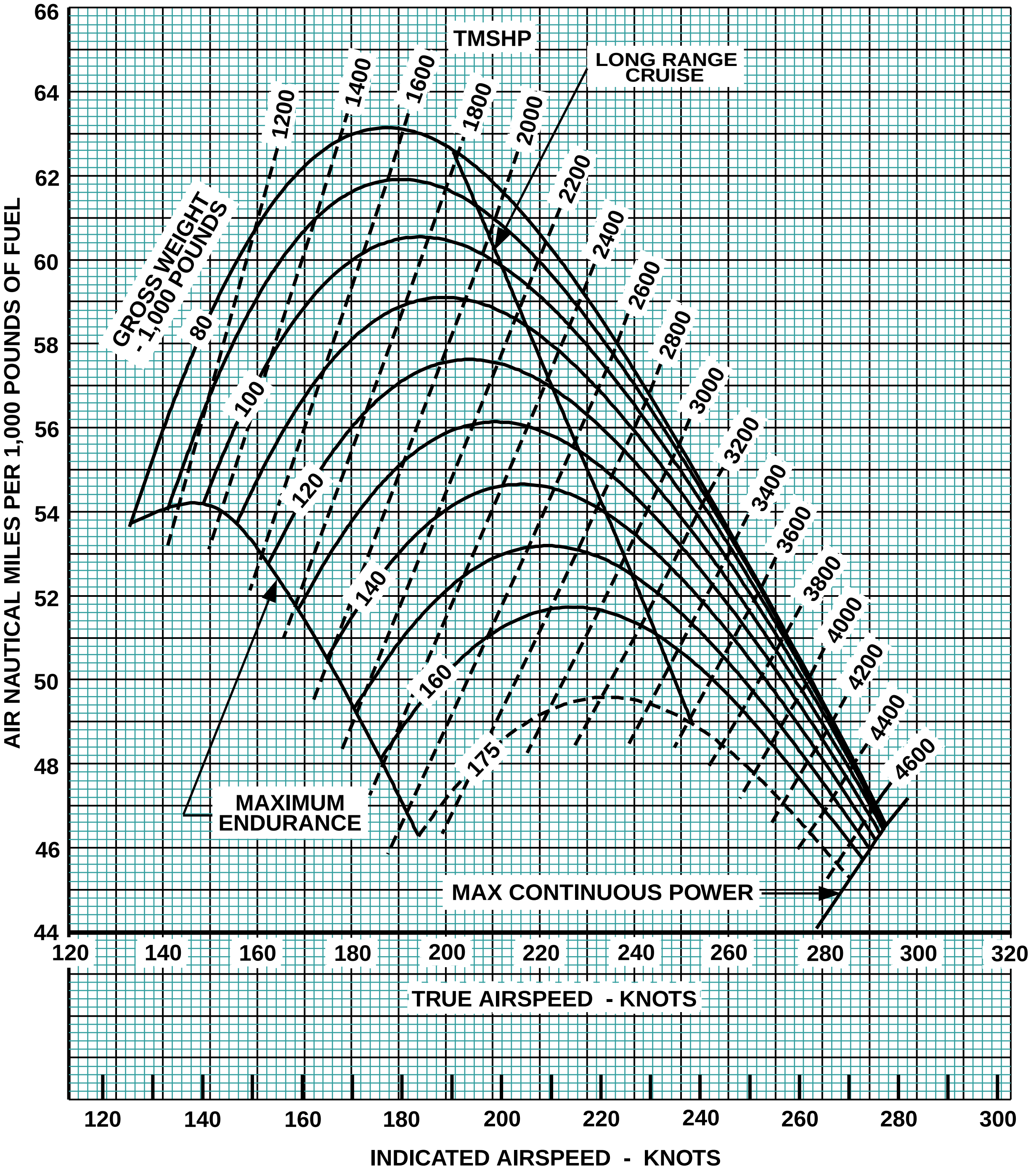


Figure 5-33.

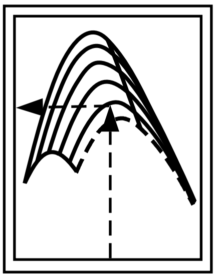
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 8,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.1279$



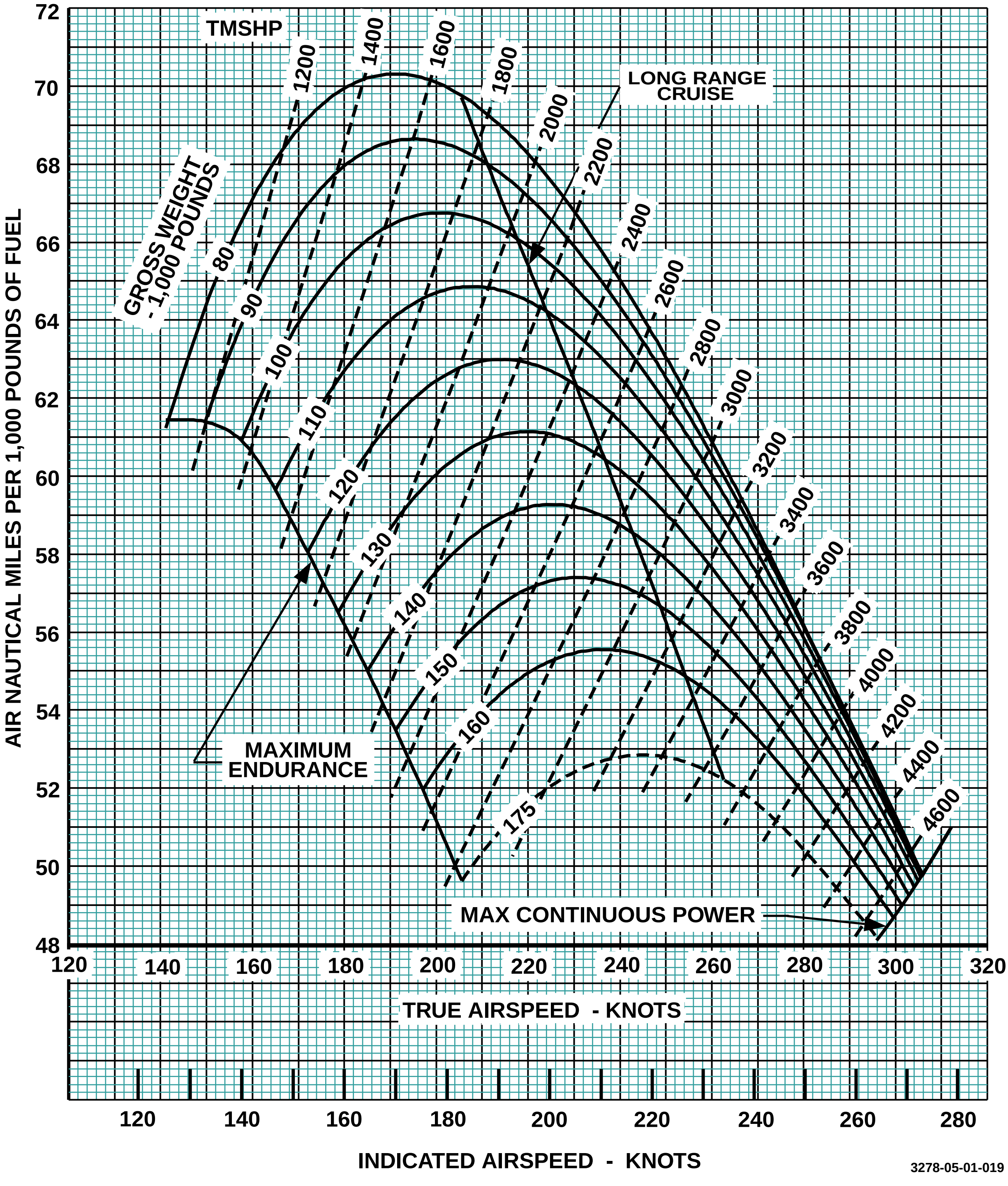


Figure 5-34.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 12,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.2010$

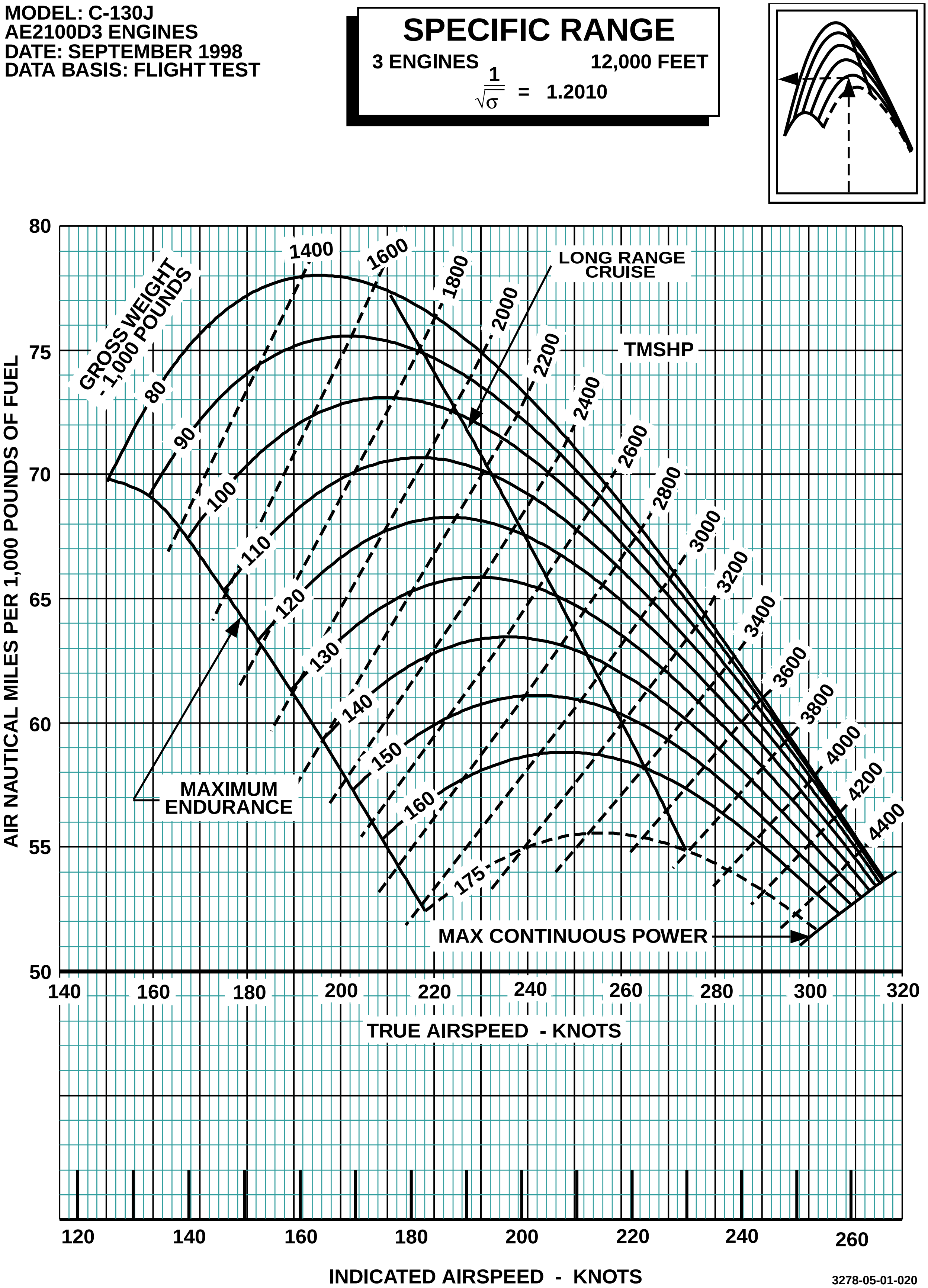


Figure 5-35.

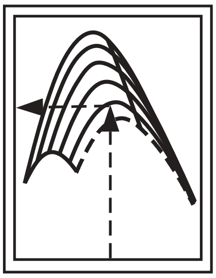
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 16,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.2812$



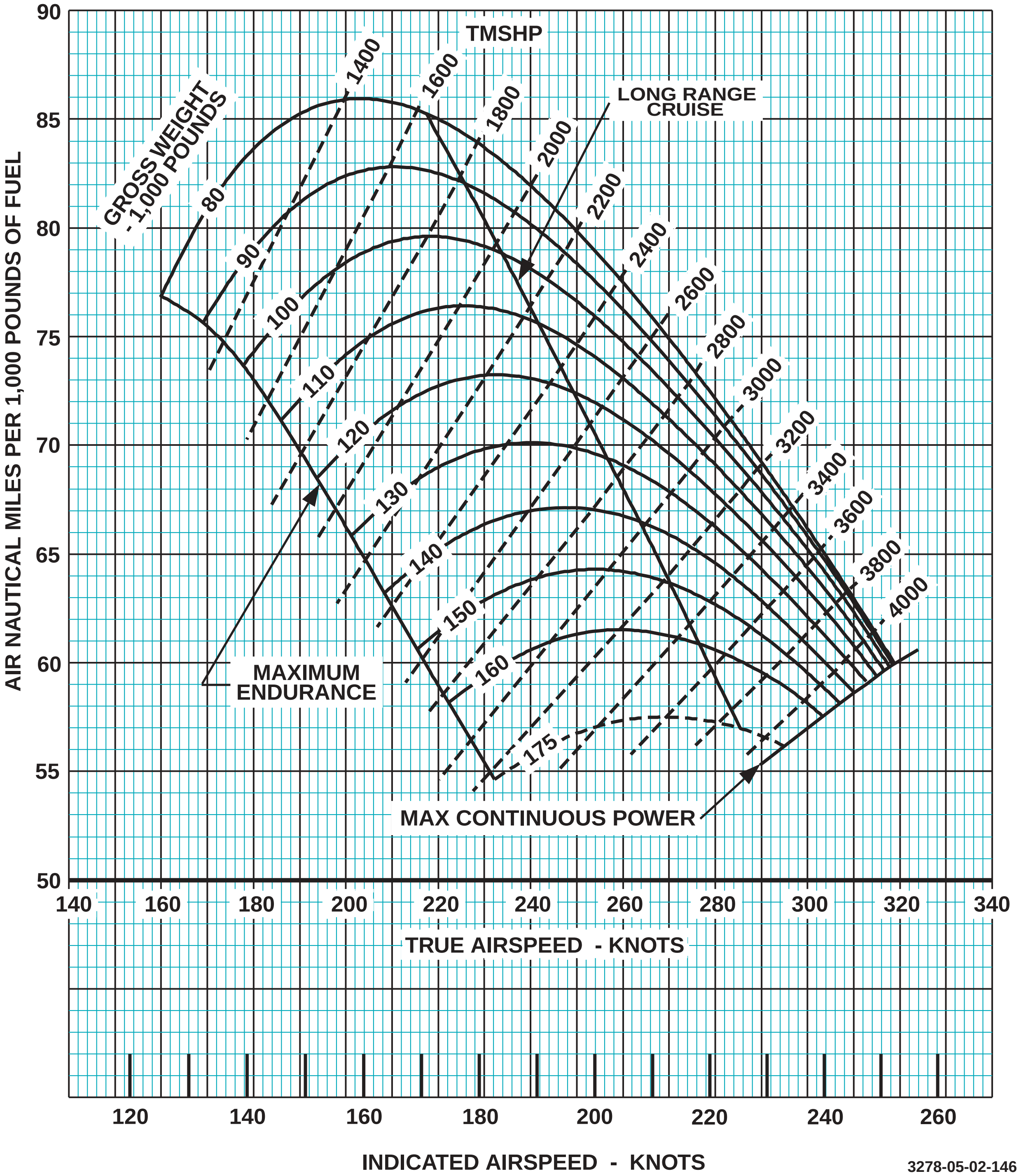


Figure 5-36.

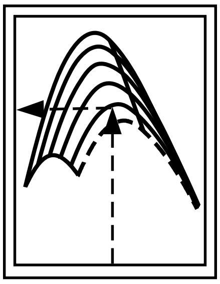
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 18,000 FEET

$$\frac{1}{\sqrt{\sigma}} = 1.3243$$



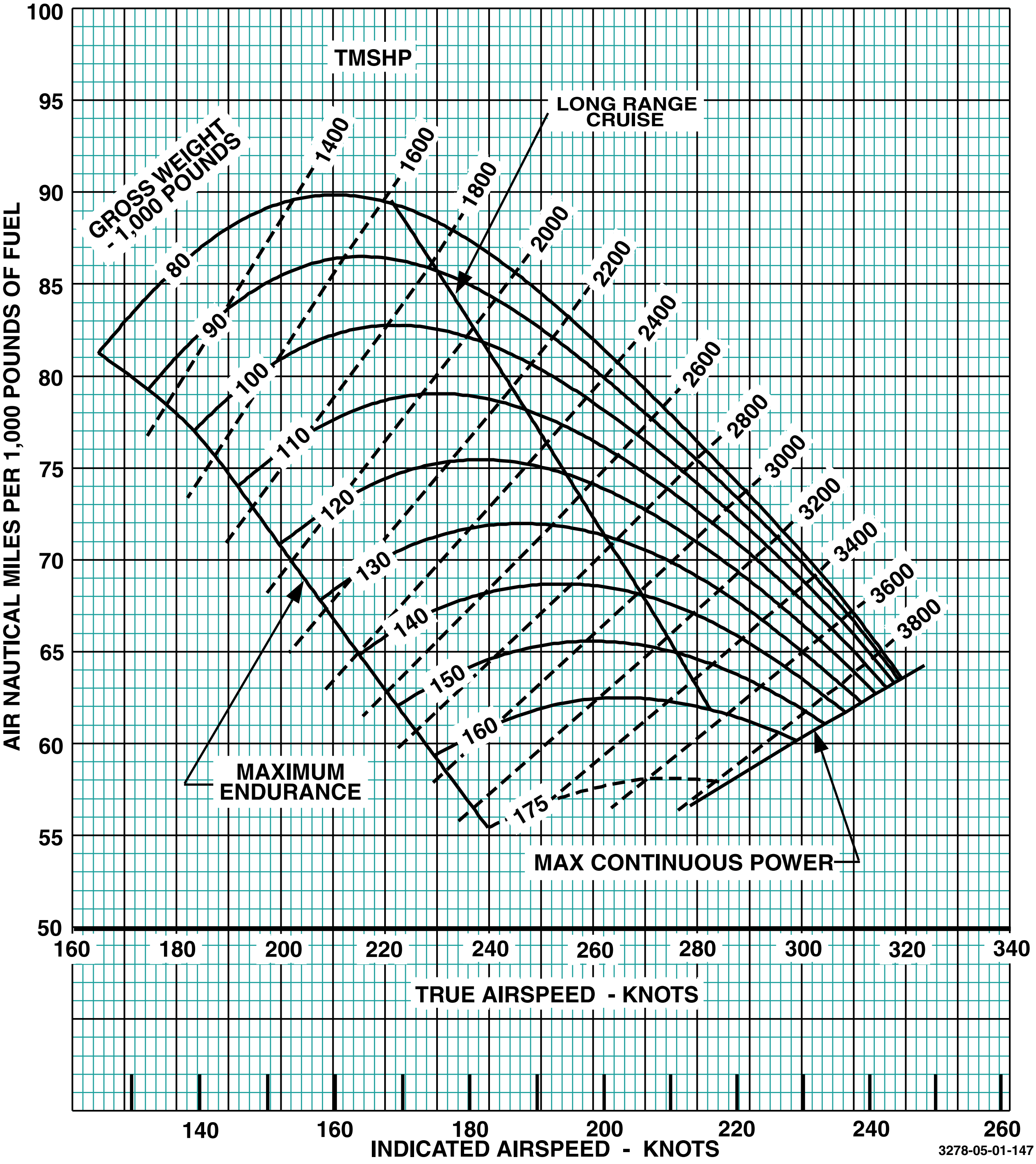


Figure 5-37.

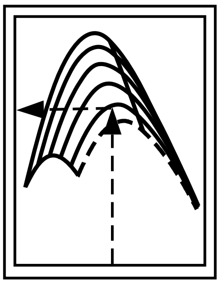
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 20,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.3701$



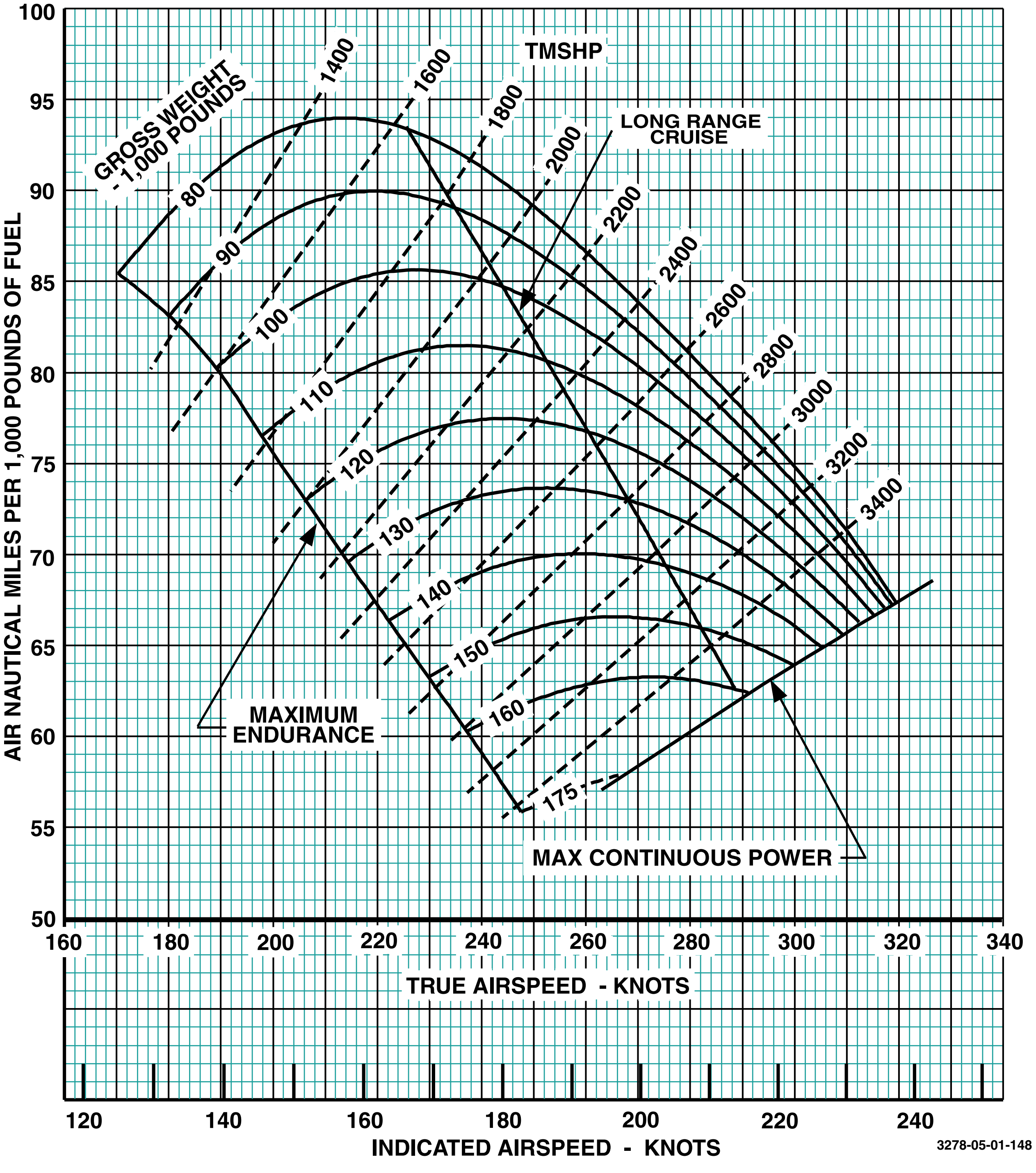


Figure 5-38.

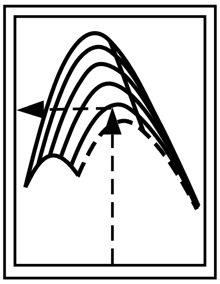
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 22,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.4171$



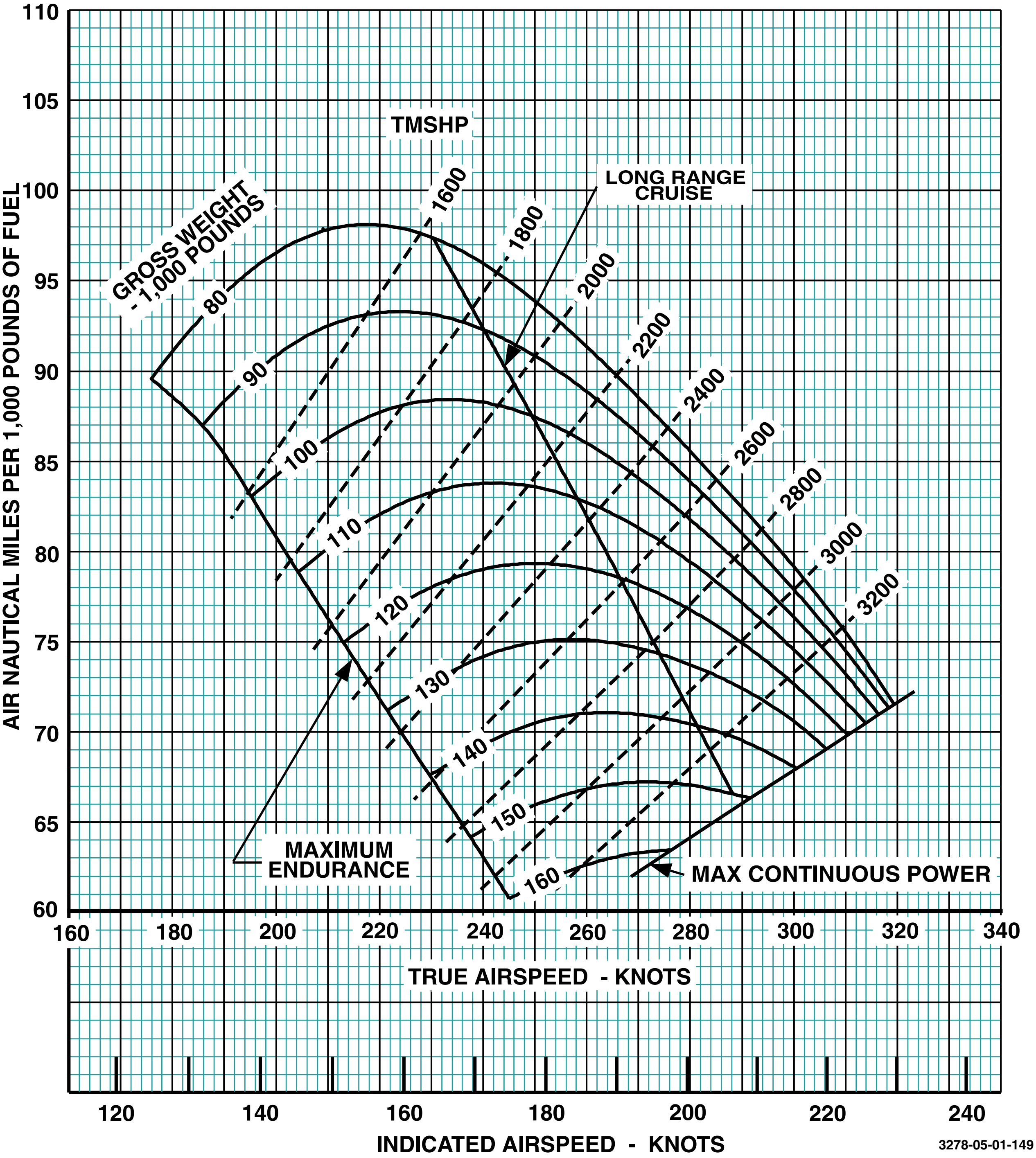


Figure 5-39.

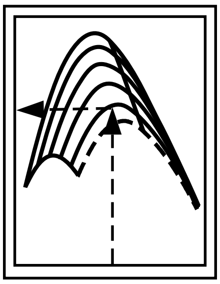
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 24,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.4671$



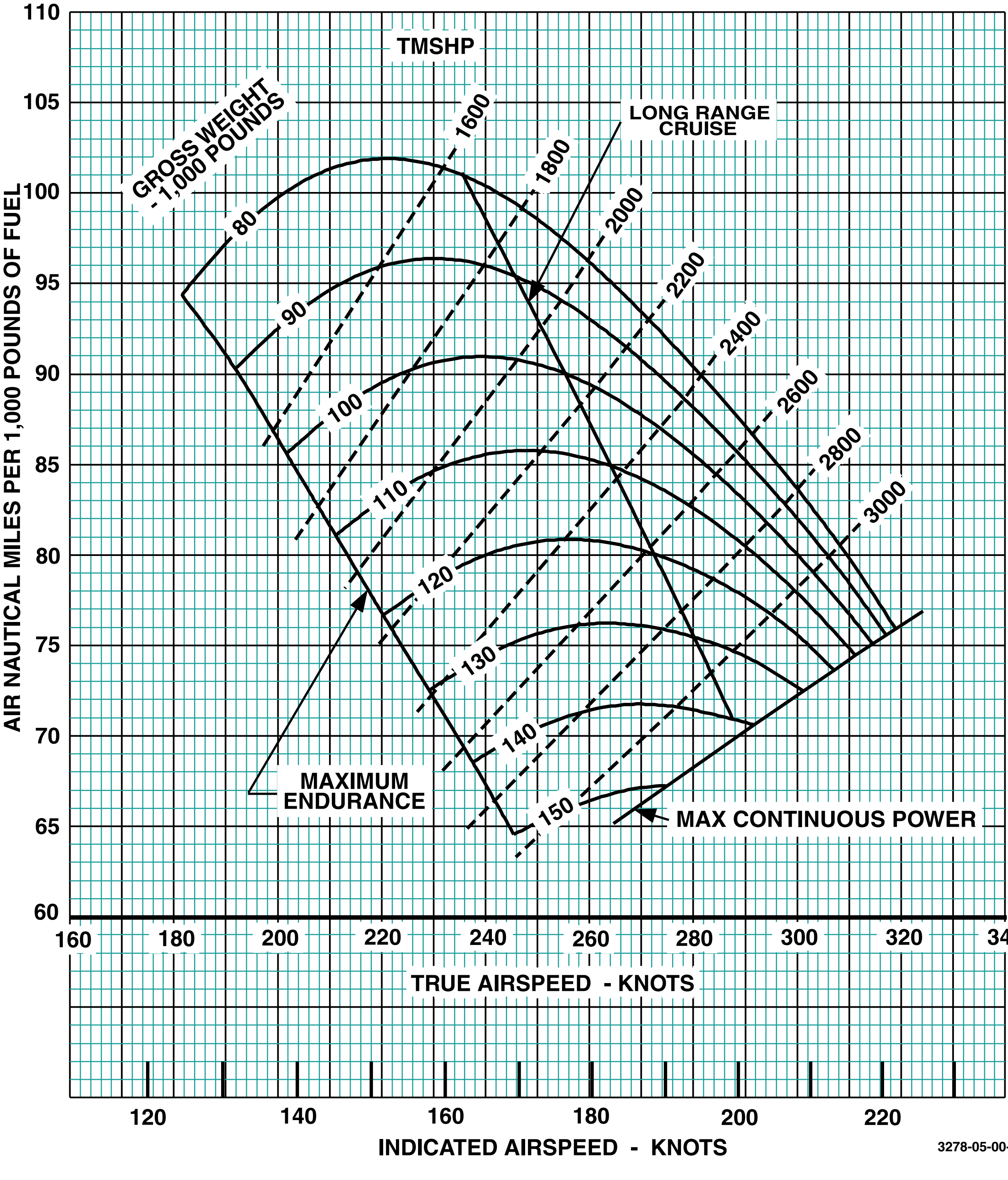


Figure 5-40.

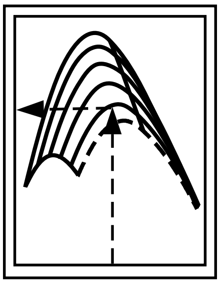
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 26,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.5197$



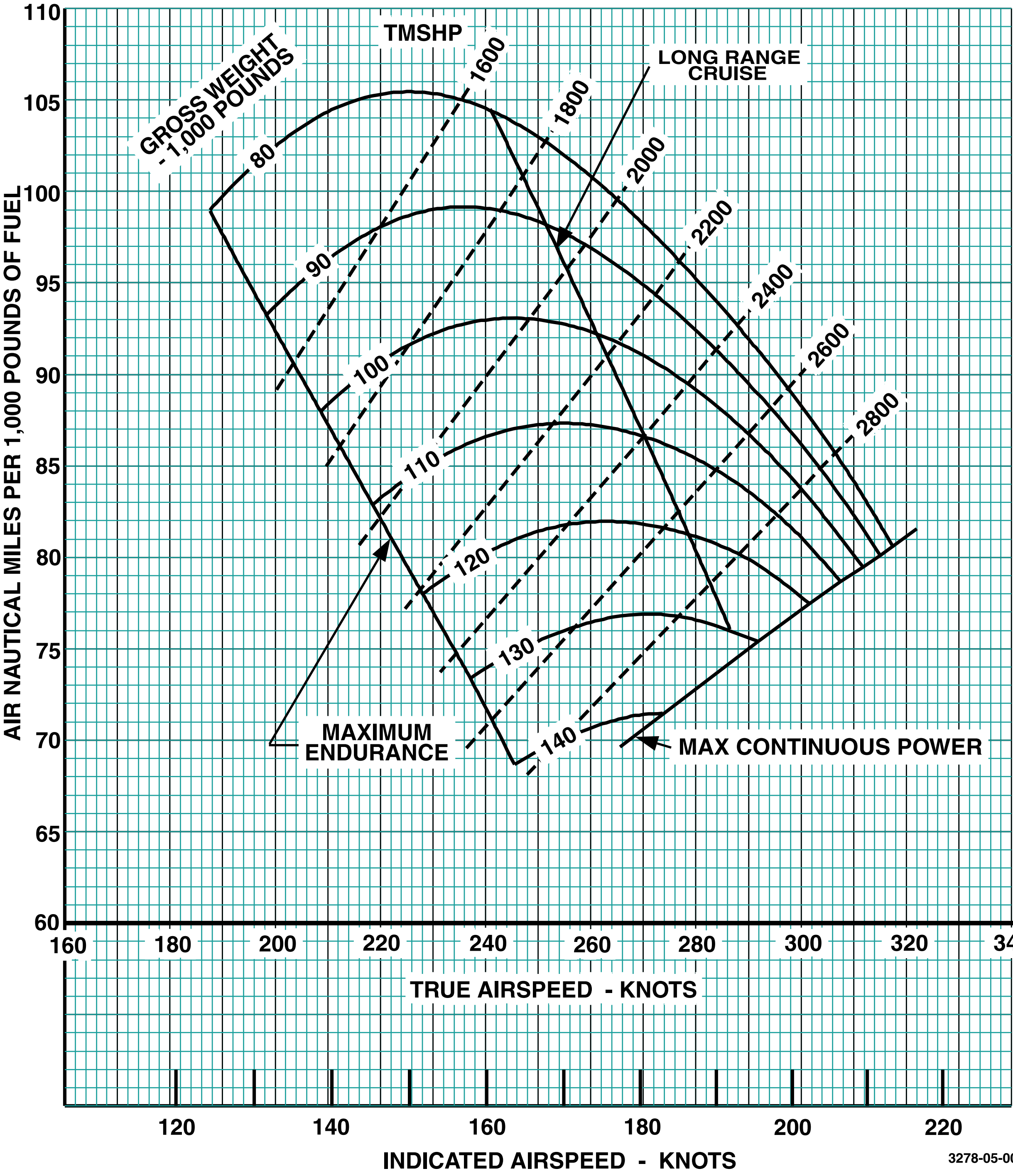


Figure 5-41.

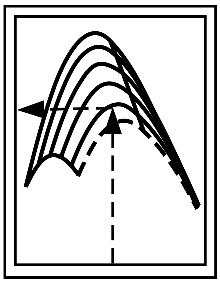
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 28,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.5751$



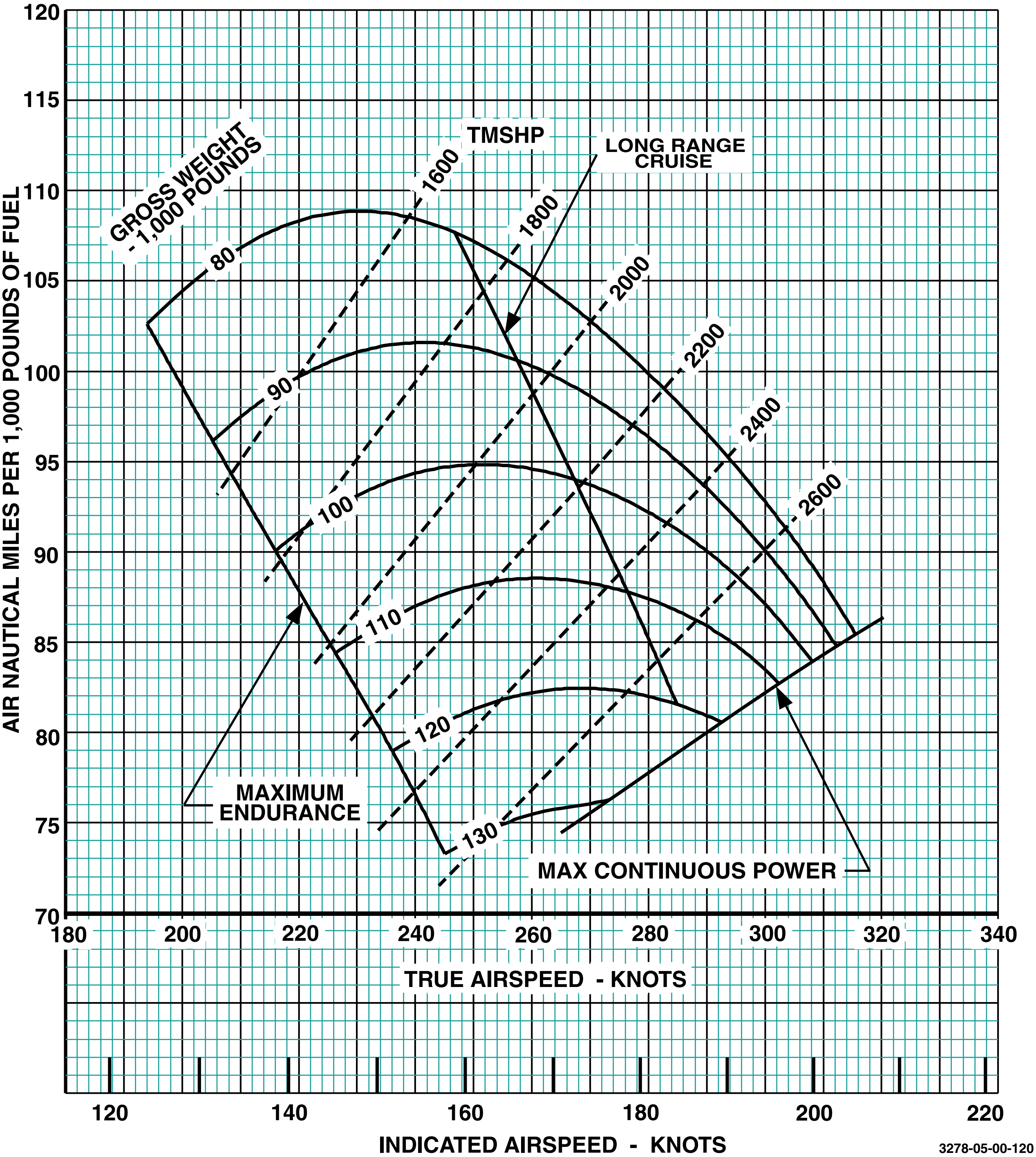
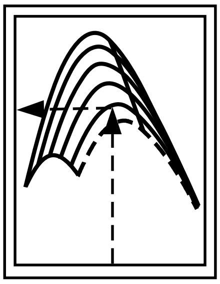


Figure 5-42.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE
3 ENGINES 30,000 FEET
$\frac{1}{\sqrt{\sigma}} = 1.6336$



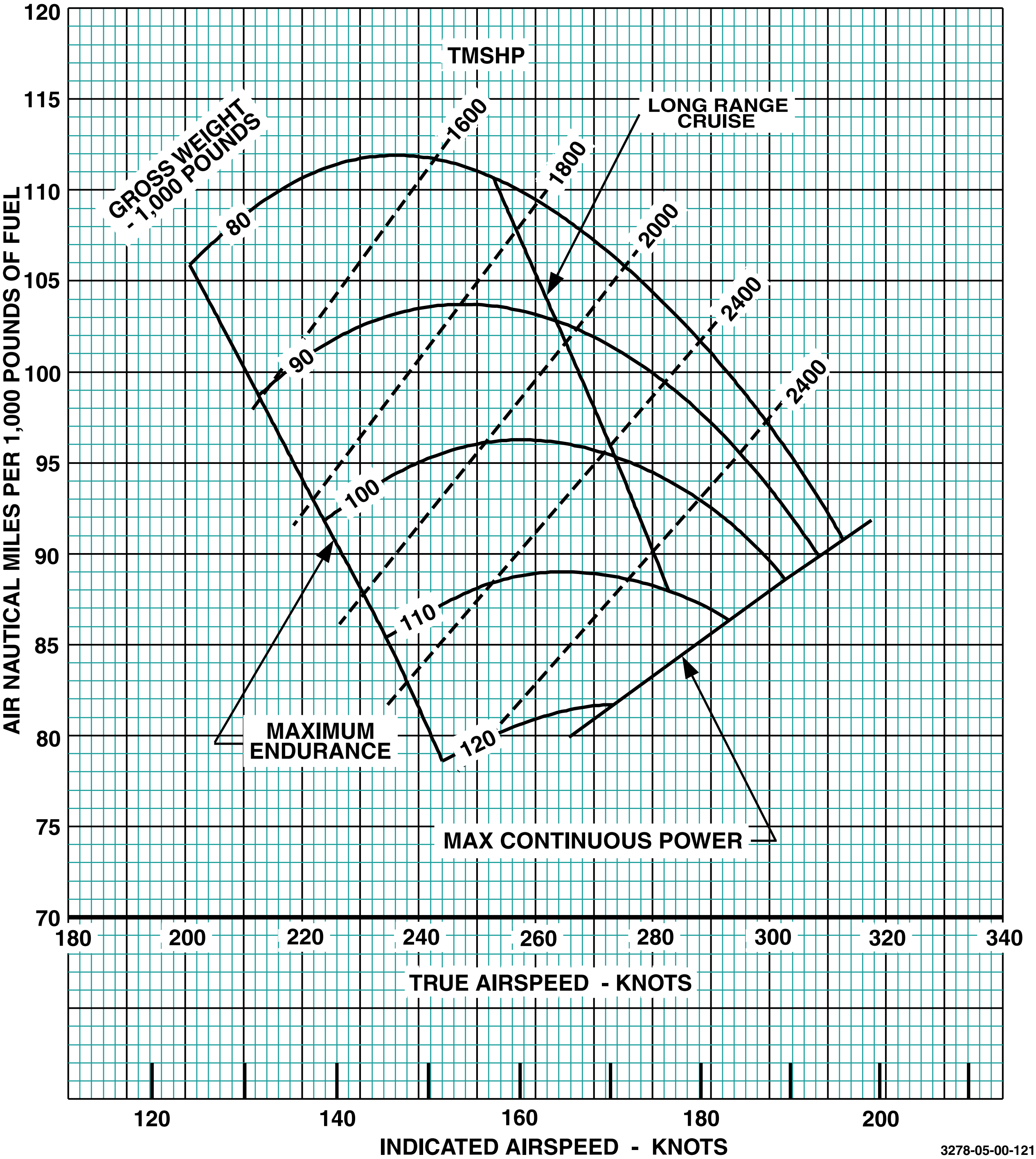


Figure 5-43.

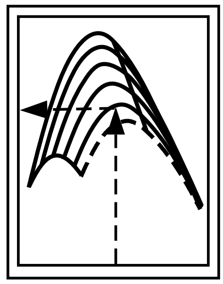
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

3 ENGINES 31,000 FEET

$\frac{1}{\sqrt{\sigma}} = 1.6640$



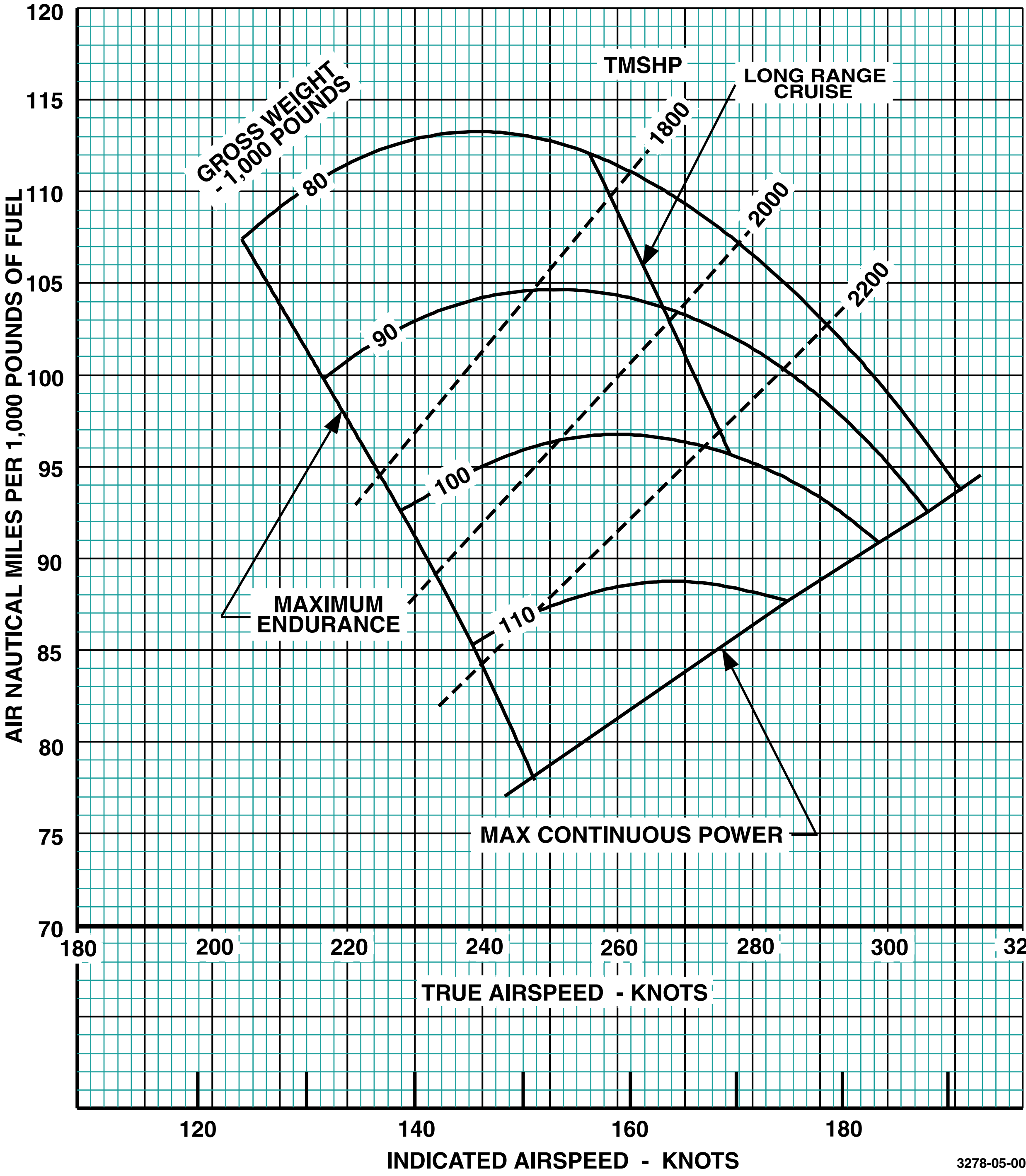


Figure 5-44.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

3 ENGINES

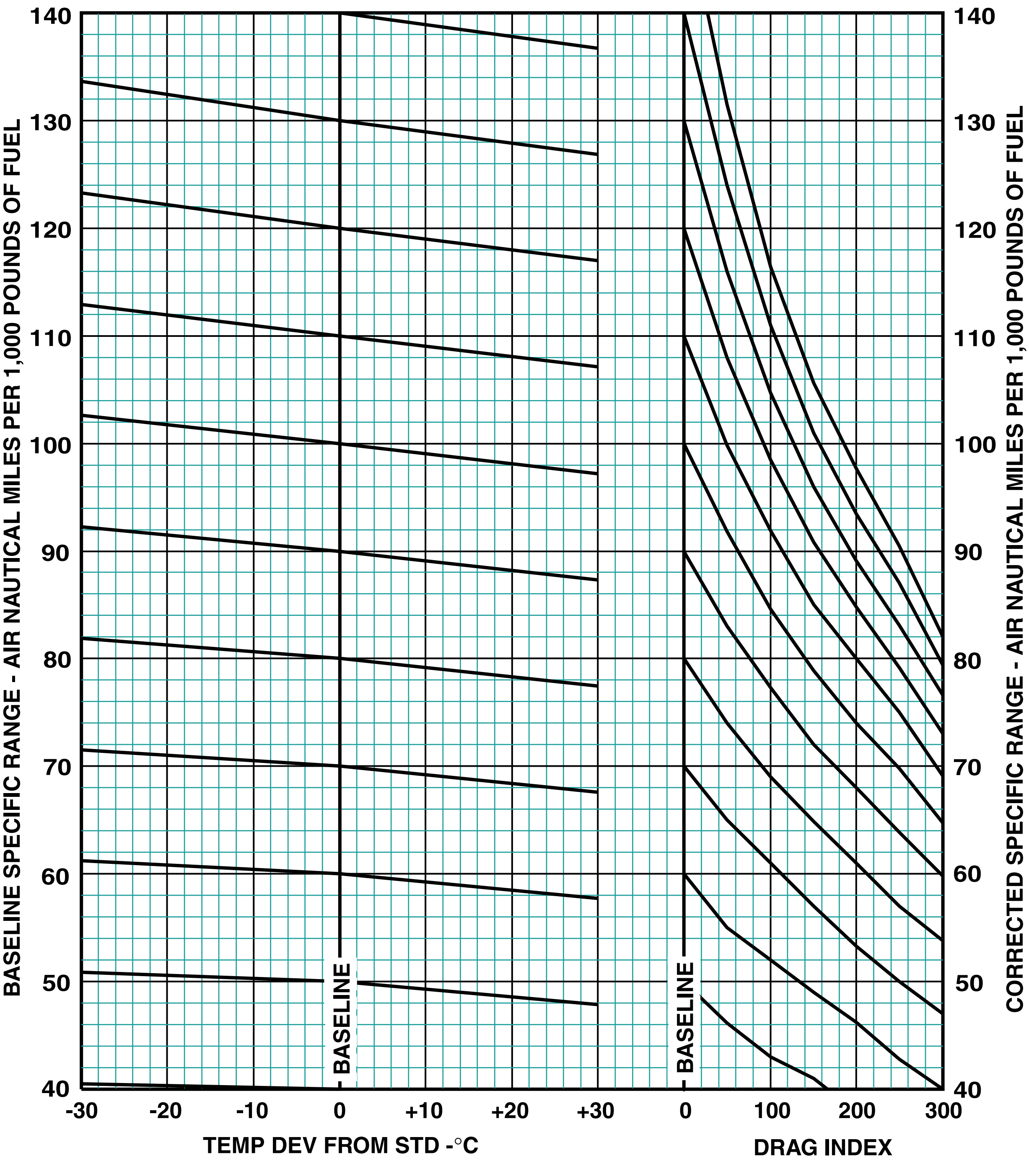


Figure 5-45.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TRUE AIRSPEED AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

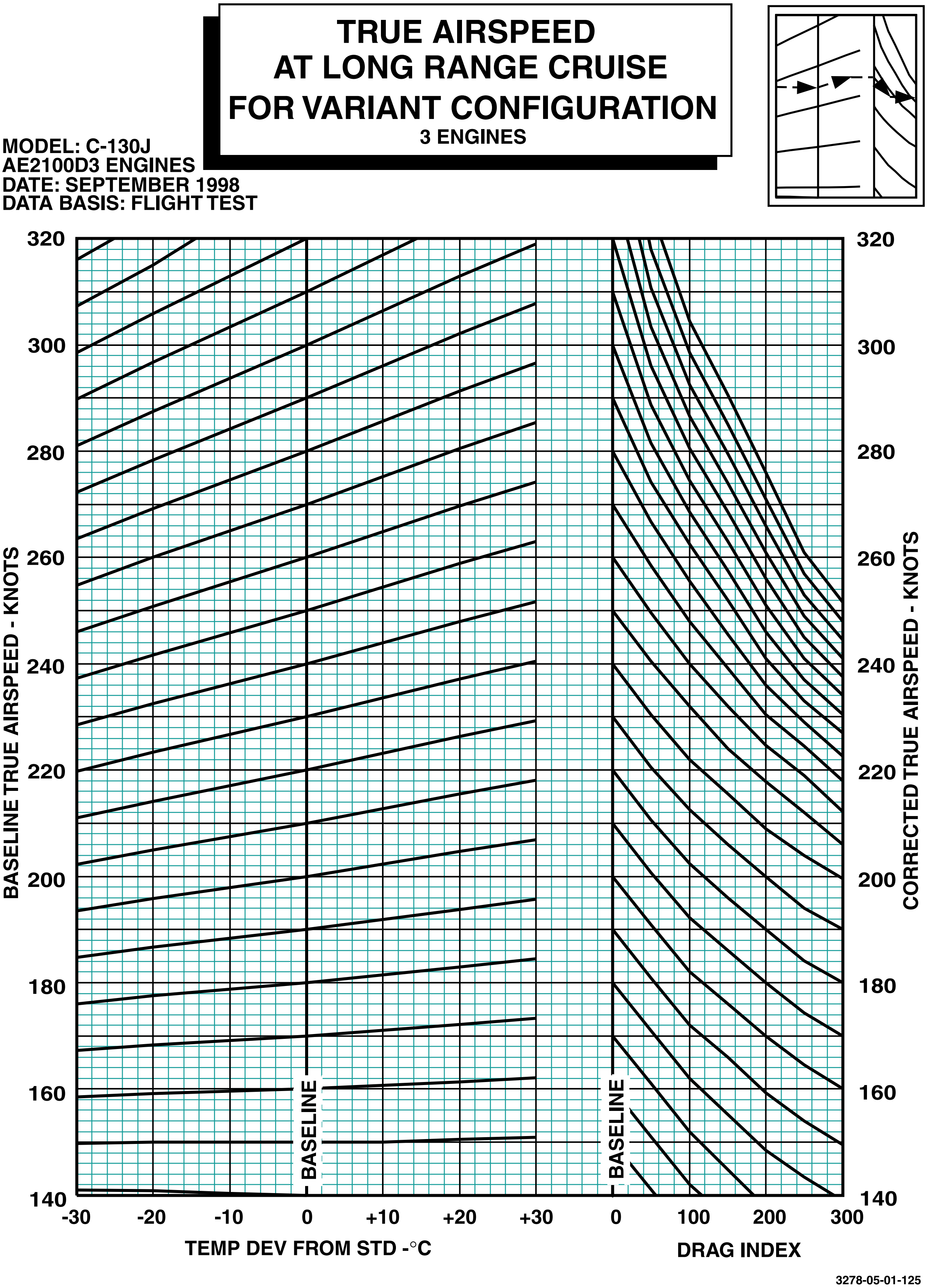
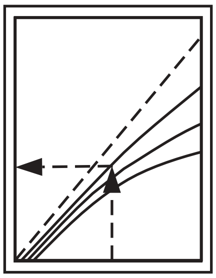


Figure 5-46.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

SPECIFIC RANGE AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

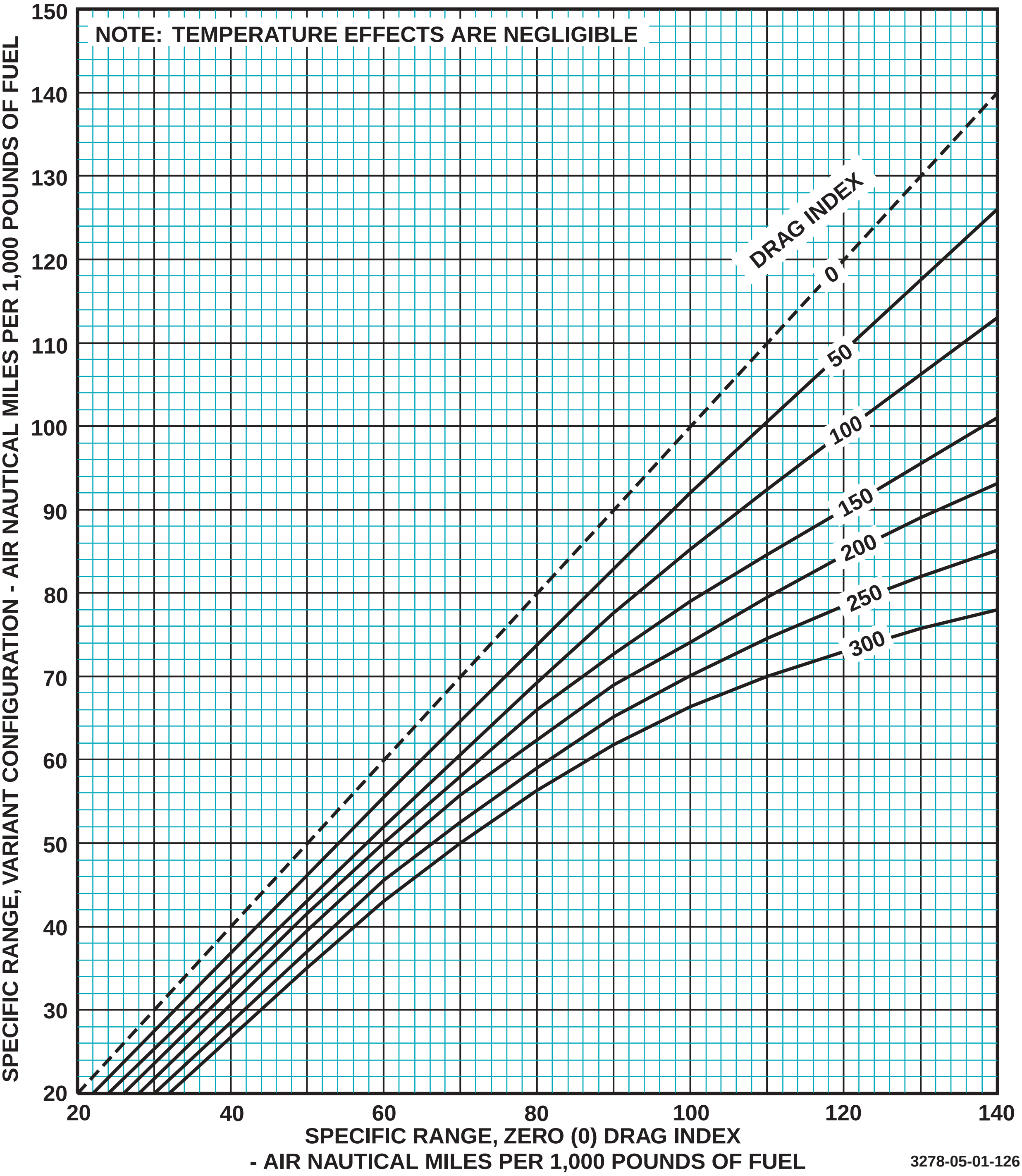
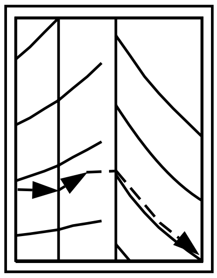


Figure 5-47.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TRUE AIRSPEED AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

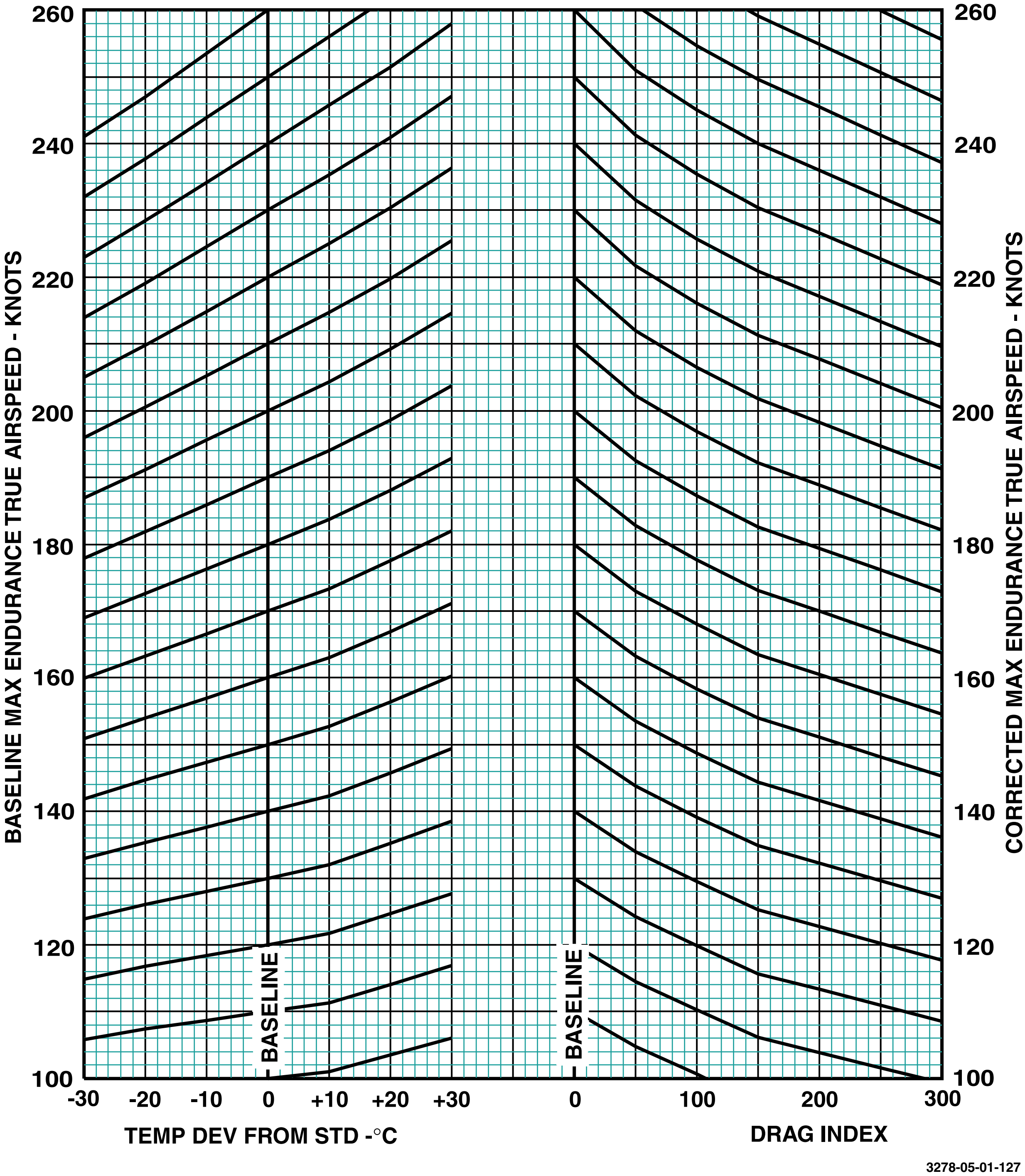


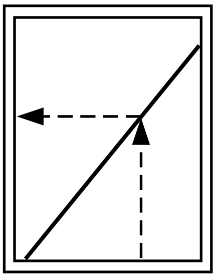
Figure 5-48.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

LONG RANGE CRUISE RANGE CORRECTION DUE TO ALL BLEED ON

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



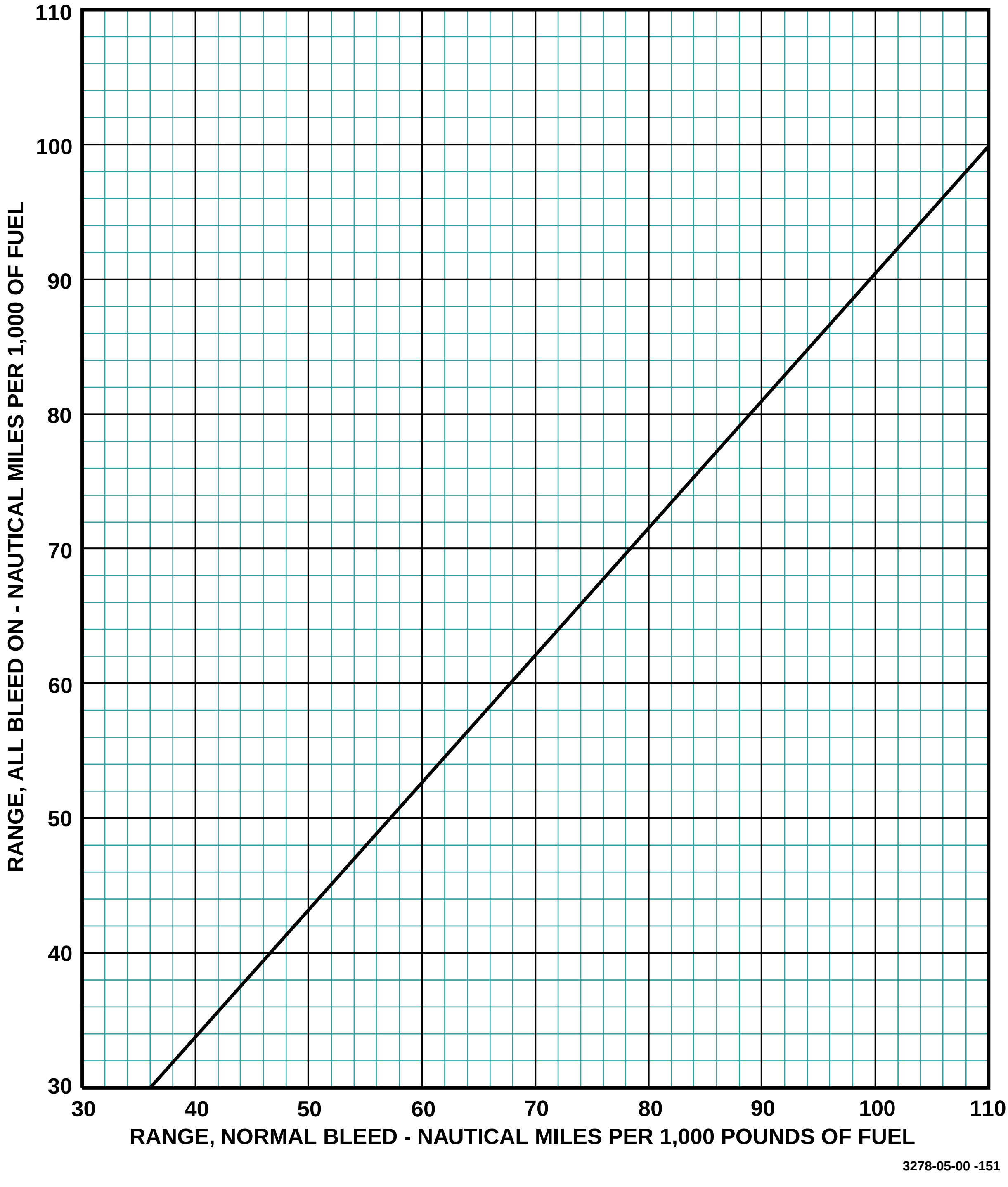


Figure 5-49.

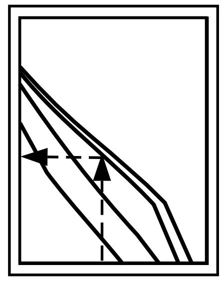
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

CRUISE CEILING

2 ENGINES NORMAL BLEED

SYMMETRICAL POWER



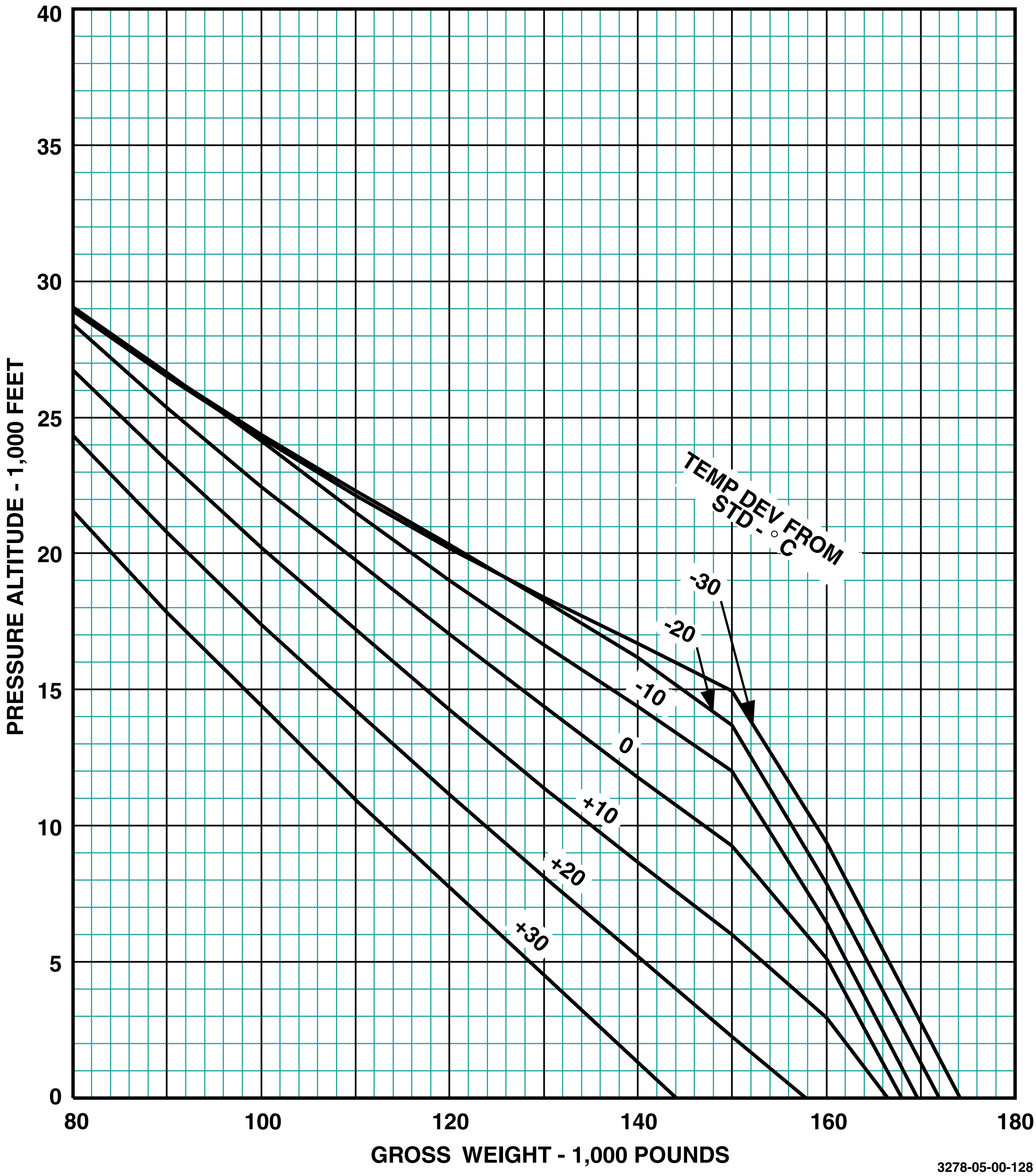


Figure 5-50.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

CRUISE CEILING FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

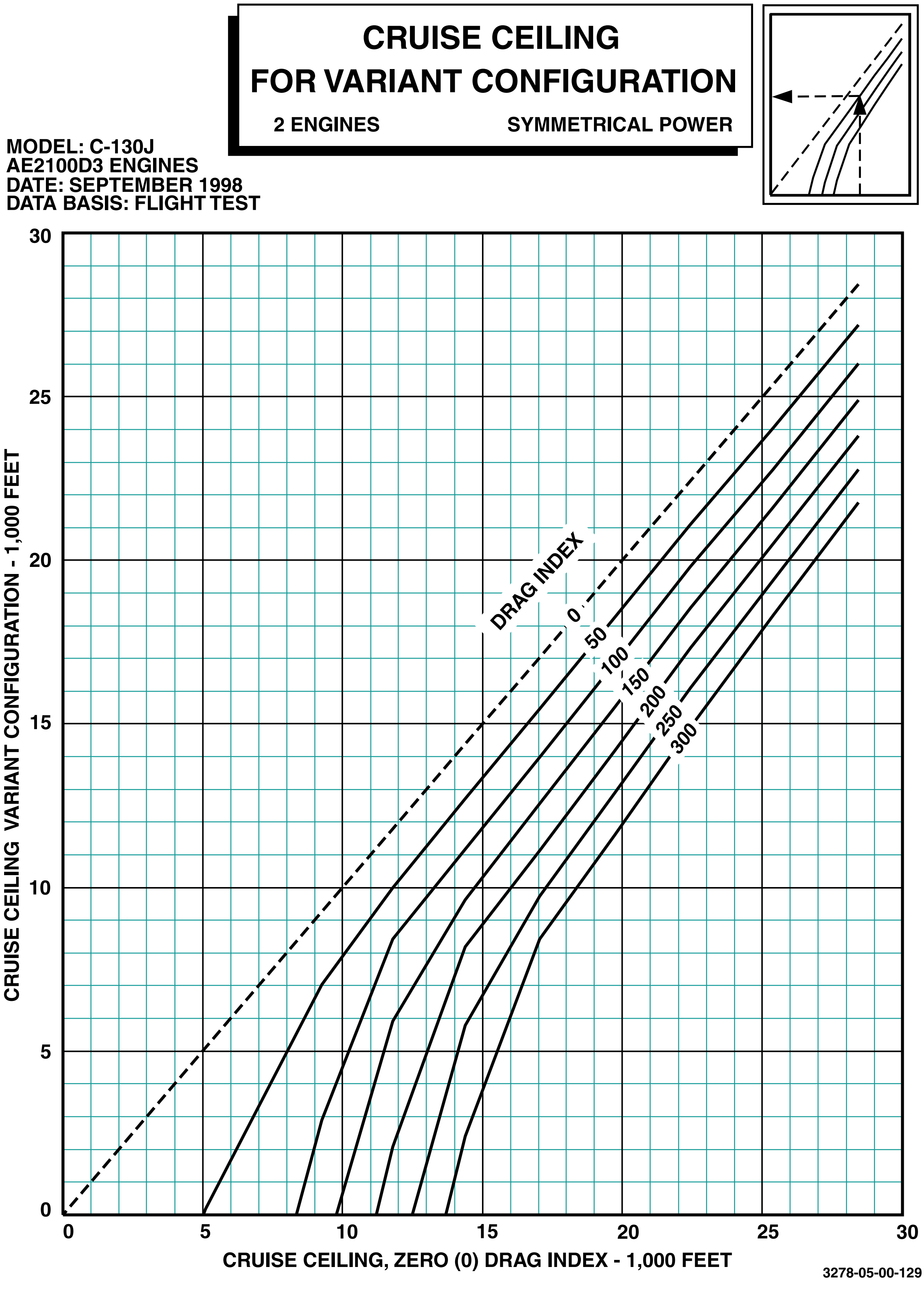


Figure 5-51.

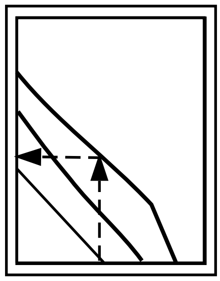
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

AIR TRAFFIC CONTROL CRUISE CEILING

2 ENGINES **NORMAL BLEED**

SYMMETRICAL POWER



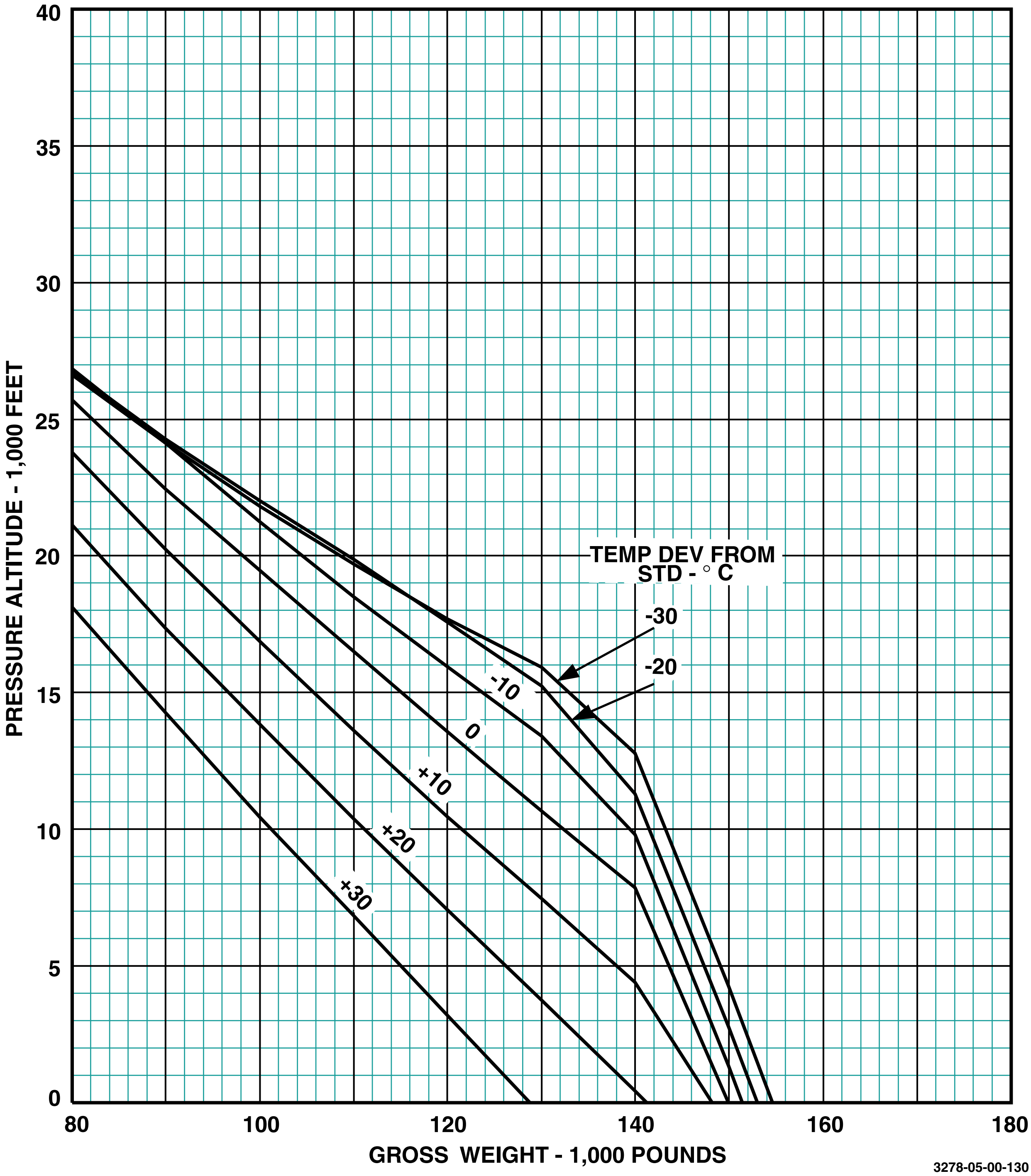
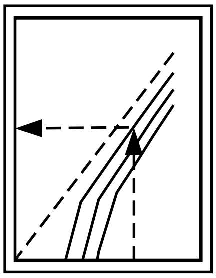


Figure 5-52.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

AIR TRAFFIC CONTROL CRUISE CEILING FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

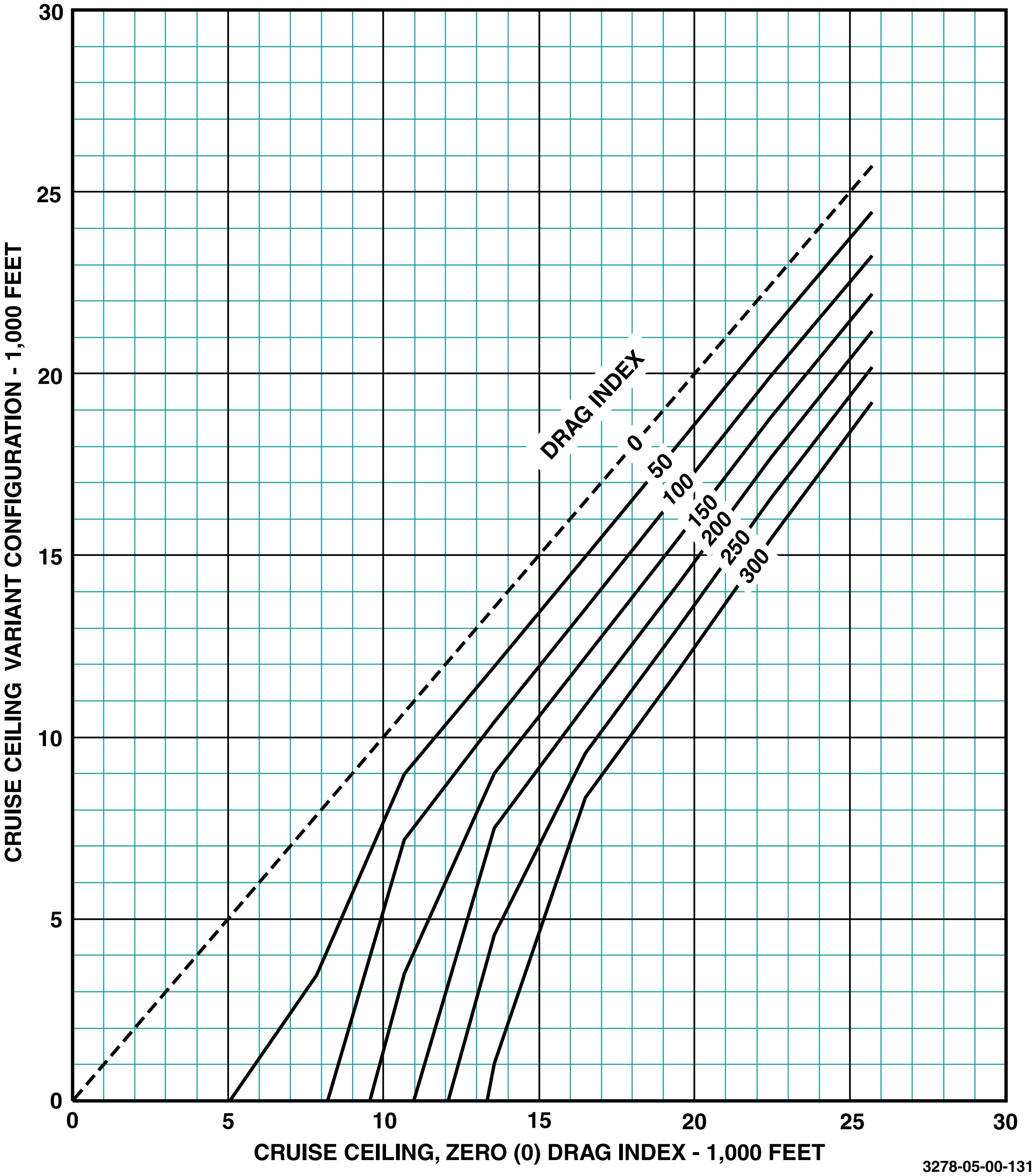


Figure 5-53.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

SEA LEVEL $\frac{1}{\sqrt{\sigma}}$ = 1.000

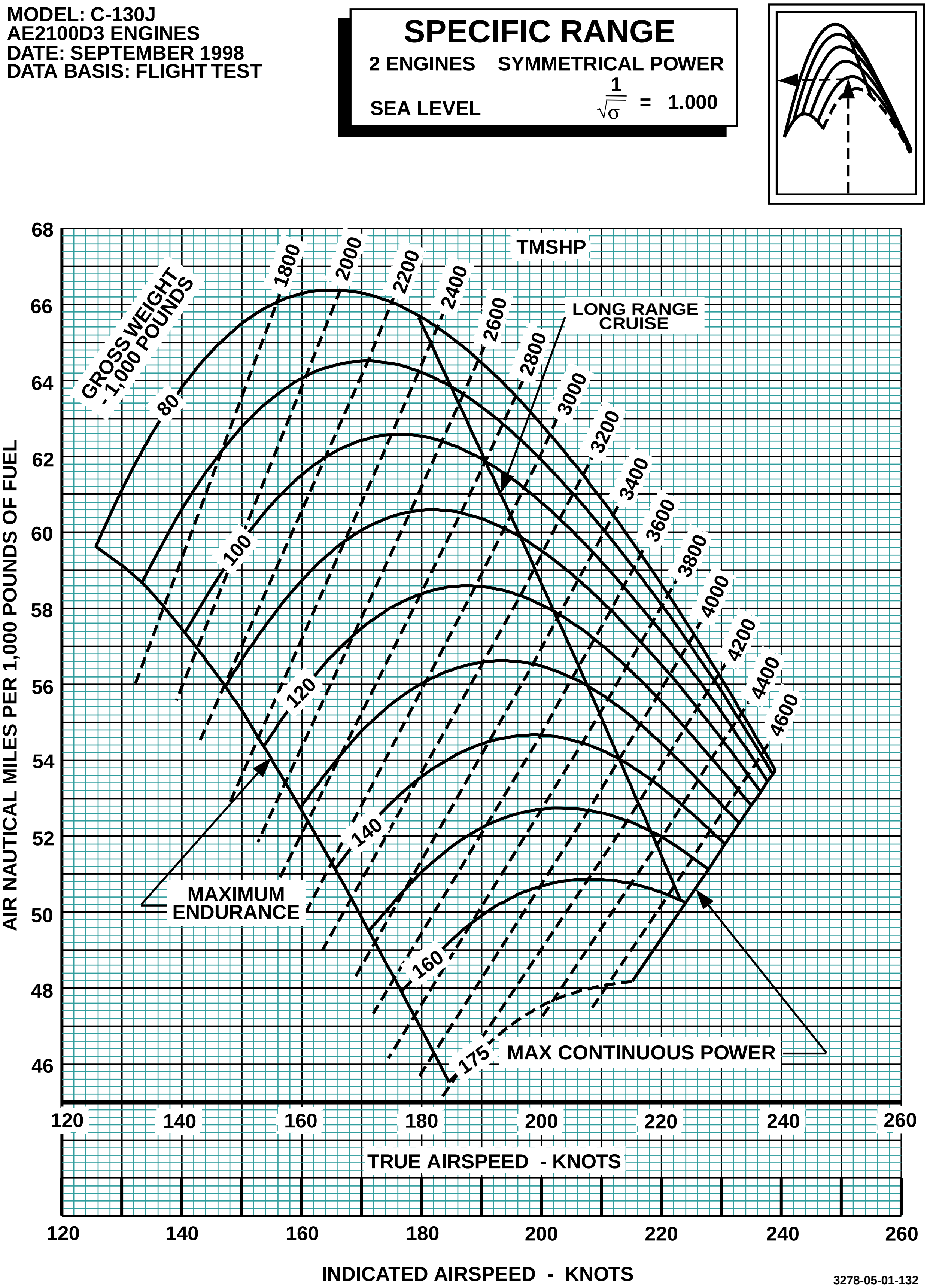


Figure 5-54.

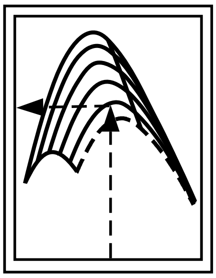
Use, copying and/or disclosure is governed by the statement on the title page of this document.

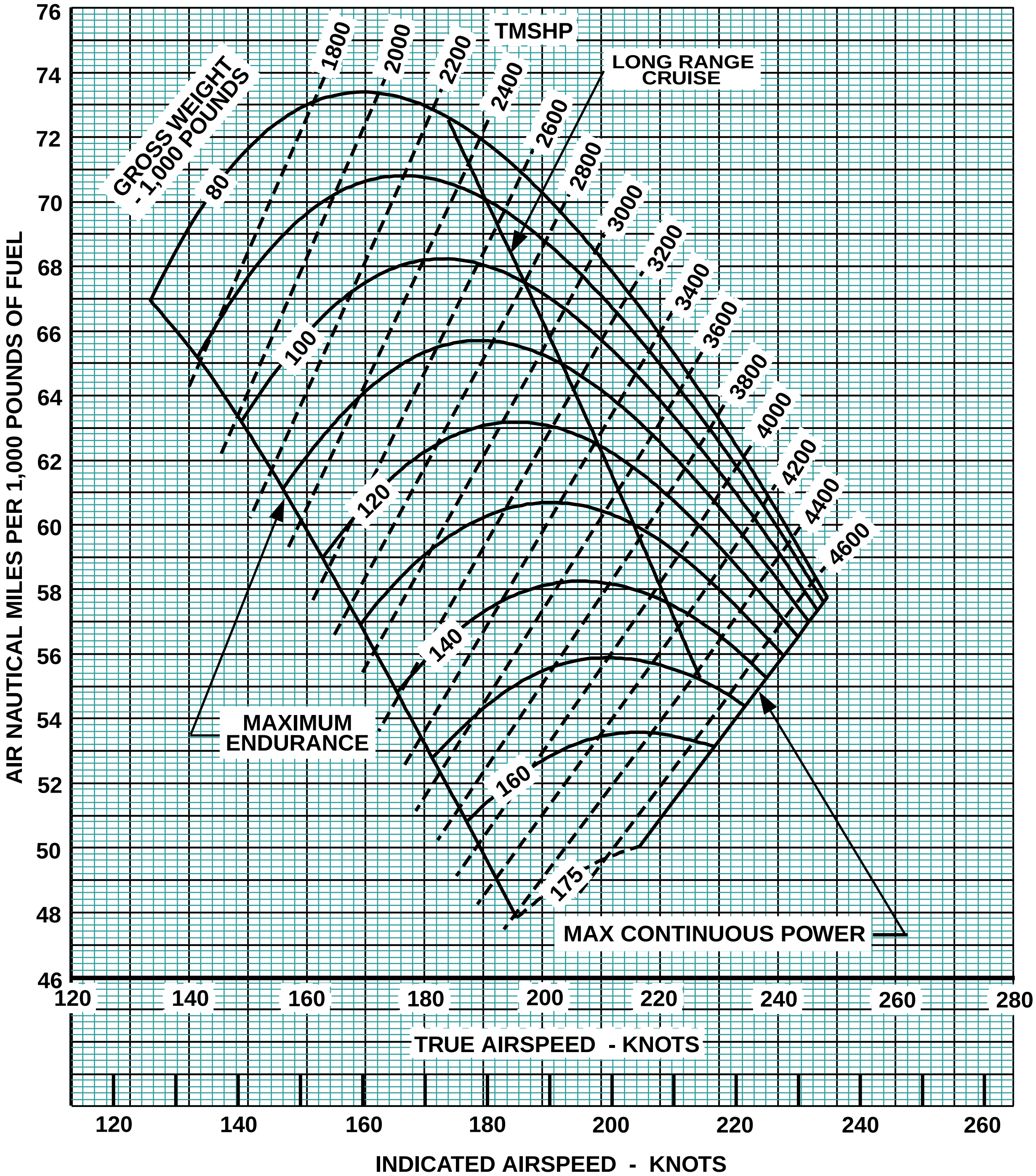
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

4,000 FEET $\frac{1}{\sqrt{\sigma}}$ = 1.0611





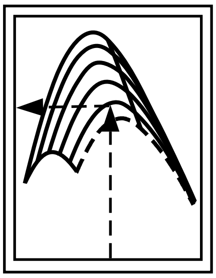
3278-05-01-133

Figure 5-55.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE
2 ENGINES SYMMETRICAL POWER
8,000 FEET $\frac{1}{\sqrt{\sigma}} = 1.1279$



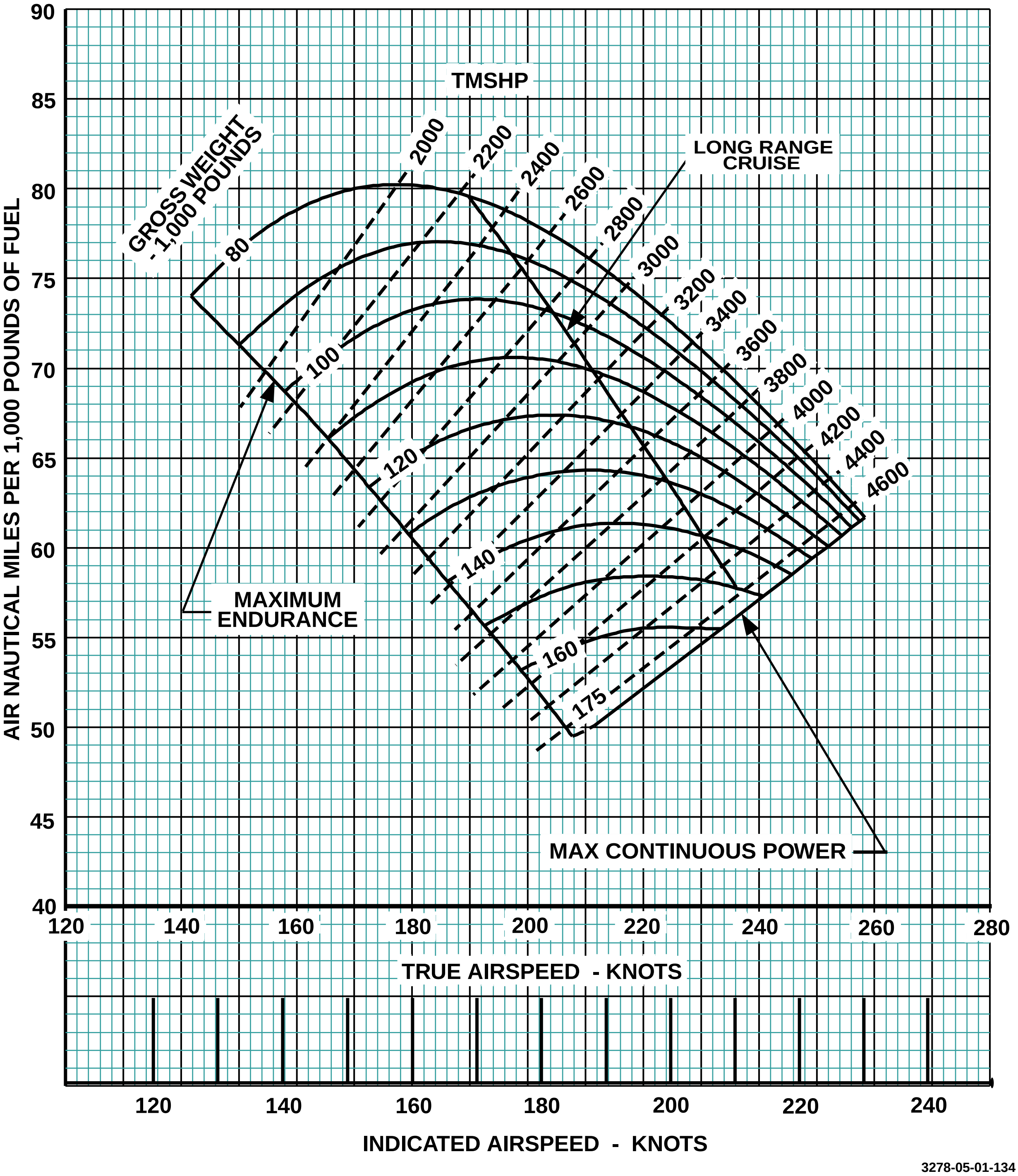


Figure 5-56.

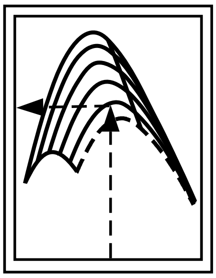
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

12,000 FEET $\frac{1}{\sqrt{\sigma}} = 1.2010$



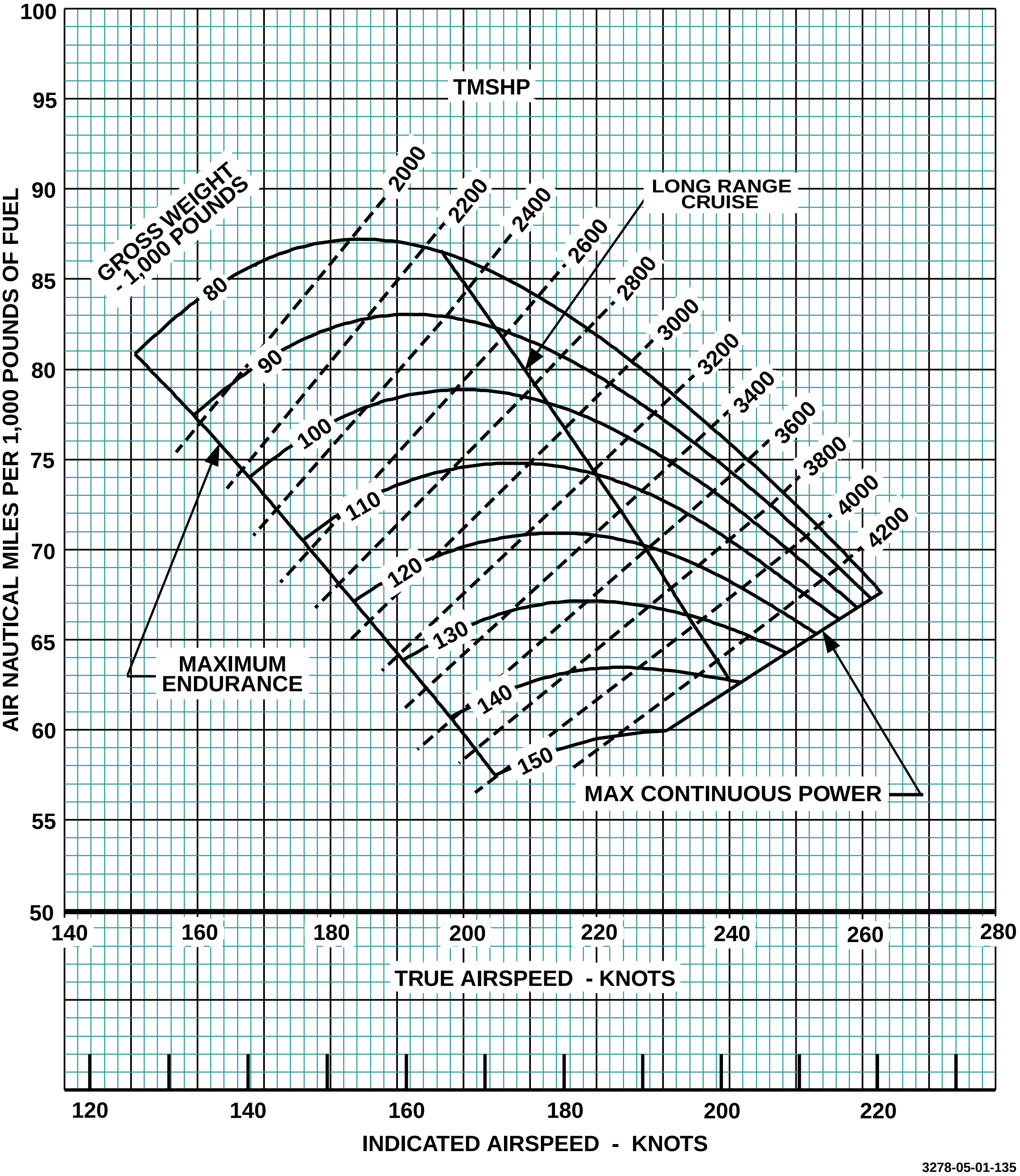


Figure 5-57.

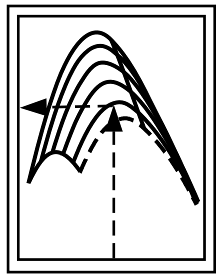
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

16,000 FEET $\frac{1}{\sqrt{\sigma}}$ = 1.2812



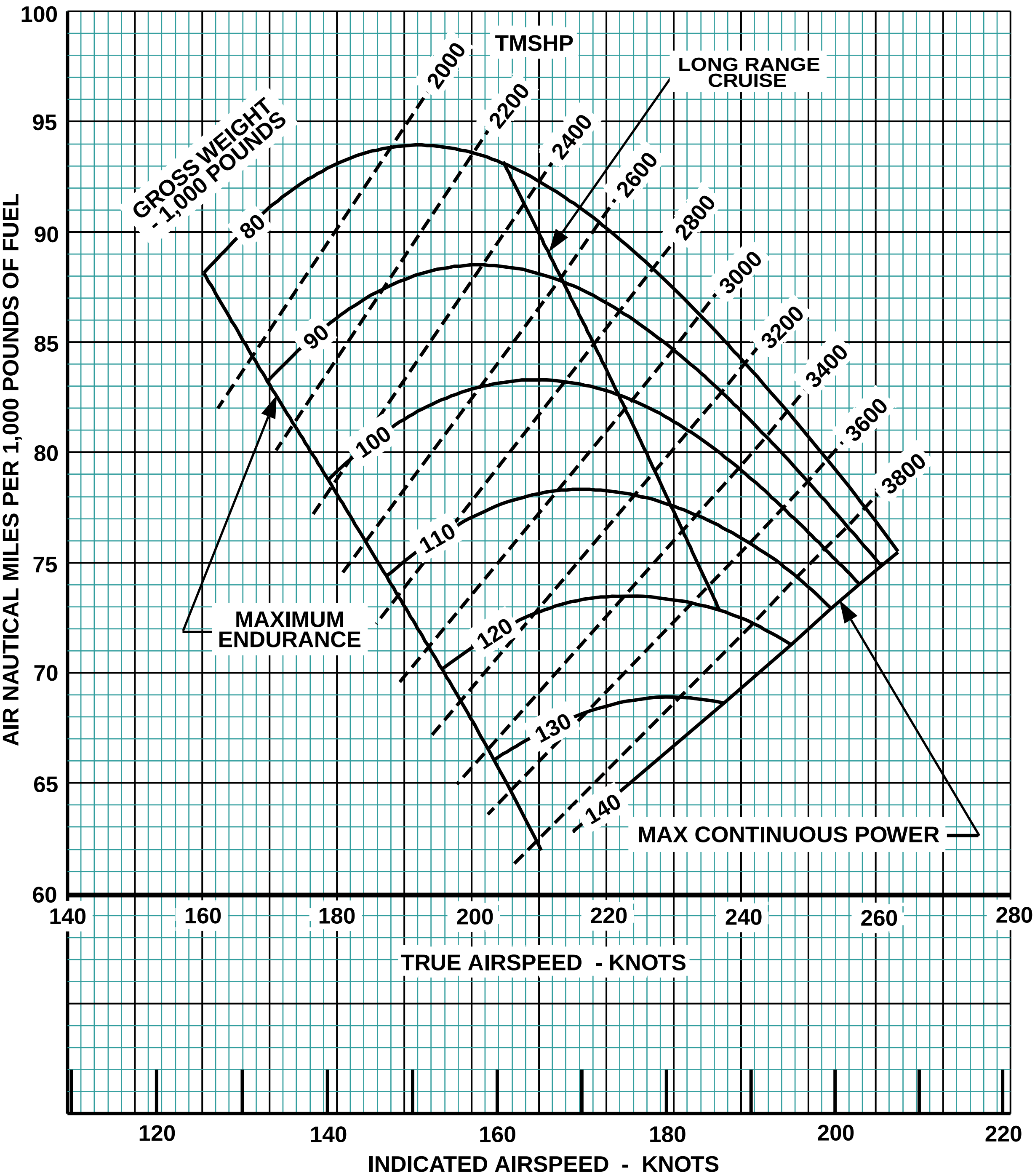


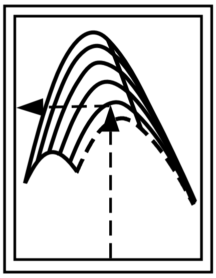
Figure 5-58.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

18,000 FEET $\frac{1}{\sqrt{\sigma}} = 1.3243$



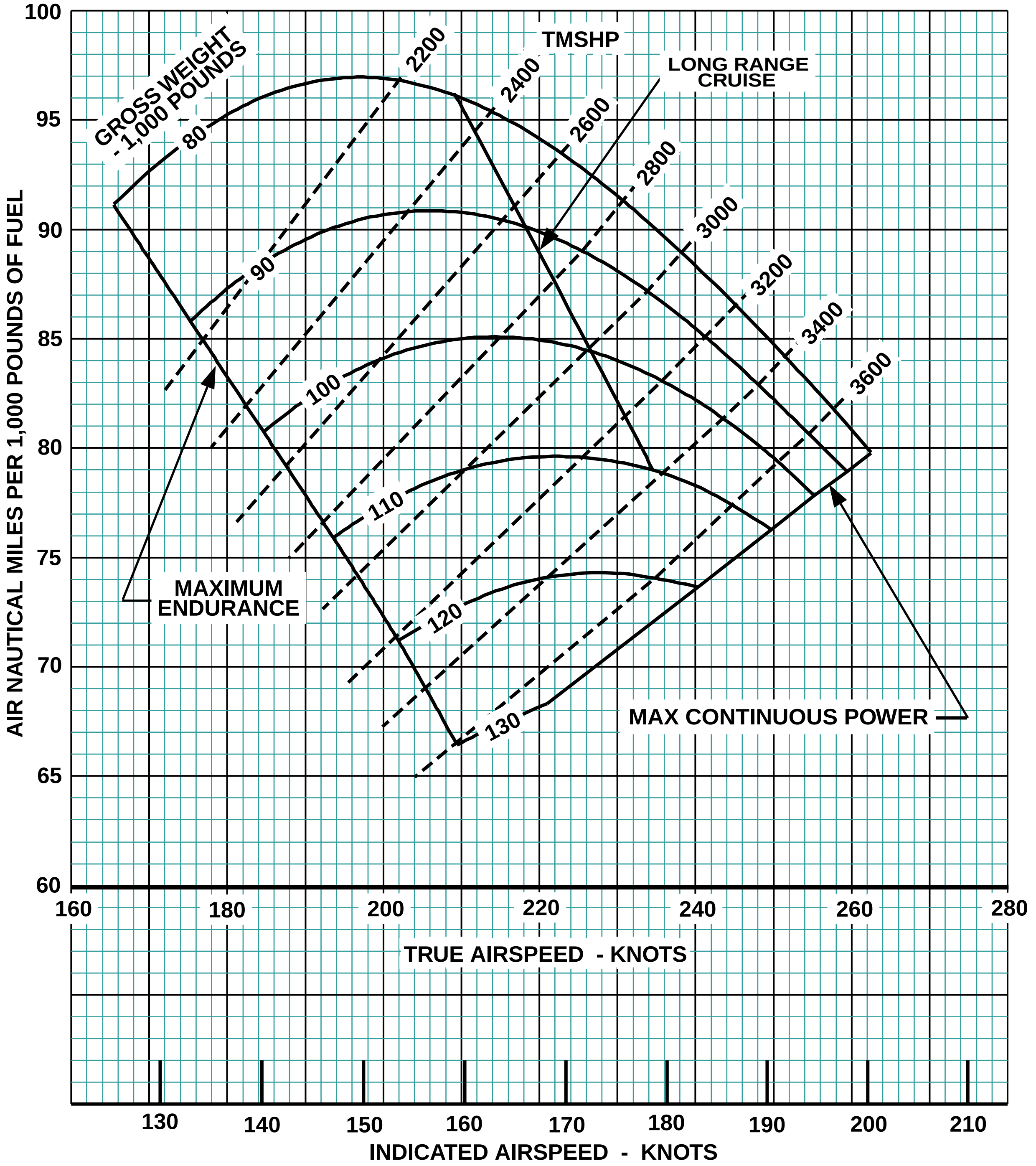


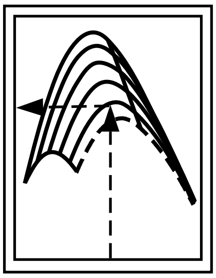
Figure 5-59.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE
2 ENGINES SYMMETRICAL POWER

20,000 FEET $\frac{1}{\sqrt{\sigma}}$ = 1.3701



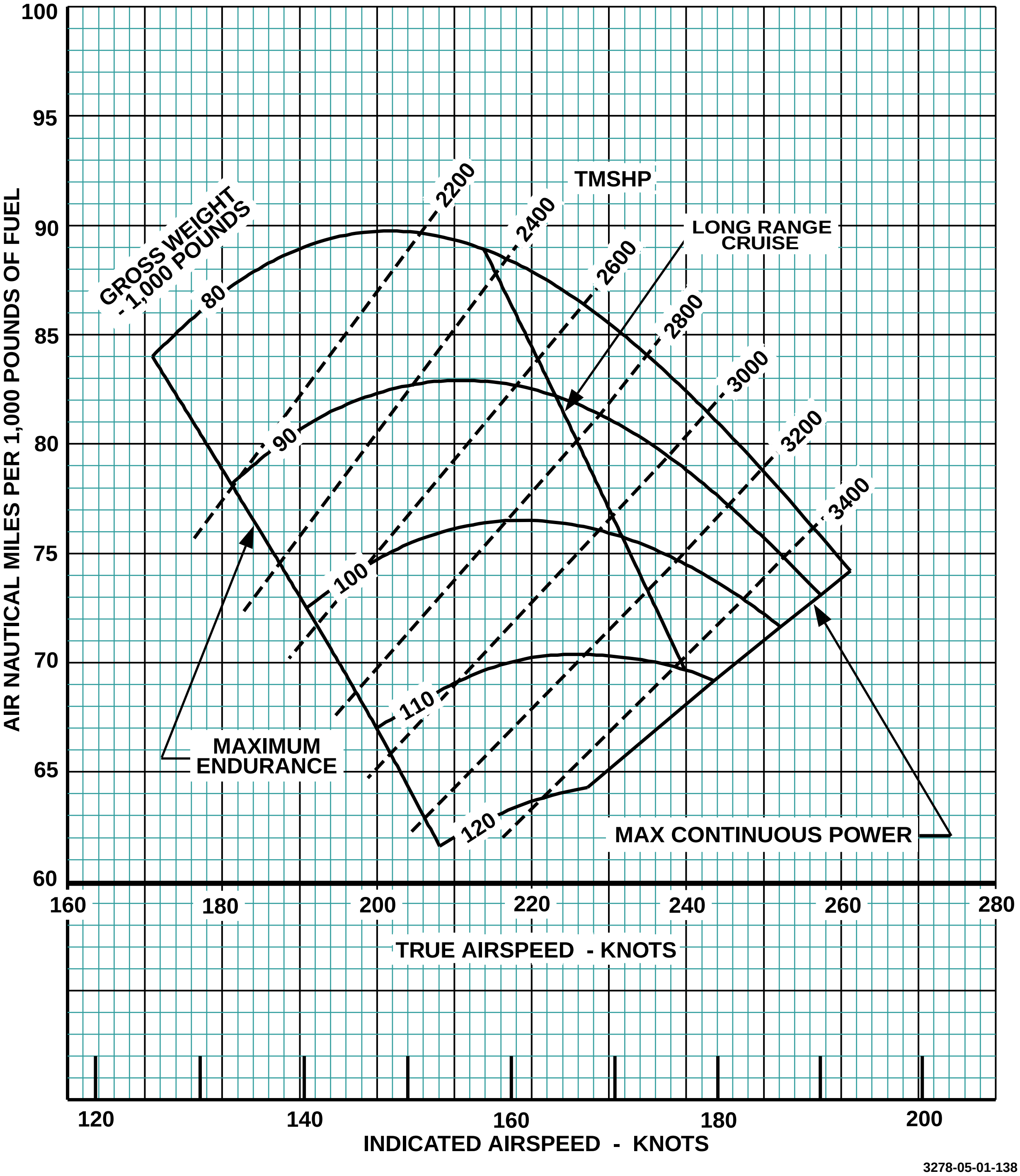


Figure 5-60.

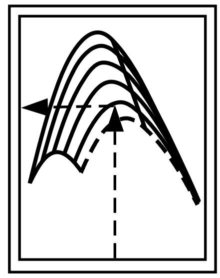
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

22,000 FEET $\frac{1}{\sqrt{\sigma}} = 1.4171$



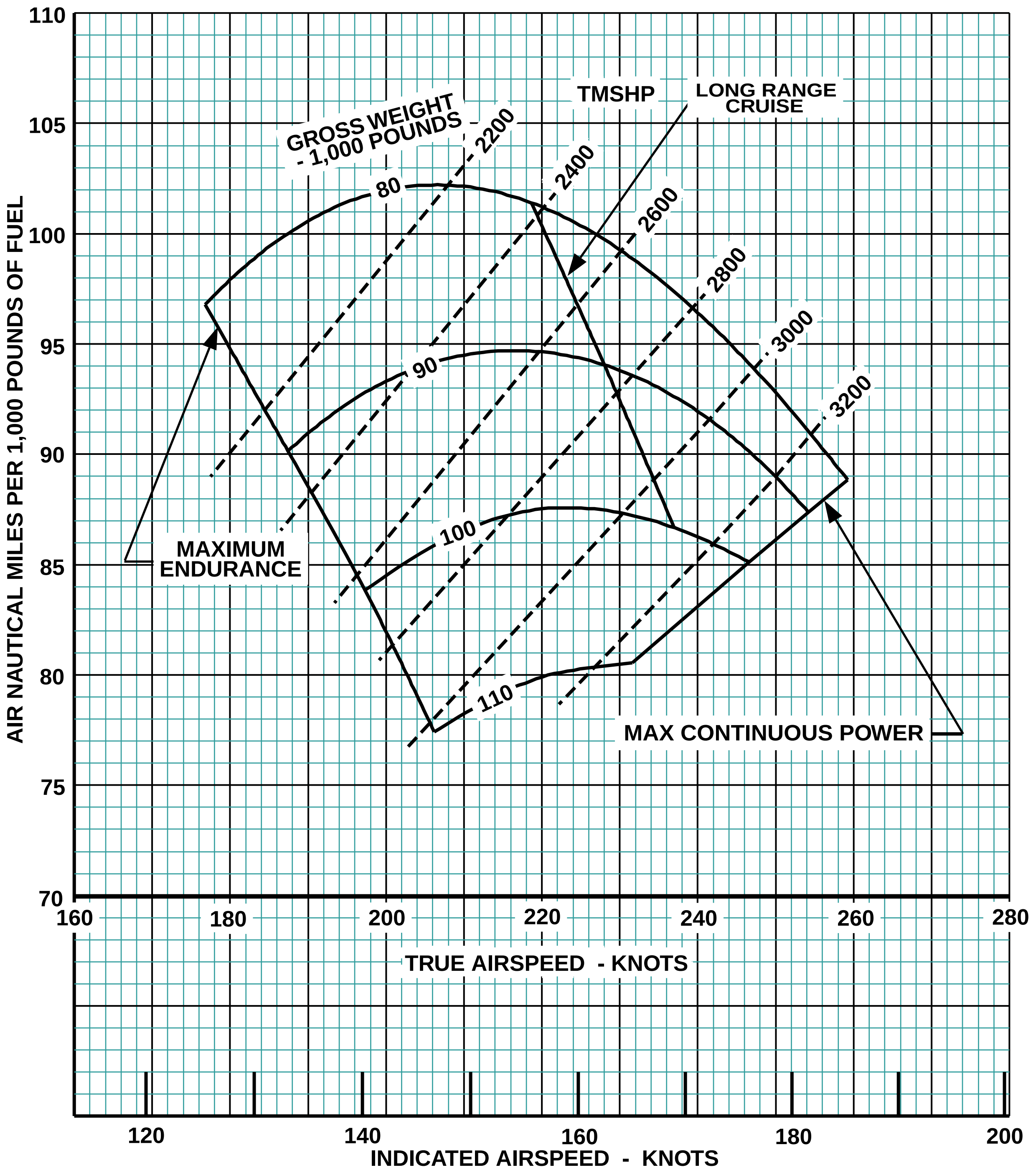
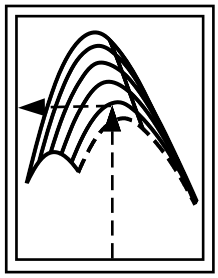


Figure 5-61.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE
2 ENGINES SYMMETRICAL POWER
23,000 FEET $\frac{1}{\sqrt{\sigma}} = 1.4418$



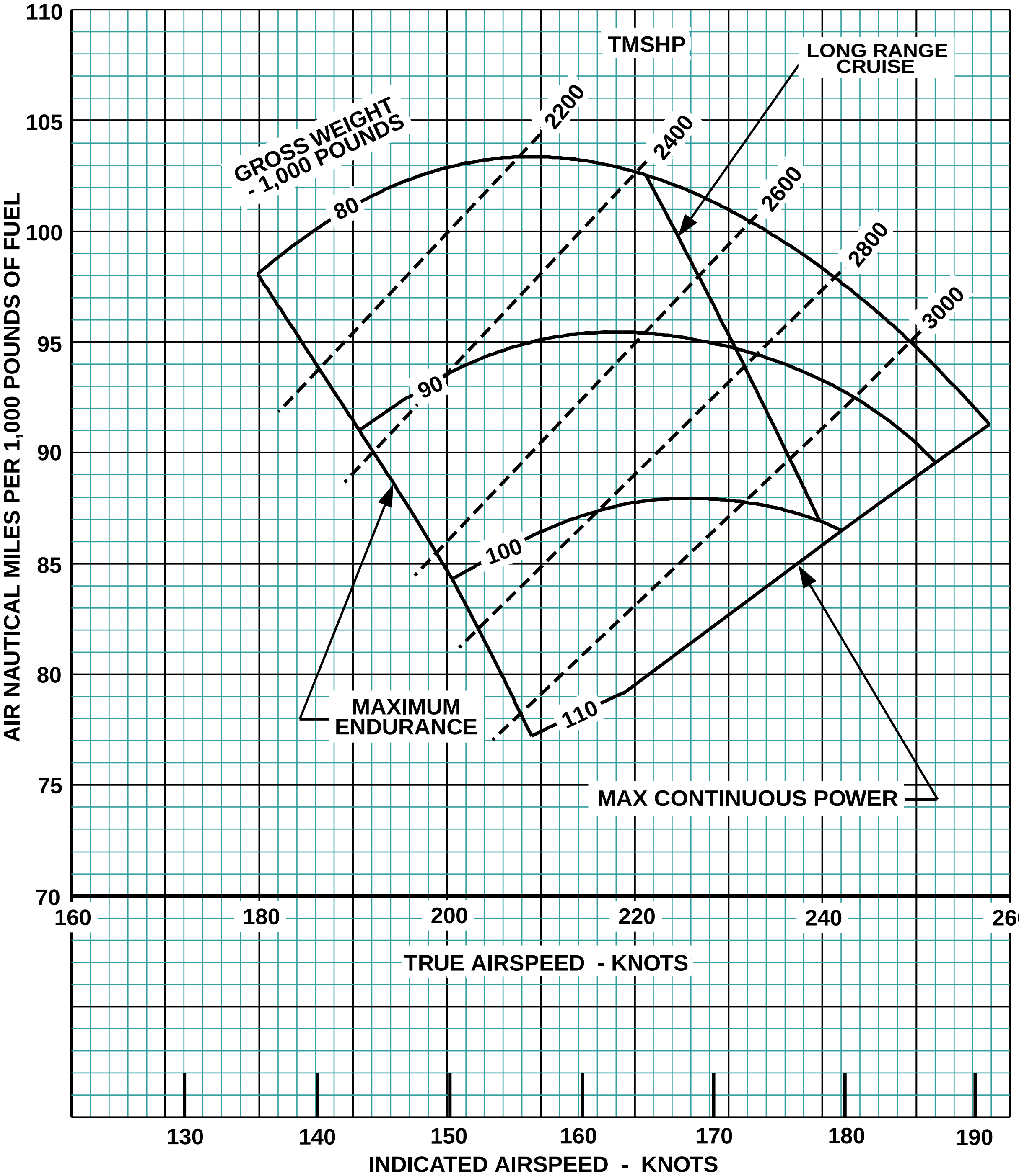


Figure 5-62.

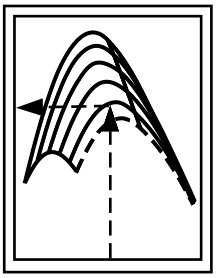
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SPECIFIC RANGE

2 ENGINES SYMMETRICAL POWER

24,000 FEET $\frac{1}{\sqrt{\sigma}} = 1.4671$



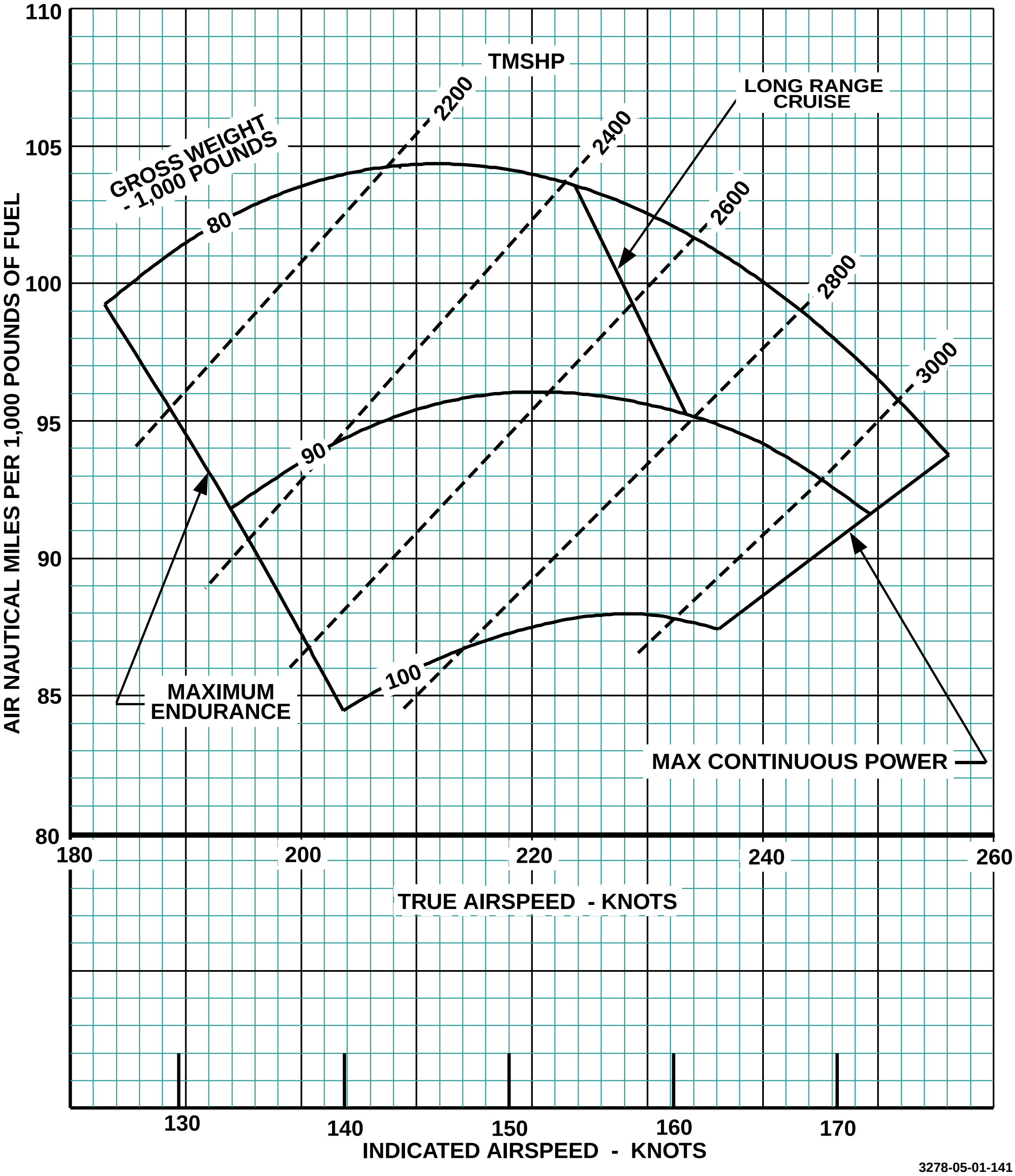
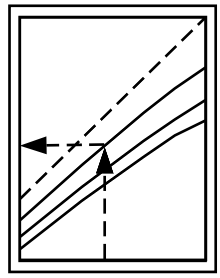


Figure 5-63.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

SPECIFIC RANGE AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

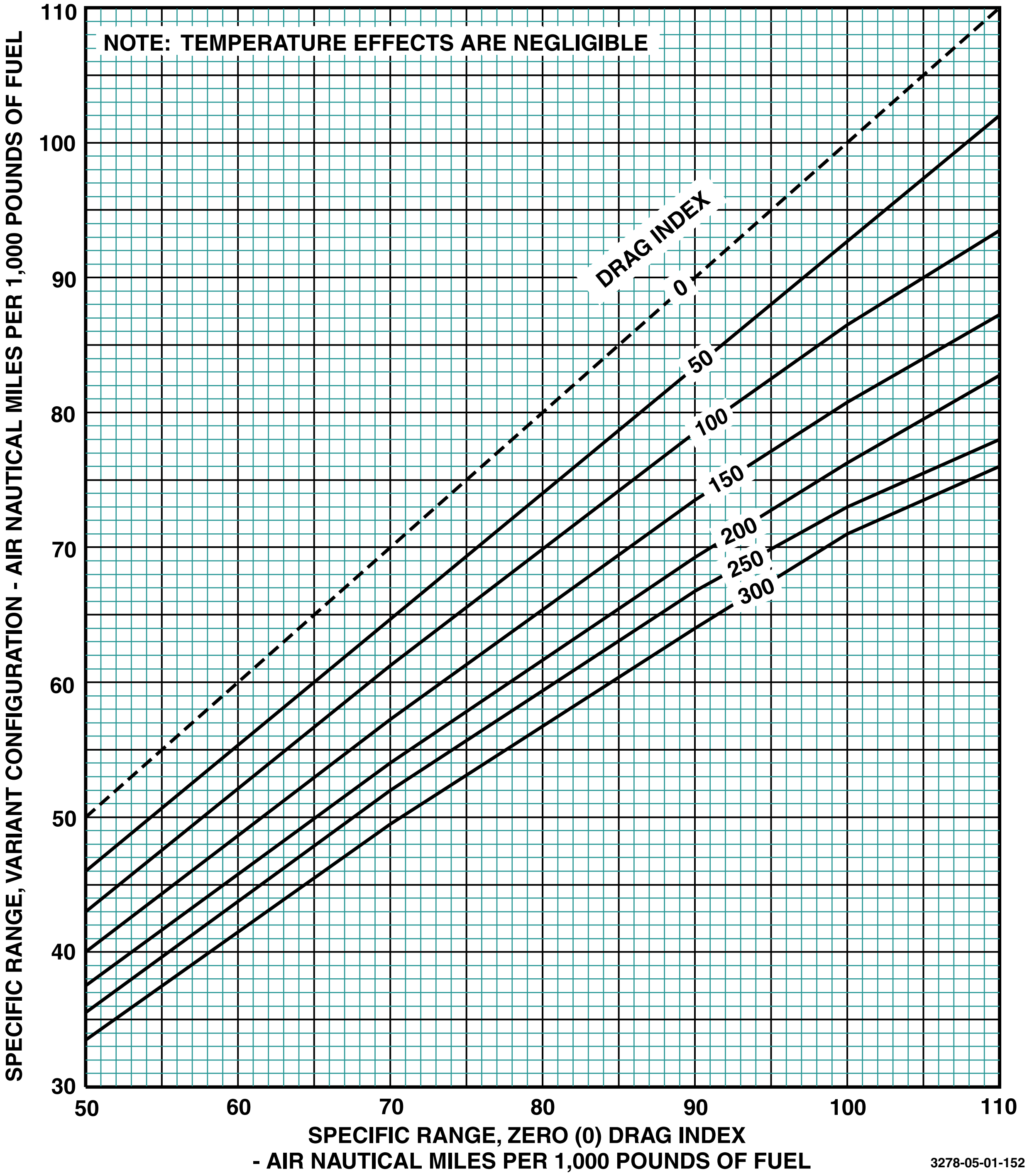


Figure 5-64.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TRUE AIRSPEED AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER

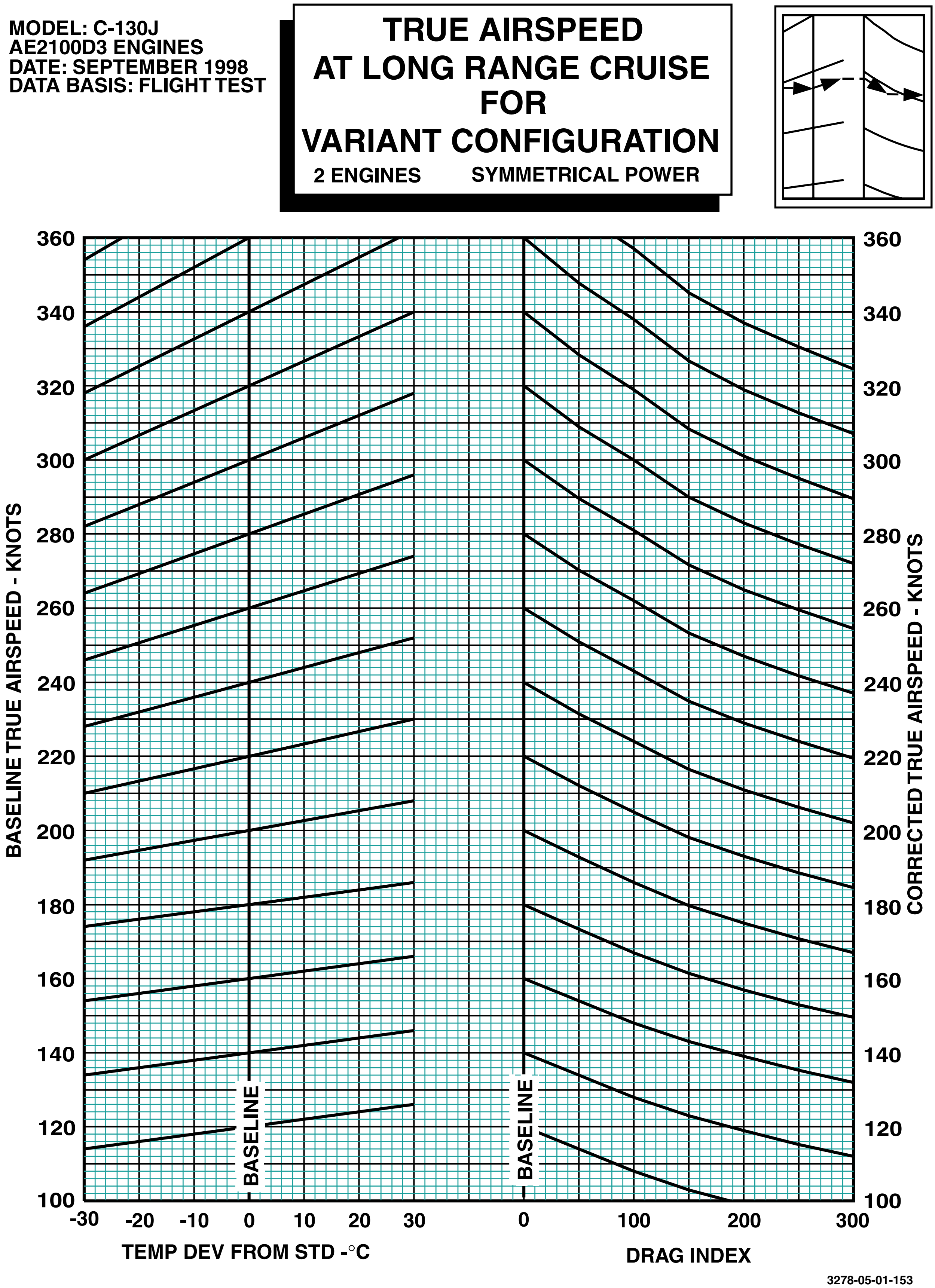


Figure 5-65.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

SPECIFIC RANGE AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

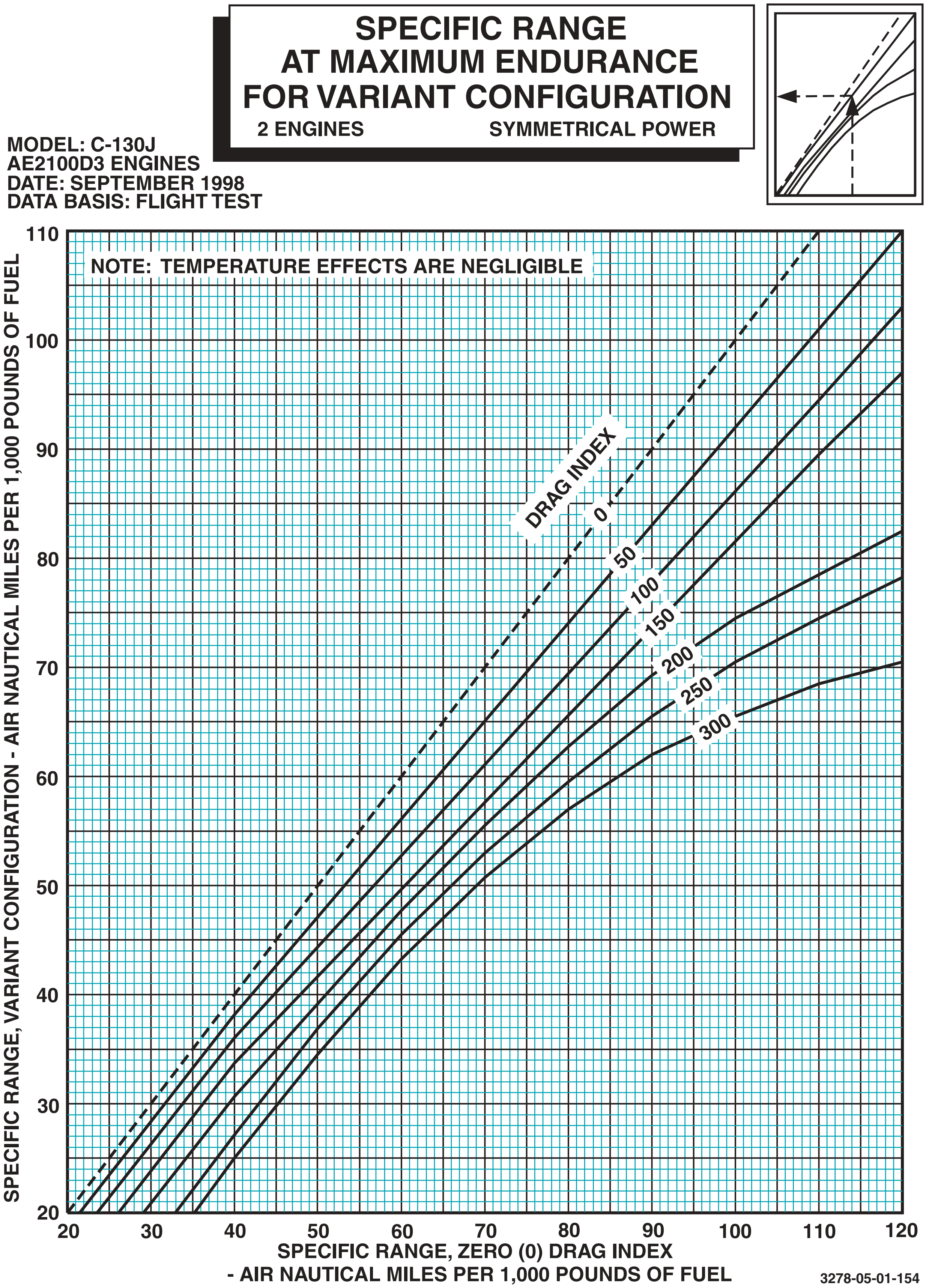


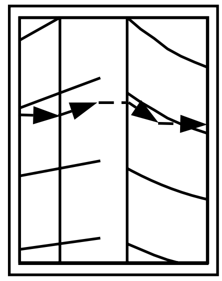
Figure 5-66.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TRUE AIRSPEED AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER



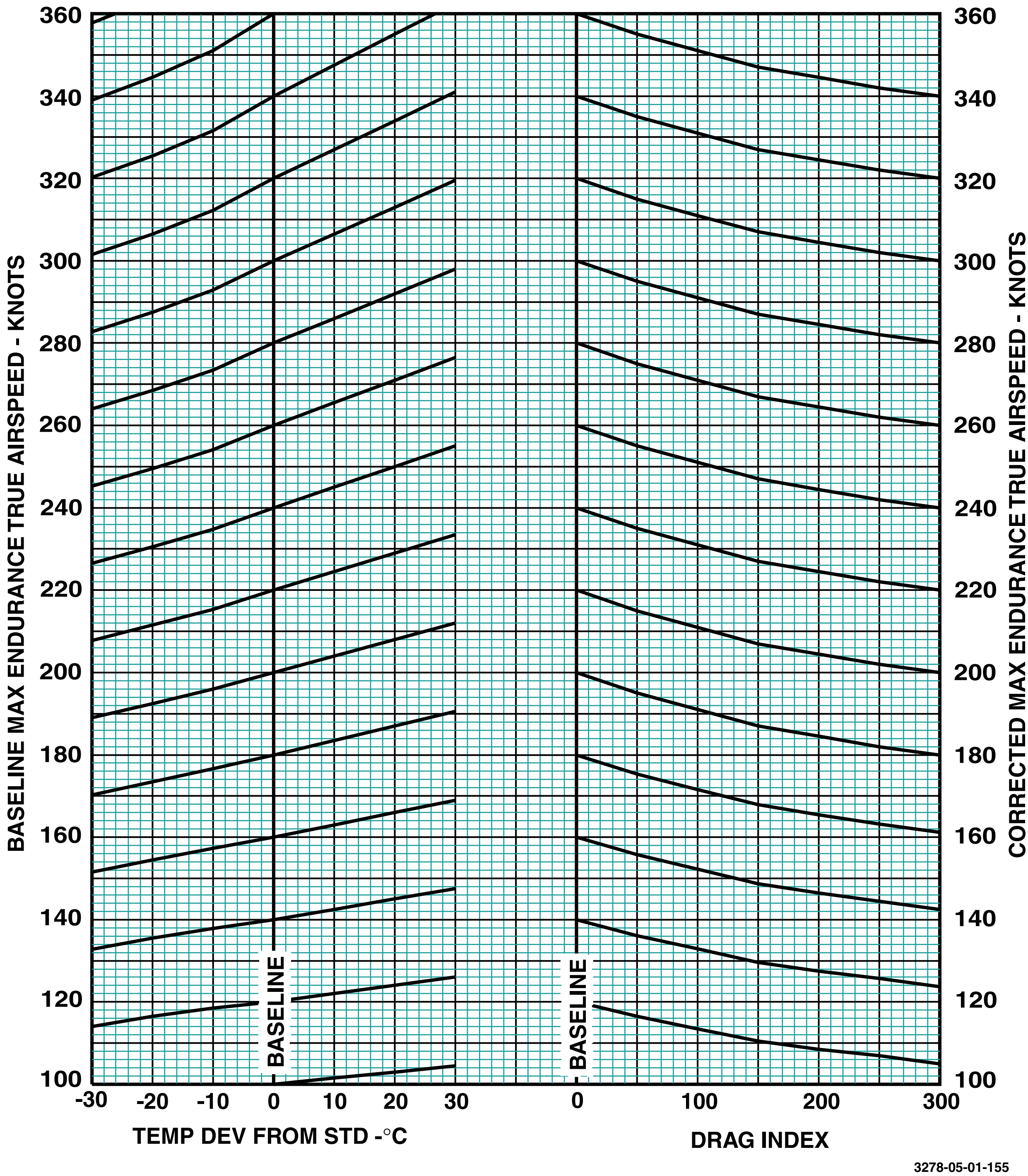


Figure 5-67.

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RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 180 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

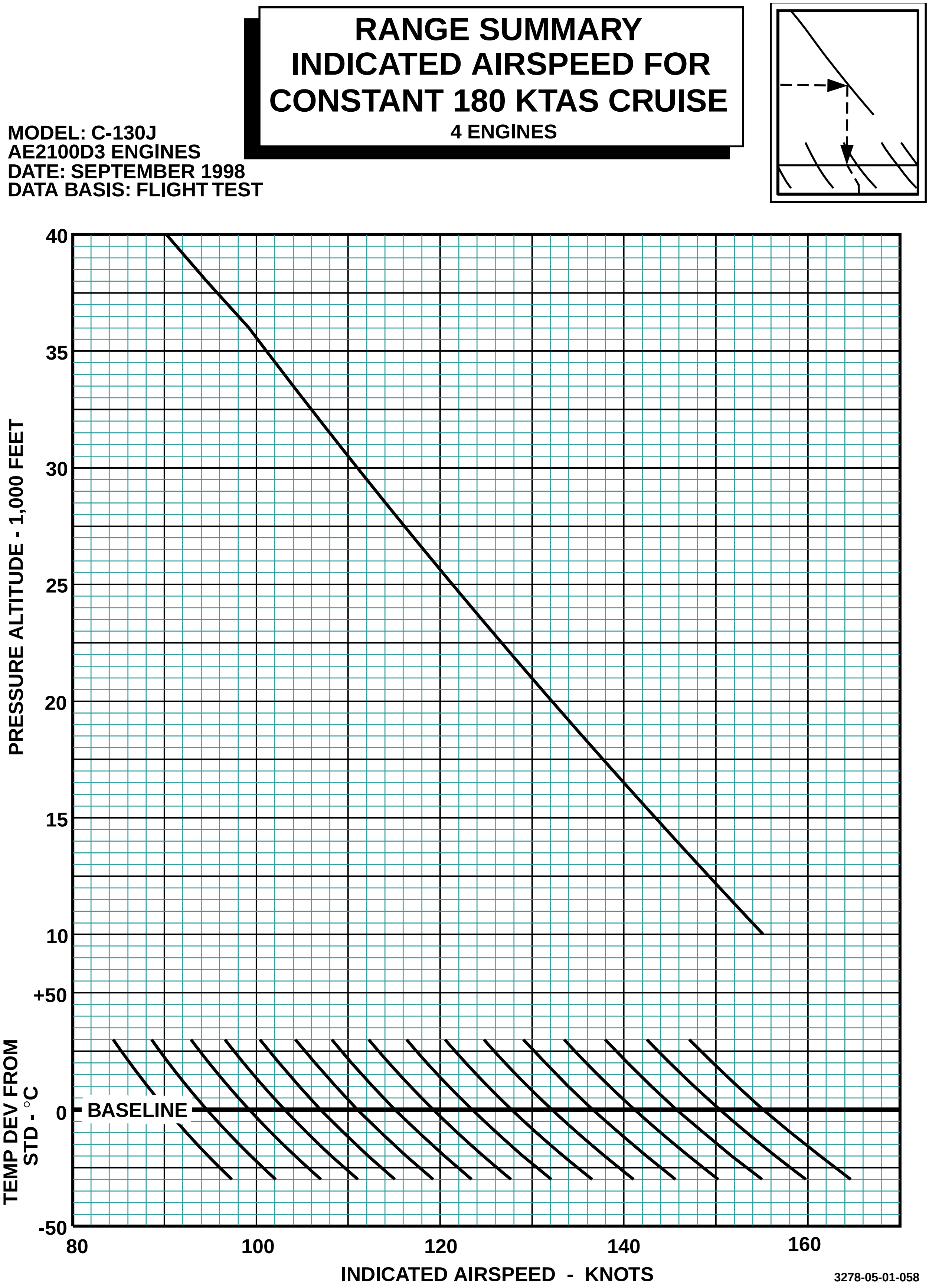


Figure 5-68.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 180 KTAS CRUISE

4 ENGINES

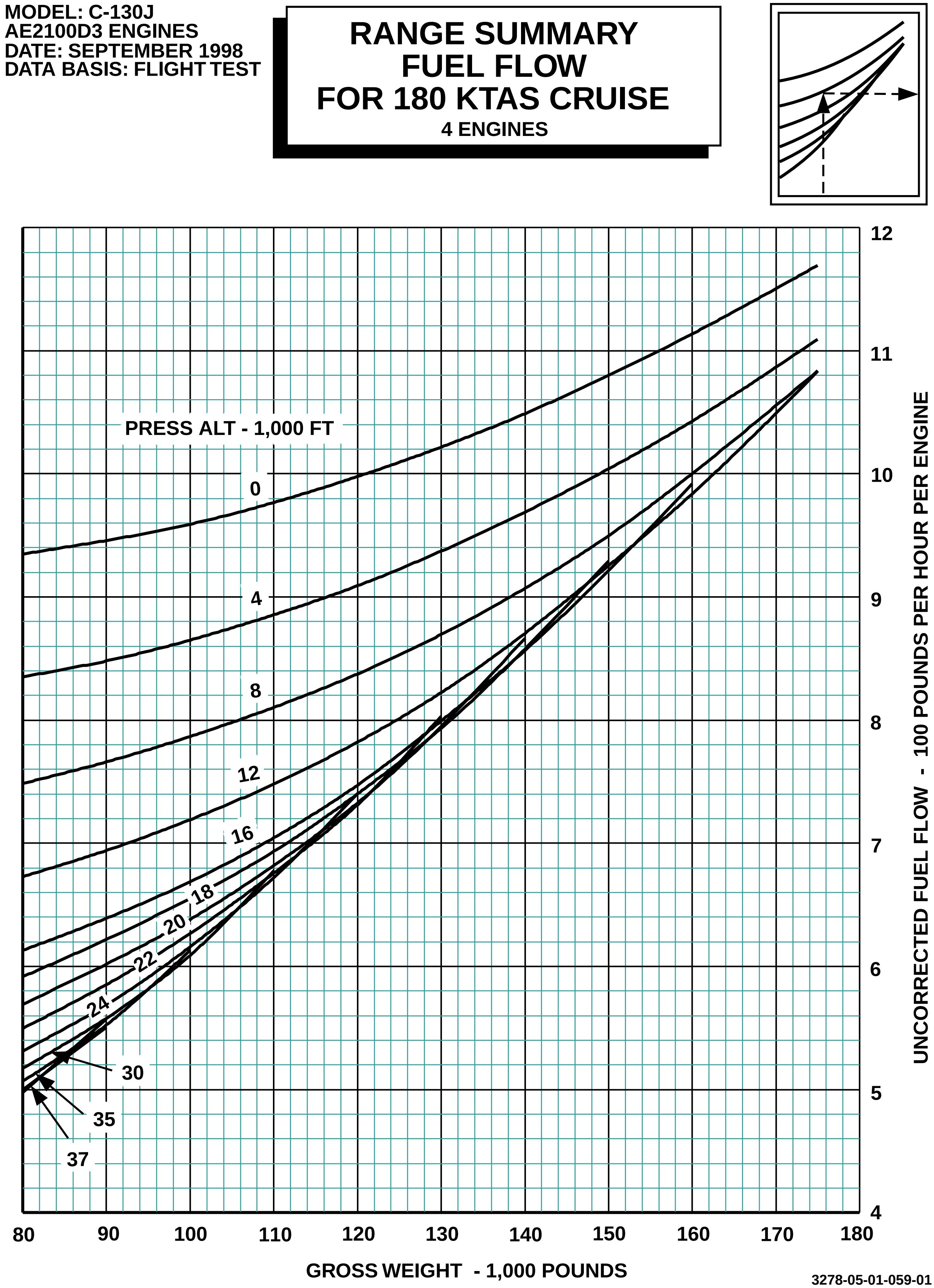


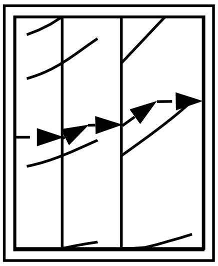
Figure 5-69. (Sheet 1 of 2)

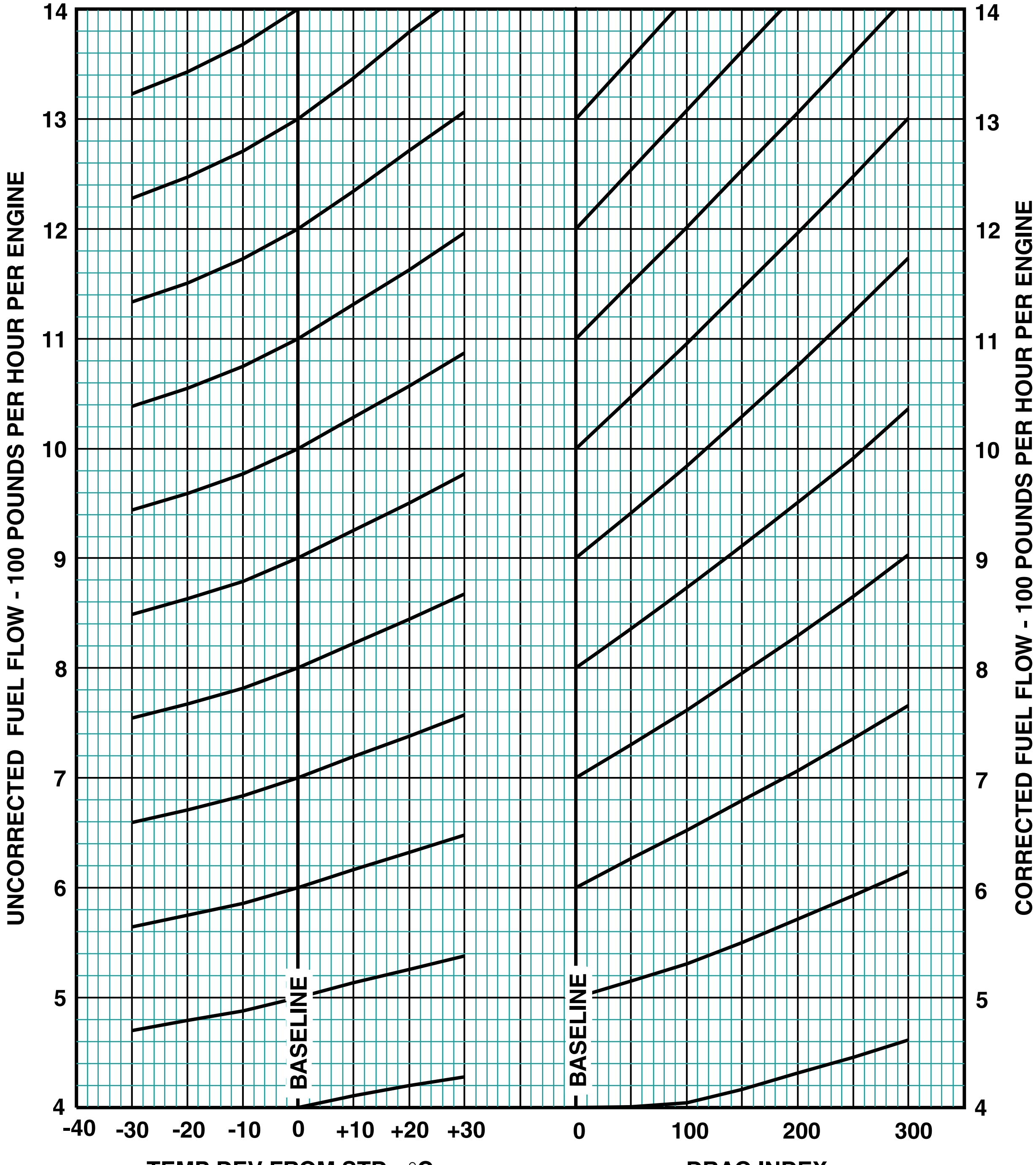
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 180 KTAS CRUISE

4 ENGINES





3278-05-01-059-02

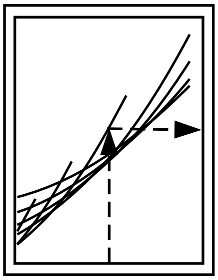
Figure 5-69. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 180 KTAS CRUISE

4 ENGINES



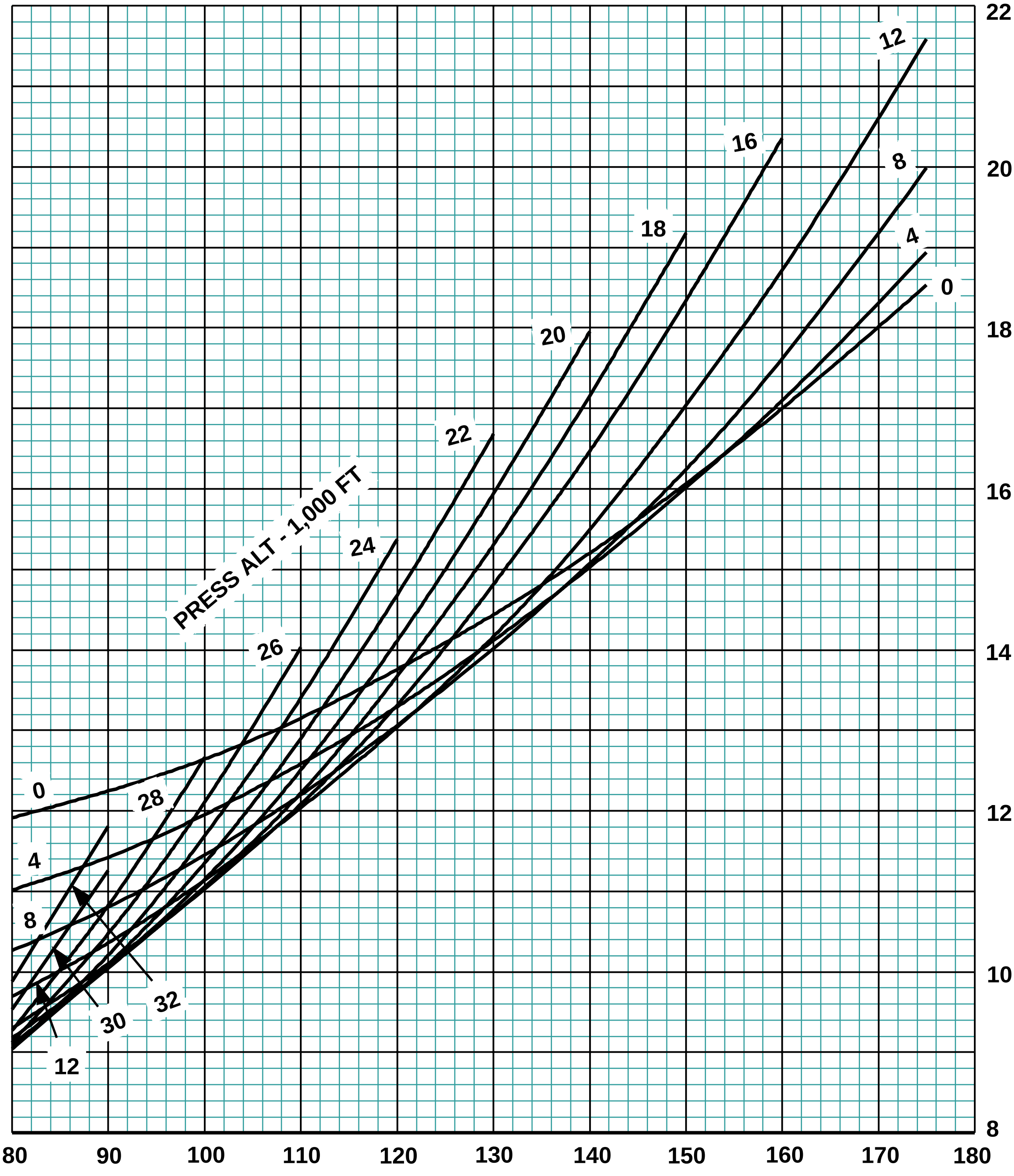


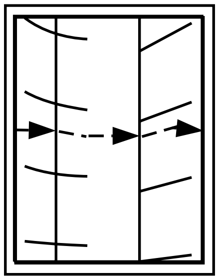
Figure 5-70. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 180 KTAS CRUISE

4 ENGINES



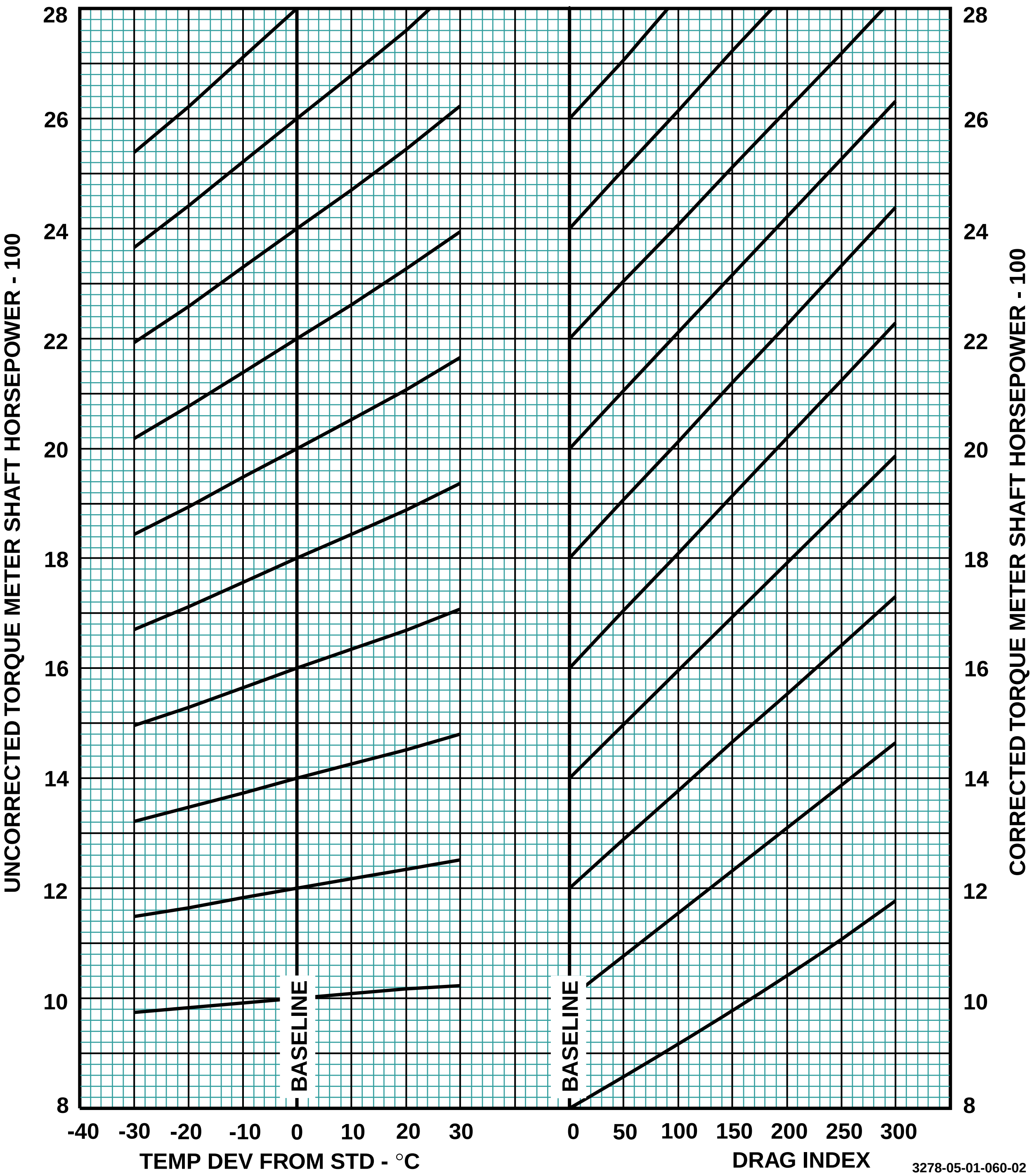


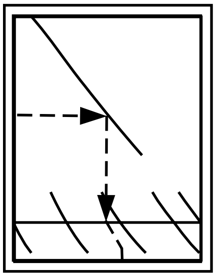
Figure 5-70. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 200 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



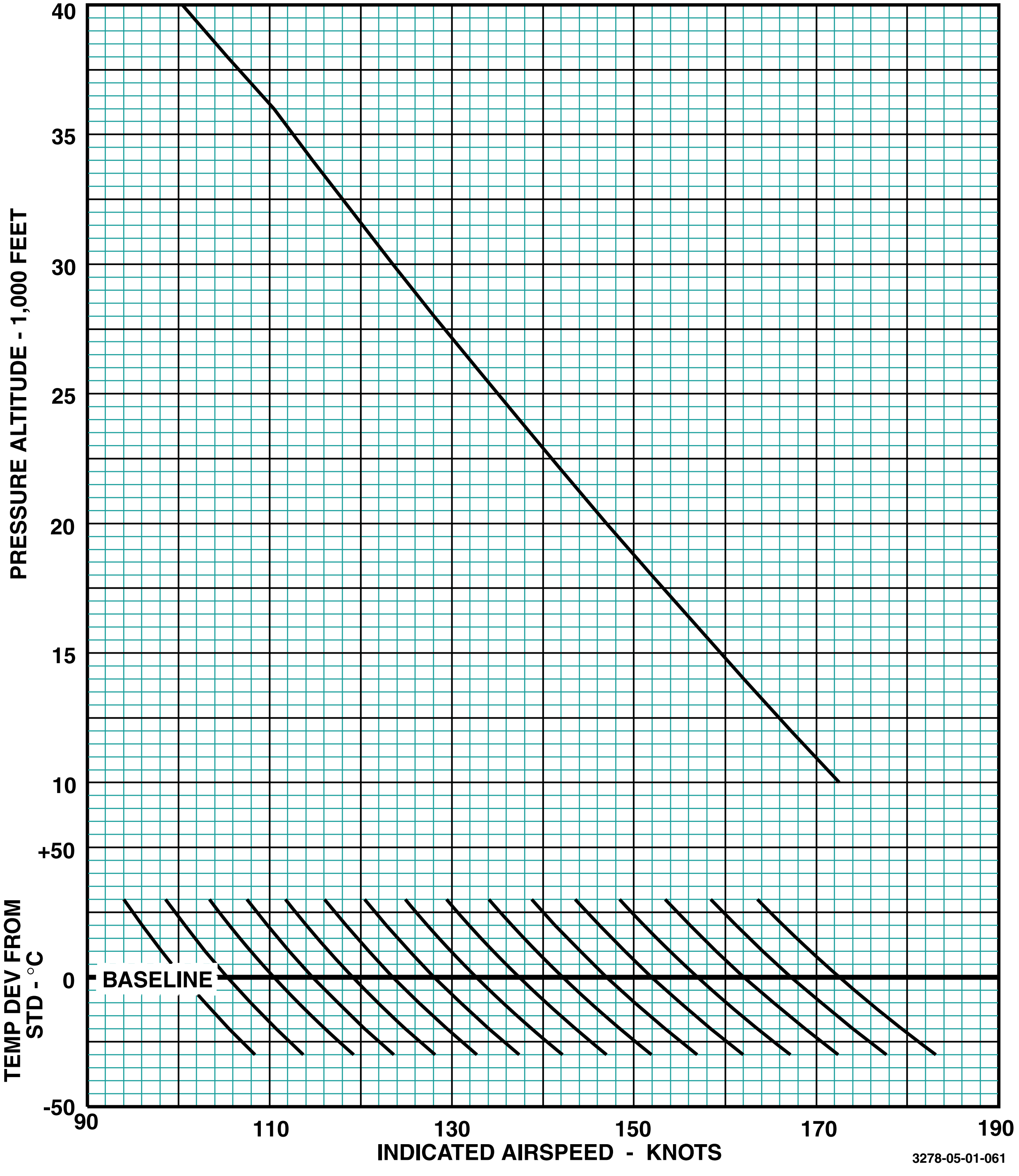


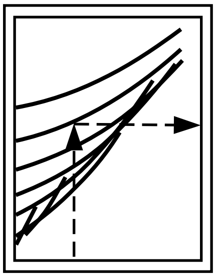
Figure 5-71.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 200 KTAS CRUISE

4 ENGINES



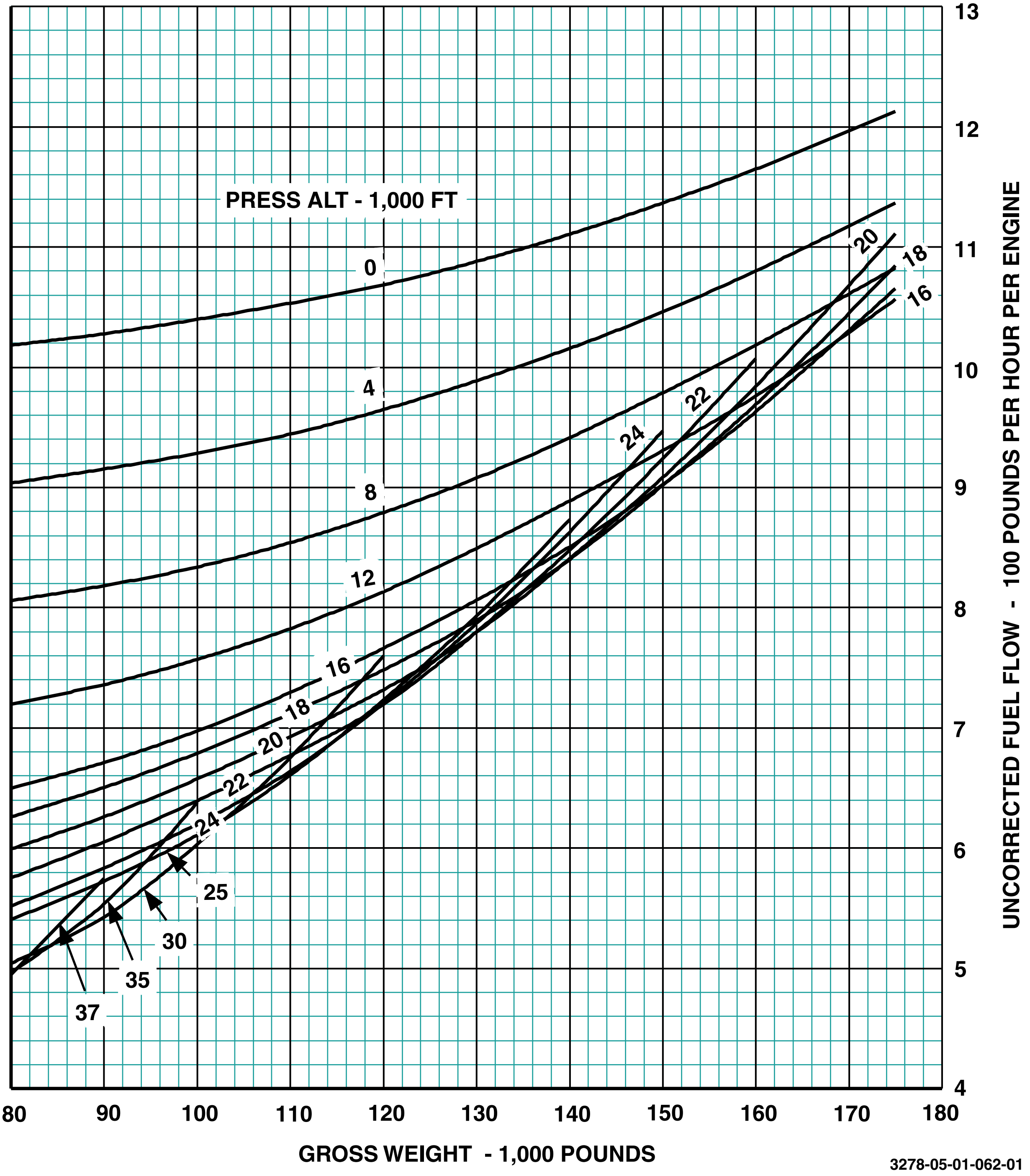


Figure 5-72. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 200 KTAS CRUISE

4 ENGINES

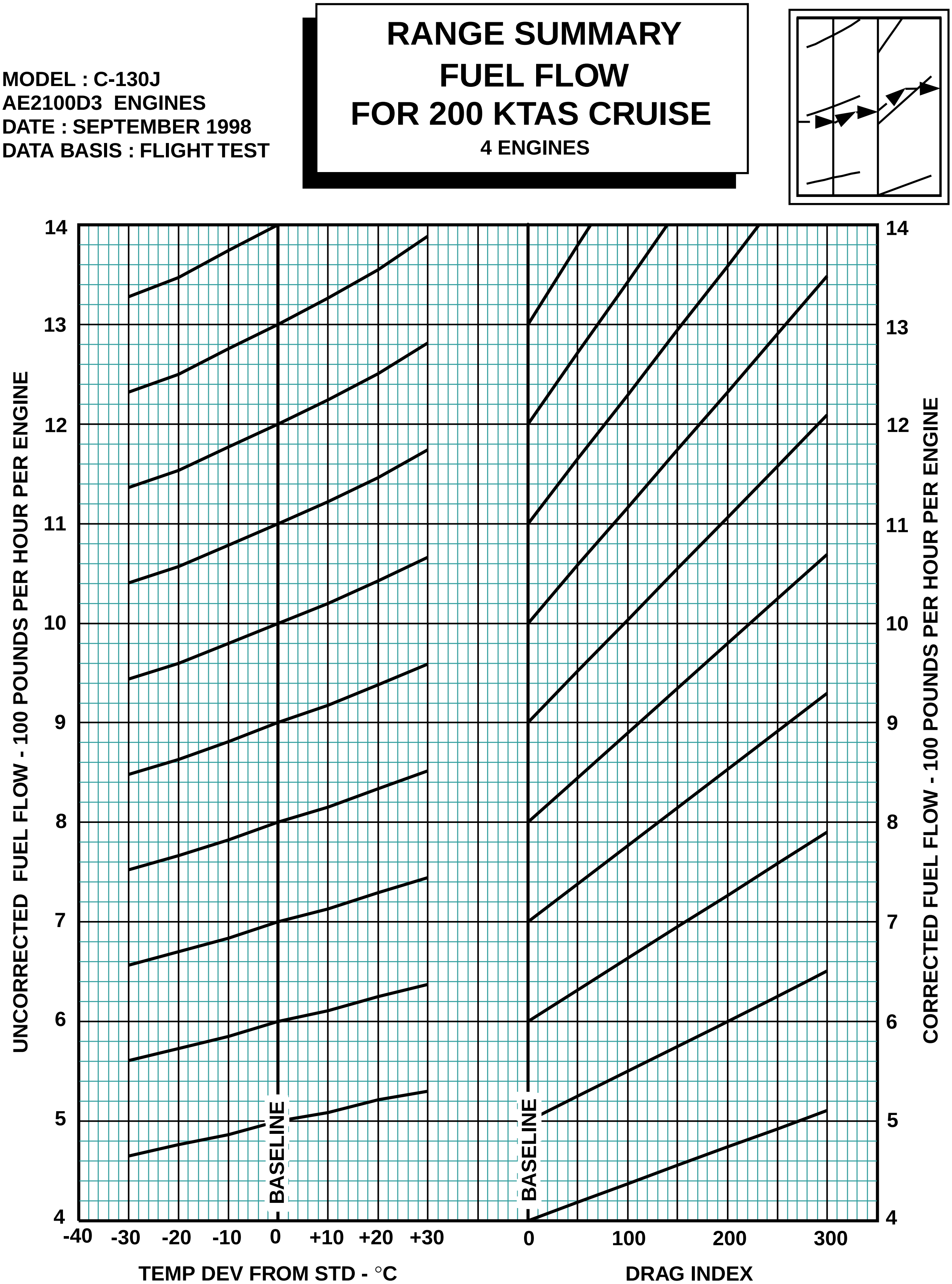


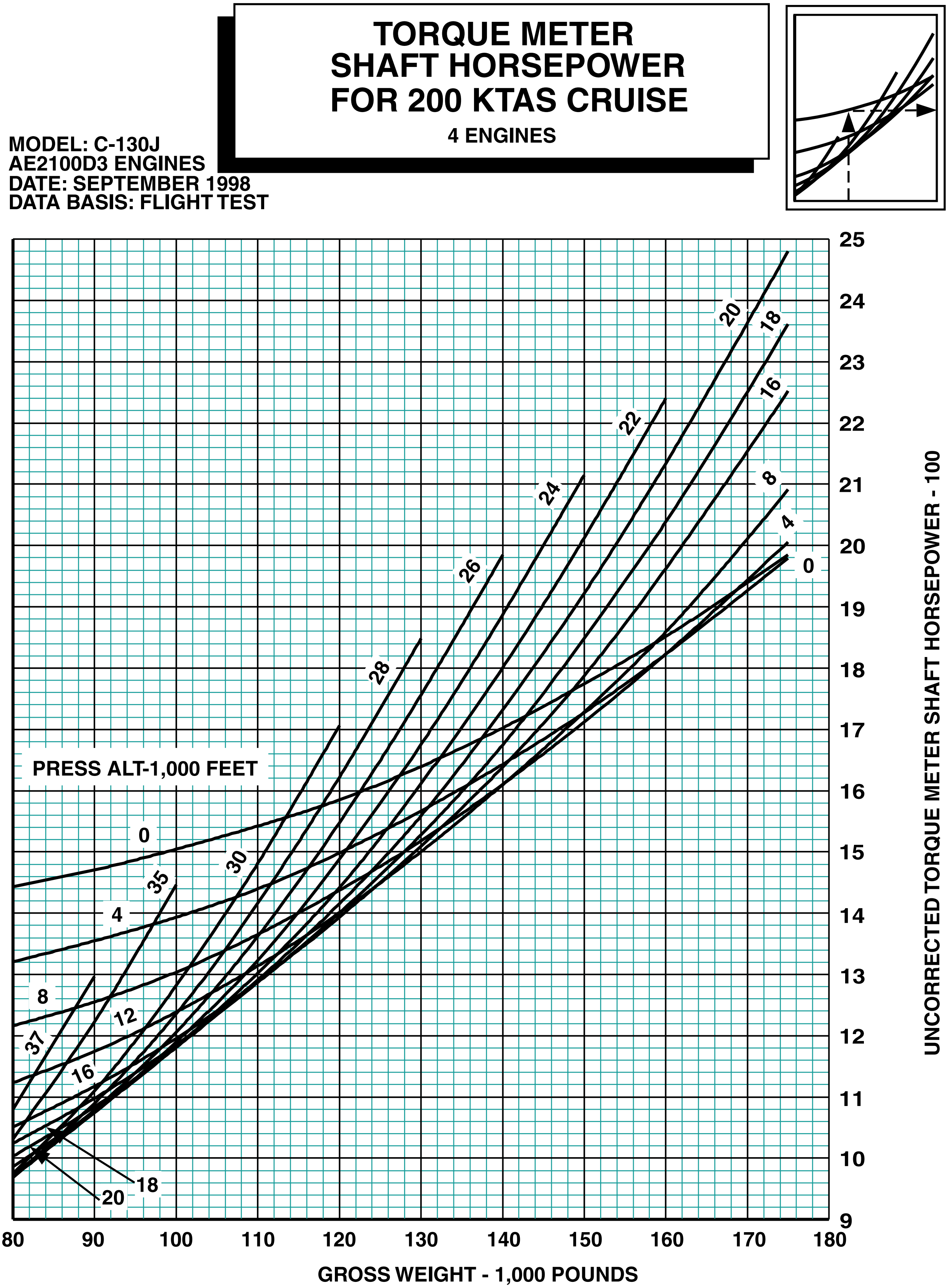
Figure 5-72. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TORQUE METER SHAFT HORSEPOWER FOR 200 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



3278-05-01-063-01

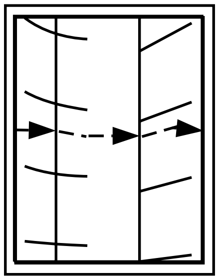
Figure 5-73. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 200 KTAS CRUISE

4 ENGINES



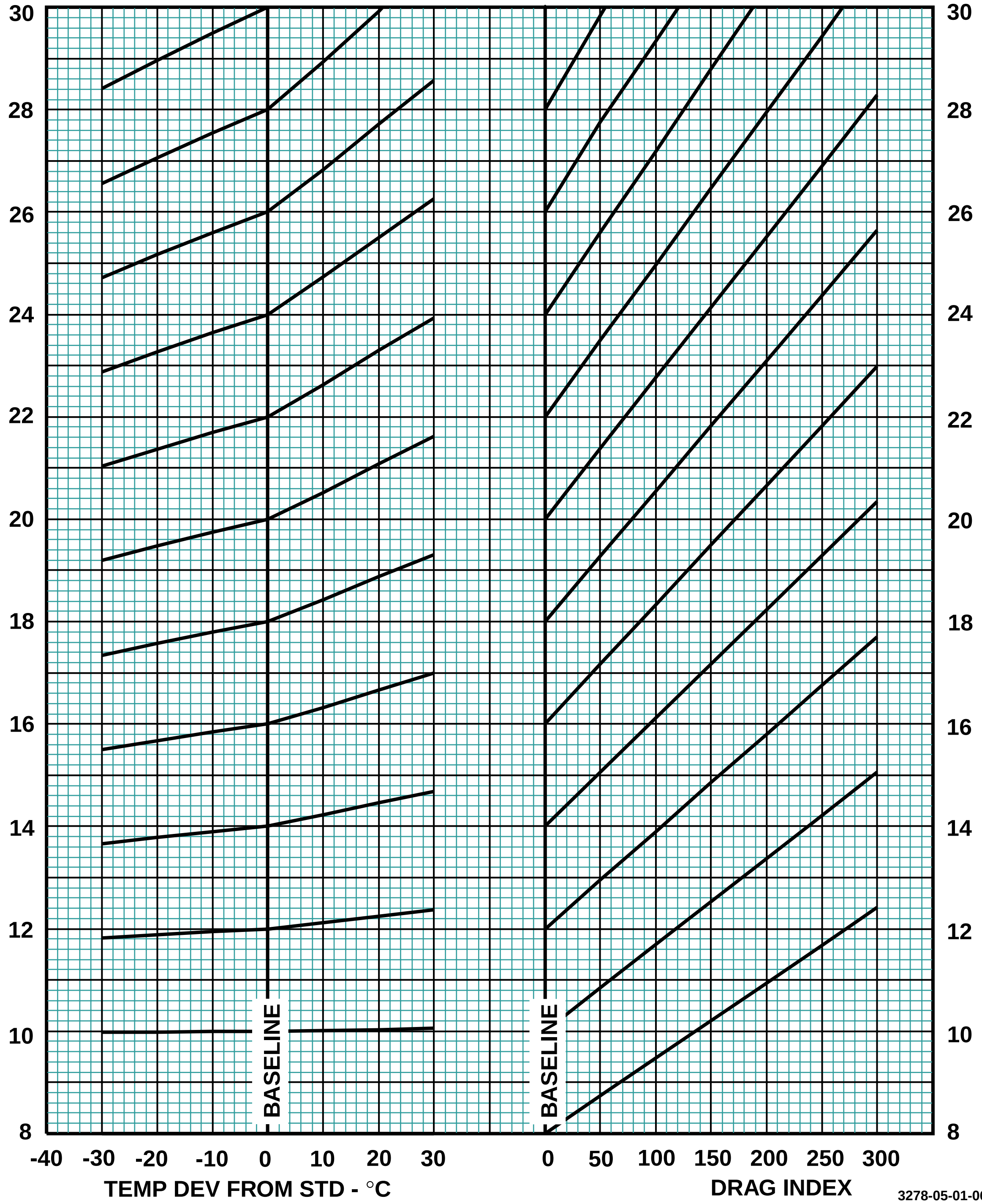
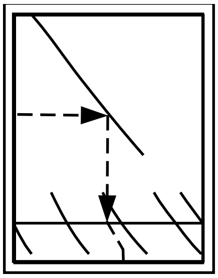


Figure 5-73. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 220 KTAS CRUISE

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

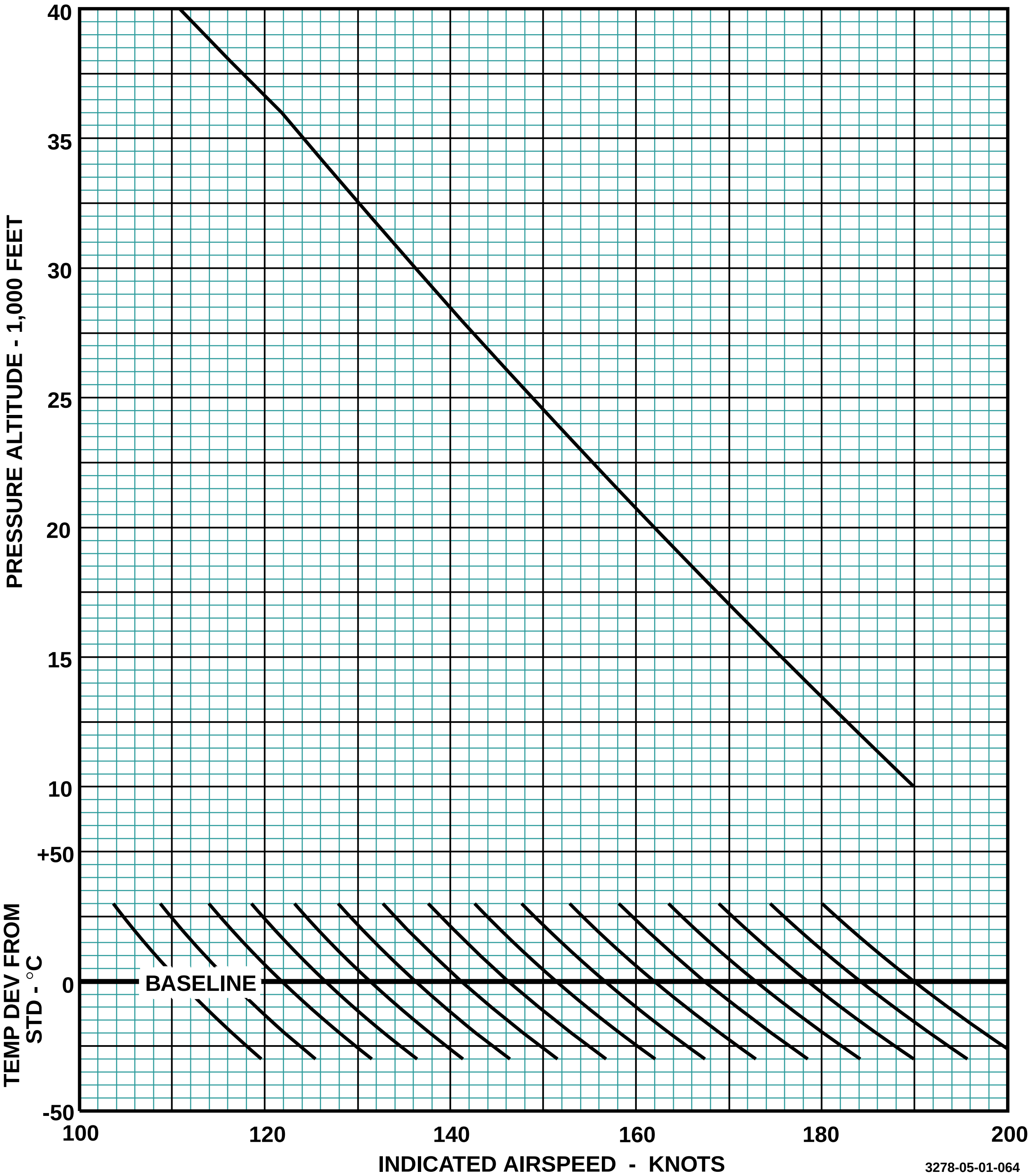
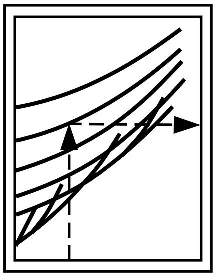


Figure 5-74.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 220 KTAS CRUISE

4 ENGINES



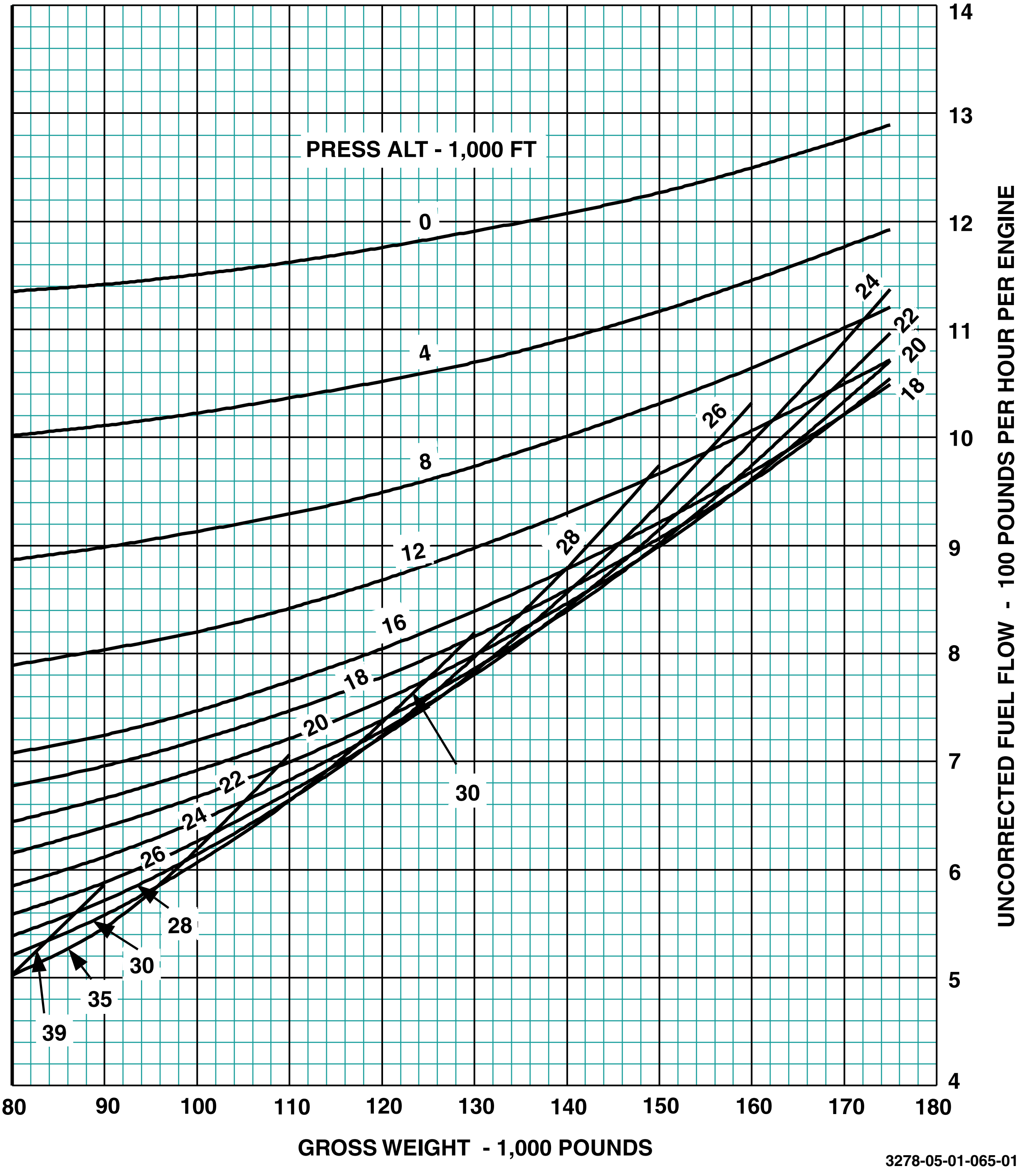


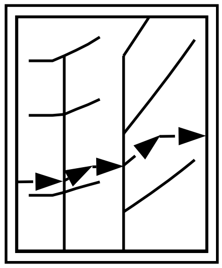
Figure 5-75. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 220 KTAS CRUISE

4 ENGINES



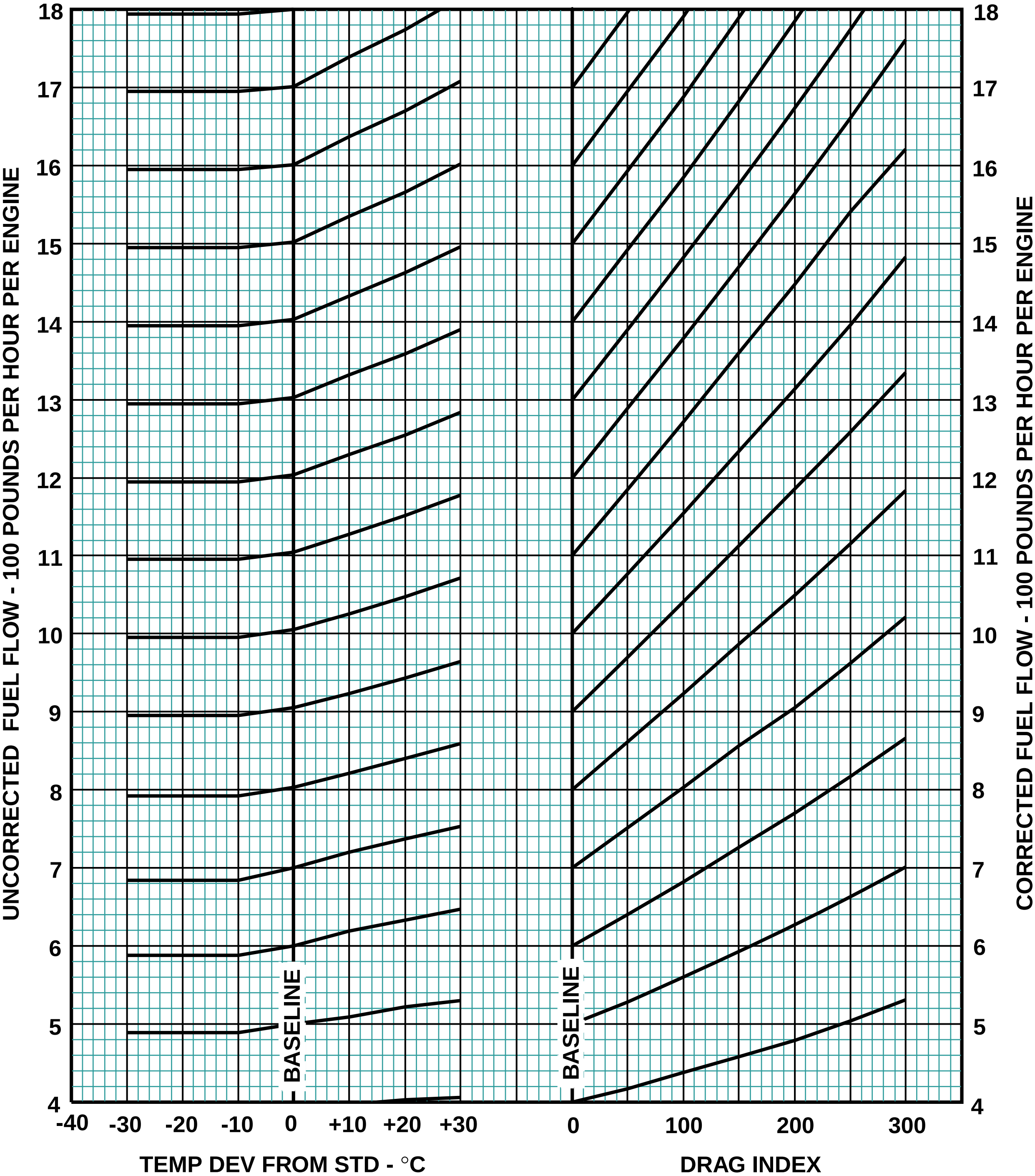


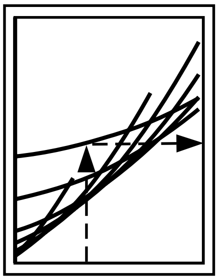
Figure 5-75. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

TORQUE METER SHAFT HORSEPOWER FOR 220 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



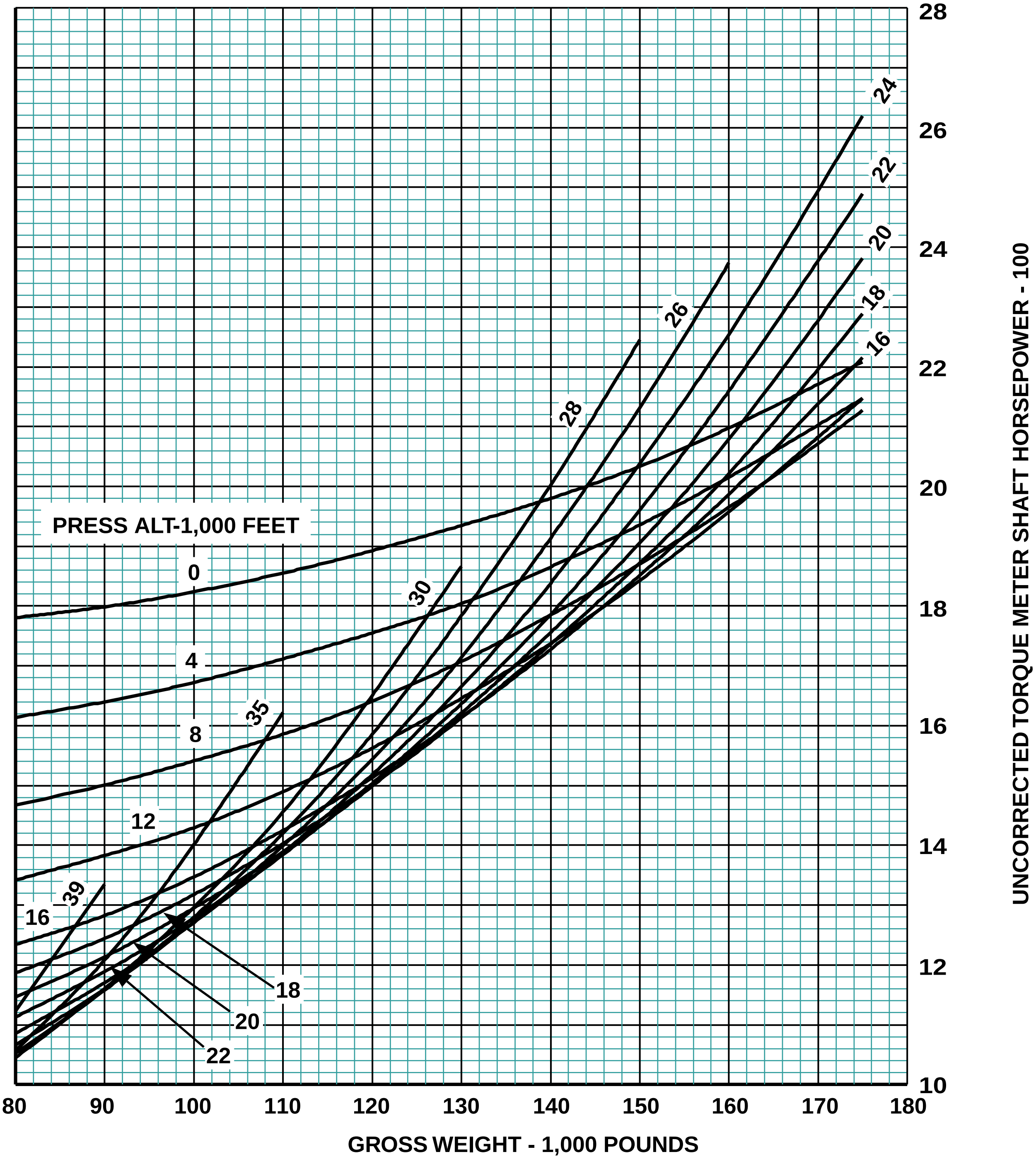


Figure 5-76. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 220 KTAS CRUISE

4 ENGINES

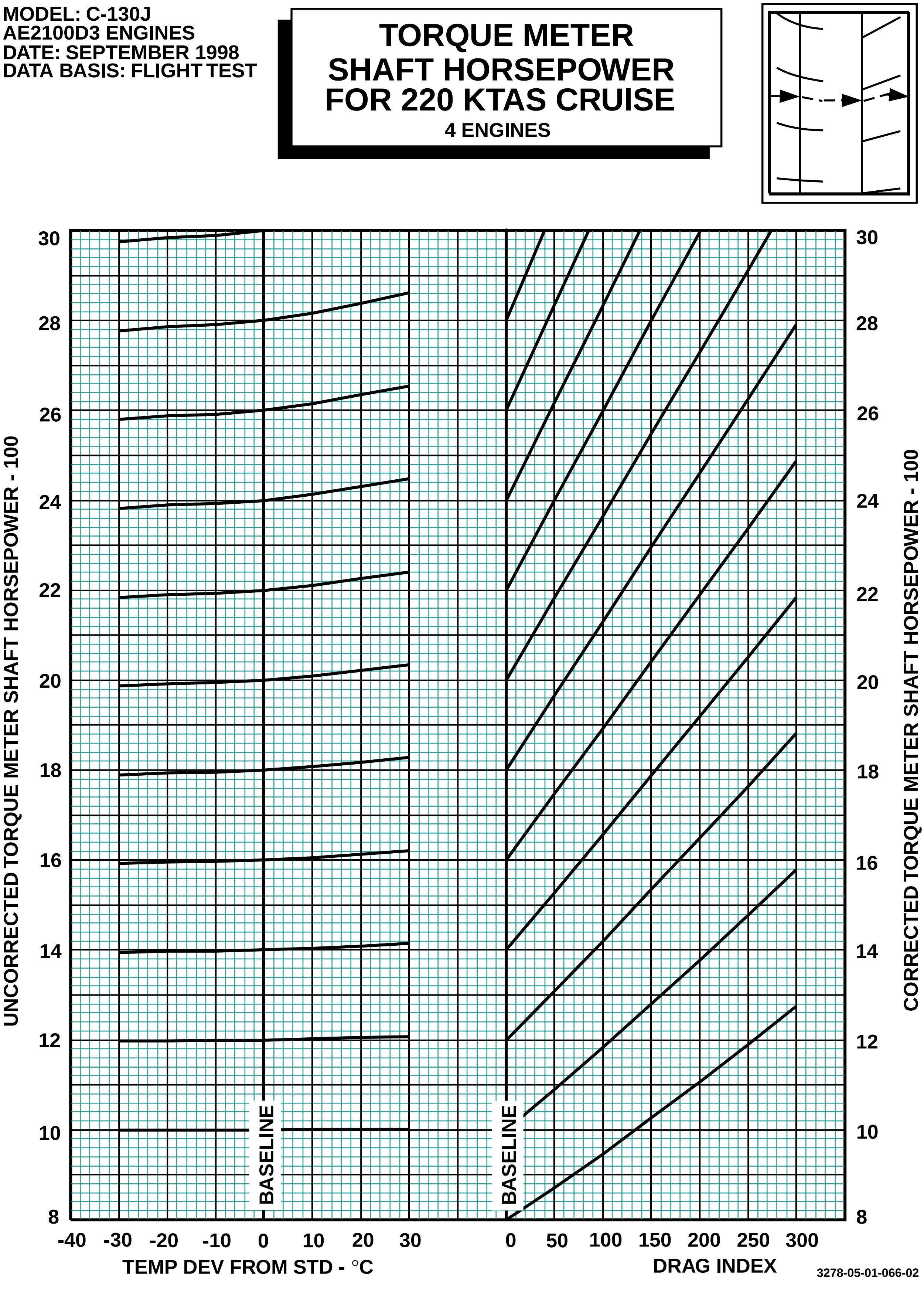


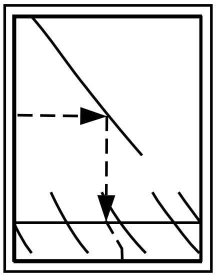
Figure 5-76. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 240 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



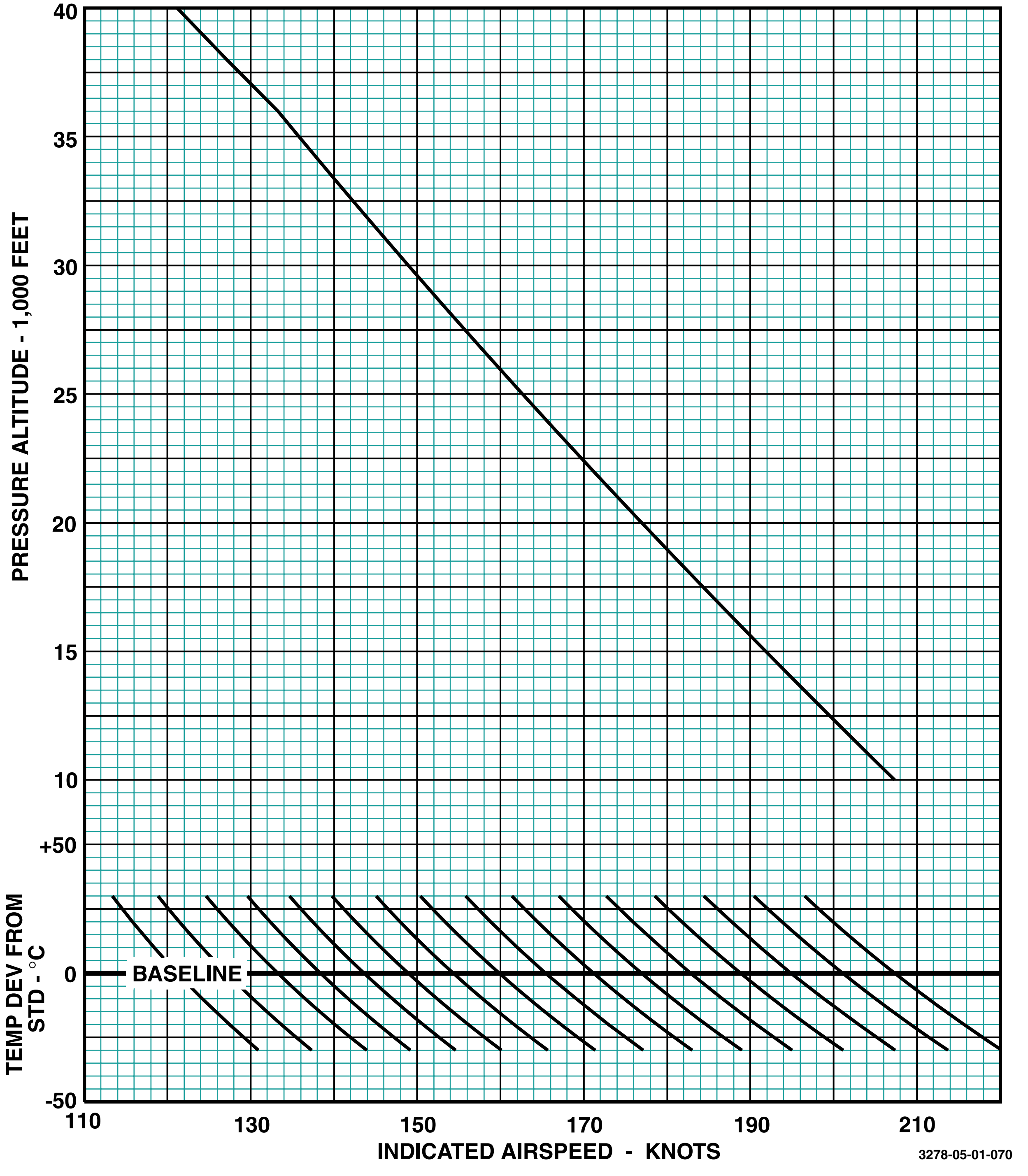


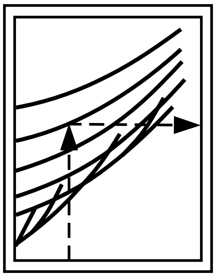
Figure 5-77.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 240 KTAS CRUISE

4 ENGINES



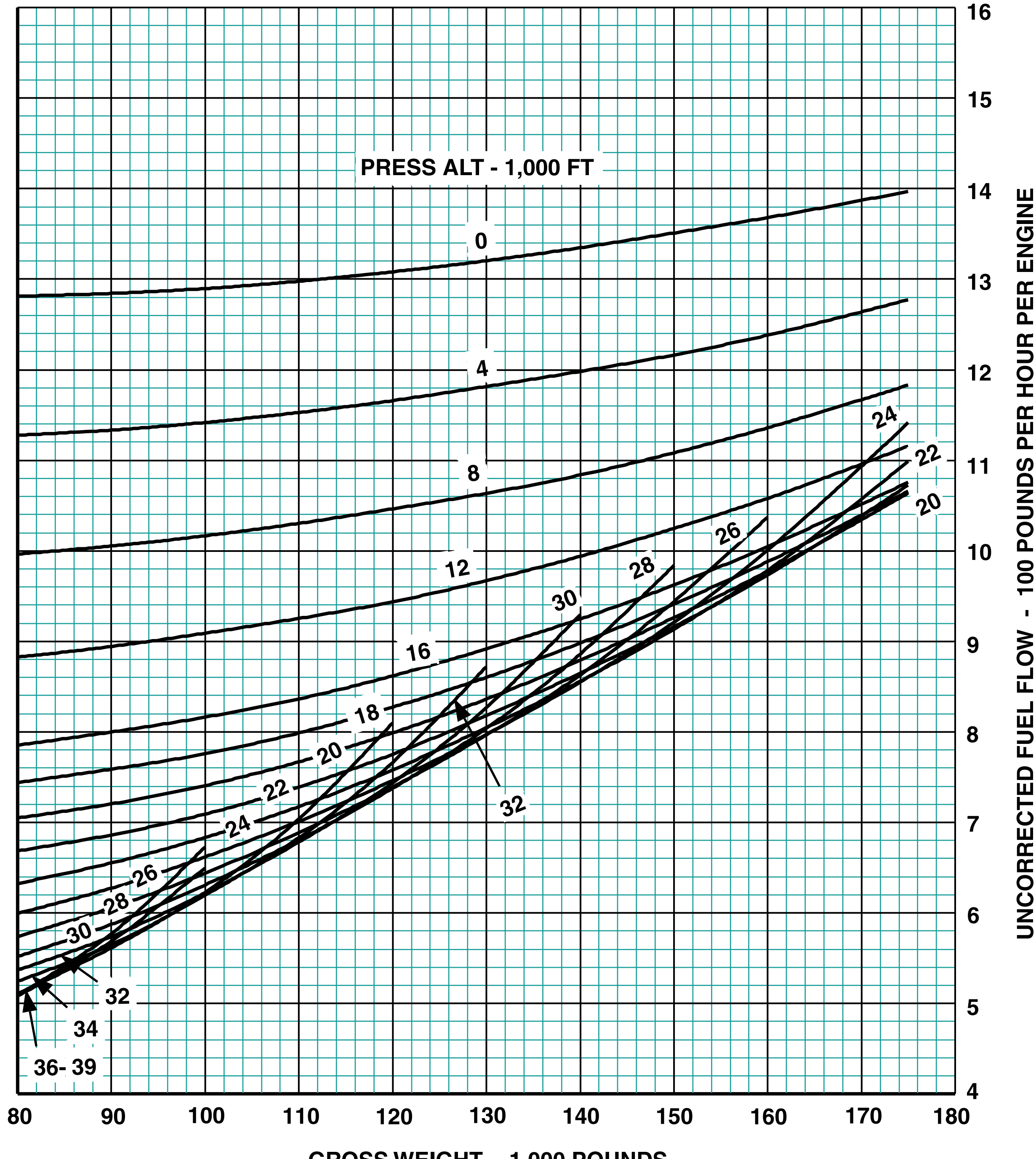


Figure 5-78. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 240 KTAS CRUISE

4 ENGINES

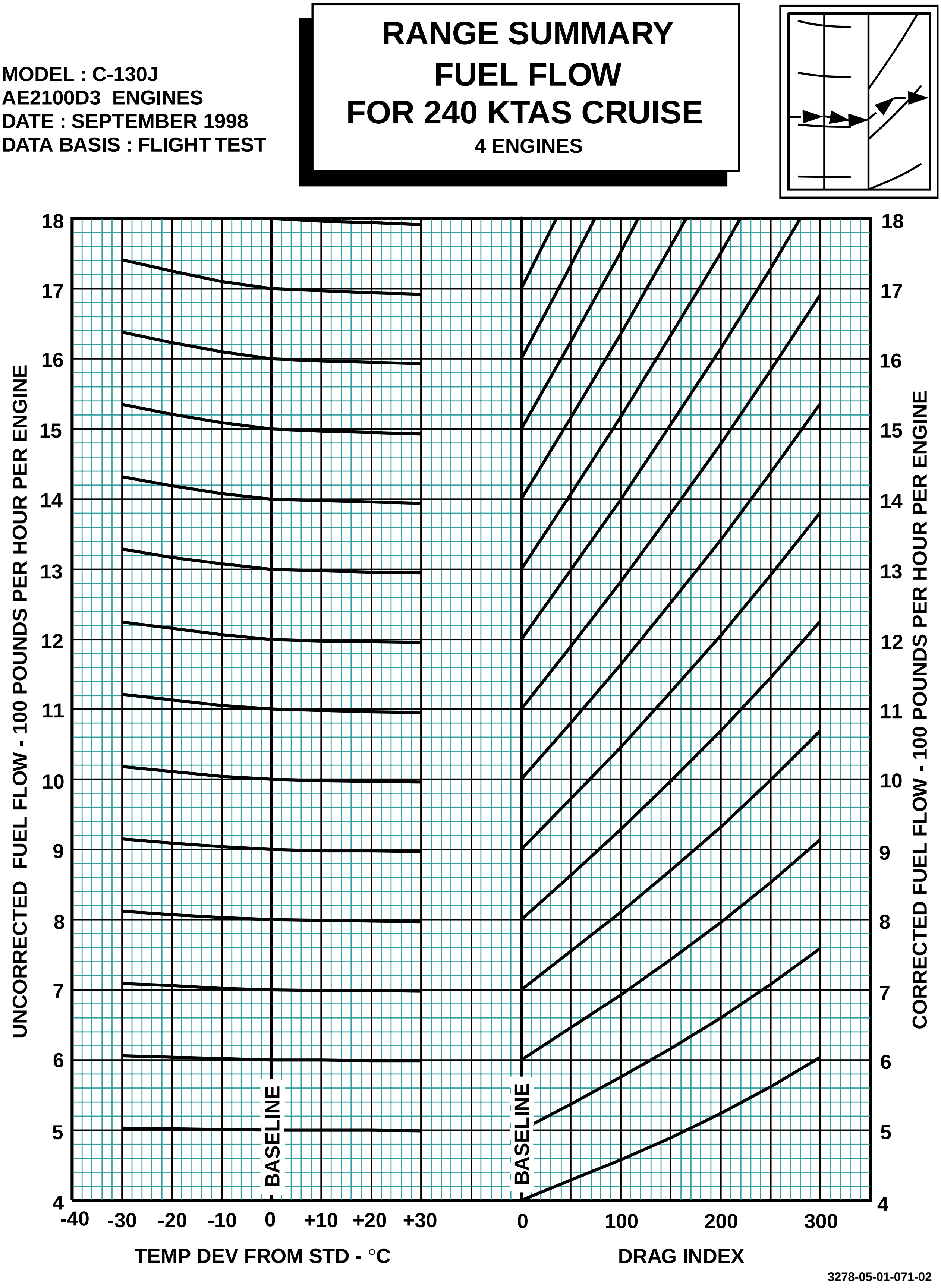


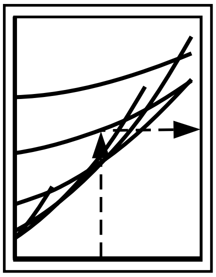
Figure 5-78. (Sheet 2 of 2)

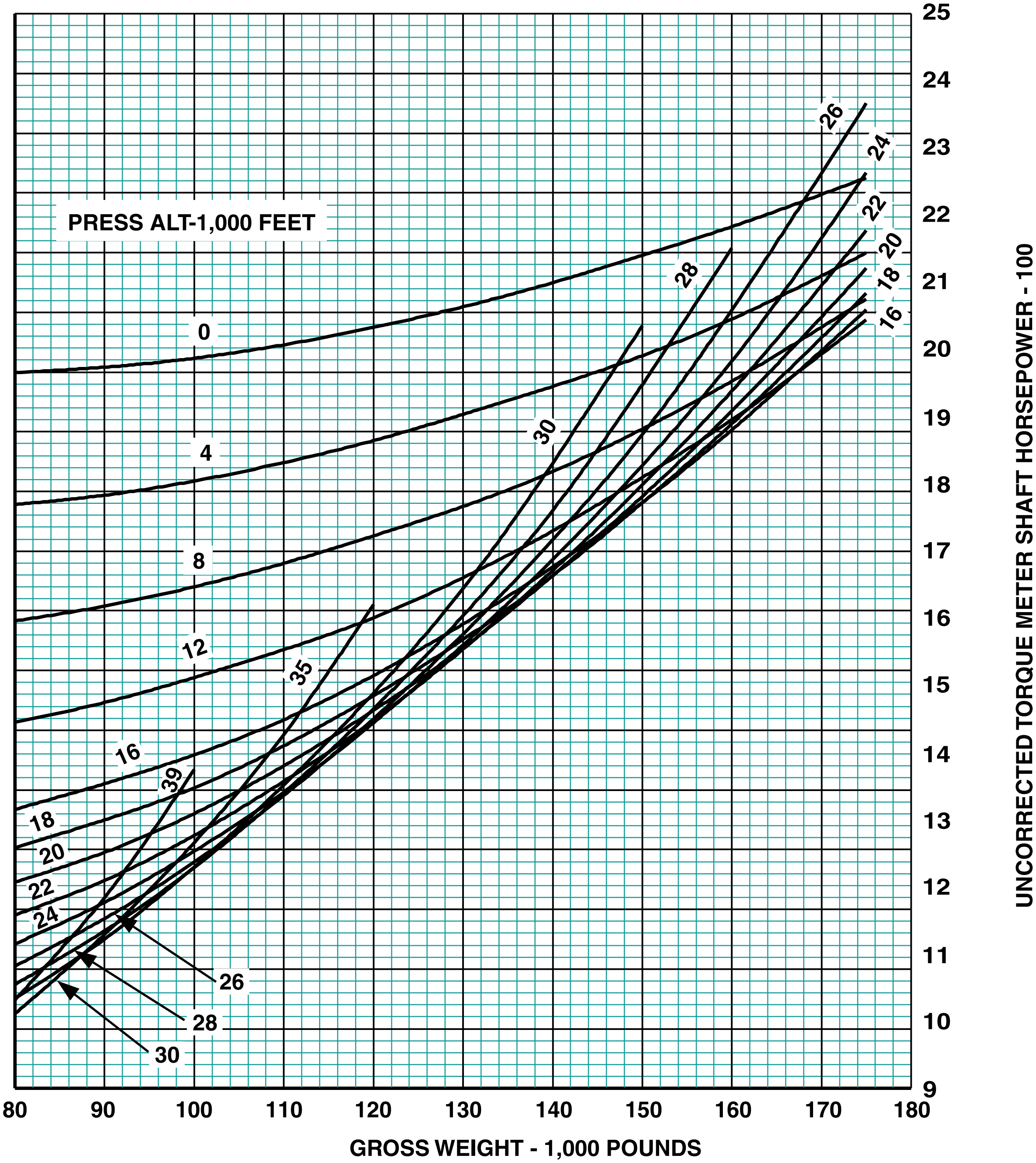
Use, copying and/or disclosure is governed by the statement on the title page of this document.

TORQUE METER SHAFT HORSEPOWER FOR 240 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST





3278-05-01-072-01

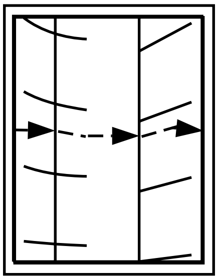
Figure 5-79. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 240 KTAS CRUISE

4 ENGINES



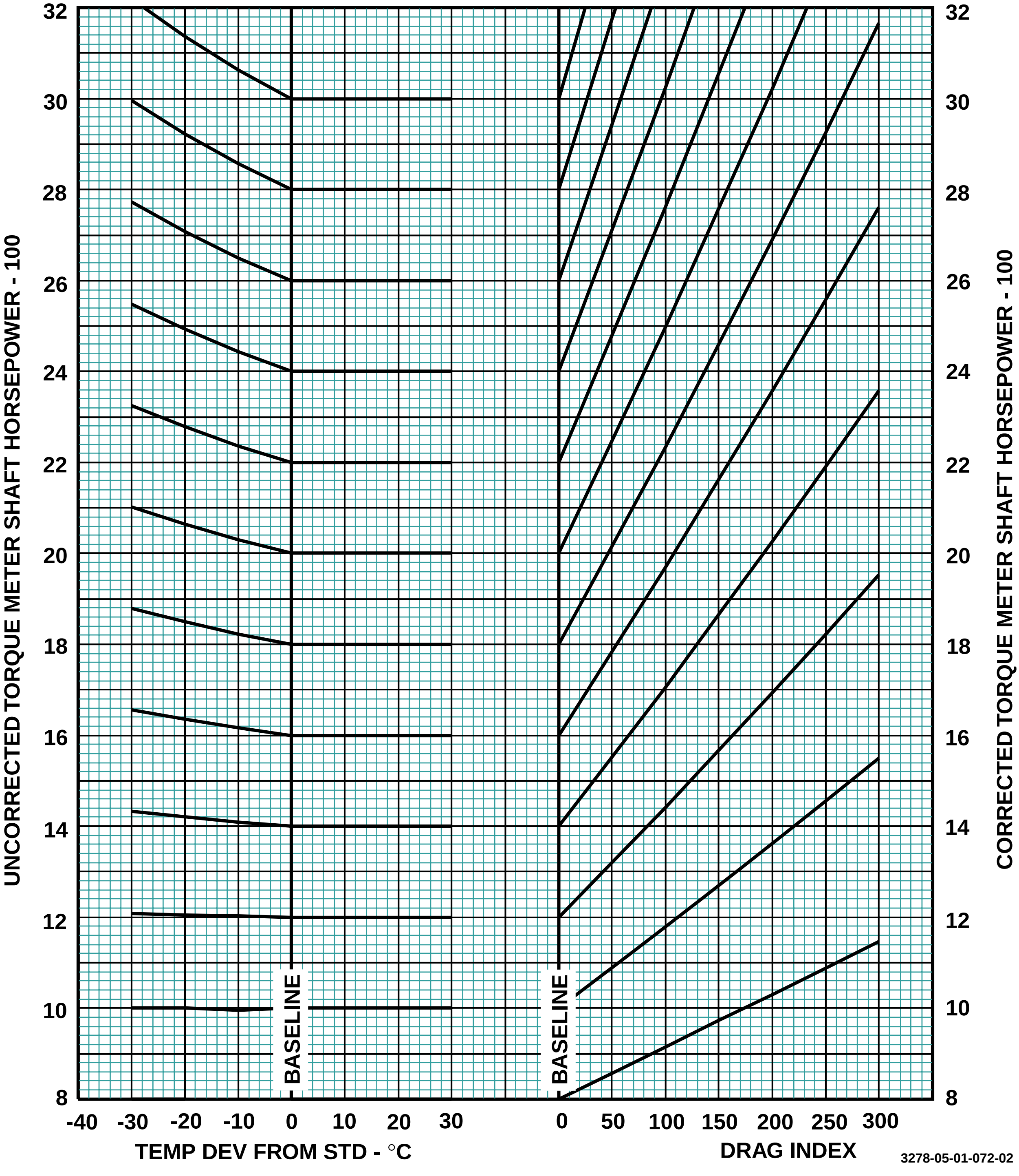
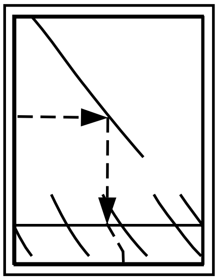


Figure 5-79. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY
INDICATED AIRSPEED FOR CONSTANT 260 KTAS CRUISE
4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



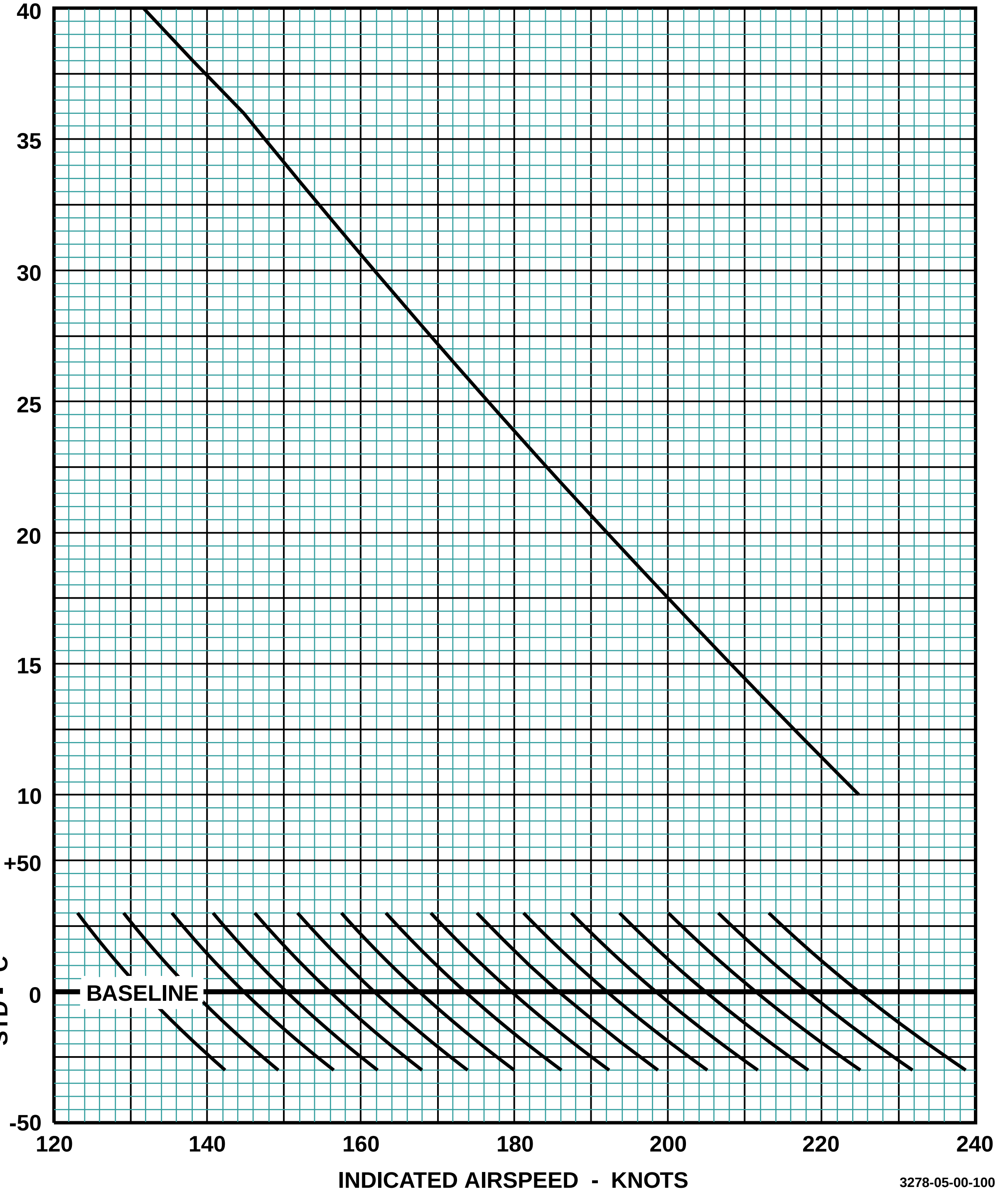


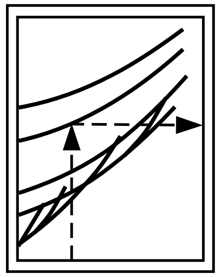
Figure 5-80.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 260 KTAS CRUISE

4 ENGINES



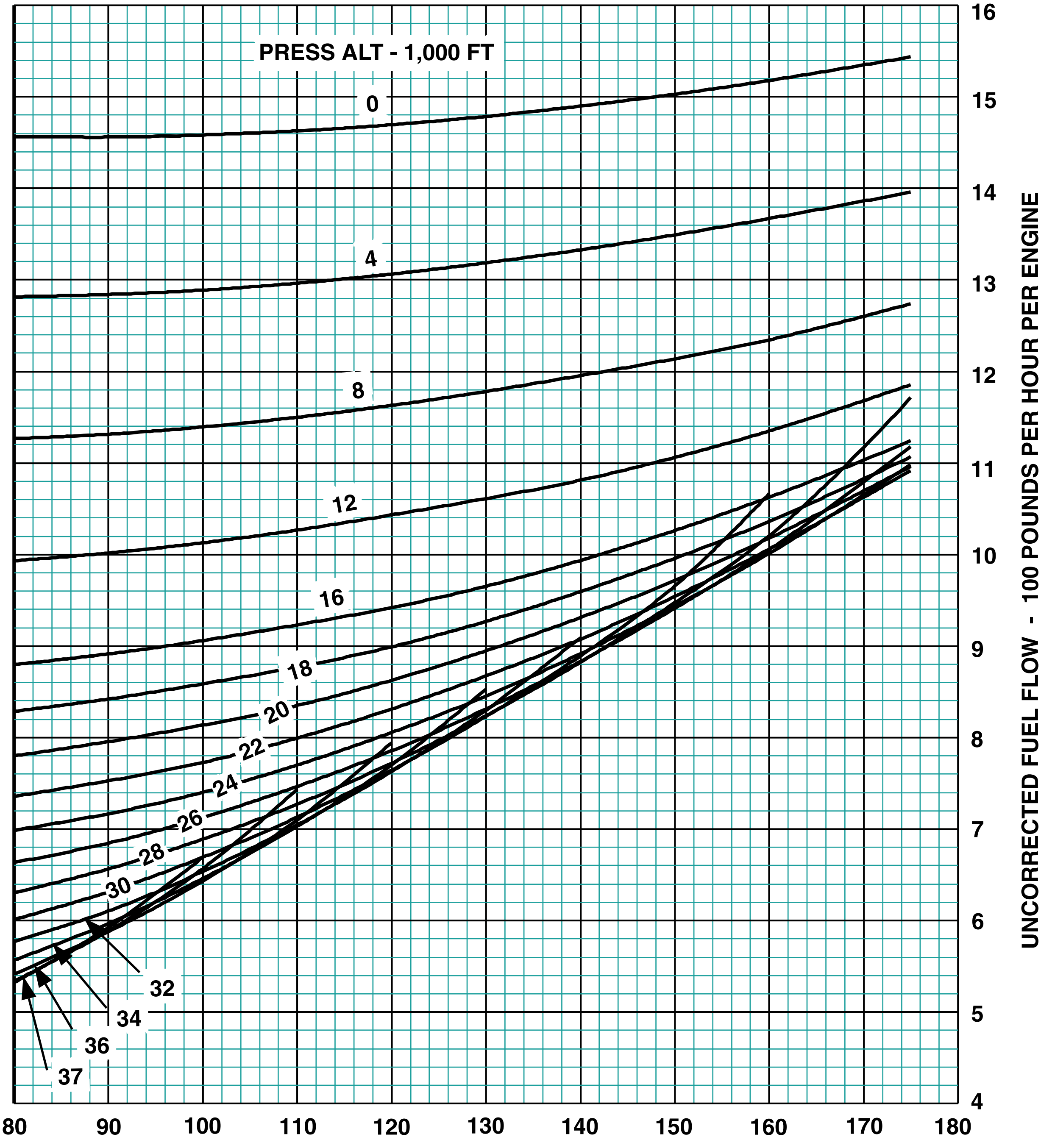


Figure 5-81. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

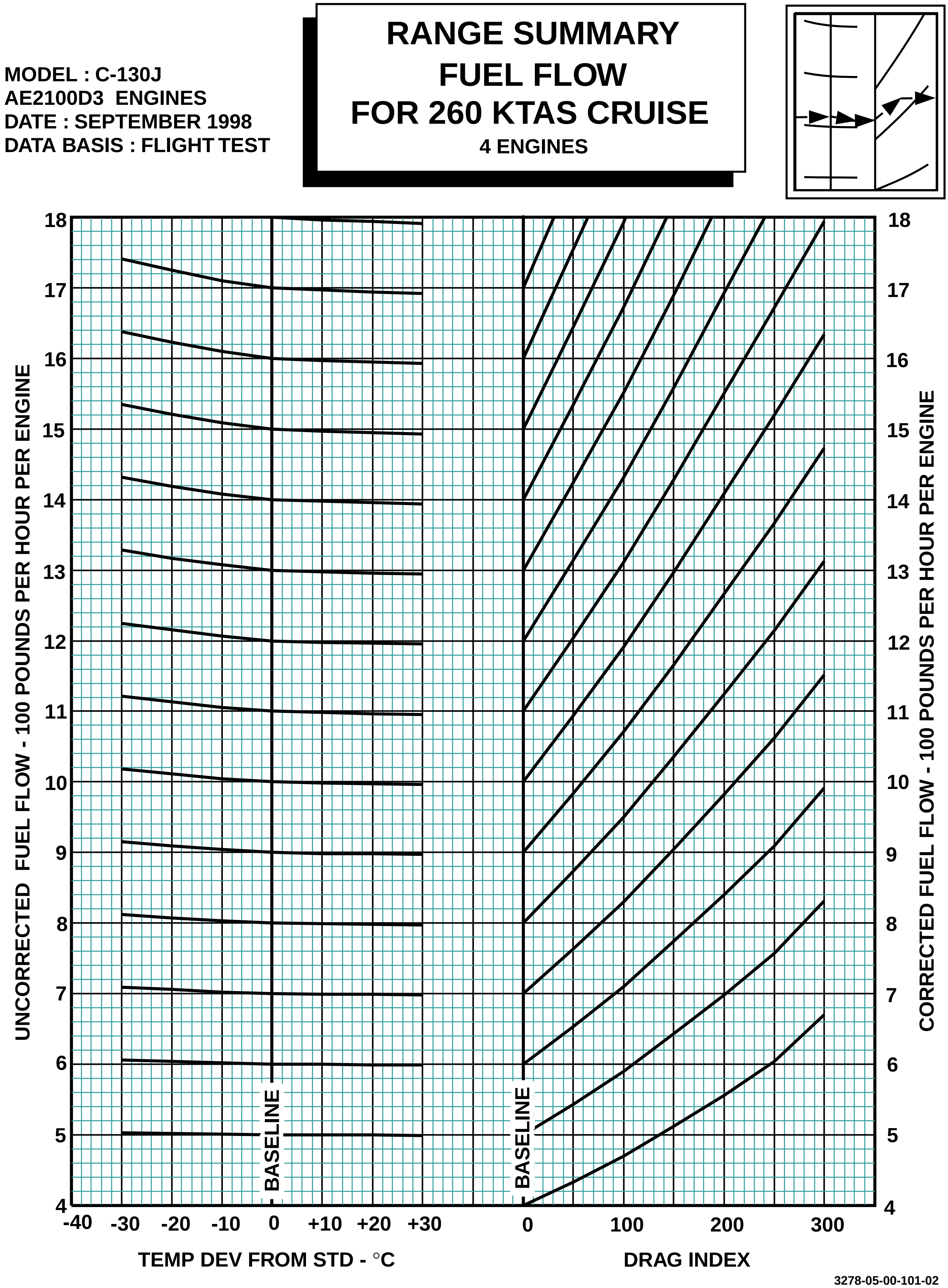


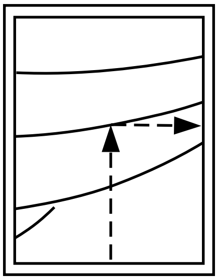
Figure 5-81. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 260 KTAS CRUISE

4 ENGINES



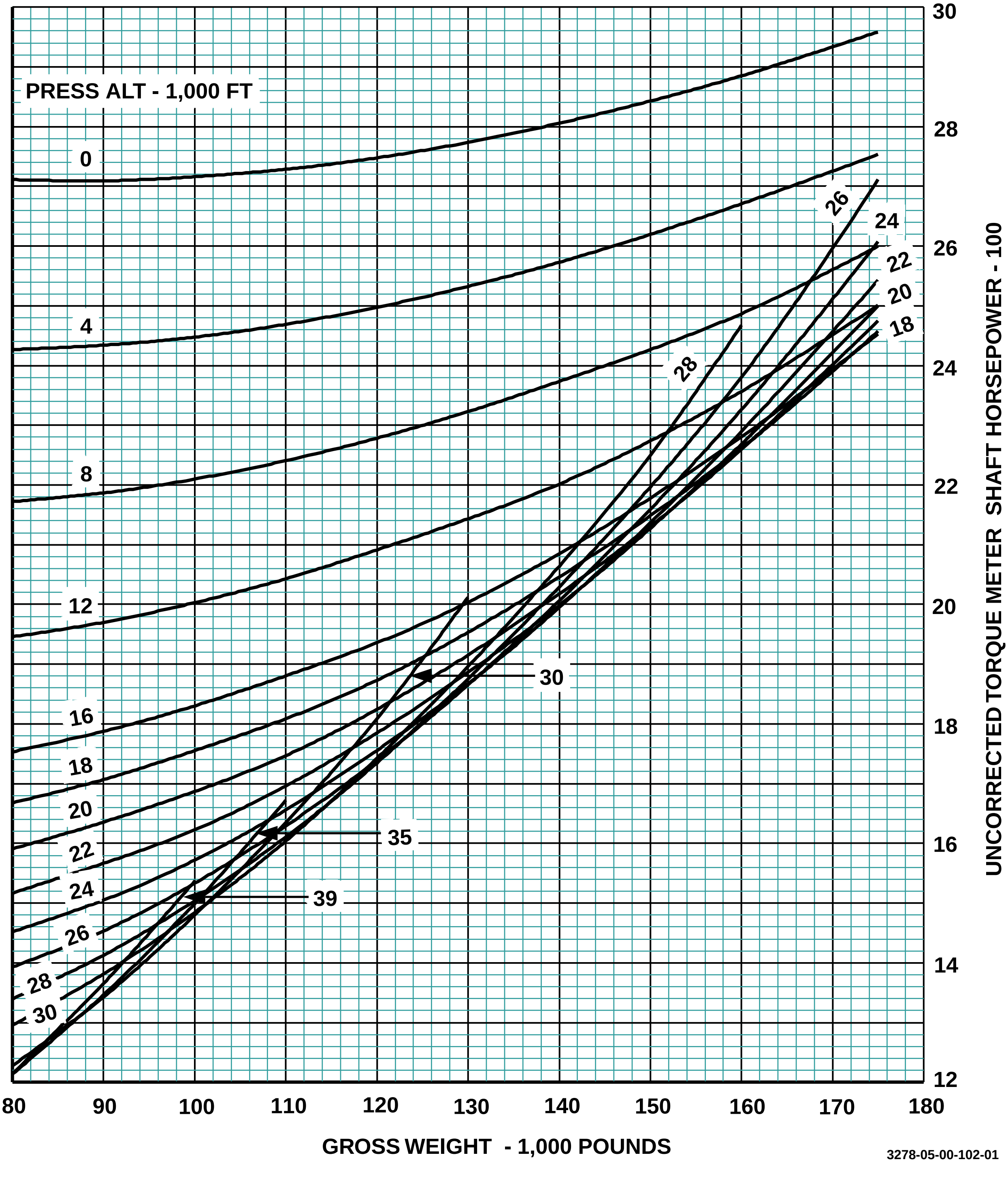


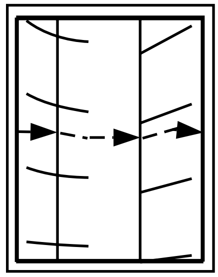
Figure 5-82. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 260 KTAS CRUISE

4 ENGINES



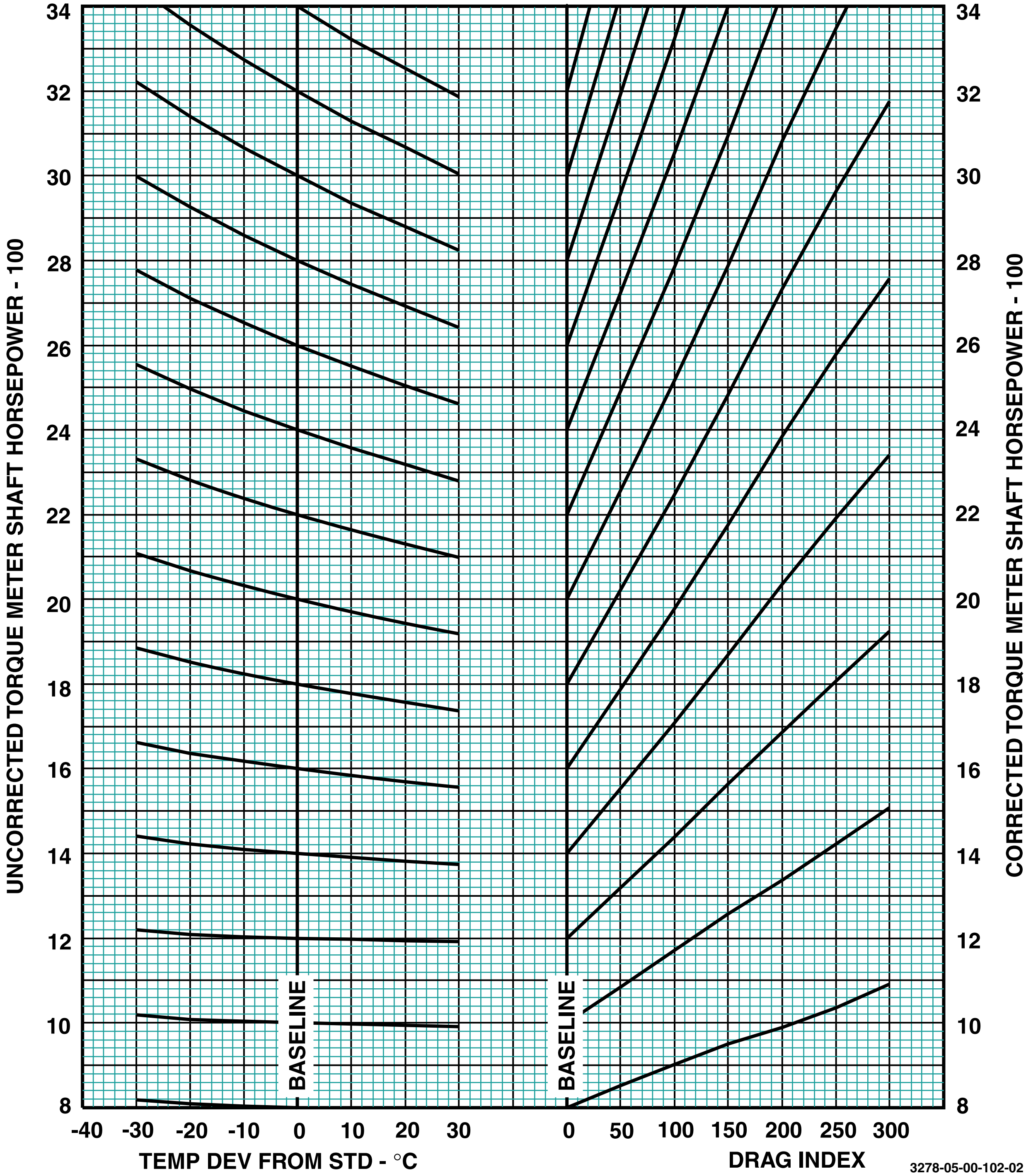


Figure 5-82. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 280 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

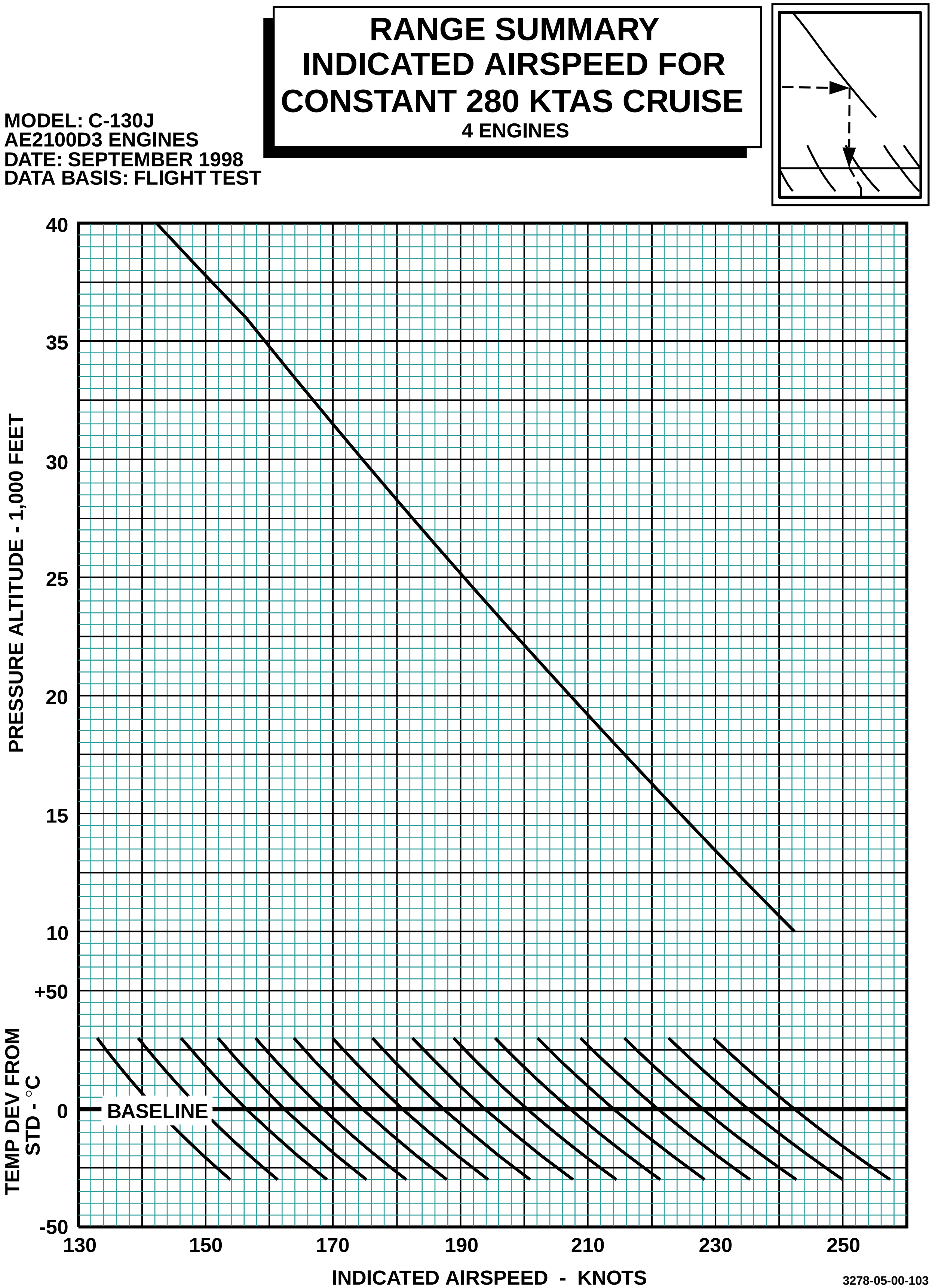


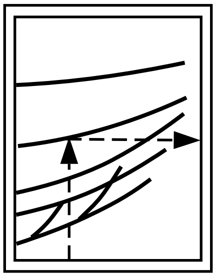
Figure 5-83.

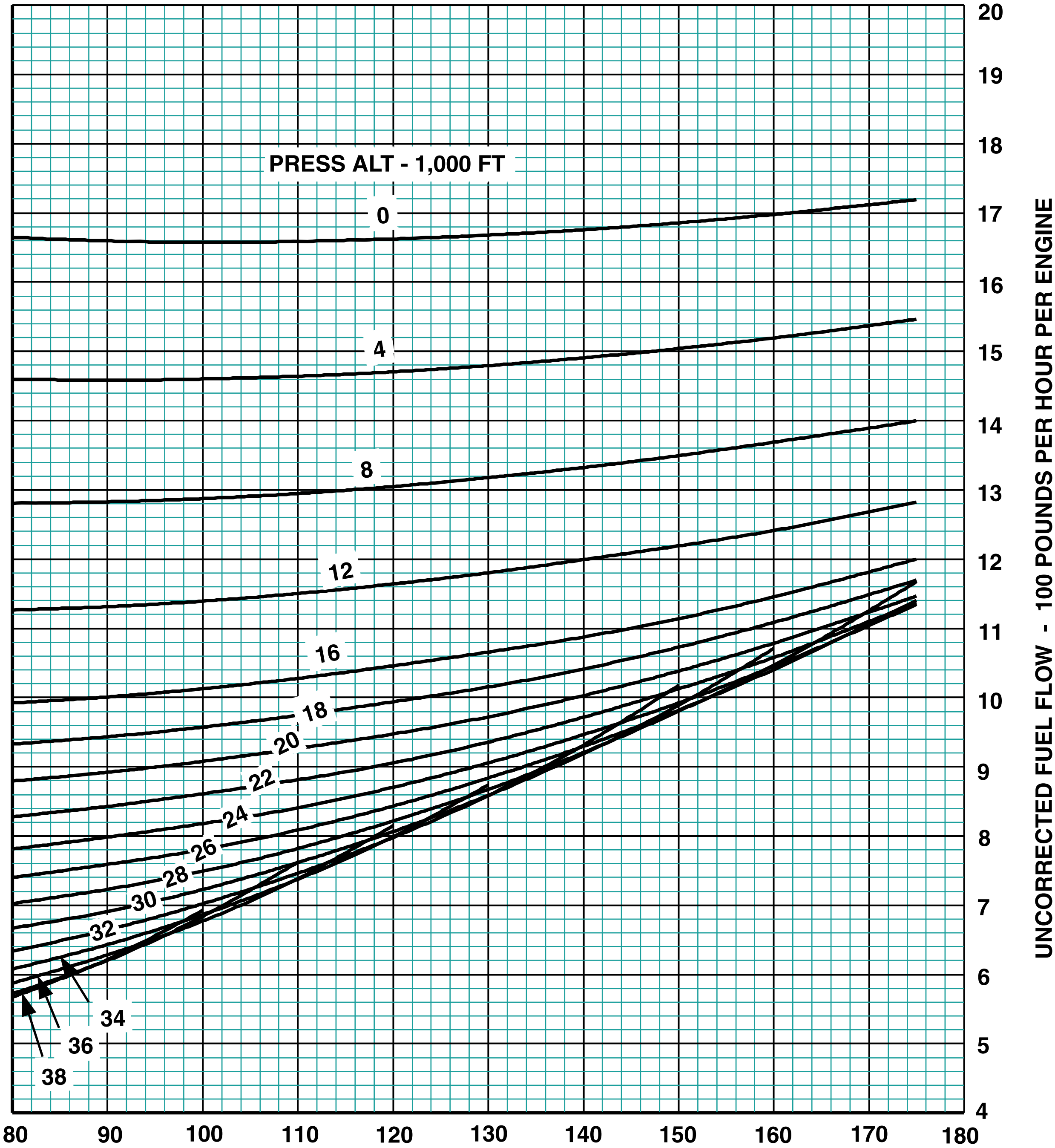
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 280 KTAS CRUISE

4 ENGINES





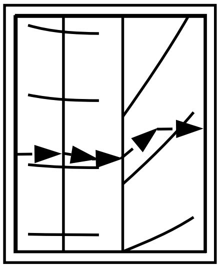
3278-05-00-104-01

Figure 5-84. (Sheet 1 of 2)

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 280 KTAS CRUISE

4 ENGINES



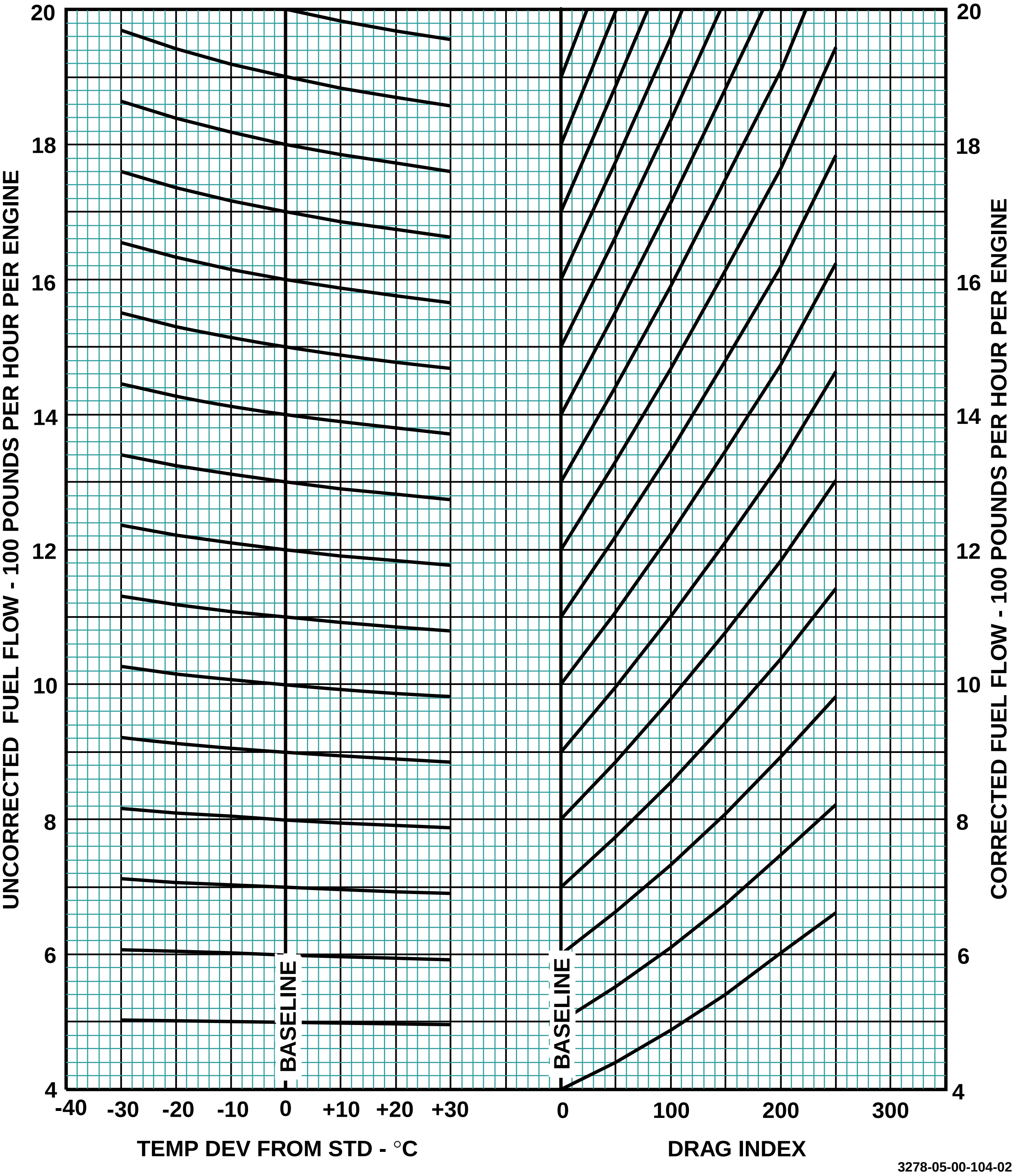


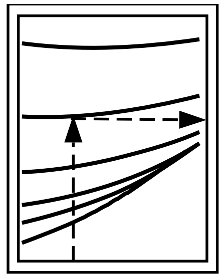
Figure 5-84. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 280 KTAS CRUISE

4 ENGINES



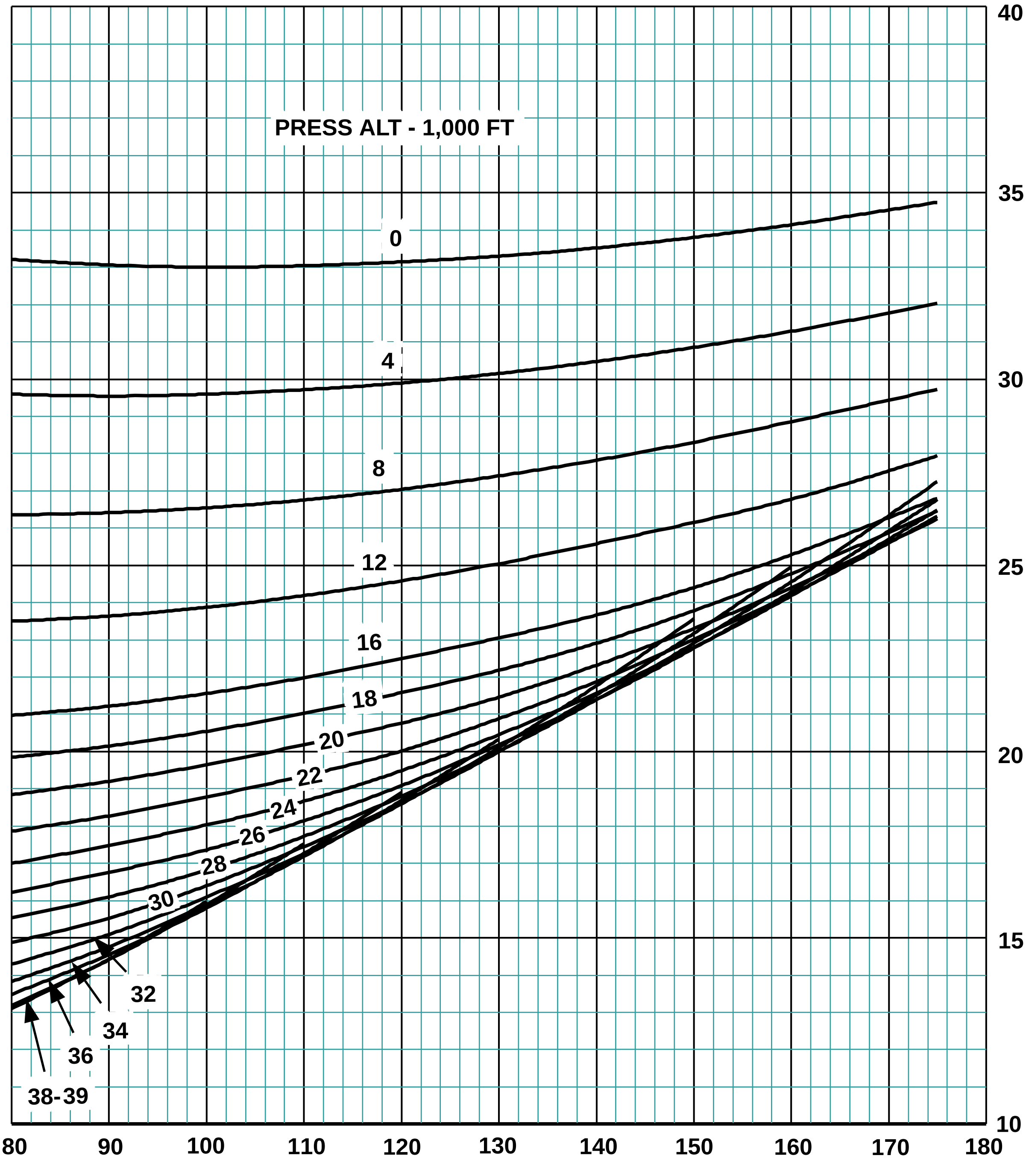


Figure 5-85. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

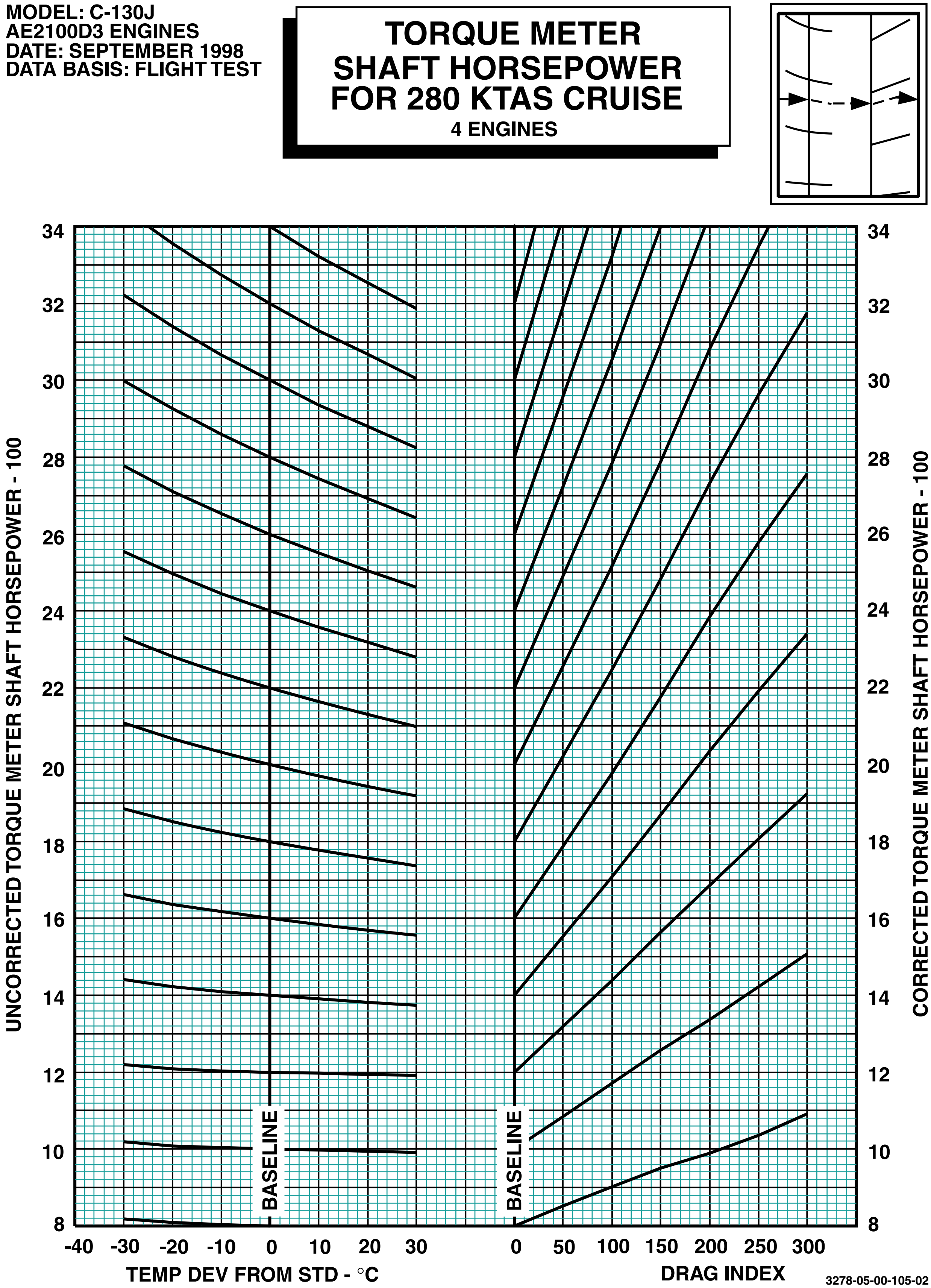


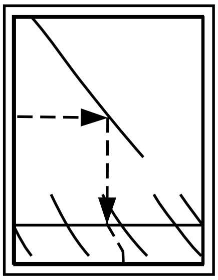
Figure 5-85. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 300 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



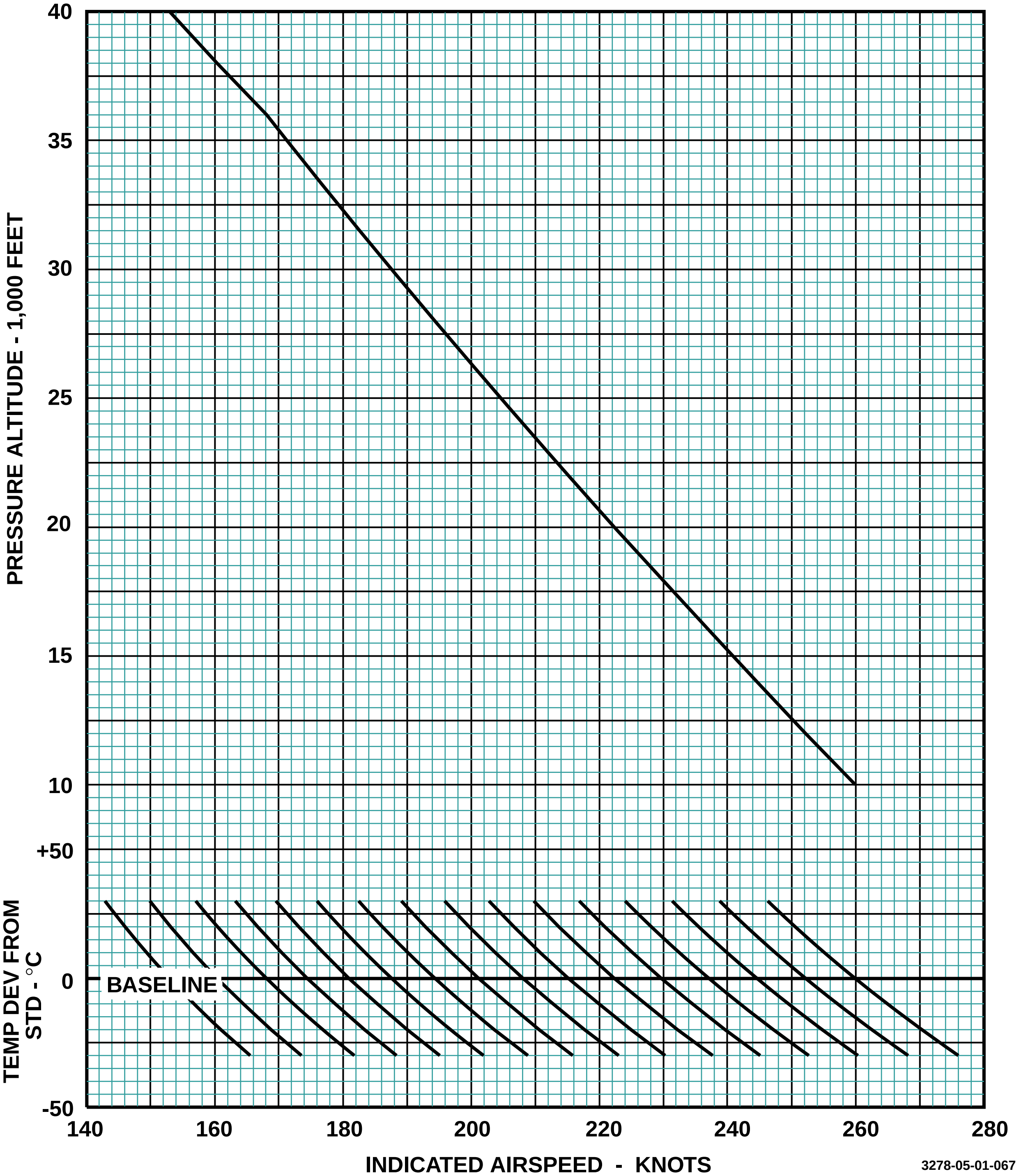


Figure 5-86.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

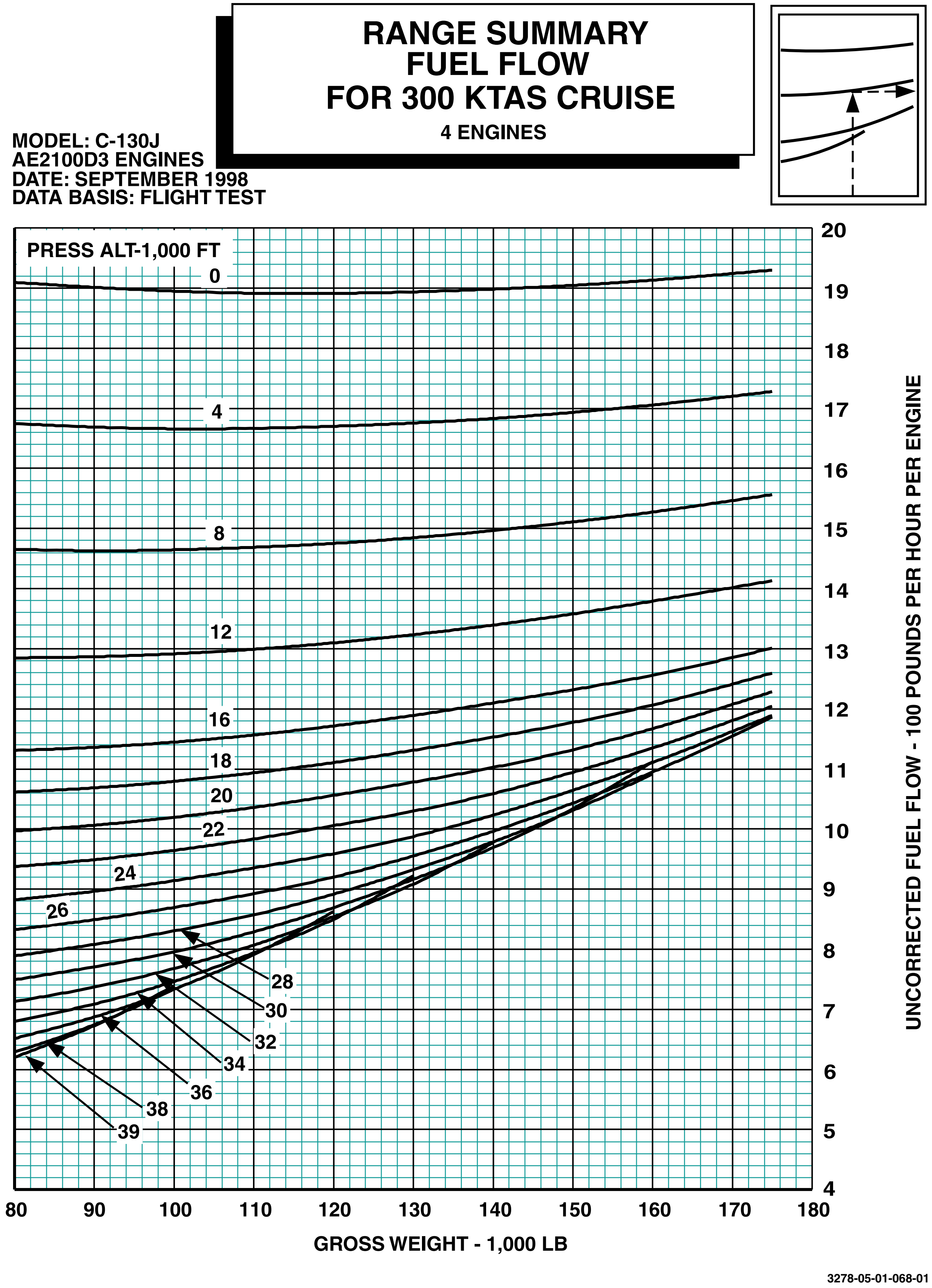


Figure 5-87. (Sheet 1 of 2)

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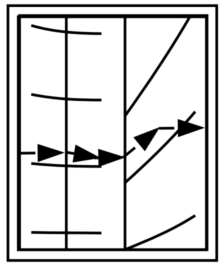
MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 300 KTAS CRUISE

4 ENGINES



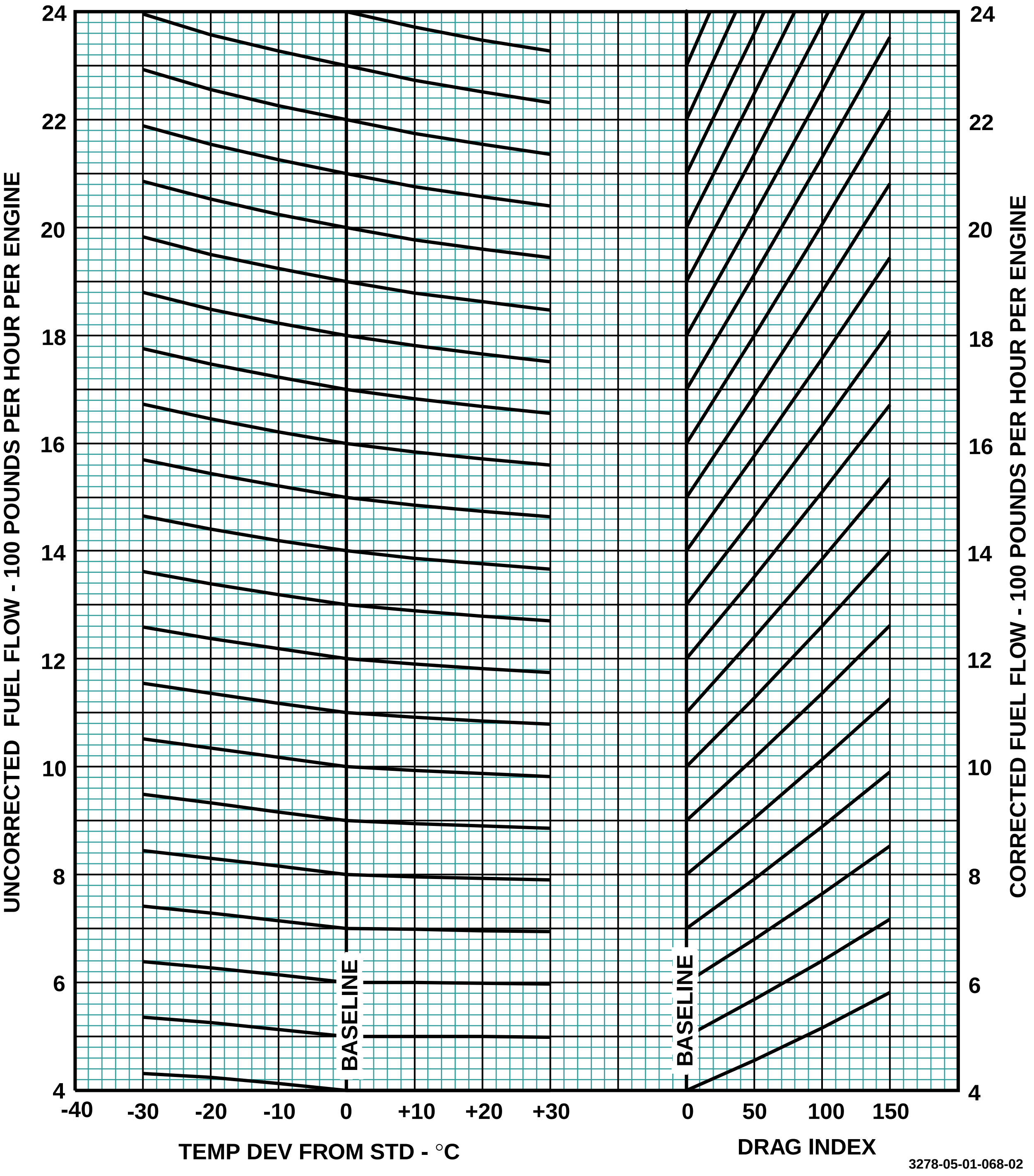


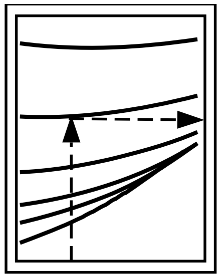
Figure 5-87. (Sheet 2 of 2)

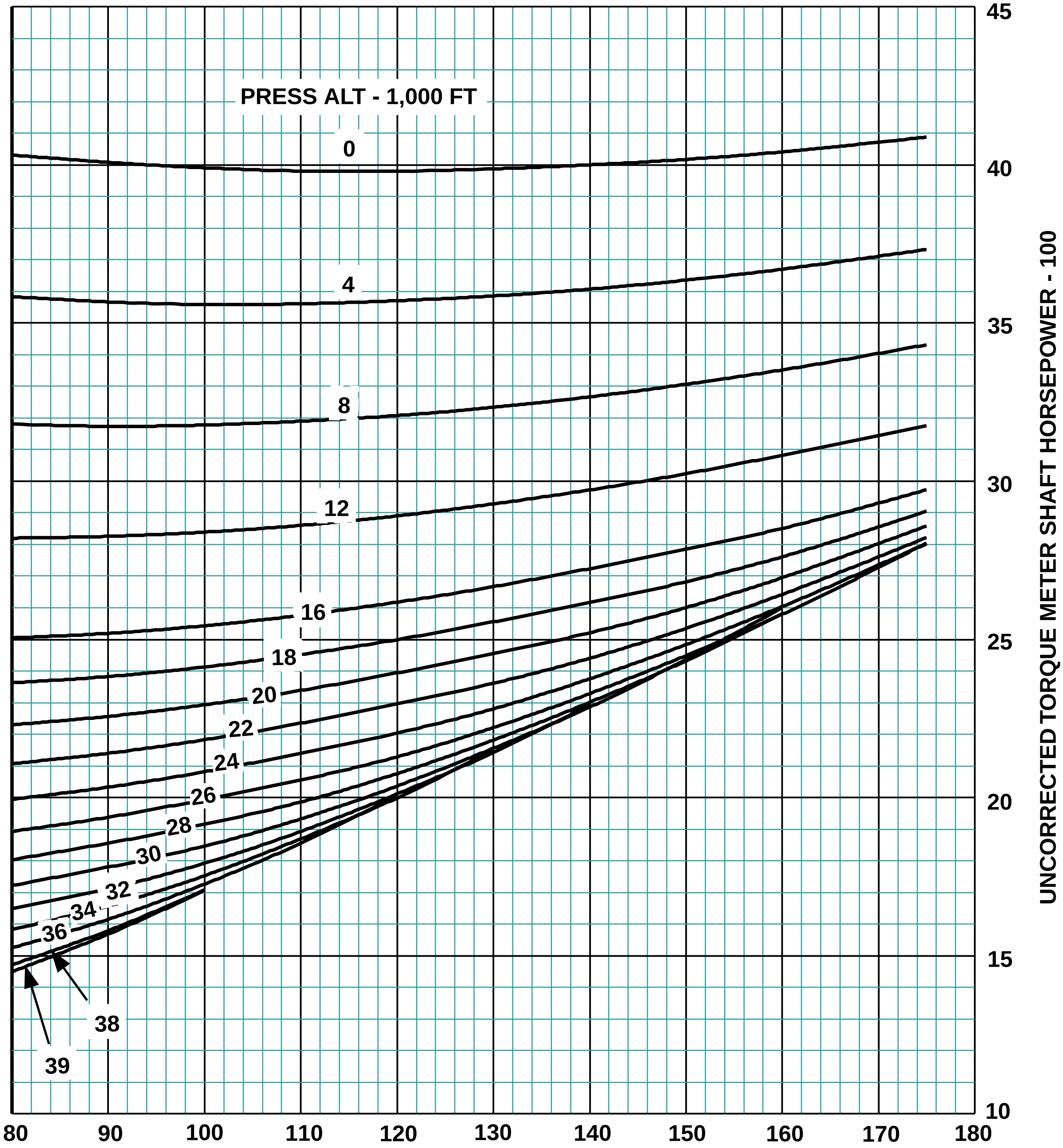
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 300 KTAS CRUISE

4 ENGINES





3278-05-01-069-01

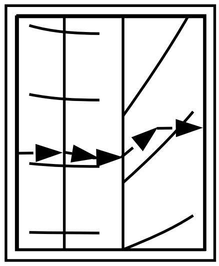
Figure 5-88. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 300 KTAS CRUISE

4 ENGINES



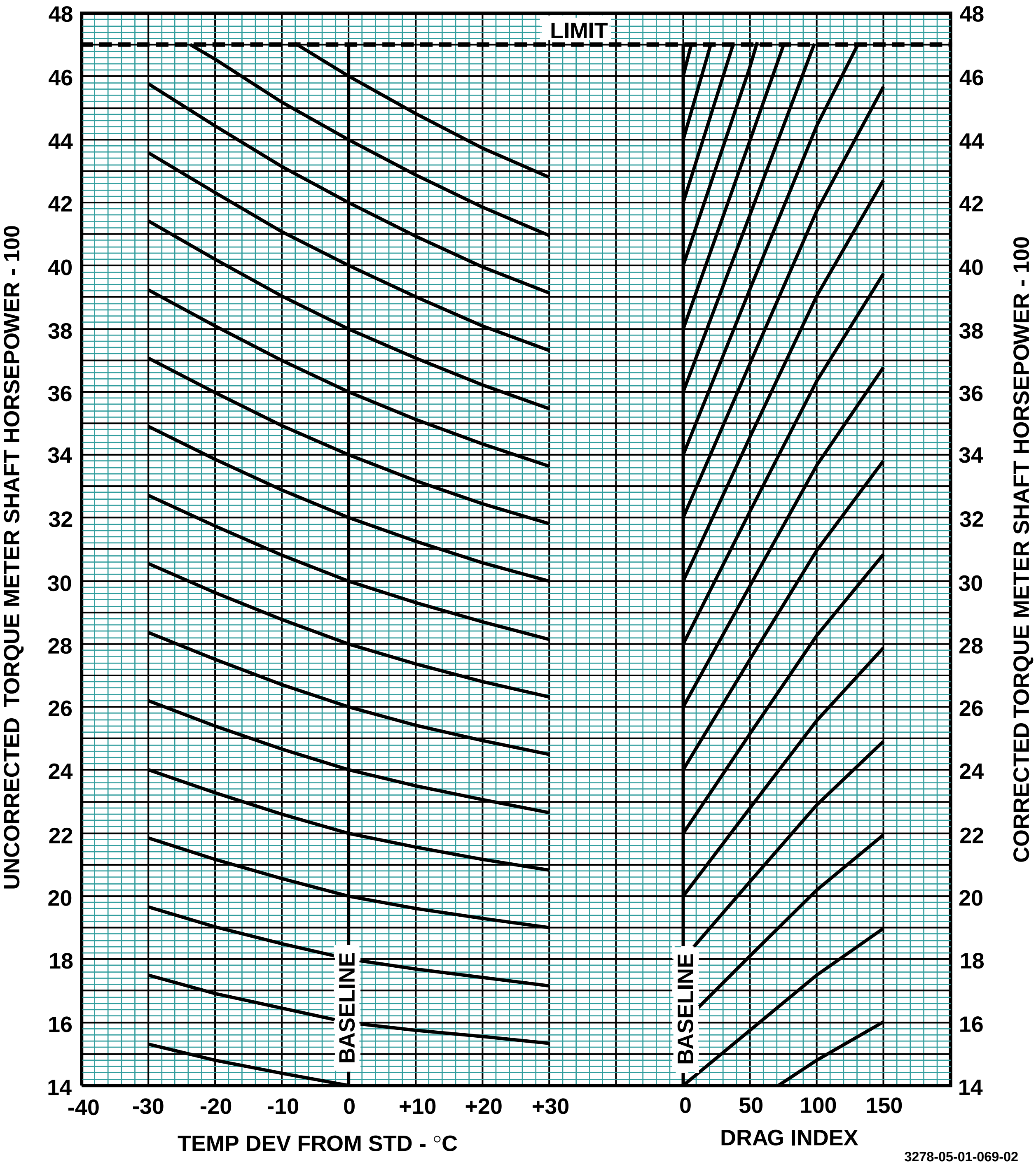


Figure 5-88. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY INDICATED AIRSPEED FOR CONSTANT 320 KTAS CRUISE

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

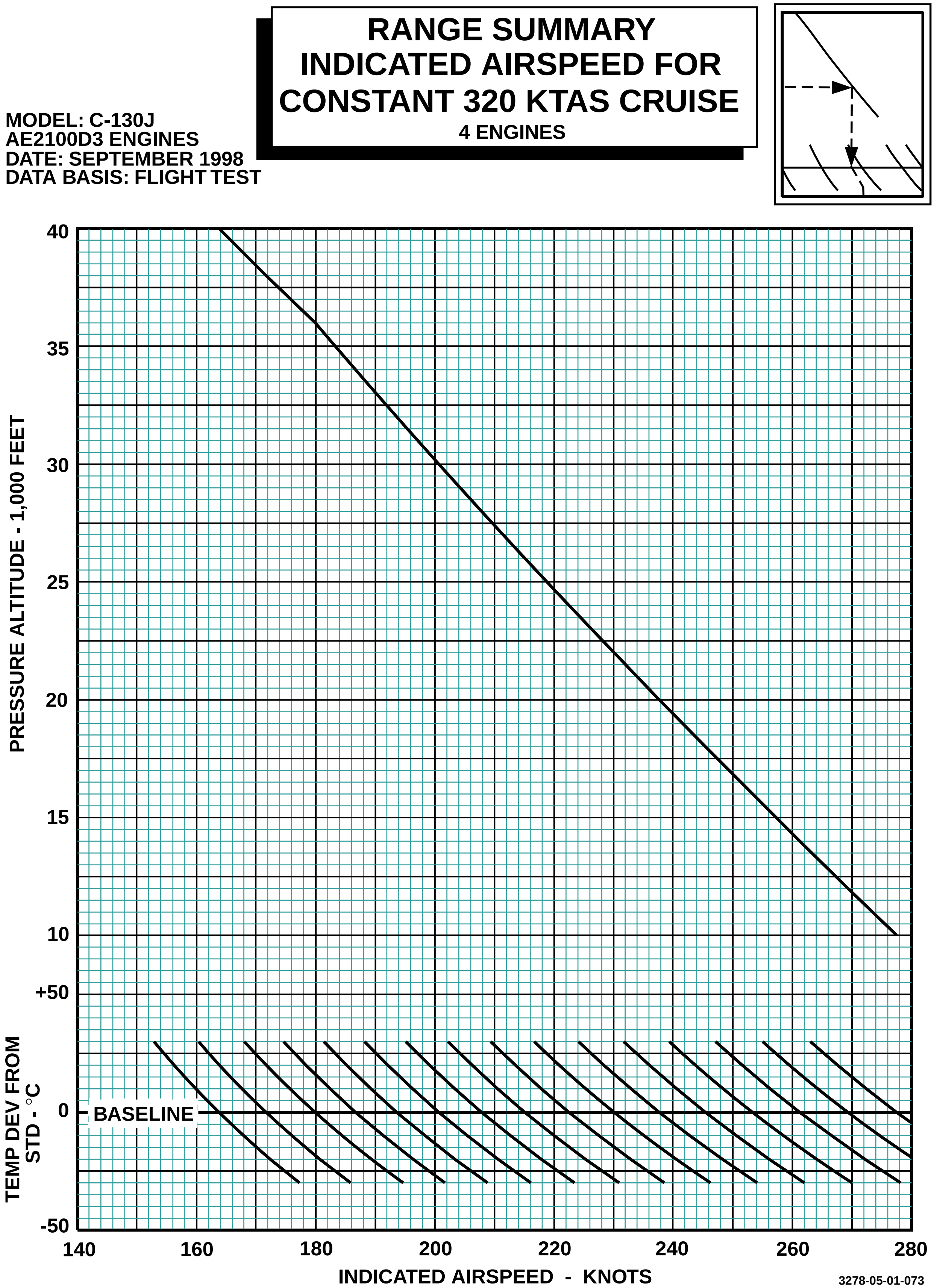
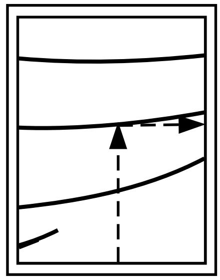


Figure 5-89.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

RANGE SUMMARY FUEL FLOW FOR 320 KTAS CRUISE

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

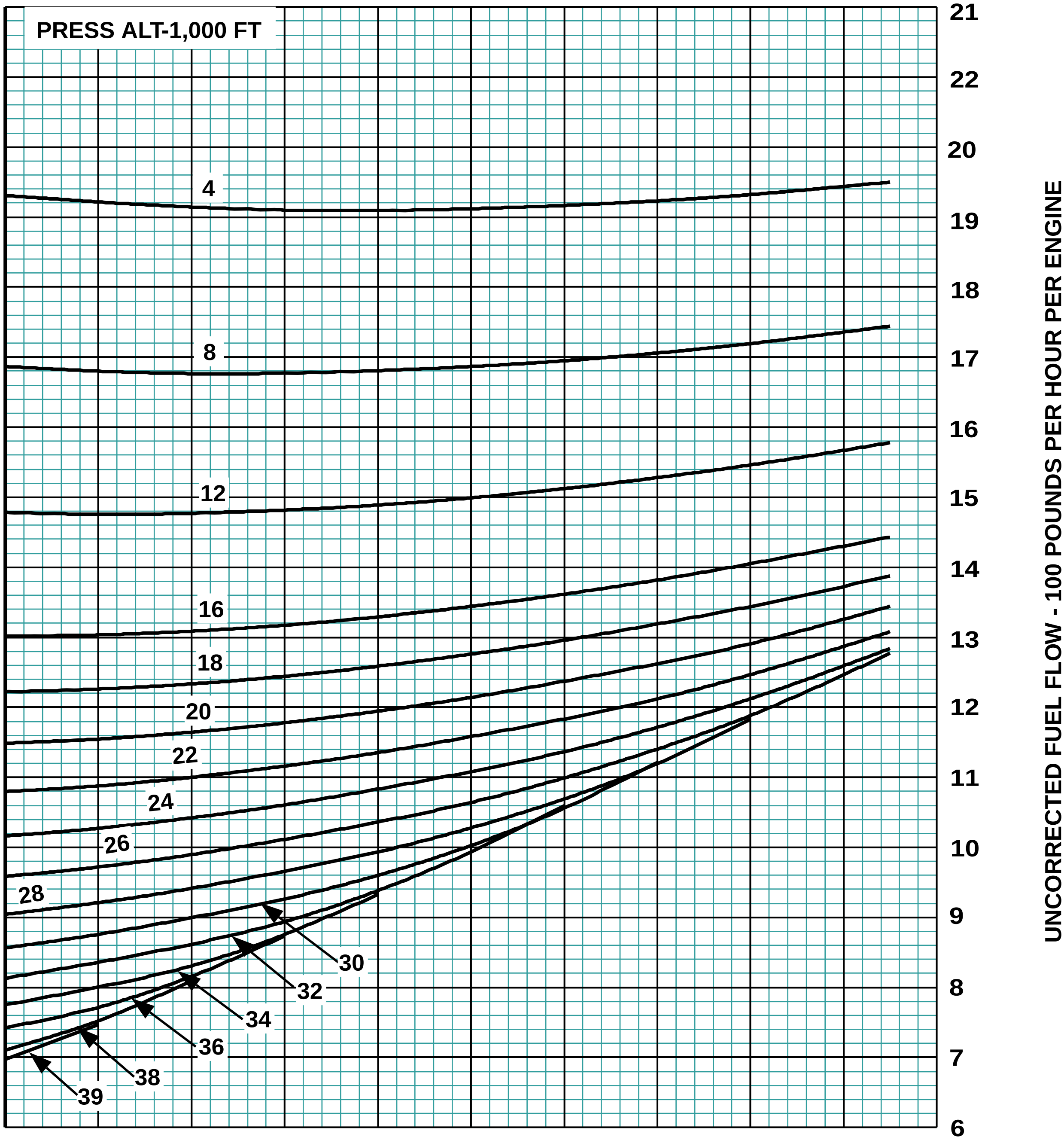


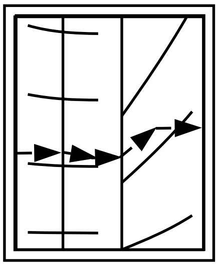
Figure 5-90. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

RANGE SUMMARY FUEL FLOW FOR 320 KTAS CRUISE

4 ENGINES



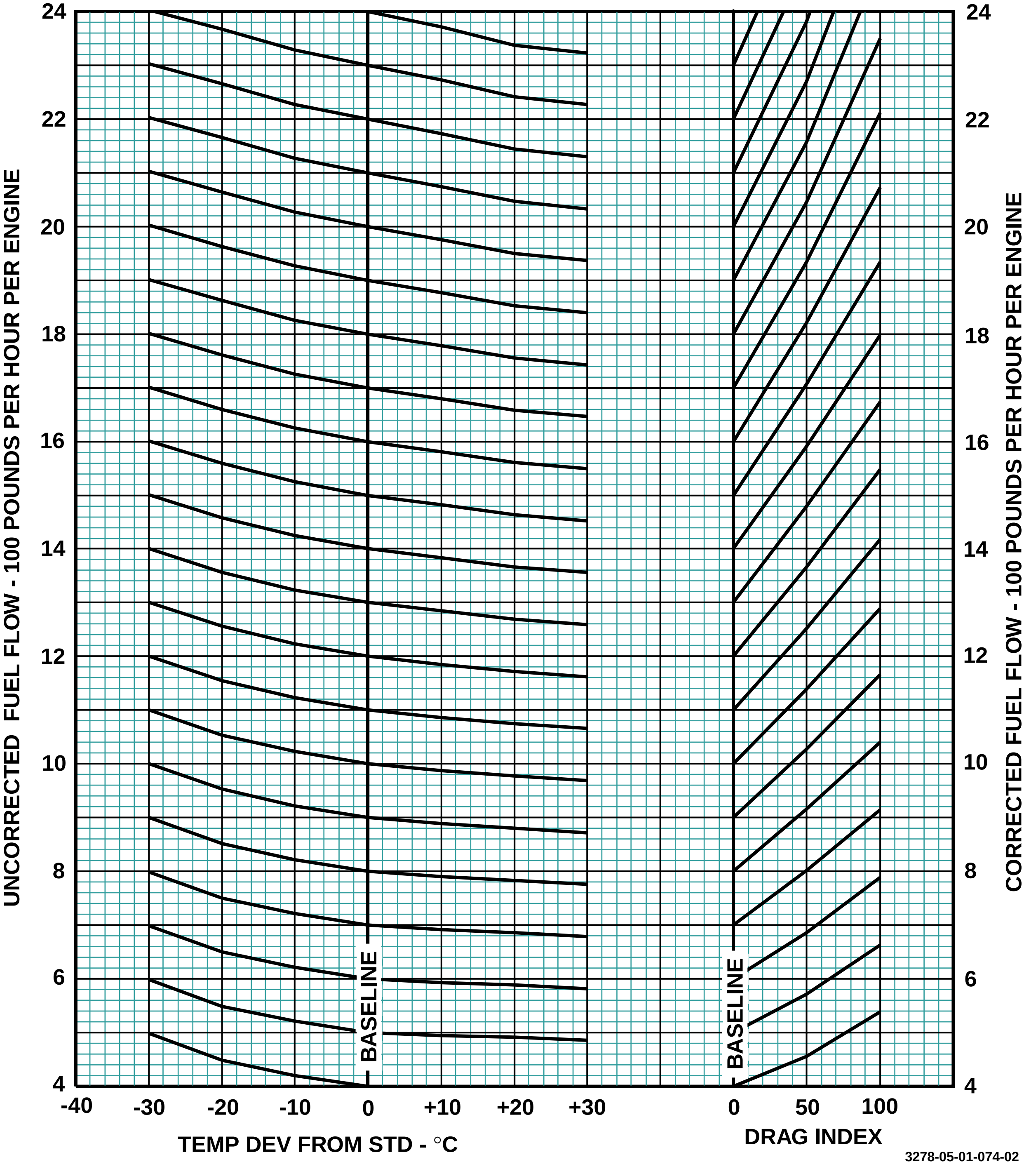


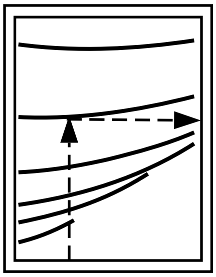
Figure 5-90. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 320 KTAS CRUISE

4 ENGINES



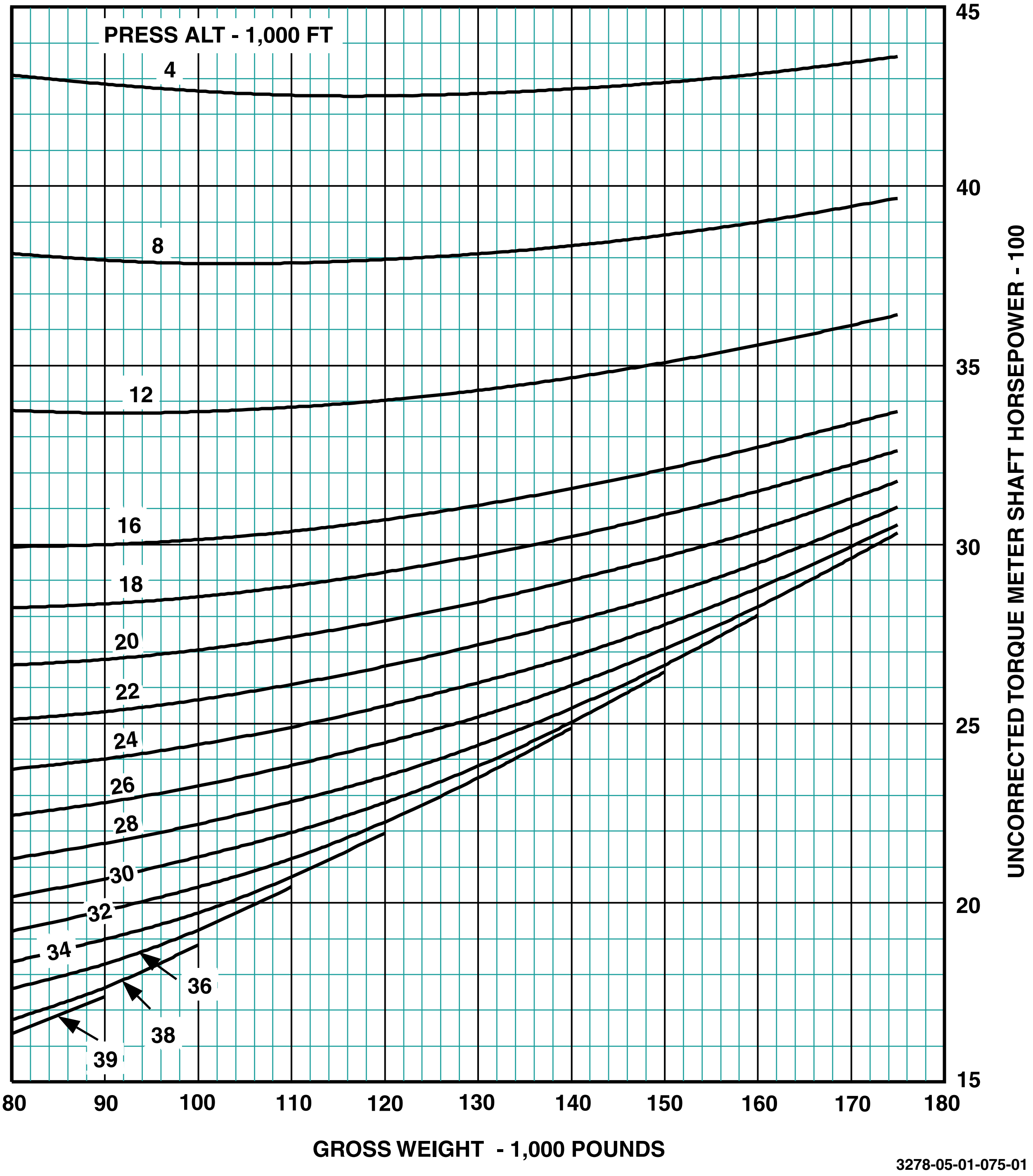


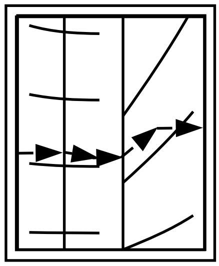
Figure 5-91. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

TORQUE METER SHAFT HORSEPOWER FOR 320 KTAS CRUISE

4 ENGINES



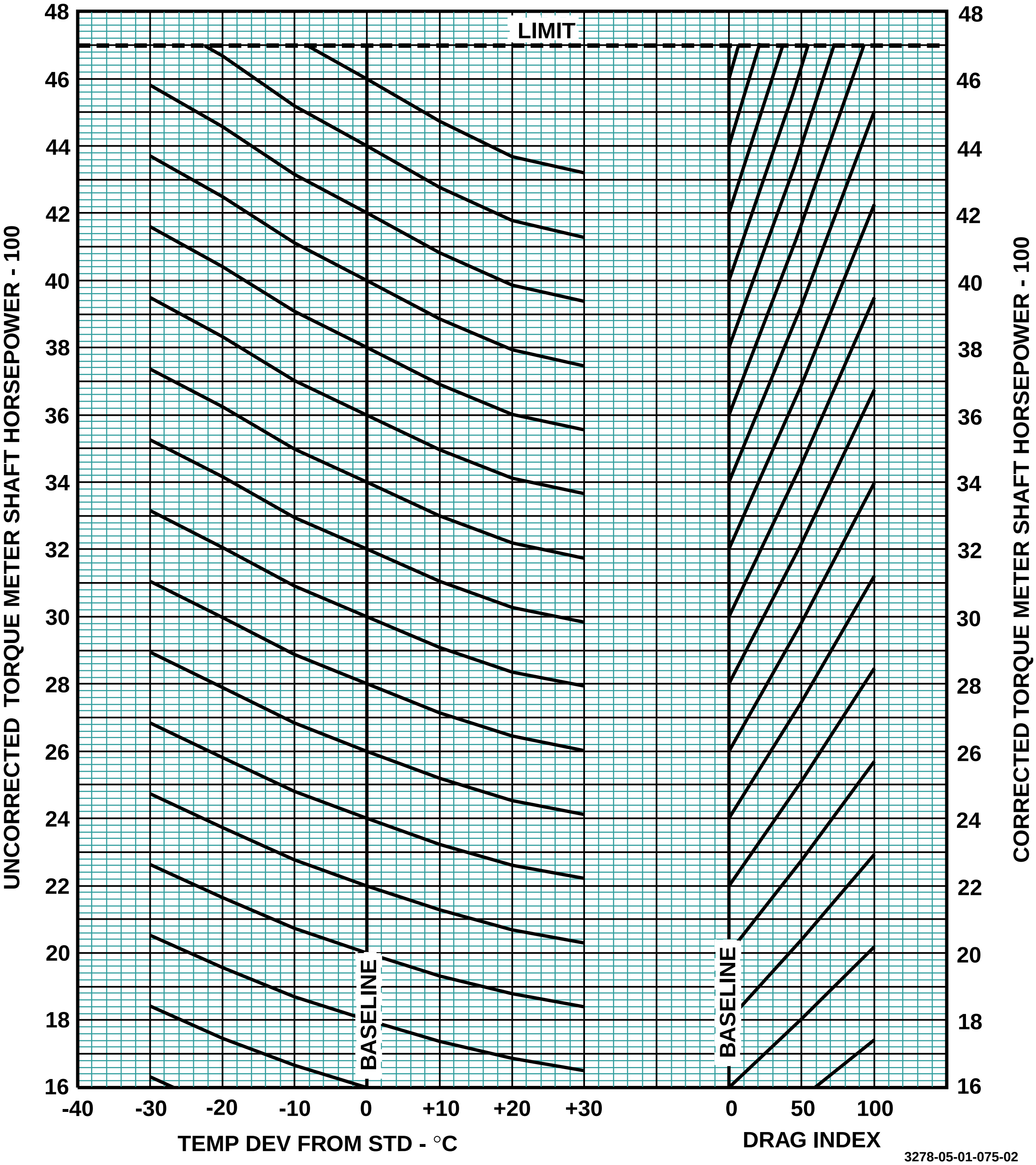


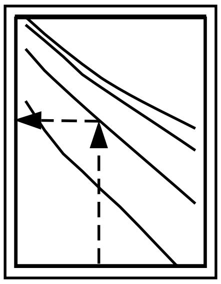
Figure 5-91. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SERVICE CEILING

3 ENGINES NORMAL BLEED



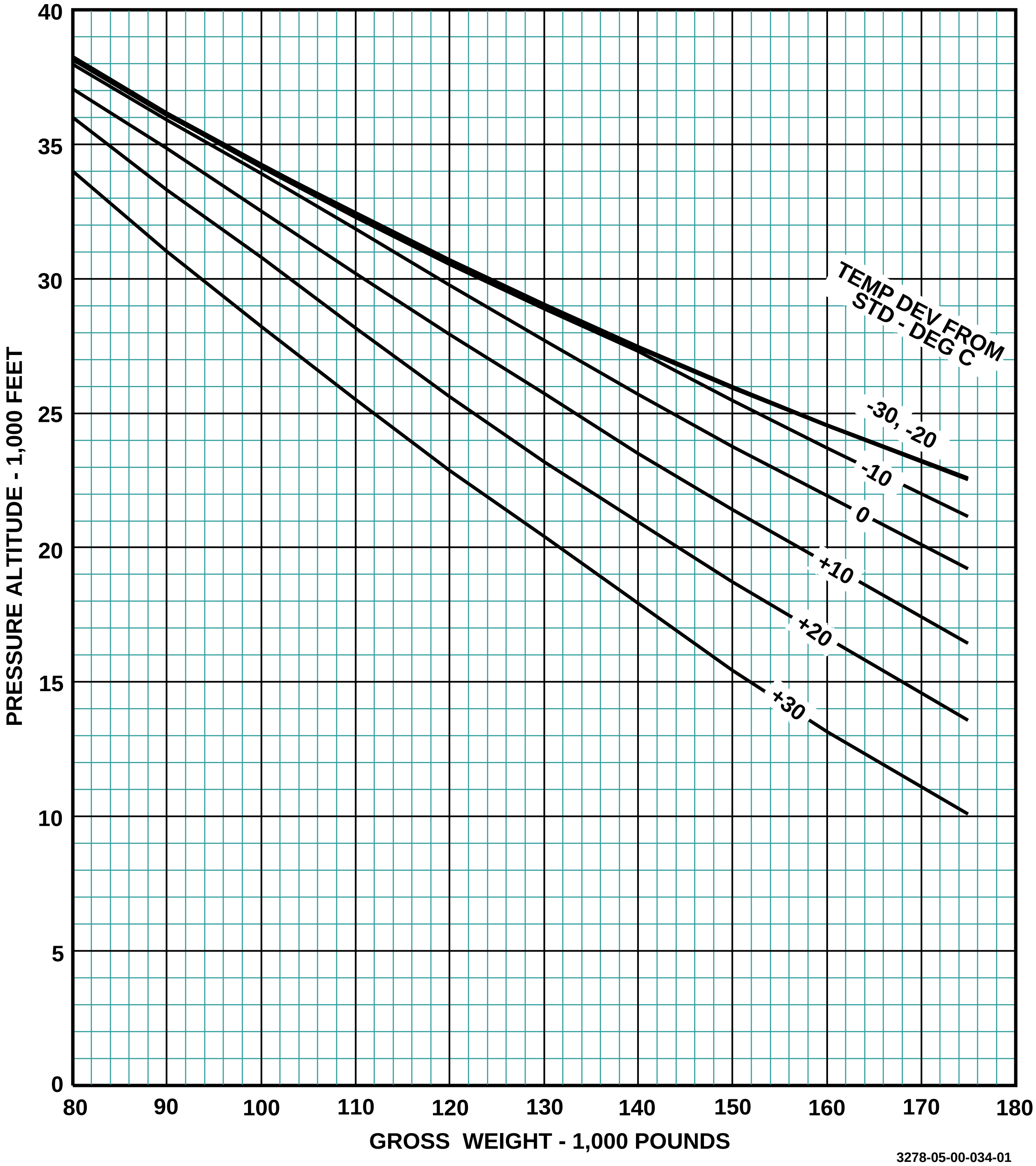


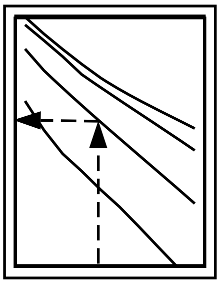
Figure 5-92. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SERVICE CEILING

3 ENGINES ALL BLEED



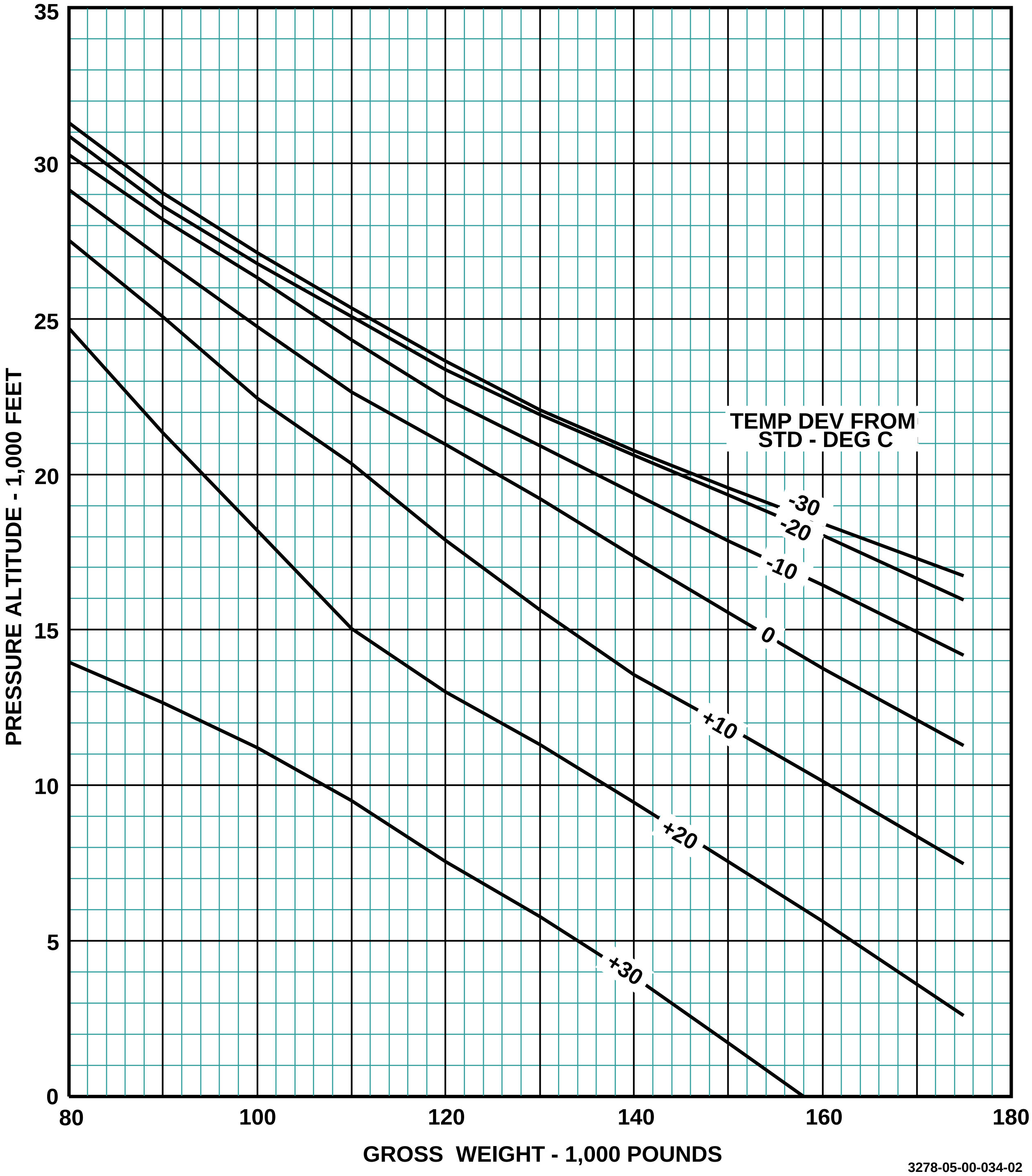


Figure 5-92. (Sheet 2 of 2)

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SERVICE CEILING FOR VARIANT CONFIGURATION

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

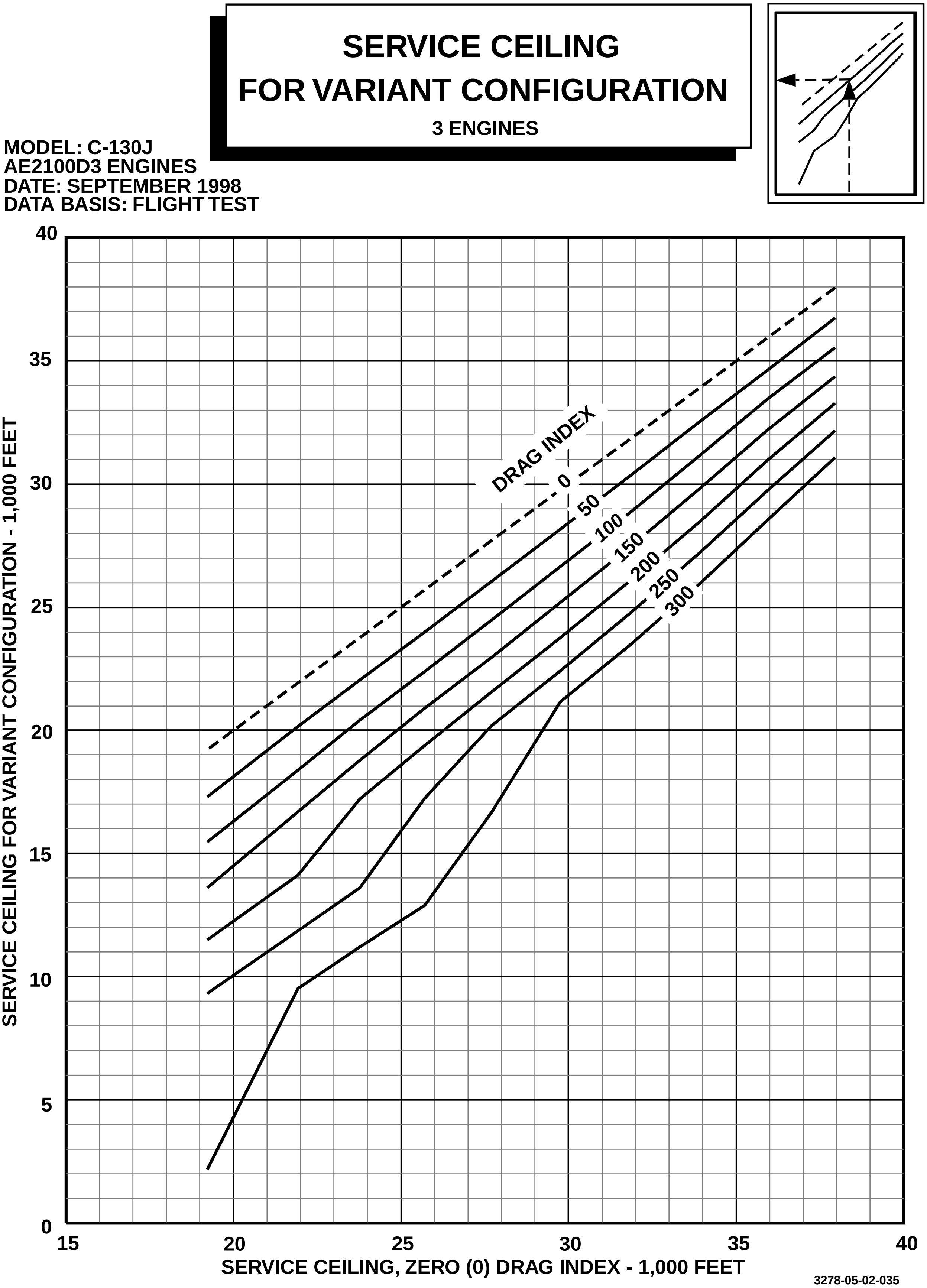

Figure 5-93.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

SERVICE CEILING

2 ENGINES NORMAL BLEED

SYMMETRICAL POWER

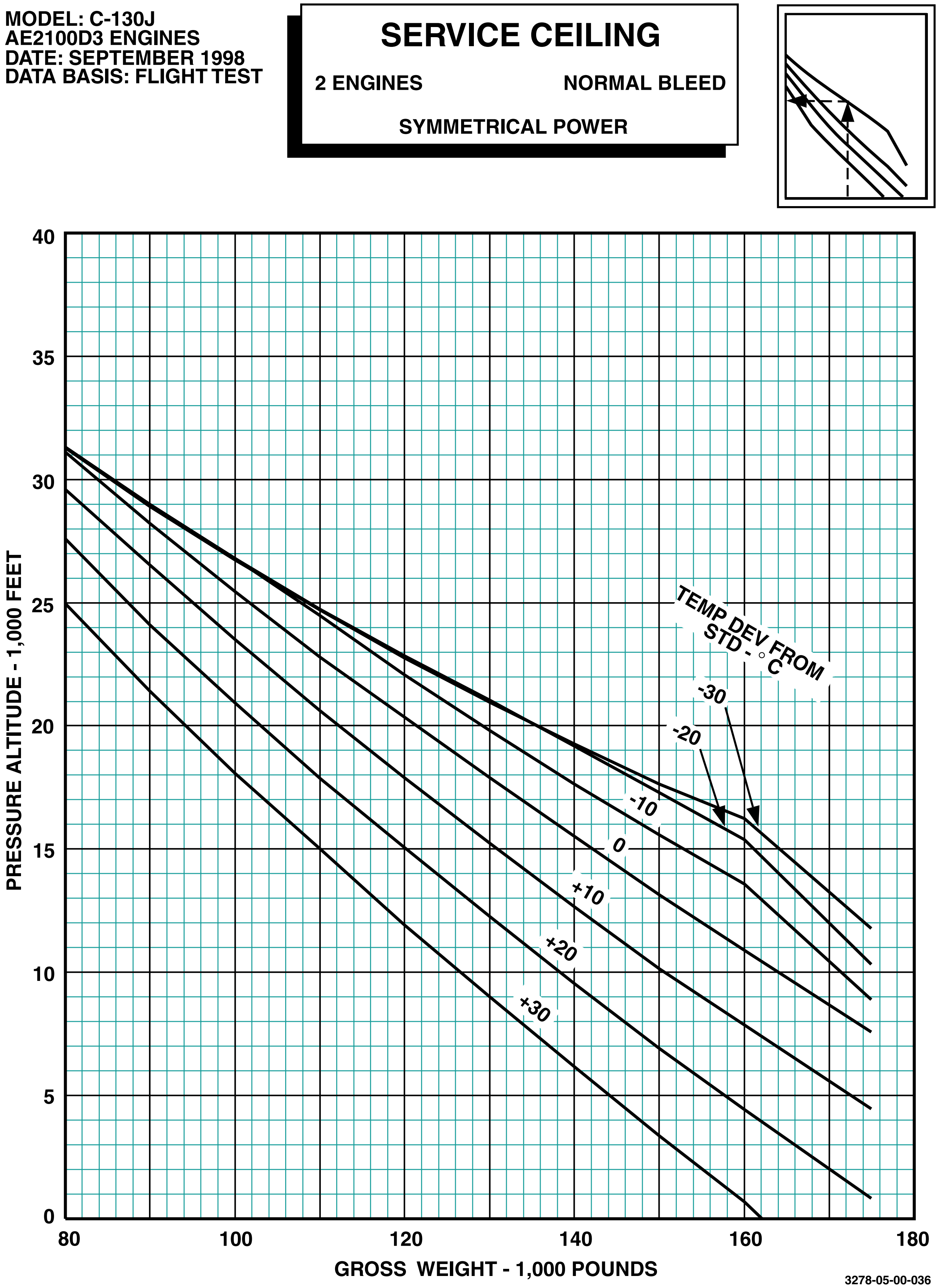

Figure 5-94.

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SERVICE CEILING FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

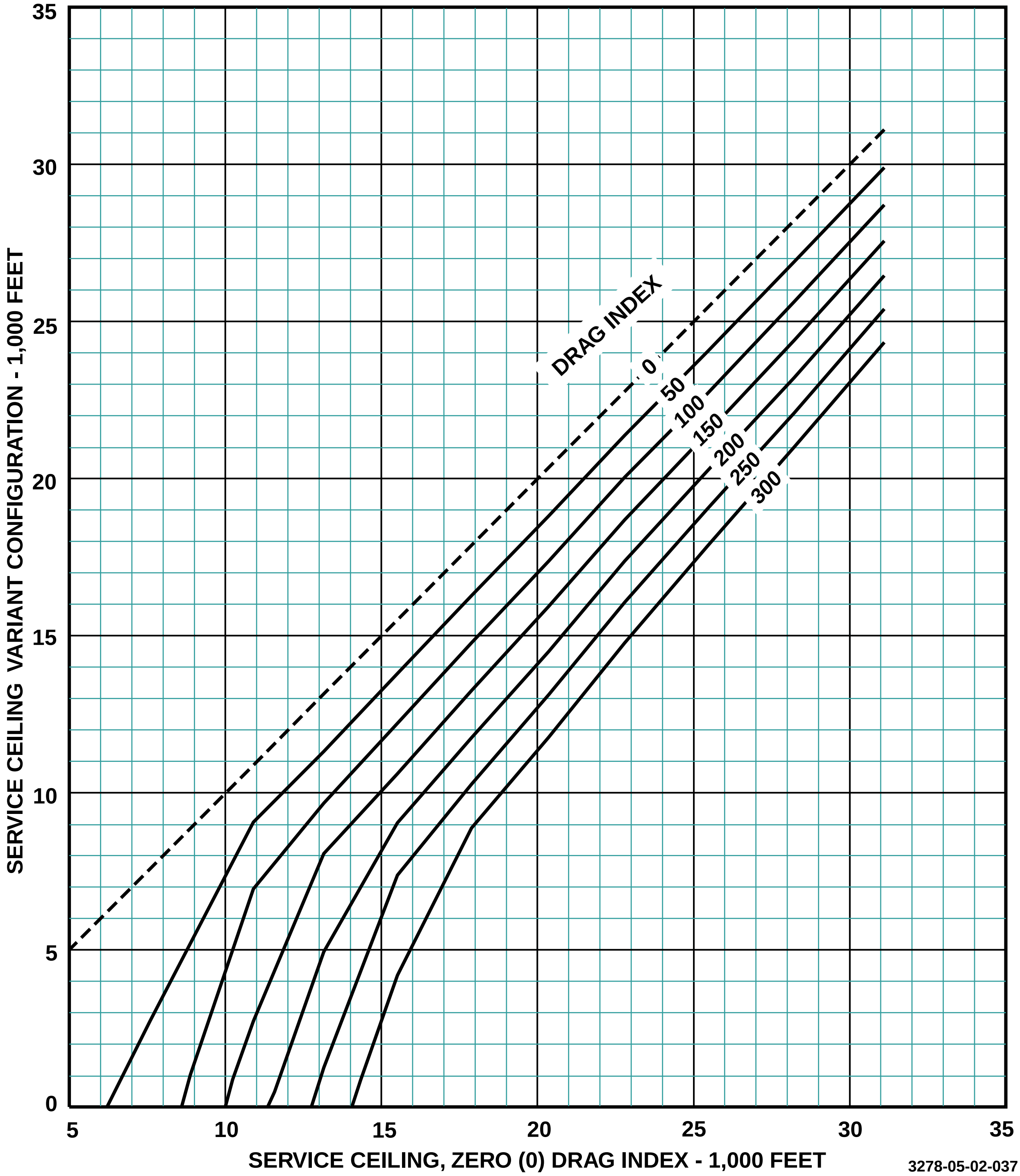

Figure 5-95.

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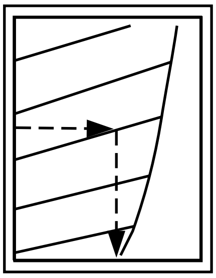
DRIFTDOWN ALTITUDE LOSS

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



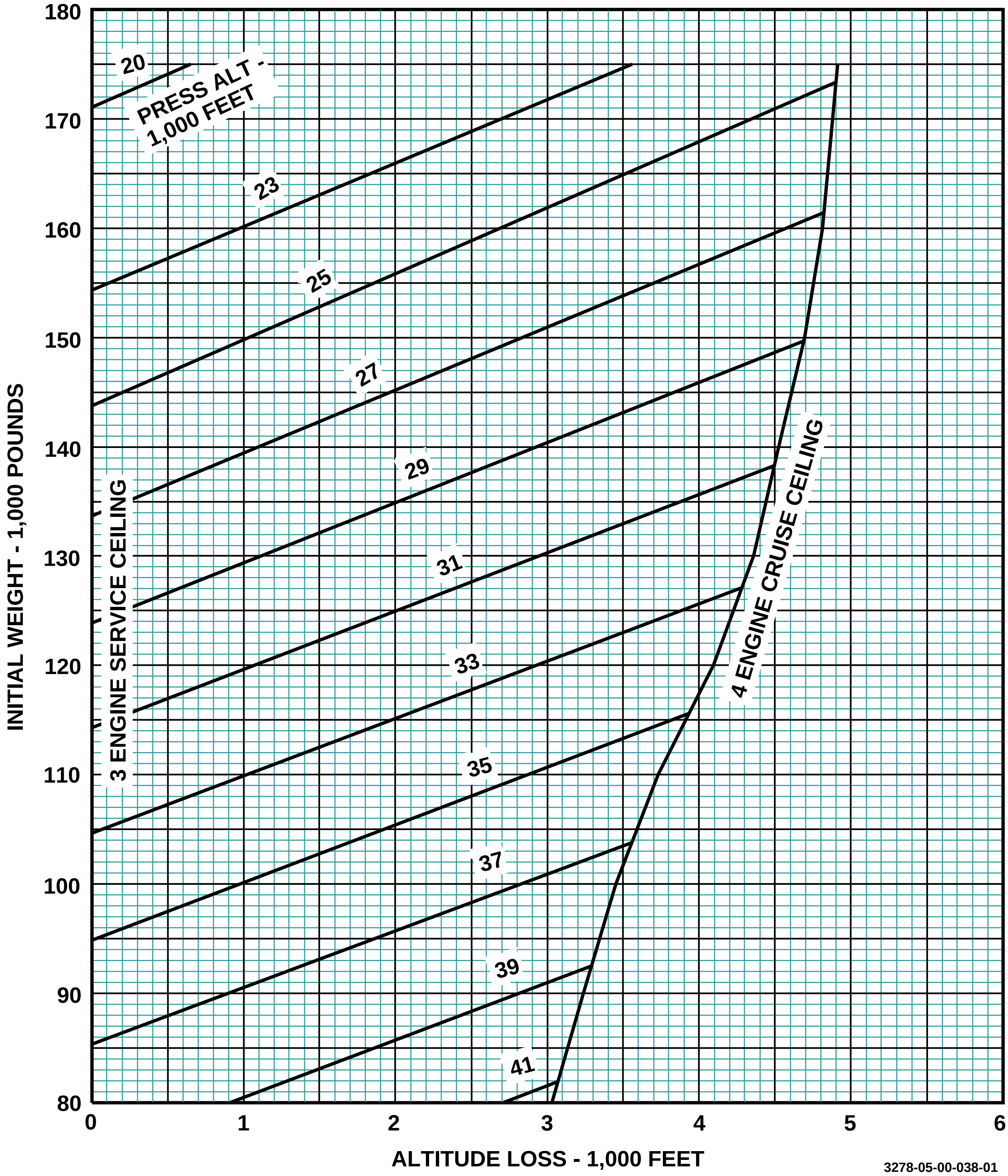


Figure 5-96.

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DRIFTDOWN ALTITUDE LOSS

FOR VARIANT CONFIGURATION
4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING
3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

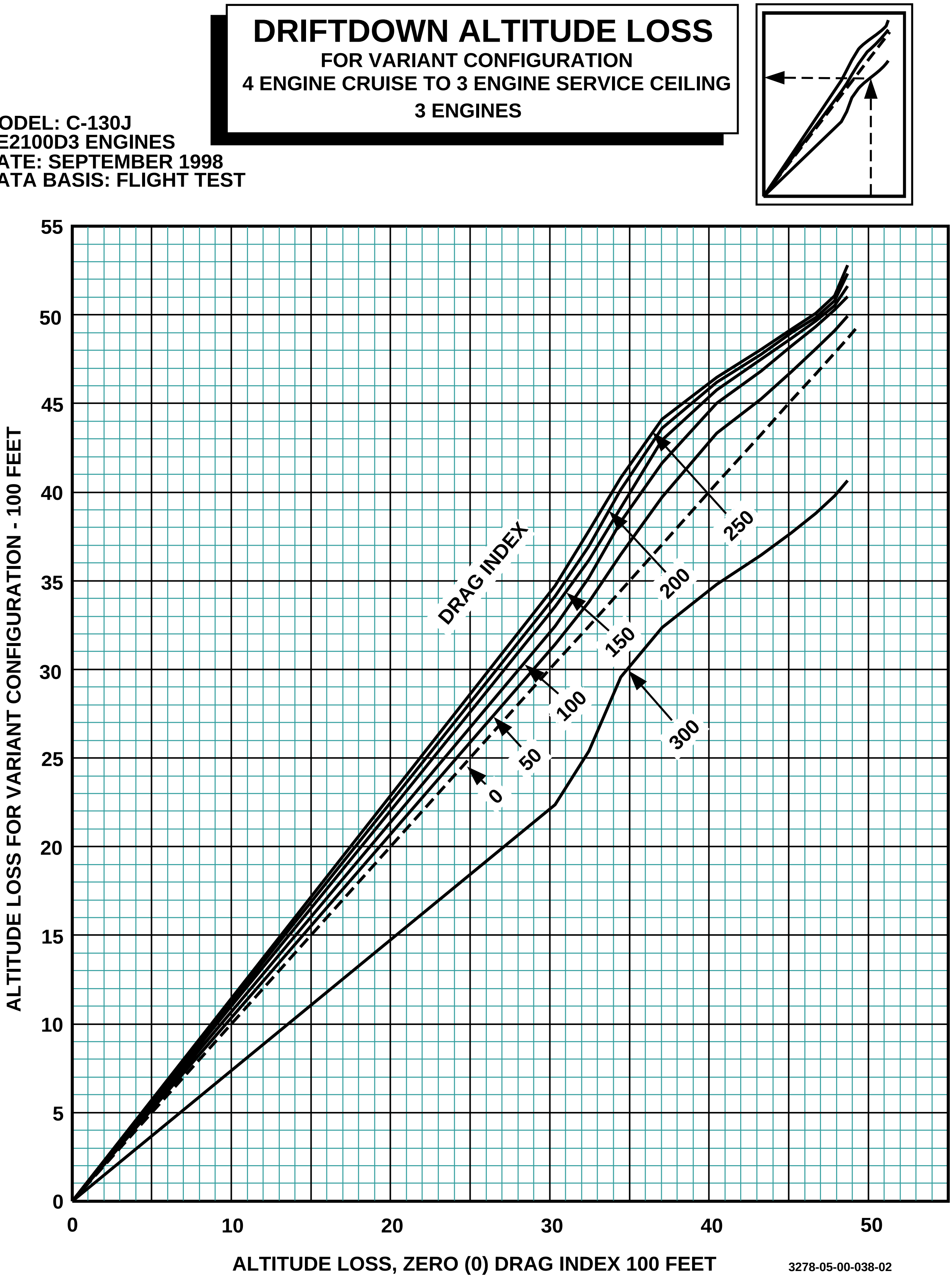


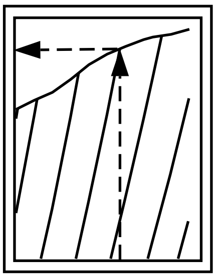
Figure 5-97.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

DRIFTDOWN TIME

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES MAX CONTINUOUS POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

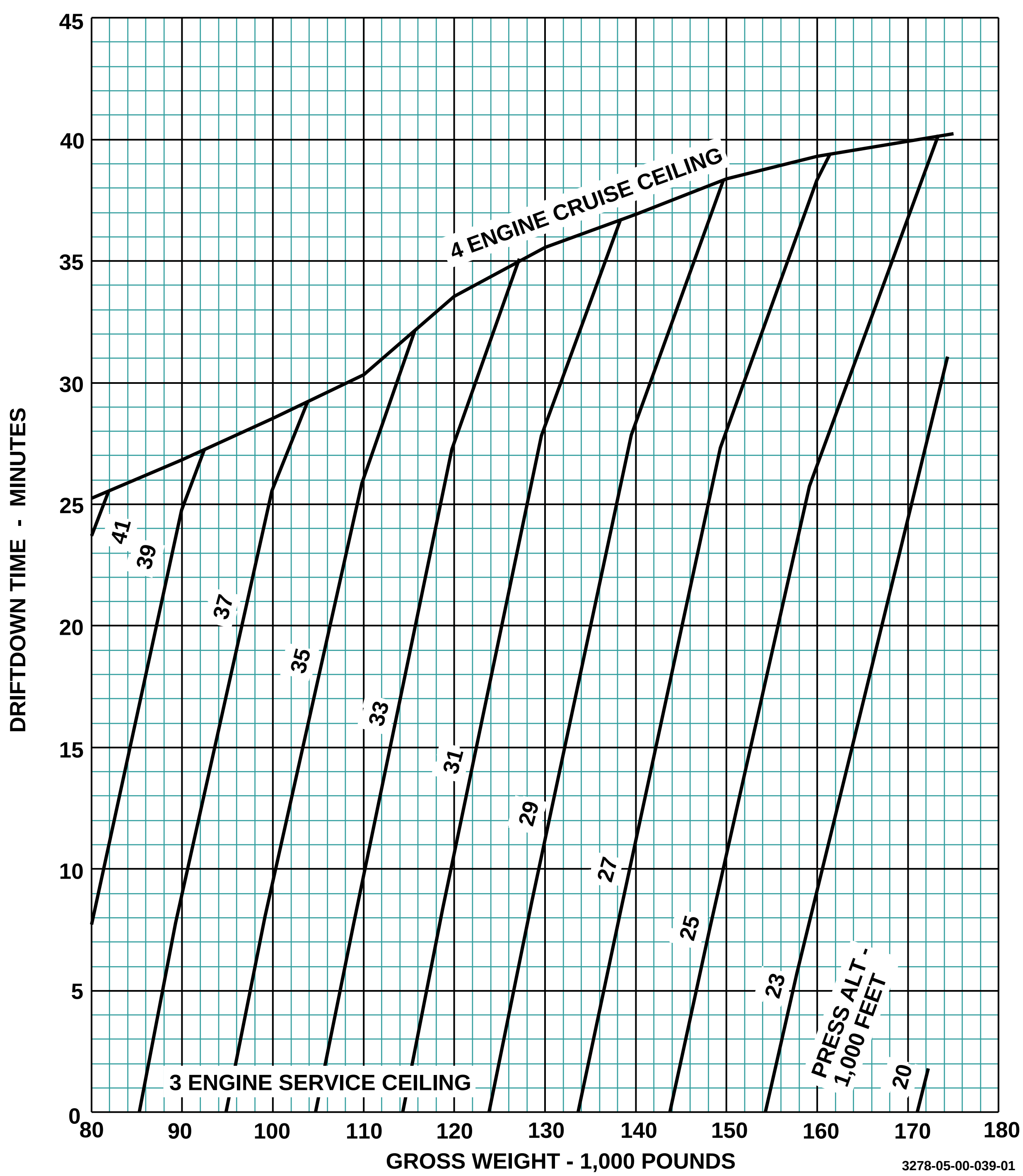


Figure 5-98.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

DRIFTDOWN TIME FOR VARIANT CONFIGURATION

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES MAX CONTINUOUS POWER

MODEL: C-130J-30
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

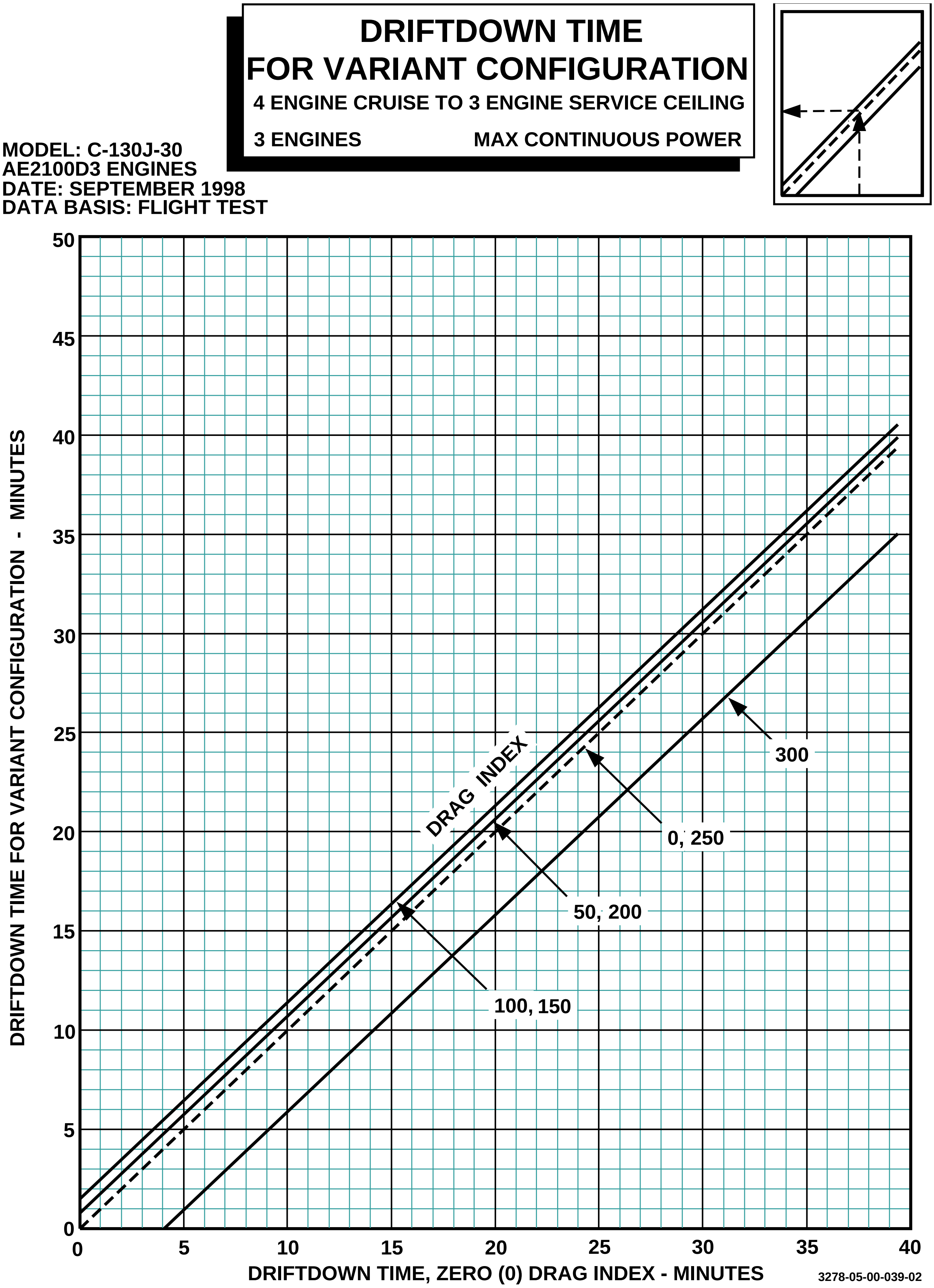


Figure 5-99.

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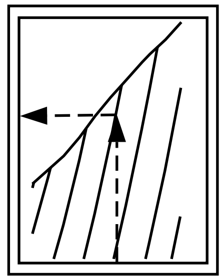
DRIFTDOWN FUEL

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES MAX CONTINUOUS POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

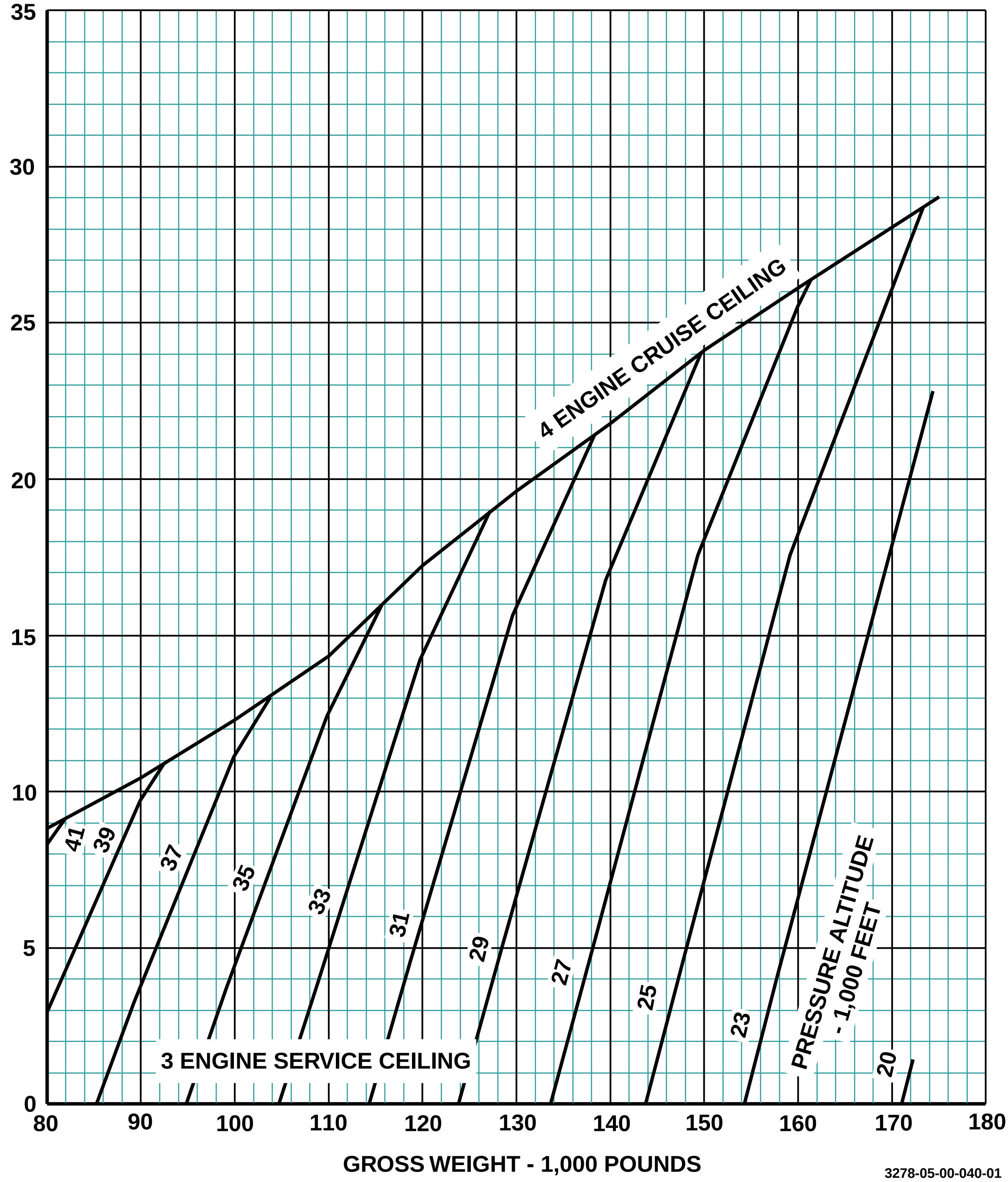


Figure 5-100.

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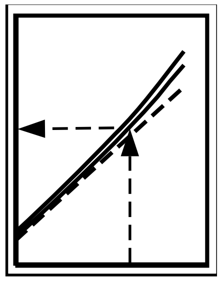
DRIFTDOWN FUEL FOR VARIANT CONFIGURATION

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES MAX CONTINUOUS POWER

MODEL: C-130J-30
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



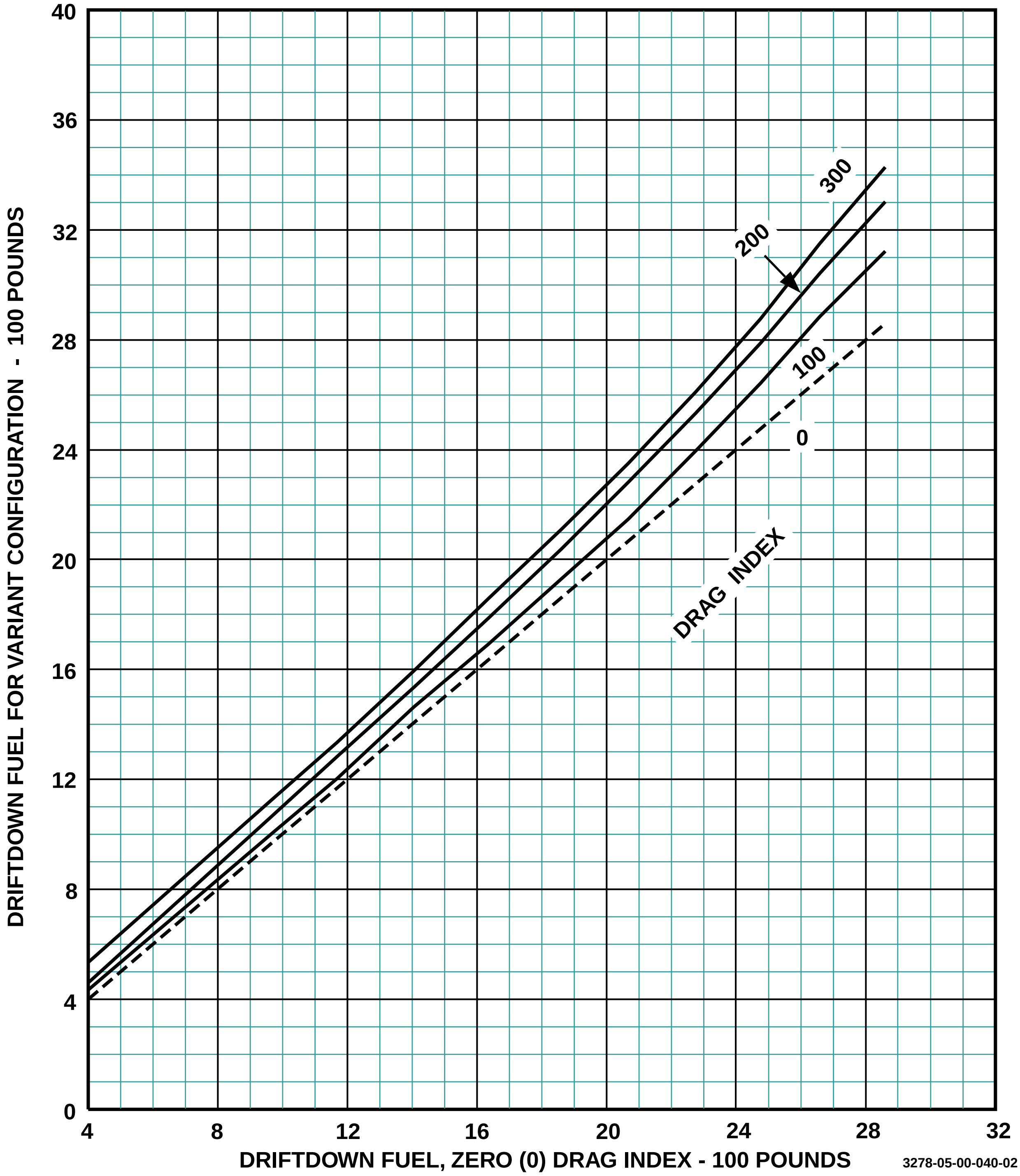


Figure 5-101.

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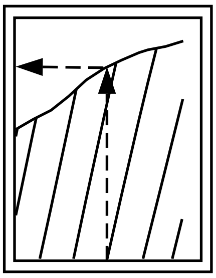
DRIFTDOWN DISTANCE

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES MAX CONTINUOUS POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



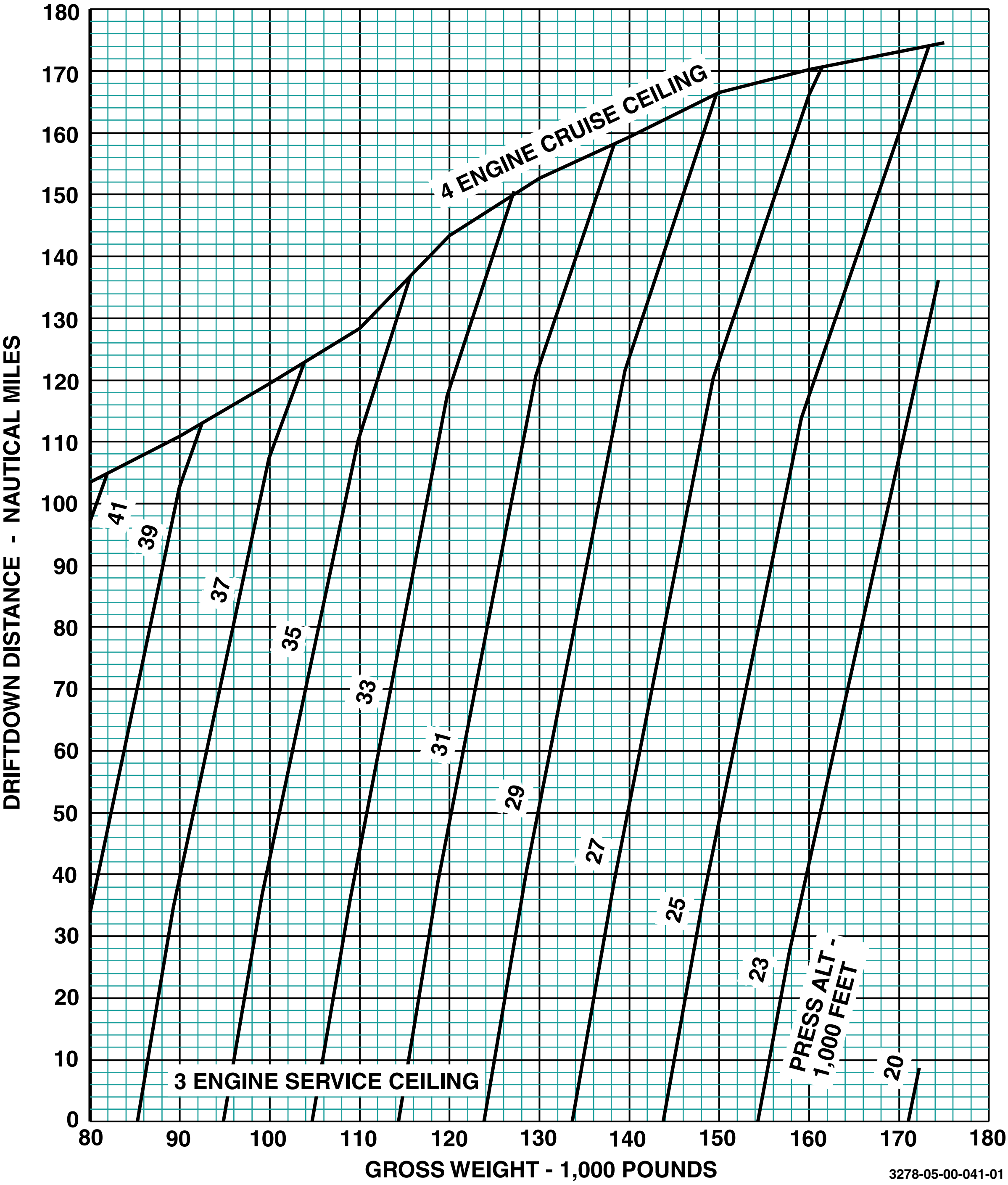


Figure 5-102.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

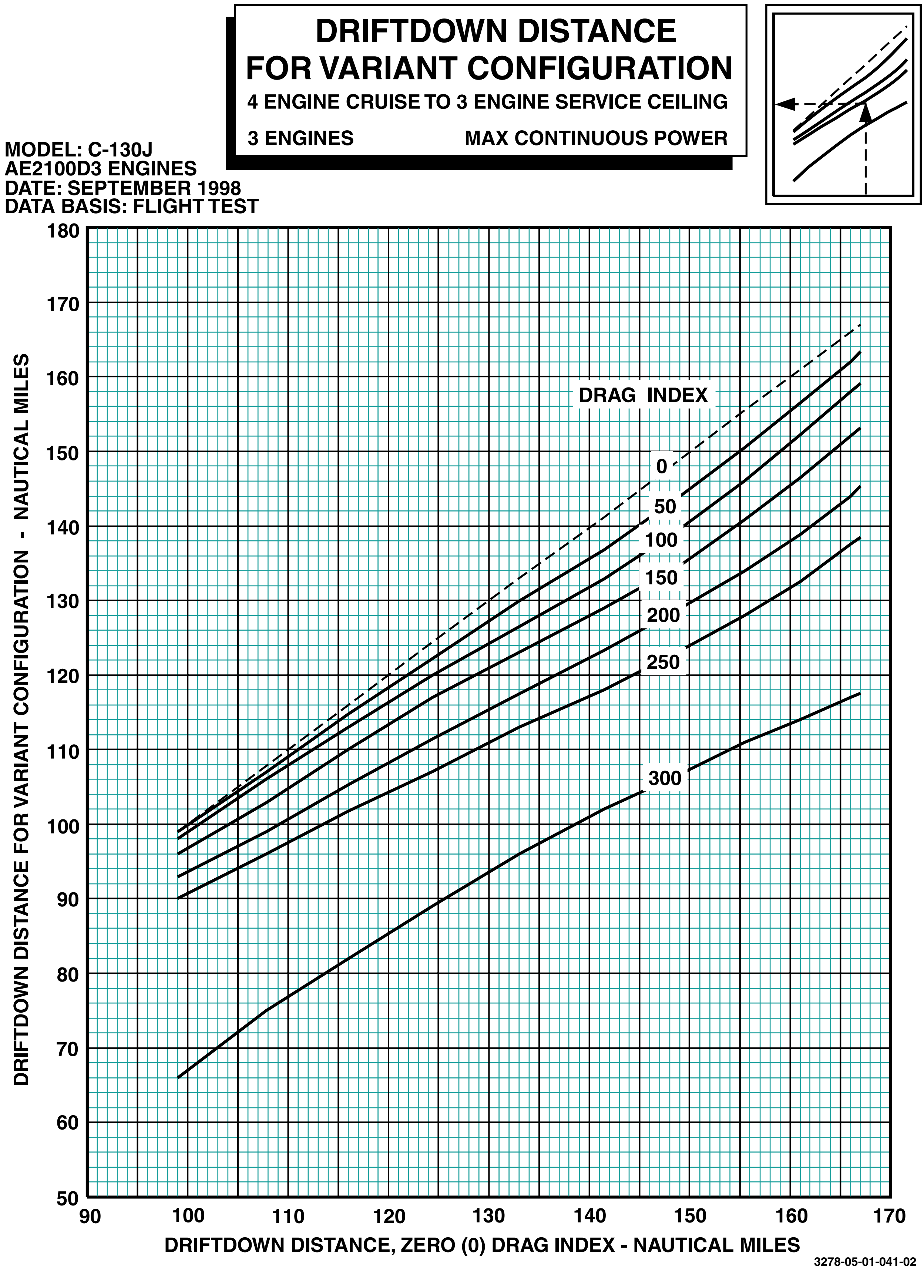


Figure 5-103.

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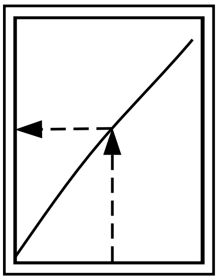
statement on the title page of this document.

DRIFTDOWN AIRSPEED

4 ENGINE CRUISE TO 3 ENGINE SERVICE CEILING

3 ENGINES **MAX CONTINUOUS POWER**



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

INITIAL SEGMENT

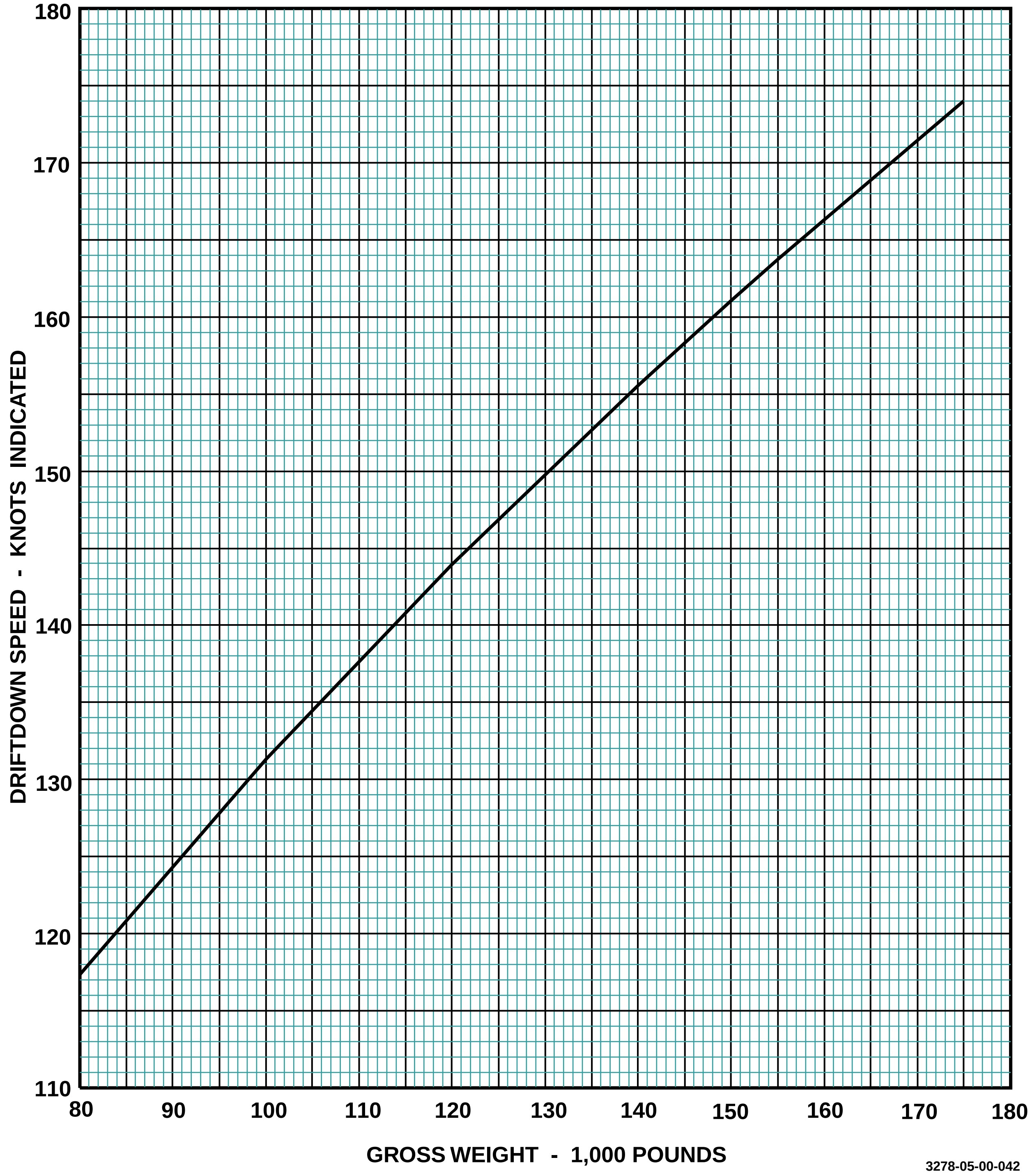


Figure 5-104.

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DRIFTDOWN ALTITUDE LOSS
3 ENGINE CRUISE TO 2 ENGINE SERVICE CEILING
2 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

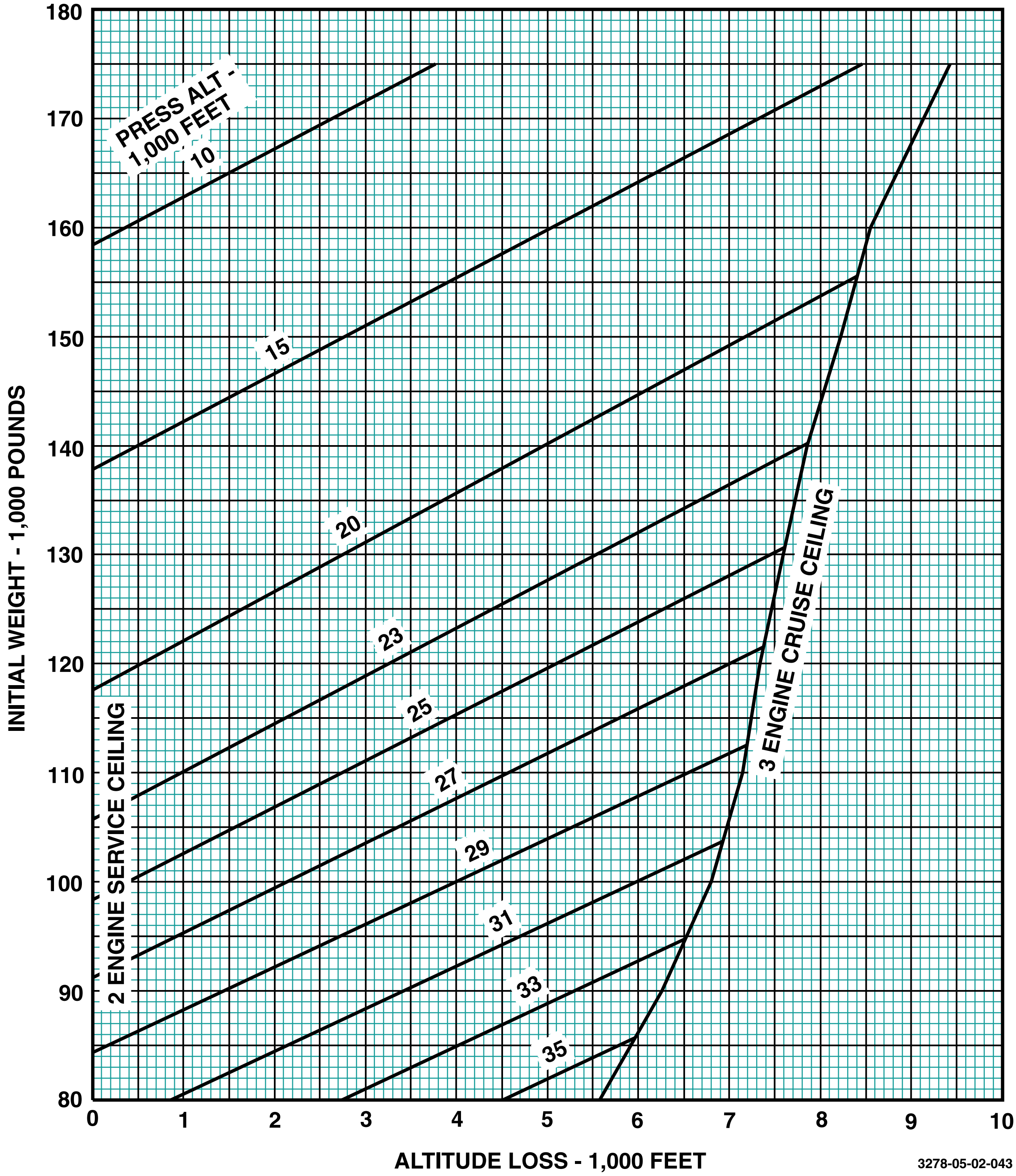

Figure 5-105.

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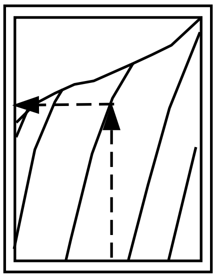
DRIFTDOWN TIME

3 ENGINE CRUISE TO 2 ENGINE SERVICE CEILING

2 ENGINES MAX CONTINUOUS POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

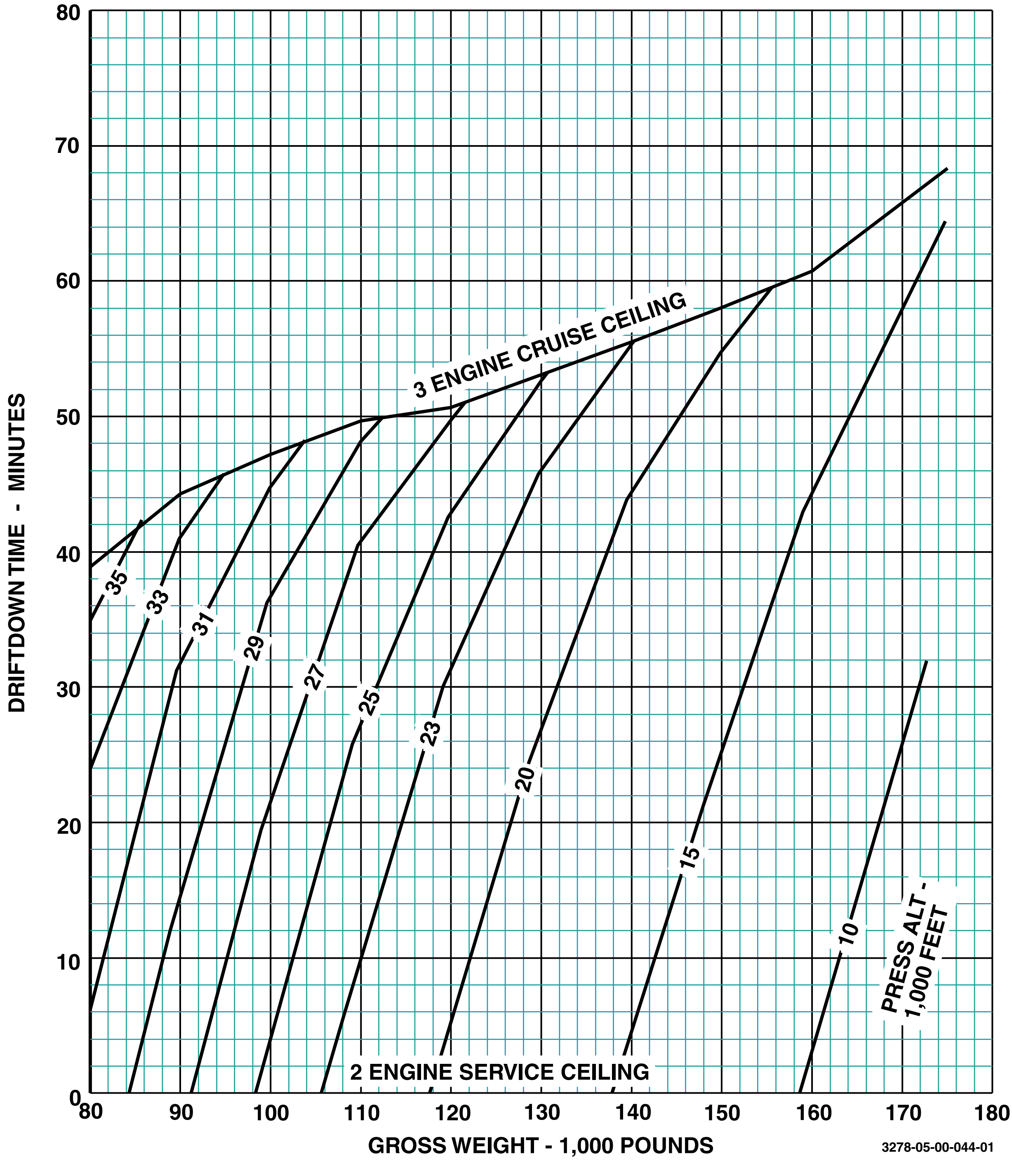


Figure 5-106.

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DRIFTDOWN FUEL

3 ENGINE CRUISE TO 2 ENGINE SERVICE CEILING

2 ENGINES — MAX CONTINUOUS POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

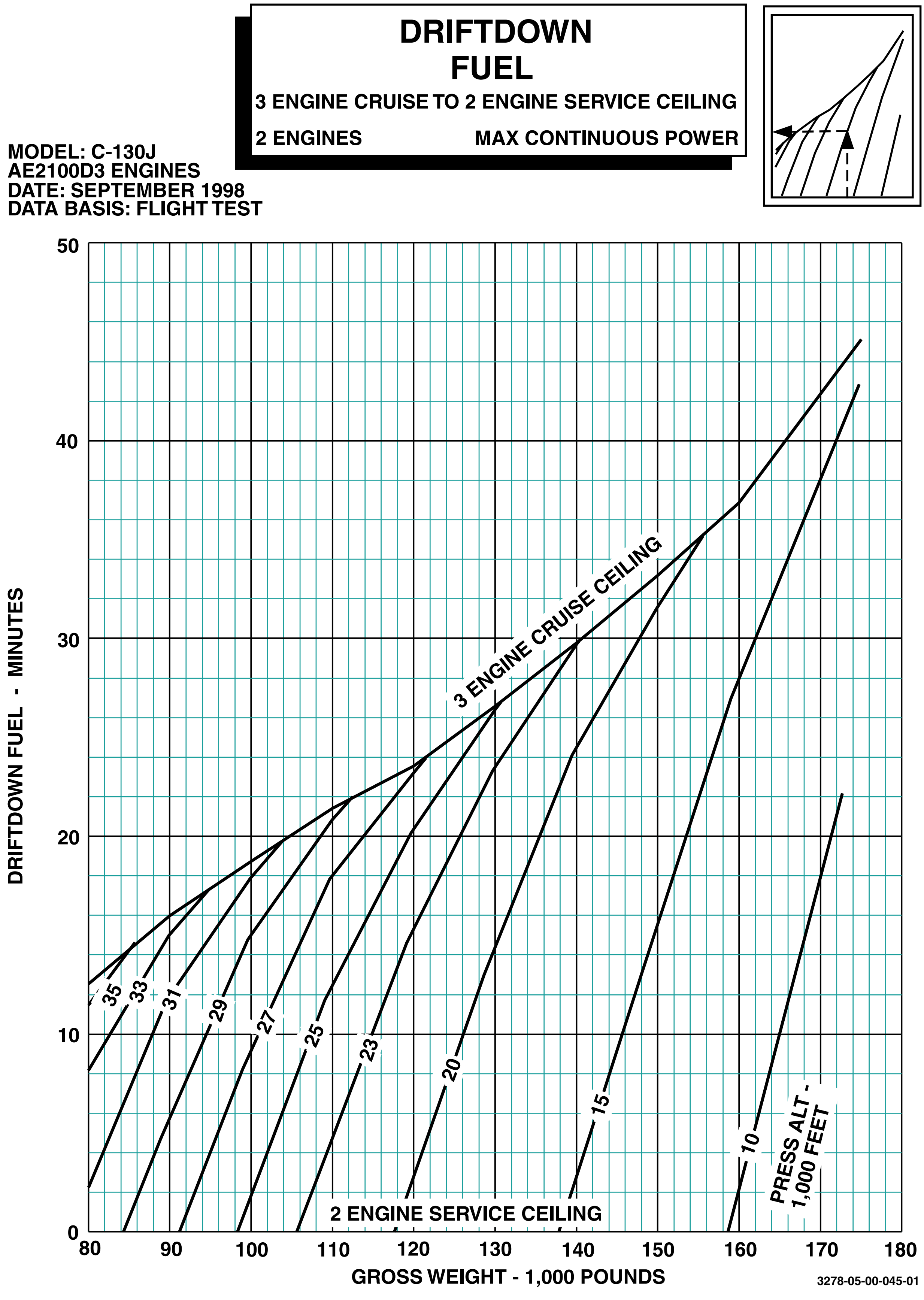

Figure 5-107.

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DRIFTDOWN DISTANCE

3 ENGINE CRUISE TO 2 ENGINE SERVICE CEILING

2 ENGINES — MAX CONTINUOUS POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

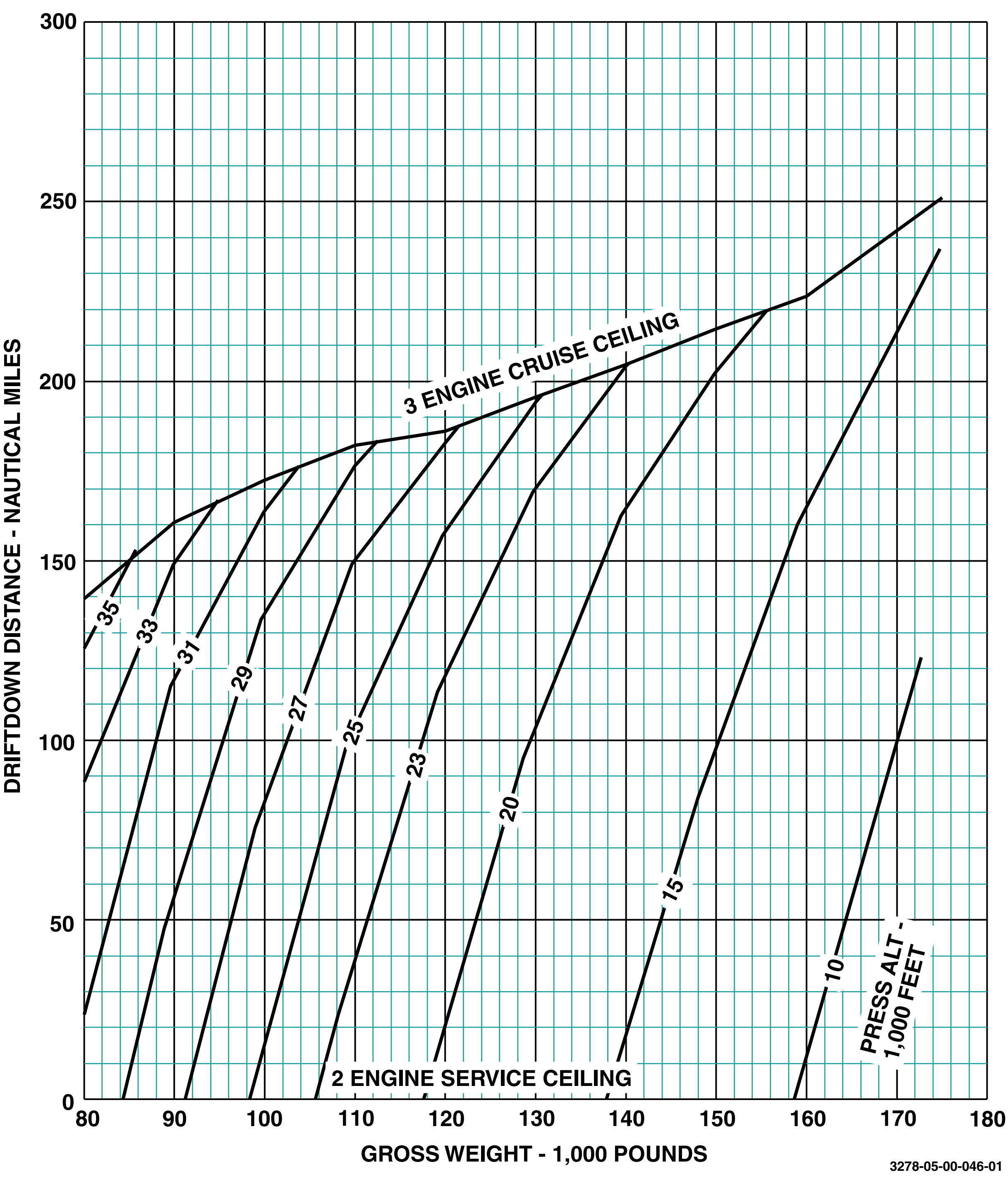

Figure 5-108.

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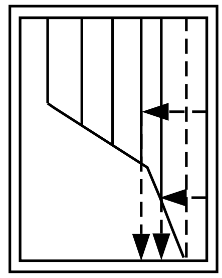
DRIFTDOWN AIRSPEED

3 ENGINE CRUISE TO 2 ENGINE SERVICE CEILING

2 ENGINES SYMMETRIC MAX CONTINUOUS POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

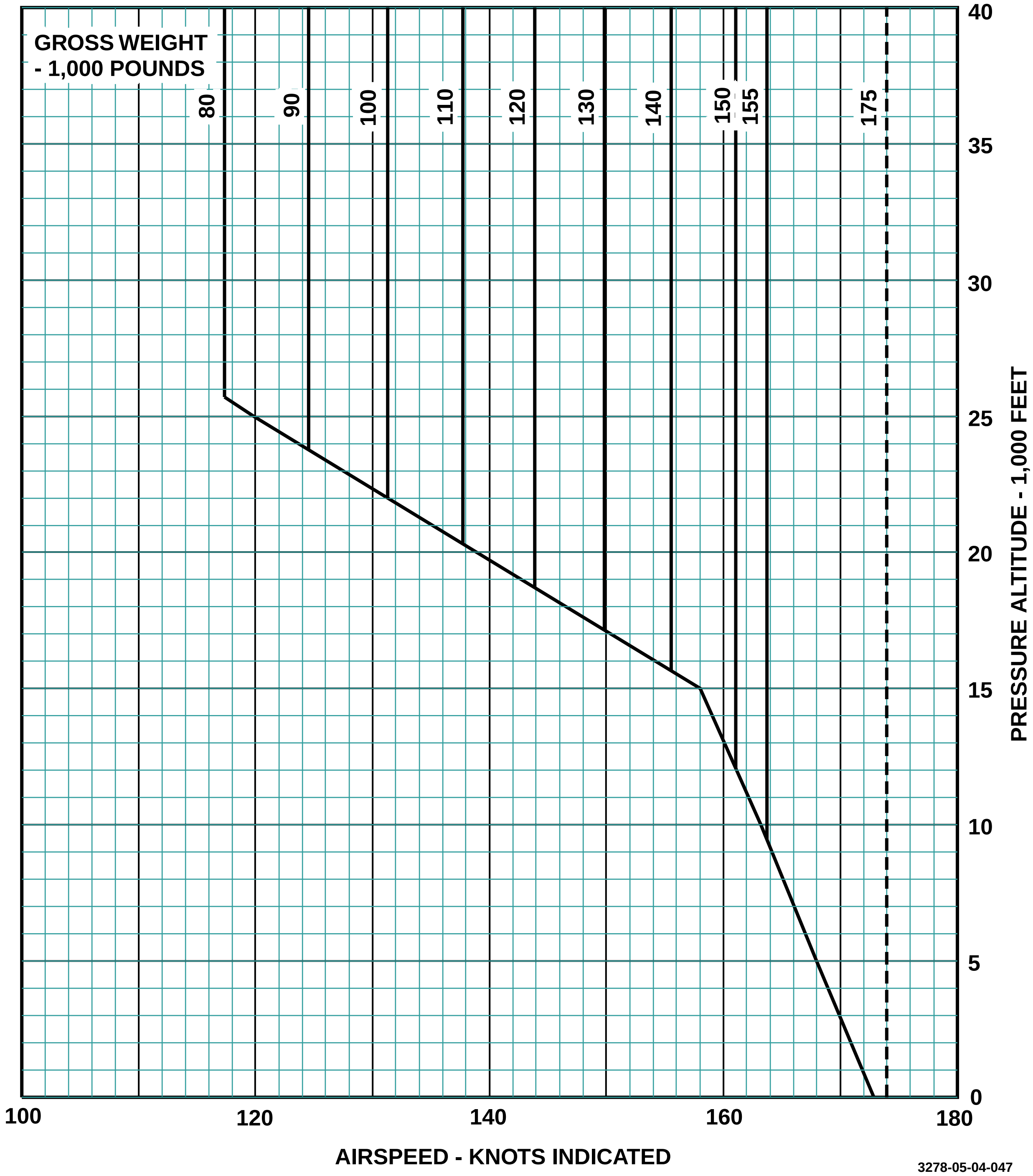


Figure 5-109.

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SECTION 6
ENDURANCE

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LIST OF CHARTS

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INTRODUCTION.

Endurance operation is flight at conditions which result in minimum fuel used for a given time; it is used for holding patterns, rendezvous, search, and loiter. In some cases, such as loiter, the speed, altitude, and configuration may be selected to give the optimum endurance. In other cases, such as search and rendezvous, an altitude is specified and the speed may be selected to give the maximum endurance.

DEFINITIONS:

Maximum Endurance.

Operation at the speed which results in the minimum fuel flow for the given desired altitude (altitude other than optimum), configuration, temperature, and gross weight.

Optimum Endurance.

Operation at the altitude which results in the minimum fuel flow for the given configuration, atmospheric conditions, and gross weight.

NOTE

When holding patterns dictate speeds and/or altitudes at other than maximum or optimum endurance conditions, the endurance can be determined from the specific range information in Section 5.

FACTORS AFFECTING ENDURANCE.

AIRSPEED AND ALTITUDE.

The most economical endurance operation can be achieved only when the recommended flight techniques are used. However, some variations may be permitted with a small effect. The airspeed may be allowed to vary by ± 10 knots, and the altitude may be allowed to vary ± 1,000 feet without affecting endurance appreciably.

NUMBER OF OPERATING ENGINES.

Endurance may be increased by shutting down one or two engines at lower altitudes. This increase results because specific fuel consumption is lower and propeller efficiencies are higher at the higher power settings. Because operation with engines shut down is dependent on the gross weight, atmospheric conditions, and altitude, the number of operating engines shall be selected only after consideration of existing conditions.

BANK ANGLE.

When holding or conducting search operations over a limited area, it may be necessary to fly a fairly steep bank angle. This kind of flight pattern will reduce the endurance time for a constant airspeed, as shown in figure 6-1.

FUEL BURNOFF.

For loiter times longer than 5,000 pounds of fuel burn-off, use weight increments of 5,000 pounds to determine average loiter weight, speed, and fuel flow. The incremental times for each average weight should be summed for each 5,000 pounds of fuel burn-off to establish the total loiter time. The 5,000-pound fuel increments are divided by total fuel flow at each average weight to establish the incremental times for summation.

FOUR-ENGINE ENDURANCE.

Four-engine maximum endurance is shown in figure 6-2 and four-engine maximum endurance fuel flow in figure 6-3. Data are given as a function of weight, pressure altitude, temperature deviation from standard, and drag index. Optimal holding altitude and fuel flow are given in figures 6-4 through 6-7. Four engine search endurance airspeeds and fuel flows with 20 percent flaps are given in figure 6-20 and figure 6-21.

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Example 1.

GIVEN:

Pressure altitude: 15,000 feet

Begin holding weight: 150,000 pounds

Drag index: + 50

Temp Dev: + 15 °C

Time: 1 hour

Normal bleed

Four-engine operation

FIND:

- Average holding indicated airspeed
- Fuel used

PROCEDURE:

The first step is to determine the average holding weight. Enter figure 6-3, sheet 1, and interpolate a fuel flow for 15,000 feet pressure altitude. Move vertically to intersect a weight of 150,000 pounds. At this point, read an uncorrected total fuel flow of 920 pounds per hour per engine. Now enter the left of figure 6-3, sheet 2, with 920 and move horizontally to the temperature baseline. Follow the temperature guidelines to plus 15 °C. Then move horizontally to the drag index baseline and follow the guidelines to plus 50 drag index. Read to the left a corrected fuel flow of 1,090 pounds per hour per engine.

The following equation is then used to estimate the average holding weight:

Avg hldg wt = beginning hldg wt − (No. operating engines × fuel flow × hold time) ÷ 2

$$= 150{,}000 - (4 \times 1{,}090 \times 1) \div 2$$
$$= 150{,}000 - (4{,}360 \div 2)$$
$$= 150{,}000 - 2{,}180$$
$$= 147{,}820 \text{ pounds}$$

This average holding weight is then used to determine the average holding speed and fuel flow. Re-enter figure 6-3, sheet 1, at 15,000 feet pressure altitude and move vertically to 147,820 pounds average holding weight. At this point, read an uncorrected total holding fuel flow of 910 pounds per hour per engine. Enter figure 6-3, sheet 2, with this value and, using the procedure described above, obtain a corrected holding fuel flow of 1,080 pounds per hour per engine. Figure 6-2 is used in a similar fashion to find the average holding airspeed of 162.5 KIAS. Compute the total fuel used as follows:

Fuel used = fuel flow × No. of operating engines × holding time = 1,080 × 4 × 1 = 4,320 pounds

NOTE

The preceding procedure should be used for short loiter times where fuel used does not exceed 5,000 pounds. For longer loiter times, weight increments of 5,000 pounds should be used to determine average loiter weight, speed, and fuel flow. The incremental times for each average weight should be summed for each 5,000 pounds of fuel burn-off to establish total loiter time. The 5,000 pound increments are divided by total fuel flow at each average weight to establish the incremental times for summation.

Example 2.

GIVEN:

Average holding weight: 135,000 pounds

Drag index: + 50

Temp Dev: 0

Normal bleed

Four-engine operation

FIND:

- Optimum holding altitude
- Fuel flow

PROCEDURE:

Enter the bottom of figure 6-4 at 135,000 pounds and move vertically to the ISA + 0 line. Read an uncorrected holding altitude of 22,250 feet. Enter the bottom of figure 6-5 with this value and move vertically to the + 50 drag index line. Read a corrected optimum holding altitude of 20,900 feet. Using the same procedure, an optimum holding fuel flow of 3,430 pounds per hour is obtained from figure 6-6 and figure 6-7.

THREE-ENGINE ENDURANCE.

Three-engine maximum endurance airspeed and fuel flow information is presented in figure 6-8 through figure 6-13. For these presentations, it is assumed that the failed engine has been feathered and proper trim applied. These figures are used in the same manner as the four-engine charts.

TWO-ENGINE ENDURANCE.

Two-engine maximum endurance airspeed and fuel flow information is presented in figure 6-14 through figure 6-19. For these presentations, it is assumed that the failed engines are located symmetrically and have been feathered with proper aircraft trim applied. These figures are used in the same manner as the four and three-engine charts.

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER1998
DATA BASIS: FLIGHT TEST

EFFECT OF BANK ANGLE ON ENDURANCE

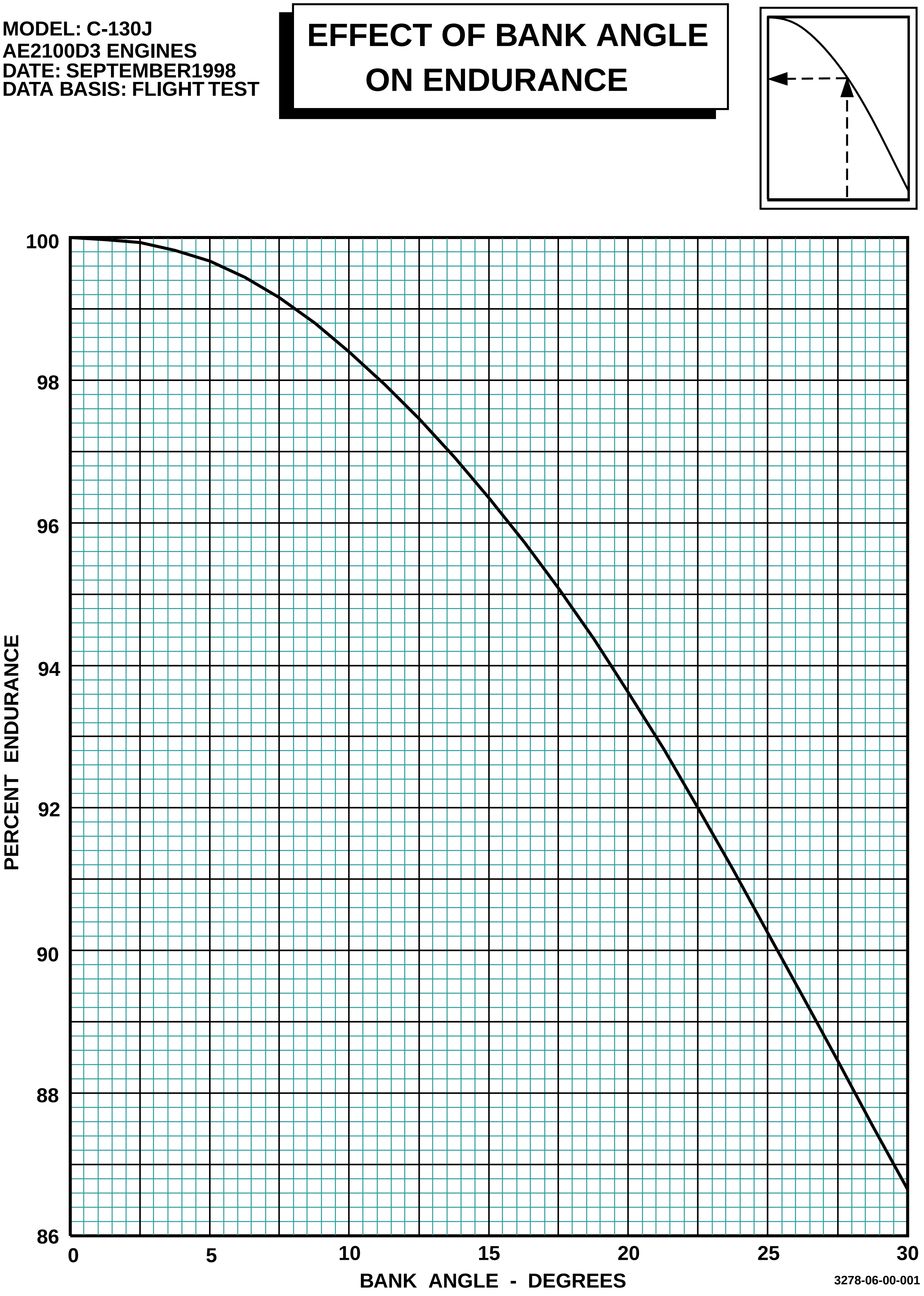


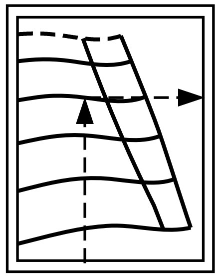
Figure 6-1.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAXIMUM ENDURANCE INDICATED AIRSPEED

4 ENGINES



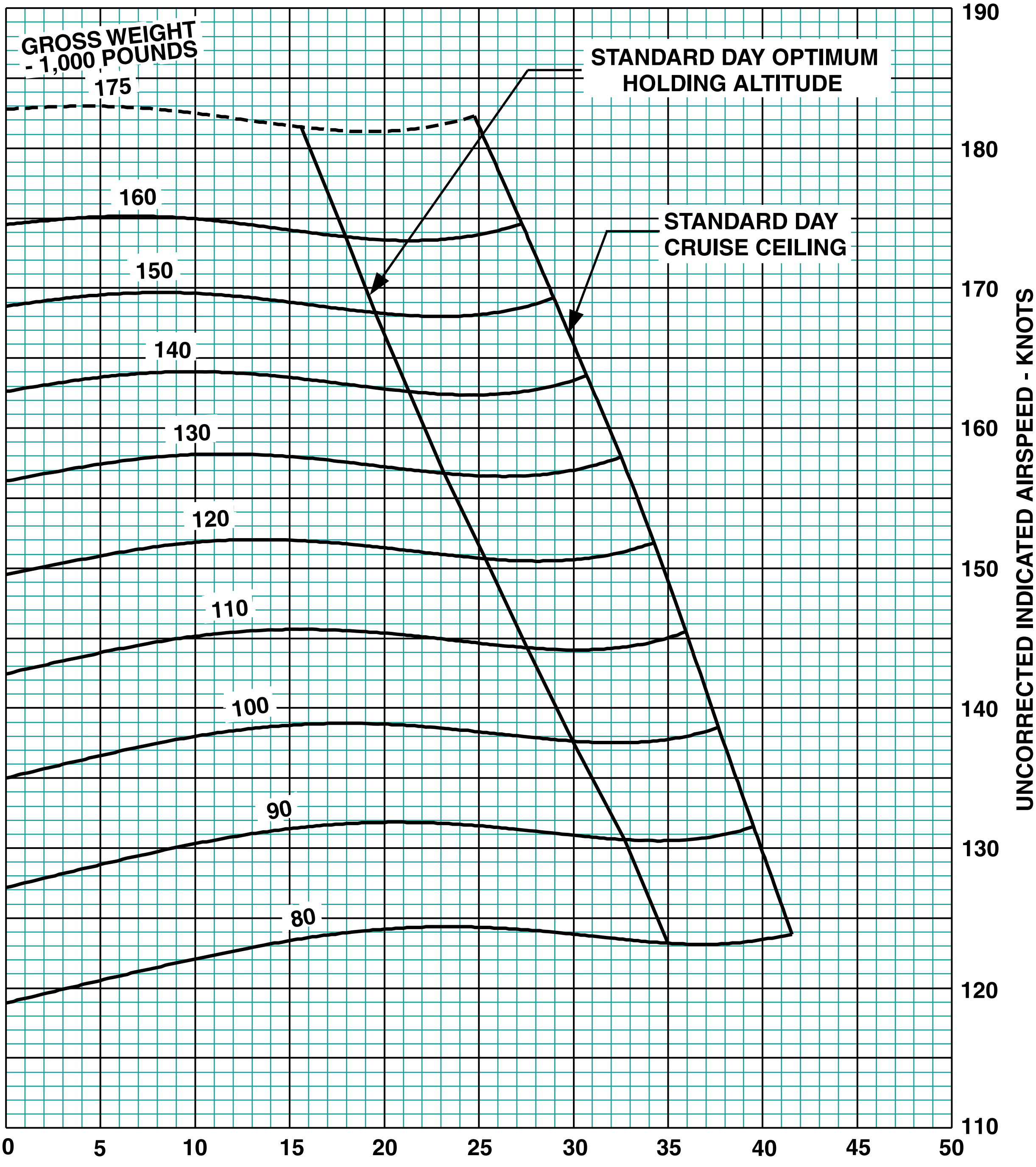
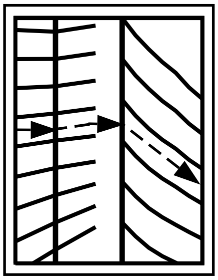


Figure 6-2. (Sheet 1 of 2)

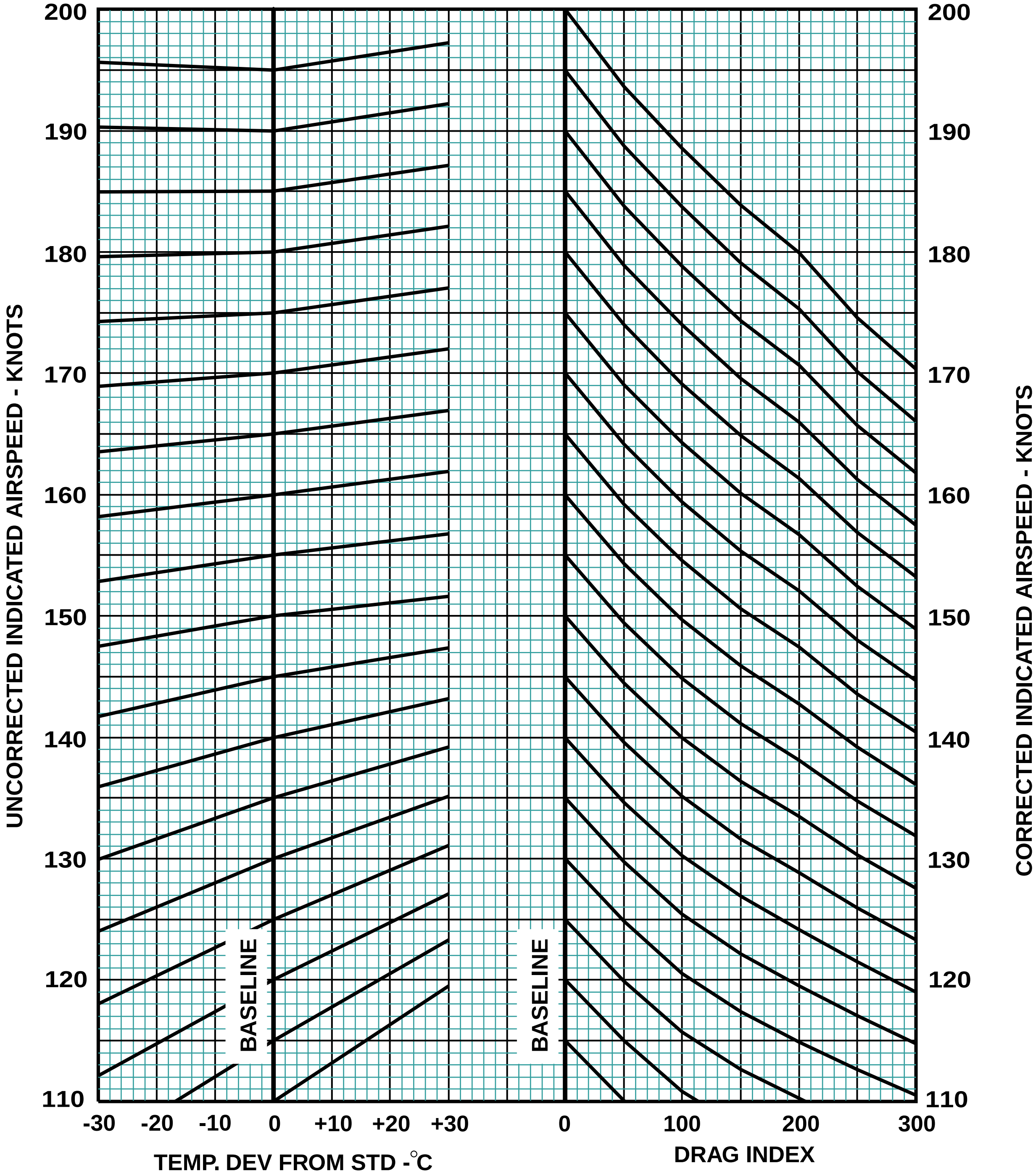
Use, copying and/or disclosure is governed by the statement on the title page of this document.

MAXIMUM ENDURANCE INDICATED AIRSPEED

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



3278-06-02-002-02

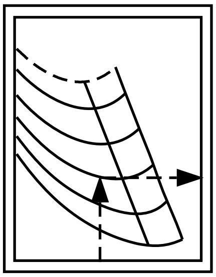
Figure 6-2. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAXIMUM ENDURANCE FUEL FLOW

4 ENGINES



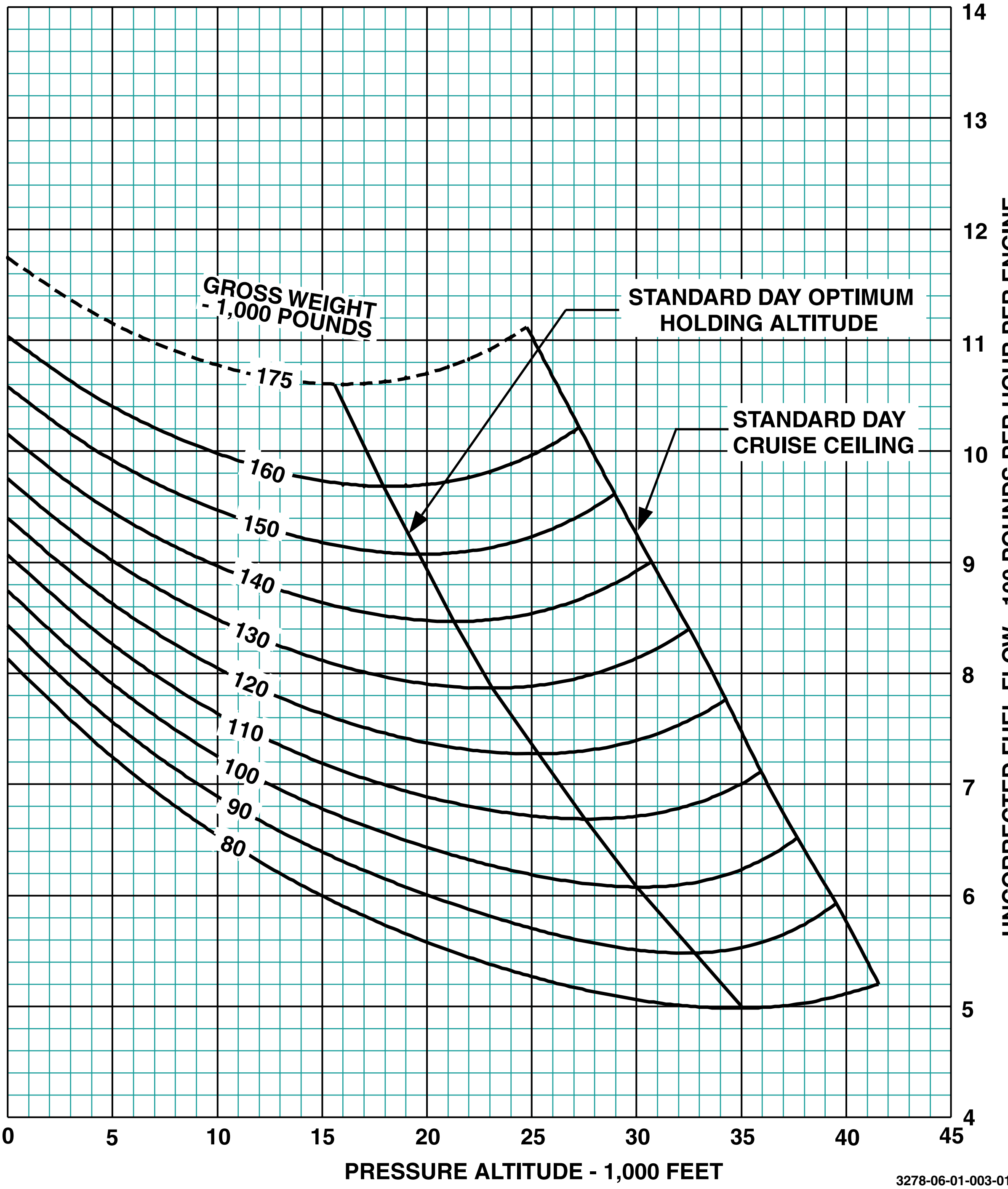


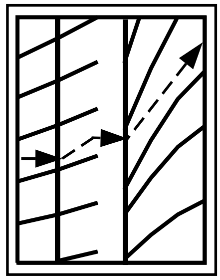
Figure 6-3. (Sheet 1 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MAXIMUM ENDURANCE FUEL FLOW

4 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



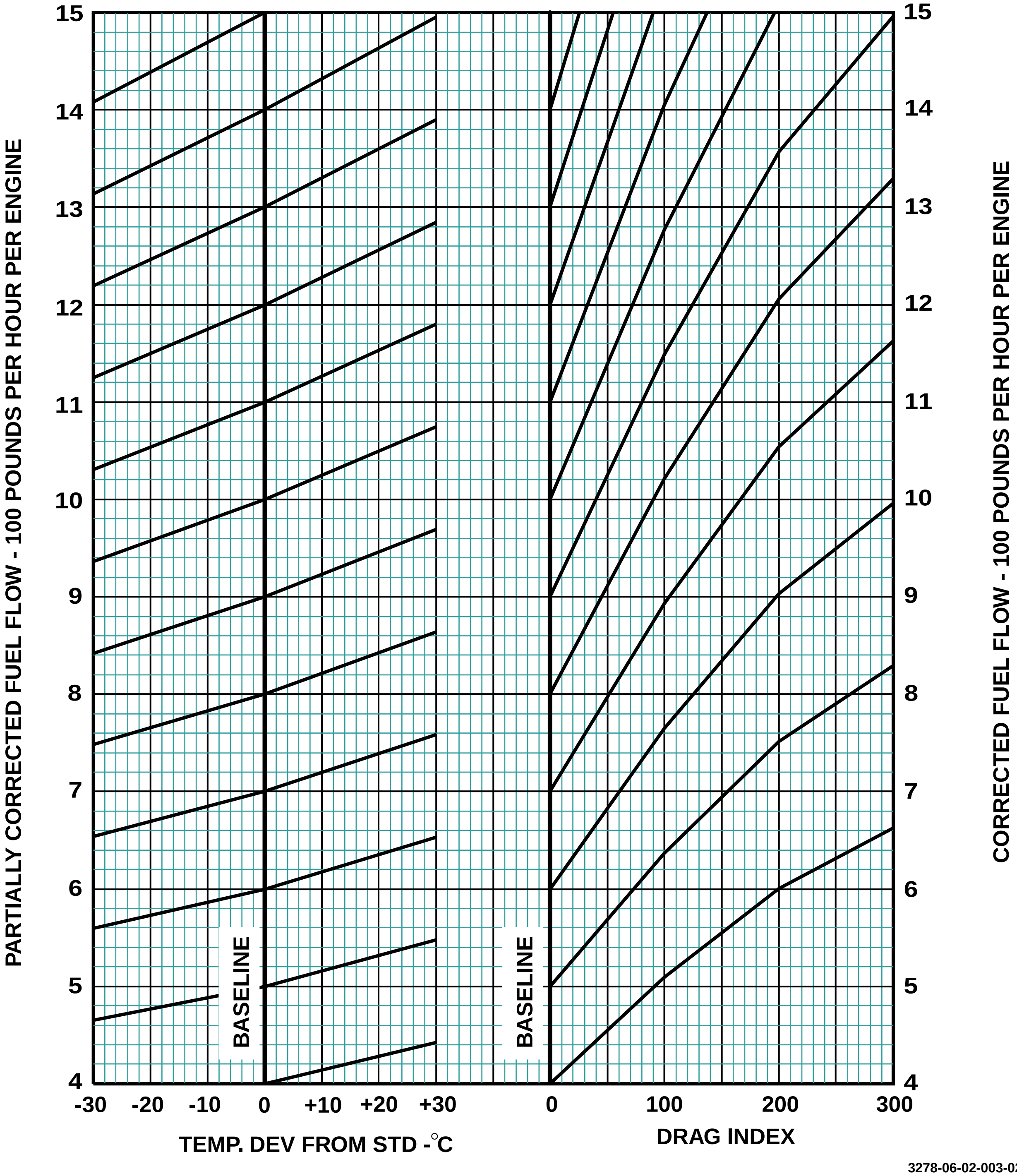


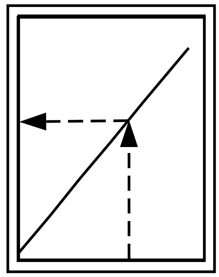
Figure 6-3. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAXIMUM ENDURANCE FUEL FLOW

4 ENGINES



BLEED EFFECTS

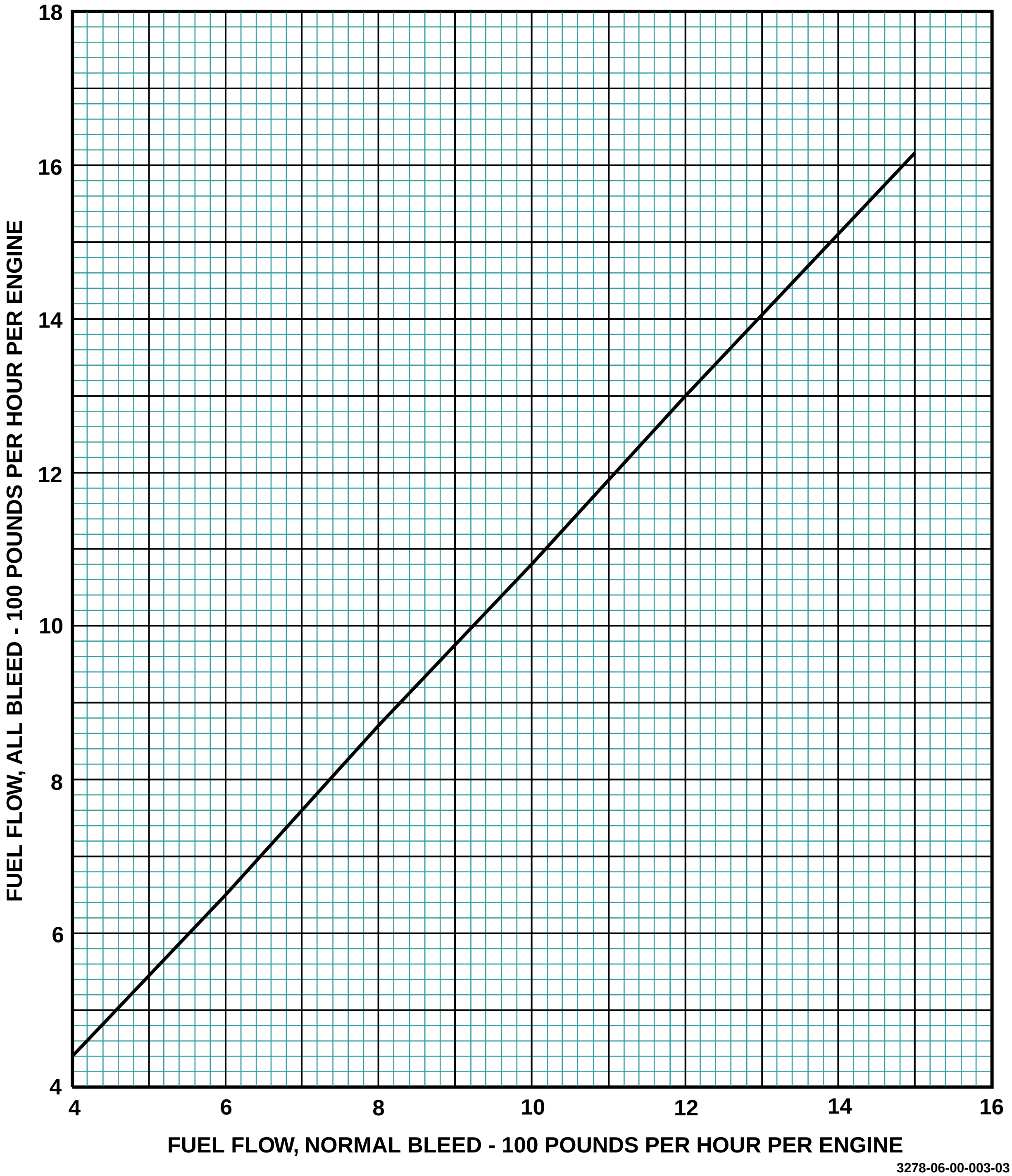


Figure 6-3. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

OPTIMUM HOLDING ALTITUDE

4 ENGINES

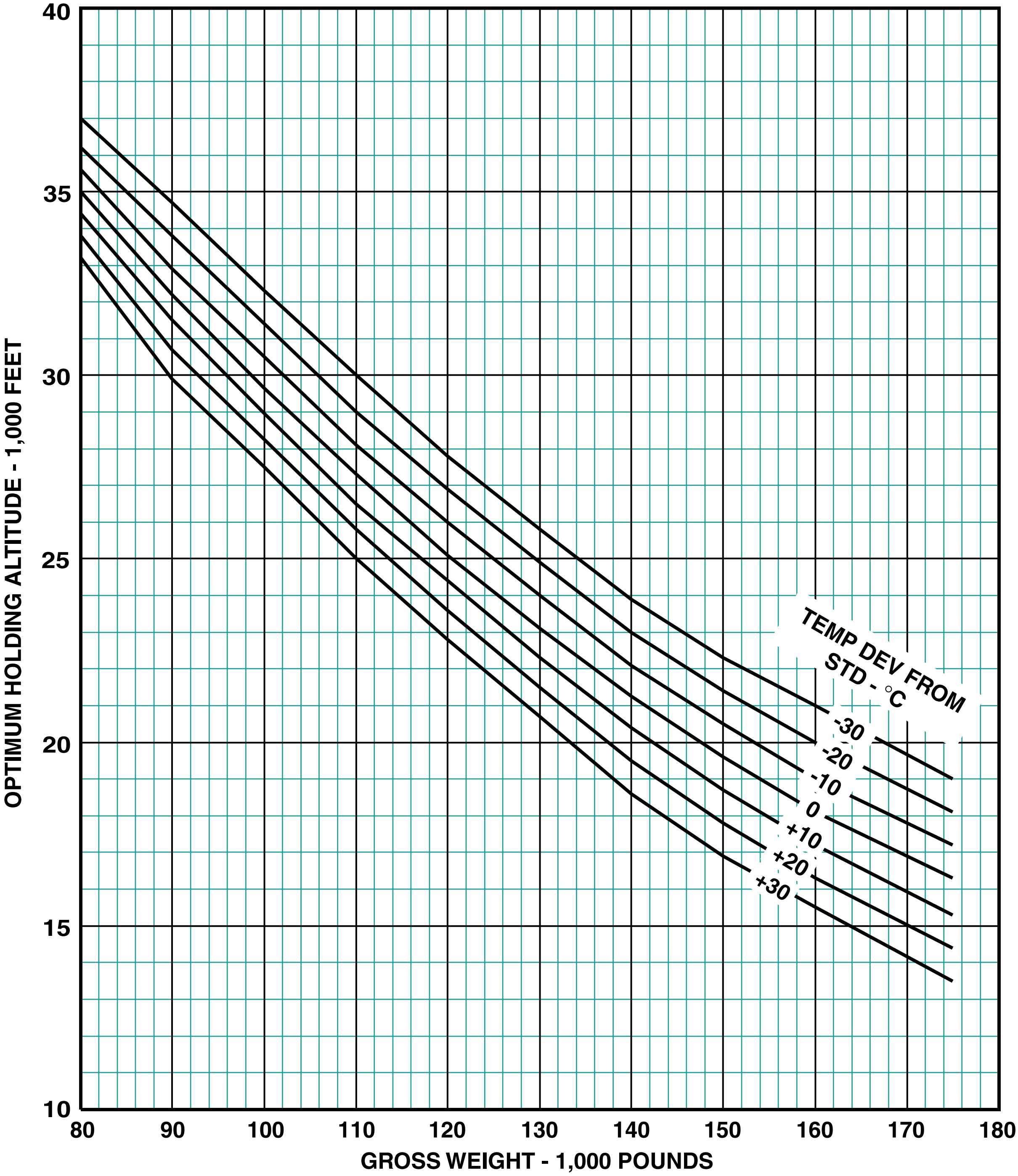


Figure 6-4.

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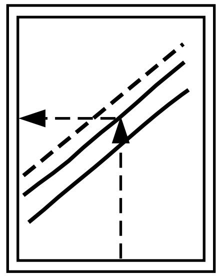
OPTIMUM HOLDING ALTITUDE FOR VARIANT CONFIGURATION

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

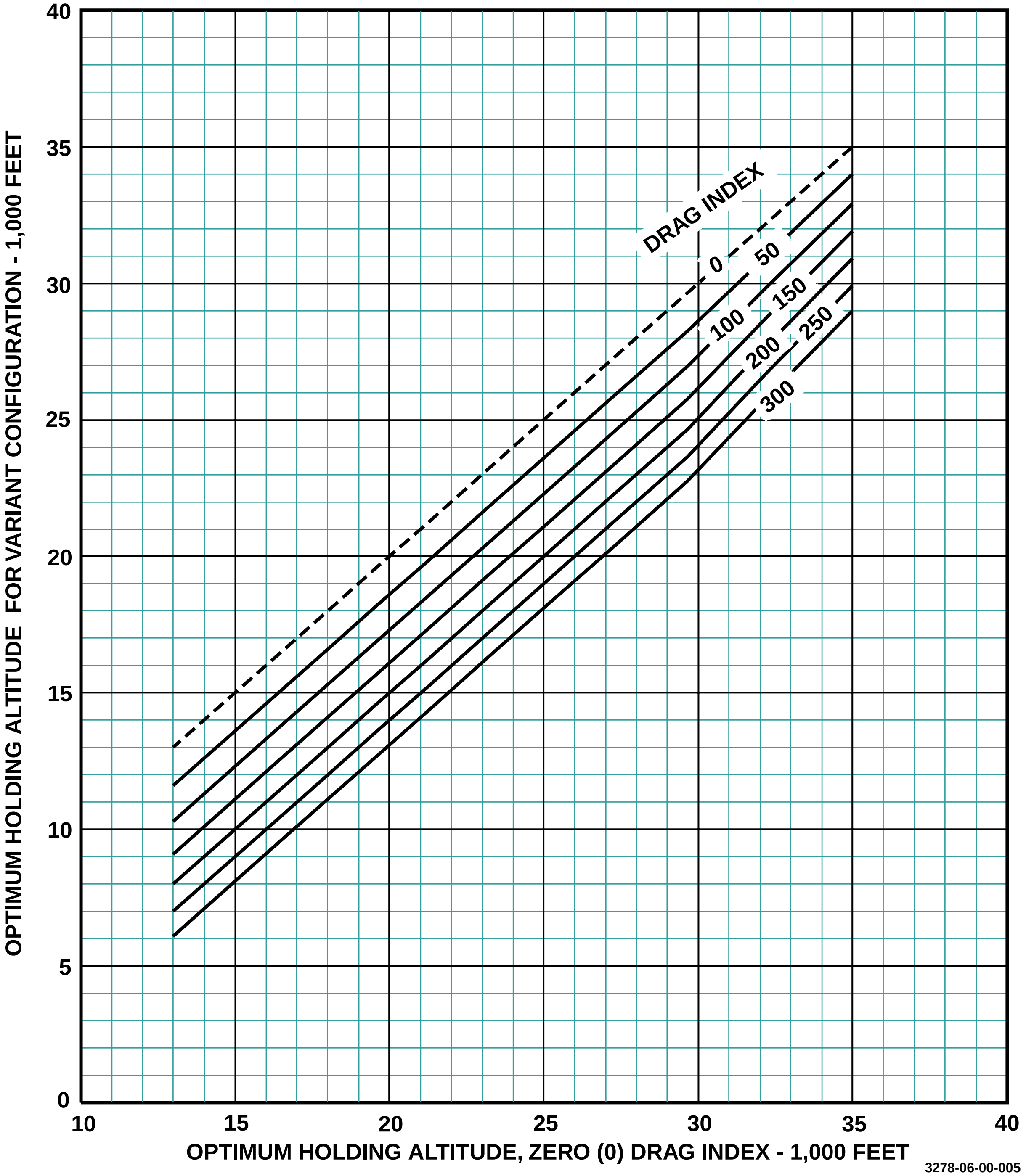


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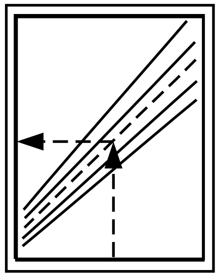
Figure 6-5.

OPTIMUM HOLDING ALTITUDE FUEL FLOW

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

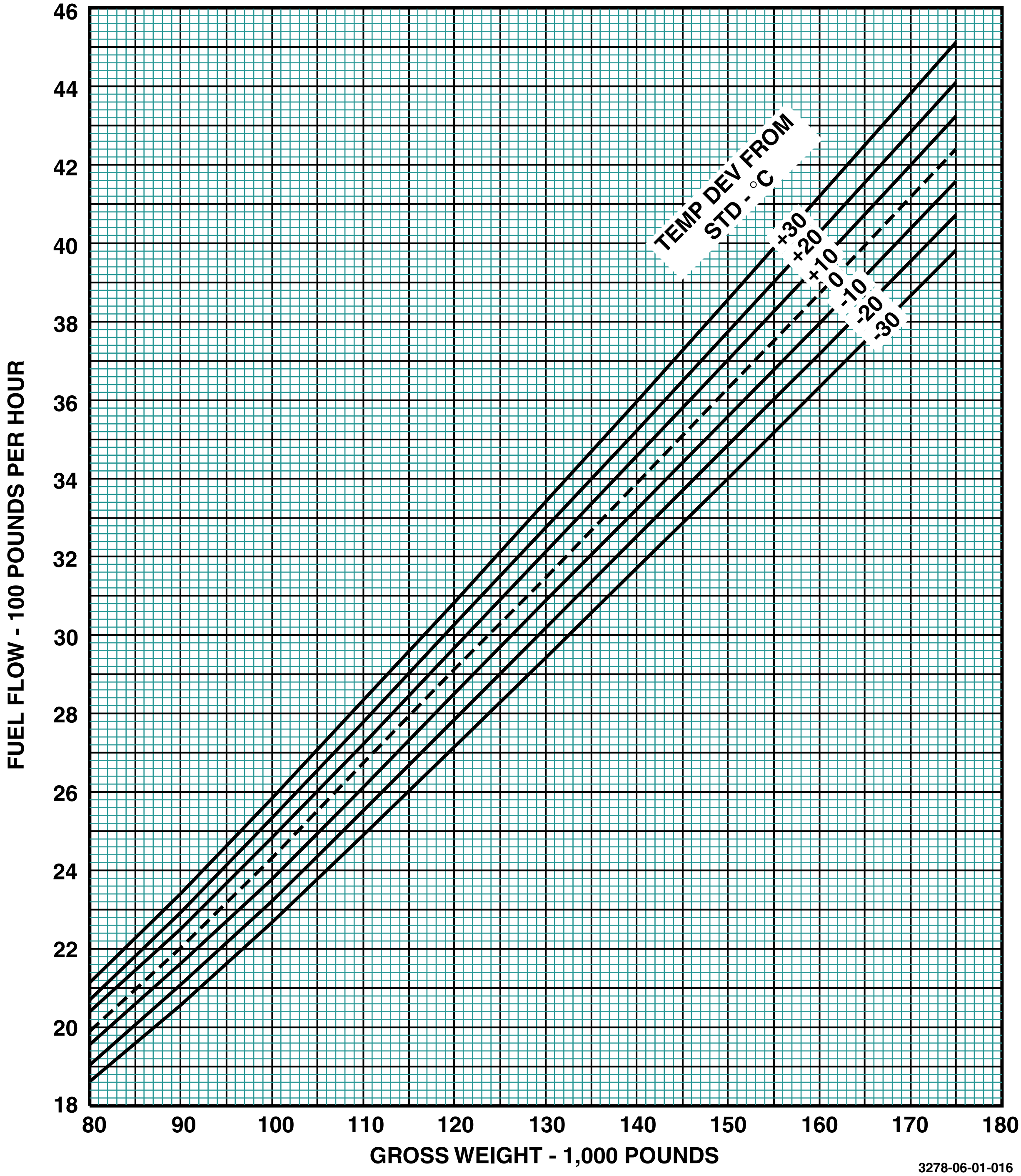
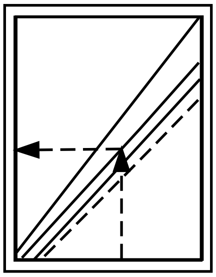


Figure 6-6.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

OPTIMUM HOLDING ALTITUDE FUEL FLOW FOR VARIANT CONFIGURATION

4 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

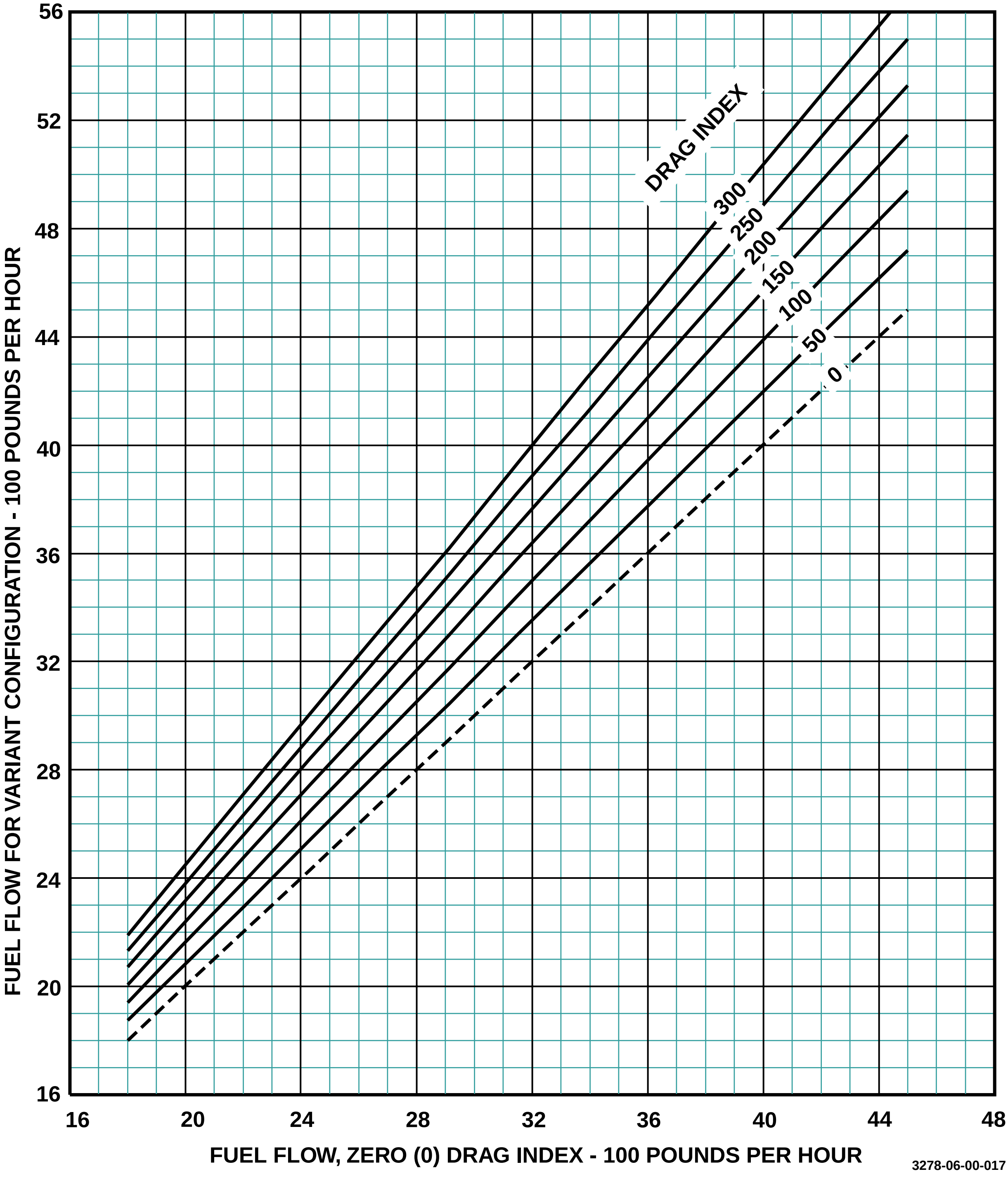
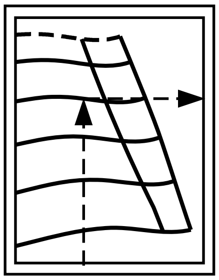


Figure 6-7.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAXIMUM ENDURANCE INDICATED AIRSPEED
3 ENGINES



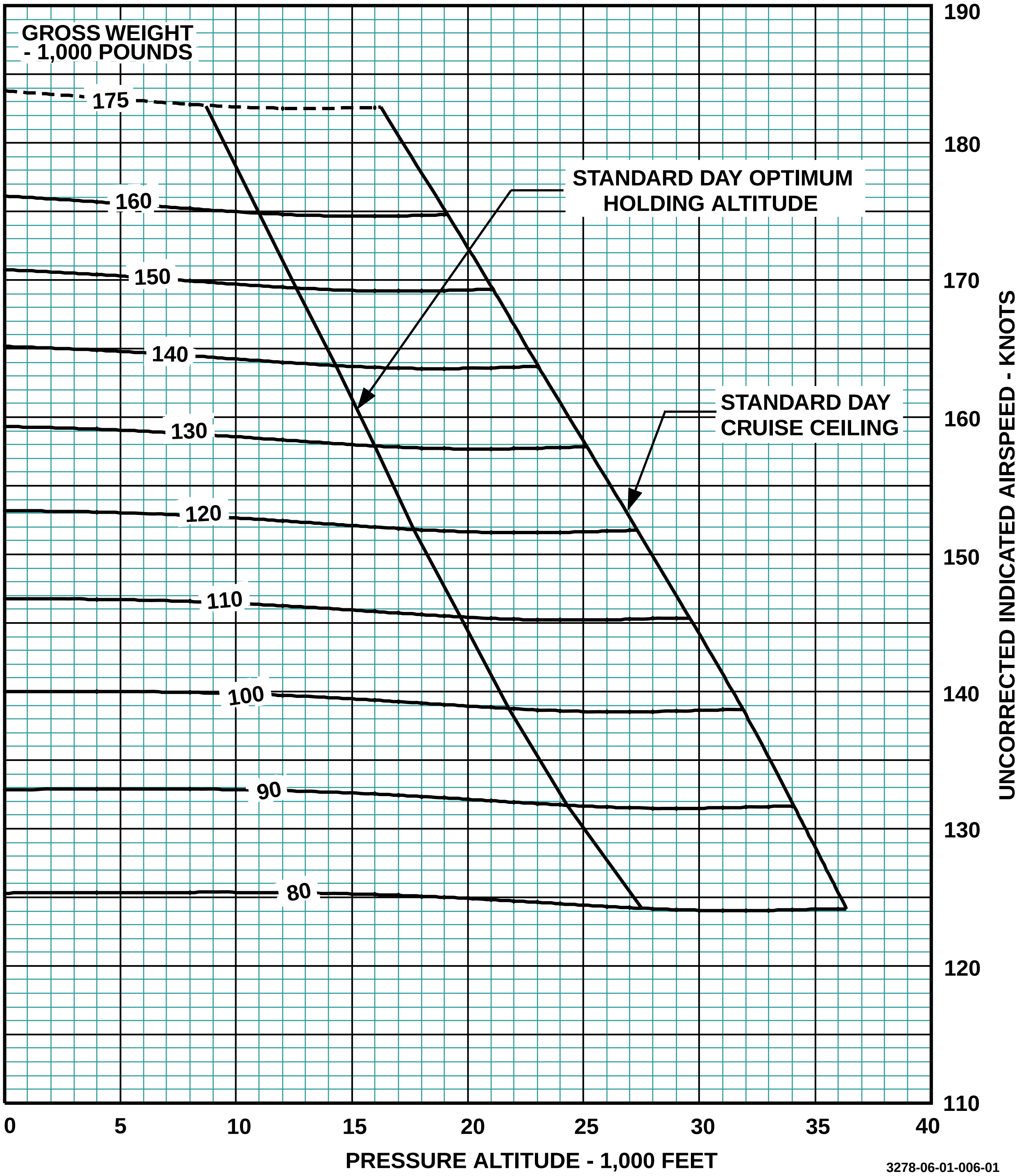


Figure 6-8. (Sheet 1 of 2)

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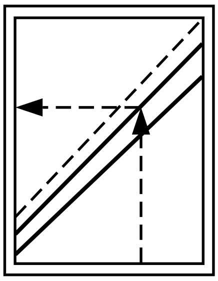
MAXIMUM ENDURANCE INDICATED AIRSPEED

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

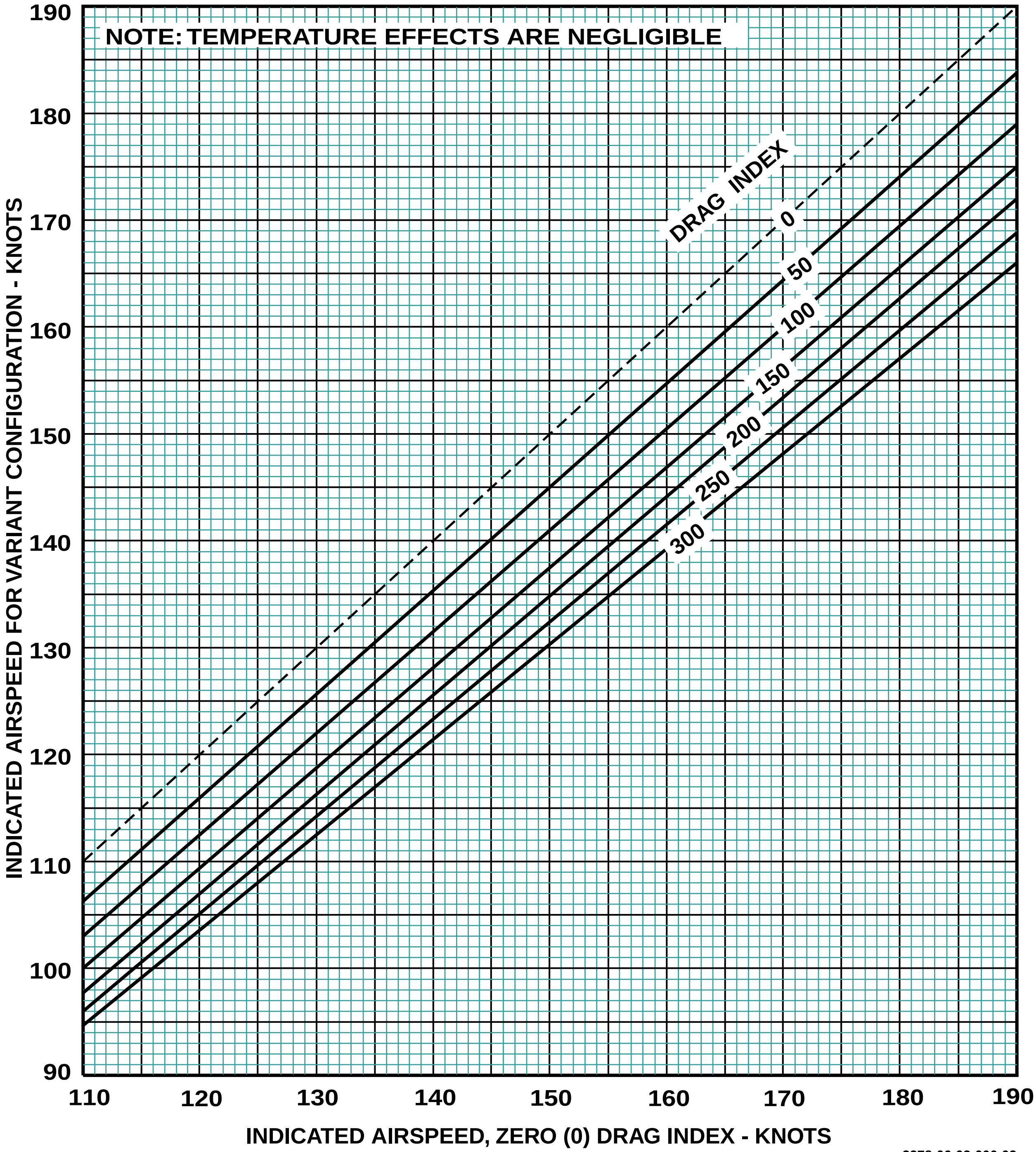


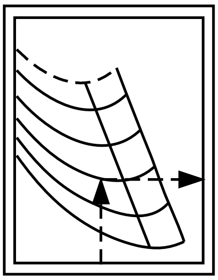
Figure 6-8. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAXIMUM ENDURANCE FUEL FLOW

3 ENGINES



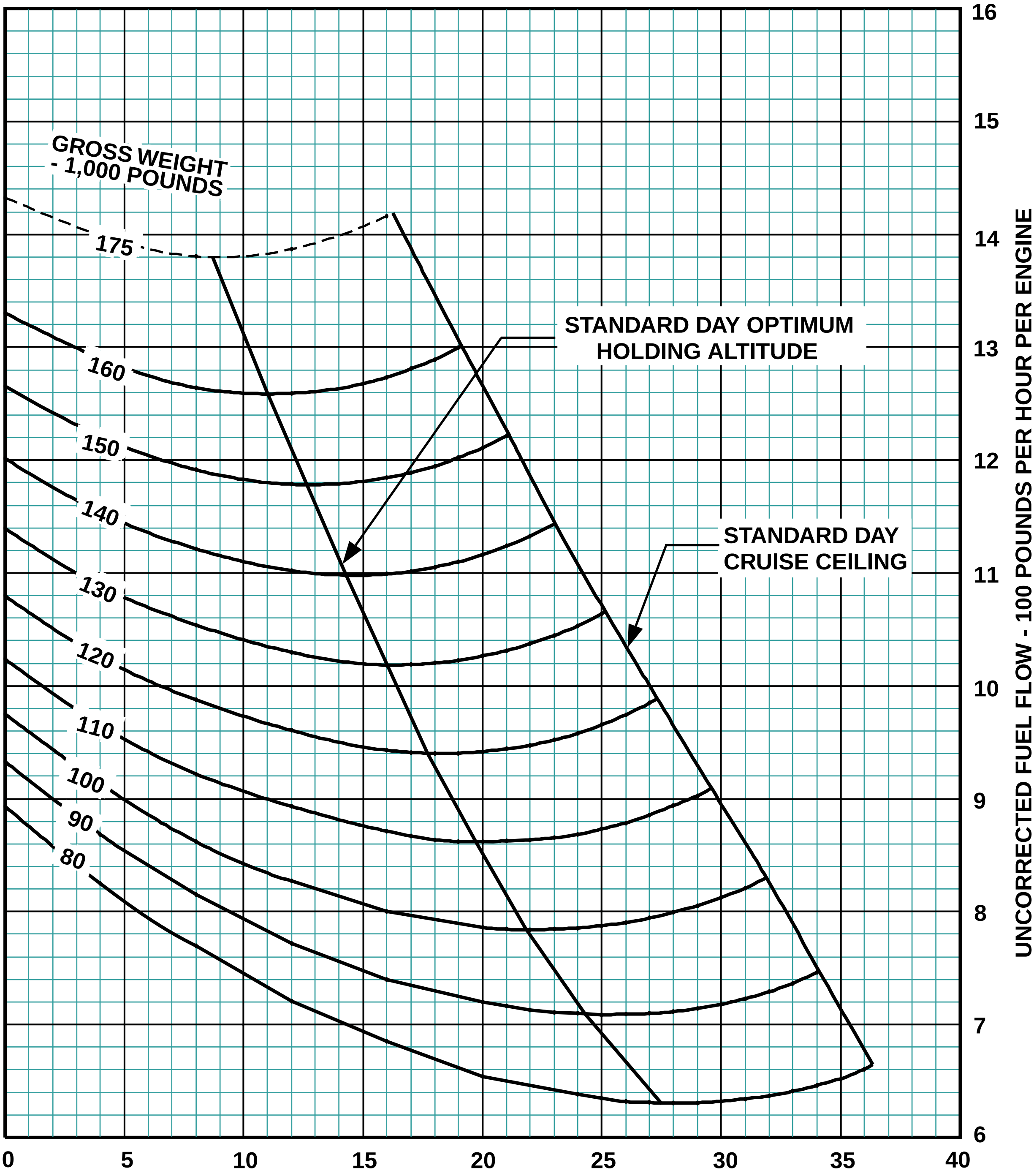
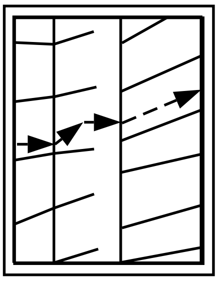


Figure 6-9. (Sheet 1 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MAXIMUM ENDURANCE FUEL FLOW

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

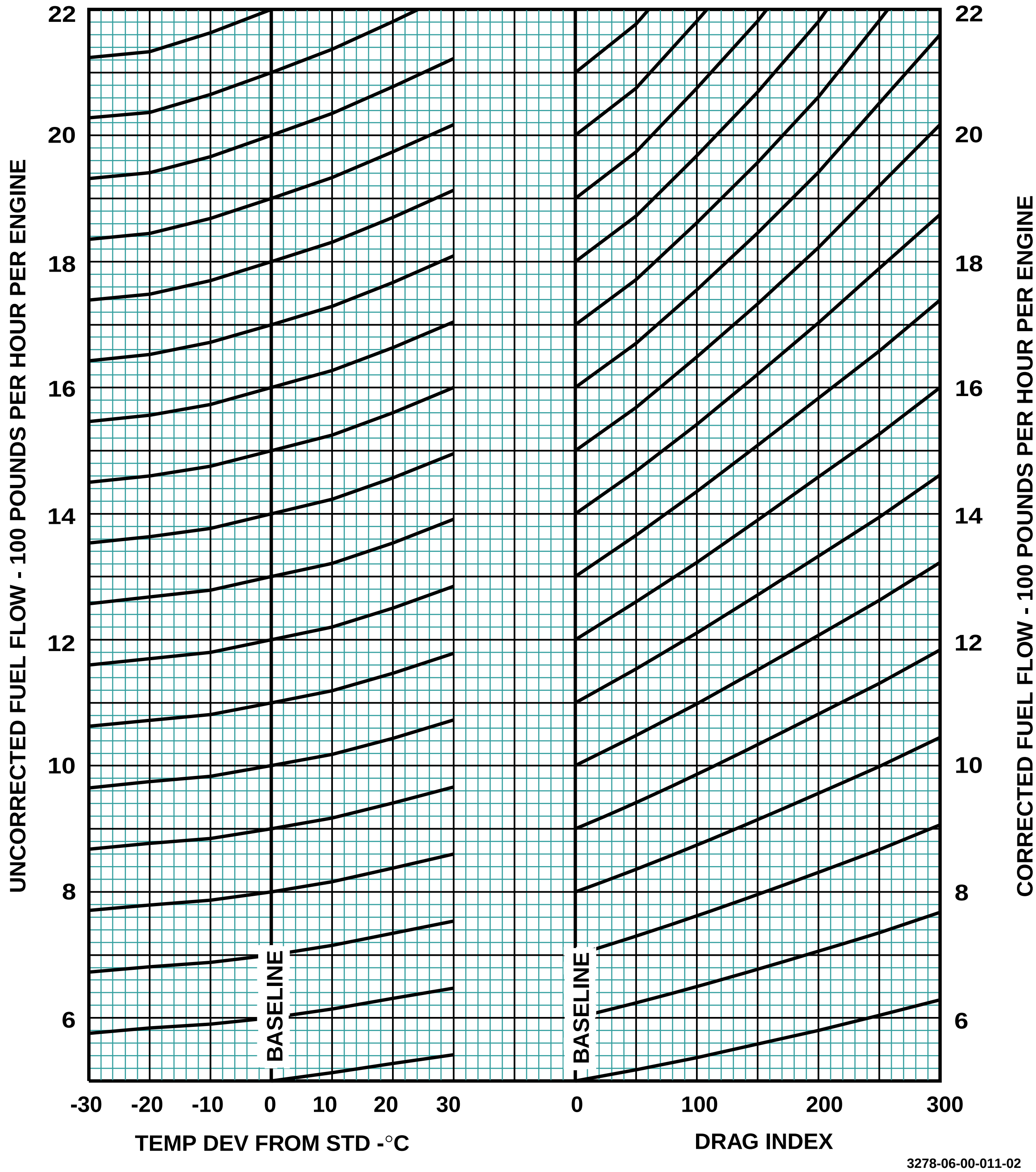


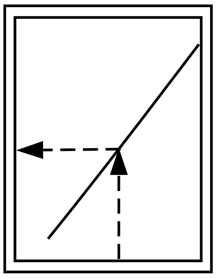
Figure 6-9. (Sheet 2 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAXIMUM ENDURANCE FUEL FLOW

3 ENGINES



BLEED EFFECTS

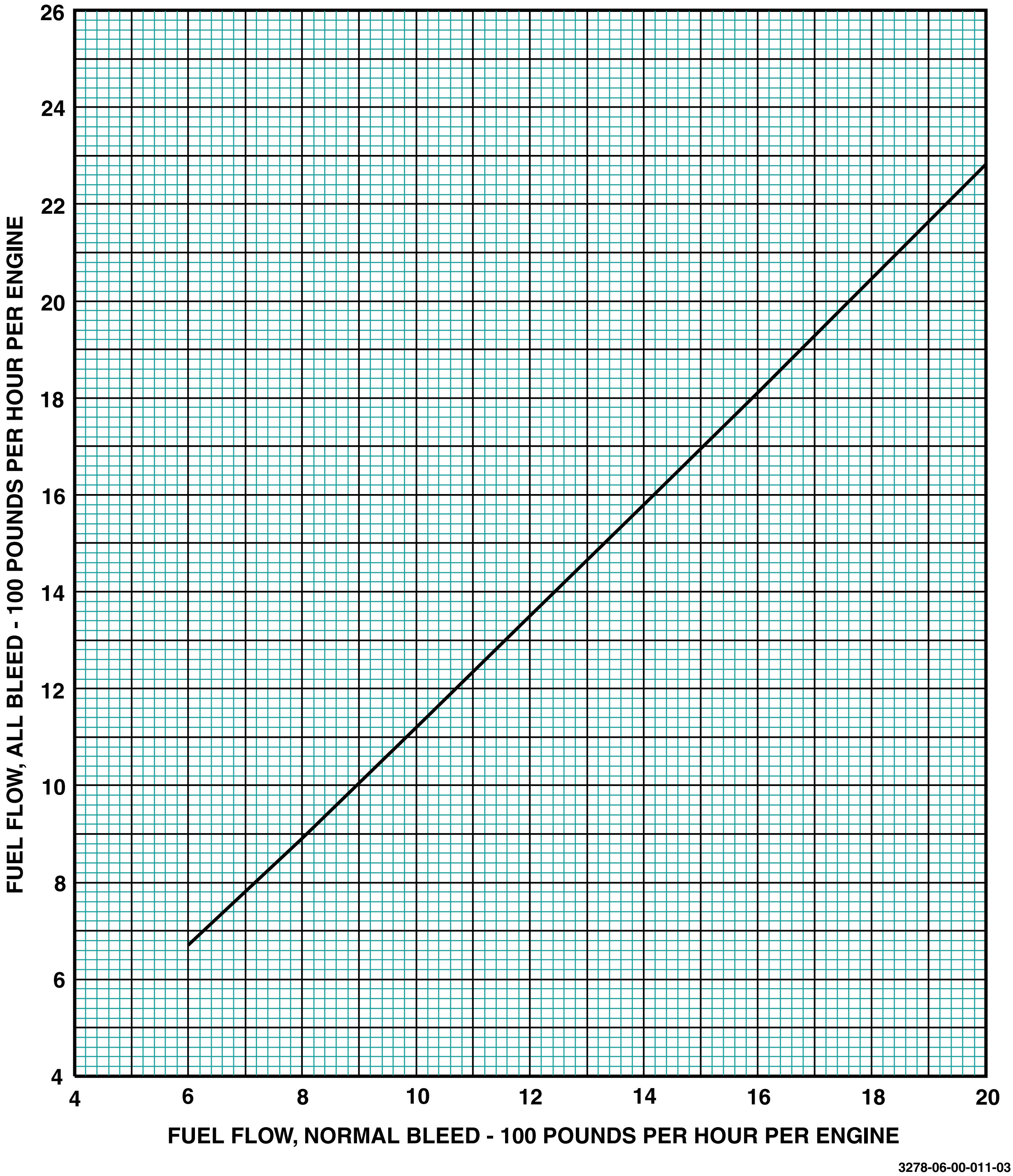


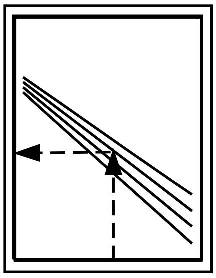
Figure 6-9. (Sheet 3 of 3)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

OPTIMUM HOLDING ALTITUDE

3 ENGINES



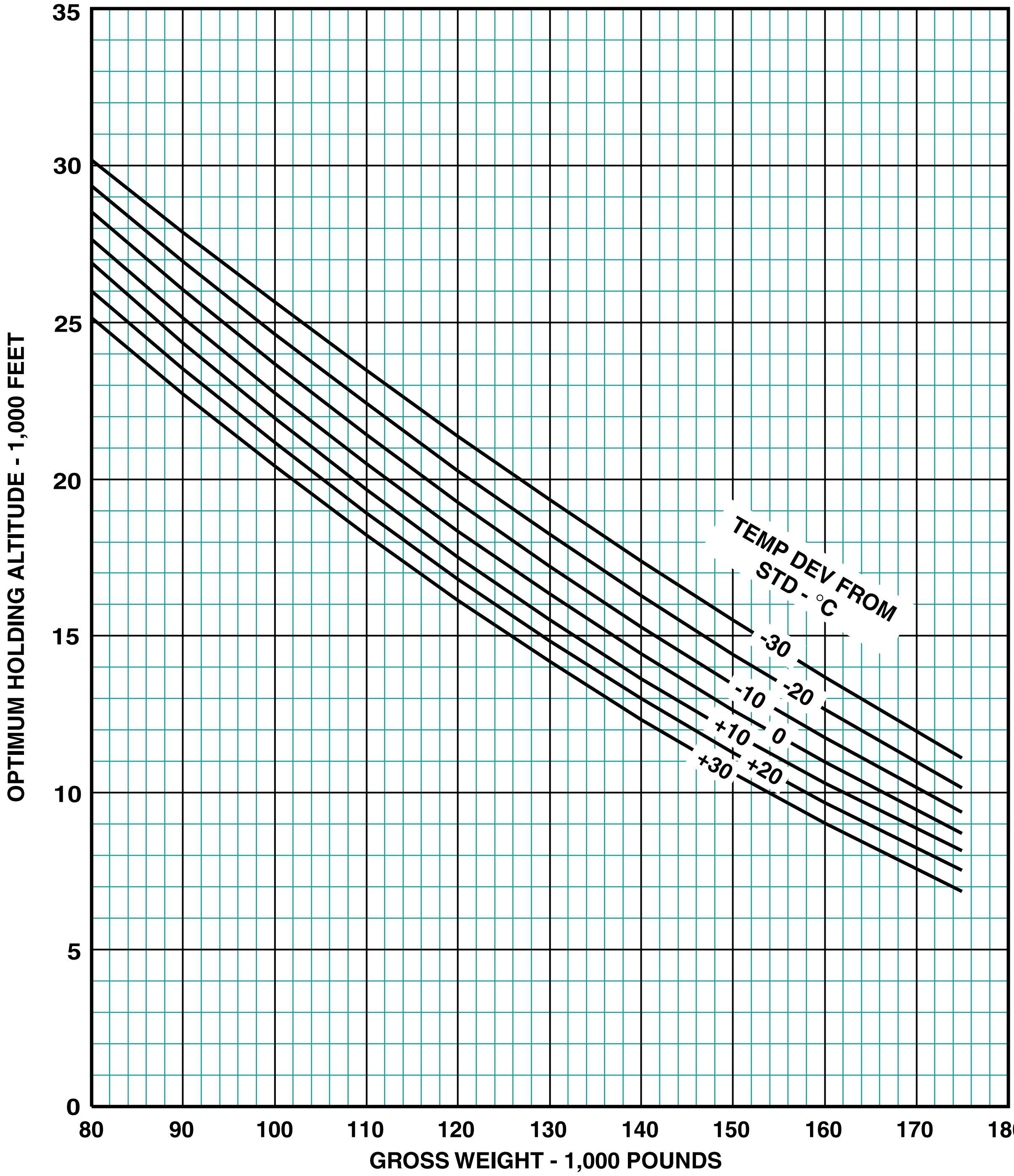


Figure 6-10.

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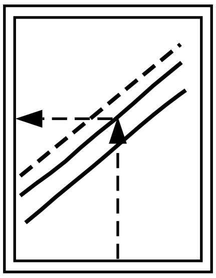
OPTIMUM HOLDING ALTITUDE FOR VARIANT CONFIGURATION

3 ENGINES



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

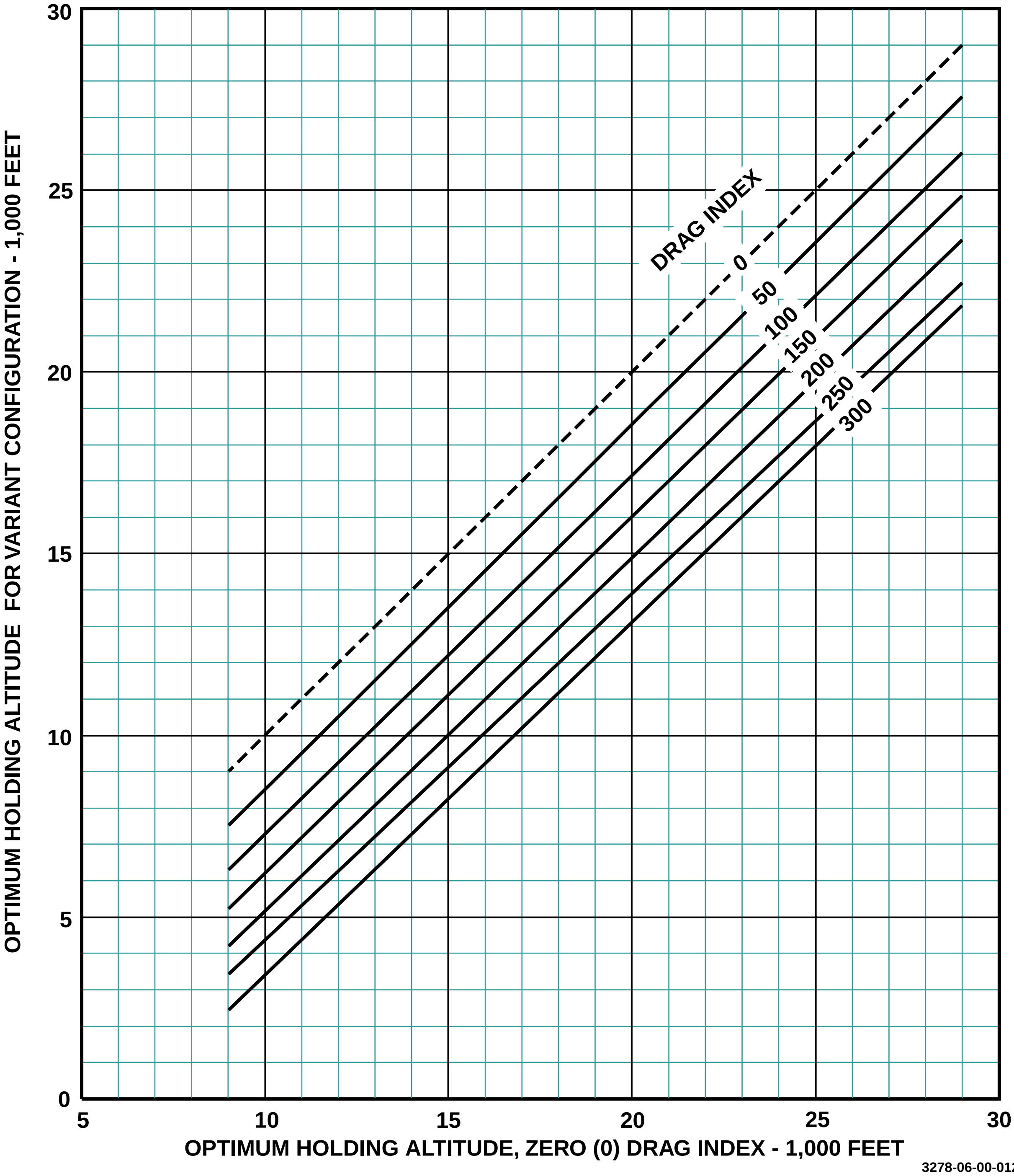


Figure 6-11.

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OPTIMUM HOLDING ALTITUDE FUEL FLOW

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

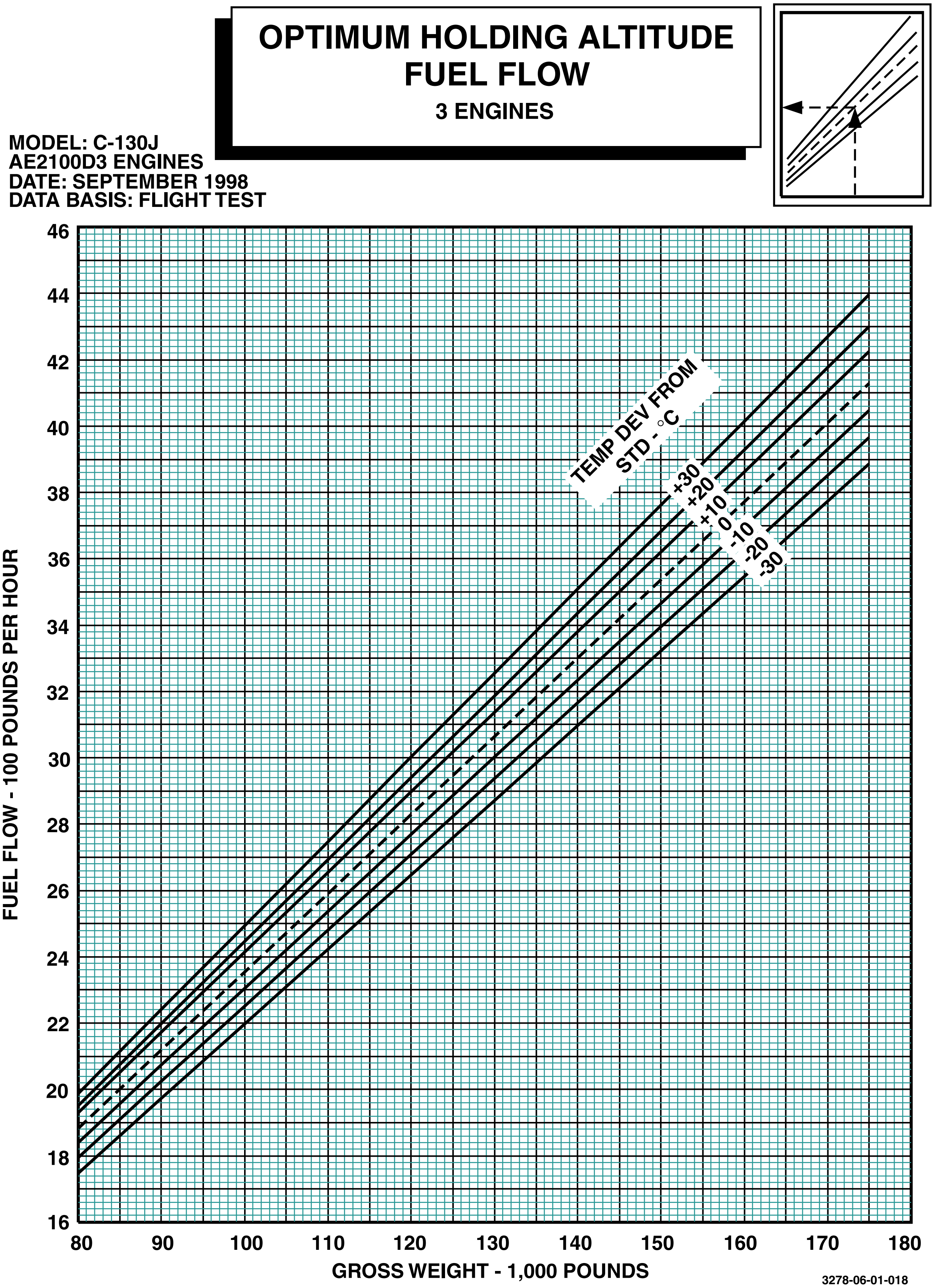

Figure 6-12.

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OPTIMUM HOLDING ALTITUDE FUEL FLOW FOR VARIANT CONFIGURATION

3 ENGINES

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

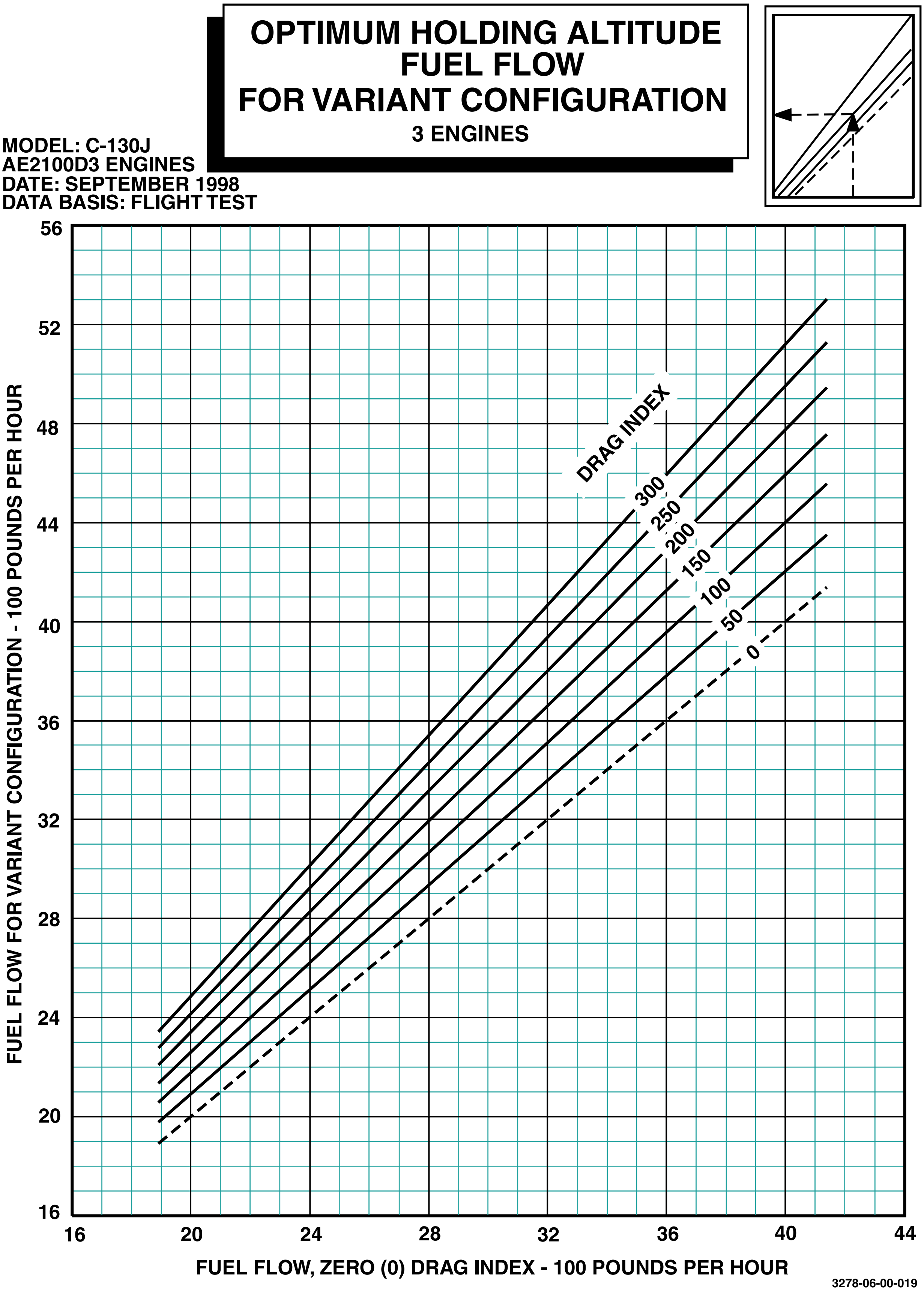


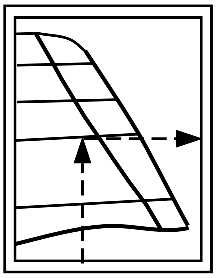
Figure 6-13.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAXIMUM ENDURANCE INDICATED AIRSPEED

2 ENGINES SYMMETRICAL POWER



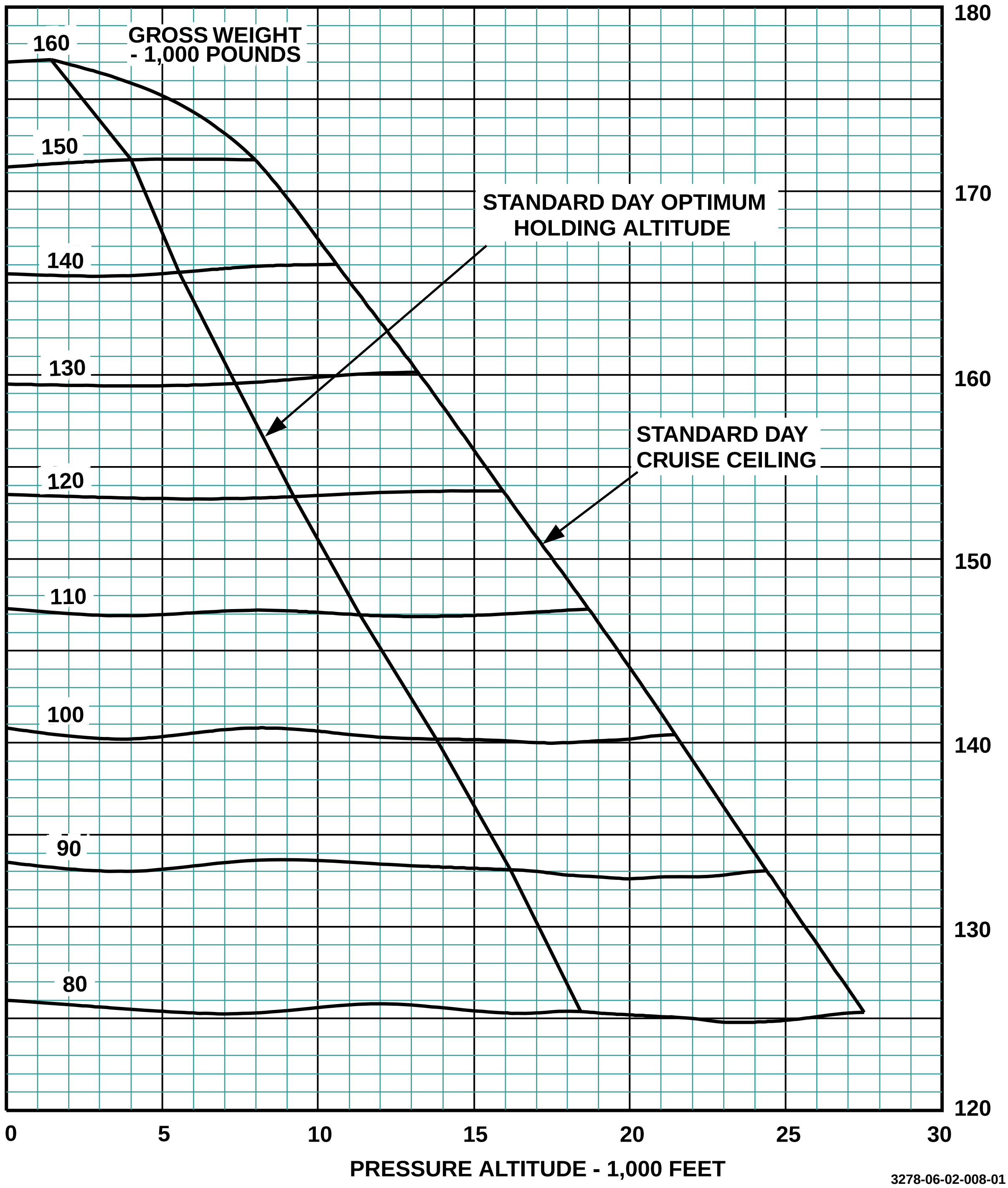
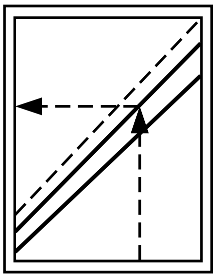


Figure 6-14. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MAXIMUM ENDURANCE INDICATED AIRSPEED

2 ENGINES SYMMETRICAL POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

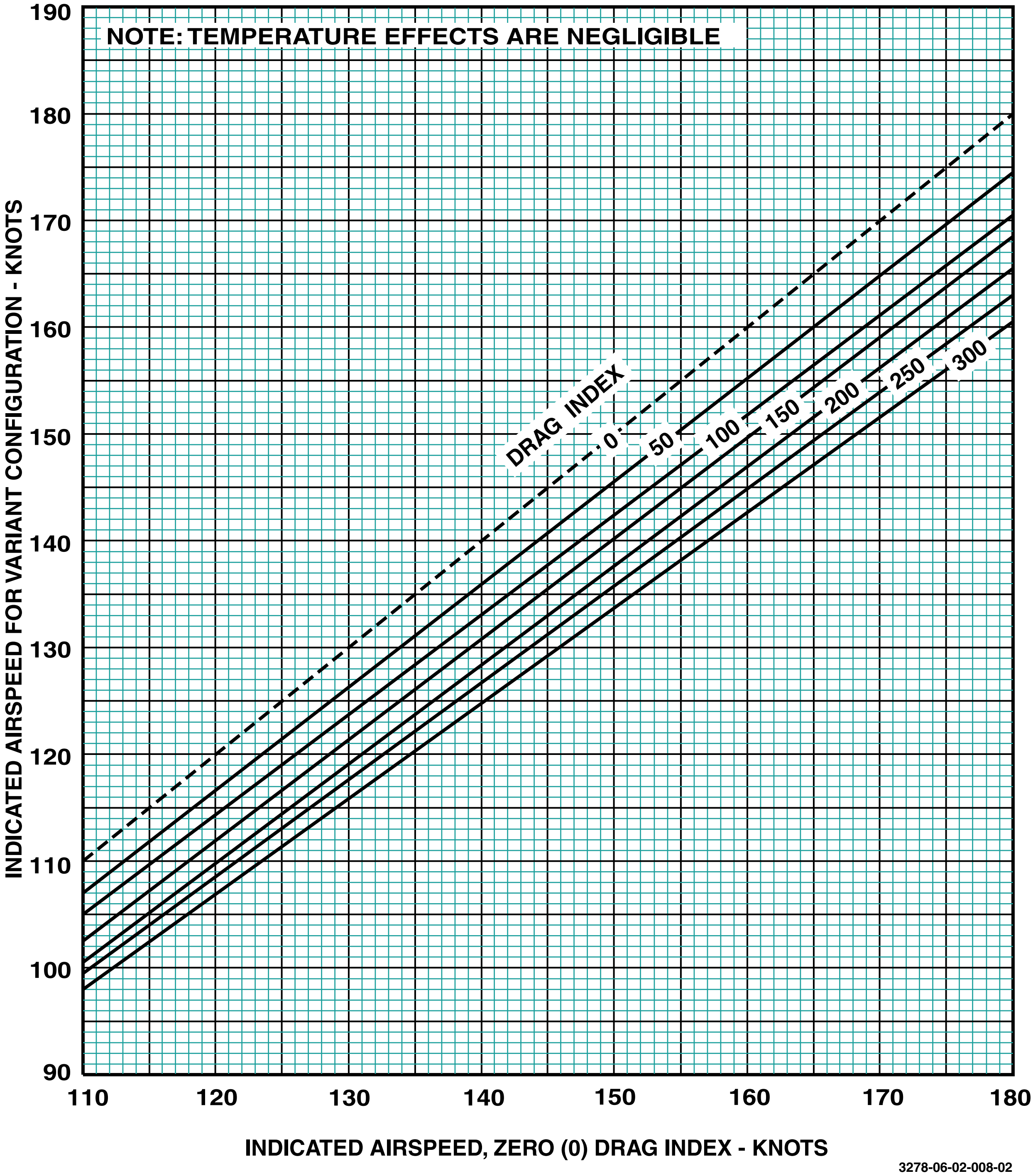


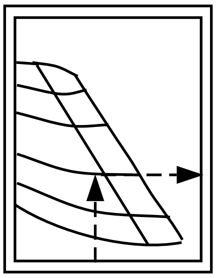
Figure 6-14. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL : C-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST

MAXIMUM ENDURANCE FUEL FLOW

2 ENGINES SYMMETRICAL POWER



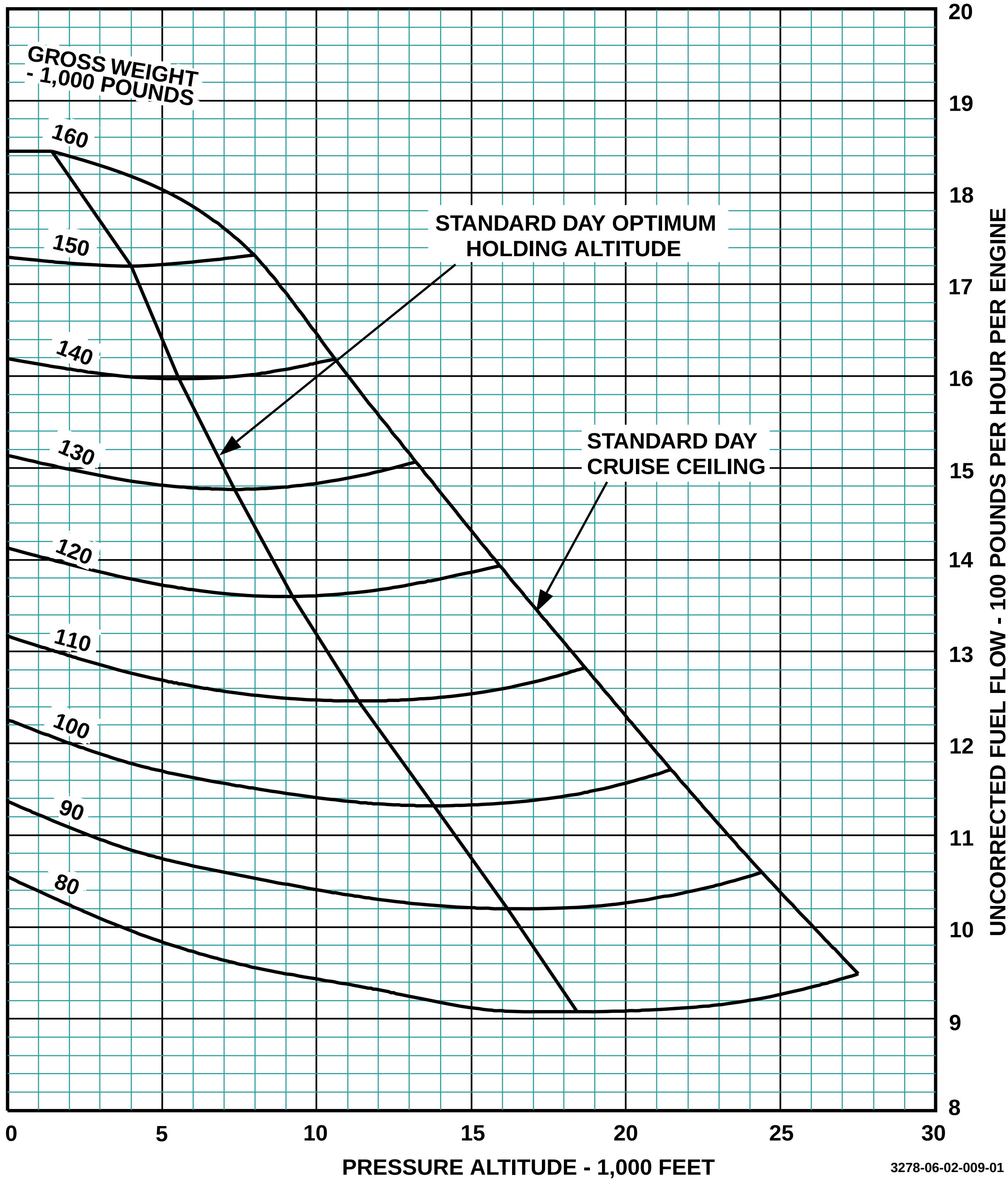


Figure 6-15. (Sheet 1 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

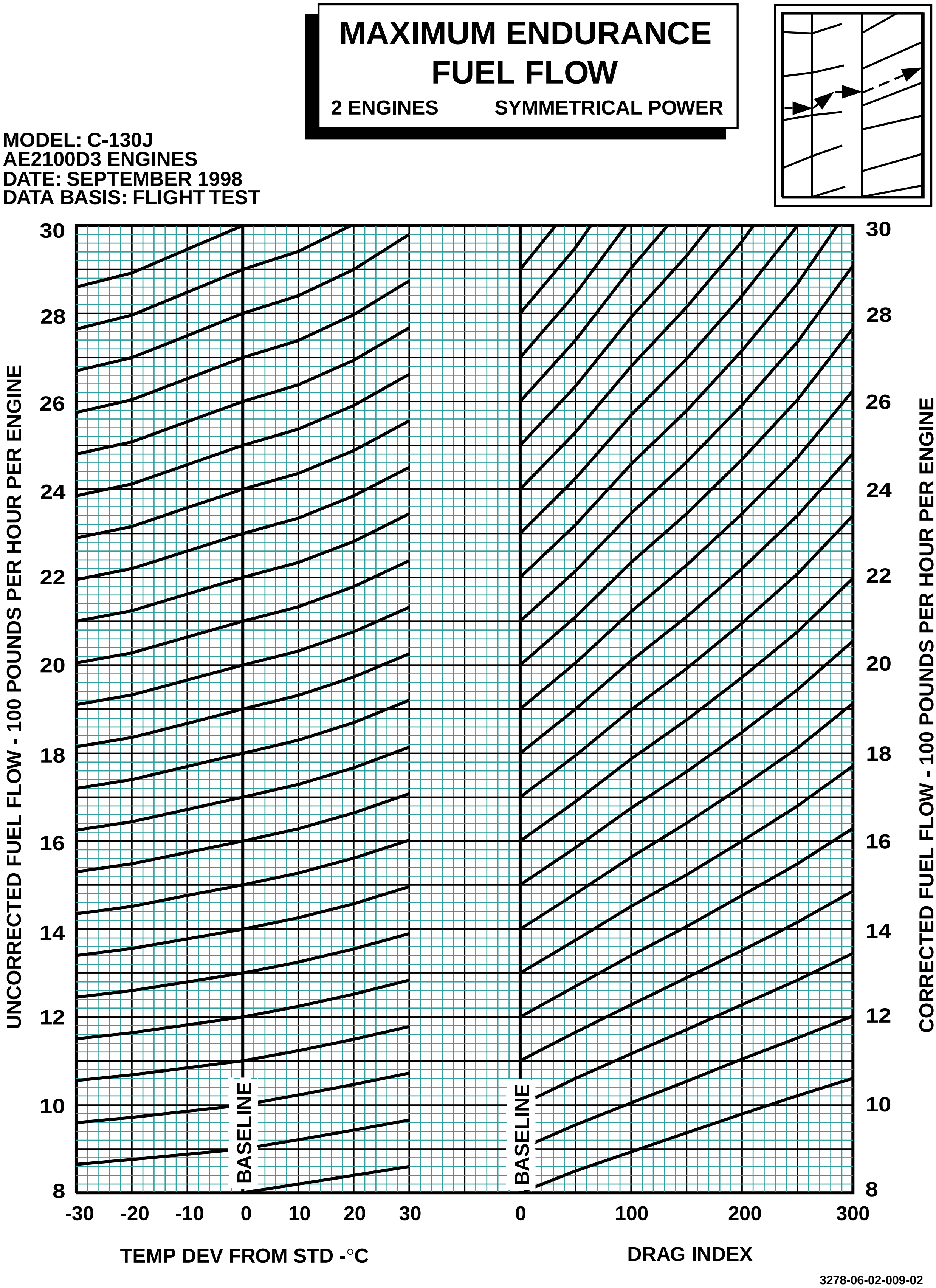


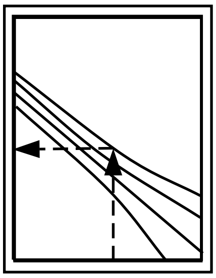
Figure 6-15. (Sheet 2 of 2)

Use, copying and/or disclosure is governed by the statement on the title page of this document.

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

OPTIMUM HOLDING ALTITUDE

2 ENGINES SYMMETRICAL POWER



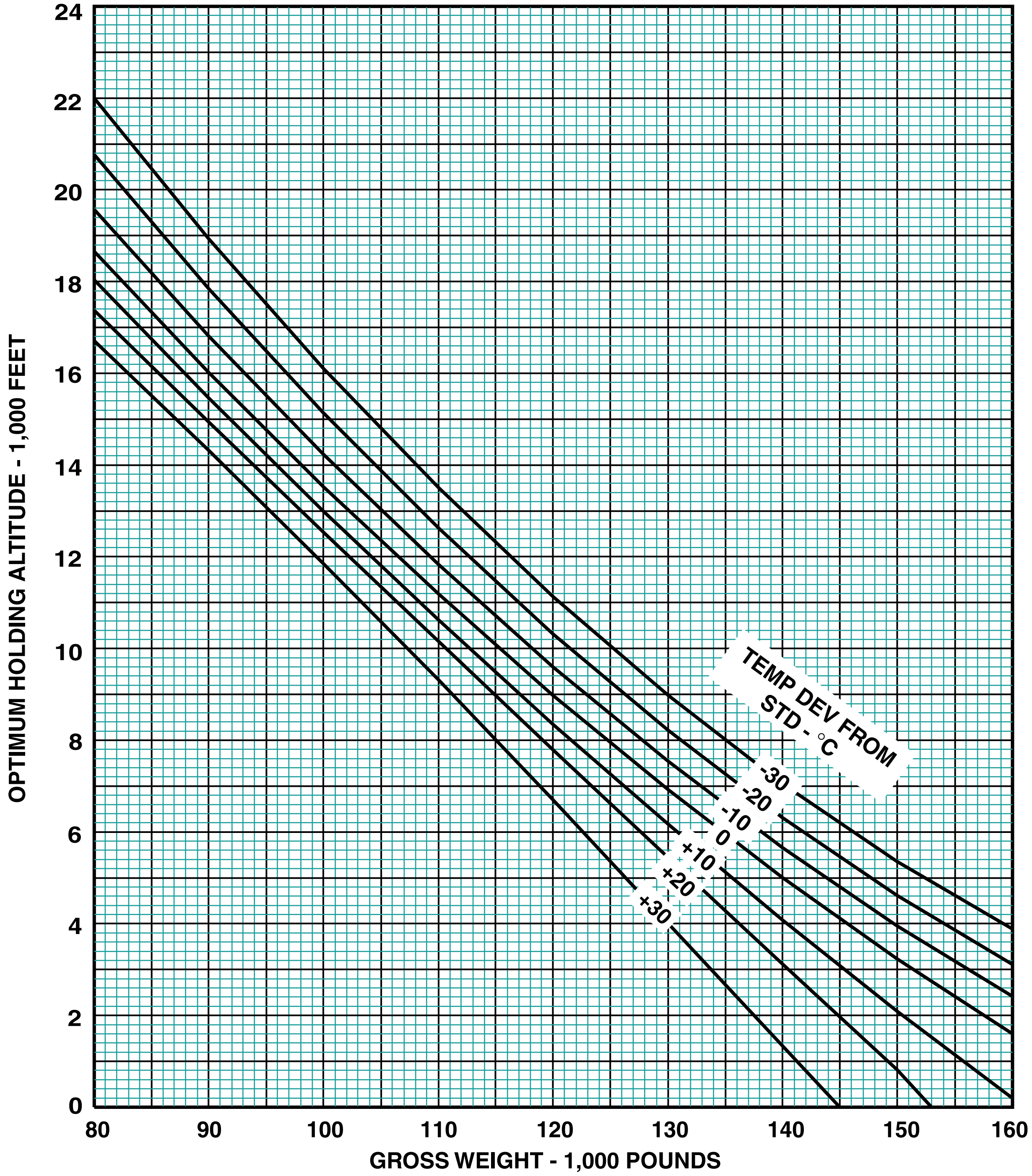


Figure 6-16.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

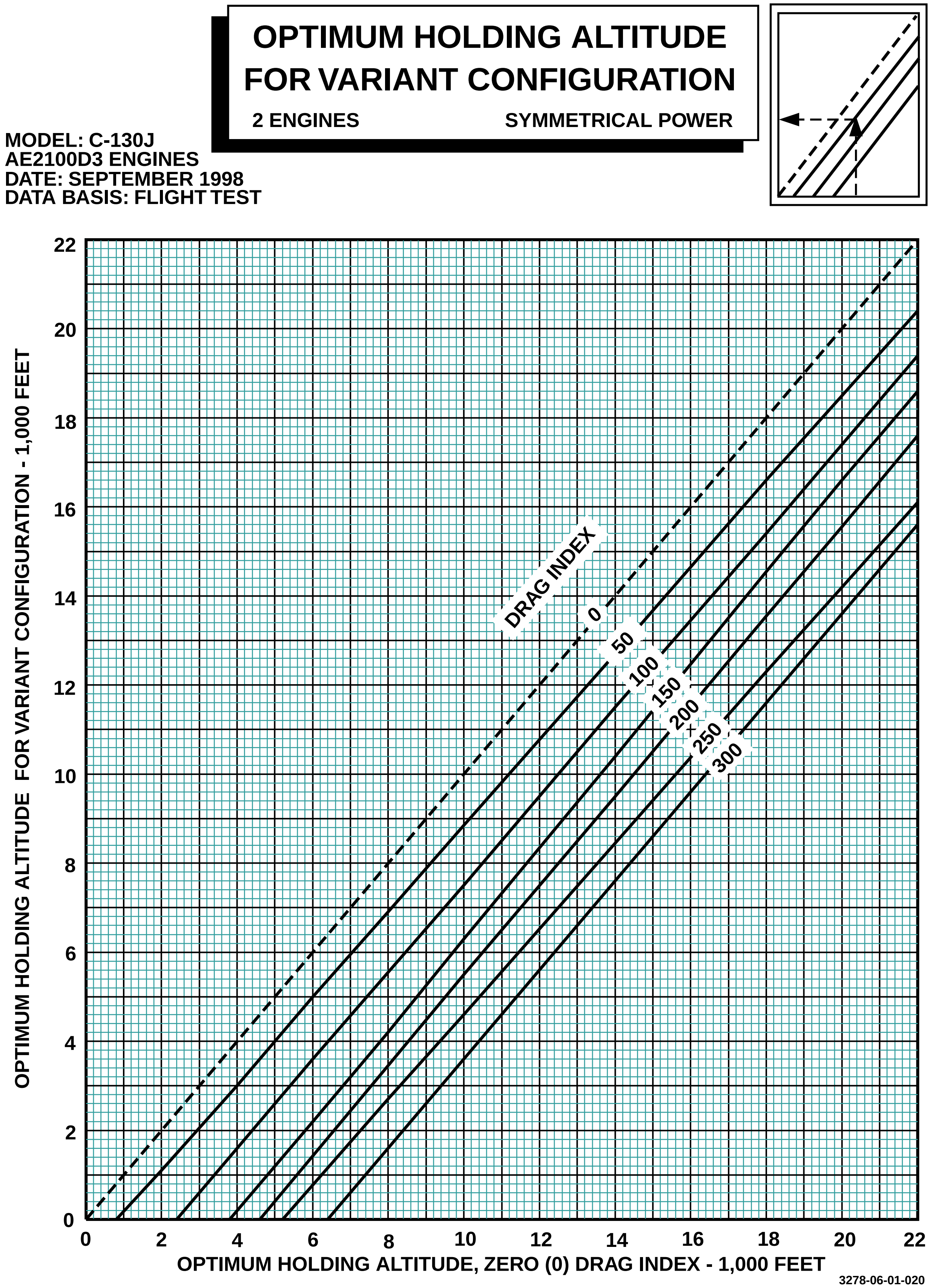
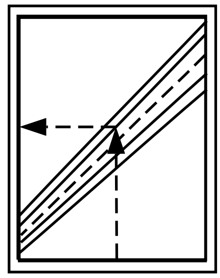


Figure 6-17.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

OPTIMUM HOLDING ALTITUDE FUEL FLOW

2 ENGINES SYMMETRICAL POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

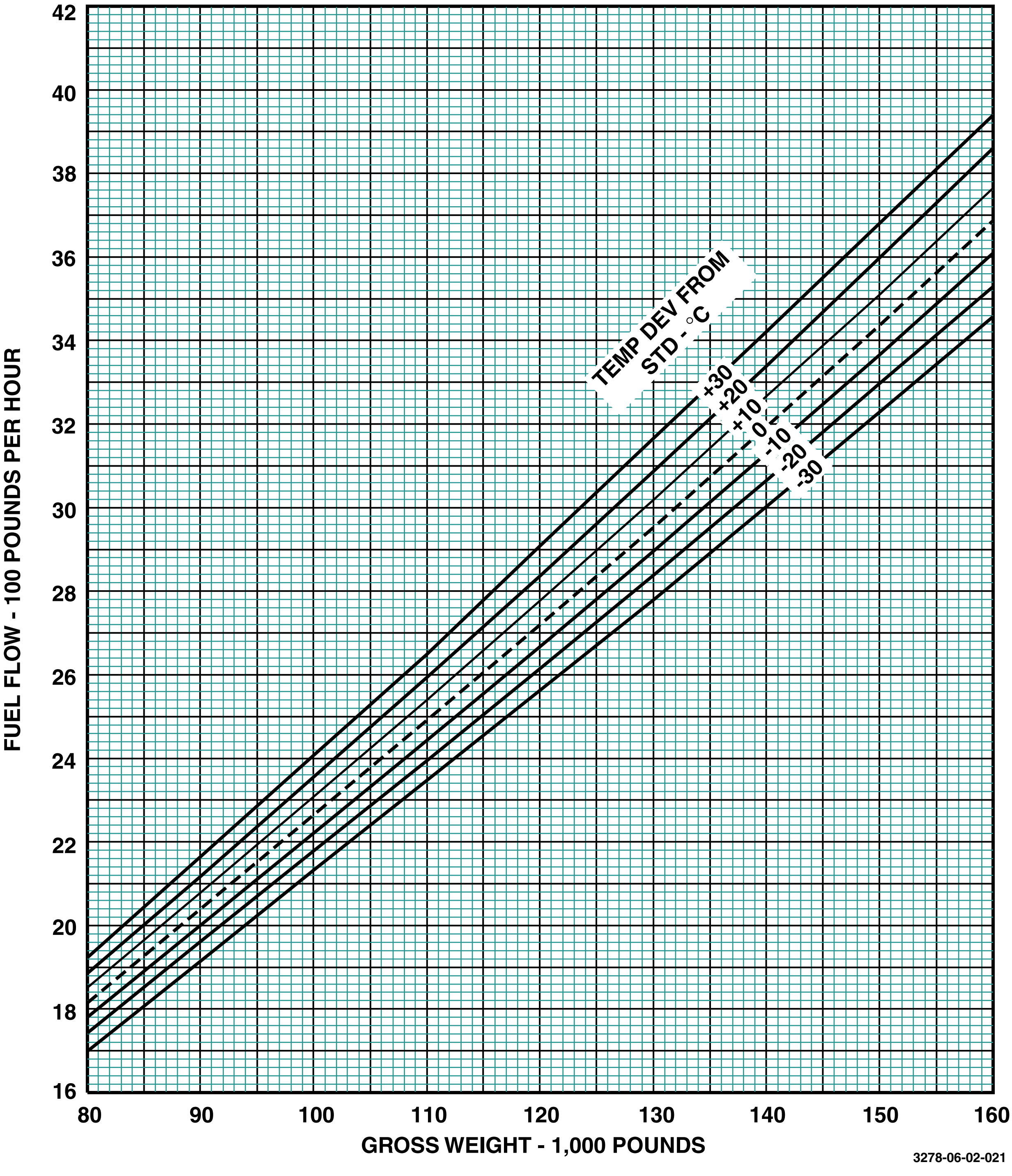
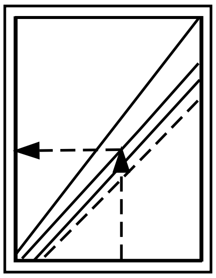


Figure 6-18.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

OPTIMUM HOLDING ALTITUDE FUEL FLOW FOR VARIANT CONFIGURATION

2 ENGINES SYMMETRICAL POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

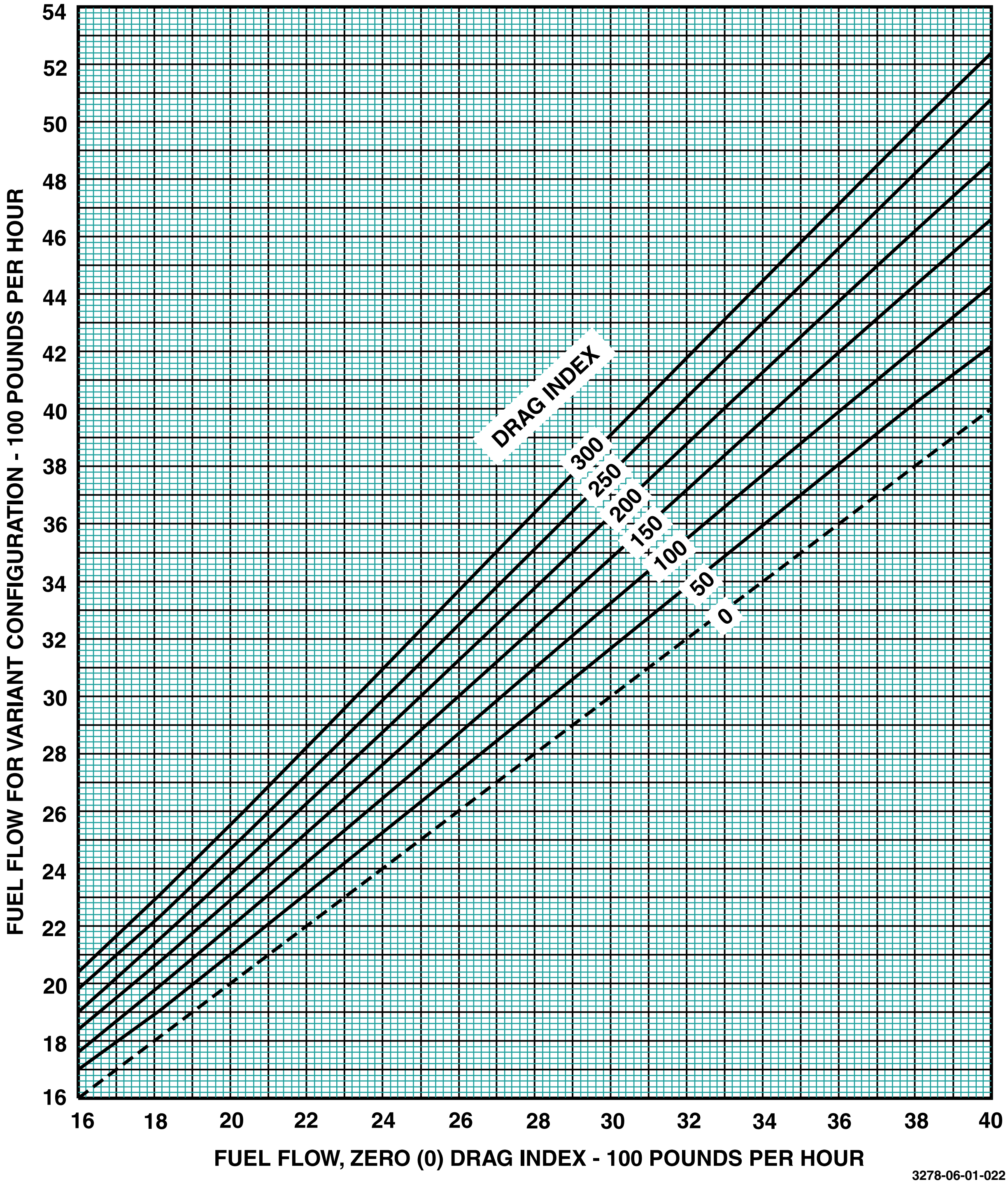


Figure 6-19.

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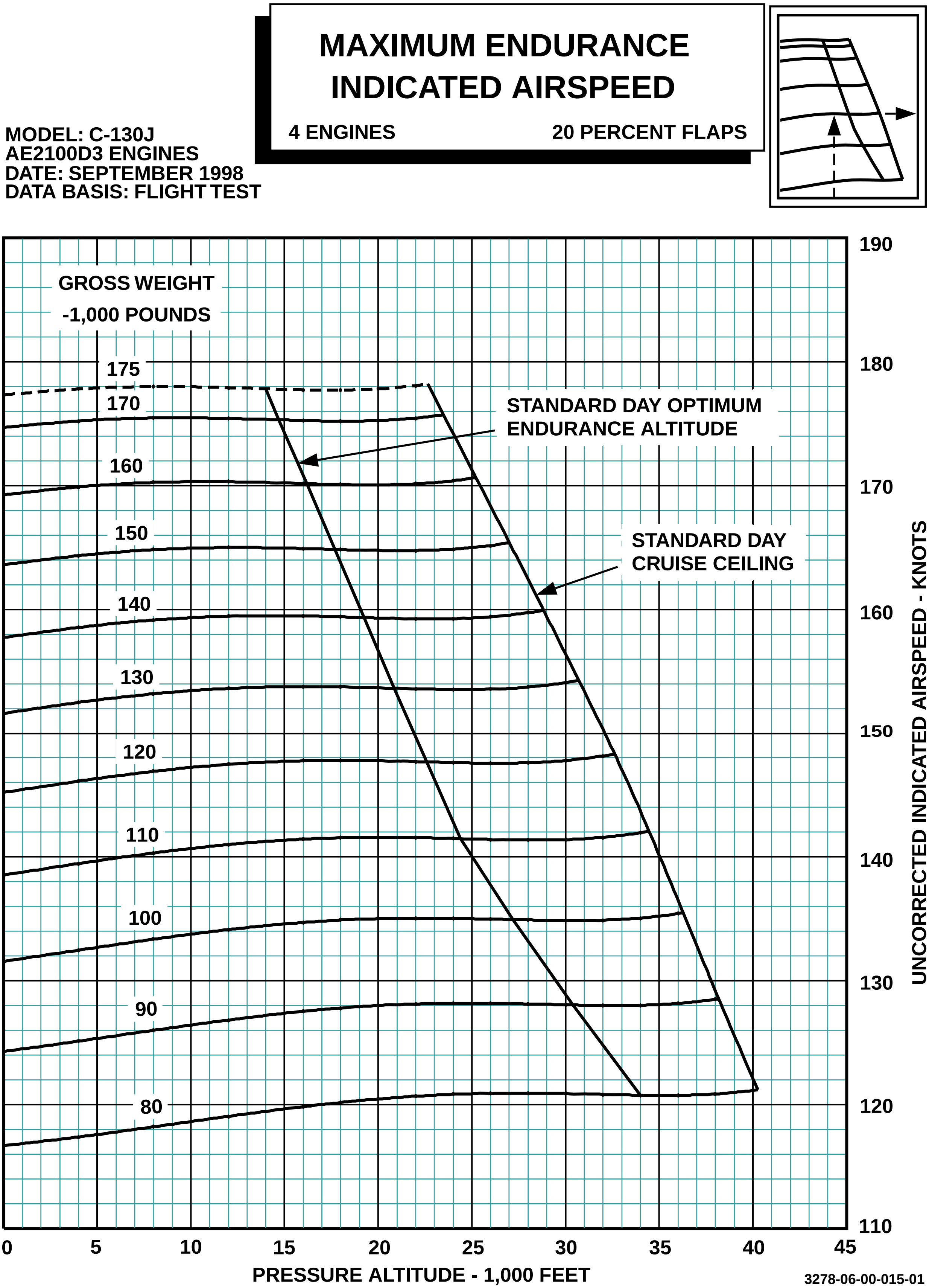

Figure 6-20. (Sheet 1 of 2)

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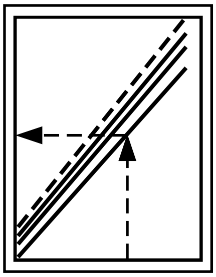
MAXIMUM ENDURANCE INDICATED AIRSPEED

4 ENGINES 20 PERCENT FLAPS



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

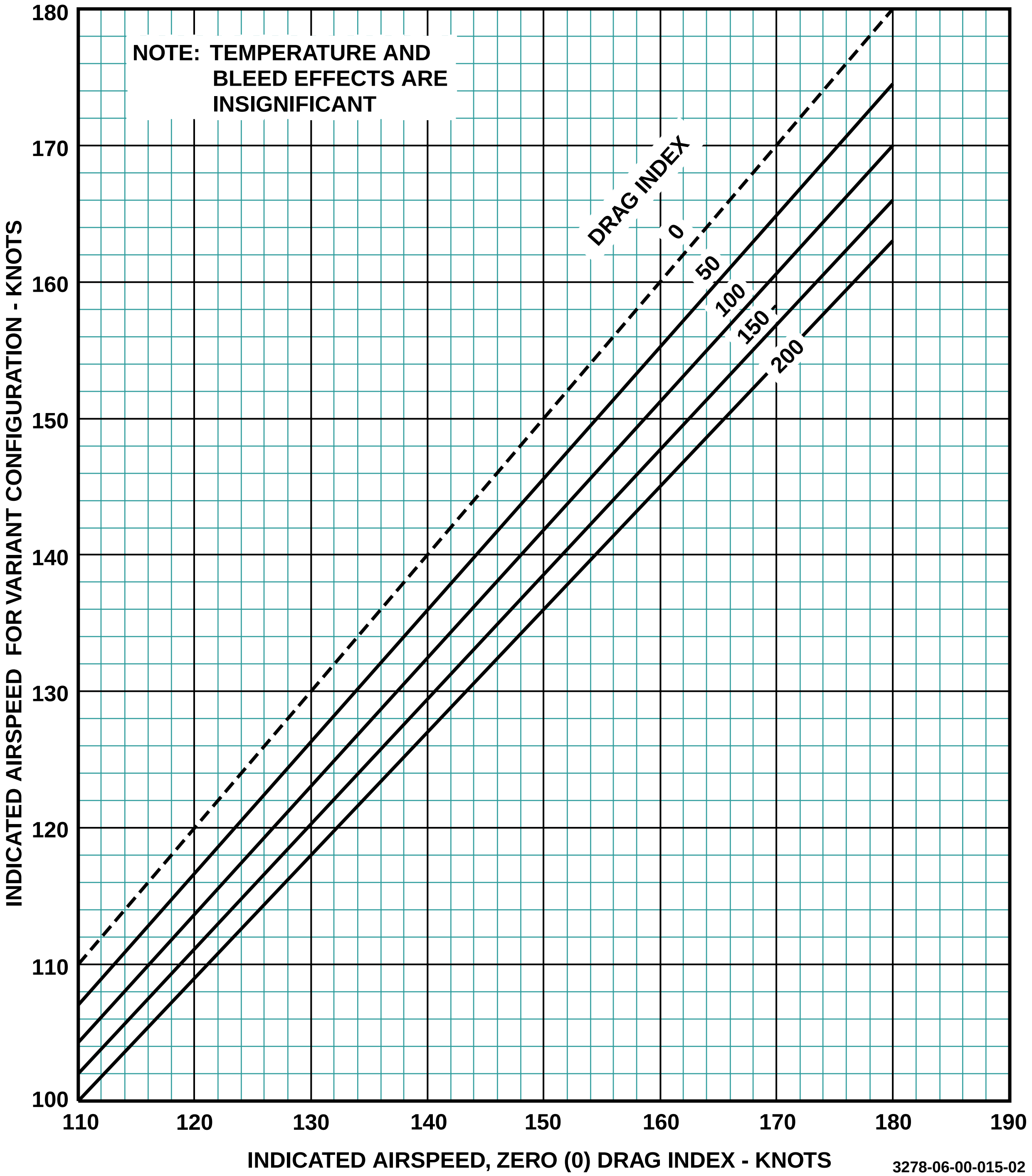


Figure 6-20. (Sheet 2 of 2)

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MAXIMUM ENDURANCE FUEL FLOW

4 ENGINES 20 PERCENT FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

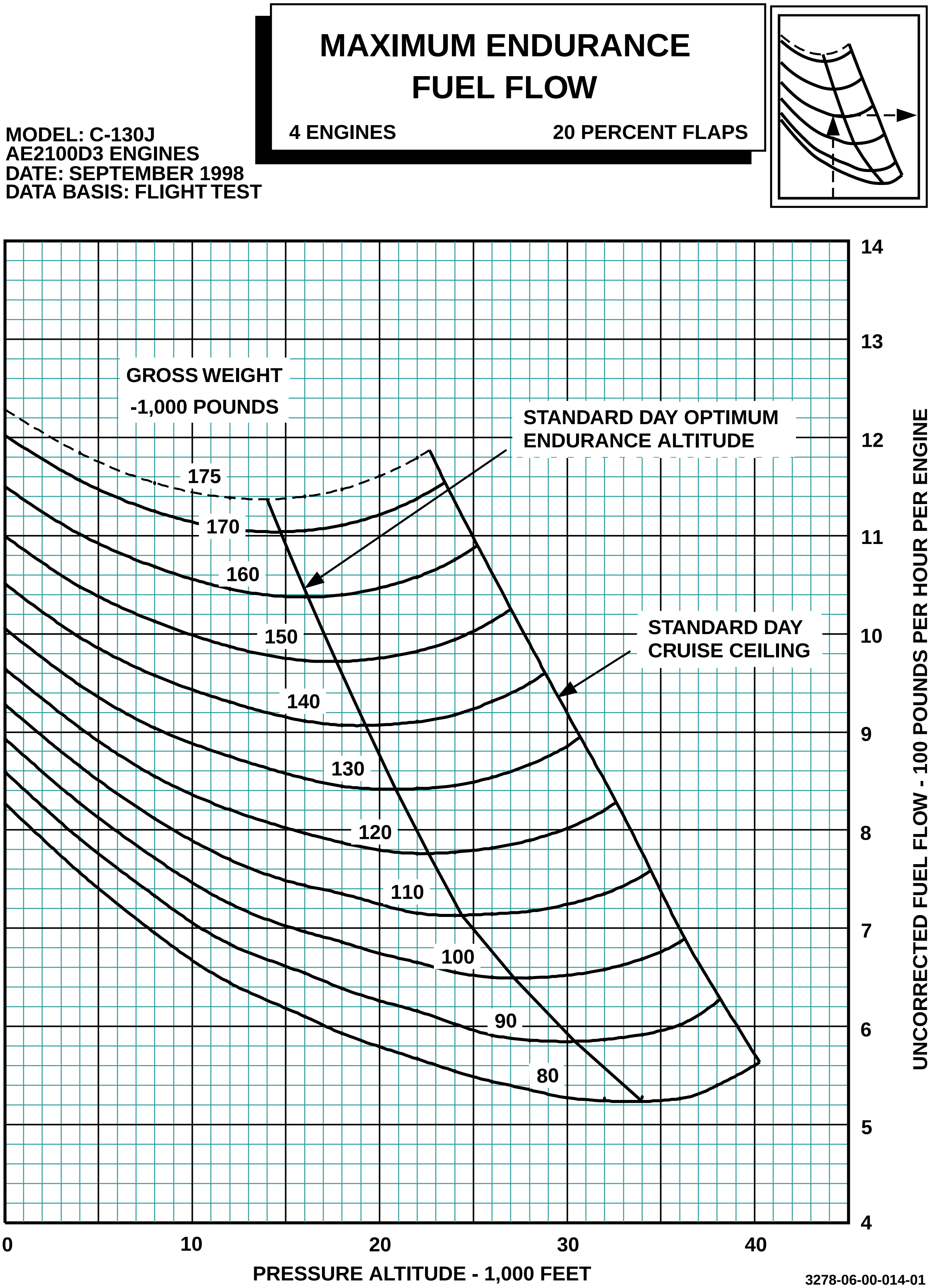

Figure 6-21. (Sheet 1 of 2)

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MAXIMUM ENDURANCE FUEL FLOW

4 ENGINES　　20 PERCENT FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

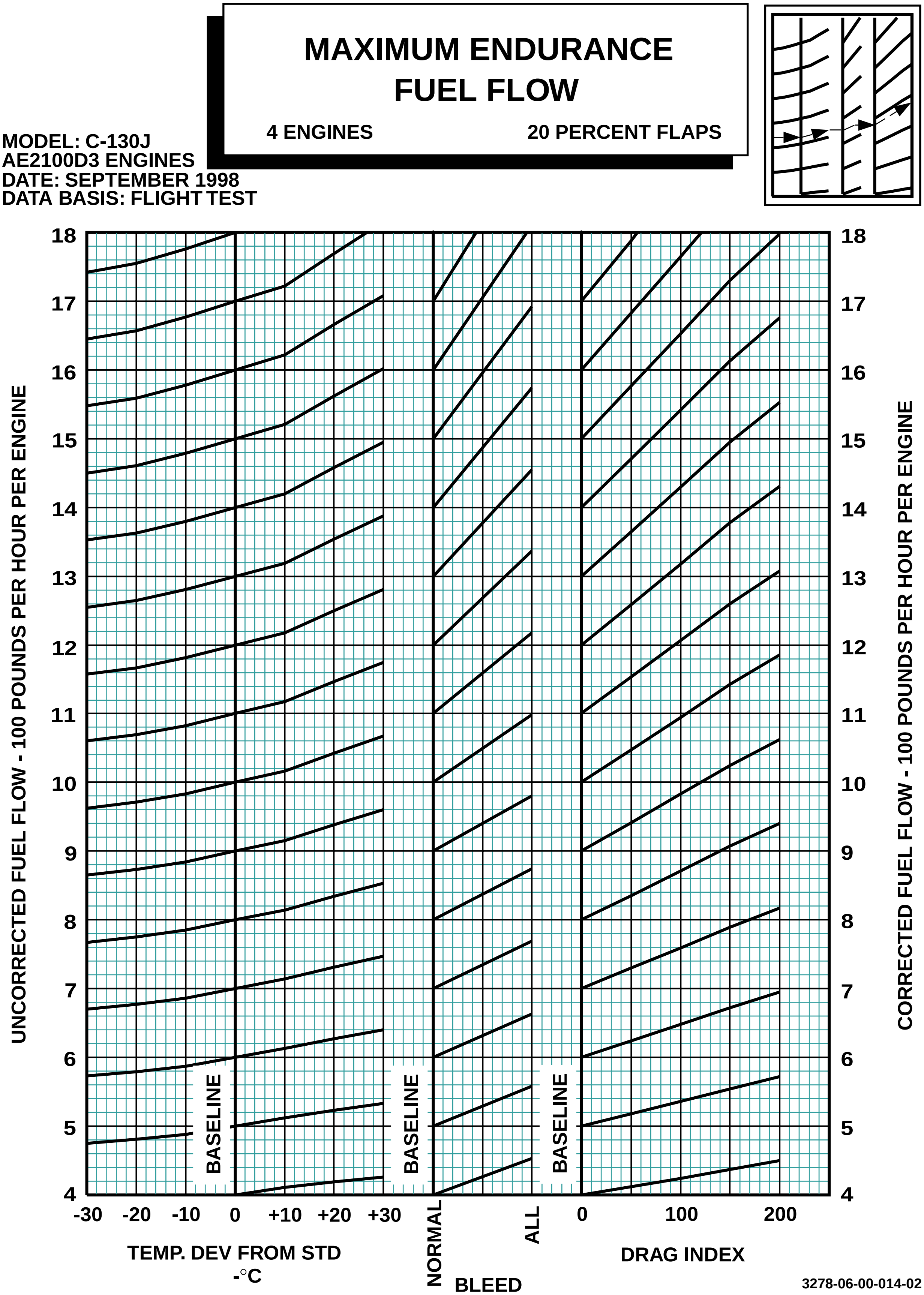

Figure 6-21. (Sheet 2 of 2)

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SECTION 7
AIR REFUELING

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LIST OF CHARTS

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INTRODUCTION.

Air refueling requires careful mission planning, special flying techniques, and a high degree of coordination between tanker and receiver. In order to fit a successful refueling operation into the mission plans of the receiver and tanker, the usual cruise data must be supplemented by additional operation information. Figures 7-1 through 7-3 provide a means of calculating fuel consumption, elapsed time, and distance covered during refueling of high performance airplanes using the high speed drogues. Figures 7-4 through 7-15 provide data for use during helicopter refueling operations using low speed drogues. All refueling operations are based on four-engine operation, with gear and flaps up for high performance airplane refueling, and gear up and flaps 70 percent for helicopter refueling.

NOTE

All figures in this section are based upon the KC-130J configuration as described in Section 1 of this manual.

NOTE

All figures in this section (except figures 7-1 and 7-15) are for operation with refueling drogues extended. Figures 7-1 and 7-15 are for operation with refueling drogues retracted.

DESCRIPTION OF CHARTS.

AIR REFUELING (HIGH SPEED DROGUES).

Speed and altitude limits for high performance airplane air refueling using the high speed drogues may be governed by either the tanker or the receiver. The tanker performance with the drogues extended will usually limit the initial contact point. The altitude capabilities during contact may depend on the receiver performance, but the maximum contact altitude will be set by the tanker cruise ceiling or tanker minimum refueling speed. Figure 7-2 presents the speed and altitude capability of the tanker with high speed drogues. This data is presented for level flight at maximum continuous power. Figure 7-2, sheet 2, provides a means of adjusting refueling speeds for additional drag in excess of the refueling configuration drag level. Speed increases with reduction in weight, as shown in figure 7-2, may not be realized during rapid fuel transfer because of inadequate time for acceleration. The total time for accomplishing the fuel transfer will be simply the time for making contact plus the time to transfer the fuel. Time to transfer the fuel is obtained by dividing the weight of the fuel transferred by the average expected fuel transfer rate. Distance covered during refueling will be the product of the average true airspeed during refueling and the time to refuel. This data is presented in the time and distance to Refuel Chart. (See figure 7-3.)

The air refueling chart (figure 7-1) assumes the following:

a. Basic operating weight empty (OW) of 88,349 pounds.

b. Use of long-range cruise-climb procedure for cruise to and return from the refueling area.

c. Start of fuel transfer weight is takeoff weight minus:

(1) 705 pounds of fuel for warmup and takeoff.

(2) Fuel for normal power climb to cruise.

(3) Fuel for long-range cruise-climb to the refueling area.

(4) One hour maximum endurance fuel for loiter and rendezvous.

d. End of cruise weight includes reserve fuel of 0.5 hour at maximum endurance plus 5 percent of initial mission fuel.

e. For radius of 120 nautical miles or less, cruise at long-range cruise at the refueling altitude.

Transferable fuel and tanker radius of action for 20,000 feet pressure altitude can be determined from the air refueling chart. (See figure 7-1.) With a given takeoff weight and radius of action, the start of fuel transfer weight is read from the weight scale. This start of fuel transfer weight is at the contact point of the refueling mission. The difference between the start of fuel transfer weight and the end of fuel transfer weight is the transferable fuel in pounds. The difference between the end of fuel transfer weight and the end of cruise weight is the fuel required to return to base. End of cruise weight equals landing weight which in turn is operating weight empty plus the reserve fuel. Four-engine, long-range cruise-climb procedures to and from the refueling area are recommended. Figure 7-1 is based on an OW of 88,349 pounds. If the actual OW

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differs from it, add to or subtract the difference from the end of fuel transfer weight and end of cruise weight to ensure the required amount of fuel to return to base.

Example 1.

GIVEN:

ISA	
Actual OW	89,000 pounds
Takeoff weight	120,000 pounds
Refuel at 20,000 feet	
Distance to refueling area	500 nautical miles

FIND:

Start of fuel transfer weight
End of fuel transfer weight
Total transferable fuel
End of cruise weight

PROCEDURE:

Enter the air refueling chart (figure 7-1) with 500 nautical miles radius and move up to the 120,000-pound takeoff gross weight line, then left and read a start of fuel transfer weight of 109,000 pounds on the weight scale. Now enter the chart with 500 nautical miles radius and move up to the end of fuel transfer weight line, then left and read an end of fuel transfer weight of 97,000 pounds. Total transferable fuel is 12,000 pounds (109,000 – 97,000). Enter the chart again with 500 nautical miles radius and move up to the end of cruise weight line, then left and read an end of cruise weight line, then left and read an end of cruise gross weight of 91,500 pounds. Now subtract the basic OW (88,349) from the actual OW (89,000) to find a difference of 651 pounds. Add this 651 pounds to the end of fuel transfer weight to find an actual end of fuel transfer weight of 97,651 pounds. The actual total transferable fuel is then found to be 11,349 pounds (109,000 –97,651). The actual end of cruise gross weight (landing weight plus reserve fuel) is found to be 92,151 pounds (91,500 + 651).

Example 2.

GIVEN:

ISA	
Refuel one high performance airplane at 20,000 feet	
Receiver fuel flow	50 pounds per minute
Tanker fuel transfer rate	1,950 pounds per minute
Fuel to be transferred	14,000 pounds
Tanker start of fuel transfer weight	108,000 pounds

FIND:

Start of refueling speed
End of refueling speed
Time to refuel after contact
Distance during refueling

PROCEDURE:

Enter the refueling speed chart (figure 7-2) with the start of fuel transfer weight of 108,000 pounds, and move up to the 20,000-foot pressure altitude line and read a start of refueling speed 239 KIAS. Now enter the chart with the end of fuel transfer weight of 94,000 pounds (108,000 – 14,000) and move up to the 20,000-foot pressure altitude lien, then right and read an end of refueling speed of 240.5 KIAS. Average refueling speed is 239.8 KIAS.

The time and distance to refuel after contact are determined from figure 7-3. Enter figure 7-3, sheet 1, with the fuel flow of the receiver (50 pounds per minute), move right to the tanker rate of 1,950 pounds per minute, then up to the 14,000-pound fuel transfer line and at the left, read 7.5 minutes refueling time. Enter figure 7-3, sheet 2, with the refueling speed of 239.8 KIAS and move up to intersect the 7.5 minutes refueling time. Read to the left an uncorrected refueling distance of 40 nautical miles. Since there are no altitude or temperature corrections to be made from figure 7-3, sheet 3, the 40 nautical miles is the corrected distance.

AIR REFUELING (LOW SPEED DROGUES).

Figures 7-4 through 7-15 provide data for use in conducting helicopter refueling operations using the low speed drogues.

Air refueling speeds are presented in figure 7-4 for operation with 70 percent flaps. This flap setting was selected to permit optimum airplane stability, lowest engine power, and to produce the lowest turbulence to the receiver.

The minimum recommended air refueling speed is 105 KIAS for weights up to 148,000 pounds. For weights above 148,000 pounds, enter figure 7-4 with the weight, move vertically to the 70 percent flaps minimum operational speed line and read at the left the minimum recommended refueling speed.

The 70 percent flaps minimum operational speed is defined as that speed which is 5 knots

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above stall warning with power required for level flight.

The minimum recommended air refueling speed is based on drogue stability, reel response characteristics, and the receivers stability.

Refueling is possible at or above the minimum operational speed and below the minimum recommended refueling speed to meet receiver emergency conditions provided caution is exercised and there is an operational requirement.

WARNING

> There is a small margin of safety between power-on and power-off stall speeds. An abrupt reduction of power, however, at the 70 percent flap minimum operational speed may result in immediate stall with no stall warning.

Figures 7-5 through 7-8 provide fuel flow data for refueling at 500, 5,000, 7,500, and 10,000-foot pressure altitudes. Figure 7-9 provides correction grids for variations in drag index from 0 to 150, and for deviation from standard temperature. Figures 7-10 through 7-14 provide engine horsepower required for refueling at 500, 5,000, 7,500, and 10,000-foot pressure altitudes and also drag index and temperature deviation correction grids.

Figure 7-15 presents total range for climb from an initial refueling altitude of 5,000 feet to the optimum cruise altitude, cruise, and maximum range descent back to 5,000 feet. The end of refueling constant weight altitude lines shown on this chart are limited by the superimposed cruise ceiling lines. For ranges that fall to the right of a cruise ceiling line for a given temperature, cruise at the cruise ceiling for the initial weight. For ranges that fall to the left of the cruise ceiling, cruise at the altitude shown on the altitude scale.

For air refueling altitudes of 7,500 or 10,000 feet, the optimum short range altitudes may be obtained from figure 7-15 simply by increasing the altitude read from the chart by the difference between 5,000 feet and the refueling altitude. For refueling altitudes less than 5,000 feet, reduce the altitude read from the chart by the difference between 5,000 feet and the refueling altitude. Cruise ceiling limits will continue to limit altitude in some cases. When cruise ceiling is limiting, the range required to climb from an end refueling altitude greater than 5,000 feet will be conservative.

Example.

GIVEN:

Airplane	KC-130J
Begin refueling weight	140,000 pounds
Refueling speed	110 KIAS
End refueling weight	120,000 pounds
Refueling altitude	7,500 feet
OAT	ISA –20 °C
Cruise range after refueling	200 nautical miles

FIND:

Total engine fuel flow
Optimum cruise altitude

PROCEDURE:

For total engine fuel flow, enter figure 7-7 with the begin refueling weight of 140,000 pounds. Move horizontally to the 110-KIAS line. Read to the left an uncorrected total fuel flow of 4,460 pounds per hour. Enter figure 7-9 with this valve and move to the temperature baseline. Follow the guidelines to –20 °C on the temperature deviation grid. Read a fuel flow of 4,290 pounds per hour. Since there is no drag index to correct for, this is the correct total fuel flow.

The optimum cruise altitude is found by entering figure 7-15 with the range of 200 nautical miles. Move up to the 120,000-pound end refueling weight and read at the left an altitude of 29,000 feet. This altitude is adjusted by the difference between the actual end refueling altitude of 7,500 feet and the chart initial refueling altitude of 5,000 feet (2,500 feet). The adjusted cruise altitude is 31,500 (29,000 + 2,500 = 31,500) feet, which is less than the cruise ceiling limit of 33,400 feet (obtained from figures 5-2 and 5-3 for a drag index of 52). For a range in excess of 500 nautical miles, the cruise ceiling will be limiting in this case.

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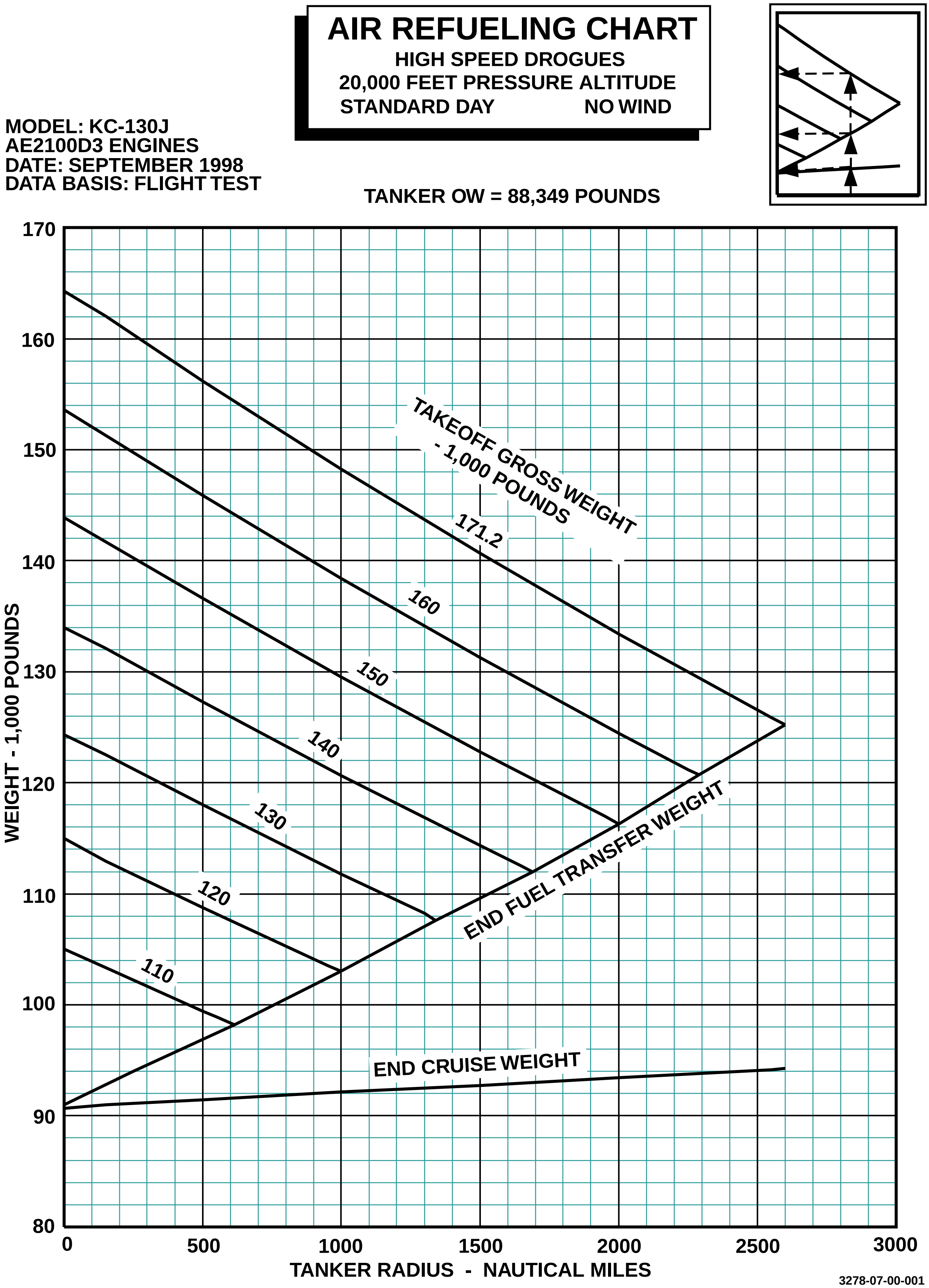

AIR REFUELING CHART
HIGH SPEED DROGUES
20,000 FEET PRESSURE ALTITUDE
STANDARD DAY NO WIND
MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST
TANKER OW = 88,349 POUNDS
TAKEOFF GROSS WEIGHT - 1,000 POUNDS
171.2
160
150
140
130
120
110
END FUEL TRANSFER WEIGHT
END CRUISE WEIGHT
WEIGHT - 1,000 POUNDS
170
160
150
140
130
120
110
100
90
80
0
500
1000
1500
2000
2500
3000
TANKER RADIUS - NAUTICAL MILES
3278-07-00-001

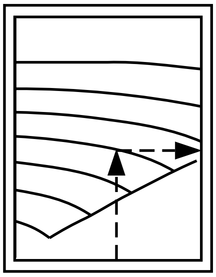
Figure 7-1.

REFUELING SPEEDS

HIGH SPEED DROGUES

4 ENGINES MAX CONTINUOUS POWER

MODEL : KC-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST



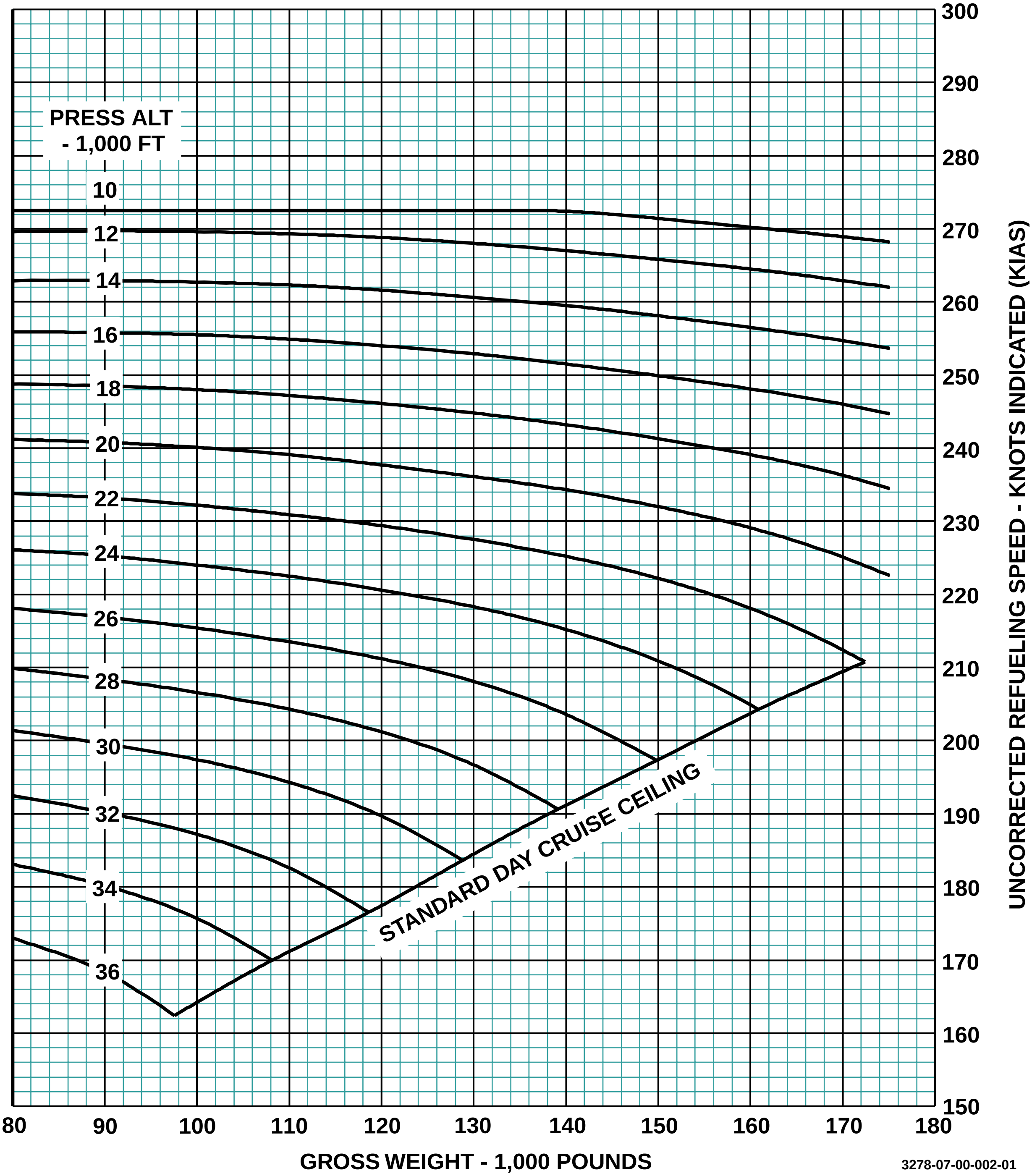


Figure 7-2. (Sheet 1 of 2)

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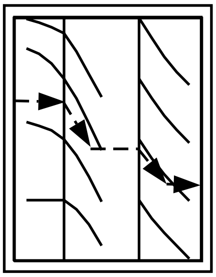
REFUELING SPEEDS VARIANT CONFIGURATION

HIGH SPEED DROGUES

4 ENGINES MAX CONTINUOUS POWER



MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

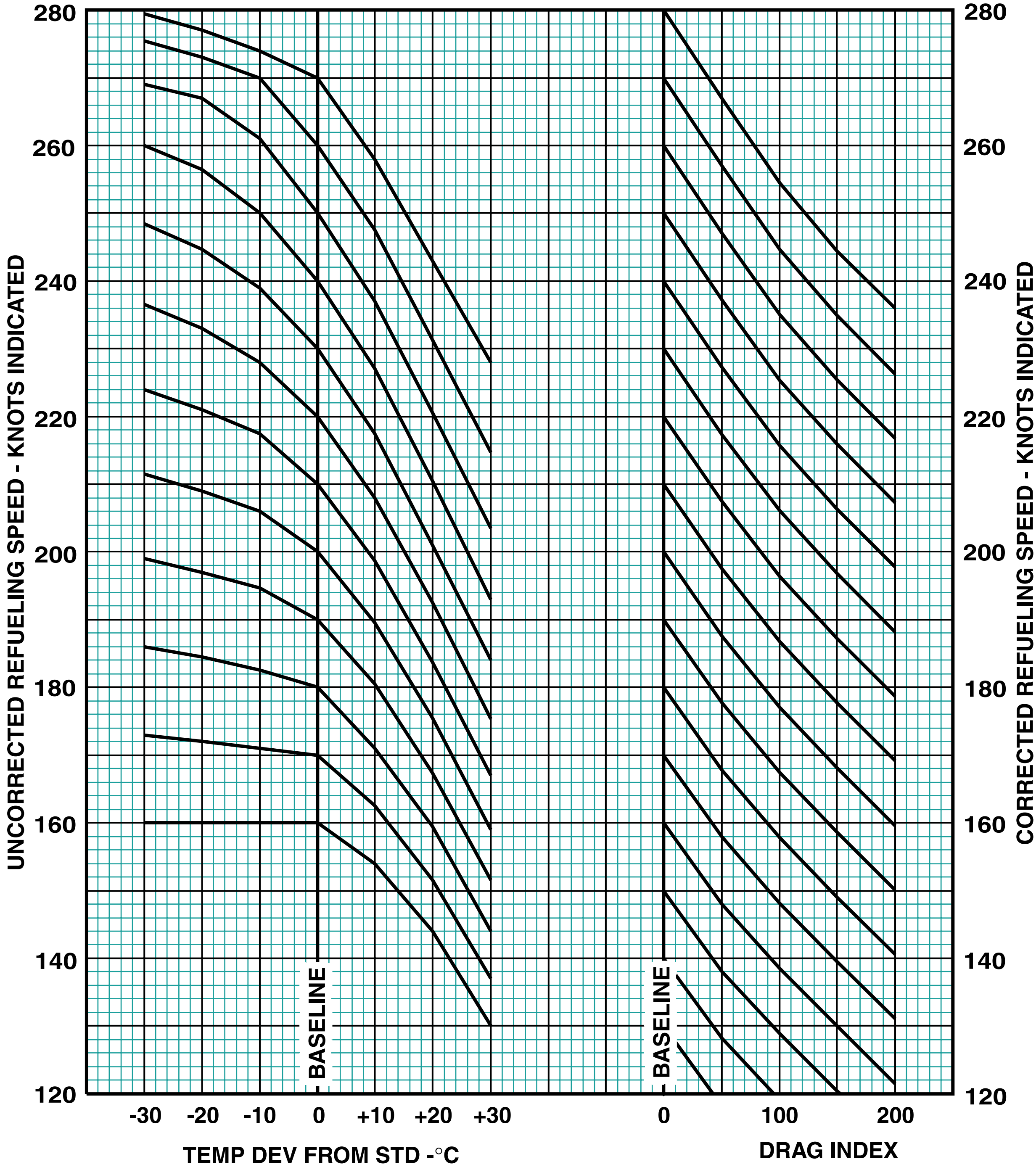


Figure 7-2. (Sheet 2 of 2)

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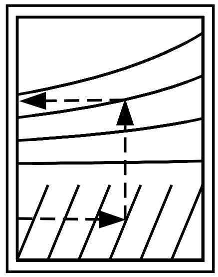
MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TIME AND DISTANCE TO REFUEL

HIGH SPEED DROGUES



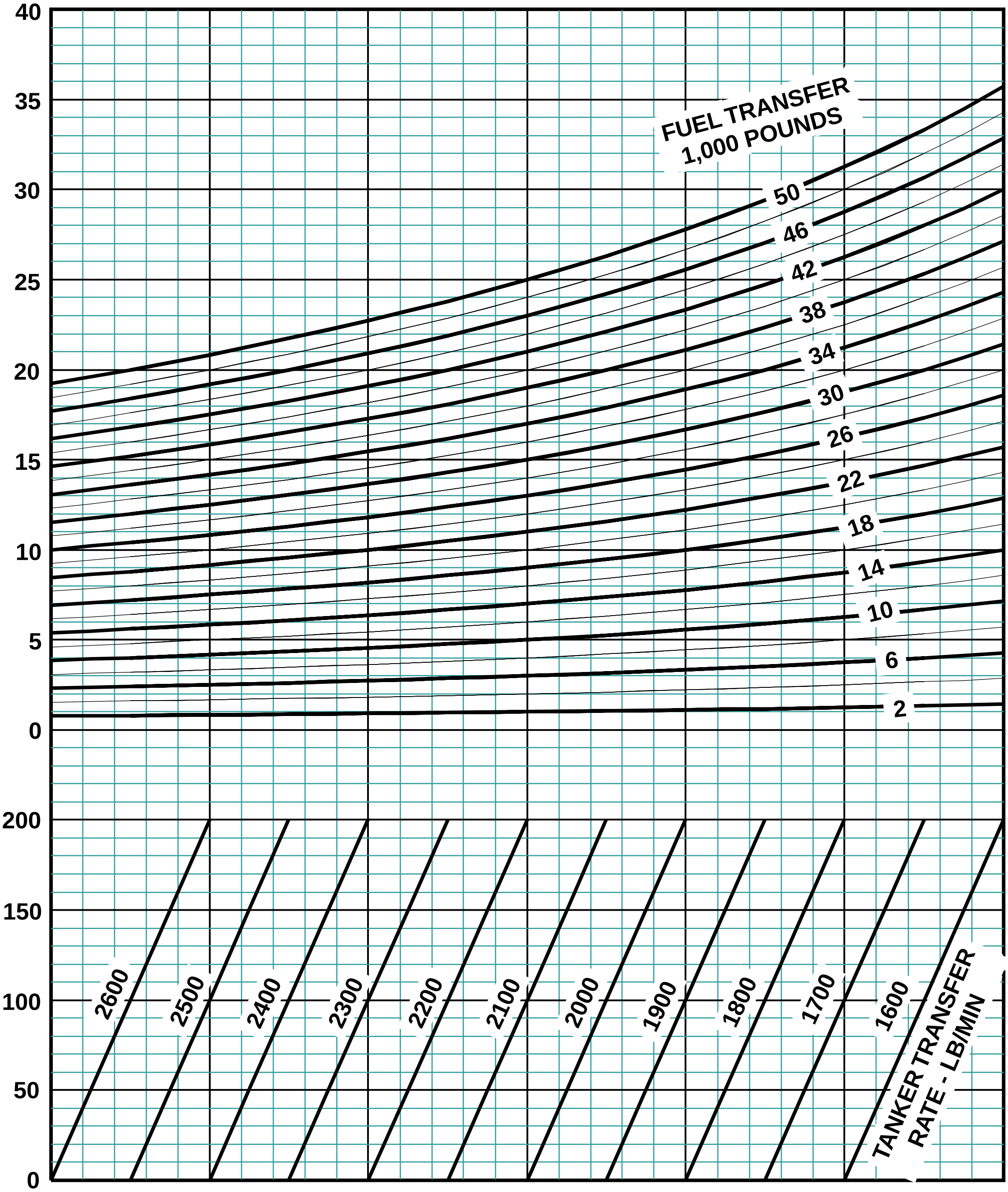


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Figure 7-3. (Sheet 1 of 3)

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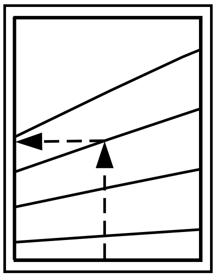
MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

TIME AND DISTANCE TO REFUEL

HIGH SPEED DROGUES



ALTITUDE = 20,000 FEET

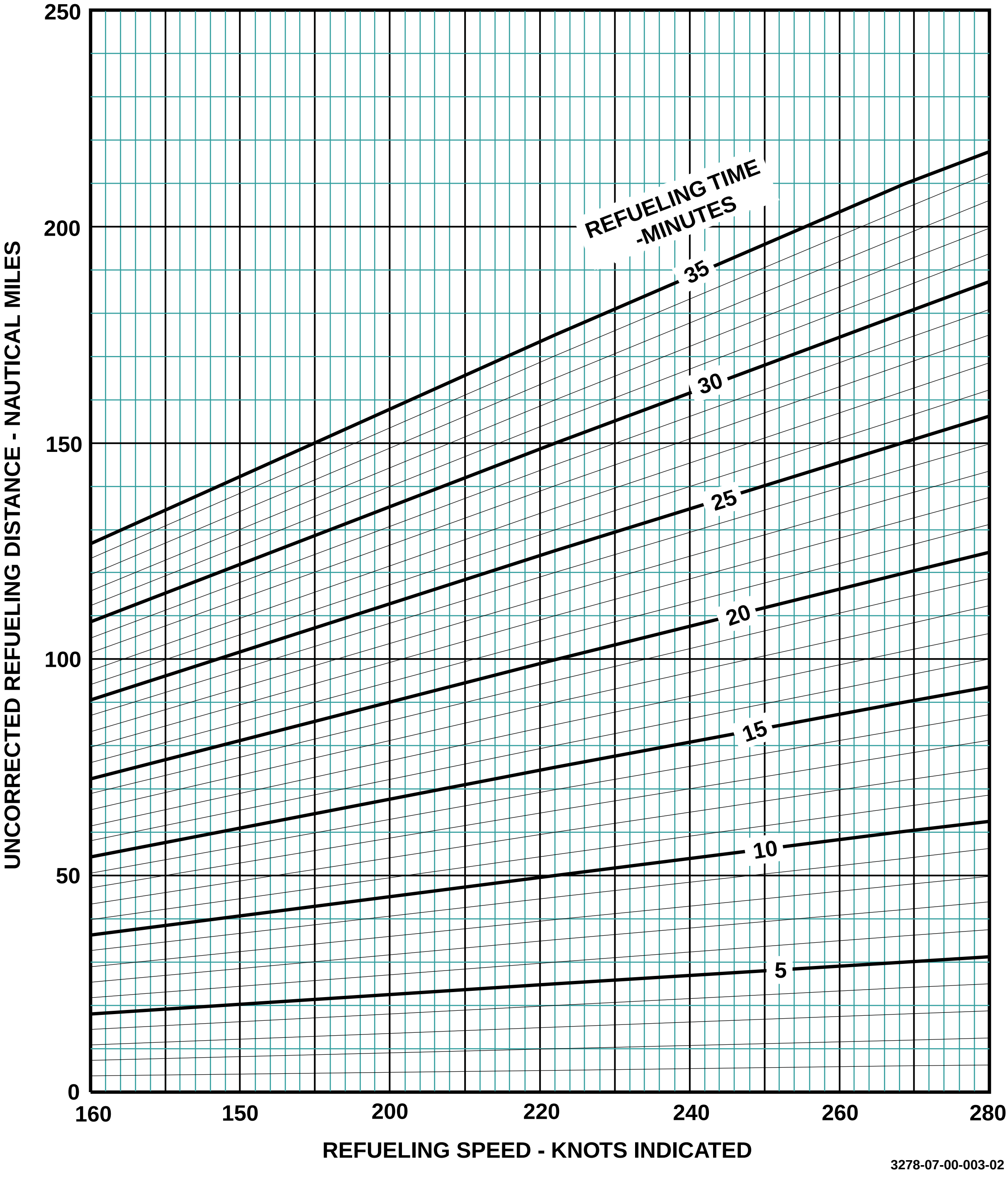


Figure 7-3. (Sheet 2 of 3)

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MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

TIME AND DISTANCE TO REFUEL

HIGH SPEED DROGUES

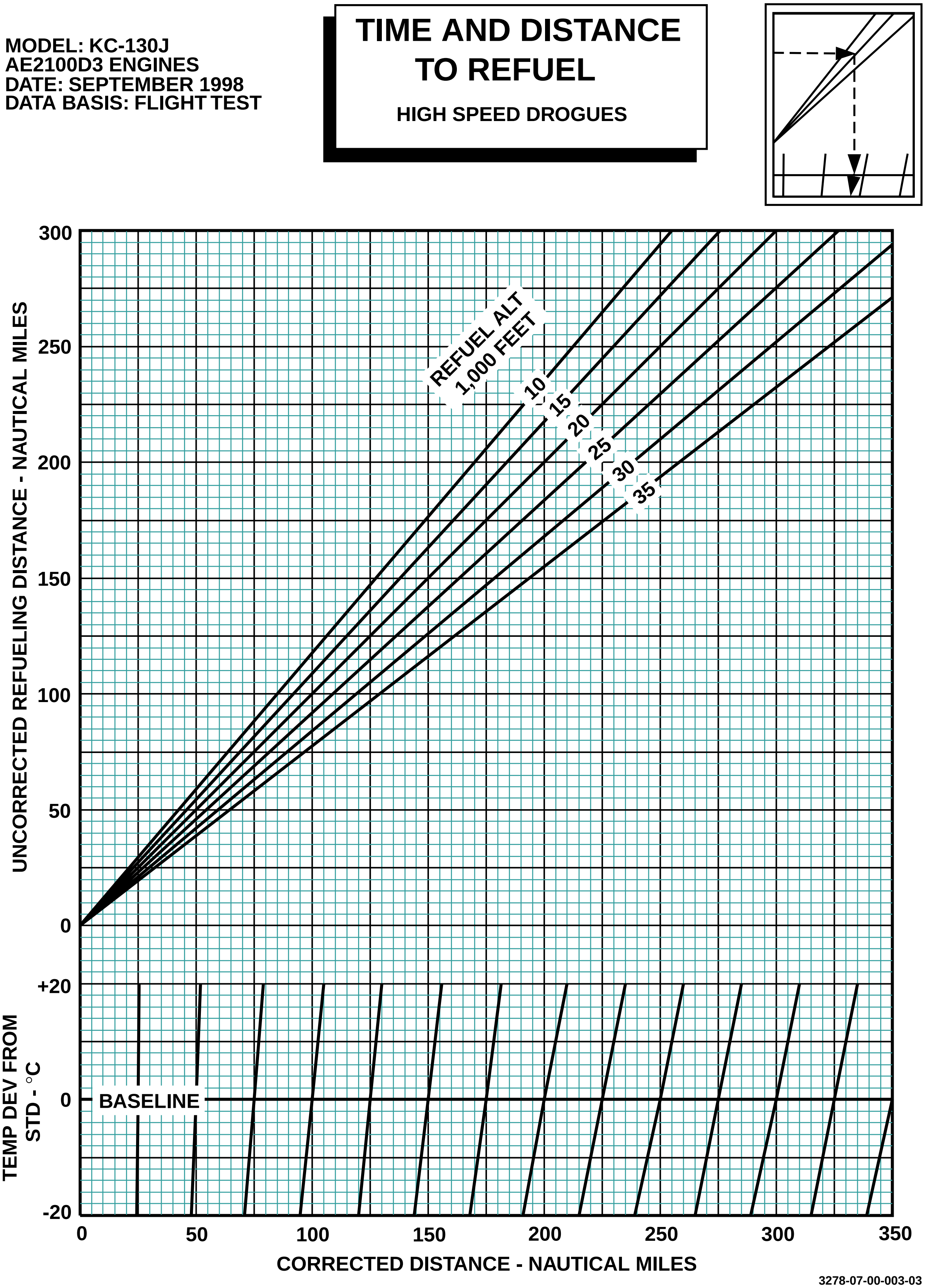

Figure 7-3. (Sheet 3 of 3)

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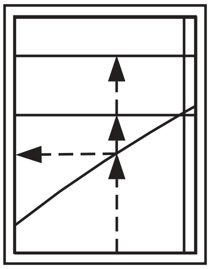
REFUELING AIRSPEED/WEIGHT LIMITS LOW SPEED DROGUES

MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED



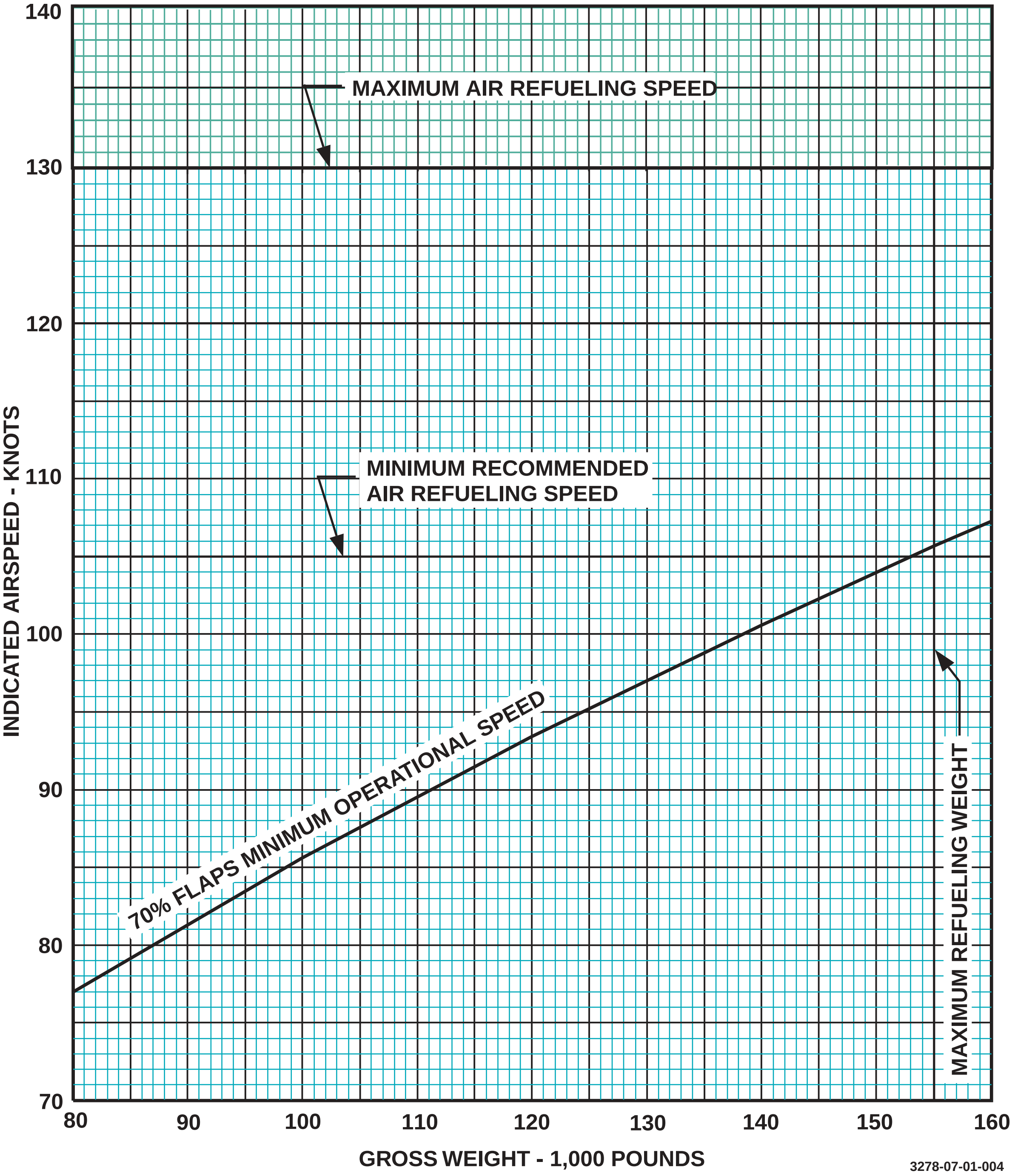


Figure 7-4.

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REFUELING FUEL FLOW
500 FEET

4 ENGINES LOW SPEED DROGUES

MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

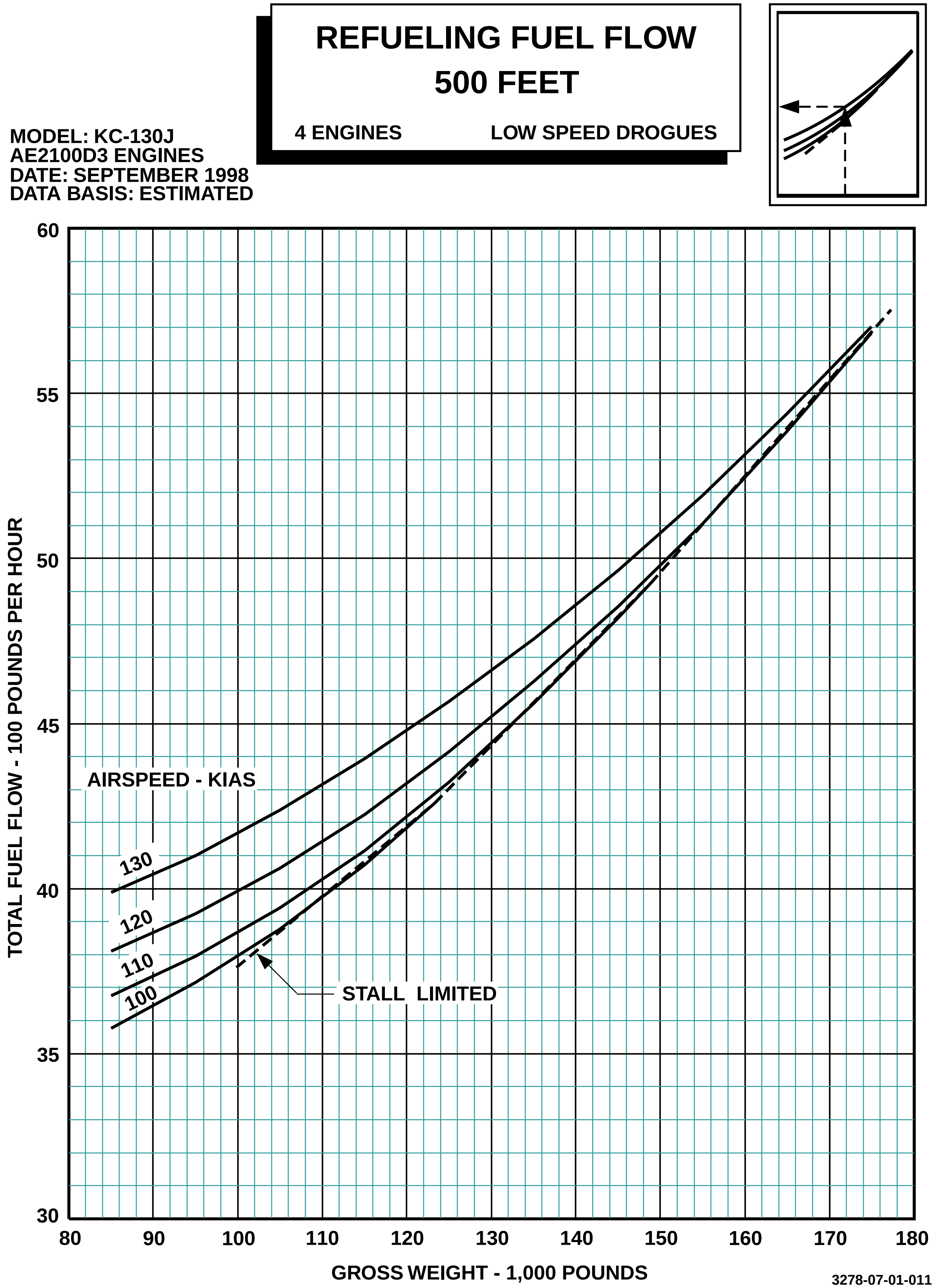

Figure 7-5.

Use, copying and/or disclosure is governed by the statement on the title page of this document.

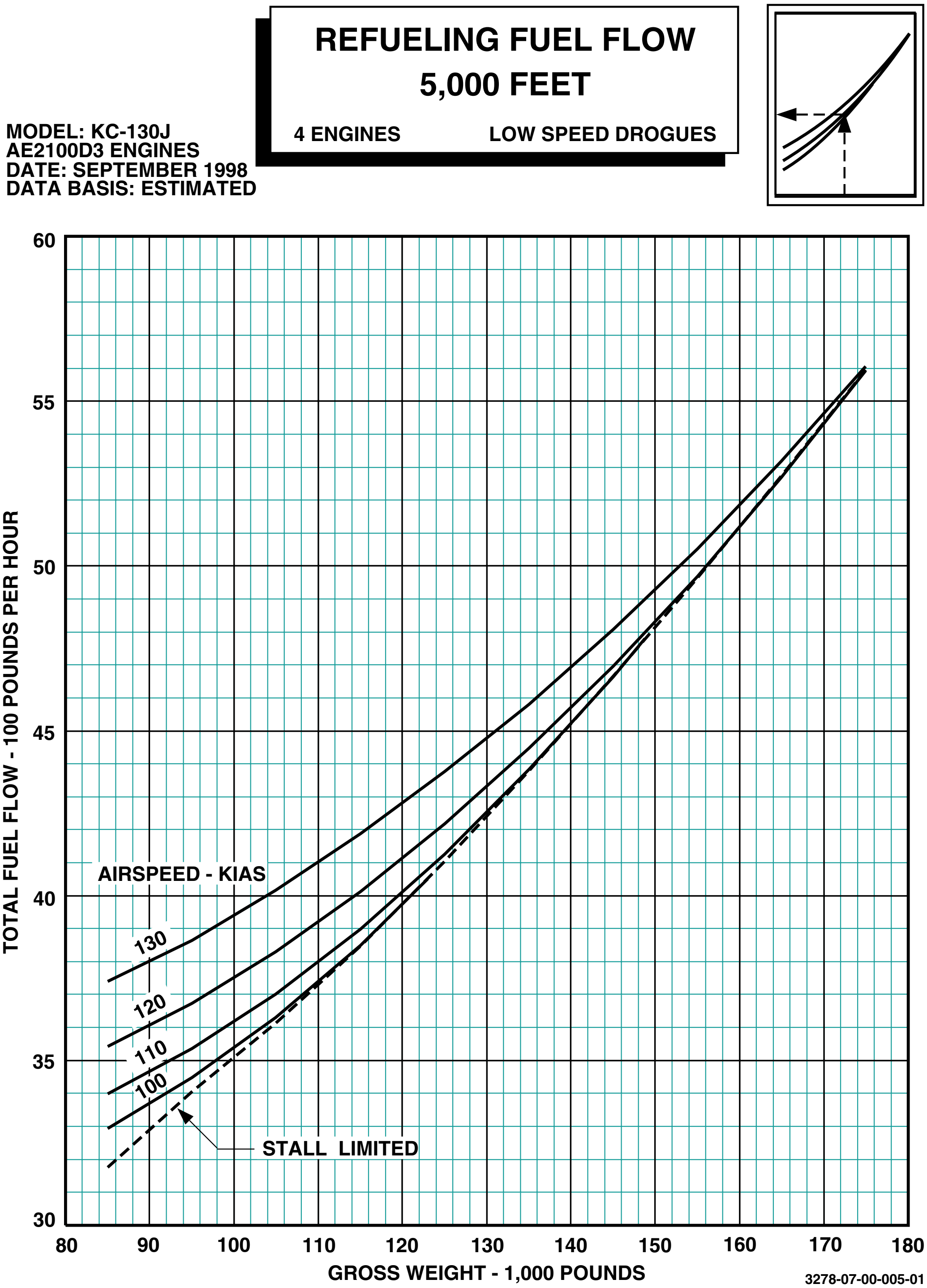

Figure 7-6.

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REFUELING FUEL FLOW 7,500 FEET

4 ENGINES LOW SPEED DROGUES

MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

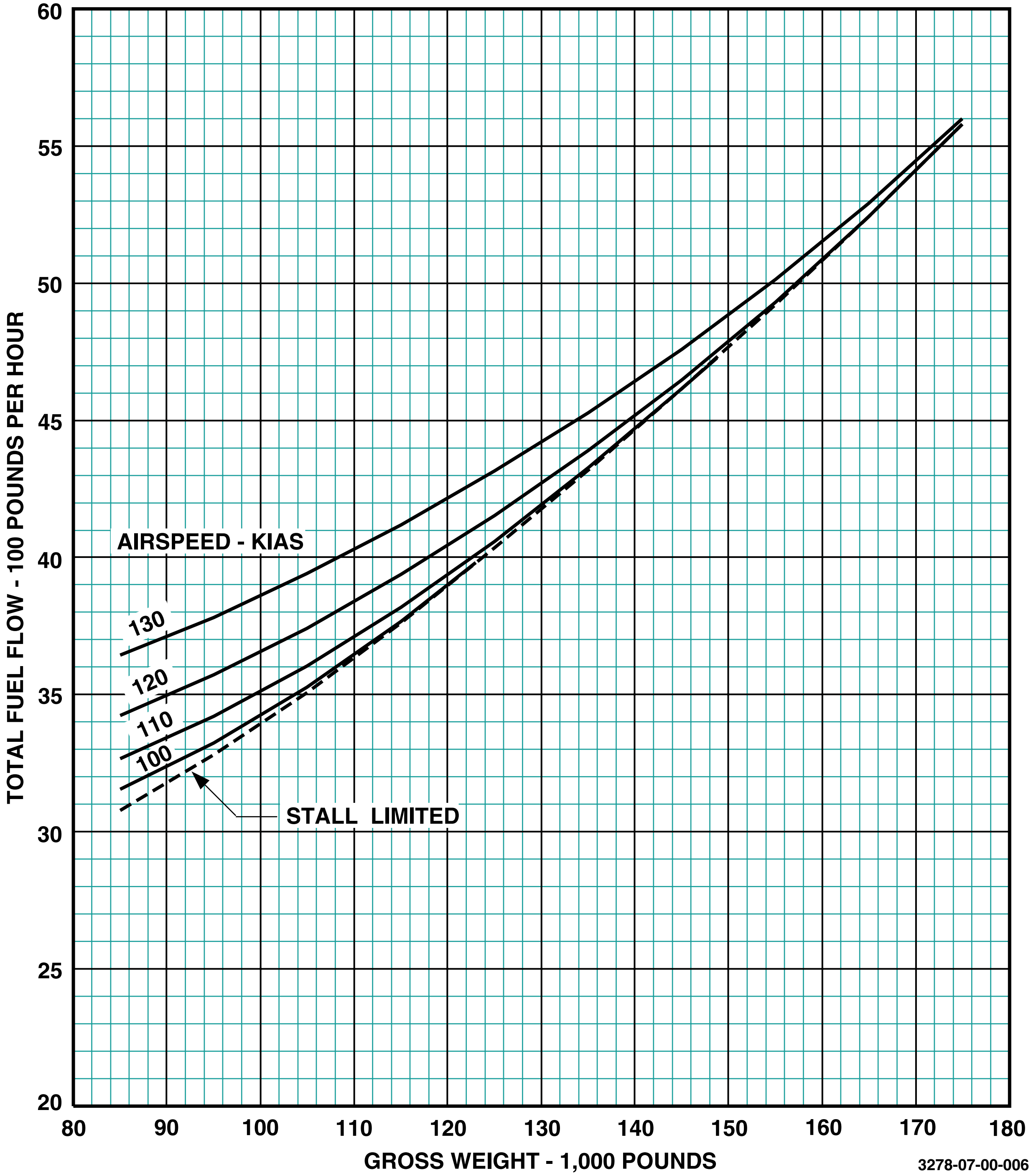

Figure 7-7.

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REFUELING FUEL FLOW
10,000 FEET

4 ENGINES LOW SPEED DROGUES

MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

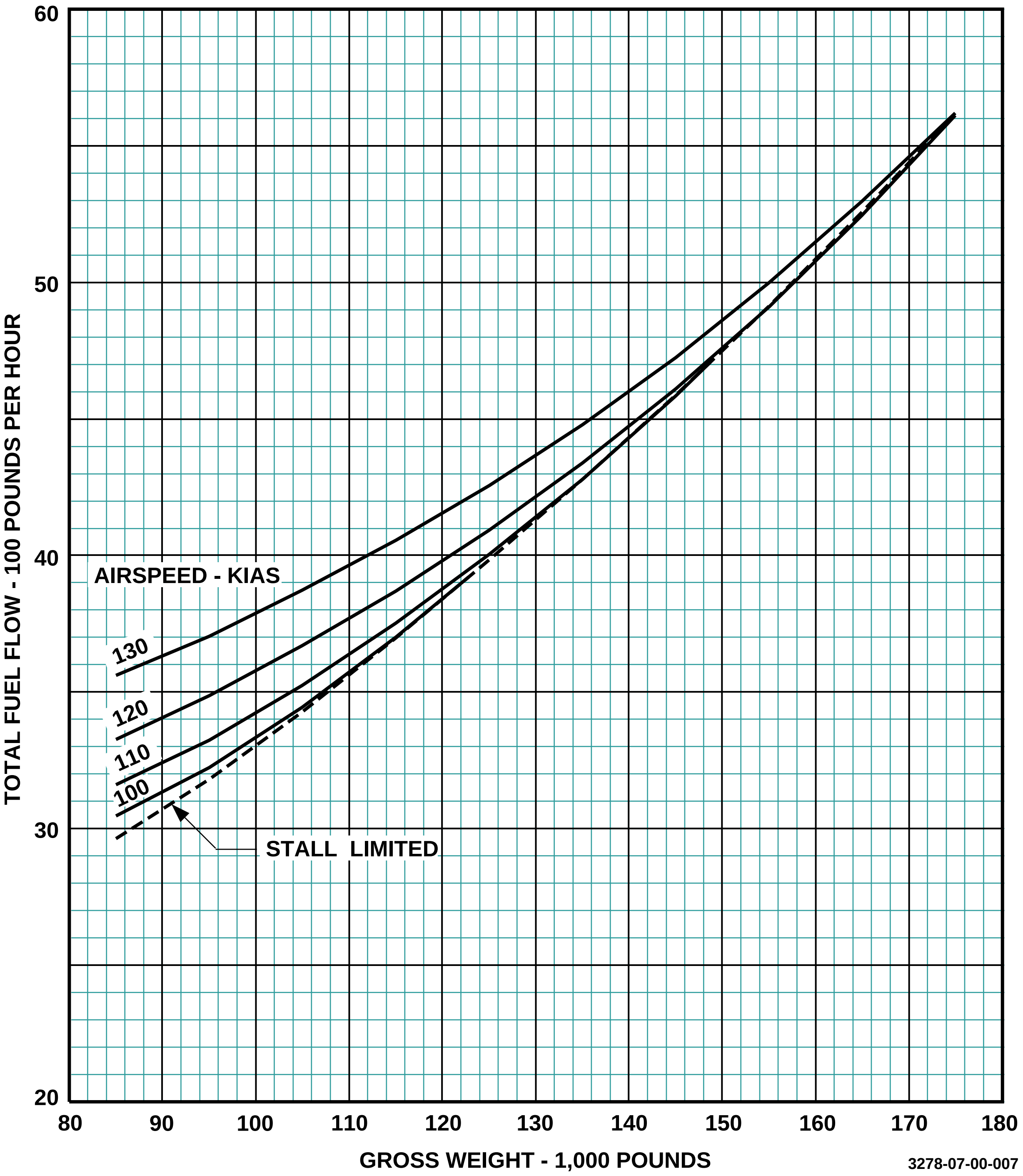

Figure 7-8.

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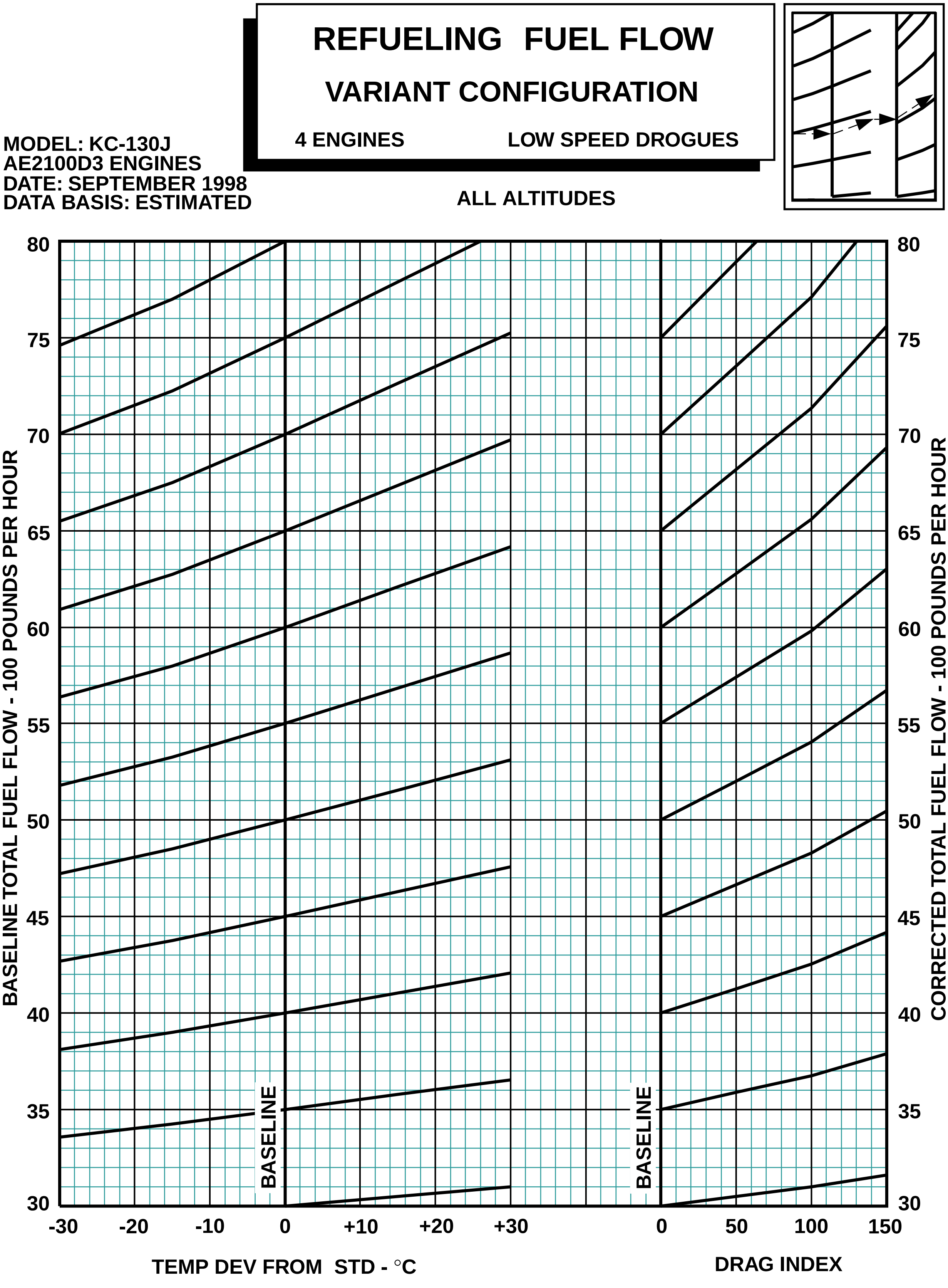

Figure 7-9.

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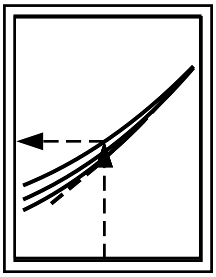
REFUELING TORQUE METER SHAFT HORSEPOWER
500 FEET

4 ENGINES LOW SPEED DROGUES



MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

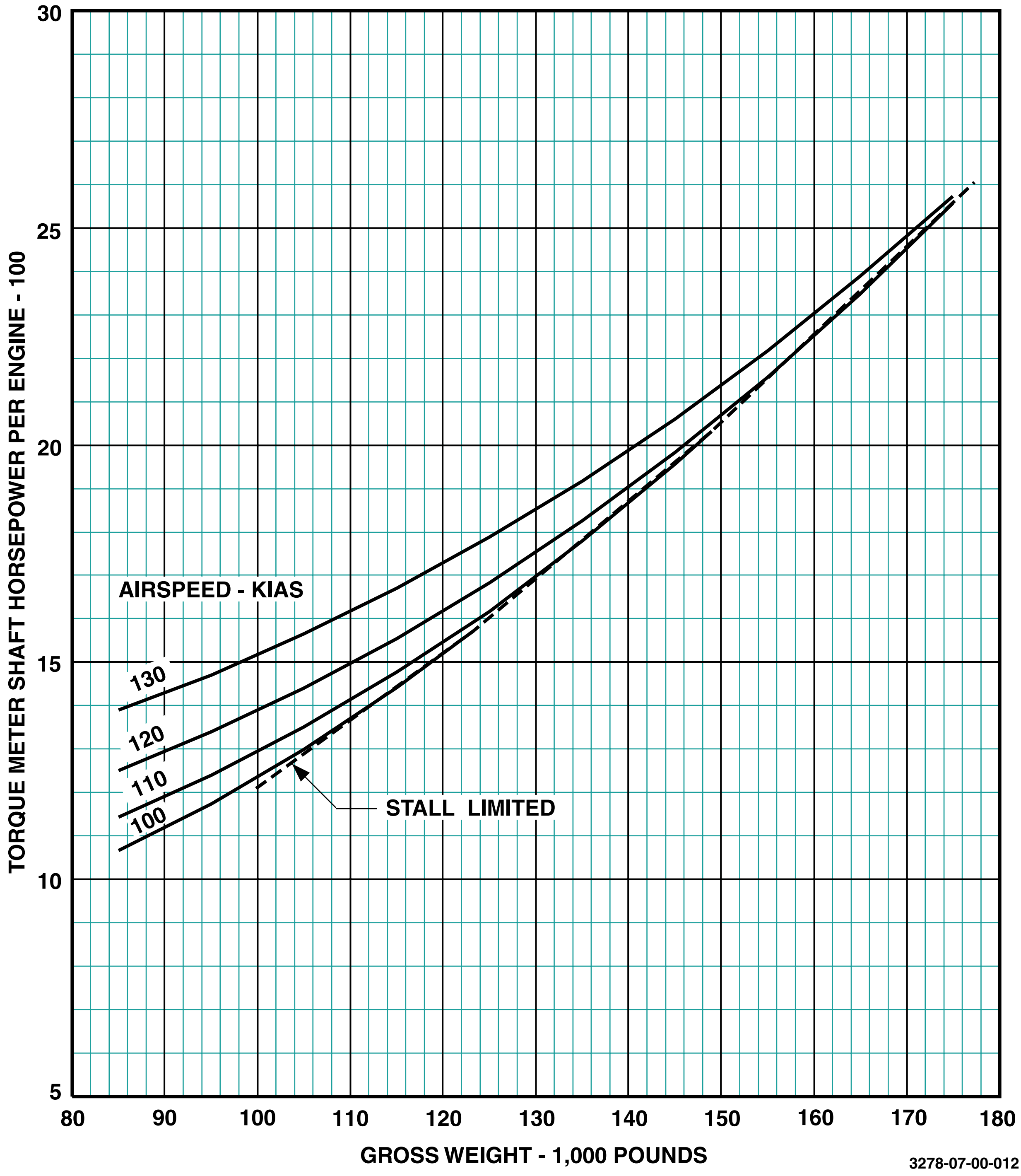


Figure 7-10.

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REFUELING TORQUE METER SHAFT HORSEPOWER
5,000 FEET

4 ENGINES LOW SPEED DROGUES

MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

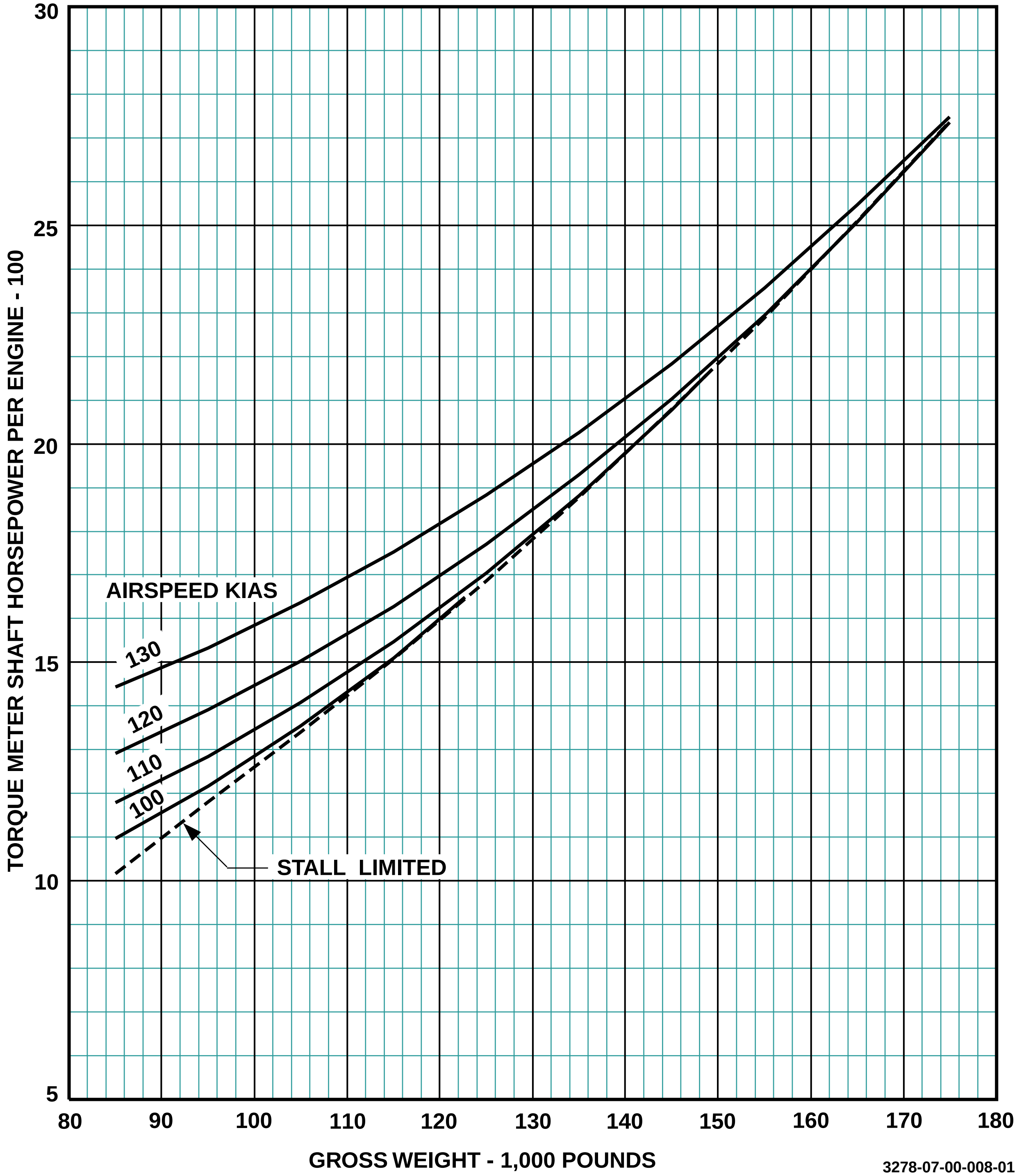

Figure 7-11.

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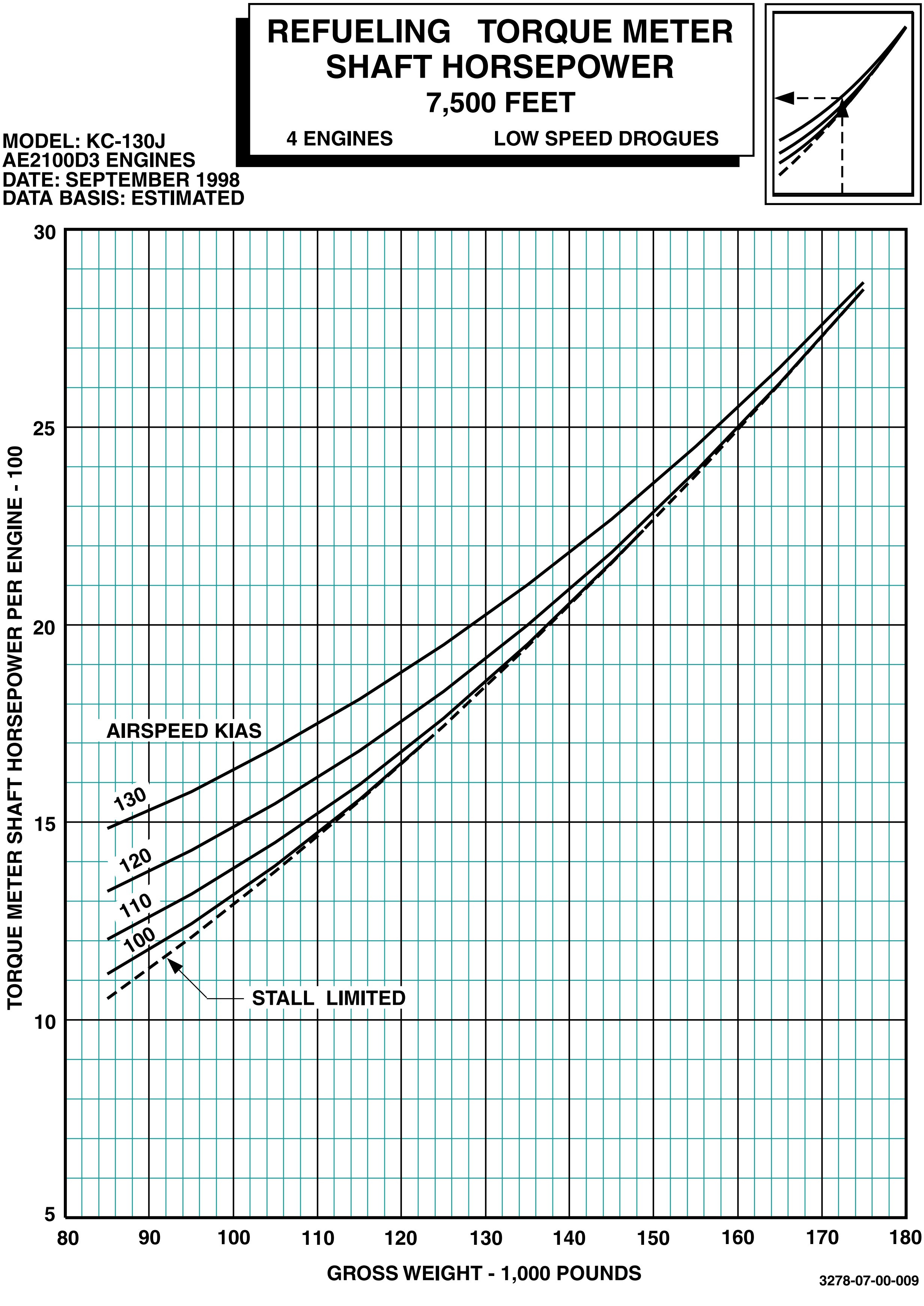

Figure 7-12.

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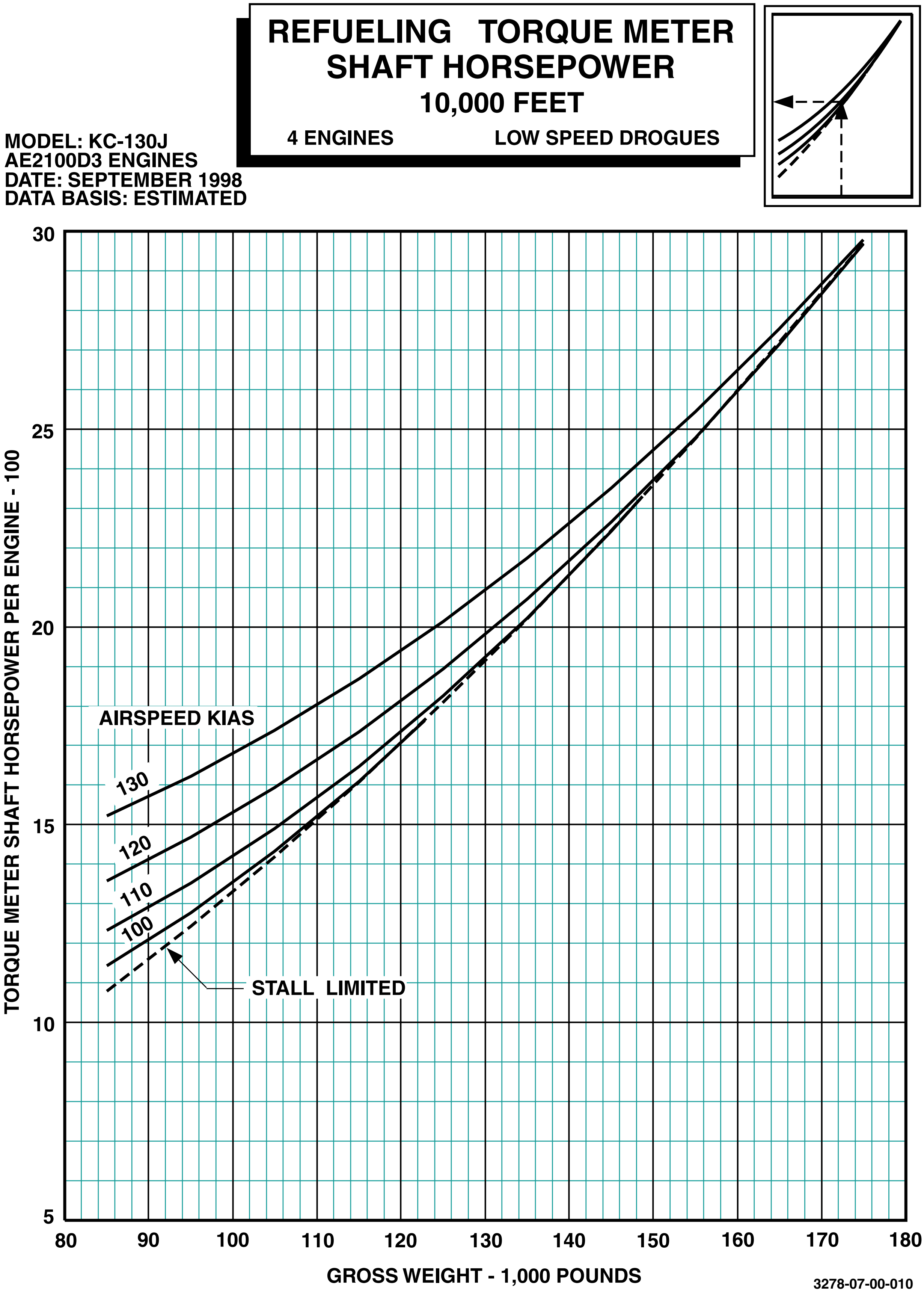

Figure 7-13.

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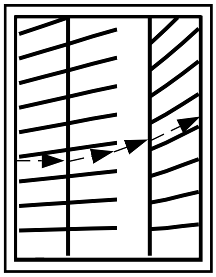
REFUELING TORQUE METER SHAFT HORSEPOWER
VARIANT CONFIGURATION

4 ENGINES LOW SPEED DROGUES



MODEL: KC-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: ESTIMATED

ALL ALTITUDES

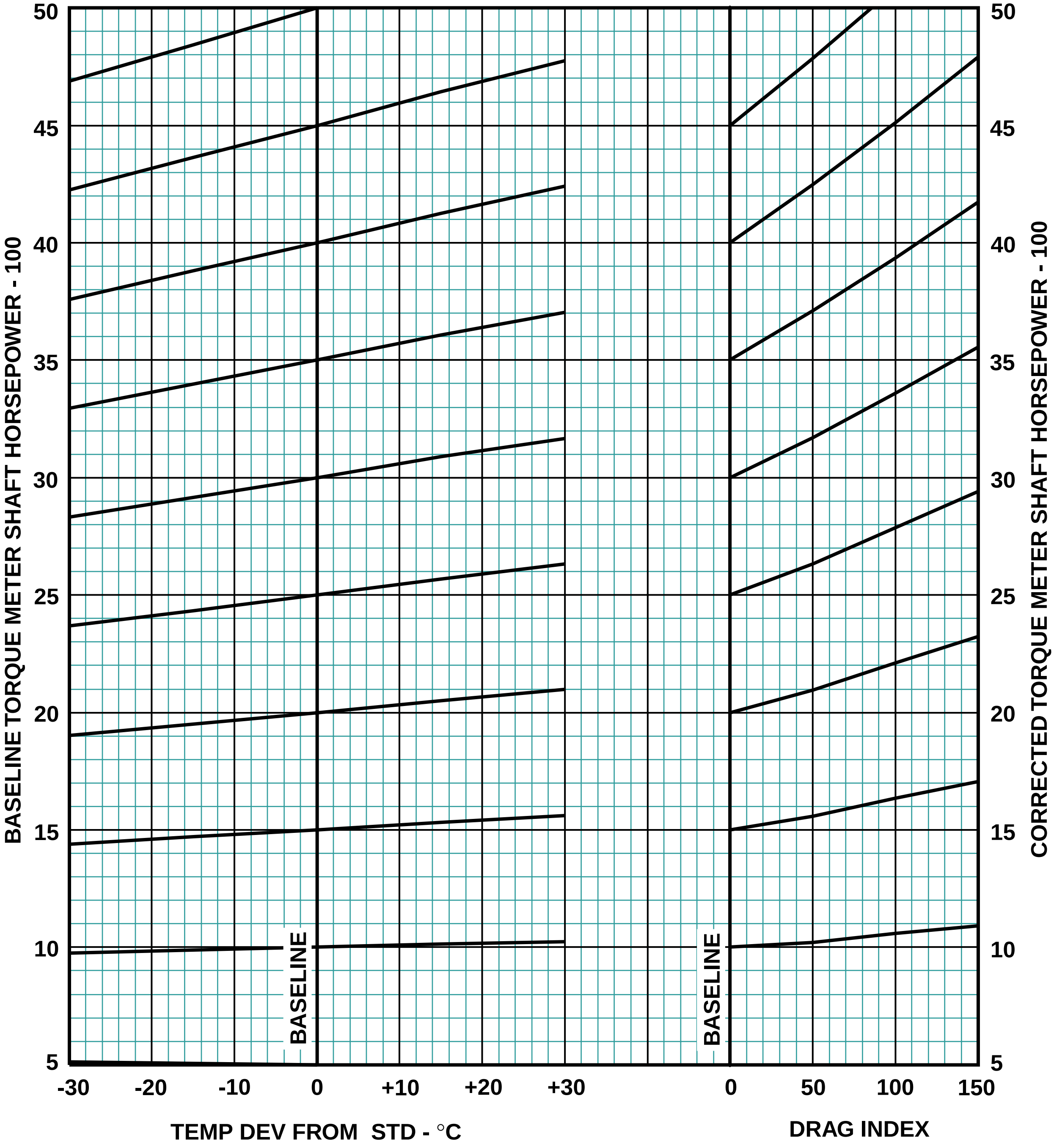


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Figure 7-14.

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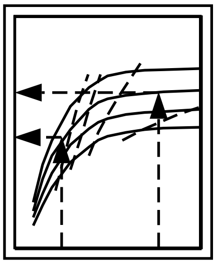
OPTIMUM ALTITUDE FOR SHORT RANGE

4 ENGINES
LOW SPEED DROGUES RETRACTED

MODEL :KC-130J
AE2100D3 ENGINES
DATE : SEPTEMBER 1998
DATA BASIS : FLIGHT TEST



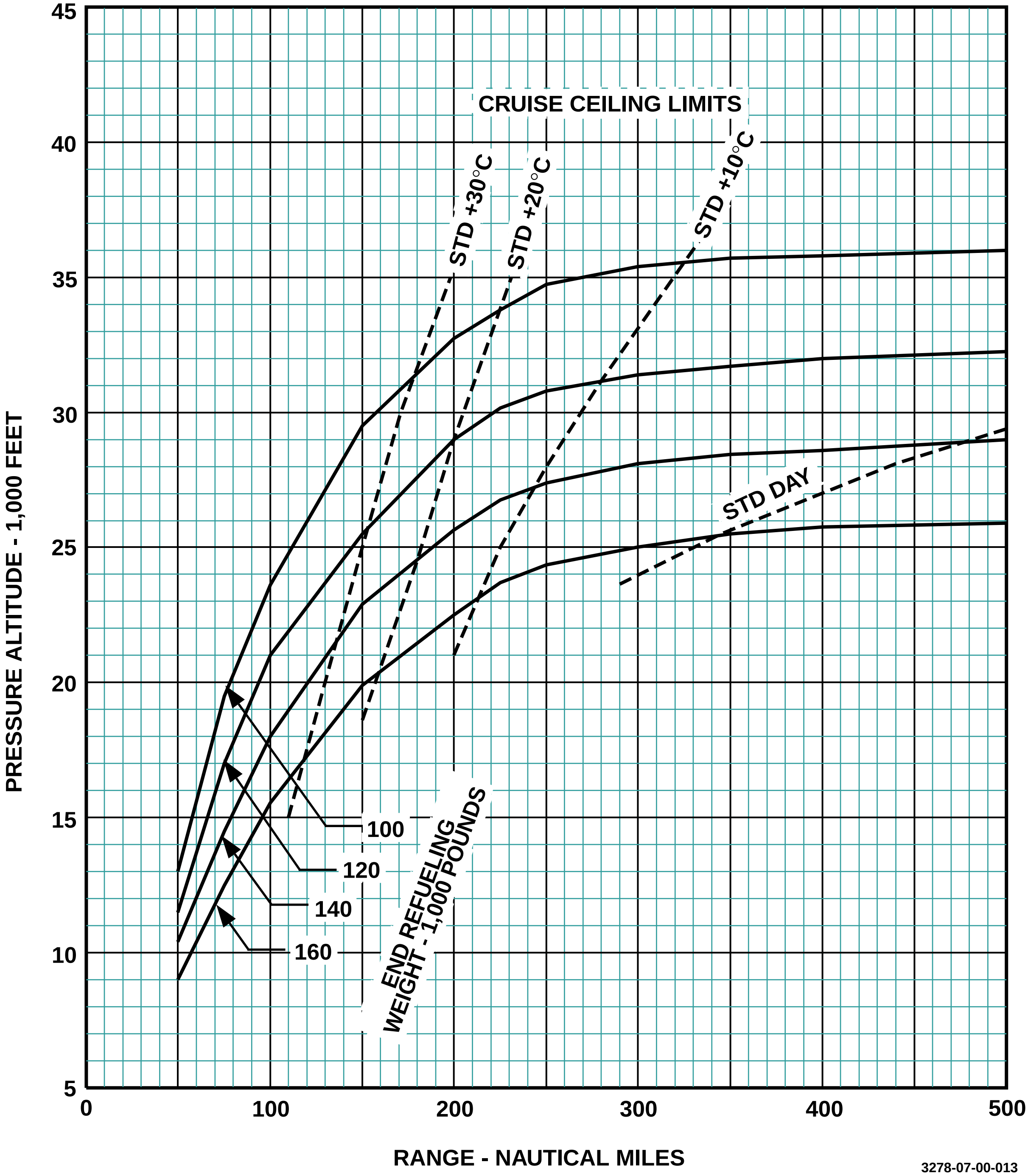


Figure 7-15.

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SECTION 8
DESCENT PERFORMANCE

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CONTENTS Page

LIST OF CHARTS

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INTRODUCTION.

The important factors in establishing mission descent performance are speed, elapsed time, fuel consumed, and distance flown. These factors and the effect of drag index variations from zero to + 300 are discussed in the following paragraphs. Service and cruise ceiling lines in an ICAO Standard Atmosphere are provided on the descent fuel, time, and distance charts. Descent performance data is provided for four different descent profiles. These profiles are:

Penetration decent
Rapid descent with full flaps
Rapid descent at dive speed
Maximum range descent

The effects of temperature variations on these profiles are also discussed.

DESCENTS.

PENETRATION DESCENT.

A penetration descent is made in two segments. The first from altitude down to 20,000 feet at speeds for maximum lift over drag with power levers at FLT IDLE and landing gear and flaps retracted. The second segment is from 20,000 feet to sea level at a constant 250 KIAS. Speed, fuel, time, and distance are shown in figure 8-1 through figure 8-4.

RAPID DESCENT WITH FULL FLAPS.

Highest rates of descent at slow airspeeds are obtained by retarding all power levers to FLT IDLE, extending the landing gear and full flaps, and descending at the flap placard speed of 145 KIAS. For this condition, fuel, time, and distances to descend are shown in figure 8-5 through figure 8-7.

RAPID DESCENT AT DIVE SPEED.

Highest rates of descent at the maximum dive speed are obtained by retarding all power levers to FLT IDLE with landing gear and flaps retracted. For this descent, speed, fuel, time, and distance are shown in figure 8-8 through figure 8-11.

MAXIMUM RANGE DESCENT.

Maximum range descents are made at speeds for maximum lift over drag with power levers at FLT IDLE and the landing gear and flaps retracted. Speed, fuel, time, and distance for maximum range descent are shown in figure 8-12 through figure 8-15.

TEMPERATURE EFFECT.

For each 10 °C from standard temperature, increase or decrease descent time, fuel, and distance by the following amounts:

	Below ISA	Above ISA
Time	+ 4 percent	– 4 percent
Fuel	+ 6 percent	– 6 percent
Distance	+ 2 percent	– 2 percent

Example.

GIVEN:

Penetration descent

Drag Index: + 50

Gross weight: 120,000 pounds

Altitude: 20,000

FIND: (for both the baseline and variant configuration):

- Descent speed
- Descent distance
- Descent fuel
- Descent time

PROCEDURE:

Indicated airspeeds for penetration descents are shown in figure 8-1. As stated on the chart, penetration descent from 20,000 feet pressure altitude is conducted at a constant 250 KIAS for either the baseline or variant configuration.

To find descent fuel, enter figure 8-3, sheet 1, with 20,000 feet pressure altitude and move up to the 120,000-pound gross weight line. Move to the left and read a descent fuel value of 165 pounds for the baseline configuration (drag index = 0). Next, enter the bottom of figure 8-3, sheet 2, with the value of 165 pounds and move upwards to intersect the drag index =+ 50 line and read the variant configuration descent fuel of 130 pounds.

Descent time and distance may be determined using the same procedures with figure 8-2 and figure 8-4 using the same process. These values are a time of 6.8 minutes and a distance of 32 nm for the baseline and 5.4 minutes and a distance of 23 nm for the variant configuration.

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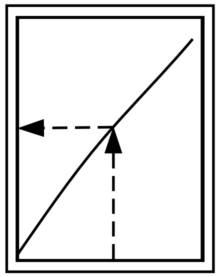
PENETRATION DESCENT SPEED

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

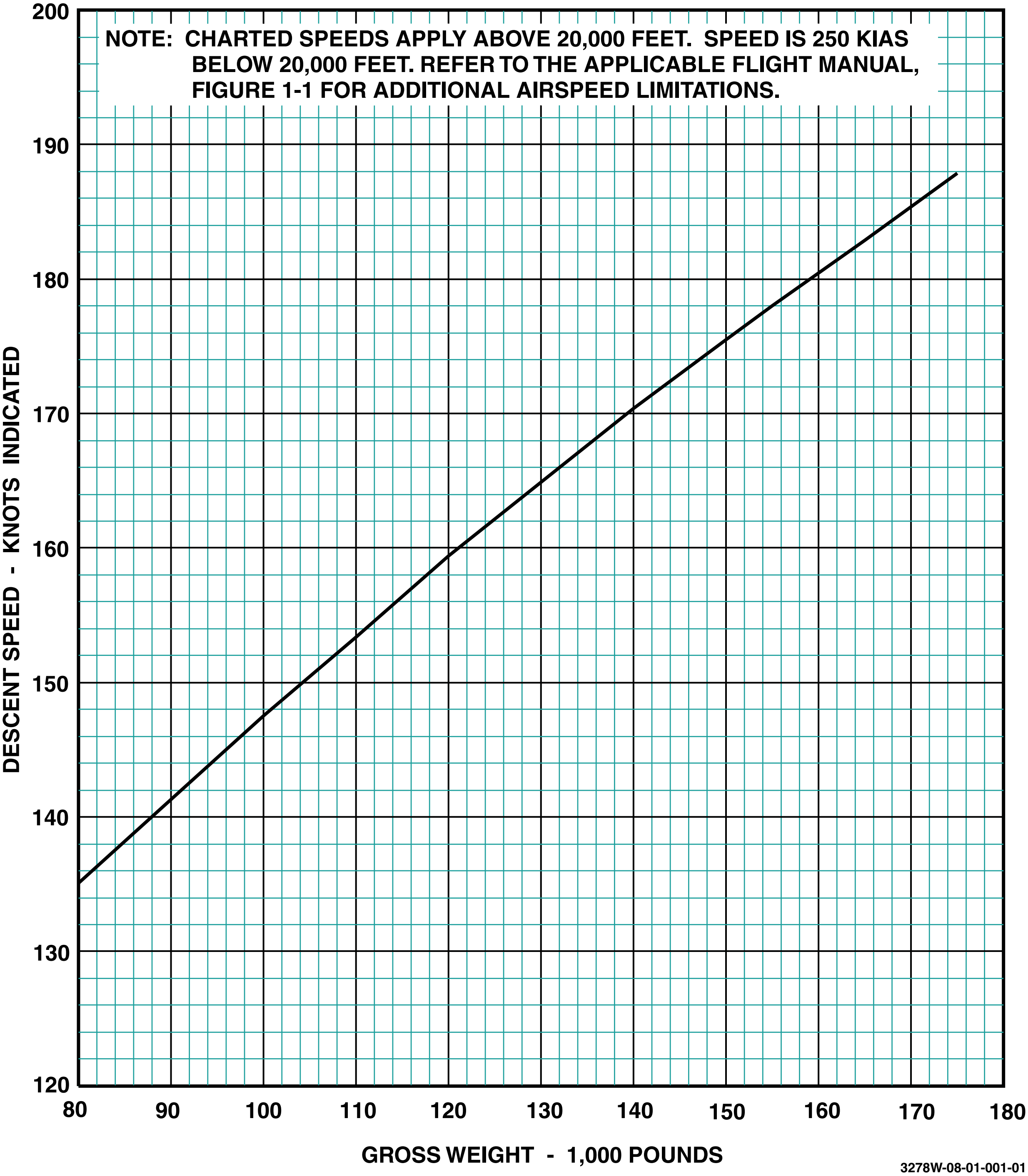


Figure 8-1. (Sheet 1 of 2)

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PENETRATION DESCENT SPEED FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

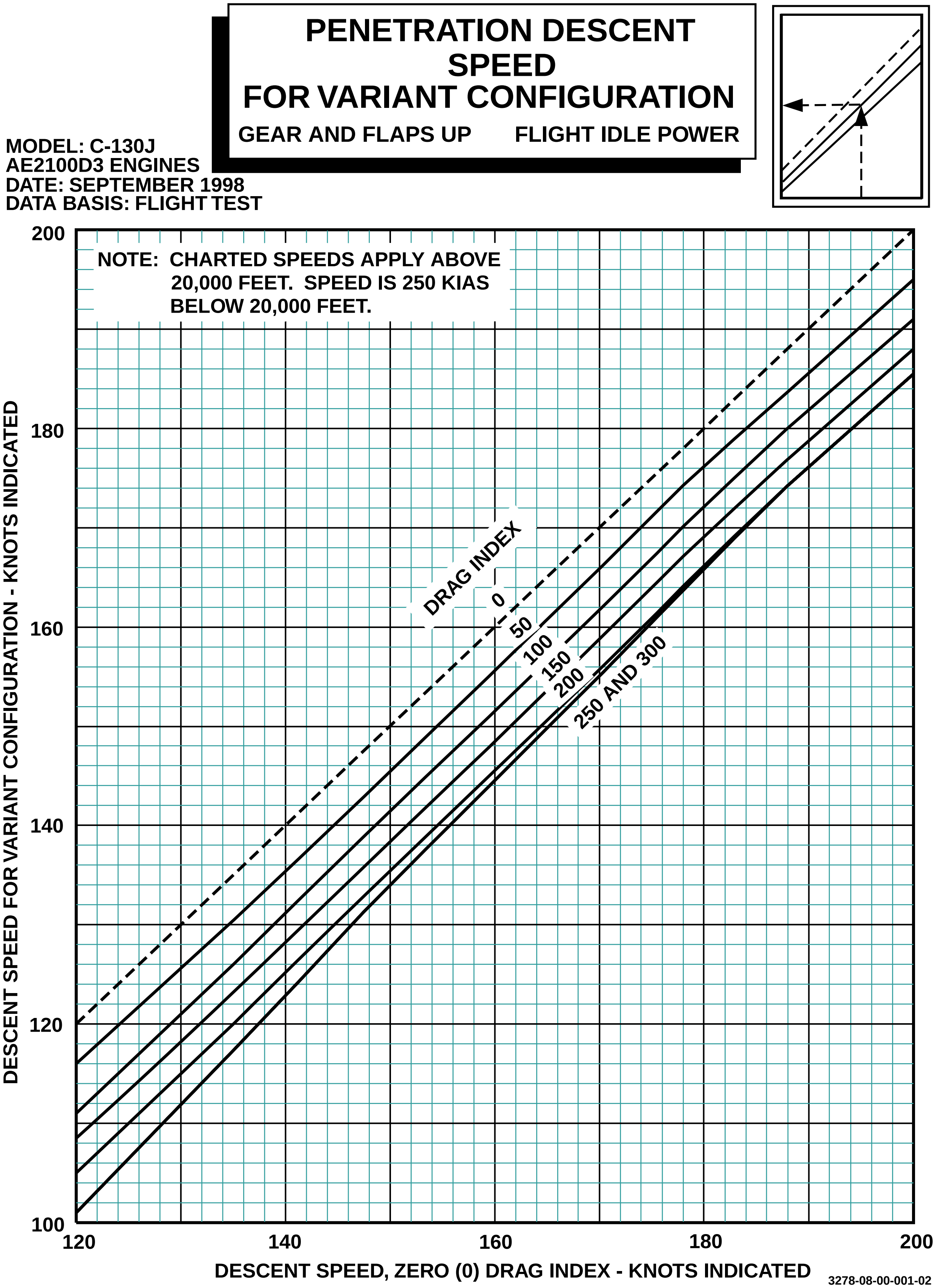

Figure 8-1. (Sheet 2 of 2)

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PENETRATION DESCENT TIME

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

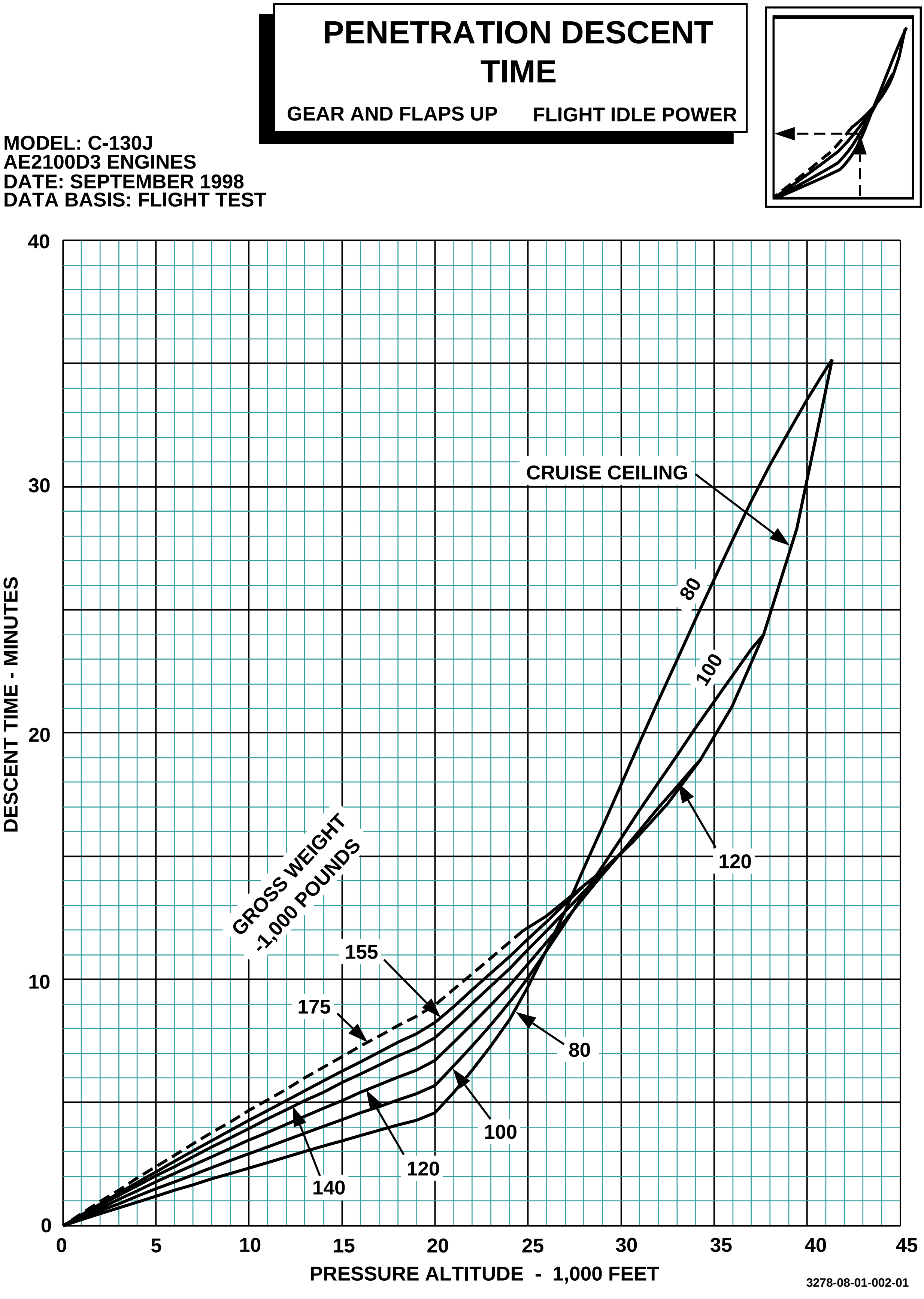

Figure 8-2. (Sheet 1 of 2)

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PENETRATION DESCENT TIME FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

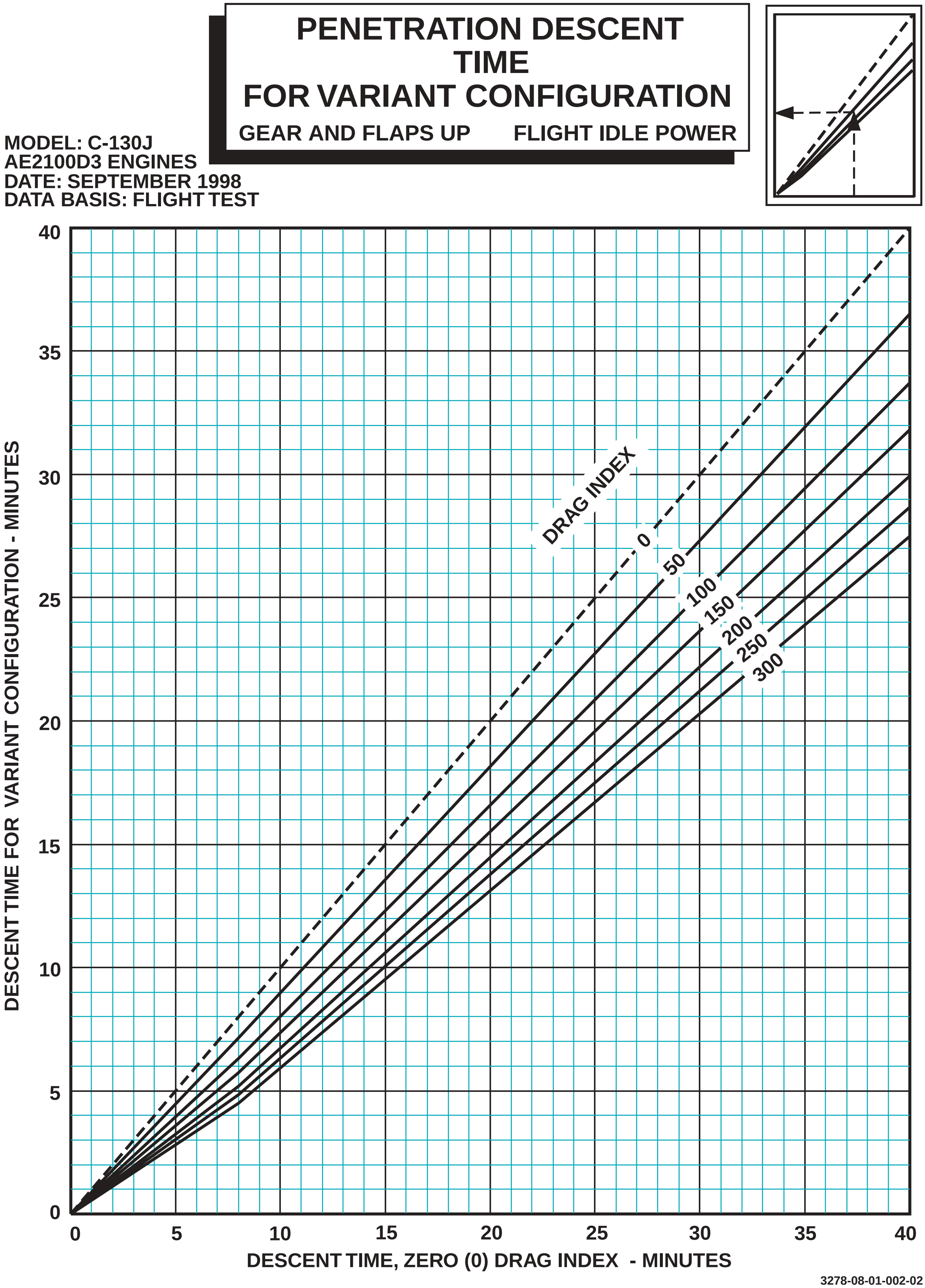

Figure 8-2. (Sheet 2 of 2)

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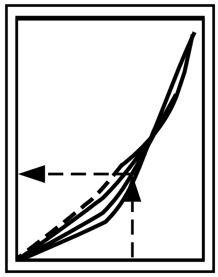
PENETRATION DESCENT FUEL

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

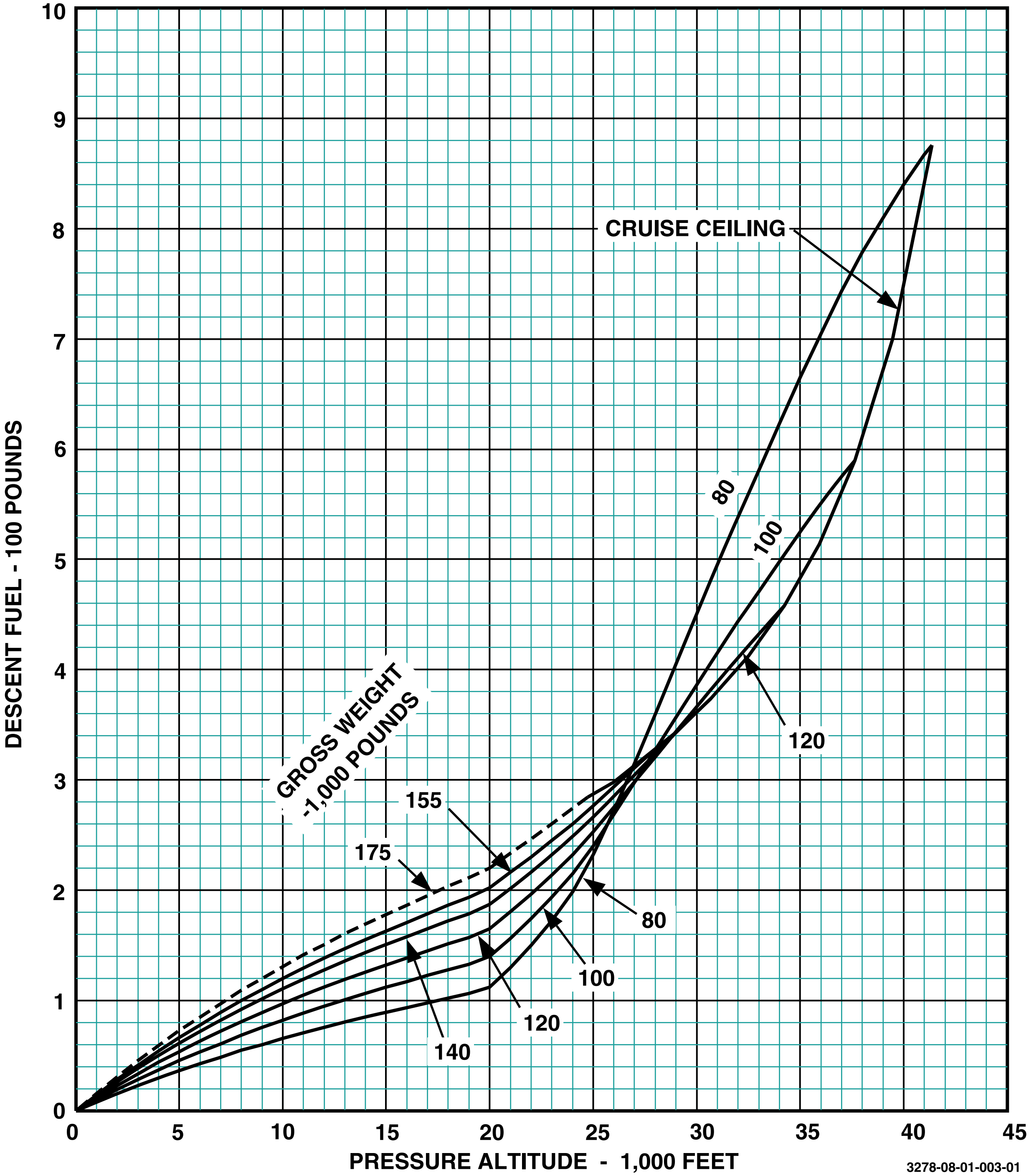


Figure 8-3. (Sheet 1 of 2)

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PENETRATION DESCENT FUEL FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

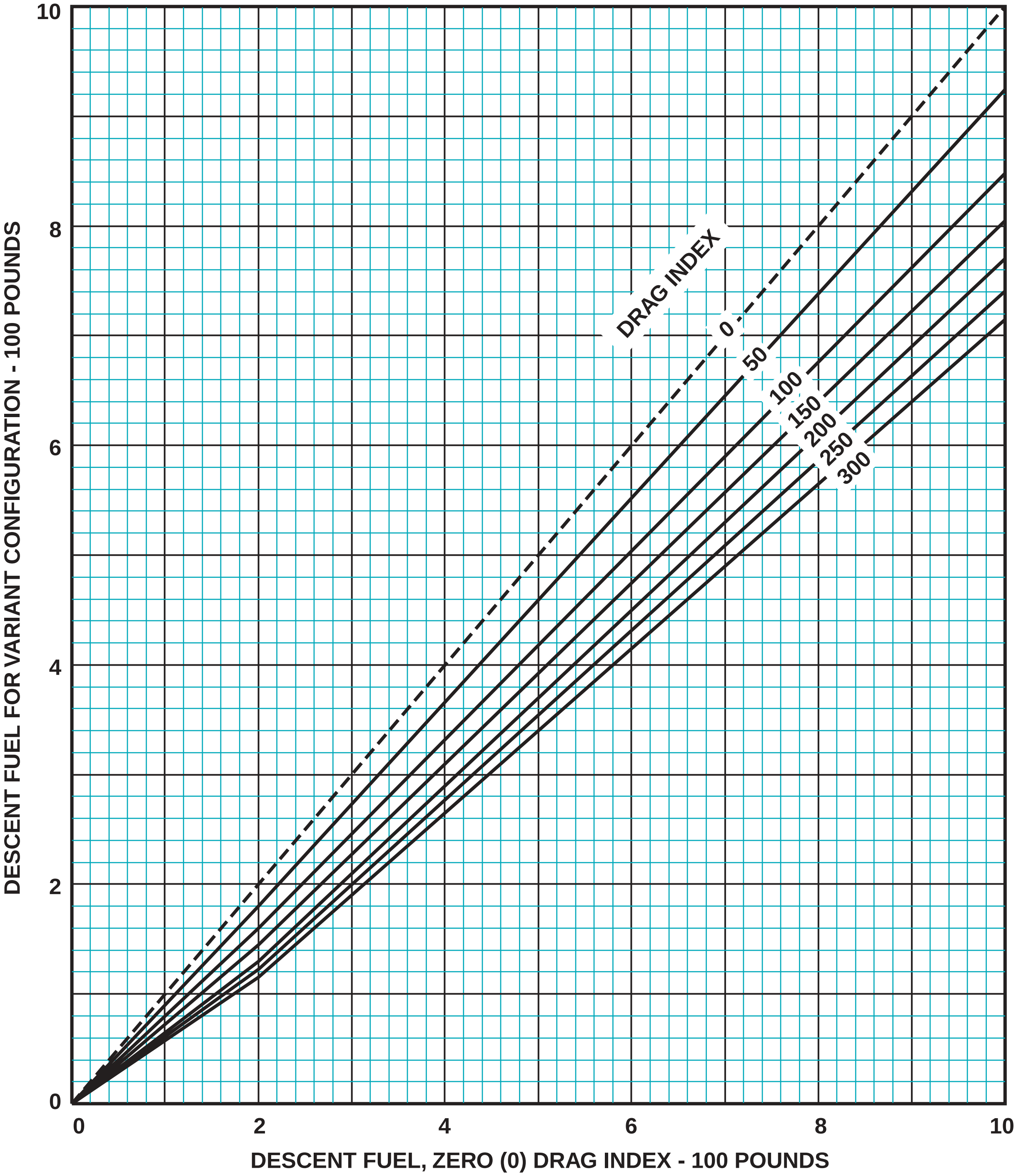

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Figure 8-3. (Sheet 2 of 2)

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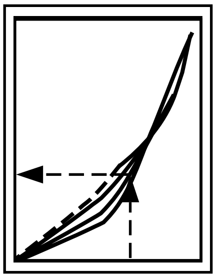
PENETRATION DESCENT DISTANCE

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

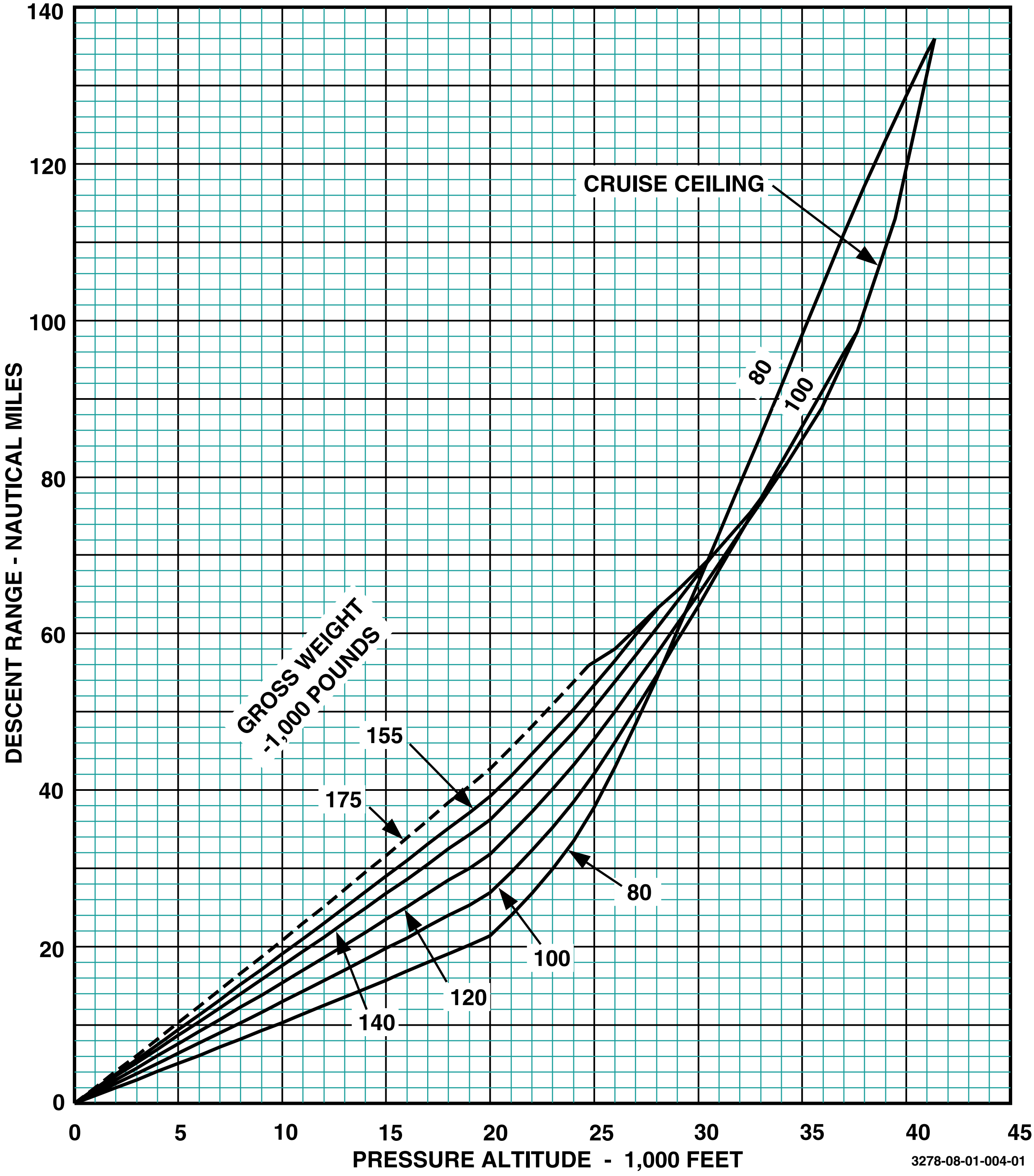


Figure 8-4. (Sheet 1 of 2)

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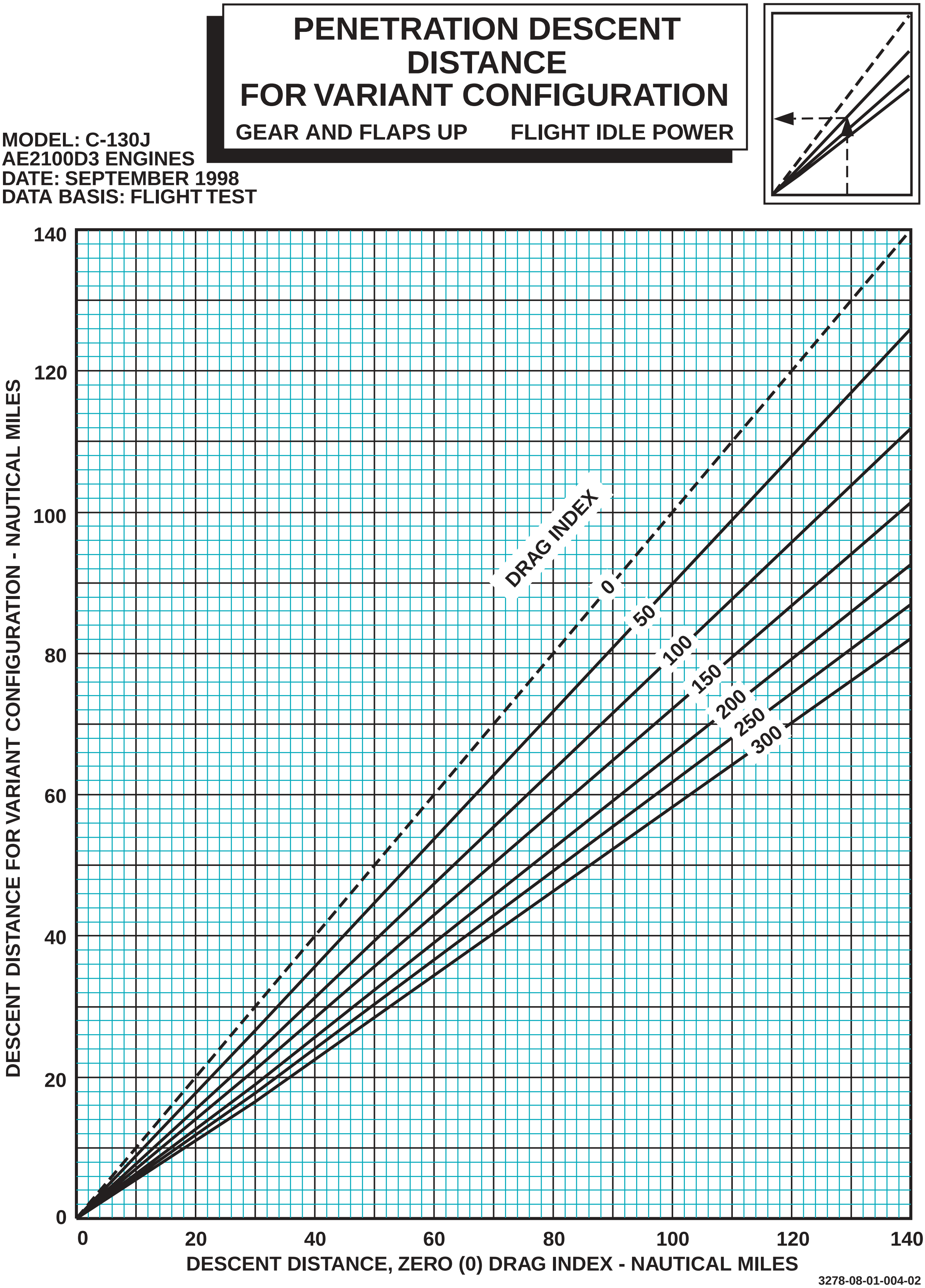

Figure 8-4. (Sheet 2 of 2)

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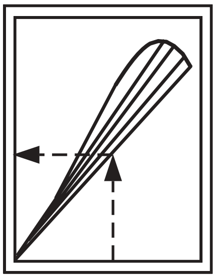
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RAPID DESCENT WITH FULL FLAPS TIME

145 KIAS GEAR DOWN



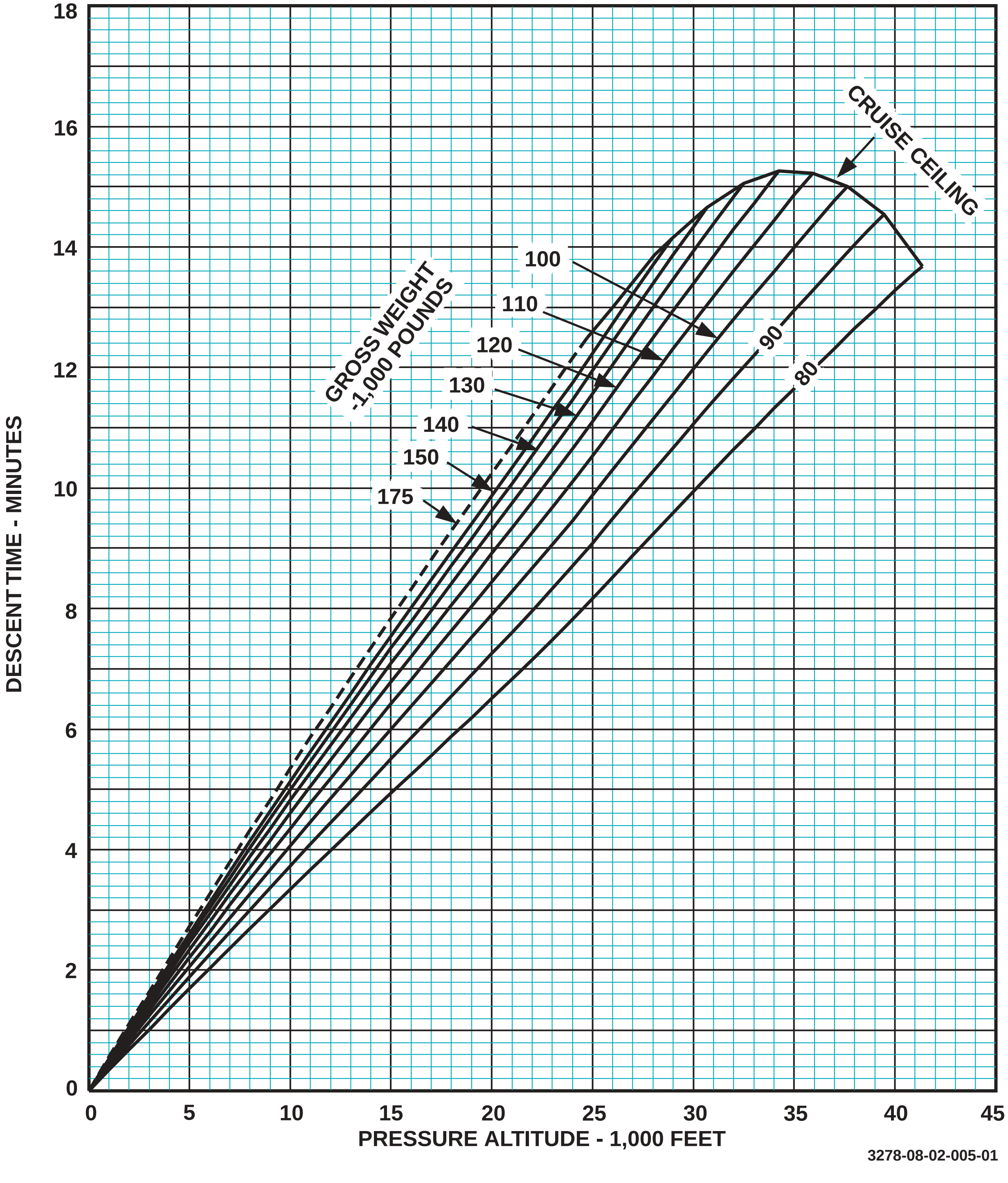


Figure 8-5. (Sheet 1 of 2)

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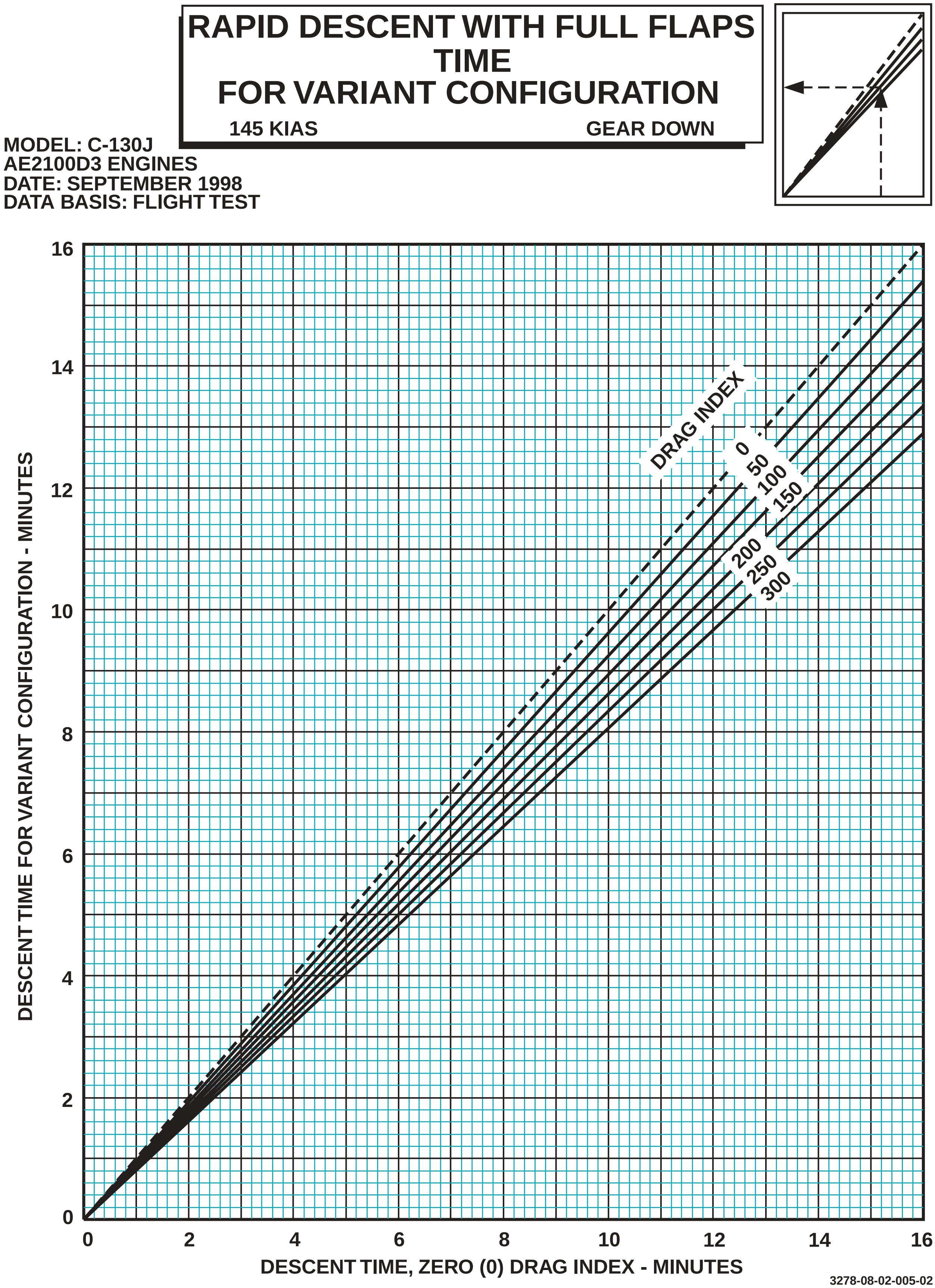

Figure 8-5. (Sheet 2 of 2)

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RAPID DESCENT WITH FULL FLAPS FUEL

145 KIAS GEAR DOWN

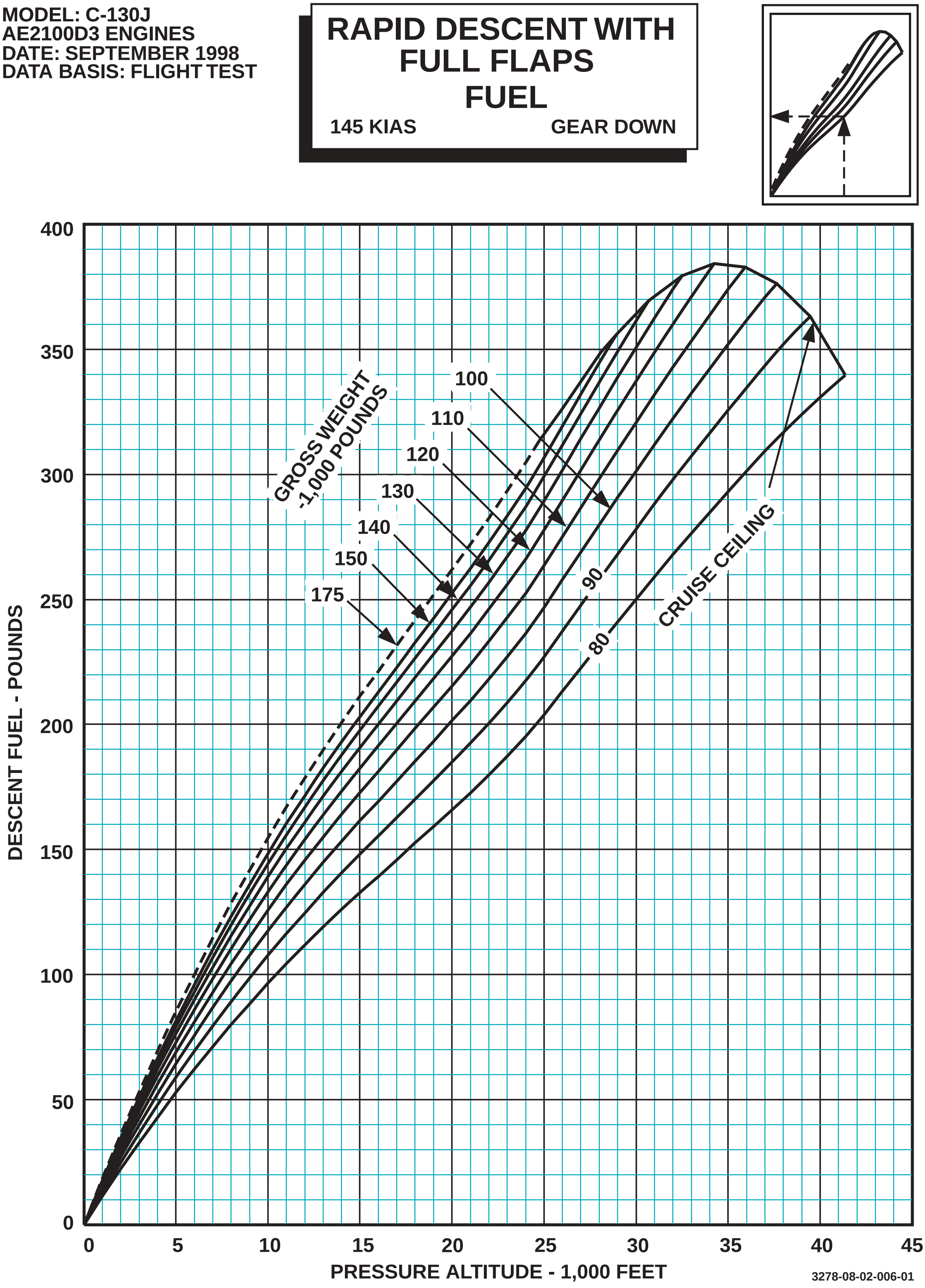

Figure 8-6. (Sheet 1 of 2)

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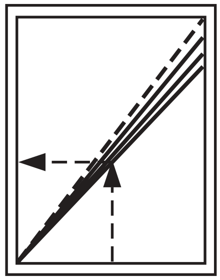
RAPID DESCENT WITH FULL FLAPS FUEL FOR VARIANT CONFIGURATION

145 KIAS GEAR DOWN



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

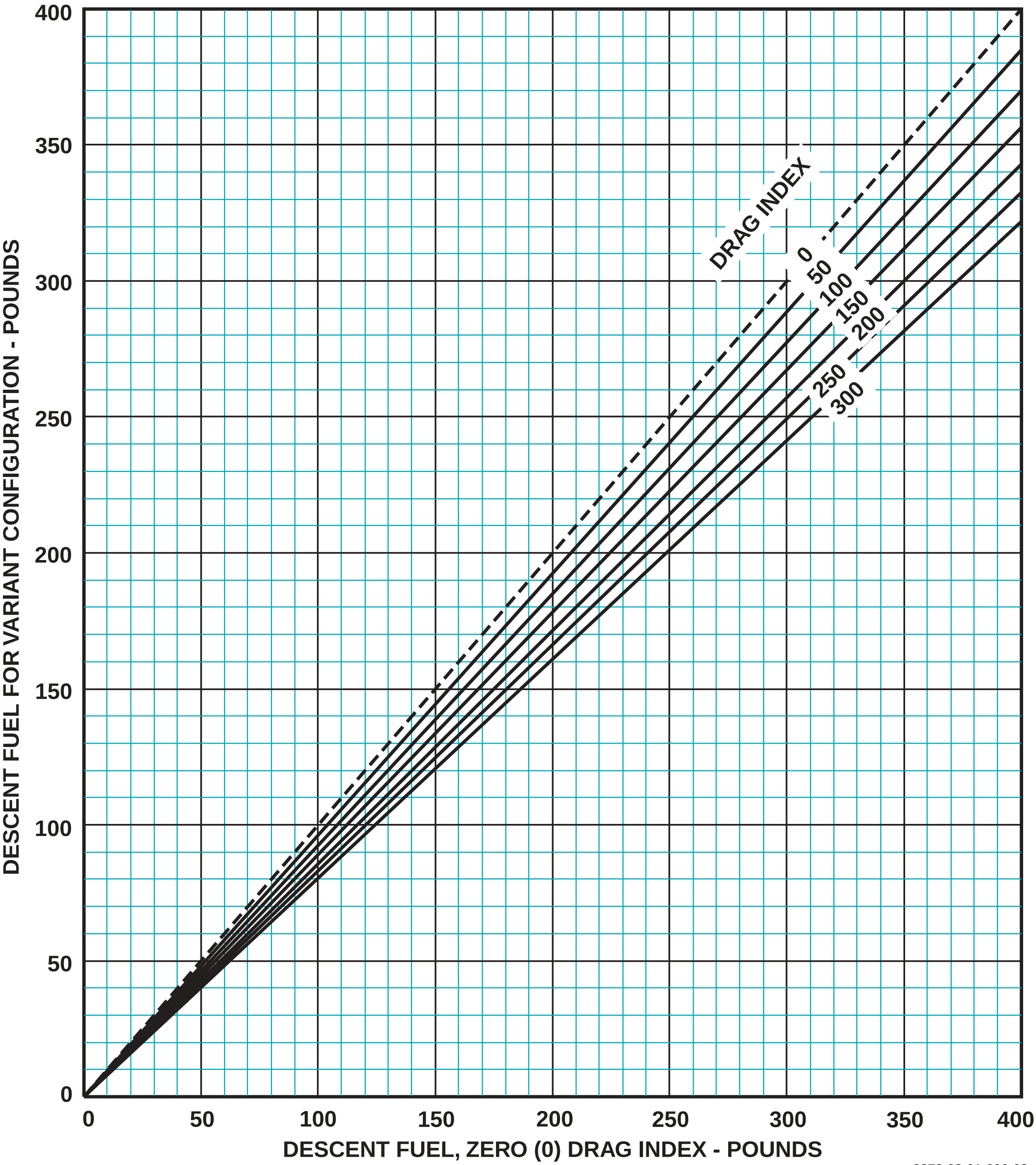


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Figure 8-6. (Sheet 2 of 2)

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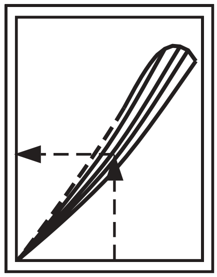
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

RAPID DESCENT WITH FULL FLAPS DISTANCE

145 KIAS **GEAR DOWN**



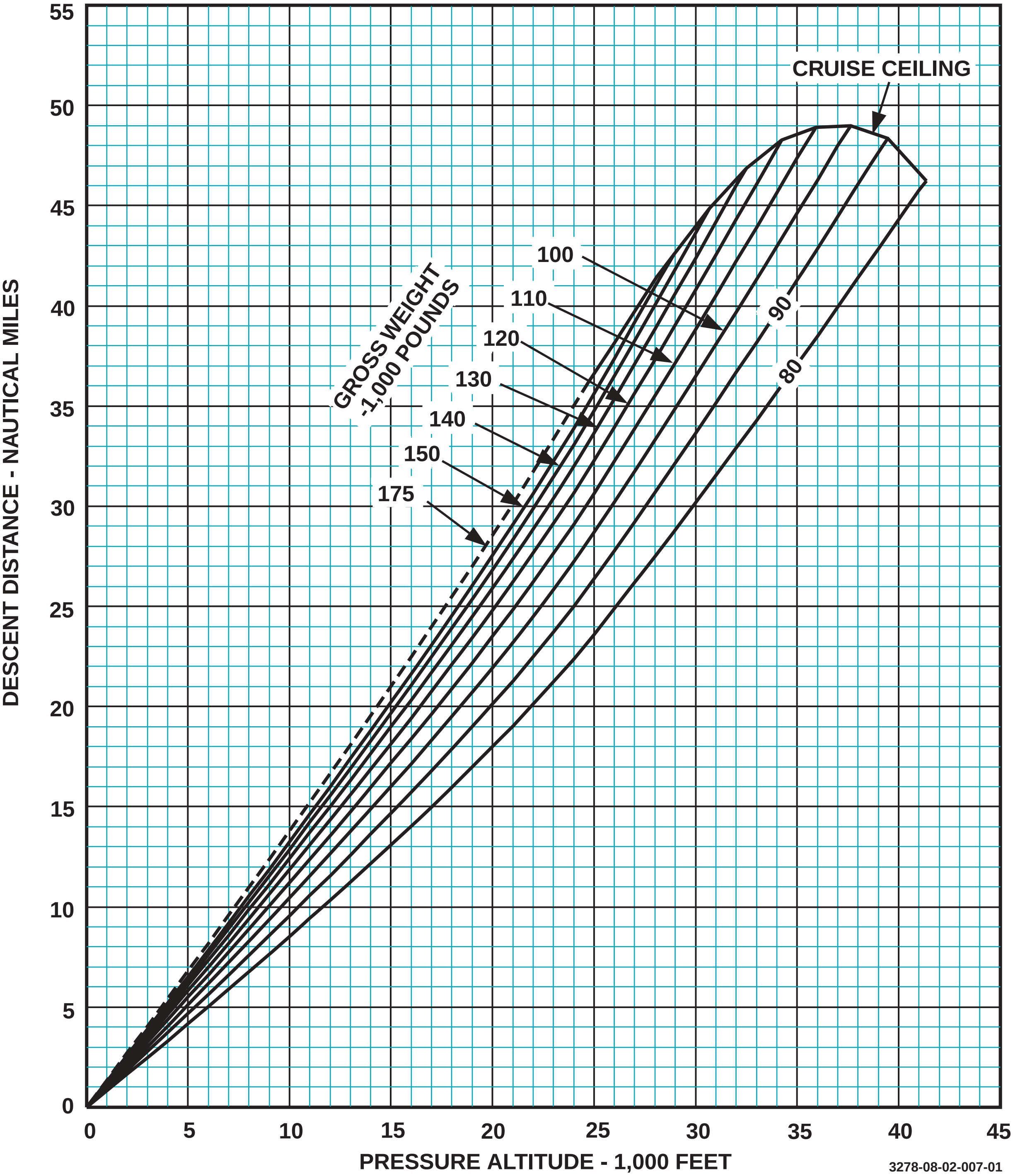


Figure 8-7. (Sheet 1 of 2)

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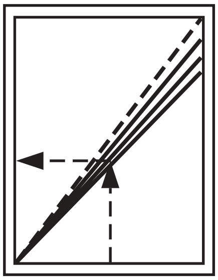
RAPID DESCENT WITH FULL FLAPS DISTANCE FOR VARIANT CONFIGURATION

145 KIAS GEAR DOWN



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

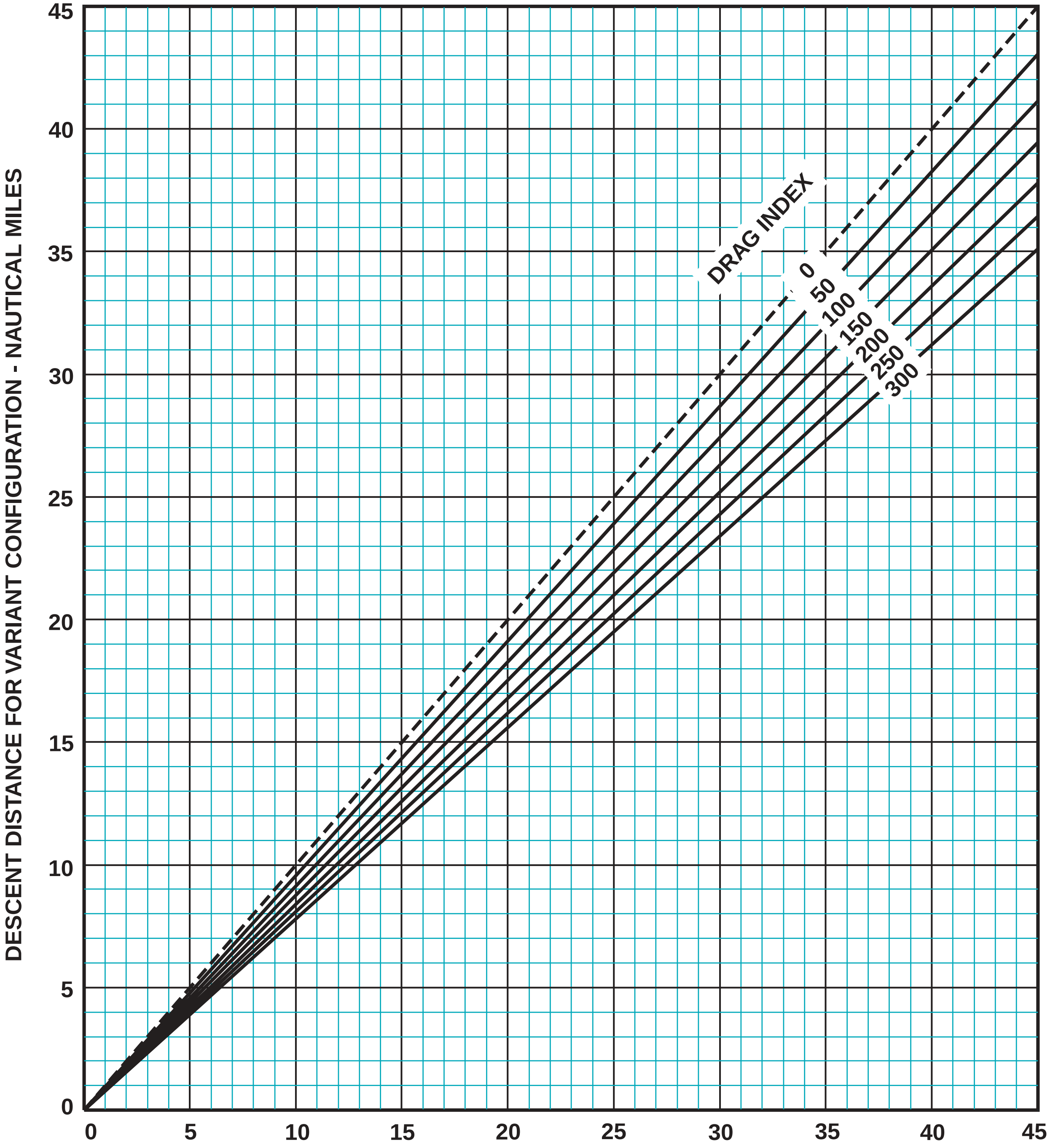


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Figure 8-7. (Sheet 2 of 2)

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RAPID DESCENT AT DIVE SPEED SPEED

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

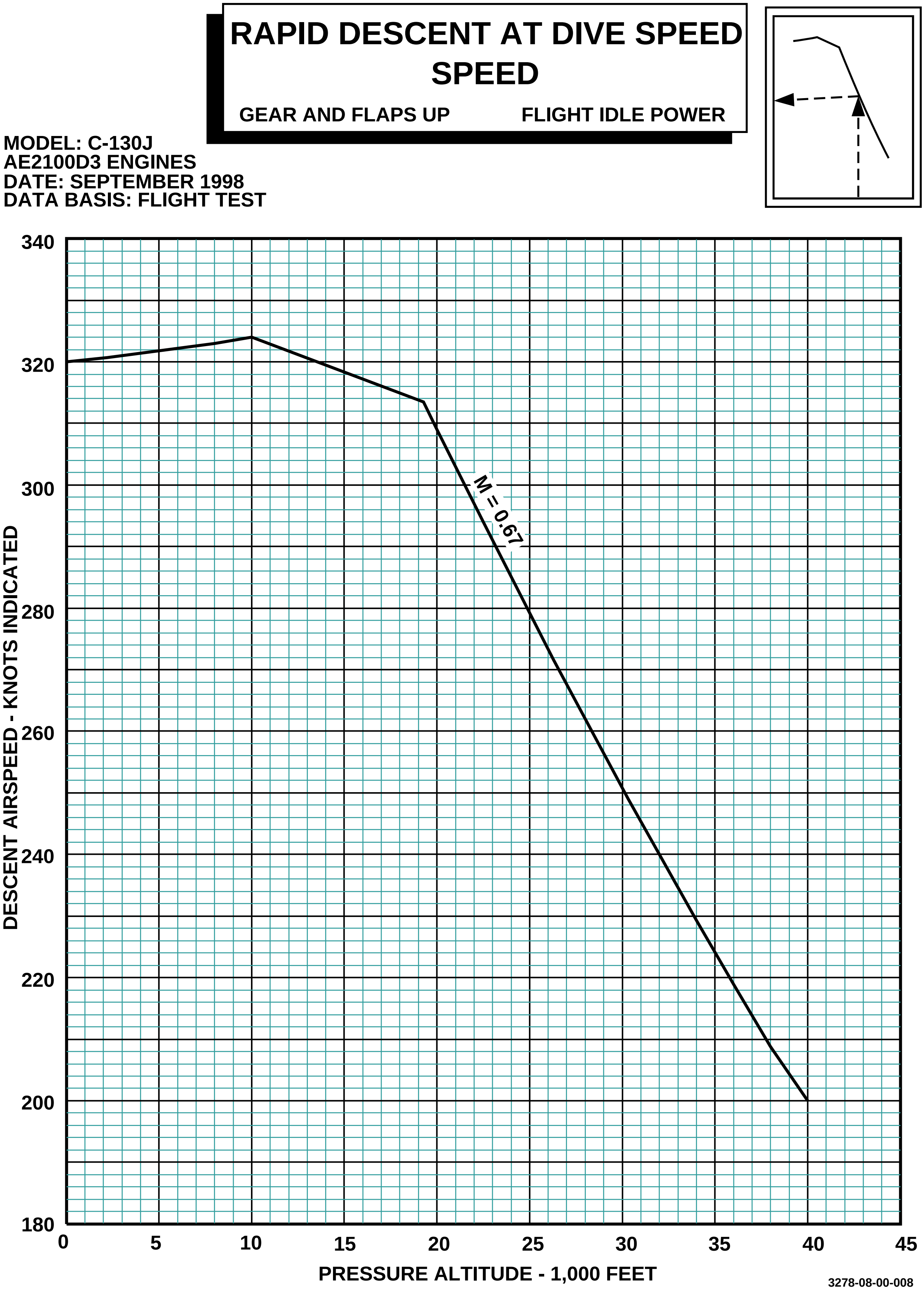

Figure 8-8.

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RAPID DESCENT AT DIVE SPEED
TIME

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

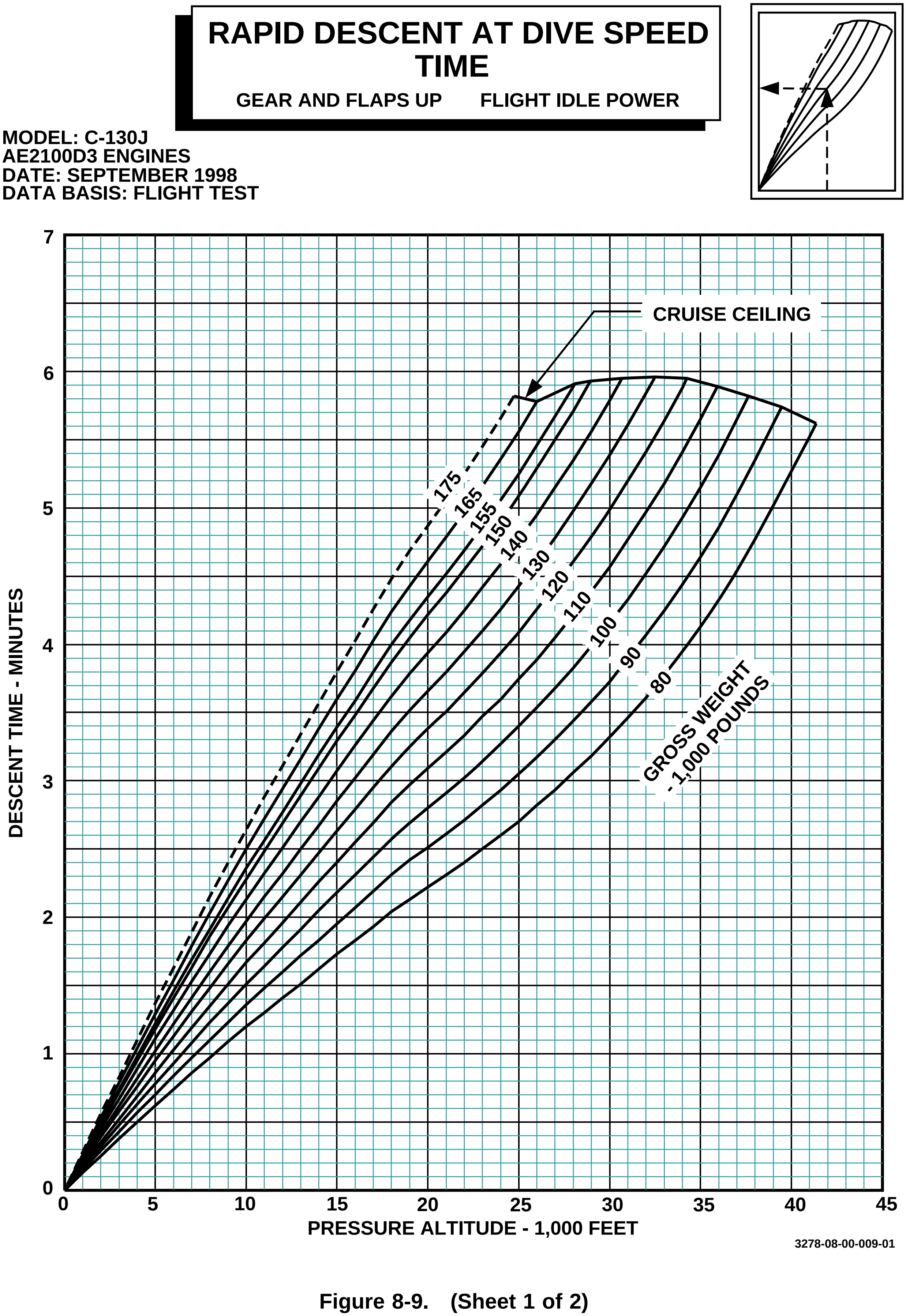

Figure 8-9. (Sheet 1 of 2)

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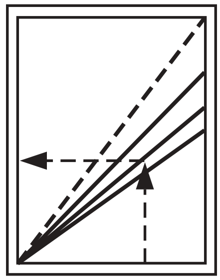
RAPID DESCENT AT DIVE SPEED TIME FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



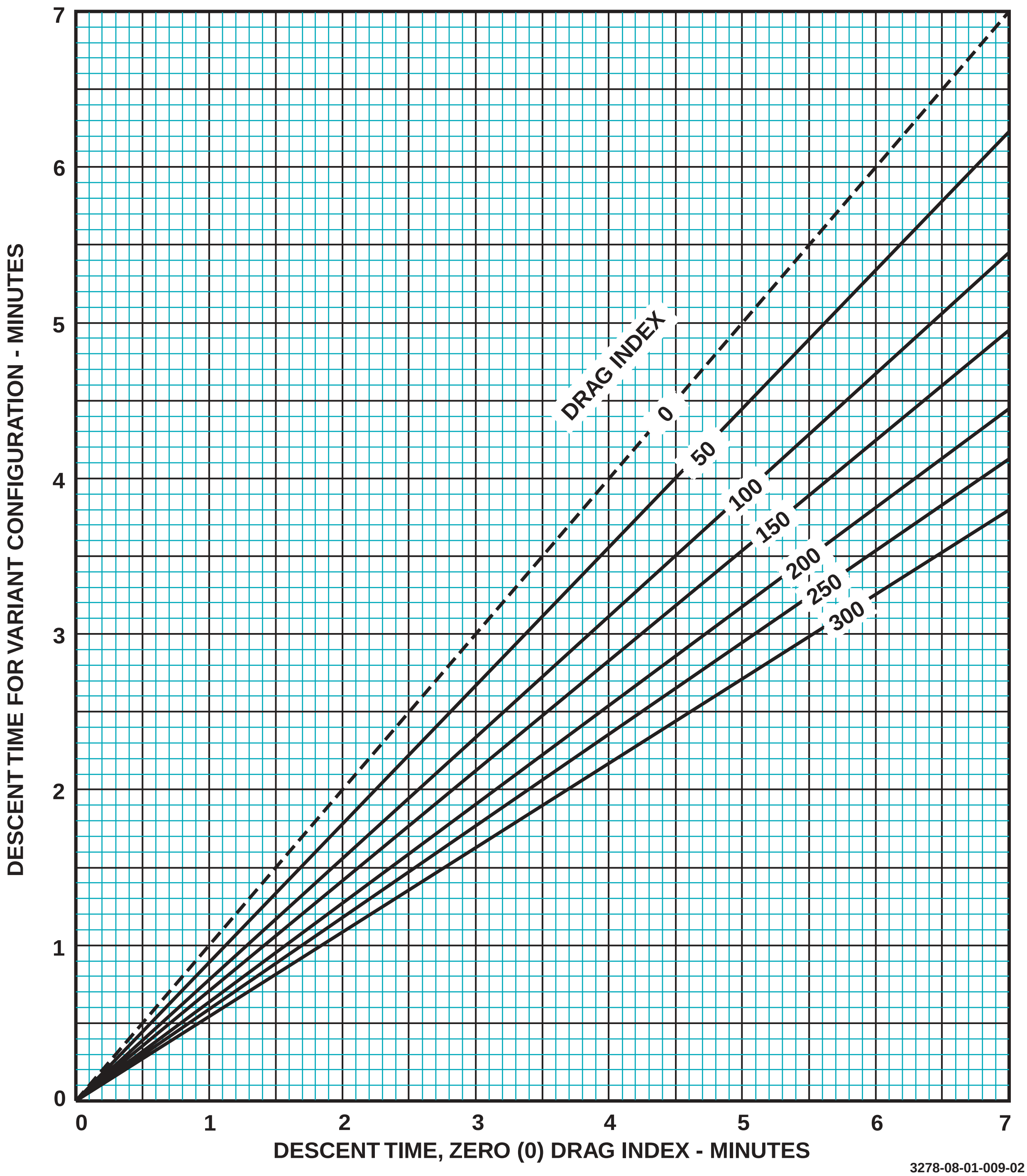


Figure 8-9. (Sheet 2 of 2)

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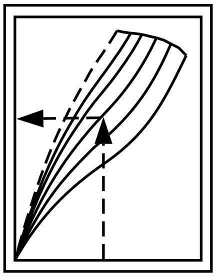
RAPID DESCENT AT DIVE SPEED FUEL

GEAR AND FLAPS UP   FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

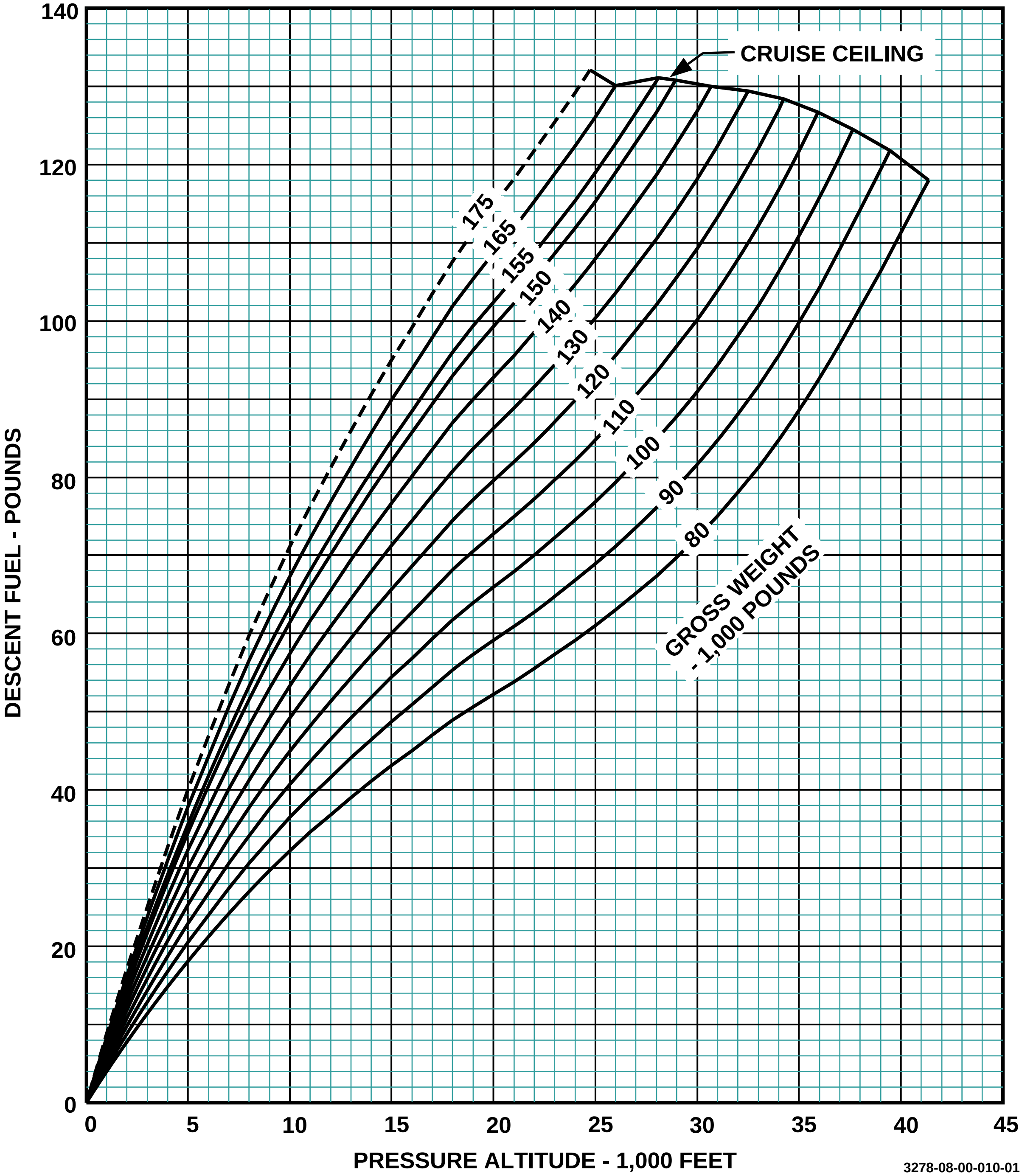


Figure 8-10. (Sheet 1 of 2)

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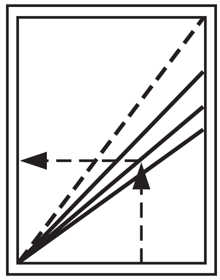
RAPID DESCENT AT DIVE SPEED FUEL FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

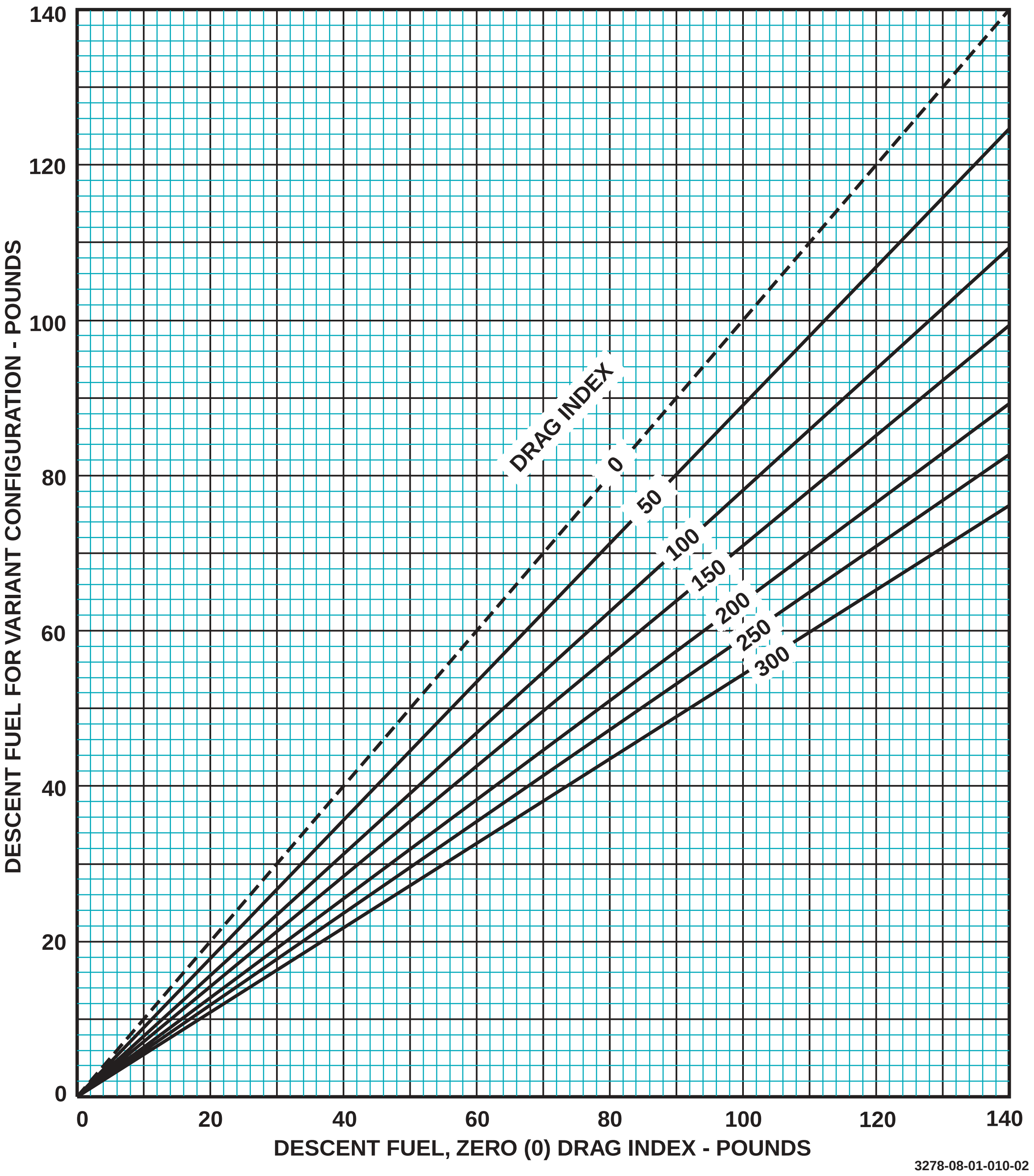


Figure 8-10. (Sheet 2 of 2)

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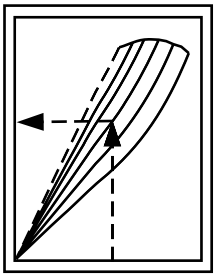
RAPID DESCENT AT DIVE SPEED DISTANCE

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

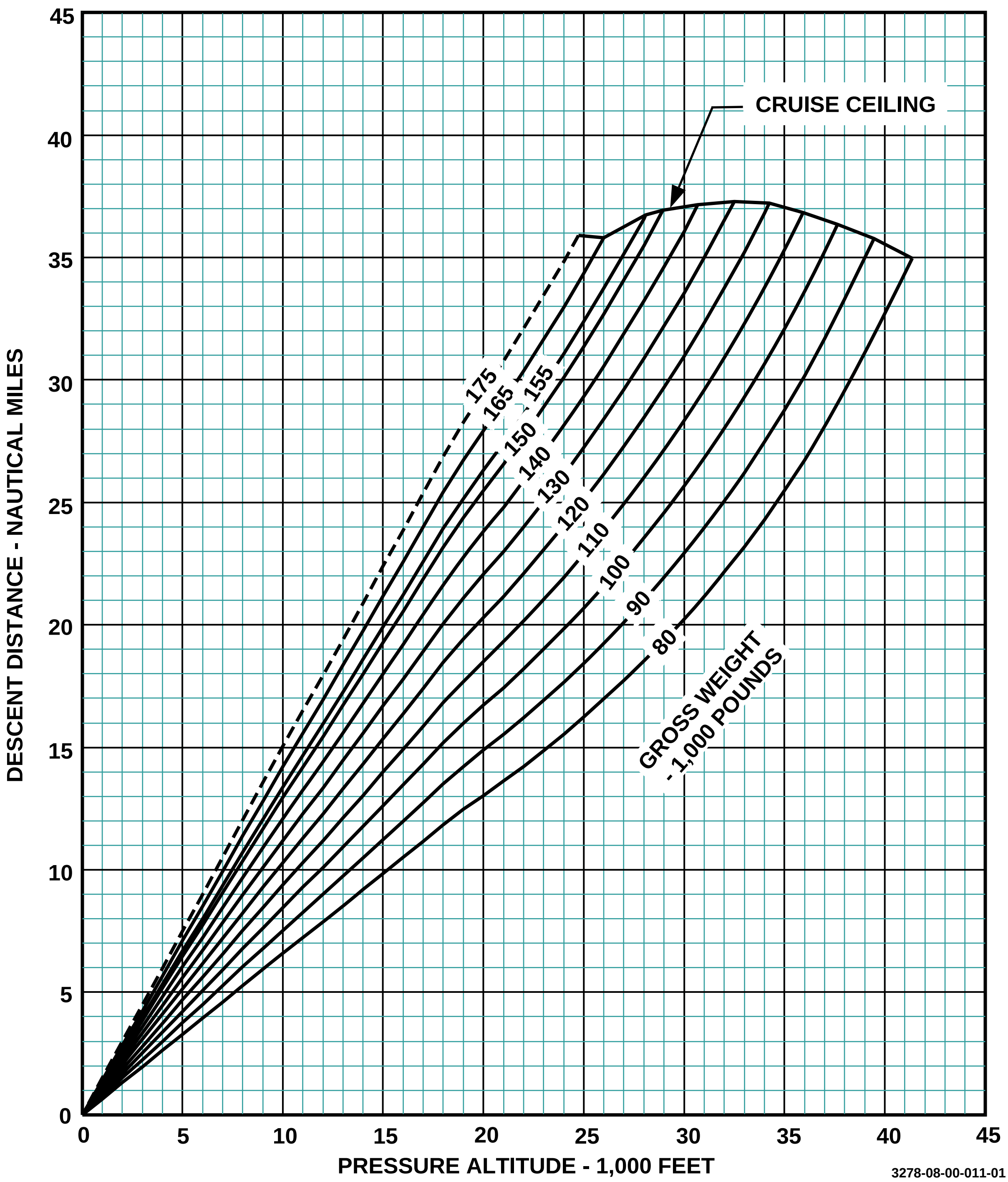


Figure 8-11. (Sheet 1 of 2)

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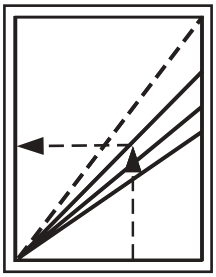
RAPID DESCENT AT DIVE SPEED DISTANCE FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

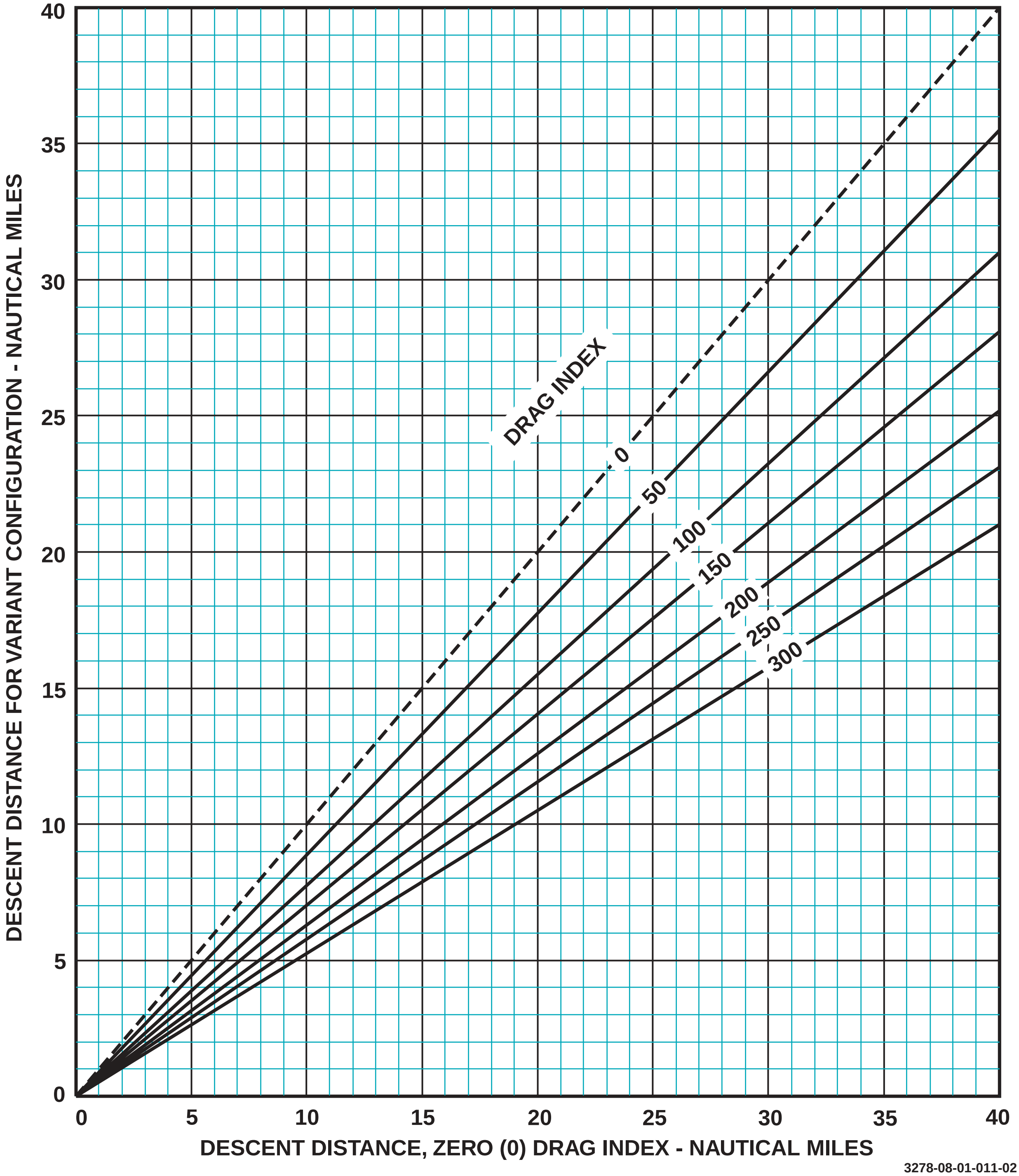


Figure 8-11. (Sheet 2 of 2)

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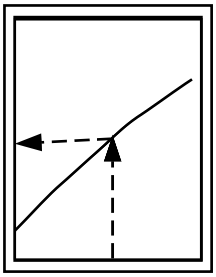
MAXIMUM RANGE DESCENT SPEED

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

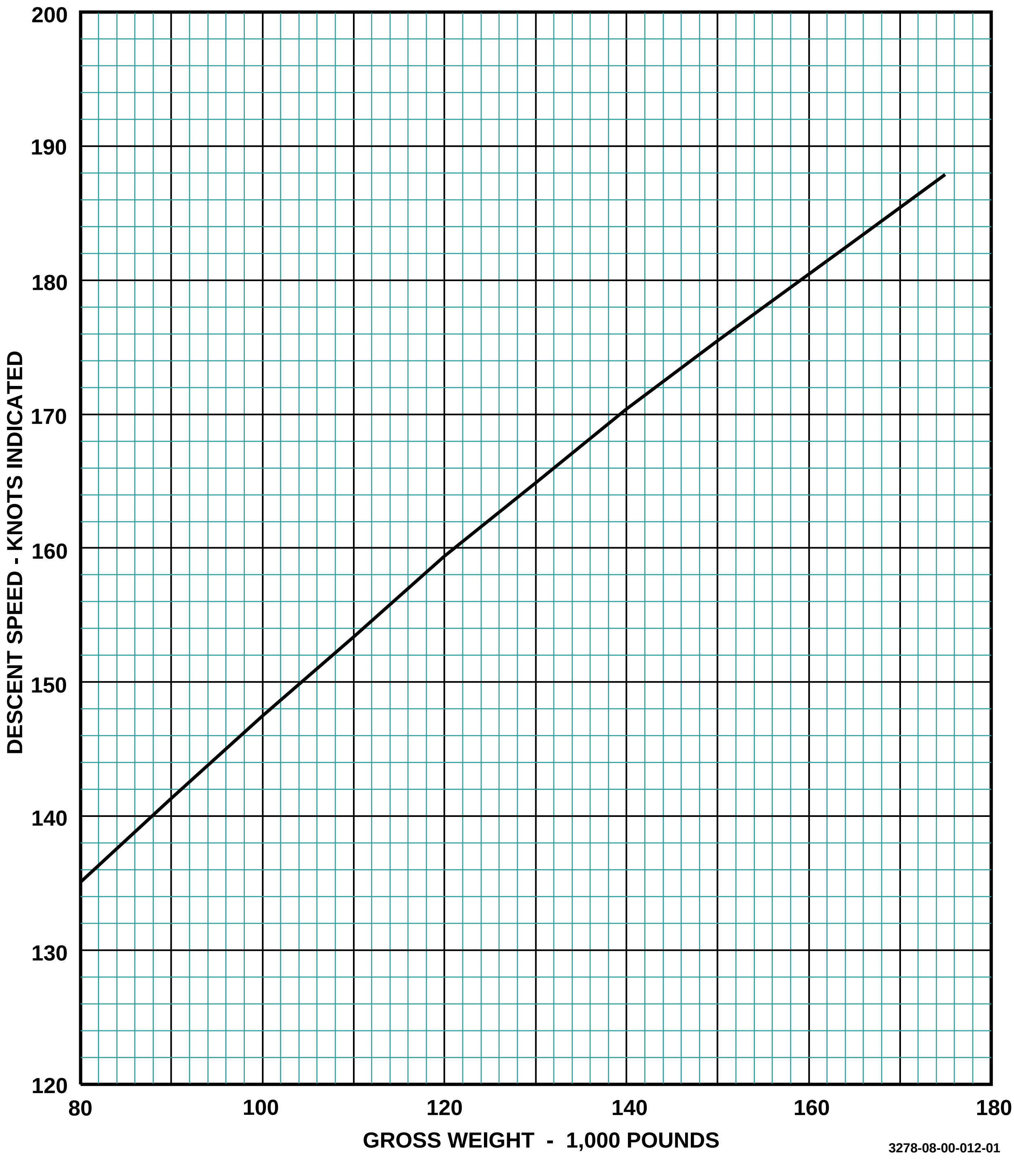


Figure 8-12. (Sheet 1 of 2)

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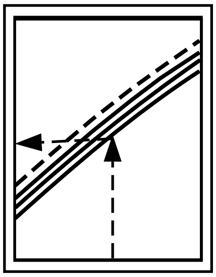
MAXIMUM RANGE DESCENT SPEED

FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

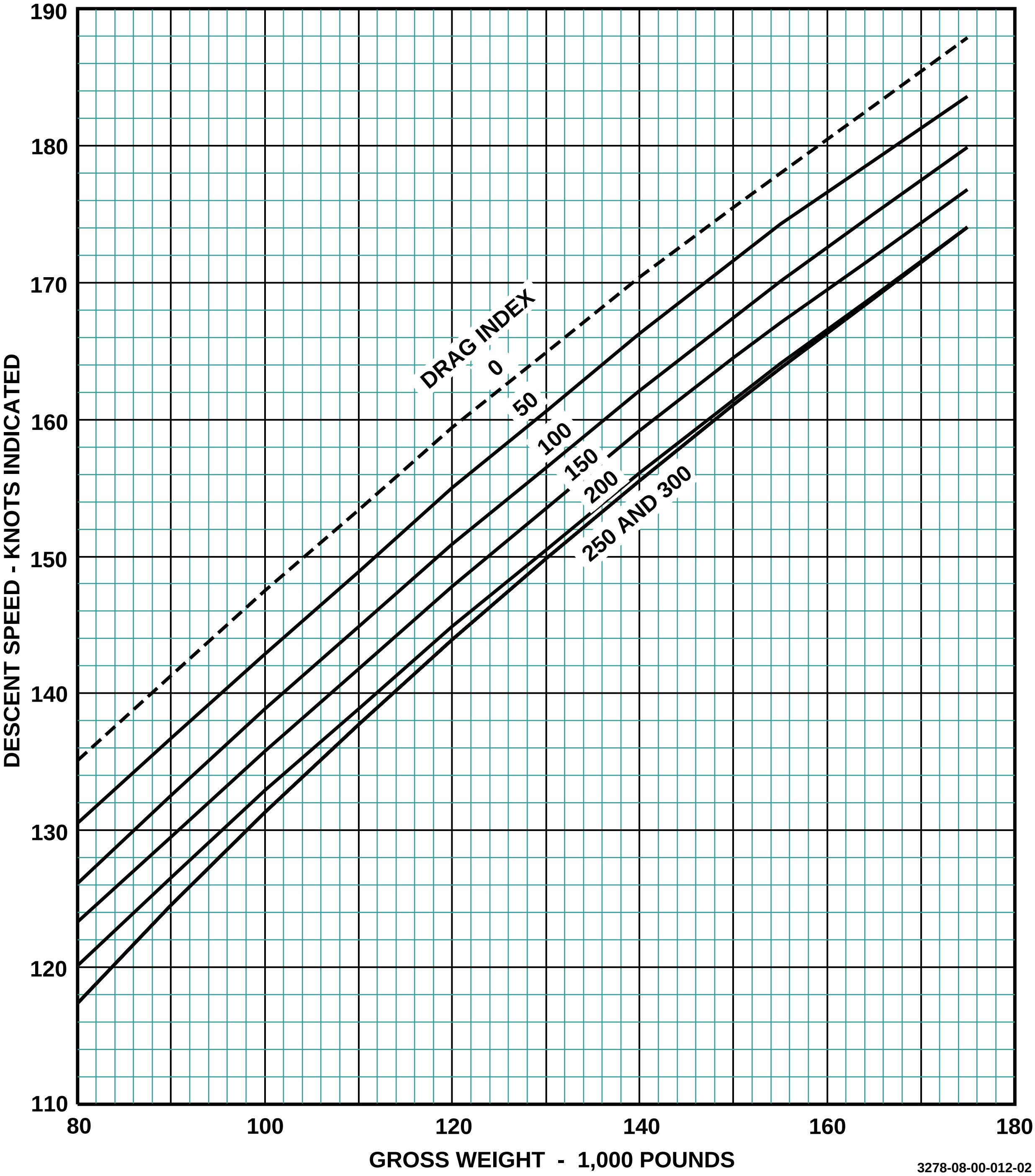


Figure 8-12. (Sheet 2 of 2)

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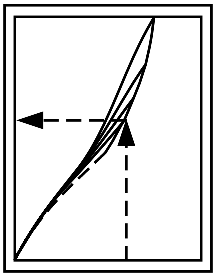
MAXIMUM RANGE DESCENT TIME

GEAR AND FLAPS UP   FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

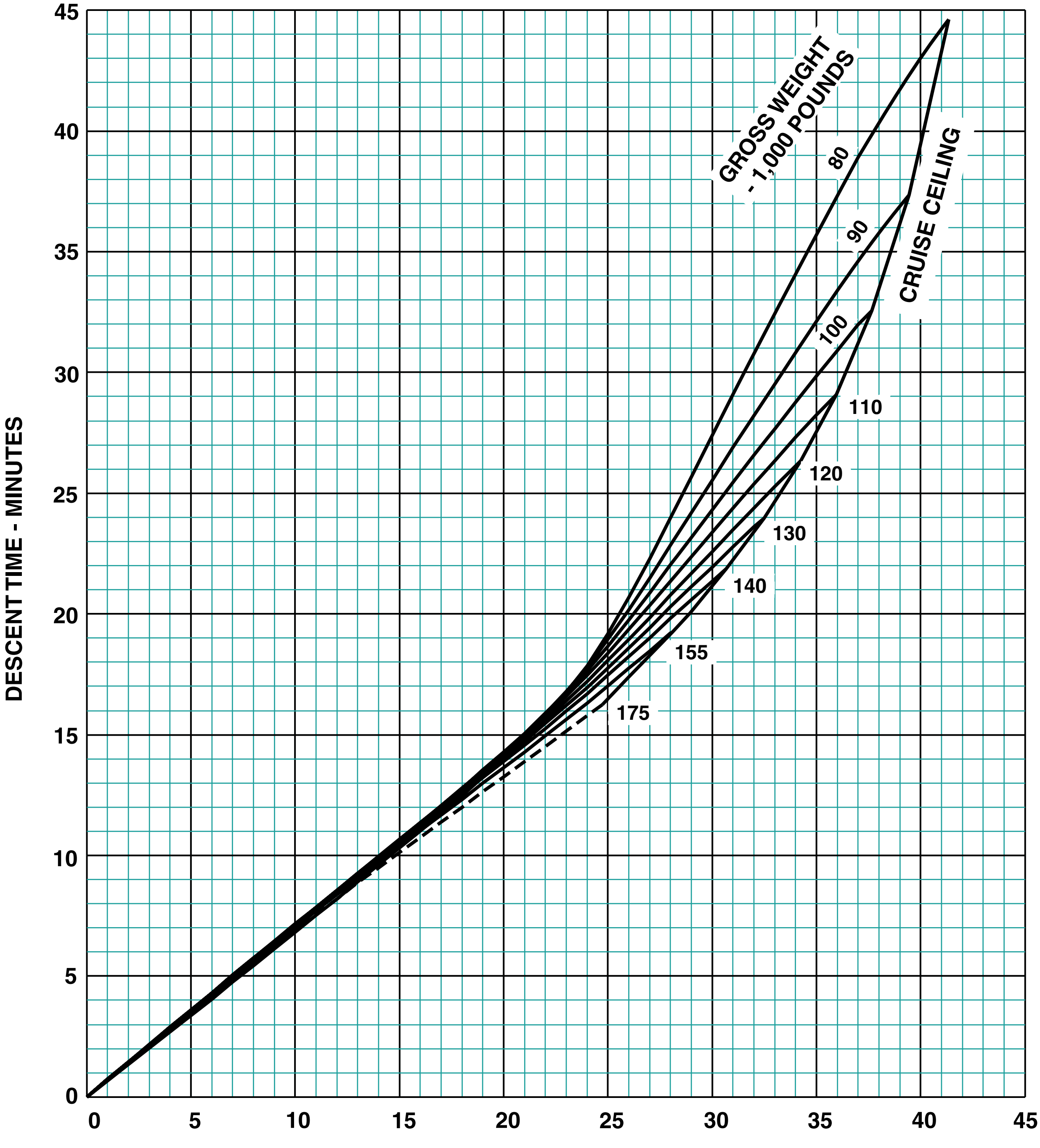


Figure 8-13. (Sheet 1 of 2)

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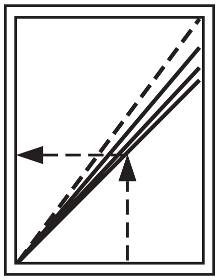
MAXIMUM RANGE DESCENT TIME FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

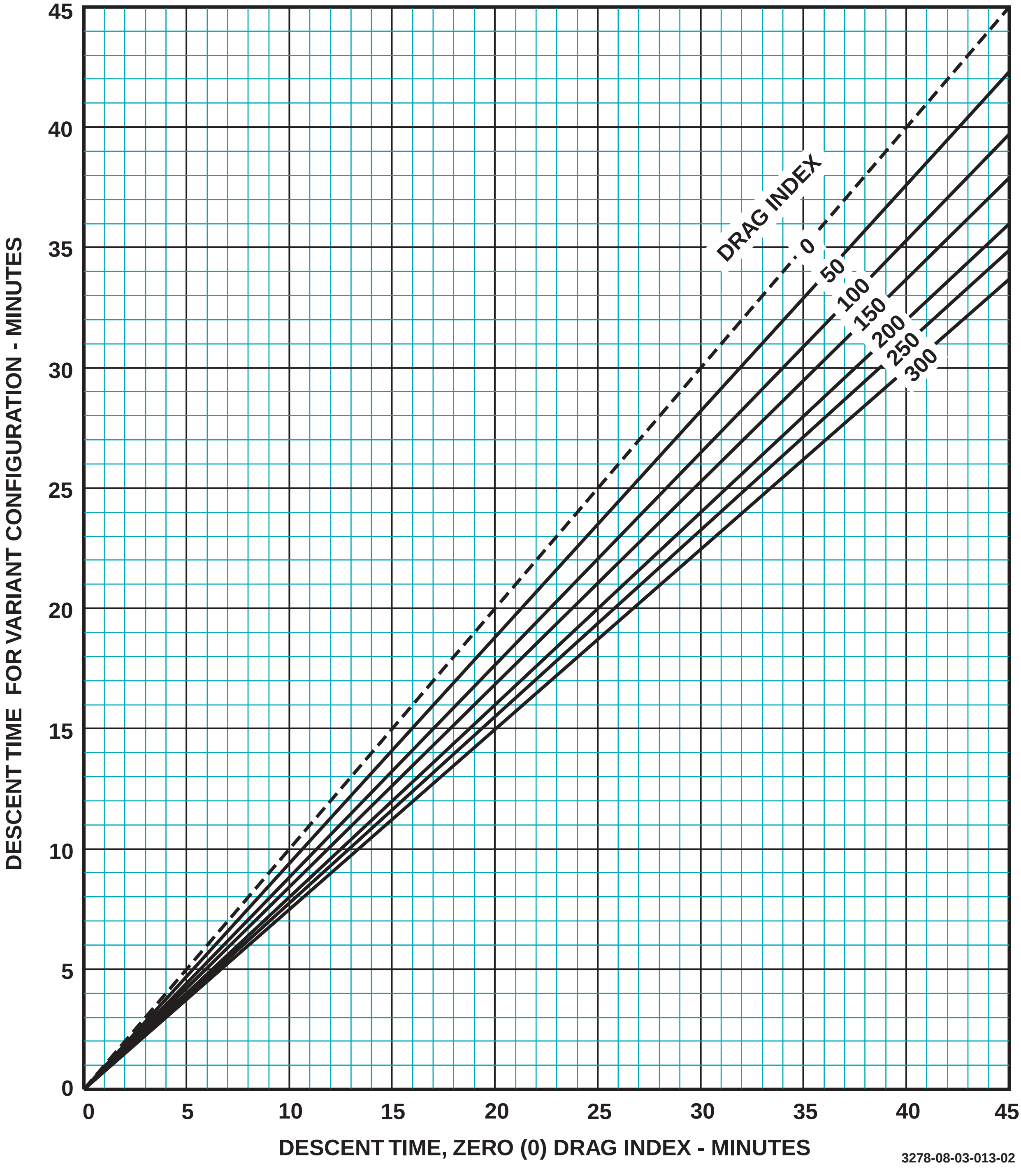


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Figure 8-13. (Sheet 2 of 2)

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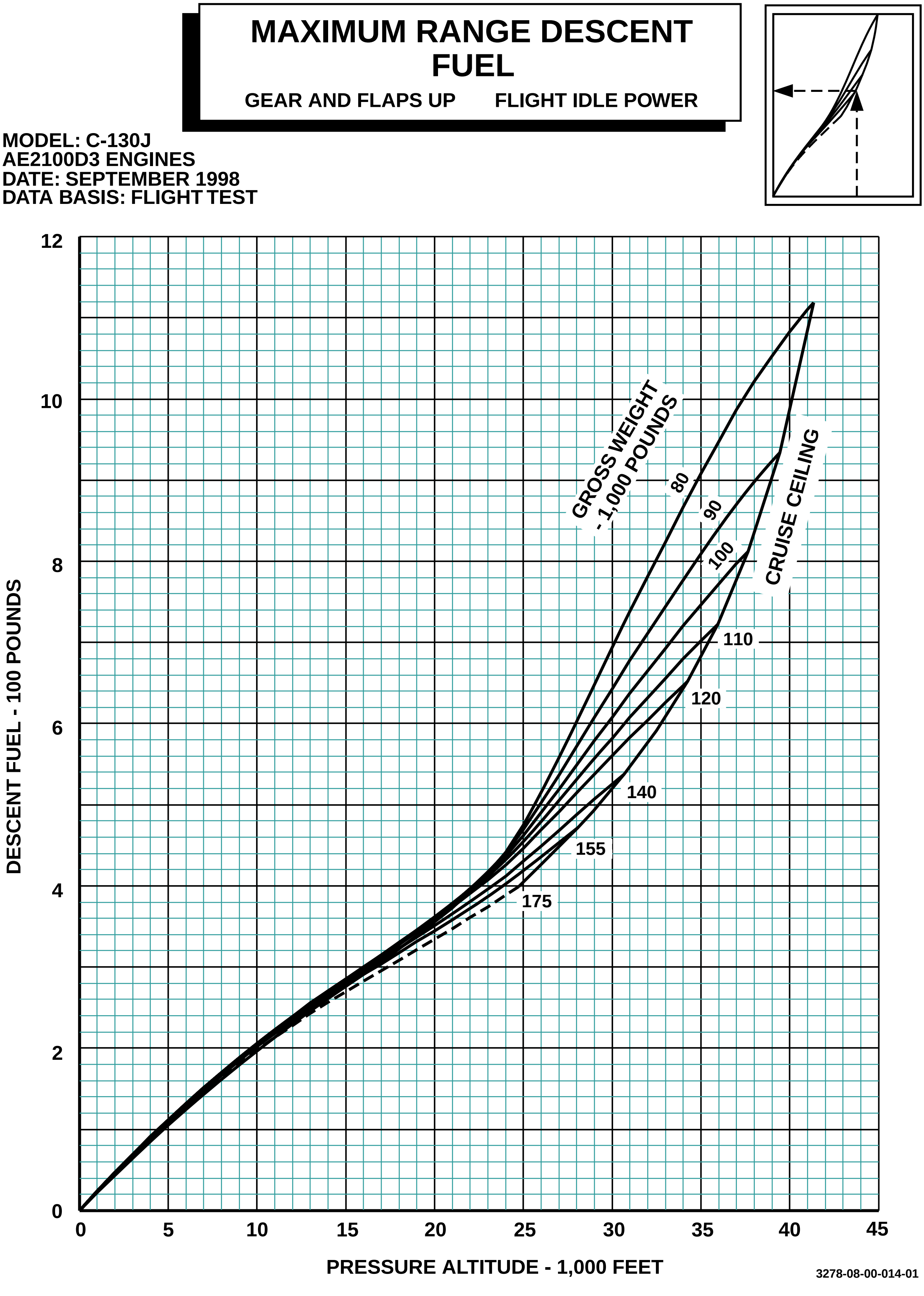

Figure 8-14. (Sheet 1 of 2)

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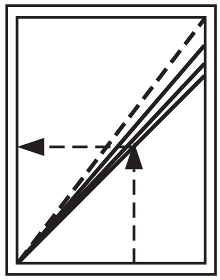
MAXIMUM RANGE DESCENT FUEL FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST



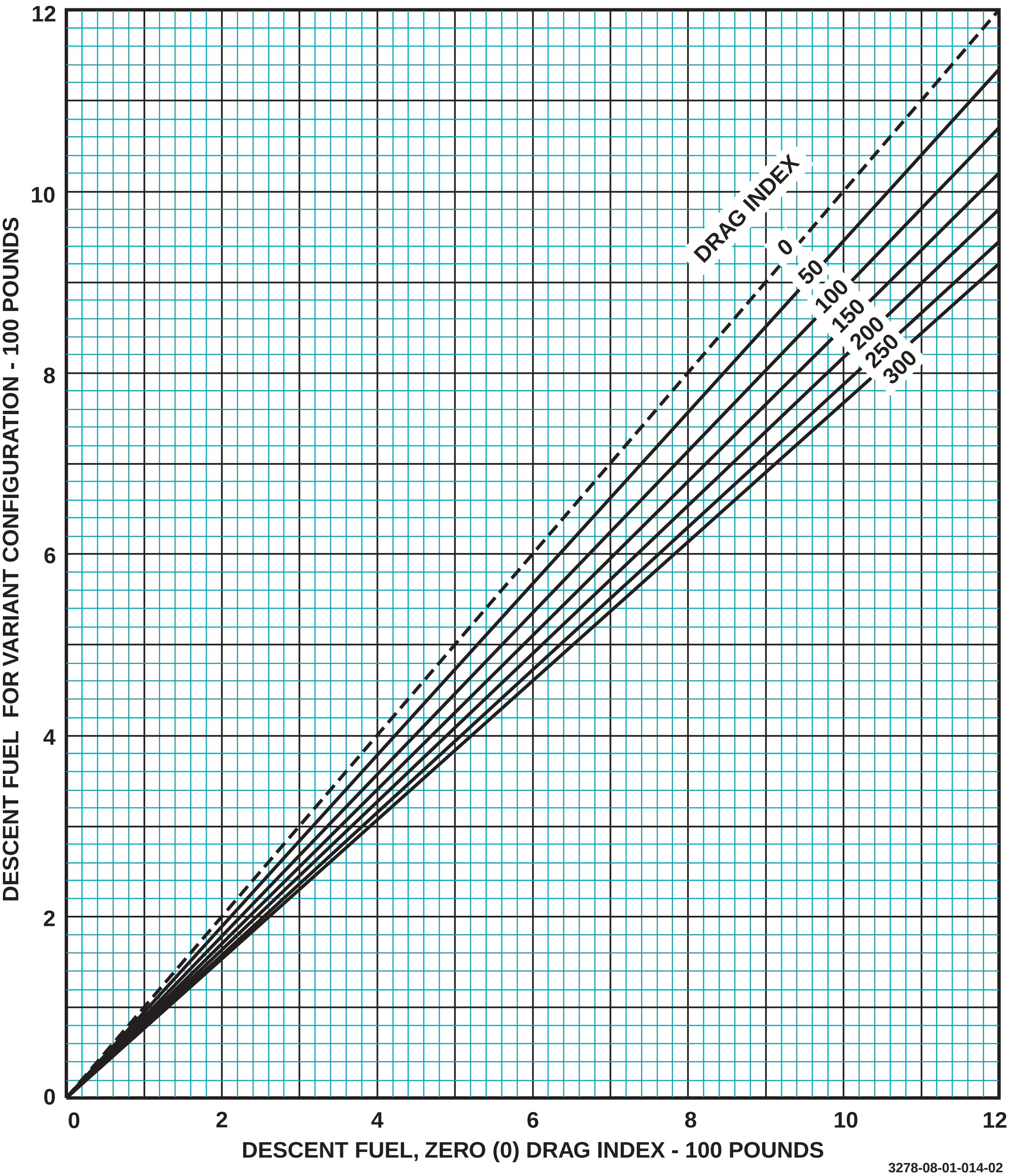


Figure 8-14. (Sheet 2 of 2)

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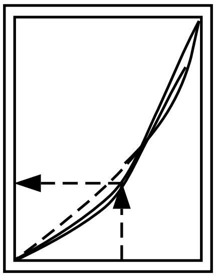
MAXIMUM RANGE DESCENT DISTANCE

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

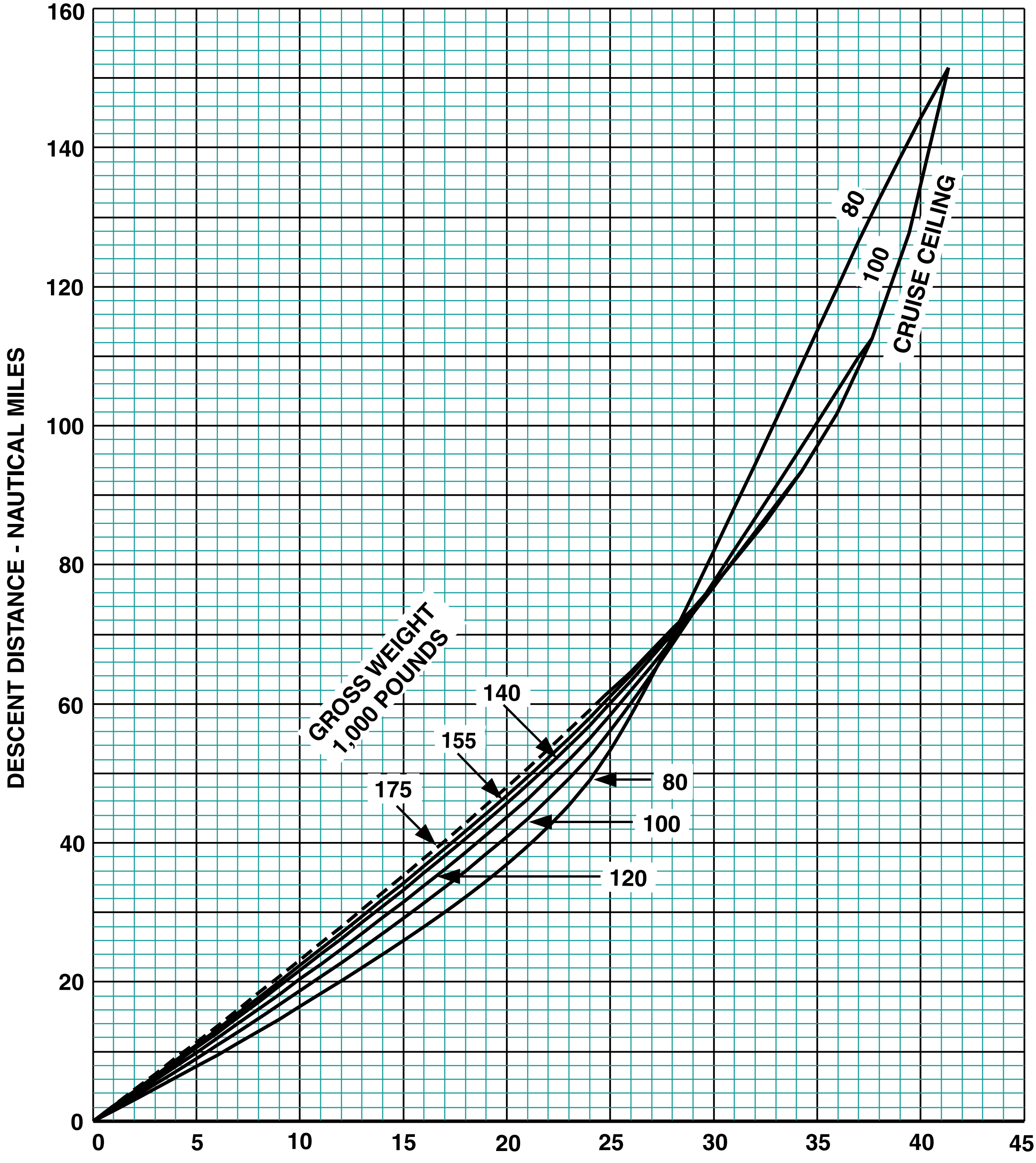


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Figure 8-15. (Sheet 1 of 2)

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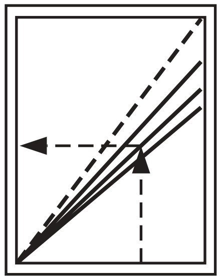
MAXIMUM RANGE DESCENT DISTANCE FOR VARIANT CONFIGURATION

GEAR AND FLAPS UP FLIGHT IDLE POWER



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

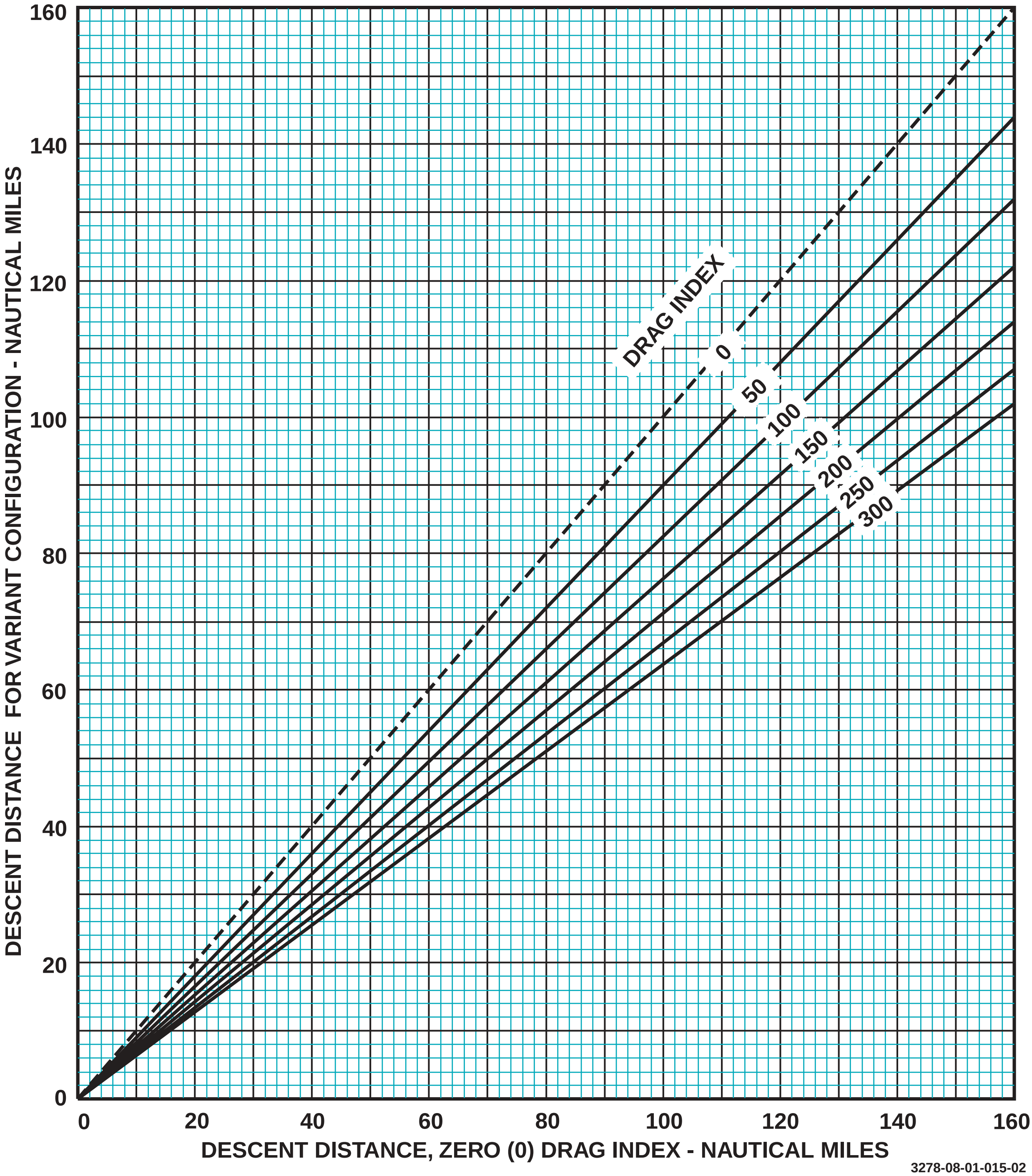


Figure 8-15. (Sheet 2 of 2)

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SECTION 9
LANDING PERFORMANCE

TABLE OF CONTENTS

CONTENTS Page

LIST OF CHARTS

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INTRODUCTION.

Landing performance is presented for a range of airplanes gross weights, runway conditions, airplane configurations, and atmospheric conditions. This data is based on flight test information. The C-130J is designed for 100 percent flap landings, but variable flap settings may be used. Caution must be exercised with flap settings less than 50 percent.

CAUTION

> It is possible to scrape the aft bottom of the airplane when landing with extreme nose high attitudes that can be attained with less than 100 percent flaps.

Landing distances are shown for normal landing conditions and also for maximum effort. For normal conditions the approach glideslope is assumed to be 3 degrees. For maximum effort landings approach glideslope may vary as required for operational considerations, but is assumed to be 3 degrees at 50 feet AGL.

Refer to the Normal Procedures section of the applicable airplane flight manual for a typical approach and landing pattern, and the Limitations section for maneuver limits during landing approach.

NOTE

> Landing gross weight should be below 155,000 pounds except in an emergency.

APPROACH, THRESHOLD, AND TOUCHDOWN SPEEDS.

Approach, threshold, and touchdown speeds for 100, 50, and 0 percent flaps are given in figure 9-1, figure 9-2, and figure 9-3. The minimum touchdown speed for 100 percent flaps is limited to 95.5 KIAS.

APPROACH SPEED.

Approach speed is threshold speed plus 10 KIAS for applicable flap settings.

THRESHOLD SPEED.

- Flaps 100%: $V_s \times 1.32$
- Flaps 50%: $V_s \times 1.28$
- Flaps 0%: $V_s \times 1.28$
- Max effort: 1.1 V_s + 5.5 KIAS
- V_s = power-off stall speed

TOUCHDOWN SPEED.

The average flight test verified touchdown speed is approximately threshold speed – 6 KIAS for 0%, 50%, and 100% flaps, normal technique. The maximum effort touchdown speed is $1.1 \times V_s$. These touchdown speeds are the basis for calculation of the ground roll distances shown on the landing distance charts and must be adhered to if consistency with the charts is expected.

Example.

GIVEN:

Gross weight: 130,000 pounds

Landing flaps: 100 percent

Normal conditions

FIND:

- Approach speed
- Threshold speed
- Touchdown speed

PROCEDURE:

Enter the bottom of figure 9-1, sheet 1, at the given gross weight of 130,000 pounds and proceed upward to intersect the normal approach, threshold and touchdown performance lines. Read left to obtain an approach speed of 135 KIAS. Follow the same procedure to read the threshold speed of 125 KIAS and a touchdown speed of 118.5 KIAS.

AIR MINIMUM CONTROL SPEEDS.

Refer to Section 3 for discussions and presentation of air minimum control speeds.

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CROSSWIND LANDING.

Figure 9-11 presents the maximum recommended crosswind that the airplane can be subjected to on the ground with 100 percent flaps and approach thrust on all four engines still maintain directional control. This figure presents maximum crosswind as a function of gross weight and RCR. The chart is based on the use of nosewheel steering, rudder control, a 5-degree crab angle, and a 3-degree bank into the crosswind with neither asymmetric brakes nor asymmetric power applied.

The Crosswind Chart (figure 9-12) presents runway (headwind or tailwind) and crosswind components in knots for wind directions of 0 to 90 degrees from the runway heading and for wind speeds up to 60 knots. Use the Crosswind Chart to determine the headwind or tailwind component value. Refer to the Application Of Winds To Takeoff And Landing table in Section 3 for a discussion of wind corrections to performance data.

After determining the crosswind component value, establish whether the scheduled value for touchdown speed (figure 9-1) falls within the caution area of the Crosswind Chart. This is accomplished by first locating the crosswind component value on the horizontal axis, then (referencing the right side vertical scale) proceeding vertically upward to the value for the scheduled touchdown speed.

When the value for the touchdown speed falls within the caution area, the touchdown speed shall be increased until the recommended area of the chart is reached, or until the airspeed has been increased by a maximum of 10 knots. (Airspeed increases cannot exceed 10 knots.) After increasing the scheduled touchdown speed, proceed horizontally to the right vertical axis and read the value for minimum touchdown speed.

If touchdown speed is to be increased for a wind gust increment (up to 10 knots), this increase may be sufficient to reach the recommended area of the chart. In this case locate the crosswind component on the horizontal axis then (referencing the right side vertical scale) proceed vertically upward to the value for the scheduled touchdown speed plus the gust increment. If the speed has not been increased a full 10 knots and it falls in the caution area, increase the speed the remainder of the 10 knots allowed or until the recommended area is reached, then proceed horizontally to the right vertical axis and read the value for minimum touchdown speed.

The landing chart provides corrections for the increased distance for the corresponding increase in touchdown speed.

Example.

GIVEN:

Gross weight: 105,500 pounds

Touchdown speed: 106 KIAS

Runway heading: 360 degrees

Reported wind: 045 degrees at 30 knots

RCR: 12

FIND:

- Maximum recommended crosswind component for landing and whether the airplane can land in existing conditions

PROCEDURE:

Enter figure 9-11 at the bottom with a gross weight of 105,500 pounds and move up to intersect the RCR = 12 line. Move left to read a maximum recommended crosswind component of 22.5 knots.

Enter figure 9-12 at the intersection of the wind angle of 45 degrees and the wind speed of 30 knots. Proceed downward from this point to read an actual crosswind component of 21.2 knots. Since the actual crosswind component of 21.2 knots is less than the recommended component of 22.5 knots from figure 9-11, the airplane can land in the existing conditions.

Note that the intersection point of the crosswind component of 21.2 knots and the touchdown speed of 106 knots lies in the recommended zone of the figure 9-12; therefore no increase in touchdown speed is required.

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LANDING DISTANCE.

The normal landing distance over a 50-foot obstacle is presented in figure 9-4 for airfield pressure altitude from sea level up to 16,000 feet.

NOTE

> Should obstacles located near the end of the runway be such that the 50-foot height must be exceeded, the effect of the additional height must be considered. Because this condition is not covered by the charts, sufficient margin must be allowed based on the pilot's judgment and experience.

The normal and maximum effort landing ground roll is presented in figure 9-5 for airfield pressure altitudes from sea level up to 16,000 feet.

Basic assumptions for the landing distance charts include:

a. A 1–second allowance for distance traveled during transition from touchdown to taxi attitude.

b. Maximum anti-skid braking (brakes at ambient temperature) and power selection achieved upon reaching taxi attitude.

The chart baseline conditions and their variations include:

ENGINE THRUST SELECTION DURING GROUND ROLL – The baseline condition assumes full reverse thrust during the ground roll. Increase in ground roll due to selection of other thrust conditions is provided by a correction grid.

The other thrust conditions that may be selected are:

a. Two outboard engines in reverse plus two inboard engines in ground idle.

b. Two outboard engines in ground idle plus two inboard engines in reverse.

c. All four engines in ground idle.

INCREASED TOUCHDOWN SPEED – The baseline touchdown speeds are defined in figure 9-1, figure 9-2, and figure 9-3. When touchdown speeds are increased for any reason, the increased ground roll may be estimated using the correction grid on figure 9-5, sheet 4.

RUNWAY CONDITION READING (RCR) – The increase in landing distance due to a wet or icy runway surface is dependent on many factors, and each situation should be considered on the basis of past experience. Runways covered with snow have a variable braking coefficient between wet and icy. The most critical factor should be applied in computing the landing data. When the tower reports a measured RCR, the landing distance must be modified to account for the variation. ICAO braking categories compare with RCR values as follows:

RUNWAY CONDITION	ICAO REPORT	RCR
Dry	Good	23
Wet	Medium	12
Icy	Poor	05

Increased landing distances for RCRs other than 23 can be estimated by the pilot, based on experience, and judgment. If no brakes are applied during landing, an RCR of 2 should be used.

Example.

GIVEN:

Gross weight: 130,000 pounds

Runway slope: + 1 percent (uphill)

Pressure altitude: 2,000 feet

Winds: – 5 knots (tailwind)

Temp Dev: + 10 °C

Landing flaps (100 percent)

4 engines in reverse after touchdown

FIND:

- Ground roll for maximum effort conditions
- Total distance over a 50–foot obstacle under normal conditions

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PROCEDURE:

Enter the bottom of figure 9-4, sheet 1, at a gross weight of 130,000 pounds and proceed upward to intersect the 2,000 foot line. Read across to the right to obtain an uncorrected distance over 50 foot obstacle of 3,230. Enter figure 9-4, sheet 2, at this value and follow the guide lines to correct for runway slope, ambient temperature, and wind (use 150 percent of reported tailwind). There is no correction to be made for engine selection as four engines in reverse is the baseline. The partially corrected ground run is 3,420 feet. Since there are no additional corrections to be made from figure 9-4, sheet 3, the corrected normal distance over a 50 foot obstacle is 3,420 feet.

Enter the bottom of figure 9-5, sheet 2, at a gross weight of 130,000 and proceed upward to intersect the 2,000 foot line. Read across to the right to obtain an uncorrected maximum effort ground roll of 1,380 feet. Enter figure 9-5, sheet 3, at this value and follow the guide lines to correct for runway slope, ambient temperature, and wind. (Use 150% of reported tailwind.) Again, there is no correction to be made for engine selection. The partially corrected ground roll is 1,550 feet under maximum effort conditions. Since there are no additional corrections to be made on figure 9-5, sheet 4, the ground roll remains at 1,550 feet.

LANDING WEIGHT LIMITED BY MAXIMUM BRAKE KINETIC ENERGY.

These landing weight limits are presented in figure 9-6. They are defined as the landing weights which will result in the maximum brake kinetic energy limit of 99 million foot–pounds. Use 50% of reported headwind or 150% of reported tailwind component for brake energy calculations.

Example.

GIVEN:

Outside air temperature: 20 °C

Runway pressure altitude: 4,000 feet

Runway slope: + 1 percent (uphill)

Winds: – 5 knots (tailwind)

FIND:

- Landing weight limit

PROCEDURE:

Enter the bottom of figure 9-6, sheet 1, at the OAT of 20 °C and move upwards to intersect the 4,000 foot line. Read to the right an uncorrected landing weight of 173,000 pounds.

Enter figure 9-6, sheet 2, with this value and correct for slope and wind (use 150% of the reported tailwind). The corrected limit landing weight is read as 165,500 pounds.

POWER LEVER TRANSITION LIMITATIONS.

Upon landing, if the power lever is moved from stabilized flight idle to ground idle at an airspeed greater than 145 KTAS, there is the likelihood of producing propeller overspeeds which fall outside the generator frequency envelope and cause them to drop offline, and also produce the loss of anti-skid. The landing performance given in this manual observes this speed limitation. This speed limit is given as indicated airspeed (KIAS) in figure 9-7. The maximum landing weight permitted to avoid this transition limit is given in figure 9-8, figure 9-9, and figure 9-10 for 100 percent flaps, 50 percent flaps, and flaps up, respectively.

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING SPEEDS

100 PERCENT FLAPS, NORMAL

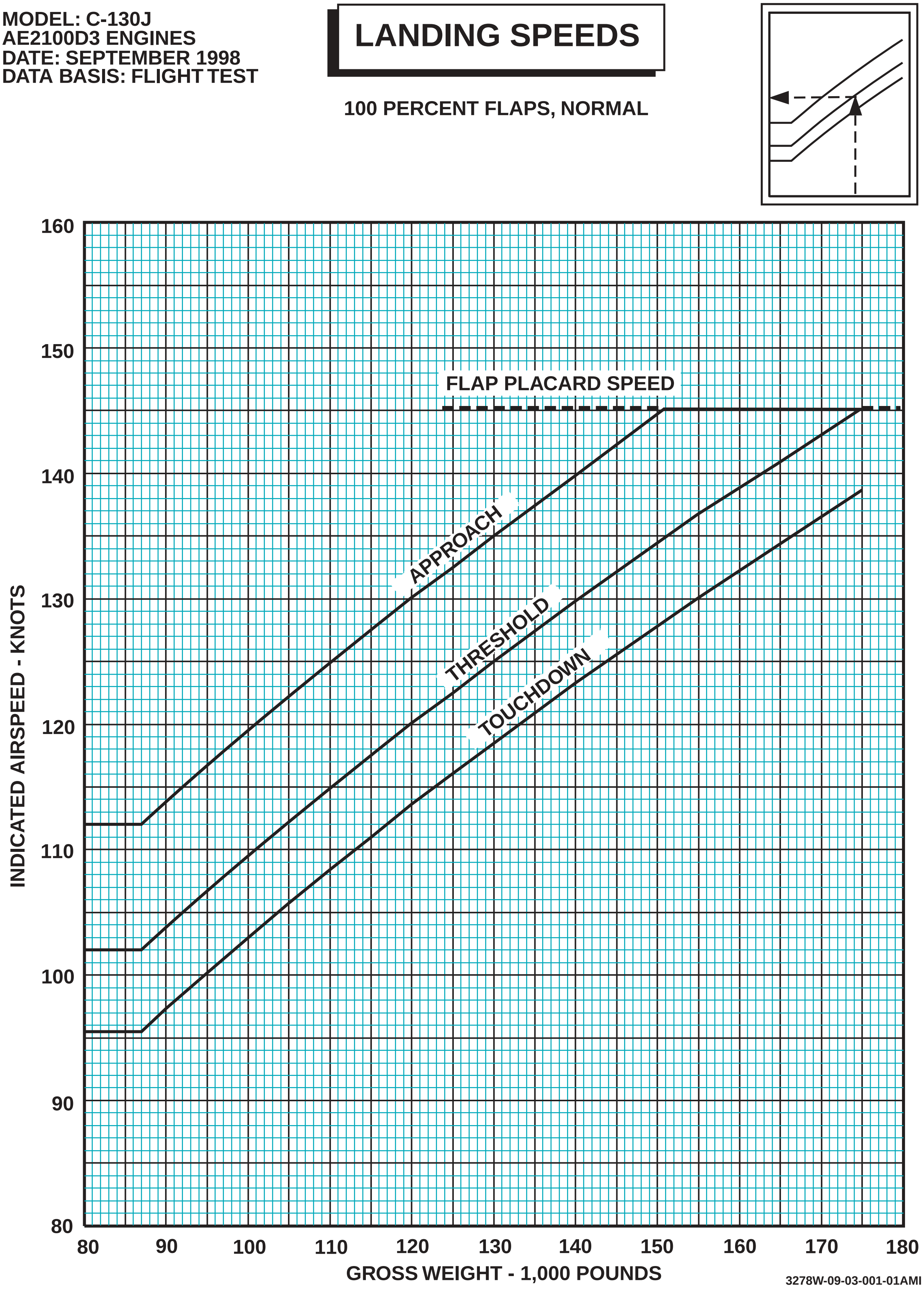

Figure 9-1. (Sheet 1 of 2)

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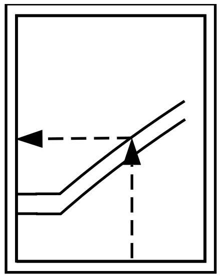
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING SPEEDS

100 PERCENT FLAPS, MAXIMUM EFFORT



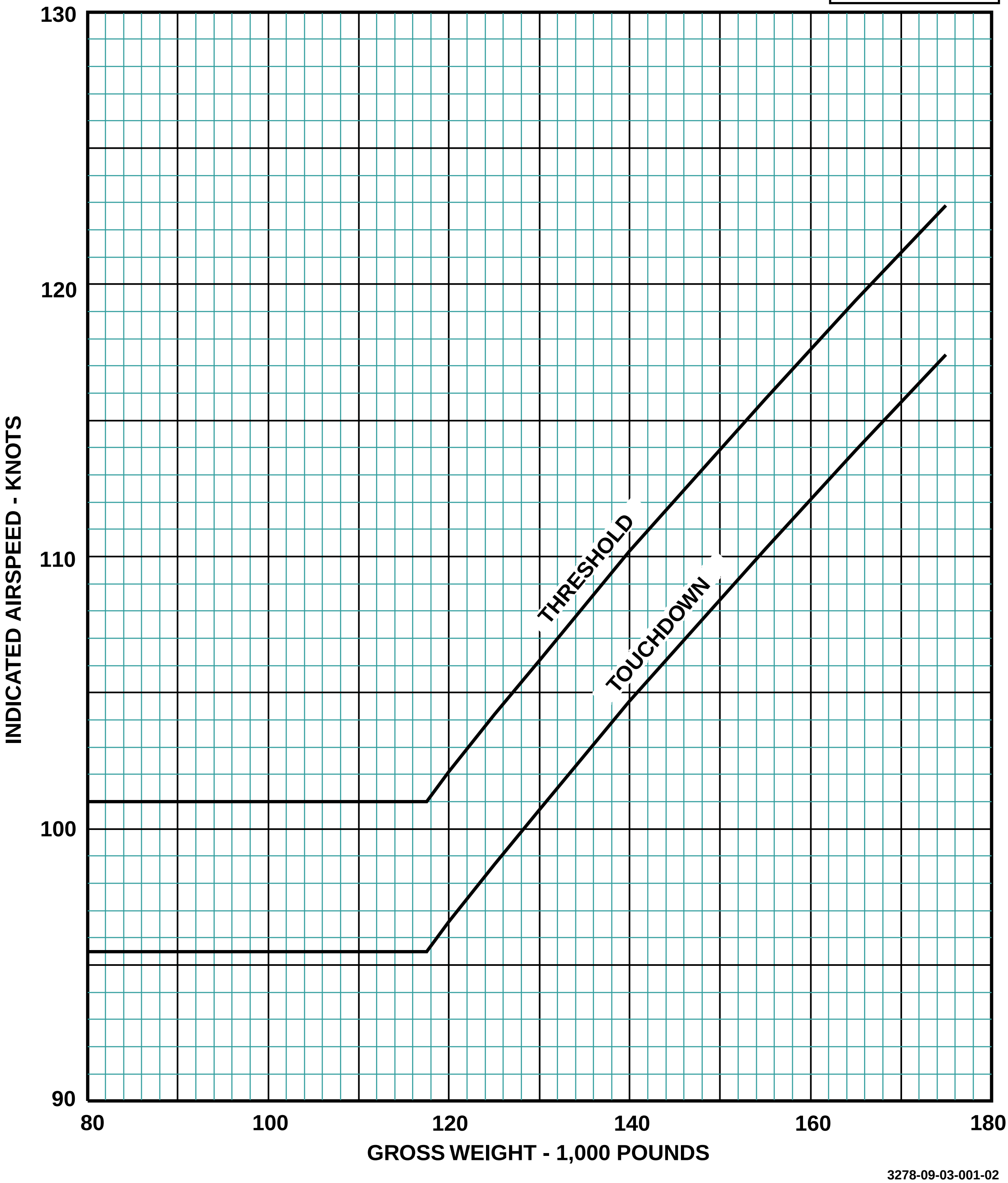


Figure 9-1. (Sheet 2 of 2)

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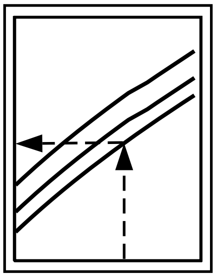
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING SPEEDS

50 PERCENT FLAPS



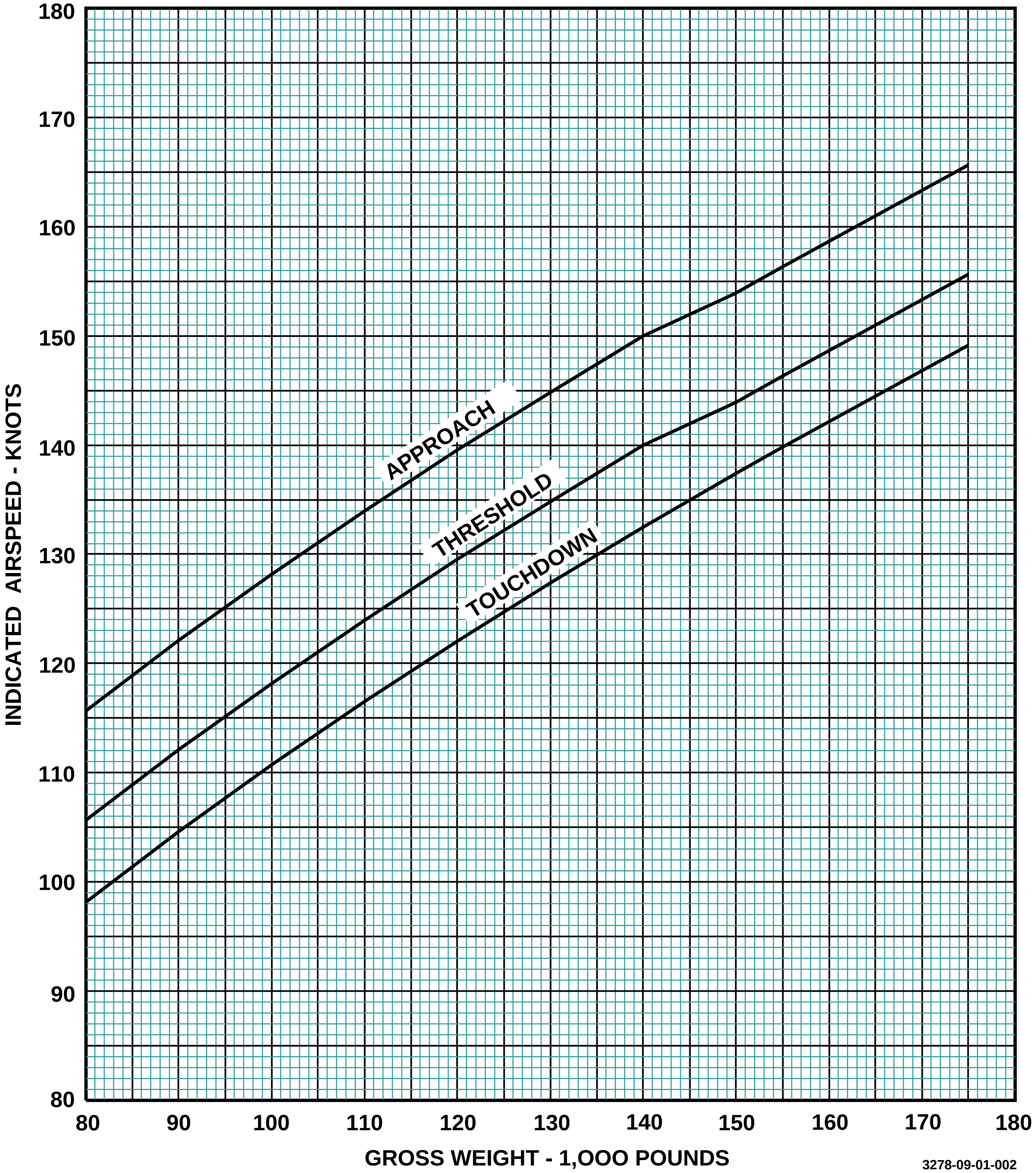


Figure 9-2.

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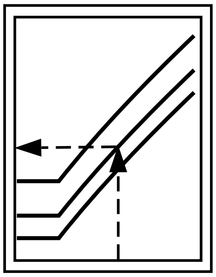
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING SPEEDS

FLAPS UP



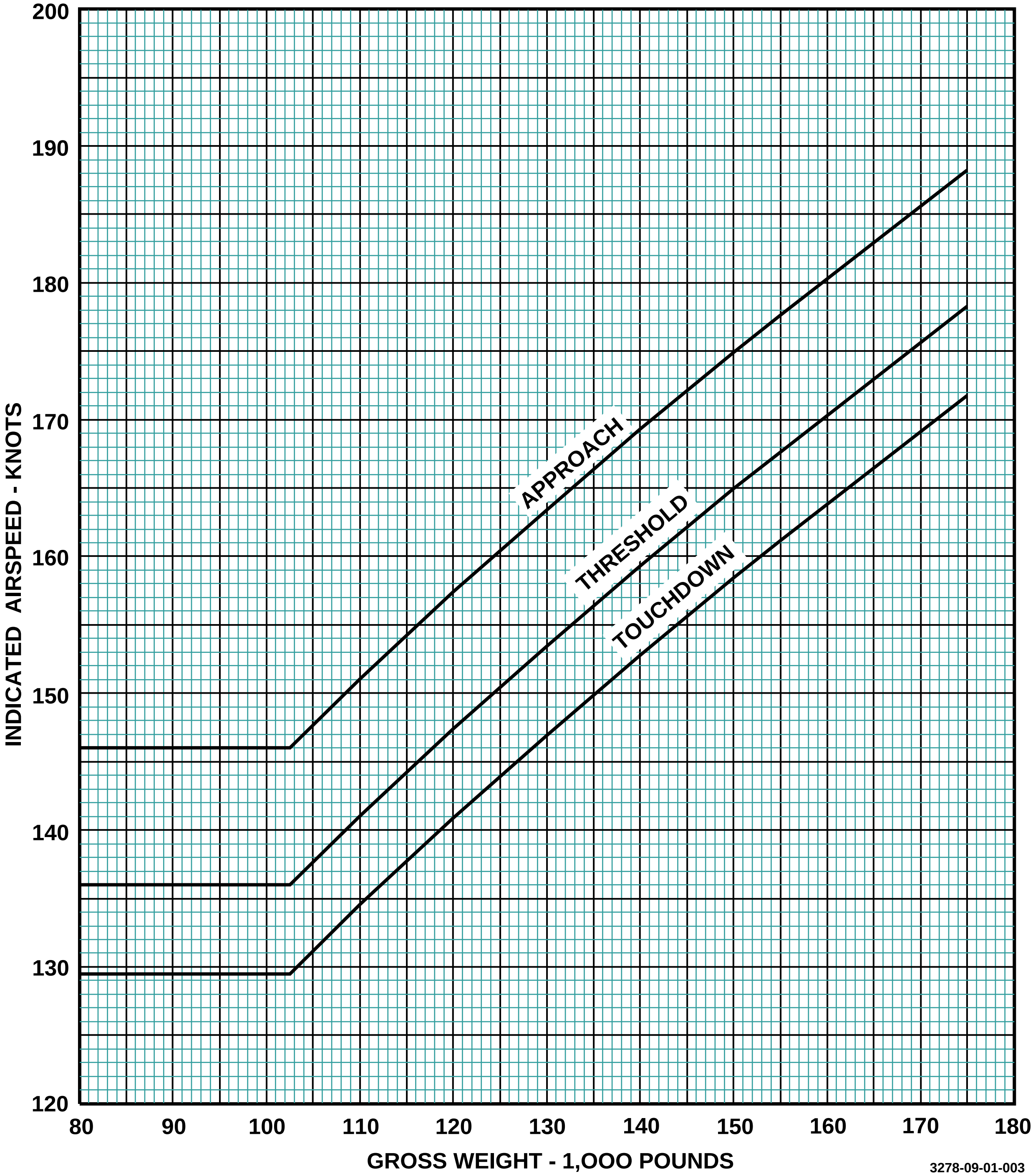


Figure 9-3.

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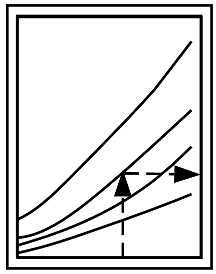
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING DISTANCE OVER 50 FOOT OBSTACLE

100 PERCENT FLAPS



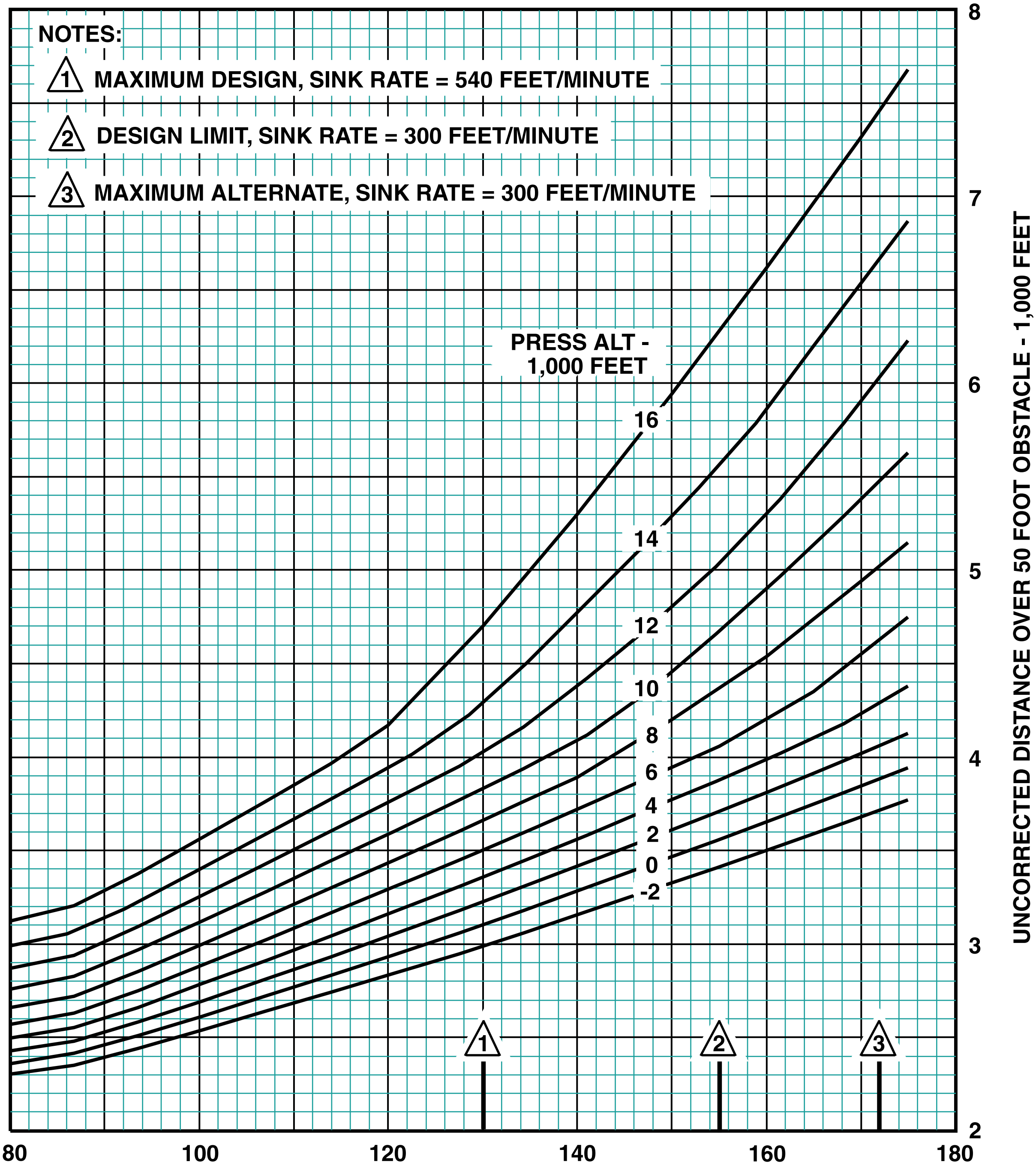


Figure 9-4. (Sheet 1 of 3)

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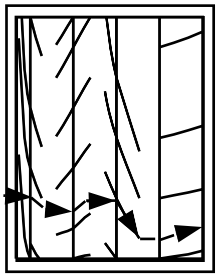
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING DISTANCE OVER 50 FOOT OBSTACLE



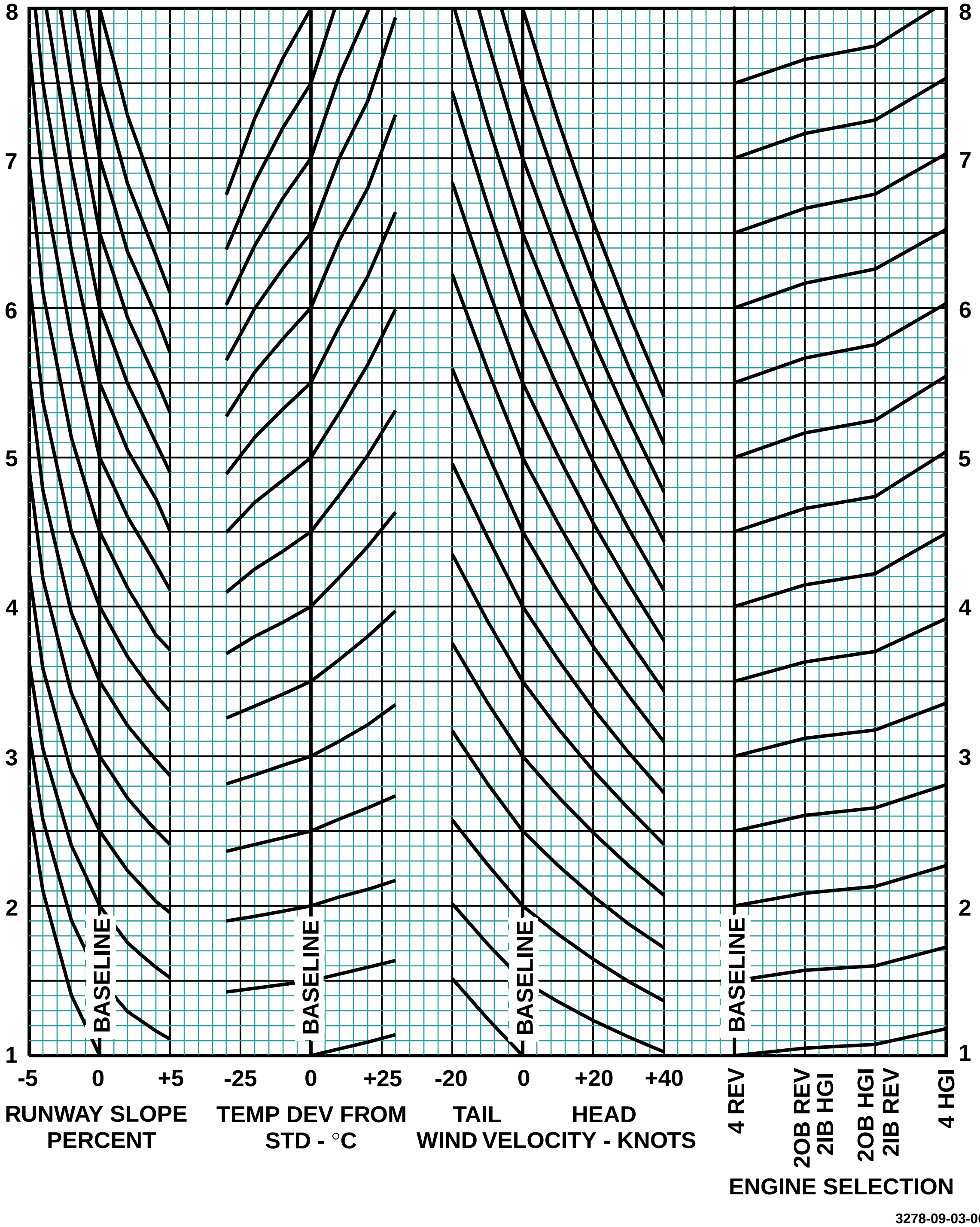


Figure 9-4. (Sheet 2 of 3)

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MODEL: C130J
AE2100D3 ENGINES
DATE: MARCH 1998
DATA BASIS: FLIGHT TEST

LANDING DISTANCE OVER 50 FOOT OBSTACLE

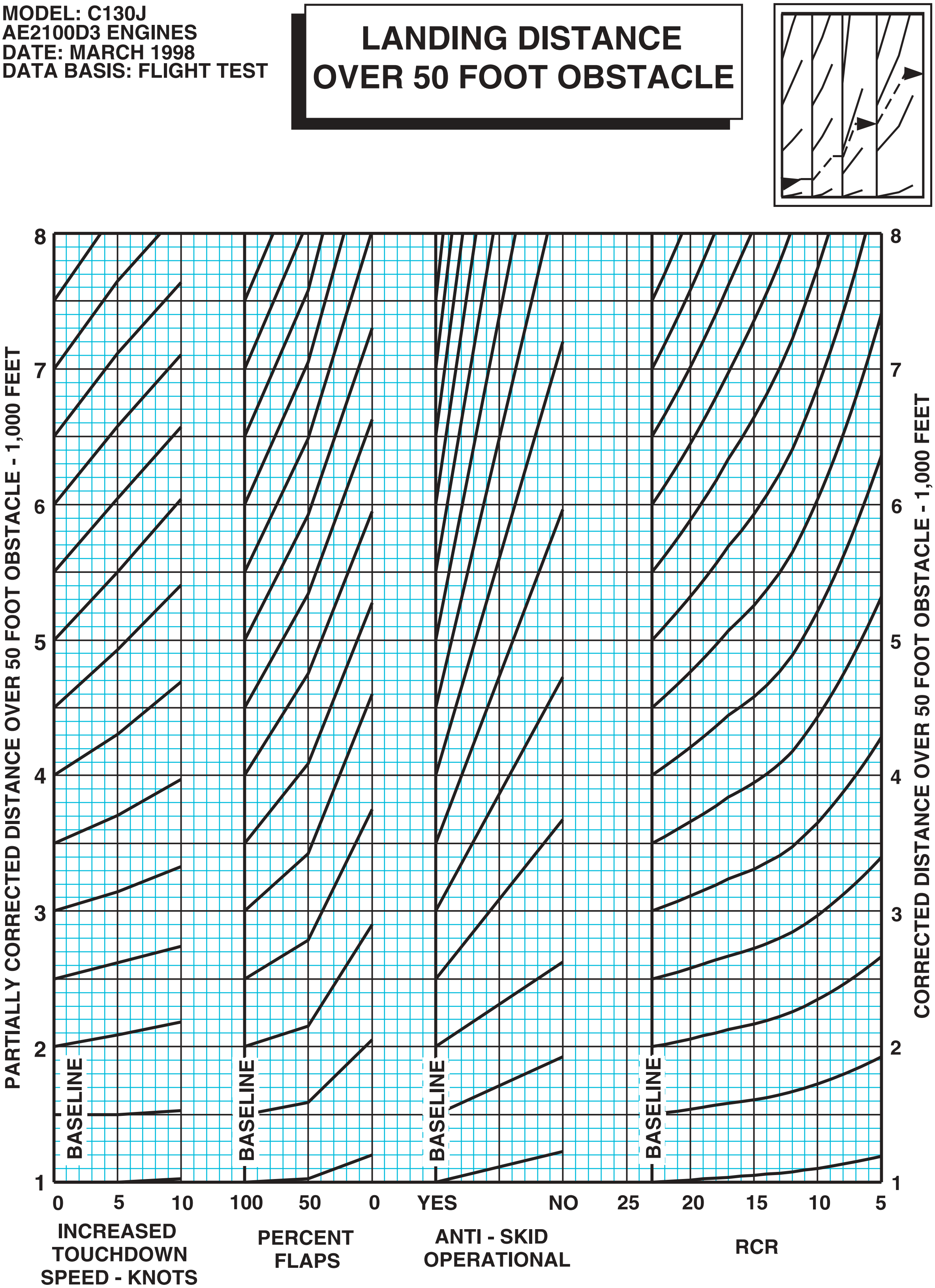

Figure 9-4. (Sheet 3 of 3)

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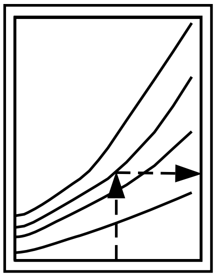
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING GROUND ROLL

NORMAL

100 PERCENT FLAPS



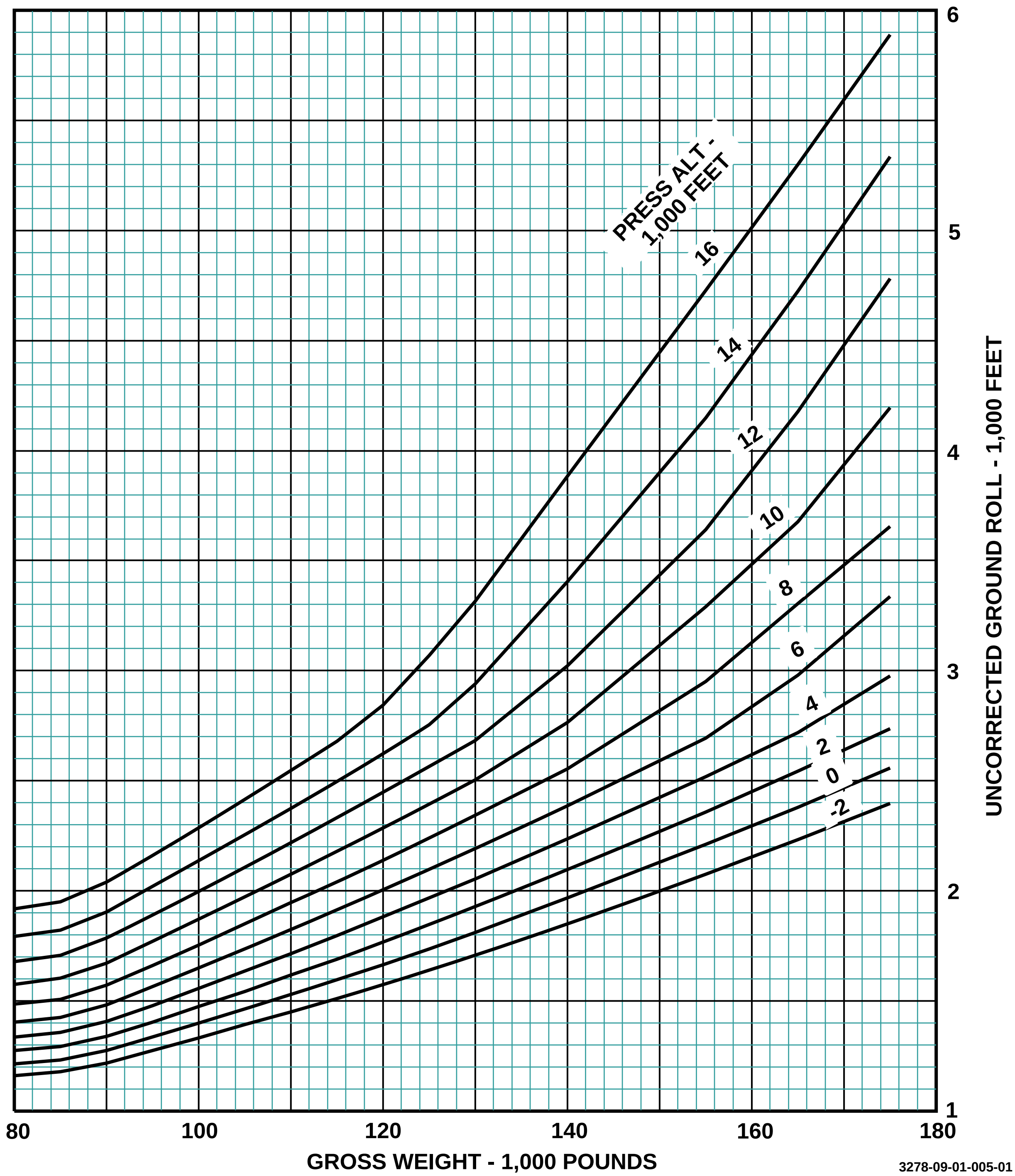


Figure 9-5. (Sheet 1 of 4)

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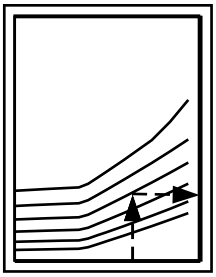
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING GROUND ROLL

MAXIMUM EFFORT



100 PERCENT FLAPS

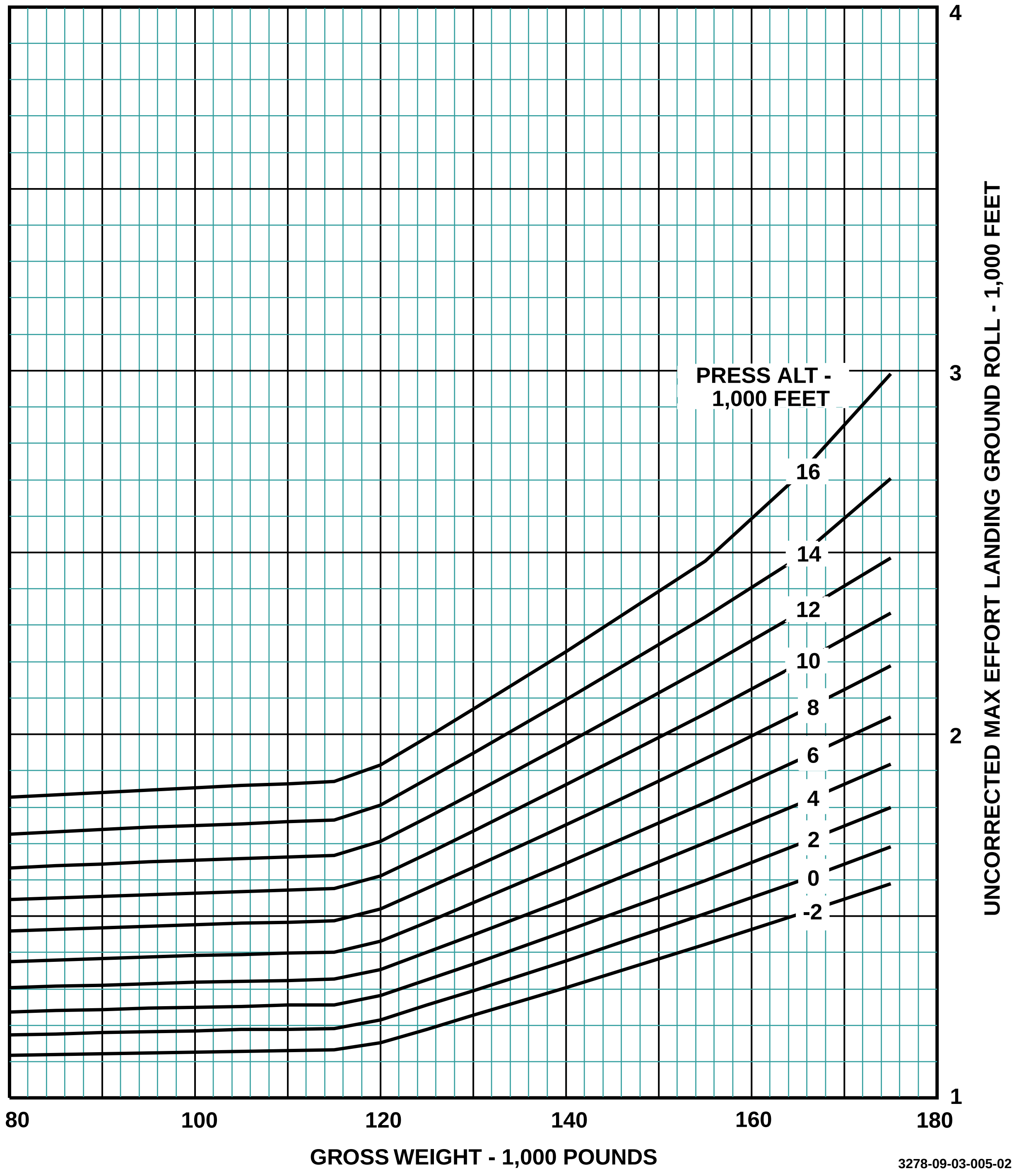


Figure 9-5. (Sheet 2 of 4)

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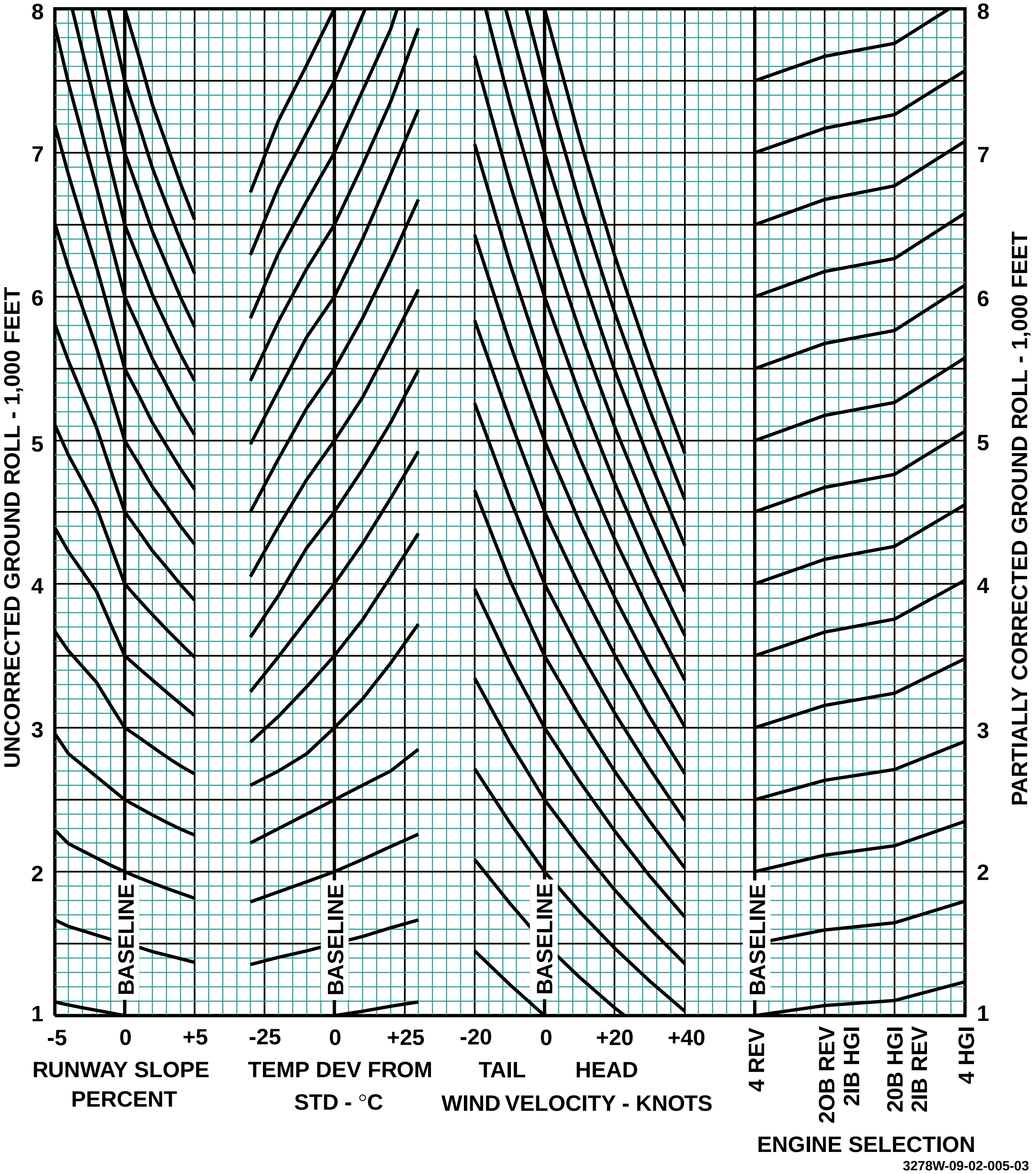
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING GROUND ROLL

NORMAL OR MAXIMUM EFFORT

100 PERCENT FLAPS

NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.



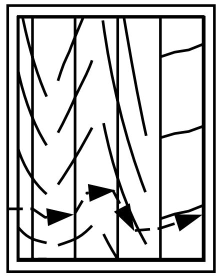


Figure 9-5. (Sheet 3 of 4)

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING GROUND ROLL

NORMAL OR MAXIMUM EFFORT

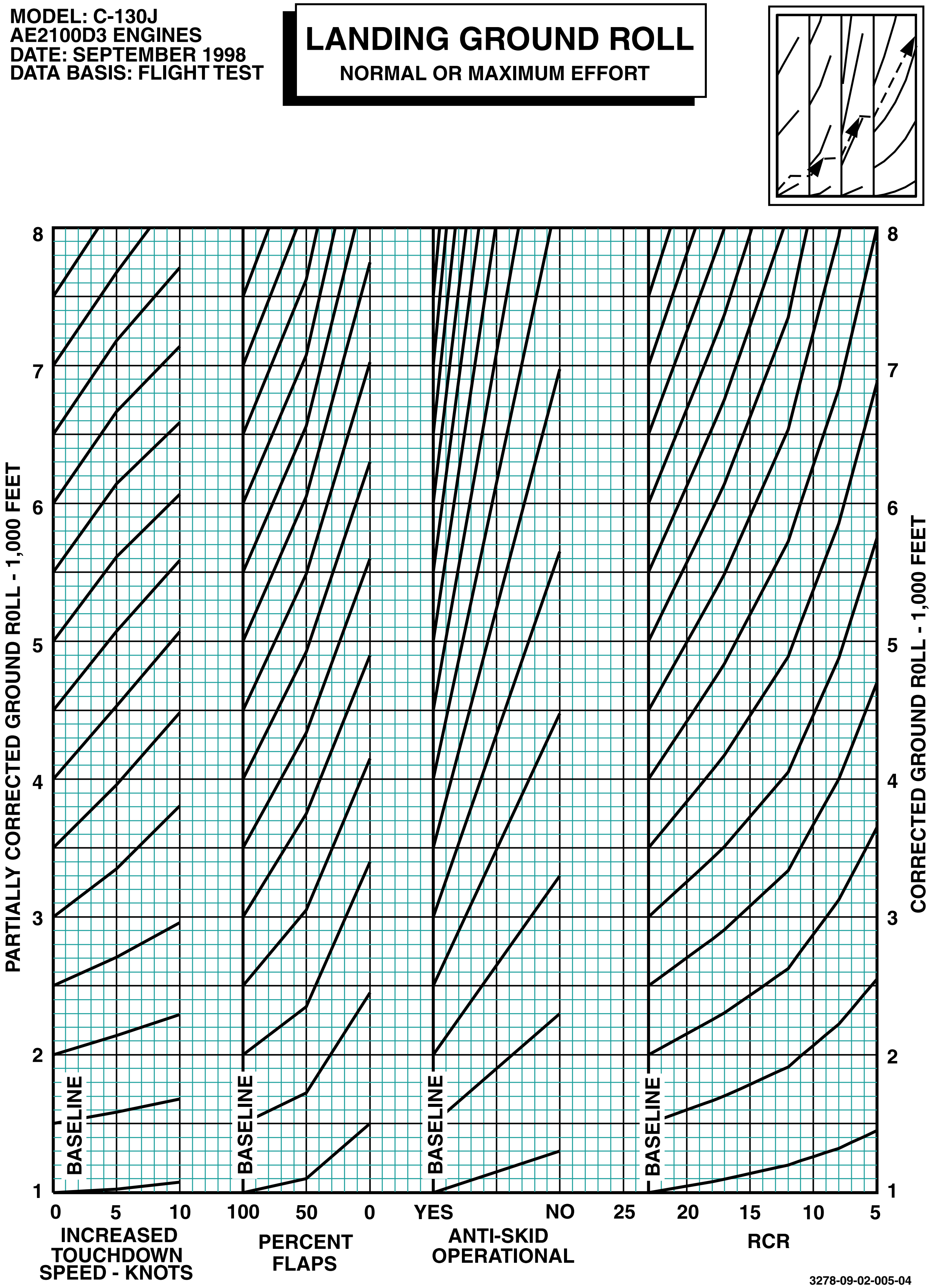

Figure 9-5. (Sheet 4 of 4)

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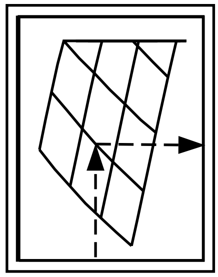
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING WEIGHT LIMITED BY MAXIMUM BRAKE KINETIC ENERGY



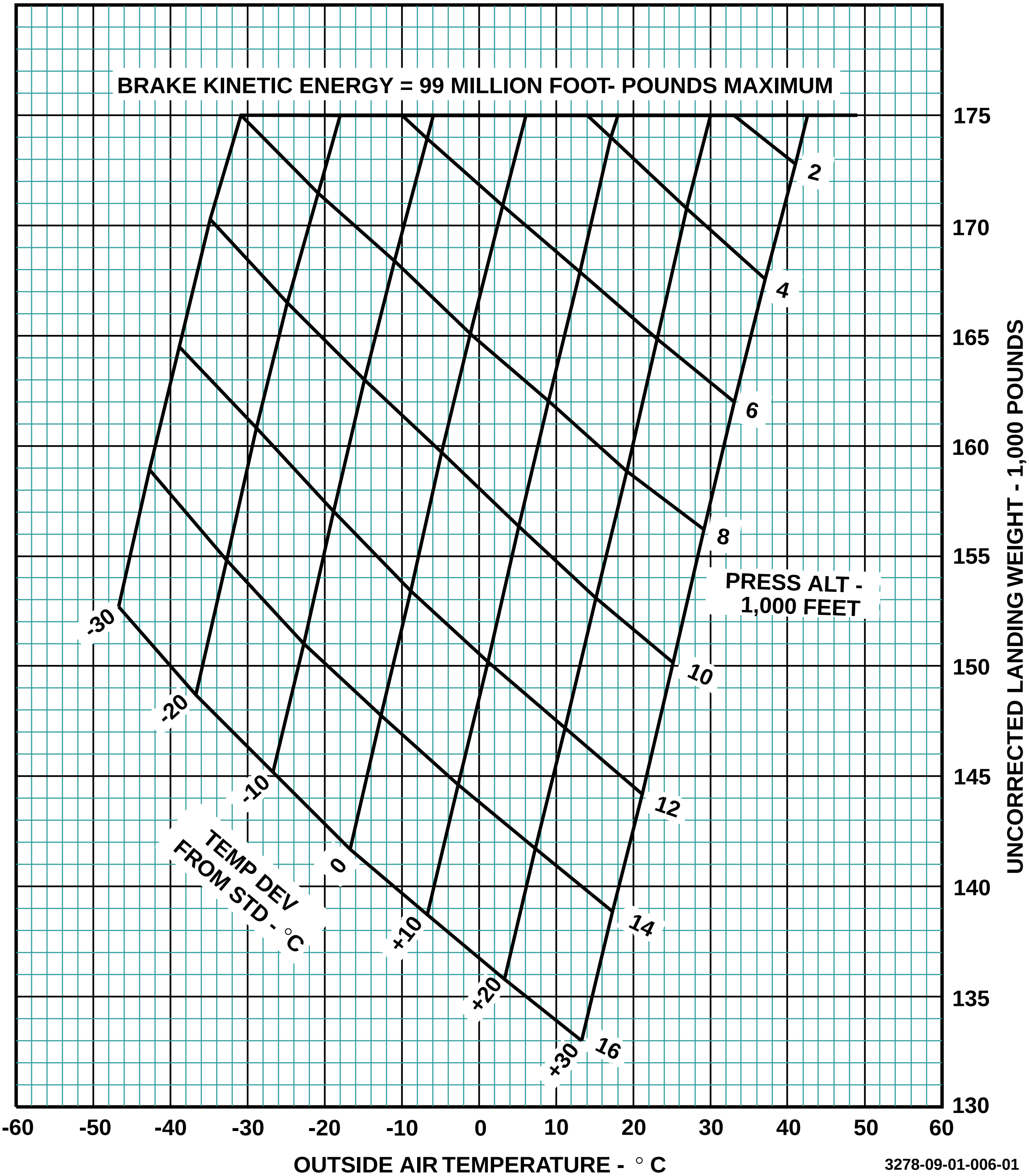


Figure 9-6. (Sheet 1 of 3)

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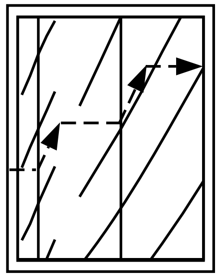
MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING WEIGHT LIMITED BY MAXIMUM BRAKE KINETIC ENERGY



NOTE: APPLY 50% FACTOR TO REPORTED HEADWIND AND 150% FACTOR TO REPORTED TAILWIND.

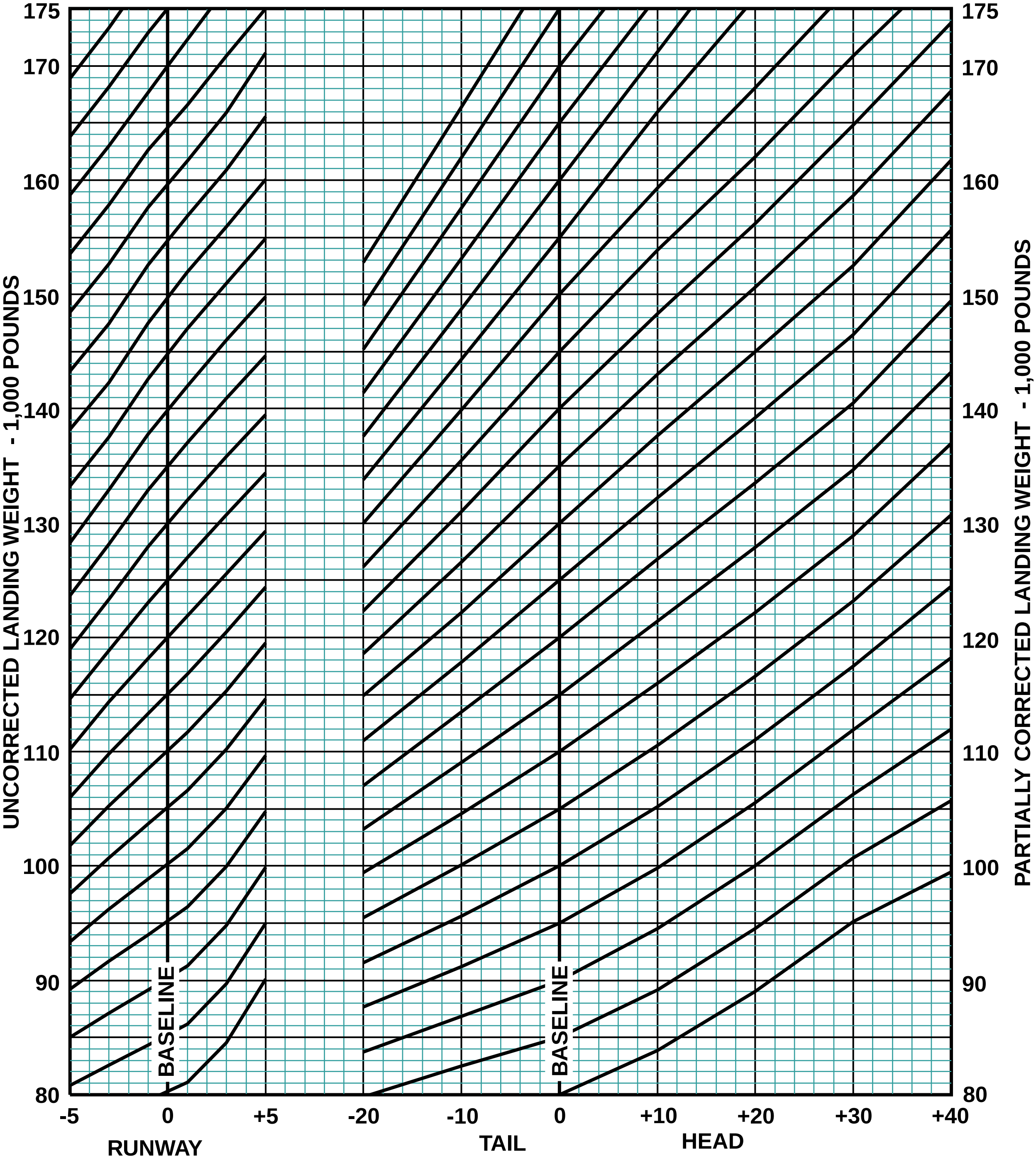


Figure 9-6. (Sheet 2 of 3)

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MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

LANDING WEIGHT LIMITED BY MAXIMUM BRAKE KINETIC ENERGY

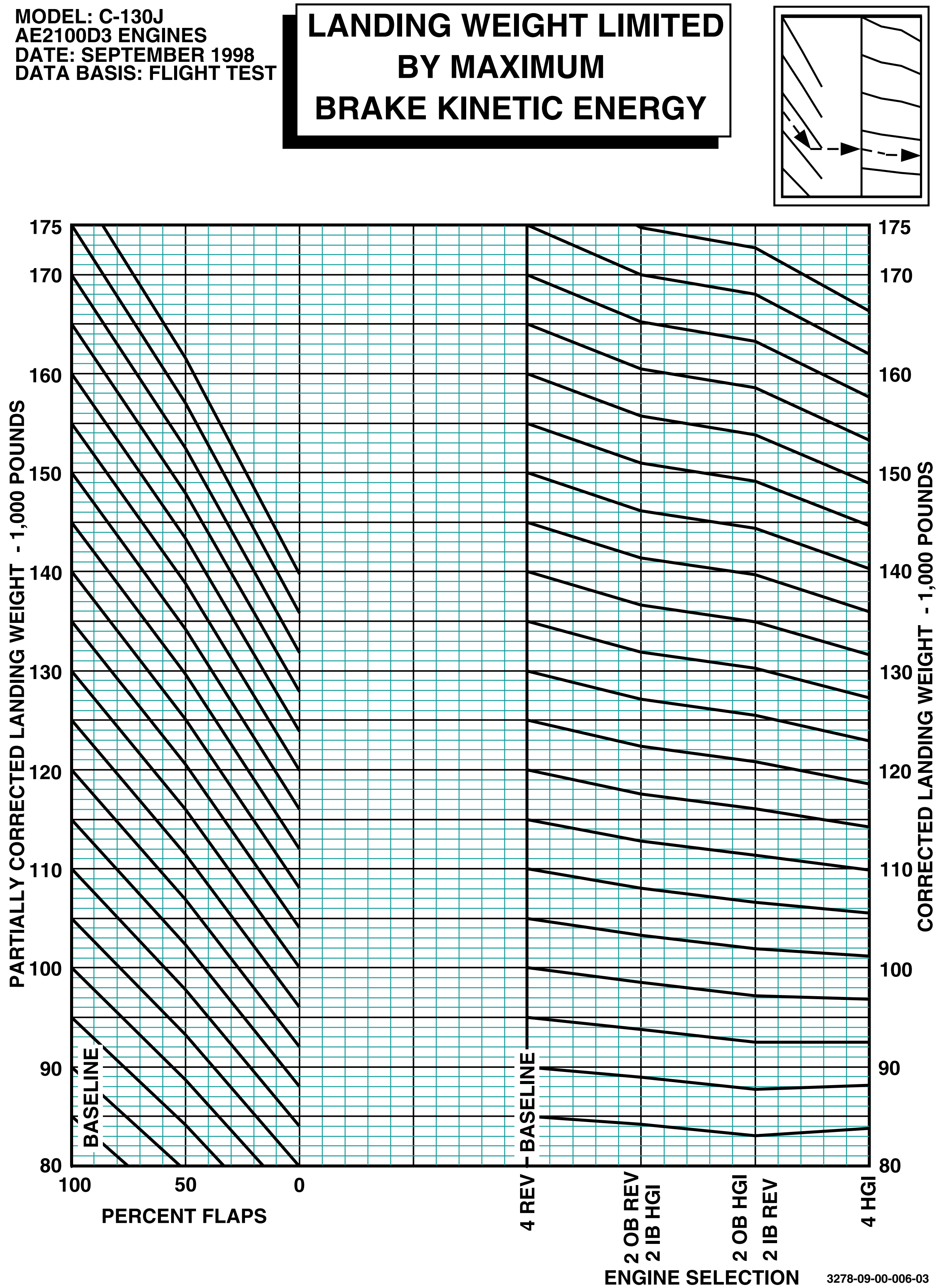

Figure 9-6. (Sheet 3 of 3)

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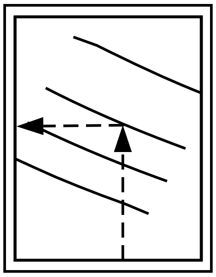
MAXIMUM SPEED FOR TRANSITION FROM FLIGHT IDLE TO HIGH SPEED GROUND IDLE

ALL FLAP SETTINGS



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

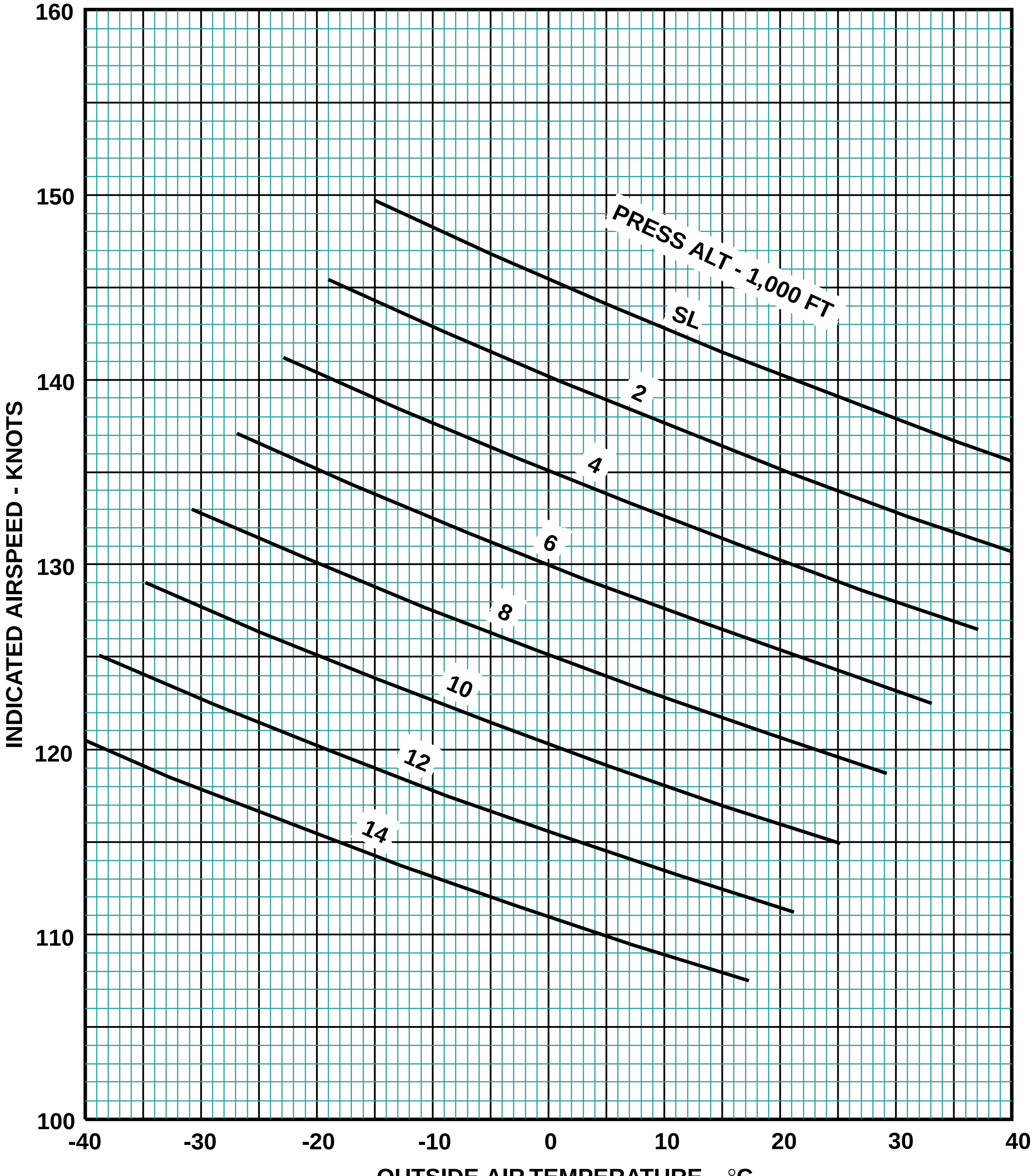


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Figure 9-7.

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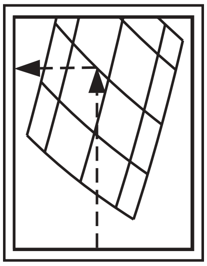
MAXIMUM LANDING WEIGHT PERMITTED BY POWER LEVER TRANSITION LIMITS



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

100 PERCENT FLAPS

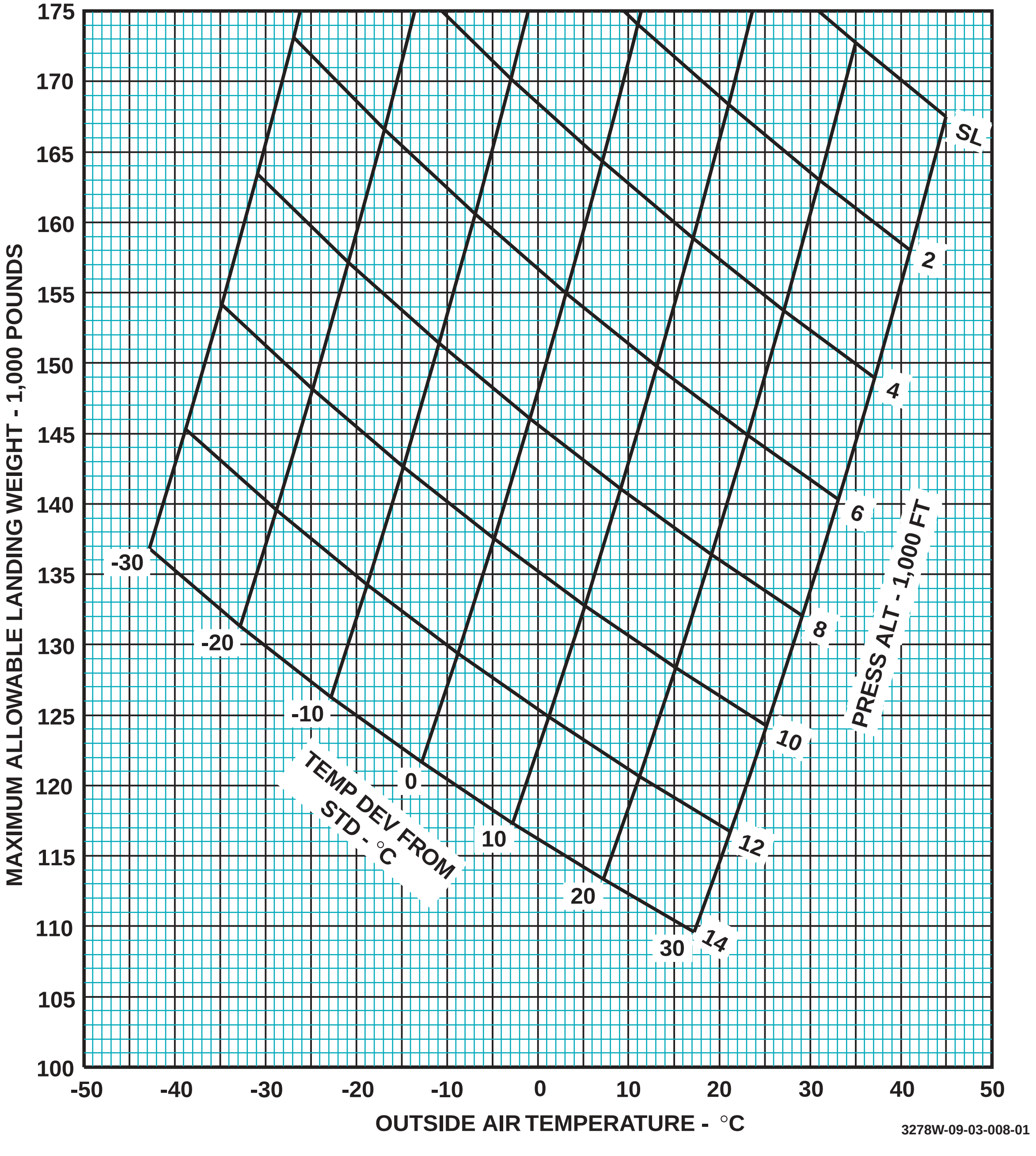
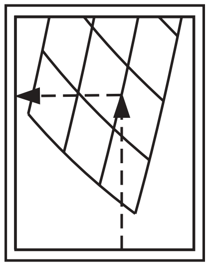


Figure 9-8. (Sheet 1 of 2)

MAXIMUM LANDING WEIGHT PERMITTED BY POWER LEVER TRANSITION LIMITS

100% FLAPS



MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

MAXIMUM EFFORT

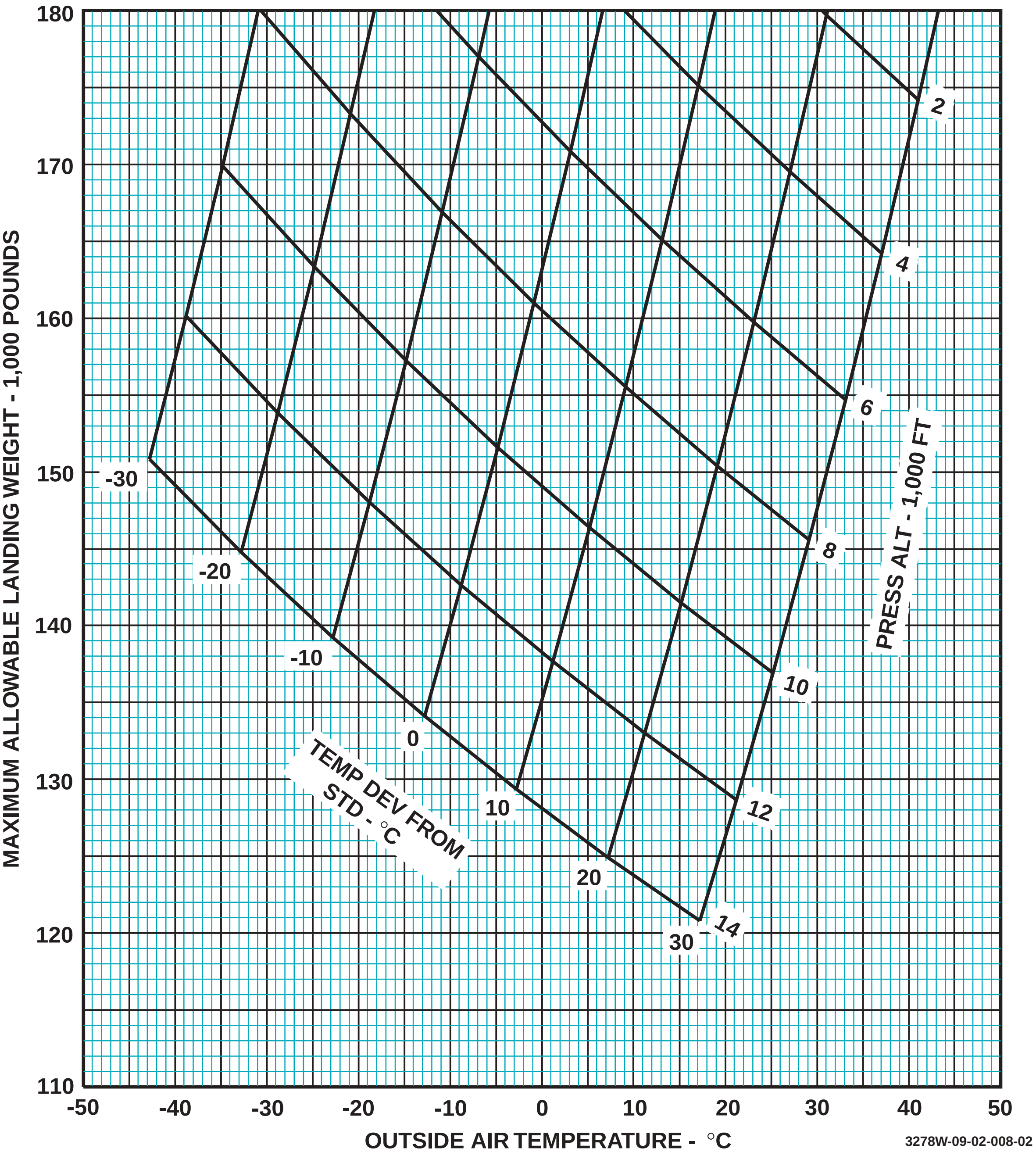


Figure 9-8. (Sheet 2 of 2)

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MAXIMUM LANDING WEIGHT PERMITTED BY POWER LEVER TRANSITION LIMITS

50% FLAPS

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

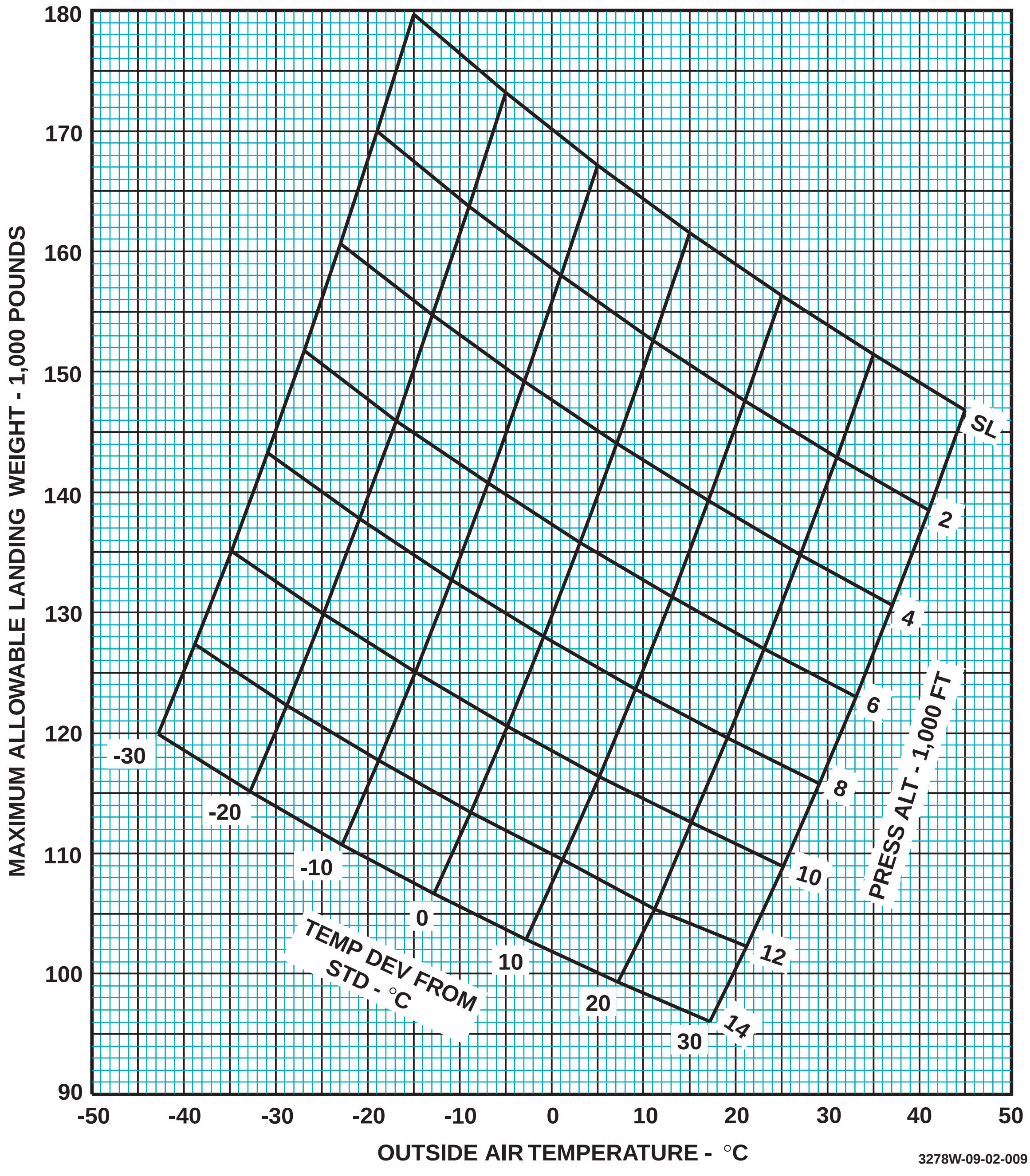

Figure 9-9.

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MAXIMUM LANDING WEIGHT PERMITTED BY POWER LEVER TRANSITION LIMITS

FLAPS UP

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1998
DATA BASIS: FLIGHT TEST

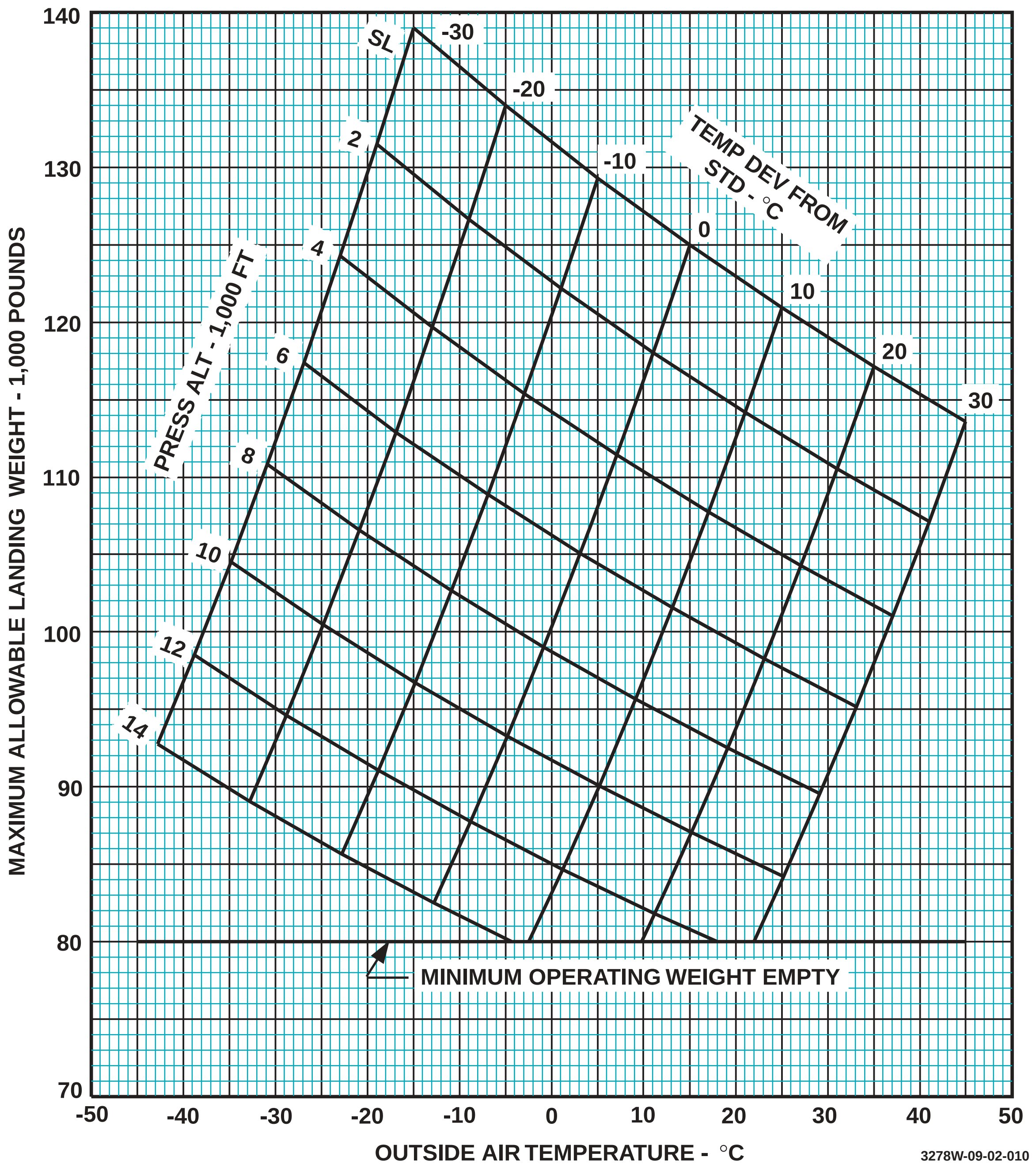

Figure 9-10.

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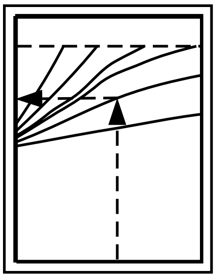
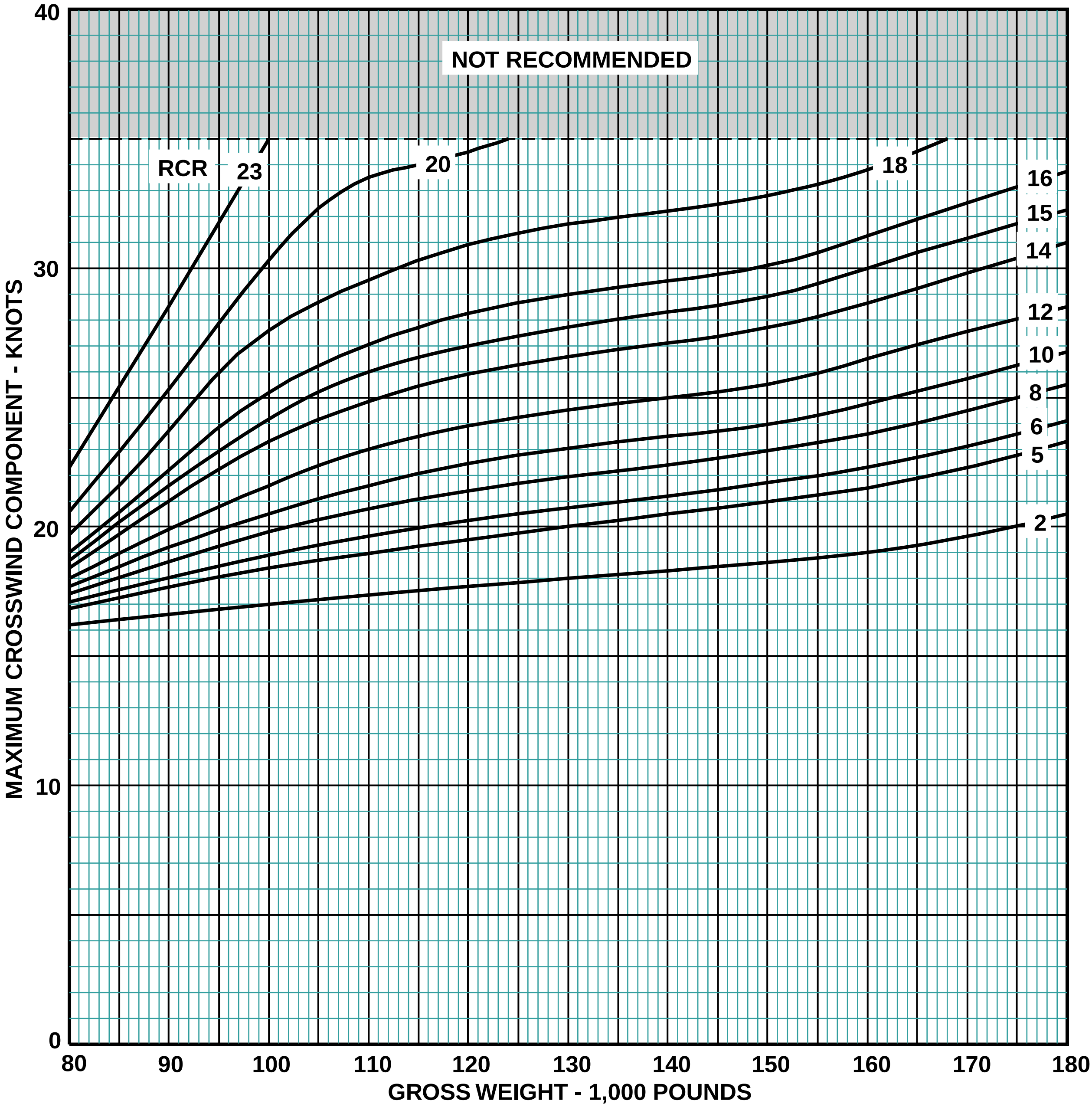
MAXIMUM RECOMMENDED CROSSWIND FOR LANDING

MODEL: C-130J
AE2100D3 ENGINES
DATE: SEPTEMBER 1999
DATA BASIS: FLIGHT TEST





3278-09-00-011

Figure 9-11.

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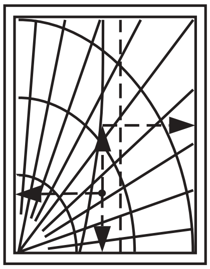
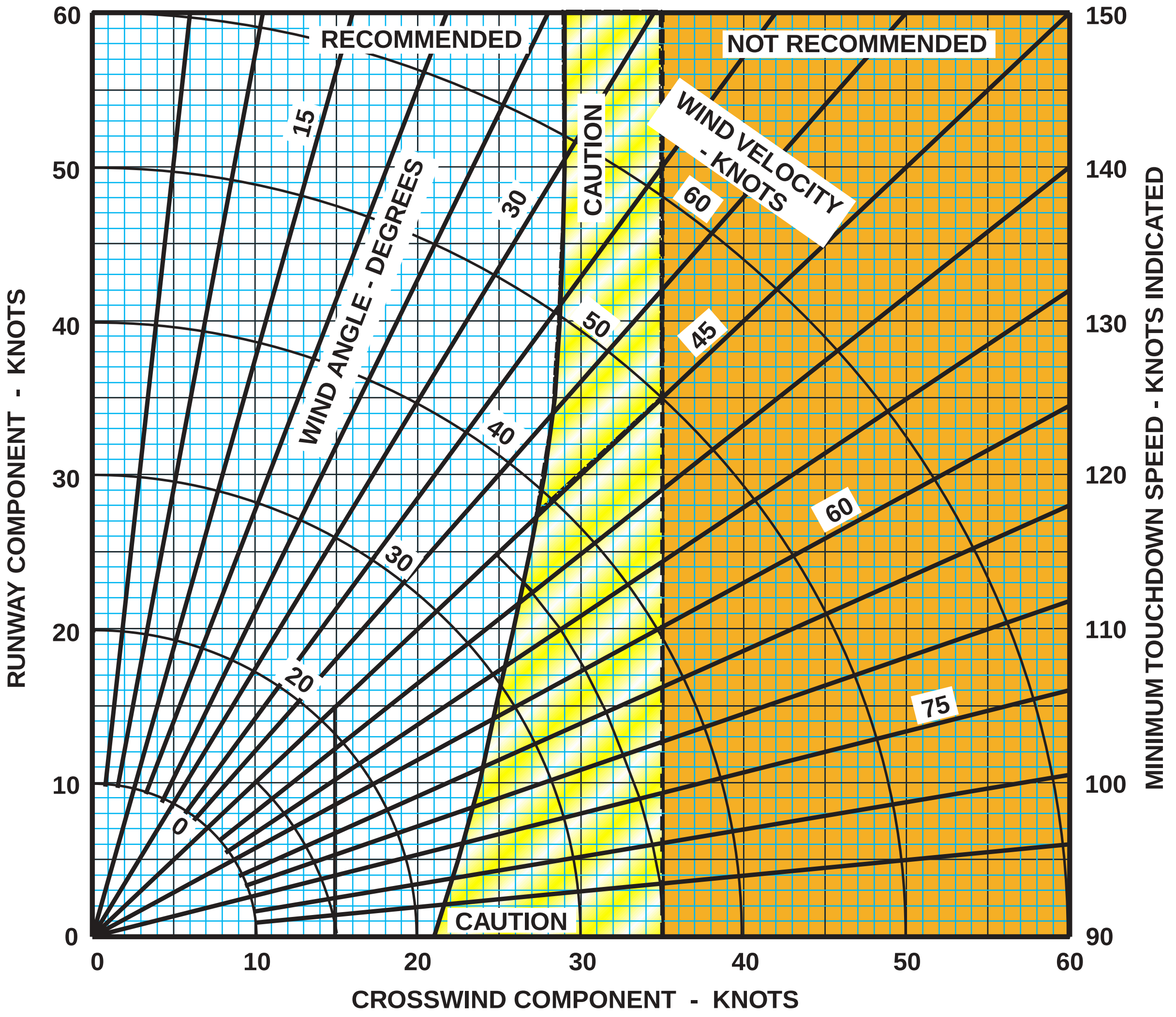
MODEL: C-130J
AE2100D3 ENGINES
DATE: MARCH 1998
DATA BASIS: FLIGHT TEST

CROSSWIND CHART
LANDING



NOTE

THE MAXIMUM ALLOWABLE INCREASE IN TOUCHDOWN SPEED IS 10 KNOTS. RECOMPUTE LANDING GROUND ROLL WHEN TOUCHDOWN SPEED IS INCREASED.



3278-09-01-012

Figure 9-12.

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SECTION 10
MISSION PLANNING

TABLE OF CONTENTS

CONTENTS Page

LIST OF CHARTS

Figure Number Title Page

INTRODUCTION.

The importance of adequate planning to the successful performance of any mission is well known. Section 10 is intended to demonstrate the proper use of the charts and the procedures to be followed in mission planning. Figure 10-1 through figure 10-10 are examples of work sheets used to obtain takeoff and landing data (TOLD) from this manual. TOLD work sheets are provided for normal, nonstandard, and maximum effort operations. Figure 10-11 is an example of a takeoff and landing data card. These forms are meant to be copied and filled out by the flight crew as an aid in mission planning and as a quick reference for information that may be required for critical phases of the flight. For CNI-MU TOLD verification, procedures are provided using the minimum number of charts from this manual that are necessary to cross check and verify the CNI-MU TOLD.

It should be the responsibility of the users to become thoroughly familiar with this section and with the examples throughout the manual so that mission planning may be accomplished quickly and accurately. Familiarization with Section 10 and the examples will aid in coping with emergency situations.

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CNI-MU TOLD VERIFICATION.

The CNI-MU can produce TOLD for conditions that are outside the range of the CMM.1C-130J-1CL-1 performance tab data. For the following situations data from this manual is used to verify CNI-MU TOLD:

- Takeoff or Landing RCR < 12
- Takeoff RSC > 0
- Pressure Altitude > 6000 feet
- Temperature < 0 °C or > 30 °C
- V_R or Touchdown (TD) speed is increased for wind gust increment
- Crosswind component > 24 knots for takeoff (or 21 knots for landing), and the value for V_R (or TD) plus the gust increment falls in the caution area of the respective crosswind chart and is increased
- Tailwind > 10 knots up to 13 knots
- Runway Slope > 1%
- CNI-MU value for CFL < runway available, but tab data refusal distance > runway available
- Climb-out flight path obstacles *
- Takeoff Weight < 100,000 lb
- Takeoff or Landing Weight > 155,000 lb
- Landing Weight < 90,000 lb
- Takeoff with All Bleed
- Maximum Effort Takeoff
- Landing with 50% Flaps or 0% Flaps

  * Use the TOLD work sheets to determine TOLD with climb-out flight path obstacles.

Check the Crosswind Charts, figure 3-11 and figure 9-12, and charts for Maximum Recommended Crosswind, figure 3-12 and figure 9-11, to determine if it is necessary to restrict takeoff power to 2500 TMSHP when less than 35 KIAS and determine the maximum recommended crosswind for takeoff or landing.

The CNI-MU normal TOLD is validated by cross checking only the data items that are critical for flight safety. When the critical CNI-MU TOLD data are verified the remainder of the CNI-MU normal TOLD may also be used.

The following CMM.1C-130J-1-1 charts and tolerances (when applicable) are used to cross check critical CNI-MU normal takeoff data:

Figure 3-8 or Figure 3-9	Take-off Factor (required to obtain other data)	
Figure 3-17	Rotation speed (V_R)	±2 KIAS
Figure 3-17	Obstacle clearance speed (V_{OBS})	±2 KIAS
Figure 3-11	Crosswind Chart (required to obtain other data)	
Figure 3-12	Maximum Recommended Crosswind For Take-off	
Figure 3-13	Critical Field Length (CFL)	±200 feet

The following CMM.1C-130J-1-1 charts and tolerances (when applicable) are used to cross check critical CNI-MU normal landing data:

Figure 9-1 or 9-2	Touchdown speed (TD)	±2 KIAS
Figure 9-12	Crosswind Chart (required to obtain other data)	
Figure 9-11	Maximum Recommended Crosswind For Landing	
Figure 1-4 (Sheet 2)	Temp Dev From Std (required to obtain other data)	

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Figure 9-4	Landing distance over a 50 foot obstacle (50 FT LDG)	±300 feet

The following CMM.1C-130J-1-1 charts are necessary when V_R or TD is increased for wind gust increment or crosswind:

Figure 3-11 or 9-12	Crosswind Chart
Figure 3-12 or 9-11	Maximum Recommended Crosswind
Figure 3-13 (Sheet 4)	Critical Field Length Corrected For Increased Rotation Speed

NOTE

If it is desired to obtain refusal distance where $V_{REF} = V_R$ for conditions outside of the CMM.1C-130J-1CL-1 tab data, set $V_{REF} = V_R$ and backtrack CMM.1C-130J-1-1, figure 3-14, Refusal Speed and Critical Engine Failure Speed, taking all applicable corrections for refusal speed.

NOTE

The following procedures for CNI-MU TOLD verification assume normal operation of the CNI-MU. If data does not appear on the CNI-MU takeoff and landing data pages, data are out of bounds, or tolerances are not met, see the section below on troubleshooting use of the CNI-MU TOLD function.

CNI-MU NORMAL TAKEOFF DATA VERIFICATION.

Check the following before proceeding with verification:

- Inputs on the CNI-MU TOLD INIT Pages are correct.
- CNI-MU gross weight is correct.
- Crosswind component is ≤ maximum recommended crosswind for takeoff.
- Is a 2500 TMSHP restriction below 35 KIAS required?

Verification:

1. Determine if the CNI-MU increases V_R for wind gust increment or crosswind component:
   a. Temporarily set wind to zero (no wind condition) and obtain the CNI-MU value for V_R.
   b. Note any increase in the CNI-MU value for V_R (ΔV_R). (This value is used in Step 3.)
   c. Restore the current wind direction, velocity and gusts in the CNI-MU, ensuring all TOLD INIT is correct and complete.
2. Check the differences between data from the CNI-MU and CMM.1C-130J-1-1. Obtain V_R, V_{OBS}, and CFL from both sources.

   NOTE

   When obtaining data from CMM.1C-130J-1-1 apply the following:

   - Use gust increment and figure 3-11 to increase V_R and V_{OBS} (not more than 10 knots) if required. (If further guidance is desired, refer to the Normal Take-Off Work Sheet Steps 7 and 16.)
   - When obtaining CFL from figure 3-13, use the value for CFL obtained from sheet 3 of 4. (Do not use sheet 4 of 4 at this time.)
   - If a 2500 TMSHP restriction is necessary, add 200 feet to CFL. (The CNI-MU automatically makes this correction when necessary.)

   Check the differences as follows:

   a. Check V_R is within ±2 KIAS.
   b. Check V_{OBS} is within ±2 KIAS.
   c. Check CFL is within ±200 feet.
3. Determine CFL as follows:
   a. If V_R is not increased in Step 1, use the CNI-MU value for CFL and proceed to Step 4.
   b. If V_R is increased 10 knots or less in Step 1, use figure 3-13, sheet 4 of 4, and enter with the noted ΔV_R and the CNI-MU value for CFL. Obtain the

value for CFL for increased V_R and proceed to Step 4.

4. If the conditions in Step 2 are met, use the value for CFL determined in Step 3 and proceed as follows:

   a. Check CNI-MU displays BE WT = WT.

   b. Operator requirements may necessitate additional distance for takeoff. Determine the sum of the value for CFL from Step 3 and any additional distance that is necessary.

   c. Check the takeoff distance required from Step 4b ≤ runway available.

5. If the conditions in Steps 2 and 4 are met, proceed as follows:

   a. The runway available is acceptable for takeoff.

   b. The data on the CNI-MU Takeoff Data pages may be used for takeoff under the specific conditions.

   c. CNI-MU takeoff data verification for the conditions is complete; skip the remaining steps.

6. If conditions in Step 2 or 4 are not met, proceed to Alternatives.

Alternatives:

- If the conditions in Verification Step 2 or 3 are not met, see the section below on troubleshooting use of the CNI-MU TOLD.
- If in Step 4 the CNI-MU BE WT limit < WT, the aircraft is too heavy for the conditions.
- If the takeoff distance required by Verification Step 4b > runway available, the aircraft is too heavy for the conditions.

CNI-MU NORMAL LANDING DATA VERIFICATION.

Check the following before proceeding with verification:

- Inputs on the CNI-MU TOLD INIT Pages are correct.
- CNI-MU gross weight is correct.
- Crosswind component is ≤ Maximum Recommended Crosswind For Landing.

Verification:

1. Check the differences between data from the CNI-MU and CMM.1C-130J-1-1. For the intended flap setting, obtain Touchdown Speed (TD) and the 50 FT LDG distance from both sources.

NOTE

When obtaining data from CMM.1C-130J-1-1 apply the following:

- Use gust increment and figure 9-12 to increase TD (not more than 10 knots) if required. (If further guidance is desired, refer to the Normal Landing Work Sheet Step 6.)
- When obtaining the value for 50 FT LDG distance for the intended flap setting use the correction grid for increased TD if necessary.

Check the differences as follows:

   a. Check TD is within ±2 KIAS.

   b. Check 50 FT LDG distance for the intended flap setting is within ±300 feet.

2. If the conditions in Step 1 are met, proceed as follows:

   a. Check CNI-MU displays BE WT = WT.

   b. Operator requirements may necessitate additional distance for landing. Determine the sum of the CNI-MU value for 50 FT LDG distance for the intended flap setting and any additional distance that is necessary.

   c. Check the landing distance required from Step 2b ≤ runway available.

3. If the conditions in Steps 1 and 2 are met, proceed as follows:

   a. The runway available is acceptable for landing.

   b. The data on the CNI-MU Landing Data pages may be used for landing under the specific conditions.

   c. CNI-MU landing data verification for the conditions is complete; skip the remaining steps.

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4. If conditions in Step 1 or 2 are not met, proceed to Alternatives.

Alternatives:

- If the conditions in Verification Step 1 are not met, see the section below on troubleshooting use of the CNI-MU TOLD.
- If CNI-MU BE WT limit < WT, consider an alternate runway or gross weight reduction.
- If the landing distance required by Verification Step 2b > runway available, the aircraft is too heavy for the conditions; consider an alternate runway, gross weight reduction, or maximum alternate landing weight.

TROUBLESHOOTING USE OF THE CNI-MU TOLD FUNCTION.

1. Most problems stem from incorrect entry data on the TOLD INIT pages. Check inputs on the TOLD INIT Pages are correct.
2. Check gross weight on the CNI-MU is correct.
3. Check if CNI-MU BE WT < WT. If so consider an alternate runway or gross weight reduction.
4. If the verification tolerances between the CNI-MU and CMM.1C-130J-1-1 data cannot be met, use the appropriate TOLD work sheet in this section to obtain the data.
5. For takeoff data, due to constraints on the method of calculation, in many situations the CNI-MU will not display data for MIN ACCEL CHECK TIME. This is normal, and, for the conditions, when critical CNI-MU TOLD is verified the remainder of the CNI-MU TOLD may be used. When not available in the CNI-MU, CMM.1C-130J-1-1 may be used to obtain minimum acceleration check time.
6. For takeoff data, when runway available is greater than Critical Field Length (CFL), the CNI-MU will set Refusal Speed (V_{REF}) equal to Takeoff Speed (V T/O). As the runway becomes shorter, the CNI-MU will display V_{REF} between Rotation Speed (V_R) and V T/O, and eventually, when approaching the CFL limit for normal operations, it will display V_{REF} less than V_R. This is normal operation for the CNI-MU, and conforms with CMM.1C-130J-1-1. In operations where field length is of concern, Refusal Speed (V_{REF}) greater than V_R should be set equal to V_R (not V T/O) because the time delay to rotate the aircraft back to the ground after V_R is not considered.

CNI-MU MAXIMUM EFFORT TOLD VERIFICATION.

The CNI-MU Maximum Effort (Max Effort) TOLD is validated by cross checking only the data items that are critical for flight safety. When the critical CNI-MU Max Effort TOLD data is verified the remainder of the CNI-MU Max Effort TOLD may also be used.

Check the Crosswind Chart, figure 3-11, and charts for Maximum Recommended Crosswind, figure 3-12 and figure 9-11, to determine if it is necessary to restrict takeoff power to 2500 TMSHP when less than 35 KIAS and determine the maximum recommended crosswind for takeoff or landing.

The following CMM.1C-130J-1-1 charts and tolerances (when applicable) are used to cross check critical CNI-MU Max Effort takeoff data:

Figure 3-8 or Figure 3-9	Take-off Factor (required to obtain other data)	
Figure 3-18	Max Effort Rotation speed (V_R)	±2 KIAS
Figure 3-18	Max Effort Obstacle clearance speed (V_{OBS})	±2 KIAS
Figure 3-11	Crosswind Chart (required to obtain other data)	
Figure 3-12	Maximum Recommended Crosswind For Take-off	

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Figure 3-32	Minimum Field Length For Max Effort Take-off (MFLMETO)	±200 feet
Figure 3-33	Take-off Distance Max Effort	±200 feet
Figure 3-14	Refusal Speed and Critical Engine Failure Speed	

The following CMM.1C-130J-1-1 charts and tolerances (when applicable) are used to cross check critical CNI-MU maximum effort landing data:

Figure 9-1 (Sheet 2)	Max Effort Touchdown Speed (Max Effort TD)	±2 KIAS
Figure 9-12	Crosswind Chart (required to obtain other data)	
Figure 9-11	Maximum Recommended Crosswind For Landing	
Figure 1-4 (Sheet 2)	Temp Dev From Std (required to obtain other data)	
Figure 9-5	Max Effort Landing Ground Roll (MAX GND ROLL)	±300 feet

The following CMM.1C-130J-1-1 charts are necessary when Max Effort V_R or Max Effort TD is increased for wind gust increment or crosswind:

Figure 3-11 or 9-12	Crosswind Chart
Figure 3-12 or 9-11	Maximum Recommended Crosswind
Figure 3-32 (Sheet 4)	MFLMETO Corrected For Increased Rotation Speed

NOTE

The following procedures for CNI-MU TOLD verification assume normal operation of the CNI-MU. If data does not appear on the CNI-MU takeoff and landing data pages, data are out of bounds, or tolerances are not met, see the section below on troubleshooting use of the CNI-MU TOLD function.

CNI-MU MAX EFFORT TAKEOFF DATA VERIFICATION.

NOTE

The following verification procedure is based on using MFLMETO as the required distance.

Check the following before proceeding with verification:

- Inputs on the CNI-MU TOLD INIT Pages are correct and MAX is selected.
- CNI-MU gross weight is correct.
- Crosswind component is ≤ Maximum Recommended Crosswind For Takeoff.
- Is a 2500 TMSHP restriction below 35 KIAS required?

Verification:

1. Determine if the CNI-MU increases Max Effort V_R for wind gust increment or crosswind component:
   a. Temporarily set wind to zero (no wind condition) and note the CNI-MU value for Max Effort V_R.
   b. Note any increase in the CNI-MU value for Max Effort V_R (Δ Max Effort V_R). (Value used in Step 3.)
   c. Restore the current wind direction, velocity and gusts in the CNI-MU, ensuring all TOLD INIT is correct and complete.
2. Check the differences between data from the CNI-MU and CMM.1C-130J-1-1. Obtain Max Effort V_R, Max Effort V_{OBS}, and MFLMETO from both sources.

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NOTE

When obtaining data from CMM.1C-130J-1-1 apply the following:

- Use gust increment and figure 3-11 to increase Max Effort V_R and Max Effort V_{OBS} (not more than 10 knots) if required. (If further guidance is desired, refer to the Maximum Effort Take-Off Work Sheet Steps 7 and 11.)
- When obtaining MFLMETO from figure 3-32, use the value for MFLMETO obtained from sheet 3 of 4. (Do not use sheet 4 of 4 at this time.)
- If a 2500 TMSHP restriction is necessary, add 200 feet to MFLMETO. (The CNI-MU automatically makes this correction when necessary.)

Check the differences as follows:

a. Check Max Effort V_R is within ±2 KIAS.

b. Check Max Effort V_{OBS} is within ±2 KIAS.

c. Check MFLMETO is within ±200 feet.

3. Determine MFLMETO as follows:

a. If Max Effort V_R is not increased in Step 1, use the CNI-MU value for MFLMETO and proceed to Step 4.

b. If Max Effort V_R is increased 10 knots or less in Step 1, use figure 3-32, sheet 4 of 4, and enter with the noted Max Effort ΔV_R and the CNI-MU value for MFLMETO. Obtain the value for MFLMETO for increased Max Effort V_R and proceed to Step 4.

4. If the conditions in Step 2 are met, proceed as follows:

a. Check CNI-MU displays BE WT = WT.

b. Operator requirements may necessitate Max Effort $V_R \geq V_{MCA}$ (use CNI-MU V_{MCA}, INGND). If necessary to increase Max Effort V_R to equal V_{MCA}, note the required increment and complete Steps 4c, 4d and 4e. If it is not necessary to increase Max Effort V_R for V_{MCA} skip Steps 4c and 4d and proceed to Step 4e.

c. If Max Effort V_R is increased for V_{MCA} increase the CNI-MU value for Max Effort V_{OBS} (from Step 2) by the same increment noted in Step 4b.

d. If the total increase in Max Effort V_R over the value from Step 1a is ≤ 10 KIAS, use figure 3-32, sheet 4 of 4, to determine MFLMETO.

If the total increase in Max Effort V_R over the value from Step 1a is > 10 KIAS, set V_{REF} = Max Effort V_R = V_{MCA} and backtrack, figure 3-14, Refusal Speed and Critical Engine Failure Speed. Take all applicable corrections for refusal speed to obtain MFLMETO.

e. Check MFLMETO from Step 3 (or MFLMETO increased for V_{MCA} from Step 4d) ≤ runway available.

5. If the conditions in Steps 2 and 4 are met, proceed as follows:

a. The runway available is acceptable for takeoff.

b. The data on the CNI-MU Takeoff Data pages may be used for takeoff under the specific conditions.

c. CNI-MU takeoff data verification for the conditions is complete; skip the remaining steps.

6. If conditions in Step 2 or 4 are not met, proceed to Alternatives.

Alternatives:

- If the conditions in Verification Step 2 or 4 are not met, see the section below on troubleshooting use of the CNI-MU TOLD.
- If in Step 4 the CNI-MU BE WT limit < WT, the aircraft is too heavy for the conditions.
- If the takeoff distance required by Verification Step 4b > runway available, the aircraft is too heavy for the conditions.

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CNI-MU MAX EFFORT LANDING DATA VERIFICATION.

Check the following before proceeding with verification:

- Inputs on the CNI-MU TOLD INIT Pages are correct.
- CNI-MU gross weight is correct.
- Crosswind component is ≤ Maximum Recommended Crosswind For Landing.

Verification:

1. Check the differences between data from the CNI-MU and CMM.1C-130J-1-1. Obtain Max Effort Touchdown Speed (MAX TD) and Max Effort Landing Ground Roll (MAX GND ROLL) distance from both sources.

NOTE

When obtaining data from CMM.1C-130J-1-1 apply the following:

- Use gust increment and figure 9-12 to increase MAX TD (not more than 10 knots) if required. (If further guidance is desired, refer to the Max Effort Landing Work Sheet, Step 6.)
- When obtaining the value for MAX GND ROLL distance use the correction grid for increased MAX TD if necessary.

Check the differences as follows:

a. Check MAX TD is within ±2 KIAS.

b. Check MAX GND ROLL distance is within ±300 feet.

2. If the conditions in Step 1 are met, proceed as follows:

a. Check CNI-MU displays BE WT = WT.

b. Operator requirements may necessatate additional distance for landing. Determine the sum of the CNI-MU value for MAX GND ROLL distance and any additional distance that is necessary.

c. Check the landing distance required from Step 2b ≤ runway available.

3. If the conditions in Steps 1 and 2 are met, proceed as follows:

a. The runway available is acceptable for landing.

b. The data on the CNI-MU Landing Data pages may be used for landing under the specific conditions.

c. CNI-MU landing data verification for the conditions is complete; skip the remaining steps.

4. If conditions in Step 1 or 2, are not met, proceed to Alternatives.

Alternatives:

- If the conditions in Verification Step 1 are not met, see the section below on troubleshooting use of the CNI-MU TOLD.
- If CNI-MU BE WT limit < WT, consider an alternate runway or gross weight reduction.
- If the landing distance required by Verification, Step 2b > runway available, the aircraft is too heavy for the conditions; consider an alternate runway, gross weight reduction, or maximum alternate landing weight.

TROUBLESHOOTING USE OF THE CNI-MU TOLD FUNCTION.

1. Most problems stem from incorrect entry data on the TOLD INIT pages. Check that inputs on the TOLD INIT pages are correct.
2. Check gross weight on the CNI-MU is correct.
3. Check if CNI-MU BE WT < WT. If so, consider an alternate runway or gross weight reduction.
4. If the verification tolerances between the CNI-MU and CMM.1C- 130J-1-1 data cannot be met, use the appropriate TOLD work sheet in this section to obtain the data.
5. For takeoff data, due to constraints on the method of calculation, in many situations the CNI-MU will not display data for MIN ACCEL CHECK TIME. This is normal, and, for the conditions,

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when critical CNI-MU TOLD is verified the remainder of the CNI-MU TOLD may be used. When not available in the CNI-MU, use CMM.1C-130J-1-1 to obtain minimum acceleration check time.

6. For takeoff data, when runway available is greater than Critical Field Length (CFL), the CNI-MU will set Refusal Speed (V_{REF}) equal to Takeoff Speed (V T/O). As the runway becomes shorter, the CNI-MU will display V_{REF} between Rotation Speed (V_R) and V T/O, and eventually, when approaching the CFL limit for normal operations and for field lengths shorter than CFL, it will display V_{REF} less than V_R. This is normal operation for the CNI-MU and conforms with CMM.1C-130J-1-1.

PLANNING A TYPICAL MISSION.

The discussion that follows is based on a typical mission with performance computed for a routine situation in which no emergencies arise. When emergencies arise, it is necessary to determine the best course of action for the existing circumstances. If the airplane performance is affected, revised performance computations may be necessary to determine the course of action.

MISSION REQUIREMENTS.

The mission to be flown with an operating weight of 84,000 pounds is assumed to be a distance of 2,145 miles from departure to destination airfield. High terrain around the departure airfield requires a three-engine rate of climb capability of 750 feet per minute. Takeoff gross weight limit will be determined by the three-engine climb capability. Allowable cargo will include passengers without supplemental oxygen equipment. Cruise will be at a constant true airspeed of 280 knots at a cruise altitude not to exceed 24,000 feet. The departure airfield is assumed to have a runway length of 8,000 feet and a pressure altitude of 3,000 feet. The destination airfield is assumed to have a length of 8,000 feet and a pressure altitude of sea level. The airplane drag index is zero.

WEATHER, TEMPERATURE, AND WIND CONDITIONS.

The following conditions are predicted for the mission:

OAT:

At departure airfield: 35 °C

Enroute: ISA + 10 °C

At destination airfield: 25 °C

Reported Winds:

At departure airfield: 20-knot headwind

Enroute factor: Zero

At destination airfield: Calm

TAKEOFF WEIGHT.

First determine from figure 3-6 that the horsepower required for takeoff is 4,075 HP. Obtain a takeoff factor of 2.85 from figure 3-8. Using the takeoff factor of 2.85 and a three-engine climb rate of 750 feet per minute, determine the gross weight limit from the Take-off Gross Weight Limited by Three-Engine Climb Performance chart (figure 3-10) to be 135,000 pounds. Figure 3-13 shows a critical field length of 4,100 feet. Figure 3-14 shows the refusal speed to be 138 KIAS. From a performance standpoint there is no limiting factor to takeoff gross weight other than the limit for three-engine climb performance which was established as 135,000 pounds.

CLIMB.

The start climb weight is the takeoff gross weight less 705 pounds allowed for taxi, run up, and takeoff fuel. Therefore, the start climb weight is 134,295 pounds. The time and fuel to climb from the field elevation (3,000 feet pressure altitude) to the cruise ceiling of 24,000 feet are:

Time: 24.5 minutes (figure 4-2, sheet 1 and sheet 2).

Fuel to climb: 2,050 (figure 4-3, sheet 1 and sheet 2).

Distance to climb: 85 nautical miles (figure 4-4, sheet 1 and sheet 2).

The climb speeds will be computed using figure 4-1; initial speed is 162.5 KIAS.

The end of climb, begin cruise weight is 134,295 pounds less 2,050 pounds, or 132,245 pounds.

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CRUISE.

Since passengers without supplemental oxygen will be aboard, the cruise altitude will remain 24,000 feet throughout the mission. Cruise fuel is computed at that altitude from the end of climb to a point over the destination airfield.

Begin cruise weight: 132,245 pounds (from climb calculations)

Distance to cruise: 2,060 miles (total distance less climb distance)

From the Range Summary Chart for 280 KTAS Cruise (figure 5-84), obtain the start of cruise fuel flow of 910 pounds per hour per engine or 3,640 pounds per hour. Divide the cruise distance (2,060 miles) by the cruise TAS (280 knots) to find a cruise time of 7.36 hours. Multiply total fuel flow (3,640 pounds/hour) × cruise time (7.36 hours) to find an approximate fuel for cruise of 26,790 pounds. This figure will be higher than actual fuel required since power will be reduced as gross weight decreases. An approximate end of cruise gross weight is found by subtracting fuel for cruise (26,790 pounds) from begin cruise gross weight (132,245 pounds) to be 105,455 pounds. Now find the fuel flow for the approximate end of cruise weight from figure 5-84 to be 3,280 pounds per hour. The average fuel flow is then found as follows:

Average fuel flow =

(begin fuel flow + end fuel flow) ÷ 2 = (3,640 + 3,280) ÷ 2

Average fuel flow = 3,460 pounds per hour

Actual fuel consumed during cruise is then found as follows:

Cruise fuel =

Average fuel flow × cruise time = 3,460 × 7.36

Cruise fuel = 25,466 pounds

Calculated end cruise gross weight is now found to be 106,779 pounds.

Cruise power would be adjusted to maintain a constant 280 KTAS cruise speed using data computed from the range summary charts for 280 KTAS.

LANDING.

Landing weight (end cruise weight): 106,779 pounds

Planned from 50 feet at 100 percent flaps

Normal approach speed (figure 9-1 and figure 9-2):

123.0 KIAS (100 percent flaps)

132 KIAS (50 percent flaps)

Threshold speed (figure 9-1):

113 KIAS (100 percent flaps)

Touchdown speed (figure 9-1):

107 KIAS (100 percent flaps)

Landing distance over 50-foot obstacle (figure 9-4):

2,800 feet (100 percent flaps, no wind)

DESCENT.

For the cruise fuel calculations, cruise was assumed to a point over the destination. A small amount of fuel may be conserved if descent is planned so as to reach the traffic pattern altitude at the destination, conditions permitting. Penetration descent is used if it is desired to conserve the maximum amount of fuel. End cruise altitude is 24,000 feet. The penetration descent data are shown in Section 8.

NOTE

> It is not important to know the exact weight at the beginning of descent. Therefore, the end cruise weight of 106,779 pounds may be used.

Time to descend (figure 8-2):

9.5 minutes

Distance to descend (figure 8-4):

40 nautical miles

Fuel for descent (figure 8-3):

220 pounds

Descent speed (figure 8-1):

151 KIAS to 20,000 feet

250 KIAS 20,000 feet and below

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ENDURANCE.

Upon arrival at the destination, assume that it is necessary to hold for an hour prior to landing. Also assume that holding will be at 10,000 feet at maximum endurance. The gross weight is determined to be 106,779 pounds under the cruise discussion.

Airspeed (figure 6-2):

144 KIAS

Fuel flow (figure 6-3):

3,080 pounds/hour

Fuel required:

$3{,}080 \times 1 = 3{,}080$ pounds

RESERVE FUEL.

The reserve fuel allowance is assumed to be 1 hour cruise at long-range cruise at the end of the cruise ceiling, plus 1.75 hours at maximum endurance at 10,000 feet. The assumption will also be made that the 1 hour at cruise will be calculated beginning with the calculated end cruise weight of 106,779 pounds, and that the endurance fuel is calculated beginning with the weight at the end of the 1-hour cruise.

Weight at beginning of 1-hour cruise: 106,779 pounds

Fuel required for this 1-hour cruise period may be found by using the specific range cruise charts for 24,000 feet (figure 5-15). Enter figure 5-15 and follow the long range cruise guide line until you intersect the 106,779 pound weight line. Reading this figure at the long range cruise point per 106,779 pounds reveals a specific range of 85.3 nautical miles per 1,000 pounds of fuel at 272 KTAS (188 KIAS). The fuel flow is then calculated by dividing the true airspeed by the specific range:

Fuel flow $= 272 \div (85.3 \div 1000)$
$= 3{,}189$ pounds per hour

The fuel for 1 hour cruise at long range cruise is therefore 3,189 pounds.

Weight at begin endurance = 106,779 – 3,189 = 103,590 pounds

Endurance fuel (figure 6-3) = $3{,}080 \times 1.75$ = 5,390

Cruise reserve fuel + endurance fuel = 3,189 + 5,390 = 8,579 pounds.

ALLOWABLE CARGO.

Operating weight = 84,000 pounds

Allowable cargo = takeoff weight – (taxi, runup, and takeoff fuel + climb fuel + cruise fuel + reserve fuel) – operating weight

Allowable cargo = 135,000 – (705 + 2,050 + 25,466 + 8,579) – 84,000

Allowable cargo = 14,200 pounds

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NORMAL TAKE-OFF WORK SHEET

1. Conditions

Field Elevation .... _______________ feet
Altimeter Setting .... _______________ in Hg
Pressure Altitude (PA) (Fig 1-9)... _______________ feet
Outside Air Temperature (OAT)... _______________ °C
ISA Deviation (Fig 1-4) .... _______________ °C
Runway Heading .... _______________ deg
Runway Available .... _______________ feet

RCR __________ **or** RSC _______ (*Use only one value)*
Slope +_______% **or** -_________% (*Use only one value)*
(uphill) or (downhill)
Wind ________ degrees at _______ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Drag Index ____________________
Normal bleed ____ **or** all bleed ____ (*Check one value)*

2. Take-off Gross Weight

Operating Weight _______ (pounds) + Cargo Weight _______ (pounds) + Fuel On Board (FOB) _______ (pounds) = [ ] Take-off Gross Weight (pounds)

3. Take-off Factor (*Use Figure 3-8 or 3-9 (pp _____or _____)*)

Take-off Factor .... _____________

4. Rotation Speed (V_R) (*Use Figure 3-17 (p_____)*)

Rotation speed (V_R), 50% flaps, normal operation .... _____________ KIAS
Note: Further corrections for V_R may be needed to determine operational V_R.

5. Maximum Recommended Crosswind *(Use Figure 3-12 (p _____))*

Maximum recommended crosswind for take-off .... _____________ knots

6. Crosswind Chart – Wind Components *(Use Figure 3-11 (p _____))*

Headwind component (enter chart with steady wind value)................ _____________ knots
Crosswind component * (enter chart with steady wind value plus the gust increment) .... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

* *The maximum recommended crosswind is the lower of 35 knots or the value from Step 5.*

7. Wind Adjustment Increment for V_R (ΔV_R for wind) *(Use Figure 3-11 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 7b.
If yes, the increment to increase V_R for wind gust equals the value for wind gust increment. Enter Wind Gust Increment from Step 1† .... ___________ Δ KIAS
(If value entered is 10, skip Step 7b and proceed to Step 7c.)

b. Is V_R plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 7b-3, then proceed to Step 7c.
If yes, proceed as follows:
1. V_R from Step 4 plus value from Step 7a .... ____________ KIAS
2. Obtain Minimum V_R from the Crosswind Chart for the value entered at Step 7b-1 † .... ____________ KIAS
3. Steps 7b-2 minus 7b-1 equals the increment to increase V_R for crosswind † .... ____________ Δ KIAS

c. The sum of the values from Step 7a and Step 7b-3 † (enter zero if none) = __________________ Total ΔV_R for Wind (Δ KIAS)

† *Rotation speed (V_R) may be increased for caution zone crosswind or wind gust increment. The total ΔV_R for wind must* not *exceed 10 knots.*

8. Torquemeter Shaft Horsepower (TMSHP)

(Use Figure 3-11 (p _____)
a. Is a 2,500 TMSHP restriction below 35 KIAS necessary?
If no, check "Unrestricted," then proceed to Step 8b.
If yes, check "Restricted."

☐ Unrestricted
☐ Restricted

(Use Figure 3-6 or 3-7 (pp _____ or _____))
b. Torquemeter shaft horsepower (static setting) required for take-off, 4-engines = [ ] TMSHP

9. Operational Rotation Speed (Operational V_R)

Is ΔV_R for wind from Step 7c > zero?
If no, Operational V_R equals the value for V_R from Step 4; enter the value, then proceed to Step 10.
If yes, Operational V_R equals V_R from Step 4 plus ΔV_R for wind from Step 7c = [ ] Operational V_R (KIAS)

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Figure 10-1. (Sheet 1 of 6)

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NORMAL TAKE-OFF WORK SHEET

10. Critical Field Length (CFL), 4 Engines *(Use Figure 3-13 (p _____))*

Applying Corrections:

1. *Apply all applicable corrections in the CFL chart to determine corrected CFL.*
2. *Final distance corrections for CFL are* not *provided in the CFL Chart.*
3. *When applying corrections for the wind components from Step 6 in the performance data charts, use only 50% of the headwind component or 150% of the tailwind component unless otherwise noted.*
4. *If ΔV_R for Wind from Step 7 is greater than zero, correct CFL for the necessary increase in V_R using Sheet 4 of 4. Otherwise, Sheet 4 of 4 is not used.*

a. Corrected CFL = ... ____________ feet

b. CFL with final distance corrections:
1. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter zero then proceed to Step 10b-2.
If yes, enter 200 feet to be added to CFL .... ____________ feet
2. Is there any additional distance correction for CFL? *(For example, distance added for certain instrument departure procedures.)*
If no, enter zero then proceed to Step 10b-3.
If yes, correction to be added to CFL .... ____________ feet
3. The sum of the values from Steps 10a, 10b-1, and 10b-2 = [ ] CFL (feet)

c. Is CFL from Step 10b-3 > Runway Available from Step 1?
If no, enter 'N/A' (Not Applicable) in the box for this step, then proceed to Step 11.
If yes, proceed as follows:
1. Runway Available from Step 1 .... _____________ feet
2. The sum of the values from Steps 10b-1 and 10b-2 .... _____________ feet
3. Step 10c-1 minus 10c-2 equals usable CFL............................. _____________ feet
4. Use the value from Step 10c-3 (or less) and backtrack the CFL Chart; take all applicable corrections to determine CFL limited gross take-off weight = [ ] CFL Limited Gross Take-off Weight (pounds)
5. Determine new take-off data for the reduced gross weight.

Note: If Step 10c-5 is necessary consider that there may be further restrictions to gross weight. Before reducing take-off gross weight, use this work sheet as necessary to complete Steps 13, 22, 23, 24 & 26 to determine the most limiting take-off gross weight.

11. Critical Engine Failure Speed (V_{CEF}) *(Use Figure 3-14 (p _____))*

Corrected CFL from Step 10a.. ____________ feet
Use this value to determine V_{CEF} = [ ] V_{CEF} (KIAS)

12. Refusal Speed (V_{REF}) *(Use Figure 3-14 (p _____))*

Is TMSHP restricted (Step 8)?
If no, proceed as follows:
1. Runway Available (from Step 1).. ____________ feet
2. Use this value to determine V_{REF}.
3. Enter the value for V_{REF}, then proceed to Step 13.

If yes, proceed as follows:
1. Runway Available (from Step 1) minus 200 feet .... ____________ feet
2. Use this value to determine V_{REF}.
3. Enter the value for V_{REF}, then proceed to Step 13.

V_{REF} = ____________ V_{REF} (KIAS)

Note: Further corrections for V_{REF} may be needed to determine operational V_{REF}.

13. Take-off Brake Energy Limit Speed (V_{MBE}) *(Use Figure 3-15 (p _____))*

a. V_{MBE} = [ ] V_{MBE} (KIAS)

b. Is V_{CEF} from Step 11 > V_{MBE}?
If no, the take-off gross weight is not limited by brake energy speed; proceed to Step 14.
If yes, proceed as follows:
1. Subtract V_{MBE} from V_{CEF} .... _____________ Δ KIAS
2. Determine Δ weight reduction .... _____________ Δ pounds
3. Reduce the take-off gross weight by at least the value from Step 13b-2.
4. Determine new take-off data.

14. Maximum Speed for Transition from Take-off Power to High Speed Ground Idle (HSGI) ($V_{HSGI/TO}$) *(Use Figure 3-16 (p _____))*

$V_{HSGI/TO}$ = [ ] $V_{HSGI/TO}$ (KIAS)

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Figure 10-1. (Sheet 2 of 6)

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NORMAL TAKE-OFF WORK SHEET

15. Operational Refusal Speed (Operational V_{REF})

V_{REF} from Step 12 .... ____________ KIAS

a. Is V_{REF} (_____ KIAS) > Operational V_R (_____ KIAS) from Step 9?
If no, enter 'N/A', then proceed to Step 15b.
If yes, enter Operational V_R .... _____________ KIAS

b. Is V_{REF} (_____ KIAS) > V_{MBE} (_____ KIAS) from Step 13?
If no, enter 'N/A,' then proceed to Step 15c.
If yes, enter V_{MBE} .... ____________ KIAS

c. Is V_{REF} (_____ KIAS) > $V_{HSGI/TO}$ (_____ KIAS) from Step 14?
If no, enter 'N/A,' then proceed to Step 15d.
If yes, enter $V_{HSGI/TO}$ .... _____________ KIAS

d. Did you answer "Yes" in Step 15a, 15b or 15c?
If no, Operational V_{REF} equals V_{REF} from Step 12; enter the value, then proceed to Step 16.
If yes, the lowest value from Step 15a, Step 15b or Step 15c equals Operational V_{REF} = [ ]

Operational V_{REF} (KIAS)

16. Operational Obstacle Clearance Speed (Operational V_{OBS}), 50% Flaps, Normal Operation *(Use Figure 3-17 (p _____))*

a. V_{OBS} .... _____________ KIAS

b. Is ΔV_R for wind from Step 7c > zero?
If no, Operational V_{OBS} equals the value for V_{OBS} from Step 16a;
enter the value, then proceed to Step 17.
If yes, Operational V_{OBS} equals V_{OBS} from Step 16a plus ΔV_R for wind from Step 7c = [ ]

Operational V_{OBS} (KIAS)

17. Take-off Pitch Attitude Schedule, 50% Flaps *(Use Figure 3-19 (p _____))*

Take-off pitch attitude schedule, 50% flaps = [ ]

Take-off Pitch Attitude (degrees)

18. Ground Minimum Control Speed, One Engine Inoperative, Gear Down, 50% Flaps, Normal Bleed (V_{MCG}) *(Use Figure 3-21 (p _____))*

V_{MCG} = [ ]

V_{MCG} (KIAS)

19. Air Minimum Control Speed, One Engine Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect (V_{MCA}) *(Use Figure 3-23 (p _____))*

V_{MCA} = [ ]

V_{MCA} (KIAS)

20. Air Minimum Control Speed, Two Engines Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect ($V_{MCA\ 2}$) *(Use Figure 3-25 (p _____))*

$V_{MCA\ 2}$ = [ ]

$V_{MCA\ 2}$ (KIAS)

21. Take-off Distance, 4 Engines, 50% Flaps *(Use Figure 3-29 (p _____))*

Applying Corrections:

1. *Apply all applicable corrections in the chart to determine the corrected take-off distance.*
2. *If the take-off distance is to be corrected for an obstacle height up to 50 feet, apply the appropriate correction.*

a. Corrected take-off distance, 4-engines = ... ____________ feet

b. Is Operational V_R from Step 9 > V_R from Step 4?
If no, enter the value from Step 21a at Step 21b-4, then proceed to Step 21c.
If yes, proceed as follows to adjust take-off distance for the increase in V_R.
1. V_R from Step 4 .... ____________ KIAS
2. Take-off distance from Step 21a .... ____________ feet
3. Operational V_R from Step 9 .... ____________ KIAS
4. *(Use Figure3-36 (p _____))* Use the values from Steps 21b-1, -2 & -3 to determine take-off distance for increased V_R..................... ____________ feet

c. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value from Step 21b-4 in the box for this step.
If yes, enter the sum of Step 21b-4 plus 200 feet = [ ]

Take-off Distance, 4-Engines, 50% Flaps (feet)

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Figure 10-1. (Sheet 3 of 6)

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NORMAL TAKE-OFF WORK SHEET

22. Climb-out Flight Path, 3 Engines, for Obstacle Clearance

a. Are there obstacles in the climb-out flight path?
If no, the take-off gross weight is not limited by climb-out flight path obstacles; enter 'N/A' in the box for this step then proceed to Step 23.
If yes, proceed as follows:
1. Known obstacle vertical distance above the take-off surface *(round up to 10's of feet)* .... ____________ feet
2. Known obstacle horizontal distance from brake release *(round down to 100's of feet)*.................................... ____________ feet

Note: Climb-out Flight Path charts do not correct for wind. With tailwinds, chart predictions are invalid.

b. *Use Figure 3-13 (p _____):*
Applying Corrections: The horizontal distance to the obstacle is effectively decreased for CFL corrections and adjustments that extend ground roll beyond baseline conditions.
1. Determine baseline CFL by applying no corrections .... ____________ feet
2. Determine CFL by applying all corrections and adjustments except for headwind component *(When they apply make increases for TMSHP restriction, and use Figure 3-37 (p _____) to determine increase for increased V_R.)* .... ____________ feet
3. Subtract 22b-1 from 22b-2 .... ____________ Δ feet
4. Subtract Step 22b-3 from Step 22a-2 to obtain adjusted horizontal distance .... ____________ feet

c. *Use Figure 3-46 (p _____):*
Applying Corrections: To obtain chart predictions with increased drag index, the effective horizontal distance to clear the obstacle is decreased.
1. Backtrack the chart by entering on the vertical axis with adjusted horizontal distance from Step 22b-4.
2. Move horizontally to the right to the value for drag index from Step 1.
3. Then move down to the horizontal axis to obtain the effective horizontal distance .... ____________ feet

d. *Use Figure 3-44 (p _____):*
Climb-out Factor, 3 Engines .... ____________

e. *Use Figure 3-45 (p _____):*
Enter the chart with the effective horizontal distance from Step 22c-3 to determine the climb-out flight path predicted vertical distance at effective horizontal distance.
Predicted vertical distance = ... ____________ feet

f. Does the predicted vertical distance from Step 22e clear the known obstacle vertical distance from Step 22a-1?
If yes, Enter 'N/A' in the box for this step then proceed to Step 23.
If no, proceed as follows:
1. Backtrack Figure 3-45 using the known vertical distance from Step 22a-1 and the effective horizontal distance from Step 22c-3 to determine required Climb-out Factor.
2. Backtrack Figure 3-44 using the required Climb-out Factor to obtain the maximum take-off gross weight limited by Climb-out Flight Path, 3 Engines. Enter the value, then proceed to Step 26.....

[ ] Maximum Take-off Gross Weight Limited by Climb-out Flight Path Obstacle (pounds)

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Figure 10-1. (Sheet 4 of 6)

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NORMAL TAKE-OFF WORK SHEET

23. Climb-out Flight Path, 3 Engines, For Instrument Departure Procedure Minimum Climb Requirement

a. Is there a published climb rate in feet per nm to a specified altitude for the planned departure? *(Check departure procedure requirements.)*
If no, and the climb rate for the instrument departure is standard, enter 'N/A' in the box for this step then proceed to Step 24.
If yes, proceed as follows:

1. Published climb requirement minus 48 ft per nm .... ____________ feet per nm for 3 engines
2. Altitude required minus runway elevation .... ____________ feet above the take-off surface

Note: Climb-out Flight Path charts do not correct for wind.
With tailwinds, chart predictions are invalid.

b. *Use Figure 3-44 (p _____):*
Climb-out Factor, 3 Engines .... ____________

c. *Use Figure 3-45 (p _____)*:
Horizontal distance from brake release. Backtrack the chart with the vertical distance from Step 23a-2 and Climb-out Factor from Step 23b .... ____________ feet

d. *Use Figure 3-46 (p _____)*:
Drag index corrected horizontal distance from brake release.
Enter with the horizontal distance from Step 23c .... ____________ feet

e. *Use Figure 3-45, Sheet 2 of 2 (p _____)*:
Applying Corrections: The horizontal distance used to determine the predicted climb gradient for the instrument departure commences after the ground roll.
Ground run distance from zero to the point where the climb begins.
Backtrack the chart with the climb-out factor from Step 23b to determine the distance from zero to the point where the climb begins .... ____________ feet

f. Horizontal distance to climb to the vertical distance from Step 23a-2.
[Step 23d minus Step 23e] divided by 6076 *(6076 feet = 1 nm.)* gives the horizontal distance to climb to the vertical distance .... ____________ nm

g. Predicted climb in feet per nm.
Divide the vertical distance from Step 23a-2 by the horizontal distance for the climb from Step 23f to get predicted climb = ... ____________ feet per nm

h. Is the predicted climb from Step 23g ≥ the climb requirement from Step 23a-1?
If yes, enter 'N/A' in the box for this step then proceed to Step 24.
If no, use trial and error with reduced gross weights to determine the gross weight limit =
Proceed to Step 26.

[ ] Maximum Take-off Gross Weight Limited by Climb Requirement (pounds)

24. Take-off Gross Weight Limited by 3-engine Climb Performance Gear Up, 50% Flaps (*Use Figure 3-10 (p _____)*)

a. 1. If Step 22a to 22f or Step 23a to 23h or both were used (*not* left blank) enter N/A in the box for this step and proceed to Step 25.
2. To meet standard climb requirements when no climb requirement is published, examination of data using Figure 3-10 has demonstrated that when the following conditions are met you may enter 'N/A' in the box for this step and proceed to Step 25.*(Check departure procedure and climb requirements.)*

Climb requirement of	≤	152 feet per nm with 3 engines, 50% flaps, take-off power, V_{OBS} and gear up
Gross weight	≤	155,000 lb
Take-off factor	≤	3.0
Drag index	≤	20
Headwind component	≥	zero

3. If conditions in Step 24a-1 or any of the conditions in Step 24a-2 were not met and 'N/A' was not entered, proceed to step 24b.

b. If available, enter the value required for ROC at Step 24b-6 then proceed to Step 24b-7; otherwise, proceed to Step 24b-1.

1. Feet per nm required (152 feet per nm nominal) .... _____________ feet per nm
2. Altitude to maintain value from Step 24b-1 *(entry optional)* ...... _____________ feet
3. Operational V_{OBS} from Step 16 .... _____________ KIAS
4. True airspeed for Step 24b-3 *(Use Figures 1-1, 1-3 & 1-5)* ...... _____________ KTAS
5. Ground speed, apply wind component ‡ to Step 24b-4 .... _____________ GS Knots
6. ROC required, the product of [Step 24b-5 (knots) X Step 24b-1 (feet/nm)] divided by 60 min/hr .... _____________ feet per minute
7. Take-off gross weight limited by 3-engine climb performance =

[ ] Take-off Gross Weight Limited by 3-Engine Climb Performance (pounds)

‡ *When using winds and temperatures aloft forecasts to estimate wind component for instrument departure procedures, a low estimate of headwind component or a high estimate of tailwind component increases safety margin.*

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Figure 10-1. (Sheet 5 of 6)

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NORMAL TAKE-OFF WORK SHEET

25. Climb-out Flight Path Speeds *(Use Figure 3-47 (p _____))*

a. Minimum flap retraction speed, 3 or 4 engines = [ ] Minimum Flap Retraction Speed (KIAS)

b. Flaps Up Safety Speed (FUSS), 3 or 4 engines = [ ] FUSS (KIAS)

c. Best climb speed, 3 or 4 engines (Use this speed with Climb-Out Flight Path, Step 22 & 23.) = [ ] Best Climb Speed (KIAS)

26. Most Limiting Take-off Gross Weight

a. Maximum take-off gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____))......... _______________ pounds
Critical field length (from Step 10).. _______________ pounds
Climb-out flight path obstacle (from Step 22) .... _______________ pounds
Climb-out flight path climb requirement (from Step 23) .... _______________ pounds
3-engine climb performance (from Step 24) .... _______________ pounds

Note: The maximum take-off gross weight limited by brake energy speed is complied with in Step 13.

b. Lowest of the values from Step 26a (disregard any 'N/A') = [ ] pounds

c. Is the take-off gross weight from Step 2 $\leq$ the value determined in Step 26b?
If no, aircraft is too heavy for conditions. Decrease take-off gross weight to at least equal the limiting take-off gross weight, then determine new take-off data.
If yes, normal take-off data is complete.

27. Optional: Acceleration Check Time, 4 Engines *(Use Figure 3-34 (p _____))*

Applying Corrections:

1. *Make wind corrections by applying 100% of headwind or tailwind component.*
2. *Acceleration check speed should be 120, 110, 100, 90, 80, 70 or 60 knots. Use the highest one of the speeds which does not exceed the following:*
   Operational V_{REF} (Step 15) minus 10 knots, then rounded down to the nearest 10 knots.

Operational V_{REF} from Step 15 .... _____________ KIAS
Acceleration speed .... _____________ KIAS

Acceleration check time = [ ] seconds

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Figure 10-1. (Sheet 6 of 6)

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NORMAL LANDING WORK SHEET

1. Conditions *(Enter 'N/A' in blanks for conditions that are not applicable.)*

Field Elevation .... ____________ feet
Altimeter Setting .... ____________ in Hg
Pressure Altitude (PA) (Fig 1-9)........ ____________ feet
Outside Air Temperature (OAT)........ ____________ °C
ISA Deviation (Fig 1-4)..................... ____________ °C
Runway Heading .... ____________ deg
Runway Available .... ____________ feet
Runway Visual Range .... ____________ RVR
Visibility (statute miles) .... ____________ mi

RCR ___________ **or** RSC ________ (*Use only one value)*
Slope +_______% **or** -__________% (*Use only one value)*
(uphill) (downhill)
Wind _________ degrees at _________ knots
Wind Gust Increment ______________ knots (*Zero if none*)
Intended Flaps Setting (100, 50 or 0) _____________ %
Engines in Reverse (check one) 4 REV __ 2 REV* __ or 4 HGI __

* *For 2 REV, use more restrictive 2 IB REV corrections to cover use of any symmetrical pair in reverse.*

2. Landing Gross Weight

Operating Weight _________ (pounds) + Landing Cargo Weight _________ (pounds) + FOB _________ (pounds) = [ ] Landing Gross Weight (pounds)

3. Touchdown Speed (TD), for Percent Flaps (*Use Figures 9-1, 9-2 and 9-3 (pp _____, _____ and _____)*)

TD for 100% flaps (normal).. ______________ KIAS
TD for 50% flaps .... ______________ KIAS
TD for 0% flaps .... ______________ KIAS

Note: Further corrections for TDs may be needed to determine operational TDs.

4. Maximum Recommended Crosswind for Landing (*Use Figure 9-11 (p _____)*)

Maximum recommended crosswind for landing .... ______________ knots

5. Crosswind Chart – Wind Components *(Use Figure 9-12 (p _____))*

Headwind component (enter chart with steady wind value)............... ______________ knots
Crosswind component † (enter chart with steady wind value plus the gust increment) .... ______________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... ______________ knots

† *The maximum recommended crosswind is the lower of 35 knots or the value from Step 4.*

6. Wind Adjustment Increment for Touchdown Speed (ΔTD for Wind) *(Use Figure 9-12 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 6b.
If yes, the increment to increase TD for wind gust at all flap settings equals the value for wind gust increment.
Enter Wind Gust Increment (from Step 1) ‡ .... ________ Δ KIAS
(If value entered is 10, skip Step 6b and proceed to Step 6c.)

b. Is TD plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 6b-3 then proceed to Step 6c.
If yes, proceed as follows:
1. TDs from Step 3 plus the value from Step 6a for each of the respective flap settings:
(i) for 100% flaps ______ KIAS; (ii) for 50% flaps ______ KIAS; (iii) for 0% flaps ______ KIAS
2. Obtain Minimum TD from the Crosswind Chart for the respective values entered at Step 6b-1i, 6b-1ii & 6b-1iii (If no increase, enter value from Step 6b-1) ‡ :
(i) for 100% flaps ______ KIAS; (ii) for 50% flaps ______ KIAS; (iii) for 0% flaps ______ KIAS
3. Step 6b-2 minus Step 6b-1 for each of the respective flap settings equals the increment used to increase the respective TD for crosswind ‡ :
(i) for 100% flaps ______ Δ KIAS; (ii) for 50% flaps ______ ΔKIAS; (iii) for 0% flaps ______ Δ KIAS

c. For each of the respective flap settings, the sum of the value from Step 6a plus the value from Step 6b-3 equals the total ΔTD for wind ‡ (enter zero if none):
1. 100% flaps, 6a (_____ΔKIAS) plus 6b-3i (_____ΔKIAS) = _______ Total ΔTD for wind ‡ (ΔKIAS)
2. 50% flaps, 6a (_____ΔKIAS) plus 6b-3ii (_____ΔKIAS) = _______ Total ΔTD for wind ‡ (ΔKIAS)
3. 0% flaps, 6a (_____ΔKIAS) plus 6b-3iii (_____ΔKIAS) = _______ Total ΔTD for wind ‡ (ΔKIAS)

‡ *TD may be increased for caution zone crosswind or wind gust increment. The total ΔTD for wind must* not *exceed 10 knots.*

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Figure 10-2. (Sheet 1 of 3)

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NORMAL LANDING WORK SHEET

7. Operational Landing Speeds, for Percent Flaps (*Use Figures 9-1, 9-2 and 9-3 (pp _____, _____ and _____)*)

a. 100% Flaps Operational Landing Speeds § :
Approach speed (APP) (_______ KIAS) plus Step 6c-1 (_____ΔKIAS) =
Threshold speed (THR) (_______ KIAS) plus Step 6c-1 (_____ΔKIAS) =
Touchdown speed (TD) (_______ KIAS) plus Step 6c-1 (_____ΔKIAS) =

100% Flaps: APP§ __________ THR __________ TD __________ KIAS

b. 50% Flaps Operational Landing Speeds:
APP speed (_______ KIAS) plus Step 6c-2 (_____ΔKIAS) =
THR speed (_______ KIAS) plus Step 6c-2 (_____ΔKIAS) =
TD speed (_______ KIAS) plus Step 6c-2 (_____ΔKIAS) =

50% Flaps: APP __________ THR __________ TD __________ KIAS

c. 0% Flaps Operational Landing Speeds:
APP speed (_______ KIAS) plus Step 6c-3 (_____ΔKIAS) =
THR speed (_______ KIAS) plus Step 6c-3 (_____ΔKIAS) =
TD speed (_______ KIAS) plus Step 6c-3 (_____ΔKIAS) =

0% Flaps: APP __________ THR __________ TD __________ KIAS

§ *Ensure that the 100% Flaps APP speed does* not *exceed the 100% Flap Limit Speed value of 145 KIAS.*

8. Landing Distance Over 50-foot Obstacle, for Percent Flaps *(Use Figure 9-4 (p _____))*

Applying Corrections:
1. *Apply all applicable corrections in the chart.*
2. *Apply the corrections for Engines in Reverse selected in Step 1.*
3. *When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD for wind from Step 6c for the respective flap settings.*
4. *When applying corrections for the wind components from Step 5 in the performance data charts, use only 50% of the headwind component or 150% of the tailwind component unless otherwise noted.*

a. Landing distance over a 50-foot obstacle for the respective flap setting:
100% Flaps.. _____________ feet
50% Flaps.. _____________ feet
0% Flaps.. _____________ feet

b. Is there any additional distance that must be added to the values for landing distance over a 50-foot obstacle entered at Step 8a?
1. If no, enter zero at Step 8b-2, then enter the values from Step 8a in the box at Step 8b-3 and proceed to Step 8c.
2. If yes, the distance correction to be added .... _____________ feet
3. Add the value from Step 8b-2 to each of the values for the flaps settings from Step 8a to determine landing distance over a 50-foot obstacle for the respective flaps setting =

100% Flaps _______________ 50% Flaps _______________ 0% Flaps _______________ feet

c. For Intended Flaps Setting from Step 1, is the landing distance over a 50-foot obstacle from Step 8b-3 greater than the Runway Available from Step 1?
If no, enter 'N/A' in the box for this step, then proceed to Step 9.
If yes, proceed as follows:
1. Runway Available from Step 1 minus distance correction from Step 8b-2 .... _____________ feet
2. Use the value from Step 8c-1 and backtrack the chart for landing distance over a 50-foot obstacle; take all applicable corrections to determine the field length limited landing gross weight =

[ ] Field Length Limited Landing Gross Weight (pounds)

9. Landing Ground Roll, for Percent Flaps *(Use Figure 9-5 (p _____))*

Applying Corrections:
1. *Apply all applicable corrections in the chart.*
2. *Apply the corrections for Engines in Reverse selected in Step 1.*
3. *When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD speeds for wind from Step 6c for the respective flap settings.*

Landing ground roll for the respective flaps setting =

100% Flaps _______________ 50% Flaps _______________ 0% Flaps _______________ feet

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Figure 10-2. (Sheet 2 of 3)

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NORMAL LANDING WORK SHEET

10. Landing Weight Limited by Maximum Brake Kinetic Energy *(Use Figure 9-6 (p _____))*

Applying Corrections:

1. *Apply all applicable corrections in the chart.*
2. *Apply the corrections for Intended Flaps setting and Engines in Reverse from Step 1.*

Landing weight limited by maximum brake kinetic energy = [ ] Landing Weight (pounds) Limited by Maximum Brake Kinetic Energy

11. Maximum Speed for Transition from Flight Idle to High Speed Ground Idle (HSGI), All Flaps Settings ($V_{HSGI/LDG}$) *(Use Figure 9-7 (p _____))*

$V_{HSGI/LDG}$ = [ ] $V_{HSGI/LDG}$ (KIAS)

12. Maximum Landing Weight Permitted by Power Lever Transition Limits *(Use Figures 9-8, 9-9 and 9-10 (pp _____, _____ and _____))*

Applying Corrections:

Use the chart for the flaps setting that corresponds to the Intended Flaps Setting selected in Step 1.

Maximum landing weight permitted by the speed ($V_{HSGI/LDG}$) for power lever transition limits = [ ] Maximum Landing Wt (pounds) Permitted by $V_{HSGI/LDG}$

13. Most Limiting Landing Gross Weight

a. Maximum Landing gross weight limited by:
   Airframe structure (see Flight Manual, Section 1 (p _____)) .... ____________ pounds
   Landing distance over 50-foot obstacle (from Step 8c) .... ____________ pounds
   Maximum brake kinetic energy (from Step 10) .... ____________ pounds
   Power lever transition limits (from Step 12) .... ____________ pounds

b. Lowest of the values from Step 13a (disregard any 'N/A') = [ ] pounds

c. Is the landing gross weight from Step 2 $\leq$ the value determined in Step13b?
   If no, aircraft is too heavy for conditions. Consider an alternate runway, maximum alternate landing weight, fuel dump or cargo jettison. If necessary, decrease landing gross weight to at least equal the limiting landing gross weight. Determine landing data for the new conditions.
   If yes, normal landing data is complete.

> Note: The landing data is not affected by ATCS inoperative. The Normal Landing Work Sheet is also used to obtain landing data for non-standard operations with ATCS inoperative.

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Figure 10-2. (Sheet 3 of 3)

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THREE-ENGINE FERRY TAKE-OFF WORK SHEET

1. Conditions

Field Elevation .... ________________ feet
Altimeter Setting .... ________________ in Hg
Pressure Altitude (PA) (Fig 1-9)... ________________ feet
Outside Air Temperature (OAT)... ________________ °C
ISA Deviation (Fig 1-4) .... ________________ °C
Runway Heading .... ________________ deg
Runway Available .... ________________ feet

RCR ____23____ **or** RSC _______ (*Use only one value*)
Slope +_______% **or** -_________% (*Use only one value*)
(uphill) (downhill)
Wind ________ degrees at _______ knots
Wind Gust Increment _____________ knots * (*Zero if none*)
Drag Index ____________________
Normal bleed ____ **or** all bleed ____ (*Check one value*)

* *Gust increment must be 5 knots or less.*

2. Take-off Gross Weight

Operating Weight _______ (pounds) + Cargo Weight _______ (pounds) + Fuel On Board (FOB) _______ (pounds) = [ ] Take-off Gross Wt (pounds)†

† *Must be 120,000 pounds or less.*

3. Torquemeter Shaft Horsepower (TMSHP) Required for Take-off *(Use Figure 3-6, normal bleed only, (p _____))*

Torquemeter shaft horsepower (static setting) required for take-off = [ ] TMSHP

4. Take-off Factor (*Use Figure 3-8 (p _____)) normal bleed only)*

Take-off factor .... _____________

5. Maximum Recommended Crosswind for Take-off, 3-Engine

Maximum recommended crosswind for take-off .... _____15_____ knots

6. Crosswind Chart – Wind Components *(Use Figure 3-11 (p _____))*

Headwind component (enter chart with steady wind value)................. _____________ knots
Crosswind component ‡ (enter chart with steady wind value plus the gust increment) .... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

‡ *The maximum recommended crosswind component for take-off is 15 knots.*

7. Air Minimum Control Speed, One Engine Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect (V_{MCA}) *(Use Figure 3-23 (p _____))*

V_{MCA} = [ ] V_{MCA} (KIAS)

8. Operational Rotation Speed (Operational V_R) (*Use Figure 3-17 (p _____)*

Applying Corrections:

1. *For 3-engine take-off, wind gust increment must be 5 knots or less.*
2. *For 3-engine take-off, V_R is not increased for wind gust increment.*
3. *For 3-engine take-off, V_R is the greater of normal V_R or V_{MCA}.*

a. 1. Rotation speed (V_R), 50% flaps, normal operation .... _____________ KIAS
2. V_{MCA} from Step 7 .... _____________ KIAS
b. Greatest of the values from Step 8a-1 or 8a-2 = [ ] Operational V_R (KIAS)

9. Operational Refusal Speed (Operational V_{REF})

Applying Corrections:

1. *Because of the 110,000-pound take-off gross weight limitation, V_{REF} will not require additional corrections for V_{MBE} or $V_{HSGI/TO}$.*
2. *For 3-engine take-off, V_{REF} cannot be determined using the chart for refusal speed and critical engine failure speed, Figure 3-14. When the minimum field length for 3-engine take-off is ≥ runway available, V_{REF} will be greater than operational V_R.*
3. *For 3-engine take-off, Operational V_{REF} is set equal to Operational V_R.*

Operational V_R from Step 8 = [ ] Operational V_{REF} (KIAS)

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Figure 10-3. (Sheet 1 of 4)

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THREE-ENGINE FERRY TAKE-OFF DATA WORK SHEET

10. Take-off Pitch Attitude Schedule, 50% Flaps *(Use Figure 3-19 (p _____))*

Take-off pitch attitude schedule, 50% flaps = [ ] Take-off Pitch Attitude (degrees)

Note: For the three-engine ferry take-off, directly accelerate to V_{MCA2} after rotation to this pitch attitude and clear of the ground. Do not plan a 3-engine obstacle clearance take-off unless specifically approved. Refer to the Flight Manual for operating procedures.

11. Operational Obstacle Clearance Speed (Operational V_{OBS}), 50% Flaps, Normal Operation *(Use Figure 3-17 (p _____))*

V_{OBS}, 50% flaps, normal operation = [ ] Operational V_{OBS} (KIAS)

Notes:
1. *Normal V_{OBS} is used for 3-engine take-off.*
2. *Do not plan a 3-engine obstacle clearance take-off using this speed unless specifically approved. See Note, Step 10.*

12. Ground Minimum Control Speed, One Engine Inoperative, Gear Down, 50% Flaps, Normal Bleed (V_{MCG}) *(Use Figure 3-21 (p _____))*

V_{MCG} = [ ] V_{MCG} (KIAS)

13. Air Minimum Control Speed, Two Engines Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect ($V_{MCA\,2}$) *(Use Figure 3-25 (p _____))*

$V_{MCA\,2}$ = [ ] $V_{MCA\,2}$ (KIAS)

14. Acceleration Check Time, 3 Engines *(Use Figure 3-35 (p _____))*

Applying Corrections:
1. *Make wind corrections by applying 100% of headwind or tailwind component.*
2. *Acceleration check speed should be 120, 110, 100, 90, 80, 70 or 60 knots. Use the highest one of the speeds which does not exceed the following:*
   Operational V_{REF} (Step 9) minus 10 knots, then rounded down to the nearest 10 knots.

Operational V_{REF} from Step 9 .... ____________ KIAS
Acceleration speed .... ____________ KIAS

Acceleration check time = [ ] Seconds

15. Minimum Field Length For 3-Engine Take-off, 50% Flaps *(Use Figure 3-30 (p _____))*

Applying Corrections:
Use only 50% of the headwind component or 150% of the tailwind component.

a. Minimum field length for 3-engine take-off = [ ] Minimum Field Length for 3-engine Take-off (feet)

b. Is minimum field length for 3-engine take-off > the Runway Available from Step 1?
If no, enter 'N/A,' in the box for this step, then proceed to Step 16.
If yes, proceed as follows:
1. Set minimum field length for 3-engine take-off equal to Runway Available from Step 1 .... _____________ feet
2. Use the value from Step 15b-1 and backtrack the chart for Minimum Field Length for 3-Engine Take-off, take all applicable corrections to determine = [ ] Gross Wt (pounds) Limited by Minimum Field Length for 3-engine Take-off
3. Determine new take-off data for the reduced gross weight.

Notes:
1. *Minimum field length for 3-engine take-off is the greatest of the following distances:*
   The distance to accelerate and climb to 50 feet multiplied by 1.15.
   The distance to abort from V_R and stop with 2 symmetrical engines in reverse and maximum anti-skid braking.
2. *Not all 2-engine out situations allow 2 symmetrical engines in REV or normal anti-skid braking.*
3. *If Step 15b-3 is necessary consider that there may be further restrictions to gross weight. Before reducing gross weight, use this work sheet as necessary to complete Steps 17 & 19 to determine the most limiting take-off gross weight.*

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Figure 10-3. (Sheet 2 of 4)

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THREE-ENGINE FERRY TAKE-OFF DATA WORK SHEET

16. Take-off Distance, 3 Engines, 50% Flaps *(Use Figure 3-31 (p _____))*

Applying Corrections:

1. *Corrections can be applied to the 3-engine take-off distance for obstacle heights up to 50 feet at the end of the take-off distance.*
   However, do not plan a 3-engine obstacle clearance take-off unless specifically approved.

Take-off distance, 3-engines, 50% flaps = [ ]
Take-off Distance, 3 engines, 50% flaps (feet)

17. Take-off Gross Weight Limited by 3-engine Climb Performance Gear Up, 50% Flaps (*Use Figure 3-10 (p _____)*)

a. Unless specifically authorized for climb at V_{OBS}§, enter 'N/A' in the box for this step and proceed to Step 18. If authorized for climb at V_{OBS}, proceed with this step.

b. If available, enter the value required for ROC at Step 17b-6 then proceed to Step 17b-7; otherwise, proceed to Step 17b-1.

1. Feet per nm required (152 feet per nm nominal) .... _____________ feet per nm
2. Altitude to maintain value from Step 17b-1 *(entry optional)*.... _____________ feet
3. Operational V_{OBS} from Step 11.. _____________ KIAS
4. True airspeed for Step 17b-3 *(Use Figures 1-1, 1-3 & 1-5)*.... _____________ KTAS
5. Ground speed, apply wind component ‖ to Step 17b-4 .... _____________ GS Knots
6. ROC required, the product of [Step 17b-5 (knots) X Step 17b-1 (feet/nm)] divided by 60 min/hr .... _____________ feet per minute
7. Take-off gross weight limited by 3-engine climb performance = [ ]
   Take-off Gross Weight Limited by 3-Engine Climb Performance (pounds)

§ *Use of this chart assumes climb at V_{OBS}; 3-engine climb at speeds below V_{MCA2} allows no safety margin in the event of an additional asymmetrical engine failure. Use of 3-engine climb speed and 3-engine climb performance data provides safety margin from V_{MCA2}. Refer to the Flight Manual for operating procedures.*

‖ *When using winds and temperatures aloft forecasts to estimate wind component for departure procedures, a low estimate of headwind component or a high estimate of tailwind component increases safety margin.*

18. Climb-out Flight Path Speeds

a. *(Use Figure 3-47 (p _____))*
   Minimum Flap Retraction Speed, 3 or 4 engines = [ ]
   3 or 4-Engine Minimum Flap Retraction Speed (KIAS)

b. *(Use Figure 3-47 (p _____))*
   Flaps Up Safety Speed (FUSS), 3 or 4 engines = [ ]
   FUSS (KIAS)

c. *(Use Figure 3-47 (p _____))*
   Best Climb Speed, 3 or 4 engines = [ ]
   Best Climb Speed (KIAS)

d. $V_{MCA\,2}$, 50% Flaps, from Step 13 = [ ]
   $V_{MCA\,2}$ (KIAS)

e. *(Long aircraft use Figure 4-23 (p _____))*
   (Short aircraft use Figure 4-5 (p _____))
   Climb speed, 3 engines =

_________ KIAS at surface
_________ KIAS at 5,000 feet
_________ KIAS at 10,000 feet
_________ KIAS at 14,000 feet
_________ KIAS at weight-based altitude (__________)

Climb Speed, 3 Engines (KIAS)

Notes:

1. *Do not plan a 3-engine obstacle clearance climb using 3 or 4-engine best climb speed unless specifically approved.*
2. *After lift-off, accelerate above V_{MCA2} prior to raising flaps above 15%. Refer to the Flight Manual for operating procedures.*
3. *Scheduled 3-engine climb speeds are always faster than V_{MCA2}.*
4. *The 3-engine ferry climb is normally performed at 3-engine climb speed or faster.*

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Figure 10-3. (Sheet 3 of 4)

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THREE-ENGINE FERRY TAKE-OFF DATA WORK SHEET

19. Most Limiting Take-off Gross Weight

a. Maximum take-off gross weight limited by:
3-engine ferry take-off limit
(see Flight Manual, Section 5 (p _____)) .... **120,000** pounds
3-engine climb performance (from Step 17) .... ____________ pounds
Minimum field length (from Step 15) .... ____________ pounds

b. Lowest of the values from Step 19a (disregard any ‘N/A’) = ____________ pounds

c. Is the take-off gross weight from Step 2 ≤ the value from Step 19b?
If no, aircraft is too heavy for conditions. Decrease take-off gross weight to at least equal the limiting take-off gross weight, then determine new take-off data.
If yes, 3-engine ferry take-off data is complete.

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Figure 10-3. (Sheet 4 of 4)

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THREE-ENGINE LANDING WORK SHEET

1. Conditions

Field Elevation .... ___________ feet
Altimeter Setting .... ___________ in Hg
Pressure Altitude (PA) (Fig 1-9)........ ___________ feet
Outside Air Temperature (OAT)........ ___________ °C
ISA Deviation (Fig 1-4)..................... ___________ °C
Runway Heading .... ___________ deg
Runway Available .... ___________ feet
Runway Visual Range .... ___________ RVR
Visibility (statute miles) .... ___________ mi

RCR __________ **or** RSC _______ (*Use only one value)*
Slope +_______% **or** -_________% (*Use only one value)*
(uphill) (downhill)
Wind ________ degrees at ________ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Intended Flaps Setting (100, 50 or 0) ____________ %
Engines in Reverse (check one) 4 HGI __ 2 REV* __

* *For 2 REV, use more restrictive 2 IB REV corrections to cover the use of any symmetrical pair in reverse.*

2. Landing Gross Weight

Operating Weight _________ (pounds) + Landing Cargo Weight _________ (pounds) + FOB _________ (pounds) = [ ] Landing Gross Weight (pounds)

3. Touchdown Speed (TD), for Percent Flaps (*Use Figures 9-1, 9-2 and 9-3 (pp _____,_____ and _____))*

TD at 100% flaps (normal) .... _____________ KIAS
TD at 50% flaps .... _____________ KIAS
TD at 0% flaps .... _____________ KIAS

Note: Further corrections for TDs may be needed to determine operational TDs.

4. Maximum Recommended Crosswind for Landing (*Use Figure 9-11 (p _____))*

Maximum recommended crosswind for landing .... _____________ knots

Note: Refer to the Flight Manual for considerations with crosswinds > 15 knots.

5. Crosswind Chart – Wind Components *(Use Figure 9-12 (p _____))*

Headwind component (enter chart with steady wind value)............... _____________ knots
Crosswind component † (enter chart with steady wind value plus the gust increment) .... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

† *The maximum recommended crosswind is the lower of 35 knots or the value from Step 4.*

6. Wind Adjustment Increment for Touchdown Speed (ΔTD for Wind) *(Use Figure 9-12 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 6b.
If yes, the increment to increase TD for wind gust at all flap settings equals the value for wind gust increment.
Enter Wind Gust Increment (from Step 1) ‡ .... _______ ΔKIAS
(If value entered is 10, skip Step 6b and proceed to Step 6c.)

b. Is TD plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 6b-3 then proceed to Step 6c.
If yes, proceed as follows:
1. TDs from Step 3 plus the value from Step 6a for each of the respective flap settings:
(i) for 100% flaps ______ KIAS; (ii) for 50% flaps ______ KIAS; (iii) for 0% flaps ______ KIAS
2. Obtain Minimum TD from the Crosswind Chart for the respective values entered at Step 6b-1i, 6b-1ii & 6b-1iii (If no increase, enter value from Step 6b-1) ‡ :
(i) for 100% flaps ______ KIAS; (ii) for 50% flaps ______ KIAS; (iii) for 0% flaps ______ KIAS
3. Step 6b-2 minus Step 6b-1 for each of the respective flap settings equals the increment used to increase the respective TD for crosswind ‡ :
(i) for 100% flaps ______ ΔKIAS; (ii) for 50% flaps ______ ΔKIAS; (iii) for 0% flaps ______ ΔKIAS

c. For each of the respective flap settings, the sum of the value from Step 6a plus the value from Step 6b-3 equals the total ΔTD for wind ‡ (enter zero if none):
1. 100% flaps, 6a (_____ΔKIAS) plus 6b-3i (_____ΔKIAS) = _______ Total ΔTD for wind ‡ (ΔKIAS)
2. 50% flaps, 6a (_____ΔKIAS) plus 6b-3ii (_____ΔKIAS) = _______ Total ΔTD for wind ‡ (ΔKIAS)
3. 0% flaps, 6a (_____ΔKIAS) plus 6b-3iii (_____ΔKIAS) = _______ Total ΔTD for wind ‡ (ΔKIAS)

‡ *TD may be increased for caution zone crosswind or wind gust increment. The total ΔTD for wind must* not *exceed 10 knots.*

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Figure 10-4. (Sheet 1 of 3)

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THREE-ENGINE LANDING WORK SHEET

7. Operational Landing Speed, for Percent Flaps (*Use Figures 9-1, 9-2 and 9-3 (pp _____, _____ and _____)*)

a. 100% Flaps Operational Landing Speeds §:
Approach speed (APP) (_______ KIAS) plus Step 6c-1 (_____ΔKIAS) =
Threshold speed (THR) (_______ KIAS) plus Step 6c-1 (_____ΔKIAS) =
Touchdown speed (TD) (_______ KIAS) plus Step 6c-1 (_____ΔKIAS) =

100% Flaps: APP § __________ THR __________ TD __________ KIAS

b. 50% Flaps Operational Landing Speeds:
APP speed (_______ KIAS) plus Step 6c-2 (_____ΔKIAS) =
THR speed (_______ KIAS) plus Step 6c-2 (_____ΔKIAS) =
TD speed (_______ KIAS) plus Step 6c-2 (_____ΔKIAS) =

50% Flaps: APP __________ THR __________ TD __________ KIAS

c. 0% Flaps Operational Landing Speeds:
APP speed (_______ KIAS) plus Step 6c-3 (_____ΔKIAS) =
THR speed (_______ KIAS) plus Step 6c-3 (_____ΔKIAS) =
TD speed (_______ KIAS) plus Step 6c-3 (_____ΔKIAS) =

0% Flaps: APP __________ THR __________ TD __________ KIAS

§ *Ensure that the 100% Flaps APP speed does* not *exceed the 100% Flap Limit Speed value of 145 KIAS.*

8. Landing Distance Over 50-foot Obstacle, for Percent Flaps *(Use Figure 9-4 (p _____))*

Applying Corrections:
1. *When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD for wind from Step 6c for the respective flap settings.*
2. *Use only 50% of the headwind component or 150% of the tailwind component.*

a. Landing distance over 50-foot obstacle for the respective flaps setting:
100% Flaps........................ _____________ feet
50% Flaps.......................... _____________ feet
0% Flaps............................ _____________ feet

b. Is there any additional distance correction for the values at Step 8a?
(Check operator requirements for distance added for current visibility.)
1. If no, enter zero at Step 8b-2, then enter the values from Step 8a in the box at Step 8b-3 and proceed to Step 8c.
2. If yes, the distance correction to be added .... _____________ feet
3. Add the value from Step 8b-2 to each of the values for the flaps settings from Step 8a to determine Landing distance over 50-foot obstacle for the respective flaps setting =

100% Flaps _______________ 50% Flaps _______________ 0% Flaps _______________ feet

c. For Intended Flaps Setting from Step 1, is the landing distance over a 50-foot obstacle from Step 8b-3 greater than the Runway Available from Step 1?
If no, enter 'N/A' in the box for this step, then proceed to Step 9.
If yes, proceed as follows:
1. Runway Available from Step 1 minus distance correction from Step 8b-2 .... _____________ feet
2. Use the value from Step 8c-1 and backtrack the chart for Landing distance over 50-foot obstacle; take all applicable corrections to determine the field length limited landing gross weight =

[ ] Field Length Limited Landing Gross Weight (pounds)

Note: In the event of an additional engine failure, not all 2-engine out situations allow 2 symmetrical engines in REV, normal anti-skid braking or operation of the flaps from the flight deck. Refer to the Flight Manual for operating procedures.

9. Landing Ground Roll, for Percent Flaps *(Use Figure 9-5 (p _____))*

Applying Corrections:
When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD for wind from Step 6c for the respective flap settings.

Landing ground roll for the respective flaps setting =

100% Flaps _______________ 50% Flaps _______________ 0% Flaps _______________ feet

Note: In the event of an additional engine failure, not all 2-engine out situations allow 2 symmetrical engines in REV, normal anti-skid braking or operation of the flaps from the flight deck. Refer to Flight Manual for operating procedures.

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Figure 10-4. (Sheet 2 of 3)

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THREE-ENGINE LANDING WORK SHEET

10. Landing Weight Limited by Maximum Brake Kinetic Energy *(Use Figure 9-6 (p _____))*

Applying Corrections:
1. *Apply all applicable corrections in the chart.*
2. *Apply the corrections for Intended Flaps Setting and Engines in Reverse from Step 1.*

Landing weight limited by maximum brake kinetic energy = [ ] Landing Weight (pounds) Limited by Maximum Brake Kinetic Energy

11. Maximum Speed for Transition from Flight Idle to High Speed Ground Idle (HSGI), All Flaps Settings ($V_{HSGI/LDG}$) *(Use Figure 9-7 (p _____))*

$V_{HSGI/LDG}$ = [ ] $V_{HSGI/LDG}$ (KIAS)

12. Maximum Landing Weight Permitted by Power Lever Transition Limits *(Use Figures 9-8, 9-9 and 9-10 (pp _____, _____ and _____))*

Applying Corrections:
Use the chart for the flaps setting that corresponds to the Intended Flaps Setting selected in Step 1.

Maximum landing weight permitted by the speed ($V_{HSGI/LDG}$) for power lever transition limits = [ ] Maximum Landing Wt (pounds) Permitted by $V_{HSGI/LDG}$

13. Most Limiting Landing Gross Weight

a. Maximum Landing gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____)) .... ____________ pounds
Landing distance over 50-foot obstacle (from Step 8c) .... ____________ pounds
Maximum brake kinetic energy (from Step 10) .... ____________ pounds
Power lever transition limits (from Step 12) .... ____________ pounds

b. Lowest of the values from Step 13a (disregard any 'N/A') = [ ] pounds

c. Is the landing gross weight from Step 2 ≤ the value determined in Step13b?
If no, aircraft is too heavy for conditions. Consider an alternate runway, maximum alternate landing weight, fuel dump or cargo jettison. If necessary, decrease landing gross weight to at least equal the limiting landing gross weight. Determine landing data for the new conditions.
If yes, 3-engine landing data is complete.

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Figure 10-4. (Sheet 3 of 3)

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FLAPS UP TAKE-OFF WORK SHEET

1. Conditions

Field Elevation .... _______________ feet
Altimeter Setting .... _______________ in Hg
Pressure Altitude (PA) (Fig 1-9)... _______________ feet
Outside Air Temperature (OAT)... _______________ °C
ISA Deviation (Fig 1-4)................ _______________ °C
Runway Heading .... _______________ deg
Runway Available .... _______________ feet

RCR __________ **or** RSC _______ (*Use only one value)*
Slope +_______% **or** -_________% (*Use only one value)*
(uphill) (downhill)
Wind ________ degrees at _______ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Drag Index ____________________
Normal bleed ____ **or** all bleed ____ (*Check one value)*

2. Take-off Gross Weight

Operating Weight _______ (pounds) + Cargo Weight _______ (pounds) + Fuel On Board (FOB) _______ (pounds) = [ ] Take-off Gross Weight (pounds)

Notes:

1. *Regardless of runway available, for the flaps up take-off the maximum take-off gross weights limited by V_{MBE} and $V_{HSGI/TO}$ are usually less than the structural limit gross weight. It may be necessary to reduce the take-off gross weight for either V_{MBE} or $V_{HSGI/TO}$.*
2. *Take-off planning considerations for an emergency immediate landing at the departure airfield may require further reduction in take-off gross weight for maximum landing gross weight limited by $V_{HSGI/TO}$ or V_{MBE}.*

3. Take-off Factor (*Use Figure 3-8 or 3-9 (pp _____ or _____)*)

Take-off Factor .... _____________

Note: Do not plan a flaps up take-off in icing conditions unless specifically approved.

4. Flaps Up Rotation Speed (Flaps Up V_R) (*Use Figure 3-20 (p _____)*)

Flaps Up V_R .... _____________ KIAS

Note: Further corrections for Flaps Up V_R may be needed to determine operational Flaps Up V_R.

5. Maximum Recommended Crosswind (*Use Figure 3-12 (p _____)*)

Maximum recommended crosswind for take-off .... _____________ knots

6. Crosswind Chart – Wind Components (*Use Figure 3-11 (p _____)*)

Headwind component (enter chart with steady wind value)............... _____________ knots
Crosswind component * (enter chart with steady wind value plus the gust increment) .... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

* *The maximum recommended crosswind is the lower of 35 knots or the value from Step 5.*

7. Wind Adjustment Increment for V_R (ΔV_R for Wind) (*Use Figure 3-11 (p _____)*)

a. Is there a wind gust increment?
   If no, enter zero for this step, then proceed to Step 7b.
   If yes, the increment to increase Flaps Up V_R for wind gust equals the value for wind gust increment. Enter Wind Gust Increment from Step 1† ..... ___________ Δ KIAS
   (If value entered is 10, skip Step 7b and proceed to Step 7c.)

b. Is Flaps Up V_R plus wind gust increment (gust may be zero) increased for caution zone crosswind?
   If no, enter zero at Step 7b-3, then proceed to Step 7c.
   If yes, proceed as follows:
   1. Flaps Up V_R from Step 4 plus value from Step 7a .... ____________ KIAS
   2. Obtain Minimum Flaps Up V_R from the Crosswind Chart for the value entered at Step 7b-1 † .... ____________ KIAS
   3. Steps 7b-2 minus 7b-1 equals the increment to increase Flaps Up V_R for crosswind † .... ____________ Δ KIAS

c. The sum of the values from Step 7a and Step 7b-3 † (enter zero if none) = ___________________ Total ΔV_R for Wind (ΔKIAS)

† *Flaps Up V_R may be increased for caution zone crosswind or wind gust increment. The total ΔV_R for wind must* not *exceed 10 knots.*

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Figure 10-5. (Sheet 1 of 4)

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FLAPS UP TAKE-OFF WORK SHEET

8. Torquemeter Shaft Horsepower (TMSHP)

(Use Figure 3-11 (p _____)

a. Is a 2,500 TMSHP restriction below 35 KIAS necessary? ☐ Unrestricted ☐ Restricted

If no, check "Unrestricted," then proceed to Step 8b.
If yes, check "Restricted."

(Use Figure 3-6 or 3-7 (pp_____ or_____))

b. Torquemeter shaft horsepower (static setting) required for take-off, 4 engines = [ ] TMSHP

9. Maximum Speed for Transition from Take-off Power to High Speed Ground Idle (HSGI) ($V_{HSGI/TO}$)
(Use Figure 3-16 (p _____))

a. $V_{HSGI/TO}$ = [ ] $V_{HSGI/TO}$ (KIAS)

b. Is Flaps Up V_R from Step 4 > $V_{HSGI/TO}$?
If no, the take-off gross weight is not limited by $V_{HSGI/TO}$; proceed to Step 10.
If yes, complete Step 10, then proceed to Step 21.

10. Take-off Brake Energy Limit Speed (V_{MBE}) *(Use Figure 3-15 (p _____))*

Applying Corrections:

1. *Apply all applicable corrections, including the corrections for Flaps Up.*
2. *Use only 50% of the headwind component or 150% of the tailwind component.*

a. V_{MBE} = [ ] V_{MBE} (KIAS)

b. Is Flaps Up V_R from Step 4 > V_{MBE}?
If no, the take-off gross weight is not limited by V_{MBE}. If the answer at Step 9b was also "no" proceed to Step 11; otherwise proceed to Step 21.
If yes, proceed to Step 21.

11. Operational Flaps Up Rotation Speed (Operational Flaps Up V_R)

Is ΔV_R for wind from Step 7c > zero?
If no, Operational Flaps Up V_R equals the value for Flaps Up V_R from Step 4; enter the value, then proceed to Step 12.
If yes, Operational Flaps Up V_R equals Flaps Up V_R from Step 4 plus ΔV_R for wind from Step 7c = [ ] Operational Flaps Up V_R (KIAS)

Note: The value for Operational Flaps Up V_R must not exceed the lowest of V_{MBE} or $V_{HSGI/TO}$. Either limit the increase in Operational Flaps Up V_R or reduce gross weight (use Step 21 if necessary) so that the lowest of V_{MBE} or $V_{HSGI/TO}$ is not exceeded.

12. Operational Refusal Speed (Operational V_{REF})

Operational Flaps Up V_R from Step 11 = [ ] Operational V_{REF} (KIAS)

Note: To determine the minimum field length for the flaps up take-off, Operational V_{REF} is set equal to Operational Flaps Up V_R.

13. Minimum Field Length for Flaps Up Take-off *(Use Figure 3-14 (p _____))*

Applying Corrections:

1. *Obtaining the data for this step requires backtracking most of the chart starting at the end of the last sheet and moving right to left to the beginning of the first sheet. When proceeding to the left through each grid, go the corrected value first then to the baseline for the grid before proceeding left again.*
2. *When backtracking, apply the corrections for "Refusal Speed" (Not Critical Engine Failure Speed).*
3. *Apply all applicable corrections when backtracking the chart.*

a. Field length for flaps up take-off:
1. Operational V_{REF} from Step 12 .... ____________ KIAS
2. Take-off gross weight from Step 2 .... ____________ pounds
3. Backtrack Figure 3-14 using the values from Steps 13a-1 & 13a-2 to determine the corrected "Runway Available." For these conditions, this value is the minimum field length for flaps up take-off........ ____________ feet

b. Minimum field length for flaps up take-off with final distance corrections:
Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value from Step 13a-3 in the box for this step, then proceed to Step 13c.
If yes, the sum of Step 13a-3 plus 200 feet = [ ] Minimum Field Length, Flaps Up Take-off (feet)

c. Is minimum field length for flaps up take-off from Step 13b > Runway Available from Step 1?
If no, enter 'N/A' in the box for this step then proceed to Step 14.
If yes, proceed as follows:
1. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value for Runway Available from Step 1, then proceed to Step 13c-2.
If yes, the Runway Available from Step 1 minus 200 feet .... ____________ feet
2. Operational V_{REF} from Step 12 .... ____________ KIAS
3. Backtrack Figure 3-14 using the values from Steps 13c-1 & 13c-2 to determine = [ ] Gross Weight (pounds) Limited by Minimum Field Length Flaps Up Take-off
4. Determine new take-off data for the reduced gross weight.

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Figure 10-5. (Sheet 2 of 4)

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FLAPS UP TAKE-OFF WORK SHEET

14. Operational Obstacle Clearance Speed (Operational V_{OBS}), Flaps Up Operation *(Use Figure 3-20 (p _____))*

a. V_{OBS} .... ______________ KIAS

b. Is ΔV_R for wind from Step 7c > zero?
If no, Operational V_{OBS} equals the value for V_{OBS} from Step 14a;
enter the value, then proceed to Step 15.
If yes, Operational V_{OBS} equals V_{OBS} from Step 14a plus ΔV_R for wind from Step 7c = [ ] Operational V_{OBS} (KIAS)

15. Air Minimum Control Speed, One Engine Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect (V_{MCA}) *(Use Figure 3-23 (p _____))*

V_{MCA} = [ ] V_{MCA} (KIAS)

Note: When properly configured for the flaps up take-off with high rudder boost (refer to the Flight Manual), the 50% flaps V_{MCA}, Figure 3-23, is the effective V_{MCA} for the configuration.

16. Air Minimum Control Speed, One Engine Inoperative, Gear Up or Down, Flaps Up, Normal Bleed, Out of Ground Effect (Flaps Up V_{MCA}) *(Use Figure 3-24 (p _____))*

Flaps Up V_{MCA} = [ ] Flaps Up V_{MCA} (KIAS)

Note: When low rudder boost is in effect, Flaps Up V_{MCA} is the effective V_{MCA} for the configuration.

17. Air Minimum Control Speed, Two Engines Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect ($V_{MCA\ 2}$) *(Use Figure 3-25 (p _____))*

$V_{MCA\ 2}$ = [ ] $V_{MCA\ 2}$ (KIAS)

Note: Although not exact, when the aircraft is properly prepared for flaps up take-off operations, with high rudder boost, this value provides a useful reference.

18. Acceleration Check Time, 4 Engines *(Use Figure 3-34 (p _____))*

Applying Corrections:

1. *Make wind corrections by applying 100% of headwind or tailwind component.*
2. *Acceleration check speed should be 120, 110, 100, 90, 80, 70 or 60 knots. Use the highest one of the speeds which does not exceed the following:*
   Operational V_{REF} (Step 12) minus 10 knots, then rounded down to the nearest 10 knots.

Operational V_{REF} from Step 12 .... ____________ KIAS
Acceleration speed .... ____________ KIAS
Acceleration check time = [ ] seconds

19. Take-off Distance, 4 Engines, 50% Flaps *(Use Figure 3-29 (p _____))*

Applying Corrections:

1. *Use Figure 3-29, Sheets 1, 2, 3 and 5 (do* not *use Sheet 4).*
2. *Apply the corrections for Flaps Up.*
3. *Corrections can be applied to the flaps up take-off distance for obstacle heights up to 50 feet at the end of the take-off distance. However, do not plan a flaps up obstacle clearance take-off unless specifically approved.*

a. Corrected take-off distance, 4-engines = ... ____________ feet

b. Is Operational Flaps Up V_R from Step 11 > Flaps Up V_R from Step 4?
If no, enter the value from Step 19a at Step 19b-4, then proceed to Step 19c.
If yes, proceed as follows to adjust take-off distance for the increase in V_R.
1. Flaps Up V_R from Step 4 .... ____________ KIAS
2. Take-off distance from Step 19a .... ____________ feet
3. Operational Flaps Up V_R from Step 11 .... ____________ KIAS
4. *(Use Figure3-36 (p _____))* Use the values from Steps 19b-1, -2 & -3 to determine take-off distance for increased Flaps Up V_R .... ____________ feet

c. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value from Step 19b-4 in the box for this step.
If yes, enter the sum of Step 19b-4 plus 200 feet = [ ] Take-off Distance, 4-Engines, Flaps Up (feet)

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Figure 10-5. (Sheet 3 of 4)

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FLAPS UP TAKE-OFF WORK SHEET

20. Climb-out Flight Path Speeds, 3 or 4 Engines *(Use Figure 3-47 (p _____))*

a. Flaps Up Safety Speed (FUSS), 3 or 4-engines = [ ] FUSS (KIAS)

b. Best climb speed, 3 or 4-engines = [ ] Best Climb Speed (KIAS)

Note:
The 4 and 3-engine climb-out flight path data presented in Figures 3-39 & 3-45 shall not be used for flaps up. This data is formulated with respect to CFL which is not provided for flaps up. Use climb performance data found in Section 4 to determine climb performance with flaps up.

21. Most Limiting Take-off Gross Weight

a. Maximum take-off gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____)) .... _______________ pounds
Minimum field length flaps up take-off (from Step 13).................... _______________ pounds

Note: The maximum take-off gross weights limited by V_{MBE} and $V_{HSGI/TO}$ were complied with in Steps 9 & 10.

b. Lowest of the values from Step 21a (disregard any 'N/A') = [ ] pounds

c. Is the take-off gross weight from Step 2 ≤ the value determined in Step 21b?
If no, aircraft is too heavy for conditions. Decrease take-off gross weight to at least equal the limiting take-off gross weight, then determine new take-off data.
If yes, flaps up take-off data is complete.

22. Optional: Determining Maximum Take-off Gross Weight Limited By V_{MBE} Or $V_{HSGI/TO}$

Applying Corrections:
This step assumes that the flaps up take-off gross weight is not limited by field length or airframe structural requirements. Before proceeding, check these items using Steps 13 & 21 if necessary.

a. *Use Figure 3-20 (p _____)*, Rotation and Obstacle Clearance Speeds
1. $V_{HSGI/TO}$ from Step 9.. _______________ KIAS
2. Set Flaps Up V_R and V_{REF} equal to $V_{HSGI/TO}$ from Step 22a-1.
3. Backtrack the chart with the value from Step 22a-1 to determine the Maximum Take-Off Gross Weight for Flaps Up $V_R = V_{REF} = V_{TO\text{-}HSGI}$ .... _______________ pounds.

b. *Use Figure 3-15 (p _____)*, Take-off Brake Energy Limit Speed (V_{MBE})
1. Flaps Up V_R from Step 4 .... _______________ KIAS
2. Set Flaps Up V_{REF} and V_{MBE} equal to V_R from Step 4.
3. Backtrack the chart with the value from Step 22b-1 to determine the Maximum Take-Off Gross Weight for Flaps Up $V_R = V_{REF} = V_{MBE}$ .... _______________ pounds.

c. For $V_{HSGI/TO}$ from Step 22a-1 and V_R ($V_R = V_{MBE}$) from Step 22b-1,
Is $V_{HSGI/TO} \leq V_R$ ($V_R = V_{MBE}$) ?
If no, proceed to Step 22d
If yes, the weight determined in Step 22a-3 is the Maximum Take-Off Gross Weight for Flaps Up. Enter the value in the box for the most limiting take-off gross weight at Step 22d, then proceed to Step 22e.

d. For $V_{HSGI/TO}$ from Step 22a-1 and V_R ($V_R = V_{MBE}$) from Step 22b-1,
If V_R ($V_R = V_{MBE}$) < $V_{HSGI/TO}$ (most common with Take-Off Factors < 1.5), the limiting flaps up take-off gross weight will fall between the values determined in Step 22a-3 and Step 22b-3. The exact value must be determined by trial and error. However, it is recommended to use the value from Step 22b-3 for the Maximum Take-Off Gross Weight for Flaps Up = [ ] Most Limiting Take-off Gross Wt (pounds)

e. Decrease take-off gross weight to at least equal the limiting take-off gross weight, then determine new take-off data.

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Figure 10-5. (Sheet 4 of 4)

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FLAPS UP LANDING WORK SHEET

1. Conditions

Field Elevation .... ____________ feet
Altimeter Setting .... ____________ in Hg
Pressure Altitude (PA) (Fig 1-9)........ ____________ feet
Outside Air Temperature (OAT)........ ____________ °C
ISA Deviation (Fig 1-4)..................... ____________ °C
Runway Heading .... ____________ deg
Runway Available .... ____________ feet
Runway Visual Range .... ____________ RVR
Visibility (statute miles) .... ____________ mi

RCR __________ **or** RSC _______ (*Use only one value)*
Slope +_______% (uphill) **or** -_________% (downhill) (*Use only one value)*
Wind ________ degrees at ________ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Intended Flaps Setting (100, 50 or 0) ____**0**____ %
Engines in Reverse (check one) 4 REV __ 2 REV* __ or 4 HGI __

* *For 2 REV, use more restrictive 2 IB REV corrections to cover use of any symmetrical pair in reverse.*

2. Landing Gross Weight

Operating Weight _________ (pounds) + Landing Cargo Weight _________ (pounds) + FOB _________ (pounds) = [   ] Landing Gross Weight (pounds)

Note: The flaps up maximum landing gross weight is often limited by either $V_{HSGI/LDG}$ or V_{MBE} before reaching the landing gross weight limited by airframe structure.

3. Touchdown Speed (TD), Flaps Up (*Use Figure 9-3, (p _____)*)

Touchdown speed, flaps up (Flaps Up TD)....................................... _____________ KIAS

Note: Further corrections for Flaps Up TD may be needed to determine Operational Flaps Up TD.

4. Maximum Recommended Crosswind for Landing (*Use Figure 9-11 (p _____)*)

Maximum recommended crosswind for landing .... _____________ knots

5. Crosswind Chart – Wind Components *(Use Figure 9-12 (p _____))*

Headwind component (enter chart with steady wind value)............... _____________ knots
Crosswind component † (enter chart with steady wind value plus the gust increment)... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

† *The maximum recommended crosswind is the lower of 35 knots or the value from Step 4.*

6. Wind Adjustment Increment for Touchdown speed (ΔTD for wind) *(Use Figure 9-12 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 6b.
If yes, the increment to increase Flaps Up TD for wind gust equals the value for wind gust increment. Enter Wind Gust Increment from Step 1‡..... ___________ Δ KIAS
(If value entered is 10, skip Step 6b and proceed to Step 6c.)

b. Is Flaps Up TD plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 6b-3, then proceed to Step 6c.
If yes, proceed as follows:
1. Flaps Up TD from Step 3 plus value from Step 6a .... ____________ KIAS
2. Obtain Minimum Flaps Up TD from the Crosswind Chart for the value entered at Step 6b-1 ‡ .... ____________ KIAS
3. Steps 6b-2 minus 6b-1 equals the increment to increase Flaps Up TD for crosswind ‡ .... ____________ Δ KIAS

c. The sum of the values from Step 6a and Step 6b-3 ‡ (enter zero if none) = ___________________
Total ΔTD for Wind (Δ KIAS)

‡ *Flaps Up TD may be increased for caution zone crosswind or wind gust increment. The total ΔTD for wind must not exceed 10 knots.*

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Figure 10-6. (Sheet 1 of 3)

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FLAPS UP LANDING WORK SHEET

7. Operational Flaps Up Landing Speeds *(Use Figure 9-3, (p _____)*

a. Operational Flaps Up Approach (APP) speed:
Flaps Up APP (________ KIAS) plus Step 6c (________ Δ KIAS) = [ ] Operational Flaps Up APP (KIAS)

b. Operational Flaps Up Threshold (THR) speed:
Flaps Up THR (________ KIAS) plus Step 6c (________ Δ KIAS) = [ ] Operational Flaps Up THR (KIAS)

c. Operational Flaps Up Touchdown (TD) speed:
Flaps Up TD (________ KIAS) plus Step 6c (________ Δ KIAS) = [ ] Operational Flaps Up TD (KIAS)

8. Landing Distance Over 50-foot Obstacle, for Percent Flaps *(Use Figure 9-4 (p _____))*

Applying Corrections:

1. *Apply the corrections for zero percent flaps in the chart.*
2. *Apply the corrections for Engines in Reverse selected in Step 1.*
3. *When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD for wind from Step 6c.*
4. *When applying corrections for the wind components from Step 5 in the performance data charts, use only 50% of the headwind component or 150% of the tailwind component unless otherwise noted.*

a. Landing distance over a 50-foot obstacle for 0% flaps:
0% Flaps... ______________ feet

b. Is there any additional distance correction for the value at Step 8a?
1. If no, enter zero at Step 8b-2, then enter the value from Step 8a in the box at Step 8b-3 and proceed to Step 8c.
2. If yes, the distance correction to be added .... ______________ feet
3. Add the values from Step 8b-2 and Step 8a to determine Landing distance over a 50-foot obstacle for 0% flaps = [ ] Landing Distance Over a 50-Foot Obstacle, 0% Flaps (feet)

c. Is the landing distance over a 50-foot obstacle from Step 8b-3 greater than the Runway Available from Step 1?
If no, enter 'N/A' in the box for this step, then proceed to Step 9.
If yes, proceed as follows:
1. Runway Available from Step 1 minus distance correction from Step 8b-2 .... ______________ feet
2. Use the value from Step 8c-1 and backtrack the chart for landing distance over a 50-foot obstacle; take all applicable corrections to determine the field length limited landing gross weight = [ ] Field Length Limited Landing Gross Weight (pounds)

9. Landing Ground Roll, for Percent Flaps *(Use Figure 9-5 (p _____))*

Applying Corrections:

1. *Apply the corrections for zero percent flaps in the chart.*
2. *Apply the corrections for Engines in Reverse selected in Step 1.*
3. *When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD for wind from Step 6c.*

Flaps up landing ground roll = [ ] Flaps Up Landing Ground Roll (feet)

10. Landing Weight Limited by Maximum Brake Kinetic Energy *(Use Figure 9-6 (p _____))*

Applying Corrections:

1. *Apply the corrections for zero percent flaps in the chart.*
2. *Apply the corrections for Engines in Reverse selected in Step 1.*

Landing weight limited by maximum brake kinetic energy = [ ] Landing Weight (pounds) Limited by Maximum Brake Kinetic Energy

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Figure 10-6. (Sheet 2 of 3)

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FLAPS UP LANDING WORK SHEET

11. Maximum Speed for Transition from Flight Idle to High Speed Ground Idle (HSGI), All Flaps Settings ($V_{HSGI/LDG}$)
(Use Figure 9-7 (p _____))

$V_{HSGI/LDG}$ =

[ ] $V_{HSGI/LDG}$ (KIAS)

12. Maximum Landing Weight Permitted by Power Lever Transition Limits
(Use Figure 9-10 (p _____))

Applying Corrections:
Use the chart for the flaps up.

Maximum landing weight permitted by the speed ($V_{HSGI/LDG}$) for power lever transition limits =

[ ] Maximum Landing Wt (pounds) Permitted by $V_{HSGI/LDG}$

13. Most Limiting Landing Gross Weight

a. Maximum Landing gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____)) .... _____________ pounds
Landing distance, over 50-foot obstacle (from Step 8c) .... _____________ pounds
Maximum brake kinetic energy (from Step 10) .... _____________ pounds
Power lever transition limits (from Step 12) .... _____________ pounds

b. Lowest of the values from Step 13a (disregard any 'N/A') =

[ ] (pounds)

c. Is the landing gross weight from Step 2 $\leq$ the value determined in Step13b?
If no, aircraft is too heavy for conditions. Consider an alternate runway, maximum alternate landing weight, fuel dump or cargo jettison. If necessary, decrease landing gross weight to at least equal the limiting landing gross weight. Determine landing data for the new conditions.
If yes, flaps up landing data is complete.

Note: Refer to the Flight Manual for High Speed Landing operating procedures.

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Figure 10-6. (Sheet 3 of 3)

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ATCS INOPERATIVE TAKE-OFF WORK SHEET

1. Conditions

Field Elevation .... _______________ feet
Altimeter Setting .... _______________ in Hg
Pressure Altitude (PA) (Fig 1-9)... _______________ feet
Outside Air Temperature (OAT)... _______________ °C
ISA Deviation (Fig 1-4) .... _______________ °C
Runway Heading .... _______________ deg
Runway Available .... _______________ feet

RCR __________ **or** RSC _______ (*Use only one value)*
Slope +_______% **or** -_________% (*Use only one value)*
(uphill) (downhill)
Wind ________ degrees at _______ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Drag Index ____________________
Normal bleed ____ **or** all bleed ____ (*Check one value)*

2. Take-off Gross Weight

Operating Weight _______ (pounds) + Cargo Weight _______ (pounds) + Fuel On Board (FOB) _______ (pounds) = [ ] Take-off Gross Weight (pounds)

3. Take-off Factor (*Use Figure 3-8 or 3-9 (pp _____ or _____)*)

Take-off Factor .... _____________

4. Rotation Speed (V_R) (*Use Figure 3-17 (p_____)*)

Rotation speed (V_R), 50% flaps, normal operation .... _____________ KIAS
Note: Further corrections for V_R may be needed to determine operational V_R.

5. Maximum Recommended Crosswind *(Use Figure 3-12 (p _____))*

Maximum recommended crosswind for take-off .... _____________ knots

6. Crosswind Chart – Wind Components *(Use Figure 3-11 (p _____))*

Headwind component (enter chart with steady wind value)................ _____________ knots
Crosswind component * (enter chart with steady wind value plus the gust increment) .... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

* *The maximum recommended crosswind is the lower of 35 knots or the value from Step 5.*

7. Wind Adjustment Increment for V_R (ΔV_R for wind) *(Use Figure 3-11 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 7b.
If yes, the increment to increase V_R for wind gust equals the value for wind gust increment. Enter Wind Gust Increment from Step 1† .... ___________ ΔKIAS
(If value entered is 10, skip Step 7b and proceed to Step 7c.)

b. Is V_R plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 7b-3, then proceed to Step 7c.
If yes, proceed as follows:
1. V_R from Step 4 plus value from Step 7a .... ____________ KIAS
2. Obtain Minimum V_R from the Crosswind Chart for the value entered at Step 7b-1 † .... ____________ KIAS
3. Steps 7b-2 minus 7b-1 equals the increment to increase V_R for crosswind † .... ____________ ΔKIAS

c. The sum of the values from Step 7a and Step 7b-3 † (enter zero if none) = __________________ Total ΔV_R for Wind (ΔKIAS)

† *Rotation speed (V_R) may be increased for caution zone crosswind or wind gust increment. The total ΔV_R for wind must* not *exceed 10 knots.*

8. Torquemeter Shaft Horsepower (TMSHP)

(Use Figure 3-11 (p _____)
a. Is a 2,500 TMSHP restriction below 35 KIAS necessary?
If no, check "Unrestricted," then proceed to Step 8b.
If yes, check "Restricted."

☐ Unrestricted
☐ Restricted

(Use Figure 3-6 or 3-7 (pp _____ or _____))
b. Torquemeter shaft horsepower (static setting) required for take-off, 4-engines = [ ] TMSHP

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Figure 10-7. (Sheet 1 of 6)

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ATCS INOPERATIVE TAKE-OFF WORK SHEET

9. Operational Rotation Speed (Operational V_R)

Is ΔV_R for wind from Step 7c > zero?
If no, Operational V_R equals the value for V_R from Step 4;
enter the value, then proceed to Step 10.
If yes, Operational V_R equals V_R from Step 4 plus ΔV_R for wind from Step 7c = [ ]

Operational V_R (KIAS)

10. Critical Field Length (CFL), 4 Engines *(Use Figure 3-13 (p ____))*

Applying Corrections:

1. *Apply corrections for ATCS inoperative.*
2. *Final distance corrections for CFL are* not *provided in the CFL Chart.*
3. *When applying corrections for the wind components from Step 6 in the performance data charts, use only 50% of the headwind component or 150% of the tailwind component unless otherwise noted.*
4. *If ΔV_R for Wind from Step 7 is greater than zero, correct CFL for the necessary increase in V_R using Sheet 4 of 4. Otherwise, Sheet 4 of 4 is not used.*

a. Corrected CFL = ... ____________ feet

b. CFL with final distance corrections:
1. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter zero then proceed to Step 10b-2.
If yes, enter 200 feet to be added to CFL .... ____________ feet
2. Is there any additional distance correction for CFL? *(For example, distance added for certain instrument departure procedures.)*
If no, enter zero then proceed to Step 10b-3.
If yes, correction to be added to CFL .... ____________ feet
3. The sum of the values from Steps 10a, 10b-1, and 10b-2 = [ ]

CFL (feet)

c. Is CFL from Step 10b-3 > Runway Available from Step 1?
If no, enter 'N/A' (Not Applicable) in the box for this step, then proceed to Step 11.
If yes, proceed as follows:
1. Runway Available from Step 1 .... ____________ feet
2. The sum of the values from Steps 10b-1 and 10b-2 .... ____________ feet
3. Step 10c-1 minus 10c-2 equals usable CFL............................ ____________ feet
4. Use the value from Step 10c-3 (or less) and backtrack the CFL Chart;
take all applicable corrections to determine CFL limited gross take-off weight = [ ]

CFL Limited Gross Take-off Weight (pounds)

5. Determine new take-off data for the reduced gross weight.

Note: If Step 10c-5 is necessary consider that there may be further restrictions to gross weight. Before reducing take-off gross weight, use this work sheet as necessary to complete Steps 13, 23, 24, 25 & 27 to determine the most limiting take-off gross weight.

11. Critical Engine Failure Speed (V_{CEF}) *(Use Figure 3-14 (p ____))*

Applying corrections for ATCS inoperative:
Corrected CFL from Step 10a.. ____________ feet
Use this value to determine V_{CEF} = [ ]

V_{CEF} (KIAS)

12. Refusal Speed (V_{REF}) *(Use Figure 3-14 (p ____))*

Applying corrections for ATCS inoperative:
Is TMSHP restricted (Step 8)?
If no, proceed as follows:
1. Runway Available (from Step 1).. ____________ feet
2. Use this value to determine V_{REF}.
3. Enter the value for V_{REF}, then proceed to Step 13.

If yes, proceed as follows:
1. Runway Available (from Step 1) minus 200 feet .... ____________ feet
2. Use this value to determine V_{REF}.
3. Enter the value for V_{REF}, then proceed to Step 13.

V_{REF} = ____________

V_{REF} (KIAS)

Note: Further corrections for V_{REF} may be needed to determine operational V_{REF}.

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Figure 10-7. (Sheet 2 of 6)

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ATCS INOPERATIVE TAKE-OFF WORK SHEET

13. Take-off Brake Energy Limit Speed (V_{MBE}) *(Use Figure 3-15 (p _____))*

a. V_{MBE} = [ ] V_{MBE} (KIAS)

b. Is V_{CEF} from Step 11 > V_{MBE}?
If no, the take-off gross weight is not limited by brake energy speed; proceed to Step 14.
If yes, proceed as follows:
1. Subtract V_{MBE} from V_{CEF} .... ______________ Δ KIAS
2. Determine Δ weight reduction .... ______________ Δ pounds
3. Reduce the take-off gross weight by at least the value from Step 13b-2.
4. Determine new take-off data.

14. Maximum Speed for Transition from Take-off Power to High Speed Ground Idle (HSGI) ($V_{HSGI/TO}$) *(Use Figure 3-16 (p _____))*

$V_{HSGI/TO}$ = [ ] $V_{HSGI/TO}$ (KIAS)

15. Operational Refusal Speed (Operational V_{REF})

V_{REF} from Step 12 .... _____________ KIAS

a. Is V_{REF} (_____ KIAS) > Operational V_R (_____ KIAS) from Step 9?
If no, enter 'N/A', then proceed to Step 15b.
If yes, enter Operational V_R .... ______________ KIAS

b. Is V_{REF} (_____ KIAS) > V_{MBE} (_____ KIAS) from Step 13?
If no, enter 'N/A,' then proceed to Step 15c.
If yes, enter V_{MBE} .... _____________ KIAS

c. Is V_{REF} (_____ KIAS) > $V_{HSGI/TO}$ (_____ KIAS) from Step 14?
If no, enter 'N/A,' then proceed to Step 15d.
If yes, enter $V_{HSGI/TO}$ .... ______________ KIAS

d. Did you answer "Yes" in Step 15a, 15b or 15c?
If no, Operational V_{REF} equals V_{REF} from Step 12; enter the value, then proceed to Step 16.
If yes, the lowest value from Step 15a, Step 15b or Step 15c equals Operational V_{REF} = [ ] Operational V_{REF} (KIAS)

16. Operational Obstacle Clearance Speed (Operational V_{OBS}), 50% Flaps, Normal Operation *(Use Figure 3-17 (p _____))*

a. V_{OBS} .... ______________ KIAS

b. Is ΔV_R for wind from Step 7c > zero?
If no, Operational V_{OBS} equals the value for V_{OBS} from Step 16a; enter the value, then proceed to Step 17.
If yes, Operational V_{OBS} equals V_{OBS} from Step 16a plus ΔV_R for wind from Step 7c = [ ] Operational V_{OBS} (KIAS)

17. Take-off Pitch Attitude Schedule, 50% Flaps *(Use Figure 3-19 (p _____))*

Take-off pitch attitude schedule, 50% flaps = [ ] Take-off Pitch Attitude (degrees)

18. Ground Minimum Control Speed, One Engine Inoperative, Gear Down, 50% Flaps, Normal Bleed (V_{MCG}) *(Use Figure 3-21 (p _____))*

V_{MCG} = [ ] V_{MCG} (KIAS)

19. Minimum Power Restoration Speed, ATCS Not Operating (V_{MPR}) *(Use Figure 3-22 (p _____))*

V_{MPR} = [ ] V_{MPR} (KIAS)

20. Air Minimum Control Speed, One Engine Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect (V_{MCA}) *(Use Figure 3-23 (p _____))*

V_{MCA} = [ ] V_{MCA} (KIAS)

21. Air Minimum Control Speed, Two Engines Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect ($V_{MCA\,2}$) *(Use Figure 3-25 (p _____))*

$V_{MCA\,2}$ = [ ] $V_{MCA\,2}$ (KIAS)

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Figure 10-7. (Sheet 3 of 6)

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ATCS INOPERATIVE TAKE-OFF WORK SHEET

22. Take-off Distance, 4 Engines, 50% Flaps *(Use Figure 3-29 (p ____))*

Applying Corrections:

1. *Apply corrections for ATCS inoperative.*
2. *If the take-off distance is to be corrected for an obstacle height up to 50 feet, apply the appropriate correction.*

a. Corrected take-off distance, 4-engines = ... ____________ feet

b. Is Operational V_R from Step 9 > V_R from Step 4?
If no, enter the value from Step 22a at Step 22b-4, then proceed to Step 22c.
If yes, proceed as follows to adjust take-off distance for the increase in V_R.
1. V_R from Step 4 .... ____________ KIAS
2. Take-off distance from Step 22a .... ____________ feet
3. Operational V_R from Step 9 .... ____________ KIAS
4. *(Use Figure3-36 (p _____))* Use the values from Steps 22b-1, -2 & -3 to determine take-off distance for increased V_R..................... ____________ feet

c. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value from Step 22b-4 in the box for this step.
If yes, enter the sum of Step 22b-4 plus 200 feet = [ ]

Take-off Distance, 4-Engines, 50% Flaps (feet)

23. Climb-out Flight Path, 3 Engines, for Obstacle Clearance

a. Are there obstacles in the climb-out flight path?
If no, the take-off gross weight is not limited by climb-out flight path obstacles; enter 'N/A' in the box for this step then proceed to Step 24.
If yes, proceed as follows:
1. Known obstacle vertical distance above the take-off surface *(round up to 10's of feet)* .... ____________ feet
2. Known obstacle horizontal distance from brake release *(round down to 100's of feet)*.................................... ____________ feet

Note: Climb-out Flight Path charts do not correct for wind. With tailwinds, chart predictions are invalid.

b. *Use Figure 3-13 (p ____):*
Applying Corrections: The horizontal distance to the obstacle is effectively decreased for CFL corrections and adjustments that extend ground roll beyond baseline conditions.
1. Determine baseline CFL by applying no corrections .... ____________ feet
2. Determine CFL by applying all corrections and adjustments except for headwind component *(When they apply make increases for TMSHP restriction, and use Figure 3-37 (p ____) to determine increase for increased V_R.)* .... ____________ feet
3. Subtract 23b-1 from 23b-2 .... ____________ Δ feet
4. Subtract Step 23b-3 from Step 23a-2 to obtain adjusted horizontal distance .... ____________ feet

c. *Use Figure 3-46 (p ____):*
Applying Corrections: To obtain chart predictions with increased drag index, the effective horizontal distance to clear the obstacle is decreased.
1. Backtrack the chart by entering on the vertical axis with adjusted horizontal distance from Step 23b-4.
2. Move horizontally to the right to the value for drag index from Step 1.
3. Then move down to the horizontal axis to obtain the effective horizontal distance .... ____________ feet

d. *Use Figure 3-44 (p ____):*
Climb-out Factor, 3 Engines .... ____________

e. *Use Figure 3-45 (p _____):*
Enter the chart with the effective horizontal distance from Step 23c-3 to determine the climb-out flight path predicted vertical distance at effective horizontal distance.
Predicted vertical distance = ... ____________ feet

f. Does the predicted vertical distance from Step 23e clear the known obstacle vertical distance from Step 23a-1?
If yes, Enter 'N/A' in the box for this step then proceed to Step 24.
If no, proceed as follows:
1. Backtrack Figure 3-45 using the known vertical distance from Step 23a-1 and the effective horizontal distance from Step 23c-3 to determine required Climb-out Factor.
2. Backtrack Figure 3-44 using the required Climb-out Factor to obtain the maximum take-off gross weight limited by Climb-out Flight Path, 3 Engines. Enter the value, then proceed to Step 27…. [ ]

Maximum Take-off Gross Weight Limited by Climb-out Flight Path Obstacle (pounds)

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Figure 10-7. (Sheet 4 of 6)

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ATCS INOPERATIVE TAKE-OFF WORK SHEET

24. Climb-out Flight Path, 3 Engines, For Instrument Departure Procedure Minimum Climb Requirement

a. Is there a published climb rate in feet per nm to a specified altitude for the planned departure? *(Check departure procedure requirements.)*
If no, and the climb rate for the instrument departure is standard, Enter 'N/A' in the box for this step then proceed to Step 25.
If yes, proceed as follows:

1. Published climb requirement minus 48 ft per nm .... ____________ feet per nm for 3-engines
2. Altitude required minus runway elevation .... ____________ feet above the take-off surface

Note: Climb-out Flight Path charts do not correct for wind. With tailwinds, chart predictions are invalid.

b. *Use Figure 3-44 (p ____):*
Climb-out Factor, 3-Engines .... ____________

c. *Use Figure 3-45 (p _____)*:
Horizontal distance from brake release. Backtrack the chart with the vertical distance from Step 24a-2 and Climb-out Factor from Step 24b .... ____________ feet

d. *Use Figure 3-46 (p _____)*:
Drag index corrected horizontal distance from brake release.
Enter with the horizontal distance from Step 24c .... ____________ feet

e. *Use Figure 3-45, Sheet 2 of 2 (p _____)*:
Applying Corrections: The horizontal distance used to determine the predicted climb gradient for the instrument departure commences after the ground roll.
Ground run distance from zero to the point where the climb begins.
Back track the chart with the climb-out factor from Step 24b to determine the distance from zero to the point where the climb begins .... ____________ feet

f. Horizontal distance to climb to the vertical distance from Step 24a-2.
[Step 24d minus Step 24e] divided by 6076 *(6076 feet = 1 nm.)* gives the horizontal distance to climb to the vertical distance .... ____________ nm

g. Predicted climb in feet per nm.
Divide the vertical distance from Step 24a-2 by the horizontal distance for the climb from Step 24f to get predicted climb = ... ____________ feet per nm

h. Is the predicted climb from Step 24g $\geq$ the climb requirement from Step 24a-1?
If yes, Enter 'N/A' in the box for this step then proceed to Step 25.
If no, use trial and error with reduced gross weights to determine the gross weight limit =
Proceed to Step 27.

[ ] Maximum Take-off Gross Weight Limited by Climb Requirement (pounds)

25. Take-off Gross Weight Limited by 3-engine Climb Performance Gear Up, 50% Flaps (*Use Figure 3-10 (p _____)*)

a. 1. If Step 23a to 23f or Step 24a to 24h or both were used (*not* left blank) enter N/A in the box for this step and proceed to Step 26.

2. To meet standard climb requirements when no climb requirement is published, examination of data using Figure 3-10 has demonstrated that when the following conditions are met you may enter 'N/A' in the box for this step and proceed to Step 26 *(Check departure procedure and climb requirements.)*:

Climb requirement of	$\leq$	152 feet per nm with 3 engines, 50% flaps, take-off power, V_{OBS} and gear up
Gross weight	$\leq$	155,000 lb
Take-off factor	$\leq$	3.0
Drag Index	$\leq$	20
Headwind component	$\geq$	zero

3. If conditions in Step 25a-1 or any of the conditions in Step 25a-2 were not met and 'N/A' was not entered, proceed to step 25b.

b. If available, enter the value required for ROC at Step 25b-6 then proceed to Step 25b-7. Otherwise proceed to Step 25b-1.

1. Feet per nm required (152 feet per nm nominal) ...._____________ feet per nm
2. Altitude to maintain value from Step 25b-1 *(entry optional)* ......_____________ feet
3. Operational V_{OBS} from Step 16 ...._____________ KIAS
4. True airspeed for Step 25b-3 *(Use Figures 1-1, 1-3 & 1-5)* ......_____________ KTAS
5. Ground speed, apply wind component ‡ to Step 25b-4 ...._____________ GS Knots
6. ROC required, the product of [Step 25b-5 (knots) X Step 25b-1 (feet/nm)] divided by 60 min/hr ...._____________ feet per minute
7. Take-off gross weight limited by 3-engine climb performance =

[ ] Take-off Gross Weight Limited by 3-Engine Climb Performance (pounds)

‡ *When using winds and temperatures aloft forecasts to estimate wind component for instrument departure procedures, a low estimate of headwind component or a high estimate of tailwind component increases safety margin.*

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Figure 10-7. (Sheet 5 of 6)

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ATCS INOPERATIVE TAKE-OFF WORK SHEET

26. Climb-out Flight Path Speeds *(Use Figure 3-47 (p _____))*

Minimum flap retraction speed, 3 or 4 engines = [ ] Minimum Flap Retraction Speed (KIAS)

Flaps Up Safety Speed (FUSS), 3 or 4 engines = [ ] FUSS (KIAS)

Best climb speed, 3 or 4 engines (Use this speed with Climb-Out Flight Path, Step 23 & 24.) = [ ] Best Climb Speed (KIAS)

27. Most Limiting Take-off Gross Weight

a. Maximum take-off gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____)) .... _______________ pounds
Critical field length (from Step 10).. _______________ pounds
Climb-out flight path obstacle (from Step 23) .... _______________ pounds
Climb-out flight path climb requirement (from Step 24) .... _______________ pounds
3-engine climb performance (from Step 25) .... _______________ pounds

Note: The maximum take-off gross weight limited by brake energy speed is complied with in Step 13.

b. Lowest of the values from Step 27a (disregard any ‘N/A’) = [ ] pounds

c. Is the take-off gross weight from Step 2 ≤ the value determined in Step 27b?
If no, aircraft is too heavy for conditions. Decrease take-off gross weight to at least equal the limiting take-off gross weight, then determine new take-off data.
If yes, normal take-off data is complete.

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Figure 10-7. (Sheet 6 of 6)

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ATCS INOPERATIVE LANDING WORK SHEET

Use the NORMAL LANDING WORK SHEET for ATCS Inoperative.

The landing data is not affected by ATCS inoperative. The steps for obtaining the landing data with ATCS inoperative are identical to those for normal landing.

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Figure 10-8.

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MAXIMUM EFFORT TAKE-OFF WORK SHEET

Is CFL > Runway Available? *(The Normal Take-off Work Sheet may be used to determine CFL.)*
If no, for reduced risk, use normal take-off data from the Normal Take-off Work Sheet.
If yes, reduce gross weight or proceed with this work sheet.

1. Conditions

Field Elevation .... _______________ feet
Altimeter Setting.......................... _______________ in Hg
Pressure Altitude (PA) (Fig 1-9).. _______________ feet
Outside Air Temperature (OAT).. _______________ °C
ISA Deviation (Fig 1-4)................ _______________ °C
Runway Heading......................... _______________ deg
Runway Available .... _______________ feet

RCR __________ **or** RSC _______ (*Use only one value)*
Slope +_______% **or** -_________% (*Use only one value)*
(uphill) (downhill)
Wind ________ degrees at _______ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Drag Index _____________________
Normal bleed ____ **or** all bleed ____ (*Check one value)*

2. Take-off Gross Weight

Operating Weight _______ (pounds) + Cargo Weight _______ (pounds) + Fuel On Board (FOB) _______ (pounds) = [ ] Take-off Gross Wt (pounds)

3. Take-off Factor (*Use Figure 3-8 or 3-9 (pp _____ or _____))*

Take-off Factor .... _____________

4. Maximum Effort Rotation Speed (Max Effort V_R) (*Use Figure 3-18 (p ____)*

Max Effort V_R .... ____________ KIAS

5. Maximum Recommended Crosswind *(Use Figure 3-12 (p ____))*

Maximum recommended crosswind for take-off................................. _____________ knots

Note: Check operator requirements or instructions which may specify that the actual crosswind component must not exceed this value.

6. Crosswind Chart – Wind Components *(Use Figure 3-11 (p _____))*

Headwind component (enter chart with steady wind value) .... _____________ knots

Crosswind component * (enter chart with steady wind value plus the gust increment) .... _____________ knots

Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

* *The maximum recommended crosswind is the lower of 35 knots or the value from Step 5.*

7. Wind Adjustment Increment for V_R (ΔV_R for wind) *(Use Figure 3-11 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 7b.
If yes, the increment to increase V_R for wind gust equals the value for wind gust increment. Enter Wind Gust Increment from Step 1† .... ___________ Δ KIAS
(If value entered is 10, skip Step 7b and proceed to Step 7c.)

b. Is V_R plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 7b-3, then proceed to Step 7c.
If yes, proceed as follows:
1. V_R from Step 4 plus value from Step 7a .... ____________ KIAS
2. Obtain Minimum V_R from the Crosswind Chart for the value entered at Step 7b-1† .... ____________ KIAS
Note: Check operator requirements which may specify that the value for Minimum Max Effort V_R must fall in the "Recommended" area of the chart.
3. Steps 7b-2 minus 7b-1 equals the increment to increase V_R for crosswind † .... ____________ Δ KIAS

c. The sum of the values from Step 7a and Step 7b-3 † (enter zero if none) = ___________________ Total ΔV_R for Wind (Δ KIAS)

† *Max Effort V_R may be increased for caution zone crosswind or wind gust increment. The total ΔV_R for wind must* not *exceed 10 knots.*

8. Torquemeter Shaft Horsepower (TMSHP)

(Use Figure 3-11 (p ____)
a. Is a 2,500 TMSHP restriction below 35 KIAS necessary?
If no, check "Unrestricted," then proceed to Step 8b.
If yes, check "Restricted."

☐ Unrestricted
☐ Restricted

(Use Figure 3-6 or 3-7 (pp _____ or _____))
b. Torquemeter shaft horsepower (static setting) required for take-off, 4-engines = [ ] TMSHP

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Figure 10-9. (Sheet 1 of 6)

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MAXIMUM EFFORT TAKE-OFF WORK SHEET

9. Air Minimum Control Speed, One Engine Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect (V_{MCA}) *(Use Figure 3-23 (p ____))*

V_{MCA} = [ ] V_{MCA} (KIAS)

10. Operational Max Effort Rotation Speed (Operational Max Effort V_R)

a. Max Effort V_R from Step 4 .... ____________ KIAS

b. 1. Enter the value from Step 7c (may be zero) .... ____________ ΔKIAS

2. Subtract V_{MCA} from Step 9 minus Max Effort V_R from Step 4, and enter value up to but not more than 10 ΔKIAS................. ____________ ΔKIAS

c. If a V_{MCA} safety limit is *not* required enter the sum of Step 10a plus Step 10b-1.
If a V_{MCA} safety limit is required enter the sum of Step 10a plus the greater of Step 10b-1 or 10b-2.
Operational Max Effort V_R = [ ] Operational Max Effort V_R (KIAS)

Note: Check operator requirements which may require that Max Effort V_R is not less than V_{MCA}. Greater than 10 knot increases Max Effort V_R may be achieved using the alternate method provided at Step 19f.

11. Operational Obstacle Clearance Speed (Operational Max Effort V_{OBS}), 50% Flaps, Maximum Effort *(Use Figure 3-18 (p____))*

a. Max Effort V_{OBS} .... ____________ KIAS

b. Is Operational Max Effort V_R from Step 10 > Max Effort V_R from Step 4?
If no, enter Max Effort V_{OBS} from Step 11a in the box for this step, then proceed to Step 12.
If yes, proceed as follows:
1. Operational Max Effort V_R from Step 10 .... _____________ KIAS
2. Max Effort V_R from Step 4 .... _____________ KIAS
3. Subtract Step 11b-2 from 11b-1 .... _____________ ΔKIAS
4. The sum of Step 11a plus Step 11b-3 = [ ] Operational Max Effort V_{OBS} (KIAS)

12. Refusal Speed (V_{REF}) *(Use Figure 3-14 (p ____))*

Is TMSHP restricted (Step 8)?
If no, proceed as follows:
1. Runway Available (from Step 1)... ____________ feet
2. Use this value to determine V_{REF}.
3. Enter the value for V_{REF}, then proceed to Step 13.

If yes, proceed as follows:
1. Runway Available (from Step 1) minus 200 feet .... ____________ feet
2. Use this value to determine V_{REF}.
3. Enter the value for V_{REF}, then proceed to Step 13.

V_{REF} = ____________________ V_{REF} (KIAS)

Note: Further corrections for V_{REF} may be needed to determine operational V_{REF}.

13. Take-off Brake Energy Limit Speed (V_{MBE}) *(Use Figure 3-15 (p ____))*

V_{MBE} = [ ] V_{MBE} (KIAS)

14. Maximum Speed for Transition from Take-off Power to High Speed Ground Idle (HSGI) ($V_{HSGI/TO}$) *(Use Figure 3-16 (p ____))*

$V_{HSGI/TO}$ = [ ] $V_{HSGI/TO}$ (KIAS)

15. Operational Refusal Speed (Operational V_{REF})

V_{REF} from Step 12 .... ____________ KIAS

a. Is V_{REF} (_____ KIAS) > Operational Max Effort V_R (_____ KIAS) from Step 10? If no, enter 'N/A', then proceed to Step 15b.
If yes, enter Operational Max Effort V_R .... _____________ KIAS

b. Is V_{REF} (_____ KIAS) > V_{MBE} (_____ KIAS) from Step 13?
If no, enter 'N/A,' then proceed to Step 15c.
If yes, enter V_{MBE} .... ____________ KIAS

c. Is V_{REF} (_____ KIAS) > $V_{HSGI/TO}$ (_____ KIAS) from Step 14?
If no, enter 'N/A,' then proceed to Step 15d.
If yes, enter $V_{HSGI/TO}$ .... _____________ KIAS

d. Did you answer "Yes" in Step 15a, 15b or 15c?
If no, Operational V_{REF} equals V_{REF} from Step 12; enter the value, then proceed to Step 16.
If yes, the lowest value from Step 15a, Step 15b or Step 15c equals Operational V_{REF} = [ ] Operational V_{REF} (KIAS)

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Figure 10-9. (Sheet 2 of 6)

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MAXIMUM EFFORT TAKE-OFF WORK SHEET

16. Take-off Pitch Attitude Schedule, 50% Flaps, Maximum Effort *(Use Figure 3-19 (p _____))*

Maximum Effort Take-off pitch attitude schedule, 50% flaps = [ ] Maximum Effort Take-off Pitch Attitude (degrees)

17. Ground Minimum Control Speed, One Engine Inoperative, Gear Down, 50% Flaps, Normal Bleed (V_{MCG}) *(Use Figure 3-21 (p _____))*

V_{MCG} = [ ] V_{MCG} (KIAS)

18. Air Minimum Control Speed, Two Engines Inoperative, Gear Up or Down, 50% Flaps, Normal Bleed, Out of Ground Effect ($V_{MCA\ 2}$) *(Use Figure 3-25 (p _____))*

$V_{MCA\ 2}$ = [ ] $V_{MCA\ 2}$ (KIAS)

19. Minimum Field Length for Maximum Effort Take-off, 50% Flaps (MFLMETO) *(Use Figures 3-32 (p _____))*

Applying Corrections:

1. *MFLMETO is corrected for increases in Max Effort V_R up to 10 KIAS using Figure 3-32, Sheet 4. To determine required distance for Max Effort V_R increases > 10 KIAS use Figure 3-14 (Step 19f).*
2. *Authorization for maximum effort may allow skipping this step and proceeding directly to Step 20. However, if MFLMETO is less than the runway available, using MFLMETO reduces risk by allowing for distance to abort take-off up to Max Effort V_R.*
3. *Apply all applicable corrections in the chart to determine partially corrected MFLMETO.*
4. *Final distance corrections for MFLMETO are* not *provided in the chart.*
5. *Use only 50% of the headwind component or 150% of the tailwind component.*

a. Determine increase in Max Effort V_R.
(Operator requirements may require that Max Effort V_R is not less than V_{MCA}.)
1. Enter the value from Step 7c .... ____________ Δ KIAS
2. Subtract V_{MCA} from Step 9 minus Max Effort V_R from Step 4.... ____________ Δ KIAS
3. If a V_{MCA} safety limit is *not* required enter the value from Step 19a-1 at Step 19a-5 (skip Step 19a-4).
4. If a V_{MCA} safety limit is required enter the greater of values from Step 19a-1 or Step 19a-2 at Step 19a-5.
5. Total increase in Max Effort V_R .... ____________ Δ KIAS

b. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter zero then proceed to Step 19c.
If yes, enter 200 feet to be added to MFLMETO .... ____________ feet

c. If the value at Step 19a-5 is > 10 Δ KIAS skip Step 19d and 19e then proceed to Step 19f.
If the value at Step 19a-5 is ≤ 10 Δ KIAS proceed with Step 19d.

d. Corrected MFLMETO. *(If the value at Step 19a-5 is greater than zero use it in Sheet 4 of 4. Otherwise, Sheet 4 of 4 is unused.)* .... ____________ feet

e. Add the values from Steps 19b plus 19d, then skip Step 19f and enter the sum at Step 19g.

f. *(Alternate method used for determining MFLMETO for Max Effort V_R increased > 10 Δ KIAS. Use of this step requires substitution of alternate values at previous Steps 10c, 11b, and 15d.)*
Determine the minimum field length required based on refusal distance as follows:
1. Use V_{MCA} from Step 9 for Operational Max Effort V_R and for refusal speed (V_{REF}). Change Operational Max Effort V_R in Step 10c and Operational V_{REF} in Step 15d to the value used for V_{MCA} from Step 9. *(V_{REF} must be ≤ V_{MBE} from Step 13 and $V_{HSGI/TO}$ from Step 14, or gross weight must be reduced.)*
Operational V_{REF} (equals V_{MCA} from Step 9)............................ ____________ KIAS
2. Change Operational Max Effort V_{OBS} in Step 11b to the sum of Max Effort V_{OBS} from Step 11a plus to the value from Step 19a-5.
3. *(Use Figure 3-14 (p _____))*
Backtrack the chart with V_{REF} from Step 19f-1. Apply the corrections for refusal speed *(not V_{CEF})*, and all other applicable corrections, to determine MFLMETO for Max Effort V_R increased > 10 Δ KIAS .... ____________ feet
4. Add the values from Steps 19b plus 19f-3, then enter the sum at Step 19g.

g. Minimum Field Length For Max Effort Takeoff = [ ] MFLMETO (feet)

(Continued next sheet)

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Figure 10-9. (Sheet 3 of 6)

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MAXIMUM EFFORT TAKE-OFF WORK SHEET

(Continue Step 19)

h. Is MFLMETO from Step 19g > Runway Available from Step 1?
If no, enter 'N/A' in the box for this step, then proceed to Step 20.
If yes, proceed as follows:
If authorized for maximum effort operations enter 'N/A' in the box for this step then proceed to Step 20.
If authorization is limited to using MFLMETO, proceed as follows to determine MFLMETO limited gross weight:
1. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value for Runway Available from Step 1, then proceed to Step 19h-2.
If yes, enter Runway Available from Step 1 minus 200 feet.
Runway available .... ____________ feet
2. For required MFLMETO distance, use the value for from Step 19h-1 (or less) in Step 19h-3.
3. *(use Figure 3-32 (p _____) when MFLMETO was determined using Step 19d.)*
Backtrack the chart, taking all applicable corrections to determine MFLMETO limited gross weight, and enter the value at Step 19h-4.
(Use Figure 3-14 (p _____) when MFLMETO was determined using Step 19f.)
Backtrack the chart, taking all applicable corrections to determine field length limited gross weight, and enter the value at Step 19h-4.
4. Gross weight limited by field length = [ ] MFLMETO Limited Gross Wt (pounds)
5. Determine new take-off data for the reduced gross weight.

Note: *If Step 19h-5 is necessary consider that there may be further restrictions to gross weight. Before reducing gross weight, use this work sheet as necessary to complete Steps 20, 21 & 24 to determine the most limiting maximum effort take-off gross weight.*

20. Take-off Distance, Maximum Effort, 4 Engines, 50% Flaps *(Use Figure 3-33 (p _____))*

Applying Corrections:
1. *Use only 50% of the headwind component or 150% of the tailwind component.*
2. *Final distance corrections for the maximum effort take-off distance are* not *provided in the chart.*
3. *Apply the correction for obstacle height to obtain corrected maximum effort take-off distance over an obstacle (up to 50 feet high) at the end of the take-off distance.*

a. Corrected maximum effort take-off distance .... ____________ feet

b. Is Operational Max Effort V_R from Step 10 > Max Effort V_R from Step 4?
If no, enter the value from Step 20a at Step 20b-4, then proceed to Step 20c.
If yes, proceed as follows to adjust maximum effort take-off distance for the increase in V_R:
1. Max Effort V_R from Step 4 .... ____________ KIAS
2. Maximum effort take-off distance from Step 20a...................... ____________ feet
3. Operational Max Effort V_R from Step 10c .... ____________ KIAS
4. *(Use Figure 3-36 (p _____))* Use the values from Steps 20b-1, -2 & -3 to determine .... ____________ feet

c. Maximum effort take-off distance corrections:
Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value from Step 20b-4 in the box for this step.
If yes, enter the sum of Step 20b-4 plus 200 feet = [ ] Maximum Effort Take-off Distance, 4-Engines, 50% Flaps (feet)

d. Is maximum effort take-off distance from Step 20c > Runway Available from Step 1?
If no, enter 'N/A' in the box for this step then proceed to Step 21.
If yes, proceed as follows:
1. Is a 2,500 TMSHP restriction required in Step 8?
If no, enter the value for Runway Available from Step 1, then proceed to Step 20d-2.
If yes, enter Runway Available from Step 1 minus 200 feet.
Runway available .... ____________ feet
2. Set maximum effort take-off distance equal to runway available from Step 20d-1.
3. *(Use Figure 3-33 (p _____) and if necessary Figure 3-36 (p _____))* Backtrack the charts with the value from Step 20d-1; take all applicable corrections to determine maximum effort take-off distance limited gross weight = [ ] Maximum Effort Take-off Distance Limited Gross Weight (pounds)
4. Determine new take-off data for the reduced gross weight. (Consider Steps 21, 22 & 24.)

Note: *Take-off distance maximum effort (Figure 3-33) includes no distance formulations for stopping. When using this distance, Operational V_{REF}, Step 15, provides the information for accelerate stop in the distance available. To assess the risk, examine how much lower V_{REF} is than Max Effort V_R and V_{MCA}.*

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Figure 10-9. (Sheet 4 of 6)

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MAXIMUM EFFORT TAKE-OFF WORK SHEET

21. Climb-out Flight Path, 4 Engines, Maximum Effort

a. Are there obstacles in the climb-out flight path?
If no, the maximum effort take-off gross weight is not limited by climb-out flight path obstacles; enter 'N/A' in the box for this step then proceed to Step 22.
If yes, proceed as follows:
1. Known obstacle vertical distance above the take-off surface *(round up to 10's of feet)* .... ____________ feet
2. Known obstacle horizontal distance from brake release *(round down to 100's of feet)*.................................... ____________ feet

Note: Climb-out Flight Path charts do not correct for wind. With tailwinds, chart predictions are invalid.

b. *Use Figure 3-33 (p ____)*
Applying Corrections: The horizontal distance to the obstacle is effectively decreased for maximum effort take-off distance corrections that extend ground roll beyond baseline conditions.
1. Determine baseline maximum effort take-off distance by applying no corrections .... ____________ feet
2. Determine maximum effort take-off distance by applying all corrections in the chart except for headwind component. Apply corrections (if any) on sheet 3 of 3 for an obstacle up to 50 feet. Apply correction for tailwind component, if any. .... ____________ feet
3. Subtract 21b-1 from 21b-2 .... ____________ Δ feet
4. Subtract Step 21b-3 from Step 21a-2 to obtain adjusted horizontal distance .... ____________ feet

c. *Use Figure 3-43 (p ____)*
Applying Corrections: To obtain chart predictions with increased drag index, the effective horizontal distance to clear the obstacle is decreased.
1. Backtrack the chart by entering on the vertical axis with adjusted horizontal distance from Step 21b-4.
2. Move horizontally to the right to the value for drag index from Step 1.
3. Then move down to the horizontal axis to obtain the effective horizontal distance .... ____________ feet

d. *Use Figure 3-41 (p ____)*
Determine Maximum Effort Climb-out Factor, 4-Engines .... ____________

e. *Use Figure 3-42 (p ____)*
Enter the chart with the effective horizontal distance from Step 21c-3.
Determine climb-out flight path predicted vertical distance at effective horizontal distance... ____________ feet

f. Does the predicted vertical distance from Step 21e clear the known obstacle vertical distance from Step 21a-1?
If yes, Enter 'N/A' in the box for this step then proceed to Step 22.
If no, proceed as follows:
1. Backtrack Figure 3-42 using the known vertical distance from Step 21a-1 and the effective horizontal distance from Step 21c-3 to determine required Climb-out Factor.
2. Backtrack Figure 3-41 using the required Climb-out Factor to obtain the maximum take-off gross weight limited by the Climb-out Flight Path, 4-Engines, Maximum Effort. Enter the value in the box for this step, then proceed to Step 22.

[ ] Maximum Take-off Gross Weight Limited by Climb-out Flight Path (pounds)

22. Climb-out Flight Path Speeds, 3 or 4 Engines *(Use Figure 3-47 (p ____))*

Minimum flap retraction speed, 3 or 4 engines = [ ] Minimum Flap Retraction Speed (KIAS)

Flaps Up Safety Speed (FUSS), 3 or 4 engines = [ ] FUSS (KIAS)

Best climb speed, 3 or 4 engines (Use this speed with Climb-Out Flight Path, Step 21.) = [ ] Best Climb Speed (KIAS)

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Figure 10-9. (Sheet 5 of 6)

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MAXIMUM EFFORT TAKE-OFF WORK SHEET

23. Acceleration Check Time, 4 Engines *(Use Figure 3-34 (p ____))*

Applying Corrections:

1. *For take-off conditions where $V_{REF} \geq V_R$, some operators may not require this step and 'N/A' may be entered.*
2. *Make wind corrections by applying 100% of headwind or tailwind component.*
3. *Acceleration check speed should be 120, 110, 100, 90, 80, 70 or 60 knots. Use the highest one of the speeds which does not exceed the following: Operational V_{REF} (Step 15) minus 10 knots, then rounded down to the nearest 10 knots.*

Operational V_{REF} from Step 15 .... ____________ KIAS
Acceleration speed .... ____________ KIAS

Acceleration check time = [   ] Seconds

24. Most Limiting Take-off Gross Weight

a. Maximum take-off gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____)) .... ______________ pounds
MFLMETO (from Step 19) .... ______________ pounds
Take-off distance maximum effort (from Step 20) .... ______________ pounds
Climb-out flight path (from Step 21) .... ______________ pounds

b. Lowest of the values from Step 24a (disregard any 'N/A') = [   ] pounds

c. Is the take-off gross weight from Step 2 $\leq$ the value determined in Step 24b?
If no, aircraft is too heavy for conditions. Decrease take-off gross weight to at least equal the limiting take-off gross weight, then determine new take-off data.
If yes, maximum effort take-off data is complete.

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Figure 10-9. (Sheet 6 of 6)

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MAXIMUM EFFORT LANDING WORK SHEET

1. Conditions

Field Elevation .... ___________ feet
Altimeter Setting .... ___________ in Hg
Pressure Altitude (PA) (Fig 1-9) .... ___________ feet
Outside Air Temperature (OAT) .... ___________ °C
ISA Deviation (Fig 1-4) .... ___________ °C
Runway Heading .... ___________ deg
Runway Available .... ___________ feet
Runway Visual Range .... ___________ RVR
Visibility (statute miles) .... ___________ mi

RCR __________ **or** RSC _______ (*Use only one value*)
Slope +_______% **or** -_________% (*Use only one value*)
(uphill) (downhill)
Wind ________ degrees at ________ knots
Wind Gust Increment _____________ knots (*Zero if none*)
Intended Flaps Setting (100, 50 or 0) ____**100**____ %
Engines in Reverse (check one) 4 REV __ 2 REV* __ or 4 HGI __
* *For 2 REV, use more restrictive 2 IB REV corrections to cover use of any symmetrical pair in reverse.*

2. Landing Gross Weight

Operating Weight _________ + Landing Cargo Weight _________ + FOB _________ = [ ]
(pounds) (pounds) (pounds) Landing Gross Weight (pounds) †

† *Maximum Effort Landing gross weight and fuel limitations are those corresponding to a landing sink rate of 540 FPM; see Flight Manual, Section 1 - Limitations.*

3. Touchdown Speed, Maximum Effort (Max Effort TD), 100% Flaps (*Use Figure 9-1, Sheet 2 of 2 (p _____)*)

Max Effort TD .... _____________ KIAS

Note: Further corrections for Max Effort TD may be needed to determine operational Max Effort TD.

4. Maximum Recommended Crosswind for Landing (*Use Figure 9-11 (p _____)*)

Maximum recommended crosswind for landing .... _____________ knots

Note: Check operator requirements which may specify that the actual crosswind component must not exceed this value.

5. Crosswind Chart – Wind Components *(Use Figure 9-12 (p _____))*

Headwind component (enter chart with steady wind value) .... _____________ knots
Crosswind component ‡ (enter chart with steady wind value plus the gust increment) .... _____________ knots
Tailwind component (enter chart with steady wind value plus the gust increment) .... _____________ knots

‡ *The maximum recommended crosswind is the lower of 35 knots or the value from Step 4.*

6. Wind Adjustment Increment for Touchdown Speed (ΔTD for Wind) *(Use Figure 9-12 (p _____))*

a. Is there a wind gust increment?
If no, enter zero for this step, then proceed to Step 6b.
If yes, the increment to increase Max Effort TD for wind gust equals the value for wind gust increment. Enter Wind Gust Increment from Step 1§ ..... ___________ Δ KIAS
(If value entered is 10, skip Step 6b and proceed to Step 6c.)

b. Is Max Effort TD plus wind gust increment (gust may be zero) increased for caution zone crosswind?
If no, enter zero at Step 6b-3, then proceed to Step 6c.
If yes, proceed as follows:
1. Max Effort TD from Step 3 plus value from Step 6a .... ____________ KIAS
2. Obtain Minimum Max Effort TD from the Crosswind Chart for the value entered at Step 6b-1 § .... ____________ KIAS
Note: Check operator requirements which may specify that the value for Minimum Max Effort V_R must fall in the "Recommended" area of the chart.
3. Steps 6b-2 minus 6b-1 equals the increment to increase Max Effort TD for crosswind § .... ____________ Δ KIAS

c. The sum of the values from Step 6a and Step 6b-3 § (enter zero if none) = ________________
Total ΔTD for Wind (ΔKIAS)

§ *Max Effrot TD may be increased for caution zone crosswind or wind gust increment. The total ΔTD for wind must not exceed 10 knots.*

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Figure 10-10. (Sheet 1 of 2)

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MAXIMUM EFFORT LANDING WORK SHEET

7. Operational Maximum Effort Landing Speeds, 100% Flaps *(Use Figure 9-1, Sheet 2 of 2 (p _____))*

a. Operational Max Effort Approach (APP) speed:
1. Max Effort Threshold (THR) speed plus 10 KIAS .... _____________ KIAS
2. The value from Step 7a-1 (________ KIAS) plus Step 6c (________ Δ KIAS) = [ ] Operational Max Effort APP (KIAS)

b. Operational Max Effort Threshold (THR) speed:
Max Effort THR (________ KIAS) plus Step 6c (________ Δ KIAS) = [ ] Operational Max Effort THR (KIAS)

c. Operational Max Effort Touchdown (TD) speed:
Max Effort TD (________ KIAS) plus Step 6c (________ Δ KIAS) = [ ] Operational Max Effort TD (KIAS)

8. Landing Ground Roll, Maximum Effort *(Use Figure 9-5, Sheet 2 of 4 (p _____))*

Applying Corrections:
1. *Apply all applicable corrections in the chart.*
2. *Apply the corrections for Engines in Reverse from Step 1.*
3. *When applying corrections in the grid labeled 'Increased Touchdown Speed' use the ΔTD for wind from Step 6c.*
4. *When applying corrections for the wind components from Step 5 in the performance data charts, use only 50% of the headwind component or 150% of the tailwind component unless otherwise noted.*

a. Maximum effort landing ground roll = [ ] Maximum Effort Landing Ground Roll (feet)

b. Enter any additional distance correction for maximum effort landing distance. (Enter zero if none.) .... _____________ feet

c. Is the sum of the values from Step 8a plus Step 8b > Runway Available from Step 1?
If no, enter 'N/A' in the box for this step then proceed to Step 9.
If yes, proceed as follows:
1. Runway Available from Step 1 minus the value from Step 8b .. _____________ feet
2. Use the value from Step 8c-1 and backtrack the chart for Landing Ground Roll, Maximum Effort; take all applicable corrections to determine the field length limited landing gross weight = [ ] Field Length Limited Landing Gross Weight (pounds)

9. Maximum Speed for Transition from Flight Idle to High Speed Ground Idle (HSGI), All Flaps Settings ($V_{HSGI/LDG}$) *(Use Figure 9-7 (p _____))*

$V_{HSGI/LDG}$ = [ ] $V_{HSGI/LDG}$ (KIAS)

10. Maximum Landing Weight Permitted by Power Lever Transition Limits, Maximum Effort *(Use Figures 9-8, Sheet 2 of 2 (p _____))*

Maximum effort, maximum landing weight permitted by the speed for power lever transition limits ($V_{HSGI/LDG}$) = [ ] Maximum Effort Maximum Landing Wt (pounds) Permitted by $V_{HSGI/LDG}$

11. Most Limiting Landing Gross Weight

a. Maximum Landing gross weight limited by:
Airframe structure (see Flight Manual, Section 1 (p _____)) .... _____________ pounds
Field length (from Step 8c) .... _____________ pounds
Power lever transition limits (from Step 10) .... _____________ pounds

Note: For Max Effort landing, gross weight limited by brake energy is not the limiting gross weight because Max Effort TD is significantly reduced from normal landing TD. The chart for Landing Weight Limited By Maximum Brake Kinetic Energy is formulated for normal TD and is not applicable for Max Effort.

b. Lowest of the values from Step 11a = [ ] pounds

c. Is the landing gross weight from Step 2 ≤ the value determined in Step11b?
If no, aircraft is too heavy for conditions. Consider an alternate runway, maximum alternate landing weight, fuel dump or cargo jettison. If necessary, decrease landing gross weight to at least equal the limiting landing gross weight. Determine landing data for the new conditions.
If yes, maximum effort landing data is complete.

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Figure 10-10. (Sheet 2 of 2)

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C-130J TAKE-OFF AND LANDING DATA CARD

CONDITIONS

PA ______	WIND ______ ° AT ______ KTS
OAT ______	OPER WT ______
RUNWAY HDG ______	FUEL WT ______
LENGTH ______	CARGO WT ______
RCR/RSC ______	GROSS WT ______
SLOPE ______	

COMPUTATIONS

TORQUE METER SHAFT HP ______

TAKE-OFF FACTOR ______

CRITICAL FIELD LENGTH ______

MIN FIELD LENGTH FOR
MAX EFFORT TAKE-OFF ______

GROUND RUN ______

ACCELERATION CHECK TIME ______ SEC

(FROM ______ TO ______ KTS)

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Figure 10-11. (Sheet 1 of 2)

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TAKE-OFF

TORQUE METER SHAFT HP		GROUND MINIMUM CONTROL SPEED
	AIR MINIMUM CONTROL SPEED	
MINIMUM POWER RESTORATION SPEED - VMPR (ATCS INOP.)	OUT OF GROUND EFFECT 1-ENGINE INOP	OUT OF GROUND EFFECT 2-ENGINES INOP
REFUSAL		TAKE-OFF
OBS CLEAR		3 ENG CLIMB

LANDING

LANDING SPEEDS

FLAPS	APPROACH	THRESHOLD	TOUCHDOWN
100%			
50%			
0%			

DISTANCE/GROUND ROLL

2 REV ☐ 4 REV ☐

FLAPS	100%	50%	0%
LDG DIST (50 FT)			
GROUND ROLL			

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Figure 10-11. (Sheet 2 of 2)

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