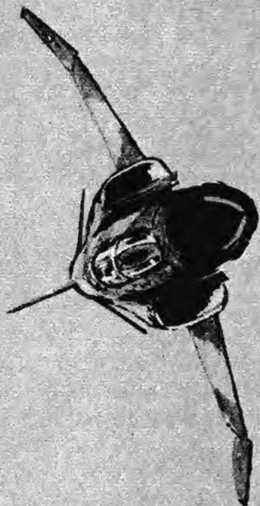
FLIGHT MANUAL



USAF SERIES F-4C, F-4D, AND F-4E AIRCRAFT

MCDONNELL DOUGLAS

NOw(A) 63-0032-i
N00019-69-C-0521

Each transmittal of this document outside of the Department of Defense must have prior approval of the Technical Order Distribution Control Activity. Refer to T.O. 00-5-2.

This manual supersedes T.O. 1F-4C-1 dated 15 July 1969 and Operational Supplement T.O. 1F-4C-1S-111.

This manual is incomplete without T.O. 1F-4C-1-1.

Commanders are responsible for bringing this publication to the attention of all affected personnel.

Published under authority of the Secretary of the Air Force.

1 OCTOBER 1970

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page.

Dates of issue for original and changed pages:

Original . . 0 . . 1 Oct 70

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CURRENT FLIGHT CREW CHECK LISTS
T.O. 1F-4C-1CL-1 1 October 1970

CURRENT PERFORMANCE DATA MANUAL
T.O. 1F-4C-1-1 15 July 1969 Change 3 - 1 October 1970

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USAF

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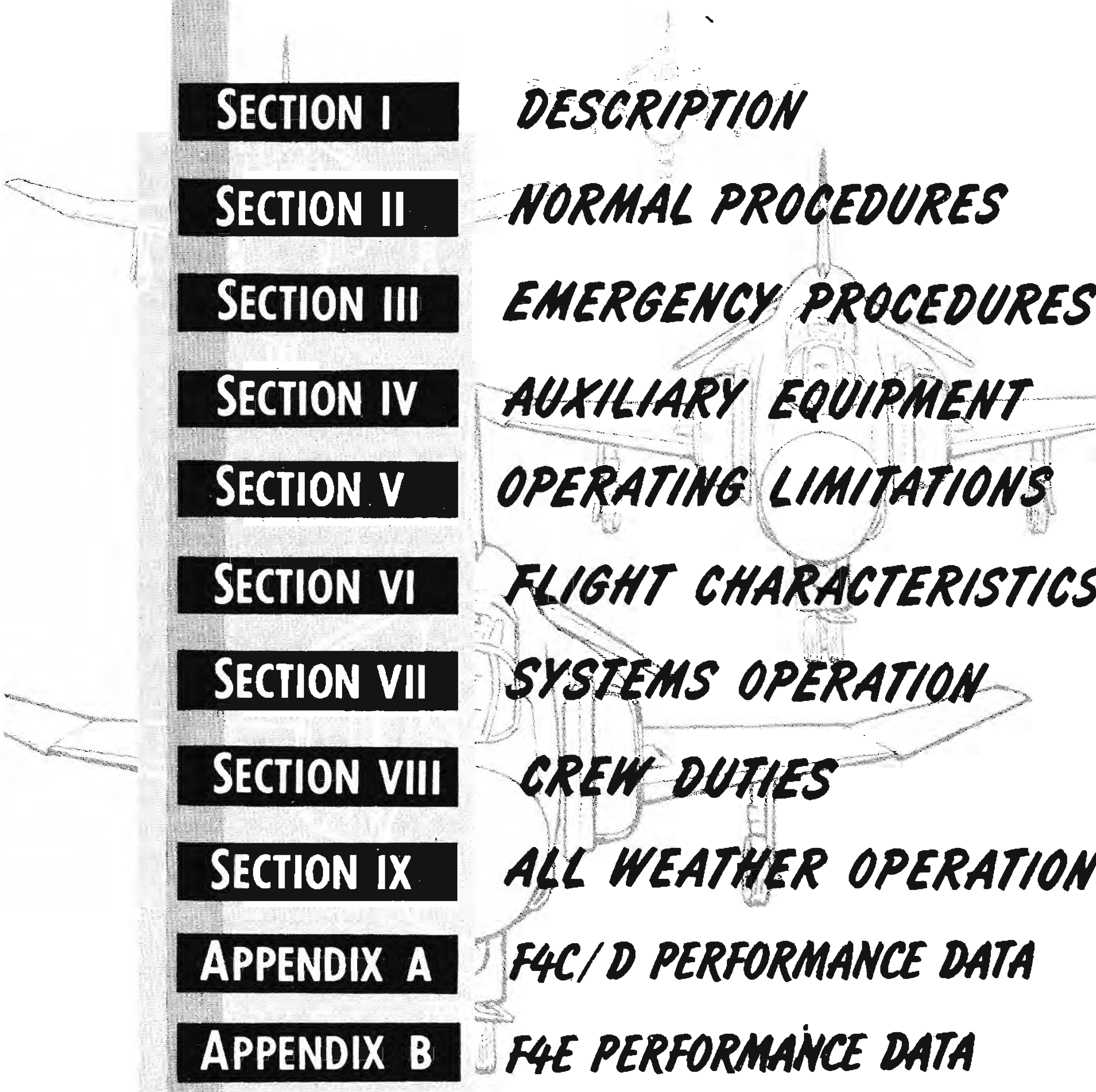
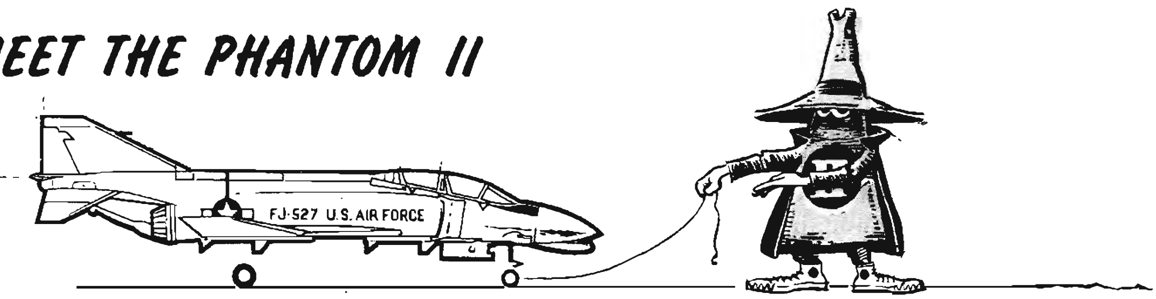


*Refer to Performance Data Manual, T.O. 1F-4C-1-1

F4-TC

MEET THE PHANTOM II



SCOPE. This manual contains necessary information for the safe and efficient operation of the F-4C/D/E Phantom II. These instructions provide you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and, therefore, basic flight principles are avoided.

SOUND JUDGMENT. Instructions in this manual are for a crew inexperienced in the operation of the aircraft. This manual provides the best possible operating instructions under most circumstances, but it is not intended to be used as a substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc. may require modification of the procedures.

PERMISSIBLE OPERATIONS. The Flight Manual takes a positive approach and normally states only what you can do. Clearance must be obtained from ASD before any questionable operation is attempted which is not specifically permitted in this manual.

CURRENCY. Currency of the manual is maintained through annual revisions, routine changes, rapid action changes, and safety and operational supplements. The annual revision is a completely reprinted manual, and contains the results of the annual Flight Manual Command Review. Routine changes are scheduled to be issued on a 90-day cycle, and normally contain ECP/TCTO coverage and changes/additions to the manual that do not require immediate dissemination. Rapid action changes are expeditiously prepared and published as formal replacement pages for the manual, and are normally issued in lieu of, or to replace, safety/operation supplements.

SUPPLEMENTS. Information involving safety or urgent operational requirements will be promptly forwarded to you by either a safety supplement or an operational supplement. Interim supplements (in TWX form) will be replaced by either a formal supplement, a rapid action change, or during a routine change/revision. The title page of the flight manual and the title block of each supplement should be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements. A monthly information sheet (in TWX form) will list the status of the latest flight manual and checklist changes, and all outstanding supplements.

CHECKLISTS. The Flight Manual contains only amplified checklists. Checklists have been issued as separate technical orders - see the back of the title page for T.O. number and date of your latest checklist. Line items in the Flight Manual and checklists are identical with respect to arrangement and item number. Whenever a Safety Supplement affects the abbreviated checklist, write in the applicable change on the affected checklist page. As soon as possible, a new checklist page incorporating the supplement will be issued. This will keep handwritten entries of Safety Supplement information in your checklist to a minimum.

PERFORMANCE DATA. To reduce the size of the basic Flight Manual, the performance data (Appendix A and B) has been removed; and is now issued as a separate technical order. The Performance Data Manual (T.O. 1F-4C-1-1) is not automatically distributed with each basic Flight Manual; therefore, it must be ordered separately. Refer to the back of the title page for current status of the Performance Data Manual.

FLIGHT MANUAL BINDERS. Loose leaf binders and sectionalized tabs are available for use with your manual. These are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1).

CHANGE SYMBOL. The change symbol, as illustrated by the black line in the margin of this paragraph, indicates text changes made to the current revision. No change symbol is used to indicate changes made to illustrations.

WARNING, CAUTIONS, AND NOTES. The following definitions apply to Warnings, Cautions, and Notes found throughout the manual.

WARNING

Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which will result in damage to equipment if not carefully followed.

Note

An operating procedure, technique, etc., which is considered essential to emphasize.

YOUR RESPONSIBILITY - TO LET US KNOW. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded through your Command Headquarters to Hq ASD, Wright-Patterson AFB, Ohio, Attn: SD4T

SAFETY SUPPLEMENT SUMMARY

The following list contains: the previously cancelled or incorporated Safety Supplements; the outstanding Safety Supplements, if any; and the Safety Supplements incorporated in this issue. In addition, space is provided to list those Safety Supplements received since the latest issue. Refer to Safety Supplement Index.

NUMBER	SUBJECT OR DISPOSITION
T.O. 1F-4C-1SS-1 thru -114	Previously cancelled or incorporated.
T.O. 1F-4C-1SS-115	Replaced by T.O. 1F-4C-1SS-117
T.O. 1F-4C-1SS-116	Replaced by T.O. 1F-4C-1SS-119
T.O. 1F-4C-1SS-117	Replaced by T.O. 1F-4C-1SS-118
T.O. 1F-4C-1SS-118	Outstanding (Flight Restrictions for Aircraft Without T.O. 1F-4-809)
T.O. 1F-4C-1SS-119	Outstanding (Personnel Locator Beacon)

OPERATIONAL SUPPLEMENT SUMMARY

The following list contains: the previously cancelled or incorporated Operational Supplement; the outstanding Operational Supplements, if any, and the Operational Supplements incorporated in this issue. In addition, space is provided to list those Operational Supplements received since the latest issue. Refer to Safety Supplement Index.

NUMBER	SUBJECT OR DISPOSITION
T.O. 1F-4C-1S-1 thru -109	Previously cancelled or incorporated.
T.O. 1F-4C-1S-110	Replaced by T.O. 1F-4C-1S-111
T.O. 1F-4C-1S-111	Certification of Rockeye II Dispenser, Section V
T.O. 1F-4C-1S-112	Outstanding (Identifies Practice Bombs)

TECHNICAL ORDER SUMMARY

TECHNICAL ORDER	ECP	TITLE	PRODUCTION EFFECTIVITY	RETROFIT EFFECTIVITY
1F-4-515	434R1	Improves reliability of AFCS	F-4D 65-636 and up, all F-4E	All F-4C and F-4D thru 65-635
1F-4-609	8044	Fuel Pressurization and Vent System	F-4D 65-612 and up, all F-4E	All F-4C and F-4D thru 65-611
1F-4-670	8077	Eliminates need for INS double align	F-4D 65-666 and up, all F-4E	All F-4C and F-4D thru 65-665
	8070	Improves Air Refuel System	All F-4E	
1F-4-701		Modifies MLG Wheel Anti-spin System	F-4D 65-666 and up, all F-4E	All F-4C and F-4D thru 65-665
1F-4-702	7066	Adds gyro fast erect switch	F-4D 66-8699 and up, all F-4E	F-4D thru 66-8698
1F-4-741		Installs modified navigation computer amplifier	F-4D 66-7676 and up, all F-4E	All F-4C and F-4D thru 66-7675
	750R1	Incorporation of AIMS	F-4D 66-7505 and up, all F-4E	
1F-4-753	687S5	Installation of air-to-air IFF system	All F-4E	F-4C 63-7421 thru 64-928, and F-4D 64-929 thru 66-8825
1F-4-754		Adds Mode 4 Capability	F-4E 68-410 and up	All F-4C/D
1F-4-755		Adds KY-28 Speech Security Unit		All F-4C/D
1F-4-769		Illuminates AOA index lights	none	All F-4C
1F-4-773		Adds fuselage cell 5/6 lockout feature	none	All F-4C/D
1F-4-776	852	Adds formation lights	F-4E 68-366 and up	All F-4C/D and F-4E thru 68-538
1F-4-788	874	Adds anti-siphon valve	F-4E 67-212 and up	All F-4C/D and F-4E thru 67-211
1F-4-789		Isolates output of permanent magnet generators	F-4E 67-283 and up	All F-4D and F-4E thru 67-282
1F-4-793		Modification of forward cockpit throttle quadrant	F-4E 67-220 and up	All F-4C/D and F-4E thru 67-219
1F-4-796	8089	Inc Automatic Fuel Transfer System	none	All F-4C/D

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TECHNICAL ORDER SUMMARY (continued)

TECHNICAL ORDER	ECP	TITLE	PRODUCTION EFFECTIVITY	RETROFIT EFFECTIVITY
1F-4-808	8094S1	Adds Koch survival Kit and emergency oxygen on ejection seat	F-4E 68-366 and up	All F-4C/D/E
1F-4-831	8095	Improve longitudinal feel system	F-4E 68-366 and up	All F-4C/D and F-4E thru 68-365
1F-4-832	8083S6	Adds thigh garters and 1:1 withdrawal ratio ejection seat	F-4E 68-303 and up	All F-4C/D and F-4E thru 67-398
	827S2P1	Improvement of fuel feed system & incorporation of self sealing fuselage cells	F-4E 68-495 and up	
1F-4-840	919R1	Adds AOA aural tone system	F-4E 68-410 and up	All F-4C/D and F-4E thru 68-409
1F-4-842	8098	Adds AOA indicator aft cockpit	F-4E 68-452 and up	All F-4C and F-4E thru 68-451
1F-4-844	769	Illuminates AOA indexer lights	F-4E 68-366 and up	All F-4D and F-4E thru 68-365
1F-4-857	8083S10	Adds Zero-Zero ejection seat capability	F-4E 68-452 and up	All F-4C/D and F-4E 66-284 thru 68-451
1F-4-860	900R1	Adds finger lifts to front cockpit throttles	F-4E 68-495 and up	F-4E 66-7651 thru 68-494
1F-4-874		Canopy initiator and linkage protection	F-4E 69-304 and up	All F-4C/D and F-4E thru 69-303
1F-4-891		Incorporates normal canopy control guard in aft cockpit	F-4E 69-7261 and up	All F-4C/D and F-4E thru 69-7260
	827S2 Part III	Adds provisions for mounting selective armor	F-4E 68-452 and up	
1F-4-898	950S1	Incorporates interdictor safety pin to ejection seats and a guard to the seat mounted initiator firing line in the rear cockpit	F-4E 69-7579 and up	All F-4C/D and F-4E thru 69-7578
1F-4-903	827S2P2	Adds APU for longitudinal control	F-4E 69-304 and up	F-4E 68-452 thru F-4E 69-303
1F-4-906	967	Adds Forward Canopy Thrusters	F-4E 68-488 and up	All F-4C/D and F-4E thru 68-487
1F-4C-591		Add auto acquisition mode switch		F-4C 63-7407 thru 64-928
1F-4C-598		Multi-station ECM Wiring Provisions		All F-4C

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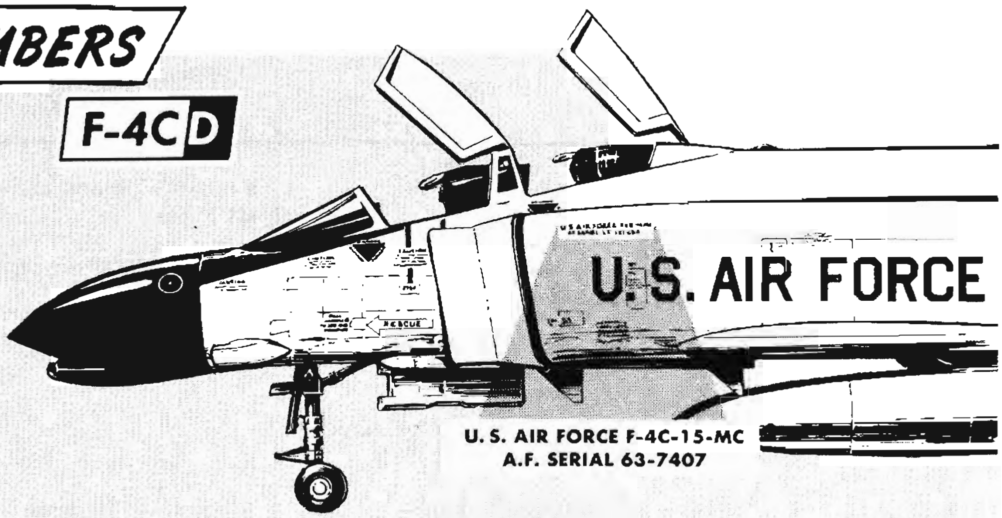
TECHNICAL ORDER SUMMARY (continued)

TECHNICAL ORDER	ECP	TITLE	PRODUCTION EFFECTIVITY	RETROFIT EFFECTIVITY
1F-4D-508	7023	AIM-4D Capability	F-4D 64-970 and up, all F-4E	F-4D thru 64-969
1F-4D-513	7069R1	Adds auto acquisition mode switch	F-4D 66-8699 and up, all F-4E	F-4D thru 66-8698
1F-4D-547		Multi-station ECM Wiring Provisions		All F-4D
1F-4D-559	2511	Adds provisions for MARK 6 MODE 0 WALLEYE		F-4D 65-771 thru 66-8825
1F-4E-513	8089	Inc Automatic Fuel Transfer System	F-4E 68-410 and up	F-4E thru 68-409
1F-4E-517	913	Incorporates 2 mode bellmouth	F-4E 67-283 and up	F-4E 66-284 thru 67-282
1F-4E-518	7137	Incorporates APR-36/37	F-4E 69-236 and up	F-4E 67-342 thru 68-53
1F-4E-527	7149	Reactivate spc in F-4E aircraft	F-4E 68-303 and up	F-4E thru 68-302
1F-4E-531		Multi-station ECM Wiring Provisions		All F-4E
1F-4E-532	703S3	Adds KY-28 Speech Security Unit		All F-4E
1F-4E-551		Adds Mode 4 Capability		F-4E thru 68-409
13A5-32-504	8083S7	Adds protector over ejection seat rocket sear and sear cable	F-4E 68-452 and up	All F-4C/D and F-4E thru 68-451
14D1-2-613C		Four line jettison lanyard (28 foot parachutes)		All 28 foot parachutes
15X2-4-501	8064	Modifies Emergency Oxygen System		

BLOCK NUMBERS

F-4C D



U. S. AIR FORCE F-4C-15-MC
A.F. SERIAL 63-7407

F-4C-15-MC
A.F. SERIAL 62-12199 and
A.F. SERIAL 63-7407 thru 63-7420

F-4C-16-MC
A.F. SERIAL 63-7421 thru 63-7442

F-4C-17-MC
A.F. SERIAL 63-7443 thru 63-7468

F-4C-18-MC
A.F. SERIAL 63-7469 thru 63-7526

F-4C-19-MC
A.F. SERIAL 63-7527 thru 63-7597

F-4C-20-MC
A.F. SERIAL 63-7598 thru 63-7662

F-4C-21-MC
A.F. SERIAL 63-7663 thru 63-7713
and 64-654 thru 64-672

F-4C-22-MC
A.F. SERIAL 64-673 thru 64-737

F-4C-23-MC
A.F. SERIAL 64-738 thru 64-817

F-4C-24-MC
A.F. SERIAL 64-818 thru 64-881

F-4C-25-MC
A.F. SERIAL 64-882 thru 64-928

F-4D-24-MC
A.F. SERIAL 64-929 thru 64-937

F-4D-25-MC
A.F. SERIAL 64-938 thru 64-963

F-4D-26-MC
A.F. SERIAL 64-964 thru 64-980
and 65-580 thru 65-611

F-4D-27-MC
A.F. SERIAL 65-612 thru 65-665

F-4D-28-MC
A.F. SERIAL 65-666 thru 65-770

F-4D-29-MC
A.F. SERIAL 65-771 thru 65-801 and
66-226 thru 66-283 and
66-7455 thru 66-7504

F-4D-30-MC
A.F. SERIAL 66-7505 thru 66-7650

F-4D-31-MC
A.F. SERIAL 66-7651 thru 66-7774
and 66-8685 thru 66-8698

F-4D-32-MC
A.F. SERIAL 66-8699 thru 66-8786

F-4D-33-MC
A.F. SERIAL 66-8787 thru 66-8825

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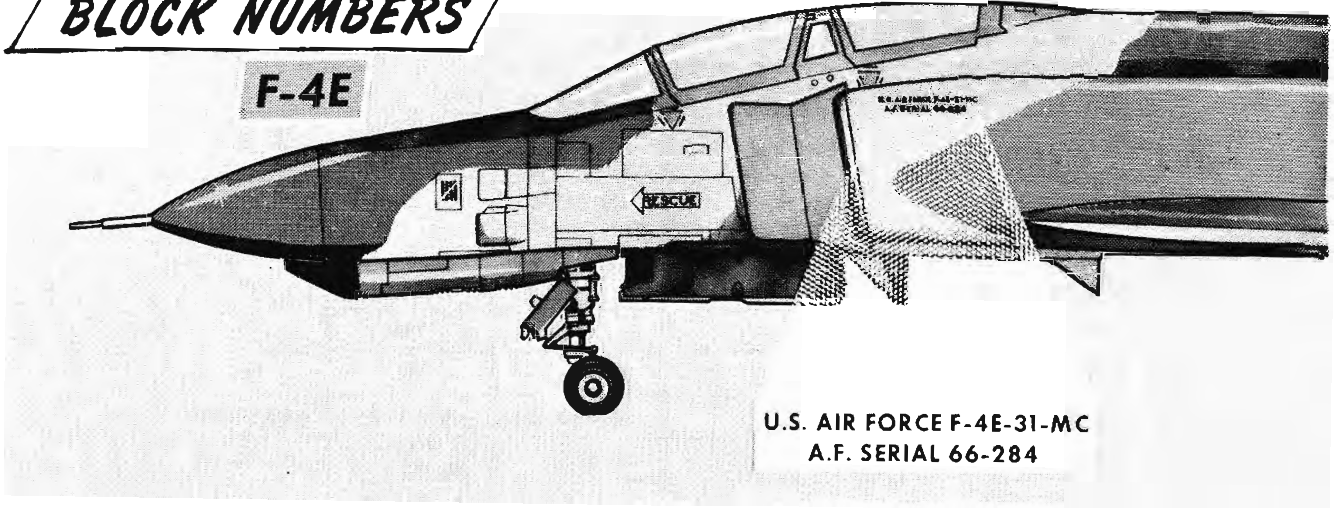
BLOCK NUMBERS

F-4E



F-4E-31-MC
A.F. SERIAL 66-284 thru 66-297

F-4E-32-MC
A.F. SERIAL 66-298 thru 66-338

F-4E-33-MC
A.F. SERIAL 66-339 thru 66-382
A.F. SERIAL 67-208 thru 67-219

F-4E-34-MC
A.F. SERIAL 67-220 thru 67-282

F-4E-35-MC
A.F. SERIAL 67-283 thru 67-341

F-4E-36-MC
A.F. SERIAL 67-342 thru 67-398

F-4E-37-MC
A.F. SERIAL 68-303 thru 68-365

F-4E-38-MC
A.F. SERIAL 68-366 thru 68-395
A.F. SERIAL 68-400 thru 68-409

F-4E-39-MC
A.F. SERIAL 68-410 thru 68-413
A.F. SERIAL 68-418 thru 68-433
A.F. SERIAL 68-438 thru 68-451

F-4E-40-MC
A.F. SERIAL 68-452 thru 68-453
A.F. SERIAL 68-458 thru 68-468
A.F. SERIAL 68-473 thru 68-483
A.F. SERIAL 68-488 thru 68-494

F-4E-41-MC
A.F. SERIAL 68-495 thru 68-498
A.F. SERIAL 68-503 thru 68-518
A.F. SERIAL 68-526 thru 68-538

F-4E-42-MC
A.F. SERIAL 69-236 thru 69-303

F-4E-43-MC
A.F. SERIAL 69-304 thru 69-7260

F-4E-44-MC
A.F. SERIAL 69-7261 thru 69-7303
A.F. SERIAL 69-7546 thru 69-7578

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MAIN DIFFERENCES TABLE

	F-4C	F-4D	F-4E
ENGINES	J79-GE-15	J79-GE-15	J79-GE-17
NO. 7 FUEL CELL	NO	NO	YES
RAM AIR TURBINE	YES	YES	NO
HYDRAULIC WING FOLD	YES	YES	NO
INTERNALLY MOUNTED GUN	NO	NO	YES
RADAR SET	AN/APQ-100	AN/APQ-109	AN/APQ-120
INTERCEPT COMPUTER	AN/APA-157	AN/APA-157 or AN/APA-165	AN/APQ-120
OPTICAL SIGHT	FIXED	AN/ASG-22	AN/ASG-26
WEAPONS RELEASE COMPUTER	NONE	AN/ASQ-91	AN/ASQ-91
INERTIAL NAVIGATION SET	AN/ASN-48	AN/ASN-63	AN/ASN-63
NAVIGATION COMPUTER	AN/ASN-46	AN/ASN-46A	AN/ASN-46A
AUXILIARY POWER UNIT	NO	NO	BLOCK 40 AND UP
SELF SEALING FUSELAGE FUEL CELLS	NO	NO	BLOCK 41 AND UP

F4-111


F-4C/D
USAF
F-4E
F4-TQ

SECTION I DESCRIPTION

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Note

- All references to airspeed in this manual quoted in Knots will equate to CAS in the F-4C/D and IAS in the F-4E aircraft.
- Since the air data computer system compensates for airspeed static source error in F-4C/D aircraft, in the event of illumination of the STATIC CORR OFF indicator light, all quoted airspeeds should be corrected for static error. Refer to airspeed position error correction charts.
- Throughout the manual, retrofit (TCTO) effectivities are presented in abbreviated form. Refer to the Technical Order Summary at the front of the manual for detailed production/retrofit effectivities.

AIRCRAFT

Note

Refer to foldout section for general arrangement illustration.

The F-4 is a two-place (tandem), supersonic, long-range, all-weather fighter-bomber built by McDonnell Douglas. Mission capabilities include: long-range, high-altitude intercepts utilizing air-to-air missiles as primary armament; a 20mm gun as secondary armament; long-range attack missions utilizing conventional or nuclear weapons as a primary armament; and close air support missions utilizing a choice of bombs, rockets and missiles as primary armament. Aircraft thrust is provided by two single-rotor, axial-flow, variable stator turbojet engines with afterburners. Aircraft appearance is characterized by a low mounted sweptback wing with obvious anhedral at the wing tips, and a one piece stabilator with obvious cathedral. Dual, irreversible hydraulic power control cylinders position the stabilator, ailerons, and spoilers. A single, irreversible, hydraulic power control cylinder positions the rudder. An integral pneumatic system, charged by a hydraulically-driven air compressor, provides normal and emergency canopy operation, as well as emergency operation for the landing gear and wing flaps. The wings fold for ease of storage and ground handling. A drag chute, contained in the fuselage, significantly reduces landing roll distances. An arresting hook that is hydraulically retracted can be utilized to stop the aircraft under a wide range of gross weight-airspeed combinations.

DIMENSIONS

The approximate overall dimensions of the aircraft are:

Span - (wings spread) 38 feet, 5 inches
Span - (wings folded) 27 feet, 7 inches
Length - F-4C/D 58 feet, 3 inches; (F-4E 63 feet)
Height - 16 feet, 5 inches
Distance between main landing gear - 17 feet, 11 inches

Minimum recommended turning radius during taxi is:

F-4C/D 33 feet, 10 inches; F-4E 41 feet, 1 inch.

GROSS WEIGHT

F-4C Aircraft

The approximate gross weights of the F-4C (Block 25) are:

29,500 pounds - Operating weight;
42,300 pounds - Operating weight, plus a full internal fuel load, clean;
46,600 pounds - Operating weight, plus a full internal fuel load, plus an external centerline tank and the Aero-27A rack;
47,700 pounds - Operating weight, plus a full internal fuel load, plus two external wing tanks;
52,000 pounds - Operating weight, plus a full internal fuel load, plus three external tanks and the Aero-27A rack.

F-4D Aircraft

The approximate gross weights of the F-4D (Block 33) are:

29,800 pounds - Operating weight;
42,100 pounds - Operating weight, plus a full internal fuel load, clean;
46,300 pounds - Operating weight, plus a full internal fuel load, plus an external centerline tank and the Aero-27A rack;
47,500 pounds - Operating weight, plus a full internal fuel load, plus two external wing tanks;
51,800 pounds - Operating weight, plus a full internal fuel load, plus three external fuel tanks and the Aero-27A rack.

F-4E Aircraft

The approximate gross weights (in pounds) of the F-4E are:

Block 35		Block 41
31,250	- Operating weight (OW);	- 31,930
44,150	- OW, plus a full internal fuel load, clean;	- 43,990
48,405	- OW, plus a full internal fuel load, plus an external centerline tank and Aero-27A rack;	- 48,245
49,576	- OW, plus a full internal fuel load, plus two external wing tanks;	- 49,416
53,831	- OW, plus a full internal fuel load, plus three external fuel tanks and the Aero-27A rack.	- 53,671

Note

Aircraft operating weight is based on the basic weight of the aircraft, plus two crewmembers and engine oil.

ARMOR PLATING

On F-4E aircraft 68-452 and up, provisions are provided for attaching parasitic-steel-armor plating to doors 15, 16, 22, 23, 28 left and right; and internal ceramic armor in the aft fuselage. This armor, when installed, protects the oxygen bay, hydraulic/engine fuel feed compartment and stabilator actuator. The armor adds approximately 144 pounds to the weight of the aircraft and shifts the CG forward approximately 0.1% MAC.

ARMAMENT

Refer to T.O. 1F-4C-34-1-1, for information on armament.

ENGINES

The F-4C/D aircraft are powered by two General Electric J79-GE-15 engines. The F-4E aircraft is powered by two General Electric J79-GE-17 engines. The engines are light-weight (approximately 4000 pounds each), high thrust, axial-flow turbojets equipped with afterburner for thrust augmentation. Under sea level, static test conditions, the J79-15 engine is rated at 10,900 pounds thrust at Mil power, while Max power is rated at 17,000 pounds thrust. Under the same conditions the J79-17 engine is rated at 11,870 pounds thrust at Mil power, while at Max power it is rated at 17,900 pounds thrust. Both J79 models feature variable stators (first six stages), a 17 stage compressor, a combustion chamber with 10 annular combustion liners, a three-stage turbine, a variable area exhaust nozzle, and modulated reheat thrust augmentation (afterburning). A turbine type starter, operated by air from an external source or by the expanding gases of a solid propellant cartridge is used to crank the engines for starting. Either the aircraft battery or an external electrical power source is used to provide electrical power during starting. Engine bleed air, taken from the 17th stage of the compressor, is ducted to the boundary layer control system, the cockpit air conditioning and pressurization system, and the equipment air conditioning system. From these systems, it is further ducted to supply air to the air data computer, the engine anti-icing system, the fuel tank pressurization system, the pneumatic system air compressor, and the windshield rain removal system.

ENGINE FUEL SYSTEM

Note

Refer to foldout section for airplane and engine fuel system illustration.

The fuel system for each engine is complete in itself, and the systems are identical. For clarity, only one system will be discussed. The afterburner fuel system is discussed separately in this subsection. The engine fuel system routes fuel from the engine fuel pump to the combustion chambers, where it is discharged in the proper proportion and state of atomization for complete burning. The system controls fuel flow throughout the entire range of power settings compensating for airspeed and altitude conditions, so that within design limits, maximum engine efficiency can be maintained.

Engine Fuel Pump

The engine fuel pump unit consists of a low pressure impeller-type boost pumping element, a high pressure gear-type pumping element, a low pressure fuel filter, a fuel filter bypass, and an output pressure relief valve. Fuel from the main fuel manifold passes through the boost-pump, the low pressure fuel filter, and the gear-pump to the engine fuel control. If the fuel pressure differential across the low pressure fuel filter exceeds approximately 25 psi, the CHECK FUEL FILTERS indicator light illuminates. If the discharge pressure of the gear-pump exceeds approximately 1125 psi, the output pressure relief valve opens to maintain safe fuel pressure. The output pressure relief valve will reset when discharge pressure returns to normal.

Check Fuel Filters Indicator Light

The CHECK FUEL FILTERS indicator light is on the telelight panel. The CHECK FUEL FILTERS indicator light and MASTER CAUTION light illuminate when the differential pressure across the low pressure filter reaches approximately 25 psi. This informs the pilot that the filter is clogged. The filter automatically opens to bypass, allowing normal fuel flow to the engine.

Note

> There are no operational restrictions on the aircraft with the CHECK FUEL FILTERS indicator light illuminated. If the light illuminates, an entry to that effect should be made on Form 781.

Engine Fuel Control

The engine fuel control is a hydro-mechanical computer that performs the following functions: provides engine speed control by regulating fuel flow; provides fuel surge protection during throttle bursts; limits turbine inlet temperature to a safe value; schedules variable stator vane angle to control airflow through the compressor; supplies signals to the afterburner; and provides positive fuel cutoff at engine shutdown. The fuel control also incorporates a throttle booster which reduces the amount of effort to move the throttles. Teleflex cables link the exhaust nozzle area control and the afterburner fuel control to the engine fuel control, so that fuel flow and nozzle area are compatible throughout the full range of engine operation. Advancing the throttle from OFF to IDLE mechanically opens the fuel cutoff valve in the fuel control. Fuel passing through the cutoff valve flows through a fuel-oil heat exchanger, which effects a transfer of heat from the scavenge oil to the fuel. The fuel then flows through the pressurizing and drain valve to the fuel nozzles. Advancement of the throttle from IDLE to MIL causes the fuel control to increase fuel flow, which increases thrust.

Fuel Flow Indicators

The engine fuel flow indicating system consists of a fuel flow transmitter and a fuel flow indicator (one for each engine). The transmitter on the outlet side of the engine fuel control, measures the flow rate of the fuel that passes through it. The flow rate is converted into an electrical impulse which is sent to the fuel flow indicator. The fuel flow indicator on the right side of the front cockpit instrument panel displays engine fuel consumption in pounds per hour. The indicator is calibrated from 0 to 12 with readings multiplied by 1000. The engine flow indicating system indicates fuel consumption of the basic engine only (afterburner fuel flow is not indicated). When in afterburner total fuel flow is approximately 4 times the indicated fuel flow.

Fuel-Oil Heat Exchangers

Metered fuel from the fuel control passes through the cooler tubes of the fuel-oil heat exchangers and then to the fuel nozzles. The fuel serves as the coolant for the scavenge oil which flows around the heat exchanger tubes. There are two fuel oil heat exchangers incorporated on the engine: one utilizes normal engine fuel as coolant, whereas the other heat exchanger uses afterburner fuel. Both fuel-oil heat exchangers serve the same purpose, however, the exchanger utilizing afterburner fuel is effective only during afterburner operation.

Fuel Pressurization and Drain Valve

The fuel pressurization and drain valve prevents fuel from entering the engine until sufficient fuel pressure is attained in the fuel control to compute the fuel flow schedules. It also drains the fuel manifold at engine shutdown to prevent post-shutdown fires, but keeps the upstream portion of the system primed to permit faster starts.

Fuel Nozzles

A flow-divider type fuel nozzle in each combustion chamber delivers metered fuel in the proper state of atomization for maximum burning, into the compressor discharge air entering the combustion chamber. The nozzles produce a uniformly distributed, cone-shaped, hollow, fuel spray upon application of pressure at the nozzle inlets. High velocity compressor air is directed around the nozzle by an air shroud to provide a cooling action around the nozzle orifice.

ENGINE OIL SYSTEM

See figure 1-1. Each engine is equipped with a completely self-contained, dry sump, full pressure oil system. Oil is stored in a 5.3-gallon, pressurized reservoir at the 1 o'clock position on the engine compressor front casing. The oil tank is constructed so that oil supply to the lubrication system is interrupted during inverted flight, due to the inability of the scavenge pumps to recover oil from the sumps and gear boxes. The oil pump is a positive-displacement, duel-element, rotary-vane type unit. The oil discharged from each element flows through a filter before distribution. Engine oil is used for lubrication, variable nozzle positioning, and constant speed drive unit operation. The standpipes which supply the three systems utilizing engine oil are in the reservoir such that the pipe for the constant speed drive unit is the highest, the one for the nozzle control is the next highest, and the lubricating system pipe is the lowest. Therefore, a leak in the constant speed drive unit would probably cause a failure of that system only, while a leak in the nozzle control system may cause failure of that system and the constant speed drive unit. A leak in the lubricating or the scavenging system will cause failure of the constant speed drive unit and the nozzle control system, and ultimately, engine bearing failure will result. After distribution to various points throughout the engine, the oil is picked up by three scavenge pumps, routed through a scavenge filter, through an air-oil heat exchanger and two fuel-oil heat exchangers and finally back to the tank. A pressurizing system maintains the proper relationship between ambient air pressure and air pressure in the bearing sumps,

ENGINE OIL SYSTEM

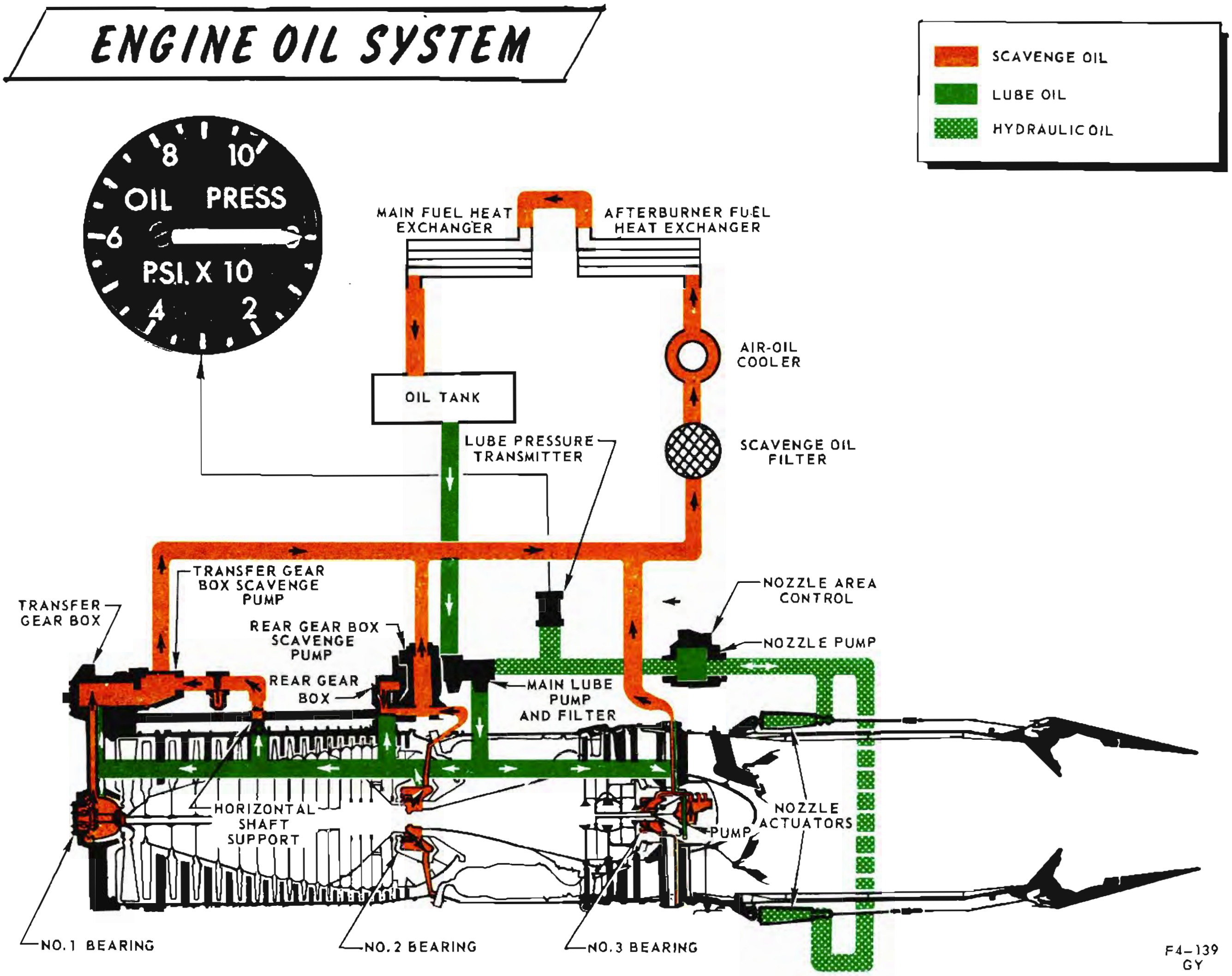
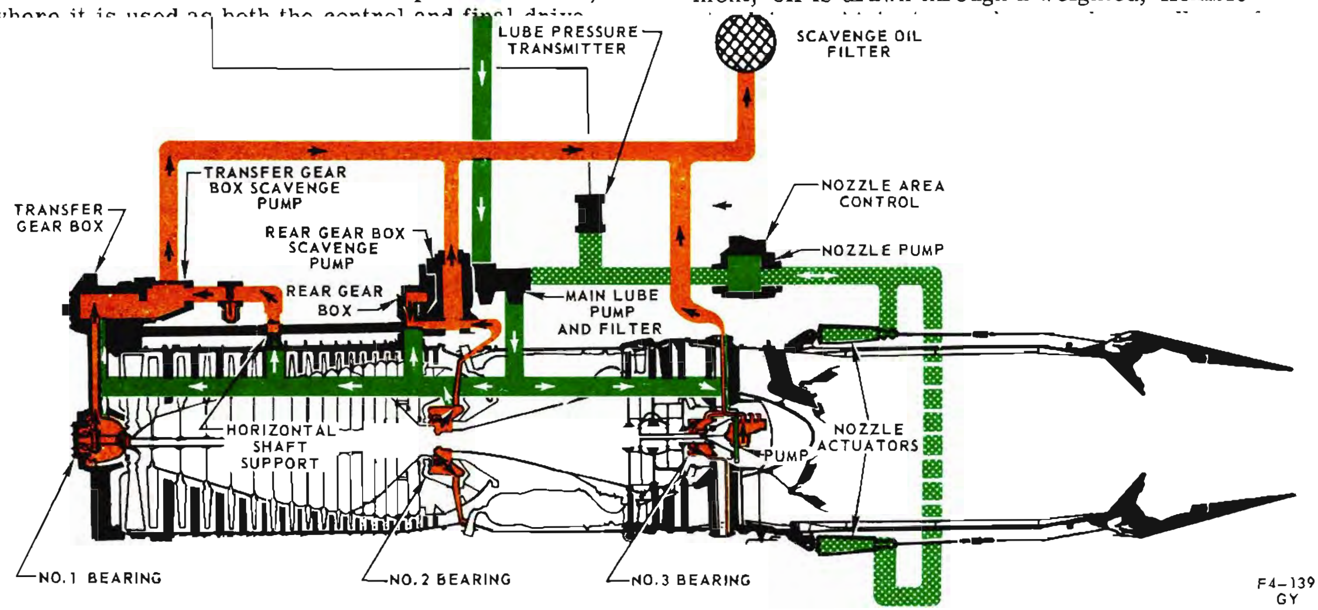


Figure 1-1

gear boxes, damper bearing, and reservoir to ensure effective oil seal operation, and to prevent damage to the reservoir and sumps due to high speed ascents or descents. Oil is also supplied directly from the reservoir to the constant speed drive unit, where it is used as both the control and final drive

valve and into an accumulation compartment in the reservoir. During inverted flight, the gravity valve will close and oil for nozzle positioning is available for approximately 30 seconds. From this compartment, oil is drawn through a weighted, flexible



ENGINE AIR INDUCTION SYSTEM

There are two independent but identical air induction systems, one for each engine. The component units are fixed ramps and variable ramps, which make up the primary air system; and a variable bypass bellmouth and auxiliary air door, which make up the secondary air system.

Variable Duct Ramp

The variable duct ramp system provides primary air, at optimum subsonic airflow, to the compressor face throughout a wide range of speeds. The ramp assembly consists of a fixed forward ramp and two variable ramps. The forward variable ramp is perforated to allow boundary layer air to be bled off and exhausted overboard. The aft variable ramp is solid. The air data computer supplies a total temperature input to the ramp control amplifier which, in turn, sends a signal to a utility hydraulic system servo unit to position the ramps for optimum airflow at high Mach numbers. The total temperature sensor is below the left air conditioning inlet duct on F-4C/D, and below the right air conditioning duct on F-4E aircraft. While taxiing in the exhaust envelope of an operating jet engine, the sensor may detect a temperature change which causes the variable duct ramps to cycle. Refer to section VII for ramp scheduling.

Duct Temperature High Indicator Light

The duct temperature high indicator light, marked DUCT TEMP HI, is on the telelight panel. The light, when illuminated, indicates that the temperature within the engine intake duct (compressor inlet) is beyond allowable limits for steady-state engine operation. Operating the engine at high altitudes, with the compressor inlet temperature above the prescribed limit, will cause the life of the gears, bearings, and carbon seals to be reduced because the lubricating oil will exceed its design temperature. Exceeding the temperature also causes structural components of the engine (compressor rear frame and combustion casings) to exceed their design limit because of high temperatures and pressures.

Variable Bypass Bellmouth

The variable bypass bellmouth is an automatic system which diverts excess air that is piling up at the compressor face into the aircraft engine compartment to help prevent compressor stalls. Air diverted in this manner is called secondary air. The variable bellmouth is a perforated ring between the intake duct structure and the engine compressor face. Between 0.4 to 0.98 Mach the bellmouth is closed, however, a limited amount of bypass air flows into the engine compartment through the perforations in the bypass bellmouth and the engine air-oil cooler bleed. Above 0.98 Mach the bypass bellmouth controller senses the optimum airflow (based on duct air velocity) for induction into the engine. When this airflow is exceeded, (rapid throttle retardation) the controller signals a utility system hydraulic actuator which opens the bypass until the optimum airflow to the engine is established.

CAUTION

F-4E aircraft after T.O. 1F-4E-517 are equipped with a two mode bellmouth control which helps to correct the stall/flameout problem associated with the J-79-17 engine. One mode of the bellmouth control is wired through the rudder feel trim circuit breaker. With the rudder feel trim circuit breaker pulled, the bellmouth is only optimized for speeds below 0.4 Mach and above 0.98 Mach. This introduces the possibility of an engine stall/flameout in the 0.4 to 0.98 Mach speed range with maximum maneuvering and/or rapid throttle movements.

Auxiliary Air Doors

Two auxiliary air doors, one for each engine compartment, are on the center underside of the fuselage. They are normally controlled by the landing gear handle and actuated open or closed by utility hydraulic pressure. When the landing gear handle is in the down position, the doors open, making additional air available to the engine compartments for cooling purposes. When the landing gear handle is in the up position, the doors close. If the engine compartment pressures exceed the designed limits, the door will be forced open by an amount proportional to the overpressure. As soon as the overpressure is relieved, the actuator will pull the door closed.

Auxiliary Air Door Indicator Lights

The auxiliary air door indicator lights on the telelight panel, marked L AUX AIR DOOR and R AUX AIR DOOR, illuminate when the auxiliary air doors operate out of phase with the landing gear handle. The lights may also illuminate momentarily when engine compartment overpressures are relieved. Illumination of the auxiliary air door indicator lights causes the MASTER CAUTION light to illuminate. If either auxiliary air door indicator light illuminates (other than momentary), corrective action should be taken immediately. Refer to section III for instructions for an auxiliary air door malfunction.

ENGINE BLEED AIR SYSTEM

The bleed air system supplies high temperature, high pressure air from the engines to the boundary layer control system, the cabin air conditioning system, and the fuel cell pressurization system. Control of the bleed air is initiated by the requirements of each system and the flow, temperature and pressure is regulated by that system. The system utilizes engine compressor bleed air tapped off the 17th stage compressor. Normally, both engines supply the air for the operation of these systems, but when necessary, single engine operation will supply sufficient air for their operation. The system ducting routes the flow of bleed air from the engines to the systems and is insulated to protect the airframe structure from heat radiation. Check valves are installed in the ducting to prevent back flow into the non-operating engine during starting and single engine operation.

ENGINE STARTING SYSTEM

The engine starting system utilizes a turbine type cartridge/pneumatic starter unit, mounted on the accessory gear box of each engine. These units provide starting capabilities with either the pneumatic starting unit (MA-1A, AF/M32A-60, or equivalent) or with an MXU-4A solid propellant cartridge. The pneumatic starting units should be capable of delivering 45 lbs/min of air at 50 psia on a standard day. Electrical power for starting is available from the AF/M32A-60. When using the MA-1A, electrical power for starting may be supplied by an external power unit or the aircraft battery. Refer to section II for detailed starting procedures.

Pneumatic Mode Starting

The pneumatic mode is the primary starting mode for all normal and routine flying operations. Air from an auxiliary starting source causes the starter turbine to rotate which, in turn, cranks the engine.

Cartridge Mode Starting

The cartridge mode is considered an alternate method of starting. Hot gases from a solid propellant cartridge causes the starter turbine to rotate and crank the engine. Cartridge ignition is controlled by the engine start switch providing the respective engine master switch is on. Refer to section II for cartridge start procedures. Refer to section VII for cartridge handling and loading procedures.

Start Switch

The engine start switch is on the left console in the front cockpit inboard of the throttles. The start switch is a three-position, lever-locked toggle switch, and is marked L and R. The switch is spring-loaded to the neutral position. When operating in the cartridge mode, placing the switch momentarily to the left or right ignites the corresponding starter cartridge. When operating in the pneumatic mode, the ground cart is operated by the ground crew and it is not necessary to activate the start switch.

ENGINE IGNITION SYSTEM

The ignition system consists of an ignition button on each throttle, a low-voltage, high-energy ignition unit on the engine, a spark plug in the number four and five combustion chambers, and the necessary wiring. The main ignition system produces an arc which ignites the atomized fuel-air mixture in the numbers four and five combustion chambers. The remaining eight combustion cans are ignited through the crossfire tubes. Depressing the ignition button causes the spark plugs to discharge, igniting the fuel-air mixture as the throttle is moved from OFF to IDLE during engine start. The spark plugs fire only while the ignition button is depressed.

Ignition Buttons

The ignition buttons are spring-loaded, push-button type switches, on each front cockpit throttle directly below the throttle grips.

ENGINE ANTI-ICING SYSTEM

Engine bleed air is supplied to the engine anti-icing system which prevents the formation of ice on the engine frontal area. The bleed air is distributed to ducts in the compressor front frame, inlet guide vanes, first stage stator vanes, nose dome, and nose dome struts. It then flows from these components through small bleed holes, and enters the engine primary airstream. The system is an anti-icing, not a de-icing system, since an actual buildup of ice will block the small bleed holes and render the system inoperative.

Anti-Icing Switch

A two-position anti-icing switch is on the left console, front cockpit. The switch is marked engine anti-icing and the switch positions are DE-ICE and NORMAL. Placing the switch to DE-ICE, opens the regulator valve which starts anti-icing air flow. With the switch in NORMAL, no anti-icing operation is being performed.

Anti-Ice Indicator Lights

A set of anti-icing lights, marked L ANTI-ICE ON, and R ANTI-ICE ON, are on the telelight panel. The lights operate from a pressure sensitive switch which is actuated by the pressure of the engine bleed air when the anti-ice system is turned on. If the lights illuminate during flight, with the anti-icing switch in NORMAL, the anti-icing shutoff valve has failed to the open position. If a failed shutoff valve is indicated during high Mach number flight (approximately 1.2 Mach or greater), reduce speed. Engine anti-ice is not needed or desired at high Mach numbers since the compressor inlet temperature is sufficient to prevent any ice accumulation and continued operation in this range could cause engine damage. An illuminated anti-ice light also illuminates the MASTER CAUTION light.

AFTERBURNER SYSTEM

The engine is equipped with an afterburner, where additional fuel may be injected into the hot exhaust gases for afterburner combustion, producing thrust augmentation. The main components of the afterburner system are the afterburner fuel pump, afterburner fuel control, afterburner fuel manifold and spray bars, torch igniter, on-off valve, afterburner fuel pressurizing valve and torch igniter.

Afterburner Fuel System

The afterburner fuel system provides fuel for thrust augmentation. A separate constant pressure drop, variable fuel control meters the afterburner fuel. Ignition is provided by a separate ignition system. In operation, the aircraft boost pumps supply fuel to the inlet of the afterburner pump. The afterburner pump supplies fuel to the check valve which will open under pressure and supply fuel to the remainder of the system. The fuel is scheduled as a function of throttle angle and compressor discharge pressure.

Afterburner Fuel Pump

The afterburner fuel pump is an engine-driven centrifugal-type pump. It operates continuously, but discharges fuel to the afterburner fuel system only when the inlet to the pump is open. To open the inlet to the afterburner fuel pump, the throttle must be moved into the afterburner modulation range. An engine speed above approximately 90.3% rpm is required to initiate afterburner operation.

Afterburner Fuel Control

The afterburner fuel control is linked mechanically to the main fuel control through teleflex cabling. Any movement of the throttle moves the main fuel control teleflex and subsequently the teleflex to the afterburner fuel control. Fuel entering the afterburner fuel control is metered in relation to throttle movement and variations in compressor discharge pressure. The afterburner fuel control varies fuel flow between the minimum necessary for afterburner combustion and the maximum fuel flow allowable for any flight condition.

Afterburner Fuel Distribution

The afterburner fuel pressurizing valve delivers fuel to four separate fuel manifolds: primary annulus, primary core, secondary annulus, and secondary core. The fuel is distributed by these manifolds to 21 multijet afterburner fuel nozzles which are equally spaced around the perimeter of the afterburner section. Each multi-jet nozzle contains four tubes, one for each manifold, and holes in the sides of the tubes spray the fuel into the exhaust gases. When afterburner is first selected, the pressurizing valve directs fuel to the primary core manifold. Further advancement directs fuel to the secondary core manifold which joins the primary core manifold in delivering fuel for afterburner operation. When the throttle is advanced still further, the pressurizing valve directs fuel to the primary annulus manifold. As the throttles are advanced to the maximum afterburner position the fuel is directed to the secondary annulus thus joining the other three manifolds in delivering fuel to the nozzles: this is full afterburner operation. The afterburner fuel manifolds and multi-jet nozzle system give smooth afterburner operation, with no appreciable acceleration surge.

AFTERBURNER IGNITION SYSTEM

The afterburner ignition system consists of the torch igniter, a spark plug, and an afterburner ignition switch. When the throttle is moved into the afterburner detent, fuel pressure from the main fuel control is directed to the pressure operated afterburner ignition switch and to the torch igniter on-off valve. The afterburner ignition switch closes, completing the electrical circuit and allowing the AB spark plug to supply a continuous arc. When the torch igniter on-off valve is opened by fuel pressure from the afterburner fuel pump, the fuel flows to the torch igniter assembly to be ignited by the AB spark plug. Ignition and fuel flow are maintained until the throttle is removed from the afterburner detent.

Note

Afterburner ignition will not be available to either engine when operating on battery power, on the RAT in F-4C/D aircraft, or when the left generator is inoperative with an open bus tie light.

VARIABLE AREA EXHAUST NOZZLE

Two sets of cylindrical nozzles, operating together, make up the variable area exhaust nozzle system. The primary nozzle (inner nozzle), hinged to the aft end of the tail pipe, controls the convergent portion of the nozzle, while the secondary nozzle (outer nozzle), hinged to a support ring, controls the divergent portion of the nozzle. The two sets of nozzles are linked together to maintain a scheduled area and spacing ratio which is infinitely variable between maximum and minimum nozzle opening. The nozzles are regulated by the nozzle area control. Movement of the nozzles is accomplished automatically by four synchronized hydraulic actuators using engine oil as its actuating fluid. The exhaust gases leave the primary nozzles at sonic velocity and are accelerated to supersonic velocity by the controlled expansion of the gases. Control of this expansion is provided by the cushioning effect of the secondary airflow through the annular passage between the two sets of nozzles.

Exhaust Nozzle Control Unit

Throttle position, nozzle position feedback, and exhaust gas temperature are utilized to schedule the correct nozzle area. During engine operation in the submilitary region, nozzle area is primarily a function of throttle angle and nozzle position feedback. The nozzle is scheduled to approximately 7/8 open at idle and the area is decreased as the throttle is advanced toward the military position. However, during a rapid throttle burst from below 79% rpm to 98% rpm, a control alternator supplies engine speed information to the temperature amplifier, which in turn schedules engine speed inputs as a function of temperature limiting. This signal prevents the primary nozzle from closing beyond a preset position, permitting a rapid increase in engine rpm. During engine operation in the military and afterburner region, it becomes necessary to limit the nozzle schedule as established by throttle angle and nozzle feedback to prohibit exhaust gas temperature from exceeding engine design limits. Exhaust gas temperature is sensed by 12 dual-loop thermocouples and the resulting signal is transmitted to the magnetic temperature amplifier. The amplifier which receives its power from the control alternator, compares the thermocouple signal to a pre-set reference voltage, representing desired engine temperature. The difference is amplified and transmitted to the nozzle area control. Nozzle area control output signals direct the operation of the variable pressure, variable displacement nozzle pump.

THROTTLES

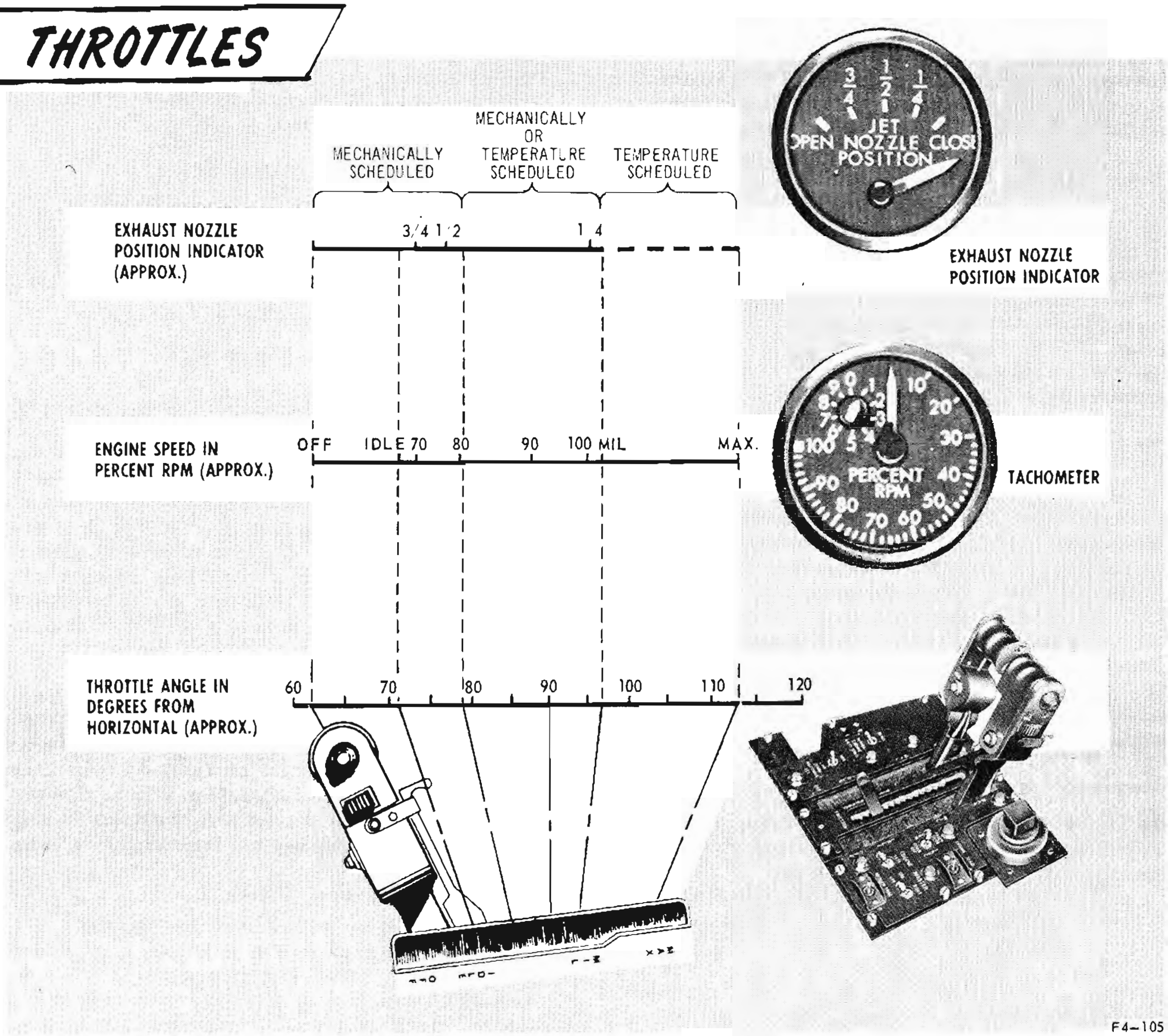


Figure 1-2

Exhaust Nozzle Position Indicators

Exhaust nozzle position indicators, which show the exit area of the exhaust nozzle, are on the front cockpit instrument panel. The instruments are calibrated from CLOSE to OPEN in four increments. The nozzle position indicators enable the AC to make a comparison of nozzle position between engines, and are also used to establish a relationship between nozzle position and exhaust gas temperature, and nozzle position and throttle settings.

ENGINE CONTROLS AND INDICATORS

Engine Master Switches

Two lever-lock, two-position engine master switches are on the left console in the front cockpit on the inboard engine control panel. Placing either switch to ON, directs power to the fuel boost pumps and the fuel transfer pumps if the aircraft is supplied with a source of ac power. If there is no source of ac power, placing either switch to ON, connects the aircraft battery to the essential 28 volt dc bus. Electrical power is then available for operating the fuel shutoff valves and for the engine ignition circuits. The circuits for the fuel shutoff valves, which are normally operated by the throttles, are such that either valve will be closed when its respective engine master switch is placed OFF, regardless of the throttle position.

Throttles

See figure 1-2. A throttle for each engine is on the front and rear cockpit left console. Movement of the throttle is transmitted by mechanical linkage to the engine fuel control. The fuel control unit incorporates a throttle booster which reduces the amount of effort needed to move the throttles. The boost power is supplied by fuel from the engine driven fuel pump.

Teleflex cables, from the engine fuel control, link the nozzle area control, and afterburner fuel control, so that fuel flow and nozzle area are compatible throughout the full range of engine operation. A friction adjusting lever is mounted between the throttles to permit adjustment of throttle friction to suit individual requirements. Limit switches which control the main fuel shutoff valves are built into the throttle quadrant. Advancing the throttle from OFF to IDLE (with the engine master switch ON) actuates electrical switches which open the corresponding fuel shutoff valve. With further advancement of the throttle from IDLE to MIL, engine thrust increases proportionally. At the MIL position, the engine is delivering its rated military thrust. Afterburner light-off can be initiated anywhere within the afterburner modulation range by shifting the throttles outboard and moving forward from the MIL position. As the throttles are advanced from the minimum to the maximum afterburner position, the increase in thrust is smooth and continuous. Movement of the throttles from IDLE to OFF, actuates a switch which closes the fuel shutoff valve, stopping fuel flow to the engine. Throttle movement through the cutouts is as follows: To move from OFF to IDLE, push forward and then shift throttles inboard. On aircraft after T.O. 1F-4-793, to reach IDLE from the OFF position, advance the throttles straight forward. To move from MIL to MAX shift throttles outboard; throttles can now be moved forward in the afterburner range. On aircraft after T.O. 1F-4-860, the throttles in the front cockpit are equipped with finger lifts, enabling rapid throttle chops to IDLE while preventing inadvertent shutoff. The finger lifts -- on forward side of throttles -- must be raised before the throttles in either cockpit can be retarded to OFF. The rear cockpit throttles are linked to the front cockpit throttles such that only the AC can start the engines, or move the throttles into the afterburner thrust range. On aircraft after T.O. 1F-4-793, the rear cockpit throttles can be moved from the OFF position with no front seat assistance. The rear cockpit throttles can be used to control thrust throughout the entire range (providing the AC selects afterburner). The throttles can be retarded from MAX to IDLE from the rear cockpit although OFF position must be selected from the front cockpit. The rear cockpit throttles each contain a load limiting device to prevent damage of the teleflex cable in the event an opposing force is applied to both front and rear cockpit throttles simultaneously. The rear cockpit throttles become disengaged from the airframe throttle system when a force of 55 to 100 pounds is applied to the rear cockpit throttles (opposing front cockpit throttles) in either the forward or aft direction. Under this condition, selection of maximum afterburner may be restricted. The rear cockpit throttles can be reset by placing the front cockpit throttles against the IDLE or MIL stop and moving the rear cockpit throttles in the opposite direction from which the disconnect occurred. The rear cockpit throttles do not have ignition buttons or landing and taxi light switches; however, the inboard throttle has a microphone button and a speed brake switch.

WARNING

If the rear cockpit throttles are held steady or jammed, the AC may be unable to exercise command of the throttles due to the extremely high breakout forces necessary to disconnect rear cockpit throttles.

Note

- Afterburner operation can be terminated from the rear cockpit; however, it will be necessary to give the rear cockpit throttles a hard pull (10 to 15 pounds) to remove the front cockpit throttles from their afterburner detent.
- To avoid the possibility of internal mechanical interference, reconnect throttles prior to retarding to the OFF position.

Tachometers

A tachometer for each engine is mounted on the right side of the front cockpit instrument panel and on the upper right side of the rear cockpit instrument panel. The system comprises four tachometer indicators and two tachometer generators (one for each engine), and is completely self-contained in that it requires no external source of power. Each indicator includes two pointers: a large pointer operating from 0 to 100 and a small pointer operating on a separate scale from 0 to 10, which indicate RPM in percent.

Exhaust Gas Temperature Indicators

The exhaust gas temperature indicators are mounted on the front cockpit instrument panel. Each indicator includes two pointers: a large pointer operating on a scale from 0 to 12 with the readings multiplied by 100 degrees Centigrade, and a smaller pointer operating on a separate scale from 0 to 10 with readings multiplied by 10. The system indicates the temperature of the exhaust gas as it leaves the turbine unit during engine operation. Twelve dual-loop thermocouples are installed on each engine. On F-4C aircraft 63-7598 and up, and on all F-4D/E aircraft, the indicators are powered by the essential 115 volt ac bus when that bus is energized. When the essential 115 volt ac bus is deenergized, the indicators receive power from an inverter which is powered by the essential 28 volt dc bus. On all other aircraft, the indicators receive power from the inverter only. On all aircraft, however, during a battery start, exhaust gas temperature information is available to the AC.

AIRCRAFT FUEL SYSTEM

Note

Refer to foldout section for airplane and engine fuel system illustration.

Fuel is carried internally in a fuselage tank, made up of interconnected cells, and two internal wing tanks. External fuel is carried in drop tanks: two 370-gallon, wing-mounted units, and a 600-gallon fuselage mounted unit. All tanks may be refueled on the ground through a single pressure refueling point, or while airborne, through the air refueling receptacle. External tanks may be individually fueled through external filler points. The fuselage cells are arranged so that cell 1, the engine feed cell, is behind the aft bulkhead of the rear cockpit. The remainder of the cells are numbered consecutively, with cell 6 being the most aft cell in the F-4C/D aircraft. In F-4E aircraft, the remainder of the cells are numbered consecutively, with cell 7 being the most aft cell. On F-4E aircraft 68-495 and up, the fuselage cells are self-sealing. Cells 2 through 6 are so arranged that they will gravity flow into cell 1 (with the exception of approximately 1500 pounds) if a complete transfer pump failure occurs. Flapper valves in cells 1, 2, and 4 prevent reverse flow through the cells when the aircraft is in a climbing attitude. Cells 4 and 6 each contain one hydraulic and one electric fuel transfer pump to transfer fuselage fuel to cells 1 and 2. Regulated engine bleed air pressure transfers internal wing fuel and all external fuel to the fuselage cells. Fuel will not transfer from internal wing or external tanks until the weight is off the gear and the tanks are pressurized. Air pressure is also used to facilitate dumping internal wing fuel, and to maintain a positive pressure in all tanks. Float type fuel level control valves control fuel level during refueling or fuel transfer operations. The fuselage cells and internal wing tanks contain capacitance-type fuel gaging units which read out in pounds on the fuel quantity indicator. The external wing tanks are vented to the internal wing tank dump lines, while all other tanks are vented to the fuel vent mast, located immediately below the rudder. See figures 1-3 and 1-4 for fuel quantities.

TRANSFER SYSTEM (F-4C/D)

The electrical fuel transfer pumps run continuously when electrical power is applied to the aircraft and either or both engine master switches are ON. The hydraulically driven fuel pumps run only under the following conditions: when hydraulic power is available with no electrical power on the aircraft, or when either engine is in afterburner operation, when the fuel level low warning circuit is energized, or when the air refuel switch is in the EXTEND position. If the hydraulic transfer pumps are started by a fuel level low condition, the fuel level low condition must be corrected and the air refuel switch cycled from the RETRACT to EXTEND and back to the RETRACT to terminate hydraulic pump operation. The pumps transfer fuselage fuel to cells 1 (engine feed tank) and 2 when transfer pump level control valves in these two cells drop to a specified level. Fuselage cells 2 through 6 are also interconnected so that fuel transfers forward to cell 1 by gravity, should a complete transfer pump failure occur. In level flight all but approximately 1500 pounds of fuel will transfer from cells 2 through 6 into cell 1 due to gravity alone. Fuel carried in the internal wing tanks and all external tanks is transferred by regulated air pressure to the fuselage cells. The internal wing fuel does not enter cell 5 so as to prevent an undesirable aft CG condition. None of the internal wing or external fuel will enter cell 1 unless the fuel level in this cell drops low enough to allow the refueling level control valve to open. The internal wing and external fuel transfer is controlled by switches on the fuel control panel. When transfer of external fuel is selected, transfer of internal wing fuel is stopped automatically and cannot be regained until the external wing fuel transfer switch is returned to OFF. When external fuel tanks are not carried, the external wing tank transfer switch is inoperative. On F-4C/D aircraft after T.O. 1F-4-796, an automatic fuel transfer system is installed. When the low-level warning circuit is energized (1800 ± 200 lbs.) all external and internal fuel not previously transferred will transfer to cells 1 and 3 regardless of the switch positions. The automatic transfer system resets during ground or air refueling to allow normal transfer. Fuel will not transfer to cells 5 and 6 during automatic transfer.

TRANSFER SYSTEM (F-4E)

The electrical fuel transfer pumps run continuously when electrical power is applied to the aircraft and either or both engine master switches are ON. The hydraulically driven fuel pumps run only under the following conditions: when hydraulic power is available with no electrical power on the aircraft, or when either engine is in afterburner operation, when the fuel level low warning circuit is energized, or when the air refuel switch is in the EXTEND position. If the hydraulic transfer pumps are started by a fuel level low condition, the fuel level low condition must be corrected and the air refuel switch cycled from the RETRACT to EXTEND and back to the RETRACT to terminate hydraulic pump operation. The pumps transfer fuselage fuel to cells 1 and 2. The level control valves open to allow fuel from the transfer pumps to enter cells 1 and 2 when the fuel level drops below that of the floats. Cell 2 transfers to cell 1 by gravity only; cell 3 gravity feeds cell 4; and cell 5 gravity feeds cell 6. Cell 7 gravity feeds cell 6 when the fuel level in cell 1 and 2 drops below 1960 pounds on aircraft through 68-494 or 1800 pounds on aircraft 68-495 and up. A dual actuator (air and fuel) transfer valve in cell 7 opens when either fuel or air pressure is applied to the valve. Fuel pressure and regulated air pressure from the boost pumps are applied to the valve in cell 7 when the fuel level in cell 2 drops below the pilot float valve, thus allowing cell 7 fuel to gravity feed cell 6. Fuel carried in the internal wing tanks and all external tanks is transferred by regulated air pressure to the fuselage cells, providing the weight is off the gear and the tanks are pressurized. The internal wing fuel does not enter cell 5 so as to prevent an undesirable aft CG condition. None of the internal or external fuel will enter cell 1 unless the fuel level in this cell drops low enough to allow the refueling level control valve to open. The internal and external fuel transfer is controlled by switches on the fuel control panel. When transfer of external fuel is selected, transfer of internal wing fuel is stopped automatically and cannot be regained until the external wing fuel transfer switch is returned to OFF. When external fuel tanks are not carried, the external wing tank transfer switch is inoperative. On aircraft after T.O. 1F-4E-513, an automatic fuel transfer system is incorporated. When the fuel level in cells 1 and 2 drop below a predetermined level all external and internal wing fuel, not previously transferred, will transfer to cells 1 and 3 regardless of the switch positions. On aircraft through 68-494, automatic transfer starts at 2500 ± 200 pounds. On aircraft 68-495 and up, automatic transfer starts at 2300 ± 200 pounds. Since the automatic fuel transfer occurs before cell 7 transfer is initiated, cell 7 fuel is not available until all external fuel and internal wing fuel has transferred. The automatic transfer system resets during ground or air refueling to allow normal transfer. Fuel will not transfer to cells 5 and 6 during automatic transfer.

Internal Wing Transfer Switch

A two-position internal wing transfer switch with positions of NORMAL and STOP TRANS is on the fuel control panel. The toggle-type switch, lever-locked to NORMAL, directly controls the positioning of the internal wing transfer low level shutoff valves through the solenoid operated function of the valve. In NORMAL, the valves are deenergized open, allowing internal wing fuel to transfer to fuselage cells 1 and 3 only, providing the internal wing tanks are pressurized and the fuel level control valves in cells 1 and 3 are open. In STOP TRANS, the internal wing transfer low-level shutoff valves are energized closed, stopping transfer of internal wing fuel to the fuselage cells. Power to operate the internal wing transfer valves is supplied by the 28 vdc bus. This provides the capability to transfer internal wing fuel on RAT or battery power.

WARNING

If the external transfer switch is positioned to an external position on which tanks are installed (OUTBD or CENTER), internal wing fuel will not transfer even though the internal wing transfer switch is positioned to NORMAL.

External Transfer Switch

The external transfer switch is a three-position toggle switch on the fuel control panel on the left console in the front cockpit. After T.O. 1F-4-773, a triangle head is installed on the external transfer switch. It is operative only with external tanks installed. The switch positions are marked CENTER, OFF and OUTBD. In CENTER, the internal wing tanks transfer low-level shutoff valves close, the centerline tank fuel shutoff valve and the fuel shutoff valve in the pressure fueling line are energized open, allowing fuel to transfer. In OUTBD, the internal wing tanks transfer low-level shutoff valves close and the left and right external tanks shutoff valves open, allowing external wing fuel to transfer. All external fuel transfers to fuselage cells 1, 3, and 5 unless the 5/6 lockout switch is in the LOCKOUT position. Power to operate the external wing transfer valves is supplied by the 28 vdc bus. This provides the capability to transfer external fuel on RAT or battery power.

Tanks 5/6 Lockout Switch

On F-4C/D aircraft after T.O. 1F-4-773 or T.O. 1F-4-796, tanks 5/6 lockout switch, on the fuel control panel, controls external fuel transfer by locking out cells 5 and 6 thereby causing the aircraft CG to move forward at a faster than normal fuel transfer rate. The switch positions are NORMAL and LOCKOUT. Placing the switch to NORMAL allows external fuel (when selected) to transfer to fuselage cells 1, 3, and 5. In LOCKOUT external fuel (when selected) transfers to fuselage cells 1 and 3 only.

FUEL BOOST SYSTEM

Fuel is supplied to the engine during all flight attitudes by two submerged electric motor-driven centrifugal type boost pumps. On F-4C/D aircraft, the left pump is a two-speed unit. During normal operation both pumps operate at high speed. Any time the emergency generator is brought on the line, the left boost pump automatically switches to low speed operation and the right boost pump is shut down. This serves to reduce a high amperage load on the emergency generator. The boost pumps are in the engine feed tank. Both pumps are mounted on the bottom of the tank and provide fuel during negative G requirements. Due to internal tank baffling and check valves, which trap approximately 850 pounds of fuel in the lower third of the tank during inverted flight, the boost pumps provide (for a limited time) a continuous fuel flow to the engines. The two boost pumps operate when either engine master switch is ON, provided ac power is supplied to the system.

Note

On F-4C/D aircraft, bringing the emergency generator on the line automatically switches left boost pump to low speed and the right pump off. The low speed boost pump output plus gravity feed supplies enough fuel pressure to the engine driven fuel pumps to enable the engines to be started. Refer to section III for additional information.

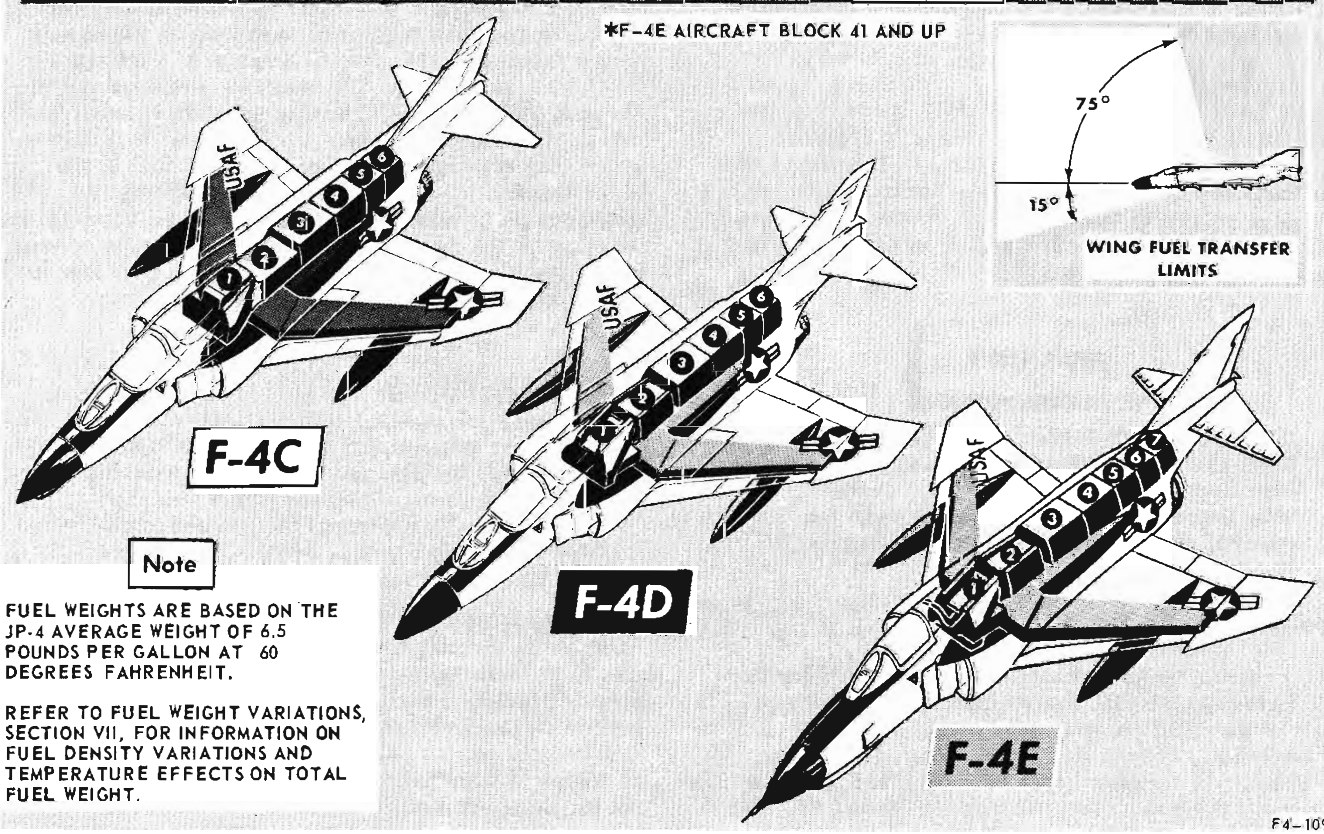
On F-4E aircraft 68-495 and up, the engine feed manifold is divided and the left boost pump supplies fuel to the left engine only, while the right boost pump supplies fuel to the right engine. Each pump is controlled by its corresponding engine master switch (left master switch on, left boost pump on) provided ac power is supplied to the system. Boost pump output for each manifold is indicated on the left or right boost pump pressure indicator. After engine start each gage will indicate 30 ± 5 psi with its corresponding engine at idle.

FUEL QUANTITY DATA TABLE

JP-4

TANK	F-4C BEFORE T.O. 1F-4-753				F-4C AFTER T.O. 1F-4-753 ALL F-4D				F-4E					
											BEFORE BLK 41		BLOCK 41 AND UP	
	FULLY SERVICED		USABLE FUEL		FULLY SERVICED		USABLE FUEL		FULLY SERVICED		USABLE FUEL		USABLE FUEL	
	GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS
FUSELAGE CELL 1	—	—	314	2041	—	—	231	1501	—	—	231	1501	215	1397
CELL 2	—	—	207	1345	—	—	207	1345	—	—	207	1345	185	1203
CELL 3	—	—	164	1066	—	—	164	1066	—	—	164	1066	147	955
CELL 4	—	—	221	1436	—	—	221	1436	—	—	221	1436	201	1307
CELL 5	—	—	201	1306	—	—	201	1306	—	—	201	1306	180	1170
CELL 6	—	—	235	1527	—	—	235	1527	—	—	235	1527	213	1385
CELL 7	—	—	—	—	—	—	—	—	—	—	104	676	84	546
TOTAL FUSELAGE FUEL	1376	8944	1342	8723	1305	8483	1259	8183	1412	9178	1363	8859	1225	7963
INTERNAL WING TANKS	644	4186	630	4095	644	4186	630	4095	644	4186	630	4095	630	4095
TOTAL INTERNAL FUEL	2020	13,130	1972	12,818	1949	12,669	1889	12,278	2056	13,364	1993	12,954	1855	12,058
EXTERNAL WING TANKS	744	4836	740	4810	744	4836	740	4810	744	4836	740	4810	740	4810
INTERNAL FUEL PLUS EXTERNAL WING TANKS	2764	17,966	2712	17,628	2693	17,505	2629	17,088	2800	18,200	2733	17,764	2595	16,868
EXTERNAL CENTER TANK	602	3913	600	3900	602	3913	600	3900	602	3913	600	3900	600	3900
INTERNAL FUEL PLUS EXTERNAL CENTER TANK	2622	17,043	2572	16,718	2551	16,582	2489	16,178	2658	17,277	2593	16,854	2455	15,958
MAXIMUM FUEL LOAD TOTAL INTERNAL PLUS ALL EXTERNAL TANKS	3366	21,879	3312	21,528	3295	21,418	3229	20,988	3402	22,113	3333	21,664	3195	20,768
TOTAL TRAPPED	54	351	—	—	66	429	—	—	69	449	—	—	—	—
	—	—	—	—	—	—	—	—	*93	*605	—	—	—	—

*F-4E AIRCRAFT BLOCK 41 AND UP



Note

FUEL WEIGHTS ARE BASED ON THE JP-4 AVERAGE WEIGHT OF 6.5 POUNDS PER GALLON AT 60 DEGREES FAHRENHEIT.

REFER TO FUEL WEIGHT VARIATIONS, SECTION VII, FOR INFORMATION ON FUEL DENSITY VARIATIONS AND TEMPERATURE EFFECTS ON TOTAL FUEL WEIGHT.

F4-109

Figure 1-3

FUEL DISTRIBUTION AND INDICATION

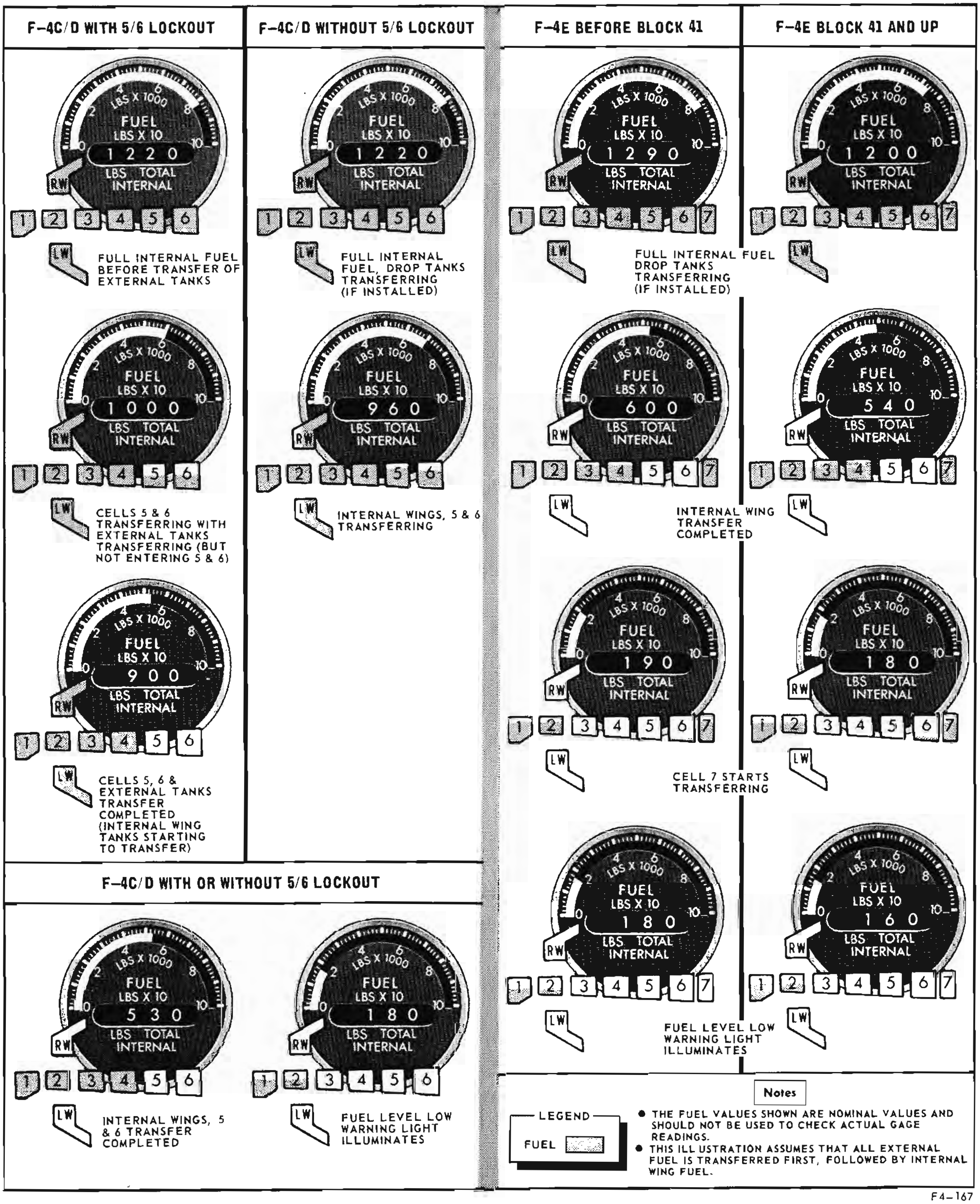


Figure 1-4

Boost Pump Check Switches

On all F-4C/D aircraft and F-4E aircraft through 68-494, the left and right boost pump check switches, with a CHECK position and a spring-loaded NORMAL position are on the fuel control panel. A boost pump ground check may be made only with external power applied to the aircraft, and with the engine master switches OFF. Holding either check switch in CHECK position operates the corresponding left or right engine shutoff valve allowing a pressure transmitter to pick up boost pump pressure. Fuel boost pump pressure transmitters transmit an electrical signal to the applicable pressure indicator on the left subpanel. To perform a boost pump pressure check, operate each boost pump check switch individually and check for a reading of 30 ± 5 psi on the applicable pressure indicator. The boost pump pressure check cannot be performed during a battery start.

Boost Pump Pressure Indicators

The boost pump pressure indicators are mounted on the left subpanel in the front cockpit. The gage dials are calibrated from 0 to 5 and readings must be multiplied by 10. Pressure transmitters mounted on the aircraft keel in the engine compartment measure the pressure in the aircraft fuel system on the inlet side of the engine fuel pump. This signal is transmitted to the indicators in the cockpit.

FUEL TANK PRESSURIZATION AND VENT SYSTEM

The pressurization and vent system provides regulated engine bleed air pressure to all internal and external tanks for pressurization, fuel transfer, and wing fuel dump. The system also provides pressure relief of the fuel tanks during climbs, and vacuum relief of the fuel tanks, as required, during descents. Pressurization is automatic and commences as soon as one engine is running and the electrical system is energized. The tanks depressurize when the air refuel switch is placed to the EXTEND position. On F-4C/D aircraft after T.O. 1F-4-609 and all F-4E aircraft, the pressurization circuit is wired through the right main gear scissor switch and the right main gear down limit switch. This circuitry provides pressurization (through the scissor switch) as soon as the weight is off the gear and continues to provide pressurization (through the down limit switch) as the gear is retracted. When the gear is retracted the scissor switch is in the same position as when the gear is extended and the aircraft is on the ground. Pressurization is terminated when the right main gear strut is compressed at touchdown.

Fuselage Pressurization and Vent

The fuselage tanks are pressurized to minimize boiling of the fuel and to prevent negative pressure from collapsing the cells during fuel transfer. The fuselage cells are vented through the pressure relief valve to a common fuel vent manifold which is vented overboard through the fuel vent mast. This also provides fuel tank ventilation and vacuum relief.

Internal Wing Tank and External Tank Pressurization and Vent

The internal wings and external tanks are pressurized to provide fuel transfer into the fuselage tanks and wing fuel dump. The internal wing tank pressure relief valves, which control both pressure and vacuum relief, open into the common manifold and are vented overboard through the fuel vent mast. The external centerline tank is also vented and relieved in this manner. The external wing tanks are vented through their pressure relief valves to the internal wing tank dump lines.

Tank Depressurization Switch

On F-4E aircraft 68-495 and up, a tank depressurization switch is installed on the fuel control panel. This guarded switch is marked NORM, ALL FUS and ALL INT. When the switch is in NORM, fuel cell pressurization operates as previously described. Placing the switch to ALL FUS, depressurizes all the fuselage cells only. If ALL INT is selected the fuselage cells and wing cells are depressurized. If the automatic fuel transfer is actuated (2300 pounds), pressurization is restored to the internal wing cells. When the switch is not in NORM, the fuel cells are partially pressurized by the scarf effect of the fuel dump mast. This action supplies sufficient pressurization during most flight regimes to prevent the collapse of the fuselage cells.

CAUTION

If the depressurization switch is in ALL INT and dive angles greater than 45° at airspeeds less than 300 knots are encountered, the fuselage cells may collapse due to negative pressure within the cells.

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity indicating system is of the capacitance-type and provides a reading, in pounds, of total internal fuel. The system components include the fuel quantity indicator, the fuel check switch, and the FUEL LEVEL LOW warning light. There are 13 fuel gaging units in the F-4C/D aircraft and 14 fuel gaging units in the F-4E aircraft located throughout the internal cells.

Fuel Quantity Indicator

A combination counter-tape fuel quantity indicator is on the instrument panel in the front cockpit. The counter unit of the gage continuously indicates the total usable fuel quantity (with readings multiplied by 10) of all internal fuel. The tape portion of the indicator simultaneously indicates the total usable fuel quantity (with readings multiplied by 1000) of fuselage fuel in cells 1 through 6 only. On F-4E aircraft, cell 7 fuel quantity is included in the counter reading.

Note

- On F-4C/D aircraft, after all internal wing fuel has transferred, the difference between the tape and counter should not exceed 350 pounds, and the fuel quantity reading on both indicators should decrease at the same rate.
- On F-4E aircraft after all wing fuel has transferred, the counter should read 600 ± 350 pounds higher than the tape when fuselage cell 7 is full. With both internal wing tanks and fuselage cell 7 empty, the difference between the tape and counter should not exceed 350 pounds.

WARNING

- At the low end of the fuel scale, the counter portion of the fuel quantity gage has a tolerance of ± 200 pounds and the tape portion has a tolerance of ± 150 pounds. If the FUEL LEVEL LOW light illuminates above an indicated 2000 pounds, on F-4C/D aircraft and F-4E aircraft through 68-494; or 1850 pounds, on F-4E aircraft 68-495 and up, ensure the FEED TANK CK & FUEL LOW WARN circuit breaker is in (H5, No. 2 panel F-4C/D; H4, No. 2 panel F-4E) and essential dc power is available. On F-4C/D aircraft, the essential DC TEST button and light may be used to check for power. On F-4E aircraft, satisfactory operation of the landing gear position indicators, flap position indicators, stabilator position indicator or the intercomm system is a check for essential dc power. The fuel level low warning light will illuminate erroneously if the FEED TANK CK & FUEL LOW WARN circuit breaker is out, or essential power is lost. If the circuit breaker is in and essential dc power is available, the fuel level low warning light should be used as the primary indication of a low fuel state.
- There is a possibility that fuel quantity variations will be noted on the fuel quantity indicator during aircraft accelerations and decelerations. These variations are due to the movement of fuel within the cells which is a result of the high acceleration and deceleration rates of the aircraft. Transient increases in fuel quantity readings may be noted during deceleration, and transient decreases in fuel quantity readings may be noted during acceleration. This erroneous quantity indication combined with allowable indicator tolerances may result in engine flameout from fuel starvation with indicated fuel remaining.

Feed Tank Check Switch

The two-position feed tank check switch, with switch positions of FEED TANK CHECK and NORM is used to check the fuel quantity in the engine feed tank. When the switch is in the spring-loaded FEED TANK CHECK position, the tape portion, and the counter portion of the fuel quantity gage indicates engine feed tank fuel quantity. On F-4C aircraft, the counter portion of the fuel quantity gage should read 1950 ± 200 pounds and the tape portion of the gage should read 1950 ± 150 pounds. On F-4D aircraft and F-4E through 68-494, the counter should read 1500 ± 200 pounds and the tape should read 1500 ± 150 pounds. On F-4E aircraft 68-495 and up, the counter should read 1400 ± 200 pounds and the tape should read 1400 ± 150 pounds. The feed tank check switch also provides an indication that there is power to the fuel quantity circuits and that the gage is functioning properly.

Fuel Level Low Warning Light

The FUEL LEVEL LOW warning light on the telelight panel illuminates when the usable fuel in cells 1 and 2 has reached a predetermined low fuel state (stabilized level flight). On F-4C/D aircraft and F-4E aircraft through 68-494, the light illuminates at 1800 ± 200 pounds. On F-4E aircraft 68-495 and up, the light illuminates 1650 ± 200 pounds. On F-4C/D aircraft, the low level sensor is located in cell 1. On F-4E aircraft, the low level sensor is located in cell 2.

WARNING

On F-4E aircraft, if the flapper valve between cells 1 and 2 sticks in the closed position; it is possible to deplete all fuel in cell 1 (sensor is in cell 2) without the illumination of the FUEL LEVEL LOW light.

Tank 7 Fuel Light (F-4E)

The TANK 7 FUEL light on the telelight panel illuminates in conjunction with the FUEL LEVEL LOW indicator light if cell 7 fuel is not being transferred. The light indicates that the dual actuator transfer valve in cell 7 did not open.

WARNING

With the TANK 7 FUEL light illuminated, the counter portion of the fuel quantity indicates 600 pounds more fuel remaining than is actually available.

External Tanks Fuel Lights

The external tank fuel lights on the telelight panel indicate an empty or full external tank. The light illuminates when fuel flow from the corresponding external tank ceases. Since external fuel transfer is intermittent rather than continuous the L EXT FUEL, CTR EXT FUEL, or R EXT FUEL light illuminates during any temporary halt of fuel flow. Intermittent external fuel transfer is desired since this means the transfer rate is greater than engine comsumption, and that the fuselage fuel is being maintained at its highest possible volume.

Note

> When selecting OUTBD or CENTER the corresponding indicator light illuminates momentarily any time fuel flow is less than 5 gallons per minute. The indicator lights illuminate any time the air refuel switch is in EXTEND (provided the refuel selector switch is in ALL TANKS). The lights also illuminate when the tanks are empty, and the automatic transfer circuit is energized, regardless of switch position.

External Tanks Full Lights

The external tanks full indicator lights are above the front cockpit instrument panel. These lights, marked LH FULL, RH FULL, and CTR FULL illuminate during air refueling when their respective tanks are full. The lights remain illuminated any time the air refueling receptacle is in the extend position, with the engine master switch on, and the respective tanks are full. The lights also illuminate when the tanks become full during ground refueling, and remain illuminated until the ground refueling switch in the right wheel well is moved to OFF.

INTERNAL WING FUEL DUMP SYSTEM

Wing fuel may be dumped in flight at any time, regardless of any other transfer switch positions, by selecting the DUMP position on the internal wing dump switch. The two-position lever-locked toggle switch, marked NORMAL and DUMP, is on the fuel control panel on the left console of the front cockpit. A hex head is installed on the dump switch to make it more easily recognized. Selecting DUMP opens the left and right wing dump shutoff valves and closes the wing transfer and vent valves. The wing air regulator will open, allowing the wing tank to remain pressurized and force fuel out the dump lines at the wing-fold trailing edge. The dump valves utilize electrical power from the right main dc bus and operate only when external power is applied or the generators are operating. At 85% rpm in level flight, the fuel dumping capability is approximately 100 gpm. The dumping rate varies directly with rpm and pitch attitude, i.e., lower rpm and/or nose pitched down will decrease the dumping rate. Air pressure will continue to bleed out the dump line until the internal wing dump switch is placed in the NORM position to close the dump valves.

EXTERNAL TANK JETTISON SYSTEM

Wing Station Jettison Switch

With external electrical power, generator power, or engine master switches on, external wing tanks can be jettisoned by selecting the JETT position with the wing external tanks jettison switch on the fuel control panel left console. If the external transfer switch has been left in either the OUTBD or CENTER position, and external tanks are not installed on the aircraft or have been jettisoned, the external wing tanks fuel shutoff valves will close. The external transfer switch will be ineffective, allowing internal wing fuel to transfer in its normal manner, providing the internal wing transfer switch is in the NORMAL position.

Centerline Station Jettison Switch

The center station jettison switch is used to jettison the centerline external tank. With weight on the gear, the jettisoning circuit is energized anytime the aft gear handle is in, and the forward gear handle is in the UP position. With weight off the gear, the circuit is energized anytime the forward gear handle is UP or DOWN and the aft gear handle is IN. When the centerline store is jettisoned, the internal wing fuel will transfer in the normal manner, providing the internal wing transfer switch is in the NORMAL position.

ELECTRICAL POWER SUPPLY SYSTEM

Note

> Refer to foldout section for electrical distribution schematic.

The aircraft electrical power supply system consists of two engine driven ac generators, two dc transformer-rectifiers, a battery, an emergency ac generator (F-4C/D only) and a power distribution bus system.

AC ELECTRICAL POWER (F-4C)

Two 400 cycle, three phase, 115/200 volt ac generators are the primary source of all electrical power. Each generator (one on each engine) is capable of supplying the system with 20,000 volt-amperes of electrical power. The generators are regulated to a speed of 8000 rpm by integral constant speed drive units. Engine oil is used as a hydraulic media in the drive units and also serves to keep the generators cool. The left engine generator supplies power directly to the instrument 115/200 volt ac bus, the left main 115/200 volt ac bus, and the left transformer-rectifier. With the left generator connected to the line, the instrument bus switching relay is energized to supply power from the left generator to the instrument 115/200 volt ac bus through contacts of the instrument bus switching relay. If the left generator is tripped off the line, the instrument bus switching relay is deenergized causing the instrument 115/200 volt ac bus to be switched from the output of the left generator to the essential 115 volt ac bus. Thus, if the left generator goes off the line due to a malfunction or the left generator control switch is turned off, the power input to the instrument 115/200 volt ac bus is automatically switched from the left generator output to the essential 115/200 volt ac bus. The right engine generator supplies power directly to the essential 115/200 volt ac bus, the right main 115/200 volt ac bus, and the right transformer-rectifier. Either generator is capable of supplying electrical power to the entire bus system through an auto-parallel controlled bus tie relay. When both generators are operating in phase with each other, and are at approximately the same frequency, the auto-parallel control energizes the bus tie relay and connects the left and right bus systems. If the electrical load division between the two generators becomes unbalanced, the fault protection circuit deenergizes the bus tie relay and each generator will supply power only to its own bus system. If one generator fails, the fault protection circuit drops the malfunctioning generator off the line and the bus tie relay energizes, allowing the remaining generator to supply power to the entire bus system. It is also possible that the bus tie relay will open, and the BUS TIE OPEN light will illuminate, during rapid engine acceleration/decelerations, when making an idle power descent, or when both engines are operating at 74 to 75% rpm. This condition is not detrimental to aircraft mission accomplishments or to the electrical power generating system. Each generator may be manually disconnected from the bus system by placing its generator control switch to OFF. The emergency generator, when operating, supplies power to the essential 115/200 volt ac bus, the instrument 115/200 volt ac bus, the instrument 28 volt ac bus, and the right transformer-rectifier. Autotransformers reduce 115/200 volt ac power to 28 volt ac power and transformer-rectifiers convert 115/200 volt ac power to 28 volt dc power.

Note

At approximately 53% engine rpm, the generators drop off the line. This rpm varies with generator load and condition of CSD.

AC ELECTRICAL POWER (F-4D/E)

The ac electrical power system on F-4D aircraft is functionally the same as F-4C aircraft except that it incorporates 30,000 volt-ampere generators. The ac electrical power system on F-4E aircraft is functionally the same as F-4D aircraft except that the essential 115/200 volt ac bus and emergency generator are removed. On F-4E aircraft the right 115/200 volt ac bus will power the instrument buses whenever the left generator goes off the line due to a malfunction or the left generator switch is turned OFF. On F-4E 69-7261 and up, an instrument 14 volt ac bus is provided to power the warning lights bus during its dimmed condition.

Note

At approximately 53% engine rpm, the generators drop off the line. This rpm varies with generator load and condition of CSD.

DC ELECTRICAL POWER (F-4C/D)

Two 100 ampere transformer-rectifiers convert 115/200 volt ac to 28 volt dc. The left transformer-rectifier supplies power to the left main 28 volt dc bus. The right transformer-rectifier supplies power to the essential 28 volt dc bus, the ignition bus, and through the essential dc line relay, to the right main 28 volt dc bus and the armament bus. The right transformer-rectifier also supplies power to the battery bus, and charges the battery through the battery relay. The output of both trasformer-rectifiers is connected in parallel through a 60 ampere bus tie current limiter. If one transformer-rectifier fails, the remaining transformer-rectifier supplies power to the entire dc bus system. The emergency generator supplies power through the right transformer-rectifier to the essential 28 volt dc bus. A limited source of dc electrical power is provided by the battery in the rear cockpit. The battery bus is energized any time the battery is installed and connected to the aircraft.

DC ELECTRICAL POWER (F-4E)

Two 100 ampere transformer-rectifiers receive 400 cycle, three phase, 115/200 volt ac power from their respective generators and supply 28 volt dc power. The right transformer-rectifier is connected to the essential 28 volt dc bus and the left transformer-rectifier is connected to the main 28 volt dc bus. The essential 28 volt dc bus is connected to the main 28 volt dc bus through the main dc line relay when the relay is energized. Closure of the main dc line relay is determined by the monitoring action of the dc tie control circuit. Essentially, the dc power circuits are designed to disconnect the two dc buses during double generator failure so that loads from the main 28 volt dc bus will not discharge the battery, and also so that in the event of a single transformer-rectifier failure, the remaining transformer-rectifier will power all the dc buses. The main dc line relay is energized when the voltage on the essential 28 volt dc bus reaches 25.5 +0.5 -0 volts. The buses become disconnected whenever the voltage on the combined buses drops below 24.5 +0.5 -0 volts for 2.0 ± 0.2 seconds. The opening of the connection is indicated by illumination of the DC BUS light. If the main 28 volt dc bus becomes disconnected and the voltage on the essential 28 volt dc bus recovers to a value above 25.5 ± 0.5 volts, the dc control circuits will not automatically reconnect the two buses together. This can only be done by simultaneously cycling both generator control switches. This feature prevents the control circuitry from recycling, or oscillating. The battery bus is connected to the essential 28 volt dc bus whenever either of the engine master switches is ON or the ground refueling switch is in the DEFUEL or REFUEL position. Whenever a transformer-rectifier(s) is powering the essential 28 volt dc bus and the battery bus is connected, the essential 28 volt dc bus charges the battery. The armament 28 volt dc bus is energized by the main 28 volt bus whenever the landing gear handle is UP or the armament safety override switch is depressed. If one transformer-rectifier fails, the remaining transformer-rectifier will power the entire system. If both transformer-rectifiers fail, the battery provides a limited source of dc power to the essential 28 volt dc and battery buses. The battery bus is energized any time the battery is installed and connected to the aircraft.

Battery (F-4C/D)

A 24 volt, 11 ampere-hour battery in the rear cockpit, is a secondary source of dc electrical power. The battery supplies power directly to the battery bus, and through the battery relay to the essential 28 volt dc bus and the ignition bus. The battery relay is energized when either engine master switch is ON, or when the ground refueling control switch is in REFUEL or DEFUEL. With the battery relay energized, when either engine driven generator is operating, the battery is charged through the battery relay. If sufficient battery voltage is not available to close the battery relay, the battery must be removed for recharging.

Note

- A check to determine battery relay closure is to turn on either master switch and check for proper positioning of the gear and flap indicators.
- If the ground refueling switch, in the right wheel well, is left in the REFUEL or DEFUEL position after ground refueling, the battery will continue to discharge.

Battery (F-4E)

On F-4E aircraft the battery and ignition buses are combined to form a single battery bus. However, ignition voltage is not present at an ignition switch without the respective engine master switch being placed to the ON position.

Note

- A check to determine battery relay closure is to turn on eigher master switch and check for proper positioning of the gear and flap indicators.
- If the ground refueling switch is left in either the REFUEL or DEFUEL position the battery will continue to discharge.

EMERGENCY GENERATOR (F-4C/D)

An emergency 400 cycle, three phase, 115/200 volt ac generator provides a limited source of electrical power if both engine driven generators become inoperative. The emergency generator is driven by a ram air turbine, and is capable of supplying 3000 volt-amperes of electrical power. When the emergency generator reaches its rated voltage, it energizes the emergency power relay which connects generator output to the essential 115/200 volt ac bus, the instrument 115/200 volt ac bus, the instrument 28 volt ac bus, the essential 28 volt dc bus, and the ignition bus. The emergency power relay will not be energized to connect the emergency generator to the bus system unless both engine driven generators are inoperative and the aircraft airspeed is above approximately 90 knots CAS. If either engine driven generator is restored, the emergency power relay deenergizes and disconnects the emergency generator from the system. The generator output voltage will decrease to the point where the emergency power relay will deenergize to remove emergency power from the buses when the aircraft airspeed drops below approximately 90 knots. The emergency generator may be activated by extending the ram air turbine. The ram air turbine is extended by placing the ram air turbine control handle to RAT OUT (push down on handle). If the emergency generator becomes inoperative, the battery assumes full load of the essential 28 volt dc bus and the battery bus. The emergency generator is capable of delivering maximum rated power for approximately 15 minutes.

Note

Record RAT operating time on Form 781.

EXTERNAL ELECTRICAL POWER

External electrical power may be connected to the aircraft bus system through an external electrical power receptacle on the bottom of the left engine intake duct. External power required is 400 cycle, three phase, 115/200 volt ac. External electrical power is distributed through the bus system in the same manner as generator output.

ELECTRICAL SYSTEM CONTROLS AND INDICATORS

Generator Control Switches

Two generator control switches, one for each generator, are on the generator control panel. With external electrical power connected to F-4C/D aircraft, and with the generator control switches in EXT ON, electrical power is supplied to the left main 115/200 volt ac bus, the left main 28/14 volt ac bus, the essential 115/200 volt ac bus, the right main 115/200 volt ac bus, the right main 28 volt ac bus, the left main 28 volt dc bus, the right main 28 volt dc bus, the ignition bus and the essential 28 volt dc bus. With external electrical power connected to F-4E aircraft, and with the generator control switches in EXT ON, electrical power is supplied to the left main 115/200 volt ac bus, the left main 28 and 14 volt ac buses, the right main 115/200 volt ac bus, the right main 28 volt ac bus, the main 28 volt dc bus, and the essential 28 volt dc bus. When either engine driven generator is operating, its output may be connected to the entire bus system by placing its respective generator control switch to GEN ON.

Note

- If a generator trips off the line due to a temporary malfunction (low voltage, etc.), the associated generator switch must be cycled to reconnect the generator to the buses. Cycling is performed by placing the switch to the OFF position and then back to ON.
- On aircraft with 20 KVA generators, a 45 second waiting period is required for cycling. On aircraft with 30 KVA generators there is no waiting period for cycling.

Instrument Ground Power Switch

When external electrical power is applied to the aircraft, placing the generator switches to EXT ON energize all buses except the instrument 115/200 volt ac bus, the instrument 28 volt ac bus, and on F-4E aircraft 69-7261 and up, the instrument 14 volt ac bus. This reduces the operating time of many of the aircraft instruments during ground repair and system testing. An instrument ground power switch, on the rear cockpit No. 2 circuit breaker panel connects external electrical power to the instrument buses. On F-4E block 39 and up, with the generators not operating, the switch engaged, and the generator control switches then placed out of the EXT position(s), the switch remains engaged and will discharge the battery unless external electrical power is disconnected. On older block aircraft, the instrument ground power switch will disengage upon loss of external electrical power. With the left generator on the line, the instrument ground power switch disengages and all instrument buses receive power from the left generator. The 115/200 volt ac instrument bus receives power from the essential 115/200 volt ac when the right generator or emergency generator is the only source of power. The F-4E instrument 115/200 ac bus receives power from the right generator when it is the only power source. The instrument buses may be deenergized, when operating on external power, by manually placing the instrument ground power switch to off (NORM).

Autopilot Ground Test Switch

On F-4C/D aircraft after T.O. 1F-4-515 and on all F-4E aircraft, with external power applied to the aircraft buses and the autopilot ground test switch in NORM, no electrical power can be applied to the AFCS circuits. To apply power to the AFCS, the autopilot ground test switch must be placed to TEST (solenoid held). The autopilot ground test switch, on the No. 2 circuit breaker panel remains in TEST with power applied to the autopilot until either external power is removed, a generator comes on the line, or the switch is manually placed to NORM. When either generator comes on the line, the autopilot ground test switch can no longer be used to remove power from the AFCS. The purpose of the switch is to prolong AFCS component life by removing power to the system while external power is applied to the aircraft for maintenance of other systems.

Essential DC Test Button (F-4C/D)

An essential dc test button on the No. 2 circuit breaker panel is used for testing the right (essential bus) and left transformer-rectifiers. With external electrical power applied to the entire bus system, depressing the essential dc test button deenergizes the essential dc relay. Electrical power to energize the ignition bus and essential 28 volt dc bus must then be supplied by the right transformer-rectifier. If the transformer-rectifiers are operating properly, the ESSENTIAL DC TEST light illuminates. Illumination of the ESSENTIAL DC TEST light indicates that both transformer-rectifiers are supplying power since, on external power, the output of the left transformer-rectifier energizes the bus tie relay so that ac power can be provided to the input of the right transformer-rectifier. The output of the right transformer-rectifier then illuminates the test light. To check the transformer-rectifiers, the engine master switches must be OFF, otherwise the battery may be supplying electrical power to the ignition and essential 28 volt dc buses and a false indication will result.

Circuit Breakers

The front cockpit contains eight essential circuit breakers, one on the left subpanel and seven on the right console circuit breaker panel. All remaining circuit breakers are in the rear cockpit. Refer to the circuit breaker panels in the foldout section for the location and name of each circuit breaker. On F-4D aircraft after T.O. 1F-4D-506 or T.O. 1F-4D-512, No. 5 circuit breaker panel is installed on the left console in the rear cockpit.

Generator Indicator Lights

The LH GEN OUT, RH GEN OUT and BUS TIE OPEN indicator lights are on the generator control panel. A generator light illuminates when a generator is removed from the bus system and the bus tie light illuminates when the generators are not paralleled. When either or both generators are connected to the aircraft bus system with the bus tie closed, the indicator lights utilize power from the 28/14 volt ac warning lights bus. The three lights utilize power from the permanent magnet generator transformer-rectifier when a generator is turning, with its generator control switch ON, and the bus tie is open. With both generators off the line and at least one engine turning with the associated generator control switch ON, all three warning lights illuminate from power derived from the permanent magnet transformer-rectifier. On F-4D/E aircraft after T.O. 1F-4-789, the generator indicator lights are powered solely by the warning lights 28/14 volts ac bus. Thus, the indicator lights do not illuminate in the event of double generator failure. For F-4D aircraft only, the indicator lights will illuminate after the RAT is extended and operating. Also, on F-4D and F-4E aircraft before 69-7261, a left generator failure accompanied by a failure of the bus tie is not noted by the illumination of the LH GEN OUT and BUS TIE OPEN lights if the pilot's instrument lights knob is out of the OFF position. These failures must be determined by other means. On F-4E aircraft 69-7261 and up, with a left generator failure and the bus tie open, the generator indicator lights will illuminate regardless of the position of the pilot's instrument lights knob. Refer to double generator failure and bus tie open, section III. The MASTER CAUTION light illuminates in conjunction with the generator indicator lights.

HYDRAULIC POWER SUPPLY SYSTEM

Note

Refer to foldout section for hydraulic systems schematic.

Hydraulic power is supplied by three completely independent closed center hydraulic systems. They are power control system one (PC-1), power control system two (PC-2), and utility system. The systems have an operating pressure of approximately 3000 psi and are pressurized any time the engines are running. The power control systems supply hydraulic pressure to the dual power control cylinders of the ailerons, spoilers, and stabilator. The utility hydraulic system supplies hydraulic pressure to all systems except the stabilator actuator. Each system may be pressurized by an external hydraulic power source. On F-4E aircraft after T.O. 1F-4-903, a stabilator auxiliary power unit (APU) is installed. This system is an electrically operated, self contained unit with an operating pressure of approximately 1700 psi. The APU supplies pressure to the stabilator actuator only.

POWER CONTROL SYSTEMS

The PC-1 and PC-2 systems are pressurized to 3000 ± 250 psi by a variable volume, constant pressure hydraulic pump mounted on each engine. The PC-1 pump, on the left engine, supplies pressure to one side of the left aileron, left spoiler, and stabilator dual power control cylinders. Pressure to one side of the right aileron, right spoiler, and stabilator dual power control cylinders is supplied by the PC-2 pump on the right engine. Utility pressure is supplied to the remaining side of both aileron and spoiler dual power control cylinders. Fluid is supplied to the pumps by airless, pressure loaded, piston type hydraulic reservoirs. The reservoirs insure positive hydraulic pressure and fluid supply at the pump suction ports regardless of aircraft altitude or flight attitude. A 50 cubic inch accumulator for each PC system precharged to 1000 psi, is utilized as a pump surge suppressor, and as a limited source of hydraulic fluid and pressure when system demands exceed pump output. A pressure transmitter in the main pressure line, supplies indications for the associated PC pressure indicator in the front cockpit. If a loss of system pressure occurs a CHECK HYD GAGES indicator light and a MASTER CAUTION light illuminate. The hydraulic fluid is maintained at a usable temperature by a fuel - hydraulic fluid heat exchanger.

Note

The PC-1, PC-2, and utility hydraulic systems are independent of each other. Therefore, the ailerons and spoilers have three independent sources of hydraulic pressure and one system will function as a backup for another system.

STABILATOR AUXILIARY POWER UNIT (APU)

On F-4E aircraft after T.O. 1F-4-903, an APU system is installed to provide a back-up for longitudinal control. The APU system is pressurized to 1700 ± 100 psi by a variable volume, constant pressure hydraulic pump in the aft fuselage. The APU supplies pressure to the PC-1 side of the stabilator if PC-1 pressure drops below 1000 psi. Fluid is supplied to the pump by an integral, 25 cubic inch, reservoir. The reservoir insures positive hydraulic pressure and fluid supply at the pump suction port at altitudes below 20,000 feet. Fluid pressure is sufficient to supply stabilator demands of moderate flight maneuvers including landing. Flight speed is restricted to below 600 KCAS/.95 Mach with normal load factors from 0 to +4 G. Stick rate input is limited to 1 G per second. A pressure switch in the pump illuminates an APU light on the telelight panel, when the pump is operating. An APU reject switch provides an option to reject the APU system if PC-1 pressure drops below 1000 psi (left engine shut down) with the PC-2 system operating normally. This switch also has a TEST position for ground check of the system. Operation of the system is automatic, provided the reject switch is in NORMAL, as soon as PC-1 drops below 1000 psi. If the reject switch is in REJECT, operation is automatic as soon as PC-2 pressure drops below 1000 psi (provided PC-1 has previously failed or the left engine was shut down). Momentary drops of the PC system below 1000 psi will cause the APU system to be energized. A holding relay in the control system will keep it activated for 1 minute after the PC pressure has recovered. The APU is powered by the right main 115 volt bus and controlled by the right main 28 volt bus.

Auxiliary Power Unit Reject Switch

The APU reject switch, on the outboard engine control panel, is a three position switch marked NORMAL, REJECT and TEST. The TEST position provides an operational check of the APU system with external power (engines shut down). The NORMAL position provides automatic operation of the APU system if PC-1 pressure drops below 1000 psi. The REJECT position provides an option to deactivate the APU after PC-1 fails, and PC-2 is still operating normally. Placing the switch to REJECT (after PC-1 failure) turns off the APU and completes a circuit to automatically reactivate the APU system if PC-2 should also fail. Loss of PC-2 with a good PC-1 system will not activate the APU.

APU Light

The APU light, on the telelight panel, illuminates anytime the APU is operating. A holding relay in the control circuit causes the light and APU to remain on for 1 minute, if momentary PC pressure drops occur.

UTILITY SYSTEM

The utility hydraulic system is pressurized to 3000 ± 250 psi by two variable volume constant pressure hydraulic pumps, one on each engine. To prevent the utility hydraulic pumps from resonating, check valves with different opening pressures are installed on the pump output lines. As a result, the right engine utility hydraulic pump delivers 2775 ± 225 psi at idle rpm, and the left engine utility hydraulic pump delivers approximately 3000 ± 250 psi at idle rpm. Fluid is supplied to the pumps by an airless, pressure loaded, piston-type hydraulic reservoir. The reservoir insures positive hydraulic pressure and fluid supply at the suction ports of the pumps regardless of aircraft altitude or flight attitude. A 50 cubic inch accumulator, precharged to 1000 psi, is utilized as a pump surge suppressor, and as a limited source of hydraulic fluid and pressure when system demands exceed the output of the pumps. If either pump fails, a CHECK HYD GAGES indicator light and MASTER CAUTION light illuminates. The hydraulic fluid is maintained at a usable temperature by two fuel-hydraulic fluid heat exchangers. The utility hydraulic system supplies hydraulic pressure to the:

- Aileron Power Control Cylinders
- Aileron Dampers
- Aileron-Rudder Interconnect
- Air Refueling Receptacle
- Anti-Skid
- Arresting Hook (retraction)
- Auxiliary Air Doors
- Flaps (leading and trailing edge)
- Forward Missile Cavity Doors
- Fuel Transfer Pumps (hydraulic)
- Gun Drive F-4E
- Gun Gas Purge Door F-4E
- Landing Gear
- Lateral Control Servo (autopilot)
- Nose Gear Steering
- Pneumatic System Air Compressor
- Radar Anenna Drive
- Rudder Damper
- Rudder-Feel System
- Rudder Power Control Cylinder
- Speed Brakes
- Spoiler Power Control Cylinders
- Variable Engine Bellmouth
- Variable Engine Intake Duct Ramps
- Wheel Brakes (normal and emergency accumulator)
- Wing Fold (folding and spreading) F-4C/D

HYDRAULIC PRESSURE INDICATORS

Hydraulic pressure transmitters, one for each system, convert pressure impulses to electrical impulses and supply them to the hydraulic pressure indicators on the front cockpit pedestal panel. The indicators cover a pressure range of 0 to 5000 psi and are marked from 0 to 5 with readings multiplied by 1000. There are three indicators, one for each system, on F-4C/D aircraft. On F-4E aircraft, two indicators are utilized, one for the utility system and one for the PC-1 and PC-2 systems. The power control systems indicator has two pointers, one labeled 1 for PC-1 and the other 2 for PC-2.

HYDRAULIC SYSTEMS INDICATOR LIGHTS

An amber CHECK HYD GAGES indicator light is on the telelight panel. This single light is utilized by both the power control systems and the utility system to indicate loss of hydraulic system pressure and direct the AC's attention to the hydraulic pressure indicators. Illumination of CHECK HYD GAGES indicator light is controlled by the hydraulic systems pressure switches. The CHECK HYD GAGES light illuminates when the pressure in any one system drops below 1500 ± 100 psi and/or when one of the utility hydraulic pumps fail. In all cases, a loss of system pressure is noted on the applicable hydraulic pressure indicator, but a failed utility hydraulic pump may not register a significant pressure drop on the utility pressure indicator. However, it can be generally concluded that an illuminated CHECK HYD GAGES light with no noted pressure drop on any of the hydraulic pressure indicators signifies that the right utility hydraulic pump has failed. An illuminated CHECK HYD GAGES light with a utility hydraulic pressure drop of 200 psi signifies that the left utility pump has failed. The MASTER CAUTION light illuminates with the CHECK HYD GAGES indicator light. The MASTER CAUTION light may be extinguished by depressing the reset button. The CHECK HYD GAGES light remains illuminated until the pressure in the faulty system increases beyond 1750 psi. If a failure occurs in one of the remaining hydraulic systems while the CHECK HYD GAGES light is already illuminated, the MASTER CAUTION light will not illuminate again and the AC will not be alerted to the second failure.

Note

The MASTER CAUTION light and CHECK HYD GAGES indicator light may illuminate momentarily when the landing gear is being lowered due to high system demands.

PNEUMATIC SYSTEM

Note

Refer to foldout section for pneumatic system illustration.

The pneumatic system provides high pressure air for the normal and emergency operation of the canopies, the normal operation of the ram air turbine (extension and retraction F-4C/D only), and the emergency operation of the landing gear and wing flaps. Air for the pneumatic system is drawn from the engine bleed air supply, via the electronic equipment cooling system, and is compressed by a hydraulic motor driven air compressor. A pneumatic pressure sensor in the system moisture separator opens a hydraulic shutoff valve, to activate the air compressor, when the system pressure falls below approximately 2750 +50, -0 psi. When the pneumatic system pressure builds to approximately 3100 +100 -50 psi, the pneumatic pressure sensor closes the hydraulic shutoff valve which deactivates the air compressor. The air compressor discharges through a moisture separator and chemical air dryer to the pneumatic system air bottles. Check valves prevent the air bottles from discharging back toward the compressor. Shutoff valves isolate the air bottles from their component systems until they are manually discharged. A pressure transmitter, for the pneumatic pressure indicator, is installed in a main pressure line.

PNEUMATIC PRESSURE INDICATOR

A pneumatic pressure indicator is on the pedestal panel in the front cockpit. A pressure transmitter supplies electrical inputs to the indicator. The indicator covers a pressure range of 0 to 5000 psi, and is marked from 0 to 50 with readings multiplied by 100. Normal system pressure range is from 2650 to 3300 psi due to pressure transmitter and pressure gage tolerances.

FLIGHT CONTROLS

Note

Refer to foldout section for flight controls schematic.

The aircraft primary flight controls consist of the stabilator, rudder, aileron, and spoilers. The stabilator, ailerons, and spoilers are actuated by irreversible, dual power cylinders. The rudder is actuated by a conventional, irreversible power cylinder. Artificial feel systems provide simulated aerodynamic control stick and rudder pedal forces due to the lack of aerodynamic feedback forces from the power control cylinders. The feel systems have trim actuators which, through the power cylinders, move the entire control surface. Secondary controls are leading edge flaps, trailing edge flaps, and wing mounted speed brakes.

LATERAL CONTROL SYSTEM

The lateral control system (a unique aileron-spoiler combination) consists of tandem forward and aft control sticks connected to the left and right aileron-spoiler by override spring cartridges, push-pull rods, walking beam bellcranks, aileron dual power cylinders with integrated control valves, spoiler power cylinders with followup type dual control valves, autopilot series servos, and lateral feel trim actuators. The ailerons travel downward 30 degrees from a full trail position. Upward travel is limited to 1 degree. The spoilers travel 45 degrees upward from a flush contour position in the upper wing surface. Lateral movement of the control stick is transmitted mechanically by the push-pull rods through the walking beam bellcranks, to the spoiler and aileron control valves. The control valves meter hydraulic fluid to their respective dual power cylinders in proportion to the mechanical displacement. An override spring cartridge is incorporated into the left and right push-pull rod systems. If one side becomes jammed, the override spring will deflect under force, allowing operation of the other lateral control surfaces. The walking beam bellcranks receive control surface movement inputs from three sources; the control stick, the lateral trim system, and the autopilot series servos. A self-serviced hydraulic damper, attached to the aileron backup structure, is utilized as an upstop for the aileron as well as a flutter damper. The control system uses dual power cylinders to allow simultaneous use of PC-1 and utility hydraulic systems in the left wing, and PC-2 and utility hydraulic systems in the right wing. If one system fails, the remaining system in that wing, will supply adequate power for control.

Aileron Control

The ailerons are controlled by dual, irreversible, power cylinders that receive metered hydraulic fluid from dual integrated control valves. The control valves, in turn, are controlled by the push-pull rods, through the walking beam bellcranks, and control stick. Each power cylinder contains four parallel inner cylinders with rods and pistons. The piston rods are joined at one end by a yoke that is attached to the aircraft structure. The cylinder portion of the power cylinder is attached to the aileron. The two outer cylinders of the right aileron receive hydraulic fluid from PC-2, and the two inner cylinders receive hydraulic fluid from the utility system. The two outer cylinders of the left aileron receive hydraulic fluid from the utility system and the two inner cylinders receive hydraulic fluid from PC-1. This arrangement provides symmetrical loading of the yoke, if one of the systems fail.

Spoiler Control

Each wing contains two spoiler surfaces, two spoiler power cylinders, and a dual spoiler control valve. Each surface has a dual, irreversible power cylinder, with a feedback linkage to a dual spoiler control valve The spoiler control valve divides each power control system input into equal parts which is then distributed to each spoiler dual power cylinder. One portion of the power cylinder of the right spoiler receives hydraulic pressure from PC-2, and the other portion receives hydraulic pressure from the utility system. One portion of the power cylinder of the left spoiler receives hydraulic pressure from PC-1, and the other portion receives hydraulic pressure from the utility system. If one of the systems fail, the other will supply adequate pressure for spoiler control.

Lateral Control Feel and Trim System

The lateral trim system consists of the trim switch, a rotary power unit, two flexible drive shafts, and two screwjack actuators. When the trim switch is energized, the rotary power unit and flexible drive shafts position the screwjack actuators. The screwjack actuators are connected to the aircraft structure on one end, and the walking beam bellcranks on the other end. As the screwjack actuators extend and retract, the lateral controls are repositioned and the control stick follows the trim movements. Lateral control artificial feel is provided by double-action spring cartridges connected in tandem with the screwjack actuators. When the control stick is moved from neutral, the springs are compressed. The farther the control stick is moved from neutral, the greater the force required to compress the springs. The spring cartridges return the control stick to neutral when the force on the control stick is removed.

STABILATOR CONTROL SYSTEM

Longitudinal control is provided by a single unit horizontal tail surface (stabilator), that is acutated by an irreversible dual power cylinder. The leading edge of the stabilator on F-4E aircraft is slotted for increased longitudinal control. System components include the control stick, push-pull rods, cables, bellcranks, integrated control valves, and irreversible dual power cylinder. Additional components include a ram air bellows and bob weight for system artificial feel, a trim actuator, and an AFCS servo that is integral with the control valve. When the control stick is moved longitudinally, the motion is transmitted by push-pull rods to a bellcrank. It is then transmitted by a cable assembly to another push-pull rod set. The second push-pull rod set actuates the control valve which meters hydraulic fluid to the dual power cylinder. Hydraulic pressure to the stabilator power cylinder is supplied by both power control hydraulic systems. If one of the power control hydraulic systems should fail, the remaining system provides adequate control response. On F-4E aircraft block 40 and up, an APU supplies hydraulic pressure to the PC-1 side of the stabilator actuator if the PC-1 system pressure fails. A hydraulic AFCS servo is integrated into the stabilator dual servo valve. It positions the dual servo valve in the same manner as control stick inputs. As a result, when the autopilot signals for a pitch attitude change, the control stick follows the movement. The bob weight in the control linkage also increases stick forces proportionately to increase in G forces.

Stabilator Control Feel and Trim System

Artificial feel is provided by a dynamic (ram air) pressure bellows acting through a variable bellcrank on the stabilator trim actuator and a 5 pound per G bob weight. When the aircraft is in trim, the ram air force on the bellows is balanced by the bob weight. As the aircraft increases or decreases in airspeed, the pressure on the bellows changes, causing the bellows bob weight assembly to become off balance. The off balance condition is then transmitted through the trim actuator, control cables, and push-pull rods back to the control sticks. Actuating the trim switch causes the stabilator trim actuator to move, balancing the forces between the bellows and the bob weight, thereby eliminating force on the control sticks. A viscous damper, attached to the trim actuator, helps prevent abrupt control surface movements by increasing control stick forces with rapid stick movements. An override spring cartridge allows the feel and trim portion of the stabilator control system to be bypassed in the event of a nose-up trim malfunction. On all aircraft after T.O. 1F-4-831, the bob weight is reduced to 3 pounds per G and the viscous damper is removed. This improves pitch stability in low altitude, high speed, aft CG configurations.

Note

Stick force on the ground (no bellows air) is very light with 3 pound per G bob weight.

Stabilator Trim Position Indicator

The stabilator trim indicator is on the left vertical panel in the front cockpit. It is directly controlled by a transmitter which is integral with the stabilator feel trim actuator. The indicator, marked in units of percent of trim, represents trim actuator position.

CONTROL STICKS

The control sticks (figure 1-5), are mounted in yokes to permit left, right, and fore and aft movement. The front cockpit control stick consists of a stick grip and motional pick-up (force) transducer. It contains five AC operated control switches, as follows: a trigger switch for missiles and the 20 mm cannon, a bomb release button, a nose gear steering/heading hold release button, a four-way trim switch and an air refueling release button. The rear cockpit control stick does not incorporate the motional transducer. The grip contains four pilot operated control switches, as follows: a trigger switch (which is inoperative), a bomb release button, a nose gear steering button and a four-way trim switch. Both sticks also contain an emergency quick release lever which, when depressed, interrupts electrical power to the anti-skid system, the automatic flight control system, stab aug and the aileron-rudder interconnect. The nose gear steering button also serves as a heading hold release for the automatic flight control system while airborne. The air refueling release button, aside from its air refueling function, initiates the AIM-4D coolant system on aircraft equipped with those missiles. The motional pick-up transducer in the front cockpit stick works in conjunction with the automatic flight control system to allow control stick steering when in the AFCS mode. It also causes the automatic flight control system to disengage if the AC exerts a force on the stick which exceeds the AFCS limits.

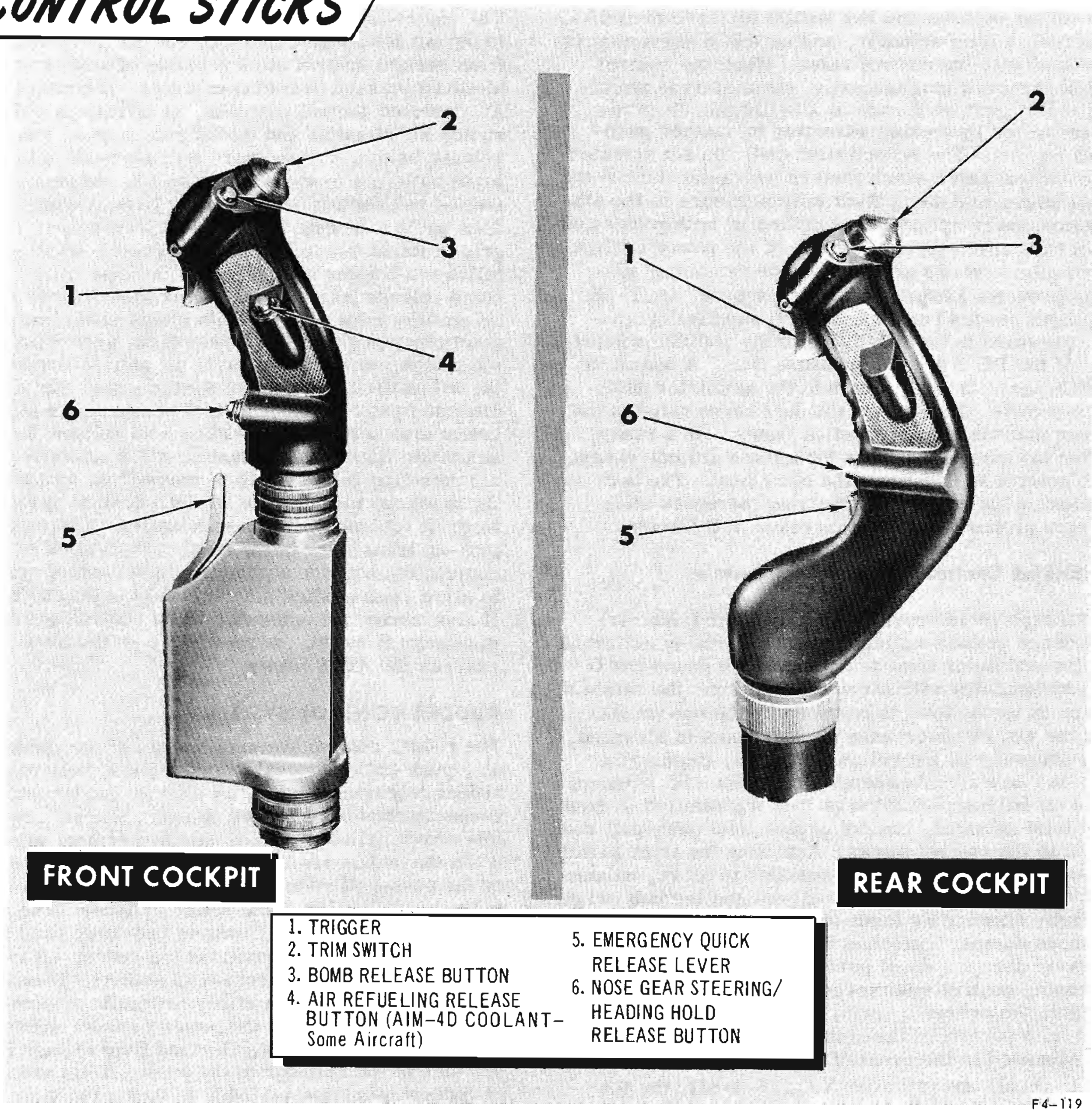
RUDDER CONTROL SYSTEM

The rudder control system consists of the rudder pedals, push-pull rods, cable assemblies, bellcranks, a rudder feel trim system, an aileron-rudder interconnect actuator, a rudder damper, and an irreversible power cylinder with an integral control valve. When the pedals are moved, the motion is transmitted by the push-pull rods, bellcranks and cable assemblies to the control valve of the power cylinder. The control valve meters utility system hydraulic fluid to the power cylinder which positions the rudder. It is possible to have limited mechanical authority over the rudder in the event of a utility hydraulic system failure. A bypass valve in the power cylinder opens when system pressure is lost, allowing fluid to pass from one side of the cylinder to the other. Total amount of rudder deflection available is then a function of air loads on the rudder. A hydraulic servo for yaw damping and AFCS operation is incorporated into the control valve of the power cylinder. Operation of the AFCS, however, does not move the rudder pedals.

Rudder Feel Trim System

Artificial feel is supplied to the rudder pedals by an artificial feel trim system. A hydraulic cylinder with utility system hydraulic pressure on both sides of a differential area piston, provides a forward cockpit pedal force of approximately 2.6 pounds per degree of rudder deflection on the low gradient and 11.5 pounds per degree of rudder deflection on the high gradient. Rear cockpit pedal forces are approximately 1.55 times greater than the forward cockpit pedal forces. Switching between gradients is accomplished

CONTROL STICKS



1. TRIGGER
2. TRIM SWITCH
3. BOMB RELEASE BUTTON
4. AIR REFUELING RELEASE BUTTON (AIM-4D COOLANT–Some Aircraft)
5. EMERGENCY QUICK RELEASE LEVER
6. NOSE GEAR STEERING/ HEADING HOLD RELEASE BUTTON

F4-119

Figure 1-5

through an airspeed pressure switch. The airspeed pressure switch is set to convert from the low to the high gradient at airspeeds between 228 to 252 knots while accelerating. During deceleration, the airspeed pressure switch will convert from the high gradient to the low gradient between 232 to 218 knots. A rudder trim switch is on the left console. Normal trim range is 7.5 ± 1 degrees of rudder deflection on each side of neutral.

CAUTION

F-4E aircraft after T.O. 1F-4E-517 are equipped with a two mode bellmouth control which helps to correct the stall/flameout problem associated with the J-79-17 engine. One mode of the bellmouth control is wired through the rudder feel trim circuit breaker. With the rudder feel trim circuit breaker pulled, the bellmouth is only optimized for speeds below 0.4 Mach and above 0.98 Mach. This introduces the possibility of an engine stall/flameout in the 0.4 to 0.98 Mach speed range with maximum maneuvering and/or rapid throttle movements.

Rudder Trim Switch

The rudder trim switch is in the front cockpit on the inboard engine control panel. This switch controls the trim actuator in the rudder feel and trim system.

RUDDER PEDALS

The rudder pedals are conventional type suspended units which are coupled to the rudder push-pull rod system by individual screwjacks. The screwjacks provide adjustment of the rudder pedals for comfort and are adjusted simultaneously by turning the rudder pedal adjusting crank in either cockpit. The pedals are also coupled to the power brake valves so that the pressure on the pedal will apply the brakes. The rudder pedals are also used to control the nose gear steering unit when the nose gear steering button on the control stick grip is depressed.

Stall Warning Vibrator

A stall warning vibrator is mounted on the front cockpit left rudder pedal to warn of approaching stall conditions. The vibrator consists of an electrical motor which drives an eccentric weight. Rotation of the weight causes the rudder pedal to vibrate, warning of an impending stall. A sufficient margin exists to return to the proper flight attitude by normal reaction to the warning. The vibrator is electrically connected to a switch in the angle of attack indicator. The switch to activate the rudder pedal vibrator is set at 22.3 units angle of attack. The stall warning vibrator motor is powered by the essential 28 volt dc bus through the angle of attack probe heater control circuit breaker on the circuit breaker panel in the rear cockpit. If a malfunction occurs where the vibrator motor runs continuously, it can be rendered inoperative by pulling this circuit breaker. The stall warning system will be in error if the slotted probe becomes iced.

WARNING

With the angle of attack heater circuit breaker pulled, power is available to nose gear steering while inflight. With gear extended and nose gear steering button inadvertently depressed, rudder displacement will cock the nose gear.

STABILITY AUGMENTATION

The stability augmentation mode is in operation when the stab aug switch on the AFCS control panel is in the ENGAGE position. In the stability augmentation mode, rate gyros and lateral accelerometers sense any changing motion about or along their respective axis and send signals to the surface controls to oppose any deviation from normal flight attitude. This action decreases any tendency of the aircraft to oscillate in roll, yaw, or pitch, or to develop lateral forces which cause aircraft slip or skid. On F-4C/D aircraft after T.O. 1F-4-515 and on all F-4E aircraft, stability augmentation can be obtained individually or in any combination for pitch, roll, or yaw axis by placing the pitch, roll, and yaw stab aug switches to the ENGAGE position. For use of stability augmentation in conjunction with AFCS, refer to section IV.

AILERON RUDDER INTERCONNECT (ARI)

The aileron-rudder interconnect system causes rudder displacement proportional to aileron displacement which provides coordinated turns at low airspeeds. The limits of the system are 15° of rudder displacement when the automatic flight control system is in the stability augmentation or autopilot mode, and 10° rudder displacement when the stab aug switch is disengaged. Components of the system include a control amplifier, a 10° servo actuator acting through a walking beam, an airspeed pressure switch, and two aileron transducers. The ARI circuit is completed through the flap blowup airspeed pressure switch. When the flap switch is down, and airspeed is below flap blowup speed, 28 volts dc is applied to the engage relay solenoids of the ARI system. Whenever the flaps are raised, or are blown up, the ARI is disengaged through the flap blowup switch. When the system is engaged, the hydraulic 10° servo is allowed to move the control linkage (if aileron displacement is present) and cause rudder displacement. If the flaps are lowered during a turn, a rudder kick will occur as a result of ARI engagement with lateral controls deflected. The system can be disengaged by depressing the emergency quick release lever on the control stick, this will disengage the stab aug switch, and the ARI will be disengaged only as long as the emergency quick release lever is held depressed. To regain the 5° of rudder authority the stab aug switch must be reengaged. On F-4C/D aircraft after T.O. 1F-4-515 and on all F-4E aircraft, the ARI system and the yaw stab aug is disengaged as long as the emergency quick release lever is held depressed; when the switch is released the ARI (10°) and the yaw stab aug (5°) rudder authority will be regained. Regardless of the amount of ARI rudder authority engaged, the pilot can easily override the ARI system by pushing on the rudder pedals.

Note

- To permanently disengage the ARI, the circuit breaker on the left utility panel must be pulled and the stab aug switch must be disengaged. Pulling the circuit breaker only, and keeping the stab aug engaged, will still provide 5° of ARI rudder authority. When the ARI circuit breaker is pulled, the anti-skid system is disabled. If it is desired to disable the ARI but retain the anti-skid and stab aug system, pull the rudder trim circuit breaker and leave stab aug engaged. This will completely disable the ARI and rudder feel trim system. However, pulling the rudder trim circuit breaker causes the feel system to revert to low gradient regardless of airspeed.
- Due to design, there are various inflight situations where rudder jumps will be experienced when the ARI system cuts in or out with a lateral input to the control stick. These rudder jumps normally occur when the flaps are raised or lowered during a turn, such as re-

tracting the flaps on climb out after takeoff or during a go-around. Assuming no manual rudder inputs, it is possible that after the flap switch is placed to the UP position during a go-around, for example, the rudder can jump from a deflected position to neutral after the flap switch is actuated. Another jump displacing the rudder back from neutral will then occur when the right trailing edge one half down limit switch closes. When the flaps go above the limits of the one half down limit switch, the rudder will again deflect to neutral. Sometimes the first jump just described will not occur because the one half down limit switch will not be open when flaps up is selected. Rudder jumps also occur whenever the flaps airspeed switch is actuated when the flaps limit speed is exceeded through the action of the airspeed switch or placing the flap switch to the DN or 1/2 position.

WING FLAPS

Each wing contains leading and trailing edge flaps. On F-4C/D aircraft, one leading edge flap is on the outboard wing panel and two leading edge flaps are on the inboard wing panel. The F-4E has one leading edge flap on the outboard wing panel and one on the inboard wing panel. The trailing edge flap is on the inboard wing panel, adjacent to the fuselage. The flaps are electrically selected and hydraulically actuated. The leading edge flaps are locked in the retracted position by overcenter mechanisms. The trailing edge flaps are locked in the retracted position by locks in the actuating cylinders. All of the flaps are held in the extended position by hydraulic pressure. A flow divider causes the trailing edge flaps to extend simultaneously. There is no synchronization, however, among the leading edge flaps, or between the leading edge and trailing edge flaps. If the wing flap switch is inadvertently left in the down position, the leading and trailing edge flaps are protected from structural damage by an airspeed pressure switch which operates the common solenoid selector valve. This switch is set to automatically retract the flaps between 230 to 244 knots. During deceleration, the flaps automatically extend (provided the flap switch is down) between 234 and 210 knots. Normal flap extension will be accomplished within 8 seconds, and retraction will be accomplished within 6 seconds.

Wing Flap Switch

The leading and trailing edge wing flap switch, on the wing flap control panel, is mounted above the front cockpit left console outboard of the throttles. The three-position toggle switch is marked UP, 1/2, and DN, and is shaped like an airfoil for ease of identification. Selecting the 1/2 position moves the leading edge flaps to the full down position and the trailing edge flaps 1/2 down. Selection of DN, moves the trailing edge flaps to the fully extended position. Selecting the 1/2 position after the flaps have been fully extended will raise the trailing edge flaps to the 1/2 position. Placing the flap switch in UP returns all the flaps to the fully retracted position. There is no individual selecting of flaps.

Emergency Flap Extension

Emergency extension of the flaps is accomplished pneumatically by high pressure air from an emergency air storage bottle. The emergency flap extension handles are mounted on the wing flap control panel in the front cockpit, and adjacent to the throttles in the rear cockpit. They are marked EMERG. Lowering the flaps pneumatically is accomplished by pulling either emergency flap extension handle aft. Since the handles are mechanically connected to the pneumatic actuation valve, emergency flap extension does not require electrical power. The emergency flap extension system bypasses the flap blowup provision and, when actuated, the flaps extend regardless of airspeed. Actuation of the emergency flap extension system extends the leading edge flaps full down and the trailing edge flaps in the one-half down position. The handles are airfoil shaped and painted in black and yellow stripes for ease of identification. The air bottle contains sufficient air for only one extension of the flaps.

CAUTION

If the emergency system is activated with normal utility hydraulic pressure available, there is a high probability of losing utility hydraulic system pressure.

Note

There is no flow divider to ensure simultaneous extension of the flaps during emergency extension, and asymmetric flap extension can occur. With dual hydraulic system failure (one PC and utility) lateral control may be difficult while flaps are in transit.

Flap Position Indicators

The leading edge and trailing edge flap indicators are on the left subpanel in the front and rear cockpits. The indicators work in conjunction with position switches on the leading and trailing edge flaps. The position of the flaps is indicated by drum dials viewed through cutouts in the instrument panel. With flaps up, the word UP appears on the indicator. Flaps in transit (from up to 1/2) are indicated by a barber pole. Half flaps are indicated by the letters DN on the leading edge indicator and the figure 1/2 on the trailing edge indicator. With flaps full down, the letters DN appear on both indicators

BOUNDARY LAYER CONTROL SYSTEM

The boundary layer control system utilizes air bleed from the 17th stage of each engine compressor. This air passes through ducts along leading edge flaps, and the trailing edge flaps. Slots along the ducts behind the outboard and center panel leading edge flaps and in front of the trailing edge flaps direct laminar air over the wing and flaps when the flaps have deflected sufficiently to expose the slots. The high temperature and high velocity laminar air directed over the wings and flaps delay flow separation over the airfoil, hence reducing turbulence and drag. This results in a lower stall speed and, therefore, a reduction of landing speed. Leading edge boundary layer control is operative in either selected (1/2 or DN) flap position. Trailing edge boundary layer control is operative only when the flaps are in the full down position.

BLC Malfunction Indicator Light

A BLC MALFUNCTION indicator light is on the telelight panel. The purpose of the light is to indicate boundary layer control valve malfunction in the flaps up condition. When any one of the four boundary layer control valves is not fully closed, and the flaps are up, the BLC MALFUNCTION light illuminates. No indication is provided for a completely inoperative system, nor is there any indication provided for a boundary layer control valve that fails to open when the flaps are down.

SPEED BRAKES

Hydraulically operated speed brake panels are mounted on the underside of the inboard wing surfaces. They are hinged on the forward side, permitting them to open down and forward. The speed brakes are electrically controlled by throttle mounted switches, an emergency speed brake switch (F-4C/D), and a lockout relay. The hydraulic portion of the system includes a flow divider, two actuating cylinders, and a solenoid selector valve. The selector valve directs the flow of hydraulic fluid to the extend or retract side of the actuating cylinder. On F-4C/D aircraft after T.O. 1F-4C-591 and T.O. 1F-4D-513, if the throttle mounted switches fail, the speed brakes may be retracted by pulling the speed brake circuit breaker. If an electrical failure occurs, the speed brakes automatically retract. If a utility system hydraulic failure occurs, the speed brakes retract (by air loads) to a low drag trail position. The speed brakes are operated by utility hydraulic pressure.

Speed Brake Switches

The throttle mounted speed brake switches have three positions - front cockpit: maintaining IN, maintaining STOP, and momentary OUT, - rear cockpit: momentary IN, maintaining STOP, and momentary OUT. The speed brakes are extended by holding either control switch to OUT. Both sides of the speed brake solenoid selector valve are energized and hydraulic fluid is directed to the extend side of the actuating cylinders. If desired, the speed brakes may be stopped at any intermediate position by releasing the control switch. When released, the control switch returns to the STOP position. If the front cockpit control switch is left in the IN position, it may be bypassed, to extend the speed brakes, by placing the rear cockpit control switch to OUT. A speed brake lockout relay is energized and removes the front cockpit control switch from the circuit. The lockout relay remains energized until the front cockpit switch is moved to the STOP position. The speed brakes may then be controlled by either switch. The speed brakes are retracted by placing either control switch to IN.

Note

With both speed brake switches in the STOP position the speed brakes may creep enough to illuminate the SPEED BRAKE OUT indicator light. In this event, placing either speed brake switch to IN will retract the speed brakes and extinguish the indicator light.

Speed Brake Emergency Retract Switch (F-4C/D)

The emergency speed brakes switch is on the front cockpit left subpanel. The switch is a lock toggle type switch and has two positions, MANUAL and RETRACT. When in MANUAL, electrical power is routed to the speed brake system as required. When in RETRACT, the electrical power source is interrupted and the speed brake solenoid selector valve becomes deenergized, retracting the speed brakes. On aircraft after T.O. 1F-4C-591 and T.O. 1F-4D-513, the emergency speed brake switch is removed and emergency speed brake retraction is accomplished by pulling the speed brake circuit breaker on the right console in the forward cockpit.

Emergency Speed Brake Operation (F-4E)

Emergency speed brake retraction is accomplished by pulling the speed brake circuit breaker on the right console in the forward cockpit.

Speed Brake Out Indicator Light

A SPEED BRAKE OUT indicator light on the telelight panel illuminates when either or both of the speed brakes are not fully closed.

Note

The SPEED BRAKE OUT indicator light does not illuminate the MASTER CAUTION light.

WING FOLD (F-4C/D)

The outer wing panel of both wings may be folded to a vertical position. The wing panels are hinged to the inner wings along the upper surface of the wing, and are locked in a spread position along the lower edge of the wing by nine fold lock pins. A hydraulic cylinder, in the outer wing panel, is used to spread and fold the wing. A wing fold control switch is in the left wheel well. A manual lock pin, a wing pin, and wing spread limit switch are in each wing. Also, a manually operated safety lock in each wing ensures that wing fold is locked when wings are spread. As an added safety precaution, the wing fold hydraulic circuit receives its hydraulic pressure from landing gear down pressure line which prevents pressurization of the wing fold circuit when the landing gear is up. Rotating the manual lockpin control shaft causes the master lock pin to unlock. When the master pin is unlocked, a red warning light illuminates on the telelight panel indicating which wing pin is unlocked. Also, a red warning flag, located 4 inches inboard of the wing fold, protrudes from the wing surface to indicate the wing pin is unlocked.

WING FOLD (F-4E)

The outer wing panel of both wings may be folded to a vertical position. The wing panels are hinged to the inner wings along the upper surface of the wing. The wing fold system is mechanically and manually actuated. Each wing fold incorporates a warning flag that protrudes above the wing surface on each wing when the safety lock is not in the lock position. The red flag is 4 inches inboard of the wing fold. The outer wing panel must be raised manually to fold position, and held in this position by a jury strut.

WARNING

To avoid injury to personnel and/or structural damage to aircraft, the wing(s) must be properly supported during spreading or folding.

Note

F-4E aircraft do not have warning lights on the telelight panel to indicate the wing fold is unlocked.

LANDING GEAR SYSTEM

The aircraft is equipped with fully retractable, tricycle landing gear. The gear is electrically controlled and hydraulically actuated by the utility hydraulic system. Accidental retraction of the landing gear when the aircraft is on the ground is prevented by safety switches on the main gear. Ground safety locks may also be installed to further secure the gear against inadvertent retraction.

MAIN GEAR

Each main gear is hydraulically retracted and extended. When the gear handle is UP and the weight is off the gear, the gear will retract. As the main gear retracts, the wheels are automatically braked to a stop by the anti-spin system and the struts are mechanically compressed. When the gear is up and locked, pressure is automatically released from the anti-spin system. The struts automatically return to their normally extended position during gear extension. The gear is locked down by an internal finger type latch in each side brace actuator. The main gear retracts inboard and is enclosed by fairing doors that protrude slightly from the underside of the wing. The gear is locked up by a hydraulically actuated overcenter uplatch mechanism. All main gear doors remain open when the gear is extended.

NOSE GEAR

The nose gear is hydraulically retracted and extended. The gear is locked in the down position by an internal finger latch within the gear actuating cylinder. A hydraulically actuated overcenter mechanism is used to lock the gear in the up position. The nose gear retracts aft into the fuselage and is covered by mechanically operated doors that close flush with the underside of the fuselage. The forward door is attached to the nose gear strut, and closes with strut retraction; the aft door is operated and latched closed by the gear uplatch mechanism. The nose gear is equipped with twin nose wheels, and a combination shimmy damper steering actuator. A self-centering cam is incorporated in the nose gear strut to position it for retraction. The aircraft can be steered by differential braking of the main gear wheels in the event nose gear steering is not utilized. In this event, the steering-damper unit acts as a shimmy damper.

LANDING GEAR CONTROL HANDLE

Operation of the landing gear is controlled by a handle at the left side of the front cockpit instrument panel. The handle has a wheel shaped knob for ease of identification. Placing the handle in the UP or DOWN position energizes a solenoid valve to connect utility system hydraulic pressure to properly position the landing gear. A red warning light is in the landing gear control handle. This light illuminates whenever the control handle is positioned to retract or extend and remains illuminated until the gear is locked in place.

Landing Gear Emergency Extension Handles

Two 100 cubic inch air bottles charged to 3000 psi provide sufficient compressed air to extend the landing gear if a utility system hydraulic failure occurs. The front cockpit control is incorporated into the landing gear control handle. Pulling the landing gear control handle full aft, when it is in the down position, operates an air valve which directs 3000 psi compressed air to open all gear doors, release the gear uplocks and extend the gear. The rear cockpit control is on the rear cockpit left subpanel and is labeled EMERG LDG GEAR. A spring loaded locking plunger locks the rear handle in the emergency position when it is pulled full aft. The front and rear cockpit emergency landing gear control handles are mechanically connected to the same air source. The system does not required any electrical power for operation.

Landing Gear Warning Light

The landing gear warning light, marked WHEELS is on the upper left corner of the front cockpit instrument panel. The light flashes only when the flaps are down and the landing gear is up. The landing gear handle light illuminates when the gear is unlocked or when the gear is out of phase with the gear handle.

Landing Gear Position Indicators

The landing gear position indicators are on the left subpanel front cockpit and the left subpanel rear cockpit. The position of the landing gear wheels is indicated by drum dials viewed through cutouts in the panel. With gear up, the word UP appears on the three indicators; gear in transient is indicated by a barber pole, and with gear down, a picture of a wheel will be seen in each indicator.

NOSE GEAR STEERING

An electrically controlled, hydraulically operated nose gear steering system is installed in the aircraft. The steering actuator is a vane type hydraulic motor, on the nose gear strut, and is geared through a planetary gear train to the strut. It performs the work of both steering and damping. A bypass valve in the steer-damper manifold directs hydraulic fluid to an electrically controlled hydraulic servo valve. This valve directs fluid to the actuator which can be pressurized on either side as directed. For the damping mode, the bypass valve traps the fluid in the actuator and channels it through damping orifices which absorb energy. When the control stick grip nose gear steering button is held down, with the main gear strut compressed and the gear handle is in the down position, the system is energized and steering is commanded by rudder pedal movement. The limit of the nose gear steering system is 70 on each side of center; however, with the steering unit deenergized, the nose gear may be rotated 360 for towing or positioning the aircraft. When energized with the nose gear in any position, the nose gear quickly returns to the position commanded by the rudder pedals. The system contains a failure detection circuit which, upon detection of an electrical short or open, or intermittent outputs from system electrical components, will shut off hydraulic pressure to the system. In this event, the nose wheel reverts to a free swivel condition.

WHEEL BRAKE SYSTEM

The main landing gear wheels are equipped with full powered brakes operated by toe action on the rudder pedals. The brake control valves are in the nose gear well and operate through a linkage arrangement to the rudder pedals. The brake control valves are capable of directing full utility system pressure to the wheel brakes with full pedal deflection. The amount of brake pedal force and the amount of utility pressure directed to the wheel brakes are proportional to pedal displacement. An anti-skid system is incorporated in the normal brake system to prevent wheel skid. An emergency brake system, when actuated, discharges accumulator hydraulic pressure to the brakes in the event of utility system failure. Operation of the brakes on the emergency system is identical to the normal system for the duration of the hydraulic accumulator supply. Anti-skid protection is not available on the emergency brake system. Each main landing wheel contains three fuse plugs to protect against tire explosion. If the brakes are used excessively, causing overheating of the wheels and tires, the fuse plugs should melt and let the tire go flat before a tire explosion can occur.

CAUTION

Peak temperatures occur in the wheel brake assembly from 15 to 30 minutes after maximum braking. To prevent brake fire and possible tire explosion, the specified procedures for cooling hot brakes should be followed. It is recommended that a minimum of 15 minutes elapse between landings where the landing gear remains extended in the airstream, and a minimum of 30 minutes between landings where the landing gear has been retracted to allow sufficient cooling. Additional time should be allowed for cooling if brakes are used for steering, cross wind taxiing operation, or a series of landings. These restrictions do not apply to touch and go landings if brakes are not used.

Note

This airplane is not equipped with a parking brake.

WHEEL BRAKE ANTI-SKID SYSTEM

The aircraft is equipped with an electrically controlled wheel brake anti-skid system which prevents wheel skid. The system detects the start of a skid condition at the wheels and automatically releases the brake pressure in proportion to the severity of the skid. Use of the anti-skid system offers protection from skids, and can provide consistently shorter landing rolls on wet, icy, and dry runways. The system has a fail-safe circuit that automatically reverts the system to manual braking if any of the electrical components of the system fail. The system is activated by placing the anti-skid control switch ON and lowering the landing gear. It may be disengaged by placing the anti-skid control switch to OFF, or by holding either emergency quick release lever depressed. An ANTI-SKID INOPERATIVE light illuminates when the system is not activated.

CAUTION

- There are two types of brake valves presently in service. The new brake valve (P/N MC4356-2) ensures that the emergency brake system pressure has priority over the normal utility pressure anytime the emergency system is activated, thereby rendering the anti-skid inoperative. With the old valve (P/N 22480), actuation of the emergency brake system with normal utility pressure still available, will not eliminate the anti-skid from the brake system.
- Anti-skid protection is not available until the wheels have initially come up to speed. Do not land with brake pedals depressed. In addition, anti-skid protection is not available below approximately 10-20 knots.

Note

- Whenever electrical power to the anti-skid system is momentarily interrupted, the system fail-safe circuit is automatically rechecked.
- Pulling the ARI circuit breaker, on the front cockpit left subpanel, will disconnect control power to the anti-skid system.

Anti-Skid Control Switch

This two-position toggle switch is on the left console, front cockpit, adjacent to the oxygen quantity gage. When the switch is ON and the landing gear handle is down, power is supplied to the system. The anti-skid system may be shut off by placing the anti-skid control switch to OFF.

Anti-Skid Inoperative Light

An ANTI-SKID INOPERATIVE light is on the left console in the front cockpit. The light illuminates any time the landing gear handle is down and the anti-skid control switch is OFF, the system is inoperative, or when the emergency quick release lever is held depressed. The light flashes momentarily when the landing gear handle is placed in the DOWN position indicating that the anti-skid circuit has been checked and is operating properly. If the light remains illuminated, the anti-skid system is inoperative and the control switch should be placed to OFF.

Emergency Quick Release Lever (Anti-Skid)

An emergency quick release lever is on each control stick below the stick grip. This lever is provided to disengage the anti-skid system as desired, or in the event of a system malfunction. The lever must be held depressed to disengage the system. Normal wheel braking is immediately available when the lever is depressed and the ANTI-SKID INOPERATIVE light illuminates. The anti-skid emergency quick release lever interrupts electrical power to the system. The circuit to the ANTI-SKID INOPERATIVE light is completed, and the light illuminates. The two control stick mounted emergency quick release levers, and the console mounted control switch are connected in series, and actuation of any one will deactivate the system. When the landing gear handle is up, all power to the anti-skid system, including the light, is shut off.

EMERGENCY HYDRAULIC BRAKE SYSTEM

An emergency hydraulic brake system is incorporated in the event of utility system hydraulic failure. Emergency pressure is provided by a hydraulic accumulator charged to 3000 psi. Differential braking pressure can be utilized when operating with the emergency system, however, braking action is limited due to depletion of hydraulic fluid from the accumulator.

Emergency Brake Handle

An emergency brake handle is on the lower left side of each cockpit instrument panel. It releases hydraulic pressure to two metering valves incorporated in the normal brake control valves and operates with the brake pedals. Pulling the emergency brake handle in either cockpit, approximately 5 inches, discharges the brake system hydraulic accumulator and provides emergency braking with normal feel but with a limited number of applications.

CAUTION

Because of the limited number of brake applications, taxiing should not be attempted when using the emergency brakes.

ARRESTING HOOK SYSTEM

A large retractable arresting hook under the stabilator provides reliable high energy stopping capabilities during takeoff and landing emergencies. The system consists of the arresting hook, a combination dash pot and actuating cylinder, a solenoid operated selector valve, a mechanical uplatch, a control cable and an arresting hook control handle. The hook extends by the action of the dash pot and gravity. The solenoid selector valve is also deenergized, allowing utility system hydraulic fluid to escape from the upside of the actuating cylinder and, as a result, allows the tail hook to extend smoothly. When the hook retracts, the solenoid selector valve routes hydraulic fluid to the upside of the actuating cylinder. Hook extension time is approximately 5 seconds, and retraction time is approximately 13 seconds. The hook is prevented from bouncing by the snubbing action of the dash pot.

ARRESTING HOOK HANDLE

An arresting hook shaped handle is on the right side of the front cockpit instrument panel. When the handle is placed in the down position, the tension on the control cable is relieved and the uplatch releases the arresting hook. When the handle is placed in the up position, the solenoid selector valve is energized and the control cable applies tension to the uplatch. If the arresting hook cable breaks, the hook will automatically extend.

CAUTION

In F-4C airplanes thru 63-7523 block 18, the arresting hook handle should be placed to the down position slowly. Rapid movement of the handle can cause the hook cable to whip and interfere with the stabilator bellcrank.

ARRESTING HOOK WARNING LIGHTS

A red warning light installed in the arresting hook control handle and a HOOK DOWN warning light on the telelight panel illuminate any time the arresting hook is not up and locked.

DRAG CHUTE SYSTEM

A 16 foot ring-slot type drag chute, contained in the empennage, significantly reduces landing roll distances. The drag chute may also be used for out of control/spin recovery. It is pulled into the airstream by a pilot chute when the spring-loaded compartment door opens. The attaching mechanism is designed so that, if the compartment door opens without cockpit handle operation, the chute is released and falls free of the aircraft. The drag chute is normally deployed after each landing, and is considered a servicing item.

DRAG CHUTE HANDLE

The drag chute is deployed by a control handle alongside of the left console, front cockpit. A cable joins the handle, the release and jettison mechanism, and the door latch mechanism. Rotating the handle back, without depressing the button on the handle, releases the door latch mechanism. The spring-loaded actuator then opens the drag chute door, and at the same time the hook lock is positioned over the drag chute attach ring. The spring-loaded pilot chute pops out, and pulls out the drag chute. The drag chute is jettisoned by depressing the button and pulling back on the handle to clear the detent: and then by lowering the handle. The release and jettison mechanism then returns to its normal position, permitting the drag chute to pull free.

ANGLE OF ATTACK SYSTEM

An angle of attack (AOA) system presents a visual indication of optimum aircraft flight conditions. The flight conditions of stall, landing approach, takeoff, range, endurance, etc., all occur at specific lift coefficients and, therefore, at specific AOA. For example, the optimum AOA for landing approaches are always the same, regardless of gross weight. Airspeeds automatically vary to compensate for the change in weight. The system consists of an airstream AOA probe transmitter, an AOA indicator, AOA indexers, and stall warning vibrator. Two electrical heaters, one in the AOA probe and one in the case (adjacent to the fuselage skin), prevent the formation of ice while flying through precipitation. The case heater element in the F-4C/D is energized when the static pressure correction switch is placed to RESET CORR. The probe heater element in the F-4C/D is automatically energized when weight is off the landing gear. In the F-4E the AOA probe heater and the AOA case heater are energized when the AOA circuit breakers and the CADC circuit breakers are pushed in and the weight is off the landing gear. The AOA circuit breakers are on the No. 3 circuit breaker panel at zones 6C and 7C in the rear cockpit. On F-4C/D aircraft the CADC circuit breakers are at zones 1G, 2G, 3G, 4G, and 5G, No. 4 panel. On F-4E aircraft, they are at zones 1K, 2K, 3K, 4L, and 5L, No. 4 panel.

ANGLE OF ATTACK INDICATOR

An AOA indicator is on the front cockpit instrument panel. In F-4C and F-4E aircraft after T.O. 1F-4-842, an AOA indicator is added to the rear cockpit instrument panel. Measurement of the aircraft AOA is accomplished by means of a slotted probe protruding through the fuselage skin. Airflow direction is sensed by a pair of parallel slots in the probe. When the airflow changes direction, pressure in one slot becomes greater than the other, and the probe rotates to align the probe slots with the airflow. Probe rotation moves three potentiometer wiper arms, producing electrical resistance variations. The resistance variations comprise the signal which is sent to the AOA indicator. The indicator is calibrated from 0 to 30 in arbitrary units, equivalent to a range of -10 to +40 angular degrees of probe rotation. On F-4C/D aircraft with nose gear up, the stall AOA is about 3 units lower than with the nose gear down due to different airflow patterns around the AOA probe. On F-4E aircraft the stall AOA is only 1 unit lower with nose gear up. Indexer reference marks are provided and are set at approximate cruise (7.9 units), approach (19.2 units) and stall (30.0 units) angles of attack. When the indicator is inoperative, the word OFF appears in a window on the face of the indicator. The AOA indicator also contains switches that illuminate the indexer lights, actuate the stall warning vibrator and provide a signal for the aural tone generator. If the slotted probe becomes iced, the entire AOA system will be in error, causing erroneous readings/signals from all systems receiving AOA information. If the probe icing was due to a popped AOA probe heater circuit breaker, the pedal shaker and the aural tone generator will not be operative. Probe icing most often results in the AOA indicator rotating to 30 units AOA causing the indexer lights to erroneously indicate very slow and the pedal shaker and aural tone generator, if operative, to erroneously indicate stall. It is possible, under some conditions, for the probe to become iced even if the heaters are working properly.

Note

The indicator reference mark set at an approximate cruise (7.9 units), pertains to maximum range cruise at optimum cruise altitude for gross weight and drag.

Angle of Attack Indexer

The AOA indexers, which operate from switches in the AOA indicator, are on each side of the windshield above the front cockpit instrument panel, and above the rear cockpit instrument panel. The indexers present AOA information by illuminating symbolic cutouts (low-speed symbol, on-speed symbol, and high-speed symbol). At very slow airspeeds (high AOA), only the low-speed symbol illuminates. At slightly slow airspeeds, the low-speed and on-speed symbols illuminate. At optimum approach airspeeds, only the on-speed symbol is illuminated. At slightly fast airspeeds, the on-speed symbol and the high-speed symbol illuminate. At very fast airspeeds (low AOA), only the high-speed symbol illuminates. On F-4C aircraft after T.O. 1F-4-769, in addition to AOA indexer lights operation with nose gear extended, the indexer lights operate continuously during flight. On F-4D/E aircraft after T.O. 1F-4-844, the indexer lights display AOA information whenever the nose gear is extended, regardless of the weapons select switch position or the mode of operation of the weapons release computer. In addition to this, the indexer lights operate continuously in flight. The only exception to this rule in normal flight operations is when AGM-12 or AGM-45/62 is selected on the weapons selector switch, or when the AN/ASQ-91 weapons release computer is in the self-test mode. See figure 1-6 for a comparison of indexer and indicator information. For AGM-45A controls and indicators, refer to T.O. 1F-4-34-1-1. Refer to section VI for additional information.

ANGLE OF ATTACK DISPLAYS

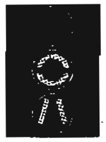
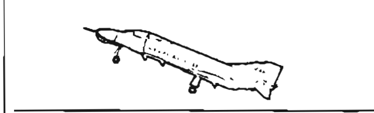
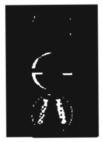
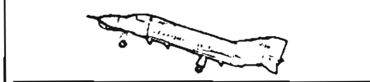
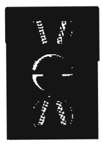
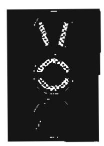
INDICATOR	INDEXER	ANGLE OF ATTACK UNIT	AIRSPEED	ATTITUDE
		20.3-30	VERY SLOW	
		19.7-20.3	SLIGHTLY SLOW	
		18.7-19.6	ON SPEED	
		18.1-18.6	SLIGHTLY FAST	
		0-18.0	VERY FAST	

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Figure 1-6

AOA AURAL TONE SYSTEM

After T.O. 1F-4-840, the angle of attack system also provides a continuous aural indication of AOA by means of an aural tone generator. In response to the AOA transmitter input signal, the generator produces an aural signal in the headsets of both crewmembers to describe the aircraft AOA. The generator (figure 1-7) describes the aircraft AOA by producing a steady or interrupted, or a combination of a steady and an interrupted signal depending on the AOA transition range. A volume control knob on the instrument emergency flood lights control panel in the front cockpit and another on the stall warning tone control panel in the rear cockpit provide volume control adjustment of the AOA aural tone signal. Once a volume control setting is established, changes in aircraft AOA do not require volume control readjustment. Above 20.3 units AOA the tone cannot be eliminated by the aircraft volume control and the only means of turning off the stall warning tone, if the need arises is by pulling the AOA probe heater control circuit breaker C7, No. 3 panel. The AOA aural tone is present under all flight conditions above 15 units AOA, and produces a 400 Hertz (Hz) tone at an initial rate of 1.5 pulses per second (pps) between 15 and 18.7 units AOA. Within this AOA range, the pulse rate increases linearly from 1.5 to 8.2 pps. In the range between 18.1 and 20.3 units AOA, the generator produces a 900 Hz steady tone. Between 19.7 and 30 units AOA the generator produces a 1600 Hz interrupted tone. The low end of the 900 Hz steady tone (between 18.1 and 18.7 units AOA) is superimposed with a 400 Hz tone, and the high end (between 19.7 and 20.3 units AOA) is superimposed with a 1600 Hz tone. Between 19.7 and 22.3 units AOA the 1600 Hz tone has an initial pulse rate of 1.5 pps which increases linearly to 6.2 pps. From 22.3 to 30 units AOA the 1600 Hz tone is produced with a pulse rate of 20 pps.

Note

If the AOA probe heater control circuit breaker is pulled, the AOA probe heater, total temperature probe heater, bellmouth pitot probe heater, aural tone generator, and stall warning pedal shaker is disabled.

ANGLE OF ATTACK AURAL TONE INDICATIONS

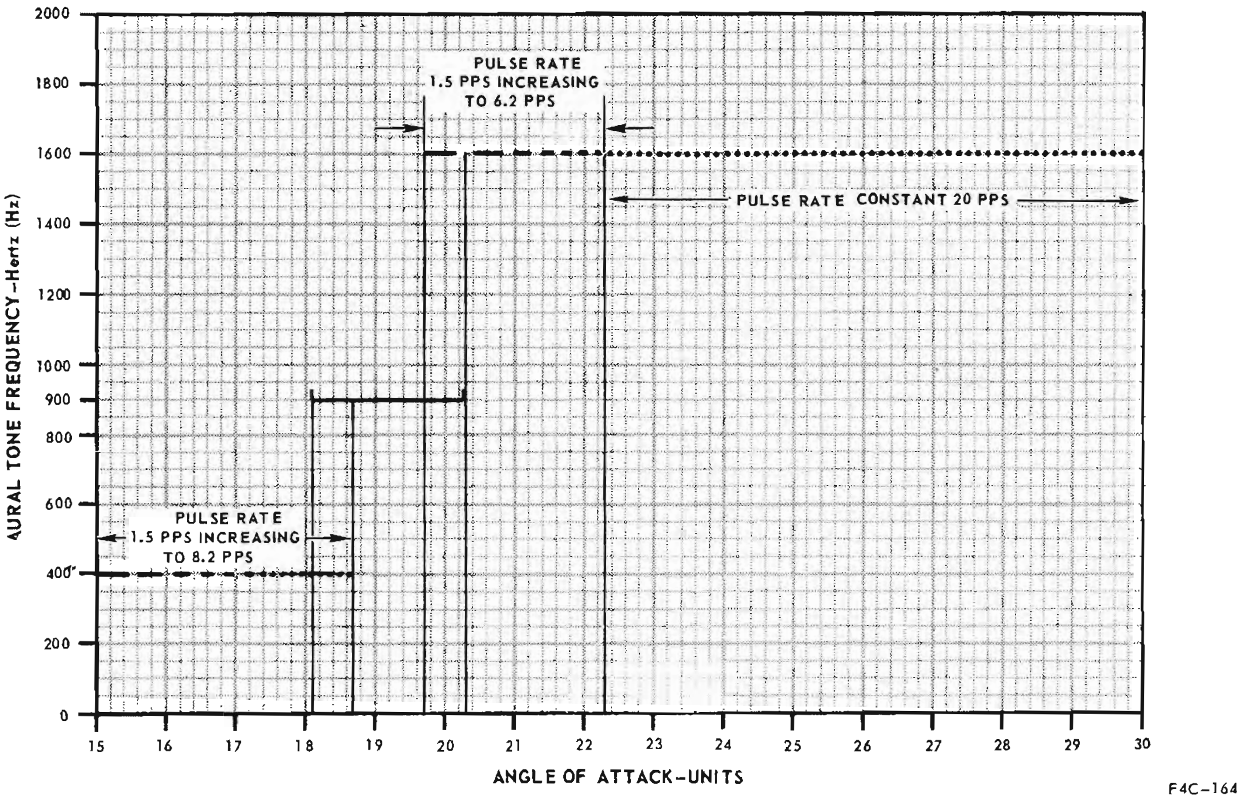

Figure 1-7

Stall Warning Vibrator

Refer to stall warning vibrator, flight control system, this section.

PITOT-STATIC SYSTEM

A conventional pitot-static system is used in the aircraft with a single pitot tube and two static ports. The pitot-static system supplies both impact (pitot) and atmospheric (static) pressure to various instruments and system components. In F-4C/D aircraft, the pitot system obtains its pressure through one source (pitot boom on the vertical stabilizer), and the static system obtains its pressure through two sources (static vents on each side of the radome). In F-4E aircraft, the two systems receive inputs from a single pitot-static boom on the nose of the aircraft. Both pitot and static pressures are supplied to airspeed pressure switches that retract the flaps; actuate the rudder feel trim system; engage the ARI (providing the flaps are DN or 1/2). Pitot and static pressures are also directed to the air data computer on F-4C/D aircraft where they correct equipment auxiliary air to corrected static pressure. Pitot and corrected static pressures are supplied to the airspeed/Mach indicator, the altimeter, and the vertical velocity indicator.

PITOT HEAT SWITCH

The pitot heat switch is on the right console in the front cockpit. The switch controls operation of the heating element in the pitot head, the bellows ram air inlet probe, and the stabilator bellows venturi. The heater elements are energized any time electrical power is applied and the pitot heat switch is in the ON position.

CAUTION

Pitot heat should not be turned on until ready to start takeoff roll unless needed for ground icing conditions.

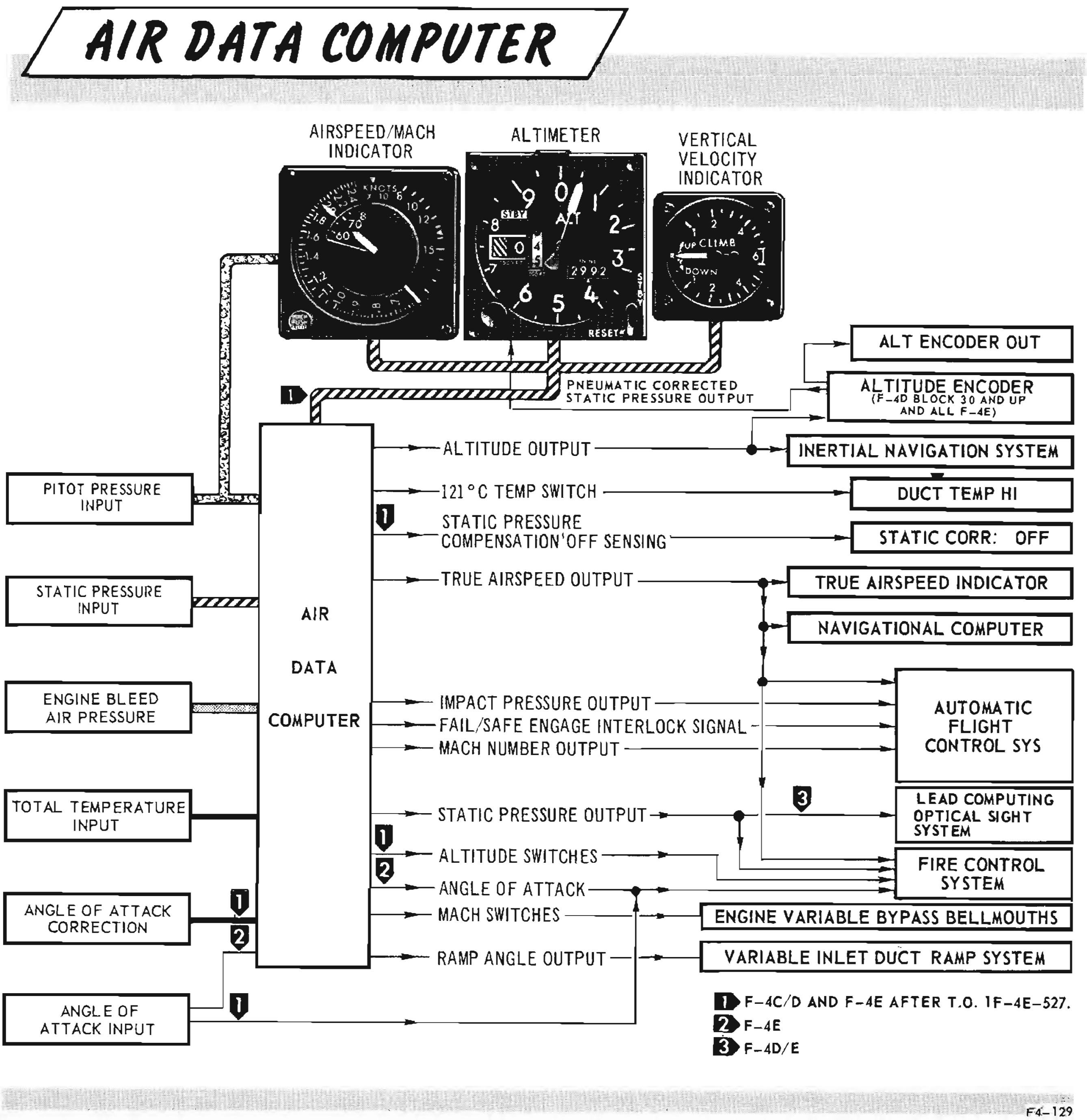

Figure 1-8

AIR DATA COMPUTER SYSTEM

The air data computer (ADC) receives inputs of static pressure, pitot pressure, engine bleed air, angle of attack and total temperature. These inputs are utilized by the ADC to provide pneumatic and functionalized electrical analog outputs to the various aircraft systems. These electrical signals (figure 1-8) are used by the following: altitude encoder unit (F-4D block 30 and up and all F-4E), automatic flight control system, DUCT TEMP HI light, fire control system, air induction system, inertial navigation system, lead computer optical sight (F-4D/E), navigational computer, STATIC CORR OFF light (F-4C/D and F-4E after T.O. 1F-4E-527), true airspeed indicator, and variable bypass bellmouths. The pneumatic output, in F-4C/D aircraft, is corrected static pressures (provided the static pressure compensator is engaged) and is used by the altimeters, vertical velocity indicators, and airspeed/Mach indicators. This provides corrected airspeed/Mach number and corrected altitude displays on their respective indicators. If the static pressure compensator (SPC) fails, as indicated by the STATIC CORR OFF light, indicated airspeed/Mach number and indicated altitude are displayed on the indicators, and all systems using Mach number, altitude or static pressure outputs from the ADC are in error. In the transonic region, changes in airflow characteristics occur suddenly and sharply. As a result, while in this region, a jump may be noticed on the altimeter, vertical velocity indicator and airspeed/Mach indicator. On F-4E aircraft before T.O. 1F-4E-527, the SPC is not used and the ADC supplies indicated static pressure outputs (from an aerodynamic compensating nose boom) to the altimeter, vertical velocity indicator and airspeed/Mach indicator. Therefore, only indicated airspeed/Mach number and indicated altitude are displayed on their respective indicators. On F-4E aircraft after T.O. 1F-4E-527, the SPC is modified and activated to eliminate major altimeter lag during rapid changes in altitudes (provided the SPC is engaged). The SPC is a pneumatic relay, not a correction module, therefore, the displays on the altimeter, vertical velocity indicator, and airspeed/Mach indicators are indicated measurements. If the SPC fails, as indicated by the STATIC CORR OFF light, substantial altimeter lag occurs during dives and climbs. Refer to the Altimeter Lag Chart in part 1 of the Performance Data Manual.

CAUTION

On F-4E aircraft before T.O. 1F-4E-527, there is a substantial altimeter lag in a climb or dive.

The air data computer may malfunction during flight through ice and/or rain, due to impact forces imposed by ice and water on the total temperature sensor.

STATIC CORR OFF LIGHT (F-4C/D)

On F-4C/D aircraft, the STATIC CORR OFF light illuminates when the static pressure compensator is inoperative. With the STATIC CORR OFF light illuminated, all instruments using static air revert to indicated displays and systems using altitude and Mach outputs, from the ADC, will also be using indicated rather than corrected outputs. A failure or interruption of the essential ac power supply, essential dc power supply, equipment auxiliary air system or the angle-of-attack system causes this light to illuminate. Static pressure error, without correction is appreciable in the transonic, and supersonic regions. When the STATIC CORR OFF light illuminates, it may be accompanied by a rapid change in the altimeter reading since the altimeter must respond to an instantaneous change in pressure being supplied to the instrument. The magnitude of change is dependent on the amount of static correction that was supplied by the SPC. A static pressure reset switch, marked CADC, is beside the throttles. This switch resets the compensator and also breaks the circuit to the light. When the switch is placed to RESET, the indicator light goes out indicating the instruments are reading correctly. If the light remains on, the compensator did not reset, and the instruments are still in error. In this event, it is necessary to refer to the airspeed and altitude correction cards. The CADC switch has positions of RESET CORR, NORM, and CORR OFF. The CORR OFF position removes static pressure correction from the instruments. The static pressure compensator must be reset (CADC switch to RESET CORR) after the engines are started prior to each flight.

STATIC CORR OFF LIGHT (F-4E AFTER T.O. 1F-4E-527)

On F-4E aircraft after T.O. 1F-4E-527, illumination of the STATIC CORR OFF light indicates the altimeter will have excessive lag during dives or rapid ascents. A failure or interruption of the essential ac power supply, essential dc power supply, or equipment auxiliary air system causes this light to illuminate. A static pressure reset switch, marked CADC, is beside the throttles. This switch resets the compensator and also breaks the circuit to the light. When the switch is placed to RESET, the light goes out indicating the altimeter is free of substantial lag. If the light remains on, the compensator did not reset, and large altimeter lags will be encountered during dives or rapid ascents. In this event, extreme caution must be exercised if diving maneuvers are executed. The CADC switch has positions of RESET CORR, NORM, and CORR OFF. The CORR OFF position removes static pressure (conditioned) corrections from the altimeter. The static pressure compensator must be reset (CADC switch to RESET CORR) after the engines have been started prior to each flight.

ALTITUDE ENCODER UNIT

On F-4D aircraft 66-7505 and up and all F-4E aircraft, an altitude encoder unit (AEU) is installed. The AEU is a dual purpose electronic unit that receives electrical inputs from the air data computer. The AEU, in turn, provides synchro outputs to the servoed altimeters and digital outputs of altitude, in 100 foot increments, to the IFF coder-receiver-transmitter. The synchro outputs parallel the pneumatic outputs to the altimeters and ensures more accurate instantaneous displays (provided RESET, on the AAU/19A altimeter, is selected after SPC is engaged). The digital output provides automatic altitude reporting, in coded form, to the air traffic control system (if mode C, on the IFF control panel, is selected).

EMERGENCY EQUIPMENT

WARNING AND INDICATOR LIGHTS

To keep instrument surveillance to a minimum, warning and indicator lights are incorporated throughout the two cockpits. The majority of the lights are in the front cockpit, and most of them are grouped on the right subpanel. All of the warning and indicator lights, with the exception of the FIRE and OVERHEAT warning lights, EJECT light, and the DC BUS light in F-4E aircraft, utilize power from the 28/14 volt ac warning lights bus. The bus itself receives 28 volt ac power from the instrument 28 volt ac bus and 14 volt ac from the left main 14 volt ac bus prior to F-4E aircraft 69-7261. On F-4E aircraft 69-7261 and up, the warning lights bus receives 14 volt ac power from instrument 14 volt ac bus. Selection of 28 or 14 volts ac for warning lights operation is made automatically with the AC instrument panel lights knob. On aircraft 69-7261 and up, warning lights dimming is controlled by the flight instrument lights control knob in the same way as the instrument panel lights knob. When the instrument panel lights are off, the warning lights operate from 28 volt ac power. When the instrument panel lights are on, the warning lights operate from 14 volts ac. In the case of a left generator failure, bus tie open, a right generator failure, bus tie open, or operation on the emergency generator (F-4C/D only), 28 volt ac power is always available to the warning lights bus. On F-4E aircraft 69-7261 and up, 14 volt ac power is also available to the warning lights bus in case of loss of both generators with the bus tie open.

Telelight Panel

A telelight panel on the front cockpit right subpanel contains the majority of the warning and indicator lights. When a safety of flight condition exists, one of the red (warning) lights illuminate. When a condition exists that requires corrective action, an amber (indicator) light illuminates. When a condition exists that is worthy of note, a green (indicator) light illuminates. Most of the lights on the telelight panel illuminate in conjunction with the MASTER CAUTION light. Lights that do not illuminate with the MASTER CAUTION light are: SPEED BRAKE OUT, R EXT FUEL, CTR EXT FUEL, L EXT FUEL, and on F-4E aircraft this includes TANK 7 FUEL and DC BUS lights.

Master Caution Light

The MASTER CAUTION light in the front cockpit operates with some of the warning and indicator lights on the telelight panel. In F-4C/D aircraft after T.O. 1F-4-814 and F-4E aircraft 67-342 and up a MASTER CAUTION light is installed in the rear cockpit and operates with the front cockpit MASTER CAUTION light. It is only necessary to monitor the MASTER CAUTION light for an indication of a condition requiring attention, and then referring to the telelight panel for the specific condition. The MASTER CAUTION light may be extinguished by depressing the master caution reset button on the generator control panel. There is no reset button in the rear cockpit. Illuminated lights on the telelight panel will not be extinguished by the master caution reset button, with the exception of the A/P DISENGAGED light, until their respective faults have been corrected. After the MASTER CAUTION light is extinguished, and an additional condition exists that requires attention, the MASTER CAUTION light will again illuminate.

Note

> If the CHECK HYD GAGES indicator light illuminates and remains illuminated, the hydraulic system gages should be monitored for the remainder of the flight. A second hydraulic system failure warning will not illuminate the MASTER CAUTION light.

Warning Light Test and Dimmer Circuit

A warning light test and dimmer circuit is used for testing the operation of the bulbs in the warning and indicator lights. All warning and indicator lights are included in the test and dimmer circuit which is powered by the 28/14 volt ac warning lights bus. The tank aboard (TK) light is also included in this circuit. The circuit does not check the operation of any of the systems utilizing a light, it merely checks the operation of the bulbs. The warning and indicator lights may be illuminated by actuating the warning lights test switch on each interior lights control panel.

RAM AIR TURBINE (F-4C/D)

A ram air turbine, in the upper left side of the fuselage, is provided as a power source for emergency ac generator. The turbine assembly is extended and retracted pneumatically. The turbine assembly consists of a housing that contains two variable pitch turbine blades, a governing unit that controls the pitch of the blades, and gearing to transfer blade rotation to a vertical drive shaft. The vertical drive shaft terminates in a gear box inside the fuselage. The gear box then drives the emergency generator. When the ram air turbine is extended into the airstream, the turbine blades are at a maximum angle-of-attack. This results in a rapid acceleration of the turbine blades and governing unit. As the regulating speed of the governing mechanism is approached, the turbine blades decrease their angle-of-attack. Turbine blade angle-of-attack (as directed by the governing mechanism) then varies with respect to the velocity of the airstream to maintain a constant 12,000 rpm. In effect, the ram air turbine functions as a constant speed drive unit for the emergency generator. Emergency electrical power will be available down to approximately 90 knots.

Ram Air Turbine Control Handle (F-4C/D)

The ram air turbine is extended and retracted pneumatically by a ram air turbine handle in the forward cockpit. Pushing DOWN on the handle extends the turbine, pulling UP on the handle retracts the turbine.

CANOPY KNIFE

A canopy knife (figure 3-1) is on the left canopy rail on both cockpits. They are used to break away the canopies for emergency egress should all other methods of opening the canopies fail.

ENGINE FIRE AND OVERHEAT DETECTOR SYSTEM

Each engine has a fire warning system for the engine compartment, and an overheat warning system for the keel section. These systems are independent of each other. Each system consists of a warning light, a control unit, and a series of continuous type sensing units. Illumination of the lights warns the AC to initiate emergency procedures.

Fire Warning System

The fire warning system serves to alert the AC to an overheat condition in the engine compartments. The system consists of two sensing element loops (one for each engine), two control units and two warning lights. Each loop contains seven sensing elements, located such that the entire engine compartment is covered. When a fire or overheat condition exists, the sensors experience an impedance drop. This impedance drop is detected by the control unit, and the fire warning light illuminates. Depressing the fire detector check button applies power to the system for a loop continuity and a light bulb check.

Note

An illuminated fire warning light may be a valid fire indication even though the self-test circuit may be inoperative.

Aft Fuselage Overheat Warning System

This system serves to warn the AC of an over-temperature condition in the keel section. Sensors are behind the skin of the keel, approximately opposite the aft end of the secondary nozzle fingers. The sensors function in the same manner as described in the preceding paragraph, causing the red overheat warning light for the affected engine to illuminate when the temperature reaches approximately 566°C.

Note

Illumination of FIRE or OVERHT warning lights shall be logged on Form 781.

Fire Detector Check Button

The warning lights may be tested by momentarily placing the warning lights test switch in the TEST position. This check will only test the bulbs. By depressing the fire detector check button the continuity of the circuitry, including the sensor units, may be checked.

EJECT LIGHT

An EJECT light provides a positive visual ejection command from the AC to the pilot. The light is controlled only from the front cockpit. The AC's switch and monitor light are incorporated into a single unit under the left canopy sill just forward of the flap switch. The switch is a push ON, push OFF type, with the push button being the lens of the light. The lens is recessed sufficiently to preclude an accidental actuation. The light in the rear cockpit is a rectangular press to test unit monitored at the bottom right of the instrument panel. Pressing the lens of the rear light will test the rear light bulb and circuitry only. When the switch in the front cockpit is depressed, both EJECT lights illuminate. Depressing the switch again will extinguish both lights. The lights both incorporate red lenses. The rear lens has the word EJECT engraved in black letters on its face. The lens in the front cockpit is plain; however, the front switch has a decal marked EJECT LT. The EJECT lights are powered by the battery bus and are operational at any time.

EXTERNAL STORES EMERGENCY RELEASE BUTTON

The external stores emergency release button (panic button) is on the front cockpit left subpanel. This button, when depressed, will jettison all external stores (except the special weapons or other armament items which are retained as a matter of policy). The button is operative under the following conditions: the aft emergency extension gear handle in the normal (IN) position and the forward gear handle in the up position, or the aft emergency extension gear handle in the normal (IN) position and the weight off the landing gear (left main gear scissors switch closed). Although the button is spring-loaded to the normal position, the AC is provided with a means to determine that the button is not sticking in the RELEASE position, as follows. On F-4C aircraft 63-7460 and up and on all F-4D/E aircraft, a black painted lip extends into the switch guard approximately 9/16 inch. On F-4C aircraft prior to 73-7460, the first 9/16 inch (approximately) inside the guard has been scraped clean of all paint. On any of the above aircraft, the AC cannot see yellow paint inside the guard unless the button is depressed to the RELEASE position. If the external transfer switch is in the OUTBD or CENTER position at the time of jettison, all external tanks fuel shutoff valves close and the external transfer switch will be ineffective, allowing internal wing fuel to transfer normally.

ARMAMENT SAFETY OVERRIDE BUTTON

The armament safety override button, under the left canopy sill, allows the safety switches to be bypassed for armament circuit checkout. The override button remains engaged, once depressed, until electrical power is removed from the aircraft, or the gear handle is up. In an airborne emergency in which all other jettison methods have failed, the AC can attempt stores jettison by depressing and holding the override button and actuating the applicable jettison switch. Depressing the armament safety override switch bypasses the forward and aft emergency extension gear handle safety switches and the left main gear safety switch. This causes the following jettison switches to become hot: external stores emergency release button, center station jettison switch, and the ECM jettison switch, if installed. On F-4C aircraft after T.O. 1F-4-508 and on all F-4D/E aircraft the missile jettison selector knob also becomes hot.

WARNING

All normal jettison circuits in the aircraft, except the external wing tanks, are disabled once the aft emergency extension gear handle in the rear cockpit is pulled. Jettison may be accomplished by use of the armament safety override button in this case. With the front cockpit gear handle up, the armament safety override switch must be depressed and held, since the switch is not solenoid held with gear handle in the up position.

INSTRUMENTS

Note

Refer to foldout section for front and rear cockpit instrument panel illustrations.

Most of the instruments are electrically operated by power from the electrical system. Some instruments such as the accelerometer, are self-contained and do not require any external source of electrical power.

Note

For information regarding instruments that are an integral part of a particular system, refer to applicable paragraphs in this section.

TRUE AIRSPEED INDICATORS

A true airspeed indicator is on the front cockpit instrument panel and the rear cockpit instrument panel. The airspeed is indicated by a small counter which rotates to show a row of numbers through a window on the indicator face. The indicators read directly in knots TAS, and have a range of 0 to 1500 knots. The system calibrated range is 150 to 1500 knots. Therefore, true airspeed readings below 150 knots are not reliable. The true airspeed inputs are produced by a signal from the total temperature sensor of the air data computer, which is routed through a potentiometer driven by a Mach number function cam. Thus, Mach number is converted into true airspeed. Scale error throughout the full range of the indicator will not exceed ± 5 knots. During any rates of change throughout the full range of indicator, transient error will not exceed ± 10 knots. The true airspeed indicator can indicate anywhere below 150 knots while the aircraft is motionless on the ground.

GROUND SPEED INDICATOR

The ground speed indicator is on the rear cockpit instrument panel. Ground speed is indicated by a small counter which rotates to show a row of numbers through a window on the indicator face. The indicator reads in knots, with a range of from 0 to 1999 knots. Ground speed inputs are produced by the navigation computer. When the inertial navigation system (INS) is operating, the navigation computer resolves rectangular components of velocity received from the INS to ground speed. The resulting ground speed signal is routed to the ground speed indicator. Actual aircraft ground speeds will be indicated, including taxiing ground speed. When the INS is inoperative, the navigation computer uses true airspeed from the air data computer, with wind direction and velocity manually inserted by the operator, to compute ground speed. The ground speed indications in this case are only as accurate as the manually inserted wind information. With the INS inoperative, the ground speed indicator can indicate anywhere below 150 knots while the aircraft is motionless on the ground.

ACCELEROMETERS

An accelerometer, to measure and record positive and negative acceleration G loads, is on the front cockpit instrument panel and the rear cockpit instrument panel. The indicator has three movable pointers. One pointer moves in the direction of the G load being applied, while the other two (one for positive G, and one for negative G) follow the indicator pointer to its maximum travel. These recording points remain at their respective maximum travel position of the G load being applied. Depressing a PUSH TO SET button, in the lower left corner of the instrument will allow the recording pointers to return to the one G position.

CAUTION

The accelerometers may read 1/2 G low, possibly lower when pull-in rates are high.

AIRSPEED/MACH INDICATORS

A combination airspeed and Mach number indicator is on the front cockpit instrument panel and the rear cockpit instrument panel. Both airspeed and Mach readings are provided by a single pointer moving over a fixed airspeed scale, graduated from 80 to 850 knots, and a movable Mach number scale graduated from Mach 0.4 to Mach 2.5. A movable airspeed marker is included as an approach speed reference and can be positioned by the knob on the face of the instrument. The same knob, when depressed and rotated, will position another pointer on the Mach number scale for indicated Mach reference. The airspeed indicator pointer and the Mach number scale are synchronized so that a proper relationship between the two is assured throughout all altitude changes.

ALTIMETER

A standard pressure altimeter is on the front cockpit instrument panel and the rear cockpit instrument panel. These units are of the counter-pointer type which display the whole thousands number in a counter window and the increments of the whole number with a pointer which rotates on the face of the instrument. The pointer scale is graduated in 50 foot units with major 100 feet scale divisions from 1 to 10. The range of the altimeter is 0 to 80,000 feet. An adjustable barometric scale is provided so that the altimeter may be set at sea level pressure. This scale range is from 28.50 to 30.90 inches mercury. In the transonic range, an altimeter jump may be noticed. F-4D aircraft 66-7505 and up and all F-4E have a servoed altimeter in each cockpit which provides both pneumatic pressure and electronic operation. The electronic portion of the altimeter is used to correct errors in the pneumatic pressure input; thereby presenting a display of correct aircraft altitude. A switch on the altimeter is spring-loaded to the center position, and has momentary positions of RESET and STBY. In the standby mode, only pneu-

ALTITUDE REPORTING FAILURE INDICATIONS

F-4D BLOCK 30 AND UP AND ALL F-4E

TYPE OF FAILURE	ALTIMETER (AAU-19/A)	ALT ENCODER OUT LIGHT	STATIC CORR OFF LIGHT	MASTER CAUTION LIGHT	RESULTING SYSTEM OPERATION
* ALTIMETER SERVO FAILURE OR MANUAL STBY SELECTION	*STBY	OFF	OFF	OFF	ALTIMETER REVERTS TO PNEUMATIC OPERATION ON CORRECTED STATIC PRESSURE.
ALTITUDE ENCODER UNIT FAILURE OR AIR DATA COMPUTER LPC MODULE FAILURE	*STBY	ON	OFF	ON	ALTIMETER REVERTS TO PNEUMATIC OPERATION ON CORRECTED STATIC PRESSURE, AND NO ALTITUDE INFORMATION SUPPLIED TO ALTITUDE REPORTING TRANSPONDER.
AIR DATA COMPUTER SPC FAILURE OR MANUAL OFF SELECTION	*STBY	ON	ON	ON	ALTIMETER REVERTS TO PNEUMATIC OPERATION ON UNCORRECTED STATIC PRESSURE, AND NO ALTITUDE INFO SUPPLIED TO ALTITUDE REPORTING TRANSPONDER.

* AIRCRAFT WITH SERVOED ALTIMETERS ONLY.

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Figure 1-9

matic pressure is applied to the altimeter. When the switch is placed in the RESET position the electronic signal is also applied to the indicator; this condition is considered to be the normal mode of the servoed indicator. If a failure occurs in the altimeter, altitude encoder unit, or the air data computer, the altimeter reverts back to the standby mode immediately. This is indicated by the appearance of the standby warning flag on the face of the altimeter, and by the possible illumination of associated warning lights (see figure 1-9). Refer to part 1 of the applicable appendix for altimeter lag and altimeter position error.

Note

F-4D aircraft 66-7505 and up and F-4E aircraft through 67-398 were delivered with standard pressure altimeters. These altimeters will be replaced with the AAU/19A altimeter when available. Automatic altitude reporting through the IFF coder-receiver is available regardless of the type of altimeter installed.

WARNING

When operating aircraft with the AAU/19A altimeter installed, use the standby mode only. Because of a servo problem within the system, it is possible that large altimeter errors may be introduced.

MAGNETIC COMPASS

A conventional magnetic compass, one in each cockpit, is provided for navigation in event of instrument or electrical malfunction. Compass cards are located above the canopy sill on the right side of the front and rear cockpit.

RADAR ALTIMETER

The radar altimeter provides the AC with accurate height information, with respect to the terrain, from 0 to 5000 feet. Accuracy of the system is ± 5 percent of the indicated altitude or ± 2 feet, whichever is greater. Operational limits allow the system to function normally from 0° to 30° bank angle and/or from 0° to 35° pitch angle. The system consists of a transmitter/receiver, individual transmitting and receiving antennas and a height indicator. The height indicator, on the left side of the AC's instrument panel, provides read-out information for the system. In the face of the indicator is a fixed dial scale and altitude pointer, a movable reference marker and an OFF flag window. The dial scale is linear from 0 to 100 feet and logarithmic from 100 to 5000 feet. A function control switch, on the lower left side of the indicator provides complete control of the system. A red, low altitude warning light is on the lower right side of the indicator.

Function Control Switch

Clockwise rotation of the function control switch applies power to the system components. By rotating the control switch further clockwise, the reference marker may be positioned. This also sets the low altitude warning light limit. Any time the aircraft descends below the preselected altitude, the low altitude warning light illuminates. A self-test function may be initiated by pressing in on the function control switch. This supplies the indicator with an artificial return signal and the altitude pointer indicates 35 ± 15 feet. Above 5000 feet, or when unreliable signals are being received, the altitude pointer is driven counterclockwise behind a mask which is located between the 0 and 5000 feet mark, and the OFF flag will appear. The OFF flag also appears when power is lost or turned off; however, the altitude pointer remains at the altitude it was indicating when the power interruption occurred.

WARNING

High frequency radar waves can penetrate snow and ice fields. When operating in areas covered with snow and ice, the radar altimeter may indicate a greater terrain clearance than actually exists.

Note

With external stores aboard and the aircraft in a maneuvering attitude, the radar altimeter will experience performance degradation. However, no degradation occurs in straight and level flight.

VERTICAL VELOCITY INDICATORS

The vertical velocity indicators indicate the rate of climb or descent of the aircraft. Each indicator is connected to the static pressure system and actuation of the pointer is controlled by the rate of change of the atmospheric pressure. It is so sensitive that it can register a rate of gain or loss of altitude which would be too small to cause a noticeable change in the altimeter reading. Each half of the indicator face is graduated in 500 foot units from 0 to 6000 feet with 100 foot scale divisions from 0 to 1000 feet. The upper half of the instrument indicates rate of climb and the lower half indicates rate of descent in thousands of feet per minute.

TURN AND SLIP INDICATORS

A turn and slip indicator is in the attitude director indicator (ADI) on the front cockpit instrument panel. A four-minute turn and slip indicator is on the rear cockpit instrument panel. The turn needle in the ADI indicates direction yaw and does not indicate turn rate. The turn needle in the rear cockpit indicates standard rates of turn in the conventional manner. Complete electrical failure renders either turn needle inoperative. In F-4C/D aircraft, the front cockpit turn needle operates normally on emergency generator power.

Note

The turn needle in the ADI is operated by a vertically mounted gyro, and deflects right or left in the direction of aircraft yaw. The rear cockpit turn needle, operated by a conventional horizontally mounted gyro, indicates aircraft turn rate about a vertical axis in reference to earth.

ATTITUDE INDICATOR (REAR COCKPIT)

The attitude indicator on the rear cockpit instrument panel receives attitude information from the attitude heading and reference system when the reference system selector knob is in either PRIM or STBY. The pitch trim knob is used to electrically rotate the attitude sphere to the desired position in relation to the fixed miniature airplane. An attitude OFF warning flag is visible on the face of the instrument when power is not applied or when any one phase of AC power to the instrument is lost.

WARNING

The attitude warning flag will not appear with a slight electrical power reduction or failure of certain components within the system. Failure of certain components can result in erroneous or complete loss of pitch and bank presentations without a visible flag.

FLIGHT DIRECTOR GROUP

The flight director group provides an integrated display of the navigation situation of the aircraft. The flight director group consists of a flight director computer, the horizontal situation indicator (HSI), and a selector panel. Although the attitude director indicator (ADI) is not a component of the flight director group, it does receive some signals from the flight director computer and shall be discussed along with the flight director group.

FLIGHT DIRECTOR COMPUTER

The flight director computer provides navigation information to the HSI, and steering information to the ADI. Except for the bearing and distance display on the HSI, all signals for the HSI, and signals for portions of the ADI pass through or originate in the computer. The flight director computer has no control over the 3 axis sphere portion of the ADI. Steering signals are computed to provide the AC with flight direction information when flying either manually or remotely set headings, and manually selected TACAN radials. These computed signals, together with the required flag signals and off scale signals, are supplied by the computer to the ADI. The steering signals are limited to ensure safe operation without affecting the inherent performance capabilities of the aircraft.

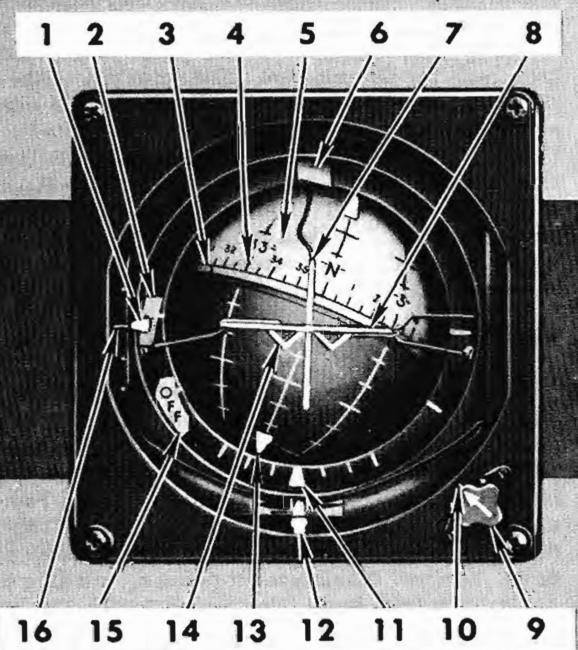
HORIZONTAL SITUATION INDICATOR (HSI)

The HSI provides a plan view (as seen from above) of the navigation situation of the aircraft. The aircraft symbol in the center of the HSI is the aircraft superimposed on a compass card. See figure 1-10. The compass card rotates to display aircraft magnetic heading under the lubber line. Index marks are provided each 45 degrees around the perimeter of the compass card. The bearing pointer and range indicator provide bearing and range information as selected by the bearing distance selector switch. When NAV COMP is selected, magnetic bearing and range to the selected destination are provided. When TAC is selected, magnetic bearing and range to the selected tacan station are provided. When the ADF position is selected, relative bearing to an ADF station is indicated by the bearing pointer. Four different navigational situation displays are provided on the HSI, selected by the mode selector knob on the navigation function selector panel. These displays are: ATT (attitude), HDG (heading), TAC (tacan), and NAV COMP (navigation computer). The mode selector knob does not affect information displayed by the bearing pointer and the range indicator. When the attitude mode is selected, the heading marker, course arrow, and course deviation indicator slave to the magnetic heading; i.e., under the lubber line. The heading marker cannot be adjusted with the heading set knob and the bank steering bar on the ADI is deflected out of view. The course selector window also displays magnetic heading. In the heading mode, the course arrow and course deviation indicator are slaved to the lubber line and display aircraft magnetic heading. The course selector window also displays magnetic heading. The heading marker may be manually set to the desired heading. This will provide ADI bank steering bar information to command an asymptotic approach to the selected heading. The tacan mode provides a display of the navigation situation with respect to the selected tacan course. To provide a complete tacan display, the mode selector knob and the bearing/distance selector switch on the navigation function selector panel are placed in the TACAN position. The bearing pointer indicates magnetic bearing and the range indicator indicates slant range to the tacan station. The course arrow and the course selector window are manually set with the course set knob to the desired tacan course. The course deviation indicator and aircraft symbol display a plan view of the relationship of the aircraft and the selected tacan course. Maximum deflection of the course deviation indicator is five degrees either side of center (2.5 degrees per dot), which provides an extremely sensitive course indication. The heading set knob manually sets the heading marker to the desired tacan course; thus providing bank steering information on the ADI to command as asymptotic approach to the tacan course. The bank steering bar does not correct for drift. Therefore, if the heading marker is not set to the heading required to maintain the desired tacan course, bank steering bar information is not accurate. The to-from indicator operates only when the tacan mode is selected and indicates whether the course selected, if intercepted and flown, will take the aircraft to or from the selected tacan station. In the navigation computer mode, the course arrow and course selector window display the aircraft magnetic ground track. The heading marker is automatically positioned to the appropriate magnetic heading (command heading) to fly in order to make good a course to the selected destination (target or base). The bank steering bar on the ADI provides bank steering information to direct an asymptotic approach to the command heading. Five mode-of-operation word messages are shown around the HSI. These works are illuminated to indicate operating mode, provided the instrument panel lights control knob is in the ON position. The intensity of the mode lights is controlled by this knob. The mode words are: TAC (tacan), NAV (navigation computer), UHF (ADF), MAN (HDG), and TGT (target/F-4D/E only). During radar offset bombing operations (F-4D/E only), illumination of the TGT mode word indicates insertion of target data. The data link and ILS lights do not illuminate since these modes are not available. There is no mode light for the attitude mode of operation.

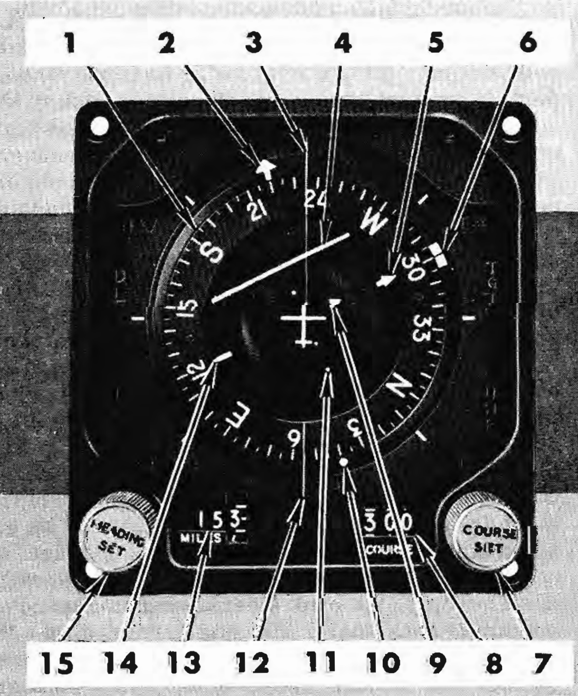
ATTITUDE DIRECTOR INDICATOR (ADI)

The ADI is a multipurpose instrument powered by the instrument 115 volt ac bus. In addition to serving as an attitude indicator, the ADI displays computed pitch and bank steering information relative to the selected mode of the flight director system. The indicator includes an attitude sphere, turn and slip indicator, pitch and bank steering bars, miniature aircraft, vertical displacement pointer, warning flags, and a pitch trim knob. See figure 1-10. The attitude sphere displays pitch, bank, and heading in relation to the miniature aircraft. Signals are received from the primary or standby attitude reference system. Either system can be selected by placing the reference selector knob on the compass controller to the desired position. When the reference system is changed from PRIM to STBY or vice versa, the ADI normally shows no appreciable change in pitch or roll, but may temporarily swing to some random point in azimuth before synchronizing back to the correct heading. A similar sphere gyration may occur when operating in STBY during maneuvers in which the airplane passes through 90 degrees or 270 degrees of pitch attitude. The pitch reference relationship of the attitude sphere to the miniature aircraft may be adjusted with the pitch trim knob. The turn indicator in the lower portion of the ADI receives its signal from the AN/AJB-7. The bank steering bar provides command steering information to intercept selected headings, tacan radials, or navigation computer destinations. Bank steering commands from the heading marker and/or course arrow are transmitted through the flight director computer to the bank steering bar. The maximum bank angle commanded is 30 degrees. In navigation computer mode the maximum heading error that can be commanded is 90 degrees. If the heading marker is manually set at 90 degrees or more from the present aircraft heading, the bank steering bar commands the maximum bank angle. Heading errors of less than 90 degrees results in bank angle commands of less than 30 degrees. If bank angles of more than 30 degrees are desired during heading/course interception, the steering bar must be disregarded. During tacan course interceptions, bank steering information is

ADI/HSI (ATTITUDE DIRECTOR INDICATOR/ HORIZONTAL SITUATION INDICATOR)



1. GLIDE SLOPE INDICATOR
2. GLIDE SLOPE WARNING FLAG
3. HORIZON BAR
4. HEADING REFERENCE SCALE
5. ATTITUDE SPHERE
6. COURSE WARNING FLAG
7. BANK STEERING BAR
8. PITCH STEERING BAR
9. PITCH TRIM KNOB
10. PITCH TRIM INDEX
11. BANK SCALE
12. TURN AND SLIP INDICATOR
13. BANK POINTER
14. MINIATURE AIRCRAFT
15. ATTITUDE WARNING FLAG
16. GLIDE SLOPE DEVIATION SCALE



1. COMPASS CARD
2. BEARING POINTER
3. UPPER LUBBER LINE
4. COURSE DEVIATION INDICATOR
5. COURSE ARROW (HEAD)
6. HEADING MARKER
7. COURSE SET KNOB
8. COURSE SELECTOR WINDOW
9. TO-FROM INDICATOR
10. BEARING POINTER (TAIL)
11. COURSE DEVIATION SCALE
12. LOWER LUBBER LINE
13. RANGE INDICATOR AND WARNING FLAG
14. COURSE ARROW (TAIL)
15. HEADING SET KNOB

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Figure 1-10

only reliable when the selected tacan course is within 60° of the present inbound course. An OFF warning flag on the ADI is visible during the start cycle time delay; when the AN/AJB-7 gyro ac power fails; when the AN/AJB-7 pitch or roll signals fail; or while the fast erect switch is being activated. If an AN/AJB-7 failure is indicated and the reference system selector knob is in the PRIM position, the OFF warning flag should be disregarded. The primary attitude reference is reliable if the INS OUT light is not illuminated.

WARNING

Failure of certain components can result in erroneous or complete loss of pitch and bank presentations without visible warning indications.

BEARING-DISTANCE-HEADING INDICATOR (BDHI)

The BDHI is a multipurpose instrument powered by the 28 volt ac instrument bus. The BDHI consists of a rotating compass card, single and double bar bearing pointers numbered 1 and 2 respectively, a range indicator, and a range warning flag. With the navigation mode selector switch in the TACAN/UHF/ADF position, the No. 1 pointer indicates UHF bearing and the No. 2 pointer indicates tacan bearing. The range indicator displays range to the selected tacan station. With the navigation mode selector switch in NAV COMP, the No. 1 pointer indicates magnetic bearing to the selected navigation computer target coordinates and the No. 2 pointer indicates magnetic ground track. The range indicator displays range to the selected navigation computer target coordinates.

NAVIGATION FUNCTION SELECTOR PANEL

The navigation function selector panel is on the front cockpit instrument panel. The panel contains a mode selector knob and a bearing/distance selector knob.

Mode Selector Knob

The mode selector knob is a rotary-type switch with positions of ATT, HDG, TACAN, and NAV COMP. The knob is used to select the source of information to be displayed on the HSI and ADI as shown in figures 1-11 thru 1-13.

Bearing/Distance Selector Switch

The bearing/distance selector switch is a three-position toggle switch with switch positions of NAV COMP, ADF, and TACAN. The bearing/distance selector switch controls the bearing pointer, range indicator and the mode word that indicates the mode selected on the HSI. The bearing/distance selector switch and mode selector knob do not have to be set up as a pair. The positions function as described in figure 1-14.

COMMUNICATION-NAVIGATION-IDENTIFICATION SYSTEM (INTEGRATED ELECTRONIC CENTRAL AN/ASQ-19)

The integrated electronic central AN/ASQ-19 combines the communication, navigation and identification systems into one unit. Communication functions are provided by a UHF receiver-transmitter, an auxiliary UHF receiver, and an intercom set. Navigation functions are provided by a tacan (tactical air navigation) set and an ADF (automatic direction finding) feature. An IFF (identification friend or foe) set, and an SIF (selective identification feature) set, provide coded radar identification of the aircraft when challenged. The communication-navigation-identification system utilizes power from the essential 115 volt ac bus (F-4C/D only), the right main 115 volt ac bus, the instrument 115 volt ac bus, the essential 28 volt dc bus, and the right main 28 volt dc bus. When the CNI equipment is operating on external power without ground cooling, it is limited to 10 minutes of accumulated operation in a one hour period. This limit does not apply to the intercom system.

EXTERNAL GROUND POWER OPERATION

With external ground power connected to the airplane and neither of the two generators connected to the line, the integrated electronic central will not operate unless the CNI ground power switch is placed to ON. The CNI ground power switch in the left wheel well, applies power to the integrated electronic central for ground operation. The switch is manually operated and electrically held and must be reset after each interruption of external power.

CAUTION

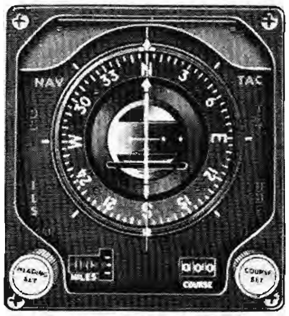
CNI equipment is limited to 10 minutes of accumulated operation in a 1 hour period when operating with external power without ground cooling.

INTERCOM SYSTEM

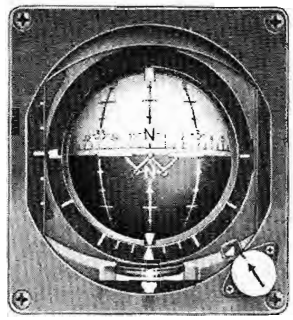
Intercommunications between AC and pilot, or AC, pilot and groundcrew are provided by the intercom system. Each cockpit is provided with a primary and secondary amplifier. During normal operations, the primary amplifiers amplify the microphone output while the secondary amplifiers amplify all audio signals, both internal and external, before feeding them to the headsets. For example, when the AC talks on intercom his microphone output goes to the front cockpit primary amplifiers. This amplifier then directs the signal to both front and rear cockpit secondary amplifiers. The secondary amplifiers feed the signal to the headsets in their respective cockpits. If any intercom amplifier becomes inoperative, communications may be restored by bypassing the faulty amplifier with the amplifier selector knob. An external intercom jack is installed in the left

ATTITUDE AND HEADING DISPLAYS

ATT (Attitude)

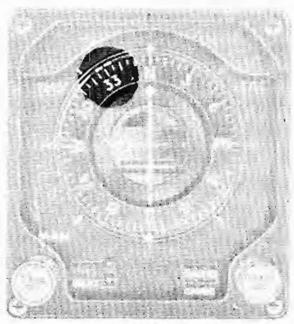


THE COURSE ARROW, COURSE DEVIATION INDICATOR AND HEADING MARKER ARE SLAVED TO THE MAGNETIC HEADING OF THE AIRPLANE (I. E. VERTICAL ON THE FACE OF THE HSI). NO MODE LIGHT IS ILLUMINATED.

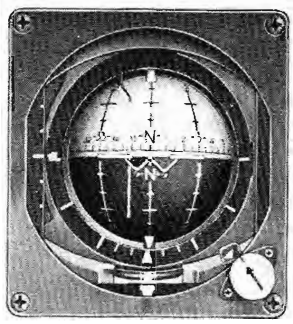


ALL POINTERS ARE DEFLECTED OUT OF VIEW. ONLY ATTITUDE AND AZIMUTH INFORMATION IS DISPLAYED.

HDG (Heading)



THE HEADING MARKER IS POSITIONED BY THE HEADING SET KNOB TO PROVIDE THE ADI BANK STEERING BAR WITH BANK AND AZIMUTH INFORMATION IN ORDER TO TURN TO THE SELECTED HEADING. THE MAN MODE LIGHT IS ILLUMINATED.



THE BANK STEERING BAR INDICATES BANK ANGLE STEERING UP TO 30° OF BANK TO APPROACH THE HEADING SELECTED BY THE HEADING SET KNOB ON THE HSI.

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Figure 1-11

wheel well to provide communications between ground and aircrews.

Note

Since the external intercom is wired in parallel with the pilot's microphone and headset, the ground crew and pilot can block each other during simultaneous transmissions. In addition, either the AC's or pilot's function selector switch must be in HOT MIC to allow aircraft to ground communications. In F-4E aircraft, the pilot's function selector switch must be in HOT MIC with the CNI switch and the UHF radio turned on to allow aircraft to ground communications. However, if the UHF is not turned on the intercom microphone buttons on the throttles can be used for aircraft to ground communications.

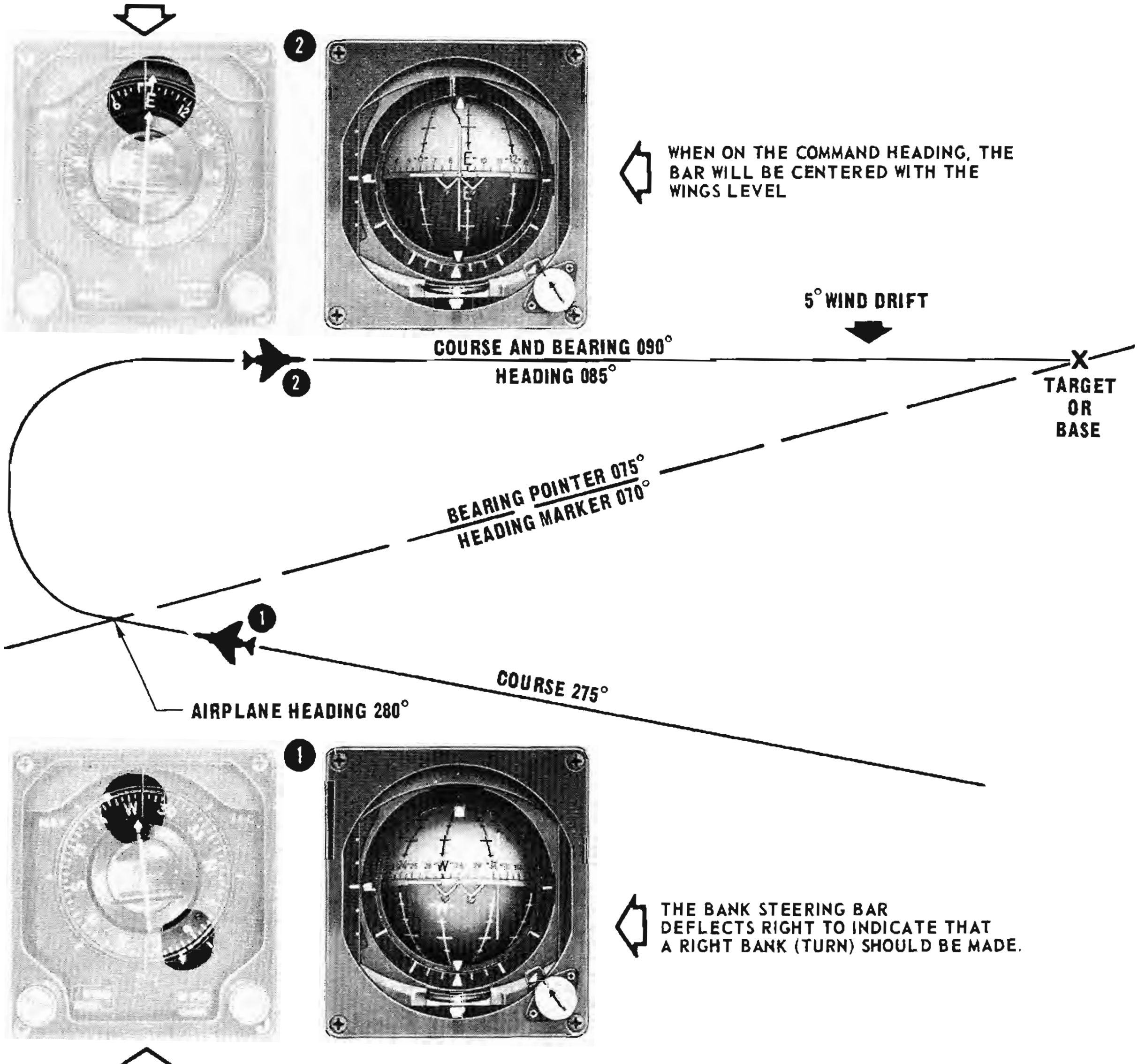
INTERCOM CONTROL PANEL

The intercom system is controlled by intercom control panels in each cockpit. The panels contain a volume control knob, an amplifier selector knob with positions of EMER ICS, NOR and EMER RAD, and a function selector switch with positions of RADIO OVERRIDE, HOT MIC, and COLD MIC. On F-4E aircraft, the intercom panels are similar with the exception that the amplifier selector knob has positions of B/U, NORM, and EMER.

NAVIGATION COMPUTER DISPLAYS

NAV/COMP (NAVIGATION COMPUTER)

WHEN ON THE COMMAND HEADING, THE HEADING MARKER WILL BE UNDER THE LUBBER LINE. THE COURSE ARROW AND BEARING POINTER WILL BE ALIGNED (BUT NOT NECESSARILY UNDER THE LUBBER LINE).



THE HEADING MARKER INDICATES THE MAGNETIC HEADING THAT MUST BE FLOWN TO MAKE GOOD A COURSE DIRECT FROM THE PRESENT POSITION OF THE AIRCRAFT TO THE DESTINATION (TARGET OR BASE) SELECTED ON THE NAV COMPUTER. WHETHER THE HEADING IS CORRECT OR NOT IS DEPENDENT UPON THE ACCURACY OF THE WIND DIRECTION AND VELOCITY, THE VARIATION, AND THE ACCURACY OF THE PRESENT POSITION. THE COURSE ARROW INDICATES THE TRACK THAT IS CURRENTLY BEING MADE GOOD, ALSO DEPENDENT UPON THE ACCURACY OF THE NAV COMPUTER SETTINGS. THE COURSE DEVIATION INDICATOR IS SLAVED TO THE COURSE ARROW. THE COURSE SELECTOR WINDOW WILL INDICATE THE SAME TRACK AS THE COURSE ARROW. THE BEARING POINTER INDICATES MAGNETIC BEARING TO DESTINATION. IN ORDER TO OBTAIN NAV COMPUTER INFORMATION FROM THE BEARING POINTER AND THE RANGE INDICATOR, THE BRG/DIST SWITCH MUST BE IN THE NAV COMP POSITION.

F4-154

Figure 1-12

TACAN DISPLAYS

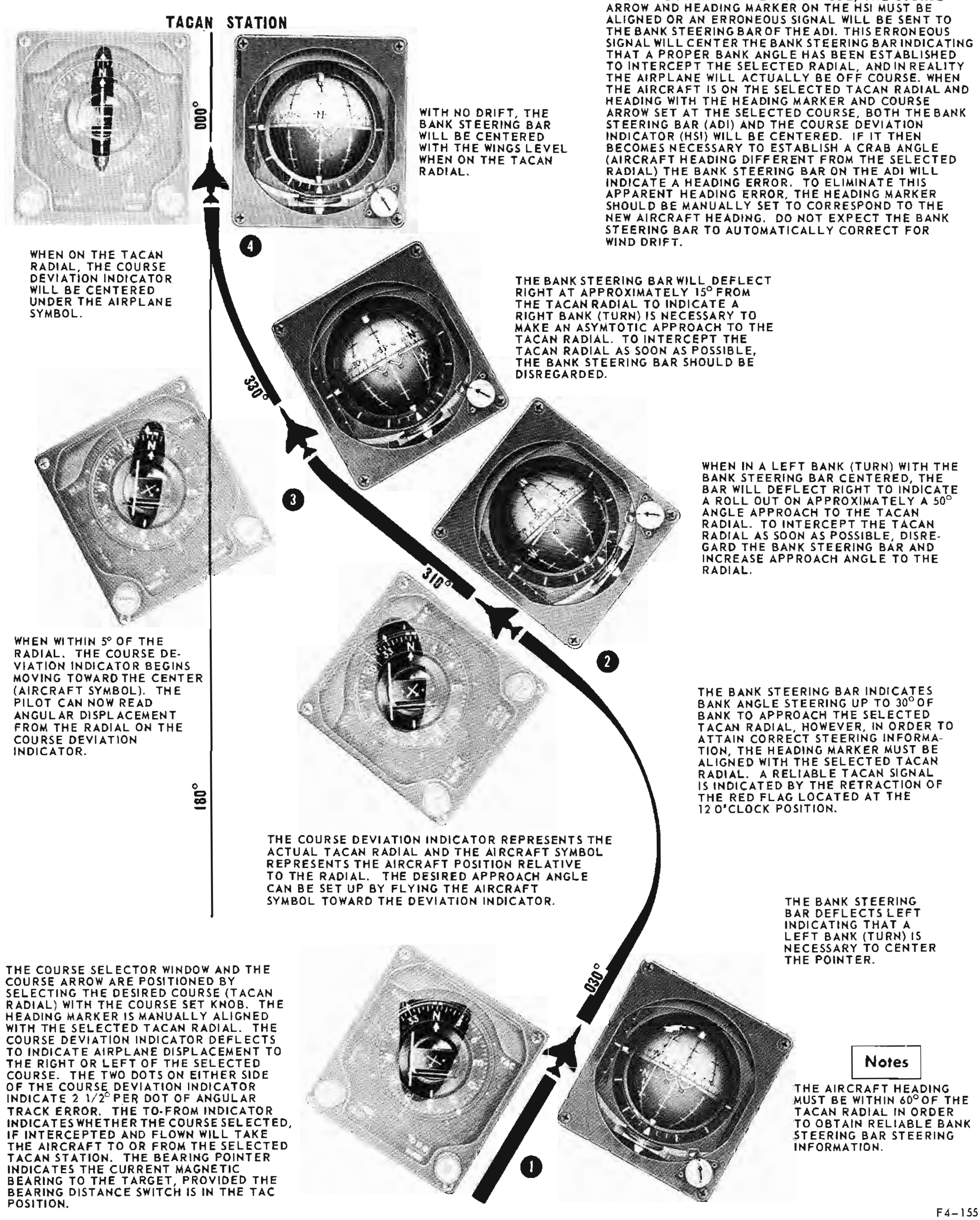
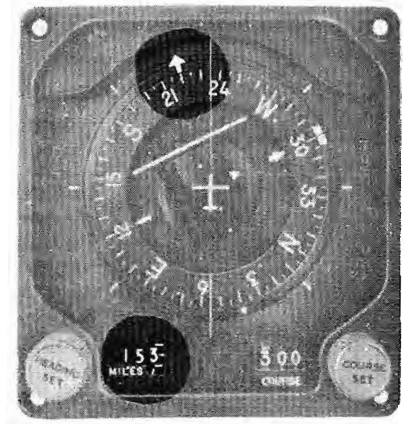


Figure 1-13

HORIZONTAL SITUATION INDICATOR BEARING and DISTANCE DISPLAYS

THE BRG/DIST SWITCH CONTROLS ONLY THE INDICATIONS DISPLAYED BY THE BEARING POINTER AND RANGE INDICATOR OF THE HSI.



BEARING DISTANCE SWITCH

NAV COMP (Navigation Computer)

THE BEARING POINTER INDICATES MAGNETIC BEARING TO THE DESTINATION SELECTED ON THE NAV COMPUTER. THE RANGE INDICATOR INDICATES THE NAUTICAL MILES TO THE DESTINATION SELECTED ON THE NAV COMPUTER (TARGET OR BASE). THE NAV LIGHT WILL BE ILLUMINATED.

BEARING DISTANCE SWITCH

ADF (Automatic Direction Finder)

THE BEARING POINTER INDICATES RELATIVE BEARING TO THE UHF STATION SELECTED ON THE COMMUNICATION CONTROL PANEL (EITHER COMM OR AUX ADF POSITION MUST BE SELECTED). THE RANGE INDICATOR WINDOW WILL BE BLANK. THE UHF LIGHT WILL BE ILLUMINATED.

BEARING DISTANCE SWITCH

TACAN

THE BEARING POINTER INDICATES MAGNETIC BEARING TO THE SELECTED TACAN STATION. THE RANGE INDICATOR INDICATES THE SLANT RANGE NAUTICAL MILES TO THE TACAN STATION (FOR DISTANCE INDICATIONS, THE TACAN SELECTOR SWITCH MUST BE IN THE T/R POSITION). THE TAC LIGHT WILL BE ILLUMINATED.

F4-156

Figure 1-14

Volume Control Knob

The intercom volume control knob is on the left side of the intercom panel. The input level of the intercom signals to the headsets is increased by rotating the volume control knob in a clockwise direction. Signals received from other radio receivers are not affected by the intercom volume control knob.

Function Selector Switch

A three-position toggle switch, with positions marked RADIO OVERRIDE, HOT MIC and COLD MIC, is on the right side of the intercom control panel. The RADIO OVERRIDE position is momentary, and the HOT MIC and COLD MIC positions are fixed. The HOT MIC position allows automatic operation of the intercom. If both function selector switches are set on COLD MIC, the microphone button on the inboard throttle must be placed to the ICS (aft) position to allow intercom operation. The RADIO OVERRIDE position is identical to HOT MIC, except that all communications are reduced in volume other than the following: communications between cockpits, the pullup tone from the attitude reference bombing computer set, the warning burst from the attitude reference bombing computer set (F-4C only), and the Shrike aural tone (F-4D/E only). Thus, these signals override all other communications. To select COLD MIC operation, the function selector switches in both cockpits must be in COLD MIC. If either crewmember selects HOT MIC or RADIO OVERRIDE, the system corresponds to that function. COLD MIC operation can be selected separately in either cockpit. To maintain intercom operation with COLD MIC selected, place the mic switch to ICS or select RADIO OVERRIDE.

Amplifier Selector Knob

An amplifier selector knob, a three-position rotary type switch, is in the center of each intercom control panel. The amplifier selector knob bypasses an amplifier if it fails. There are three settings for the control: NOR, EMER RAD, and EMER ICS. The NOR position is used when both stages are functioning properly. The EMER RAD and EMER ICS positions are used to bypass the faulty amplifier. On F-4E aircraft, the amplifier selector knob on both intercom panels has positions of B/U, NORM, and

COMMUNICATION-NAVIGATION-IDENTIFICATION EQUIPMENT

TYPE DESIGNATION	FUNCTION	RANGE
INTERCOM AN/ASQ-19	Intercockpit and cockpit-to-ground communications.	
UHF RADIO AN/ASQ-19	UHF radio communication between airplane and ship, airplane and shore, or between airplanes.	Up to line of sight, depending upon frequency and antenna coverage.
AUTOMATIC DIRECTION FINDER AN/ASQ-19	Indicates relative bearing of and homes on radio signal sources.	Up to line of sight, depending upon frequency and antenna coverage.
TACAN AN/ASQ-19	Indicates bearing and distance to ground stations. Determines identity and dependability of beacon.	Line-of-sight distance up to 196 miles depending upon altitude and attitude.
IFF-SIF AN/ASQ-19	IFF identifies airplane as Friend or Foe. SIF provides selective identification of a single airplane within a group.	0–200 miles or line-of-sight.
NAVIGATION COMPUTER AN/ASN-46 * AN/ASN-46A **	AN/ASN-46 – Provides great circle dead reckoning information above 120 Nautical Miles. AN/ASN-46A – Provides great circle dead reckoning information above 120 NM and rhumb line information below 120 NM.	Not applicable.
INERTIAL NAVIGATOR AN/ASN-48 * AN/ASN-63 **	Provides direction, velocity, and distance inputs to the navigation computer.	Not applicable.

* F-4C Aircraft
** F-4D/E Aircraft

F4-157

Figure 1-15

EMER. If the headset amplifier in either ICS station fails, place the switch to the B/U (back-up) position in the cockpit with the defective station. This switches from the normal headset amplifier to the back-up amplifier and restores normal operation. If selecting B/U does not restore ICS operation, select EMER (emergency). Audio from the operative station is then connected directly to the back-up headset amplifier in the defective station. The volume control on the station with EMER selected has no effect on the audio level.

Note

If both amplifier selector knobs are in an emergency position (EMER RAD and/or EMER ICS), and both intercom volume control knobs are above 75 percent of their volume range, a loud squeal is heard in both headsets. To eliminate the squeal, turn either volume control knob to a position below 75 percent of its volume range.

Intercom Microphone Button

An intercom microphone button is installed on each cockpit inboard throttle grip. The intercom microphone button is utilized for inter-cockpit and cockpit to ground communication when both function selector switches on the intercom control panels are in COLD MIC. When the intercom microphone button is actuated, a reduction of UHF volume occurs to facilitate crew communication.

INTERCOM EMERGENCY PROCEDURES

AC'S INDICATION	AC'S ACTION	PILOT'S INDICATION	PILOT'S ACTION	RESULTS		DUPLEX
				AC'S	PILOT	
Normal Operation	None	Headset Dead	Switch to EMER RAD	N	SR	NO
		No intercom sidetone, other signals OK; AC can't hear Pilot.	Switch to EMER ICS	N	SR	NO
Headset Dead	Switch to EMER RAD	Normal	None	SR	N	YES
		No intercom sidetone, other signals OK	Switch to EMER ICS	SR	SR	NO
		Headset Dead	Switch to EMER RAD	SR	SR	NO
No intercom sidetone, other signals OK; Pilot can't hear AC.	Switch to EMER ICS	Normal	None	SR	N	YES
		No intercom sidetone, other signals OK; AC can't hear Pilot.	Switch to EMER ICS	SR	SR	NO
		Headset Dead	Switch to EMER RAD	SR	SR	NO

Code: N-normal operation, SR = sidetone volume reduced; other intercom and audio signals normal. To eliminate feedback whistle during emergency operation by both cockpits, cut volume.

F4-158

Figure 1-16

Intercom Preflight Check

To check the intercom system prior to flight:

1. Function selector switch - HOT MIC
2. Amplifier selector knob - NOR
3. Volume control knob - ROTATE CLOCKWISE

With the intercom controls positioned as stated, check the duplex operation of the system by talking into the microphones. Rotate the volume control knobs to insure that they are operating properly. Place the amplifiers selector knob to EMER RAD and EMER ICS to insure that their amplifiers are operating properly. Place the function selector switch to COLD MIC and check the operation of the intercom microphone buttons on the throttles. Individually place the function selector switches to RADIO OVERRIDE and check for reduction of UHF communication and/or tacan volume. The RADIO OVERRIDE positions should be checked individually since a reduction in volume for the radio receivers is accomplished in both headsets when only one switch is actuated.

Normal Operation

The intercom system utilizes essential 28 volt dc power. In F-4C/D aircraft, the system is fully energized when aircraft electrical power is applied. In F-4E aircraft, when aircraft electrical power is applied the intercom system functions only by using the intercom microphone buttons. To obtain HOT MIC operation the UHF radio must be turned on in the cockpit which has communication command. If ground electrical power is applied, the CNI switch must also be turned on. Therefore, with electrical power applied (and UHF radio on, F-4E aircraft), place the function selector switches to HOT MIC, the amplifier selector knob to NOR, and the volume control knob as desired. Intercom can be maintained on battery power alone providing an engine master switch is on. The system becomes inoperative when all electrical power is shut off.

COMM-NAV CONTROL PANELS

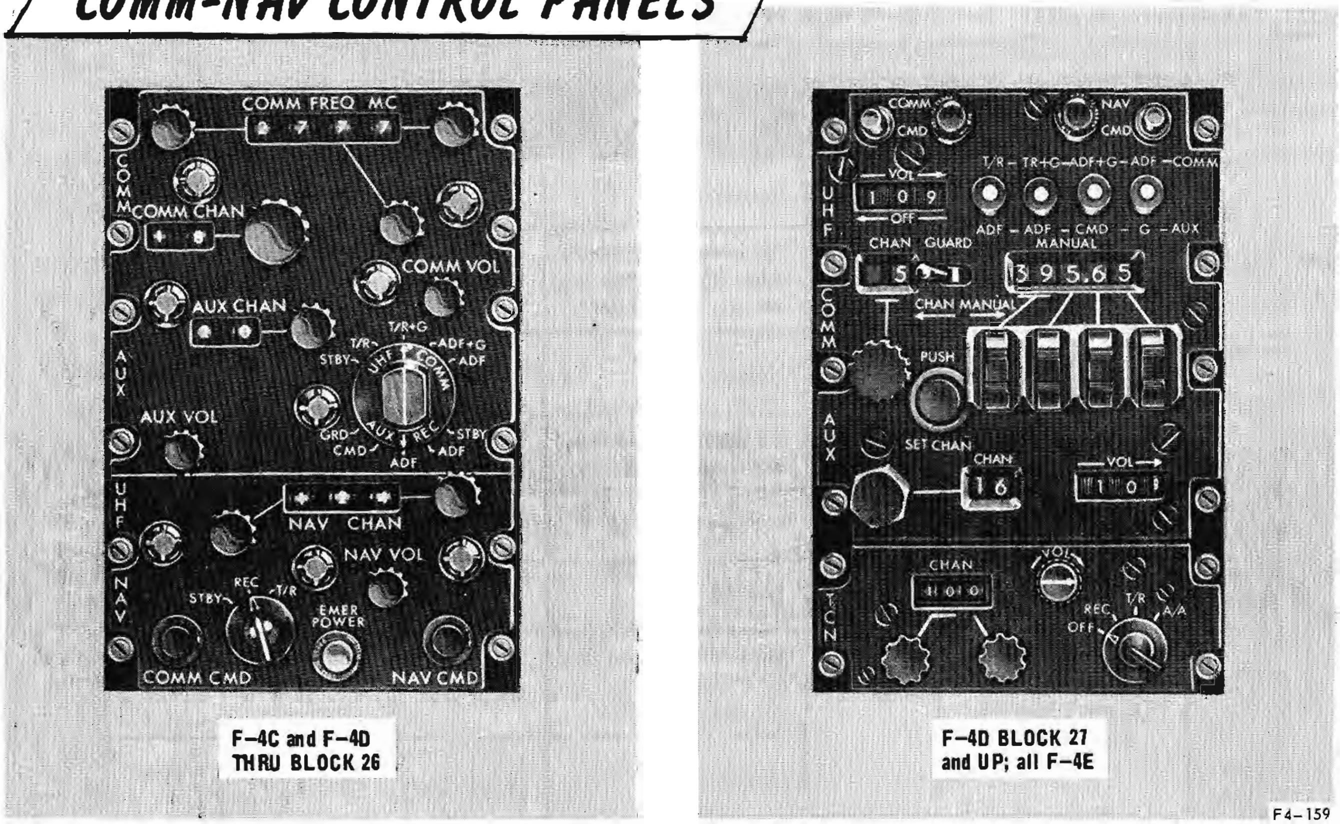


Figure 1-17

Note

- The intercom system is operative when the engine master switches or the refuel-defuel switch is energized.
- If the UHF system fails, the HOT MIC mode is inoperative on F-4E aircraft. In this event, COLD MIC and the throttle MIC switches must be utilized for intercommunication.

Emergency Operation

Intercommunication can be maintained despite amplifier failure in one or both intercoms. The intercom emergency procedures table (figure 1-16) shows how to recognize an amplifier failure and how to set the amplifier selector knobs to maintain communications. Some emergency procedures require the pilot to push-to-talk, eliminating duplex operation.

UHF RADIO

Ultra high frequency voice communications and automatic direction finding are provided by the UHF radio subsystems of the integrated electronic central. These subsystems contain the communication radio transmitter-receiver, referred to as the comm transmitter-receiver, and the amplifier-power supply-receiver unit. The receiver in this unit is referred to as the aux receiver. The subsystems are controlled by control panels in each cockpit. The comm transmitter-receiver transmits and receives amplitude modulated signals on 1750 (3500 in the F-4D aircraft 65-612 and up and all F-4E aircraft) manually selected frequencies, or on 18 preset frequency channels, within the 225.0 to 399.95 MHz frequency range. It is also used to transmit and receive guard (243.0 MHz). The receiver of this unit may be utilized to receive ADF signals, modulated or unmodulated within its frequency range, and display them on the horizontal situation and bearing-distance-heading indicators. The aux receiver complements the receiver in the comm transmitter-receiver unit. It receives amplitude modulated signals on 20 preset frequency channels within the 265.0 to 284.9 MHz range and guard, 243.0 MHz. It is also used to receive ADF signals, modulated or unmodulated, within its frequency range, and display them on the horizontal situation and bearing-distance-heading indicators. The audio signals from the receivers are fed to the secondary amplifiers in the intercom system and then to the headsets. The subsystems utilize two UHF blade type antennas and one ADF antenna. Selection of either blade antenna is made with the antenna selection switch. Either crewmember may take command of the UHF radio as necessary. If desired, the number of preset channels may be greatly increased by channelizing different frequencies for each cockpit.

Note

On F-4C/D aircraft after T.O. 1F-4-755, and F-4E aircraft after T.O. 1F-4E-532, provisions for the installation of the speech security system (KY-28) are provided. This system can have a direct effect on UHF transmission and reception. Refer to T.O. 1F-4C-34-1-1B for detailed description of the system and its operational application.

UHF RADIO CONTROLS (F-4C/D)

On all F-4C aircraft and F-4D aircraft thru 65-611, the UHF radio is operated by controls on the communication control panel (figure 1-17), the communication command button on the navigation control panel, the antenna selector switch on the outboard engine panel in the forward cockpit, the UHF remote channel indicators on the instrument panel in both cockpits and the microphone switch. The controls on the communication control panels include the communication frequency control knob, communication volume control knob, auxiliary channel control knob, auxiliary volume control knob, and communication function selector knob.

Communication Command Button (Comm Cmd)

A push-button control labeled COMM CMD is on the navigation control panel (figure 1-17). Operation of this button allows the crewmember to take or relinquish command of the comm transmitter-receiver, aux receiver and ADF functions. A green light in the center of the button illuminates in the cockpit which has communication command.

Communication Frequency Control Knobs (Comm Freq MC)

The three comm freq mc control knobs at the top of the center control panel are used to manually set in the 1750 operating frequencies of the comm transmitter-receiver. To use this feature, turn the comm chan control knob to the M (manual) position. When the comm chan control knob is in any position other than M, the comm freq mc control knobs are ineffective.

Communication Channel Control Knob (Comm Chan)

The comm chan control knob is at the upper left on the central control panel. This knob when rotated, selects any one of 18 preset channels which is shown in the comm-chan window. There is also an M position which permits the operator to select manually any one of 1750 operating frequencies, and a G position, which permits operation on the guard frequency of 243.0 MHz.

Auxiliary Channel Control Knob

The operating channels for the auxiliary receiver are selected by operation of the aux chan control knob on the left side of each central control panel. The channel selected is shown in the aux chan window directly to the right of the aux chan control knob.

Auxiliary Volume Control Knob (Aux Vol)

The auxiliary volume control knob is under the aux chan window on the central control panel. This knob controls the audio level of the aux receiver.

Communication Function Selector Knob

The communication function selector knob, labeled UHF COMM and AUX REC, is at the right side of the central control panel. This control provides facilities for selection of the various modes of operation of the aux receiver and the comm receiver-transmitter. As the control is rotated, different modes of operation are selected. There are five possible control settings for each receiver. One control position for one receiver corresponds to a control position for the other. The auxiliary receiver functions are selected from the positions at the bottom of the dial while the comm transmitter-receiver functions are selected from the top of the dial.

SELECTION	FUNCTION
STBY - STBY	Comm receiver and transmitter standby Comm guard receiver-standby AUX receiver - standby AUX guard receiver - standby
T/R - ADF	Comm receiver - communication reception Comm transmitter - communications transmission Comm guard receiver-not used AUX receiver - ADF reception AUX guard receiver - not used
T/R+G - ADF	Comm receiver - communication reception Comm transmitter - communication transmission Comm guard receiver-guard reception AUX receiver - ADF reception AUX guard receiver - not used

SELECTION	FUNCTION
ADF+G - CMD	Comm receiver - ADF reception Comm transmitter - communication transmission with ADF interruption during transmission Comm guard receiver - guard reception AUX receiver - communication reception AUX guard receiver - not used
ADF - GRD	Comm receiver - ADF reception Comm transmitter - communication transmission with ADF interruption during transmittion Comm guard receiver - not used AUX receiver - not used AUX guard receiver - guard reception

Antenna Selection Switch

A two-position antenna selection switch, in the front cockpit and labeled UPPER and LOWER, enables the AC to select either the upper or lower UHF blade antenna for UHF radio operation.

UHF Remote Channel Indicator

A UHF channel indicator is on the left side of the front and rear cockpit instrument panels. This enables the crewmembers to change UHF channels without shifting their vision from the instrument panel.

Microphone Switch

Two three-position microphone switches, one on the inboard side of the right throttle control handle in each cockpit, are used to key the comm transmitter when it is desired to communicate with a ground station or another aircraft. The switch has three positions: ICS aft position, UHF forward position and a center OFF position.

UHF RADIO CONTROLS (F-4D/E)

On F-4D aircraft block 27 and up, and all F-4E aircraft, the UHF radio is operated by controls on the communications control panel, (figure 1-17), the antenna selector switch on the outboard engine panel in the front cockpit, the UHF remote channel indicators on the instrument panel in both cockpits, and the microphone switch. The controls on the communication control panels include the communication command button and indicator, UHF volume control knob, mode selector switch, communication channel control knob, set channel pushbutton, communication frequency thumbwheels, auxiliary channel control knob, auxiliary volume control knob, and the communication-auxiliary pushbuttons.

Communication Command Button and Indicator

The communication command (COMM CMD) button and indicator are on the upper left corner of the communication control panel. Operation of this button allows the crewmember to take or relinquish command of the comm transmitter-receiver, aux receiver and ADF functions. A green light to the right of the button illuminates in the cockpit which has communication command.

UHF Volume Control

The UHF volume control is a thumbwheel type control which turns on the UHF communications and ADF systems, and controls the volume of the comm receiver-transmitter. The thumbwheel also has an on-off switch, with the 0 position being off. When adjusting the volume, the higher the number, the stronger the audio signal. The volume control is effective in each cockpit, regardless of which cockpit has command.

Mode Selector Switch

The mode selector switch is a three-position toggle switch which controls the mode of channel selection as indicated below.

CHAN	When used in conjunction with the comm channel control knob, provides selection of preset channels 1 thru 18.
GUARD	Channels the comm receiver and transmitter to the guard frequency with the T/R-ADF pushbutton depressed. With the T/R+G - ADF pushbutton depressed, the comm receiver and transmitter are channeled to the guard frequency and the guard receiver is on. This control is effective only from the cockpit with comm cmd.
MANUAL	Permits manual selection of the comm receiver and transmitter frequency as indicated by the manual frequency dials. This control is effective only from the cockpit with comm cmd.

Communication Channel Control Knob

The communication (COMM) channel control knob is a rotary switch used to select preset comm channels 1 through 18. The mode selector switch must be in the CHAN position for the comm channel control knob to be operative. The selected channel is indicated in the channel indicator adjacent to the comm channel control knob.

Set Channel Pushbutton

The set channel pushbutton is used to preset comm channels 1 through 18. To set in a frequency into a channel, the mode selector switch must be placed to the CHAN position, the comm channel control knob must be rotated to the desired channel and the comm frequency thumbwheels must be positioned to the desired frequency. When the set channel pushbutton is then depressed, the frequency is set into the desired channel.

Communication Frequency Thumbwheels

The communication (COMM) frequency thumbwheels are four rotary controls used to set a frequency into the comm receiver-transmitter or to preset frequencies into the comm receiver-transmitter channels. Frequencies can be set into the comm receiver-transmitter with the mode selector switch in the MANUAL position, and frequencies can be set into the comm receiver-transmitter channels with the mode selector switch in the CHAN position while depressing the set channel pushbutton. Frequencies from 225.00 to 399.95 MHz, in increments of 0.05 MHz, can be set using the comm frequency thumbwheels. The frequency selected is displayed on the manual frequency dials above the thumbwheels. The thumbwheels are effective only from the cockpit with comm cmd except when used for presetting comm channels 1 through 18.

Auxiliary Volume Control

The auxiliary (AUX) volume control is a thumbwheel type control which is used to control the volume of the AUX receiver.

AUX Channel Control Knob

The auxiliary (AUX) channel knob is a rotary switch used to select preset AUX channels 1 through 20. The channel frequencies cannot be reset from the cockpit. This control is effective only from the cockpit with comm cmd.

COMM-AUX Pushbuttons

The COMM-AUX pushbuttons control the mode of operation of the UHF comm receiver-transmitter, AUX receiver, and ADF systems. The comm receiver, comm transmitter, comm guard receiver, AUX receiver and AUX guard receiver are controlled by the pushbuttons as indicated below (only the comm receiver-transmitter shall be discussed at this time):

T/R - ADF	Comm receiver - communication reception. Comm transmitter - communication transmission Comm guard receiver - not used AUX receiver - ADF reception AUX guard - not used
T/R+G - ADF	Comm receiver - communication reception Comm transmitter - communication transmission Comm guard receiver - guard reception AUX receiver - ADF reception AUX guard receiver - not used
ADF+G - CMD	Comm receiver - ADF reception Comm transmitter - communication transmission with interruption of ADF during transmission Comm guard receiver - guard reception AUX receiver - communication reception within AUX receiver frequency range AUX guard receiver - not used
ADF-G	Comm receiver - ADF reception Comm transmitter - communication transmission with interruption of ADF during transmission Comm guard receiver - not used AUX receiver - not used AUX guard receiver - guard reception

The pushbuttons are effective only from the cockpit with comm cmd.

Note

It is possible to have all pushbuttons in the UP position, which renders all functions of the UHF radio inoperative.

UHF Remote Channel Indicator

A UHF remote channel indicator is on the front and rear cockpit instrument panels. The indicators provide a secondary means of indicating the channel to which the comm receiver-transmitter is tuned when the mode selector switch is positioned to CHAN. The channel indicated on the UHF remote channel indicator corresponds to the channel indication on the control panel indicator associated with the comm channel control knob. The remote indicators indicate G when GUARD is selected and M when MANUAL is selected.

Microphone Switch

Two three-position microphone switches, one on the inboard side of the right throttle control handle in each cockpit, are used to key the comm transmitter when it is desired to communicate with a ground station or another aircraft. The switch has three positions: ICS aft position, UHF forward position and a center OFF position.

COMM RECEIVER-TRANSMITTER PREFLIGHT CHECK

A quick check to prove the equipment is operating at an adequate power level can be made by performing a receiver-transmit check with the base control tower on several frequencies. If reception is poor at the aircraft and/or at the control tower, the need for corrective maintenance is indicated.

COMM RECEIVER-TRANSMITTER OPERATION (F-4C/D)

On all F-4C aircraft and F-4D aircraft thru block 26, the comm receiver-transmitter operation is as follows:

1. Place the communication function selector knob in the T/R position.
2. Rotate the comm chan control knob to the desired channel of operation.
3. Adjust comm vol control knob to approximately one-half its complete clockwise rotation.
4. After the first receiver signal is heard in the headphones, the volume may be adjusted.
5. Transmitting operation is accomplished on the same channel by depressing the throttle mounted microphone button.

Manual Adjustment of Frequencies

1. Rotate the comm chan control knob until the M position is shown in the comm chan window.
2. Place the communication function selector knob in the desired position. T/R or T/R+G.
3. Adjust each of the three comm freq mc control knobs at the top of central control to show the desired operating frequency in the comm freq mc window.

Guard Operation

1. Rotate the comm chan control knob until the G position is shown in the comm chan window.
2. Place the communication function selector knob to the T/R+G position.

ADF OPERATION (F-4C/D)

On all F-4C aircraft and F-4D aircraft thru 65-611, the ADF operation is as follows:

1. Set the bearing distance selector switches to ADF.
2. Place the communication function selector knob in the ADF+G position for ADF plus guard receiver operation, or place the switch in the ADF position for ADF operation only.

COMM RECEIVER-TRANSMITTER OPERATION (F-4D/E)

On F-4D aircraft 65-612 and up, and all F-4E aircraft, the comm receiver-transmitter operation is as follows:

1. Rotate the UHF volume control to the ON position and adjust it to about half of its rotation.
2. Place the mode selector switch to the CHAN position.
3. Depress the T/R - ADF comm-aux pushbutton.
4. Rotate the comm channel control knob to the desired channel.
5. After the first receiver signal is heard in the headphones, the volume may be adjusted.
6. Transmitting on the same channel is accomplished by depressing the throttle mounted microphone button.

Manual Adjustment of Frequencies

1. Place the mode selector switch to MANUAL.
2. Depress the desired comm-aux button, T/R - ADF or T/R+G - ADF.
3. Rotate the comm freq thumbwheel to select the desired frequency.

Guard Operation

1. Place the mode selector switch to GUARD.
2. Depress the T/R+G - ADF comm-aux pushbutton.

ADF OPERATION (F-4D/E)

On F-4D aircraft 65-612 and up, and all F-4E aircraft, the ADF operation is as follows:

1. Set the bearing distance selector switches to ADF.
2. Depress either the ADF+G-CMD or the ADF-GRD comm-aux pushbutton.
3. Place the mode selector switch to the MANUAL position and select the desired frequency through proper setting of the comm freq thumbwheels.

AUXILIARY RECEIVER PREFLIGHT CHECK

The auxiliary receiver can be preflighted in the following manner. Position the communication function selector knob to the auxiliary receiver CMD position and rotate the auxiliary volume control fully clockwise. A sound should be heard on the headsets under these conditions. Make this check on several frequencies. A further check may be made by receiving from the base control tower if deemed necessary.

ADF LOOP PREFLIGHT CHECK

The ADF loop should be checked with each of the two receivers utilized in the system, the comm receiver-transmitter, and the auxiliary receiver. Place the communication function selector knob (comm-aux pushbutton) on either central control panel to the comm receiver-transmitter ADF or the comm receiver-transmitter ADF+G position. Tune the main receiver-transmitter to the frequency of a station to known geographical location by use of the comm freq mc control knobs (comm frequency thumbwheels), and adjust the comm vol control knob to obtain a comfortable listening level in the headset. Observe the bearing pointer and note that it indicates the approximate direction of arrival of the known signal relative to the aircraft heading. Place the communication function selector knob (comm-aux pushbuttons) in the auxiliary receiver ADF position and tune the auxiliary receiver to a station of known geographical location by use of the aux chan control knob. Select ADF on the bearing/distance selector switch. Note that the bearing pointer indicates the approximate direction of arrival of the known signal relative to the aircraft heading. Adjust the aux vol control knob to obtain a comfortable listening level. (A 100 Hertz buzz should be heard in the headset while the antenna is searching.) A check may also be accomplished by utilizing the transmitting facilities in the base control tower if the aircraft is taxied to a remote point of the base.

CAUTION

On F-4C/D aircraft, the ADF antenna pattern is distorted when in the gear down configuration because of the close proximity of the nose landing gear door to the antenna. Therefore, the ADF system should not be relied upon as a primary navigational aid in the gear down configuration.

Note

- On F-4C/D aircraft, a bearing error in the system likely exceeds 30° when used on the ground, and therefore no accuracy tolerances are established for this condition.
- A tolerance of ± 3.5° of jitter (pointer hunting) of the bearing pointer is permissible.

Due to ADF pattern distortion at the higher frequencies of the UHF band, sizeable bearing inaccuracies can be expected at frequencies above 310 MHz. Precise navigational operation should be limited to assigned ADF frequencies (265 to 284.9 MHz) when using the auxiliary receiver, and to frequencies lower than 310 MHz when using the comm receiver-transmitter.

TACAN (TACTICAL AIR NAVIGATION) SET

The tacan navigation set functions to give precise bearing and distance information at ranges up to 196 miles (depending on aircraft attitude and altitude) from an associated ground or shipboard transmitting station. It also determines the identity of the transmitting station and indicates the dependability of the transmitting station signal. It also provides deviation indication from a selected course. The tacan navigation set employs UHF radio frequencies, the propagation of which is virtually limited to line of sight distances. The maximum distances from the beacon at which reliable tacan signals can be obtained depends on the altitude of the aircraft and the height of the transmitting antenna.

TACAN CONTROLS (F-4C/D)

On all F-4C aircraft and F-4D aircraft thru 65-611, controls for tacan operation are on the navigation control panels in the front and rear cockpit. Additional controls are the mode selector knob and brg/dist selector switches on the navigation function selector panel in the front cockpit instrument panel, and the navigation selector switch on the navigation function selector panel in the rear cockpit instrument panel.

Navigation Command Button

The nav cmd button control transfers control of UHF navigation (tacan) functions from one cockpit to the other. When the green light in the center of the nav cmd button in one cockpit illuminates, command of the tacan functions has been obtained in that cockpit. Then, the channel controls and function knob in that cockpit only are effective. The nav vol control knob is effective in both cockpits regardless of the take-command station.

Mode Selector Knob

The mode selector knob is a four-position rotary switch used to select the source of information for display on the HSI and ADI. In the TACAN position, the tacan system supplies the HSI with information to display the source of the selected tacan radial, deviation from the selected radial, and whether the course is to or from the tacan station. A steering signal which aids the pilot in making an asymptotic approach to the selected tacan radial is displayed on the bank steering bar of the ADI. The vertical director warning flag on the ADI is in view when the displayed tacan information is unreliable.

BRG/DIST Selector Switch

The brg/dist selector switch is a three-position switch used to control the source of information to the HSI bearing pointer, range indicator and mode word which indicates mode selected. With the switch in TACAN, the tacan system supplies information to the HSI bearing pointer and range indicator to indicate distance and magnetic bearing to the tacan station.

Navigation Function Selector Switch

When the navigation function select switch is placed to the UHF/ADF - TACAN position, the No. 2 pointer of the BDHI uses tacan system information to display magnetic bearing to the tacan station.

Tacan Function Selector Knob

The tacan function selector knob is a three-position rotary switch with positions marked STBY, REC, and T/R.

STBY - Only filament and blower power are being supplied to the receiver and transmitter.
REC - Only the receiver portion of the system is in operation. The system receives and decodes bearing signals from the tacan station and provides bearing information for HSI and BDHI bearing displays and ADI steering display.
T/R - In addition to the REC functions the system transmitter sends a signal to the tacan station and receives a signal which is used to determine the aircraft distance from the tacan station. This distance is displayed on the HSI and BDHI is nautical miles.

Navigation Channel Control Knobs

Two nav chan control knobs, one to the right and one to the left of the nav chan window permit channel selection. The left knob selects the tens and hundreds digits of the operating channel. The right knob selects the units digits of the operating channel. The dial system is numbered 0 to 129, each number from 1 to 126 represents a specific pair (transmitting and receiving) of frequencies. Number 0, 127, 128 and 129 on the channel dial are not usable.

Navigation Volume Control Knob

The nav vol control knob is used to adjust the volume of an audio identification signal received from the transmitting station. The identification signal, consists of a two- or three-letter tone signal in international morse code. The identification signal is normally transmitted every 30 seconds.

TACAN CONTROLS (F-4D/E)

On F-4D aircraft 65-612 and up and on all F-4E aircraft, controls for tacan operation are on the navigation control panels in the front and rear cockpits. Additional controls are the navigation command buttons and indicators on the communication control panel, the mode selector knob and brg/dist selector switch on the navigation function selector panel in the front cockpit instrument panel, and the navigation function selector switch on the navigation function control panel on the instrument panel in the rear cockpit.

Navigation Command Button and Indicator

The navigation command (nav cmd) button and indicator are on the upper right corner of the communication control panel. Operation of this button allows the crewmember to take or relinquish command of the tacan system. A green light to the left of the button illuminates in the cockpit which has navigation command.

TACAN Function Selector Knob

The tacan function selector knob is a four-position rotary switch with positions marked OFF, REC, T/R and A/A.

OFF - The tacan system is deenergized.

REC - Only the receiver portion of the system is in operation. The system receives and decodes bearing signals from the tacan station and provides bearing information for HSI and BDHI bearing displays and ADI steering display.

T/R - In addition to the REC functions the system transmitter sends a signal to the tacan station and receives a signal which is used to determine the aircraft distance from the tacan station. This distance is displayed on the HSI and BDHI in nautical miles.

A/A - The A/A position is inoperative.

Tacan Channel (TCN CHAN) Control Knobs

Refer to navigation channel control knobs, this section.

Tacan Volume (TCN VOL) Control Knob

Refer to navigation volume control knob, this section.

Mode Selector Knob

Refer to mode selector knob, this section.

BRG/DIST Selector Switch

Refer to BRG/DIST selector switch, this section.

Navigation Function Selector Switch

Refer to navigation function selector switch, this section.

FLIGHT CHECKS OF TACAN SYSTEM

To check operation of the tacan receiver and transmitter while in flight, proceed as follows:

1. After sufficient warm-up time for the tacan transmitter and receiver, set function selector knob to T/R. Set mode and bearing/distance selector switches to TACAN.
2. Tune to and identify a tacan ground station.
3. When the aircraft is directly over a suitable visual checkpoint, note bearing and distance on BDHI and HSI. This should correspond to the bearing and distance of the tacan ground station as determined from an aeronautical chart.

WARNING

When in the gear down configuration, reflections and improper polarization of the tacan antenna may cause erratic deviations in the bearing pointer. These deviations are usually greater close to the station and vary with the relationship of the pattern to the station. When using tacan with gear down, cross check with ground radar, airborne radar and other means. In addition, with gear up, the tacan system may occasionally be subject to a false lockon which results in an erroneous bearing indication. Because of an inherent characteristic of the system, the error is probably ± 40 degrees, but can be any value which is a multiple of 40 degrees and can be either side of the correct bearing. Therefore, when using the tacan with gear up, cross check for false lockon with ground radar, airborne radar, dead reckoning, or other available means. These cross checks are especially important when switching channels. If a false lockon is suspected switch to another channel, check it for correct bearing, and then switch back to the desired channel. If a false lockon still persists, utilize other equipment or aids available.

4. Set the navigation channel to an unused channel. After about 10 seconds, the range warning flag on the range indicator should cover the distance display, the bearing pointer of the indicator should resume searching, and the audio identification signal should cease.
5. Turn off the equipment by placing the navigation function selector knob to STBY/OFF.

IFF/SIF RADAR IDENTIFICATION (F-4C/D)

The IFF and SIF (selective identification feature) form the radar identification system. The F-4D aircraft provides SIF capability only, and the F-4C can have either a combination of Mark X IFF and SIF capability, or SIF only, depending upon the type of equipment installed. On aircraft with the combination Mark X IFF and SIF installed only one can be used. Selection of Mark X or SIF can only be made on the ground prior to flight. The identification system provides automatic selective identification of the aircraft in which it is installed when properly challenged by surface or airborne radar sets. Supplementary purposes are to provide momentary identification of position upon request and to transmit a specially coded response to indicate an emergency. In operation, the radar identification system receives coded interrogation signals and transmits coded responsive signals to the source of the challenge, where the response is displayed, together with associated radar information (target, etc.) on the radar scope. Proper reply indicates the target is friendly. Three modes of operation are provided for response to interrogation signals. These are known as mode 1, mode 2, and mode 3, which are used for security identification, personal identification and traffic identification, respectively. The Mark X IFF provides replies to challenges in all three selected modes during normal operation, provides special replies to challenges in all three modes during emergency operation, and provides special replies to challenges in mode 2 only during identification of position (I/P) operation. When using SIF, there are three possibilities of operation depending upon which type of equipment is installed. With the first type replies during normal operation in all three modes, replies in mode 1 only during emergency operation, and replies in mode 1 only during I/P operation. With the second type reply in all three modes during normal operation, replies in mode 1 only during emergency operation, and replies in modes 1 and 3 only during I/P operation. With the third type, replies in all modes during normal, emergency and I/P operation. F-4D aircraft have only the last type of equipment. In F-4C aircraft, the type of equipment installed cannot be determined from the cockpit. The IFF/SIF radar identification system is operated by two control panels, the IFF control panel and the SIF control panel. Both panels are on the front cockpit right console.

IFF CONTROL PANEL

The IFF control panel is used for operation of the Mark X and SIF. The panel contains the master control knob, the two mode selector switches, and the I/P switch.

Master Control Knob

The master control knob is a five position knob marked OFF, STBY, LOW, NORM and EMER. The OFF position removes all power except filament voltage from the set. Filament voltage is present any time the aircraft bus system is energized. In STBY, the system is inoperative but ready for instant use. In LOW, the system operates in partial sensitivity and replies only in the presence of strong interrogations. In NORM, the system operates in full sensitivity which provides maximum performance. In EMER, the system responds with special coded signals indicating an emergency. A dial stop to the lower left of the knob, must be pressed to position the knob to the EMER position. The emergency Mark X IFF or SIF is tripped automatically upon ejection of either or both crewmembers, regardless of switch position. If the master control knob is in the OFF position prior to ejection, the emergency signal is not transmitted until 90 seconds after ejection. The system operates in mode 1 whenever the master control knob is placed to any position other than OFF or STBY.

Mode 2 Selector Switch

The mode 2 selector switch is a two position toggle switch with positions MODE 2 and OUT. The MODE 2 position activates mode 2 operation and permits replies to mode 2 interrogations. The OUT position disables mode 2 operation.

Mode 3 Selector Switch

The mode 3 selector switch is a two position toggle switch with positions MODE 3 and OUT. The MODE 3 position activates mode 3 operation and permits replies to mode 3 interrogations. The OUT position disables mode 3 operation.

Identification of Position Switch

The identification of position (I/P) switch is a three position toggle switch with positions I/P, MIC and OUT. The I/P position, a spring-loaded momentary position, is used to enable the system to reply to interrogations with special coded signals which are displayed to the ground radar operator to determine the position of the responding aircraft. After the switch is released, the system responds with I/P signals for a period of from 15 to 30 seconds, depending upon which configuration is installed in the aircraft. The period for the equipment installed in the F-4D is from 15 to 30 seconds. The MIC position has the same functions as the I/P position, except that the UHF microphone switch must be keyed. The OUT position disables the I/P function and standard replies are provided by the system. For Mark X operation, only mode 3 interrogations are replied to and the mode 2 selector switch must be in the OUT position.

SIF CONTROL PANEL

The SIF control panel is used for operation of the SIF only. The panel contains the mode 1 code selector switch and the mode 3 code selector switch, which are used to select the coded replies for modes 1 and 3, respectively. Mode 2 replies are preset prior to flight and cannot be reset while airborne.

Mode 1 Code Selector Switch

The mode 1 code selector switch is a rotary type switch containing two concentric knobs which are rotated to select reply codes for mode 1 operation. The outer knob controls the first digit of the reply code and has eight positions, 0 through 7. The inner knob controls the second digit of the reply code and has four positions, 0 through 3. Thus, selection of 5 on the outer knob and 3 on the inner knob selects a reply code 53. There are 31 possible mode 1 code selections.

Mode 3 Code Selector Switch

The mode 3 code selector switch functions the same as the mode 1 code selector switch, except that the inner knob has eight positions. There are 63 possible mode 3 code selections.

OPERATION OF RADAR IDENTIFICATION SYSTEM

1. Rotate master control knob to STBY to maintain equipment inoperative but ready for instant use.
2. Rotate master control knob to NORM to place equipment in operation.

Note

- The LOW position of the master control knob should be used only upon request from a controlling agency.
- Mode 1 is in operation when the master control knob is in any position except OFF or STBY.

3. Set Mode 2 and Mode 3 selector switches as desired.
4. For emergency operation in Mark X, press dial stop and rotate master control knob to EMER. For emergency SIF operation in the F-4C, press dial stop and rotate master control knob to EMER, and set Mode 3, code 77 on SIF code selector switches.

Note

In early modes of SIF, no emergency replies in mode 3 can be transmitted, so normal code 77 is selected to indicate an emergency.

For emergency SIF operation in the F-4D press dial stop and rotate the master control knob to EMER.

5. Rotate master control knob to OFF to turn set off.

IDENTIFICATION SYSTEM (IFF) (F-4D/E)

Note

On F-4D aircraft 66-7487 thru 66-7504, the IFF control panel (figure 1-18) contains the mode C selector switch and the mode 4 switches; however, these aircraft do not have the mode C altitude reporting capability, or the mode 4 capability. Also, on these aircraft the mode 2 and mode 3/A self test position is inoperative, and mode 1 is made operative when the master switch is in any operating mode.

The identification system provides automatic identification of the airplane in which it is installed when challenged by surface or airborne radar sets. Supplementary purposes are to provide momentary identification of position upon request, and to transmit a specially coded response to indicate an emergency. In operation, the identification system receives coded interrogation signals and transmits coded response signals to the source of the challenge. Proper reply indicates the target is friendly. Three modes of operation are provided for interrogation or response to interrogation signals. These are known as mode 1, mode 2 and mode 3/A, which are used for security identification, personal identification and traffic identification, respectively. Controls are provided for on the IFF control panel for a fourth mode, mode 4, but this mode is presently inoperative. The codes for modes 1 and 3/A can be set in the cockpit, but the code for mode 2 must be set on the ground. Mode 2 can be set from code 0000 to code 7777.

IFF CONTROL PANEL

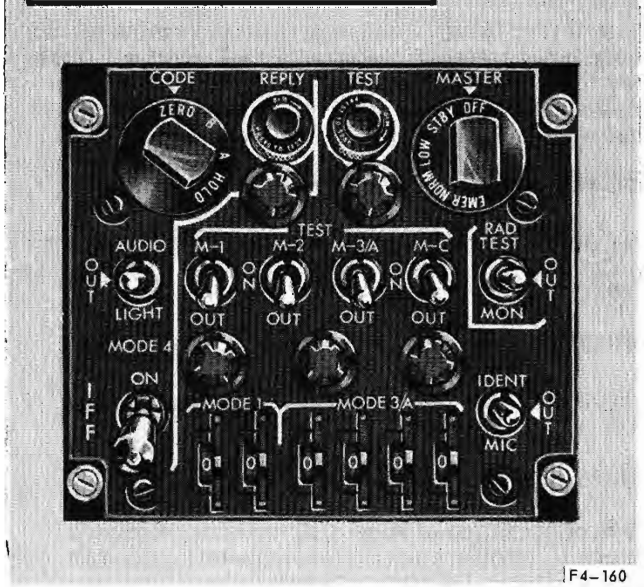


Figure 1-18

IFF CONTROLS AND INDICATORS

F-4C/D aircraft after T.O. 1F-4-754 contain the IFF control panel (figure 1-18) and have the Mode 4 operating capability. F-4E aircraft 68-410 and up, and F-4E aircraft after T.O. 1F-4E-551, also have Mode 4 capability. The controls on the IFF control panel consist of the MASTER switch, the Mode 1, Mode 2, Mode 3/A and Mode 4 selector switches, the Mode C selector switch, used for altitude reporting (labeled MC-ON-OUT), the Mode 1 and Mode 3/A code selectors, the identification of position switch, the Mode 4 indication switch (with positions AUDIO-OUT-LIGHT), the Mode 4 function switch (with positions ZERO-B-A-HOLD), and the monitor - radiation test enable switch. The IFF indicators are on the IFF control panel. They consist of the self test reply indicator light (labeled TEST), and the Mode 4 reply indicator light (labeled REPLY). An IFF light and ALT ENCODER OUT light are on the telelight panel. Illumination of the IFF light indicates that Mode 4 is not functioning. The ALT ENCODER OUT light illuminates if the altitude reporting signal from the altitude encoder unit is unreliable.

Master Switch

The master switch is a five position rotary switch which controls the operation of the entire system as indicated below:

OFF	Identification system deenergized.
STBY	Full power supplied to the system, but with interrogations blocked.
LOW	Causes identification system to operate with reduced sensitivity.
NORM	Allows system to operate at normal sensitivity.
EMER	Allows the system to respond to interrogations in Modes 1, 2, 3/A, and 4. The reply for Modes 1 and 2 is the code selected on the applicable dials, while Mode 3/A transmits code 7700. Upon ejection from either cockpit, emergency operation automatically becomes active.

Mode 1 Selector Switch

The three position Mode 1 selector switch controls the operation of Mode 1 as follows:

M-1	Self test position. (Inoperative)
ON	Enables Mode 1 for operation.
OUT	Disables Mode 1.

Mode 2 Selector Switch

The three position Mode 2 selector switch controls operation of Mode 2 as follows:

M-2	Self test position. TEST light illuminates if Mode 2 is operating properly.
ON	Enables Mode 2 for operation.
OUT	Disables Mode 2.

Mode 3/A Selector Switch

The three position Mode 3/A selector switch controls operation of Mode 3/A as follows:

M-3/A	Self test position. TEST light illuminates if Mode 3/A is operating properly.
ON	Enables Mode 3/A for operation.
OUT	Disables Mode 3/A.

Mode C Selector Switch

The three position Mode C selector switch controls operation of Mode C as follows:

M-C	Self test position. (Inoperative)
ON	Enables Mode C for operation.
OUT	Disables Mode C.

Mode 4 Selector Switch

The two position selector switch controls the operation of Mode 4 as follows:

ON	Enables Mode 4 for operation.
OUT	Disables Mode 4.

Mode 1 and Mode 3/A Code Selectors

The Mode 1 code selector selects Mode 1 codes from 00 to 73. The Mode 3/A code selector selects Mode 3/A codes from 0000 to 7777.

Identification of Position Switch

The identification switch is a three position toggle switch utilized by the pilot upon request to provide momentary identification of position. The three positions are as follows:

IDENT	Allows the system to respond with identification of position replies in all modes that are being used. The response is continued for a 15 to 30 second duration after the switch is released.
OUT	Disables identification of position capability.
MIC	Same as positioning the switch to IDENT, except that the UHF microphone button must be keyed.

Mode 4 Indication Switch

This switch has positions of AUDIO, OUT, and LIGHT. In AUDIO, an audio signal indicates Mode 4 interrogations are being received. The Mode 4 REPLY light illuminates when replies are transmitted. In LIGHT, the Mode 4 REPLY light illuminates when Mode 4 replies are transmitted. Audio is not present. In OUT, both light and audio indications are inoperative.

Mode 4 Function Switch

This switch has positions of ZERO, B, A, and HOLD. When the switch is placed to A, the system's transponder responds to Mode 4 interrogations from an interrogator using the same setting as set into the A position. In B, interrogations from an interrogator using the same code setting as that set into the B positions are answered. The code settings for the A and B positions are inserted before flight. Both code settings can be zeroized by placing the Mode 4 function switch to ZERO. The HOLD position is not used in flight.

Monitor-Radiation Test Switch

This switch has positions of RAD TEST, MON, and OUT. The switch is placed to the OUT position and is not used during flight.

SELF TEST OPERATION

To self test Modes 2 and 3/A, hold the switch for the mode being tested to the upper (test) position. If the test light on the IFF control panel illuminates, this indicates the mode is operating properly. Mode 1 and Mode C do not have the self test feature.

AIR-TO-AIR INTERROGATION SYSTEM (GAINTIME)

For description and operation of this system, refer to Gaintime and Related Equipment manual, T.O. 12P4-2ASQ-111.

INTERROGATOR SET AN/APX-76

For description and operation of this set, refer to T.O. 1F-4C-34-1-1A.

CNI EMERGENCY OPERATION (F-4C/D)

Loss of operation of some CNI units and degraded operation of others occurs when operating on RAT power or when the EMER POWER light on the navigation control panel is illuminated. On F-4D aircraft 65-612 and up the EMER POWER light has been removed. When operating on RAT power the UHF communications receiver, ICS and IFF operate normally. On aircraft thru 65-611 the communications transmitter operates at reduced power while on aircraft 65-612 and up the transmitter operates normally. When operating on RAT power the auxiliary receiver, ADF and tacan are inoperative. On those aircraft with an EMER POWER light, if the light illuminates, the communication receiver, auxiliary receiver, ADF and ICS operate normally. The tacan will be inoperative. On aircraft thru 65-611 the communications transmitter operates at reduced power, while on aircraft 65-612 and up the transmitter operates normally. The SIF operates normally in F-4D aircraft while IFF (SIF) operation in the F-4C depends upon which power supply is malfunctioning.

CANOPIES

Each cockpit area is enclosed by a separate transparent, acrylic plastic, clam shell type canopy. The canopies are hinged aft of each cockpit enclosure and open approximately 53°. Canopy operation, both normal and emergency, is accomplished pneumatically. Clean dry air at 3000 psi is supplied by the basic pneumatic system and is reduced by a pressure regulator to 900 ± 100 psi for use in the normal canopy system. Individual manual internal and external controls are provided for each cockpit. Normal canopy closing time, from full open to lock light out is 4 to 9 seconds. Each cockpit employs an inflatable canopy seal to seal the canopies for cockpit pressurization. The canopy seals are automatically inflated after canopy closing and deflated prior to canopy opening. The respective cockpit canopy internal control handle is on the left side of the cockpit above the flap control panel and just below the canopy sill. Each canopy control operates independently of the other. Pull the control handle aft to OPEN the canopy; push forward to CLOSE the canopy. The cockpit external canopy control pushbuttons are on the left side of the aircraft just below the respective canopy frame. Push the OPEN button to open the canopy; push the CLOSE button to close the canopy. The pushbuttons operate the same valves as the internal canopy controls. After T.O. 1F-4-891, a guard is installed around the rear canopy control to prevent inadvertent actuation of the rear canopy control due to uncontrolled rearward motion of aft crewman.

EXTERNAL CANOPY MANUAL LOCK/UNLOCK HANDLES

The canopy external manual unlock handle is on the left side of the fuselage below the rear end of the respective canopy. Operating a push-type latch causes the handle to pop out about 1-3/4 inches. A 63° rotation of the handle unlocks the canopy lock mechanism and permits the canopy to be lifted open manually. Operating the handles in the opposite direction, when the canopy is closed, locks the canopy. Before manual locking or unlocking of the canopy, the normal canopy pushbutton must be pressed to close position before locking, to open position before unlocking. The manual lock/unlock handle is used in the event the aircraft pneumatic systems are depleted.

INTERNAL CANOPY MANUAL UNLOCK HANDLES

The respective cockpit manual canopy unlock handle is on the right side of each cockpit. The handle, when pulled aft, unlocks the canopy so that it may be pushed open. Before manual unlocking of the canopy, the normal control lever must be placed in the OPEN position. The manual unlock handle is used in the event the aircraft pneumatic systems are depleted.

CANOPY UNLOCKED WARNING LIGHT

A red CANOPY UNLOCKED warning light, on the telelight panel in the front cockpit and on the instrument panel in the rear cockpit, is used to notify the crew that a canopy is unlocked. The front cockpit CANOPY UNLOCKED light illuminates when either canopy is unlocked. The rear cockpit warning light illuminates only when the rear canopy is unlocked.

CAUTION

The canopy should not be stopped in an intermediate position.

CANOPY EMERGENCY SYSTEMS

The canopies are jettisoned by compressed air supplied from the basic pneumatic system to two independent canopy jettison systems (one for each cockpit). Each canopy jettison system incorporates an air bottle which traps and stores compressed air at 3000 psi and a pressure operated valve that is off-seated by ballistic pressure when the seat mounted or bulkhead mounted initiator is fired. The seat mounted initiator is fired by pulling the face curtain or lower ejection handle during the ejection sequence. The bulkhead mounted initiator is fired by the emergency canopy release handle or the external canopy jettison lanyard. When the external canopy jettison lanyard is actuated, both canopy jettison systems are operated and both canopies are jettisoned in sequence (front canopy first) for ground rescue purposes. When the ejection handles or the canopy jettison handles are pulled, an initiator is fired. Gas pressure from the initiator off-seats the pressure operated valve which directs air pressure to the bottom side of the canopy actuator. At the same time, all air pressure from the top of the canopy actuator is directed to a dump valve. The canopy opens quickly and its momentum shears the canopy attaching points. After T.O. 1F-4-906, electrically initiated cartridge thrusters are incorporated in the canopy sills under the forward cockpit canopy. The thrusters are designed to assist the canopy actuating cylinder during canopy jettisoning by providing a thrust on the forward part of the canopy to lift it quickly up into the airstream as soon as the canopy is unlocked. The thrusters are fired electrically by a thermal battery which is activated by gases from either the seat mounted or cockpit mounted initiators. Once having been activated, the battery fires the thrusters through the canopy unlock switch as soon as the canopy unlocks and the switch closes. The canopy will not jettison when it is open because the canopy actuator is already at the top of its stroke, therefore, it cannot develop momentum. On aircraft after T.O. 1F-4-874, a plastic protector is installed over the aft bulkhead mounted canopy initiator and its adjacent actuating linkages. The purpose of the protector is to prevent inadvertent canopy jettison. Space is provided for installation and removal of the initiator safety pin, and a window is provided in the protector for inspection of the linkages and safety pin. On aircraft after T.O. 1F-4-898, a guard is installed over the seat mounted initiator in the rear cockpit to give added protection against inadvertent initiation due to foreign objects.

WARNING

Do not jettison front canopy if rear canopy is open and rear seat is occupied because the front canopy will collide with the rear canopy and fall into the rear cockpit.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

The exterior lights consist of the position lights (wing and tail) join-up lights (wing only), fuselage lights, anti-collision light, landing light, taxi light, inflight refueling receptacle light and flood lights and electroluminescent formation lights. The exterior lights control panel is on the right console, front cockpit. The exterior lights control panel contains all the manual controls for exterior lighting.

Position and Join-Up Lights

The position lights include a green light on the right wing tip, a red light on the left wing tip, and a white light on the tip of the vertical stabilizer. The join-up lights consist of an additional green and red light on the trailing edge of the applicable wing tip. The wing lights and join-up lights are controlled by one switch, labeled WING, with positions marked OFF, DIM and BRT. The wing and join-up lights do not have flash capabilities. The tail light is controlled by a similar switch labeled TAIL. The tail light will not illuminate unless the flasher switch is in the STEADY or FLASH positions. The tail light flashes when the flasher switch is in the FLASH position. When the switches are in BRT, the lights illuminate at full brilliance. Placing the switches to DIM reduces the brilliance of the lights. The position and join-up lights BRIGHT utilize right main 28 volt ac power, and the lights DIM utilize left main 14 volt ac power.

Anti-Collision and Fuselage Lights

Three semi-flush white lights are on the fuselage, one immediately aft of the rear cockpit canopy, and one light below each of the engine intake ducts. One red anti-collision light is on the leading edge of the vertical stabilizer. The anti-collision and fuselage lights are controlled by one switch, labeled FUS, with positions marked OFF, DIM and BRT. The anti-collision light illuminates only when the fuselage switch is in the BRT and flasher switch is in the FLASH position. The fuselage lights will not illuminate unless the flasher switch is in the STEADY or FLASH positions. The fuselage lights flash when the flasher switch is in the FLASH position. The fuselage lights BRT and DIM utilize left main 28 volt ac bus. One of the two lamps in the anti-collision light utilizes right main 28 volt ac power and the other lamp utilizes left main 28 volt ac power.

Exterior Lights Flasher Switch

The exterior lights flasher switch, on the exterior lights control panel, actuates a flasher relay and flasher unit when FLASH is selected. The flasher unit operates in conjunction with the fuselage lights, anti-collision light and tail light. The two positions of the exterior lights flasher switch are FLASH and STEADY. If steady is selected the tail light and fuselage lights produce a steady illumination, providing the FUS light switch and TAIL light are in the DIM or BRT positions. Placing the flasher switch to FLASH causes the fuselage lights, tail light, and anti-collision light to flash. With the flasher switch in the OFF position, the anti-collision light is not energized. On F-4C/D aircraft the flasher unit and relay is powered by the right main 28 volt dc bus. On F-4E aircraft the flasher unit and relay is powered by the main 28 volts dc bus.

Landing and Taxi Lights

The landing and taxi lights are on the forward nose gear door. The landing and taxi lights switch is on the outboard side of the left throttle grip, and has three positions - LANDING, OFF, and TAXI. On F-4C aircraft after T.O. 1F-4C-591 and on all F-4D/E aircraft after T.O. 1F-4D-513, the switch is on the sub-panel of the front canopy. The taxi light is illuminated by right 28 volt ac bus power and the landing light is illuminated by left 28 volt ac bus power. Since circuitry of both lights goes through the left main landing gear down limit switch, the left main landing gear must be down for operation of either light.

IFR Receptacle Light and Flood Lights

A light in the air refueling receptacle compartment illuminates automatically when the air refueling receptacle is raised for night air refueling operations. On all F-4E aircraft, two IFR flood lights are added to the fuel cell 2 door and face aft to improve illumination of the receptacle. This makes night air refueling contacts more accessible, thereby reducing possible damage to the receptacle or boom. These lights also illuminate automatically when the receptacle is raised. The IFR receiver flood lights circuit breaker is on the No. 2 circuit breaker panel, zone H6 (F-4C), zone H7 (F-4D), and zone E6 (F-4E). The air refueling receptacle circuit breaker is also on the No. 2 circuit breaker panel, zone D1. On F-4C/D aircraft the air refueling receptacle utilizes essential 28 volt dc electrical power. On all F-4E aircraft, the air refueling receptacle receives power from the right main 28 volt ac bus. The IFR receiver flood lights receive their power from the right main 28 volt ac bus.

Formation Lights

On all aircraft after T.O. 1F-4-776, electroluminescent formation lights on the outer wing tips between the position lights and join-up lights, and on both sides of the vertical stabilizer, mid-fuselage and forward fuselage are controlled by the formation lights switch and a variable control knob on the forward cockpit exterior lights control panel. The switch has positions ON, OFF, and MOM (momentary). The control knob, to the right of this switch, controls the intensity of the formation lights with positions OFF, DIM, MED, BRT, and JOIN-UP. The JOIN-UP position which is merely brighter than the BRT position is selected during the initial join-up operation. The left outer wing tip formation lights are red and the rest of the formation lights are green. Use of these lights during daylight hours is prohibited and a 3 amp fuse on the panel protects the dimming circuitry in the event of accidental daylight switch actuation which could result in excessive current. Power for these lights is provided by the right 115 volt ac bus.

CAUTION

Do not use formation lights during daylight hours.

INTERIOR LIGHTING (FRONT COCKPIT)

Most of the lighting controls for the front cockpit, are on the cockpit lights control panel right console. A utility light, under the right canopy sill, has its own on-off switch and intensity control. An emergency red floodlight switch is above the cockpit lights control panel. The interior lights utilize ac power, from either the engine driven generators or RAT.

However, the instrument panel lights, the instrument emergency floodlights (BRT) and the console red floodlights (BRT) are the only lights that are illuminated by the RAT driven generator in F-4C/D aircraft.

Instrument Panel Lights

Variation in instrument panel lighting is controlled by the instrument panel lights control knob, on the cockpit lights control panel. The control knob, labeled INSTR PANEL, has positions marked OFF and BRT. As the control knob is rotated out of the OFF detent, the instrument panel lights illuminate dimly, and any energized warning and caution lights, except FIRE and OVERHEAT warning lights, are reduced in intensity. On F-4E aircraft 69-7261 and up, warning and caution lights dimming is controlled by the flight instruments lights control knob in the same manner as the instrument panel lights control knob. As the control knob is rotated toward BRT, the instrument panel lights increase in intensity. Secondary instrument panel lighting is provided by emergency (red) floodlights under the instrument panel glare shield. The control for the emergency floodlights is above the cockpit lights control panel, and it is labeled instrument panel emergency flood. The emergency floodlights switch is marked OFF, DIM and BRT. On F-4C/D aircraft, the instrument panel lights are powered by the essential 115/200 volt ac bus. On F-4E aircraft the instrument panel lights are powered by the right main 115/200 volt ac bus. The red floodlights BRIGHT are powered by the essential 28 volt dc bus, and DIM by the left main 14 volt ac bus.

Console Lights

Console lighting is comprised of a combination of edge lights and floodlights. Variation in edge light intensity is controlled by the console lights control knob on the cockpit lights control panel. The control knob has positions marked OFF and BRT, and controls all edge lighting on the left console, the right console, the pedestal panel, and the armament control panels on the instrument panel. When the control knob is rotated out of the OFF detent, the console lights illuminate dim, and the console floodlights illuminate. The console floodlights switch, on the cockpit lights control panel, selects DIM, MED or BRT brilliance of the console floodlights. The console floodlights are off only when the console floodlights switch is in the DIM position and the console lights control knob is in the OFF detent. The console edge lights receive power from the left main 115/200 volt ac bus. On F-4C/D aircraft the console floodlights MED and BRT are powered by a 28 volt tap from the left main 115/200 volt ac bus. On F-4E aircraft the console floodlights MED and BRT are powered by a 28 volt tap from the right main 115/200 volt ac bus through an autotransformer.

White Floodlights

One white floodlight (thunderstorm light) is above each console, under the canopy sill. The white floodlight control switch has positions marked OFF and ON and is mounted on the cockpit lights control panel. The switch is a lever-lock type switch to prevent inadvertent actuation. Power for the white floodlights is provided by the battery through the 28 volt battery bus, which is energized at all times.

Magnetic (Standby) Compass Light

The standby magnetic compass light is controlled by the standby compass light switch and the console lights control knob. The light is turned on by placing the standby compass switch to ON and turning the console light control knob from the OFF position. The light intensity is then varied by the control knob. Power for the light is provided by the left 115/200 volt ac bus forward cockpit console lights autotransformer.

Indexer Lights

Angle of attack indexer lights are provided for both cockpits. The indexer lights control knob has positions marked DIM and BRT. Rotating the control knob clockwise from DIM to BRT increases the intensity of the indexer lights. Power for the indexer lights is provided by the instrument 28 volt ac bus.

Utility Light

A detachable utility light is under the right canopy sill. The light has its own on-off and intensity control. The light may be changed from red to white to red by depressing the lens latch button and rotating the lens housing. Power for the utility light is supplied by the left main 28 volt ac bus.

Warning Lights Test Switch

The warning lights test switch, a two-position toggle switch, is on the cockpit lights control panel. The switch has positions marked NORM and TEST and is spring-loaded to the NORM position. When the switch is placed to TEST, all warning lights illuminate except the AIR DATA MODE, EJECT, and EMERGENCY POWER lights. The warning lights test circuit receives power from the warning lights 28/14 volt ac bus. On F-4C/D aircraft the warning lights test control circuit receives power from the right 28 volt dc bus and on F-4E aircraft from the main 28 volt dc bus.

Instrument Lights Intensity Control Panel

F-4E aircraft 69-7261 and up contain an instrument lights intensity control panel on the right console. The control panel contains six knobs which are used to independently vary the intensity of the lights on the following instruments: airspeed/mach indicator, attitude director indicator, angle of attack indicator, vertical velocity indicator, altimeter, and the horizontal situation indicator. The intensity of each light increases as its control knob is rotated clockwise.

Flight Instrument Lights Control Panel

F-4E aircraft 69-7261 and up contain a flight instrument lights control panel on the left corner of the main instrument panel. The control panel contains a knob which is used to control simultaneously the intensity of the lights of the following instruments: airspeed/mach indicator, attitude director indicator, angle of attack indicator, vertical velocity indicator, altimeter, and the horizontal situation indicator. The fully counterclockwise position is OFF. As the control is rotated clockwise the intensity of the lights increase. A switch within the control, actuated when the control knob is moved from OFF, dims the warning lights and HSI mode lights.

INTERIOR LIGHTING (REAR COCKPIT)

Cockpit lighting control knobs and switches in the rear cockpit are identical to those in the front cockpit. However, the angle of attack indexer light control knob on the F-4C is on a separate panel. The cockpit lights control panel is on the right console and has a two-position white floodlights switch, a two-position magnetic compass light switch, a three-position console floodlights (red) switch, a two-position warning lights test switch, and instrument panel lights control knob and a console edge lights control knob. All control knobs and switches work identically to those in the front cockpit. However, the intensity of the rear cockpit warning lights is dependent on the position of the front cockpit instrument panel light control knob.

OXYGEN SYSTEM

Breathing oxygen is supplied by a 10 liter (10.6 quart) liquid oxygen system. The system basically consists of a converter (a coil to convert from liquid to gaseous oxygen), a console mounted pressure demand regulator, to be utilized with the standard flight suit, and an additional oxygen on-off lever which is utilized with the full pressure suit. When wearing a standard flight suit, the pressure suit oxygen supply lever should be OFF. When wearing a pressure suit, the console mounted pressure demand regulator is not utilized and its oxygen supply lever should be OFF. The oxygen system functions at a pressure of 75 ± 25 psi, and remains within that range until the converter is depleted. Relief valves are incorporated to prevent excessive pressure build-up. See figure 1-19 for the oxygen duration chart.

Note

- The console mounted pressure demand regulator does not supply oxygen to the pressure suit. A separate pressure demand regulator is mounted in the pressure suit helmet.
- Even though there is no flow from the system, approximately 15% of the system capacity is lost every 24 hours. This loss is due to the conversion of liquid oxygen to gaseous oxygen and subsequent pressure relief.

OXYGEN REGULATOR (CONSOLE MOUNTED)

The console mounted oxygen regulator is on the left console in the front cockpit and the left subpanel in the rear cockpit. The regulator automatically controls the pressure and rate of flow of oxygen based on demand and altitude. It provides a proper mixture of air and oxygen at low altitudes, and pressure oxygen at high altitudes. The console mounted oxygen regulator also provides a relief for any excess oxygen mask pressures.

Supply Lever

A two-position supply lever, on the lower right corner of the regulator panel, controls the flow (on or off) of oxygen from the regulator. With the lever in the OFF position, only cockpit air is available at the mask.

WARNING

If the oxygen supply lever is in OFF position when the standard flight suit is worn, the crewmember will only be breathing cockpit air. Therefore, it is imperative to check for oxygen flow prior to takeoff, or hypoxia will occur as altitudes are reached that require oxygen.

Diluter Lever

A two-position diluter lever, in the center of the regulator panel, controls the mixture of air and oxygen. For a proportional amount of air to oxygen, the NORMAL OXYGEN position should be selected. For only oxygen, the 100% OXYGEN position should be selected.

Emergency Lever

A three-position emergency lever on the lower left corner of the regulator panel, permits selection of emergency positive pressure, normal oxygen supply, or testing pressure for a face mask check. The lever should remain in the center (NORMAL) position at all times, unless an unscheduled pressure increase is required. Moving the lever to EMERGENCY provides continuous positive pressure to the face mask for emergency use. Moving the lever to TEST MASK provides positive pressure to test the face mask for leaks.

CAUTION

It is mandatory that the oxygen face mask be well fitted to the face. A leaking mask results in depletion of the oxygen supply and may also result in extremely cold oxygen flowing to the face mask.

OXYGEN DURATION CHART

STANDARD SUIT WITH MASK, 100% AND NORMAL

OXYGEN DURATION-HOURS

COCKPIT ALTITUDE FEET	GAGE QUANTITY-LITERS										
	10	9	8	7	6	5	4	3	2	1	BELOW 1
35,000 and UP	24.3 24.3	21.8 21.8	19.4 19.4	17.0 17.0	14.6 14.6	12.1 12.1	9.7 9.7	7.2 7.2	4.8 4.8	2.4 2.4	EMERGENCY-DESCEND ALTITUDE NOT REQUIRING OXYGEN
30,000	17.8 18.0	16.0 16.2	14.2 14.4	12.5 12.6	10.7 10.8	8.9 9.0	7.1 7.2	5.3 5.4	3.5 3.6	1.7 1.8	
25,000	13.7 17.0	12.3 15.3	10.9 13.6	9.6 11.9	8.2 10.2	6.8 8.5	5.4 6.8	4.1 5.1	2.7 3.4	.3 1.7	
20,000	10.3 19.2	9.3 17.2	8.3 15.3	7.2 13.4	6.2 11.4	5.1 9.6	4.1 7.6	3.1 5.7	2.0 3.8	1.0 1.9	
15,000	8.3 23.4	7.4 21.0	6.7 18.7	5.8 16.4	5.0 13.9	4.1 11.7	3.3 9.3	2.5 7.0	1.6 4.6	.8 2.3	
10,000	6.7 23.4	6.0 21.0	5.3 18.7	4.7 16.4	4.1 13.9	3.3 11.7	2.6 9.3	2.0 7.0	1.3 4.6	.6 2.3	

- UPPER FIGURES INDICATE DILUTER LEVER–100% OXYGEN
- LOWER FIGURES INDICATE DILUTER LEVER–NORMAL OXYGEN

PRESSURE SUIT: 100% OXYGEN

OXYGEN DURATION-HOURS

COCKPIT ALTITUDE FEET	GAGE QUANTITY-LITERS										
	10	9	8	7	6	5	4	3	2	1	BELOW 1
30,000	10.0	9.0	8.0	7.0	6.0	5.0	4.0	3.0	2.0	1.0	EMERGENCY-DESCEND ALTITUDE NOT REQUIRING OXYGEN
25,000	7.7	6.9	6.1	5.4	4.6	3.8	3.1	2.3	1.5	.7	
20,000	5.9	5.3	4.8	4.2	3.6	2.9	2.3	1.7	1.1	.6	
15,000	4.7	4.2	3.7	3.3	2.8	2.3	1.8	1.4	.9	.4	
10,000	3.8	3.4	3.0	2.6	2.2	1.9	1.5	1.1	.7	.4	
5,000	3.0	2.7	2.4	2.1	1.8	1.5	1.2	.9	.6	.3	
SEA LEVEL	2.5	2.2	2.0	1.7	1.5	1.2	1.0	.7	.5	.2	

Note

- THE DURATION TIME IS DOUBLED WHEN ONLY ONE CREWMEMBER IS USING OXYGEN
- DURATION FIGURES BASED ON OXYGEN REQUIREMENT RATES GIVEN IN MIL-1-9475A(USAF) TABLES 1, 2 AND 3.
- OXYGEN DURATION INCREASES AS COCKPIT ALTITUDE INCREASES BECAUSE THERE IS LESS AMBIENT PRESSURE ACTING UPON THE LUNGS AT ALTITUDE THAN AT SEA LEVEL. THEREFORE, A SMALLER QUANTITY OF OXYGEN AT ALTITUDE WILL EXPAND THE LUNGS TO THE SAME SIZE THAT THEY WERE AT SEA LEVEL.

F4-161

Figure 1-19

Oxygen Flow Indicator

An oxygen flow indicator alternately shows black and white with each breath, indicating oxygen flow.

Oxygen Pressure Gage

An oxygen pressure gage indicates oxygen supply pressure in pounds per square inch. The gage is calibrated from 0 to 500 psi with normal pressure indicated at approximately 75 psi.

OXYGEN QUANTITY GAGE

A 10-liter (10.6 quart) quantity gage on the left console in the front and rear cockpits indicates the quantity of liquid oxygen in the converter. The gage is directly connected to the converter and utilizes the pressure differential between the liquid and gaseous portions of the system to indicate quantity in liters.

Note

The liquid oxygen quantity gage should indicate 10 liters when the system is fully serviced.

STANDARD FLIGHT SUIT OXYGEN SUPPLY

Breathing oxygen can be supplied to the face mask by the console mounted pressure demand regulator, the pressure suit oxygen control panel, and the emergency oxygen storage bottle in the survival kit. Under normal operation, oxygen is converted from a liquid state to a gaseous state by the oxygen converter and warm-up plate assembly. The gaseous oxygen, at a pressure of approximately 75 psi, is then routed to the console mounted pressure demand regulator. The regulator then supplies oxygen upon demand at low altitudes, or under pressure at high altitudes, to the face mask through the aircraft oxygen supply hose, the oxygen omni-connector, and the face mask hose. If the console mounted pressure demand regulator fails, an unlimited alternate supply of oxygen may be received through the pressure suit oxygen supply lines. This oxygen when required, is routed from the oxygen converter through the pressure suit oxygen valve to the lower block of the composite disconnect. It then passes into the intermediate block, through a one-way check valve to the upper block and then through a flow restrictor. After the flow restrictor, the oxygen passes through an omni-connector and then continues on to the face mask. In case of a failure of the main oxygen supply system, a limited amount of oxygen can be obtained from the survival kit emergency oxygen storage bottle. When the emergency oxygen manual release ring is pulled, either manually or automatically upon ejection, oxygen at a pressure of 1800 psi is released. The high pressure oxygen passes through a pressure reducer, and enters the composite disconnect at the intermediate block. From there the oxygen takes the same paths as did the alternate supply of oxygen for the respective aircraft described above. Refer to figure 1-20 for a comparison of normal, alternate and emergency oxygen supply and flow.

Note

On F-4E aircraft after T.O. 1F-4-808 incorporation of the Koch survival kit eliminates uses of the pressure suit, and the oxygen supply system has only a normal and an emergency flow. See figure 1-21 for comparison of normal and emergency flow.

WARNING

To prevent excessive alternate or emergency oxygen loss, the aircraft oxygen supply hose must be disconnected from the lower portion of the oxygen omni-connector.

Note

Resistance to exhalation is noted when utilizing oxygen, in the alternate flow or emergency flow modes. This is caused by a back pressure build up of the oxygen being delivered to the face mask once inhalation has ceased. This condition can be alleviated by spilling oxygen out of the side of the mask.

PRESSURE SUIT OXYGEN SUPPLY

Breathing oxygen is supplied to the pressure suit pressure demand regulator from one of two sources: the main oxygen supply or the emergency oxygen supply. Under normal operation, oxygen is converted from a liquid state to a gaseous state by converter coils. The gaseous oxygen, now at a pressure of approximately 75 psi, is routed to the console mounted pressure suit oxygen supply valve. If the main oxygen supply fails, emergency oxygen can be obtained from the survival kit oxygen bottle. When the emergency oxygen release ring is pulled manually, or automatically upon ejection, oxygen at a pressure of 1800 psi passes through a pressure reducer. The oxygen, reduced to a pressure of approximately 75 psi, then passes into the intermediate block of the composite disconnect, through a one way check valve, to the upper block.

OXYGEN CONNECTION (STANDARD FLIGHT SUIT)

For proper normal, alternate and emergency operation of the standard flight suit oxygen supply system:

1. Couple the standard flight suit oxygen supply hose (right side of the ejection seat) to the lower port of the oxygen omni-connector.
2. Insert the male connector, on the end of the oxygen face mask tube, into the female receiving port of the oxygen omni-connector.
3. Connect the emergency oxygen supply hose to the oxygen omni-connector.

STANDARD FLIGHT SUIT OXYGEN SUPPLY

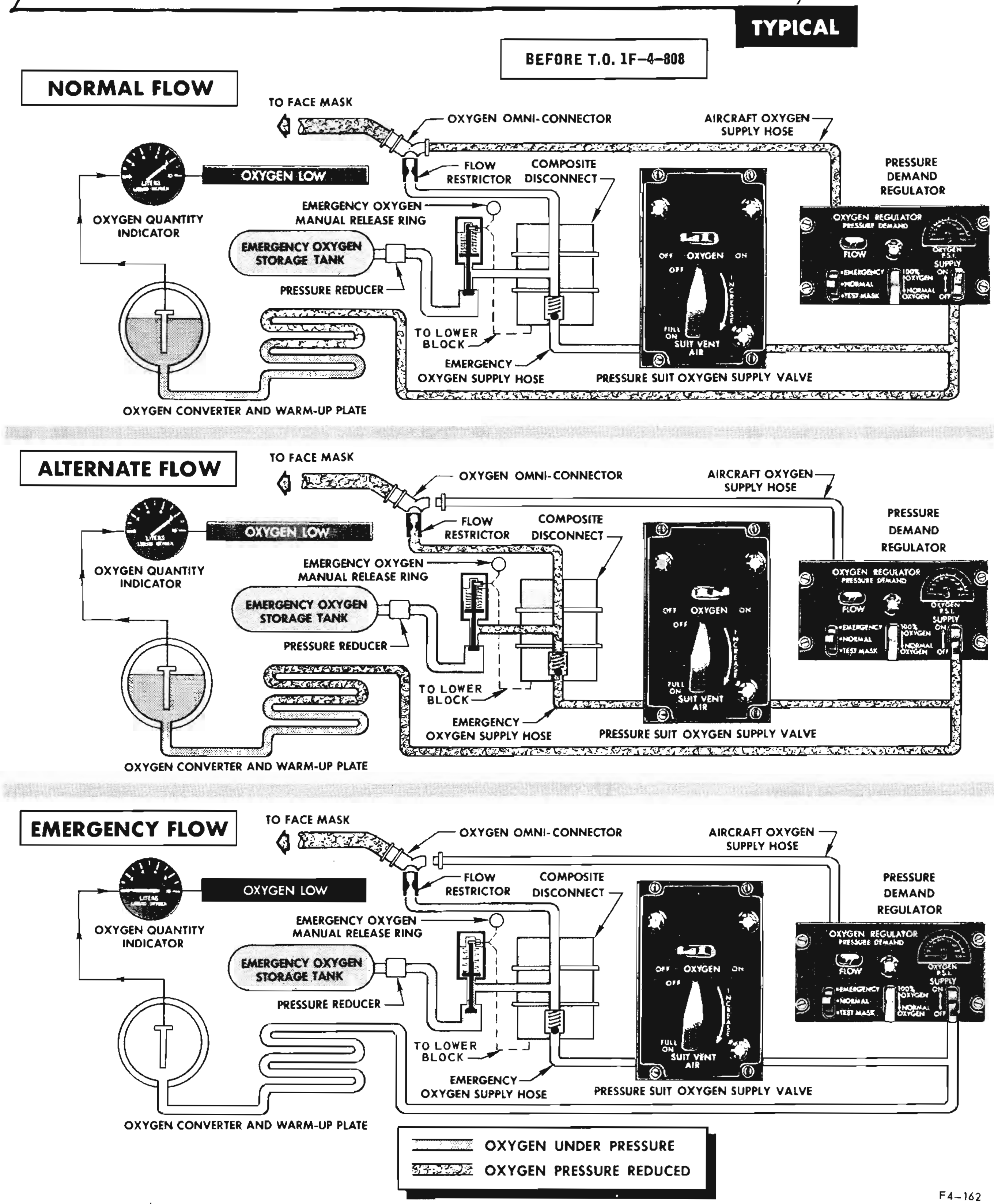
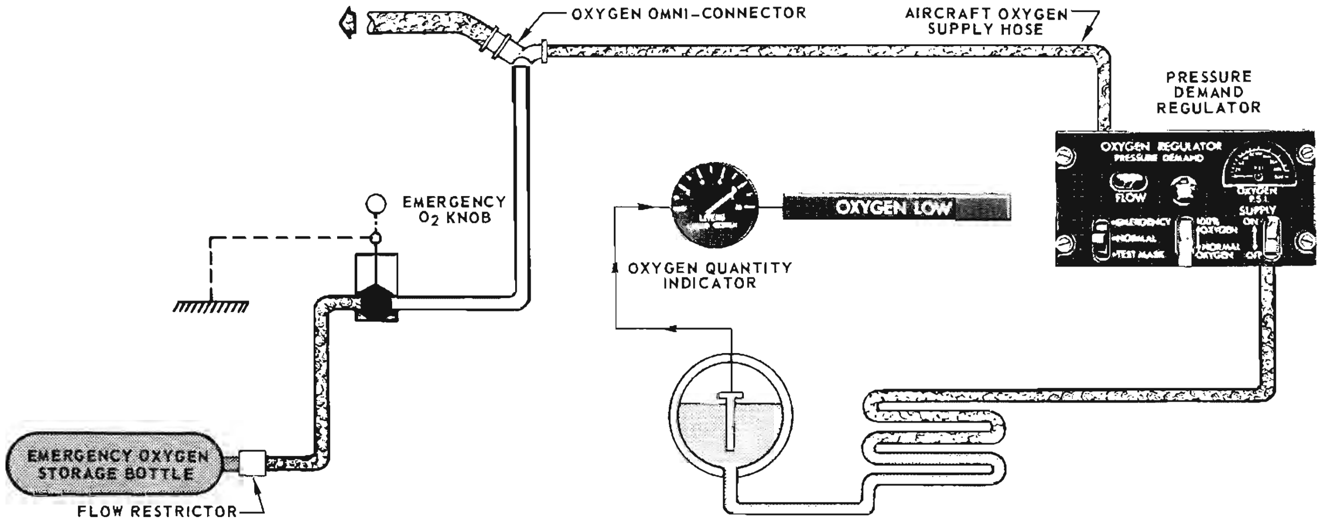


Figure 1-20

STANDARD FLIGHT SUIT OXYGEN SUPPLY

AFTER T.O. 1F-4-808

NORMAL FLOW



EMERGENCY FLOW

Note

THIS MODE OCCURS DURING EJECTION AFTER SEAT LEAVES AIRCRAFT BEFORE MAN/SEAT SEPARATION, AND ALSO ANY TIME AFTER EMERGENCY OXYGEN KNOB IS PULLED.

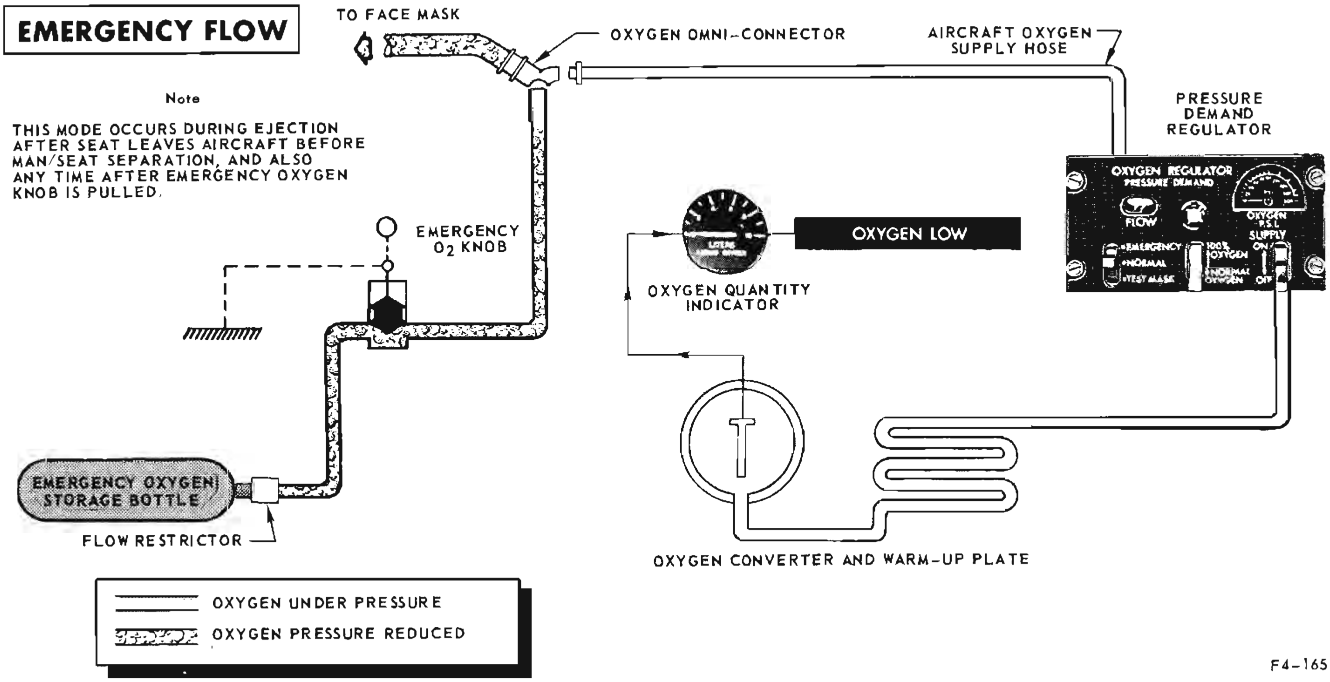


Figure 1-21

OXYGEN CONNECTION (FULL PRESSURE SUIT)

For proper operation of the pressure suit oxygen supply system:

1. Connect the emergency oxygen supply hose to the V fitting on the pressure suit controller.

To check the operation of the pressure suit oxygen supply system:

1. Check the pressure suit oxygen supply selector - ON
2. Check the oxygen control panel oxygen supply selector - OFF
3. Check the oxygen quantity gage at 9 liters minimum.
4. Check the oxygen pressure gage at 75 ± 25 psi.
5. Close the pressure suit helmet face visor.
6. Turn helmet mounted oxygen regulator ON.
7. Breathe normally and check for oxygen flow.

Note

On aircraft after T.O. 1F-4-808, the anti-G and suit vent lines are removed from the survival kit and are relocated along the left console. This modification eliminates the pressure suit support capabilities.

MK-H7 EJECTION SEAT

Note

Refer to foldout section for Ejection Seat illustration.

The MK-H7 ejection seat system can provide the crew with a safe and efficient escape from the aircraft. The seat is propelled from the aircraft by an ejection gun on the back of the seat which is assisted by a rocket motor on the bottom of the seat. The seat system includes an automatic ejection sequencing system through which three ejection sequences can be selected. In the event of an ejection-sequence system malfunction, the automatic features can be manually overridden. If necessary, ejection can be accomplished at runway level, provided the airspeed is at least 50 knots and the aircraft is wings level with no sink rate. On aircraft after T.O. 1F-4-857 (zero-zero seat) an improved 28-foot personnel parachute is installed to provide ejection capability at ground level and at zero knots airspeed with wings level and no sink rate. However, the canopy must be closed for it to jettison and remove the interlock block for both the 50- and zero-knot seats. The zero-knot safe ejection capability at ground level is limited to crewmembers with a maximum boarding weight of 247 pounds. All crewmembers with a boarding weight in excess of 247 pounds must have a minimum airspeed of 50 knots for safe ground-level ejection. Boarding weight is defined to include the crewman, his clothing, and personnel equipment. This weight excludes his parachute and seat pan survival kit. Due to the aerodynamic instability of the seat at higher airspeeds, the minimum ejection altitude between 550 and 600 knots is 50 feet. The ejection seat is an automatic device that primarily regulates the opening of the personnel parachute at a predetermined altitude, or if below that altitude, after a specified time period. Operation of the ejection seat is divided into two phases: primary and secondary operation. Primary operation of the seat includes all operating events that occur during the ejection sequence. This sequence begins when actuation of the face curtain or lower ejection handle which causes the canopy to jettison and the ejection gun to fire. It continues until a normal parachute descent of the occupant is accomplished. After the seat is initially fired during the ejection sequence, seat operation is completely automatic and requires no additional action by the occupant during the sequence. Secondary operation of the seat consists of controlling shoulder movement, seat bucket positioning, manual release of the leg restraint lines, and leg restraint line adjustment.

EJECTION SEAT SEQUENCING

Three ejection sequences (figure 1-22) may be selected: (1) Dual ejection may be initiated from the front cockpit, and (2) dual, or (3) single ejection may be initiated from the rear cockpit. A command selector valve is provided in the rear cockpit to select single or dual ejection. Ejection is initiated by pulling the face curtain or the lower ejection handle. When the face curtain or lower ejection handle is pulled to the first position, the seat mounted sequencing initiator fires and the automatic ejection sequence is initiated. The ejection gun can be fired manually as soon as the canopy jettisons and removes the interlock block. After T.O. 1F-4-898, the ejection gun firing mechanism (interdictor) safety pin is also removed when the canopy is jettisoned. If the pull is maintained on the ejection handle the seat is fired before it is fired automatically by the sequence actuator. During single automatic ejection from the rear cockpit the rear canopy is jettisoned after which the seat is fired approximately 0.54 second after ejection initiation. During dual automatic ejection initiated from either cockpit, the rear seat fires as in single ejection, that is, approximately 0.54 second after initiation. Front canopy jettison is initiated after a 0.75 second delay and the front sequence actuator fires the front seat automatically approximately 1.39 seconds after initiation. This ensures adequate clearance between the two ejection seats and the aircraft canopies. The sequence of seat operation after the powered retraction system retracts the shoulder harness (which occurs immediately after ejection initiation) and after the canopy is jettisoned is as follows. As the canopy jettisons, the canopy interlock block, which is attached to the canopy, is pulled from the interrupter mechanism of the seat. After T.O. 1F-4-898, the ejection gun firing mechanism (interdictor) safety pin is also removed when the canopy is jettisoned. This allows the ejection gun firing linkage to be actuated by the automatic ejection sequencing system or by a continued pull on the ejection handle, thus firing the primary cartridge in the ejection gun. Gas pressure generated by the primary cartridge causes the inner and intermediate tubes of the gun to extend. The initial upward movement of the inner tube unlocks the top latch mechanism which

releases the seat from the aircraft. As the gun extends, two auxiliary cartridges are fired as they become exposed to the hot propellant gases within the gun. Staggered firing of the ejection gun cartridges furnishes even stroke. As the seat rises, the emergency oxygen is tripped. Trip rods attached to the aircraft structure trigger the drogue gun and time release mechanisms, and the emergency IFF/SIF is switched ON. As the crewmember ejects, his legs are drawn back, the restraint lines pull through the snubbers, and when all the slack is taken up in the lines, the floor attachments break away at the shear rivets. His legs are restrained against the front of the seat bucket by the snubbers. The rocket pack fires to propel the seat to a greater height and is fired through the action of a 6-foot lanyard connected between cockpit floor and the rocket initiator sear. Approximately 0.75 second after ejection the drogue fires a drogue projectile to deploy the 22 inch controller drogue which, in turn, deploys a 60 inch stabilizer drogue. The seat is stabilized and decelerated by the drogues as the man/seat descends rapidly through the upper atmosphere with the occupant securely restrained in the seat. Automatic operation of the time release mechanism occurs approximately 2.25 seconds after reaching the preset barostat altitude (11,500 +3000, -0 feet) or, in ejections below this altitude, the time release operates approximately 2.25 seconds after the trip rod is pulled. When the time release mechanism operates, the harness attachment locks are released through mechanical linkages on the seat. At the same time, the scissors open to release the drogues from the seat. The pull of the drogues is transferred to the link line which releases the face curtain restraint straps and the parachute restraint straps, and the drogues pull the personnel parachute safety pin line and deploy the personnel parachute. The personnel parachute safety line is connected on one end to the parachute link line and the other end secures the flap on the top of the personnel parachute. The purpose of the pin is to secure the parachute from premature opening due to windblast during descent prior to time release mechanism actuation. The occupant is held to the seat by the sticker clips until the opening shock of the parachute snaps him out of the seat. The automatic ejection sequence takes approximately 4 seconds from firing the ejction gun to full parachute deployment.
If the automatic sequencing system malfunctions, the canopies can be separately jettisoned by the emergency canopy release handles or manual canopy unlock handles; and the ejection seats can then be fired individually from each cockpit by an additional pull on an ejection handle.

Dual Ejection Initiated From the Front Cockpit

The dual ejection sequence is initiated whenever the crewmember pulls either the face curtain handle or the lower ejection handle to fire the front seat mounted initiator. Gas pressure from the seat mounted initiator is routed to the sequencing system which ejects the rear seat prior to front seat ejection.

WARNING

If the front canopy is lost, the front canopy interlock block with its ejection sequence time delay will also be lost. If ejection is then initiated from the front seat, this could expose the rear crewmember to the front seats rocket blast and a collision between seats could possibly result. If loss of the front canopy or both canopies occurs, the rear crewmember should rotate the command selector valve handle to the open (horizontal) position and initiate ejection for both crewmembers. With loss of the rear canopy only, normal ejection can be initiated from either cockpit.

Dual Ejection Initiated From Rear Cockpit

The rear crewmember initiates a dual ejection by opening the command selector valve and pulling either the face curtain or lower handle to fire the seat mounted initiator. Gas pressure generated by the initiator is routed to the sequencing system which ejects the rear seat prior to front seat ejection.

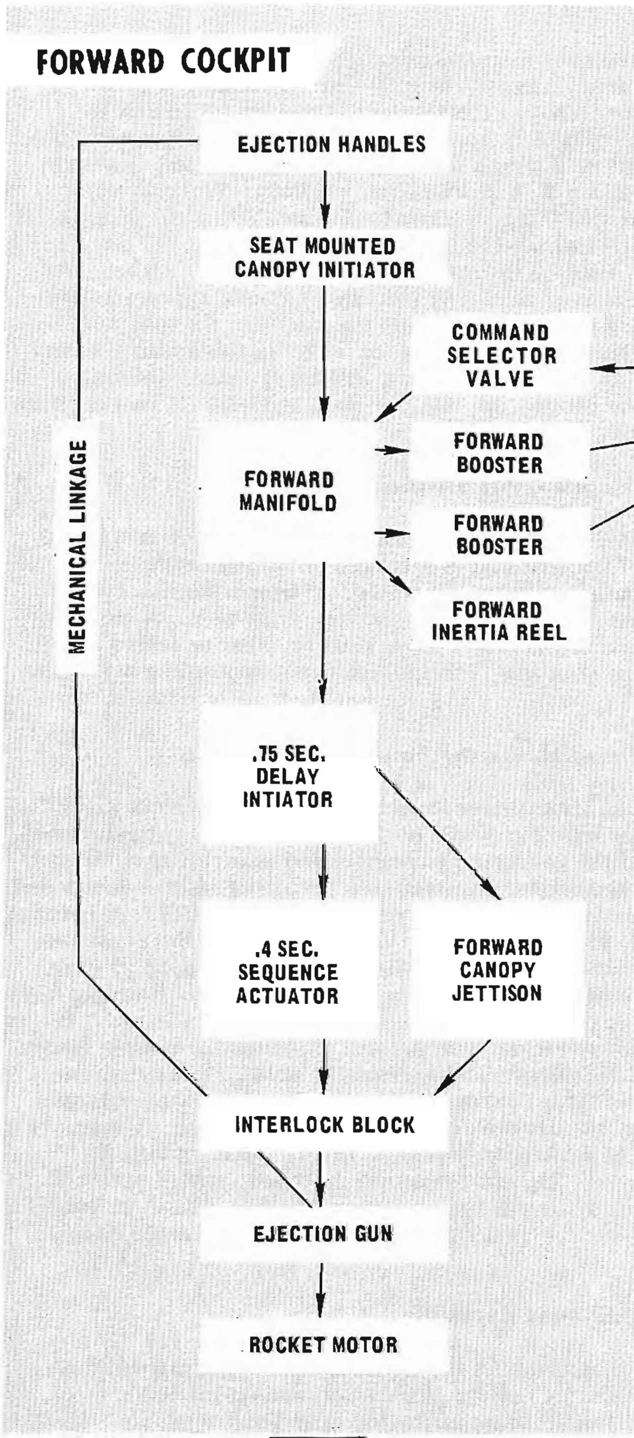
Single Ejection Initiated From Rear Cockpit

Single ejection occurs when the rear cockpit crewmember pulls the face curtain handle or lower ejection handle with the command selector valve in the normal (closed) position. Gas pressure generated by the rear seat mounted initiator is routed to the sequencing system which operates the rear seat inertia reel, rear canopy pressure operated valve (jettisoning the rear canopy), and the rear pressure operated sequence actuator (ejecting rear seat), in that order.

EJECTION SEAT COMPONENTS

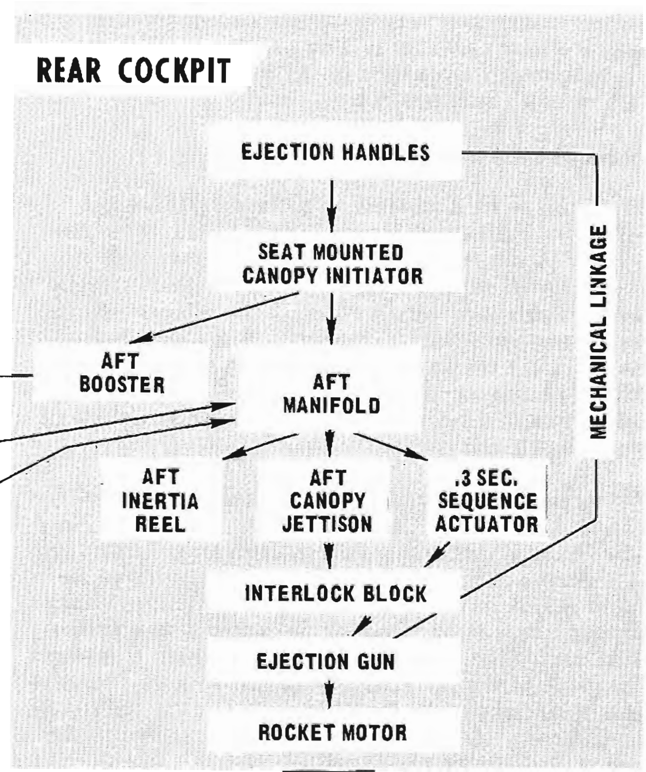
The main components of the ejection seat system include: the ejection sequencing system, the main beam assembly, the firing linkages and canopy interlock mechanism, the ejection gun, the drogue gun, the drogue chute scissors mechanism, the time release mechanism, the guillotine assembly, the sticker clips, the rocket motor, the personnel parachute, the leg restrainers, the shoulder harness powered inertia reel lock, and a seat-mounted emergency oxygen bottle on aircraft after T.O. 1F-4-808. Ejection seat controls include: the face curtain ejection handle, the lower ejection handle, the lower ejection handle guard, the command selector valve handle, the seat positioning switch, the leg restraint release handle, the shoulder harness release handle, the emergency harness release handle, and the emergency oxygen knob on aircraft after T.O. 1F-4-808.

AUTOMATIC SEQUENCING SYSTEM



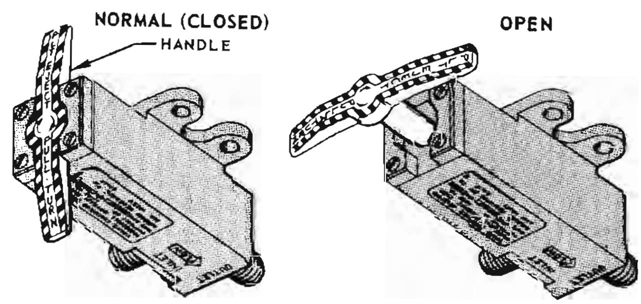
Note

ELAPSED TIME TO EJECTION GUN FIRING – 1.392 SECONDS.



Note

ELAPSED TIME TO EJECTION GUN FIRING – 0.54 SECONDS.



COMMAND SELECTOR VALVE

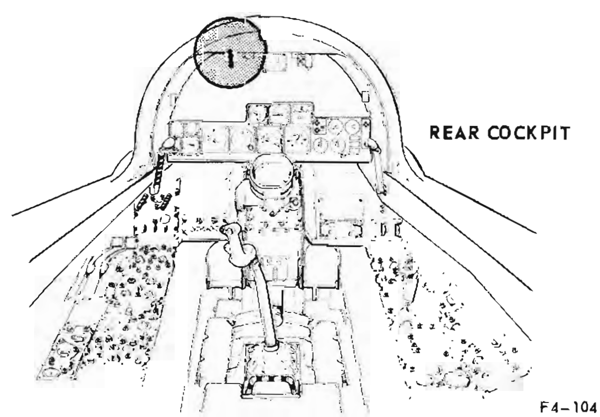


Figure 1-22

Ejection Sequencing System

The ejection sequencing system is a pyrotechnic system interconnecting the seat and canopy systems to provide sequenced canopy jettison and seat ejection during emergency egress of both crewmembers. Single ejection capability is also provided for the rear crewmember. Operation of the system is described in Ejection Seat Sequencing.

Main Beam Assembly

The main beam assembly is a strong lightweight structure built to withstand high G loads. This assembly is the main frame of the seat assembly which supports the seat bucket, drogue container, drogue shackle scissors, drogue gun, time release mechanism, and personnel parachute. It is composed of two vertical beams bridged by three crossmembers. The top latch mechanism is attached to the top of the left vertical beam and secures the seat structure to the catapult gun barrel.

Firing Linkages and Canopy Interlock Mechanism

The firing linkages and canopy interlock mechanism is mounted across the top of the aft corners of the main beams on the seat. This mechanism provides proper sequencing between the canopy and ejection seat during the ejection sequence and also transmits the force of the face curtain handle or lower ejection handle to the canopy initiator and ejection gun firing mechanism. An interlock block is connected to the canopy by a cable and is pulled from the interlock mechanism as the canopy jettisons during the ejection sequence. The interlock block engaged in the firing linkage prevents firing of the ejection seat by either ejection handle before the canopy has been jettisoned from the aircraft. After T.O. 1F-4-898, a safety link connects the canopy interlock block to the ejection gun firing mechanism (interdictor) safety pin. The interdictor safety pin remains inserted in the ejection gun firing mechanism sear at all times except after canopy jettison. This gives added protection against inadvertent initiation due to foreign object damage.

WARNING

No foreign objects should be placed on top of the ejection seat. When required, the safety pin bag should be suspended along the left side of the headbox utilizing the face curtain and catapult mechanism safety pin streamers.

Ejection Gun

The ejection gun is mounted between the main beams and is attached to the bulkhead of the cockpit by two mounting lugs. It propels the seat from the cockpit during the ejection sequence. The gun is composed of the four major assemblies which are the breech firing mechanism, the outer casing, and the inner and intermediate tubes. Water seals are fitted around the primary and auxiliary cartridges and the breech firing mechanism. These seals prevent water from entering the gun prior to underwater ejection from the aircraft.

Drogue Gun

The drogue gun is mounted on the upper left side of the main beam assembly and is fired by a trip rod connected to the aircraft structure. The unit is triggered by seat ejection and fires a drogue projectile to deploy a 22 inch controller drogue, approximately 0.75 second after ejection. The controller drogue in turn deploys the 60-inch stabilizer drogue. On aircraft 68-452 and up, a cocking indicator is installed on the bottom of the drogue gun. When the gun is cocked, the indicator extends approximately 1/2 inch below the gun housing with the indicator shaft showing. If the indicator is flush with the bottom of the gun housing without the shaft showing, the drogue gun is not cocked and will not fire during ejection.

Drogue Chute Scissors Mechanism

The drogue chute scissors mechanism is on the top of the seat and is attached to the top crossmember of the main beam assembly. This mechanism connects the drogue chutes to the top of the seat. A movable jaw of the scissor releases the drogue chutes from the seat when the time release mechanism actuates.

Time Release Mechanism

The time release mechanism is on the right side of the ejection seat. Its function is to delay deployment of the personnel parachute and separation of the occupant from the seat until the occupant has descended from the upper atmosphere and/or has slowed enough to prevent excessive opening shock of the personnel parachute. The mechanism is armed upon ejection. Initiation of the timing sequence follows immediately, providing the altitude is within preset limits. The time release mechanism, releases the drogue chute attachment shackle from the scissors allowing the personnel parachute to be pulled from its container by the drogue chutes. At the same time, it releases the parachute restraint straps, face curtain (if used), lap belt, shoulder harness, wedge pack and leg restraint lines to allow the occupant to be pulled from the seat when the personnel parachute deploys.

Guillotine Assembly

Components of the guillotine assembly are on the right side of the seat bucket and on the left side of the main beam assembly near the drogue gun. Under normal ejection conditions, the parachute withdrawal line withdraws from the guillotine as the drogue chutes deploy the personnel parachute. During manual separation from the seat, guillotine actuation is accomplished when the emergency harness release handle is pulled. The guillotine cartridge fires and forces a blade assembly upward which severs the parachute withdrawal line connected to the drogues.

Sticker Clips

The sticker clips are attached by belts to the survival kit-harness and retain the occupant in the seat until the personnel parachute blossoms and pulls the occupant clear, thus insuring no risk of man seat collision.

Rocket Motor

A rocket motor sustains the seat thrust after ejection gun separation and increases the ejection velocity/altitude of the seat without additional loading on the occupant. The rocket motor is on the bottom of the seat bucket and consists of a number of small diameter combustion tubes containing solid propellant. The rocket motor thrust angle is automatically adjusted according to seat bucket position to compensate for varying CG. As the ejection seat nears the end of the ejection gun stroke a static line attached to the cockpit floor fires the igniter cartridge, causing simultaneous ignition of the propellant. On aircraft after T.O. 13A5-32-504, a fiberglass protector is installed on the bottom of the seat around the rocket sear and sear cable. The protector prevents accidental pulling of the rocket sear. The protector breaks off during ejection when the sear cable becomes taut.

Personnel Parachute

The personnel parachute is a 29.7 foot skysail incorporating a hardshell container. The container rests on a bracket on the backrest part of the seat and held in place by two parachute restraint straps and two lines attached to the bottom of the container. The lines are routed downward to loop around the sticker clip lugs. When the restraint straps are installed, two box springs are inserted between the parachute container and ejection seat. These springs are held compressed by the restraint straps. When the restraint straps and lines are released through action of the time delay release mechanism or the emergency harness release handle, the springs serve to eject the parachute container from the seat during ejection or emergency egress. The container separates from the crewmember after chute deployment. On aircraft after T.O. 1F-4-857, the skysail parachute is replaced by a 28 foot parachute. The increased performance of the 28 foot chute lowers the minimum airspeed limit for ground level ejection. All 28 foot chutes with T.O. 14D1-2-613C incorporate a "four line jettison lanyards" system which reduces chute oscillation and provides limited steerability. The lanyards, when pulled, release four lines from the chute to produce a large lobe, or scallop, at the rear center of the canopy. In this configuration, the chute can be steered by pulling on the left or right rear risers. The four line jettison lanyards are two red loops, one located half way up the inboard side of each rear chute riser.

WARNING

Do not pull lanyards until canopy has been checked free of torn panels or partial canopy inversions. A partial inversion makes the canopy form a figure eight when viewed from below, and can be corrected by pulling on the suspension lines of the smaller loop of the figure eight. The four line jettison lanyards should never be pulled at night since the canopy can not be checked.

Face Curtain Ejection Handle

The face curtain ejection handle is at the top of the seat, projecting forward and is connected by cables to the firing linkages on the seat. The face curtain extends approximately 10 inches before the canopy initiator is fired, and approximately 12-14 inches to fire the ejection gun. The face curtain provides protection for the face and eyes, and a measure of head restraint against the airblast that may be experienced in ejections at high airspeeds. A break-out force of 50-70 lbs is required to release the handle from its stowage and the pull must be in a forward or downward direction. The handle is designed to withstand forces in an upward direction to minimize the risk of inadvertent actuation by airblast in the event of canopy loss in flight. Thus, if the occupant sits high in the seat with the face curtain ejection handle below the level of the flying helmet, some difficulty may be experienced in locating and pulling the handle without sacrificing correct posture on ejection. Ideally, the sitting height should be adjusted to allow the face curtain to be drawn forward over the helmet without interference. When using the face curtain ejection handle a momentary stop may be encountered while the canopy is jettisoning and the pull force must be maintained on the handle to fire the seat as soon as the interlock block is withdrawn.

Lower Ejection Handle

The lower ejection handle is on the forward edge of the seat bucket, between the crewmembers legs. The handle is connected to the firing linkages on top of the seat and fires the same canopy initiator as does the face curtain. An upward pull (45 lbs max) is required. Approximately 1-1/4 inch extension of the handle will fire the canopy initiator, and 4-1/2 to 5 inch extension will fire the seat, once the canopy interlock block is removed.

Lower Ejection Handle Guard

The lower ejection handle has a guard which prevents inadvertent operation. With the guard handle in the down position, the handle is unlocked. With the guard in the up position, the lower ejection handle is locked and cannot be used for ejection.

Command Selector Valve Handle

The command selector valve handle above the instrument panel on the left side of the rear cockpit, is used to select single or dual ejection. The vertical (CLOSED) position of the handle is the single ejection position and the handle is normally kept in this position during flight. To select dual ejection, pull the handle straight out without applying torque to the handle. The handle will rotate 90 degrees clockwise to the open position through cam action.

Seat Positioning Switch

The ejection seats may be adjusted vertically only. Seat positioning is accomplished by actuating a momentary contact switch on the right forward side of the seat bucket. Each seat can be adjusted (up or down) through a total distance of 6 inches. It is not necessary to adjust the seat height before ejection; however, if it is decided to eject by using the face curtain, the seat should be lowered to afford the adequate clearance between the helmet and face curtain ejection handle.

Leg Restrainers

The leg restraint assembly consists of garters worn by the crewmember, leg restraint lines with lock pins, snubber units, and shear fitting secured to the floor. The garters are strapped to the leg just below the knee. When the seat is ejected, the slack in the leg restraint line is taken up by the upward travel of the seat, pulling the occupant's legs to the front face of the seat bucket. When all the slack has been removed in the leg restraint lines, the tension of the lines cause the shear fitting to fail. The occupant's legs are firmly held against the seat bucket by the snubber unit until the harness is released and the occupant is separated from the seat. Rings on the face of the snubber units are provided to adjust the amount of slack in the leg restraint lines. If the seat is raised and then lowered, it may be necessary to readjust the leg restraint lines by pulling the finger rings and drawing the lines forward through the snubbers. On aircraft after T.O. 1F-4-832, the leg restrainers utilize two garters on each restraint line, a calf garter worn above the flight boot and a thigh garter worn on the thigh above the knee. Each garter contains a quick release which allows the garter to be released and left in the aircraft without disturbing garter adjustment. The leg restraint line routing under the seat is changed to provide a slower leg withdrawal during ejection. The garter with the double ring is worn above the ankle and the single ring garter is worn on the thigh. When routing the restraint lines through the garters, be certain the lines are not twisted and route through the calf garter (first through outboard ring of calf garter then through inboard ring) then through the thigh garter before inserting the lock pins in the snubber boxes (figure 1-23).

Leg Restraint Release Handle

The leg restraint release handle is on the left forward side of the seat bucket. When the handle is moved to the aft (unlocked) position, the lock pins on the leg lines are released from the leg lock mechanism and the leg lines can then slide out of the garters.

Shoulder Harness Powered Inertia Reel Lock

The rocket seat contains a powered inertia reel lock which provides a velocity (G sensing) system (inertia lock) and a power retraction system. The inertia lock system provides a safe restraint during aircraft violent maneuvers. Restraint is accomplished by a G sensing mechanism functioning in accordance with reel strap pay-out (strap velocity). In addition, manual locking of the inertia lock can be accomplished by the shoulder harness release handle. The powered retraction system provides automatic retraction of the shoulder harness for ejection The device is gas powered and functions only when ejection is desired by pulling the face curtain or lower ejection handles.

Shoulder Harness Release Handle

The shoulder harness release handle has two positions, a forward or locked position, and an aft or unlocked position.

Note

> Selecting the unlocked position of the shoulder harness release handle will not prevent the inertia lock from locking when the velocity (G sensing) system detects a high rate of velocity change of the crewmember in a forward direction. Once the shoulder harness is automatically locked, it must be manually unlocked by cycling the release handle full forward then full aft. It is noteworthy that G force on the aircraft by itself will not lock the inertia lock.

Emergency Harness Release Handle

The emergency harness release handle is on the right front edge of the seat bucket. The primary purpose of this handle is to provide single action release of the harness attachments for rapid emergency evacuation on the ground. The handle may also be used to separate manually from the seat after ejection in the unlikely event that the automatic sequence fails. To actuate the handle, squeeze the trigger and pull the handle up and aft until it locks in the UP position. When the handle is pulled, the lap belt, shoulder harness and leg restraint locks are released and the guillotine unit fires to cut the parachute withdrawal line. The parachute restraint straps are also released to allow the personnel parachute pack to separate from the seat. Once released from the seat, the lap belt, shoulder harness, etc. cannot be reconnected during flight. The emergency harness release handle should not be pulled in flight for the following reasons:

1. During uncontrollable flight, negative G forces may prevent the occupant from controlling the aircraft or assuming the correct ejection position.
2. A hazard to survival is created if the pilot is required to proceed with a forced landing since no harness restraint will be available.

LEG RESTRAINERS

BLOCK 37 AND UP, OR AFTER T.O. 1F-4-832

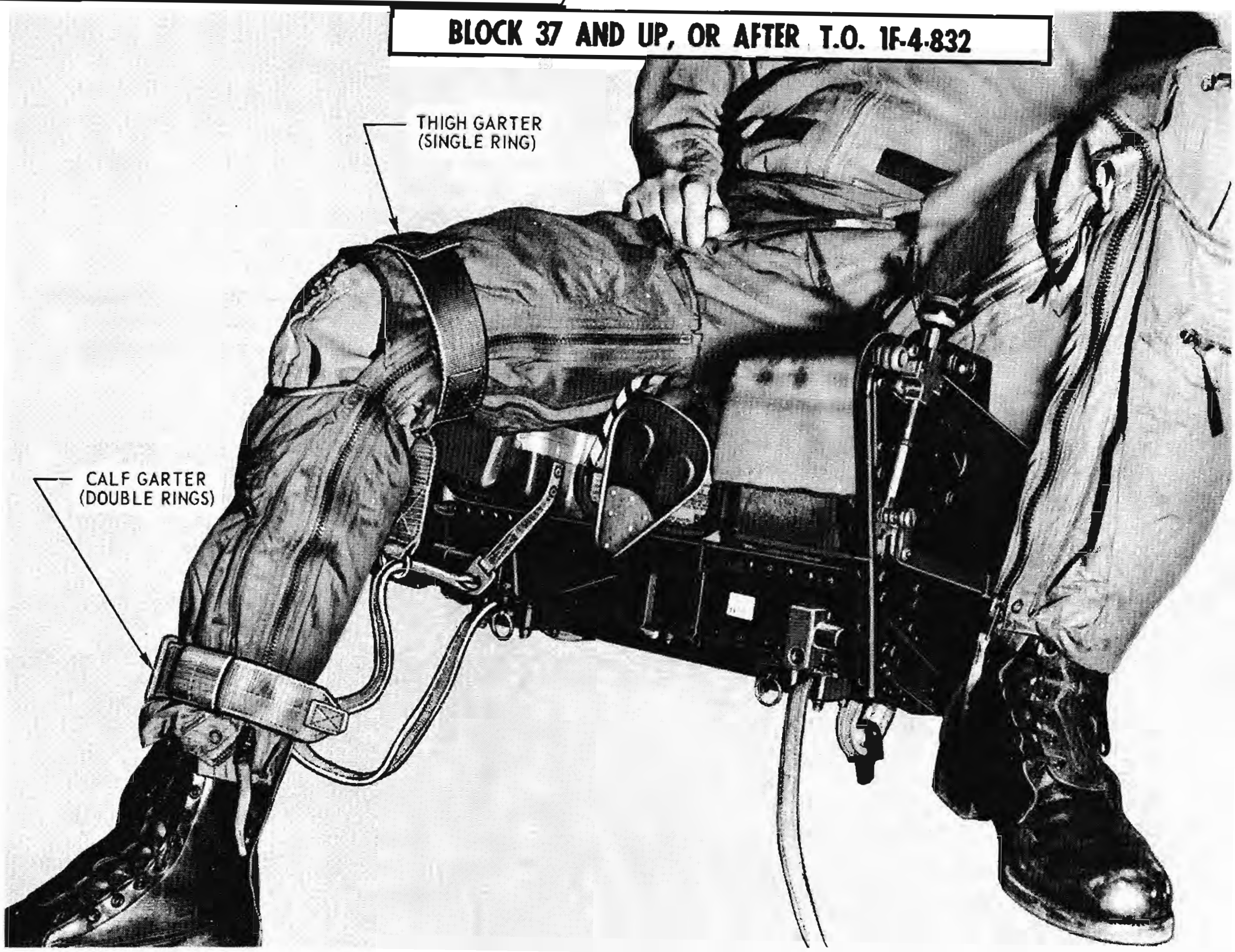


Figure 1-23

3. Safe ejection is impossible because the occupant will separate from the seat during ejection, and severe shock loads will be imposed on the body.

Seat-Mounted Emergency Oxygen Bottle

On aircraft after T.O. 1F-4-808, a bailout oxygen bottle system is installed on the left side of the ejection seat bucket. Actuation of the oxygen bottle is accomplished automatically on ejection. An actuating arm, attached to the bottle valve by a cable, strikes a bracket mounted on the seat rails as the ejection seat moves up the rails. Manually, the emergency oxygen can be actuated by pulling up on the emergency oxygen knob. The bottle provides approximately a 10 minute supply of oxygen.

Emergency Oxygen Knob

The emergency oxygen knob is on the forward left side of the seat bucket, just aft of the leg restraint release handle. Once the emergency oxygen knob is pulled the emergency oxygen cannot be shut off, and after man/seat separation there may be no or not enough emergency oxygen available for the remaining descent.

INTEGRATED (PARACHUTE) HARNESS

The harness (figure 1-24) is a vest like garment worn by the crewmember, and serves the purpose of providing attachment points for connecting the parachute riser-shoulder harness, and survival kit to the individual. The integrated harness also has provisions for installing a type URT-27 or URT-33 personnel locator radio beacon. The beacon may be automatically actuated upon egress from the cockpit. When a beacon is installed on the harness, its switch should be placed ON. Automatic actuation of the beacon may be obtained on egress by attaching the actuating lanyard strap hook to the D-ring of the radio beacon actuator strap installed on the upper part of the airplane oxygen supply hose where it enters the CRU-60 connector. If automatic actuation is not desired, disconnect the hook from the D-ring on the oxygen supply hose. If the beacon is inadvertently actuated, place the switch OFF. When not is use, the beacon-

INTEGRATED HARNESS

TYPICAL

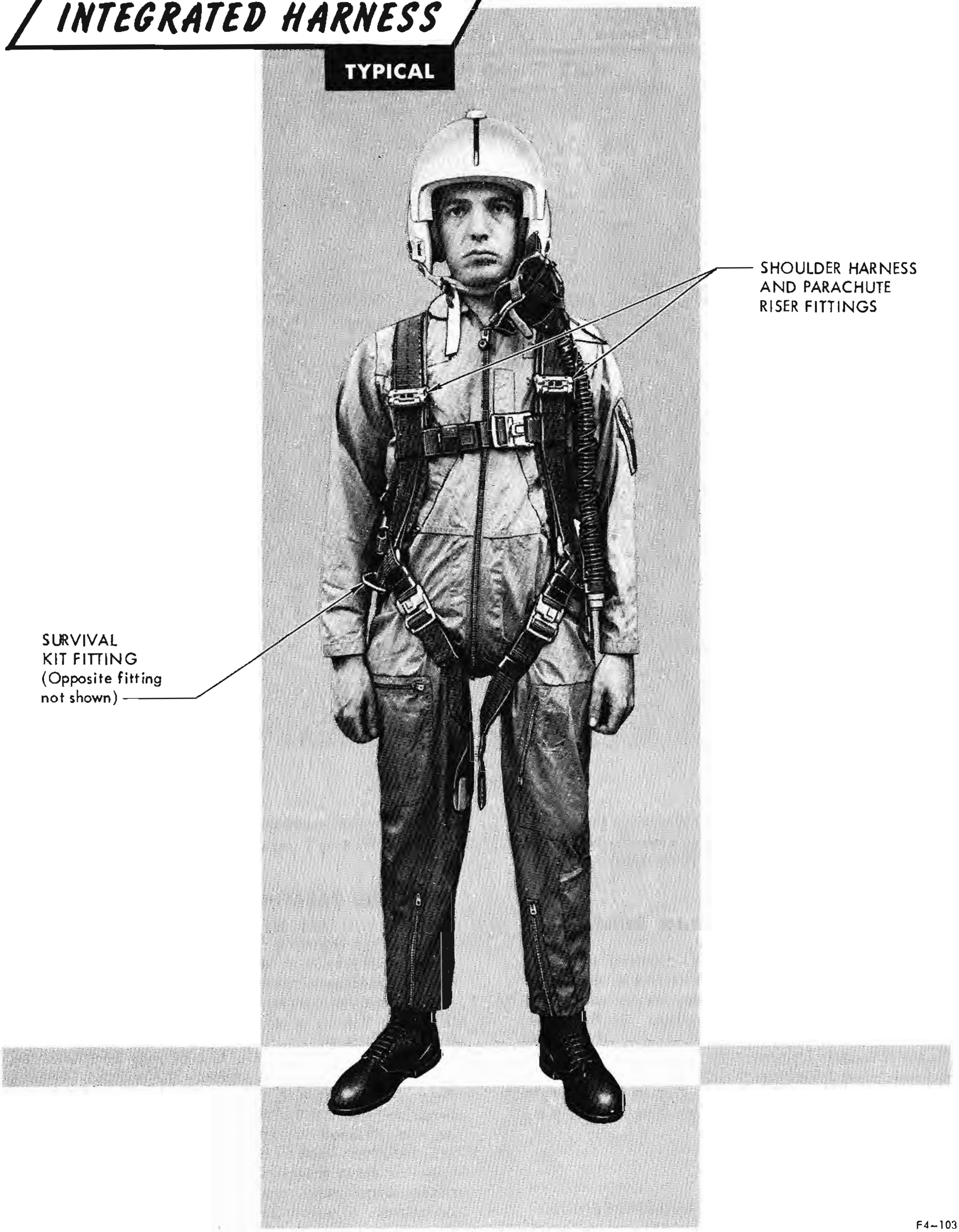


Figure 1-24

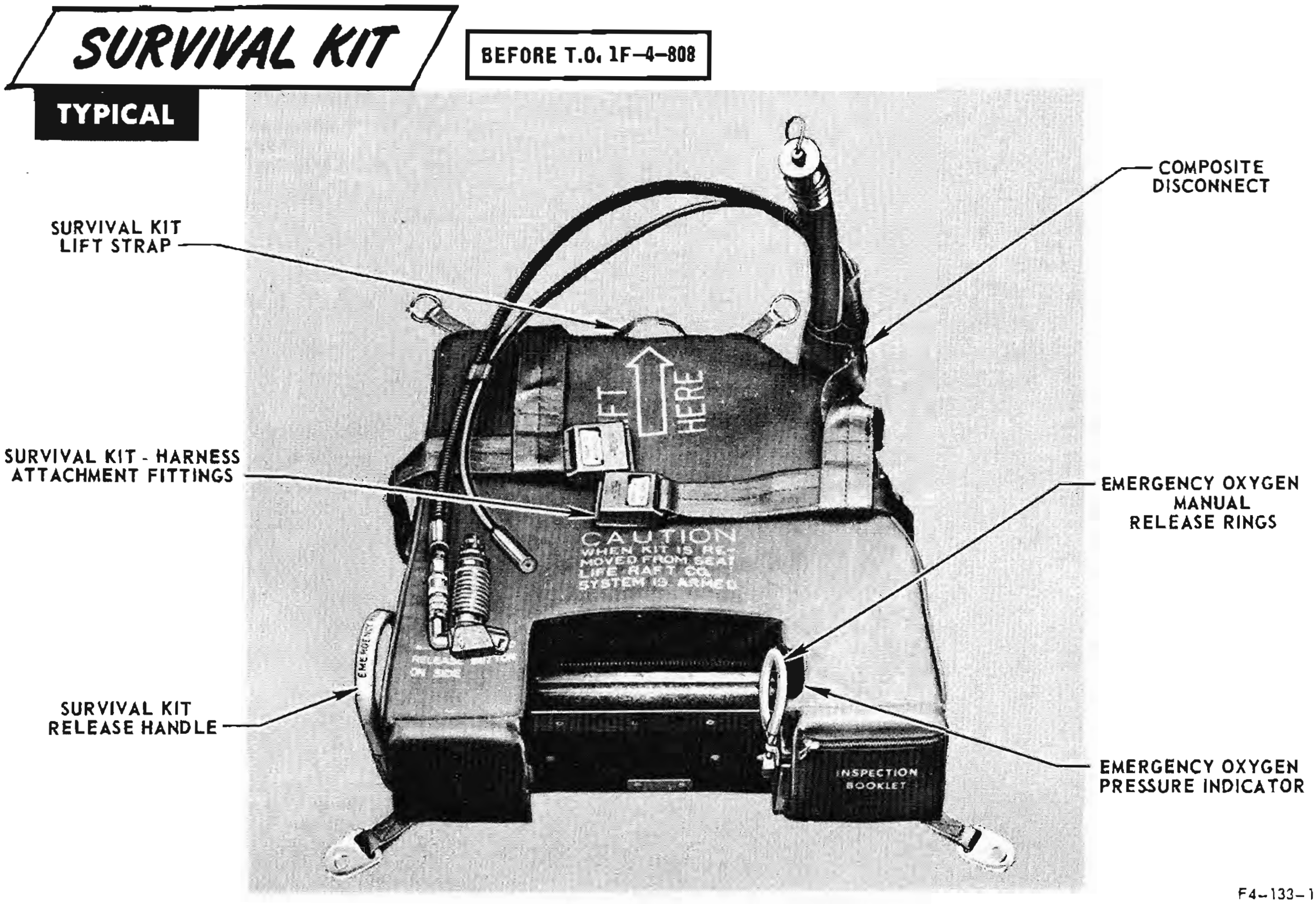


Figure 1-25

actuating lanyard may be stowed by attaching the snap on the hook to the unused stud at top of the beacon pocket and inserting the hook back into the coils of the spring.

SURVIVAL KIT

Provisions for survival after ejection, bail-out, or ditching are stored in the survival kit (figure 1-25). The kit is composed of a two piece fiberglass container. The lower portion of the kit contains emergency provisions, including an inflatable raft and an emergency oxygen storage bottle. The upper portion of the kit serves as the kit cover and has a cushion attached to the top for the crewmember to sit on. The kit contains an emergency oxygen manual release ring and an emergency oxygen pressure indicator, both on the left forward portion of the kit inboard of the crewmember's left leg. The kit also mounts the composite disconnect on the left aft corner. The kit is attached to the crewmember's harness by attachment fittings on the kit retaining straps. The retaining straps are secured to the kit by retaining strap locks on both sides of the kit. Upon ejection, a valve in the emergency oxygen system is automatically tripped and oxygen is routed from the emergency oxygen cylinder through the intermediate block to the crewmember for breathing and for pressure suit pressurization when ambient pressure is below 3.4 ± 0.2 psi (above approximately 35,000 feet). If for some reason the emergency oxygen is not tripped automatically during ejection, it can be tripped by pulling up on the emergency oxygen manual release ring. T.O. 15X2-4-501 incorporates a retaining strap on the emergency oxygen manual release ring which prevents possible breakage of the ring stem when the handle is not pulled vertically. Care should be exercised in pulling the ring until the retaining strap is retrofitted into the older kits. The survival kit release handle, on the right forward outboard corner of the kit, is pulled after seat separation to separate the upper and lower portions of the kit and to separate the composite disconnect upper block from the intermediate block.

WARNING

With kits containing oxygen (before T.O. 1F-4-808) do not pull the survival kit release handle until below 10,000 feet (can be determined by seat separation during automatic sequence or suit altimeter after manual seat separation) since oxygen starvation could result from cutoff of the emergency oxygen supply.

SURVIVAL KIT

BLOCK 38 AND UP, OR AFTER T.O. 1F-4-808

TYPICAL

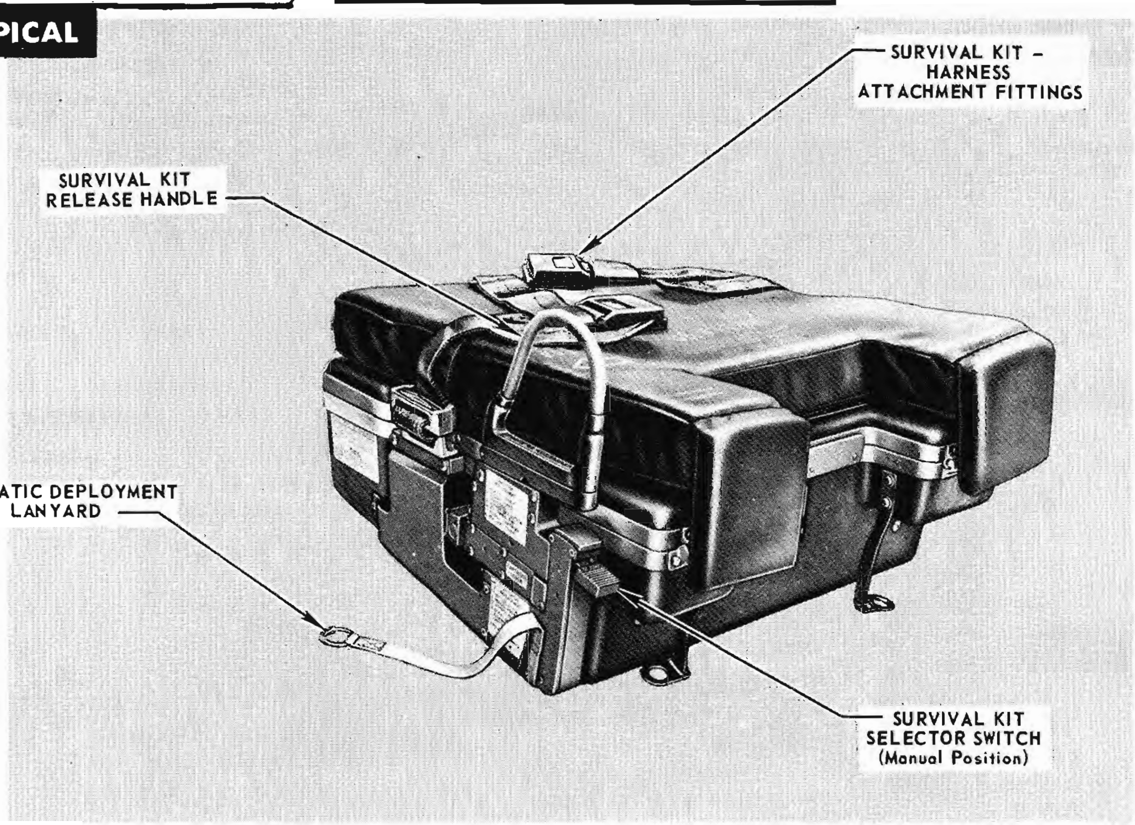


Figure 1-26

Following actuation of the survival kit release handle, the kit upper and lower portions and the raft containing the emergency provisions drop to a position below the crewmember, where they are held during descent by a drop line which remains attached to the harness by the right retaining strap. During kit deployment, the life raft CO_2 bottle will be actuated by gravity pull to inflate the raft when the drop line reaches full extension. In the event of emergency egress on the ground when it is desired to leave the survival kit in the aircraft, the survival kit release handle is pulled after releasing the parachute riser fittings. Pulling the handle releases the survival kit retaining straps from the retaining strap locks on both sides of the kit and releases the upper block from the intermediate block. This is due to the action of an arming plunger located on the bottom of the forward right corner of the kit. Any time the kit bottom is seated against a surface such as in the ejection seat, the arming plunger is depressed up into the kit body to release the retaining straps and to prevent separation of the upper and lower portions of the kit. Four hold-down straps are installed on the survival kit. The hold-down straps are on each corner of the kit and are used to attach the kit to the ejection seat so that the kit will not rise above the seat during negative G conditions. The rear hold-down straps attach to the seat at the lap belt lug attachment points and the forward hold-down straps are attached at the leg restraint lines lock pin attachment points. The hold-down straps are released from ejection seat attachment when the time release mechanism releases the leg restraint lines lock pins and lap belt lugs during ejection, or whenever the emergency harness release handle is pulled. On aircraft after T.O. 1F-4-808, a new survival kit (figure 1-26) is provided which incorporates selective automatic kit deployment and removes the emergency oxygen and composite disconnect from the kit. Selective deployment gives the crewman the option of manual or automatic hands off separation of the kit and deployment of raft/rucksack assembly, depending on the mode selected on the survival kit selector switch. Automatic operation is controlled by a lanyard attached on one end to an actuator in the bottom of the kit and to the seat emergency harness release handle on the other end. When man/seat separation occurs, the lanyard pulls the actuator which subsequently fires a cartridge activated piston. Four seconds later, this piston strikes an arm which is attached to the lid latches, unlocking them and allowing the kit to drop away in a deployed condition, while still being attached to the crewman by his left hand kit-to-man connector. For this sequence to occur the crewman has to select automatic on his selector switch located on the kit forward and slightly below the survival kit release handle. Once the emergency harness release handle is pulled, such as occurs during manual man/seat

COMPOSITE DISCONNECT

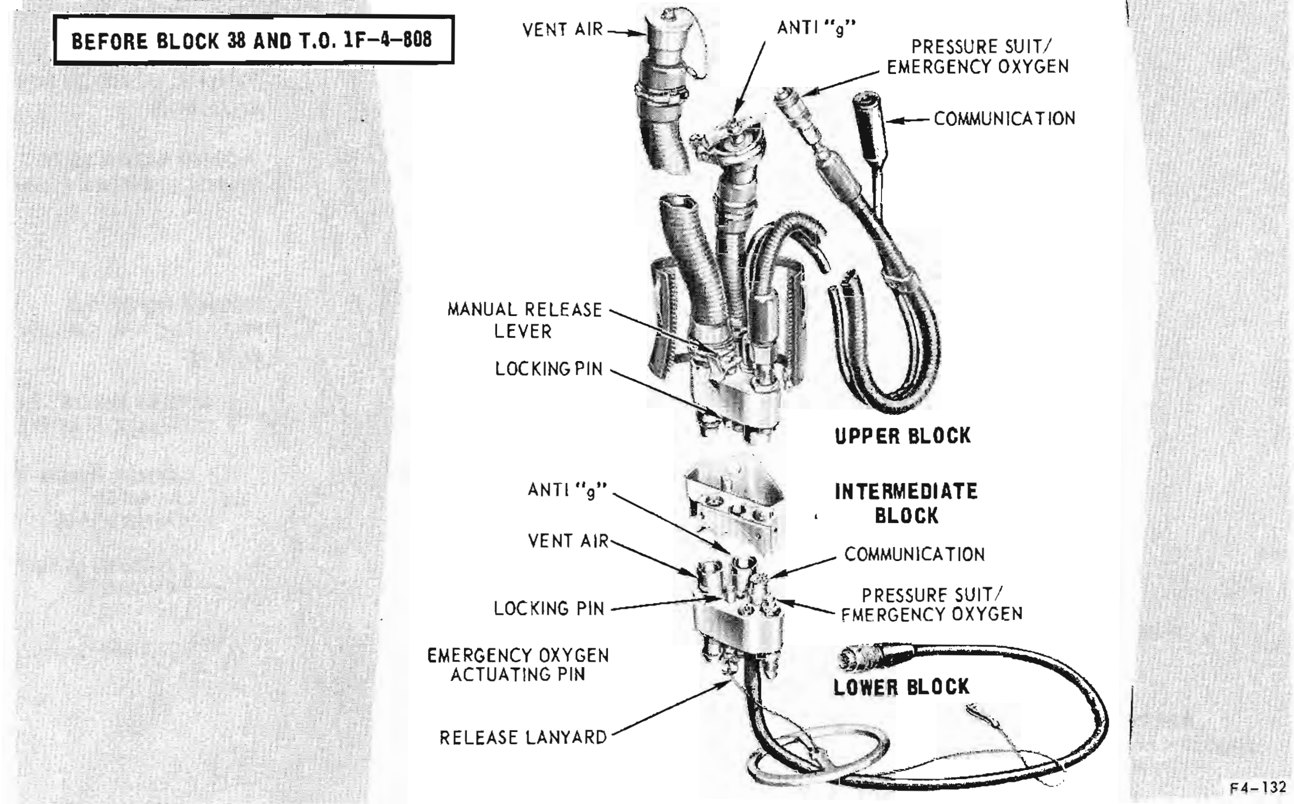


Figure 1-27

separation, the automatic feature is negated and the survival kit release handle must be pulled to open the kit. If automatic deployment is not desired, the crewman can select the manual mode and actuate the kit when desired by pulling up on the survival kit release handle. The manual mode is selected by pushing the switch handle down to the horizontal position and the automatic mode is selected by pulling the handle up to the vertical position. Except for the automatic kit deployment feature, the emergency egress, ejection and ditching procedures are the same as for the replaced kit.

Composite Disconnect

Before T.O. 1F-4-808, the composite disconnect (figure 1-27) attached to the left rear corner of the survival kit is the personal equipment tie-in between the crewmember and the aircraft. The composite disconnect is composed of three sections: an upper block, intermediate block, and lower block. Pressure suit vent air, pressure suit oxygen, anti-G suit air, and the communication line pass through all three blocks. The emergency oxygen is routed to the intermediate block and then passes through the upper block into the emergency oxygen supply hose. On aircraft after T.O. 1F-4-808, the composite disconnect is removed from the survival kit. With removal of the composite disconnect from the seat the G suit and vent air connections are now located adjacent to the left console, although the vent air system is deactivated for pressure suit use, and the communications line is located on the oxygen supply line on the right side of the cockpit.

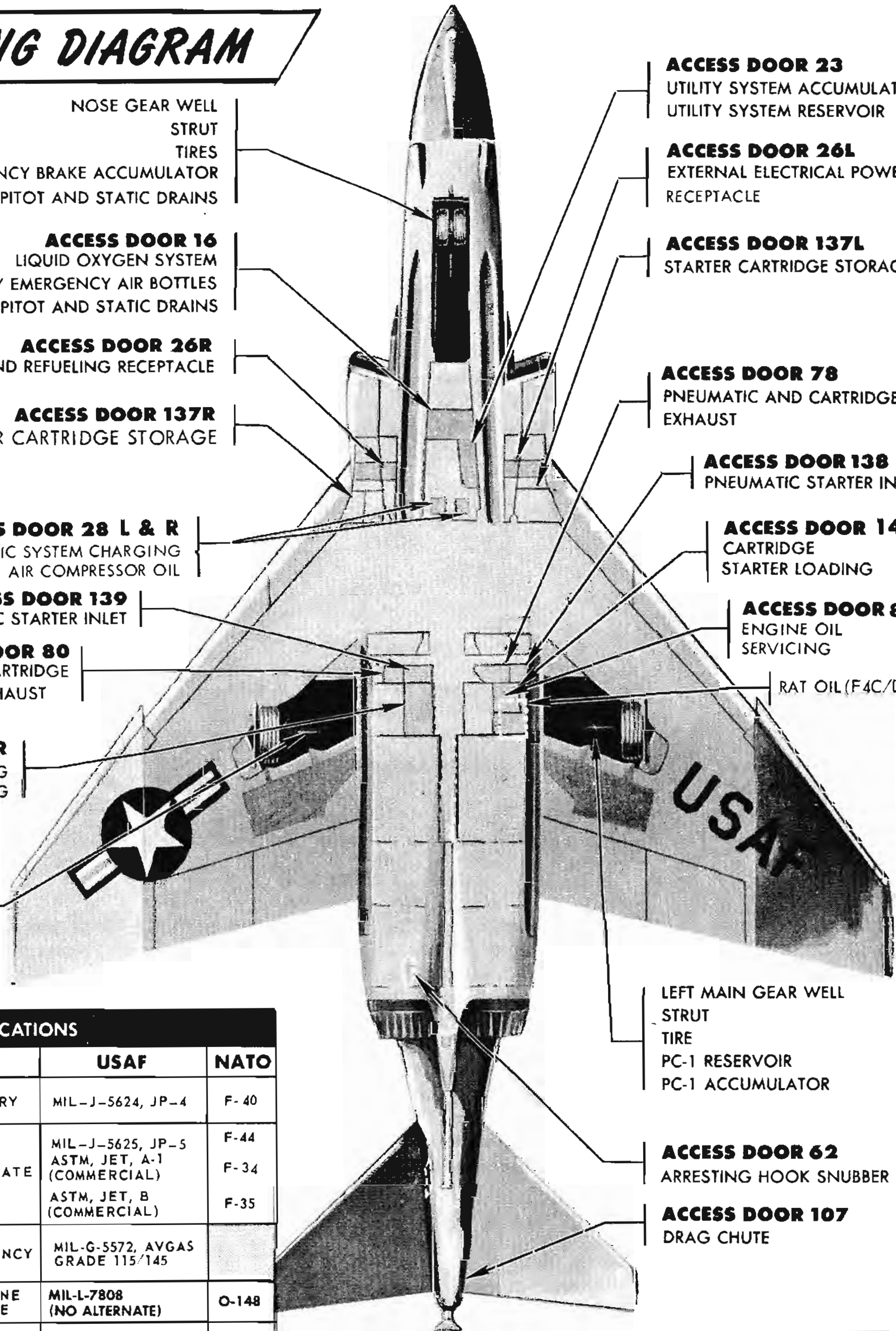
SERVICING

See figure 1-28 for servicing requirements.

AUXILIARY EQUIPMENT

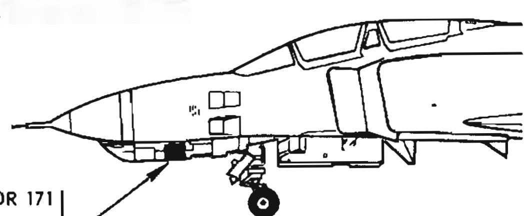
Information concerning the cockpit air conditioning and pressurization system, cockpit defrosting and anti-icing system, autopilot, navigation equipment, fire control system, armament, refueling systems, and miscellaneous equipment are found in section IV of this manual.

SERVICING DIAGRAM



SPECIFICATIONS			
		USAF	NATO
FUEL NOTE • THE BASIC AND AFTER-BURNER FUEL CONTROLS MUST BE ADJUSTED FOR SPECIFIC DENSITY OF THE FUEL BEING USED. • REFER TO SECTION V, OPERATING LIMITIONS, FOR ADDITIONAL INFORMATION WHEN EMERGENCY OR ALTERNATE FUEL IS UTILIZED.	PRIMARY	MIL-J-5624, JP-4	F-40
	ALTERNATE	MIL-J-5625, JP-5	F-44
		ASTM, JET, A-1 (COMMERCIAL)	F-34
		ASTM, JET, B (COMMERCIAL)	F-35
	EMERGENCY	MIL-G-5572, AVGAS GRADE 115/145	
OIL	TURBINE ENGINE	MIL-L-7808 (NO ALTERNATE)	O-148
HYDRAULIC FLUID		MIL-H-5606	H-515
OXYGEN	LIQUID	MIL-O-27210 TYPE II	
NITROGEN	GASEOUS	BB-N-411 GRADE A TYPE I CLASS I	
OIL	M61A1 GUN	MIL-L-46000	F4E

- UTILIZE MA-1A ENGINE STARTING UNIT OR EQUIVALENT FOR A PNEUMATIC START
- UTILIZE A MXU-4A SOLID PROPELLANT CARTRIDGE FOR A CARTRIDGE START



F4-126

Figure 1-28

SECTION II NORMAL PROCEDURES

TABLE OF CONTENTS

Note

The aircrew procedures through the Before Taxiing paragraph are separated into individual procedures for the aircraft commander and pilot. These separate procedures allow the individual crewmember to perform the checks without requiring him to read the checks performed by the other crewmember. The remaining procedures are combined and are coded for applicable crewmember action. Items coded (AC-P) are applicable to both the aircraft commander and pilot. Items coded (P) are applicable to the pilot only, and items not coded are applicable to the aircraft commander only.

PREPARATION FOR FLIGHT

FLIGHT RESTRICTIONS

Refer to section V, Operating Limitations, for detailed aircraft and engine operating limitations.

FLIGHT PLANNING

Refer to Performance Data Manual, T.O. 1F-4C-1-1.

TAKEOFF AND LANDING DATA CARD

If the takeoff distance exceeds one-half of the available runway length, the takeoff and landing data card should be completed, refer to Performance Data Manual, T.O. 1F-4C-1-1 and T.O. 1F-4C-1CL-1.

WEIGHT AND BALANCE

For maximum gross weight limitations, refer to section V, Operating Limitations. For aircraft loading information, refer to section V, Performance Data Manual, T.O. 1F-4C-1-1, and to the handbook of Weight and Balance Data, T.O. 1-1B-40.

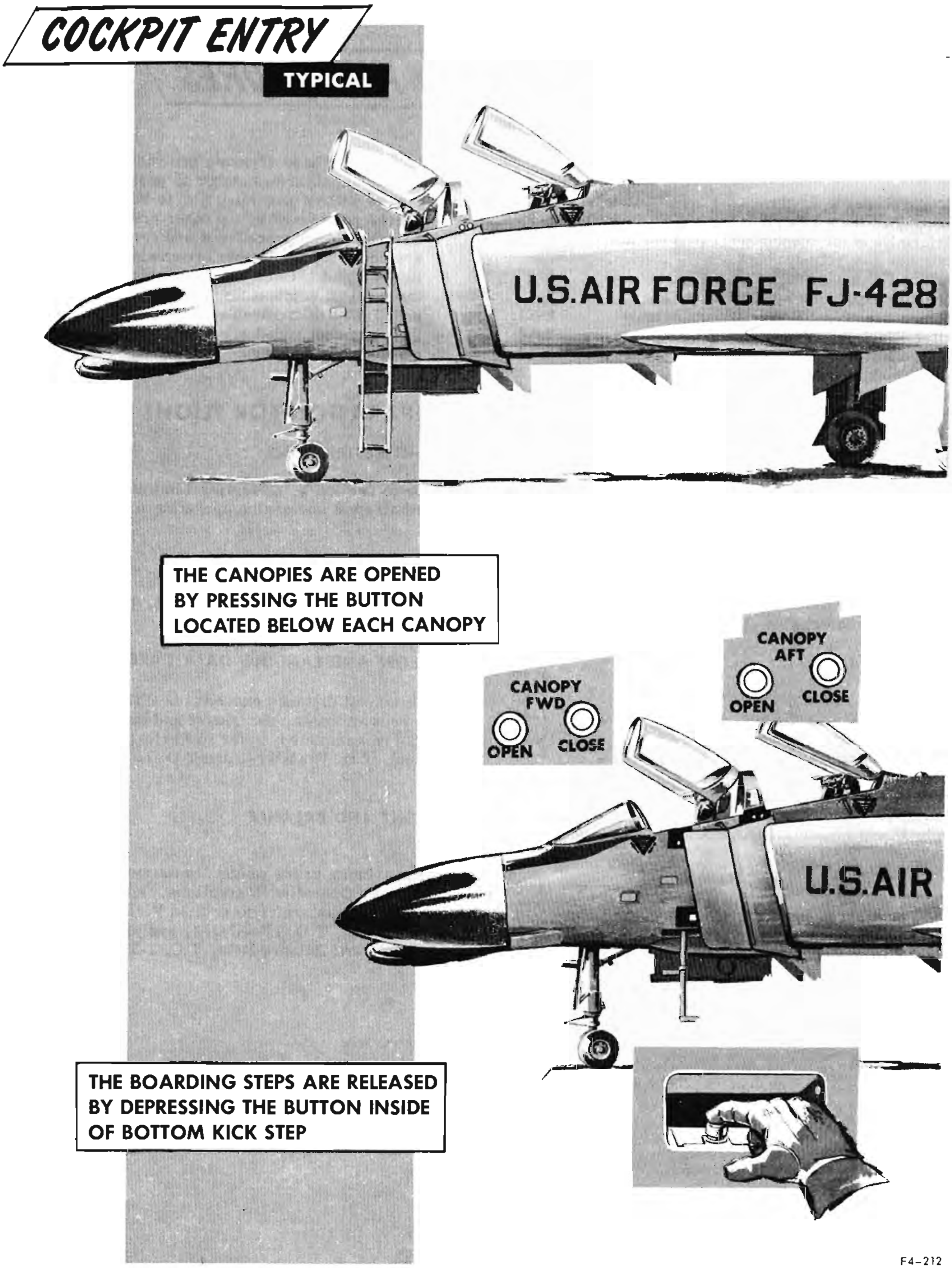

COCKPIT ENTRY
TYPICAL
U.S.AIR FORCE FJ-428
THE CANOPIES ARE OPENED BY PRESSING THE BUTTON LOCATED BELOW EACH CANOPY
CANOPY FWD
OPEN
CLOSE
CANOPY AFT
OPEN
CLOSE
U.S.AIR
THE BOARDING STEPS ARE RELEASED BY DEPRESSING THE BUTTON INSIDE OF BOTTOM KICK STEP
F4-212

Figure 2-1

PREFLIGHT CHECK

1. Check Form 781 for aircraft status and release.

BEFORE EXTERIOR INSPECTION (FRONT COCKPIT)

1. Check ejection gun and face curtain safety pins installed and lower ejection handle guard up.
2. Generator switches - OFF
3. ECM pod jettison switch - NORM (some aircraft)
4. Wing station jettison switch - NORM

CAUTION

The external wing tanks can be jettisoned by the external wing tank jettison switch any time electrical power is on the airplane and the external tanks safety pins are removed.

5. Center station jettison switch - NORM
6. Internal wing dump switch - NORM

CAUTION

With electrical power applied to the aircraft, wing fuel will be dumped any time the internal wing dump switch is in the DUMP position.

7. Throttles - OFF
8. Eject light - CHECK
9. Engine master switches - OFF
10. External stores emergency release - CHECK
11. Gear handle - DOWN
12. Missile jettison selector - OFF
13. Armament switches - OFF/SAFE
14. Pitot heat - OFF
15. Battery - CHECK
    To determine battery relay closure, turn on engine master switch and check for proper positioning of gear and flaps position indicators. Turn engine master switch off.
16. Reference system selector - STBY
17. Publications and flight data - CHECK
18. External power - CHECK ON
19. Generator switches - EXT ON

CAUTION

Do not place the generator control switches to EXT ON until external power has been connected and has reached rated voltage and frequency (400 cycles), 115/200 volts ac.

Note

If a battery start is to be made, those checks requiring electrical power will have to be performed after the engines have been started.

*20. (F-4E) Transformer rectifier - CHECK

Note

Both transformer-rectifiers are operating if the landing gear indicators indicate gear down with the generator switches in EXT. The engine master switches must be off for this check.

* Cannot be performed when battery start is made.

EXTERIOR INSPECTION

1. Gear ground locks - REMOVED
2. Intake and refrigeration ducts - CLEAR
3. External stores - CHECK
4. Armament pylon safety lockout pins - AS REQUIRED

WARNING

The pylon inflight lockout pins must be installed or stores on the left inboard, left outboard, and right inboard armament pylons cannot be jettisoned without first going through the DCU-94/A bomb control monitor panel. In no way, without the pylon unlock pins installed, can the stores on the right outboard pylon by jettisoned. All missiles, except the AGM 12C, can be jettisoned with or without the pylon inflight lockout pins installed.

5. Centerline rack access panels (inside aux air door areas) - SECURE
6. Wings - SPREAD AND LOCKED
   Ensure that wing pin lock warning flags are flush with wing surfaces.
7. All protective covers - REMOVED
8. Drag chute pin - REMOVE
9. Arresting hook ground lock - REMOVED

BEFORE ENTERING FRONT COCKPIT

1. Canopy condition - CHECK
   Check for cracks in the canopy and windshield plexiglass. Check condition of the canopy pressure seals.

CAUTION

The center mirror on the forward canopy can be tilted sufficiently to prevent canopy closing; therefore, assure that the mirror will clear the windshield bow before closing canopy.

2. Canopy safety strut - REMOVED
3. Canopy actuator - SHEAR PIN INTACT
4. Face curtain and ejection gun firing mechanism safety pin or interdictor pin (after T.O. 1F-4-898) - INSTALLED; ALL OTHER PINS REMOVED

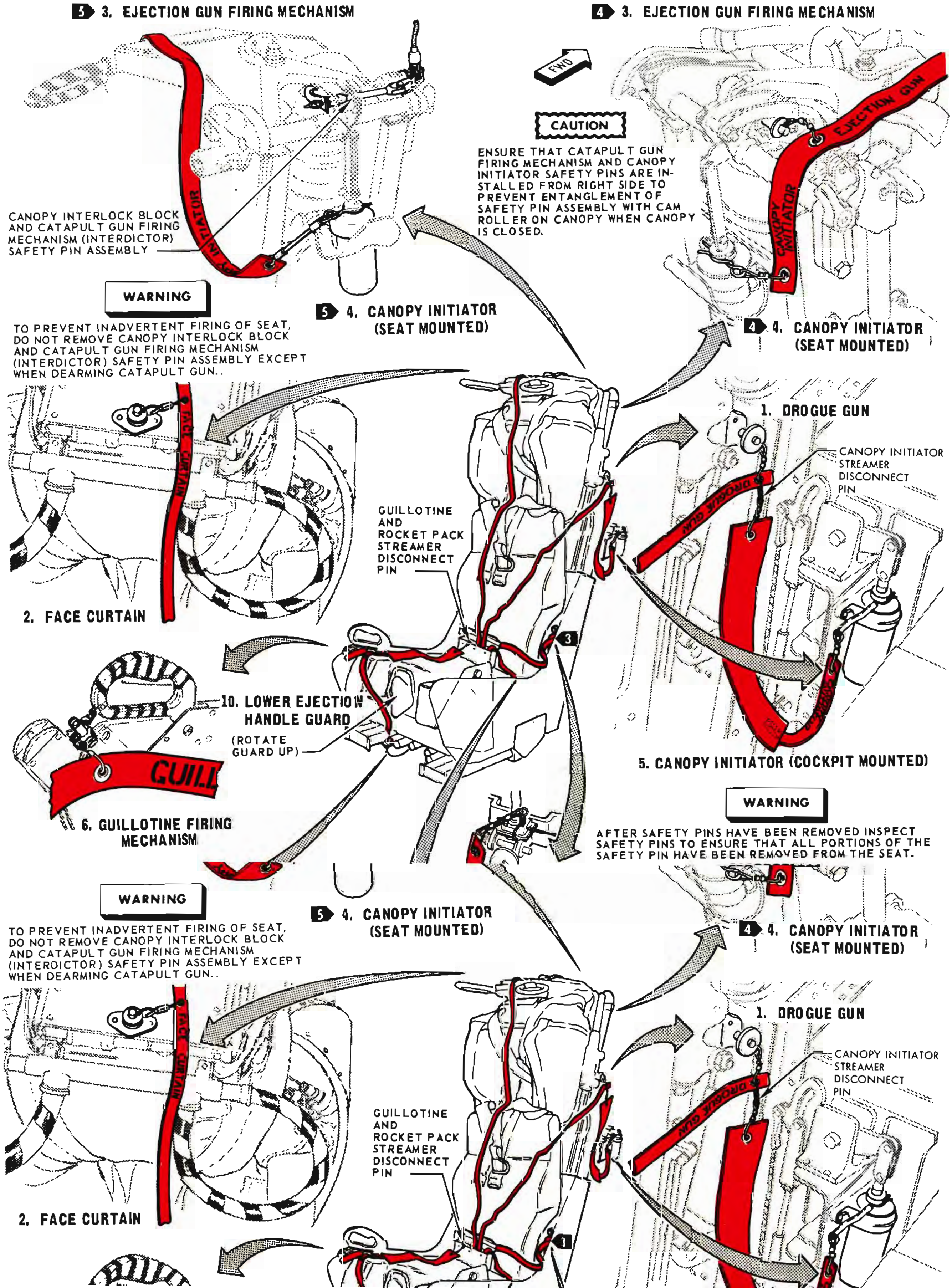
WARNING

The rocket motor and igniter sear are located under the seat. Do not use this area for stowage, and exercise extreme caution when performing any function in the vicinity of the rocket pack; e.g., pulling rocket motor safety pin, adjusting leg restraint lines, etc.

CAUTION

Exercise caution regarding hand movements in the vicinity of the airplane mounted canopy initiator linkages. Also, do not stow flight equipment or personal items in this area. Failure to comply could result in inadvertent jettisoning of the canopy.

EJECTION SEAT AND CANOPY INITIATOR SAFETY PINS



BEFORE ENTERING FRONT COCKPIT CONTINUED

5. Interlock block - CHECK INSTALLED AND ATTACHED TO CANOPY
6. Banana links - CHECK ENGAGED IN MAIN SEAR
7. Sequence initiator - LINKAGE CONNECTED, PIN OUT
8. Scissors - CHECK LOCKED ON TO SHACKLE AND TIED DOWN AND ENSURE SCISSORS GUARD IS NOT BENT

WARNING

If the scissors shackle tie-down thread passes through the wire loop, the drogue chute may not deploy.

9. Drogue chute withdrawal line - CHECK ROUTED OVER ALL OTHER LINES
10. Top latch mechanism - PLUNGER FLUSH

WARNING

If the plunger is not flush, the seat is not locked into position and inadvertent ejection could result.

11. Parachute withdrawal line - CHECK QUICK DISCONNECT IS CONNECTED AND RUNS THROUGH GUILLOTINE
12. Safety pin line - CHECK NOT THROUGH GUILLOTINE
13. Parachute alignment ring - SAFETY PIN AND WITHDRAWAL LINES ROUTED THROUGH
14. Guillotine - CHECK PASSAGE AND HOSE SECURITY
15. Drogue gun assembly - SHEAR PIN INTACT, SAFETY PIN OUT, TRIP ROD CORRECTED WITH NO RED SHOWING ON INNER BARREL
16. Drogue gun cocking indicator - COCKED (F-4E 68-452 and up)
    If the indicator is approximately 1/2 inch below the gun housing it is cocked. If flush with the housing it is uncocked and will not fire on ejection.
17. Bulkhead mounted canopy initiator - LINKAGE CONNECTED, PIN OUT
18. Harness assembly - CHECK
19. Emergency oxygen - CHECK PRESSURE AND SAFETY PIN REMOVED (after T.O. 1F-4-808)

Note

Proper servicing of the emergency oxygen bottle is indicated by a gage reading of 1800 psi at 70° F. The pressure indication varies with temperature to determine correct indication, add 3 psi for each degree above 70° F and subtract 3 psi for each degree below 70° F. Thus the bottle is correctly serviced if the gage reads 1890 psi at 100° F. Figure FO-10 shows approximate pressure values for various gage needle locations.

20. Upper block - CONNECTED, OXYGEN AND COMMUNICATION LINES - LOCATED IN FRONT OF LUMBAR PAD (before T.O. 1F-4-808)
21. Emergency oxygen actuation knob and linkage - CHECK (after T.O. 1F-4-808)
    Check knob not actuated. If actuated, knob is tilted approximately 45° from vertical. Check security of shear pin in cable to linkage connection by applying light tension on cable.
22. Rocket motor - SAFETY PIN REMOVED AND LEG GUARDS IN PLACE
23. Leg garters - CHECK LOCKED IN, AND LANYARDS NOT TWISTED
24. Survial kit - CHECK HANDLE DOWN. SELECTOR SWITCH AUTO POSITION (after T.O. 1F-4-808)
25. Emergency harness release handle - CHECK DOWN WITH SEAR ENGAGED, SAFETY PIN OUT, AND ACTUATION LANYARD CONNECTED (after T.O. 1F-4-808)
26. Time release trip rod - CONNECTED
27. Ejection gun firing mechanism safety pin - REMOVED (before T.O. 1F-4-808 and if knowledgeable ground personnel are not available)

FRONT COCKPIT INTERIOR CHECK

1. Rudder pedals - ADJUST
2. Leg restraint lines - BUCKLED AND SECURED
   Check restraint lines buckled and properly adjusted. Check that lines are secured to seat and floor and not twisted. On aircraft with dual garter system, check that leg restraint lines are threaded through the calf garters (double D-ring, routing first through the outboard ring and then through the inboard ring), then through the thigh garters (single D-ring) before the lock pins are inserted in the snubber boxes. Check that the leg restraint line lock pins are threaded through hold-down strap lugs on survival kits equipped with negative G hold-down straps. Check that the survival kit-to-seat retention straps (if incorporated) are attached to the leg restraint line lock pins at the lock pin attachment points.

WARNING

- The leg restraint lines must be buckled at all times during flight to ensure that the legs will be pulled back upon ejection. This will enhance seat stability and will prevent leg injury by keeping the legs from flailing following ejection.
- Failure to route the restraint lines properly through the garters with the dual garter system could cause serious injury during ejection.

3. Harnessing and personal equipment leads - FASTEN
   Attach the parachute riser-shoulder harness fittings to the integrated harness lower buckles. Attach and firmly adjust the survival kit straps. Secure and firmly adjust the lap belt. Connect oxygen, communication and anti-G leads. After T.O. 1F-4-808, route the anti-G hose line behind personal harness sling if hose interferes with controls on left console. Check the operation of the shoulder harness locking mechanism.

WARNING

Before T.O. 1F-4-808, to prevent the upper block assembly of the composite disconnect from becoming entangled during emergency evacuation of the cockpit, the oxygen and communication leads from the composite disconnect should be routed between the crewmember and the back pad, or lumbar pad (if incorporated).

4. Ejection seat height - ADJUST
5. Ejection gun safety pin (before T.O. 1F-4-898) and face curtain safety pin - CHECK REMOVED

WARNING

Exercise extreme caution after the ejection gun safety pin has been removed. Avoid dislodging the canopy interlock block and putting forward pressure on the ejection gun firing linkage at the top rear of the seat. After all personnel leads have been fastened, remove the face curtain safety pin and stow.

6. Stick grip - CHECK
   Check that the stick grip is firmly attached to the stick
7. Auxiliary armament control panel - SET
   a. (F-4C/D) Coolant control switch - OFF
   b. (F-4C) Outboard station selector switch - SAFE
   c. (F-4C) Center station selector switch - SAFE
   d. (F-4C) Gun clear switch - AS DESIRED
   e. (F-4D/E) Gyro switch - NORM

FRONT COCKPIT INTERIOR CHECK CONTINUED

f. Aural tone control knob - LOW
g. Boarding steps position indicator - PROTRUDING
8. Intercom control panel - SET
a. Volume control - AS DESIRED
b. Amplifier selector knob - NORM
c. Function selector switch - HOT MIC
9. Fuel control panel - SET
a. Wing station jettison switch - NORM

CAUTION

The external wing tanks can be jettisoned by the external wing tank jettison switch any time electrical power is on the airplane and the external tanks safety pins are removed.

b. Center station jettison switch - NORM
c. Internal wing transfer switch - NORMAL (STOP TRANS before T.O. 1F-4-609)
d. Internal wing dump switch - NORM
e. Refuel selection switch - ALL TANKS

CAUTION

With electrical power applied to the airplane, wing fuel will be dumped any time the internal wing dump switch is in the DUMP position.

f. External transfer switch - AS REQUIRED
g. Air refuel switch - RETRACT
h. Tanks 5/6 lockout switch - AS REQUIRED (some aircraft)

*10. Boost pumps and engine fuel shutoff valve - CHECK (some aircraft)
Actuate the left boost pump check switch and observe that the left boost pump pressure indicator reads 30 ± 5 psi. Also, note that zero fuel flow is registered on the left fuel flow indicator. Allow 3 seconds after release of left switch, then repeat the procedure using the right boost pump check switch.

Note

Ensure boost pump check switches return to the NORMAL position after actuation. Failure of the switches to return will cause an interruption of fuel valve electrical power and could result in engine fuel starvation at start. Zero fuel flow reading is an indication that the fuel shutoff valves are closed.

11. Ram air turbine control handle - RAT IN (some aircraft)
12. Flap switch - UP
13. Emergency flap handle - FORWARD
14. Speed brake switch - IN
15. Throttle friction lever - SET AS DESIRED
*16. APU System - CHECK (some aircraft)
a. APU reject switch - TEST (APU light on)
b. Move control stick fore and aft and check corresponding stabilator movement.
c. APU reject switch - NORMAL (APU light out after one minute)
17. DVST display switch - AS DESIRED (some aircraft)
18. LCOSS display switch - AS DESIRED (some aircraft)
19. Engine anti-icing switch - NORMAL
20. Communication antenna selector switch - UPR

* Cannot be performed when a battery start is made.

FRONT COCKPIT INTERIOR CHECK CONTINUED

WARNING

Electromagnetic interference radiating from the lower UHF antenna may interfere with the nose wheel steering system. Therefore, the upper UHF antenna should be used any time the aircraft is not airborne.

21. Drag chute control handle - DOWN AND SECURE
22. Oxygen quantity gage - CHECK
    Check that the oxygen quantity is sufficient for the intended mission, the OFF flag on the gage face is not visible, and the OXYGEN LOW light is extinguished. Press oxygen test button and check OXYGEN LOW light and MASTER CAUTION light illuminate at 1 liter.
23. Oxygen supply system - CHECK AND SET
    a. Pressure suit oxygen supply lever - OFF
    b. Check the console mounted pressure demand regulator supply lever - ON
    c. Emergency and dilution levers - NORMAL
    d. Check the oxygen pressure gage at 75 $\pm$ 25 psi.
    e. Put mask on and place emergency lever in emergency position; breathe normally and check flow indicator operation. Hold breath; all flow should stop and the flow indicator should return to no-flow position (black). A white indicator indicates flow due to a leak that must be corrected before flight.
    f. Return emergency lever to - NORMAL

WARNING

If the oxygen supply lever is OFF when standard flight suit is worn, the crewmember will only be breathing cockpit air. It is therefore imperative to check for oxygen flow prior to takeoff or hypoxia will occur as altitudes are reached that require oxygen.

    g. Console mounted pressure demand regulator supply lever - AS REQUIRED
       When operating with a standard flight suit, the oxygen supply lever should be safety wired to the ON position. When operating with a full pressure suit, break the safety wire and place the lever in the OFF position. Refer to section I, Oxygen Connection (Full Pressure Suit) for procedures to check proper operation of the pressure suit oxygen supply system.
24. Pressure suit oxygen supply lever - CHECK
    Check the pressure suit oxygen supply lever OFF when on a nonpressure suit mission and ON when on a pressure suit mission.
25. Pressure suit vent air knob - CHECK
    Check the pressure suit vent air knob OFF when on a nonpressure suit mission and ON (as desired) when on a pressure suit mission. Refer to section IV.
26. Anti-skid switch - OFF
27. Landing and taxi lights switch - OFF
28. Flap position indicators - UP
29. Landing gear position indicators - GEAR DOWN INDICATION
30. Emergency speed brake switch - MANUAL (some aircraft)
31. Aileron rudder interconnect circuit breaker - IN
32. Emergency brake control handle - IN AND SECURE.
33. Canopy emergency jettison handle - FORWARD
34. RHAW systems - CHECK (as required) then off
    Refer to T.O. 1F-4C-34-1-1.
35. Missile control panel - SET
    a. Missile power switch - OFF
    b. Missile select switch - AS DESIRED
    c. Missile arm switch - SAFE
    d. Missile interlock switch - IN

FRONT COCKPIT INTERIOR CHECK CONTINUED

WARNING

If the missile power switch is in the PWR ON position, and the radar power switch in the rear cockpit is in any position other than OFF or TEST, radiation will be emitted which can be harmful to ground personnel.

36. Missile jettison selector knob - OFF
37. (F-4C) Bomb control panel - SET
    a. Special weapon jettison switch - NORM
    b. Bombing mode selector knob - OFF
38. (F-4D/E) Delivery mode selector knob - OFF
39. Accelerometer - SET
40. (F-4D/E) Sight mode selector knob - STBY/CAGE (AS APPLICABLE)

CAUTION

- The sight mode selector knob should be in the STBY, or CAGE position to prevent damage to servo mirror.
- The sight shutter should be closed when not in use to prevent damage to internal components caused by sunlight focused by the sight combining lens.

41. (F-4C) Optical sight unit - CHECK (if required)
    Refer to T.O. 1F-4C-34-1-1 for preflight check.
42. Fuel quantity gage - CHECK
    Actuate and hold feed tank check switch to check fuel quantity (counter and tape) in feed tank.
43. Fire warning lights - TEST
    Check that fire and overheat warning lights illuminate when the fire warning lights test button is depressed.
44. ADI - SET
    Miniature aircraft level with horizon bar.
45. Clock - WIND AND SET
46. Navigation function selector panel - SET
    a. Bearing distance selector switch - AS DESIRED
    b. Mode selector knob - AS DESIRED
47. (F-4C) Multiple weapons control panel - SET
    a. Weapon selector knob - BOMBS
    b. GAM-AUX switch - NORM
    c. Master arm switch - SAFE
    d. Step switch - NORMAL
    e. Fuse arm switch - SAFE
    f. Interval switch - AS DESIRED
    g. Station selector knob - OFF
48. (F-4D/E) Station and weapon selection panel - SET
    a. Master arm switch - SAFE
    b. Guns control switch - NORM
    c. Guns clear switch - AS DESIRED
    d. Weapon selector knob - BOMBS
    e. Interval switch - AS DESIRED
    f. Band selector switch - AS DESIRED
    g. Reject switch - NORM
    h. Fuse arm switch - SAFE
    i. Station select lights - CHECK OUT
49. Canopy manual unlock handle - FORWARD
50. Arresting hook control handle - UP
51. Emergency vent knob - IN

FRONT COCKPIT INTERIOR CHECK CONTINUED

52. Communication-navigation control panel - SET
    a. Communication frequency control knobs - AS REQUIRED
    b. Communication channel control knob - AS REQUIRED
    c. Mode select switch - AS REQUIRED (some aircraft)
    d. Communication volume control knob - AS DESIRED
    e. Auxiliary channel control knob - AS REQUIRED
    f. Auxiliary volume control knob - AS DESIRED
    g. Communication function selector knob - T/R +G
    h. Navigation channel control knobs - AS REQUIRED
    i. Navigation volume control knobs - AS DESIRED
    j. Tacan function selector knob - T/R
    k. Communication command button - AS DESIRED
    l. Navigation command button - AS DESIRED
53. Rain removal switch - OFF
54. Defog-foot heat control handle - AS DESIRED
55. Pitot heat switch - OFF
56. Circuit breakers - CHECK
57. IFF/SIF control panel - STBY
58. Temperature control panel - SET
    a. Temperature control knob - AS DESIRED
    b. Mode selector switch - AUTO
59. DCU-94/A bomb control monitor panel - SET (some aircraft)
    a. Station selector switches - AFT
    b. Master release lock switch - AFT
    c. Option selector knob - OFF
60. Cockpit lights control panel - AS REQUIRED
    a. White floodlight switch - OFF
    b. Instrument panel lights control knob - AS REQUIRED
    c. Console lights control knob - AS REQUIRED
    d. Standby compass light switch - AS REQUIRED
    e. Console floodlight switch - AS REQUIRED
    f. Indexer lights control knob - AS REQUIRED
61. Warning and indicator lights - TEST
62. Compass control panel - SET
    a. Latitude compensator - SET
    b. Reference system selector knob - STBY
    c. Mode control knob - SLAVED
    d. Synchronization indicator - CHECK
63. Exterior lights control panel - SET
    a. Fuselage lights switch - AS REQUIRED
    b. Wing lights switch - AS REQUIRED
    c. Tail lights switch - AS REQUIRED
    d. Exterior lights flasher switch - AS REQUIRED
64. KY-28 control panel - SET (some aircraft)
    a. Power selector knob - OFF
    b. Mode switch - P
       Refer to T.O. 1F-4C-34-1-1B.
65. Intercom system - CHECK

BEFORE ELECTRICAL POWER (REAR COCKPIT)

1. Check ejection gun and face curtain safety pins installed and lower ejection handle guard up.
2. Check throttles connected between front and rear cockpits.
   Move rear cockpit throttles in both directions and check for corresponding front cockpit throttle movement. If rear cockpit throttles move in either direction without corresponding front cockpit throttle movement, this indicates that the throttles are disconnected and should be reconnected before continuing.
3. Command selector valve handle - VERTICAL (closed)
4. Eject light - CHECK
   Confirm illumination when front cockpit light is depressed.
5. Radar power - OFF

BEFORE ELECTRICAL POWER (REAR COCKPIT) CONTINUED

CAUTION

The radar power selector knob should remain OFF until the aircraft is operating on internal power and the engines are up to IDLE power (or 50% rpm minimum).

6. RHAW/ECM equipment - OFF (some aircraft)
   Refer to T.O. 1F-4C-34-1-1A and T.O. 1F-4C-34-1-1B.
7. INS - OFF
8. Nuclear store consent switch - SAFE
9. Nav computer - OFF
10. Circuit breaker panels - CHECK
11. Electrical test receptacle - ENSURE CAP TIGHTENED

Note

It is possible to trip both generators off the line if the electrical test receptacle 3P325 under the right canopy sill is loose. The generators cannot be restored until the cap is tightened.

AFTER ELECTRICAL POWER (REAR COCKPIT)

*1. Instrument ground power switch - ACTUATE
   Actuate the instrument ground power switch to connect the instrument 115/200 volt ac bus and the instrument 28 volt ac bus to the electrical system.

*2. Essential dc test button - DEPRESS (some aircraft)
   Depress the essential dc test button and observe that the essential dc test light illuminates.

Note

The transformer-rectifiers cannot be properly checked unless the master switches are off.

3. Navigation computer - SET
   a. Function select knob - STBY
   b. Variation counter - SET LOCAL MAGNETIC VARIATION
   c. Wind counters - SET PREFLIGHT WIND DIRECTION AND SPEED
   d. Position update switch - NORM
   e. Present position counters - SET
   f. Target counters - SET AS REQUIRED
   g. Function selector knob - RESET
   h. Function selector knob - STBY

Note

Base coordinates may be stored in the AN/ASN-46 navigation computer by placing the function selector knob to RESET and inserting coordinates in the present position windows. The function selector knob must be placed in STBY and present position coordinates set prior to aligning the INS. TGT 2 coordinates may be stored in the AN/ASN-46A navigation computer by placing the function selector knob to RESET and inserting coordinates in the target windows. The coordinates may be changed at any time in flight.

4. INS alignment - AS DESIRED

* Cannot be performed when battery start is made.

AFTER ELECTRICAL POWER (REAR COCKPIT) CONTINUED

Gyro Compass Alignment:

a. Align mode switch - GYRO COMP
b. Power control knob - STBY
c. When HEAT light is out, power control knob - ALIGN
d. After the ALIGN light has cycled from off to steady, recycle the power control to STBY for approximately 30 seconds and back to ALIGN: (Unmodified Computers).

Note

Cycling the power control knob from ALIGN to STBY and back to ALIGN too rapidly can cause a system No-Go.

e. After the ALIGN light has again cycled from off to steady, and then to flashing, null out the variation sensed by the system with the magnetic variation control knob.

CAUTION

To avoid electrical power interruption which could result in an INS No-Go indication, ensure that the INS is not in the align mode when the generator switches are placed to ON. In the event a power interruption does occur, switch the power control knob to OFF. When power is restored, go directly from OFF to ALIGN.

f. Power control knob - NAV

Heading Memory Alignment:

a. Perform a normal INS alignment through the flashing ALIGN light.
b. Align mode switch - HDG MEM
c. Inertial navigation set - OFF/STBY (As Required)
d. Navigation computer - OFF/STBY (As Required)

Note

From this time until completion of the heading memory alignment, the airplane must not be moved.

After ground power available and before taxiing, perform the following steps:

e. Navigation computer - STBY
f. Inertial navigation set - ALIGN

Note

If time permits the INS may first be placed to STBY until the heat light extinguishes and then to ALIGN for greater system accuracy.

g. Inertial navigation set - NAV
Place the INS to NAV after the ALIGN light flashes and prior to aircraft power transfer.
h. Align mode switch - GYRO COMP

Note

If the align mode switch is placed to Gyro Comp prior to switching to NAV the heading memory information will be lost.

BEFORE ENTERING REAR COCKPIT

1. Canopy condition - CHECK
   Check for cracks in the canopy and windshield plexiglass. Check condition of the canopy pressure seals.
2. Canopy safety strut - REMOVED
3. Canopy actuator - SHEAR PIN INTACT
4. Face curtain and ejection gun firing mechanism safety pin or interdictor pin (after T.O. 1F-4-898) - INSTALLED; ALL OTHER PINS REMOVED

WARNING

The rocket motor and igniter sear are located under the seat. Do not use this area for stowage, and exercise extreme caution when performing any function in the vicinity of the rocket pack: e.g., pulling rocket motor safety pin, adjusting leg restraint lines, etc.

CAUTION

Exercise caution regarding hand movements in the vicinity of the airplane mounted canopy initiator linkages. Also, do not stow flight equipment or personal items in this area. Failure to comply could result in inadvertent jettisoning of the canopy.

5. Interlock block - CHECK INSTALLED AND ATTACHED TO CANOPY
6. Banana links - CHECK ENGAGED IN MAIN SEAR
7. Sequence initiator - LINKAGE CONNECTED, PIN OUT
8. Scissors - CHECK LOCKED ON TO SHACKLE AND TIED DOWN AND ENSURE SCISSORS GUARD IS NOT BENT

WARNING

If the scissors shackle tie-down thread passes through the wire loop, the drogue chute may not deploy.

9. Drogue chute withdrawal line - CHECK ROUTED OVER ALL OTHER LINES
10. Top latch mechanism - PLUNGER FLUSH

WARNING

If the plunger is not flush, the seat is not locked into position and inadvertent ejection could result.

11. Parachute withdrawal line - CHECK QUICK DISCONNECT IS CONNECTED AND RUNS THROUGH GUILLOTINE
12. Safety pin line - CHECK NOT THROUGH GUILLOTINE
13. Parachute alignment ring - SAFETY PIN AND WITHDRAWAL LINES ROUTED THROUGH
14. Guillotine - CHECK PASSAGE AND HOSE SECURITY
15. Drogue gun assembly - SHEAR PIN INTACT, SAFETY PIN OUT, TRIP ROD CONNECTED WITH NO RED SHOWING ON INNER BARREL
16. Drogue gun cocking indicator - COCKED (F-4E 68-452 and up)
    If the indicator is approximately 1/2-inch below the gun housing it is cocked. If flush with the housing it is uncocked and will not fire on ejection.
17. Bulkhead mounted canopy initiator - LINKAGE CONNECTED, PIN OUT
18. Harness assembly - CHECK
19. Emergency oxygen - CHECK PRESSURE AND SAFETY PIN REMOVED (after T.O. 1F-4-808)

BEFORE ENTERING REAR COCKPIT CONTINUED

Note

Proper servicing of the emergency oxygen bottle is indicated by a gage reading of 1800 psi at 70°F. The pressure indication varies with temperature to determine correct indication, add 3 psi for each degree above 70 F and subtract 3 psi for each degree below 70°F. Thus the bottle is correctly serviced if the gage reads 1890 psi at 100°F. Figure FO-10 shows approximate pressure values for various gage needle locations.

20. Upper block - CONNECTED, OXYGEN AND COMMUNICATION LINES - LOCATED IN FRONT OF LUMBAR PAD (before T.O. 1F-4-808)
21. Emergency oxygen actuation knob and linkage - CHECK (after T.O. 1F-4-808)
    Check knob not actuated. If actuated, knob is tilted approximately 45° from vertical. Check security of shear pin in cable to linkage connection by applying light tension on cable.
22. Rocket motor - SAFETY PIN REMOVED AND LEG GUARDS IN PLACE
23. Leg garters - CHECK LOCKED IN, AND LANYARDS NOT TWISTED
24. Survival kit - CHECK HANDLE DOWN. SELECTOR SWITCH AUTO POSITION (after T.O. 1F-4-808)
25. Emergency harness release handle - CHECK DOWN WITH SEAR ENGAGED, SAFETY PIN OUT, AND ACTUATION LANYARD CONNECTED (after T.O. 1F-4-808)
26. Time release trip rod - CONNECTED
27. Ejection gun firing mechanism safety pin - REMOVED (before T.O. 1F-4-898 and if knowledgeable ground personnel are not available)

REAR COCKPIT INTERIOR CHECK

1. Rudder pedals - ADJUST
2. Leg restraint lines - BUCKLED AND SECURE
   Check restraint lines buckles are properly adjusted, check that lines are secure to seat and floor, and not twisted. Check that the leg restraint line lock pins are threaded through hold down strap lugs on survival kits equipped with negative G hold down straps. Check that the survival kit-to-seat retention straps (if incorporated) are attached to the leg restraint line lock pins at the lock pin attachment point. On aircraft with dual garter system, check that leg restraint lines are threaded through the calf garters (double D-rings, routing first through outboard ring then through inboard ring), then through the thigh garters (single D-ring) before the lock pins are inserted in the snubber boxes.

WARNING

- The leg restraint lines must be buckled at all times during flight to insure legs will be pulled back upon ejection. This will enhance seat stability and will prevent leg injury by keeping legs from flailing following ejection.
- Failure to route the restraint lines properly through the garters with the dual garter system could cause serious injury during ejection.

3. Harnessing and personal equipment leads - FASTEN
   Attach the parachute riser-shoulder harness fittings to the integrated harness lower buckles. Attach and firmly adjust the survival kit straps. Secure and firmly adjust the lap belt. Connect oxygen and communication leads. Check the operation of the shoulder harness locking mechanism. Check that the survival kit-to-seat retention straps (if incorporated) are attached to the leg restraint line lock pins at the lock pin attachment points.

REAR COCKPIT INTERIOR CHECK CONTINUED

WARNING

Before T.O. 1F-4-808, to prevent the upper block assembly of the composite disconnect from becoming entangled during emergency evacuation of the cockpit, the oxygen and communication leads from the composite disconnect should be routed between the crewmember and the lumbar pad.

4. Ejection seat height - ADJUST
5. Ejection gun safety pin (before T.O. 1F-4-898) and face curtains safety pin - CHECK REMOVED

WARNING

Exercise extreme caution after the ejection gun safety pin has been removed. Avoid dislodging the canopy interlock block and putting forward pressure on the ejection gun firing linkage at the top rear of the seat. After all personnel leads have been fastened, remove the face curtain safety pin and stow.

6. Stick grip - CHECK
   Check that the stick grip is firmly attached to the stick.
7. Communication navigation control panel - SET
   a. Communication frequency control knobs - AS REQUIRED
   b. Communication channel control knobs - AS REQUIRED
   c. Mode select switch - AS REQUIRED (some aircraft)
   d. Communication volume control knob - AS DESIRED
   e. Auxiliary channel control knob - AS REQUIRED
   f. Auxiliary volumes control knob - AS DESIRED
   g. Communication function selector knob - T/R +G
   h. Navigation channel control knob - AS REQUIRED
   i. Navigation volume control knob - AS DESIRED
   j. Tacan function selector knob - T/R
   k. Communication command button - AS DESIRED
   l. Navigation command button - AS DESIRED
8. Oxygen supply system - CHECK AND SET
   a. Pressure suit oxygen supply lever - OFF
   b. Check the console mounted pressure demand regulator supply lever - ON
   c. Emergency and dilution levers - NORMAL
   d. Check the oxygen pressure gage at 75 ± 25 psi.
   e. Put mask on and place emergency lever in emergency position; breathe normally and check flow indicator operation. Hold breath; all flow should stop and the flow indicator should return to no-flow position (black). A white indicator indicates flow due to a leak that must be corrected before flight.
   f. Return emergency lever to - NORMAL

WARNING

If the oxygen supply lever is OFF when standard flight suit is worn, the crewmember will only be breathing cockpit air. It is therefore imperative to check for oxygen flow prior to takeoff or hypoxia will occur as altitudes are reached that require oxygen.

REAR COCKPIT INTERIOR CHECK CONTINUED

g. Console mounted pressure demand regulator supply lever - AS REQUIRED
When operating with a standard flight suit, the oxygen supply lever should be safety wired to the ON position. When operating with a full pressure suit, break the safety wire and place the lever in the OFF position. Refer to section I, Oxygen Connection (Full Pressure Suit) for procedures to check proper operation of the pressure suit oxygen supply system.

9. Pressure suit oxygen supply lever - CHECK
   Check the pressure suit oxygen supply lever OFF when on a nonpressure suit mission and ON when on a pressure suit mission.
10. Pressure suit vent air knob - CHECK
   Check the pressure suit vent air knob OFF when on a nonpressure suit mission and ON (as desired) when on a pressure suit mission. Refer to section IV.
11. Emergency flap handle - FORWARD
12. Intercom control panel - SET
   a. Volume control knob - AS DESIRED
   b. Amplifier selector knob - NORM
   c. Function selector knob - HOT MIC
13. Oxygen quantity gage - CHECK
   Check that the oxygen quantity is sufficient for the intended mission, the OFF flag on the gage face is not visible, and the OXYGEN LOW light is extinguished. Press oxygen test button and check OXYGEN LOW light and MASTER CAUTION light illuminate at 1 liter.
14. Emergency gear handle - IN & SECURE
15. Emergency brake handle - IN & SECURE
16. Flap position indicators - UP
17. Landing gear position indicators - GEAR DOWN INDICATION
18. Canopy emergency jettison handle - FORWARD
19. Radar scope - SECURE
   Check that radar scope retaining pins are properly installed.
20. Attitude indicator - SET
   Set miniature aircraft level with horizon bar.
21. Clock - WIND AND SET
22. Accelerometer - SET
23. Navigation function selector switch - AS DESIRED
24. Canopy manual unlock handle - FORWARD
25. Cockpit lights control panel - SET
   a. White floodlight switch - OFF
   b. Instrument panel lights control knob - AS REQUIRED
   c. Console lights control knob - AS REQUIRED
   d. Standby compass light switch - AS REQUIRED
   e. Console floodlights switch - AS DESIRED
   f. Indexer lights control knob - AS DESIRED
26. Warning and indicator lights - TEST
   Actuate the warning light test switch to TEST and note that all warning and indicator lights illuminate.
27. Intercom system - CHECK

BEFORE STARTING ENGINES

1. CNI Switch - ON
   Have ground personnel place the CNI switch in the left wheel well to the ON position.

CAUTION

When the CNI equipment is operating on external power without cooling air applied, it is limited to 10 minutes of accumulated operation in a 1 hour period in order to prevent heat damage to the equipment.

2. Fore and Aft Area - CLEAR
   Ensure the wheels are chocked and the engine intake, and exhaust areas, and starter exhaust areas are clear of personnel and equipment. Refer to Danger Areas Illustration, this section.
3. Fire Guard - POSTED

STARTING ENGINES

The engines can be started by utilizing electrical power from an external power source or the aircraft battery, and by utilizing air pressure from a ground cart or a pyrotechnic cartridge. As a result, several starting combinations can be realized, i.e., external power source and ground cart, external power source and cartridge, battery and cartridge, and battery and ground cart. Refer to section VII, System Operation, for a description of engine starter operation.

CAUTION

With the flaps extended, the boundary layer control ducts will be open, and the resulting loss of engine bleed air may cause a hot start. If the exhaust gas temperatures exceed operating limits, move the throttle to OFF immediately, and windmill the engine for 20 seconds.

PNEUMATIC START

CAUTION

Do not make a pneumatic start with an unfired cartridge installed in the starter. The cartridge may ignite and the resulting added torque may shear the starter output shaft.

Note

- The following engine start procedure established the right engine as being started first. This procedure was adopted in order to ascertain that both utility hydraulic system pumps are operating properly. The right engine pump delivers 2775 ± 225 psi at idle, while the left engine pump delivers 3000 ± 250 psi at idle. Because of this, the single needle utility hydraulic pressure indicator cannot be used to determine pump operation unless the right engine is started first.
- The following pneumatic start procedure is based upon external power being available. During a start in which battery power is used, the procedure is the same except the oil pressure indicator, fuel flow indicator, hydraulic pressure indicator, and FIRE and OVERHT warning light will not be operative until airplane generated power is available.

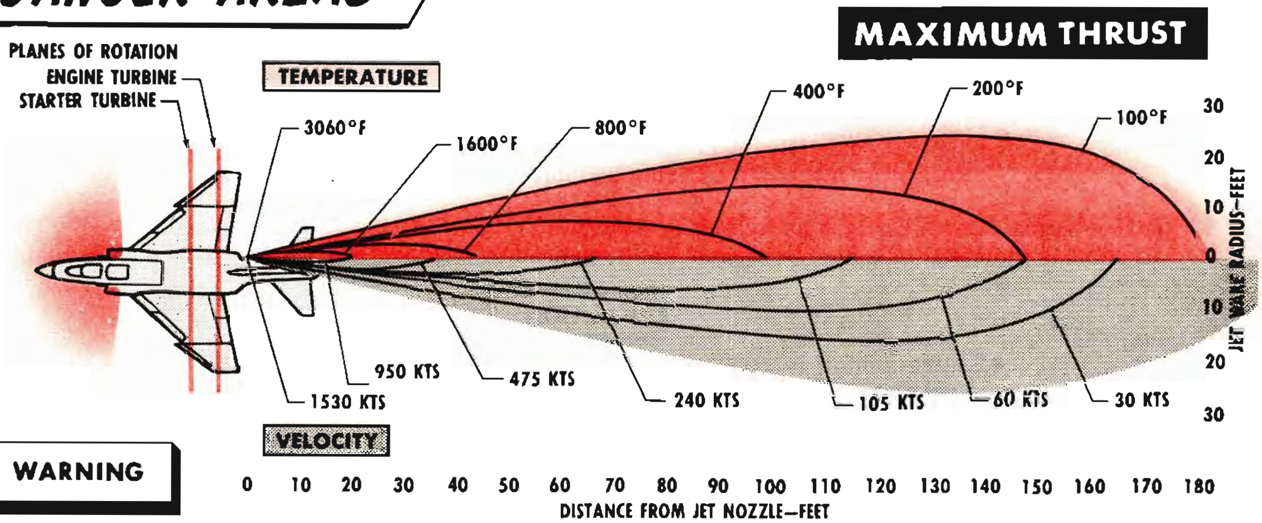
1. External air source - CONNECT TO RIGHT STARTER (MA-1A starting unit or equivalent).
2. Engine master switches - ON
3. Engine - CRANK
   Signal ground crew to start external airflow and monitor the tachometer for the first indication of engine rotation.

CAUTION

If there is no indication of engine rpm within 15 seconds or no indication of oil pressure within 30 seconds after initiating a start discontinue the start and investigate.

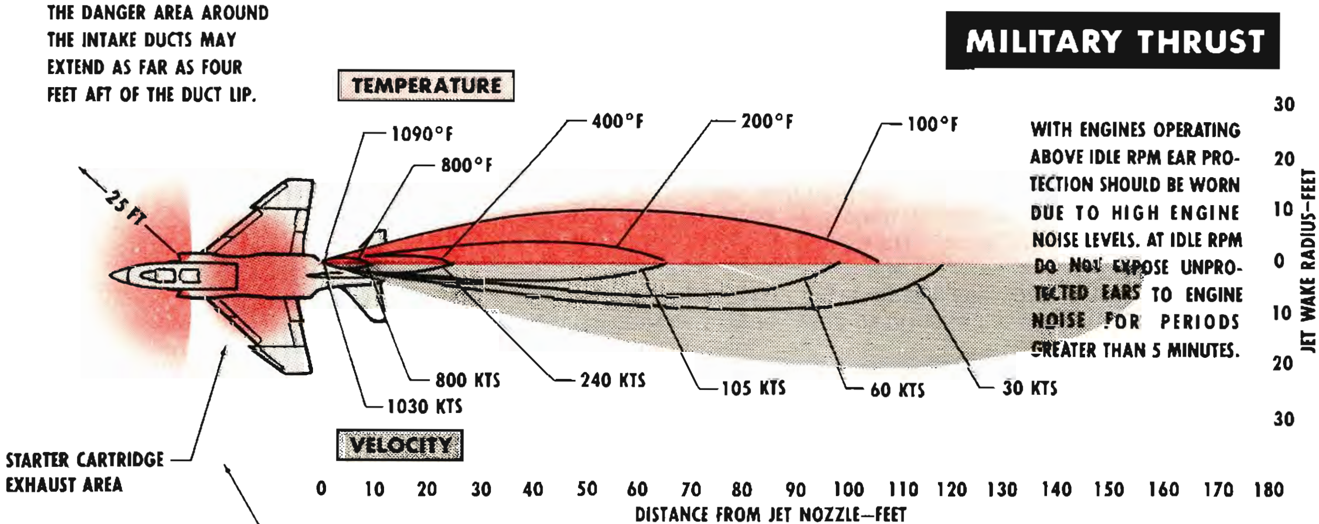
4. At 10% rpm, ignition button - DEPRESS WHILE ADVANCING THROTTLE
   Depress the ignition button and simultaneously advance the throttle to a position halfway up the throttle quadrant, and then return the throttle to IDLE.

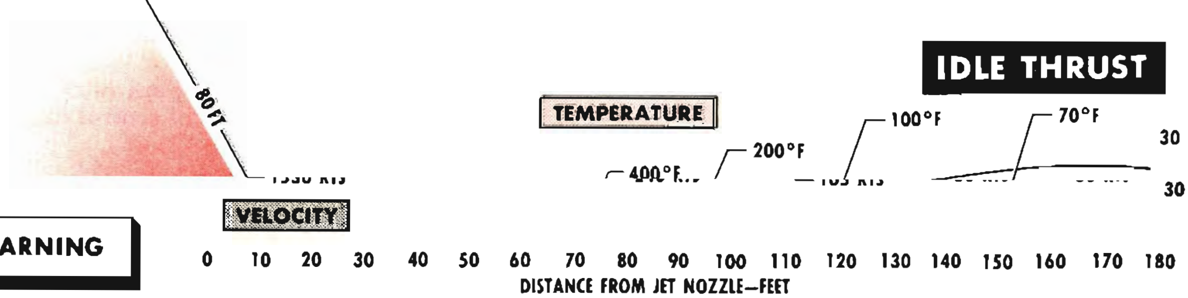
DANGER AREAS



WARNING

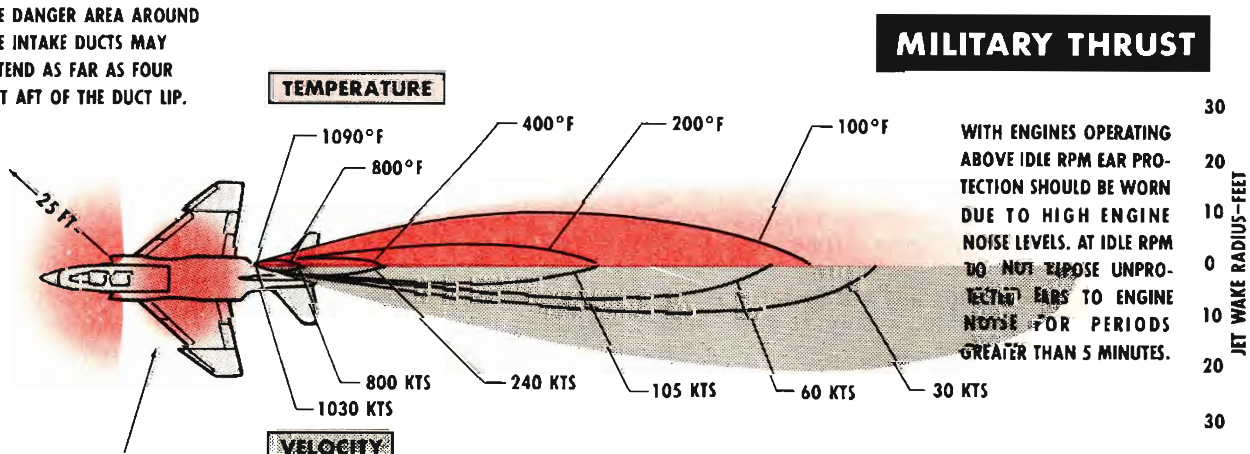
AT HIGH THRUST SETTINGS, THE DANGER AREA AROUND THE INTAKE DUCTS MAY EXTEND AS FAR AS FOUR FEET AFT OF THE DUCT LIP.





WARNING

AT HIGH THRUST SETTINGS, THE DANGER AREA AROUND THE INTAKE DUCTS MAY EXTEND AS FAR AS FOUR FEET AFT OF THE DUCT LIP.



PNEUMATIC START CONTINUED

CAUTION

Do not attempt to start the engine before reaching 10% rpm. If the starting procedure is initiated at a lower rpm additional heat distress of the engine hot section is anticipated. Overtemperature of the turbine will generally occur during a low rpm start if starter air is inadvertently interrupted during the start cycle.

5. Ignition button release as soon as lightoff is indicated.
   Lightoff is indicated by a rise in exhaust gas temperature followed by an increase in engine rpm.

CAUTION

- Engine lightoff is usually noted at approximately 13 to 16% rpm with a fuel flow of 225 to 750 pounds per hour, (with cool start fuel control cams), or 425 to 800 pounds per hour (without cool start fuel control cams). Fuel flow values higher than these are likely to result in hot starts.
- To prevent the possibility of an overtemperature condition from occurring, the engines should be shut down prior to reaching the actual EGT limit. Therefore, it is recommended that the throttle be chopped to OFF if the EGT exceeds 750°C.
- In the event of a hot or false start, and the throttle cannot be returned to OFF, the engine may be shut down from any throttle setting by placing its engine master switch OFF. This closes the fuel shutoff valve and deprives the engine of fuel. The engine will flameout in approximately 30 seconds from idle and approximately 2 seconds from military.
- After any wet or false start, allow 1 minute or longer for the combustion system to drain before restarting the engine.
- If the engine does not lightoff within 15 seconds after fuel flow is indicated, discontinue the start and investigate.
- If the engine does not continue to accelerate after lightoff, discontinue the start.

6. At 45% rpm, signal ground crew to stop external airflow and disconnect ground cart.
7. Exhaust gas temperature indicator - WITHIN LIMITS
8. Fuel flow indicator - WITHIN LIMITS
   Fuel flow should not exceed 800 pph (without cool start fuel control cams) or 750 pph (with cool start fuel control cams) at lightoff, and 800 to 1400 pph (with or without cool start fuel control cams) at idle.

Note

Fuel consumed during starting is approximately 65 pounds per engine.

9. Idle rpm - 65 ± 1%
10. Right boost pump indicator - 30 ± 5 psi (some aircraft)
11. Oil pressure indication - 12 PSI MIN
12. Hydraulic pressure indicators - WITHIN LIMITS
    With the right engine started, the PC-2 hydraulic pressure indicator should read 3000 ± 250 psi and the utility hydraulic pressure indicator should read 2775 ± 225 psi.

Note

- The hydraulic pressure indicator light (CHECK HYD GAGES) remains illuminated until the left engine is started and all four hydraulic pumps are operating above 1750 psi.
- When the left engine is started, the utility hydraulic pressure indicator should read 3000 ± 250 psi.

PNEUMATIC START CONTINUED

13. Generator control switches - GEN ON
    Ensure RH GEN OUT and BUS TIE OPEN indicator lights go out.

Note

- Oil pressure should be below 50 psi before placing the generator control switches to GEN ON.
- To avoid an electrical power interruption which could result in an INS No-Go indication, the AC should ensure that INS is not in the align mode when the generator switches are placed to GEN ON.

CAUTION

With only one engine operating, excessive rapid movement of the control stick may rupture the inoperative power control system reservoir.

WARNING

Check that auxiliary air doors and speed brakes (if out) are clear prior to cycling generator switches. Any interruption in electrical power will cause them to close violently, with possible injury to ground crew personnel.

14. APU light - CHECK ON

Note

The APU light will remain illuminated for approximately 1 minute after the left engine is started.

15. Start the left engine per steps 1 through 12, substituting LEFT in all cases.
    After the left engine is started, ensure that the LH GEN OUT light goes out.

Note

- If the bus tie indicator does not go out within approximately 18 seconds, accelerate either engine to approximately 70% rpm and cycle right generator.
- In the event of low ambient temperatures, the bus tie light may not immediately go out after the left engine is started and the left generator light goes out. This may be due to failure of the generators to synchronize quickly because of cold oil in the left generator CSD.

16. External air - DISCONNECT
17. External electrical power - DISCONNECT
18. Right generator control switch - CYCLE
    Cycle the right generator control switch (OFF, then GEN ON), and check that the RH GEN OUT light illuminates.

WARNING

Do not cycle both generator control switches at once. Any interruption in electrical power will cause the auxiliary air doors and the speed brakes (if out) to close violently, with possible injury to ground crew personnel.

19. Bus tie light - OUT
    Ensure that the bus tie indicator remains out when placing the right generator control switch to OFF, and that it flashes on momentarily when the switch is returned to the GEN ON position.

PNEUMATIC START CONTINUED

20. If a battery start was made, complete the Interior Check.
    Items marked with an asterisk cannot be accomplished with the engines started and will have to be omitted.
21. Inertial navigation set - ALIGN (battery start)
    If a battery start was made, perform a heading memory or gyro compass alignment (as desired) as outlined in the After Electrical Power (Rear Cockpit) check.

CARTRIDGE START

WARNING

- Never attempt to load a cartridge in either starter with the engine master switches on, ground refueling switch on, or external electrical power applied. If a malfunction in safety circuits occurs, serious injury could result.
- Ensure that all ground personnel remain well clear of the starter exhaust ports during cartridge starts. Exhaust temperatures may reach 1500°F.
- When carrying centerline stores, other than the SUU-21 trainer or cargo carrier, cartridge starts are prohibited unless an asbestos blanket is used to protect the store.
- Cartridge starts are prohibited when carrying nuclear stores on the centerline, except during the activation of emergency war plans.

Note

- The following engine start procedure establishes the right engine as being started first. This procedure was adopted in order to ascertain that both utility hydraulic system pumps are operating properly. The right engine pump delivers 2775 ± 225 psi at idle, while the left engine pump delivers 3000 ± 250 psi at idle. Because of this, the single needle utility hydraulic pressure indicator cannot be used to determine pump operation unless the right engine is started first.
- The following cartridge start procedure is based upon external power being available. During a start in which battery power is used, the procedure is the same except, the oil pressure indicator, fuel flow indicator, hydraulic pressure indicator, and FIRE and OVERHT warning light will not be operative until airplane generated ac power is available.
- To avoid possible irritation caused by cartridge exhaust smoke/gases, it may be advisable to close canopies and select 100% oxygen during start cycle.

1. Centerline store cartridge start heat shield - INSTALLED (if applicable)
2. Engine master switches - ON
3. Ignition button - DEPRESS WHILE ADVANCING THROTTLE
   Depress the ignition button and simultaneously move the throttle halfway up the quadrant, and then return the throttle to idle.
4. Engine start switch - R (right)
   The start switch need not be held in R once cartridge ignition is started, however, allowing the spring-loaded switch to snap back towards the center position may allow the switch to bounce across the neutral position and fire the left cartridge.

CARTRIDGE START CONTINUED

WARNING

- If there is absolutely no indication of an engine rpm rise and no smoke is visible at the starter exhaust port, a misfire has occurred. It will not be possible to start the engine until the starter is reloaded. Refer to section VII, Systems Operation, for misfire safety and handling instructions.
- If there is a delay in obtaining engine rotation or brief engine rotation to a low rpm is produced, and smoke is visible at the starter exhaust port, a hangfire has occurred. The cartridge may smolder from 20 to 150 seconds. Refer to section VII, System Operation, for hangfire procedures.

Note

Once cartridge ignition has been initiated, the engine will continue to accelerate until the cartridge propellant is consumed. The start may be discontinued by moving the throttle to OFF or moving the engine master switch to OFF.

5. Release the ignition button as soon as lightoff is indicated.
   Lightoff will be indicated by a rapid rise in exhaust gas temperature, followed by an increase in engine rpm.

CAUTION

- Engine lightoff is usually noted at approximately 13 of 16% rpm with a fuel flow of 225 to 750 pph; (with cool start fuel control cams) or 425 to 800 pph (without cool start fuel control cams). Fuel flow values higher than these are likely to result in hot starts.
- The max limit for EGT during start is 980°C for 10 seconds; however, if the EGT exceeds 750°C, chop throttle to OFF to prevent an overtemperature. Record all pertinent data; i.e., temperature peak, time at temperature, fuel flow, etc.
- If the engine does not lightoff within 15 seconds after fuel flow is indicated, discontinue the start and investigate.
- If the engine does not continue to accelerate after lightoff, discontinue the start.

6. Exhaust gas temperature indicator - WITHIN LIMITS
7. Fuel flow indicator - WITHIN LIMITS
   Fuel flow should not exceed 800 pph (without cool start fuel control cams) or 750 pph (with cool start fuel control cams) at lightoff, and 800 to 1400 pph (with or without cool start fuel control cams) at idle.

Note

Fuel consumed during starting is approximately 65 pounds per engine.

8. Idle rpm - 65 ± 1%
9. Right boost pump indicator - 30 ± 5 psi (some aircraft)
10. Oil pressure indication - 12 PSI MIN
11. Hydraulic pressure indicators - WITHIN LIMITS
    With the right engine started, the PC-2 hydraulic pressure indicator should read 3000 ± 250 psi and the utility hydraulic pressure indicator should read approximately 2775 ± 225 psi.

CARTRIDGE START CONTINUED

Note

- The hydraulic pressure indicator light (CHECK HYD GAGES) remains illuminated until the left engine is started and all four hydraulic pumps are operating above 1750 psi.

- When the left engine is started, the utility hydraulic pressure indicator should read 3000 ± 250 psi.

CAUTION

- In the event of a hot or false start and the throttle cannot be returned to OFF, the engine may be shut down from any throttle setting by placing its engine master switch OFF. This will close the fuel shutoff valve and deprive the engine of fuel. The engine will flameout in approximately 30 seconds from idle and approximately 2 seconds from military.

- After any wet or false start, allow 1 minute or longer for the combustion system to drain before restarting the engine.

12. Generator control switches - GEN ON
    Ensure RH GEN OUT and BUS TIE OPEN lights go out.

Note

Oil pressure should be below 50 psi before placing the generator control switches to GEN ON.

Note

To avoid an electrical power interruption which could result in an INS No-Go indication, the AC should ensure that the INS is not in the align mode when the generator switches are placed to GEN ON.

CAUTION

With only one engine operating, excessive rapid movement of the control stick may rupture the inoperative power control system reservoir.

WARNING

Check that auxiliary air doors and speed brakes (if out) are clear prior to cycling generator switches. Any interruption in electrical power will cause them to close violently, with possible injury to ground crew personnel.

13. APU light - CHECK ON

Note

The APU light will remain illuminated until approximately 1 minute after the left engine is started.

14. Start the left engine per steps 1 through 11 substituting LEFT in all cases.
    After the left engine is started, ensure that the LH GEN OUT light goes out.

CARTRIDGE START CONTINUED

Note

- If the bus tie indicator does not go out within approximately 18 seconds, accelerate either engine to approximately 70% rpm and cycle right generator.
- In the event of low ambient temperatures, the BUS TIE OPEN light may not immediately go out after the left engine is started and the left generator light goes out. This may be due to failure of the generators to synchronize quickly because of cold oil in the left generator CSD.

15. External electrical power - DISCONNECT
16. Right generator control switch - CYCLE
    Cycle the right generator control switch (OFF, then GEN ON), and check that the RH GEN OUT light illuminates.

WARNING

Do not cycle both generator control switches at once. Any interruption in electrical power will cause the auxiliary air doors and the speed brakes (if out) to close violently, with possible injury to ground crew personnel.

17. Bus tie indicator light - OUT
    Ensure that the bus tie indicator remains out when placing the right generator control switch to OFF, and that it flashes on momentarily when the switch is returned to the GEN ON position.
18. Interior check - CONTINUE (if applicable)
    If a battery start was made, complete the interior check beginning with After Electrical Power is Supplied. Items marked with an asterisk cannot be accomplished with the engines started, and will have to be omitted.
19. Inertial navigation set - ALIGN (battery start)
    If a battery start was made, perform a heading memory or gyro compass alignment (as desired) as outlined in steps 3 and 4 of the After Electrical Power (Rear Cockpit) check.
20. Centerline store cartridge start heatshield - REMOVE (if installed).

ENGINE GROUND OPERATION

No engine warm-up is necessary, however; allow the engines to operate at idle until instrument readings stabilize. As soon as instrument readings stabilize, the throttle may be advanced to maximum thrust.

CAUTION

(F-4E) During extended ground operation, the radar may become overheated due to insufficient cooling during operation at high ambient temperatures or low engine power setting. Under the above conditions, limit ground operation of the radar to 20 to 30 minutes maximum and observe the radar overtemp light.

BEFORE TAXIING - FRONT COCKPIT

1. Communication and navigation equipment - CHECK
2. Altimeter and SPC - SET & CHECK
    a. Set current altimeter setting on the barometric scale.
    b. Altimeter pointer should indicate the field elevation within ± 75 feet.
    c. (All F-4C/D aircraft and F-4E after T.O. 1F-4E-527.) Place the SPC switch to the RESET CORR position. The STATIC CORR OFF light should go out and remain extinguished. Altimeter jump should not exceed 50 feet (F-4C/D aircraft), and 25 feet (F-4E aircraft). Altimeter oscillations of any magnitude are unacceptable.

BEFORE TAXIING - FRONT COCKPIT CONTINUED

Note

If the STATIC CORR OFF indicator light illuminates (F-4C/D), all quoted airspeeds should be corrected for static error.

d. (All F-4C/D aircraft and F-4E after T.O. 1F-4E-527.) With the static correction on (SPC engaged), the altimeter should indicate the field elevation within ± 90 feet.
e. The difference between the front and rear cockpit altimeters should not exceed 106 feet.

3. Radar altimeter - AS DESIRED
   a. Function control switch - ON
      Allow 5 minutes warm-up. Check that the OFF flap moves out of view and altitude pointer fluctuates.
   b. Function control switch - DEPRESS
      Check that pointer moves to 35 ± 15 feet and stabilizes.
   c. Low altitude warning light - CHECK
      With function control switch depressed, move reference marker above and below pointer. Warning light must illuminate within ± 5 feet of indicated altitude.
   d. Function control switch - RELEASE
      Move reference marker to below 5 feet. Check that warning light is off and altitude pointer fluctuates.
   e. Reference marker - SET
      Set to desired low altitude limit.
4. Speed brakes - CYCLE
   Open and close the speed brakes to check proper operation. Have ground crew check that speed brakes extend simultaneously. Obtain a signal from the ground crew that the speed brakes are fully closed and observe that the SPEED BRAKE OUT indicator light is extinguished.
5. Flaps - CHECK
   Extend the flaps to full down, then raise them to the 1/2 position. Observe that the flap indicators show the proper flap position; leading edge DN, trailing edge DN, then leading edge DN, trailing edge 1/2. While cycling flaps, have ground crew confirm that both trailing edge wing flaps extend together at the same time and rate. If one flap extends slower than the other, a split flap condition is probable, and the mission should be aborted. Obtain ground crew signal that the boundary layer control is operating.
6. Flight controls - CHECK (FLAPS AT 1/2 POSITION)
   a. Cycle the flight controls and check for corresponding movement of the control stick and the control surfaces. While cycling the ailerons, check ARI by noting corresponding rudder movement. Have the ground crew check for hydraulic leaks on both aileron power control cylinders. If leaks are observed, ABORT.
   b. On all aircraft before T.O. 1F-4-831, set takeoff pitch trim (2 units nose down) and release the control stick from the full aft stop. The control stick should move forward to at least the 1/2 travel position, and further movement toward the forward stop should require no more than approximately 1 pound push force. Stick movement should be smooth and free of any restrictions. On all aircraft after T.O. 1F-4-831, set takeoff pitch trim to 3 units nose down. Stick movement should be smooth and free of any restrictions (3 pound bob weight may not return the stick to 1/2 position).

Note

Aileron-spoiler operation can be visually checked from the rear cockpit.

7. Stab aug switches - ENGAGE
   a. Engage each axis of stab aug individually and ascertain that each control surface does not move more than 1/4 inch.
   b. Depress emergency disengage lever (both cockpits) for stab aug disengagement.

Note

Ailerons must be trimmed and held to neutral or a rudder deflection will be apparent due to ARI inputs.

8. Flaps - UP
   After obtaining signal, raise flaps and monitor the BLC MALFUNCTION light for valve malfunction.
9. Reference system selector knob - PRIM (ensure INS is in NAV)

BEFORE TAXIING - FRONT COCKPIT CONTINUED

10. Compass mode control knob - SYNC
11. LCOSS BIT checks - INITIATE
12. Automatic flight control system - CHECK
    a. Neutralize the controls

Note

- Neutralize the controls by grasping control stick column below the stick grip.
- The AFCS cannot be engaged if INS is in ALIGN.

    b. AFCS switch - ENGAGE
    c. Engage altitude hold. Only slight stick movement should occur. If any hard-over control surface movement occurs, do not use the AFCS.

WARNING

If the altitude hold switch will not hold in the ENGAGE position, a malfunction exists in the pitch AFCS channel. If a pitch AFCS malfunction is indicated, do not use the AFCS mode since a hazardous control condition exists.

    d. Front cockpit emergency quick release lever - DEPRESS
       Check that AFCS and ALT HOLD switches on the AFCS panel move aft. Check illumination of AUTO PILOT DISENGAGE, MASTER CAUTION, and PITCH AUG OFF lights.
    e. AFCS - ENGAGE
    f. Rear cockpit emergency quick release lever - DEPRESS
       Check that the AFCS switch on the AFCS panel moves aft. Confirm illumination of AUTO PILOT DISENGAGE, and PITCH AUG OFF light.
    g. Master caution reset button - DEPRESS
13. Stab aug switches - DISENGAGE
14. Trim - SET
    a. 2 units nose down before T.O. 1F-4-831
    b. 3 units nose down after T.O. 1F-4-831
       Check operation of the trim indicator. Receive a signal from the ground crew/rear cockpit occupant that the ailerons and rudder are set at neutral.
15. Seat pins - CHECK REMOVED & STOWED

Note

Do not move aircraft with INS in ALIGN mode.

16. Wheel chocks and ground interphone cord - REMOVED
17. Pneumatic pressure - CHECK

BEFORE TAXIING - REAR COCKPIT

1. If battery start was made, complete the interior check.
2. Communication and navigation equipment - CHECK
3. Altimeter - CHECK
    a. Set current altimeter setting on the barometric scale.
    b. Altimeter pointer should indicate the field elevation within ± 75 feet.
    c. (All F-4C/D aircraft and F-4E after T.O. 1F-4E-527.) When the SPC switch is positioned to RESET the altimeter jump should not exceed 50 feet (F-4C/D aircraft), and 25 feet (F-4E aircraft). Altimeter oscillations of any magnitude are unacceptable.
    d. (All F-4C/D aircraft and F-4E after T.O. 1F-4E-527.) With the static correction on (SPC engaged), the altimeter should indicate the field elevation within ± 90 feet.
    e. The difference between the front and rear cockpit altimeters should not exceed 106 feet.
4. Radar BIT checks - INITIATE
5. WRCS BIT checks - INITIATE
6. Navigation computer function selector knob - AS DESIRED
7. Seat pins - CHECK REMOVED & STOWED

TAXIING

1. Nose gear steering - ENGAGE & CHECK
   Engage nose gear steering and actuate in both directions to ensure proper operation.

WARNING

If, after engagement of nose gear steering with upper UHF antenna selected, no response is noted or unscheduled steering commands are detected, disengage nose gear steering, and do not re-engage. The aircraft should not be taxied or flown with inoperative nose wheel steering except in an emergency.

2. Wheel brakes - TEST
   After initial roll, apply the wheel brakes to check their operation.

CAUTION

- Taxi with canopies full open or full closed; with the canopies open, maintain taxi speeds below 60 knots to prevent damage to the canopy operating mechanism.
- The canopies should be closed and adequate distance between aircraft maintained during formation taxi. An open canopy may become damaged from engine exhaust blast.
- While taxiing during high gross weight conditions, the turning radius must be increased to relieve excessive side loads on the main landing gear struts, wheels, and tires.
- With the flaps down and the engines operating at idle, the RADAR-CNI COOL OFF light may illuminate.

3. (AC-P) Flight instruments - CHECK OPERATION
4. (AC-P) Oxygen diluter lever - AS REQUIRED

BEFORE TAKEOFF

CAUTION

Exercise care in positioning the aircraft on the runway for the pretakeoff engine check during formation operations. Clearance should be 150 feet at military thrust settings and 300 feet at maximum thrust settings. Try to stagger the airplane positions so that no aircraft is directly behind another. Ensure that the canopies are closed and locked. Refer to figure 2-4 for Danger Areas.

1. Stab aug switches - ENGAGE
2. Flight controls - UNRESTRICTED (pilot visually check ailerons and spoilers)
3. Stabilator trim - SET
   a. 2 units nose down before T.O. 1F-4-831
   b. 3 units nose down after T.O. 1F-4-831
4. (AC-P) Lower ejection handle safety guard - CLEAR
   Rotate the lower ejection handle safety guard to the down (horizontal) position.

WARNING

The lower ejection handle safety guard, when lowered, can rebound to the safe position if it is lowered too rapidly.

5. Fuel quantity - CHECK

TURNING RADIUS AND GROUND CLEARANCE

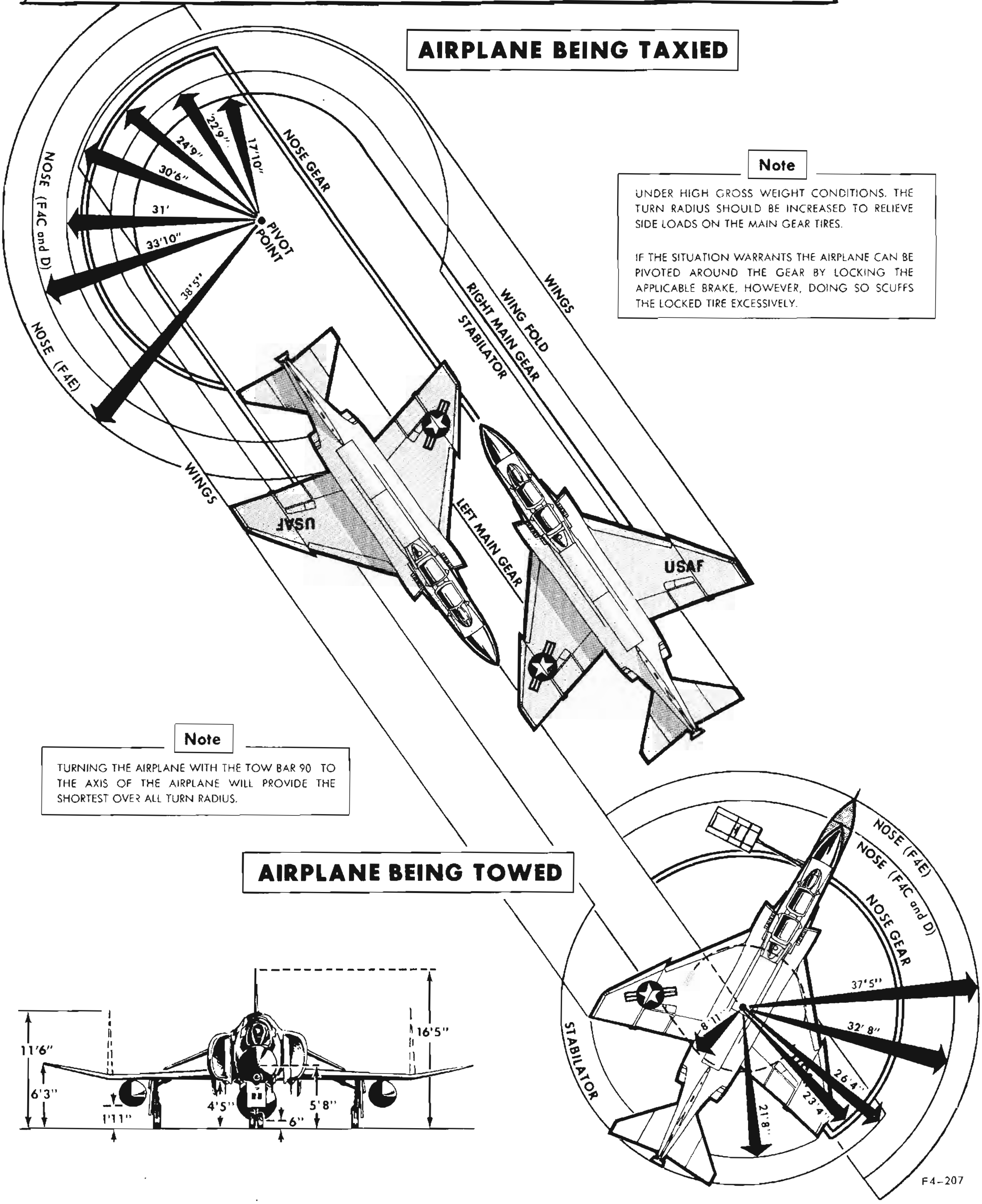


Figure 2-4

BEFORE TAKEOFF CONTINUED

6. (AC-P) Canopies - CLOSE, CHECK WARNING LIGHT OUT AND STRIPES ALIGNED
   a. Operate engines at idle rpm.

CAUTION

Attempted canopy closure with engine rpm above idle may result in canopy not fully locking due to back pressure caused by the aircraft pressurization system.

   b. Set air temp control knob in the 2 o'clock position, and the defog-footheat lever in foot heat.
   c. Close aft canopy; ascertain aft CANOPY UNLOCK light out, forward CANOPY UNLOCK light ON.
   d. Close forward canopy; check forward canopy closing time. Time must not exceed 9 seconds from lever actuation to completion of locking cycle. Check CANOPY UNLOCKED light out.

CAUTION

- The center mirror on the forward canopy can be tilted sufficiently to prevent canopy closing; therefore, assure that the mirror will clear the windshield bow before closing canopy.
- If canopy closing time exceeds 9 seconds, canopy rigging should be inspected by ground crew personnel to preclude loss of canopy during flight.

   e. Check that alignment tape on canopy lock push rod aligns with the alignment mark on the bracket hanging from the left canopy sill. On aircraft that do not have alignment marks, assure locking rollers have engaged canopy hooks by observing approximately 1 inch aft travel of push-pull rod.

Note

During the canopy closing cycle of the front cockpit, the pilot will observe the front canopy actuator shear pin for its integrity.

WARNING

If a canopy malfunction occurs during the closing cycle or in the event that either the front or aft CANOPY UNLOCKED light remains on after attempted closure, refer to Canopy Malfunction, section III.

CAUTION

To ensure canopy retention during flight, the canopy control handle must be retained in the closed (full forward detent) position.

7. Defog-footheat and temperature controls - AS REQUIRED

Note

When operating in high humidity conditions, it is recommended that the defog-footheat handle be positioned to DEFOG and a higher-than-normal temperature be selected prior to initiating takeoff run to preclude cockpit fogging as throttles are advanced.

BEFORE TAKEOFF CONTINUED

8. Engines - CHECK
   a. Idle fuel flow - CHECK
   b. Left throttle - MIL
   Allow the engine rpm to stabilize and observe that the EGT, exhaust nozzle position, fuel flow, oil pressure, hydraulic pressure and pneumatic pressure gages are within their normal operating ranges; and that the rpm, EGT and fuel flow on the idling engine remain stable.

WARNING

During engine run-up, a rise in rpm above 67.5%, a drop in EGT of more than 25°C, or a drop of more than 100 pph in fuel flow on the idling engine, indicates a defective bleed air check valve for the corresponding engine and constitutes an abort. This check is valid with flaps UP only.

   c. Left throttle - CHOP TO IDLE
   Check that the fuel flow does not drop below a minimum of 425 pph on engines without cool start fuel control cams, and does not drop below 225 pph on engines with cool start fuel control cams.

WARNING

- If the fuel flow drops below 425 pph on engines without cool start fuel control cams, or 225 pph on engines with cool start fuel control cams, but the engine recovers to original rpm, proceed with the flight. However, do not snap decelerate these engines.
- If engine rpm fails to recover to the original idle rpm value, regardless of the fuel flow reading, the flight should be aborted.

CAUTION

Check the engines individually as the engines develop enough thrust to slip the tires on their rims if both engines are checked together and maximum braking is applied.

Note

It is mandatory that a Form 781 entry be made on all engines which drop below the minimum fuel flow on snap decelerations and/or fail to recover to the original idle rpm.

   d. Check right engine after left engine stabilizes at idle rpm.

Note

Fuel consumed during the engine check is approximately 50 pounds per engine.

BEFORE TAKEOFF CONTINUED

9. Variable area inlet ramp - CHECK FULLY RETRACTED
10. Internal wing transfer switch - NORMAL
11. External transfer switch - CENTER or OUTBD

WARNING

If external tanks are installed, and the external transfer switch is positioned to OUTBD or CENTER, internal wing fuel will not transfer even though the internal wing transfer switch is positioned to NORMAL.

12. Flaps - 1/2

CAUTION

Do not operate either or both engines at military thrust, with the flaps extended, for a period longer than 1 minute. Ground operations in excess of 1 minute will cause the boundary layer control bleed air to overheat the leading edge wing rib.

13. Engine anti-ice switch - AS REQUIRED
14. Anti-skid - ON, LIGHT OUT
15. Compass heading - CHECK
    If a significant error exists on the HSI compass card, re-sync the compass by placing the reference system selector knob to STBY and back to PRIM.
16. Pitot heat - AS REQUIRED
17. Warning lights - CHECK
18. IFF/SIF - AS REQUIRED
19. (AC-P) Inertial reel - AS DESIRED

TAKEOFF

NORMAL TAKEOFF

The half-flap position is recommended for all takeoffs. After taking the runway and completing necessary pre-takeoff checks, engines can be run to 85% with brakes held and nose gear steering engaged to ensure nose gear alignment (figure 2-5). With both engines operating in excess of 85% and the brakes locked, there is a possibility of rotating the tires on the wheel rims or skidding the tires. After releasing brakes, advance both throttles rapidly to full military power and check rpm, exhaust temperatures and nozzle position. If an afterburner takeoff is desired, shift the throttles into the afterburner detent and advance full forward for max thrust. Maintain directional control with nose gear steering or rudder as required. The rudder becomes effective for steering at approximately 70 knots. Wheel braking should not be used for directional control during takeoff roll. Nose gear steering should be disengaged when rudder steering becomes effective. If it becomes necessary to re-engage nose gear steering at the higher speeds, rudder pedals should be returned to neutral prior to engagement since rudder pedal displacement necessary for rudder steering will generally be excessive for nose gear steering. Sufficient aft stick should be applied prior to nose wheel liftoff speed to attain the desired pitch attitude. As the nose rises, pitch attitude must be controlled to maintain a 10° to 12° nose high attitude for aircraft fly-off. Caution must be exercised to preclude over-rotation due to excessive aft stick rate or an extended takeoff roll due to late liftoff. The basic takeoff attitude should be held during acceleration and transition to a clean configuration. The AUX AIR DOOR, WHEELS, AND MASTER CAUTION lights may illuminate momentarily as the landing gear and flaps are retracted.

CAUTION

Rapid full aft movement of the stick between takeoff airspeed and 30 knots below takeoff airspeed may result in the stabilator hitting the runway with the possibility of stabilator actuator damage.

FULL FLAP TAKEOFF

Full flaps takeoffs are prohibited due to increased drag, decreased thrust, and severely decreased stabilator effectiveness. If a forward CG condition exists, the airspeed required for rotation may well be unattainable within available runway length.

NO-FLAP TAKEOFF

No-flap takeoffs are not normally performed, but can be made with a slight increase in takeoff roll and speed. Stabilator effectiveness under these condi-

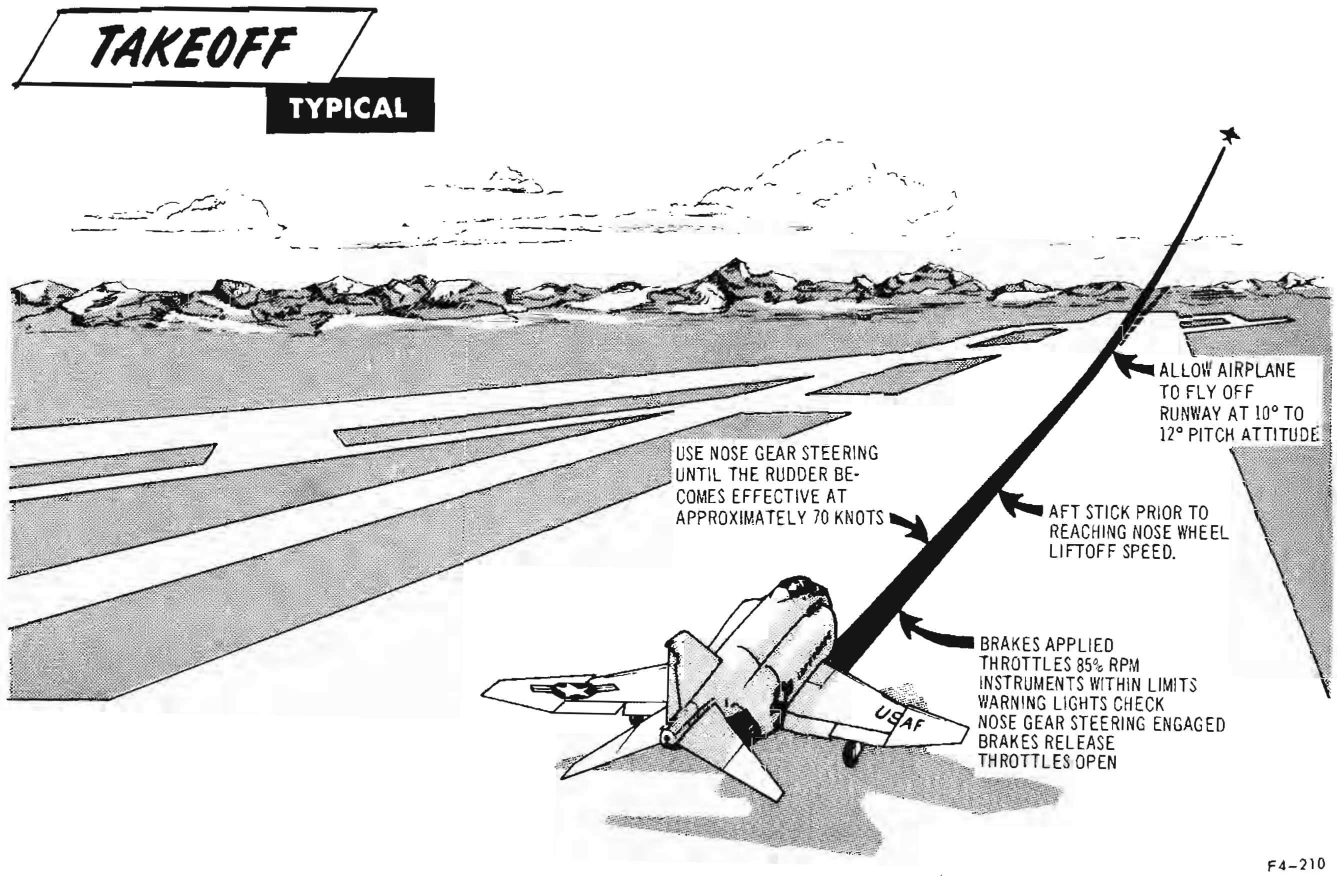


Figure 2-5

tions is considerably increased and extreme caution must be exercised to prevent overrotation which could result in the stabilator striking the runway.

WARNING

Due to increased stabilator authority with the flaps up, aircraft rotation can be initiated at lower than normal airspeeds and overrotation is a definite possibility. If it appears that overrotation is occurring, positive control movement (stick forward) must be taken to prevent the stabilator from contacting the runway and/or loss of aircraft control.

MINIMUM RUN/HEAVY GROSS WEIGHT TAKEOFF

A minimum run/heavy gross weight takeoff (aircraft over 50,000 pounds) is accomplished in the same manner as a normal takeoff with the following exceptions: It is recommended that all minimum run/heavy gross weight takeoffs be made with afterburner. During the takeoff run, full aft stick must be applied prior to reaching 80 knots. As the aircraft starts to rotate, the stick should be adjusted to maintain 10° to 12° pitch attitude for aircraft fly-off. The possibility of a main landing gear tire failure increases with an extended takeoff ground run under heavy gross weight conditions. Nose wheel liftoff speed and takeoff speed are increased during heavy gross weight conditions.

In the event of an aborted takeoff, it must be remembered that stopping distance is greatly increased as abort speed increases.

CAUTION

On F-4E aircraft with a combination of light gross weight and aft CG, the minimum run takeoff technique (i.e., full aft stick prior to reaching 80 knots) produces rapid pitch rates during nose rotation. This combination can exist when the radar package and nose gun (or equivalent ballast) are not installed.

CROSSWIND TAKEOFF

Under crosswind conditions, the aircraft tends to weather vane into the wind. The weather vaning tendency can be easily controlled with nose gear steering. As forward speed increases, weather vaning tendency decreases. At speeds above 70 knots rudder effectiveness will normally be sufficient to maintain directional control. After the nose is lifted to takeoff attitude, the aircraft will have a tendency to drift toward the downwind side of the runway. Therefore, when a long time period is expected between nose lift-off and aircraft fly-off, or when the crosswind effect is particularly severe, nose lift-off can be delayed accordingly. Under normal operational conditions this action should not be required. As the aircraft leaves the ground it should be crabbed into the wind, wings level, to maintain runway alignment.

AFTER TAKEOFF - CLIMB

When the aircraft is definitely airborne:

1. Gear - UP
   Check that the landing gear position indicators display the word UP, and the landing gear handle warning light is out.

CAUTION

- The landing gear and gear doors should be completely up and locked before the gear limit airspeed of 250 knots is reached, otherwise, excessive air loads may damage the landing gear mechanism and prevent subsequent operation.
- When actuating the landing gear, keep a forward pressure on the landing gear control handle to prevent inadvertent actuation of the emergency system.

2. Flaps - UP
   Check that the flap position indicators display the word UP.

Note

Rudder jumps may occur during flap retraction with a lateral stick input.

3. (AC-P) Oxygen diluter lever - NORMAL OXYGEN

Note

On F-4E, when transmitting on UHF using the lower antenna, a change in engine operation could occur. This can be seen as a shift or fluctuation of EGT, RPM, FUEL FLOW, and NOZZLE position.

4. (AC-P) RHAW/ECM equipment - ON (as required)

CLIMB TECHNIQUES

A simplified climb can be made by maintaining a 10° to 12° nose high attitude until reaching 350 knots and then vary pitch as necessary to maintain 350 knots until reaching cruise Mach/TAS. Vary pitch as necessary to maintain cruise Mach/TAS until reaching cruise altitude. A simplified maximum thrust climb, at normal gross weights, can be made by maintaining a 10° to 12° nose high attitude until reaching 350 knots and then vary pitch as necessary to maintain 350 knots until reaching Mach 0.9. Vary the pitch attitude as necessary to maintain Mach 0.9 until reaching cruise altitude.

CRUISE

1. (AC-P) Altimeters - COMPARE
2. (AC-P) Cockpit altimeter - CHECK
3. External fuel transfer - MONITOR AS REQUIRED
   If carrying external tanks, turn external fuel transfer switch to OFF when external tanks are empty and keep internal wing transfer switch to NORMAL.

WARNING

When transfer of external fuel is selected, transfer of internal wing fuel is stopped automatically and cannot be regained until the external wing fuel transfer switch is turned to the OFF position, even though the internal wing transfer switch is positioned to NORMAL. However, aircraft with automatic fuel transfer will transfer when the automatic fuel transfer circuit is energized. When the external fuel tanks are not carried, the external wing tank transfer switch is inoperative.

CRUISE CONTINUED

4. INS Inflight Alignment - AS REQUIRED
   a. Aircraft straight and level
   b. Power control knob - cycle to OFF, then ALIGN (unmodified sets) or STBY (modified sets).
   c. After 40 seconds, power control knob - NAV

CAUTION

Do not exceed 60 seconds as damage to the INS platform can result. In addition, the INS platform may start fine alignment and lose the aircraft's pitch and roll axis as a reference, and attitude information will be incorrect. The length of time the primary attitude reference is usable after an inflight alignment is not predictable. However, subsequent alignments can be attempted as needed.

WARNING

The probability exists that engine flameout may occur while flying above 35,000 feet in cirrus clouds. Such incidents have occurred, and are generally believed to have been caused by excessive ingestion of ice crystals. Under such conditions, flameouts can occur without warning. However, in all known incidents of this type, re-lights have been accomplished and maintained at lower altitudes. Therefore, if flameout occurs at high altitudes in clouds, it is recommended that re-light attempts be deferred until descent to a lower altitude and, if possible, to a less dense part of the cloud. (In F-4E aircraft, if double flameout occurs, disregard above recommendation see section III.)

CAUTION

If radar has malfunctioned while at altitude, do not turn radar power off unless further damage is imminent. The radar component will cold soak and collect moisture upon descent causing additional costly repairs.

Note

- The windshield defogging system should be operated at the highest temperature possible (consistent with crew comfort) during all high altitude flights. This will provide sufficient preheating to prevent the formation of frost or fog during descent.
- When making throttle chops from the aft cockpit, avoid violently slamming the handles against the idle stops and also avoid maintaining a high force to hold them against the stops. This practice can in a few instances induce an engine flameout.

FLIGHT CHARACTERISTICS

Refer to section VI, Flight Characteristics.

DESCENT

Prior to performing a rapid descent, the windshield and canopy surfaces should be preheated to prevent the formation of frost or fog.

Note

If it becomes necessary to dump fuel during a descent, thrust settings in excess of 85% rpm may be required to ensure rapid inflight dumping.

1. Defog-footheat control handle - AS DESIRED
2. Temperature control knob - AS DESIRED
3. Radar altimeter - ON & CHECK (as required)
   Allow at least a 5 minute warm-up period before relying on the radar altimeter.
4. Pitot heat switch - AS REQUIRED
5. Engine anti-icing switch - AS REQUIRED
6. AFCS - DISENGAGED

BEFORE LANDING

1. Fuel quantity - CHECK

Note

If the automatic fuel transfer circuit is energized and external tanks are installed and empty, their corresponding external fuel flow lights will illuminate.

WARNING

Due to fuel quantity indicator tolerances at the low end of the fuel scale, the FUEL LEVEL LOW warning light may illuminate above 2000 pounds fuel remaining, on F-4C/D aircraft and F-4E aircraft through 68-494; 1850 pounds on F-4E aircraft 68-495 and up. Therefore, the lowest indication should be used as the primary indication of a low fuel state in the engine feed tank.

WARNING

Transient fuel readings are especially hazardous when decelerating in the emergency fuel range. When decelerating and descending, the fuel quantity indicator may read higher than the actual usable fuel on board. This erroneous quantity indication combined with allowable indicator tolerances may result in engine flameout, from fuel starvation with indicated fuel remaining.

2. (AC-P) Inertia reel - AS DESIRED
3. Communications antenna selector switch - UPR
4. Gunsight - STBY/CAGE (if applicable)
5. RHAW/ECM equipment - OFF
6. Armament switches - OFF or SAFE

LANDING

IN THE PATTERN

1. Gear - DOWN
2. Flaps - DOWN

WARNING

Maintain straight and level flight when extending or retracting the flaps. Assure proper flap position prior to turning base leg.

3. Hydraulic pressure - CHECK
4. Warning lights - CHECK
5. Landing/taxi light - AS DESIRED

LANDING TECHNIQUE

For a normal landing, fly the pattern as illustrated in figure 2-6. Enter the pattern as local policy dictates.

Note

Avoid buffet through the landing pattern.

Adjust power, if necessary, to attain allowable gear lowering airspeed on downwind. Extend landing gear and full flaps in level flight on downwind.

WARNING

If high angles of attack develop during the turn to downwind, the rudder should be used as a primary means of rollout since adverse yaw may be introduced by the use of ailerons. Altitude may be insufficient for recovery if uncontrolled flight is encountered.

Note

Actual flap extension may not occur until slowing to 210 kts.

Ensure flaps are full down prior to initiating turn to base leg. Establish and maintain On Speed angle-of-attack on the base leg or final approach, adjusting pitch attitude (to maintain AOA) and power (to maintain desired glide slope/rate of descent). When the aircraft reaches 20 to 30 feet altitude above the ground, ground effect will tend to rotate the aircraft in the nose-down direction. Maintaining pitch attitude will result in transition to a slow indication at touch-down, which is desired. Flying a 2-1/2° to 3° glide slope will produce an approach rate of descent of about 700 feet per minute. Sink rate at touchdown will be appreciably reduced by ground effect.

CAUTION

Flying a steeper than normal final approach or not maintaining pitch attitude when entering ground effect, can cause touchdown sink rates to exceed the design limit of the main landing gear struts. (Refer to section V for touchdown sink rates vs gross weight limitations.)

At touchdown reduce power to idle and deploy drag chute. Utilize rudder down to approximately 70 knots, then use nose wheel steering as required to maintain directional control.

Note

Nose gear steering should only be engaged with rudder at or near the neutral position.

WARNING

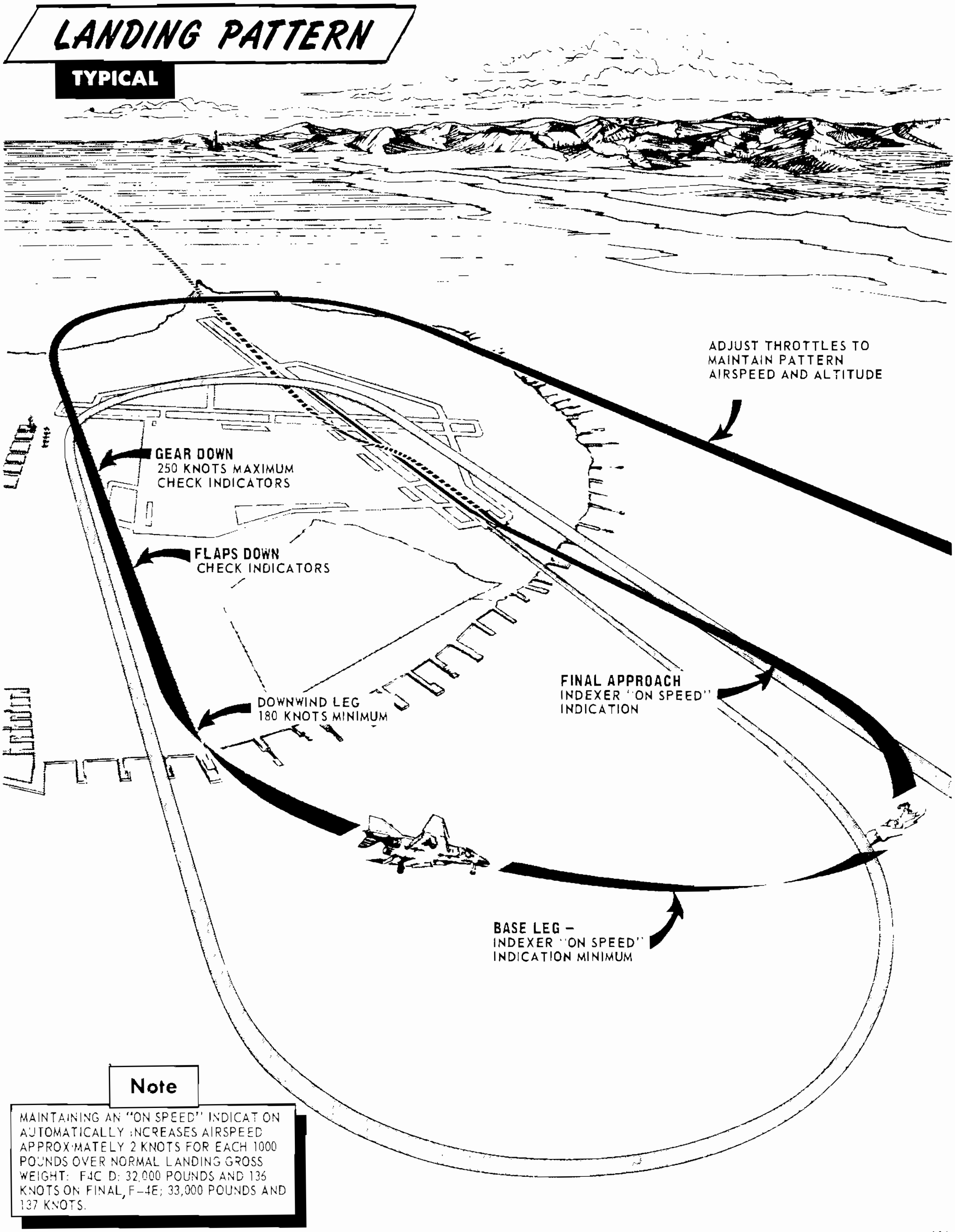
If no response is noted or unscheduled steering commands are detected when engaging nose wheel steering, disengage and do not reengage.

HALF-FLAP LANDING

The half flap approach and landing is similar to that used for full flaps except with half flaps the pilot has increased stabilator effectiveness because of higher airspeed and aerodynamic configuration. Additionally, trailing edge BLC is not available with half flaps; therefore, a slightly wider approach should be used. Flying on speed with half flaps will result in an approximate 12 knot increase in final approach speed.

NO FLAP LANDING

(Refer to section III).



LANDING PATTERN
TYPICAL
ADJUST THROTTLES TO MAINTAIN PATTERN AIRSPEED AND ALTITUDE
GEAR DOWN
250 KNOTS MAXIMUM
CHECK INDICATORS
FLAPS DOWN
CHECK INDICATORS
FINAL APPROACH
INDEXER "ON SPEED" INDICATION
DOWNWIND LEG
180 KNOTS MINIMUM
BASE LEG –
INDEXER "ON SPEED" INDICATION MINIMUM
Note
MAINTAINING AN "ON SPEED" INDICATION AUTOMATICALLY INCREASES AIRSPEED APPROXIMATELY 2 KNOTS FOR EACH 1000 POUNDS OVER NORMAL LANDING GROSS WEIGHT: F4C D: 32,000 POUNDS AND 136 KNOTS ON FINAL, F-4E; 33,000 POUNDS AND 137 KNOTS.
F4-206

Figure 2-6

SHORT FIELD LANDING

Short field landings require that normal final approach procedures be followed with precision and the aircraft be touched down as close to the end of the runway as safety permits. Full aft stick throughout the landing roll increases both aerodynamic drag and wheel brake effectiveness. Apply maximum braking by utilizing anti-skid modulation as soon as the nose gear is on the ground and nose gear steering is engaged.

CAUTION

The anti-skid system requires the wheels be up to speed before anti-skid protection is available. Applying the brakes prior to touchdown will result in blown tires.

Note

Nose gear steering should be used to maintain runway alignment and supplemented with differential braking only if required.

CROSSWIND LANDING (DRY RUNWAY)

Carefully compensate for crosswind in the traffic pattern to guard against undershooting or overshooting the final turn. Fly the final approach course with the aircraft ground track properly aligned with the runway. The crosswind may be compensated for either by using the wing low method, the crab method, or a combination of the two. When using the wing low method, the ARI can be overpowered by use of the rudder pedals, or the ARI can be disengaged by pulling the rudder trim circuit breaker. If the crab method is employed, the aircraft heading should be aligned with the runway just prior to touchdown. After touchdown, use rudder, aileron and spoiler, and nose gear steering as required to maintain directional control. Crosswind effect on the aircraft is not severe; however, rudder differential braking and/or nose gear steering must be used as required to maintain alignment with runway. Use of the drag chute intensifies the weather vane effect for any given deployment condition. The weather vane effect increases as the forward velocity of the aircraft decreases, therefore, if the drag chute is to be used, it should be used at the initial portion rather than the latter portion of the landing roll. This also assures use of the drag chute in the speed region where it is most effective. If drag chute is used and excessive weather vaning is encountered, jettison drag chute. Since the nose gear rapidly assumes a position relative to the rudder pedals, nose gear steering should be initiated with the rudder pedals at or near the neutral position. For this reason the use of nose gear steering is advocated early in the landing roll rather than at a time when large amounts of rudder are required to hold the aircraft aligned on the runway. The most important aspect of directional control under crosswind conditions is keeping the aircraft precisely aligned with the runway rather than trying to correct back to the runway heading after it has deviated.

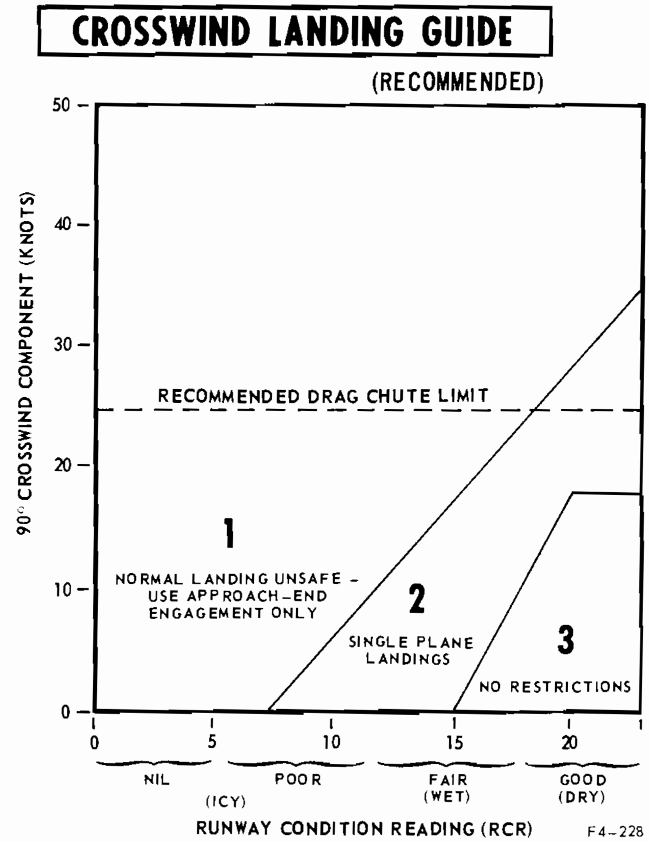


Figure 2-7

CROSSWIND LANDING (WET RUNWAY)

The problem of maintaining directional control on a wet runway is greatly intensified with an increase in effective crosswind. Refer to the Crosswind Landing Guide (figure 2-7) to determine the advisability of making an approach-end engagement. If a crosswind landing is to be made on a slippery runway, it should be done at the lowest practicable gross weight. Plan the pattern to be well established on final in a wings-level crab and with an ON SPEED indication. Establish the rate of descent at approximately 800 fpm (slightly steeper than normal), and plan to touch down on centerline within the first 500 feet. Make a firm touchdown (500-600 fpm) while maintaining the wings-level crab. Touching down in the crab results in a continuation of a straight track down the runway. Immediately after touchdown retard throttles to IDLE, deploy the drag chute, and engage nose gear steering. As wheel-cornering capability overcomes aerodynamic effects, the nose of the aircraft will gradually assume the track down the runway. Nose gear steering is the primary method of maintaining directional control, and should be utilized as early as possible. Be ready to jettison the drag chute if the weather vaning effect begins to interfere with maintaining desired track. When directional control is firmly established, utilize maximum anti-skid braking. Little, if any, deceleration will be felt initially, but will increase as braking potential improves with lowered speeds. Differential thrust should be used only as a last resort in steering toward the overrun arresting gear.

HEAVY GROSS WEIGHT LANDING

The heavy gross weight landing pattern is the same as the basic pattern shown in figure 2-6 with the exception that it should be expanded slightly to compensate for the lower maneuvering capability of the heavy gross weight aircraft at low speeds. As in the normal pattern, an on speed indication on the indexer will provide the optimum angle of attack and airspeed for the aircraft in the landing configuration for both level flight and maneuvering flight. Flying an on speed indexer indication increases airspeed approximately 2 knots for each 1000-pound increase in landing gross weight.

WET RUNWAY LANDING

The technique for a wet runway landing is essentially the same as for a normal landing. However, under crosswind conditions the problem of maintaining directional control becomes more acute. Refer to Crosswind Landing (Wet Runway) and the Crosswind Landing Guide (figure 2-7). Particular attention should be paid to maintaining final approach speed and touching down as close to the end of the runway as safety permits. As with the normal landing technique, power should be reduced to IDLE immediately upon touchdown, the drag chute deployed, and the stick held full aft throughout the landing roll. If excessive weather vaning is encountered, jettison drag chute. Full aft stick provides additional aerodynamic drag and transfers aircraft weight to the main gear to provide maximum wheel brake potential. Nose gear steering, spoilers and ailerons, and as a last resort, asymmetric power can all be used to maintain directional control. The anti-skid system protects against a locked wheel and can effectively and safely produce the maximum deceleration possible for the existing runway conditions. If maximum deceleration is desired, sufficient brake pressure must be applied to keep the anti-skid system active. For this purpose any amount of excess pedal displacement is satisfactory, up to and including full deflection. During the high speed portion of the landing roll, particularly under wet or icy conditions, little deceleration will be felt because the braking potential is very low. As braking potential increases with lowered speeds, the anti-skid system will increase deceleration accordingly. Unless the pilot is familiar with the variables in braking potential of the aircraft, this low deceleration under high speed or adverse runway conditions might be mistakenly interpreted as brake or anti-skid failure.

GO-AROUND TECHNIQUE

Any decision to go around should be made as early as possible. When the decision to go around is made, smoothly increase thrust as required. Do not attempt to rotate the nose or stop rate-of-descent until adequate airspeed is built up. Continue to use the on speed indication as the optimum angle of attack until level flight is attained. As airspeed increases, establish normal takeoff attitude, retract gear and flaps at a safe airspeed and go around. Fly clear of the runway as soon as practicable to preclude climbing into incoming traffic. Refer to Go-Around, figure 2-8.

Note

During go-around a rapid trim change is required to preclude high forward stick forces.

WARNING

Do not exceed 16 units AOA in F-4C/D aircraft or 18 units AOA in F-4E aircraft during go-around with gear retracted. Refer to Angle of Attack, section VI.

CAUTION

- If a decision is made to go-around after touchdown, do not exceed normal takeoff attitude for the aircraft can drag the stabilator and possibly leave the ground in a stalled condition.
- Because of the extremely high thrust/weight ratio and the excessive fuel consumption of afterburner use, it should be used only if required for safety of flight.

Note

Rudder jumps may occur during flap retraction with lateral stick input.

TOUCH-AND-GO TECHNIQUE

After making a normal approach and touchdown, smoothly advance throttles to full military power. Apply aft stick until the nose rotates 10° to 12° of pitch attitude maintaining this attitude until the aircraft is flying. When definitely airborne, retract the gear, followed by the flaps as the aircraft accelerates through a safe airspeed.

CAUTION

If full flaps are used, nose gear lift-off speed on go-around is higher than for a normal takeoff since full flaps degrade stabilator effectiveness while the aircraft is on the ground. The nose gear will break ground rather abruptly at very close to normal takeoff speeds. Therefore, caution must be exercised to prevent overrotation of higher-than-normal take-off attitude.

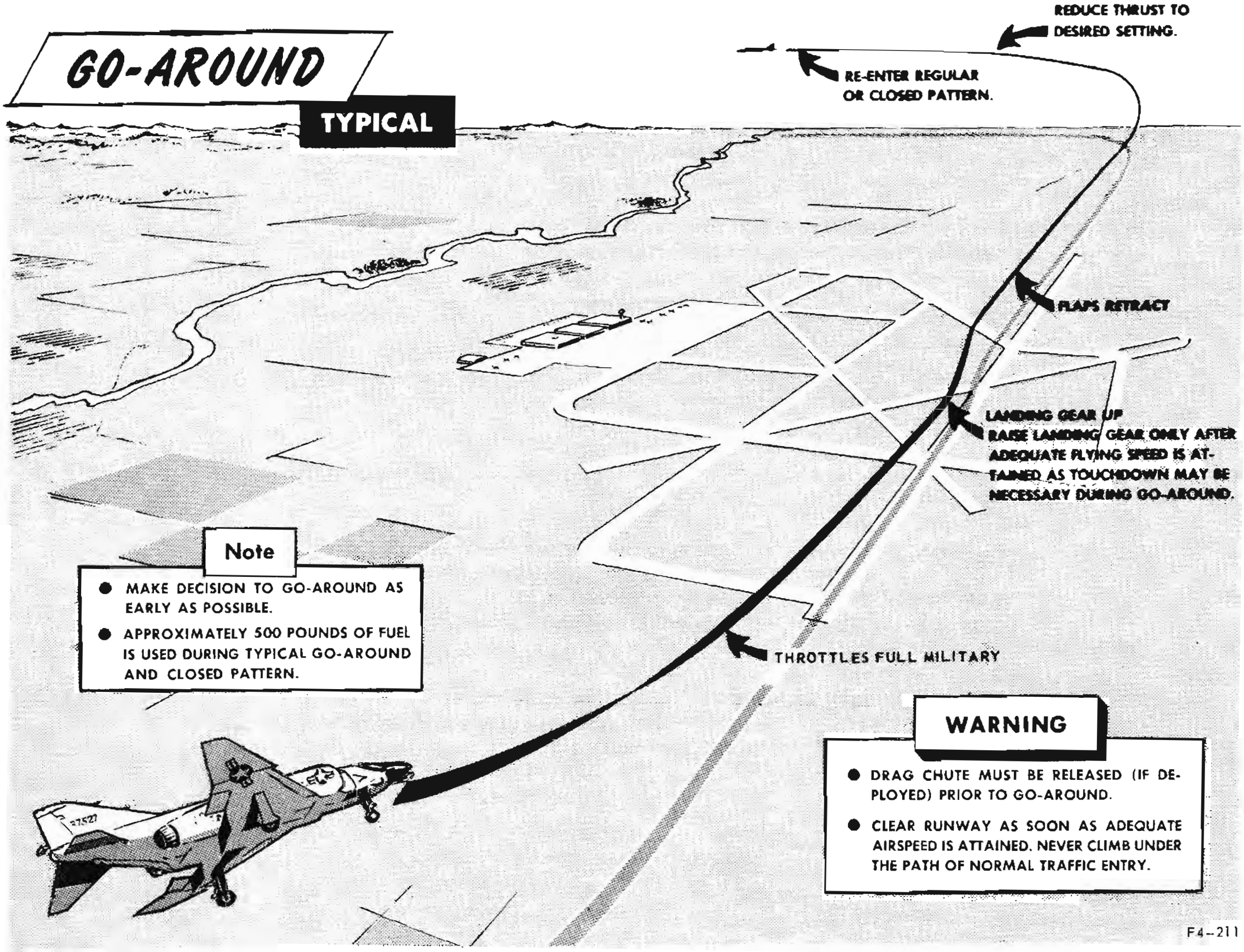


Figure 2-8

AFTER LANDING

After completing landing roll and when below 20 knots

1. Anti-skid switch - OFF

Note

After clearing the active runway, a single engine may be shut down for taxiing. Refer to Engine Shutdown procedures, this section. Single engine taxiing requires no special technique. On F-4E aircraft after T.O. 1F-4-903, if the left engine is shut down, the APU reject switch should be placed in REJECT.

2. Cockpit pressure altimeter - CHECK

WARNING

Before opening the canopies, check the cockpit pressure altimeter to assure that the cockpit is fully depressurized. Attempting to open a canopy while the cockpit is pressurized may cause damage or loss of the canopy. Refer to Cockpit Over pressurization, section III.

AFTER LANDING CONTINUED

WARNING

Account for all loose items before opening canopy. Inadvertent seat ejection may occur if any foreign object in the cockpit becomes jammed between the canopy actuator and the primary seat mounted initiator or the ejection gun firing mechanism sear.

CAUTION

- Taxi with canopies full open or full closed; if the canopies are open during taxiing, do not exceed the canopy open structural limit speed.
- Do not make sharp turns during taxiing with the drag chute deployed to prevent damaging the chute.
- Taxiing at high thrust settings with the drag chute deployed will lead to a reduced service life of the drag chute. Avoid taxiing over drag chutes previously jettisoned to prevent the drag chute from being drawn into the engine intakes and possibly cause damage to the engines.
- The drag chute should be jettisoned before taxiing downwind in winds exceeding 15 knots because of the possibility of the chute collapsing and burning upon contact on hot areas of the engine exhaust nozzles.

After clearing the active runway -

3. (AC-P) Lower ejection handle guard - UP
4. (P) Radar power selector knob - OFF
5. Landing/taxi light - AS REQUIRED
6. Drag chute - JETTISON
7. Stab aug switches - OFF
8. Internal wing dump switch - NORMAL

CAUTION

The internal wing dump switch must be placed to NORMAL position prior to engine shutdown. If the switch is left in DUMP, fuel spillage will occur during refueling on battery power.

9. Flaps - UP
10. Engine anti-ice switch - NORMAL
11. Radar altimeter function selector knob - OFF
12. Stabilator trim - SET
    a. 2 units nose down before T.O. 1F-4-831
    b. 3 units nose down after T.O. 1F-4-831
13. Rain removal switch - OFF
14. Pitot heat switch - OFF
15. IFF/SIF - OFF
16. Reference system selector knob - STBY
17. Temperature control knob - FULL HOT
    Place the temperature control knob to full HOT to evaporate any water that may have collected in the air conditioning system during descent.
18. Defog-footheat control handle - DEFOG
19. (AC-P) TACAN - OFF
20. Air refuel switch - EXTEND
21. Fuel quantity gage - MONITOR
    If fuel quantity shown on the tape depletes rapidly, it is an indication that the defuel valve is in the open position.
22. Refueling selection switch - AS DESIRED

HOT REFUELING

Prior to entering the refueling pit -

1. After landing checklist completed
2. Right generator switch - OFF
3. Bus tie light - OUT
4. Utility hydraulic pressure indicators - WITHIN LIMITS
5. Right throttle - OFF
6. Air refuel switch - EXTEND

WARNING

- Stop short of refueling pit for tire inspection.
- Do not enter the refueling hydrants when hung ordnance is aboard, another aircraft is in the hydrant area, or a known hot brake condition exists (if notified of hot brakes, taxi clear of the refueling area).
- Use minimum power while taxiing in the refueling area.

7. Refuel selection switch - AS DESIRED.
8. Remain alert to all visual and voice signals from the refueling supervisor.
9. Do not refuel unless intercom contact is complete between AC and refueling supervisor.
10. Monitor ground control frequency during refueling operation.

WARNING

- Do not transmit on UHF while refueling except in an emergency.
- If fuel starts running out the vent mast while refueling, place the refuel selection switch to the INT ONLY position. If fuel continues to run out the vent mast, discontinue refueling operation until the malfunction is corrected.
- In the event of fire, advise tower of situation and taxi clear of area.

11. When refueling is complete, taxi to parking area and complete checklist.

ENGINE SHUTDOWN

1. Wheels - CHOCKED
2. (AC-P) Ejection seat - RAISE
   Elevate the seat to facilitate cockpit cleaning, and to gain clearance for insertion of rocket motor safety pin.

WARNING

Before T.O. 13A5-32-504, do not raise the seat after flight until an inspection is made of the rocket motor sear mechanism and lanyard under the seat to ensure that all foreign objects and leg restraint lines are clear of the area. After ensuring that the mechanism is clear, the seat may be raised high enough to facilitate insertion of the rocket motor safety pin.

ENGINE SHUTDOWN CONTINUED

3. Defog-footheat control handle - FULL AFT
4. Temperature control knob - 12 O'CLOCK POSITION
5. Air refuel switch - RETRACT
6. (P) Inertial navigation power control knob - OFF or align if required then OFF
7. Right throttle - OFF

CAUTION

Excessive rapid movement of the control stick with one engine operating may rupture the inoperative power control system reservoir.

8. Left throttle - OFF

WARNING

When generator drops off the line the auxiliary air doors will slam closed violently.

9. Engine master switches - OFF
10. APU reject switch - NORMAL (some aircraft)

BEFORE LEAVING COCKPIT

1. (AC-P) All switches and controls - OFF
2. (AC-P) Personal equipment leads - DISCONNECTED
3. Sight shutter - CLOSED

CAUTION

The sight shutter should be closed when not in use to prevent damage to internal components caused by sunlight focused by the sight combining lens.

4. (P) Blackout curtain - STOWED (if installed)

WARNING

The blackout curtain should be stowed at all times when not in use. Failure to do so may interfere with normal ejection procedures. In addition, an unstowed blackout curtain could cause inadvertent canopy jettison on the ground when the canopy is actuated.

5. (AC-P) Front and rear cockpit face curtain and ejection gun safety pins - INSTALLED

WARNING

Ensure all personal equipment leads and straps are free of cockpit controls and ejection seat handles.

SCRAMBLE

The following scramble procedures are established with the assumption that the following actions have been completed prior to the aircraft being placed on an alert status.

a. Complete preflight inspection to include a power on cockpit inspection and engine operation check.
b. INS aligned and placed in heading memory.
c. Aircraft is cocked for scramble per local policy and instructions.

If the above actions are not completed prior to scramble, normal procedures should be used.

BEFORE TAXIING - FRONT COCKPIT (SCRAMBLES ONLY)

1. Communications and navigation equipment - CHECK
2. Flaps - 1/2
3. Flight controls - CYCLE & CHECK
4. Pressure altimeters - SET & CHECK
5. (F-4C/D) - Static pressure compensators - RESET & CHECK
6. Takeoff trim - SET
   a. 2 units nose down before T.O. 1F-4-831
   b. 3 units nose down after T.O. 1F-4-831
7. Clearance to taxi from pilot.
8. Reference system selector - PRIM
9. Seat pins - CHECK REMOVED & STOWED
10. Wheel chocks and ground interphone cord - REMOVED

BEFORE TAXIING - REAR COCKPIT (SCRAMBLES ONLY)

1. Communication and navigation equipment - CHECK
2. Pressure altimeter - SET & CHECK
3. Radar power - STBY
4. (F-4E) Radar overtemp light - OFF, MONITOR
5. Navigation computer function selector knob - STBY
6. INS - ALIGNMENT COMPLETE
   Heading memory alignment should be used for scrambles. To perform this alignment, set the power control knob to ALIGN. After the ALIGN light flashes set the power control knob to NAV, and then set the align mode switch to GYRO COMP. If the inertial navigation set has not been previously aligned for heading memory, attitude reference can be obtained by performing a coarse alignment (ALIGN - wait 40 seconds - NAV).

WARNING

At any time coarse alignment is utilized, the AC must be prepared to switch to the standby attitude reference system at the first indication of primary system failure or malfunction.

7. Navigation computer function selector knob - AS DESIRED
8. Seat pins - CHECK REMOVED & STOWED
9. Notify AC - CLEAR TO TAXI

BEFORE TAKEOFF (SCRAMBLES ONLY)

1. Stab aug switches - ENGAGE
2. (AC-P) Canopies - CLOSE & CHECK
3. (AC-P) Lower ejection handle guards - CLEAR
4. Fuel panel - SET & CHECKED
   a. Internal wing transfer switch - NORMAL
   b. External transfer switch - CENTER or OUTBD
   c. Tanks 5/6 lockout switch - AS REQUIRED (some aircraft)
   d. Tank depressure switch - NORM (some aircraft)
5. APU reject switch - NORMAL (some aircraft)
6. Flaps - 1/2
7. Anti-skid - ON, LIGHT OUT
8. Warning lights - CHECKED

BEFORE TAKEOFF (SCRAMBLES ONLY) CONTINUED

9. Pitot heat/anti-ice - AS REQUIRED
10. IFF/SIF - AS REQUIRED
11. (AC-P) Inertia reel - AS DESIRED
12. Variable inlet ramps - CHECK FULLY RETRACTED
    As throttles are advanced to 85% rpm: check that variramps are in the fully retracted (flush) position.

SOLO FLIGHT INSPECTION (REAR COCKPIT)

1. Command selector valve handle - VERTICAL (closed).
2. Canopy initiator safety pin (bulkhead mounted) - REMOVED
   With the initiator safety pin installed, the front canopy cannot be jettisoned by means of the canopy jettison lanyard.
3. Ejection seat and canopy safety pins - INSTALLED
4. Lap belt, leg restraints, and harness assembly - SECURED
5. Communication-navigation control panel - SET
   a. Communication function selector knob - T/R +G
   b. Communication channel control knob/mode selector switch - GUARD
   c. Navigation function selector knob - T/R
   d. Navigation channel control knob - AS REQUIRED
6. Pressure suit vent air knob - OFF
7. Emergency flap handle - FORWARD
8. Amplifier selector knob - NORM
9. Function selector switch - HOT MIC
10. Oxygen supply levers - OFF
11. Emergency gear handle - IN AND SECURE
12. Emergency brake handle - IN AND SECURE
13. Radar scope retaining pins - INSTALLED
14. Radar power selector knob - OFF
15. Circuit breakers - IN
16. Rear cockpit electrical test receptacle - ENSURE CAP TIGHTENED

Note

It is possible to trip both generators off the line if the electrical test receptacle 3P325 under the right canopy sill is loose. The generators cannot be restored until the cap is tightened.

17. Cockpit light switches - OFF
18. All loose items - SECURE
19. All other equipment - AS REQUIRED

*20. Instrument ground switch - ACTUATE
   Actuate the instrument ground power switch to energize the instrument 115/200 volt ac bus and the instrument 28 volt ac bus.

*21. Essential dc test button - DEPRESS (some aircraft)
   Depress the essential dc test button and observe that the essential dc test light illuminates.

22. Inertial navigation set - ALIGNED
    Align the INS as outlined in After Electrical Power (Rear Cockpit).
23. Canopy - CLOSED

* Cannot be performed when battery start is made.

SECTION III EMERGENCY PROCEDURES

TABLE OF CONTENTS

This section contains procedures to be followed to correct an emergency condition. These procedures will insure maximum safety for the crew and/or aircraft until a safe landing or other appropriate action is accomplished. Multiple emergencies, adverse weather, and other peculiar conditions may require modification of these procedures. The critical items **(BOLD FACE LETTERS)** contained in the various emergency procedures cover the most adverse conditions and should be committed to memory. The nature and severity of the encountered emergency will dictate the necessity for complying with the critical items in their entirety. It is essential, therefore, that aircrews determine the correct course of action by use of common sense and sound judgement. As soon as possible, the AC should notify the pilot, flight or flight leader, and tower of any existing emergency and of the intended action. When an emergency occurs, three basic rules are established which apply to airborne emergencies. They should be thoroughly understood by all aircrews:

1. Maintain aircraft control.
2. Analyze the situation and take proper action.
3. Land as soon as practicable.

WARNING

- During any inflight emergency when structural damage is known or suspected that may adversely effect aircraft handling characteristics, a controllability check should be performed at a safe altitude. This check should be performed in the gear down, flaps up configuration. Do not allow airspeed to decrease below the computed landing speed. If adequate control response is available, and if it is practicable, maintain this configuration and accomplish a no-flap landing.
- The canopies should be retained during all emergencies, except ditching, that could result in a crash or fire such as crash landings, aborted takeoffs, and barrier engagements. The protection the canopies afford the crew during these emegencies far outweighs the isolated risk of entrapment due to a canopy malfunction or overturn. During the aircraft abandonment phase, normal canopy opening procedures should be considered first to preclude the possibility of a static seat ejection.
- All odors not identifiable by the flight crew shall be considered toxic. Immediately go on 100% oxygen. Properly vent the aircraft and land as soon as practicable. Do not takeoff when unidentified odors are detected.

GROUND-OPERATION EMERGENCIES

CANOPY MALFUNCTION

Canopy unlock light remains on-

1. Canopy - OPEN NORMALLY
2. Attempt to reclose canopy.
3. If canopy will not lock, leave canopy closed and request maintenance assistance.

WARNING

Do not taxi the aircraft with a known canopy malfunction with the canopy open. The canopy may separate from the aircraft causing damage to the aircraft and/or injury to the aircrew.

Canopy will not open-

1. Canopy control handle - OPEN
2. Manual canopy unlock handle - PULL AFT

WARNING

Canopy control must be in the OPEN position, otherwise the canopy will not unlock using the manual canopy unlock handle.

Note

High breakout force may be required to manually unlock canopy.

3. If necessary, push up on canopy to assist opening.

COCKPIT OVERPRESSURIZATION

1. Emergency vent knob - PULL

WARNING

Do not attempt to open the canopy by the normal method if the cockpit is overpressurized since this may cause the canopy to lift and separate from the aircraft and fall on the banana links resulting in an inadvertent ejection.

If vent knob does not relieve pressure-

2. Cockpit heat and vent circuit breakers (C8, D6, No. 3 panel) - PULL

ENGINE FIRE OR OVERHEAT DURING START/SHUTDOWN

1. **THROTTLES – OFF**
2. Engines master switches - OFF

WHEEL BRAKE ANTI-SKID FAILURE

In the event of brake loss with normal utility hydraulic pressure and the anti-skid switch ON:

1. Wheel brakes - RELEASE

CAUTION

The brakes should be released before the anti-skid system is disengaged to prevent the possibility of skidding. When the anti-skid system is disengaged manually or due to a malfunction, the brakes will immediately be applied proportional to pedal displacement.

Note

The anti-skid system will not protect against skids below approximately 10-20 knots. A malfunctioning anti-skid system which relieves brake pressure below this speed range might be interpreted as wheel brake failure. Assuming a normal utility hydraulic pressure, brakes can be regained by deactivating the anti-skid system and reapplying the brakes. If the brakes are not regained by this action, there is a possibility that they might be regained by keeping the anti-skid system deactivated, and pulling the emergency brake handle.

2. Anti-skid - OFF.

Note

The anti-skid system can be temporarily disengaged by depressing the emergency quick release lever on the control stick. This lever, however, must be held depressed to keep the system disengaged.

3. Wheel brakes - REAPPLY
   If braking returns, leave anti-skid switch OFF; if not, activate the emergency brake system.

4. Hook - DOWN (if required)

CAUTION

If normal braking is available, and anti-skid protection is lost, it is possible to lock a wheel(s) and produce a skid which could result in a blown tire(s). The runway condition and aircraft speed will dictate the amount of braking that can be applied without skidding a wheel. Refer to Wheel Brake Operation, Section VII.

WHEEL BRAKE FAILURE

If utility system hydraulic failure occurs, the aircraft can be stopped, using the emergency brake system.

1. Emergency brake handle - PULL & HOLD
   Delay pulling the emergency brake handle until braking is actually desired.

Note

If emergency brake handle in one cockpit is not effective, pull the emergency brake handle in the opposite cockpit.

2. Wheel brakes - APPLY
   Pedal pressure is identical to the normal brake system. Brakes should be slowly applied to the desired amount and held until the airplane stops.

Note

Without utility hydraulic system pressure available, differential braking will become the primary method of maintaining directional control since nose gear steering will not be available.

CAUTION

- Since application and full release of the brake system dumps the amount of fluid that was in the brake, every effort should be made to use smooth steady brake applications with a minimum of pumping.
- The anti-skid feature is inoperative during emergency brake operation. Do not attempt to taxi after the emergency brake handle has been pulled.

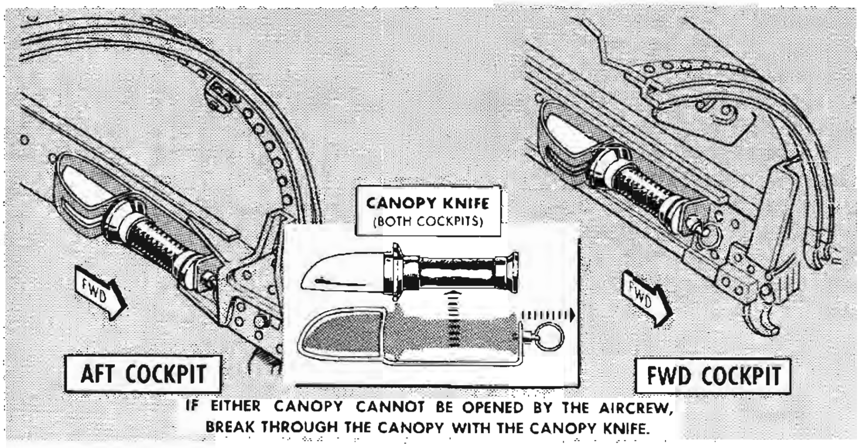
EMERGENCY ENTRANCE AND EXIT

See figure 3-1.

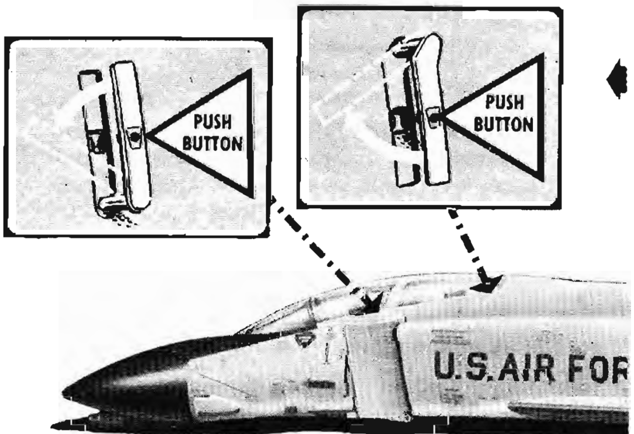
EMERGENCY EVACUATION

1. **LOWER EJECTION HANDLE GUARD – UP**
2. **SHOULDER HARNESS – RELEASE**
3. **SURVIVAL KIT RELEASE HANDLE – ROTATE AFT**
4. **EMERGENCY HARNESS RELEASE HANDLE – LOCK UP**
5. **CANOPY – OPEN**
   a. Normal
   b. Manual unlock handle
   c. Emergency jettison handle
   d. Break canopy with canopy knife.

EMERGENCY ENTRANCE / EXIT



To manually open the canopies, depress the push buttons on the manual release handles. Depress the OPEN buttons on each normal canopy control. Rotate the FORWARD canopy manual release handle COUNTERCLOCKWISE. Rotate the AFT canopy manual release handle CLOCKWISE. After the canopies have been unlocked they can be lifted open manually.



WARNING

THE CANOPIES MUST BE HELD OR PROPPED UP IN THE OPEN POSITION WHEN RAISED MANUALLY.

Entrance to the cockpits while the engines are running is hazardous because of the possibility of being drawn into the intake duct. To reduce this hazard, it is suggested that a crash truck be driven up against the duct, thereby blocking the duct. The canopies can then be jettisoned or opened, and entry can be made from the top of the vehicle or from the wing.

To jettison the canopies, open access door 7, extend canopy jettison lanyard to its full length (approximately 20 inches) and PULL.

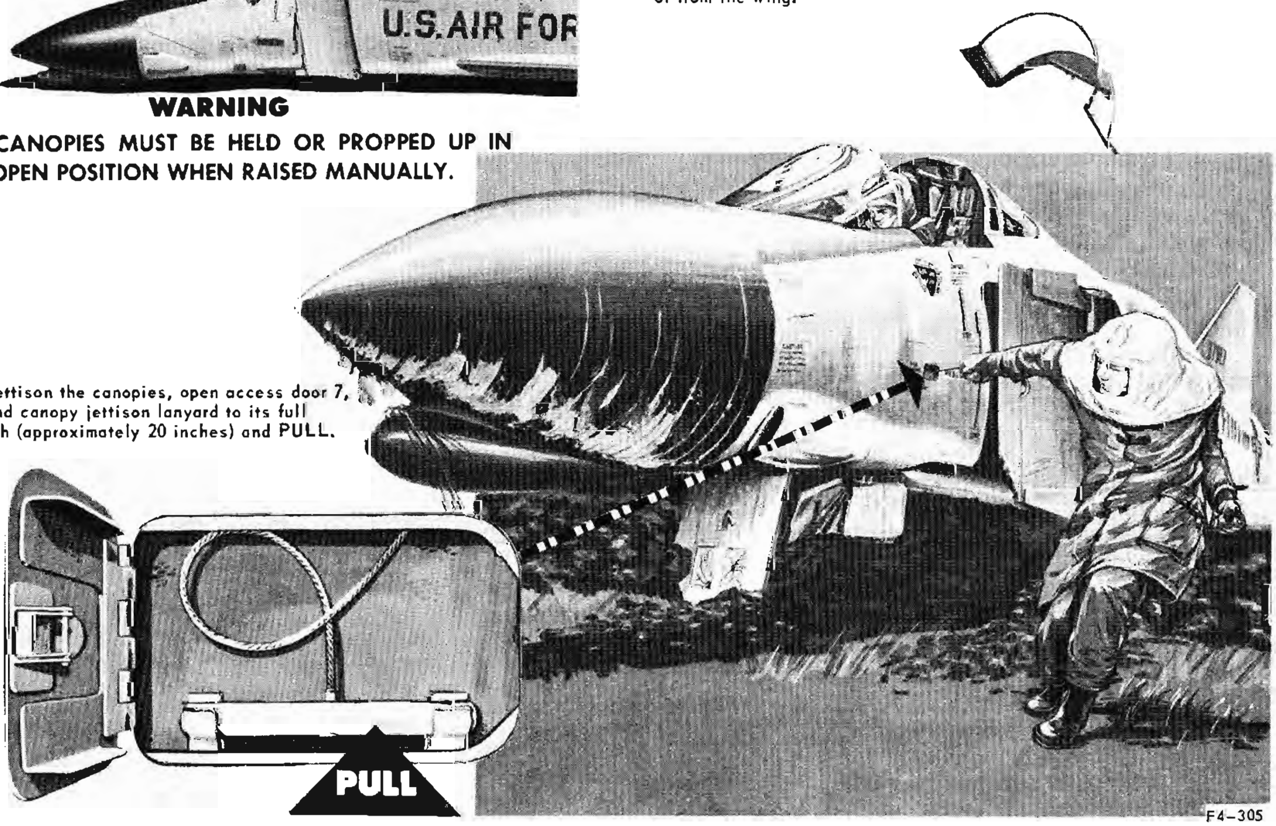


Figure 3-1

TAKEOFF EMERGENCIES

ABORT

1. **THROTTLES–IDLE**
2. **DRAG CHUTE – DEPLOY**
3. **BRAKES–APPLY**
4. **HOOK–DOWN**

AFTERBURNER FAILURE DURING TAKEOFF

If the afterburner fails to light, re-cycle the throttle to MIL and then back into the afterburner range. If an afterburner fails after light-off the resulting loss of thrust is significant. Takeoff need not be aborted if remaining runway is compatible with thrust available. After failure, the variable area exhaust nozzle will continue to function as directed by exhaust gas temperature. In this circumstance, the nozzle moves as a function of temperature limiting only.

1. Throttle of bad engine - MIL

ENGINE FAILURE DURING TAKEOFF

If an engine fails before aircraft lift-off, the decision to abort or continue the takeoff is dependent on length of runway remaining, the aircraft gross weight, the airspeed at the time of failure, field elevation and runway temperature.

Note

If an engine fails during a military thrust takeoff, and the takeoff cannot be aborted, immediately advance the operating engine throttle to maximum thrust and follow engine failure during flight procedures, this section, as soon as practicable.

If decision to stop is made -

1. **ABORT**

If takeoff is continued -

If an engine fails, and the takeoff must be continued, lateral and directional control can be maintained if the aircraft remains above stall speed. However, the ability to maintain altitude or to climb depends upon aircraft gross weight and airspeed.

1. **THROTTLES – AFTERBURNER**
2. **EXTERNAL LOAD – JETTISON (IF NECESSARY)**
3. Climb to safe ejection altitude and investigate. After reaching safe ejection altitude, proceed with Engine Failure During Flight procedures.

ENGINE FIRE OR OVERHEAT DURING TAKEOFF

If decision to stop is made -

1. **ABORT**
2. **THROTTLE BAD ENGINE–OFF**

If takeoff is continued -

1. **THROTTLE GOOD ENGINE – AFTERBURNER**
2. **THROTTLE BAD ENGINE – IDLE**
3. **EXTERNAL LOAD – JETTISON (IF NECESSARY)**
4. **THROTTLE BAD ENGINE – OFF (IF FIRE CONFIRMED)**
   Retard throttle of bad engine to OFF if warning light remains on or other indications of fire exist; e.g., explosion, smoke, EGT.
5. **IF FIRE PERSISTS – EJECT**
6. If fire ceases, land as soon as practicable.

BLOWN TIRE DURING TAKEOFF

The decision to continue the takeoff or abort will depend on the speed at the time of the failure, stopping distance required, and arresting gear available. Generally it is better to continue the takeoff if the tire blows above 100 knots.

CAUTION

Directional control is extremely critical; therefore, immediate corrective action must be taken and all available means of maintaining directional control must be considered.

If decision to stop is made -

1. **ABORT**
2. **NOSE GEAR STEERING – ENGAGE**
3. **ANTI-SKID – OFF**
   Release brakes prior to disengaging the anti-skid to prevent blowing the good tire.

CAUTION

- Avoid braking on the wheel with the blown tire. Heavy braking could cause a flat spot on the wheel which could prevent further rotation and make aircraft control more difficult.
- Do not shut down the engines until adequate firefighting equipment is available. Fuel drained overboard during engine shutdown could contact the hot wheel and cause a fire.
- Do not retract wing flaps. If the wing flaps seals have been damaged by pieces of broken tire, retracting the wing flaps will increase the damage.

If takeoff is continued -

1. **GEAR & FLAPS–DO NOT RETRACT**
   Leave wing flaps extended and stay below flap-blowup speed if practicable. If the wing

flap seals were damaged as a result of a blown tire, retracting the flaps will increase the damage.

2. Tire - CHECK
   Check the condition of the blown tire, if possible, by verification from another aircraft/tower.

AUXILIARY AIR DOOR MALFUNCTION (GEAR UP)

If the L AUX AIR DOOR, and/or R AUX AIR DOOR indicator lights illuminate with landing gear handle UP:

1. Maintain 250 knots or less.
2. Landing gear - CYCLE
3. If light(s) remain on with landing gear up, maintain no more than cruise power setting to avoid engine compartment overheating.

CAUTION

Extended engine operation at high power settings will result in engine compartment and aft fuselage overheating.

Note

The auxiliary air doors can be closed by pulling the left and right AUX AIR DOOR circuit breakers. This will not affect normal operation of the aux air doors in flight. However, it should be remembered, the circuit breakers must be reset prior to lowering the landing gear.

BOUNDARY LAYER CONTROL SYSTEM MALFUNCTION

A boundary layer control system malfunction is indicated by illumination of the BLC MALFUNCTION indicator light. The only type of malfunction indicated by the light will be at least one of the four BLC valves stuck open when the flaps are full up. In the event of a BLC malfunction:

WARNING

Operating at normal power settings in excess of 30 seconds with the BLC MALFUNCTION light illuminated and flaps up may result in damage to the warning light circuit wiring which may cause the BLC light to extinguish and the wheels light to illuminate. Therefore, a flashing WHEELS light with flaps up, should be treated as a BLC malfunction. Continued flight under the aforementioned conditions can then result in additional electrical, hydraulic and structural damage to the wing from overheating.

1. **FLAPS – DOWN**
2. Maintain airspeed consistent with gross weight and flap blow-up airspeed.
3. Landing gear - DOWN
4. Land as soon as practicable.
5. After landing, leave flaps fully extended.

FUEL SIPHONING DURING TAKEOFF/CLIMB

Excessive fuel siphoning on takeoff could result in a torching effect if the afterburners are utilized. No damage will result from torching siphoned fuel; however, excessive fuel siphoning does unnecessarily deplete the fuel supply. If excessive fuel siphoning is noted:

1. External transfer switch - OFF
2. Internal wing transfer switch - STOP TRANSFER

When siphoning ceases -

3. Internal wing transfer switch - NORMAL
4. External transfer switch - AS DESIRED

LANDING GEAR FAILS TO RETRACT

1. Climb to a safe altitude while maintaining airspeed below 250 knots.

WARNING

Airspeed is critical and should be maintained consistent with gross weight. Avoid abrupt throttle reductions.

2. Landing gear control circuit breaker - IN
3. Landing gear handle - CYCLE
   Move landing gear handle down. When gear indicates locked, raise gear.

CAUTION

If landing gear handle is stuck in the down position, do not attempt to force the gear handle to the up position.

4. If landing gear cannot be retracted or continues to indicate unsafe, move landing gear handle down, and remain below 250 knots.

INFLIGHT EMERGENCIES

OUT-OF-CONTROL RECOVERY

Note

If an out-of-control condition is experienced without sufficient altitude to effect recovery, the crew should eject. The progression of a departure from controlled flight to a spin is unpredictable and may occur quite rapidly. Refer to section VI, Flight Characteristics, for additional information.

Recovery from most out-of-control situations can be effected rapidly with forward stick. At the first indication of a departure from controlled flight, the ailerons and rudder should be neutralized while moving the stick smoothly forward (full forward if necessary). In most cases, recovery will be effected before the stick reaches the full forward position. The throttles should be retarded to idle to reduce the possibility of engine flameout unless at low altitude where thrust may be needed for recovery. The probability of engine flameout is also reduced at the lower altitudes. The drag chute will effect recovery from most departures, and should be deployed without hesitation if the aircraft does not recover rapidly with full forward stick.

Large oscillations in pitch, roll, and yaw may be present as the aircraft unloads (zero or negative G) during the recovery. This unloading, using forward stick, is the best means of reducing these oscillations and is a positive indication that recovery is imminent. To preclude pitching back into another out-of-control situation, forward stick should be maintained until all oscillations stop. No attempt should be made to fly AOA while large roll and yaw motions are present because the AOA probe gives erroneous information under these conditions. The aircraft may enter a series of uncommanded rapid rolls as it recovers and accelerates. While AOA may indicate less than 30 units, the rudder and aileron are relatively ineffective in stopping these recovery rolls. These rolls should not be mistaken for a spin or spin reversal; they will cease within two or three rolls. After recovery do not exceed buffet onset during the dive recovery or 19 units AOA maximum if at low altitude. Jettisoning the drag chute is not necessary as it will normally fail and streamline behind the aircraft as speed increases.

The following Out-of-Control procedure will be used if departure from controlled flight is experienced.

1. **STICK – FORWARD**
2. **AILERONS AND RUDDER – NEUTRAL**
3. **IF NOT RECOVERED – MAINTAIN FULL FORWARD STICK AND DEPLOY DRAG CHUTE**
4. Throttles - IDLE (Unless at low altitude)

WARNING

If both engines flame out, an airstart of at least one engine must be obtained immediately to preclude loss of electrical and hydraulic power.

UPRIGHT SPINS

The Out-of-Control procedure will recover the aircraft from nearly all spins regardless of CG position or external store loading. The rudder is relatively ineffective in a spin; however, applying full aileron in the direction of the spin will effect a more rapid recovery. Aileron should not be applied, however, until the AC has ascertained that a spin condition exists. Visual cues outside the cockpit, an excessive yaw rate, and the turn needle should all be used to verify a spin condition and spin direction. AOA is not a primary indication to determine a spin condition since the AOA probe gives erroneous information when large roll and yaw motions are present. The AOA indicator may show less than 30 units and even below 15 units momentarily during a spin; however, the AOA indication will be 30 units during most of the upright spin. Even if the indicated AOA comes down during an out-of-control or spin condition, the stick should remain forward until the aircraft unloads and yaw and roll motions cease. Spin reversals (changing spin direction) are rare using forward stick for spin recovery. If a reversal should occur, verify spin direction and apply aileron with the spin.

The following Upright Spin recovery procedure should be used only if the aircraft has not been recovered utilizing the Out-of-Control procedure and the AC has positively ascertained that the aircraft is spinning.

1. **STICK – MAINTAIN FULL FORWARD**
2. **AILERON – FULL WITH SPIN (TURN NEEDLE)**
3. **AIRCRAFT UNLOADED – AILERONS NEUTRAL**
4. If Out of Control at 10,000 Feet AGL - EJECT

Note

Altitude loss in a spin may be as much as 2000 feet per turn. Total altitude loss from departure to wings - level recovery is dependent upon many variables. When a spin is entered, the total altitude loss may be as little as 5000 to 10,000 feet; however, it will be closer to 15,000 feet under most conditions. If the AC considers that there is insufficient altitude for recovery, the crew should eject immediately.

INVERTED SPINS

The aircraft is highly resistant to an inverted spin and will recover rapidly with neutral ailerons and rudder. The Out-of-Control procedure should be used if an inverted spin is entered. When roll and yaw oscillations cease, maintain 5 to 10 units AOA until speed is sufficient to perform a normal dive recovery.

AIRSTART ENVELOPE

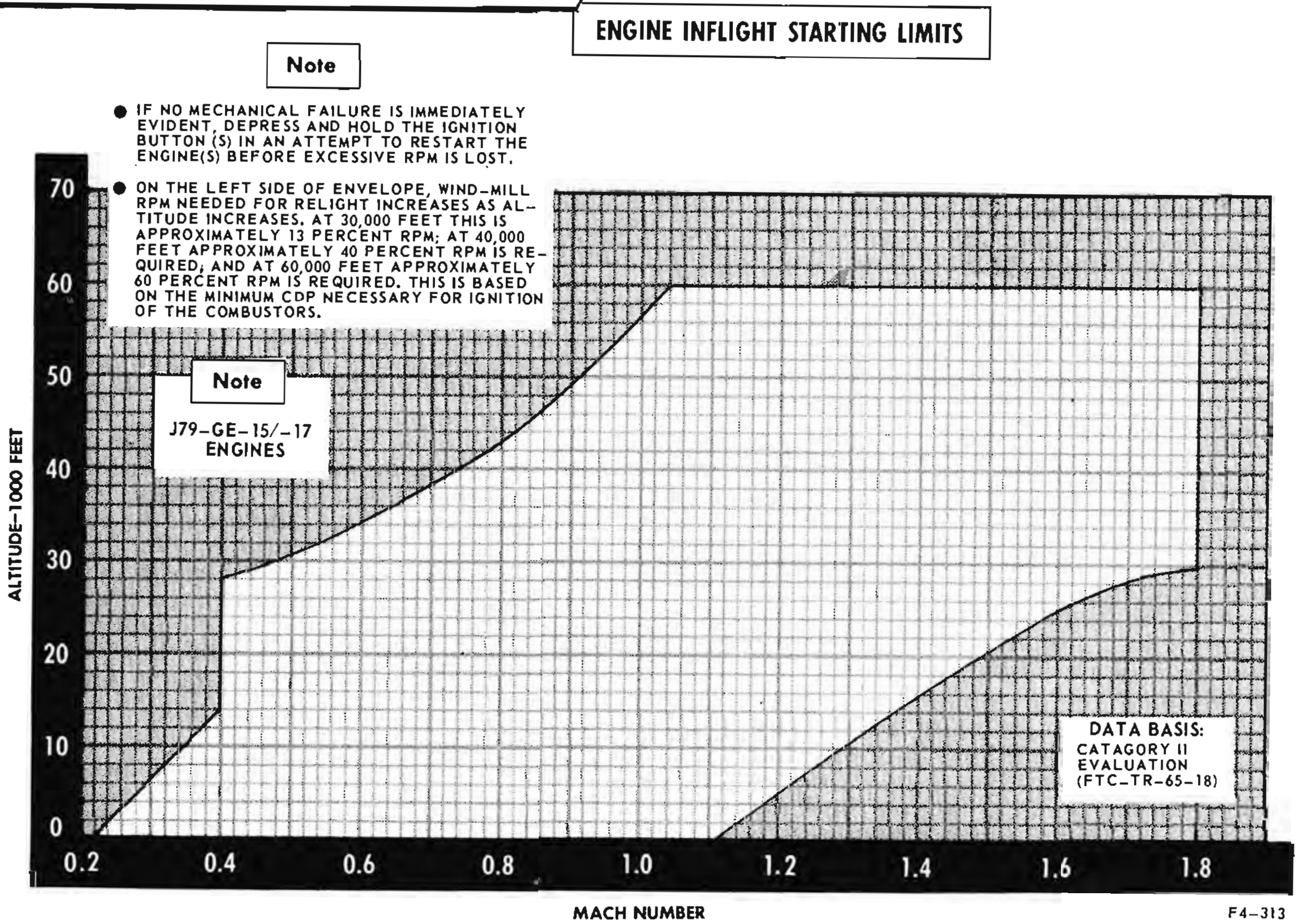


Figure 3-2

ENGINE FAILURE DURING FLIGHT

Note

- Before T.O. 1F-4-860, exerting an outboard pressure on the throttles when attempting an airstart can prevent advancement of the throttles past approximately the 80% RPM position. If this occurs on relight, move throttles inboard to allow power to be increased.
- If a mechanical failure is not immediately evidenced by explosion, engine vibration, or engine seizure, depress and hold the ignition button(s) in an attempt to restart the engine(s) before excessive rpm is lost.
- A normal relight and acceleration should not be expected above 60,000 feet, however, if a relight is attempted and the engine does not come out of idle rpm, descend to a lower altitude. Refer to Airstart Envelope, figure 3-2
- If engine failure occurs during air refueling, immediately disengage from the tanker. Place the air refuel switch to RETRACT and check the fuel quantity gage for an indication of a failed open defuel valve.

CAUTION

To reduce the possibility of engine seizure, do not delay an airstart attempt.

AIRSTART

1. Ignition button - HOLD DEPRESSED
2. Throttle - ANY POSITION BEYOND IDLE
3. Engine rpm, exhaust temperature, and fuel flow - MONITOR

   An engine relight is indicated by an increase in exhaust temperature, followed by an increase in engine rpm.

CAUTION

If a relight does not occur within 30 seconds; or the engines do not accelerate after light-off; or the exhaust temperature exceeds its maximum limits; or the oil pressure does not reach its minimum limit; retard the throttle to OFF.

MECHANICAL FAILURE

1. Throttle - OFF
2. Engine master switch - OFF
3. Land as soon as practicable

SINGLE-ENGINE FLIGHT CHARACTERISTICS

Single-engine flight characteristics are essentially the same as the normal flight characteristics due to the proximity of the thrust lines to the center of the aircraft. With one engine inoperative, slight rudder deflection is required to prevent yaw toward the failed engine. The aircraft design is such that no one system is entirely dependent upon a specific engine, thus loss of one engine will not result in the loss of a complete system. Aircraft service ceiling for single-engine operation (military thrust or afterburner thrust) is a function of aircraft configuration and gross weight. A simple rule of thumb to use in the event of an engine failure is: maintain 250 knots (military thrust on good engine). If 250 knots cannot be maintained, descend at 250 knots until rate-of-descent stops. This places the aircraft close to the service ceiling for the operating gross weight and power available. If a climb is desired, use afterburner thrust on the good engine. During single-engine operation with various landing gear and wing flap configurations, care must be exercised to avoid rapid airspeed bleed-off and/or excessive sink rates. Limited thrust available makes airspeed response to power much slower than normal two-engine operation.

DOUBLE ENGINE FAILURE DURING FLIGHT

1. **RAT – EXTEND (F-4C/D)**
2. **EITHER ENGINE – AIRSTART**

Note

Hold ignition button for 5 seconds.

If neither engine starts-

3. **FUEL STATUS – CHECK**
   a. Tape and fuel low level warning light - CHECK
   b. External transfer switch - OFF
   c. Internal wing transfer - NORMAL
4. Either throttle - OFF

Note

To provide maximum fuel flow to accomplish an airstart, retain throttle on one engine in the OFF position.

5. Other engine - AIRSTART
6. Remaining engine - AIRSTART
7. If neither engine can be started, attempt airstart by holding boost pump check switches in CHECK position and pull applicable FUEL VALVE POWER circuit breaker, F-4C/D/E; (H1, No. 2 panel)
8. If neither engine can be started - EJECT

Note

If engine rpm has dropped to 10-12%, approximately 40 seconds after lightoff is required to accelerate to military thrust.

ENGINE FIRE OR OVERHEAT DURING FLIGHT

WARNING

If Engine Fire or Overheat Warning light illuminates while in the landing configuration, follow Single Engine Failure on Final procedures before reducing throttle on the bad engine.

1. Throttle bad engine - IDLE
2. If warning light goes out - CHECK FIRE DETECTION SYSTEM
   Depress fire test button to determine that the fire detecting elements are not burned through.
3. If detection system check is satisfactory (i.e., warning lights illuminate when checked) - LAND AS SOON AS PRACTICABLE

CAUTION

Increasing thrust on the bad engine after the throttle has been retarded and the warning light has been extinguished may cause fire or overheat damage, and/or possible burn through the fire detecting elements.

4. If warning light remains illuminated or fire detection system is inoperative or fire is confirmed - SHUTDOWN ENGINE
5. If fire persists - EJECT
6. If fire ceases - LAND AS SOON AS PRACTICABLE

CAUTION

Do not attempt to restart the bad engine. If the fire ceases, and a landing is to be accomplished, make a single engine landing.

HARD-OVER RUDDER INFLIGHT

1. Maintain approximately 250 knots not to exceed 13 units angle of attack.
2. Avoid abrupt pull-up maneuvering at high angle of attack.
3. Rudder trim circuit breaker - PULL

VARIABLE AREA INLET RAMP FAILURE

There are no provisions made for emergency operation of the inlet ramps. Malfunction of the inlet ramp control or actuating system may cause the ramp to assume the fully retracted (maximum duct area) position or the fully extended (minimum duct area) position. Extended inlet ramps may be detected by: observing the ramp position in the rear view mirror; significantly reduced fuel flow at power settings above 85% rpm; high pitched howl at airspeeds above

WARNING / INDICATOR LIGHTS

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
WHEELS	FLAPS DOWN–GEAR UP	LOWER LANDING GEAR OR RAISE FLAPS TO EXTINGUISH	AN ILLUMINATED WHEELS LIGHT WITH LANDING GEAR HANDLE UP AND THE FLAPS UP SHOULD BE TREATED AS A BLC MALFUNCTION.
FIRE TEST / FIRE → / OVER HT	FIRE OR OVERHEAT CONDITION EXISTS IN INDICATED ENGINE COMPARTMENT.	CARRY OUT PRESCRIBED EMERGENCY PROCEDURE AS NECESSARY.	LIGHT INDICATES EXCESSIVE TEMPERATURES IN AFFECTED ENGINE COMPARTMENT.
MASTER CAUTION	SOME SYSTEM HAS A CAUTION CONDITION.	CHECK TELELIGHT PANEL.	LIGHT ILLUMINATES WITH LIGHTS ON THE TELELIGHT PANEL EXCEPT: L/R / CTR EXT FUEL, SPEEDBRAKES OUT, TANK 7 FUEL, AND DC BUS
ALT ENCODER OUT	UNRELIABLE SIGNAL OR NO SIGNAL FROM ALT ENCODER UNIT.	NONE INFO ONLY	IF LIGHT STAYS ON: PERFORM THIS FUNCTION THROUGH VOICE COMMUNICATIONS.
IFF			THIS LIGHT IS INOPERATIVE UNTIL MODE 4 IS MADE OPERATIVE.
** L WING PIN UNLOCKED R WING PIN UNLOCKED	WING(S) IS UNLOCKED.	NONE	GROUND CREW MUST LOCK WINGS
CANOPY UNLOCKED	CANOPY IS UNLOCKED	ON THE GROUND: ● CARRY OUT PRESCRIBED EMERGENCY PROCEDURES. INFLIGHT: ● COCKPIT PRESS.–DUMP ● CHECK CANOPY HANDLE FULLY CLOSED.	NONE
FUEL LEVEL LOW	FUEL REMAINING IN CELLS 1 AND 2: F-4C/D ACFT AND F-4E ACFT THRU 68-494, 1800 ± 200 POUNDS. F-4E ACFT 68-495 AND UP, 1650 ± 200 POUNDS.	NONE INFO ONLY	CHECK ALL FUEL TRANSFERRED TO THE FUSELAGE. CHECK FEED TK CHK AND FUEL LOW WARN CB IN. CHECK DC PWR AVAILABLE.
L EXT FUEL CTR EXT FUEL R EXT FUEL	● TANK IS EMPTY. ● FUEL FLOW HAS STOPPED. ● TANK IS FULL (DURING AIR REFUELING).	NONE INFO ONLY	INTERMITTENT ILLUMINATION DURING FUEL TRANSFER IS NORMAL.
CHK HYD GAGES	PRESSURE BELOW 1500 ± 100 PSI IN ANY SYSTEM OR UTILITY HYD PUMP INOPERATIVE	ANALYZE SITUATION.	CARRY OUT PRESCRIBED EMERGENCY PROCEDURES.
WINDSHIELD TEMP HIGH	WINDSHIELD IS OVERHEATED.	RAIN REMOVAL SWITCH– OFF.	● LIGHT WILL ILLUMINATE IF RIGHT GENERATOR DROPS OFF LINE AND BUS TIE IS OPEN. ● INTERMITTENT ILLUMINATION DURING HIGH MACH FLT, RAIN REMOVAL SYS OFF, IS NORM.
DUCT TEMP HI	INLET TEMPERATURE IS ABOVE, 121°C.	BELOW 30,000 FEET: REDUCE SPEED.	ABOVE 30,000 FEET: REFER TO ENGINE AIRSPEED LIMITATIONS, SECTION V.
SPEED BRAKE OUT	SPEEDBRAKES ARE NOT CLOSED.	NONE INFO ONLY	MASTER CAUTION WILL NOT ILLUMINATE.
AUTOPILOT PITCH TRIM	AUTOPILOT PITCH TRIM CIRCUIT IS MALFUNCTIONING	● STICK–GRASP FIRMLY, ● AUTOPILOT–DISENGAGE.	DISREGARD A LIGHT OF LESS THAN 20 SECOND DURATION.
OXYGEN LOW	OXYGEN QUANTITY IS 1 LITER OR LESS.	DESCEND TO SAFE ALTITUDE.	NONE

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Figure 3-3

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
CABIN TURB OVERSPEED	TURBINE SUBJECTED TO EXTREME PRESSURE AND/OR TEMPERATURE.	● REDUCE THRUST. ● REDUCE SPEED.	IF LIGHT STAYS ON: EMERGENCY VENT KNOB–PULL
L AUX AIR DOOR R AUX AIR DOOR	DOOR(S) OUT OF PHASE WITH GEAR HANDLE.	CARRY OUT PRESCRIBED EMERGENCY PROCEDURES.	DISREGARD MOMENTARY LIGHT.
L ANTI ICE ON R ANTI ICE ON	● SWITCH ON– NORMAL INDICATION ● SWITCH OFF– ERRONEOUS INDICATION	SWITCH OFF: ● REDUCE AIR SPEED	SWITCH OFF: ● IF LIGHT GOES OUT, ACCELERATE AND DISREGARD LIGHT IF IT ILLUMINATES ● IF LIGHT STAYS ON, REMAIN AT REDUCED SPEED
PITCH AUG OFF	PITCH STAB AUG IS DISENGAGED	AVOID ABRUPT CONTROL MOVEMENT WHEN FLYING AT AIRSPEEDS GREATER THAN 300 KNOTS BELOW 10,000 FEET AT LOW STATIC MARGINS.	ILLUMINATES ANY TIME BUSES ARE ENERGIZED AND PITCH STAB AUG IS DISENGAGED
BLC MALFUNCTION	FLAPS ARE UP AND A BLC VALVE IS STILL OPEN	REDUCE THRUST AND CARRY OUT PRESCRIBED EMERGENCY PROCEDURES	CONTINUED FLIGHT WITH FLAPS UP AND LIGHT ON MAY RESULT IN ELECTRICAL, HYD. AND STRUCTURAL DAMAGE TO AIRCRAFT
STATIC CORR OFF	AIR DATA COMPUTER MALFUNCTION.	● ALT/MACH HOLD–DISENGAGE ● WAIT 15 SECONDS. ● RESET–PUSH.	IF LIGHT STAYS ON: ● STATIC COMPENSATOR SWITCH–CORR OFF. ● USE INSTRUMENT POSITION CORRECTION DATA AS NECESSARY.
RADAR-CNI COOL OFF	EQUIPMENT COOLING TURBINE SHUTDOWN.	● AIRSPEED–REDUCE. ● WAIT 15 SECONDS. ● RESET–PUSH.	IF LIGHT STAYS ON: REMAIN AT REDUCED AIR SPEED TO PREVENT EQUIPMENT DAMAGE.
AUTOPILOT DISENGAGE	AUTOPILOT HAS DISENGAGED.	RE–ENGAGE AUTOPILOT AS DESIRED	NONE
CHECK FUEL FILTERS	ONE OR BOTH LOW PRESSURE FUEL FILTERS ARE PARTIALLY CLOGGED	NONE INFO ONLY	NOTE IN FORM 781
HOOK DOWN	HOOK IS NOT UP AND LOCKED.	NONE INFO ONLY	NONE
INERTIAL NAV SYS OUT	INERTIAL NAV SYSTEM MALFUNCTION.	REFERENCE SYSTEM SELECTOR –STBY.	PERFORM INFLIGHT ALIGN TO REGAIN PRIMARY ATTITUDE REFERENCE
LH GEN OUT RH GEN OUT	CORRESPONDING GENERATOR IS OFF THE LINE.	CARRY OUT PRESCRIBED EMERGENCY PROCEDURE	NONE
BUS TIE OPEN	GENERATORS ARE OUT OF FREQUENCY, PHASE OR BOTH.	CARRY OUT PRESCRIBED EMERGENCY PROCEDURE	NO OPERATING RESTRICTIONS ARE IMPOSED.
ANTI-SKID INOPERATIVE	ANTI–SKID IS NOT ENGAGED OR HAS MALFUNCTIONED	ANTI–SKID SWITCH–ON	LIGHT ON AND SWITCH ON CARRY OUT PRESCRIBED EMERGENCY PROCEDURE DISREGARD MOMENTARY LIGHT
* TANK 7 FUEL	FUSELAGE CELL 7 TRANSFER VALVE HAS FAILED TO OPEN WHEN FUEL LEVEL LOW LIGHT ILLUMINATES.	NONE INFO ONLY	● FUSELAGE CELL 7 WILL NOT BE AVAILABLE AND FUEL QUANTITY INDICATOR COUNTER WILL READ 700 POUNDS HIGH. ● ONLY FUEL READ ON TAPE IS AVAILABLE.
* DC BUS	MAIN 28 VOLTS D–C BUS DIS–CONNECTED FROM ESS 28 VOLTS D–C BUS BECAUSE OF LOW VOLTAGE ON 28 VOLTS D–C BUS.	CYCLE BOTH GENERATORS SIMULTANEOUSLY	IF LIGHT STAYS ON: MONITOR GENERATORS FOR POSSIBLE FAULT.
APU	PC–1 PRESSURE BELOW 1000 PSI.	IF PC–2 SYSTEM IS OPERATING NORMALLY: APU REJECT SWITCH–REJECT	MOMENTARY DROPS IN PC PRESSURE CAUSES LIGHT TO ILLUMINATE FOR ONE MINUTE.

*F–4E ONLY **F–4C/D ONLY

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300 knots; and significantly reduced thrust (approximately 35%) at power settings above 90% rpm. Engine acceleration time and response to throttle movement are not affected by the extended ramp. No special procedures are required for throttle manipulation under these conditions below 18,000 feet altitude.

RAMPS RETRACTED AT SPEEDS ABOVE 1.5 MACH

If the inlet ramps fail to extend while accelerating between 1.5 and 1.8 Mach, reduce airspeed to below 1.5 Mach and continue the mission.

CAUTION

Compressor stalls may occur at airspeeds above 1.7 Mach with the inlet ramps in the retracted position.

RAMPS EXTENDED AT SPEEDS BELOW 1.5 MACH

If the inlet ramps fail to the fully extended position, reduce engine power to below 80% rpm. Engine operation below 80% rpm is usually normal under stabilized conditions, but can be affected during throttle advancements. As a rule, jam accelerations, afterburning, airstarts, and stall margin degrades as altitude increases, however, jam accelerations can result in compressor stall/flameout. Range, altitude and go-around performance are also degraded. Power settings above 94% rpm produce increased fuel flows without increasing engine thrust output. If the inlet ramps fail to the extended position, maintain the highest altitude at which the maximum range Mach number recommended for existing gross weight and configuration can be maintained with 94% rpm or less.

Note

- It may be possible to retract a ramp which has failed in the extended position by cycling the applicable ramp control circuit breaker G6 or G7, No. 2 panel.
- With the inlet ramps extended, the reduction in maximum range varies from 5% at 10,000 feet to 18% at 30,000 feet. Single engine range is reduced by 10% at all attainable altitudes.

CAUTION

Compressor stall and flameout may occur at power settings above 80% rpm at 18,000 feet and above with the inlet ramps in the extended position.

COMPRESSOR STALL

A compressor stall is an aerodynamic disruption of airflow through the compressor, and is caused by subjecting the compressor to a pressure ratio above its capabilities at the existing conditions. The compressor capability may be reduced by FOD corrosion, rocket/missile motor exhaust, gun gases, misrigged or malfunctioning IGV's, and the compressor may be subject to abnormal operating conditions as a result of a malfunction of the ramp or bellmouth system. Compressor stalls may be self clearing, may cause the engine to flameout, or may result in a steady state, fully developed stall. The first case requires no immediate action. In the second case, the flameout clears the stall and an airstart is required. The third case requires recognition and corrective action to restore thrust and prevent engine damage by overtemperature. The stall can be recognized by the simultaneous existence of high EGT, low rpm, low fuel flow, open nozzle, loss of thrust, and lack of engine response to throttle. Compressor stalls may be accompanied by muffled bangs. The most positive stall clearing procedure is to stopcock the engine and perform an airstart. A throttle chop to idle may clear the stall if a significant fuel flow reduction from the stall condition is achieved. In the event of a compressor stall, proceed as follows:

1. Ignition bad engine - HOLD DEPRESSED
2. Throttle - OFF
3. Throttle - ANY POSITION BEYOND IDLE
4. RPM, EGT, and Fuel Flow - MONITOR

Note

If stall is cleared but desired thrust cannot be obtained because of repeated stalling, the engine may be operated at any obtainable rpm, as long as EGT is within limits.

BLEED AIR DUCT FAILURE

Severe damage to the aircraft may result from a bleed air duct failure due to the high temperature produced by the bleed air system. The extremely hot air leaking from a failed duct may ignite flammables in the immediate vicinity of the duct failure. The following symptoms may be indicative of a bleed air system failure: a mild audible thump or bang on the airframe; complete or partial loss of cockpit pressurization; loss of pylons, missiles or other external stores; generator failure, popping of circuit breakers and illumination of several warning/indicator lights; erratic fuel quantity indications; mild stick transients; stiffness of throttles; hydraulic failure; smoke emitting from the intake duct louvers; fuel fumes in the cockpit; high fuel flow/erratic response to throttle movement (indicative of main fuel hose rupture).

CAUTION

Early analysis of a bleed air duct failure is required in order to prevent serious damage to, or possible loss of the aircraft.

If several of the preceeding symptoms occur in close sequence:

1. Avoid high power settings.
2. Check for other indications of fire.

If circumstances permit -

3. Flaps - 1/2
4. Land as soon as practicable.

EJECTION PROCEDURES

IF TIME AND CONDITIONS PERMIT

- LOCK SHOULDER HARNESS
- TIGHTEN LAP BELT
- LOWER HELMET VISOR
- ADJUST SITTING HEIGHT AS NECESSARY

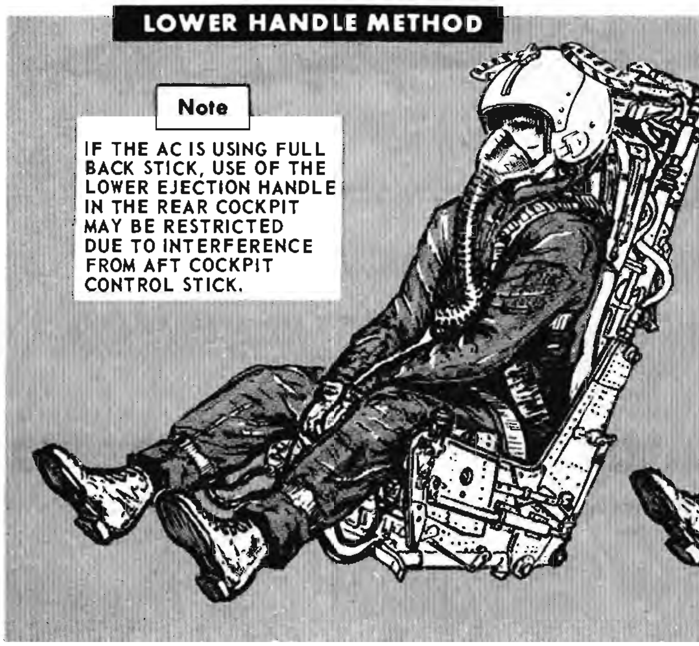
1. ALERT OTHER CREWMEMBER

2. ASSUME PROPER POSITION

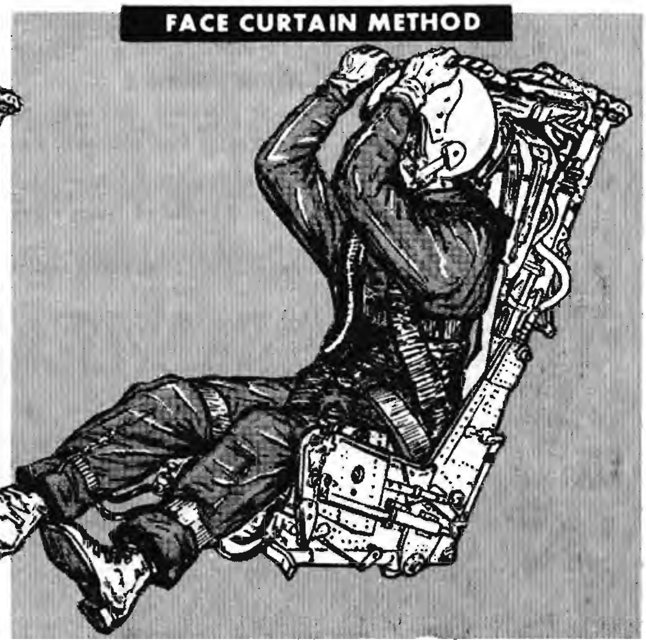
3. EJECTION HANDLE-PULL

BEFORE EJECTION SEQUENCE

SIT ERECT, BUTTOCKS BACK, SHOULDERS AGAINST PARACHUTE PACK, HEAD ERECT, SPINE STRAIGHT, LEGS EXTENDED AND THIGHS ON SEAT CUSHION. DURING A SEQUENCED EJECTION, THE CREWMEMBER NOT INITIATING EJECTION SHOULD FIRMLY GRASP THE LOWER HANDLE WITH BOTH HANDS, AS PRESCRIBED BELOW, WITHOUT PULLING.



GRASP THE LOWER EJECTION HANDLE, USING A TWO HANDED GRIP WITH THE THUMB AND AT LEAST TWO FINGERS OF EACH HAND. PULL UP ON LOWER HANDLE UNTIL STOP IS ENCOUNTERED. WHEN CANOPY JETTISONS, CONTINUE PULLING UP ON LOWER EJECTION HANDLE UNTIL FULL TRAVEL IS REACHED.

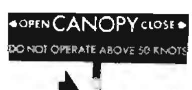


REACH OVERHEAD WITH PALMS AFT KEEPING ELBOWS SHOULDER WIDTH APART. GRASP FACE CURTAIN HANDLE. PULL FORWARD AND DOWN UNTIL STOP IS REACHED. WHEN CANOPY JETTISONS, CONTINUE PULLING FACE CURTAIN UNTIL FULL TRAVEL IS REACHED.

IF CANOPY FAILS TO JETTISON—

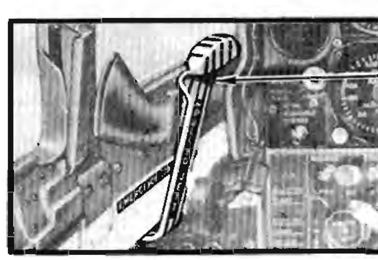
IF CANOPY DOES NOT JETTISON AFTER PULLING THE DESIRED EJECTION HANDLE, CONTINUE HOLDING THE HANDLE WITHOUT APPLYING TENSION AND PROCEED WITH THE FOLLOWING:

1. Normal canopy control handle – OPEN
2. Manual canopy unlock handle – PULL



IF CANOPY STILL FAILS TO JETTISON—

3. Emergency canopy release handle – PULL



IF CANOPY STILL FAILS TO JETTISON—

4. Put negative G's on aircraft

WHEN CANOPY SEPARATES—

5. Pull ejection seat handle

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Figure 3-4 (Sheet 1 of 3)

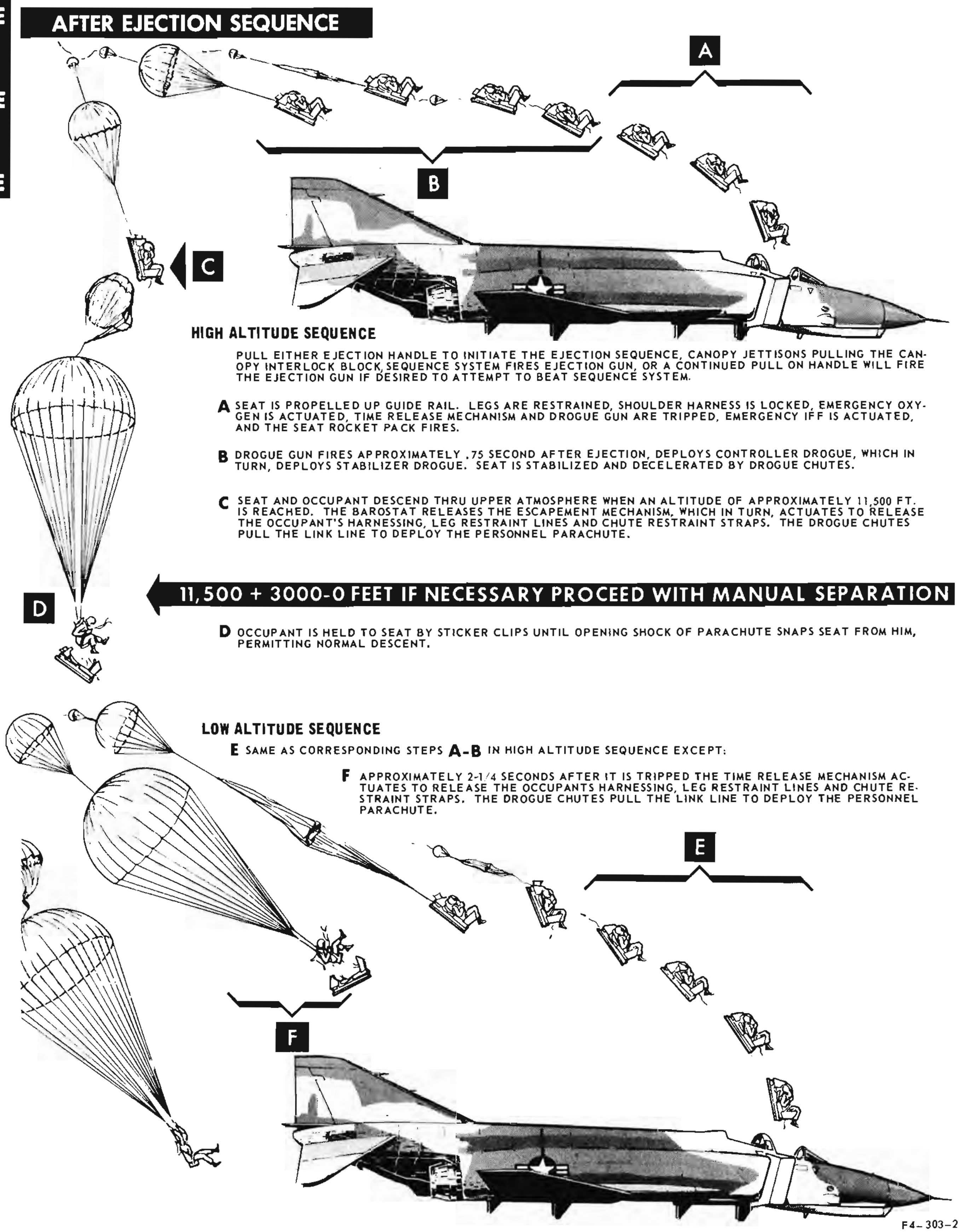
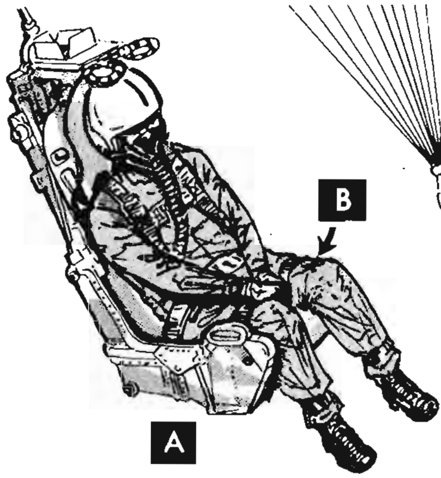
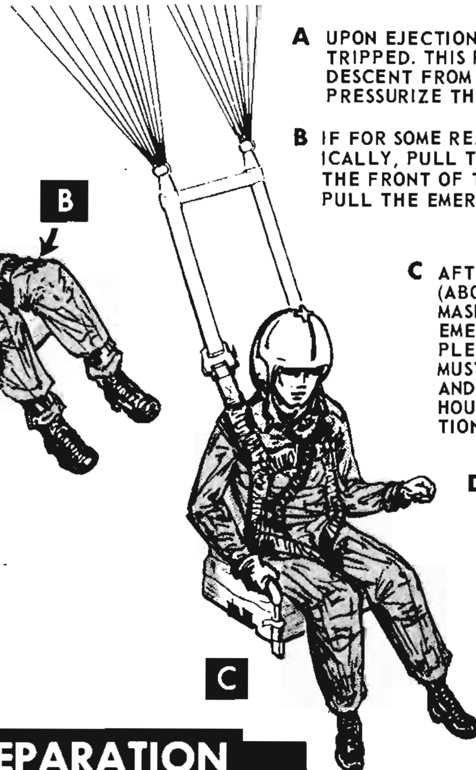
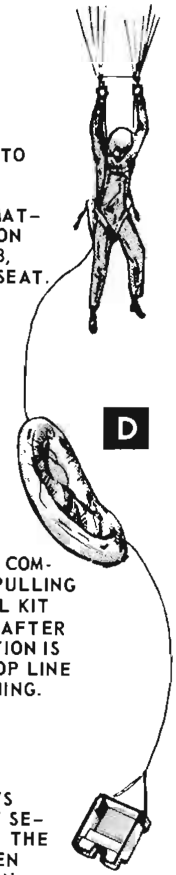


Figure 3-4 (Sheet 2 of 3)

SURVIVAL KIT DEPLOYMENT







A UPON EJECTION, SURVIVAL KIT EMERGENCY OXYGEN IS TRIPPED. THIS PROVIDES BREATHING OXYGEN DURING DESCENT FROM HIGH ALTITUDES. OXYGEN IS ALSO USED TO PRESSURIZE THE SUIT ABOVE 35,000 FEET.

B IF FOR SOME REASON THE OXYGEN FAILS TO TRIP AUTOMATICALLY, PULL THE EMERGENCY OXYGEN RELEASE RING ON THE FRONT OF THE SURVIVAL KIT. AFTER T.O. 1F-4-808, PULL THE EMERGENCY OXYGEN KNOB ON LEFT SIDE OF SEAT.

C AFTER THE PARACHUTE HAS OPENED (ABOUT 11,500 FT) OPEN FACE VISOR/MASK TO PREVENT SUFFOCATION WHEN EMERGENCY OXYGEN SUPPLY IS DEPLETED. THE SURVIVAL KIT HANDLE MUST BE GRASPED BY THE FWD PART AND PULLED RAPIDLY OUT OF THE HOUSING TO INSURE RELIABLE OPERATION.

D CONTINUE PULL ON HANDLE UNTIL IT COMPLETELY RELEASES FROM THE KIT. PULLING THE KIT HANDLE OPENS THE SURVIVAL KIT AND CAUSES THE RAFT TO INFLATE. AFTER T.O. 15X11-20-505, LIFE RAFT INFLATION IS INITIATED BY GRAVITY WHEN THE DROP LINE IS FULLY EXTENDED AFTER KIT OPENING.

Note

AFTER T.O. 1F-4-808, THE KIT DEPLOYS AUTOMATICALLY IF THE SURVIVAL KIT SELECTOR SWITCH IS SET TO AUTOMATIC. THE AUTO FEATURE IS LOST, HOWEVER, WHEN THE EMERGENCY HARNESS RELEASE HANDLE IS PULLED.

MANUAL SEPARATION

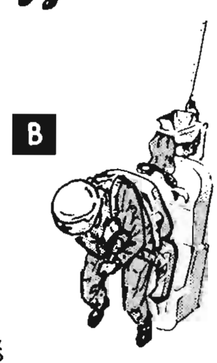
Note

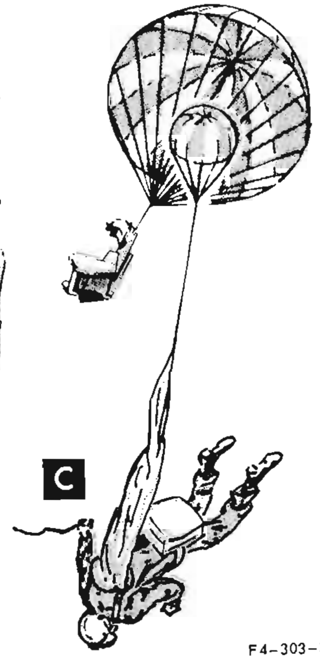
SHOULD THE TIME RELEASE MECHANISM FAIL TO OPERATE AUTOMATICALLY, THE OCCUPANT WOULD MANUALLY SEPARATE FROM THE SEAT AS FOLLOWS:

A ACTUATE EMERGENCY RELEASE HANDLE ON RIGHT SIDE OF SEAT TO FULL AFT POSITION. THIS WILL RELEASE THE RESTRAINT HARNESS AND LEG RESTRAINT CORD AND SEVERS PARACHUTE WITHDRAWAL LINE. THE OCCUPANT IS NOW HELD IN SEAT ONLY BY STICKER CLIPS.

B PUSH FREE OF STICKER CLIPS AND CLEAR SEAT.

C GRASP THE LEFT PARACHUTE RISER WITH THE LEFT HAND AROUND THE RIPCORD HANDLE HOUSING (LOCATED ON THE LEFT SHOULDER) AND PULL PARACHUTE RIPCORD HANDLE SHARPLY WITH THE RIGHT HAND TO OPEN THE PARACHUTE.





WARNING

- DO NOT PULL SURVIVAL KIT RELEASE HANDLE BEFORE MAN/SEAT SEPARATION SINCE THIS CAUSES THE KIT TO BE LOST.
- AFTER LANDING, TO INSURE THE COLLAPSING OF THE PARACHUTE CANOPY, IT IS NECESSARY TO RELEASE BOTH PARACHUTE RISER-SHOULDER HARNESS RELEASE FITTINGS.
- THE PERSONNEL PARACHUTE CONTAINS TWO CANOPY VENT HOLD DOWN LINES WHICH PROVIDE A MORE RAPID CANOPY BLOSSOMING. THESE LINES MAY BE FOUND HANGING LOOSE AFTER CHUTE OPENING AND SHOULD BE CUT IF THEY CAUSE INTERFERENCE WHEN RELEASING THE CHUTE AFTER LANDING.
- AFTER T.O. 1F-4-808, THERE IS NO EMERGENCY OXYGEN AVAILABLE AFTER MAN/SEAT SEPARATION.

F4-303-3

Figure 3-4 (Sheet 3 of 3)

BLEED AIR CHECK VALVE FAILURE

No indication of a bleed air check valve failure will be noted in flight until the throttle is retarded and then readvanced on the engine with the failed bleed air check valve. If the throttle has been retarded and then readvanced, either rpm will hang-up or a minor compressor stall and flame-out will occur at approximately 85% rpm. If a flame-out occurs, a restart can be made, but rpm will probably not go above 65%, EGT will rise to approximately 625 , and the nozzle will go full open. In either case normal engine performance can be regained as follows:

1. Throttle good engine - IDLE
   Idling the good engine will equalize the pressure in the air line.
2. Throttle bad engine - ADVANCE
3. Throttle good engine - ADVANCE
   The good engine should not be accelerated to, or operated at, a rpm greater than that of the affected engine for the remainder of the flight.
4. Land as soon as practicable.

DOUBLE EXHAUST NOZZLE FAILURE

If both exhaust nozzles fail open, the thrust available above 80% rpm (in MIL range) is approximately equal to the thrust available during single-engine operation. Afterburner light-off above 15,000 feet is marginal: however, afterburner light-off probability increases with a decrease in altitude and normal afterburner thrust is available.

GLIDE DISTANCE

The aircraft will glide approximately 6 nautical miles for every 5000 feet of altitude. The recommended glide airspeed is 215 knots. Below 50,000 feet 215 knots provides near maximum glide distance and allows the windmilling engines to maintain power control hydraulic pressures within safe limits.

EJECTION

WARNING

If at all possible, do not eject above 500 knots or 0.8 Mach, whichever is less. With the rear canopy gone, resulting negative pressures on the front canopy could preclude its separation above this speed. If ejection is necessary above this speed, and time permits, the front canopy should be jettisoned using the canopy emergency jettison handle, followed by a dual sequenced ejection initiated from the rear seat only. Do not initiate the ejection sequence from the front seat with the front canopy gone. With the addition of the forward canopy thrusters after T.O. 1F-4-906, the above limitations do not apply.

If necessary, ejection can be accomplished at ground level, provided the airspeed is between 50 and 550 knots and aircraft is wings level with no sink rate. On aircraft after T.O. 1F-4-857 (zero-zero seat), ejection can be accomplished at ground level between zero and 550 knots airspeed with wings level and no sink rate providing the crewmember does not exceed a maximum boarding weight of 247 pounds. If the 247 pound boarding weight is exceeded, the 50 knot mimimum airspeed restriction for safe ground level ejection must still be observed. Boarding weight is defined to include the crewman, his clothing, and personnel equipment; excluding his parachute and seat pan survival kit. Due to the aerodynamic instability of the seats at higher airspeeds, a minimum ejection altitude of 50 feet should be observed at airspeeds greater than 550 knots.

WARNING

Ejection below 50 knots at ground level is not recommended with ejection seats not having the zero-zero capability. Tests performed with these seats below 50 knots demonstrated unreliable performance, and any ejection below 50 knots at ground level must be considered hazardous.

Although the H-7 seat is qualified to 600 knots, a human factors study and analysis reveals that ejections between 450 and 600 knots exposes the crewmember to hazardous windblast forces which can result in possible serious injury. It is therefore recommended that ejection be initiated at or below 450 knots, circumstances permitting.

Under level flight conditions, eject at least 2000 feet above the terrain whenever possible. Under out of control conditions, eject at least 10,000 feet above the terrain whenever possible.

WARNING

- Do not delay ejection below 2000 feet above the terrain in futile attempts to start the engine, or for other reasons that may commit you to an unsafe ejection or a dangerous flame-out landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitudes decrease below 2000 feet above the terrain.

- The emergency harness release handle shall not be pulled prior to ejection, regardless of altitude, because of several serious disadvantages:

- During uncontrollable flight negative G forces may prevent proper body positioning for ejection.

- Extreme hazard to survival in the event altitude becomes too low for ejection and a forced landing is required.

- Ejection will result in premature seat separation and severe shock loads will be imposed on the body.

- Cancellation of the automatic features of the ejection seat and parachute actuator, which precludes parachute deployment if the crewmember is unconscious.

Note

If the harness relese handle is pulled during flight, do not shift body position in seat and immediately reseat harness release handle in an attempt to refasten the lap belt restraint. If it is decided to proceed with an ejection seat egress, obtain a positive climb angle, reduce airspeed to lowest possible, sit erect, and utilize the face curtain ejection handle.

SEAT EJECTION PROCEDURES

Basic ejection seat escape procedures, and associated seat separation sequences are shown in figure 3-4. The following ejection procedures should be utilized by all crewmembers:

a. Time and circumstances permitting, the designated pilot in command will make the decision to eject.
b. Time and circumstances permitting, prior to initiating ejection for both crewmembers, the aircraft commander will alert the pilot by one of the following methods to prepare for ejection:

Primary - Intercom and eject light
First Alternate - Eject light
Second Alternate - Rapid movement of stick from side to side to gain crewmember attention, then -

daylight: Signal with left fist, thumb up, over left shoulder
night: Signal with vertical wave of flashlight over left shoulder.

c. Only if the front seat occupant is incapacitated or the procedure is pre-briefed, shall the rear seat occupant open the command selector valve and initiate ejection for both crewmembers.
d. The above procedures in no way preclude either occupant from initiating ejection at any time he determines that circumstances warrant such action.

WARNING

- If the dual ejection sequence is initiated from either cockpit without first alerting the other crewmember, incapacitation from improper body position on ejection could result.

- If fire/smoke is the major cause factor for ejection, the front seat pilot should initiate the ejection. An individual ejection by the rear seat occupant could result in incapacitation of the front seat pilot from intense heat and fire caused by windblast and draft effects of a jettisoned canopy.

- If the front canopy is lost, the front canopy interlock block with its ejection sequence time delay will also be lost. If ejection is then initiated from the front seat, this could expose the rear crewmember to the front seats rocket blast and a collision between seats could possibly result. If loss of the front canopy or both canopies occurs, the rear crewmember should rotate the command selector valve handle to the open (horizontal) position and initiate ejection for both crewmembers. With loss of the rear canopy only, normal ejection can be initiated from either cockpit.

LOW ALTITUDE EJECTION

During any low altitude ejection, the chances for a successful ejection can be greatly increased by zooming the aircraft (if airspeed permits) to exchange airspeed for altitude. The zoom should not exceed a 20 degree nose up attitude. Ejection should be accomplished while the aircraft is in a positive climb. This will result in a more nearly vertical trajectory for the seat, thus providing more altitude and time for seat separation and parachute deployment.

After ejection do not attempt to beat the automatic system in low altitude ejection or benefits of automatic seat separation/parachute deployment will be lost. Minimum time in trajectory from seat firing to parachute fully opened will occur in ejections below 350 knots.

Note

Fastest parachute deployment occurs at approximately 250 knots. At speeds below 130 knots, airflow is not sufficient to affect rapid chute deployment. Optimum speed for minimum time for chute to deploy is 250-300 knots.

After ejection, manual separation from the seat should only be made if the seat fails to function automatically (approximately 2 seconds required). If manual seat separation is performed, the automatic feature of the parachute is lost. If a decision is made to manually separate:

a. Actuate emergency harness release handle to full aft position.
b. Push free of sticker clips and clear of the seat.
c. Pull parachute ripcord handle.

EJECTION ALTITUDE VS. SINK RATE

AFTER T.O. 1F-4-857

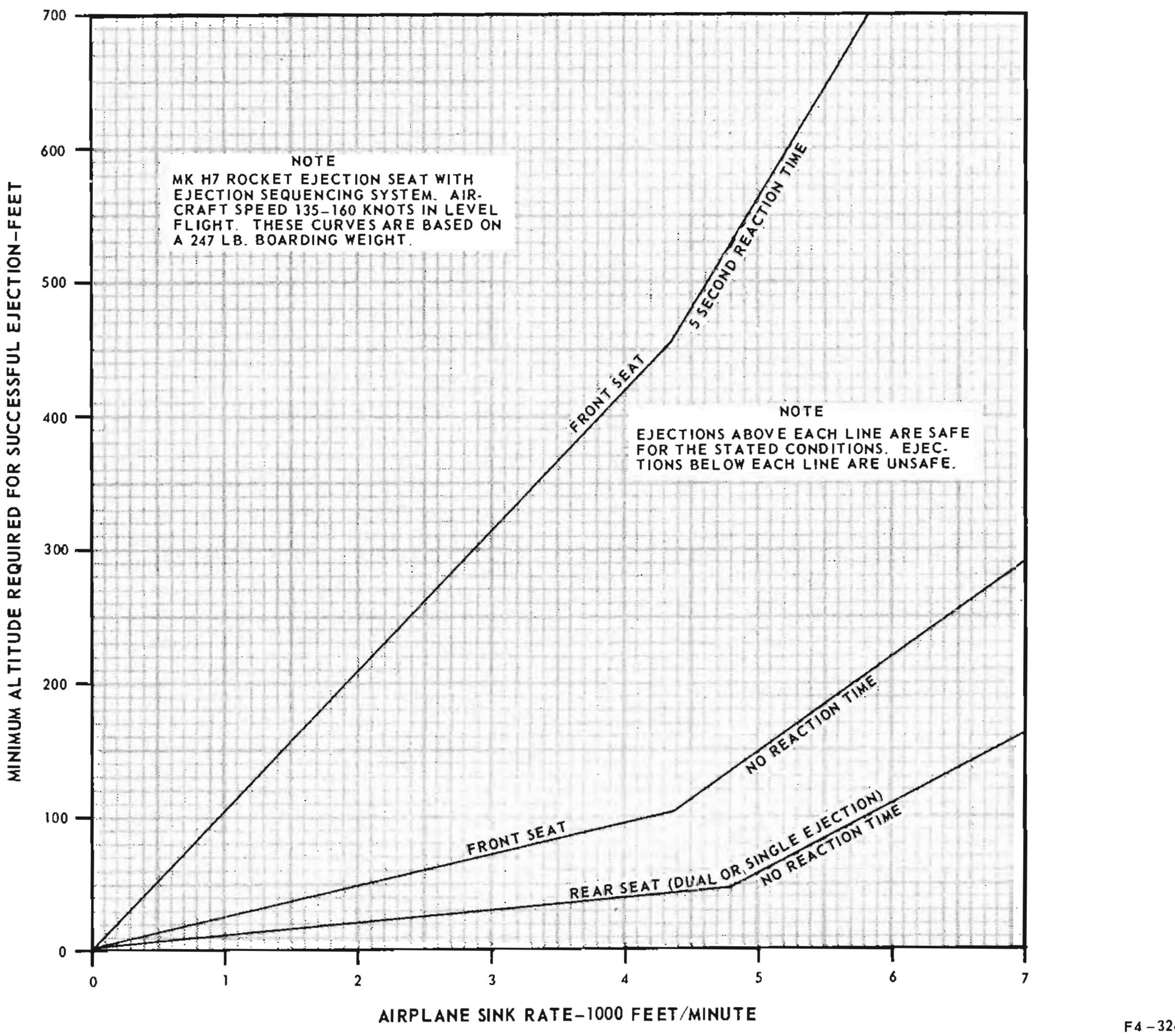


Figure 3-5

WARNING

The minimum ejection altitudes quoted in the Ejection Altitude vs Sink Rate charts (figures 3-5 and 3-6) are provided to show seat capability (with and without reaction time) as affected by the aircraft sink rate. These charts do not provide any safety factor for such matters as equipment malfunction delays in separating from the seat, etc. The charts labeled Minimum Ejection Altitude vs Airspeed and Dive Angle (figures 3-7 and 3-8) show the minimum ejection altitude before T.O. 1F-4-857 for a given airspeed and dive angle, such as encountered in a dive bombing run. The above minimum ejection altitude shall not be used as the basis for delaying ejection when above 2000 feet, since accident statistics emphatically show a progressive decrease in successful ejections as altitudes decrease below 2000 feet.

HIGH ALTITUDE EJECTION

For a high altitude ejection the basic ejection procedures (figure 3-4) are applicable. The zoom maneuver is still useful to slow the aircraft to a safer ejection speed or to provide more time and glide distance as long as an immediate ejection is not necessary.

After high altitude ejections, considerable time will elapse during drogue chute descent before automatic chute deployment. See figure 3-9. No attempt should be made to manually separate from the seat except when terrain altitude exceeds the preset barostat altitude or there is a definite failure of the automatic sequence. Manual separation requires considerable more time and altitude before chute deployment than automatic operation.

EJECTION SEAT FAILURE

In the event the canopy jettisons, but the seat does not fire, pull the face curtain or lower ejection handle again. If seat still fails to eject:

1. If possible, maintain 200-250 knots.
2. Emergency harness release handle - PULL
   Pull up on the emergency harness release handle on the right side of the seat to disconnect the parachute harness and leg restraint harness from the seat. The emergency harness release handle also fires a cartridge actuated guillotine which cuts the link line between the drogue chute and the personnel parachute.
3. Sticker clips - RELEASE
4. Full nose down trim while holding airplane level.
5. Roll inverted, push stick forward and push sharply to fall clear of airplane.
6. Parachute - DEPLOY (below 10,000 feet)

SURVIVAL KIT DEPLOYMENT

The survival kit functions under two conditions, ejection and emergency evacuation. During ejection as the seat leaves the aircraft, the emergency oxygen is automatically tripped and is supplied to the occupant as the seat is descending. If emergency oxygen is not tripped automatically upon ejection, an emergency oxygen manual release ring is located between the crewmember's legs near the front of the survival kit. This ring when pulled up approximately one inch allows emergency oxygen to be supplied to the seat occupant. The emergency oxygen provides a 10 to 15 minute supply of breathing oxygen. At approximately 10,000 feet the ejection seat time release mechanism deploys the personnel parachute, the occupant and survival kit are snapped from the seat. At this time the survival kit release handle should be actuated to release the kit and inflate the raft. When released, the lower half of the container separates, the upper block of the composite disconnect releases, and the upper half of the container separates, and life raft inflation will be initiated by gravity when the kit dropline reaches its limit of travel. The lower half of the container is attached to the raft by a lanyard approximately 10 feet long; the raft is attached to the upper half of the container by a lanyard approximately 4 feet long; and the upper half of the container is attached to the crewmember's right survival kit-harness attachment by a lanyard approximately 10 feet long. This reduces the bulk weight of the crewmember at touchdown, thereby reducing the possibility of injury and oscillation. On aircraft after T.O. 1F-4-808, if the emergency oxygen fails to trip during ejection, an emergency oxygen knob on the left forward side of the seat can be pulled to provide emergency oxygen for descent from altitude. The emergency oxygen provides an approximate 10 minute supply while the crewmember is in the seat. Once man/seat separation occurs, the emergency oxygen bottle remains with the seat and there is no oxygen available to the crewmember. If the survival kit selector switch is in the automatic (vertical) position when man/seat separation occurs, the kit deploys approximately 4 seconds later. Whenever the emergency harness release handle is pulled, the automatic feature of the survival kit is lost and manual opening procedures must be used. With the selector switch in the manual (horizontal) position, the kit is deployed by pulling the survival kit release handle. The handle should be pulled with one continuous motion. The handle separates from the kit when the kit lid is unlatched. After kit opening, the upper kit container falls free, the life raft inflates by gravity pull when the drop line attached to the raft CO_2 bottle actuator reaches its limit of downward travel, and the lower kit container with the emergency provisions drops below the life raft. The drop line, which retains the raft and lower kit, remains attached to the crewmember's harness by the left retaining strap.

WARNING

- During ejection, do not pull the survival kit release handle while sitting in the seat. The kit drop line from the crewmember will be detached, and the kit will be lost when the personnel chute opens.
- If the survival kit handle is pulled after landing in water, the kit cover must be pulled from the lower portion of the kit and a snatch pull on the drop line is required to inflate the life raft.

ELECTRICAL FIRE

Circuit breakers and fuses protect most circuits and tend to automatically isolate an electrical fire. If an electrical fire occurs:

1. Generator control switches - OFF

CAUTION

When both generator control switches are turned off, all attitude reference and boost pump pressure will be lost.

2. All electrical switches - OFF
3. Generator control switches - ON
4. Reposition electrical switches - ON
5. Isolate affected equipment
6. Affected equipment - OFF
7. Circuit breaker(s) - PULL (if available)

If fire persists -

8. (F-4C/D) Ram air turbine - EXTEND
9. Generator control switches - OFF
10. Land as soon as practicable.

EJECTION ALTITUDE VS. SINK RATE

BEFORE T.O. 1F-4-857

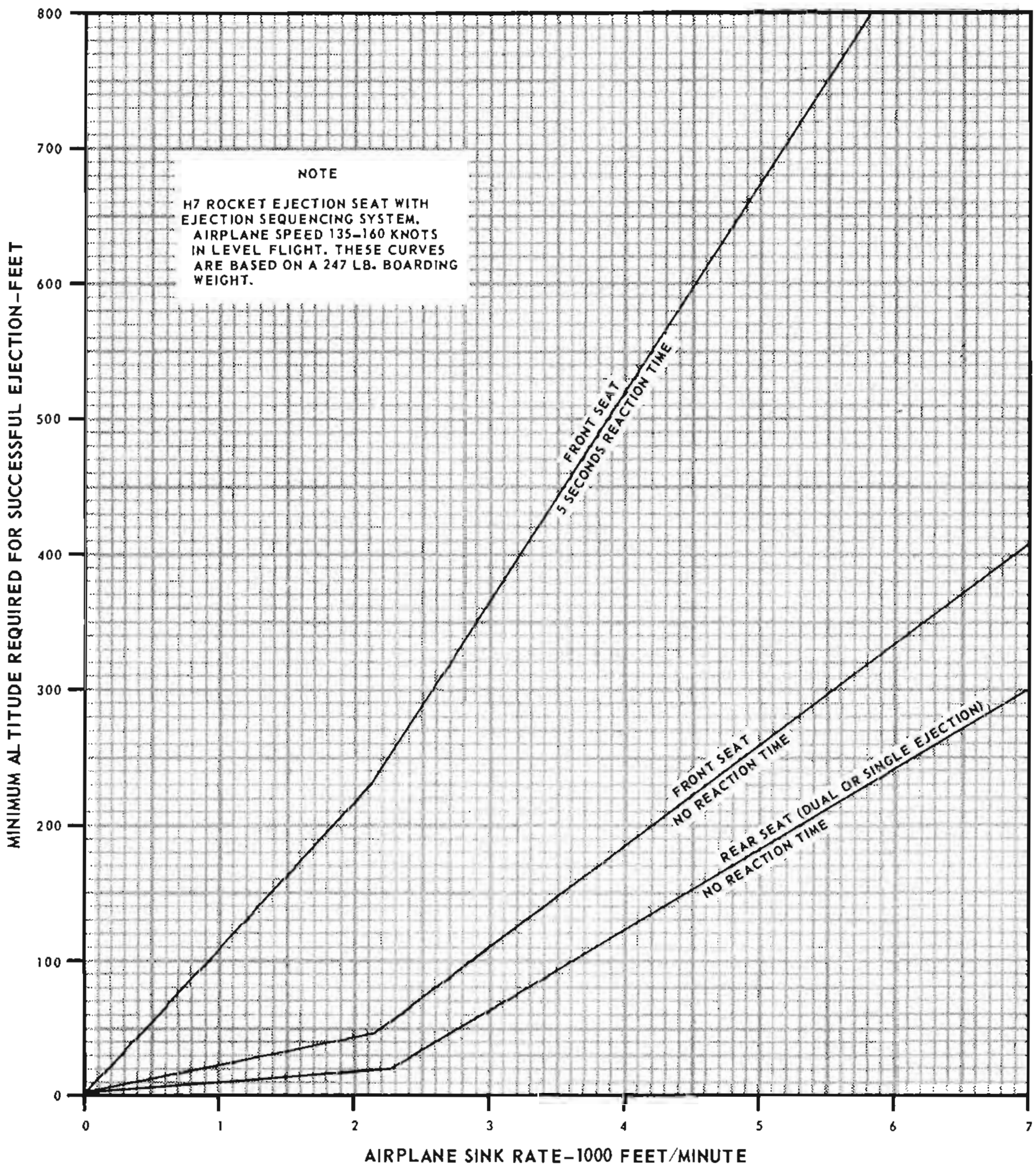
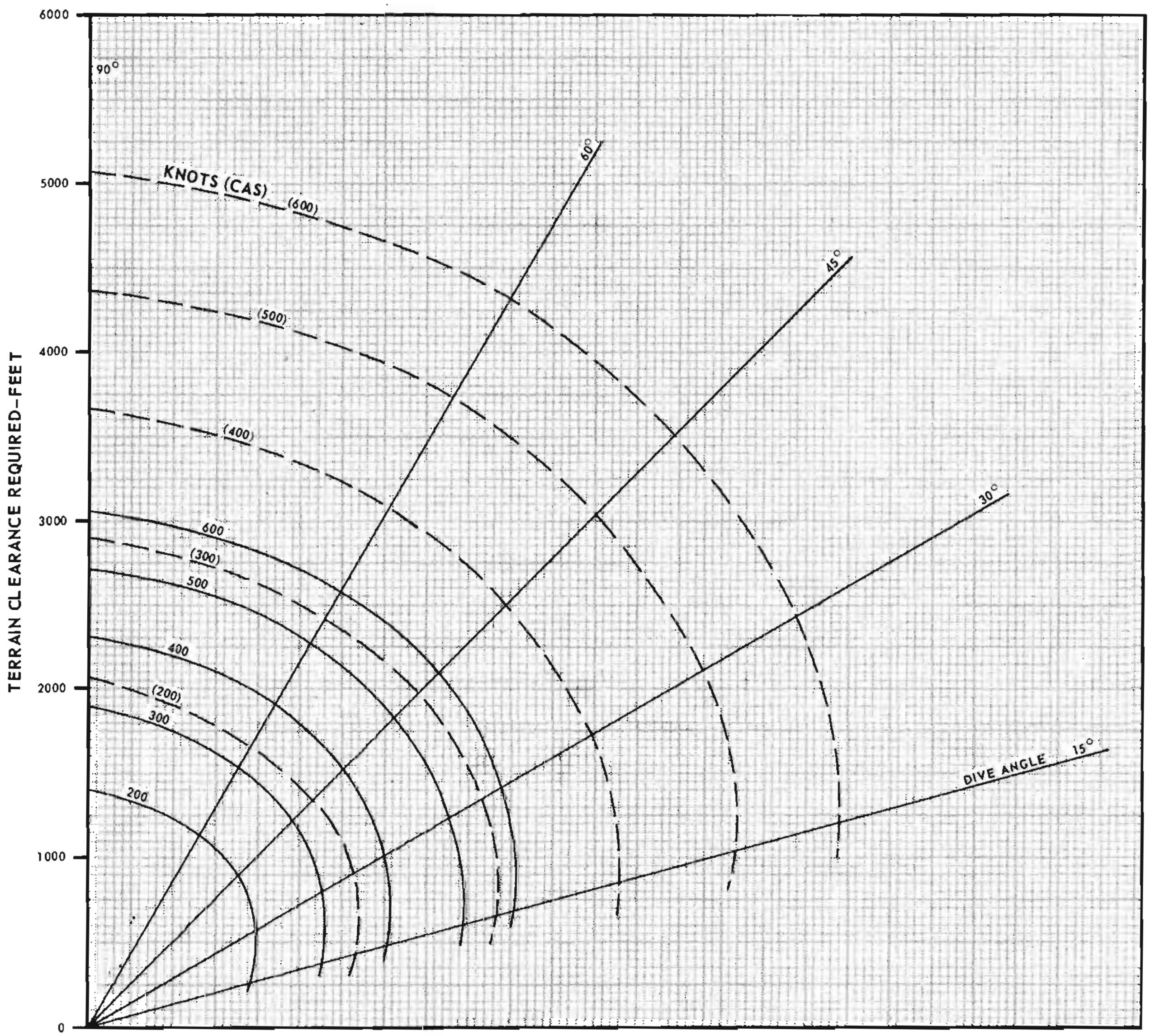


Figure 3-6

MINIMUM EJECTION ALTITUDE vs. AIRSPEED AND DIVE ANGLE

BEFORE T.O. 1F-4-857



Note

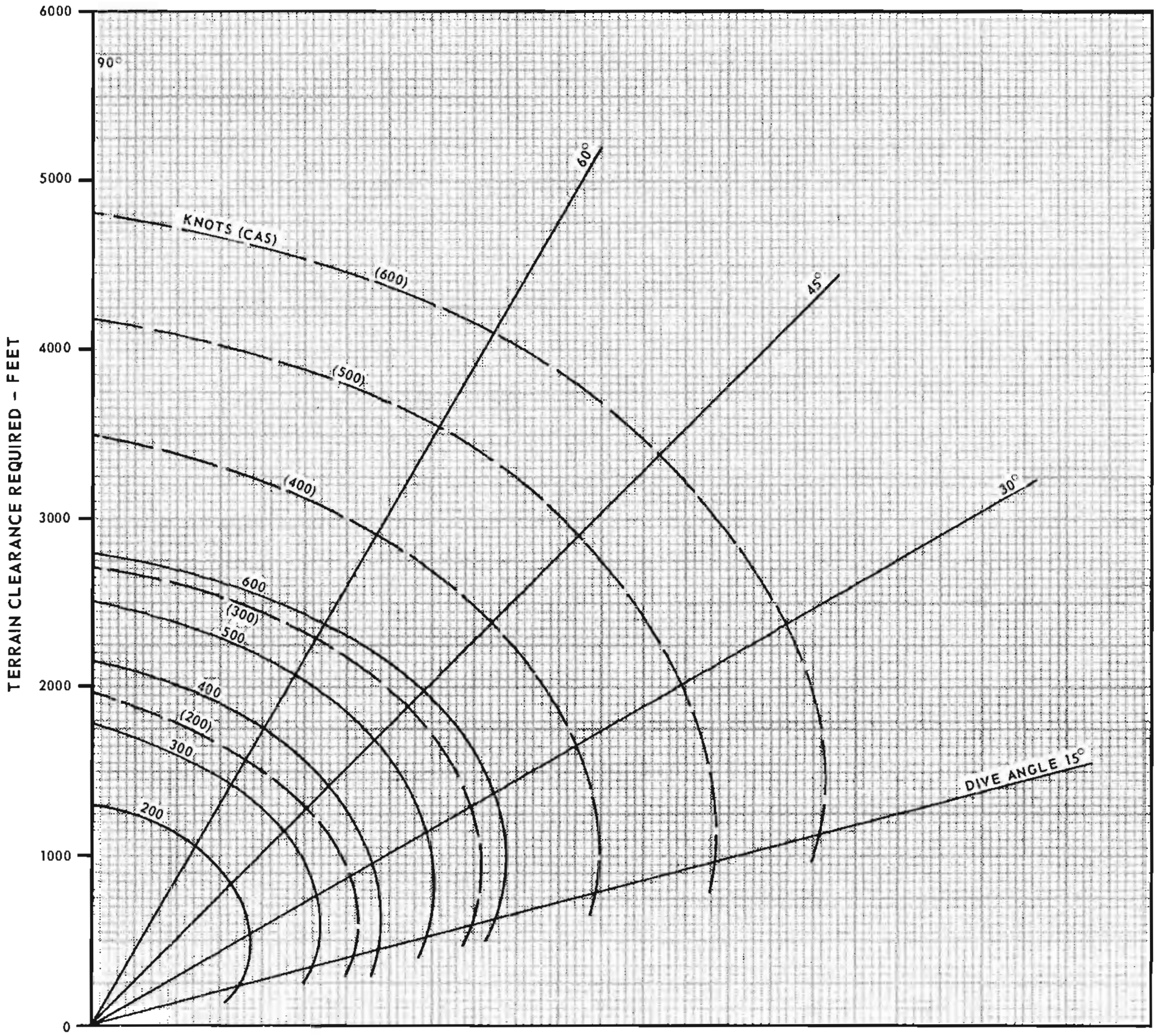
THESE CURVES ARE BASED ON A 247 LB. BOARDING WEIGHT. THE SOLID CURVES INDICATE MINIMUM TERRAIN CLEARANCE WITH NO CREWMEMBER REACTION TIME. THE DASHED CURVES INDICATE MINIMUM TERRAIN CLEARANCE WITH A TWO (2) SECOND CREWMEMBER REACTION TIME. THE CURVES ARE BASED ON WINGS LEVEL BANK ATTITUDE AND APPROPRIATE ANGLE OF ATTACK. TIME REQUIRED FOR THE SEQUENCING SYSTEM TO EJECT BOTH CANOPIES AND SEATS IS INCLUDED. THE CURVES DO NOT INCLUDE A CORRECTION FOR BAROMETIC ALTIMETER LAG; FOR PROPER VALUES REFER TO PART 1 OF APPLICABLE APPENDIX.

F4-319

Figure 3-7

MINIMUM EJECTION ALTITUDE vs. AIRSPEED AND DIVE ANGLE

AFTER T.O. 1F-4-857



Note

These curves are based on a 247 lb. boarding weight. The solid curves indicate minimum terrain clearance with no crew member reaction time. The dashed curves indicate minimum terrain clearance with a two (2) second crew member reaction time. The curves are based on wings level bank attitude and appropriate angle of attack. Time required for the sequencing system to eject both canopies and both seats is included. It is assumed that the pilot initiates the sequencing system and continues pulling either ejection handle to fire the front seat as soon as the front canopy and interlock block are clear. If the pilot does not continue pulling, or the sequence is initiated by the rear crew member, relying on the front seat mounted time delay initiator to fire the front seat, an additional 250 feet altitude is required for a 90° dive angle at 600 knots, with proportionately less additional altitude required as dive angle and speed decrease. The curves do not include a correction for barometric altimeter lag; for proper values refer to part 1 of applicable index.

F4-325

Figure 3-8

EJECTION SEAT DESCENT TIME

STABILIZER DROGUE DEPLOYED

NOTE

TIME OF DESCENT FROM HEIGHT H_O TO 10,000 FT. AND FROM 10,000 FT. TO SEA LEVEL OF EJECTION SEAT WITH 5 FT. DROGUE CHUTE DEPLOYED. TOTAL WEIGHT OF SEAT AND PILOT–450 LB.

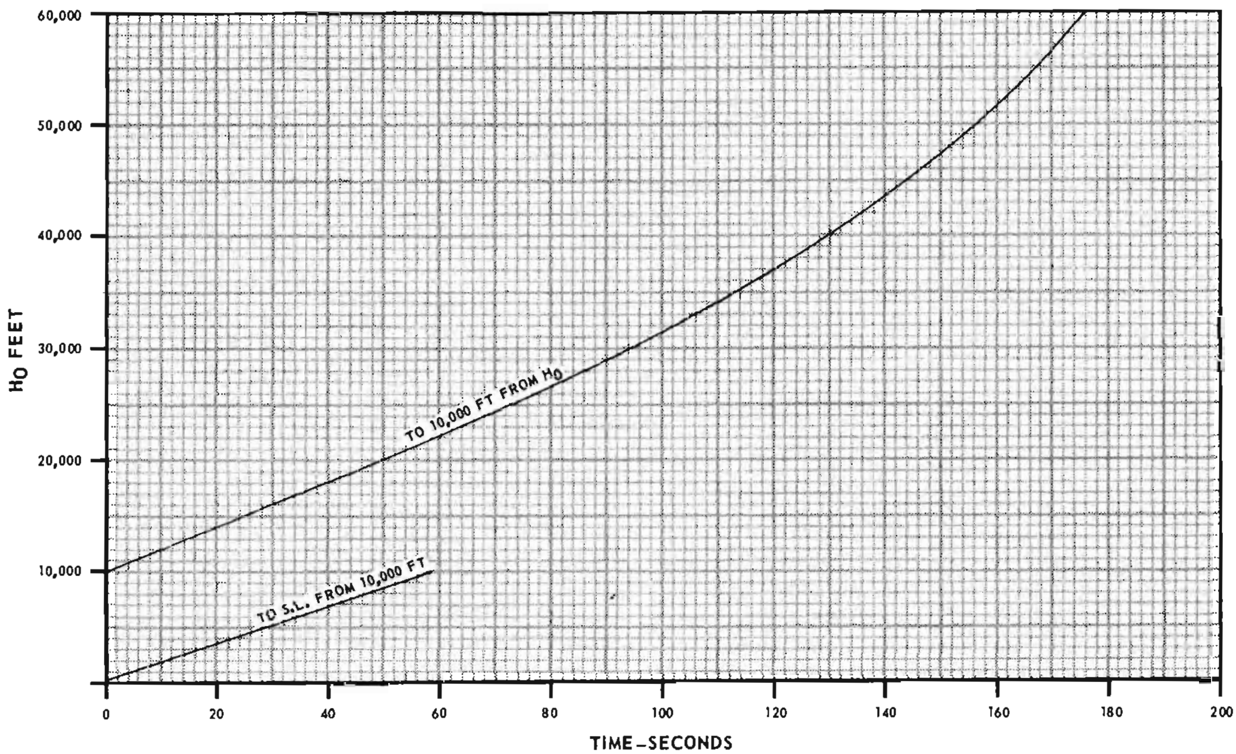


Figure 3-9

ELIMINATION OF SMOKE AND FUMES

To eliminate smoke and fumes from the cockpit -

1. **OXYGEN-100%**
2. Emergency vent knob - PULL

Note

When necessary to depressurize the cockpit, descend to below 25,000 feet if possible.

If smoke or fumes persists -

3. Aft canopy - JETTISON

If front canopy is jettisoned, there will be no ejection sequencing.

WARNING

Aircrews should exhaust every effort to eliminate smoke and fume contaminates and should be prepared for an immediate ejection prior to jettisoning the aft canopy. If the canopy is jettisoned, the resultant draft and windblast may cause smoldering materials to burst into flame with catastrophic and possible incapacitating effects.

EXTREME COCKPIT TEMPERATURES

WARNING

Extreme cockpit temperatures due to equipment malfunction may result in aircrew disablement and permanent injury. If the cockpit temperature becomes extreme, abort the mission and land as soon as practicable.

If the cockpit air conditioning system malfunctions with a resulting extreme hot or cold cockpit temperature, check suit vent air lever off and proceed as follows: (Perform only those steps necessary to control temperature for safe recovery)

1. Temperature control switch - MANUAL
   Temperature adjustment may be obtained by bumping the temperature control switch to the hot or cold position.
2. Temperature control switch - AUTO
3. Defog foot heat control lever - FORWARD OR AFT

Note

When the cockpit temperature becomes extreme and cannot be controlled with manual temperature controls, placing the temperature control switch to auto will allow temperature range schedules to be selected by positioning the defog foot heat control lever forward for high and aft for low.

4. Cockpit air conditioning inlets - OPEN
   Placing the defog foot heat lever forward and checking the eye ball type nozzles in the rear seat open will give maximum dispersion of the extreme temperatures and prevent a concentration being deflected toward confined body areas.
5. Cockpit heat and vent circuit breaker (C8, No. 3 panel) - PULL
6. Emergency vent knob - PULL

Note

When necessary to depressurize the cockpit descend to below 25,000 feet if possible.

7. Aft canopy - JETTISON

OIL SYSTEM FAILURE

An oil system failure is recognized by a drop in oil pressure or a complete loss of pressure. In general, it is advisable to shut the engine down as early as possible after a loss of oil pressure is indicated, to minimize the possibility of damage to the engine. The engine will operate satisfactorily at military thrust for a period of one minute with an interrupted oil supply. The engine may operate for 4 to 5 minutes at 80 to 90% before a complete failure occurs. However, continuous operation, at any engine speed, with the oil supply interrupted results in bearing failure and eventual engine seizure. The rate at which a bearing will fail, measured from the moment the oil supply is interrupted, cannot be accurately predicted. Malfuntions of the oil system are indicated by a change from normal operating pressure, sometimes followed by vibrations. Vibrations may increase progressively until complete bearing failure occurs. Engine seizure is imminent.

Note

Variable area exhaust nozzle failure or generator failure are possible indications of an impending oil system failure.

1. If a minimum oil pressure of 30 psi at Mil thrust cannot be maintained, throttle - IDLE
2. If a minimum of 12 psi at idle thrust cannot be maintained, engine - SHUTDOWN
3. Land as soon as practicable.

Oil pressure change accompanied by vibrations-

1. Throttle - OFF

WARNING

Retard the throttle to OFF to prevent major engine damage, and possible airplane damage.

If engine shutdown is not feasible -

1. Throttle - 80% - 90% RPM
2. Avoid abrupt maneuvers causing high G forces.
3. Avoid unnecessary throttle changes.

FUEL BOOST PUMPS INOPERATIVE

The possibility of simultaneous mechanical failure of both boost pumps is highly remote. However, a failure may occur as a result of electrical malfunction. Provision is made to supply fuel to the engines by gravity flow in the event of a double boost pump failure. This provision will allow engine operation at all power settings up to military power below approximately 20,000 feet altitude. If both boost pumps fail at altitudes above 20,000 feet and/or high power settings, flameout or an unstable rpm indication on one or both engines may occur.

If one boost pump fails-

1. Afterburners - modulate or shut off to maintain a 5 psi minimum boost pump pressure.
   A 5 psi boost pump pressure will generally permit unrestricted use of the engines without afterburner at any altitude.

Note

On F-4E aircraft 68-495 and up, afterburner and normal engine operation is degraded on the engine with the failed boost pump only.

If both boost pumps fail-

1. Adjust throttle and/or descend until a stable rpm can be maintained.
   Afterburner operation is not recommended. Unrestricted military thrust operation is available from sea level to 20,000 feet.

AIR REFUELING OF FUSELAGE TANKS ONLY

If the internal wing tanks become damaged and can not hold fuel, emergency refueling of the fuselage tanks only can be accomplished as follows:

1. External transfer switch - OFF
2. Refuel selector switch - INT ONLY
3. Pull fuel valve power circuit breaker (H1, No. 2 panel).
4. Air refuel switch - EXTEND
5. Commence refueling.

Note

Do not attempt to refuel external tanks. Damage to internal wing tanks may prevent external wing tanks from transferring. The centerline tank cannot be refueled using the above procedure.

FUEL TRANSFER FAILURES

INTERNAL WING FUEL FAILS TO TRANSFER

Failure of internal wing fuel to transfer can be caused by either the wing tanks failing to pressurize, or the wing transfer valves failing to open. If internal wing fuel is not transferring:

1. External transfer switch - OFF
2. Internal wing transfer switch - NORMAL
3. Tank depressurization switch - NORM (some aircraft)
4. Air refuel switch - RETRACT
5. Internal wing fuel transfer control circuit breaker - IN (H2, No. 2 panel)

If fuel still fails to transfer-

6. Reduce airspeed below 250 knots, lower landing gear and check for fuel transfer.

CENTERLINE FUEL FAILS TO TRANSFER

Failure of the centerline fuel to transfer can be caused by either the tank shutoff valve failing to the closed position, or the tank failing to pressurize. If the centerline fuel fails to transfer:

1. External transfer switch - CENTER
2. Air refuel switch - RETRACT
3. External wing fuel transfer control circuit breaker - IN (J2, No. 2 panel).

If fuel still fails to transfer-

4. Reduce airspeed below 250 knots, lower landing gear and check for fuel transfer.

EXTERNAL WING FUEL FAILS TO TRANSFER

Failure of the external wing fuel to transfer can be caused by either the external wing tank shutoff valve failing to the closed position or the tanks failing to pressurize. If the external wing tanks fail to transfer:

1. External wing transfer switch - OUTBD
2. Air refuel switch - RETRACT
3. External wing fuel transfer control circuit breaker - IN (J2, No. 2 panel).
4. Fuel valve power circuit breaker - IN (H1, No. 2 panel).

If fuel still fails to transfer-

5. Reduce airspeed below 250 knots, lower landing gear and check for fuel transfer.

REVERSE TRANSFER OF FUSELAGE FUEL TO EXTERNAL TANKS

CENTERLINE TANK

Reverse fuel transfer from the fuselage tanks to the centerline tank is indicated by a rapid decrease in both the tape and counter and is caused by an open defuel valve. Boost pump pressure forces fuel from the engine fuel manifold through the open defuel valve to the centerline tank.

If it is necessary to obtain fuel from the centerline tank, proceed as follows:

1. Boost pump control circuit breakers - PULL
   a. Left boost pump normal control circuit breaker (J4, No. 2 panel)
   b. Right boost pump control circuit breaker (D2, No. 2 panel)
2. External tank transfer switch - CENTER

EXTERNAL WING TANK

Reverse fuel transfer from the fuselage cells to the external wing tanks can occur if external wing tank pressurization is lost (e.g., from combat damage), and is indicated by a rapid decrease in both tape and counter reading. The pressure differential on the refuel/transfer fuel level control valves caused by fuselage tank pressure will open the valves and allow fuselage fuel to reverse transfer to the external wing tanks. After T.O. 1F-4-788, a relief valve is added to the refuel/transfer fuel level control valve to prevent a pressure differential from occurring, thus preventing this reverse transfer.

If tape and counter are both decreasing and centerline and/or external wing tanks are installed, proceed as follows-

1. External tank transfer switch - OFF
2. Tape and counter readings - MONITOR
   If the tape and counter readings continue to decrease:
3. Centerline/wing station jettison switch - JETTISON

Note

If fuel and circumstances permit, it may be possible to determine which tank is receiving fuel by positioning the external tank transfer switch to CENTER or OUTBD and monitoring applicable EXT FUEL indicator light.

REVERSE TRANSFER OF FUSELAGE FUEL TO INTERNAL WING TANKS

Reverse fuel transfer from the fuselage cells to the internal wing tanks is indicated by a rapidly decreasing sector reading with a normal counter, and is caused by an open defuel valve and a failed open internal wing fuel level control valve. If external wing tank fuel is available and transferring, the counter may slowly increase. Boost pump pressure forces fuel from the engine fuel manifold through the open defuel valve to the internal wing tanks. If reverse fuel transfer occurs, proceed as follows:

F-4C/D

1. Ram air turbine - EXTEND
2. Generators - OFF
3. Boost pump control circuit breakers - PULL
   a. Left boost pump normal control circuit breaker (J4, No. 2 panel).
   b. Left boost pump emergency control circuit breaker (H4, No. 2 panel).
   c. Right boost pump control circuit breaker (D2, No. 2 panel).
4. Generators - ON
5. Ram air turbine - RETRACT
6. Tape and counter readings - MONITOR
7. Land as soon as practicable.

F-4E

1. Boost pump control circuit breakers - PULL (J4 and D2, No. 2 panel).
2. Tape and counter readings - MONITOR
3. Land as soon as practicable.

FAILED OPEN DEFUEL VALVE DURING REFUELING

When the air refuel switch is placed to EXTEND and there is an indication of a failed open defuel valve, proceed as follows:

1. Air refuel switch - RETRACT
2. External transfer switch - OFF
3. Refuel selector - INT ONLY
4. Boost pump control circuit breakers - PULL
   a. (F-4E) Left boost pump normal control circuit breaker (J4, No. 2 panel).
   b. (F-4C/D) Left boost pump emergency control circuit breaker (H4, No. 2 panel).
   c. Right boost pump control circuit breaker (D2, No. 2 panel).

Note

With the fuel boost pump circuit breakers pulled, it is recommended that air refueling be accomplished at altitudes of less than 20,000 feet.

5. Air refuel switch - EXTEND
6. Commence refueling.

When approximately 6000 pounds is indicated on the tape-

7. Boost pump control circuit breakers - RESET
8. Refuel selector - ALL TANKS
9. Continue refueling

SINGLE GENERATOR FAILURE

Single generator failure is indicated by illumination of the appropriate GEN OUT indicator light. One generator (with bus tie relay closed) is sufficient to support the entire electrical load. See Emergency Power Distribution chart (figure 3-10 or 3-11) for equipment that will be lost with one or both generators inoperative. Should generator failure occur, proceed as follows:

1. Oil pressure - CHECK
   CSD failure may be the source of trouble and subsequent engine failure due to the oil starvation could result. Refer to Oil System Failure, this section.
2. If right generator fails, stab aug switches - OFF

Note

When failure of the right generator occurs, the stab aug should be disengaged before cycling the generator control switch to prevent possible control surface transients. Stab aug may be re-engaged with the right generator control switch retained OFF or after the switch has been returned to the ON position.

3. Generator control switch - CYCLE
   Cycle generator switch from ON to OFF to ON. For 20 KVA generators, cycle from ON to OFF - wait 45 seconds - then ON. If either generator does not come on the line, turn generator switch OFF - wait 45 seconds, then ON.

WARNING

The cycling of the inoperative generator may result in the opening of the bus tie relay or the loss of the operative generator causing further loss of necessary equipment. Consequently, cycling of the inoperative generator should not be accomplished in weather or night operations.

4. Check generator indicator light - OUT
   If generator fault has been corrected, the generator is reconnected to the system and the indicator light will go out.

If the generator indicator light remains illuminated-

5. Generator control switch - OFF

6. Monitor oil pressure gage.
   CSD failure may be the source of trouble and subsequent engine failure due to oil starvation could result.
7. (F-4C/D) RAT - OUT (prior to landing)
8. Land as soon as practicable.

DOUBLE GENERATOR FAILURE

In most cases the generators will not fail simultaneously; it is more likely that one generator will fail, followed by the failure of the other generator. When both generators fail, both generator out lights are illuminated. After T.O. 1F-4-789, the generator warning lights do not illuminate for a double failure. A double generator failure can be determined by a sudden loss of cabin pressurization (sudden quiet), the appearance of the OFF flag on the attitude director indicator (ADI), and numerous electrically powered systems becoming inoperative. On all F-4E aircraft, double generator failure is accompanied by illumination of the DC BUS light.

CAUTION

With double generator failure rudder feel force automatically reverts from 11.5 to 2.6 pounds per degree of rudder reflection. As a result, rudder pedal forces at high airspeeds become extremely sensitive, and excessive structural loads can be imposed on the aircraft if full rudder deflection is commanded.

1. (F-4C/D) Ram air turbine - EXTEND

Note

- Refer to the Emergency Power Distribution Chart for inoperative/operative equipment.
- It is doubtful that rated load would be connected to the emergency generator under emergency conditions; therefore, the generator will probably operate for longer than the rated 15 minutes without malfunction.

2. All unessential electrical switches - OFF
3. Generator control switches - CYCLE
4. Confirm generator(s) operating
5. (F-4C/D) Attitude reference selector knob - STBY

If generator(s) are still inoperative-

6. Generator control switches - OFF
7. (F-4C/D) Monitor oil pressure gage
   CDS failure may be the source of trouble and subsequent engine failure due to oil starvation could result.
8. Land as soon as practicable, lower gear using Landing Gear Emergency Lowering procedure.
9. Make no-flap landing.

CAUTION

With the loss of the engine driven generators, the emergency pneumatic system must be utilized to extend the landing gear and flaps. If the emergency flap system is actuated with normal utility hydraulic pressure available, there is a high probability of losing utility hydraulic system pressure.

10. Make approach-end engagement if possible.
    If the gear was lowered prior to loss of electrical power, the pneumatic system should still be utilized. Blowing the gear down will assist the integral locks in keeping the gear down and locked since, with the loss of electrical power, the landing gear selector valve will revert to a neutral position. In the neutral position, both sides of the actuating cylinder will be routed to utility return, resulting in no hydraulic pressure on the down side of the landing gear actuator. Therefore, by blowing the gear down, 3000 psi pneumatic pressure will be exerted on the down side of the landing gear actuator to keep the gear down and locked. The flaps, if lowered prior to the double generator failure, will retract to a low drag trail position, and will have to be blown down pneumatically. If total electrical power is lost while taxiing, the emergency pneumatic landing gear system should be actuated to assure that the gear remains locked. The engine variable bypass bellmouth and auxiliary air doors will also be rendered inoperative. Refer to Auxiliary Air Door Malfunction (Gear Down), this section.

BUS TIE OPEN

Basically an illuminated BUS TIE OPEN light is an indication that the right and left generator bus systems are no longer interconnected. A failed generator, a shorted lead on the generator side of a generator relay contactor, a short in one of the bus systems (bus side of the generator relay contactors), is indicated by momentary illumination of the BUS TIE OPEN light, followed within 5 seconds by illumination of the applicable GEN OUT light as the BUS TIE OPEN light goes out. If the BUS TIE OPEN light remains extinguished, the fault within the bus system (bus side of the generator relay contactors) has corrected itself or the fault has been isolated within the generating system (generator side of the generator relay contactor). If the BUS TIE OPEN light reilluminates within 2 seconds after being extinguished, the short is still present within the tripped out generator's bus system (short on the bus system side of the generator relay contactor) and that bus system will be denied power from the normal operating generator. In either case, an attempt should be made to reset the disconnected generator. If the left generator is disconnected and the bus tie relay is open, the left main ac buses will be lost. If the right generator is disconnected and the bus tie relay is open, the right main ac and essential buses are lost. After

EMERGENCY POWER DISTRIBUTION F-4C D

INOPERATIVE EQUIPMENT

LH Gen Out-Bus Tie Open

AFTERBURNER IGNITION
ANTI–COLLISION LIGHT (ONE FILAMENT)
ANTI–SKID
BULLUP GUIDANCE XMTR
1 ECM PODS (STA 2, 4, & 5)
ENGINE ANTI–ICING
EQUIPMENT COOLING
26 FORMATION LIGHTS
FRONT COCKPIT CONSOLE LIGHTS
FRONT COCKPIT RED INST FLOODLIGHTS (DIM)
FUSELAGE LIGHTS
INS HEATER
20 KA 71/A CAMERA
LANDING LIGHT
7 LEAD COMPUTING OPTICAL SIGHT
MISSILE (POWER)
NOSE GEAR STEERING
NUMBER 4 TRANSFER PUMP
RADAR (POWER)
RED FLOODLIGHTS (MED)
RIGHT FUEL BOOST PUMP
18 RHAW
SEAT ADJUST
8 SHRIKE GUIDANCE
9 STRIKE CAMERA
UTILITY LIGHTS
UTILITY POWER (A-C)
12 VGH RECORDER
WARNING LIGHTS (DIM)
7 WEAPON RELEASE COMPUTER SET
WING AND TAIL LIGHTS (DIM)

RH Gen Out-Bus Tie Open

27 A/A IFF SYS
AILERON TRIM
AILERON-RUDDER INTERCONNECT
AIR DATA COMPUTER
AIRSPEED PITOT HEATER
15 ALTIMETER VIBRATORS
16 ALTITUDE ENCODER
ANGLE-OF-ATTACK HEATER
ANTI-COLLISON LIGHT (ONE FILAMENT)
AUTOMATIC FLIGHT CONTROL SYSTEM
BELLMOUTH PITOT HEATER
COCKPIT HEAT AND VENT
COMMUNICATION-NAVIGATION-IDENTIFICATION
1 ECM PODS (STA 6 & 8)
ENGINE FIRE DETECTOR
ENGINE RAMPS
10 EXTERNAL POD COOLING
FRONT COCKPIT INSTRUMENT LIGHTS
FUEL QUANTITY INDICATOR
11 HOMING AND WARNING
10 KA-71 CAMERA
LEFT FUEL BOOST PUMP
NUMBER 6 TRANSFER PUMP
OXYGEN QUANTITY INDICATORS
RADAR ALTIMETER
RADAR SCOPE CAMERA
REAR COCKPIT LIGHTS TRANSFORMER
SIDEWINDER
SPECIAL WEAPONS
TAXI LIGHT
WINDSHIELD TEMPERATURE SENSING
WING AND TAIL LIGHTS (BRIGHT)

Additional Inoperative Equipment When The Battery Fails

RH GEN OUT–BUS TIE OPEN

AIRCRAFT MONITOR AND CONTROL (DCU–94/A)
AIR REFUELING RECEPTACLE
ANGLE-OF-ATTACK INDICATOR
4 AOA AURAL TONE GENERATOR
BOMBING COMPUTER
CENTERLINE SPECIAL WEAPON SAFE
1 ECM POD DESTRUCT (STA 2, 4, 5, 6, & 8)
EJECT LIGHTS
EXHAUST GAS TEMPERATURE INDICATORS
EXHAUST NOZZLE POSITION INDICATORS
EXTERNAL STORES EMERGENCY RELEASE
EXTERNAL WING FUEL TRANSFER (CONTROL)
FLAP POSITION INDICATOR
FRONT COCKPIT RED INSTRUMENT FLOODS (BRT)
FUEL CONTROL (L & R ENGINE FUEL SHUTOFF VALVES)
FUEL LEVEL LOW WARNING LIGHT
21 GUARD RCVR (COMM)
IGNITION
INTERCOM
INTERNAL WING FUEL TRANSFER (CONT)
2 KY–28
LANDING GEAR POSITION INDICATOR
MASTER CAUTION LIGHT RESET
MISSILE JETTISON
OUTBOARD STORES JETTISON (SEC)
5 RMU-8/A (STOP & CUT FUNCTION)
SPECIAL WEAPON UNLOCK
STABILATOR TRIM
WHITE FLOODLIGHTS
TRIM (CONTROL)

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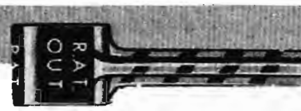
Figure 3-10 (Sheet 1 of 3)



INOPERATIVE EQUIPMENT

Emergency Generator Operating

- 27 A/A IFF SYS
- AFTERBURNER IGNITION (LEFT & RIGHT)
- AILERON FEEL TRIM POWER
- AILERON RUDDER INTERCONNECT
- AIRSPEED PITOT HEATER
- ALTIMETER VIBRATOR
- 16 ALTITUDE ENCODER POWER
- AN/ARW-77
- 9 STRIKE CAMERA
- 23 ANGLE OF ATTACK HEATER PROBE
- ANTI-ICING (ENGINE)
- ANTI-SKID
- ARRESTING HOOK AND WING FOLD CONTROL
- AUTOMATIC FLIGHT CONTROL SYSTEM (A/P)
- AUXILIARY AIR DOOR CONTROL (LEFT AND RIGHT)
- BELLMOUTH CONTROL LEFT AND RIGHT
- BELLMOUTH PILOT HEATER
- 10 CAMERA POD HEATING/COOLING SYSTEM
- CENTERLINE SPECIAL WEAPONS ARMAMENT
- COCKPIT HEAT AND VENT
- CONVENTIONAL WEAPONS ARM, RELEASE AND FIRE
- CNI (TACAN, ADF, AUX. RCVR, UHF XMTR, REDUCED POWER, 25 IFF)
- 17 ECM CONTROL
- 1 ECM PODS & DESTRUCT (STA 2, 4, 5, 6 & 8)
- ECM SYSTEM (7 APS-107, ER-142 AND TAPE RECORDER)
- ENGINE RAMPS CONTROL
- EQUIPMENT COOLING
- FLAP CONTROL
- 26 FORMATION LIGHTS
- FUEL DUMP INTERNAL WING
- 11 HOMING AND WARNING
- 25 IFF SYSTEM
- IN FLIGHT REFUELING RECEIVER
- INERTIAL NAVIGATION SYSTEM
- 10 KA-71/A STRIKE CAMERA
- LANDING GEAR CONTROL POWER
- 7 LEAD COMPUTING OPTICAL SIGHT SYSTEM POWER
- LIGHTS, AFT COCKPIT (UTILITY LIGHT)
- LIGHTS, EXTERIOR (EXT. LIGHTS CONTROL, FUSELAGE AND ANTI-COLLISION LIGHTS, WING & TAIL LIGHTS BRIGHT, ANTI-COLLISION LIGHT, WING & TAIL LIGHT DIM, LANDING & TAXI LIGHTS CONTROL, TAXI LIGHT, LANDING LIGHT)
- LIGHTS, FORWARD COCKPIT CONSOLE
- LIGHTS, FORWARD COCKPIT (RED FLOODLIGHTS MED., FWD. COCKPIT RED INSTRUMENT FLOODLIGHTS DIM)
- LIGHTS, WARNING CONTROL
- MISSILE FIRING(ALL MISSILES)
- NAVIGATIONAL COMPUTER
- NOSE GEAR STEERING CONTROL
- OXYGEN QUANTITY GUAGE
- PNEUMATIC SYSTEM CONTROL
- PUMP, FUEL BOOST LEFT AND RIGHT
- PUMP, #4 AND #6 TRANSFER
- PUMP, #4 AND #6 TRANSFER CONTROL
- RADAR ALTIMETER
- 18 RADAR HOMING AND WARNING POWER
- RADAR POWER
- RADAR SCOPE POWER
- RAIN REMOVAL CONTROL
- RMU-8/A POWER CONTROL
- RUDDER TRIM
- SEAT ADJUST
- SPEED BRAKE CONTROL
- STABILATOR FEEL TRIM POSITION INDICATOR
- TURN AND SLIP INDICATOR
- 12 VGH RECORDER
- 7 WRCS POWER

OPERATIVE EQUIPMENT

Emergency Generator Operating

- AIR DATA COMPUTER
- AIRCRAFT MONITOR AND CONTROL (DCU-94/A)
- AIR REFUELING RECEPTACLE
- 3 ANGLE-OF-ATTACK HEATER
- ANGLE-OF-ATTACK SYSTEM
- 4 AOA AURAL TONE GENERATOR
- ATTITUDE REFERENCE AND BOMBING COMPUTER
- ATTITUDE INDICATORS
- CENTERLINE SPECIAL WEAPONS SAFE
- EJECT LIGHTS
- ENGINE FIRE DETECTOR
- ENGINE FUEL FLOW INDICATORS
- ENGINE FUEL PRESSURE INDICATORS
- ENGINE OIL PRESSURE INDICATORS
- EXHAUST GAS TEMPERATURE INDICATOR
- EXHAUST NOZZLE POSITION INDICATOR
- EXTERNAL STORES EMERGENCY RELEASE
- EXTERNAL WING FUEL TRANSFER CONTROL
- FLAP POSITION INDICATOR
- FRONT COCKPIT INSTRUMENT LIGHTS
- FRONT COCKPIT RED FLOODLIGHTS (BRT)
- FUEL LEVEL LOW WARNING LIGHT
- FUEL QUANTITY INDICATOR
- FUEL VALVE POWER
- IFF/SIF
- IGNITION
- INDEXER LIGHTS
- INTERCOM
- INTERNAL WING FUEL TRANSFER CONTROL
- 2 KY-28
- LANDING GEAR POSITION INDICATOR
- LEFT FUEL BOOST PUMP (LOW SPEED)
- 14 LEFT MAIN FUEL CONTROL (ENG FUEL SHUTOFF VALVE)
- 13 MAIN FUEL CONTROL (ENG FUEL SHUTOFF VALVES)
- MASTER CAUTION LIGHT RESET
- MISSILE JETTISON
- PC-1 HYDRAULIC PRESSURE INDICATOR
- PC-2 HYDRAULIC PRESSURE INDICATOR
- PNEUMATIC PRESSURE INDICATOR
- 6 RADAR SIGHT WARNING LIGHT
- REAR COCKPIT INSTRUMENT & CONSOLE PANEL LIGHTS
- REAR COCKPIT CONSOLE RED FLOODS (DIM)
- RED FLOODLIGHTS (BRIGHT)
- 14 RIGHT MAIN FUEL CONTROL (ENG FUEL SHUTOFF VALVE)
- 5 RMU-8/A (STOP & CUT FUNCTION)
- SPECIAL WEAPON UNLOCK
- STABILATOR TRIM
- UHF RADIO
- UTILITY HYDRAULIC PRESSURE INDICATOR
- WARNING LIGHTS (BRIGHT)
- WHITE FLOODLIGHTS
- WINDSHIELD TEMPERATURE SENSING

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Figure 3-10 (Sheet 2 of 3)

EMERGENCY POWER DISTRIBUTION

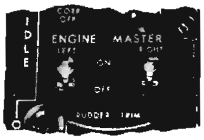
F-4C D

OPERATIVE EQUIPMENT

Battery Only

Note

TO PROLONG BATTERY LIFE, TURN OFF ALL NON-ESSENTIAL EQUIPMENT.



- [1] AIR REFUELING RECEPTACLE
- AIRCRAFT MONITOR AND CONTROL (DCU-94/A)
- ANGLE-OF-ATTACK INDICATOR
- [4] AOA AURAL TONE GENERATOR
- CENTERLINE SPECIAL WEAPON SAFE
- EJECT LIGHTS
- EXHAUST GAS TEMPERATURE INDICATORS
- EXHAUST NOZZLE POSITION INDICATORS
- EXTERNAL STORES EMERGENCY RELEASE
- [1] EXTERNAL WING FUEL TRANSFER (CONTROL)
- FLAP POSITION INDICATOR
- FRONT COCKPIT INSTRUMENT PANEL RED FLOODS (BRT) FUEL VALVE POWER
- [21] GUARD RCVR (COMM)
- IGNITION
- INTERCOM
- [1] INTERNAL WING FUEL TRANSFER (CONTROL)
- LANDING GEAR POSITION INDICATOR
- [2] KY-28
- [13] MAIN FUEL CONTROL (ENG FUEL SHUTOFF VALVES)
- [14] LEFT MAIN FUEL CONTROL (ENG FUEL SHUTOFF VALVE)
- MASTER CAUTION LIGHT RESET
- OUTBOARD STORES JETTISON
- [14] RIGHT MAIN FUEL CONTROL (ENG FUEL SHUTOFF VALVE)
- [5] RMU-8/A (STOP & CUT FUNCTION)
- SPECIAL WEAPON UNLOCK
- STABILATOR TRIM
- WHITE FLOODLIGHTS

[1] F-4C AFTER T.O. 1F-4C-598 OR F-4D AFTER T.O. 1F-4C-547.
[2] AFTER T.O. 1F-4-755.
[3] F-4C-15 THRU F-4C-17 AND F-4D.
[4] AFTER T.O. 1F-4-840.
[5] F-4C-24 AND UP, AND F-4C-15 THRU F-4C-23 AFTER T.O. 1F-4C-522.
[6] F-4C ONLY.
[7] F-4D ONLY.
[8] ALL F-4D'S, AND ALL OTHERS AFTER T.O. 1F-4C-523.
[9] F-4C-15 THRU F-4C-23 AFTER T.O. 1F-4C-539.
[10] F-4C-15 THRU F-4C-25 AFTER T.O. 1F-4C-547, OR F-4C-23 AFTER T.O. 1F-4C-548.
[11] F-4C-15 THRU F-4C-25 AFTER T.O. 1F-4C-576, OR F-4C-23 AFTER T.O. 1F-4C-548.
[12] F-4C BLK 21 THRU 25 AND F-4D BLK 24 THRU 27, PRIOR TO INCORPORATION OF T.O. 1F-4-645.
[13] F-4C BLK 15 THRU 21 BEFORE T.O. 1F-4-618.
[14] ALL F-4D'S; F-4C BLK 22 AND UP, AND F-4C BLK 15 THRU 21 AFTER T.O. 1F-4-618.
[15] ALL F-4C'S; F-4D BLK 24 THRU 29.
[16] F-4D BLK 30 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-754.
[17] F-4C BLK 19 AND UP
[18] F-4D AFTER T.O. 1F-4D-512.
[20] F-4D BLK 27 AIRCRAFT 65-660.
[21] F-4D BLK 27 AND UP.
[22] F-4C BLK 18 AND UP, AND F-4C BLK 15 THRU BLK 17 AFTER T.O. 1F-4C-503.
[23] F-4C BLK 18 AND UP
[24] F-4C BLK 15 THRU 21 BEFORE T.O. 1F-4-577.
[25] F-4C BLK 25, 64-928 ONLY.
[26] AFTER T.O. 1F-4-776.
[27] AFTER T.O. 1F-4-753.

F4C/D-315-3

Figure 3-10 (Sheet 3 of 3)

T.O. 1F-4-789, a left generator failure accompanied by a failure of the bus tie is not noted by the illumination of the L H GEN OUT and BUS TIE OPEN lights if the pilot's instrument panel lights knob is out of the OFF position. Failure can be detected by loss of radar, at which time the instrument lights should be turned OFF and the generator lights monitored for verification of failure. Since a left generator failure accompanied by a bus tie failure is difficult to detect when using instrument lights without the radar operating, it is recommended that any time the instrument lighting is being used, the console floods should be in the MED position. The MED position of the console floods is powered by the left generator; therefore, the console floods can be used as a failure indicator. On F-4E aircraft 69-7261 and up, the flight instruments lights control knob is used to dim the warning lights. In addition, the generator indicator lights illuminate during a left generator failure with the bus tie open, regardless of the position of the flight instruments lights control knob.

CAUTION

On F-4C/D aircraft, the essential buses may be regained by extending the RAT and placing the left generator switch to OFF when required. This cycling of the emergency generator, with the bus tie relay open, should be done with caution since the original short-fault probably still exists and could be further aggravated by application of emergency power.

BOTH GENERATORS OPERATING

A BUS TIE OPEN light with both generators operating should not necessitate aborting the mission if the bus tie can be closed by turning either generator control switch OFF. In most cases the bus tie can be closed by cycling a generator. If the bus tie remains open after generator cycling, the out of phase/frequency condition still exists. Under this condition it is possible to create a frequency oscillation which may impair performance of systems utilizing inputs from both generators. In view of the above, proceed as follows:

Note

During the Before Takeoff Check, when the throttle burst is made from idle to military power and then back to idle, it is possible for the BUS TIE OPEN light to illuminate momentarily. The momentary illumination should be disregarded.

1. Stab aug switches - OFF
2. Right generator switch - CYCLE
   Cycle the right generator so as not to interrupt power to the fire control system. Once power to the fire control system is interrupted, it requires a 3.5 minute warm-up time before re-engaging.

If the BUS TIE light remains illuminated and instruments are unreliable-

3. Right generator switch - OFF
4. Check bus tie light - OUT

If BUS TIE light remains on-

5. Right generator switch - ON
6. (F-4C/D) SPC - OFF
7. Stab-aug - ON
8. Land as soon as practicable

LEFT GENERATOR OUT

1. Left generator control switch - CYCLE
   If the LH GEN OUT and BUS TIE OPEN lights remain illuminated, the left main ac buses will be lost.
2. Turn off all electrical equipment not essential to flight. Refer to emergency power distribution chart.
3. Land as soon as practicable.

Note

To insure warning light indications, turn front cockpit instrument panel lights control knob OFF.

RIGHT GENERATOR OUT

1. Stab Aug Switches - OFF
2. Right generator control switch - CYCLE
   If the RH GEN OUT and BUS TIE OPEN lights remain illuminated, the right main ac and essential buses will be lost.

(F-4C/D) To regain temporary use of the essential buses-

3. Ram air turbine - EXTEND
4. Left generator control switch - OFF
   The left generator must be turned off in order to connect the emergency generator to the essential buses.
5. Attitude reference selector knob - STBY
6. Land as soon as practicable, lower gear using Landing Gear Emergency Lowering procedure.

CAUTION

With the loss of the engine driven generators, the emergency pneumatic system must be utilized to extend the landing gear and flaps. If the emergency flap system is actuated with normal utility hydraulic pressure available, there is a high probability of losing utility hydraulic system pressure.

DC BUS LIGHT ILLUMINATED (F-4E)

Illumination of the DC BUS light indicates that the electrical tie between the essential 28 volts dc bus and main 28 volts dc bus is open. The cause could be failure of the voltage monitoring system which ties the dc buses together, loss of both generators or both transformer-rectifiers, or a dc bus fault causing a voltage depression on both buses for 2 seconds or longer. If the voltage monitoring system fails, there is no effect on electrical operation of equipment powered by the dc buses. If both generators and/or both transformer-rectifiers fail, the battery will power the essential dc bus for a period of time. When the DC BUS light illuminates because of a 2 second or longer voltage depression on one of the buses, it may be due to a low voltage condition. If the condition is permanent, probably one of the dc buses will be dead or degraded. If the DC BUS light should come on, check operation of equipment powered by each bus in order to determine its condition. The main 28 volt dc bus can be checked by operating the speed brakes or checking the warning lights dimming feature. Condition of the essential 28 volts dc bus may not be so easily determined as it will be powered by the battery until it is discharged to the point where they are disconnected. If the DC BUS light comes on, proceed as follows:

1. Equipment operated by both dc buses - CHECK
2. Land as soon as practicable

FLIGHT CONTROL MALFUNCTION

Upon initial detection of any abnormal flight control movement, immediately depress the paddle switch and hold, in order to determine if the stab aug or AFCS was causing the abnormality.

1. Paddle switch - HOLD DEPRESSED
2. AFCS - DO NOT ENGAGE
3. Stab aug switches - AS REQUIRED
4. Paddle switch - RELEASE
5. Malfunction other than AFCS - LAND AS SOON AS PRACTICABLE

Note

With pitch aug disengaged or inoperative, do not exceed 300 KNOTS, below 10,000 feet, and avoid abrupt control movements.

COMPLETE BELLOWS FAILURE OR ICE/ WATER BLOCKAGE OF BELLOWS RAM AIR INLET

A complete bellows failure or ice/water blockage of the ram air line is recognized by a nose down feel force at the control stick, not to exceed 5 pounds per G (3 pounds per G on aircraft after T.O. 1F-4-831). This force cannot be trimmed out. If ice or water blockage is suspected, nose up trim should not be applied to relieve stick forces. If nose up trim has been applied before the bellows failure was recognized, trim should be returned to near neutral (0 units if in doubt) before attempting any corrective action. The intermittent nature of this condition and the suddenness in which the system can return to normal could cause pitch transients if trim is improperly used. When ice or water blockage is suspected, check pitot heat switch ON and descend to air that is above freezing if possible. Should a complete bellows failure or ice/water blockage occur:

1. Stabilator trim - NEUTRAL (if required)
2. Check pitot heat switch - ON
3. Avoid abrupt fore and aft stick movements.

Note

The effect of control surface transients is lessened at lower airspeeds.

RUNAWAY STABILATOR TRIM

If the stabilator trim appears to be running away, it is possible, under certain conditions, to alleviate it by engaging the autopilot, providing; the stabilator trim circuit breaker has been pulled immediately upon detection of runaway trim; runaway trim is in the nose up direction, or nose down runaway trim has not exceeded 2-1/2 units; and airspeed is reduced to 300 knots or less.

If the above conditions are met:

1. Pull stabilator feel trim circuit breaker.
2. Reduce airspeed to 300 knots or less.
3. Autopilot - ENGAGE

CAUTION

If the autopilot is used to alleviate excessive out-of-trim forces (for example full nose-down runaway trim) the autopilot pitch parallel servo may be overpowered, thus preventing normal operation. If the aircraft commander supplies stick force in an attempt to help the autopilot hold against the overpowering trim forces, the autopilot may alternately disengage and reengage accompanied by large transients in pitch force. If the autopilot cannot maintain flight attitude without assistance from the aircraft commander, disengage the autopilot. Be prepared to accept large transients when disengaging the autopilot after it has been used to hold against runaway trim.

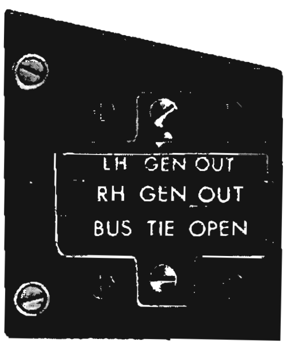
4. Land as soon as practicable.

EMERGENCY POWER DISTRIBUTION F-4E

INOPERATIVE EQUIPMENT

LH Gen Out-Bus Tie Open

AN/ARW-77
ANTI-ICE
ANTI-COLLISION LT (ONE FILAMENT)
ANTI-SKID
5 CORDS HTR
5 CORDS PWR
13 ECM PODS (STA 2, 4, & 5)
EQUIP COOLING
FUS LTS
FWD CKPT CONSOLE LTS
FWD CKPT RED INST FLOODS DIM
INS HEATER
L AFTERBURNER IGNITION
LANDING LT
LCOSS
LH 28V TRANSFORMER
12 LH FUEL BOOST PUMP
LH MISSILE FIRING
LH MISSILE POWER
LH TRANSFORMER RECTIFIER
NO. 4 ELEC FUEL TRANS PUMP
NOSE GUN
NOSE WHEEL STEERING
RED CONSOLE FLOODS MED
11 RH FUEL BOOST PUMP
RADAR PWR
R AFTERBURNER IGNITION
RADAR SCOPE CAMERA
RH MISSILE PWR
SEAT ADJUST
SHRIKE GUIDANCE
UTILITY LT
UTILITY PWR AC
16 WARNING LTS DIM
WING AND TAIL LT DIM
WRCS PWR



INOPERATIVE EQUIPMENT

RH Gen Out-Bus Tie Open

ADF
AILERON FEEL TRIM
AILERON RUDDER INTERCONNECT
AIRSPEED PITOT HTR
ALTITUDE ENCODER
ANGLE OF ATTACK PROBE HTR PWR
ANTI COLLISION LT (ONE FILAMENT)
6 APR-36/37
7 APU
ARMAMENT POWER
AUTO PILOT
AUX RECEIVER
BELLMOUTH PITOT HTR
CADC
CKPT HT AND VENT
5 CORDS PWR
13 ECM PODS (STA 6 & 8)
ENGINE FIRE AND OVERHT DET
4 FORM LTS
FUEL QUANTITY INDICATOR
FWD CKPT INSTRUMENT LTS
IFF
2 IFR RECEP FLOOD LTS
LH EGT
11 LH FUEL BOOST PUMP
L ENGINE RAMP CONT
NO. 6 ELEC FUEL TRANS PUMP
OXYGEN GAGE
RADAR ALTIMETER
RIGHT ENGINE RAMP CONT
RH 28V TRANSFORMER
1 RHAW PWR
RH EGT
12 RH FUEL BOOST PUMP
RH TRANSFORMER RECTIFIER
TACAN
TAXI LT
UHF RADIO
WINDSHIELD TEMP SENSING
WING AND TAIL LT BRT

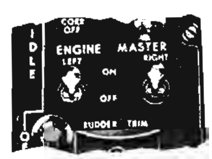
F4E-315-1

Figure 3-11 (Sheet 1 of 2)

INOPERATIVE EQUIPMENT
Main 28 Volt DC Bus Out

ADF
AILERON RUDDER INTERCONNECT
ALTIMETER VIBRATOR
(6) APR-36/37
(7) APU
ARRESTING HOOK (UP OPERATION)
AUX AIR DOORS
AUX RECEIVER
CKPT HEAT AND VENT
CONVENTIONAL WEAPONS RELEASE AND FIRE
(5) CORDS PWR
ECM CONTROL
(13) ECM PODS & DESTRUCT (STA 2, 4, 5, 6 & 8)
(3) ENG VARIABLE BELLMOUTH
EQUIP COOLING CONTROL
FLAPS
FUSELAGE, ANTI COLLISION AND TAIL LTS
INTERNAL WING DUMP
LCOSS
LANDING GEAR
LANDING AND TAXI LTS
LH FUEL BOOST PUMP
MISSILE FIRING
NAV COMPUTER
NO. 4 ELEC FUEL TRANS PUMP
NO. 6 ELEC FUEL TRANS PUMP
NOSE GUN
NOSE WHEEL STEERING
PNEUMATIC COMPRESSOR
RADAR
RAIN REMOVAL
RADAR SCOPE CAMERA
(1) RHAW PWR
RH FUEL BOOST PUMP
RMU-8/A (NORMAL OPERATION)
(8) RUDDER TRIM
(9) RUDDER TRIM/BELLMOUTH CONT
SPEED BRAKE
SPECIAL WEAPONS ℄ ARM
STABILATOR POSITION INDICATOR
TACAN
TURN AND SLIP INDICATOR
UTILITY POWER D-C
VGH RECEIVER POWER D-C
WALLEYE INDENT POWER
WARNING LIGHTS DIM
WRCS POWER

OPERATIVE EQUIPMENT
Battery Power Only



AIR REFUEL RECEPTACLE
ALL STORES EMER JETT
ANGLE OF ATTACK INDICATOR
(14) AOA AURAL TONE GENERATOR
EGT INVERTER
EJECTION LIGHT
EXTERNAL WING FUEL TRANSFER CONTROL
FEED TANK CHECK AND FUEL LOW WARNING
FLAP POSITION INDICATOR
FUEL CONTROL
FUEL VALVE POWER
FWD CKPT INST FLOODS BRT
INTERCOM
INTERNAL WING FUEL TRANSFER CONTROL
(15) KY-28
LANDING GEAR POSITION INDICATOR
LEFT AND RIGHT MAIN IGNITION
MASTER CAUTION LT RESET
MISSILE FAIRING
MISSILE JETT
NOZZLE POSITION INDICATOR
OUTBOARD STATION JETT
RMU-8/A EMER POWER
SPECIAL WEAPONS ℄ SAFE
SPECIAL WEAPONS UNLOCK
STABILATOR FEEL TRIM
TRIM CONTROL
WHITE FLOOD LIGHT

(1) AIRCRAFT BLK 33 66-368 THRU BLK 41
(2) AIRCRAFT BLK 34 AND UP
(3) AIRCRAFT BLK 35 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-517
(4) AIRCRAFT BLK 38 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-776
(5) AIRCRAFT BLK 31 THRU 38
(6) AIRCRAFT BLK 42 AND UP, AND 67-342 THRU 68-538 AFTER T.O. 1F-4E-518
(7) AIRCRAFT BLK 40 AND UP
(8) AIRCRAFT BLK 31 THRU 34 BEFORE T.O. 1F-4E-517
(9) AIRCRAFT BLK 35 AND UP, AND ALL OTHERS AFTER T.O. 1F-4E-517
(10) AIRCRAFT BLK 39 AND UP
(11) AIRCRAFT BLK 31 THRU 40
(12) AIRCRAFT BLK 41 AND UP
(13) AIRCRAFT AFTER T.O. 1F-4E-531
(14) AIRCRAFT BLK 39 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-840
(15) AIRCRAFT AFTER T.O. 1F-4E-532
(16) AIRCRAFT BLK 31 THRU 43

F4E-315-2

Figure 3-11 (Sheet 2 of 2)

SPEED BRAKE EMERGENCY OPERATION

Three basic failures, and their combinations, can affect the speed brakes. They are: switch failure, electrical failure, and utility hydraulic system failure. If utility hydraulic system fails with the speed brakes extended, the speed brakes will be forced by air loads to a low drag trail position, regardless of switch positions. If an electrical failure occurs, the speed brakes automatically retract to a fully closed position. If both throttle-mounted switches fail, the speed brakes may be fully retracted by use of the emergency speed brake switch. To retract the speed brakes on aircraft with the emergency speed brake switch removed, pull the speed brake circuit breaker.

UTILITY HYDRAULIC SYSTEM FAILURE

Note

- Due to the possibility of leaking check valves in the emergency air bottles, it is advisable to lower the gear as soon as possible after utility hydraulic system failure.
- If the CHECK HYD GAGES indicator light illuminates and remains illuminated, monitor the hydraulic system gages for the remainder of the flight, since warning of a second hydraulic system failure will not be given.

The following equipment is inoperative with utility hydraulic failure-

a. Air refueling receptacle
b. Anti-skid protection
c. Arresting hook (retraction)
d. Auxiliary air doors
e. Fuel transfer pumps (hydraulic)
f. Nose gear steering
g. (F-4E) Nose gun drive and gun gas purge door
h. Pneumatic system air compressor
i. Radar antenna drive
j. Variable engine bellmouth
k. Variable engine intake duct ramps
l. Roll stab aug
m. Yaw stab aug
n. AFCS

The following equipment is affected by utility hydraulic failure-

a. Aileron power control cylinders
   PC-1 will assume full demand of left aileron. PC-2 will assume full demand of right aileron.
b. Flaps
   1/2 flaps available with pneumatic operation. If flaps are down when utility failure occurs, flaps will move to the trail position.
c. Landing gear
   Gear extension by pneumatic system.
d. Rudder
   Limited manual rudder available.
e. Speed brakes
   If extended, will move to trail position.
f. Spoiler power control cylinders
   PC-1 will assume full demand of the left spoiler. PC-2 will assume full demand of the right spoiler.
g. Wheel brakes
   Limited emergency braking available.

SINGLE POWER CONTROL SYSTEM FAILURE

A hydraulic pump failure of either PC-1 or PC-2 presents no immediate problem, since the utility system provides satisfactory power to the rudder and to the failed lateral control system. The remaining PC system will provide stabilator power. If either power control system should fail:

1. Anticipate utility hydraulic system failure

Note

If the CHECK HYD GAGES indicator light illuminates and remains illuminated, monitor the hydraulic system gages for the remainder of the flight, since warning of a second hydraulic system failure will not be given.

2. Land as soon as practicable.
3. Plan for straight in half-flap approach.
4. Extend gear at 250 knots when established on final.

Note

Maintain 250 knots to insure adequate control in the event of utility failure during gear extension.

5. Slow aircraft to 200 knots and extend flaps to 1/2.
6. Fly 17 units AOA on final.

Note

On F-4C/D aircraft and F-4E before 68-452, if PC-1 hydraulic pressure is lost or drops below 500 psi, stab aug in the pitch axis and AFCS is inoperative. However, the AUTO PILOT DISENGAGE and PITCH AUG OFF lights do not illuminate. In F-4E aircraft 68-452 and up, the stabilator auxiliary power unit, if not rejected, supplies hydraulic power to the AFCS and pitch augmentation systems.

SINGLE POWER CONTROL AND UTILITY SYSTEM FAILURE

If a simultaneous loss of the utility system and one of the power control systems occurs, the operable aileron and spoiler will provide adequate lateral control for an emergency landing; however, handling qualities are significantly degraded. With this combination failure, the rudder is unpowered. Stabilator and aileron spoiler combination of only one wing will be powered by the remaining power control system. The most noticeable change will be variable response to lateral inputs dependent upon which control surface (aileron or spoiler) is used for rolling or turning. The aileron will be the more effective surface; therefore, rolling into the operating wing (use of spoiler) provides less response than rolling away from the operating wing (use of aileron). Lateral control response is reduced below 300 knots and continues to be degraded down to the recommended 17 units final approach AOA. Rapid roll rates should be avoided.

1. Maintain 250-500 knots.
2. Jettison any asymmetric load at recommended airspeed if possible.
3. Make an approach-end engagement, if possible.
4. Plan straight-in approach or wide traffic pattern (select runway to minimize crosswind, if possible).
5. Extend gear pneumatically at 250 knots.
6. Make a no-flap landing.
7. Anti-skid - OFF.
8. Fly 17 units AOA on final.

Note

Only emergency brakes are available during landing; nose wheel steering, and anti-skid systems are inoperative.

DOUBLE POWER CONTROL SYSTEM FAILURE

On F-4C/D and F-4E aircraft before T.O. 1F-4-903, if a complete power control system hydraulic failure occurs, the aircraft becomes uncontrollable; i.e., airloads will force stabilator leading edge down, causing the aircraft to pitch-up.

1. **EJECT**

On F-4E aircraft after T.O. 1F-4-903, with a complete PC-1 and PC-2 failure, degraded longitudinal control is available from the APU. If both power control systems fail:

CAUTION

Rapid control inputs should be avoided to prevent system saturation and control stiffening.

1. Reduce speed below 600 knots or .95 Mach.
2. Descend to 20,000 feet or below.
3. Use moderate control inputs.
4. Follow procedures for Single Power Control System failure, this section.
5. If the APU or utility system fails - EJECT

JETTISONING

The procedures for jettisoning are shown in Jettisoning charts, figures 3-12 and 3-13.

LANDING EMERGENCIES

SIMULATED SINGLE-ENGINE LANDING

A simulated single-engine landing should be flown with one engine at idle rpm, following the Single-Engine Landing procedure, this section.

SINGLE ENGINE FAILURE ON FINAL

At the first indication of engine failure, the throttle of the operating engine must be advanced to obtain full military or afterburner thrust and the flaps immediately raised to the one-half position. Any unnecessary delay in applying power to the good engine will result in excessive sink rates and/or airspeed bleed-off. Raising the flaps to one-half while flying full-flap on speed will reduce drag and minimize power loss to the BLC system, but some loss in altitude can be expected. Accept a continued rate of descent until level-off can be smoothly effected. External store drag is negligible at low airspeed and will have little affect on aircraft performance. Gross weight dictates the thrust required to either continue the approach or execute a go-around. Very little yaw rate is induced by military thrust on one engine. However, afterburner thrust creates a slight asymmetrical control problem which should be controlled with the rudder. Normally, in this situation, the approach can be continued to a single-engine landing.

1. **THROTTLE GOOD ENGINE – AFTERBURNER**
2. **FLAPS – 1/2**

WARNING

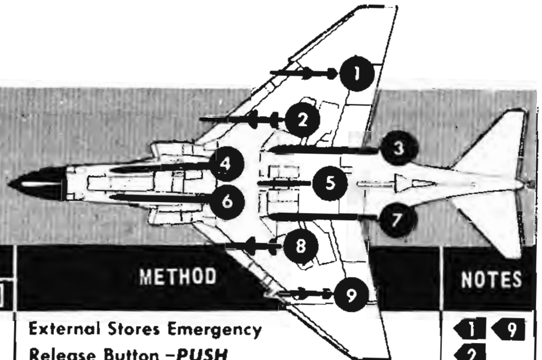
Expect an altitude loss of approximately 100-500 feet when retracting flaps to 1/2.

3. Follow Single Engine Landing or Single Engine Go-Around procedures, this section.

Note

If the left engine fails on final and the bus tie remains open, afterburner ignition will not be available. However, if afterburner thrust is required, afterburner lights-off are generally obtainable through turbine torching by jam accelerating the right engine at 90% rpm or above.

JETTISONING CHART F-4C D



WARNING

THE AIM-9D/E'S, AIM-4D'S AND HVAR'S ARE FIRED UNARMED AND UNGUIDED WHEN JETTISONED.

CAUTION

Whenever the necessity arises for jettison from stations 2 and 8 with the gear down, the possibility exists for gear damage due to store-gear collision.

* WEIGHT MUST BE OFF GEAR

	STORES	STATION	GEAR HANDLE POSITION FRONT 8	GEAR HANDLE POSITION REAR 8	METHOD	NOTES
	ALL EXCEPT SPECIAL WEAPON and RMU-8/A	1 thru 9	UP or DOWN*	IN	External Stores Emergency Release Button -*PUSH*	1, 9, 2
TANKS	OUTBOARD WING	1 and 9	UP or DOWN	IN or OUT	Wing Station Jettison Switch - *JETT*	5
TANKS	℄	5	UP or DOWN*	IN	Center Station Jettison Switch - *JETT*	
GUIDED MISSILE or WEAPON	ALL	2, 3, 4, 6, 7, 8	UP or DOWN	IN or OUT	Missile Jettison Selector Knob - *ALL* 6 Missile Jettison Selector Knob - *PUSH*	4, 1, 5, 3
GUIDED MISSILE or WEAPON	INDIVIDUAL MISSILE STATIONS	2, 3, 4, 6, 7, 8	UP or DOWN	IN or OUT	Missile Jettison Selector Knob - *APPROPRIATE STATION* Missile Jettison Selector Knob - *PUSH*	4, 1, 5, 3
GUIDED MISSILE or WEAPON	OUTBOARD WING	1 and 9	UP or DOWN	IN or OUT	Wing Station Jettison Switch - *JETT*	5
SPECIAL WEAPON	Refer to Aircrew Bomb Delivery Technical Manual, T.O. 1F-4C-25-2					
MULTI-WEAPONS	OUTBOARD WING	1 and 9	UP or DOWN	IN or OUT	Wing Station Jettison Switch - *JETT*	1, 5
MULTI-WEAPONS AND ECM PODS	INBOARD WING	2 and 8	UP or DOWN	IN or OUT	Missiles Jettison Selector Knob - *LEFT WING* Missile Jettison Selector Knob - *PUSH* Missile Jettison Selector Knob - *RIGHT WING* Missile Jettison Selector Knob - *PUSH*	1, 5
MULTI-WEAPONS AND ECM PODS	℄	5	UP or DOWN*	IN	Center Station Jettison Switch - *JETT*	
ECM PODS	RT OUTBOARD WING	9	UP or DOWN*	IN	ECM Jettison Switch - JETT 7 Wing Station Jettison Switch - JETT 10	1, 5

1. To jettison stores, except tanks and missiles other than the AGM-12C, AGM-12E, or MK 1 MOD 0, from stations 1, 2, 8 and 9, it is required that inflight lockout pins be installed in the armament pylons. On F-4C aircraft, installation of the inflight lockout pins is indicated by illumination of the LO, LI, RI, RO "unlock" lights on the DCU-94/A control panel with the LO, LI, RI, and RO station selection switches in the aft positions and power on the aircraft. On F-4D aircraft thru block 33, the RO "unlock" light is not connected and installation of the inflight lockout pin cannot therefore be determined from the cockpit. On F-4C and F-4D aircraft thru block 33, to jettison from stations 1, 2 and 8 without inflight lockout pins installed, the master release lock switch and the desired station selection switch(es) must be placed in their forward positions before proceeding with normal jettison procedures. After placing the master release lock and station selection switch(es) to the forward position(s), the selected "unlock" lights will illuminate. Station 9 jettison cannot be performed without an inflight lockout pin installed.
2. AIM-4 missiles will not jettison from stations 2 and 8 using external stores emergency release button, and flaps must be up to jettison AIM-9 missiles. On F-4D aircraft after T.O. 1F-4D-536, the external stores emergency release button will not jettison AIM-9 missiles from stations 2 and 8.
3. The flaps must be up (on F-4C's the flap control switch must be in the UP position; on F-4D's the TE flap up limit switches must be in the flaps up position) to jettison AIM-9, and the gear and flaps must be up (TE flap limit switches) to jettison AIM-4D missiles from stations 2 and 8.
4. Missiles mounted on forward fuselage stations 4 and 6 cannot be jettisoned (indicated by illumination of "TK" light on missile status control panel) if 600-gallon tank, a MER, or SUU-16/A gun pod (prior to block 28) is carried on centerline station 5.

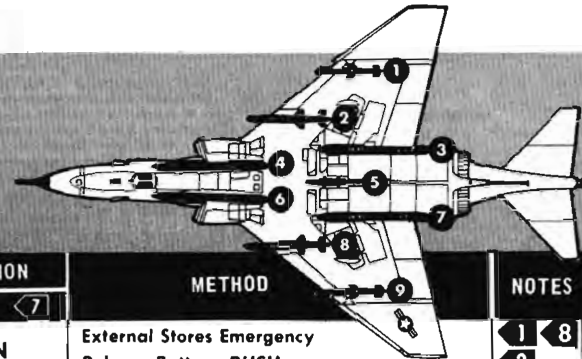
WARNING

5. Wing station jettison switch is "hot" at all times with external or generator power on the aircraft, or with a master switch or with ground refueling switch out of the OFF position to connect battery power to the essential dc bus. Missile jettison selector knob on aircraft prior to 64-970 is "hot" under the same conditions as the wing station jettison switch. On aircraft 64-970 and up, and all other F-4Ds after T.O. 1F-4D-508, to energize the missile selector jettison knob the gear handle in the aft cockpit must be in and one of the following conditions must exist; forward cockpit landing gear handle up, weight of aircraft off gear, or armament safety override switch depressed.
6. The ALL position of the missile jettison selector knob is eliminated on F-4D aircraft 66-8750 and up, and all others after T.O. 1F-4-890.
7. On F-4D aircraft blocks 31 thru 33.
8. The safety function of the aft gear handle switch, the forward gear handle switch and the left main gear scissors switch is overridden if the armament safety override switch is depressed. Jettison of stores from the centerline station while on takeoff roll can result in damage to the aircraft.
9. ECM pods on stations 4 and 6 are not jettisonable.
10. F-4C aircraft, and F-4D aircraft blocks 24 thru 30.

F4C D-312

Figure 3-12

JETTISONING CHART F-4E



WARNING

THE AIM-4D AND AIM-9 MISSILES ARE FIRED UNARMED AND UNGUIDED WHEN JETTISONED.

CAUTION

Whenever the necessity arises for jettison from stations 2 and 8 with the gear down, the possibility exists for gear damage due to store-gear collision.

* WEIGHT MUST BE OFF GEAR

	STORES	STATION	GEAR HANDLE POSITION FRONT ⟨7	GEAR HANDLE POSITION REAR ⟨7	METHOD	NOTES
	ALL EXCEPT SPECIAL WEAPON and RMU-8/A	1 thru 9	UP or DOWN*	IN	External Stores Emergency Release Button – *PUSH*	1, 8, 2
TANKS	OUTBOARD WING	1 and 9	UP or DOWN	IN or OUT	Wing Station Jettison Switch – *JETT*	5
TANKS	℄	5	UP or DOWN*	IN	Center Station Jettison Switch – *JETT*	
GUIDED MISSILE or WEAPON	ALL	2, 3, 4, 6, 7, 8	UP or DOWN*	IN	Missile Jettison Selector Knob – *ALL* Missile Jettison Selector Knob – *PUSH*	4, 1, 6, 3
GUIDED MISSILE or WEAPON	INDIVIDUAL MISSILE STATIONS	2, 3, 4, 6, 7, 8	UP or DOWN*	IN	Missile Jettison Selector Knob – *APPROPRIATE STATION* Missile Jettison Selector Knob – *PUSH*	4, 1, 3
GUIDED MISSILE or WEAPON	OUTBOARD WING	1 and 9	UP or DOWN	IN or OUT	Wing Station Jettison Switch – *JETT*	5
MULTI-WEAPONS	OUTBOARD WING	1 and 9	UP or DOWN	IN or OUT	Wing Station Jettison Switch – *JETT*	1, 5
MULTI-WEAPONS AND ECM PODS	INBOARD WING	2 and 8	UP or DOWN*	IN	Missiles Jettison Selector Knob – *LEFT WING* Missile Jettison Selector Knob – *PUSH* Missile Jettison Selector Knob – *RIGHT WING* Missile Jettison Selector Knob – *PUSH*	1
MULTI-WEAPONS AND ECM PODS	℄	5	UP or DOWN*	IN	Center Station Jettison Switch – *JETT*	
ECM PODS	RT OUTBOARD WING	9	UP or DOWN*	IN	ECM Jettison Switch – JETT	1
SPECIAL WEAPON	Refer to Aircrew Bomb Delivery Manual T.O. 1F-4C-25-2					

1. To jettison stores from stations 1, 2, 8, and 9, except for tanks and missiles other than the AGM-12C, AGM-12E or MK1 MOD 0, it is required that inflight lockout pins be installed in the armament pylons. Installation of the inflight lockout pins is indicated by illumination of the LO, LI, and RI "unlocked" lights on the DCU-94/A control panel with the LO, LI, and RI station select switches in the aft positions and power on the aircraft. The RO "unlocked" light is not connected and installation of the inflight lockout pin cannot therefore be determined from the cockpit. To jettison from stations 1, 2, and 8 without inflight lockout pins installed, the master release lock switch and the desired station selection switch(es) must be in the forward position and the nuclear consent switch placed to REL before proceeding with nuclear jettison procedures. To jettison from stations 1, 2, and 8 without inflight lockout pins installed, the master release lock switch and the desired station selection switch(es) must be placed in their forward positions before proceeding with normal jettison procedures. After placing the master release lock and station selection switch(es) to the forward position(s), the selected "unlocked" lights will be illuminated. Station 9 jettison cannot be performed without an inflight lockout pin installed.
2. AIM-4 missiles will not jettison from stations 2 and 8 and AIM-7 missiles on aircraft 66-325 of block 32 and up will not jettison from fuselage stations using external stores emergency release button. On aircraft 69-7261 and up, and all others after T.O. 1F-4E-511, AIM-9 missiles will not jettison from stations 2 and 8 using external stores emergency release button.
3. Gear and flaps must be up to jettison AIM-4D missiles from stations 2 and 8. On aircraft 69-7261 and up, and all others after T.O. 1F-4E-511, the flaps must be up to jettison AIM-9 missiles from stations 2 and 8.
4. Missiles mounted on forward fuselage stations 4 and 6 cannot be jettisoned if 600-gallon tank or MER is carried on centerline station 5.

WARNING

5. Wing station jettison switch is "hot" at all times with external or generator power on the aircraft, or with a master switch on or with the ground refueling switch out of the off position to connect battery power to the essential dc bus.
6. The ALL position of the missile jettison selector knob is eliminated on aircraft 66-325 and up, and all others after T.O. 1F-4-890.
7. The safety function of the aft gear handle switch, the forward gear handle switch and the left main gear scissors switch is overridden if the armament safety override switch is depressed. Jettison of stores from the centerline station while on takeoff roll can result in damage to the aircraft.
8. ECM pods on stations 4 and 6 are not jettisonable.

F4E-312

Figure 3-13

SINGLE ENGINE LANDING

The pattern should be expanded to avoid steep turns. If a single-engine landing is to be made:

1. Reduce the airplane gross weight to minimum practicable.
2. Inlet ramp on good engine - CHECK FULLY RETRACTED.
   If inlet ramp is in the extended position, the AB must be utilized to make a safe approach.
3. All nonessential electrical equipment - OFF
4. (F-4C/D) Ram air turbine - EXTEND.
5. Expand pattern to avoid steep turns.
6. Gear - DOWN
7. Flaps - 1/2

WARNING

Single-engine approaches utilizing full flaps must be avoided. The added drag and further reduction of thrust with opening of trailing edge BLC valves will place the aircraft in an environment where level flight cannot be maintained with military thrust on one engine. If full flaps must be used to make a single engine landing, the afterburner will have to be utilized to make the approach.

8. Final - 2 to 3 miles, 2-1/2 - 3 GLIDE SLOPE
9. Fly 17 units AOA on final.

WARNING

If the generator or utility system on the operating engine fails, the wing flaps will retract to a low drag trail position.

Note

If the left engine is shut down, and the bus tie is open, afterburner ignition is not available. However, if afterburner thrust is required, afterburner light-offs are generally obtainable through turbine torching by jam accelerating the right engine at 90% rpm or above.

SINGLE ENGINE GO-AROUND

At the first indication that a go-around may be necessary, advance the throttle of operating engine to Maximum thrust. Continue the approach until sufficient airspeed to level off is attained. Begin a shallow angle climb and retract the landing gear and wing flaps to minimize drag.

SPLIT-FLAP CONDITION

An unusual roll occurring when the flaps are extended may be due to a split flap condition. When a split flap condition occurs or is suspected:

1. Immediately accelerate to above 200 knots.
2. Retract flaps while maintaining positive aircraft control with ailerons and rudder.
3. Follow instructions for a No-Flap Landing.

NO-FLAP LANDING

The pattern is expanded to avoid steep turns. The downwind leg, base leg, and final approach speeds are increased 22 knots to provide adequate lateral control.

When making a no-flap landing:

1. Gear - DOWN
2. Flaps - UP
3. Final 2 to 3 miles, 2-1/2° - 3° GLIDE SLOPE
4. Maintain on-speed AOA (normal approach speed plus approximately 22 knots).

LANDING WITH VARIABLE INLET RAMP FAILURE

If both engines are operating, full-flap landings can be safely made with the inlet ramp fully extended. Reduce gross weight to below 33,000 pounds prior to landing. Normal thrust settings must be increased 1% to 2% rpm to maintain an on-speed approach. Safe go-around can be performed with military thrust at gross weights up 33,000 pounds. At higher gross weights, afterburner may be required for a late go-around.

Both ramps extended-

1. Gear - DOWN
2. Flaps - 1/2
3. Final - 2 to 3 miles, 2-1/2° - 3 GLIDE SLOPE
4. Fly 17 units AOA on final.

LANDING WITH EXHAUST NOZZLE FAILURE

If both exhaust nozzles fail open, the thrust available above 80% rpm is approximately equal to the thrust available during single-engine operation.

1. Reduce the airplane gross weight to minimum practicable.
2. Gear - DOWN
3. Flaps - 1/2
4. Final - 2 to 3 miles, 2-1/2 - 3 GLIDE SLOPE
5. Fly 17 units AOA on final.

LANDING WITH BOTH ENGINES INOPERATIVE

Landing with both engines inoperative will not be attempted unless escape from the aircraft is impossible. See figure 3-14.

LANDING WITH A BLOWN TIRE

The situation may occur when a landing with a blown tire must be made, or a tire may rupture during the landing ground roll. A blown tire and high speed require immediate corrective action to keep the aircraft aligned with the runway, therefore:

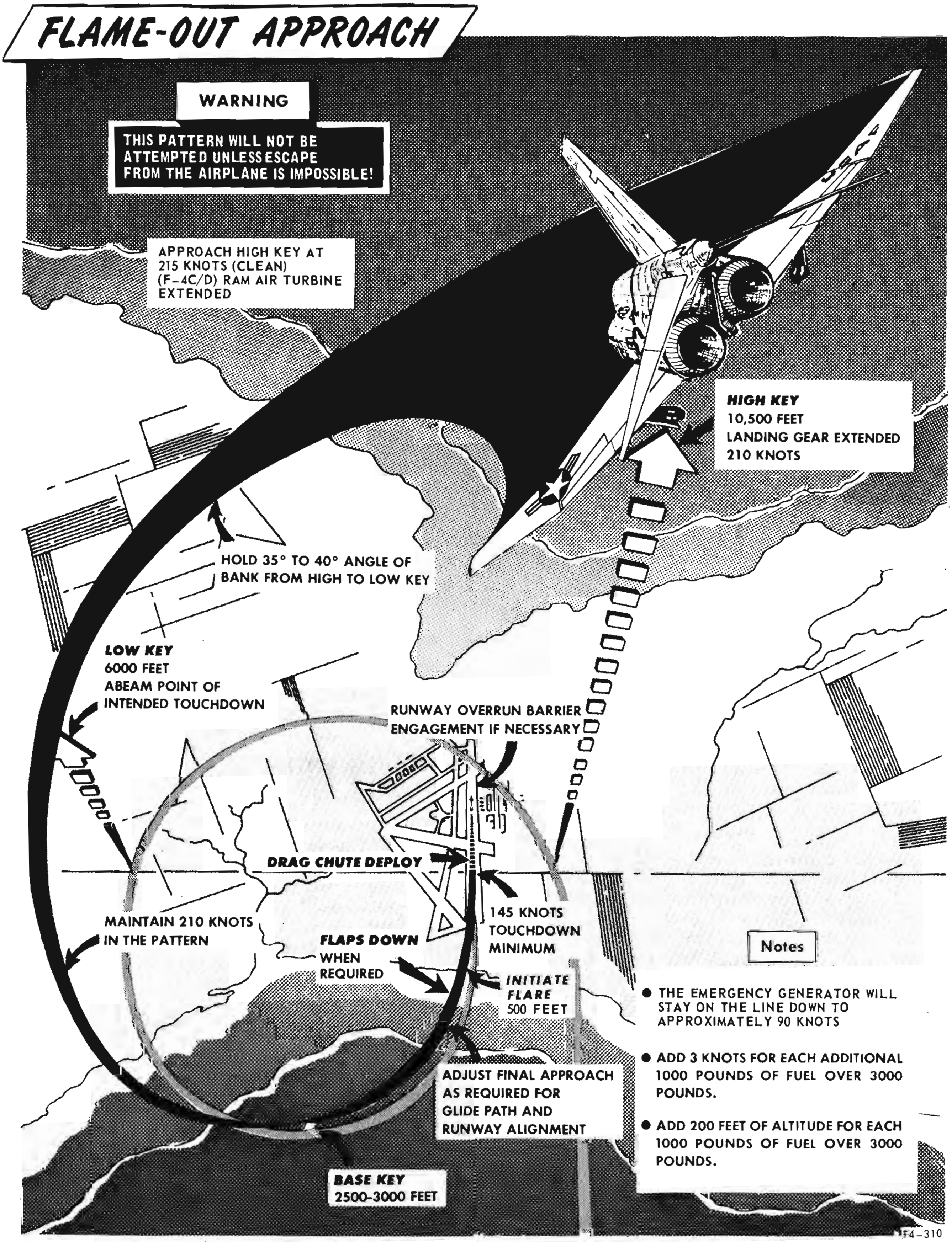

FLAME-OUT APPROACH
WARNING
THIS PATTERN WILL NOT BE ATTEMPTED UNLESS ESCAPE FROM THE AIRPLANE IS IMPOSSIBLE!
APPROACH HIGH KEY AT 215 KNOTS (CLEAN) (F-4C/D) RAM AIR TURBINE EXTENDED
HIGH KEY
10,500 FEET
LANDING GEAR EXTENDED
210 KNOTS
HOLD 35° TO 40° ANGLE OF BANK FROM HIGH TO LOW KEY
LOW KEY
6000 FEET
ABEAM POINT OF INTENDED TOUCHDOWN
RUNWAY OVERRUN BARRIER ENGAGEMENT IF NECESSARY
DRAG CHUTE DEPLOY
145 KNOTS TOUCHDOWN MINIMUM
MAINTAIN 210 KNOTS IN THE PATTERN
FLAPS DOWN WHEN REQUIRED
INITIATE FLARE 500 FEET
ADJUST FINAL APPROACH AS REQUIRED FOR GLIDE PATH AND RUNWAY ALIGNMENT
BASE KEY
2500-3000 FEET
Notes
● THE EMERGENCY GENERATOR WILL STAY ON THE LINE DOWN TO APPROXIMATELY 90 KNOTS
● ADD 3 KNOTS FOR EACH ADDITIONAL 1000 POUNDS OF FUEL OVER 3000 POUNDS.
● ADD 200 FEET OF ALTITUDE FOR EACH 1000 POUNDS OF FUEL OVER 3000 POUNDS.
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Figure 3-14

LANDING WITH A KNOWN BLOWN TIRE

1. Anti-skid switch - OFF
   Turn the anti-skid switch OFF to prevent loss of braking on the good tire resulting from skid indications from the blown tire.
2. Plan to make an approach-end engagement.
   Refer to Approach-End Engagement Procedure, this section.

If an approach-end engagement is not feasible-

3. Fly a normal on-speed approach.
4. Land a side of runway opposite blown tire.
5. Touchdown with weight on good tire.
6. Use nose gear steering to maintain directional control.
   If nose gear steering is inoperative, use of differential thrust and/or aerodynamic steering should be considered.
7. Drag chute - DEPLOY
8. Use light opposite braking to slow aircraft.

CAUTION

Avoid braking on the wheel with the blown tire. Heavy braking could cause a flat spot on the wheel which could prevent further wheel rotation and make aircraft control more difficult.

9. Do not retract flaps.
   The wing flap seals may have been damaged by pieces of broken tire and retracting the wing flaps will increase the damage.
10. If fire equipment is available, throttles - OFF
    If possible, do not shut down engines until adequate fire fighting equipment is available.

WARNING

The damaged wheel may either be on fire or very hot, and fuel drained overboard during engine shutdown could contact the hot wheel and cause a fire.

BLOWN TIRE DURING LANDING ROLLOUT

1. **NOSE GEAR STEERING – ENGAGE**
2. **ANTI-SKID – OFF**
3. **HOOK – DOWN (if arresting gear available)**

CAUTION

Avoid braking on the wheel with the blown tire. Heavy braking could cause a flat spot on the wheel which could prevent further wheel rotation and make aircraft control more difficult.

4. Use light opposite braking to slow aircraft.
5. Do not retract flaps.
   The wing flap seals may have been damaged by pieces of broken tire and retracting the wing flaps will increase the damage.
6. If fire equipment is available, throttles - OFF
   If possible, do not shut down engines until adequate fire fighting equipment is available.

WARNING

The damaged wheel may either be on fire or very hot, and fuel drained overboard during engine shutdown could contact the hot wheel and cause a fire.

LANDING FROM THE REAR COCKPIT WITH AIRCRAFT COMMANDER DISABLED

A landing made from the rear seat when the front seat occupant is incapacitated presents a number of problems. The problem areas are: flap and gear lowering, directional control, braking and engine shutdown. The landing gear and flaps can be lowered by the emergency method (blown down) from the aft cockpit. Assuming normal utility pressure, there is a possibility of rupturing the utility hydraulic reservoir when the gear and flaps are blown down. However, tests have shown that the probability of the reservoir rupturing when the gear is lowered is fairly remote. These same tests have shown the probability of the reservoir rupturing when the flaps are lowered is almost certain. Therefore, it would be advisable to land with flaps up, if practicable. With the gear blown down and normal utility pressure available, the brakes will be locked on aircraft before T.O. 1F-4-701 until the scissor switch is compressed. This will more than likely result in blown main gear tires, however, normal braking and nose wheel steering will still be available. If the flaps are blown down, the resultant rupture of the utility hydraulic reservoir necessitates a landing be made without nose wheel steering or normal brakes. Another problem is engine auto-acceleration because there is no way of shutting down an engine from the rear seat. This presents the problem of stopping an aircraft with an auto-accelerating engine.

CAUTION

Because of the limited number of brake applications, taxiing should not be attempted when using the emergency brakes.

Additional items not available to the rear seat occupant are, utility hydraulic pressure indicator (loss of speed brakes and power rudder indicates utility failure), arresting hook, and drag chute.

BOUNDARY LAYER CONTROL FAILURE

A boundary layer control (BLC) failure affects the handling characteristics and approach speeds of the aircraft. The BLC failure, however, usually will not affect the complete BLC system, but rather one portion of the system only, i.e.:

a. Trailing edge BLC inoperative on one side.
b. Leading edge BLC inoperative on one side.
c. Leading and trailing edge BLC inoperative on same side.

The BLC failure will probably occur prior to, or in the transistion to flaps down during a landing approach, with the result being an asymmetric BLC condition. The asymmetric BLC condition has been found to be controllable even with both leading edge and trailing edge BLC inoperative on the same side.

1. Fly on speed AOA (or normal approach plus 15 knots)

LANDING WITH UTILITY HYDRAULIC SYSTEM FAILURE

CAUTION

When landing with a utility hydraulic system failure, nose gear steering and anti-skid protection will not be available, and auto acceleration will probably occur.

Note

If the CHECK HYD GAGES indicator light illuminates and remains illuminated, monitor the hydraulic system gages for the remainder of the flight, since warning of a PC hydraulic system failure will not be given.

1. Lower landing gear pneumatically.
   Refer to Landing Gear Emergency Lowering, this section.
2. Extend flaps pneumatically.
   Refer to Wing Flaps Emergency Lowering, this section.
3. Anti-skid - OFF.
4. Fly 17 units AOA on final.
   The increase in speed at 17 units AOA will help preclude directional control difficulties in the event that subsequent failures degrade available lateral control.
5. Make an approach end engagement, if possible.
   Refer to Approach End Engagement, this section.
6. Utilize emergency braking.
   Refer to Wheel Brake Emergency Operation, this section.
7. Anticipate auto acceleration.
   Refer to Aux Air Door Malfunction, this section.

DIRECTIONAL CONTROL WITH UTILITY HYDRAULIC SYSTEM FAILURE

Without utility hydraulic system pressure available, differential braking, spoilers, ailerons, and asymmetric power will become the primary method of maintaining directional control. Differential braking is accomplished by utilizing emergency brake system. The brakes should be cycled as little as possible to conserve emergency accumulator pressure. Should accumulator pressure become depleted through repeated applications of the brakes, the manual rudder plus spoilers, ailerons and asymmetric power will be the only remaining source for directional control. Small deflections of the manual rudder are available at landing speeds, therefore, in cross-winds and at low roll-out speeds directional control must be provided by differential braking. Use of the drag chute in a strong cross-wind will require additional differential braking. It may be necessary to jettison the drag chute to regain directional control in a cross-wind. On wet runways, this could be a very significant factor in maintaining heading through the use of differential brakes.

LANDING WITH HARD-OVER RUDDER

The aircraft can be flown and landed with a hard-over rudder if the proper procedures are followed. Satisfactory aileron control is available up to 16 units angle of attack. Above 16 units, full lateral stick is required to maintain level flight. *If an inadvertent roll into the hard-over rudder occurs and full lateral stick will not reduce the roll rate, the angle of attack must be reduced to regain lateral control.* When a hard-over rudder occurs, angle of attack indications are in error due to aircraft sideslip. If the hard-over rudder is on the same side of the aircraft as the angle of attack probe, the indicated angle of attack is 2 units lower than actual. If the hard-over rudder is opposite to the angle of attack probe, the indicated angle of attack is 2 units higher than actual. On F-4C/D aircraft the probe is located on the left side. On F-4E aircraft the probe is located on the right side. Therefore, when flying an approach, it is imperative that an approach airspeed be used and that the angle of attack be disregarded. Inflight deployment of the drag chute considerably reduces sideslip and bank angles resulting in an easier approach and landing. However, due to the low reliability of the drag chute during inflight deployments, it is recommended that this procedure be used only if an approach-end barrier engagement is not available. Use of asymmetric thrust also reduces sideslip and bank angles and should be used if a hard-over rudder landing is made without the drag chute. If sufficient single engine thrust is available, additional asymmetric thrust effect can be obtained by extending the speed brakes. A half-flap approach and landing is used to provide better lateral control and increased go-around capability.

If approach-end arresting gear is available -

1. Flaps - 1/2
2. Fly final approach airspeed as shown in the following table.

FUEL LOAD X 1000 CORRESPONDING TO GROSS WEIGHT, NO EXTERNAL STORES				APPROACH SPEEDS 1/2 FLAPS, GEAR DOWN
C	D	E	GROSS WEIGHT POUNDS	KNOTS
0.7	0.4	–	30,000	151
1.7	1.4	.1	31,000	154
2.7	2.4	1.1	32,000	156
3.7	3.4	2.1	33,000	158
4.7	4.4	3.1	34,000	161
5.7	5.4	4.1	35,000	163
6.7	6.4	5.1	36,000	165
7.7	7.4	6.1	37,000	168
8.7	8.4	7.1	38,000	170
9.7	9.4	8.1	39,000	172
10.7	10.4	9.1	40,000	174

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3. Engine opposite hard-over rudder - IDLE
4. If sufficient single engine thrust is available - EXTEND SPEED BRAKES
5. Make an approach end engagement.
   Refer to Approach End Engagement procedure, this section.
6. Drag chute - DEPLOY AT TOUCHDOWN
   Deploy drag chute immediately upon touchdown to assist in directional control while approaching the arresting gear.

If approach-end arresting gear is not available -

1. Flaps - 1/2
2. Maintain 15 knots above the airspeed shown in the preceding table.
3. Deploy drag chute on final approach 1-1/2 miles from touchdown.
4. Fly final approach airspeed as shown in the preceding table. Approximately 90% rpm will be required.
5. Land on side of runway opposite the hard-over rudder.
6. Use nose gear steering (only if rudder pedals are neutral) and light braking on the wheel opposite the hard-over rudder to maintain directional control.

LANDING GEAR UNSAFE INDICATION

An unsafe landing gear does not necessarily constitute an emergency. The unsafe indication could be caused by a malfunction within the indicating system. Cross-check all landing gear indications (landing gear handle, landing gear handle warning light, landing gear position indicators) and the utility system hydraulic pressure. If possible, obtain a visual gear check. If gear indicates unsafe:

1. Airspeed below 250 knots.
2. Landing gear - RECYCLE
   If the utility system hydraulic pressure is within limits, recycle the landing gear.
3. Check that the gear indicates locked.

If unsafe condition still exists -

4. Landing gear handle - UP
5. Apply negative G
6. While under negative G, place gear handle down.
   Negative G will help if unsafe gear is caused by high break-out forces.
7. Landing gear circuit breaker - PULL & RESET

If landing gear is still unsafe -

8. Use landing gear emergency lowering procedure.

LANDING GEAR EMERGENCY LOWERING

CAUTION

If the landing gear is inadvertently extended in flight by emergency pneumatic pressure, they must be left in the extended position until post-flight servicing. If retraction in flight is attempted, rupture of the utility reservoir will probably occur with subsequent loss of the utility hydraulic system.

If normal landing gear operation fails, the landing gear can be lowered by the following procedures:

1. Airspeed - 250 KNOTS
2. Landing gear circuit breaker - PULL
3. Landing gear handle - DOWN
4. Landing gear handle - HOLD FULL AFT

WARNING

Hold handle in full aft position until gear indicates down and locked, and then leave the landing gear handle in the full aft position. Returning the handle to its normal position allows the compressed air from the gear down side of the actuating cylinder to be vented overboard.

Note

It is possible to actuate the landing gear emergency system by pulling the landing gear control handle aft while the handle is in any position from UP through DOWN. If the handle cannot be pulled aft while in the down position, slowly raise the handle while continuing to pull aft. Once the handle moves aft, hold the handle in the full aft position until the landing gear indicates down and locked; then continue to hold back pressure on the handle and return it to the full down position.

LANDING GEAR MALFUNCTIONS-EMERGENCY LANDINGS

Before attempting a landing utilizing a listed procedure, consider:

a. The location and type of arresting gear to be used.
b. Crosswind conditions.
c. Runway and/or overrun conditions.
d. If considerations are not favorable eject.

	FINAL CONFIGURATION	ARRESTED LANDING NOTES	NON-ARRESTED LANDING NOTES
APPROACH END ENGAGEMENT RECOMMENDED	ALL GEAR UP	2, 3, 4, 5, 9, 11	2, 3, 4, 5, 9, 11
	ONE MAIN GEAR UP NOSE GEAR DOWN	1, 11 or 2, 4, 7, 9	1, 11 or 2, 3, 4, 5, 8, 9, 10
	ONE OR BOTH STUB MAIN GEAR NOSE GEAR DOWN	1, 11 or 2, 3, 4, 7, 8, 9	1, 11 or 2, 3, 4, 5, 8, 9, 10
	BOTH MAIN GEAR UP NOSE GEAR DOWN	2, 3, 4, 5, 9	2, 3, 4, 5, 9, 10
APPROACH END ENGAGEMENT NOT RECOMMENDED	NOSE GEAR UP MAIN GEAR DOWN		2, 3, 4, 6, 9, 10, 11
	STUB NOSE GEAR MAIN GEAR DOWN		1, 2, 3, 6, 9, 10, 11
	ONE MAIN GEAR UP NOSE GEAR UP		1, if unable, recommend eject.

WARNING

An arrested landing should not be attempted with nose gear up and main gear extended as severe aircraft damage and possible crew injury may result.

Notes

1. If landing gear can be actuated, retract all gear and refer to ALL GEAR UP.
2. Retain wing drop tanks, if empty. Airplane damage will be minimized.
3. Jettison centerline drop tank.
4. Foam runway if practicable (Foam runway beyond arrest gear for arrested landing)
5. Deploy drag chute at touchdown, crosswind permitting.
6. Delay drag chute deployment until after nose is lowered to runway.
7. Do not deploy drag chute except for missed engagement when go-around is not anticipated.
8. Land off center opposite the failed gear.
9. Utilize 1/2 flaps, fly computed on speed plus 10 knots with a flat approach.
10. Keep engine operating in order to retain nose gear steering and/or power boost brakes.
11. Angle of attack will indicate 3 to 4 units low with nose gear door up.

- Multiple emergencies, adverse weather and/or other peculiar conditions may require modification to these procedures.
- An arrested landing with a stub gear extended may sever the arrest cable with the stub.
- Jettison armament, with consideration given to retaining armament racks.
- Dump or burn fuel load down.
- Depressurize wing drop tanks by pulling air refuel receptacle circuit breaker and placing air refuel switch to EXTEND.

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Figure 3-15

WARNING

- If the landing gear emergency lowering system is activated from the rear cockpit without pulling the landing gear circuit breaker or without placing the landing gear handle in the front cockpit in the DOWN position, anti-rotation brake pressure will be applied to both wheel brakes until the main landing gear struts have fully compressed during landing. It is estimated that the wheels will skid for approximately 5 feet before the struts will compress and relieve brake pressure. Therefore, a possibility does exist that one or both main gear tires may be blown on landing due to locked brakes at touchdown. On F-4C/D aircraft after T.O. 1F-4-701, and on F-4E aircraft the landing gear up hydraulic lines are modified so that the wheel brakes will not be locked when the emergency landing gear system is actuated from the rear cockpit.

- With the exception of the external wing tanks, all normal jettison circuits in the aircraft are disabled once the emergency landing gear control handle in the rear cockpit is pulled. However, jettison may still be accomplished by utilizing the armament safety override button.

If landing gear is still unsafe-

5. Retain front cockpit handle in extend position and pull rear cockpit emergency gear lowering handle.
6. Yaw airplane to assist in locking main gear.
7. Bounce airplane on main gear to assist lowering/locking the nose gear.
   Due to increased stabilator effectiveness, a no-flap touch and go is recommended.
8. If one main gear is still unsafe and the utility system pressure is within limits, refer to Landing Gear Emergency Retraction this section.
9. If gear is still unsafe and the utility system pressure is not within limits, refer to Landing Gear Malfunctions-Emergency Landings chart, figure 3-15.

LANDING GEAR EMERGENCY RETRACTION

If gear retraction is desired after an attempted Landing Gear Emergency Lowering, and the utility system pressure is within limits, retract the gear using the following procedures:

1. Return the emergency gear handle(s) to the normal position.

Note

The aft cockpit spring-loaded locking plunger must be pushed UP before the rear handle can be reset.

2. Wait a minimum of 1 minute.
3. Landing gear handle - UP
4. Landing gear circuit breaker - RESET

CAUTION

The landing gear circuit breaker must not be reset until the emergency handle(s) is/are returned to normal, maintained in that position for a minimum of 1 minute, and the landing gear handle placed UP. Only then may the circuit breaker be safely reset.

5. After gear is retracted, refer to Landing Gear Malfunctions-Emergency Landings chart, figure 3-15.

WING FLAPS EMERGENCY LOWERING

CAUTION

The emergency flap system should be activated only in the event of utility system failure. If the emergency system is activated with normal utility hydraulic pressure available there is a high probability of losing utility hydraulic system pressure. With utility system pressure available and a known or suspected flap malfunction, a no-flap landing is recommended.

If normal flap operation fails, the flaps can be lowered pneumatically by executing the following steps:

1. Airspeed - BELOW 250 KNOTS

Note

Air loads will prevent trailing edge flaps from fully extending to the 1/2 down stop until after airspeed has decreased to approximately 220 knots. During this period trailing edge flaps will indicate barber pole and asymmetric air loads (roll, yaw, gust, etc.) may produce corresponding asymmetric flap position transients.

2. Flap circuit breaker - PULL
3. Wing flap emergency extension handle - PULL AFT

Note

- If front cockpit emergency flap lowering fails, retain front cockpit handle in aft position and utilize rear cockpit emergency flap handle.

- Asymmetric flap extension may occur when the flaps are extended by the emergency method. This will result in a momentary roll which can be countered by normal application of aircraft controls.

4. Wing flap position indicators - CHECK

Flap extension by the emergency method will place the leading edge flaps in the full down position and the trailing edge flaps in the 1/2 position. In this configuration, trailing edge BLC will not be available. Refer to Half Flap Landing, Section II.

Note

Leave the emergency wing flap extension handle in the full aft position. Returning the handle to its normal position allows the compressed air from the flap down side of the actuating cylinder to be vented overboard.

AUXILIARY AIR DOOR MALFUNCTION (GEAR DOWN)

If the auxiliary air doors fail to open when the landing gear is lowered, there is a possibility that the engines may automatically accelerate up to 100% rpm. A utility hydraulic system failure or double generator failure will render the variable bypass bellmouth and auxiliary air doors inoperative. Operation of an engine with an open variable bypass bellmouth and closed auxiliary air door will allow engine compartment secondary air to recirculate to the engine compressor inlet. During low altitude or ground operation, the temperature of the recirculating air may be high enough to initiate T_2 reset through normal detection by the compressor inlet temperature sensor. As T_2 reset occurs, it increases the engine idle speed to maintain proper airflow and thrust under high temperature conditions, and cause the idle speed to increase to 100% rpm. The auto-accelerated engine can be shut down, if on the ground, by placing the throttle to OFF. If a false reset occurs while airborne, a near normal landing can be made by modulating the exhaust nozzles of the affected engine(s).

AUTO-ACCELERATION OF ONE ENGINE

1. Throttle of bad engine - IDLE
2. Fly an on-speed approach.
   Modulate throttle of good engine for desired thrust. The combined thrust of the auto-accelerated engine in idle, and the good engine in idle, will not be in excess of that required to make an optimum on-speed approach.
3. At touchdown, bad engine - SHUTDOWN

AUTO-ACCELERATION OF BOTH ENGINES

1. Throttle of either engine - IDLE
2. Modulate the throttle of the remaining engine for desired thrust.
3. Continue approach at slightly increased airspeed.
4. At touchdown, left engine - SHUTDOWN

ARRESTING HOOK EMERGENCY OPERATION

If the arresting hook fails to extend when the control handle is placed in the down position, deenergize the solenoid selector valve by pulling the arresting hook circuit breaker in the rear cockpit. Pressure is then removed from the up side of the arresting hook actuator cylinder and the hook will extend. There are no provisions for arresting hook retraction in the event of a utility hydraulic failure or double generator failure.

1. Arresting hook and wing fold control circuit breaker - PULL (A4 No. 3 panel)

APPROACH-END ENGAGEMENT

Approach end arrestments are considered practicable whenever a malfunction presents a threat to directional control and there is suitable landing surface in front of the arrestment cable on which to land and lower the nose prior to cable contact. Consideration should also be given to the engaging speed limits to prevent structural failure to the arresting gear or the aircraft. See Field Arresting Gear Data, (figure 3-18).

1. Notify tower.
2. Reduce gross weight to lowest practicable.
3. Fly pattern as dictated by emergency.
4. Arresting hook - DOWN
5. Inertia reel - LOCKED
6. Fly final approach to touchdown 300-500 feet short of barrier.
7. Throttles - IDLE
8. Stick - FORWARD
9. Engage cable with brakes off.

CAUTION

The arrestment cable may be damaged by the wheel rims of aircraft with blown tires. In instances where wheels are locked, the damage to the cable is more severe and cable failure is probable.

Note

- The throttles may be inadvertently advanced should deceleration forces cause the aircraft commander's hand to be thrown forward on the throttles.
- The arrestment cable will pull the aircraft rearward after engagement. Be prepared to counteract any excessive rearward acceleration with normal or emergency brakes.
- Use of the drag chute during approach-end engagements should be considered only in light of existing environmental factors such as arrestment cable location, runway condition, crosswind, nature of emergency, and probability of go-around. When drag chute is utilized the pilot must be prepared to jettison the drag chute should a go-around be required.

OVERRUN-END ENGAGEMENT

1. Hook - DOWN
2. Utilize nose gear steering and/or brakes to engage barrier at a 90° angle.

CAUTION

The arrestment cable may be damaged by the wheel rims of aircraft with blown tires. In instances where wheels are locked, the damage to the cable is more severe and cable failure is probable.

Note

If rudder control, nose gear steering, and brakes are lost, steering can be accomplished only by differential thrust.

DITCHING CHART

WARNING

THE AIRCRAFT SHOULD BE DITCHED ONLY WHEN ALL OTHER ATTEMPTS OF EGRESS HAVE FAILED.

BEFORE IMPACT

1. Canopy – JETTISON (fwd first) (AC–P)
2. Arresting hook – DOWN
3. Leg restraint release handle – PULL AFT (AC–P)

   Pull leg restraint lines and lock pins thru garter rings before ditching to expedite egress from cockpit.
4. Oxygen mask – TIGHTEN (AC–P)
5. Oxygen diluter selector – 100% (AC–P)
6. Shoulder harness – LOCK (AC–P)
7. Fly parallel to swell pattern
8. Attempt touchdown along wave crest

AFTER IMPACT

1. Release parachute riser–shoulder harness release fittings (AC–P)

WARNING

Do not pull the survival kit release handle until clear of the aircraft. Pulling the handle with the kit resting on the seat will cause the kit to be left in the aircraft. Pulling the handle while standing up in the cockpit will cause the kit to open and remain in the cockpit, and the crewmember will remain attached to the kit by the dropline.

WARNING

- If the lower ejection handle guard is down, rotate the guard up prior to evacuating the cockpit.

2. Pull up on the emergency harness handle and using a hand–hold for additional leverage stand straight up without twisting to release sticker clips from the seat. After T.O. 1F–4–808, place the survival kit selector switch to MANUAL before standing up. (AC–P)

WARNING

When the diluter lever is set at 100% OXYGEN, the regulator is a suitable underwater breathing device and may be used for temporary underwater survival in the event there is a delay in escaping from the cockpit. The emergency oxygen can also be utilized for temporary underwater survival by pulling the actuation knob or ring. Before T.O. 1F–4–808, the bailout bottle will be automatically actuated when the crewmember stands up. After T.O. 1F–4–808, there is no emergency oxygen available once the crewmember separates from the seat.

3. Abandon aircraft (AC–P)
4. Inflate life vest (AC–P)

WARNING

To prevent the lungs from bursting due to differential pressure, the crewmember must exhale while ascending to the surface from substantial depths.

5. Inflate life raft (AC–P).

Note

To inflate the raft the survival kit release handle must be pulled, then the CO_2 bottle cable in the kit must be pulled.

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Figure 3-16

AIRSPEED INDICATOR FAILURE

FLIGHT CONDITION	ANGLE-OF-ATTACK UNITS
MILITARY POWER CLIMB	
Drag Index = 0	Sea level 5.5
	combat ceiling . . 7.6
Drag Index = 120	Sea level 7.6
	combat ceiling . . 8.5
MAXIMUM POWER CLIMB	
All Drag Indexes	Sea level 4.0
	combat ceiling . . 9.2
CRUISE AT ALTITUDES BELOW 20,000 FT. (all gross weights)	
Drag Index = 0	5.8
Drag Index = 130	8.0
CRUISE AT OPTIMUM ALTITUDE	
Drag Index = 0	6.9
Drag Index = 130	8.0
ENDURANCE AT OPTIMUM ALTITUDE	
Drag Index = 0	7.9
Drag Index = 130	9.3
DESCENTS (low to medium gross weight)	
250 KNOTS, idle power	8.5
300 KNOTS, 80% rpm.	6.5
GEAR AND FLAPS EXTENSION	
Safe Gear Extension (with flaps up)	9.0
Safe Flap Extension (with gear down)	13.0
STALL	
Stall Warning (pedal shaker)	22.3
APPROACH	
GCA Pattern (200 KNOTS, gear up, half flaps).	11.0
Final "On Speed" approach (gear down, all engine/flap configurations)	19.2

Notes

- Due to the basic inaccuracy of setting up flight conditions (other than landing approach) by reference to the angle of attack indicator, the information included in this table should be used only in an emergency situation.
- The ranges shown for angle of attack versus drag index, while not entirely linear, may be interpolated linerally for practical purposes.

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Figure 3-17

FIELD ARRESTMENT GEAR DATA

AIRCRAFT WEIGHT–POUNDS	BAK–6	BAK–9	BAK–12 1" PENDANT	BAK–12 1 1/4" PENDANT	BAK–13	M–21
	MAXIMUM ENGAGEMENT SPEED – KNOTS					
30,000	160	188	190	190	160	
32,000	160	186	190	190	160	
34,000	160	184	190	190	160	
36,000	158	182	190	190	160	150
38,000	156	180	190	190	160	145
40,000	154	177	190	190	160	
42,000	153	173	190	190	160	
44,000	152	169	189	190	160	
46,000	150	165	187	190	160	
48,000	148	161	183	190	160	
50,000	146	158	177	189	160	
52,000	145	155	172	185	160	
54,000		151	169	181	160	135
56,000		147	165	177	160	
58,000		143	162	173	160	
60,000		139	159	170	160	

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Figure 3-18

SECTION IV AUXILIARY EQUIPMENT

TABLE OF CONTENTS

AIR CONDITIONING AND PRESSURIZATION SYSTEM

Air conditioning in the aircraft is divided into two major systems, one for the cockpit areas and one for electronic equipment cooling. The cockpit and the pressure suits for both crewmembers are pressurized and supplied with conditioned air from the cockpit air conditioning system. The same air that pressurizes and heats the cockpit is used to keep the windshield free of fog, frost, and rain and in F-4E aircraft, to purge the gun gasses from the breech of the M61A1 nose gun. The equipment air conditioning system provides cooling air for the main radar package and communication-navigation-identification equipment. Both systems utilize high temperature, high pressure, 17th stage engine compressor bleed air from either or both engines.

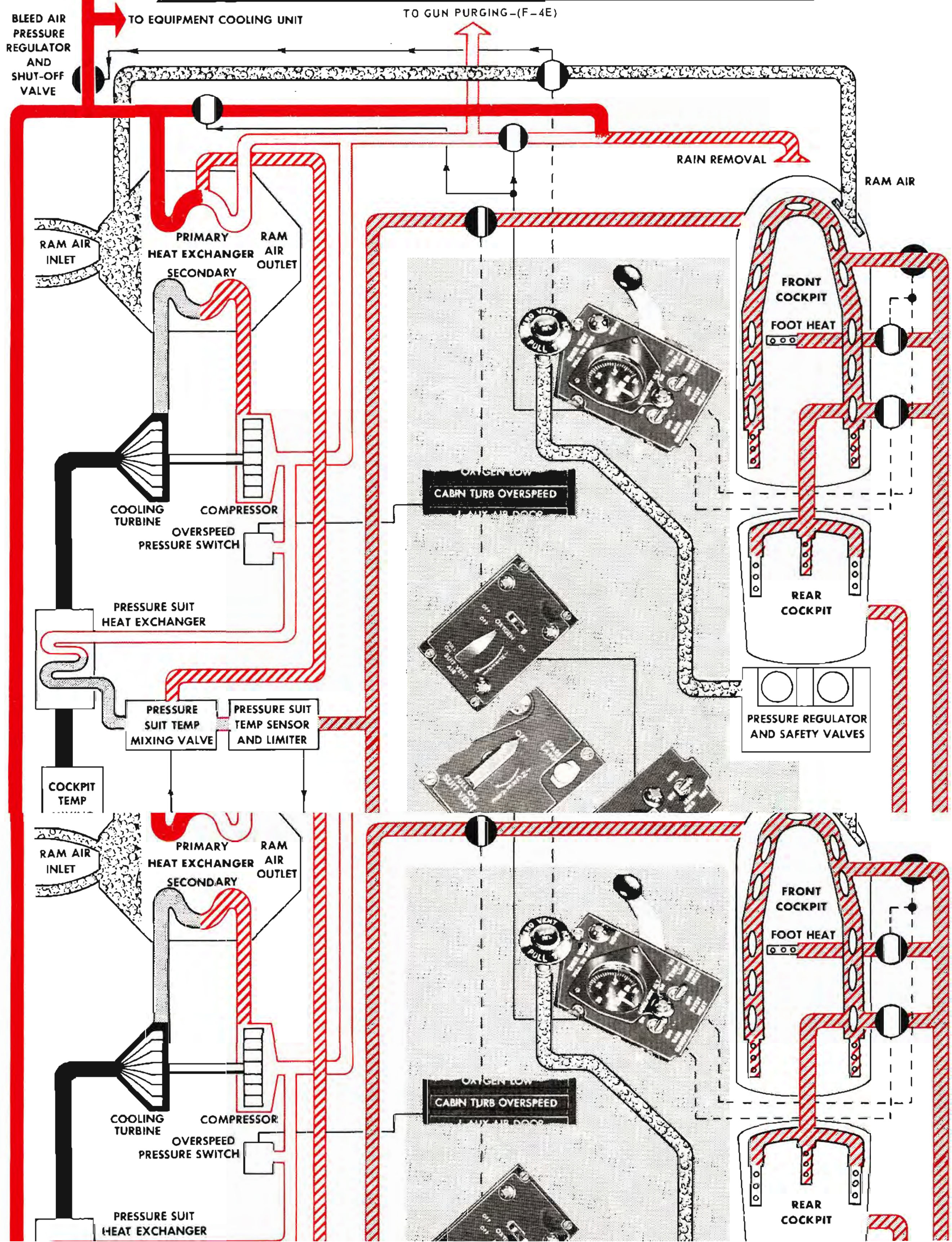
AIR CONDITIONING

The cockpit/pressure suit air conditioning system (figure 4-1) consists of two air-to-air heat exchangers, an expansion turbine, pressure regulator and shutoff valve, mixing valves, and a temperature control which allow a selection of cockpit conditioning temperatures, pressure suit temperatures, defogging, rain removal and ram air operations. Individual temperature ranges and control systems for the pressure suits and cockpit are provided. High temperature, high pressure, engine compressor bleed air passes through the primary and secondary heat exchanger and is expanded (cooled) through the cooling turbine. After being mixed with hot compressor bleed air (as required by the temperature selection) it enters the cockpit through several manifolds,one near the front cockpit rudder pedals, one near the rear cockpit rudder pedals, one along the lower surface of each windshield side panel and one at the base of the flat optical panel of the windshield. Two eyeball type air nozzles are just below the canopy sill on the right and left side of the rear cockpit.

COCKPIT/PRESSURE SUIT AIR CONDITIONING

The cockpit air conditioning system operation can best be explained by referring to the cockpit pressure suit temperature schedule (figure 4-2). The low temperature range, refers to the curve labeled foot heat, produces temperatures from -29°C to 38°C. These temperatures refer to the inlet air and not cockpit temperature; therefore, cockpit temperature is determined by a combination of inlet air and environmental conditions. The low temperature curve is the governing schedule for all air entering the cockpit while in automatic temperature control with the defog-foot heat lever in the LOW range. A little air is always entering through the defog port and this air increases (while foot heat air decreases) as the lever is moved forward. But until a switch is made, both defog and foot heat air enter on the low temperature schedule. The switchover to the high temperature curve occurs at approximately 75% of forward lever travel. This allows the AC to use a greater portion of air for windshield defog while on the low temperature schedule, and afford the flight crew a greater degree of comfort. Thus full range on the auto rheostat (from 7 o'clock to 5 o'clock positions) will only produce -29°C to 38°C air unless the defog-foot heat lever is moved into the HI range. When the switch is made, the temperature schedule of all entering air switches to the high temperature curve. Thus, if 250° were knob position (about 3:00 o'clock), 31°C would be the temperature of incoming air in the low temperature range, but when the switch is made, the temperature would change to 58°C. As the defog-foot heat lever is moved forward through full travel, the foot heat butterfly valves for both front and rear cockpits are closing as the defog valve opens. Thus the defog air volume increases on a rather steep slope, and when the lever

COCKPIT AIR-CONDITIONING AND PRESSURIZATION SYSTEM



is closed to full defog position (full forward), the temperature of the air entering the cockpit is quite warm.

Note

- The detection of a low pitched howl in many cases indicates icing in the pressure suit heat exchanger. This organ piping effect can be eliminated by increasing the cabin air temperature.

- If a situation develops where the pilot is comfortable or cold and the AC is too hot, it is possible that suit vent air flow in the lines is blocked by ice. This condition can be prevented by disconnecting the suit and switching the temperature control knob to full hot for approximately 10 seconds to dry out water which might be in the lines.

Manual Override-Cockpit Temperature Mixing Valve

If the automatic temperature control system malfunctions, the manual position of the temperature control auto-manual switch can be used to select a full range of temperatures up to 110°C. The HI/LOW switch on the defog-foot heat lever is bypassed. Thus the entire temperature range for both foot heat and defog air is scheduled directly by the mixing valve position, which in turn is moved only when the temperature control switch is held to either HOT or COLD. The switch is spring-loaded to OFF and in the OFF position the mixing valve is held stationary.

Note

Should a failure in the automatic system warrant a manual override selection, ensure the switch is moved ONLY in the direction of the desired temperature change. Movement in the opposite direction could worsen the situation and cause extreme aircrew discomfort. Extremely hot conditions can be alleviated by pulling the Emergency Vent Knob (below 25,000 feet), lowering the flaps, (below 220 knots), pull the cockpit heat and vent circuit breaker or as a last resort, jettisoning the rear cockpit conopy.

Cockpit Fogging

It is possible, through selection of cold temperature settings, particularly on humid days, for the air conditioning system to deliver air at temperatures well below the dew-point, with resultant cockpit fogging. This fog can be rapidly dissipated by selecting a slightly warmer temperature. When operating in high humidity conditions, it is recommended that a warmer than normal temperature be selected prior to starting the takeoff run, to preclude the possibility of cockpit fogging as thrust is increased.

Pressure Suit Operation

When the pressure suit mixing valve becomes active (vent air turned on), both pressure suit and cockpit air schedules are followed while in automatic temperature control; that is, with the defog-foot heat lever in the LOW range, vent air will be provided to the pressure suit at its schedule, while simultaneously foot heat and defog air will enter on the LOW temperature schedule. Moving the defog lever in the HI range again switches foot heat and defog air to the high temperature schedule, but the pressure suit schedule remains unchanged.

Manual Override-Pressure Suit Temperature Mixing Valve

Manual override operation complicates the picture a bit when the pressure suit is involved, in that only the pressure suit mixing valve is actuated when the override switch is moved to HOT or COLD. The cockpit air mixing valve remains in its last automatic selected position. The relative volumes of defog and foot heat air can be changed by defog-foot heat lever action, but the temperature is fixed when manual override is selected. This characteristic can cause an undesirable situation if the automatic temperature control becomes inoperative during the cruise portion of a flight. Cockpit air temperature normally will not be at a high setting with the pressure suit on so when manual override is selected the cockpit air mixing valve remains at a fixed, moderate temperature position. Therefore, when higher temperature defog air is desired for letdown, it is not available since manual override only controls suit vent air. However, when the suit vent air lever is turned off the suit mixing valve becomes stationary at the cold position and the cockpit mixing valve again is operative. Since suit vent air would not be absolutely necessary during letdown into fog producing altitudes, this method to control cockpit air temperatures is reasonable. However, it must be remembered when operating in manual override, the suit vent air must be off, if manual control of cockpit temperatures is desired. Suit vent air can be turned on again after increasing defog air temperature. It also must be remembered that the pilot has no control over pressure suit air temperature. He can control flow, but must accept the AC's selected temperature. Therefore, if the AC turns vent air off, driving the mixing valve to cold, the pilot will be receiving full cold air, unless he elects to turn it off.

CAUTION

The manual override should be used only if an automatic temperature control system malfunction occurs. To increase the temperature in this mode, the manual control switch should be held toward the HOT position for no more than one-half second at a time between pauses of at least three seconds until the desired temperature is reached. Actuating the switch for more extended periods does not allow the temperature limiter adequate time to function, and may result in an overheat condition. Detection of smoke to the cockpit after use of manual control is evidence of improper use of the switch and requires the selection of a colder valve position to avoid overheating of the cockpit distribution ducting.

COCKPIT/PRESSURE SUIT TEMPERATURE SCHEDULE

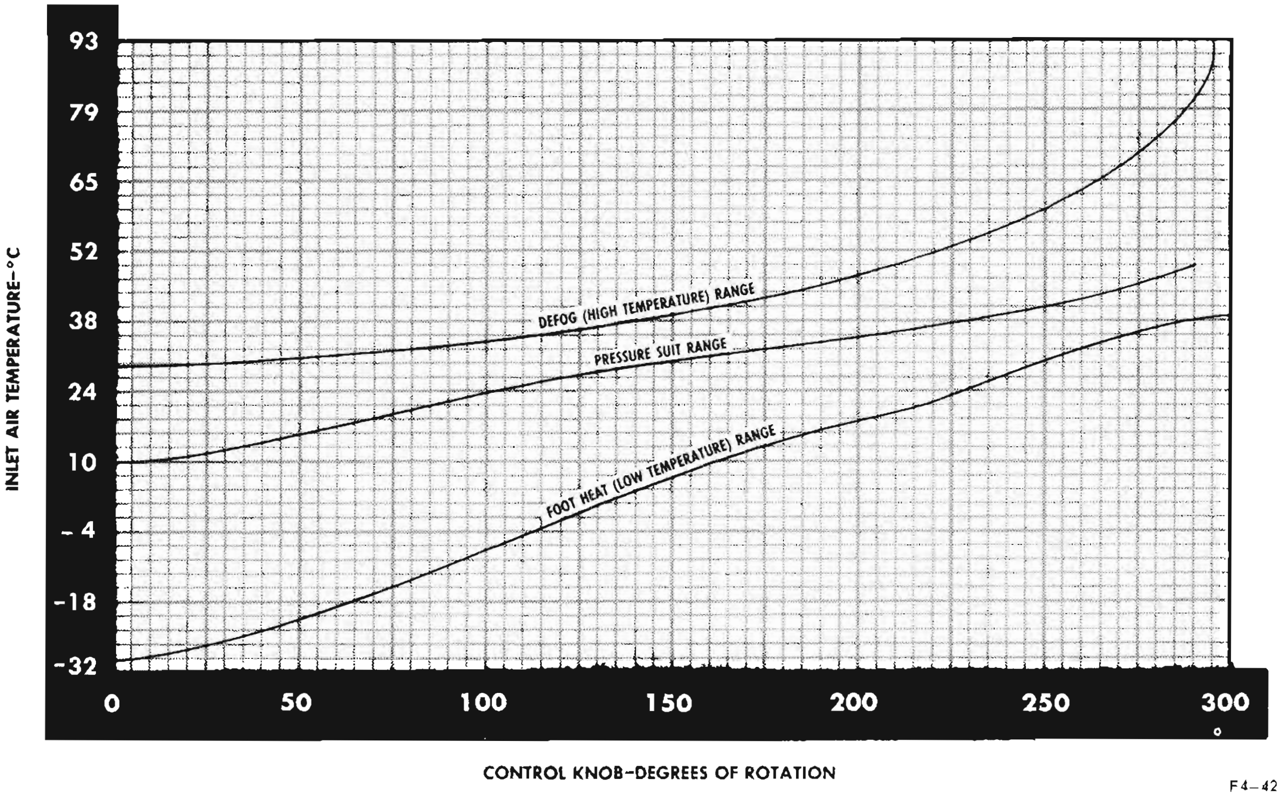


Figure 4-2

Note

- Prolonged use of the full hot MANUAL position could result in excessive cockpit heat, and/or circuit breaker popping during the takeoff phase, since airflow and temperature with the switch in the MANUAL position is directly proportional to engine rpm. The MANUAL COLD position can be utilized in conjunction with the defog lever to direct cooler air, than that obtained in the AUTO position, through the defog ducts.

- If cockpit and pressure suit temperature becomes too high at low altitudes, and cannot be lowered, dump the cockpit pressure, open the face visor, take off the gloves, and unzip the pressure suit to afford some degree of comfort.

COCKPIT PRESSURIZATION

With the canopy closed and the engine and cockpit refrigeration system in operation, the cockpit automatically becomes pressurized at an altitude of 8000 feet and above. (figure 4-3). The pressure in the cockpit is maintained by a cockpit pressure regulator (on the floor of the rear cockpit), which controls the outflow of air from the cockpit. Below 8000 feet, the regulator relieves cockpit air at a rate to keep the cockpit unpressurized. From 8000 feet up to approximately 23, 100 feet, the regulator maintains a cockpit altitude of 8000 feet. From 23, 100 feet and up, the regulator maintains a pressure differential of 5 psi between the cockpit altitude and airplane altitude and thus, at an airplane altitude of 50, 000 feet the cockpit altitude is approximately 19, 000 feet. Operation of the pressure regulator is completely automatic. The cockpit safety (and dump) valve prevents the cockpit pressure differential from exceeding positive or negative differential pressure limits in case of a malfunction of the cockpit pressure regulator; and to provide an emergency means of dumping the cockpit air. The dump feature of the safety valve is pneumatically connected to a dump feature on the cockpit pressure regulator. Both valves, which are operated pneumatically from a single control, have sufficient capacity to permit the cockpit differential pressure to be reduced from 5.5 psi to 0.05 within 5 seconds or less.

COCKPIT PRESSURE SCHEDULE

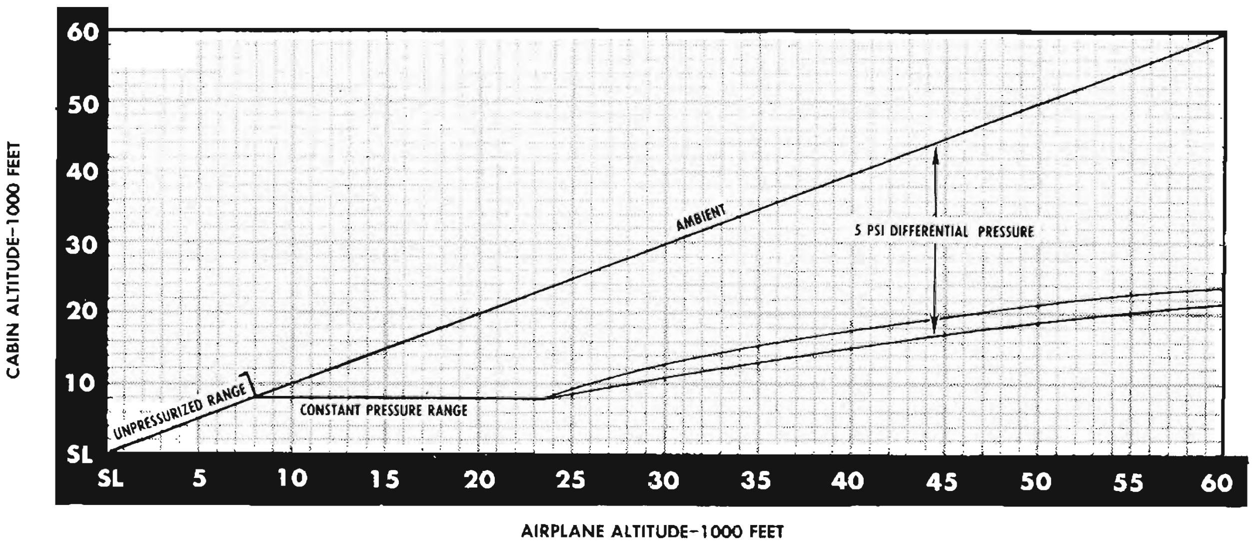


Figure 4-3

Cockpit Pressure Altimeters

The pressure altitude of the cockpit is indicated on a pressure altimeter. The front cockpit altimeter is on the right console. The rear cockpit altimeter is in a panel on the left console. The cockpit altimeters are vented directly to cockpit pressure.

Cockpit Turbine Overspeed Indicator Light

The cockpit turbine overspeed indicator light is on the telelight panel front cockpit. The light illuminates when the cooling turbine in the refrigeration unit is being subjected to pressures and temperatures in excess of normal operation. If possible, the aircraft speed and engine thrust should be reduced until the light goes out. If the light fails to go out, select ram air by pulling UP on the emergency vent knob. This diverts ram air into the cockpit and at the same time, shuts off bleed air to the air conditioning system, thereby stopping the cooling turbine.

WINDSHIELD DEFOGGING

Fogging of the windshield is prevented by heating the inside surface of the glass with incoming cockpit air that is diverted into the defogging manifolds, located along the lower surfaces of the side and center windshield panels. The defog-foot heat lever provides selection of windshield defogging. The lever proportions the cockpit airflow between the footheat defusers and windshield defogging tubes, such that, in the FOOT-HEAT position approximately 90% of the total cockpit airflow is delivered to the cockpit air distribution manifolds, and 10% through the windshield defog manifold. At the DEFOG position approximately 20% of the total airflow is delivered through the footheat manifolds, and 80% through the windshield defog manifold. Actuation of the high range temperature schedule is achieved only after the lever travel has moved approximately 75% (F-4C through 63-7597) or 50% (all F-4D/E and F-4C 63-7598 and up) of forward lever travel. The pilot should attempt to anticipate fogging conditions, so that, through proper management of temperature and airflow, it will not become necessary to subject the windshield and the crew to high temperatures and defog airflows which are required to clear an already fogged windshield.

Windshield Rain Removal

The rain removal system utilizes partially cooled air, taken from the cockpit air conditioning system, as its air/heat source. This air is 17th stage engine compressor bleed air which is bled off the cockpit air conditioning system after it passes through the air to air heat exchanger. Placing the rain removal switch to ON causes the rain removal valve to open, and allows the air to flow across the windshield center panel. The action of the rain removal air on the rain droplets breaks them up into small particles and pushes them off the windshield. Since the system uses bleed air, it will be most effective with the flaps up and the boundary layer control system inoperative. The rain removal system is adequate when flying through light rain, but is marginal when operating in moderate to heavy precipitation, particularly with the flaps down (BLC operating). The WINDSHIELD TEMP HI indicator light on the telelight illuminates if the windshield approaches a temperature which will cause optical distortion. The system must be turned OFF immediately upon illumination of the WINDSHIELD TEMP HI light. The temperature sensing control unit utilizes a bridge network to sense the high temperature condition. It is possible for the bridge to be improperly calibrated, in which case the indicator light may illuminate during high Mach flight with the rain removal switch in the OFF position. In this case the light may be disregarded. Use of the rain removal system during takeoff should be limited to those cases where visibility, due to precipitation, is a problem. The system should not be operated with a dry windshield except during ground checks.

CAUTION

- To prevent possible heat damage to the windshield, turn the rain removal system ON only when operation of the system is essential to safety.
- Do not operate the rain removal system after takeoff under maximum power/supersonic conditions.

CAUTION

For a static ground check the system is limited to operation with leading edge flaps in full down position and engines running at or below 88 percent.

Note

If the windshield rain removal system cannot be shutdown, pull up on the cockpit emergency vent knob. Engine bleed air will be shut off prior to entering the rain removal ducts.

EMERGENCY VENT KNOB

The cockpit may be cleared of smoke or fumes, and/or the cockpit air conditioning system may be shut down by pulling up on the emergency vent knob. When the emergency vent knob is pulled, all air to the cockpit and pressure suit, rain removal, and nose gun compartment (F-4E only) is shut off; the cockpit pressure regulator dump valve is opened; and the ram air shutoff valve is opened.

CAUTION

The emergency vent knob or the cockpit heat and vent circuit breaker on circuit breaker panel No. 3 (zone 8c) are the only means of shutting down the cockpit air conditioning system when the engines are operating.

COCKPIT HEATING PROCEDURE

1. Temperature control switch - AUTO
2. Temperature control knob - AS DESIRED
   Adjust the temperature control knob for any desired cockpit temperature.
3. Defog-foot heat control lever - AS DESIRED
   Adjust the defog-foot heat control lever for personal comfort and effective windshield defogging.

Note

If the automatic temperature control system fails, a temporary adjustment may be obtained by bumping the temperature control switch to the HOT or COLD position.

WINDSHIELD DEFOGGING PROCEDURE

1. Temperature control switch - AUTO
2. Defog-foot heat control lever - DEFOG
   During cruise operations, prior to letdown, place the defog-foot heat lever into the DEFOG position to preheat windshield and canopy surfaces.
3. Temperature control knob - 2 O'CLOCK
   During cruise operations, prior to letdown, place the temperature control knob in the 2 o'clock position (200 degrees of clockwise rotation) to increase the defog temperature for windshield and canopy preheating.

Note

If the flaps are lowered for letdown and fogging persists, retract the flaps or increase power (use speed brakes as necessary to maintain airspeed) to provide higher defogging air flow.

PRESSURE SUIT PRESSURIZATION

The pressure suit pressurization system delivers up to 10 cfm of air, per suit, at any temperature selected. This air is provided at a pressure of approximately 3 psi above cockpit pressure to insure proper flow of ventilating air through the suit. For operation when the cockpit altitude exceeds 35,000 feet, the air is provided at a pressure of approximately 6.5 psi. If ram air is selected for the cockpit, thereby shutting off the flow of conditioned air, the flow of air from the air conditioning system to the pressure suit will also be stopped. If ram air is selected above 35,000 feet and the flow of conditioned air to the suit is stopped, suit pressurization is automatically and instantly provided by the aircraft oxygen system.

WARNING

Do not turn the pressure suit vent air to the FULL ON position when the boundary layer control system is operating. Once the flaps are raised, as on takeoff, the increased volume of engine bleed air to the air conditioning and pressurization system can cause the pressure suit to balloon. If the pressure suit controller should then malfunction, the increased suit pressure could become high enough to cause immobilization.

EQUIPMENT AIR CONDITIONING SYSTEM

The equipment air conditioning system, on the left side of the forward fuselage, supplies cooled air for electronic equipment cooling. The electronic equipment cooled by this system is in the radar compartment in the nose and in the electronic equipment compartment aft of the nosewheel well. In addition, cooling is provided for an electronic equipment shelf behind the rear cockpit bulkhead in the F-4D/E. The air conditioning system also supplies partially cooled air to the equipment auxiliary air system. The heart of the equipment air conditioning system is the turbine section, where a cooling turbine and a compressor are placed at opposite ends of a common shaft. High pressure, high temperature, 17th stage engine compressor bleed air is directed to the periphery of the cooling turbine after passing through an air to air heat exchanger. As the bleed air passes from the periphery to the center of the cooling turbine, it causes the shaft to rotate. The air also undergoes rapid expansion with a resulting temperature and pressure drop. This air is then directed through ducts to the equipment requiring cooling. Ram air enters the airplane at the forward left fuselage air scoop and splits into two parts. One part is directed through the compressor and the other through the air to air heat exchanger where it acts as a cooling media and thence to the ram air exit duct. The compressor serves as a balancing load for the cooling turbine. The compressor exhaust is discharged through an ejector assembly, which ejects the high pressure air into the ram air exit, thus inducing air through the heat exchanger during periods of low ram pressure.

Controls and Indicators

Control of the system is entirely automatic. The temperature is controlled at approximately 29°C from the sea level to 25,000 feet and 4°C from 25,000 feet up. Overtemperature conditions are sensed in the cooling duct and, should they occur, the air conditioning system will be shut down and the RADAR-CNI COOL OFF indicator lights in the front and rear cockpits, will be illuminated and emergency ram air cooling will be provided. Reset buttons, one for each cockpit serve to reset the temperature limiter and to restart the air conditioning system. If the indicator light should illuminate, reduce airspeed below the speed at which the light illuminated, wait at least 15 seconds and then depress the Reset Button. If the light remains illuminated, no further attempt should be made to restart the air conditioning system. Avoid operation for prolonged periods with RADAR-CNI COOL OFF light illuminated unless operational necessity dictates otherwise. If maximum allowable cooling temperatures are exceeded, equipment life and/or reliability may be adversely affected.

RADAR COMPARTMENT PRESSURIZATION

The aircraft nose radar compartment is pressurized to approximately 1.4 psi above ambient pressure to prevent electrical arcing in the equipment. The same air which is used to cool the compartment serves to pressurize it by passing through an out-flow type pressure regulator. Pressurization is initiated when the landing gear handle is raised, and relieved when the handle is lowered. Compartment pressurization will be lost if the RADAR-CNI COOL OFF light illuminates. Refer to T.O. 1F-4C-34-1-1A for Radar Emergency Operating Procedures.

EQUIPMENT AUXILIARY AIR SYSTEM

The equipment auxiliary air system utilizes partially cooled air from the equipment air conditioning system. The air is 17th stage engine compressor bleed air which is bled off the equipment air conditioning system after it has passed through the air to air heat exchanger. The partially cooled air is distributed to the anti-G suit, front and rear canopy seals, air data computer, radar wave guide, pilot's radar scope, radio receiver(s)-transmitter, fuel system pressurization and the pneumatic system air compressor.

PRESSURE SUIT

The A/P22S-2 pressure suit (figure 4-4) consists of a four layer garment, a hard shell helmet, pressure gloves, fabric boots, and leather boots. The layers incorporated aid in the diffusion and ventilation process as well as providing body pressurization in the absence of adequate cockpit pressure. The gloves and fabric boots are detachable while leather overboots may be worn as conditions dictate. The suit controller is mounted on the suit midriff right side. Ventilating air is supplied from the cockpit air conditioning system and after flowing through the suit, is expelled into the cockpit. A pressure altimeter is installed on the left thigh of the suit. The pressure suit responds to and function under several distinct conditions that might be encountered in flight:

1. In normal flight with adequate cockpit pressure, the suit is slightly pressurized (unmeasurable) due to suit resistance to air flow.
2. When the cockpit altitude exceeds 35,000 feet, the suit becomes pressurized by ventilating air.
3. If the ventilating air supply is lost, the aircraft oxygen system will pressurize the suit as well as supply breathing oxygen.
4. If the aircraft oxygen system fails, or in the event of ejection, the emergency oxygen supply will pressurize the suit as well as supply breathing oxygen.

HELMET

The helmet is equipped with a demand oxygen regulator, clear visor, spray bar for anti-fogging, tinted visor and a headset and boom microphone. The oxygen regulator is provided to control the flow of oxygen to the facial area. The regulator senses suit pressure, and will keep the oxygen to the facial area at a slightly higher pressure than that of the suit so that the suit air will not flow into the facial area. When the demand valve is opened by the negative pressure of inhalation, oxygen is emitted to the facial area. During exhalation, a positive pressure will force the exhaled gases to pass from the facial area to the pressure suit body through exhalation valves located below the chin. The face visor is sealed by means of a tube which is inflated by oxygen when the

PRESSURE SUIT

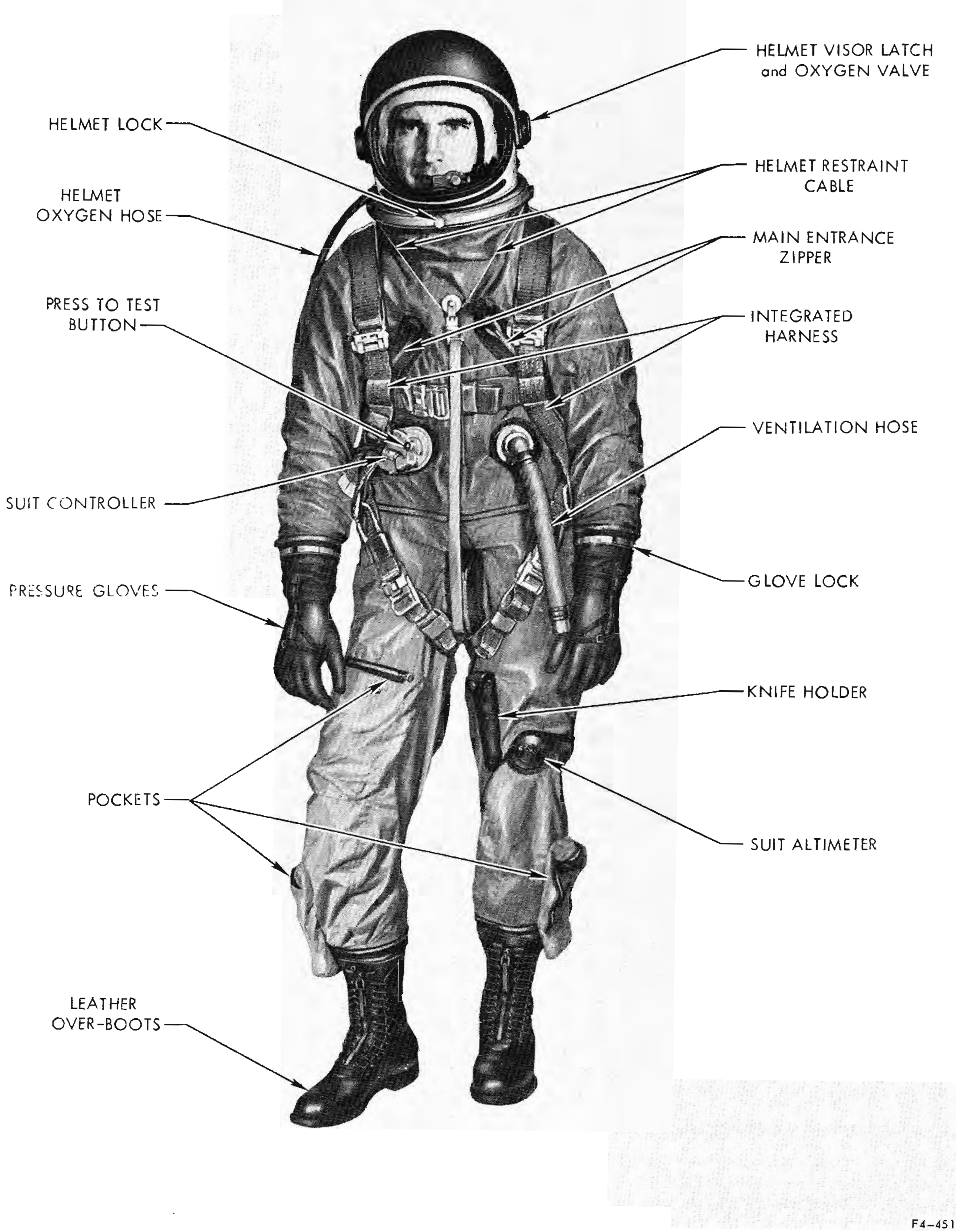


Figure 4-4

visor is closed. To raise the face visor, depress the latch on the left side of the helmet, which deflates the seal tube, and lift. The full pressure suit helmet provides equivalent crash protection to the standard helmet, however, due to its attachment to the suit coverall, it provides superior helmet retaining qualities.

SUIT CONTROLLER

The suit controller on the pressure suit exhaust port, is completely automatic and requires no adjustment or control. All exhaust air must pass through the suit controller before being expelled. Upon sensing a cockpit pressure exceeding 35,000 feet, the controller will resist exhaust flow enabling an absolute suit pressure of 35,000 feet to be maintained. The differential suit pressure is the difference between the cockpit altitude and the suit altitude of approximately 35,000 feet. If ventilation air loss occurs above a cockpit pressure of 35,000 feet, the suit is pressurized by the aircraft oxygen system. A check valve in the ventilation inlet prevents any oxygen in the suit from escaping. There is no ventilation when the suit is pressurized by oxygen. Upon ejection above 35,000 feet, the suit controller still maintains a maximum of 35,000 feet pressure altitude in the suit. However, the oxygen supply for controller operation and suit pressurization comes from the emergency oxygen supply which is triggered upon ejection.

PRESSURE SUIT CHECK (PRIOR TO TAKEOFF)

Prior to ground check, ensure all personal leads are properly connected (oxygen, radio, and suit ventilation). Lower the face visor by pulling down on the latching knob on the left side of the helmet. As the visor closes, a pneumatic seal inflates and oxygen flows into the helmet through the helmet spray bar. Press the controller mounted press-to-test button and the suit automatically inflates to 2-2.5 psi above ambient. While holding the test button down, check breathing and adjust helmet hold-down strap. Release the test button and the suit will deflate to ambient. Press the face visor latch down and hold. The pneumatic seal will deflate and unlock the visor. Raise the face visor while holding the latch in the down position. Pressure suit operation can be checked inflight by pulling the emergency vent knob between 12,000 feet and 20,000 feet. When the cockpit is depressurized, begin a climb to 40,000 feet and monitor pressure suit altitude. After checking pressure suit operation, pressurize the cockpit by pushing the emergency vent knob in.

CAUTION

Prior to making an inflight pressure suit check, turn off all radio and radar equipment. Depressurization at high altitudes will cause arcing in the electronic equipment in the cockpit.

ANTI-G SUIT SYSTEM

The anti-G system delivers low pressure equipment auxiliary air to the anti-G suits. The air is routed through the anti-G suit control valve and then to the suit. The suit remains deflated up to approximately 1.5 G. As this force is reached or exceeded, air flows into the suit in proportion to the G forces experienced. When the G force levels off to a constant, the suit remains inflated in proportion to the constant G force. As the G forces decrease, the suit begins to deflate, again in proportion to the decreasing G forces. A manual inflation button in the anti-G suit control valve allows the crewman to manually inflate his suit for purposes of checking the system or for fatigue relief. A pressure relief valve incorporated within the system is set to relieve at approximately 11 psi and is used as a safety back-up in the event of a malfunction. The system is automatic and operates any time an engine is running.

WARNING

- Do not use an anti-G suit in which the suit check valve is installed, as a malfunction of this valve could prevent the suit from deflating.
- Ensure that the anti-G suit hose is free and clear of all other cockpit equipment, so that in an emergency, quick detachment is possible.
- If the anti-G suit fails to deflate after a maneuver, detach the suit hose from the system immediately and leave it detached for the rest of the flight.

Note

After T.O. 1F-4-808, the anti-G and suit vent lines are removed from the survival kit and are relocated along the left console. This modification eliminates the pressure suit support capabilities.

RADAR ALTIMETER

The radar altimeter provides the AC with accurate height information, with respect to the terrain, from 0 to 5000 feet. Accuracy of the system is ± 5 percent of the indicated altitude or ± 2 feet, whichever is greater. Operational limits allow the system to function normally from 0° to 30° bank angle and/or from 0° to 35° pitch angle. The system consists of a transmitter/receiver, individual transmitting and receiving antennas and a height indicator. The height indicator, on the left side of the AC's instrument panel, provides read-out information for the system. In the face of the indicator is a fixed dial scale and altitude pointer, a movable reference marker and an OFF flag window. The dial scale is linear from 0 to 100 feet and logarithmic from 100 to 5000 feet. A function control switch, on the lower left side of the indicator provides complete control of the system. A red, low altitude warning light is on the lower right side of the indicator. The system obtains power from the right main 28 volt dc bus and the right main 115/200 volt ac bus.

FUNCTION CONTROL SWITCH

Clockwise rotation of the function control switch applies power to the system components. By rotating the control switch further clockwise, the reference marker may be positioned. This also sets the low altitude warning light limit. Any time the aircraft descends below the preselected altitude, the low altitude warning light illuminates. A self-test function may be initiated by pressing in on the function control switch. This supplies the indicator with an artificial return signal and the altitude pointer moves to 35 ± 15 feet. Above 5000 feet, or when unreliable signals are being received, the altitude pointer is driven counterclockwise behind a mask which is between the 0 and 5000 feet mark, and the OFF flag appears. The OFF flag also appears when power is lost or turned off; however, the altitude pointer remains at the altitude it was indicating when the power interruption occurred.

WARNING

High frequency radar waves can penetrate snow and ice fields. When operating in areas covered with snow and ice, the radar altimeter may indicate a greater terrain clearance than actually exists.

Note

With certain configurations of external stores, the radar altimeter is subject to performance degradation in a maneuvering attitude. The amount of degradation is commensurate with the size and location of the external stores, and the degree of maneuvering. However, no degradation occurs in straight and level flight.

AUTOMATIC FLIGHT CONTROL SYSTEM AN/ASA-32

The automatic flight control system is an electro-hydraulic system designed to provide stable, accurate and coordinated flight maneuvers without interfering with manual control. The automatic flight control system is capable of performing two modes of operation: stability augmentation and AFCS. Stability augmentation improves aircraft stability in pitch, roll and yaw; it opposes any changes of attitude but does not return the aircraft to a given attitude or heading. This mode may be used while the aircraft is under manual control. Stability augmentation can be engaged individually or in any combination for pitch, roll, or yaw axis. However, all three channels must be engaged before complete AFCS operation can be engaged. The AFCS mode maintains any aircraft heading and/or attitude selected within the AFCS limits and corrects for any deviation from the selected heading or attitude of the aircraft within the AFCS limits. The altitude hold mode of operation holds any altitude selected while in the AFCS mode.

STABILITY AUGMENTATION

In stability augmentation mode, the system senses motion about the horizontal, vertical and lateral axes, by means of rate gyro sensors and along the lateral axis by means of an accelerometer. All attitude, heading and bank angle changes cause these sensing devices to transmit signals representing the changing motion about their respective axes. These signals are sent to servo valves in the control surface actuators. Therefore, any output signals from the rate gyro sensors, indicating yawing, pitching, or rolling motion, or from the lateral accelerometer indicating side slip, causes the automatic flight control system to position the appropriate control surfaces to oppose that motion. This action decreases any tendency of the aircraft to oscillate in roll, yaw or pitch. In stability augmentation mode, the rate gyro sensors send signals to the surface controls to oppose any deviations from selected flight attitude but do not return the aircraft to its original heading or attitude. Stability augmentation can be obtained individually or in any combination for pitch, roll, or yaw axis by placing the pitch, roll, and yaw stab aug switches to the ENGAGE position.

AFCS MODE

In the AFCS mode, vertical gyro, directional gyro and accelerometer signals are used, in addition to the rate gyro sensor signals, to maintain the aircraft in a desired attitude with maximum pitch, roll and yaw stability. The AFCS system can be engaged and hold maneuvers and attitudes within a range of ±70° pitch, 70° in bank and 360° in azimuth, providing the G limits are not being exceeded. The AFCS components are the AFCS panel, the control amplifier, force transducer, accelerometers, and rate gyro sensors. Equipment used in connection with AFCS operation are the attitude reference and bombing computer, the air data computer, lateral series servos, directional series servo, and longitudinal servo.

CONTROL AMPLIFIER

The control amplifier comprises the control center for the entire flight control system. It receives the signals from the various sensing elements in the system and supplies power to the flight control components.

ATTITUDE REFERENCE AND BOMBING COMPUTER (AN/AJB-7)

The attitude reference and bombing computer provides the vertical and directional references for the

AFCS. The directional reference is controlled by the compass controller on the front cockpit right console. With the compass controller in the SLAVED mode, the AFCS receives magnetic heading as a directional reference. The DG mode on the compass controller provides deviations from a manually-set heading as a directional reference to the AFCS. The COMP mode is an emergency mode of the AN/AJB-7 and an interlock is opened to prevent AFCS engagement. This is done to preclude erratic magnetic heading signals from being applied to the AFCS. The AFCS is also disengaged when the mode selector on the compass controller is switched between SLAVED and DG, or when the reference system selector knob is switched between PRIM and STBY. However, the AFCS can be re-engaged after either of the controls has been switched to its new position.

AIR DATA COMPUTER

The air data computer performs two functions for the AFCS. First, it provides all required gain changes, (necessary to maintain constant maneuvering rates regardless of changes in airspeed and altitude). Second, it contains a clutched synchro which supplies the AFCS with a signal proportional to the deviation from the barometric altitude which existed when the altitude switch was placed in the engaged position. This signal is used by the AFCS to move the stabilator as necessary to maintain constant barometric altitude.

FORCE TRANSDUCER

The force transducer senses the physical force applied to the control stick. This unit actually comprises the visible portion of the control stick with the stick grip mounted on top of it. The force transducer contains pressure sensitive switches which react to longitudinal and lateral stick forces. A lateral stick force of approximately 1.5 pounds closes a force switch. When a roll force switch closes the roll rate gyro signal in stab aug and the roll rate and attitude gyro signals in AFCS mode are cut out so that AC initiated maneuvers are not opposed while in the AFCS mode. The AC maneuvers the aircraft by mechanical linkages until the lateral stick force is reduced to less than approximately 1.5 pounds. At this time the roll channel is returned to normal AFCS operation. A forward stick force of 3.75 ± 0.25 pounds or an aft stick force of 2.55 ± 0.25 pounds closes switches to operate certain AFCS components, and cause a force sensing device to send a signal, proportional to the applied stick force, to the servo amplifier and stabilator position is controlled through the AFCS. If the pitch or roll limits of the AFCS are exceeded (± 70°), the AFCS in effect, is disengaged, although the AFCS switch remains ENGAGED. Therefore, when the aircraft returns to within the limits of the AFCS, the AFCS is again engaged.

Note

Since there is no stick transducer in the rear cockpit, pilot initiated maneuvers from that position with AFCS engaged results in undesirable transient operations, therefore do not attempt to fly the aircraft from the rear cockpit.

ACCELEROMETERS

During AFCS mode, two accelerometers are utilized to insure proper functioning of the AFCS system. One of the accelerometers, a G limiting type prevents excess G loads from occurring as a result of AFCS operation. The other accelerometer is a lateral accelerometer which is used to perform coordinated maneuvers while in AFCS or stab aug operation.

G-LIMIT ACCELEROMETER. The normal load factor interlock (G-disengage) feature of the AFCS inhibits the system from commanding excessive load factor on the aircraft. The system reverts automatically from whatever mode is engaged to stability augmentation if plus 4 or minus 1 G is sensed by the G-disengage accelerometer switch. This switch is mounted forward on the radar bulkhead so that if the aircraft is rotated rapidly into a maneuver, disengagement occurs at lower values than normal load factor due to the anticipation resulting from the forward location sensing a component of pitching acceleration. The G disengage feature is inoperative outside the ± 70 limits of the autopilot.

WARNING

The G switch does not disengage the autopilot under conditions of slow airspeed or heavy gross weight before the aircraft stalls. If the autopilot remains engaged during a stall, the autopilot provides pro-spin controls.

LATERAL ACCELEROMETER. This accelerometer detects aircraft skids or slips and produces error signals proportional to the lateral forces developed. These error signals cause the AFCS to take corrective action with the rudder to coordinate the maneuver being performed.

SERVOS

The automatic flight control system contains four control servos which operate the aircraft flight controls during stability augmentation and AFCS operation. Two lateral series servos (one in each wing) operate the spoilers and ailerons. A directional series servo, on the rudder power control cylinder, operates the rudder. A longitudinal servo, integral with the stabilator power cylinder, functions in series to operate the stabilator during stab aug operation. This same servo functions in parallel to operate the stabilator during AFCS operation.

Note

With AFCS engaged (parallel mode), if a malfunction occurs this mode can be overpowered by exerting sufficient force on the control stick. The AFCS is then disengaged by depressing the emergency quick release lever.

RATE GYRO SENSORS

Refer to Stability Augmentation Mode, previously discussed in this section.

AFCS CONTROLS

The automatic flight control system panel is on the front cockpit left console. This panel contains all the controls for the normal operation of the flight control system.

Stab Switches

The three stab aug switches for pitch, roll and yaw are two-position toggle switches on the AFCS panel. Placing any one of these switches in the ENGAGE position establishes the stability augmentation mode for the axis selected. These switches can be engaged individually or in any combination for stability augmentation in pitch, roll, or yaw. The switches are lever lock type switches and the toggle must be lifted slightly before the switch position can be changed.

AFCS Switch

The AFCS switch can become energized only if the pitch stab aug switch is engaged. However, for the AFCS mode to be fully effective, holding attitude and heading selected, all three stab aug switches must be energized.

Altitude Hold Switch

The altitude hold switch is a two-position toggle switch on the AFCS panel. The altitude hold feature functions only if AFCS is engaged. Placing the switch to the ENGAGE position energizes an altitude sensor in the air data computer which is controlled by barometric altitude. As the altitude varies an error signal is produced and fed to the pitch servo amplifier. The amplifier then sends a signal to the stabilator actuator, which deflects the stabilator as necessary to return the aircraft to its hold altitude. The altitude sensor holds the aircraft within ± 50 feet or ± 0.3 percent of the reference altitude at speeds up to 0.9 Mach and at speeds greater than 1.0 Mach. Altimeter fluctuations while accelerating through the transonic range (0.9 to 1.0 Mach) produce transient fluctuations which, although not violent, may cause the reference altitude to slip. Engaging the altitude hold mode in climbs greater than 1000 feet per minute, may result in a reference altitude other than the engage altitude.

Heading Hold Cutout

When operating in the AFCS mode, the established heading is maintained within the 5° bank angle reference. If it is desired to hold bank angles of less than ± 5° or to make small heading corrections involving bank maneuvers of less than ± 5°, it is necessary to depress and then release the nose gear steering button. This actuates the heading hold cutout option, and deactivates the heading hold function of the AFCS. The cutout option remains engaged until the nose gear steering button is again depressed or the AFCS is disengaged.

Emergency Quick Release Lever (AFCS)

A spring-loaded emergency quick release lever is on each control stick. This lever operates in the same manner from both the front and the rear cockpits. Depressing the lever causes the AFCS and altitude hold switch to return to OFF. The stability augmentation mode, ARI and anti-skid, are disengaged as long as the lever is held depressed. When the lever is released, the stability augmentation and ARI are again in operation, but the AFCS is no longer engaged. To permanently disengage the stability augmentation mode, the pitch, roll, and yaw stab aug switches must be placed off. To permanently disengage the ARI and anti-skid, the yaw stab aug switch must be off and the ARI circuit breaker, on the front cockpit left subpanel, must be pulled. An alternate method of permanently disengaging the ARI, which allows the anti-skid system to remain operative, is to place the yaw stab aug switch to the off position and pull the rudder trim circuit breaker.

Auto Pilot Disengage Indicator Light

An AUTO PILOT DISENGAGE indicator light is on the telelight panel. After initial engagement of the AFCS mode, the AUTO PILOT DISENGAGE indicator light and the MASTER CAUTION light illuminates when the AFCS is disengaged. Both lights are extinguished by pressing the master caution reset switch. The lights remain extinguished until the AFCS is again engaged and disengaged.

Note

In F-4C/D aircraft and F-4E aircraft before T.O. 1F-4-903, if PC-1 hydraulic pressure is lost or drops below 500 psi, the pitch axis in stab aug and AFCS is inoperative. In F-4E aircraft after T.O. 1F-4-903, the stabilator auxiliary power unit, if not rejected, supplies hydraulic power to the AFCS and pitch augmentation systems. If utility hydraulic pressure is lost or drops below 500 psi, the roll axis and yaw axis in stab aug and AFC are inoperative. In either case, the AUTO PILOT DISENGAGE light and the PITCH AUG OFF light do not illuminate. The CHECK HYD GAGES light and the MASTER CAUTION light illuminate at approximately 1500 psi.

Pitch Aug Off Indicator Light

The PITCH AUG OFF indicator light is on the telelight panel. The PITCH AUG OFF and MASTER CAUTION lights illuminate when power is on the airplane and the pitch stab aug switch is not engaged. Depressing the master caution reset button extinguishes the MASTER CAUTION light; however, the PITCH AUG OFF light remains illuminated until the pitch stab aug is engaged.

AUTO PILOT PITCH TRIM

An automatic pitch trim feature is included in the AFCS which attempts to keep the aircraft longitudinally trimmed to the flight conditions experienced while in AFCS mode. Thus, an out-of-trim condition which would not be sensed while in autopilot mode, is prevented, insuring against an excessive pitch transient when disengaging the autopilot. The automatic pitch trim operates at approximately 40% the speed of the normal trim system, resulting in a slight delay after changing flight conditions before the basic aircraft is properly trimmed. During control stick steering maneuvering, the auto trim is inoperative. Auto-trim operation can be observed on the pitch trim indicator after changing flight conditions in the AFCS mode.

Auto Pilot Pitch Trim Indicator Light

An AUTO PILOT PITCH TRIM indicator light is on the telelight panel. This light illuminates during AFCS operation if the automatic pitch trim followup is inoperative or lagging sufficiently behind aircraft maneuvering to cause an out-of-trim condition in basic aircraft. It is possible to develop an out-of-trim condition in basic aircraft while maneuvering in the AFCS mode since auto pitch trim is only 40% of normal trim rate and is inoperative when the stick grip transducer switches are made (i.e., during CSS maneuvering). However, this out-of-trim condition must exist for approximately 10 seconds before the AUTO PILOT PITCH TRIM indicator light illuminates, thus eliminating constant on-off light flickering. Momentary illumination of the light does not necessarily indicate a malfunction; however, if the light remains on and it is apparent from the pitch trim indication that the trim is not working, the AC should realize that a pitch transient may be experienced when the AFCS mode is disengaged. Airspeed/pitch trim indicator relationship should provide an indication of the severity of the condition. If an out-of-trim condition is realized by the steady illumination of the AUTO PILOT PITCH TRIM indicator light, the AC should grasp the stick firmly before disengaging the AFCS mode in anticipation of a pitch bump. However, before disengaging the AFCS following an automatic pitch trim malfunction, the AC may elect to alleviate the out-of-trim condition by operating the manual trim button and observing the pitch trim indicator. If the out-of-trim condition is thus reduced to within five pounds of stick force from neutral trim, the AUTO PILOT PITCH TRIM indicator light is extinguished. Illumination of AUTO PILOT PITCH TRIM indicator light also illuminates the MASTER CAUTION light. Depressing the master caution reset button only extinguishes the MASTER CAUTION light leaving the AUTO PILOT PITCH TRIM indicator light illuminated.

NORMAL OPERATION

1. To engage the stability augmentation mode, place the pitch, roll, and yaw stab aug switches to ENGAGE.

Note

The stability augmentation mode can be selected individually or in any combination for pitch, roll, and yaw axis. The pitch stab aug switch must be engaged before the AFCS switch can become energized. However, all three switches must be engaged for complete AFCS operation.

2. Trim aircraft in the stability augmentation mode before engaging AFCS mode.
3. To engage AFCS mode, establish an aircraft attitude within AFCS limits. Place the AFCS switch to ENGAGE.

WARNING

- When selecting the AFCS mode, have hand on control stick to counteract any abrupt control movements in the event of an AFCS malfunction.
- Do not have the AFCS engaged when the AN/AJB-7 bombing mode is being used. Transients introduced into the attitude input of the AFCS at pull-up can cause pitch and/or roll oscillations.
- Do not attempt to change pitch attitude of the aircraft from the rear cockpit in the AFCS mode. Since no force transducer is in the rear cockpit control stick, applying force causes pitch trim to run up and down depending on pressure applied. If the AC attempts to take control at that point, violent transients may be encountered.

Note

- Do not operate manual trim button while in the AFCS mode unless roll reversal is encountered or the AUTO PILOT PITCH TRIM light is illuminated. Use a small amount of manual trim to counteract encountered roll reversal or to extinguish the AUTO PILOT PITCH TRIM light.
- The pitch rate gyro, as utilized by the AFCS modes, inadvertently senses structural vibrations of the airframe and tends to amplify these vibrations by generating commands through the autopilot to the stabilator. These vibrations can become quite pronounced while flying at very low indicated airspeeds. There should be no cause for alarm if this phenomenon occurs and the vibration, or chatter, can be eliminated by reverting to stability augmentation mode or by increasing airspeed above approximately 190 to 200 knots CAS.

4. When altitude hold mode is desired, place altitude hold switch to ENGAGE.

Note

To change altitude when operating in altitude hold, use the control stick. This disengages the altitude hold circuits and the altitude hold switch moves to OFF. Re-engage altitude hold at the new altitude if altitude hold is desired.

Note

The AFCS is disengaged when the emergency quick release lever on the control stick is depressed. The stability augmentation and ARI are disengaged as long as the lever is held depressed but return to operation when the lever is released.

GENERATOR SWITCHING

Power to the autopilot, air data computer, and the AJB-7 may be momentarily interrupted during the starting and stopping of the aircraft engines or generators. When the right engine or generator is started with the left generator already on the line, the connection between the right and left main busses is momentarily opened to allow the right generator to come on the line. The stab aug switches are not solenoid held and remain on without electrical power. The AFCS, AJB-7, and air data computer are not affected by starting or stopping the left engine or generator with the right generator on the line.

Note

If failure of the right generator occurs, disengage the stab aug switch prior to cycling the generator. This prevents the possible occurrence of control surface transients. Stab aug may be re-engaged with the right generator control switch retained OFF or stab aug may be re-engaged after the generator control switch has been returned to the ON position.

OPERATIONAL PRECAUTIONS

Roll Reversal

There is a possibility of a condition called roll reversal occurring when operating the automatic flight control system in the AFCS mode. This condition occurs infrequently and is apparent only when attempting small changes in bank angle. Roll reversal is associated with a small out-of-trim condition in the lateral channel, and is apparent as a slow rolling of the aircraft in the opposite direction of the stick force. If, for instance, the aircraft is out of trim laterally to the left when the AFCS mode is engaged, roll reversal may occur when right stick forces are applied. A roll reversal situation may also be caused by operating the manual lateral trim button while in the AFCS mode, followed by small stick forces being applied opposite to the direction of the trim. There is also a possibility of roll reversal occurring even if the aircraft had been trimmed prior to engaging the AFCS mode, and the manual trim button had not been touched. This condition is brought about by changes in aircraft trim accompanying changed flight conditions. In view of the above, the following instructions should be observed:

1. Trim aircraft in stability augmentation mode before engaging AFCS mode.
2. Do not operate manual trim button while AFCS mode is engaged unless roll reversal is encountered, at which time, judiciously use a small amount of manual trim to counteract the encountered roll reversal.

AFCS Operation With Static Pressure Compensator Inoperative (F-4C/D)

A malfunction of the static pressure compensator (indicated by the illumination of the STATIC CORR OFF indicator light) has no effect upon AFCS operation. The AFCS operates satisfactorily with the static pressure compensator inoperative, but is now using uncorrected static pressure as a reference. This may cause a momentary erratic movement at the time of the static pressure compensator failure. If the ALT hold mode is engaged the aircraft assumes indicated altitude which is displayed on the altimeter.

Pitch Oscillations

When using the altitude hold mode, the aircraft may experience pitch oscillations in the transonic regions due to fluctuations in the air data computer airspeed system. The nature of these oscillations vary from stick pumping to divergent pitch oscillations. It is recommended that if pitch oscillations occur at transonic speeds, the following corrective steps be attempted:

1. AFCS switch - DISENGAGE
2. Static pressure compensator switch - OFF
3. AFCS switch - ENGAGE
4. Engage altitude hold mode

If the oscillations persist after the above action, or if they are encountered at supersonic speeds:

1. Disengage altitude hold mode.

WARNING

Divergent pitch oscillations should not be allowed to develop. If any divergent pitch activity is noted, corrective action should be taken immediately.

AILERON RUDDER INTERCONNECT

The aileron rudder interconnect (ARI) system facilitates rudder displacement proportional to aileron displacement, providing coordinated turns at low airspeeds. The limits of the system are 15° of rudder displacement when the automatic flight control system is in the stability augmentation or AFCS mode, and 10° rudder displacement when the stab-aug switch is disengaged. Components of the ARI system include the ARI control amplifier, the 10° servo actuator, the flap blowup airspeed pressure switch and two aileron transducers. The yaw servo amplifier and the force transducer of the AFCS are also used. The rudder servo actuator is utilized for part of the rudder movement.

Operation

When the flap control switch is down, and airspeed is below approximately 230 knots, the flaps blowup airspeed pressure switch closes, applying 28 volts dc to energize the 10° servo actuator shut off valve. This allows the hydraulic 10° servo actuator to move the control linkage (if aileron displacement is present) and actuate the integrated rudder actuator for rudder displacement. The system can be disengaged by depressing the emergency quick release lever on the control stick; this disengages the ARI only as long as it is held depressed. To permanently disengage the ARI system, the circuit breaker on the left subpanel must be pulled, and stab-aug must be disengaged. Pulling the circuit breaker only, and keeping the stability augmentation engaged still provides 5° of ARI rudder authority. An alternate method of permanently disengaging the ARI, which allows the anti-skid system to remain operative, is to pull the rudder trim circuit breaker. The yaw stab-aug is disengaged as long as the emergency quick release lever is held depressed, when the lever is released the yaw stab-aug (5°) rudder authority is regained.

INERTIAL NAVIGATION AND ATTITUDE REFERENCE SYSTEM

The system consists of two separate gyro reference components and a navigation computer. The inertial navigation set, AN/ASN-48 (F-4C) and AN/ASN-63 (F-4D/E) supplies the primary azimuth and attitude reference, and in addition supplies direction, velocity, and distance inputs to the navigation computer. The AN/ASN-63 also supplies aircraft attitude, true heading, velocities, and height above sea level to the Weapons Release Computer Set (WRCS). The AN/AJB-7 is the standby attitude reference and in addition supplies information for LABS and LADD bombing maneuvers. The AN/AJB-7 is also used in conjunction with the WRCS in the F-4D/E aircraft.

INERTIAL NAVIGATION SET

The inertial navigation set (INS) is a self-contained, fully automatic unit which uses a gyro stabilized (inertial) platform upon which are mounted three sensitive accelerometers. During alignment, the sensitive axes of the accelerometers are aligned through interaction of the accelerometers and gyros; one is aligned to the north-south axis, one to the east-west axis, and one to the vertical axis. With the platform stabilized in pitch and roll by gyros, and oriented to true north, the accelerometers sense acceleration in any direction. This acceleration is integrated by a computer to produce velocity (ground speed), course, and distance traveled. The AN/ASN-48/63 contains circuitry to correct for apparent precession, based on the latitude of the INS position. The AN/ASN-48 (F-4C) provides navigation and attitude information to various aircraft systems. The AN/ASN-63 (F-4D/E) provides the same information, with the addition of output signals to the WRCS, Lead Computing Optical Sight System and Radar.

Inertial Navigator Control Panel

The inertial navigator control panel is used to align the inertial navigation set and place it in operation. The controls include a power control knob with positions of OFF, STBY, ALIGN and NAV, and an align mode switch with positions of HDG MEM and GYRO COMP. The STBY position applies power to bring the inertial platform up to operating temperature as indicated by the illumination of the amber HEAT light. The HEAT light goes out when the unit reaches operating temperature. The ALIGN position is selected for stabilization of the platform and alignment to true north. The sequence of alignment is indicated by the green ALIGN light. During coarse alignment and fine leveling, the light is not illuminated. A steady green ALIGN light indicates that gyro compassing is occurring. The light begins to flash when the INS has aligned its north-south axis to within 1/6 of one degree of true north. The NAV position is selected after the align phase is completed (as noted by the green ALIGN light flashing) and is the normal operating position for the inertial navigation set. The align mode switch determines the method of alignment. The GYRO COMP alignment is the normal, and most accurate means of aligning the system. The HDG MEM alignment is used for aircraft on alert or under other possible scramble situations. In the HDG MEM mode heading information obtained from a previous gyro compass alignment is maintained in the system after the set is turned off.

Inertial Navigation System Out Lights

The Inertial Nav Sys Out lights, in the front cockpit on the right subpanel, and in the rear cockpit on the main instrument panel, illuminate when the set is in OFF or STBY, or when a malfunction has occurred. If the set is operating normally the lights extinguish when the power control knob is placed to the ALIGN position. In aircraft after T.O. 1F-4-670, the lights are illuminated in the OFF position and extinguished when the knob is placed to the STBY position.

ALIGNMENT PROCEDURES

During the align sequence of the inertial navigation set, the compass system is automatically in the compass mode and the horizontal situation indicator and bearing distance heading indicator compass cards read magnetic heading directly from the flux valve. ADI azimuth information is not usable. If the wings are folded, the flux valve reading is not accurate and a greater magnetic variation is required to realize a variation synchronization on the navigation computer control panel. The reason is that in the wings folded position condition, the flux valve which is in the left wing, is oriented about 60° from its proper position. If the magnetic variation of the local area is used, gyro compassing takes longer to complete. Before aligning the inertial navigation set, place the function selector knob to STBY, the position update switch to NORMAL, the variation counter to the local magnetic variation, and the position counter to the local latitude and longitude.

Gyro Compass Alignment-Cold Start and Unmodified Inertial Navigation Systems

The gyro compass mode of alignment is the most accurate means of alignment, with a 5 nautical miles of error per hour of circular error probability (CEP). However, it requires a longer period of time to accomplish than the other modes. All F-4E aircraft and F-4C/D aircraft after T.O. 1F-4-670 normally have a modified computer installed. However, it is possible to replace a modified computer with an unmodified computer. The cold start modification enables the gyros to spin during standby and heat the system more evenly, therefore obtaining greater system accuracy. Coarse alignment is accomplished during the heating cycle. Unmodified computers accomplish only the heating cycle during standby and a double alignment procedure should be accomplished on this type computer. The time required for the system to reach operating temperature (160°F) is determined by the ambient temperature. The system warms up at the rate of at least 20°F per minute. When the HEAT light goes out, place the power control knob to ALIGN. Modified computers have a heat delay in the computer of 110 seconds after the system reaches operating temperature, and the heat light does not extinguish until this time delay has elapsed. Gyro compassing cannot be accomplished with either system until the heat light has extinguished. Completion of Best Available True Heading Alignment (BATH) is indicated by illumination of the green align light. On modified computers the time is 75 seconds and 135 seconds on unmodified computers. When the align light illuminates gyro compassing has commenced. For double alignment procedures on unmodified computers, place the power control knob back to standby for approximately 30 seconds and then return the knob to ALIGN. The align light illuminates again after 135 seconds. The time for completion of the gyro compassing cycle varies due to the error present after BATH alignment. When the axis of the platform reaches within 10 arc minutes (1/6°) of true north a flasher circuit delay energizes to insure the system maintains alignment. The duration of the delay is 50 seconds and the align light does not flash indicating completion of gyro compassing until the delay has elapsed. The system should be left in the ALIGN mode as long as possible for greater system accuracy. The power control knob is then placed to NAV for system operation and the align light goes out. The heat or align light is not functional in the NAV mode.

BEST AVAILABLE TRUE HEADING ALIGNMENT

If operational considerations dictate, the time required to align the INS can be reduced, with a corresponding reduction in INS operational accuracy, by performing a Best Available True Heading (BATH) alignment. A normal Gyro Compass alignment is accomplished up to a steady green ALIGN light. With the ALIGN light on steady, instead of waiting for the light to flash, place the power control knob to NAV. Since the set was not allowed to complete gyrocompassing (precise alignment with true north) accuracy of the INS outputs is reduced. The degree of inaccuracies cannot be determined, but the maximum error is approximately 7-1/2 nautical mile per hour circular error probability.

Heading Memory Alignment

Heading memory alignment is used when minimum alignment time is required and provides a 7-1/2 nautical mile per hour circular error probability. If heading memory alignment is accomplished within 2 hours after a gyro compass alignment has been performed, the heading memory alignment accuracy approaches gyro compass accuracy. Prior to heading memory alignment, a gyro compass alignment must have been performed through the flashing of the ALIGN light indicating that the system is aligned. The power control knob must be left in ALIGN until after placing the align mode switch to HDG MEM. The power control knob is then placed to OFF or STBY. From this time until the completion of the heading memory alignment, the aircraft must not be moved. When the unit is shut down in the heading memory mode, the platform retains the true north information obtained from the above procedure. To align the unit by the heading memory method, the align mode switch is in the HDG MEM position. The power control knob is placed to align mode until the align light flashes and then to NAV. If time permits, the system may be placed in the STBY mode until the heat light is extinguished, and then to ALIGN for greater system accuracy.

Inflight Alignment Procedure

An inflight alignment of the INS platform may be accomplished to provide attitude information to the Attitude Director Indicator. Navigation information from the INS is unusable since the aircraft is moving when this alignment is performed. To perform the procedure, first fly the aircraft straight and level. Cycle the power control knob to OFF then to ALIGN (unmodified sets) or STBY (modified sets). After 60 seconds place the power control knob to NAV.

CAUTION

> Do not exceed 60 seconds as damage to the INS platform may result. During coarse alignment, if the ALIGN position is selected for longer than 60 seconds, the INS platform starts fine alignment and loses the aircraft's pitch and roll axis as a reference, and attitude information is incorrect. The length of time the primary attitude is usable after an inflight alignment is not predictable. However, subsequent alignments may be attempted as needed. If inflight alignment is not desired place the INS power control knob to OFF.

ATTITUDE REFERENCE SYSTEM

The AN/AJB-7 is a two gyro all attitude reference platform which supplies standby attitude and azimuth information to the attitude director indicator, the horizontal situation indicator, and the bearing distance heading indicator in the rear cockpit. It also provides a standby attitude horizon for the front and rear cockpit radar indicators. The rear cockpit remote attitude indicator, the autopilot, and the bombing computer receive attitude information from the AN/AJB-7 at all times.

Compass Controller

The compass controller provides the controls and indicator necessary for proper operation of the azimuth system and the selection between the primary and standby attitude sources. The mode selector knob initiates the proper relay switching in the compass adapter compensator to select the operating modes (compass, DG and slaved). The SYNC position of the mode selector knob, spring-loaded to return to the SLAVED position, is used for fast synchronization of the compass flux valve and the azimuth reference system. The degree of synchronization is indicated by the sync indicator meter. The set heading control knob, spring-loaded to return to the center or zero position, manually adjusts the azimuth setting of the ADI, HSI and BDHI. When operating the compass system using the AJB-7 directional gyro (STBY selected on the reference system selector knob and DG on the mode switch), corrections for gyro precession are required to maintain system accuracy. Compensation is provided by the hemisphere switch (N-S) and the latitude control, when they are set to the local hemisphere and latitude respectively. The reference system selector knob, with positions of PRIM and STBY, provides selection between the inertial navigation set and the displacement gyroscope as the source of attitude information. The following inputs are provided by the inertial navigation set when the knob is in PRIM, or by the AN/AJB-7 when the knob is in STBY.

a. Azimuth and attitude information to the attitude director indicator.
b. Azimuth information to the horizontal situation indicator.
c. Azimuth information to the bearing distance heading indicator (rear cockpit).
d. Attitude information to the fire control system.

Note

Primary (inertial) information is not available unless the selector switch on the inertial navigator control panel is in the NAV position.

When switching from STBY to PRIM or vice versa, attitude information appears almost immediately but may be accompanied by some unusual gyrations of the attitude director indicator. This phenomenon is a simultaneous 180° flop about all three axes after which normal attitude reference is displayed. Whether or not this occurs is determined by which side of the AJB-7 is uppermost during the initial erection. Accurate heading information may not be immediately available when switching between PRIM and STBY, if the aircraft is in a turn having a turn rate of more than 15° per minute. In this condition, the fast synchronization feature of the compass is cut out. This is done to prevent erroneous heading errors resulting from turning errors which are generated in the flux gate compass. Switching between PRIM and STBY under the preceding conditions can result in random erroneous heading information. To correct this situation, the aircraft must be flown straight and level (rate of turn less than 15° per minute) for approximately 20 seconds and then manually synchronized by placing the compass controller mode switch to the SYNC position.

Note

On F-4D aircraft after T.O. 1F-4-702 and on all F-4E aircraft, there is a gyro fast erect switch on the auxiliary armament control panel on the left console in the front cockpit. This switch has a NORMAL and a momentary FAST ERECT position. After a fast turn maneuver the AC can fast erect the gyro by momentarily placing the switch to the FAST ERECT position.

OPERATING MODES

Compass Mode

The compass mode is considered an emergency mode. When the reference systems are not usable because of malfunctions, the compass mode provides a source of magnetic heading information to other aircraft systems. However, the interlock with the AFCS mode of operation of the automatic flight control system is automatically opened in the compass mode to prevent erratic magnetic heading signals from being applied to the autopilot. Also, the attitude director indicator azimuth indications should not be used since it is still connected to the malfunctioning reference system. To place the attitude reference system in the compass mode proceed as follows:

1. Mode switch on the compass controller - COMP

DG Mode

The DG mode is used in north and south latitudes greater than 70° and in areas where the earth's magnetic field is appreciably distorted. When the DG mode is initially selected, the magnetic heading of the aircraft must be set into the system with the set heading control on the compass controller. The system then uses this reference for subsequent heading indications. Apparent drift compensating voltages are inserted by use of the hemisphere switch (N-S) and latitude control on the compass system controller when operating with the attitude reference selector knob in the STBY (AN AJB-7) position. However, when operating with the attitude reference selector in the PRIM (inertial) position, the latitude control knob must be set at zero, as a heading error is induced in the system if the control knob is set at any other value. To place the reference system in the DG mode proceed as follows:

1. Mode switch on compass controller - DG
2. Hemisphere switch - LOCAL HEMISPHERE

3. Latitude control knob - ZERO (with attitude selector knob in PRIM)
   - LOCAL LATITUDE (with attitude selector knob in STBY)
4. Aircraft magnetic heading - SET
   Set aircraft magnetic heading on the HSI, using the set heading knob.
5. Readjust the latitude control knob for each 2° change in latitude, if operating the attitude reference selector in STBY.

Slaved Mode

The slaved mode is the mode ordinarily used under normal conditions. In the slaved mode, the azimuth system is primarily controlled by signals from the compass transmitter (flux valve). Because system accuracy, is now dependent upon the earth's magnetic field, the slaved mode should not be used in latitudes greater than 70° and in areas where the earth's magnetic field is distorted. To place the reference system in the slaved mode proceed as follows:

1. Mode switch on compass controller - SLAVED
2. Sync indicator meter - CHECK
   Allow 10 seconds for automatic fast synchronization and check the sync indicator meter for a center-scale indication. Slight deviation of the needle from the center position is corrected by normal sync.
3. Pitch trim control on ADI - ADJUST
   Adjust the pitch trim control on the ADI for zero pitch attitude.

NAVIGATION COMPUTER SET AN/ASN-46

On F-4C/D aircraft before T.O. 1F-4-741 and T.O. 1F-4-799, there is an AN/ASN-46 navigation computer set installed which is a great circle computer consisting of a control panel and an amplifier computer. The set may be operated in conjunction with the inertial (Inertial mode) or independently, with the inertial turned OFF (Air Data mode). Readouts available from the navigation computer are the same in either mode, but more accurate in the inertial mode. When operating in the inertial mode, all inputs necessary for the operation of the navigation computer are supplied by the inertial navigation set (INS) except initial aircraft position, initial magnetic variation, and the desired target coordinates, which must be provided by the operator. In air data mode, the operator must continuously provide the navigation computer with true wind direction and velocity, magnetic variation, and desired target coordinates. True airspeed is provided by the air data computer (ADC); magnetic heading comes from the compass system. If a failure in the INS occurs, the navigation computer automatically transfers to the air data mode, which is indicated by the illumination of the AIR DATA MODE light on the computer control panel. The navigation computer provides the aircrew with the following readouts:

a. Aircraft present position in latitude and longitude, based on INS information in the inertial mode, or dead reckoning computations in the air data mode.

b. The continuous great circle bearing and distance to either of two preset targets.

c. Aircraft ground speed.

d. Aircraft magnetic ground track.

e. Aircraft drift angle (magnetic heading relative to magnetic track).

Accuracy of the present position readout in the inertial mode is 5 nautical miles per hour, or less, circular error of probability. In air data mode, the accuracy of the present position readout depends primarily on the accuracy of the wind and magnetic variation information provided manually by the operator. Assuming correct wind and magnetic variation information, the accuracy of the equipment in the air data mode is as follows:

1. Present position latitude (between 72° N or S latitude) ± 17 nautical miles per hour of operation.
2. Present position longitude (between 72° N or S latitude) ± 27 nautical miles per hour.

For purposes of discussion, the navigation computer can be divided into two functional sections; a present position computer and a course and distance computer.

PRESENT POSITION COMPUTER

In the inertial mode, the present position computer functions to provide a readout of aircraft position in latitude and longitude. Prior to flight, the operator sets the initial position into the navigation computer present position counters. During alignment, these coordinates are also inserted into the INS. As the aircraft moves in any horizontal direction, the navigation computer receives change in latitude and longitude signals from the INS. The changing latitude and longitude signals are used to drive the present position counters, thereby continuously reflecting the aircraft's present position. In air data mode, the present position computer uses true airspeed from the ADC, wind and magnetic variation information manually set by the operator, and magnetic heading information from the compass system to compute ground speed and true course traveled. Ground speed is integrated with time to attain distance, which is converted to a change in latitude and longitude. The changing latitude and longitude is reflected in the present position counters, thereby providing a continuous dead reckoning aircraft position.

Course and Distance Computer

The basis of course and distance computation is the solution of the spherical triangle formed on the earth's surface by the geographic north pole (true north), the present position, and the preselected target or base. The latitude and longitude of the base and the target are manually inserted into the system by means of the position and target counters on the computer control panel. The base coordinates are retained by memory circuits of the position counters. Since this information is known within the system, as is present position of the aircraft which is available continuously from the present position computer, two sides of the spherical triangle and the angle between them are known. This makes it possible to solve for the third side and angle using the information available. The third side represents the great circle distance and the angle represents the great circle bearing or course angle.

NAVIGATION COMPUTER CONTROL PANEL

The navigation computer control panel contains all controls and counters necessary for the proper operation of the navigation computer.

Function Selector Knob

The function selector knob is a five-position rotary switch with positions of OFF, TARGET, BASE, STBY, and RESET. The OFF position removes all power from the system. The TARGET position selects outputs of range and bearing to preselected coordinates set on the target counters. The BASE position selects the same output displays as the TARGET position, but are referenced to the preselected coordinates which are retained in the memory circuits. The STBY position supplies filament voltage to the amplifier-computer; the latitude and longitude integrator channels of the system are inoperative. The RESET position is used to place any desired set of coordinates into the memory circuits. Placing the knob to RESET causes the original memorized coordinates to be lost. Moving the knob from RESET to any other position causes the coordinates appearing on the present position counters to be memorized. A restriction on the knob prevents accidental switching to OFF or RESET. The knob must be pulled out slightly to override this restriction.

Wind Control Knobs

The wind control knobs consist of the wind speed and the wind from control knob. The wind speed control knob is used to manually insert the wind speed affecting flight into the system and is displayed on the wind speed counter. The wind from control knob is used to manually insert the true wind direction.

Magnetic Variation Control Knob

The magnetic variation control knob is used to manually insert the magnetic variation angle into the system.

Position Control Knobs

The position control knobs are initially used to insert any desired set of coordinates (base, alternate target, or destination point) into the memory circuits of the system. The position control knobs are also used to manually insert present position latitude and longitude to establish an initial fix for the dead reckoning function of the navigation computer or as a reference for INS alignment. The memory coordinates are not physically displayed while retained in the system. The position latitude and longitude counters continuously indicate the aircraft present position in degrees and minutes during flight.

Target Control Knobs

The target control knobs are used to manually insert the target latitude and longitude into the system. These coordinates are displayed on the target latitude and longitude counters. The system provides output displays to fly to these coordinates when the function selector knob is placed to TARGET.

Position Update Switch

The position update switch is used to update the position latitude and longitude during flight. The switch positions are SET, NORMAL, and FIX.

Variation Sync Meter

The variation sync meter indicates the error in the manual magnetic variation setting during the inertial mode. Rotating the variation control knob in the appropriate direction centers the vertical bar in the variation sync meter, indicating that the correct magnetic variation is set on the variation counter. Rotation of the variation control knob in the air data mode has no effect on the meter.

NAVIGATION COMPUTER OPERATION

All control knobs required to operate the navigational computer are on the computer control panel. To simplify the procedure, it should be understood, that where a counter setting is specified, the control knob associated with the particular counter is rotated to set the counter. In the case of the position latitude and position longitude counters, and the magnetic variation knob, the associated control knobs must be pressed in to engage them with their respective counters before they can be rotated effectively. To set the flight plan into the navigation computer, proceed as follows:

1. Place function switch to STBY.
2. Set magnetic variation counter to local magnetic variation.
3. Set wind from counter and wind speed counter to true wind direction and wind speed that affects the flight, to facilitate operation in the air data mode if necessary.
4. Place position update switch to NORMAL.
5. Set the local latitude and longitude in the position counters.
6. Set the latitude and longitude of the target or destination on the target counters.
7. Place the function selector knob to RESET.
8. Place the function selector knob to STBY.

Note

Base coordinates may be stored in the AN/ASN-46 navigation computer by placing the function selector knob to RESET and inserting coordinates in the present position windows. The function selector knob must be placed in STBY and present position coordinates set prior to aligning the INS. The coordinates may be changed at any time in flight.

OUTPUT DISPLAYS

The navigation computer display information in the front cockpit is shown in figure 1-11. To display navigation computer information on the BDHI, select the NAV COMP position on the navigation selection switch. The display information on the BDHI is as follows:

1. Magnetic bearing to target or base displayed on No. 1 pointer when read against the compass card. A relative bearing to the target or base can also be read by noting the number of degrees from the index clockwise to the No. 1 pointer.
2. Magnetic ground track displayed on No. 2 pointer when read against the compass card. Left or right drift angle can also be read by noting the number of degrees left or right from the index.
3. Distance to the target or base displayed on the range counter.
4. Magnetic heading when compass card is read under the index.

To travel the great circle route to the target or base, the aircraft should be flown on a course that causes the bearing and track pointers to be coincident. However, it is not necessary to fly the course shown by the coincidental pointers. Departure from the route may be made, as a part of evasive maneuvers or to fly a search pattern, without affecting the operation of the system. Since computations are being made continuously, the current position of the airplane is shown at all times on the position counters regardless of the path flown. As the target (or base) is approached, the distance on the range counter decreases. When the target is reached, uncertainty is exhibited by the No. 1 pointer which turns 180° as the target is passed in order to indicate bearing to target.

Updating Methods

The position counters should be checked and updated at each opportunity by one of the following methods:

1. VISUAL/RADAR reference to a geographical position. Adjust the position latitude and longitude to agree with the latitude and longitude of the VISUAL/RADAR fix. This latitude and longitude may be obtained from maps, charts, or publications.
2. TACAN fix.
   Set the latitude and longitude of the acquired tacan station in the target counters or in base memory. Adjust the present position counters so that no. 1 pointer and range counter on the BDHI agree with the tacan readout.
3. GCI or radar monitored fix.
   Set the latitude and longitude of the controlling agency in the target counters or in base memory. Adjust the position counters so that no. 1 pointer and range counter on the BDHI agree with the bearing and distance provided by the controller.

Updating Procedures, Inertial Mode

The aircraft's present position (represented by the position latitude and longitude counters) may be updated in the inertial mode as follows:

a. A few minutes before reaching the point of known coordinates, pull outward on the position update switch and place it to SET. This disengages the position latitude and longitude counters.

b. Rotate the position latitude and longitude control knobs until the coordinates of the approaching point appear in the position latitude and longitude counters.

c. Place the position update switch to FIX and hold in this position.

d. When exactly over the known point, release the switch: it is spring-loaded and returns to the NORMAL position, completing the updating procedure.

The inertial navigation set updates at a rate of approximately three minutes of latitude and three minutes of longitude per second. For example if the latitude was changed by 5 minutes and the longitude was changed by 15 minutes, the longitude change would determine the amount of time the position update switch must be held in the FIX position. In this example, the position update switch must be held in the FIX position for a minimum time of 5 seconds prior to reaching the known point, otherwise the INS is only partially updated. When the position update switch is moved from SET to FIX, it must pass through the NORMAL position. A time delay circuit in the computer control panel prevents the position counters from going to normal operation for about one-half second. Therefore, the switch movement from SET to FIX must be a smooth continuous movement in order to prevent an unwanted interval of NORMAL operation.

Updating Procedures, Air Data Mode

The aircraft's present position may be updated in the air data mode by either of two methods. One method of updating is to rotate the position latitude and longitude control knobs until the coordinates of the aircraft's actual present position appear in the position latitude and longitude counters. This may be accomplished with the function selector knob in any position except RESET or OFF. The other method utilizes the position update switch and has the advantage that the navigation computer may be instantaneously updated when the aircraft is over the point of known coordinates.

NAVIGATION COMPUTER SET AN/ASN-46A

On F-4C/D aircraft after T.O. 1F-4-741 and T.O. 1F-4-799, and all F-4E aircraft there is an AN/ASN-46A navigation computer set installed. This set contains both a great circle and a rhumb line computer. The great circle computer is utilized at ranges of greater than 120 nautical miles. At 120 ± 10 nautical miles, the set automatically switches to rhumb line computations. The navigation computer consists of a control panel and an amplifier computer. The set may be operated with the inertial turned OFF (Air Data Mode). Readouts available from the navigation computer are the same in either mode, but more accurate in the inertial mode. When operating in the inertial mode, all inputs necessary for the operation of the navigation computer are supplied by the inertial navigation set (INS) except initial aircraft position, initial magnetic variation, and the desired target coordinates, which must be provided by the operator. In the air data mode, the operator must continuously provide the navigation computer with true wind direction and velocity, magnetic variation, and desired target coordinates. True airspeed is provided by the air data computer (ADC); magnetic heading comes from the compass system. If a failure of the INS occurs, the navigation computer automatically transfers to the air data mode, which is indicated by the illumination of the AIR DATA MODE light on the computer control panel. The navigation computer provides the aircrew with the following readouts:

a. Aircraft present position in latitude and longitude, based on INS information in the inertial mode or dead reckoning computations in the air data mode.
b. The continuous great circle (over 120 NM) or rhumb line (under 120 NM) bearing and distance to either of two preset targets.
c. Aircraft ground speed.
d. Aircraft magnetic ground track.
e. Aircraft drift angle (magnetic heading relative to magnetic track).

Accuracy of the present position readout in the inertial mode is 5 nautical miles per hour, or less, circular error of probability. In air data mode, the accuracy of the present position readout depends primarily on the accuracy of the wind and magnetic variation information provided manually by the operator. Assuming correct wind and magnetic variation information, the accuracy of the equipment in air data mode is as follows:

1. Present position latitude (between 72° N or S latitude) ± 17 nautical miles per hour of operation.
2. Present position longitude (between 72° N or S latitude) ± 27 nautical miles per hour.

For purposes of discussion, the navigation computer can be divided into two functional sections; a present position computer, and a course and distance computer.

PRESENT POSITION COMPUTER

In the inertial mode, the present position computer functions to provide a readout of aircraft position in latitude and longitude. Prior to flight, the operator sets the initial position into the navigation computer present position counters. During alignment, these coordinates are also inserted into the INS. As the aircraft moves in any horizontal direction, the navigation computer receives change in latitude and longitide signals from the INS. The changing latitude and longitude signals are used to drive the present position counters, thereby continuously reflecting the aircraft's present position. In air data mode, the present position computer uses true airspeed from the ADC, wind and magnetic variation information manually set by the operator, and magnetic heading information from the compass system to compute ground speed and true course traveled. Ground speed is integrated with time to attain distance, which is converted to a change in latitude and longitude. The changing latitude and longitude is reflected in the present position counters, thereby providing a continuous dead reckoning aircraft position.

COURSE AND DISTANCE COMPUTER

The basis of course and distance computation at ranges greater than 120 nautical miles (great circle computer) is the solution of the spherical triangle, formed on the earth's surface by the geographic north pole (true north), the present position, and the preselected target or memorized coordinates. The rhumb line computer solves a plane right triangle whose known sides are the latitude and longitude difference between the present position and the selected target or memorized coordinates. The system automatically switches from great circle computations to rhumb line computations when the great circle range to the selected target is 120 ± 10 miles.

NAVIGATION COMPUTER CONTROL PANEL

The navigation computer control panel rear cockpit right console, contains all controls and counters necessary for the operation of the naviagation computer.

Function Selector Knob

The function selector knob is a five-position rotary switch with positions of OFF, STBY, TARGET 1, TARGET 2, and RESET. The OFF position removes all power from the system. The STBY position supplies filament voltage to the amplifier computer but the latitude and longitude integrator channels of the system are inoperative. The TARGET 1 position selects readouts of range and bearing to preselected coordinates set on the target counters. The TARGET 2 position selects range and bearing readouts referenced to memorized coordinates. The RESET position is used to place any desired set of coordinates into the memory circuits. Placing the knob to RESET causes the previously memorized coordinates to be lost. Moving the knob from RESET to any other position causes the coordinates appearing on the target counters to be memorized. A restriction on the knob prevents accidental switching to OFF or RESET. The knob must be pulled out slightly to override this restriction.

Wind Control Knobs

The wind control knobs consist of the wind speed and the wind from control knob. The wind speed control knob is used to manually insert the wind speed affecting flight into the system and is displayed on the wind speed counter. The wind from control knob is used to manually insert the true wind direction.

Magnetic Variation Control Knob

The magnetic variation control knob is used to manually insert the magnetic variation angle into the system.

Position Control Knobs

The position control knobs are used to manually insert present position latitude and longitude to establish an initial fix for the dead reckoning function of the navigation computer or as a reference for INS alignment. The position latitude and longitude counters continuously indicate the aircraft present position in degrees and minutes during flight.

Target Control Knobs

The target control knobs serve two purposes; one is to insert any desired set of coordinates (base, alternate target, or destination point) into the memory circuits of the system, the other is to manually insert the target latitude and longitude into the system. The system provides output displays to fly to memorized coordinates when the function selector knob is placed to TARGET 2, and to the coordinates appearing on the target counters when the function selector knob is placed to TARGET 1.

Position Update Switch

The position update switch is used to update the position latitude and longitude during flight. The switch positions are SET, NORMAL, and FIX.

Variation Sync Meter

The variation sync meter indicates the error in the manual magnetic variation setting during the inertial mode. Rotating the variation control knob in the appropriate direction centers the vertical bar in the variation sync meter, indicating that the correct magnetic variation is set on the variation counter. Rotation of the variation control knob in the air data mode has no effect on the meter.

Test Cap Off Light

This light illuminates when the test cap on the front of the amplifier-computer is not properly connected, or when the true air speed circuit from the air data computer is open.

Latitude and Longitude Sync Lights

The LAT and LONG sync lights illuminate when the latitude and longitude position counters do not agree with the inertial navigation set latitude or longitude output.

NAVIGATION COMPUTER OPERATION

All control knobs required to operate the navigational computer are on the computer control panel. To simplify the procedure, it should be understood that where a counter setting is specified, the control knob associated with the particular counter is rotated to set the counter. In the case of the position latitude and longitude counters and the magnetic variation counter, the associated control knobs must be pressed in to engage them with their respective counters before they can be rotated effectively. To set the flight plan into the navigation computer, proceed as follows:

1. Place function switch to STBY.
2. Set magnetic variation counter to local magnetic variation.
3. Set wind from and wind speed counters to true wind direction and wind speed that affects the flight, to facilitate operation in the air data mode if necessary.
4. Place position update switch to NORMAL.
5. Set the local latitude and longitude in the present position counters.
6. Set the latitude and longitude of the target or destination on the target counters.
7. Place the function selector knob to RESET.
8. Place the function selector knob to STBY.

Note

TGT 2 coordinates may be stored in the AN/ASN-46A navigation computer by placing the function selector knob to RESET and inserting the coordinates in the target windows. The coordinates may be changed at any time in flight.

OUTPUT DISPLAYS

The navigation computer display information in the front cockpit is shown in figure 1-11. To display navigation computer information on the BDHI, select the NAV COMP position on the navigation selection switch. The display information on the BDHI is as follows:

1. Magnetic bearing to target or base displayed on No. 1 pointer when read against the compass card. A relative bearing to the target or base can also be read by noting the number of degrees from the index clockwise to the No. 1 pointer.
2. Magnetic ground track displayed on No. 2 pointer when read against the compass card. Left or right drift angle can also be read by noting the number of degrees left or right from the index.
3. Distance to the target or base displayed on the range counter.
4. Magnetic heading when compass card is read under the index.

To travel the great circle route to the target or base, the aircraft should be flown on a course that causes the bearing and track pointers to be coincident. However, it is not necessary to fly the course shown by the coincidental pointers. Departure from the route may be made, as a part of evasive maneuvers or to fly a search pattern, without affecting the operation of the system. Since computations are being made continuously, the current position of the airplane is shown at all times on the position counters regardless of the path flown. As the target (or base) is approached, the distance on the range counter decreases. When the target is reached, uncertainty is exhibited by the No. 1 pointer which turns 180° as the target is passed in order to indicate bearing to target.

Updating Methods

The position counters should be checked and updated at each opportunity by one of the following methods:

1. VISUAL/RADAR reference to a geographical position. Adjust the position latitude and longitude to agree with the latitude and longitude of the VISUAL/RADAR fix. This latitude and longitude may be obtained from maps, charts, or publications.
2. TACAN fix.
   Set the latitude and longitude of the acquired tacan station in the target counters or in base memory. Adjust the present position counters so that the no. 1 pointer and range counter on the BDHI agree with the tacan readout.
3. GCI or radar monitored fix.
   Set the latitude and longitude of the controlling agency in the target counters or in base memory. Adjust the position counters so that the no. 1 pointer and range counter on the BDHI agree with the bearing and distance provided by the controller.

Updating Procedures, Inertial Mode

The aircraft's present position (represented by the position latitude and longitude counters) may be updated in the inertial mode as follows:

a. A few minutes before reaching the point of known coordinates, pull outward on the position update switch and place it to SET. This disengages the position latitude and longitude counters.

b. Rotate the position latitude and longitude control knobs until the coordinates of the approaching point appear in the position latitude and longitude counters.

c. Place the position update switch to FIX and hold in this position.

d. When exactly over the known point, release the switch: it is spring-loaded and returns to the NORMAL position, completing the updating procedure.

The inertial navigation set updates at a rate of approximately 3 minutes of latitude and 3 minutes of longitude per second. For example, if the latitude was changed by 5 minutes and the longitude was changed by 15 minutes, the longitude change would determine the amount of time the position update switch must be held in FIX position. In this example, the position update switch must be held in the FIX position for a minimum time of 5 seconds prior to reaching the known point, otherwise the INS is only partially updated. When the position update switch is moved from SET to FIX, it must pass through NORMAL position. A time delay circuit in the computer control panel prevents the position counters from going to normal operation for about one-half second. Therefore, the switch movement from SET to FIX must be a smooth continuous movement in order to prevent an unwanted interval of NORMAL operation.

Updating Procedures, Air Data Mode

The aircraft present position may be updated in the air data mode by either of two methods. One method of updating is to rotate the position latitude and longitude control knobs until the coordinates of the aircraft actual present position appear in the position latitude and longitude counters. This may be accomplished with the function selector knob in any position except RESET or OFF. The other method utilizes the position update switch and has the advantage that the navigation computer may be instantaneously updated when the aircraft is over the point of known coordinates.

Leap Frog Operation

A leap frog type of operation may be used wherein the aircraft is normally flown in TGT 2 toward a memorized point. While enroute, the next point is set on the target counters. When the first destination (the initial TGT 2) is reached, the function selector knob is momentarily moved to RESET and then to TGT 2. When this is done, the target counter settings are transferred to the memory circuits and the coordinates of the point just reached are erased. The target counters are now free to receive new coordinates. While on the second leg, the target counters may be set to a third destination without interfering with steering to the second. When the second destination is reached, the procedure may be repeated and a fourth destination can be established while flying to the third. This procedure can be repeated as many times as desired.

REFUELING SYSTEMS

AIR REFUELING SYSTEM

The air refueling system utilizes a hydraulically actuated receptacle, aft of the rear cockpit, above the number 2 fuselage fuel cell. Actuation of the receptacle is controlled by the air refuel switch on the fuel control panel. Placing the air refuel switch to EXTEND, extends the receptacle, interrupts the fuel control panel continuity, and illuminates the air refuel READY light. When the receptacle is extended, the air refueling lights (exterior) illuminate. With the receptacle extended, the AC must fly a formation position with the tanker. The boom operator in the tanker then extends the boom into the receptacle. Once the boom is locked in the receptacle, the READY light goes out and fuel is transferred (at a rate up to 600 gallons per minute) to any fuel cell or tank that will accept it. An induction coil in the receptacle connects the receiver refueling amplifier and tanker electrical circuits. This illuminates the director lights, and establishes the automatic (flight outside the boom envelope) and manual (tanker initiated) disengage capabilities. If the boom becomes disengaged, an air refuel DISENGAGED light illuminates indicating fuel transfer is interrupted. Once disengaged, the system must be reset to resume taking fuel. When the fuel system is reset, the READY light illuminates indicating a new hook-up can be made. At the completion of the air refueling sequence, the boom receptacle may be retracted and continuity restored to the fuel control panel, by placing the air refuel switch to RETRACT. On F-4E aircraft 67-398 and up, an amplifier override relay is added to the air refueling circuit to permit normal boom-receptacle engagement with a failed amplifier. Air refueling can then be accmoplished with a failed amplifier, but the director lights will be inoperative and the tanker disengage features (both automatic and manual) will be lost. For normal and emergency air refueling procedures refer to F/RF-4 Flight Crew Air Refueling Procedures (T.O. 1-1C-1-8).

CAUTION

On F-4C/D aircraft, the READY light illuminates when the air refuel switch is actuated to the EXTEND position; therefore, it is possible to have the READY light illuminated without the receptacle extended.

Air Refuel Switch

The air refuel switch is a two-position toggle switch on the fuel control panel front cockpit. Placing the air refuel switch to EXTEND, extends the boom receptacle, interrupts the normal continuity to the fuel control panel, and illuminates the air refuel READY light. On all F-4E aircraft, the ready light will not illuminate until the receptacle is fully extended. After the boom is locked into the receptacle, fuel is transferred to any fuel cell or tank that will accept it. Fuel to each cell or tank is automatically shut off by its fuel level control valve. Three external tanks FULL indicator lights illuminate when their respective tanks become full. Placing the air refuel switch to RETRACT, retracts the receptacle and restores normal continuity to the fuel control panel. On F-4C/D aircraft after T.O. 1F-4-773, and on F-4E aircraft after T.O. 1F-4E-513, the air refuel switch is used to reset the fuel system during air refueling by cycling from EXTEND to RETRACT and back to EXTEND.

CAUTION

When the air refuel switch is in EXTEND, pressurization to all internal and external fuel tanks is dumped and fuel will not transfer from internal wing or external fuel tanks. If receptacle door is damaged during refueling operations, this switch must be positioned to RETRACT to pressurize fuel tanks and transfer fuel. The air refuel receptacle circuit breaker should be pulled before actuating air refuel switch to prevent possible further damage to receptacle.

Refuel Selection Switch

A two-position refuel selection switch, marked INT ONLY and ALL TANKS, is on the fuel control panel. The INT ONLY position closes the external tank(s) fuel shut-off valves, allowing only the fuselage and wing tanks to be refueled. The ALL TANKS position opens the external tank(s) fuel shut-off valves, allowing all fuel tanks to be refueled.

Air Refueling Release Button

The air refueling release button is a pushbutton type switch on the front cockpit stick grip. When release from the boom is desired, depress and hold the release button down until the air refuel DISENGAGED light illuminates. Throttle and attitude changes should not be made until the boom is clear of the receptacle. On F-4D aircraft after T.O. 1F-4D-508, and on all F-4E aircraft, the air refueling release button also functions to initiate AIM-4D coolant.

Note

On F-4D aircraft after T.O. 1F-4D-508, when the missile arm switch is in the ARM position and the missile select switch is in the HEAT position, the air refueling release button will not release the boom when depressed.

Air Refuel Reset Button

The air refuel reset button is a pushbutton type switch on the fuel control panel. If the boom becomes disconnected during the refueling operation, the fuel system can be readied again by depressing the air refuel reset button. The reset button may also be used to disengage from the refueling boom in situations where the air refueling release button will not effect disengagement. When used for this purpose, depress and hold the button until disengagement is accomplished. When all other means of disengagement fail, pull the IFR RCVR circuit breaker (No. 2 circuit breaker panel). Once disengagement is effected, reset the circuit breaker. On F-4C/D aircraft after T.O. 1F-4-773, and on F-4E aircraft after T.O. 1F-4E-513, the air refuel reset button is removed from the fuel control panel and reset must be accomplished by cycling the air refuel switch as previously described.

Ready Light

The air refuel READY light indicates that the fuel system is being conditioned to receive fuel and illuminates when the air refuel switch is placed to EXTEND. On all F-4E aircraft, the REFUEL light will not illuminate until the refuel receptacle is fully extended. The air refuel READY light remains illuminated until the boom is locked into the receptacle or the air refuel switch is placed to RETRACT.

Disengaged Light

The air refuel DISENGAGED light indicates boom disengagement during the refueling cycle. The air refuel DISENGAGED light remains illuminated until the fuel system is reset to continue refueling, or the boom receptacle is retracted.

CAUTION

- Illumination of the DISENGAGED light is not a positive indication of disconnect.
- On F-4E aircraft 67-398 and up, a marginal or improperly rigged contact limit switch can cause the DISENGAGED light to illuminate after the boom is locked in the receptacle. If this occurs, refueling can be continued using the procedures for a failed refueling amplifier.

External Tanks Full Lights

Three external tanks full lights, marked L.H. FULL, CTR. FULL and R.H. FULL, illuminate during air refueling when their respective tanks become full. The external tanks full light(s) remain illuminated until the air refueling receptacle is retracted.

GROUND REFUELING PROCEDURES

The aircraft is pressure refueled through a single point receptacle, located in door 26R, at an approximate rate of 250 gallons per minute. The system allows a controlled partial refueling capability. If desired, fuel may be locked out of both wing tanks and No. 5 and 6 (F-4C/D) or 5, 6, and 7 (F-4E) fuselage cells. The resulting fuel load (approximately 5500 pounds) is attained without creating an undesirable CG condition. Actuating and holding the left and right wing tanks and No. 5 fuselage tank fuel lever control valve switches, prevents fuel from entering the left and right wing tanks and fuselage cells 5 and 6. The No. 7 fuselage cell in F-4E aircraft can be locked out only by depressing and holding the air and fuel actuator checkout plungers in the right wheel well.

Engines Off (External Power)

The fuel system may be conditioned to receive fuel as follows:

1. External electrical power - APPLY
2. Generator control switches - EXT ON
3. Engine master switches - OFF
4. Ground fueling switch - REFUEL
   Placing the ground fueling switch, in the right wheel well, to REFUEL, conditions the fuel system for refueling.
5. Refuel selector switch - AS DESIRED

Note

If the ground refueling switch, in the right wheel well, is left in the refuel or defuel position, the battery will continue to discharge.

Engines Off (Battery)

The fuel system may be conditioned to receive fuel as follows:

1. Generator control switches - OFF
2. Throttles - OFF
3. Engine master switches - OFF
4. Internal wing fuel dump switch - CHECK NORMAL

CAUTION

The dump valves close only when ac power is available and refueling should not be attempted with battery power if the dump switch is in the DUMP position. Be prepared to shut down refueling operation if fuel spillage occurs. The fuel spillage may be caused by the dump switch being placed to NORMAL when no ac electrical power was available.

5. Ground fueling switch - REFUEL
   Placing the ground fueling switch, in the right wheel well, to REFUEL, conditions the fuel system for refueling.
6. Refuel selector switch - AS DESIRED

Note

If the ground refueling switch, in the right wheel well, is left in the refuel or defuel position, the battery will continue to discharge.

FIRE CONTROL SYSTEM

Refer to T.O. 1F-4C-34-1-1A for detailed description of the system and its operational application.

RADAR RECORDING CAMERA SYSTEM (DRSC)

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

MULTIPLE WEAPONS CONTROL SYSTEM

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

OPTICAL SIGHT UNIT

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

WEAPONS RELEASE COMPUTER SET AN/ASQ-91

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

STATION AND WEAPON SELECTION PANEL

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

SUSPENSION EQUIPMENT

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

SPECIAL WEAPONS DELIVERY SYSTEMS

Refer to T.O. 1F-4C-34-1-1 and T.O. 1F-4C-25 for detailed description of the system and its operational application.

AGM-12 SYSTEM

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

SUU-16/A GUN POD

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

SUU-23/A GUN POD

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

NOSE GUN SYSTEM, M61A1

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

AGM-45 MISSILE LAUNCHING SYSTEM

Refer to T.O. 1F-4C-34-1-1A for detailed description of the system and its operational application.

LOW ALTITUDE BOMBING SYSTEM (LABS)

Refer to T.O. 1F-4C-34-1-1 and T.O. 1F-4C-25 for detailed description of the system and its operational application.

LOW ANGLED DROGUED DELIVERY BOMBING SYSTEM (LADD)

Refer to T.O. 1F-4C-34-1-1 and T.O. 1F-4C-25 for detailed description of the system and its operational application.

RMU-8 TOW SYSTEM

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

A/A 37U-15 TOW TARGET SYSTEM

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

MARK 1 MOD 0 GUIDED WEAPON SYSTEM

Refer to T.O. 1F-4C-34-1-1A for detailed description of the system and its operational application.

COMBAT DOCUMENTATION MOTION PICTURE CAMERA SYSTEM

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

KA-71A STRIKE CAMERA SYSTEM

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

RADAR HOMING AND WARNING SYSTEM

Refer to T.O. 1F-4C-34-1-1A for detailed description of the system and its operational application.

ELECTRONIC COUNTERMEASURES POD QRC-160 (ALQ SERIES)

Refer to T.O. 1F-4C-34-1-1A for detailed description of the system and its operational application.

RADAR X-BAND TRANSPONDER SST-181X

Refer to T.O. 1F-4C-34-1-1 for detailed description of the system and its operational application.

SPEECH SECURITY UNIT (KY-28)

Refer to T.O. 1F-4C-34-1-1B for detailed description of the system and its operational application.

MISCELLANEOUS EQUIPMENT

REAR VIEW MIRRORS

There are three rear view mirrors installed on the front cockpit canopy arch, and two mirrors installed on the rear cockpit arch.

SPARE LAMPS

Spare lamps for the console panels are provided. The lamps are adjacent to the utility electrical receptacle on the right console front cockpit, and on the pressure suit control panel on the left console in the rear cockpit.

SECTION V OPERATING LIMITATIONS

TABLE OF CONTENTS

Note

Refer to other sections of the Flight Manual for operating limitations that are characteristic of a particular phase of operation; i.e., emergency procedures, starting procedures, auxiliary equipment operation, etc.

CREW REQUIREMENTS

The minimum crew for safe flight is one. An additional crewmember, as required, will be added at the discretion of the Commander.

INSTRUMENT MARKINGS

Instrument range markings are shown in figure 5-1.

INSTRUMENT FLUCTUATION

FUEL FLOW

100 PPH maximum for indicator readings of 0 - 3000 PPH. 750 PPH maximum for indicator readings of 3001 - 12,000 PPH.

RPM

± 0.2% from steady-state condition.

EGT

± 5°C maximum for steady-state operation from IDLE through MIL power settings. ± 8°C maximum for steady-state after burning.

EXHAUST NOZZLE

Limited by EGT fluctuation.

OIL PRESSURE

± 2.5 PSI from steady-state pressure.

ENGINE LIMITATIONS

CARTRIDGE START DUTY CYCLE

Only two cartridge starts at least 5 minutes apart can be performed in any 60-minute period. If cartridge and pneumatic starts are interspersed, the starts must be performed at least 5 minutes apart with the cartridge start limitation still applicable.

ENGINE SPEED

Normally, engine speed indications will not exceed 100 ± 0.5% rpm; however, certain overspeed conditions are permissible. Allowable overspeeds (not time-limited) are 103% rpm for ground operation and 102% rpm for inflight operation.

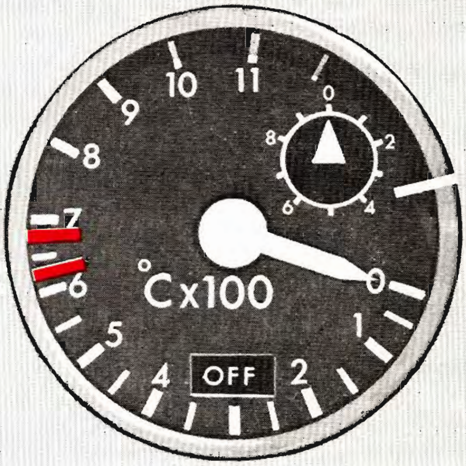
RPM DROP

Drop-off to 87% rpm with 12 seconds recovery time is allowable when initiating afterburner.

INSTRUMENT MARKINGS

BASED ON JP-4 FUEL

EXHAUST TEMPERATURE

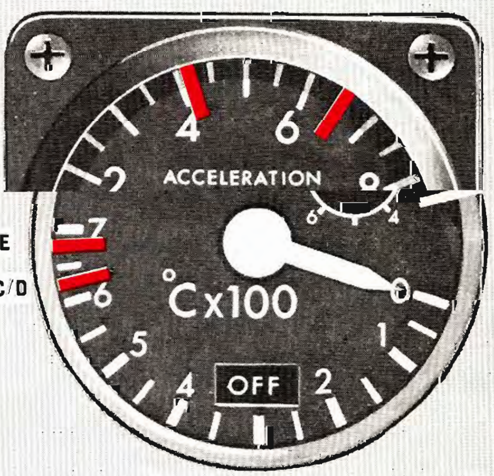


635° MAXIMUM STEADY STATE (F-4C/D)
678° MAXIMUM STEADY STATE (F-4E)

TACHOMETER

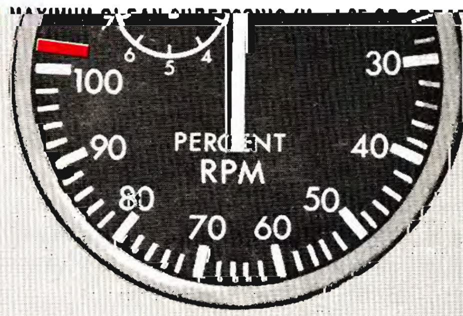
102% RPM – MAXIMUM STEADY STATE OVERSPEED (IN FLIGHT)

ACCELEROMETER



POSITIVE LOAD FACTOR (G) LIMITS

8.5G MAXIMUM CLEAN SUBSONIC (M= 0.72 OR LESS) AT COMBAT DESIGN GROSS WEIGHT – 37,500 POUNDS



635° MAXIMUM STEADY STATE (F-4C/D)
678° MAXIMUM STEADY STATE (F-4E)

102% RPM – MAXIMUM STEADY STATE OVERSPEED (IN FLIGHT)

ACCELEROMETER

12 PSI - MINIMUM AT IDLE RPM

60 PSI - MAXIMUM

35 PSI - STATIC MINIMUM AT MILITARY THRUST

30-60 PSI - INFLIGHT - NORMAL

Notes

- FROM FLIGHT TO FLIGHT, INDICATED PRESSURE AT MILITARY THRUST MUST REPEAT WITHIN $^{+5}_{-10}$ PSI OF THE KNOWN NORMAL INDICATED PRESSURE OF A PARTICULAR AIRPLANE ENGINE COMBINATION.
- ANY STEADY-STATE OPERATION ERRATIC PRESSURE CHANGE WHICH EXCEEDS 5 PSI FOR MORE THAN 1 SECOND MUST BE INVESTIGATED.
- DURING T_2 CUTBACK AND OTHER ENGINE SPEED REDUCTIONS, INDICATED PRESSURE WILL DECREASE APPROXIMATELY 1 PSI PER 1 PERCENT REDUCTION IN RPM.

OIL PRESSURE

* 2750-3250 PSI - NORMAL PC-1

* 2750-3250 PSI - NORMAL PC-2

* 2750-3250 PSI - NORMAL UTILITY

2000-2750 NORMAL WITH RAPID CONTROL MOVEMENT.

3250-3400 IF PRESSURE EXCEEDS 3250 STEADY STATE, AN ENTRY MUST BE LOGGED ON FORM 781.

3400 MAXIMUM

HYDRAULIC PRESSURE

*PRESSURE WITH NO DEMAND ON SYSTEM.

APPROXIMATELY 1 PSI PER 1 PERCENT REDUCTION IN RPM.

OIL PRESSURE

* 2750-3250 PSI - NORMAL PC-1

* 2750-3250 PSI - NORMAL PC-2

* 2750-3250 PSI - NORMAL UTILITY

2000-2750 NORMAL WITH RAPID CONTROL MOVEMENT.

3250-3400 IF PRESSURE EXCEEDS 3250 STEADY STATE, AN ENTRY MUST BE LOGGED ON FORM 781.

3400 MAXIMUM

HYDRAULIC PRESSURE

ENGINE TEMPERATURE LIMITATIONS

Engine temperatures are limited by degrees and time as shown on figure 5-2.

ENGINE EXHAUST TEMPERATURE LIMITATIONS

CONDITION	TEMP	TIME
Starting–from light–off	1000 °C 980 °C 930 °C 900 °C Down to 733 °C	3 sec 10 sec 1 min 1 min 30 sec
During all engine operation other than starting	Above 750°C (F-4C/D) 635°C (F-4E) 678 °C	3 sec NO TIME LIMIT NO TIME LIMIT

Notes

If any of the above limits are exceeded the aircraft will be aborted and written up. In addition, if 705°C is exceeded during start for any period of time, the engine will require corrective action to prevent recurrence. This is not an abort item.

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Figure 5-2

THROTTLE BURSTS

When operating with maximum engine compressor bleed air (flaps down and cockpit pressurized) in outside air temperatures of -37°C and below, rapid throttle bursts may result in an rpm hang-up. If a throttle burst into maximum afterburner is made, cyclic engine operation may result. When rapid throttle bursting is necessary under these conditions, it is recommended that the throttle be advanced to minimum afterburner first and the engine rpm be allowed to stabilize before advancing further into the afterburner range.

WINDMILLING LIMITATIONS

Prior to shutdown under non-emergency conditions, reduce thrust to idle and allow EGT to stabilize. For non-emergency shutdowns, do not allow engine windmill rpm to remain below 7% for longer than 10 minutes. The number of intervals operating below 7% rpm is not limited, provided each 10-minute period below 7% rpm is followed by at least a 10-minute period operating above 7% rpm. Operation at 7% rpm or above is required to provide adequate circulation of lubricating oil to various engine components.

THRUST LIMITATIONS

Maximum and military thrust is limited to 30 minutes below 35,000 feet, and 2 hours above 35,000 feet. For F-4E aircraft, figure 5-3 is used to determine engine temperature/rpm operating limits in relation to steady state military thrust for takeoff. Under these conditions ambient air temperature may be considered as compressor inlet temperature. The chart depicts minimum, maximum, and normal limits.

IGNITION LIMITATIONS

The engine ignition time-cycle is limited to 2 minutes ON, 3 minutes OFF, 2 minutes ON, and 23 minutes OFF.

AFTERBURNER SHUTDOWN LIMITATIONS

Gradual afterburner shutdown is required in certain areas of the airplane flight envelope. It is intended to allow the airplane to decelerate from high speeds to medium speeds before the engine exhaust nozzles close. This prevents the exhaust nozzles from becoming overpressurized due to peak pressures between maximum thrust and military thrust. Refer to Airplane Speed Restrictions (figure 5-4) for gradual afterburner shutdown speeds in relation to altitude.

ENGINE G LIMITATIONS

Due to limited oil distribution to the variable nozzle system during negative G or zero G flight, the airplane is limited to:

1. 30 seconds of negative G flight.
2. 10 seconds of zero G flight.

MILITARY POWER OPERATING LIMITS

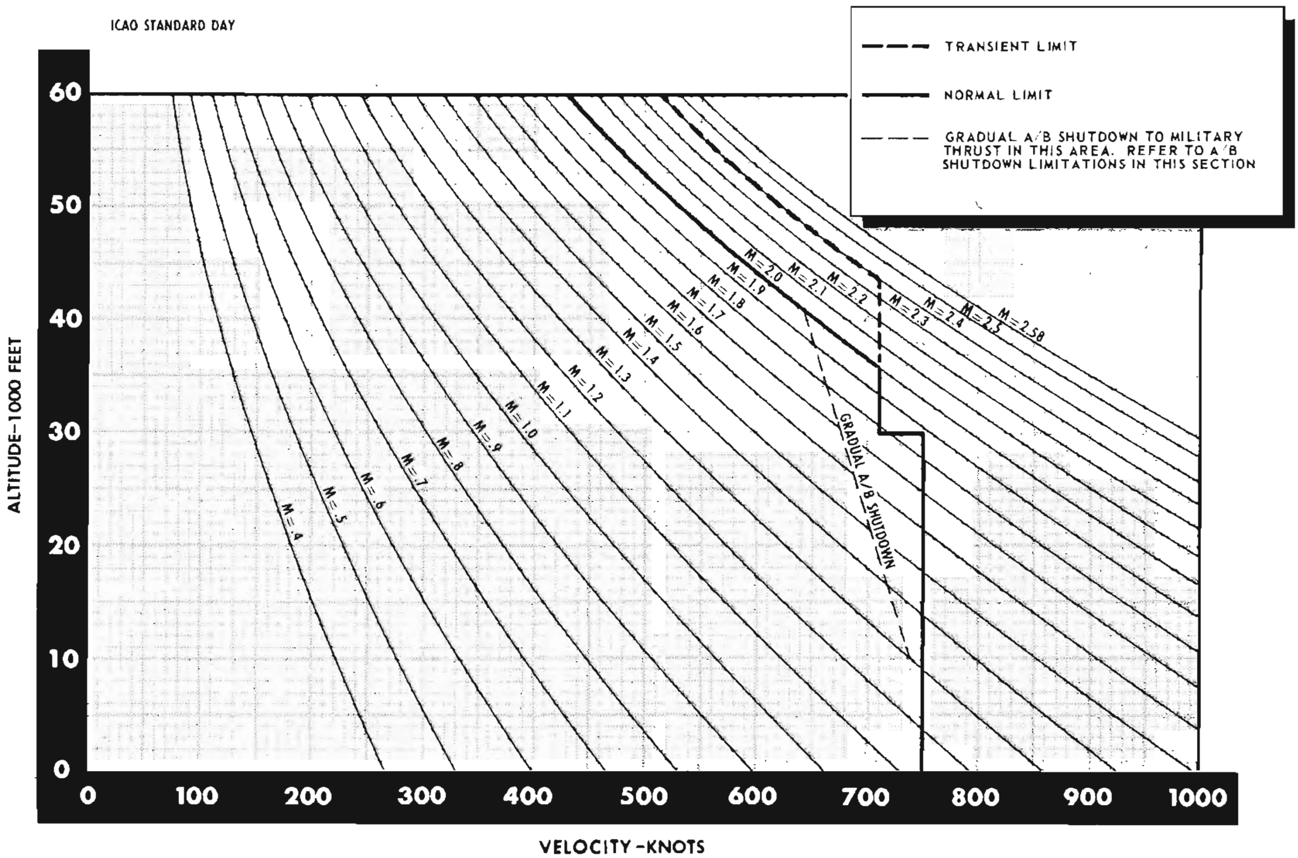
OAT °C	RPM (±1%)	EGT °C
-50	90.5	527-584
-45	91.0	527-597
-40	91.5	527-606
-35	92.0	536-618
-30	92.5	548-628
-25	93.0	560-640
-20	93.5	572-650
-15	94.0	584-662
-10	94.5	596-672
- 5	95.0	608-678
0	95.5	620-678
+ 5	96.0	632-678
+ 10	96.5	644-678
+ 15	97.0	656-678
+ 20	97.5	648-678
+ 25	98.0	640-678
+ 30	98.5	632-678
+ 35	99.0	632-678
+ 40	99.5	632-670
+ 45	100.0	632-660
+ 50	100.0	632-660

F4E-523

Figure 5-3

AIRPLANE SPEED RESTRICTIONS

CLEAN OR (4) AIM-7 MISSILES



Note UNDER SOME CONDITIONS, MAXIMUM AIRSPEEDS ARE DETERMINED BY INLET TEMPERATURE LIMITATIONS AND TRANSIENT OPERATIONS LIMITATIONS. REFER TO ENGINE AIRSPEED LIMITATIONS CHART, THIS SECTION.

F4-504

Figure 5-4

ENGINE AIRSPEED LIMITS		
ALTITUDE RANGE	STEADY STATE LIMIT	TRANSIENT LIMIT
SEA LEVEL TO 30,000 FEET	POINT AT WHICH DUCT TEMP HI LIGHT ILLUMINATES (121°C), OR 750 KNOTS WHICHEVER OCCURS FIRST.	NONE
30,000 FEET AND UP	POINT AT WHICH DUCT TEMP HI LIGHT ILLUMINATES OR 710 KNOTS WHICHEVER OCCURS FIRST.	5 MINUTES PER FLIGHT ABOVE THE STEADY STATE LIMIT. NOT TO EXCEED 710 KNOTS OR .4 MACH ABOVE THE SPEED AT WHICH THE STEADY STATE LIMIT IS REACHED.

F4-521

Figure 5-5

ALTERNATE FUEL

The engines may be operated on JP-5. ASTM JET A-1, ASTM JET B, NATO F-34, or NATO F-35 fuel as an alternate when JP-4 is not available. The engines start and operate satisfactorily on these fuels; however, air temperature must be higher than -29°C and the fuel temperature above -23°C. Relights can be expected at altitudes up to 35,000 feet and at speeds up to 1.0 Mach.

CAUTION

When these alternate fuels are utilized, the main and afterburner fuel controls should be set to the corresponding specific gravity. Prior to flight, ensure that the fuel tanks are drained of water to prevent freezing.

EMERGENCY FUEL

In an emergency, the engines may be operated on MIL-G-5572B 115/145 AVGAS if JP-4 or an alternate fuel is not available. When AVGAS is used, the aircraft is restricted to one flight of no more than 5 hours duration at subsonic speeds. AVGAS has a specific gravity range between 0.730-0.685. The AC should be aware that the following degradations in engine performance will occur.

1. Longer time to start and accelerate, with possible missed-starts or start-stalls.
2. Maximum engine RPM and EGT may not be attained.
3. Slow acceleration throughout the operating range.
4. Lower than normal afterburner thrust.
5. Reduced aircraft range.

AIRSPEED LIMITATIONS

The maximum permissible airspeeds for flight in smooth or moderately turbulent air are shown in figure 5-4. Under some conditions, maximum airspeeds are determined by inlet temperature limitations and transient operations limitations; refer to Engine Airspeed Limits (figure 5-5). Limiting airspeeds for operation of various airplane systems are presented in figure 5-6.

Note

When flying below 10,000 feet, caution should be used when operating the aircraft above 0.87 Mach to preclude oscillations in case of stability augmentation failure.

PROHIBITED MANEUVERS

1. Full-deflection aileron roll in excess of 360°
2. Intentional spins.
3. Intentional maneuvers, with the automatic flight control system engaged, that exceeds the automatic disengagement limits of the system. Refer to Automatic Flight Control System, Section IV, this manual. (Does not apply to Functional Check Flights)
4. Takeoffs with full flaps. This does not include Touch and Go landings when full flaps have been selected for landing.

SYSTEMS OPERATION LIMITATIONS

CONDITION		AIRSPEED or MACH Whichever is Less	LOAD FACTOR
LANDING GEAR EXTENDED		250 KNOTS	0 TO + 2.0 G
WING FLAPS FULLY OR PARTIALLY EXTENDED		250 KNOTS	0 TO + 2.0 G
RAM AIR TURBINE	INFLIGHT OPERATION	515 KNOTS OR 1.1 MACH	0 TO + 3.0 G
	EXTENDED	515 KNOTS OR 1.1 MACH	-1.0 TO + 5.2 G
AIR REFUELING RECEPTACLE	INFLIGHT OPERATION	320 KNOTS OR 0.85 MACH	-1.5 TO - 3.0 G
	EXTENDED	400 KNOTS OR 0.85 MACH	
CANOPY OPEN, GROUND OPERATION		60 KNOTS	NOT APPLICABLE
CANOPY JETTISON, INFLIGHT		SAME AS BASIC AIRPLANE	SAME AS BASIC AIRPLANE
DRAG CHUTE DEPLOYMENT		200 KNOTS	NOT APPLICABLE
COCKPIT ACCESS STEPS EXTENDED		400 KNOTS	NOT APPLICABLE

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Figure 5-6

TOUCHDOWN SINK RATE LIMITS

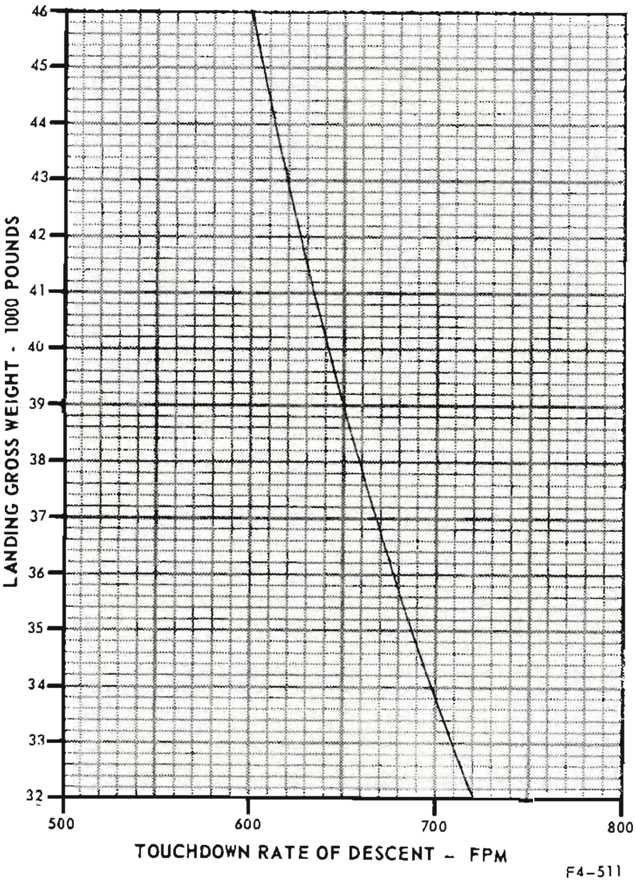


Figure 5-7

GROSS WEIGHT LIMITATIONS

The maximum allowable gross weights are:

1. 58,000 pounds for takeoff.
2. 46,000 pounds for landing.

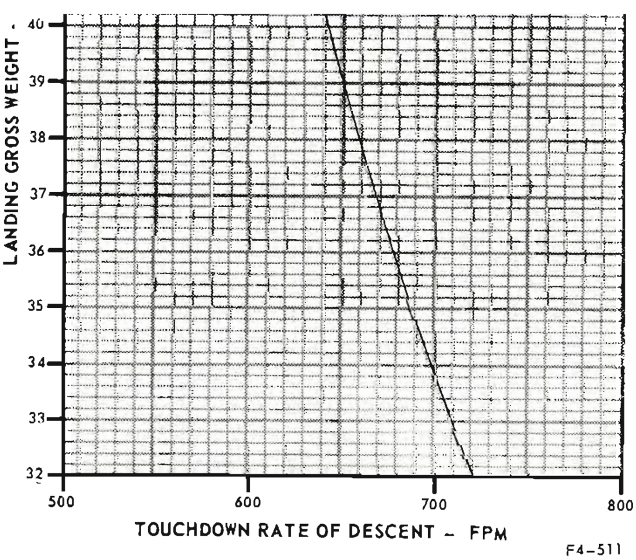
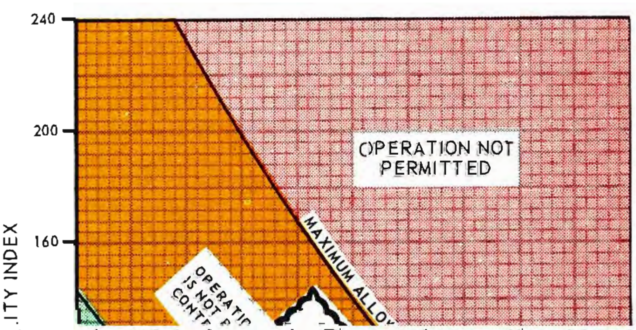


Figure 5-7

CENTER OF GRAVITY LIMITATIONS

The center of gravity (CG) position moves forward as fuselage fuel is transferred and consumed. For a clean configuration (no external stores), the approximate CG travel is from 33.5% to 29.2% of the mean aerodynamic chord (MAC) for the F-4C, from 33.9% to 28.6% MAC for the F-4D, and from 32.7% to 26.1% MAC for the F-4E. Therefore, fuselage fuel distribution becomes the primary control of CG position. A tape indication of 8000 pounds indicates an aft CG condition since all fuselage cells are full. A tape indication of 5500 pounds (cells 5 and 6 nearly empty) indicates mid-range CG. This mid-range CG condition can be attained earlier by utilizing the tanks 5/6 lockout feature (F-4C/D after T.O. 1F-4-773) from the time of engine start. At 2500-3000 pounds on the tape, the CG is forward. The maximum allowable aft CG must be kept forward of 36% MAC, and with some loadings as far forward as 32% MAC. This is necessary to maintain minimum longitudinal stability. The addition of external stores on the wing stations decreases longitudinal stability and reduces stick forces required per G throughout the flight envelope. The amount of decrease varies with the weight and shape of the loads and their location on the wing, and is further aggravated by heavy gross weights, maximum performance maneuvering, and low speed flight. Inboard-mounted stores shift the CG forward, while outboard-mounted stores result in a small shift aft and increase the destabilizing effect. Centerline

AFT CG LIMITS



tape, the CG is forward. The maximum allowable aft CG must be kept forward of 36% MAC, and with some loadings as far forward as 32% MAC. This is necessary to maintain minimum longitudinal stability. The addition of external stores on the wing stations decreases longitudinal stability and reduces stick forces required per G throughout the flight envelope. The amount of decrease varies with the weight and shape of the loads and their location on the wing, and is further aggravated by heavy gross weights, maximum performance maneuvering, and low speed flight. Inboard-mounted stores shift the CG forward, while outboard-mounted stores result in a small shift aft and increase the destabilizing effect. Centerline

AFT CG LIMITS

stores normally shift the CG aft, but have no significant aerodynamic destabilizing effect. Maximum aerodynamic destabilizing occurs when stores are mounted on all wing stations. Because of this, when carrying wing-mounted external stores, it is necessary to establish a maximum allowable aft CG in order to maintain minimum longitudinal stability. The minimum acceptable level of stability is based on controllability, using smooth control inputs for tracking and maneuvering; no allowance is made for abrupt control inputs. To ensure acceptable longitudinal stability, it is necessary to consider aerodynamic stability effects in conjunction with CG location. Each wing-mounted store and its associated suspension equipment is assigned a unit stability number which reflects its aerodynamic destabilizing effect. Stability numbers for individual stores and suspension equipment are contained in Part 1 of the Performance Data Manual. After computing the aircraft stability index (sum of stability numbers) refer to the allowable AFT CG Limit Chart (figure 5-8) to determine maximum allowable aft CG location. To determine CG location, refer to the Handbook of Weight and Balance Data (T.O. 1-1B-40) and DD form 365F for the loaded aircraft. Once the aircraft stability index has been computed and the aircraft CG location for the given loading determined, figure 5-8 may be used to plot the point which represents these two numbers. If this point falls within the red colored area, operation is not permitted. The most undesirable case of fuel loading (full fuel) and stores loading should be considered in determining if a given configuration can be flown. When this point falls within the yellow colored band, flight is permitted but the airplane has a stability margin which is considered to be the minimum acceptable (minimum longitudinal stability). Flight within this area requires smooth and precise control inputs for tracking and maneuvering, and AOA above buffet onset should be avoided. The CG will begin to move forward once external fuel transfer has been completed and fuselage fuel is being consumed (earlier if the tanks 5/6 lockout feature is used). However, the airplane stability index will not change until some or all of the wing mounted external stores are released (or jettisoned). As the CG moves forward in the yellow area, longitudinal stability improves. This added improvement in stability is reflected in the better maneuvering and tracking flight characteristics. As the CG moves into the green area, flying qualities are further improved.

The maximum allowable forward CG for F-4C/D aircraft is 25% MAC. For F-4E aircraft, the maximum allowable forward CG is 22% MAC. However, to maintain adequate longitudinal control, the allowable forward CG is restricted to 22.5% MAC for the one-half flap configuration and 23.5% for the full-flap configuration. Normally, these forward CG limits will only be exceeded at landing gross weights if heavy external stores are retained on the inboard wing stations. If necessary, jettisoning these stores will move the CG within acceptable limits.

CAUTION

When flying at airspeeds in excess of 350 knots below 10,000 feet with CG aft of 32.0% MAC, avoid abrupt control motions. CG location aft of 32.0% MAC will normally occur whenever full internal fuel is maintained in conjunction with external stores.

ACCELERATION LIMITATIONS

The maximum accelerations presently permitted for flight in smooth or moderately turbulent air are as shown in figure 5-9. Separate plots are provided for symmetrical maneuvers (coordinated maneuvers without an accompanying roll rate) and unsymmetrical maneuvers (rolling pullouts, etc.). Additional load factor limits for speeds above 1.5 Mach are shown in figure 5-10. Accelerometer range markings are shown in figure 5-1. Maximum accelerations for in-flight operation of various aircraft systems are shown in figure 5-6.

FLIGHT STRENGTH DIAGRAM

The flight strength diagram (figure 5-10) is a composite presentation of the airplane's operating envelope at two different gross weights. Parameters of each envelope include maximum allowable Mach number, wings-level stall speed at sea level, and the positive and negative load factor limits. This diagram further restricts allowable negative load factors at speeds above 1.5 Mach, and allowable positive load factors at speeds above 1.8 Mach.

EXTERNAL STORES LIMITATIONS

Only the external stores listed in this section may be carried and released, singly or in combination, by the aircraft. Different stores authorized for carriage on a specific station will not be combined unless depicted in combination. The External Stores Limitations chart (figure 5-11) illustrates all authorized loading configurations; maximum permissible airspeeds and accelerations for carriage, launch, release, and jettison; maximum allowable roll rates and roll accelerations (stick throw); maximum dive angles for delivery; and pertinent remarks/notes for each authorized store. The External Stores Limitations chart indicates store-to-airframe structural and flight handling characteristic compatibility only; electromagnetic radiation capability is indicated in the applicable equipment Technical Order when not stated in the Remarks column.

WARNING

Jettison and release limits are based on test data with the landing gear and flaps up. If centerline or inboard release or jettisoning is required with the landing gear down, or with the landing gear and flaps down, damage may occur to the aircraft which may result in loss of control.

Note

- Where applicable, alternate limitations are also included within a boxed area. These alternate limitations permit higher speeds if lower acceleration limits are observed.

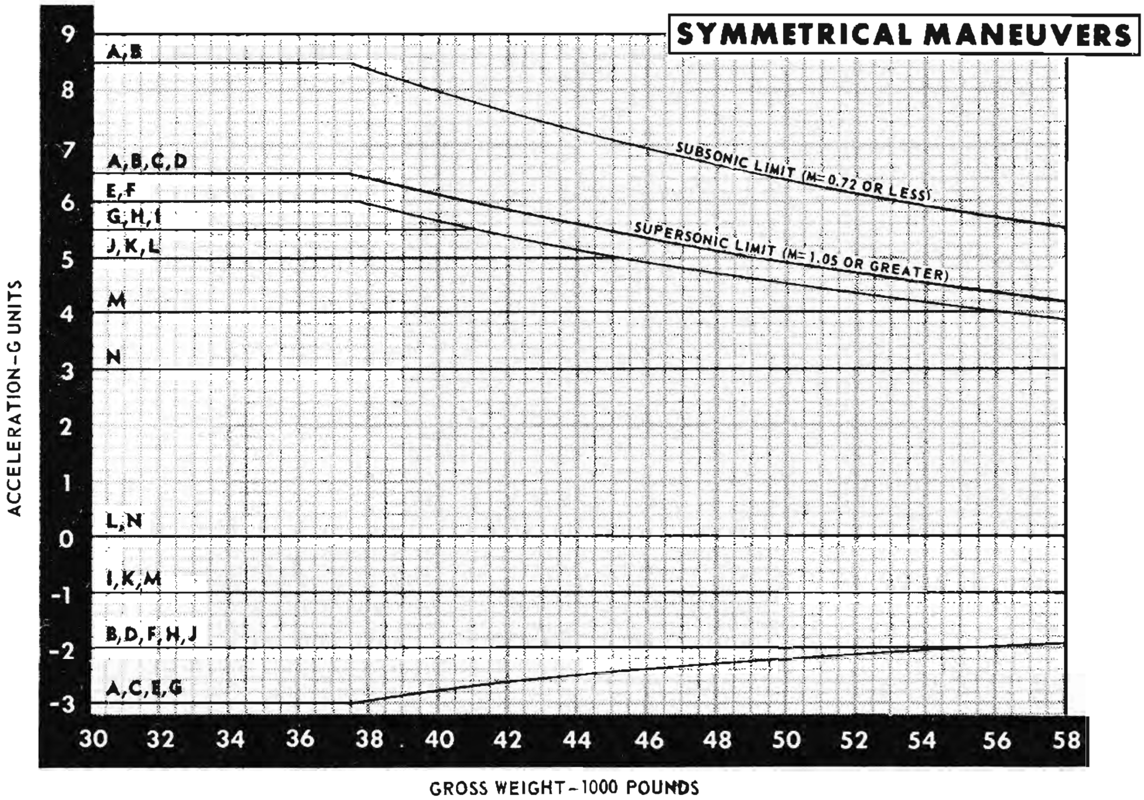
- Avoid jettisoning or releasing any store(s) at the extremities of the published envelopes whenever possible.

- Release of weapons with a load factor in excess of 3 G may result in a small percentage of hung bombs; i.e., the failure of the bomb to release from the MER or TER ejector unit.

CNI EQUIPMENT LIMITATIONS

The maximum permissible altitude with CNI equipment on is 60,000 feet. Flight above 60,000 feet with CNI equipment on may result in damage to the equipment.

ACCELERATION LIMITATIONS



CONFIGURATIONS:

A. • BASIC AIRPLANE WITH OR WITHOUT FUSELAGE MISSILES
• SUU-16/A OR SUU-23/A GUN POD AT STATION 5.
B. EMPTY TO 10% FULL MAC CENTERLINE TANK
C. SPECIAL WEAPON OR SUU-21/A DISPENSER AT STATION 5.
D. 10% FULL TO 75% FULL MAC CENTERLINE TANK.
E. SUU-16/A OR SUU-23/A GUN POD AT STATIONS 1 & 9; AIM-4D, AIM-9B, AGM-12B, OR AGM-45 MISSILES; WALLEYE WEAPONS; ECM PODS.
F. EMPTY TO 10% FULL EXTERNAL WING TANKS.
G. MK 84 GP BOMB AT STATION 5.
H. AGM-12C OR AGM-12E MISSILES, MK 84 GP BOMB AT STATIONS 1 & 9, SPECIAL WEAPON AT STATIONS 1,2, & 8.
I. SUU-21/A DISPENSER AT STATIONS 1,2, & 8.
J. 75% FULL TO FULL MAC CENTERLINE TANK OR 10% FULL TO 75% FULL EXTERNAL WING TANKS.
K. ALL OTHER AUTHORIZED STORES (BOMBS, ROCKETS, DISPENSERS, TOW TARGETS, SPRAY TANKS, ETC.) THAT ARE NOT SPECIFICALLY NOTED.
L. EMPTY TO 75% FULL ROYAL JET CENTERLINE TANK.
M. 75% FULL TO FULL EXTERNAL WING TANKS.
N. 75% FULL TO FULL ROYAL JET CENTERLINE TANK.

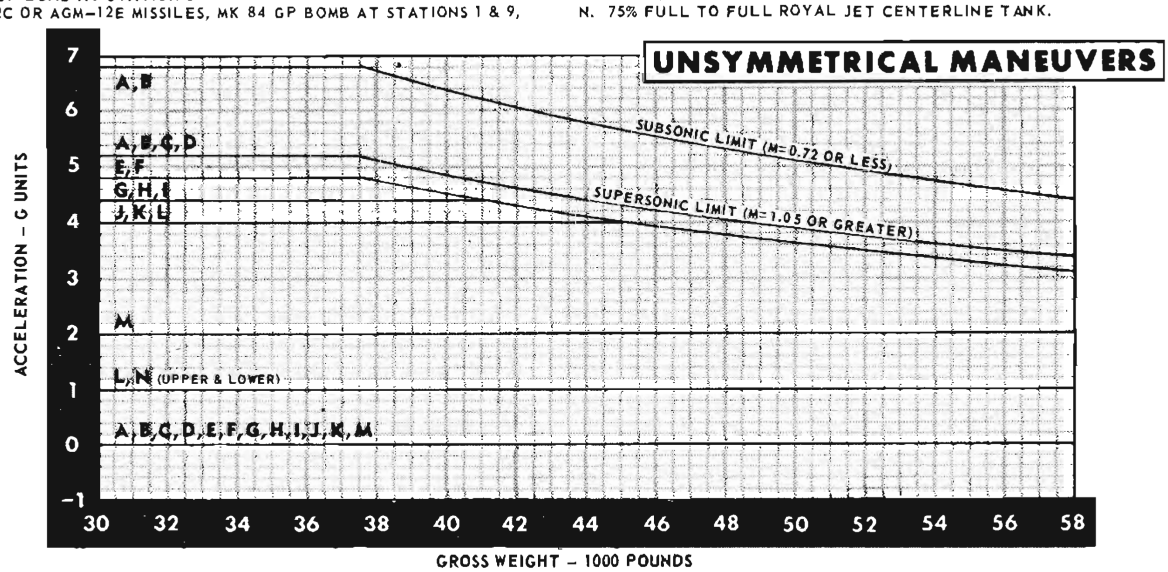
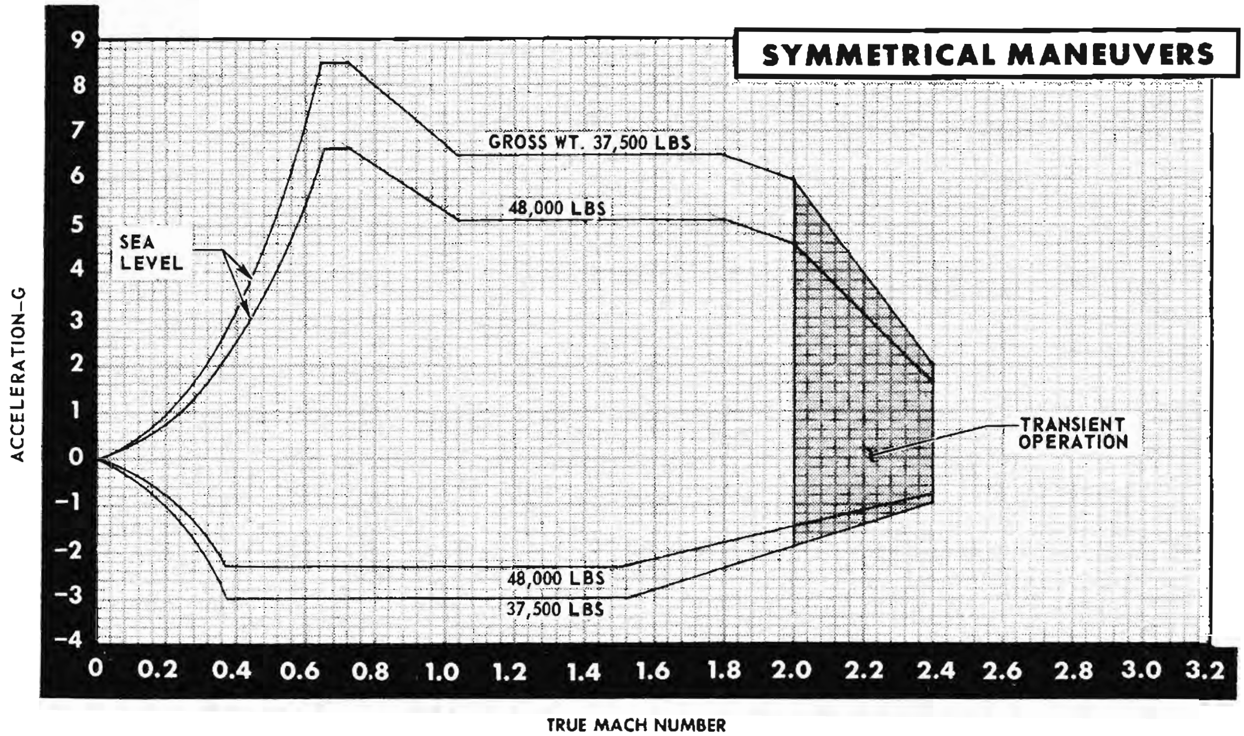


Figure 5-9

FLIGHT STRENGTH DIAGRAM



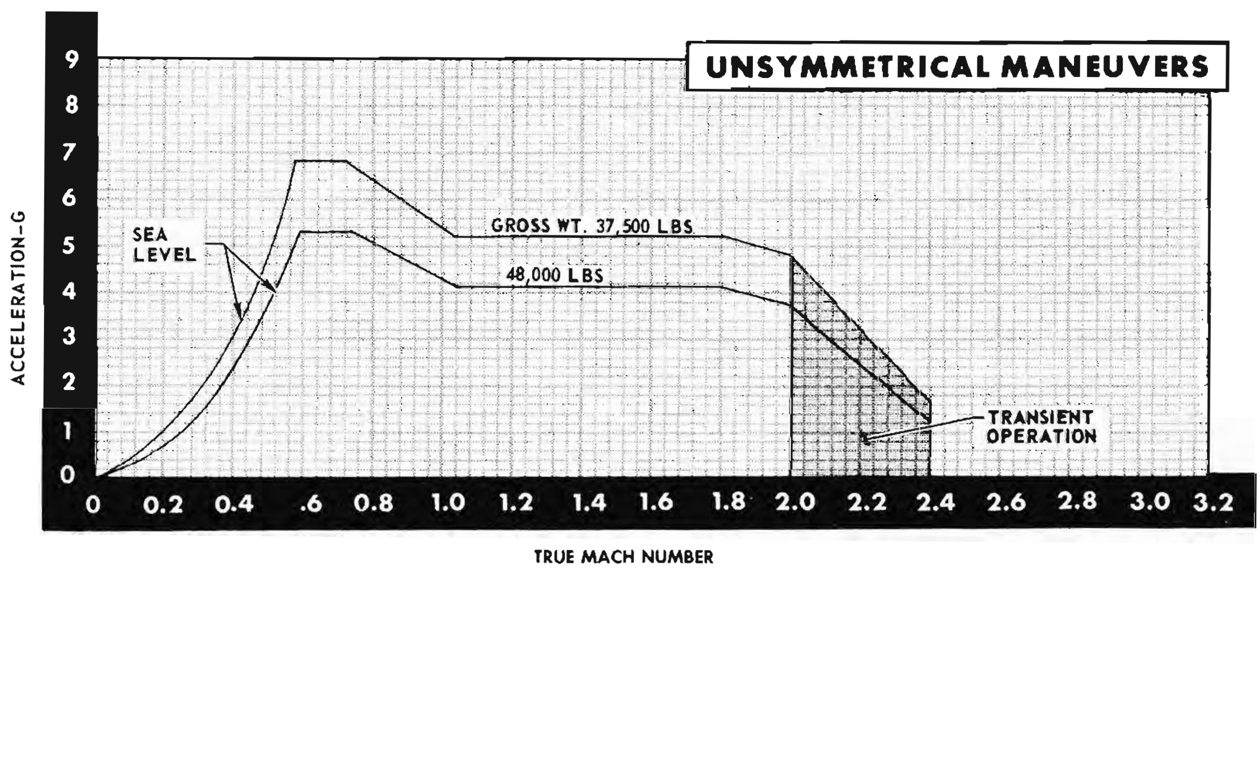
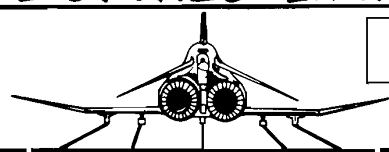
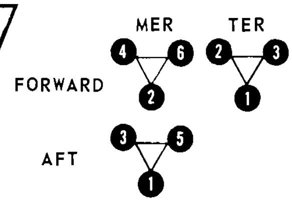


Figure 5-10

EXTERNAL STORES LIMITATIONS



FUEL TANKS AND SPECIAL WEAPONS

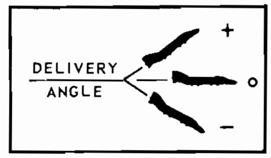


STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M
McDonnell 600 Gallon CL Tank	Aero 27/A Bomb Rack		Empty to 10% Full	●			✈	✈	✈ Upper -2.0 (Lower)	✈	200	Full	* 175 E 175	* 425 390	* 1.8 1.1
			10% Full to 75% Full	●			✈	✈	+6.5 -2.0	+5.2 0.0	150	1/2	Not Authorized		
			75% Full to Full	●			✈	✈	+5.0 -2.0	+4.0 0.0	150	1/2	* 175 E 175	* 425 390	* 1.8 1.1
Royal Jet 600 Gallon CL Tank	Aero 27/A Bomb Rack		Empty to 10% Full	●			600	1.8	+5.0 0.0	+4.0 +1.0	*	*	** 175 E 175	** 425 390	** 1.8 1.1
			10% Full to 75% Full	●			600	1.8	+5.0 0.0	+4.0 +1.0	*	*	Not Authorized		
			75% Full to Full	●			600	1.8	+3.0 0.0	+1.0 +1.0	*	*	** 175 E 175	** 425 390	** 1.8 1.1
McDonnell 370 Gallon Wing Tank and Sergeant Fletcher 370 Gallon Wing Tank	Wing Tank Pylon only for McDonnell Wing Tank	●		Empty to 10% Full		●	750	1.6	+6.0 -2.0	+4.8 0.0	270	FULL	*BELOW 35,000 FT: (1G Level Flight) 175 to 375, (2G Sym Flight) 400 to 445, (3G Sym Flight) 425 to 510. ABOVE 35,000 FT: (1G Level Flight) 175 to 410, (2G Sym Flight) 440 to 490, (3G Sym Flight) 460 to 550.		
		●		10% Full to 75% Full **		●	550	1.6	+5.0 -2.0	+4.0 0.0	120	1/2			
		●		75% Full to Full		●	550	1.6	+4.0 -1.0	+2.0 0.0	120	1/2			
B28 Bomb or B43 Bomb, or Dummy Unit Maximum Load-2	MAU-12B/A 30 inch	●					550	1.1	+5.5 -2.0	+4.4 0.0	150	FULL	175	550	1.1
	Aero 27/A 30 inch			●			✈	✈	+6.5 -3.0	+5.2 0.0	150	FULL	175	✈	✈
B57 Bomb or Dummy Unit Maximum Load-4	MAU-12B/A 30 inch	●					550	1.1	+5.5 -2.0	+4.4 0.0	150	FULL	175	550	1.1
	Aero 27/A 30 inch			●			✈	✈	+6.5 -3.0	+5.2 0.0	150	FULL	175	✈	✈
	MAU-12B/A 14 inch		●		●		✈	✈	+5.5 -2.0	+4.4 0.0	150	FULL	175	550	1.1
B61 Bomb or Dummy Unit Maximum Load-2	MAU-12B/A 30 inch	●					550	1.1	+5.5 -2.0	+4.4 0.0	150	FULL	175	550	1.1
	Aero 27/A 30 inch			●			✈	✈	+6.5 -3.0	+5.2 0.0	150	FULL	175	✈	✈

F4-516-1

Figure 5-11 (Sheet 1 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable

NE, Not Established

F-4E Only

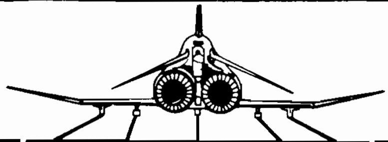
✈ Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
A	NA	NA	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Jettison 1G level flight. ✱ External tanks must be jettisoned either full or empty. ● F-4C/D. (Full or empty): Jettison between 375 and 425 KCAS below 15,000 feet may cause airplane contact and minor damage. ● **F-4E. (Full or Empty): Jettison between 350 and 390 knots below 15,000 feet may cause airplane contact and minor damage.**
B	NA	NA	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Jettison 1G level flight. ✱✱ External tanks must be jettisoned either full or empty. ✱ Only gradual coordinated turns are permitted. ● F-4C/D. (Full or empty): Jettison between 375 and 425 KCAS below 15,000 feet may cause airplane contact and minor damage. ● **F-4E. (Full or Empty): Jettison between 350 and 390 knots below 15,000 feet may cause airplane contact and minor damage.**
C	NA	NA	NA	NA	NA	NA	NA	NA	NA	● If gross wt is over 37,500 lbs, refer to Accelerations Limitations Chart ● When carrying tanks on stations 1 and/or 9, do not release rocket pods (either full or empty) from the outboard shoulder of TER's on stations 2 and 8. ✱ External tanks must be jettisoned either full or empty. ✱✱ Jettison not authorized when tanks are 10% Full to 75% Full. External tanks must be jettisoned either full or empty.
D	NA	NA	NA	NA	NE	175	550	1.1	NE	● Releasing and jettisoning special weapons are based on special considerations. Refer to T.O. 1F-4C-25 series publications to obtain release/jettison criteria and additional limitations as imposed by the weapon. ● If gross wt is over 37,500 lbs on STA 5 or is over 41,000 lbs on STA 1, refer to Accelerations Limitations Chart. ● Wing-station carriage is not authorized for aircraft before T.O. 1F-4-696.
	NA	NA	NA	NA	NE	175	✈	✈		
E	NA	NA	NA	NA	NE	175	550	1.1	NE	● Releasing and jettisoning special weapons are based on special considerations. Refer to T.O. 1F-4C-25 series publications to obtain release/jettison criteria and additional limitations as imposed by the weapon. ● If gross wt is over 37,500 lbs on STA 5 or is over 41,000 lbs on STA 1/2/8, refer to Accelerations Limitations Chart. ● Wing-station carriage is not authorized for aircraft before T.O. 1F-4-696.
	NA	NA	NA	NA	NE	175	✈	✈		
	NA	NA	NA	NA	NE	175	550	1.1		
	NA	NA	NA	NA	NE	175	550	1.1	NE	● Releasing and jettisoning special weapons are based on special considerations. Refer to T.O. 1F-4C-25 series publications to obtain release/jettison criteria and additional limitations as imposed by the weapon. ● If gross wt is over 37,500 lbs on STA 5 or is over 41,000 lbs on STA 1, refer to Accelerations Limitations Chart. ● Wing-station carriage is not authorized for aircraft before T.O. 1F-4-696
	NA	NA	NA	NA	NE	175	✈	✈		

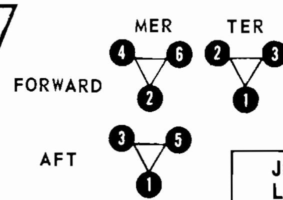
F4-516-2

Figure 5-11 (Sheet 2 of 38)

EXTERNAL STORES LIMITATIONS



MISSILES



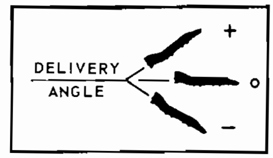
STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON (JETTISON 1G LEVEL FLIGHT) MIN KNOTS	MAX KNOTS	M	
AGM-12B Missile Maximum Load – 4	LAU-34/A Launcher	●				●	600	1.75	+6.0 -3.0	+4.8 -0.0	200	FULL	175	550	1.1	
			●		●											A
AGM-12C Missile Maximum Load-2	MAU-12B/A		●		●		✈	✈	+5.5 -2.0	+4.4 0.0	150	FULL	175	550	0.95	B
AGM-12E Missile Maximum Load-2	MAU-12B/A		●		●		✈	✈	+5.5 -2.0	+4.4 0.0	150	FULL	175	550	0.95	C
AGM-45 Missile Maximum Load-4	LAU-34/A Launcher	●	●		●	●	✈	✈	+6.0 -3.0	+4.8 0.0	200	FULL	175 E 225	550 500	1.1 1.1	D
MK 1 Mod 0 (Walleye Weapons) Maximum Load–4	MAU-12B/A	●	●		●	●	NA	0.95	+6.0 -3.0	+4.8 0.0	200	FULL	175	550	0.95	E
AIM-4D Missile Maximum Load-4	AIM-4D Inboard and Lower Launchers		●		●		✈	✈	+6.0 -3.0	+4.8 0.0	200	FULL	175	✈	✈	
	AIM-4D Inboard Launcher		●		●											F
AIM-9B Missile	LAU-7A/A Launcher		●		●		*	*	+6.0 - 3.0	+4.8 0.0	200	FULL	175	NA	1.9	G
AIM-9E Missile	LAU-7A/A Launcher		●		●		*	*	+6.5 -3.0	+5.2 0.0	*	*	*	*	*	
AIM-9B/E Missile	Aero-3/B Launcher															H
TDU-11/B HVAR (IR TARGET) Maximum Load–4	LAU-7A/A Launcher		●		●		NE	NE	NE	NE	NE	NE	NE	550	1.5	

STORE	MISSILE WING FREEDOM	MISSILE STATIONS	3	4	6	7	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M
AIM-7D/E, AIM-7E-2 Missiles Maximum Load–4	2.25° Wing lock delay SW LOCKED	FWD		●	●		*	*	*	*	*	*	NA	*	*
		AFT	●			●	*	*	*	*	*	*	NA	*	*
	21° Wing lock delay SW UNLOCKED	FWD		●	●		*	*	*	*	*	*	NA	*	*
		AFT	●			●	*	*	*	*	*	*	NA	*	

F4-516-3

Figure 5-11 (Sheet 3 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplone.



NA, Not Applicable

NE, Not Established

F-4E Only

✈ Aircraft Limits

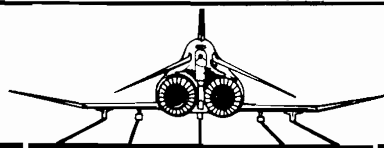
	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	MAXIMUM M	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	MAXIMUM M		
A	1	NA	NA	0.95	NA	NA	NA	NA	Level to −60°	● Launching the AGM-12B from wing stations 2 and 8 could cause a compressor stall and or a high EGT. ● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart
B	1	NA	NA	0.95	NA	NA	NA	NA	Level to −60°	● If gross weight is over 41,000 lbs, refer to Acceleration Limitations Chart.
C	1	NA	NA	0.95	NA	NA	NA	NA	Level to −60°	● If gross weight is over 41,000 lbs, refer to Acceleration Limitations.
D	*	175	✈	✈	NA	NA	NA	NA	+50° to −50°	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. * Same as AIM-7 Missile. Refer to AIM-7 Missile T.O. 1F-4C-34-1-1A.
E	*	175	550	0.95	NA	NA	NA	NA	NE	● F-4D/E only. * Refer to T.O. 1F-4C-34-1-1A. ● If gross weight is over 37,500 lbs, see Acceleration Limitations Chart.
F	*	175	✈	✈	NA	NA	NA	NA	NA	● F-4D/E only. * Refer to T.O. 1F-4C-34-1-1A. ● F-4E: Engine stall/flameout of one or both engines may be experienced when firing AIM-4D missiles with AIM-4D ECP 53 (Guide During Boost) inc. This is due to engine ingestion of missile exhaust gases. ● When AIM-4D launchers are empty, use basic Aircraft limits ● If gross weight is over 37,500 lbs, see Acceleration Limitations Chart.
G	**	175	NA	1.9	NA	NA	NA	NA	NA	* Aircraft limits except with MK 8 warhead, see figure 5-12. ** Refer to T.O. 1F-4C-34-1-1A. ● If gross weight is over 37,500 lbs, see Acceleration Limitations Chart.
H	**	*	*	*	NA	NA	NA	NA	NA	* Aircraft limits except with MK 8 warhead, see figure 5-12 ** Refer to T.O. 1F-4C-34-1-1A. ● If gross weight is over 34,500 lbs, see Acceleration Limitations Chart.
	NE	NE	550	1.5	NA	NA	NA	NA	NA	

LAUNCHING AIRSPEED OR MACH WHICHEVER IS LESS	LAUNCH ACCEL G	DELIVERY ANGLE	REMARKS
MAX - 650 KNOTS TO 30,000 FEET. NO LIMIT ABOVE 30,000 FEET. MIN - 0.7 MACH	**	NA	* Aircraft limits except with MK 18 warhead. When carrying MK 18 warheads that have been subjected to soak temperatures between 32°C and 39°C prior to flight, do not exceed 30 minutes continuous operation at 0.9 Mach below 10,000 feet. If warheads are subjected to soak temperatures between 39°C and 46°C, do not exceed 15 minutes continuous operation at 0.9 Mach below 10,000 feet or 15 minutes at 1.3 Mach between 10,000 feet and 30,000 feet.
MAX - 600 KNOTS TO 20,000 FEET; 575 KNOTS FROM 20,000 TO 40,000 FEET. NO LIMIT ABOVE 40,000 FEET. MIN - 0.7 MACH	**	NA	** Refer to T.O. 1F-4C-34-1-1A. ● If the tank-aboard relay is energized (TK light illuminated), the missiles mounted on fuselage stations 4 and 6 cannot be launched or jettisoned.
MAX - SAME AS BASIC AIRPLANE MIN - 0.7 MACH	**	NA	● If gross weight is over 37,500 lbs, see Acceleration Limitation Chart. ● Only unmodified AIM-7D missiles can have 21° wing freedom.
MAX - SAME AS BASIC AIRPLANE MIN - 0.7 MACH	**	NA	

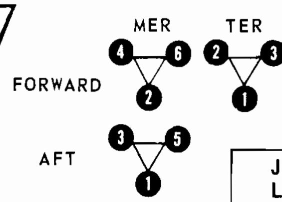
F4-516-4

Figure 5-11 (Sheet 4 of 38)

EXTERNAL STORES LIMITATIONS



GP BOMBS AND LAND MINES



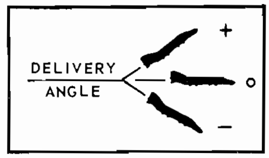
JETTISON 1G LEVEL FLIGHT

STORE	SUSPENSION	STATION LOADING 1	STATION LOADING 2	STATION LOADING 5	STATION LOADING 8	STATION LOADING 9	CARRIAGE AIRSPEED KNOTS	CARRIAGE AIRSPEED MACH	CARRIAGE ACCEL G SYM.	CARRIAGE ACCEL G UNSYM.	CARRIAGE ROLL RATE DEG/SEC	CARRIAGE STICK THROW	JETTISON MIN KNOTS	JETTISON MAX KNOTS	JETTISON MAX M	
BLU-31/B Land Mine Maximum Load-15	MER (Shifted Aft)						550	1.1	+5.0 -1.0	+4.0 0.0	120	1/2	175	600	1.2	
							$\boxed{650}$	$\boxed{1.3}$	$\boxed{+3.0}$ $\boxed{0.0}$	$\boxed{+2.4}$ $\boxed{0.0}$						
	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	175	650	1.3	
							$\boxed{650}$	$\boxed{1.3}$	$\boxed{+3.0}$ $\boxed{0.0}$	$\boxed{+2.4}$ $\boxed{0.0}$			E 375 Single Speed	375	1.1	
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	650	1.3	
							$\boxed{650}$	$\boxed{1.3}$	$\boxed{+3.0}$ $\boxed{0.0}$	$\boxed{+2.4}$ $\boxed{0.0}$			E 300	500	1.1	A
M117 GP Bomb with M131A1 Conical Fin Maximum Load – 17	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	550	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	150	1/2	275	450	1.1	
													E 375 Single Speed	375	1.1	
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	1.1	
													E 225	500	1.1	B

F4–516–5

Figure 5-11 (Sheet 5 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings–level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



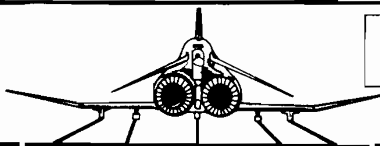
NA, Not Applicable
NE, Not Established
F–4E Only
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
A	NA	NA	NA	NA	1	175	650	1.3	Level to -30°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
B	NA	NA	NA	NA	+5.0	175	550	1.1	+60° to –60°	● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● For stations 2 and 8, ripple mode can be used in 1G level flight only to preclude the G jump or keep the G jump within limits.

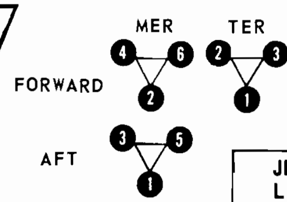
F4–516–6

Figure 5-11 (Sheet 6 of 38)

EXTERNAL STORES LIMITATIONS



GP BOMBS AND LAND MINES

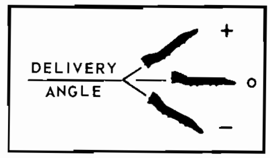


STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON 1G LEVEL FLIGHT MIN KNOTS	MAX KNOTS	M
M117 GP Bomb with MAU-103/B Fin Maximum Load-19	MER (Shifted Fwd)	X				X	550	1.1	+5.0 -1.0	+4.0 0.0	120	1/2	275	550	1.1
							600	1.3	+3.0 0.0	+2.4 0.0					
				X			550	1.1	+5.0 -1.0	+4.0 0.0	150	1/2	275	450	1.1
							600	1.3	+3.0 0.0	+2.4 0.0			E 375	375	1.1
													Single Speed		
	TER		X		X		550	1.1	+5.0 -1.0	4.0 0.0	120	FULL	175	550	1.1
							600	1.3	+3.0 0.0	+2.4 0.0			E 225	500	1.1
M117 GP Bomb with MAU-103A/B Fin Maximum Load-17	MER (Shifted Fwd)			X			550	1.1	+5.0 -1.0	+4.0 0.0	150	1/2	275	450	1.1
							600	1.1	+3.0 0.0	+2.4 0.0			E 375	375	1.1
													Single Speed		
	TER		X		X		550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	1.1
							600	1.1	+3.0 0.0	+2.4 0.0			E 225	500	1.1
	MER (Shifted Fwd)	X				X	550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	550	1.1
							600	1.1	+3.0 0.0	+2.4 0.0					

F4-516-7

Figure 5-11 (Sheet 7 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplone.



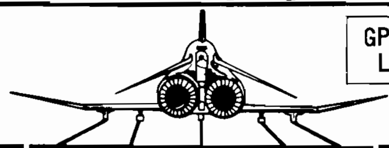
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

EMPLOYMENT MAX ACCEL G	EMPLOYMENT MIN KNOTS	EMPLOYMENT MAXIMUM KNOTS	EMPLOYMENT MAXIMUM M	RELEASE MAX ACCEL G	RELEASE MIN KNOTS	RELEASE MAXIMUM KNOTS	RELEASE MAXIMUM M	DELIVERY ANGLE	REMARKS
NA	NA	NA	NA	+5.0 +3.0	175 175	550 600	1.1 1.3	Level to −60°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● For stations 2 and 8, ripple mode can be used in 1G level flight only to preclude the G jump or keep the G jump within limits.
A NA	NA	NA	NA	+5.0 +3.0	175 175	550 600	1.1 1.1	Level to −60°	● If gross weight is over 45,000 lbs. refer to Acceleration Limatations Chart. ● For stations 2 and 8, ripple mode can be used in 1G level flight only to preclude the G jump or keep the G jump within limits.

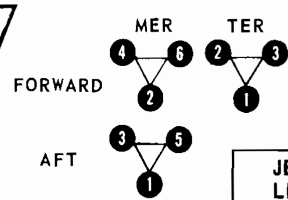
F4-516-8

Figure 5-11 (Sheet 8 of 38)

EXTERNAL STORES LIMITATIONS



GP BOMBS AND LAND MINES



JETTISON 1G LEVEL FLIGHT

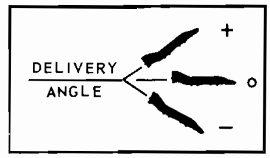
STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M
M117D (Destructor) M117RE and M117RE (LD) (Retarded) –Bomb	MER (Shifted Fwd) Single Release Only						550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	300 E 350	500 350 Single Speed	1.1 1.1
							600	1.3	+3.0 0.0	+2.4 0.0					
Maximum Load Single-16 Ripple-4	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	600	1.3
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2	E225	500	1.1
	MER (Shifted Fwd) Single Release Only						550	1.1	+5.0 -1.0	+4.0 0.0	120	1/2	375	500	1.1
							600	1.3	+3.0 0.0	+2.4 0.0					
M118 GP Bomb	AERO-27/A or BRU-5/A Bomb Rack						600	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	175	600	1.1
M129E1 Leaflet Bomb Maximum Load – 18	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	550	1.1
							550	1.1	+5.0 -1.0	+4.0 0.0	90	1/2	275 E 375	450 375 Single Speed	1.1 1.1
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E225	550 500	1.1 1.1
	MAU-12B/A						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	1.1

A
B
C

F4-516-9

Figure 5-11 (Sheet 9 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings–level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



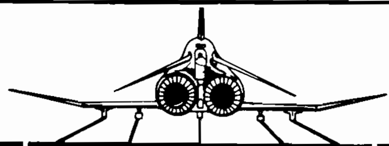
NA, Not Applicable
NE, Not Established
F–4E Only
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	M	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	M		
A	NA	NA	NA	NA	1	175	600	1.3	Level to –45°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Ripple release is not permitted at stations 1, 5 & 9 because bomb–to–bomb collision may result. ● Simultaneous release of M117RE munitions from the inboard TER's and centerline MER is prohibited.
B	NA	NA	NA	NA	+4.0	175	600	1.1	+60° to –60°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Jettison acceleration is the same as release.
C	NA	NA	NA	NA	1	175	550	1.1	Level	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.

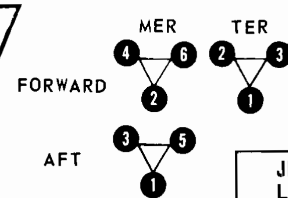
F4–516–10

Figure 5-11 (Sheet 10 of 38)

EXTERNAL STORES LIMITATIONS



GP BOMBS AND LAND MINES

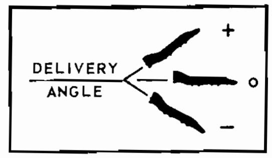


STORE	SUSPENSION	STATION LOADING 1	STATION LOADING 2	STATION LOADING 5	STATION LOADING 8	STATION LOADING 9	CARRIAGE AIRSPEED KNOTS	CARRIAGE AIRSPEED MACH	CARRIAGE ACCEL G SYM.	CARRIAGE ACCEL G UNSYM.	CARRIAGE ROLL RATE DEG/SEC	CARRIAGE STICK THROW	JETTISON 1G LEVEL FLIGHT MIN KNOTS	JETTISON 1G LEVEL FLIGHT MAX KNOTS	JETTISON 1G LEVEL FLIGHT MAX M	
MC-1 Gas Bomb Maximum Load-17	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	550	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	90	1/2	275 E 375	450 375 Single Speed	1.1 1.1	
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	550 500	1.1 1.1	
	MAU-12B/A						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	1.1	A
MK 81 LDGP Bomb Maximum Load-24	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	275 Single Speed	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	175 E 325	450 325 Single Speed	1.1 1.1	
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	550 500	1.1 1.1	B

F4-516-11

Figure 5-11 (Sheet 11 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings–level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



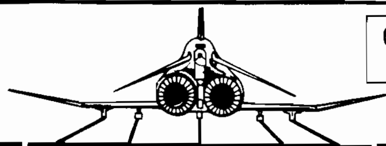
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
A	NA	NA	NA	NA	1	175	550	1.1	Level to – 60°	● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
B	NA	NA	NA	NA	+5.0	175	550	1.1	+60° to –60°	● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended. ● M-1 fuze extenders (18, 24, and 36–inches) can be used with MK 81 LDGP bombs on all authorized TER station and on all authorized forward MER stations carried on aircraft station five. The MK 81 LDGP bombs can be carried in tandem on aircraft station five when the 18–inch fuze extender, or no fuze extender is used in the bombs suspended from the aft MER stations. Maximum carriage speed (tandem carriage) is 475 knots. Maximum carriage speed (non–tandem carriage) is 500 knots. Maximum release speed (tandem and non–tandem) is 475 KNOTS. Carriage load factor remains unchanged. Maximum dive angle is 60 degrees. With one station selected, there is no release interval limitation. With two or more stations selected, select either .10 SEC or .14 SEC INTVL if the ripple release mode is used. During flights of 2½ hours duration or longer, 475 knots should not be exceeded. During flights of shorter duration, the maximum airspeed should not be used for more than 30 minutes total. If one steel clip is used in lieu of Fahnstack Clips, the maximum carriage speed is 550 knots ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.

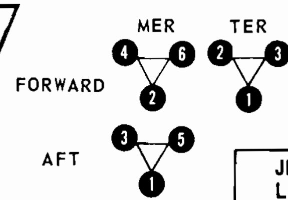
F4-516-12

Figure 5-11 (Sheet 12 of 38)

EXTERNAL STORES LIMITATIONS



GP BOMBS AND LAND MINES



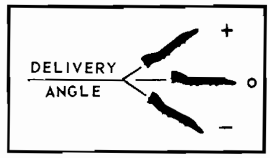
JETTISON 1G LEVEL FLIGHT

STORE	SUSPENSION	STATION LOADING 1	STATION LOADING 2	STATION LOADING 5	STATION LOADING 8	STATION LOADING 9	CARRIAGE AIRSPEED KNOTS	CARRIAGE AIRSPEED MACH	CARRIAGE ACCEL G SYM.	CARRIAGE ACCEL G UNSYM.	CARRIAGE ROLL RATE DEG/SEC	CARRIAGE STICK THROW	JETTISON MIN KNOTS	JETTISON MAX KNOTS	JETTISON MAX M
MK 82 LDGP Bomb Maximum Load-24	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	1/2	175	450	1.1
							550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	175 E 325	450 325	1.1 1.1
													Single Speed		
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	550 500	1.1 1.1

F4-516-13

Figure 5-11 (Sheet 13 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



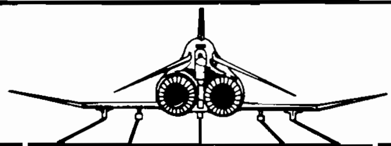
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	MAXIMUM M	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	MAXIMUM M		
NA	NA	NA	NA	+5.0	175	550	1.1	+60° to −60°	● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended. ● M-1 fuze extenders (18, 24, and 36 inch) can be used with the MK-82 LDGP bombs on all authorized TER stations and on all authorized forward MER stations carried on aircraft station five. the MK 82 LDGP bombs can be carried in tandem on aircraft station five when fuze extenders are not used in the bombs suspended from the aft MER stations. Maximum carriage speed (tandem carriage) is 475 knots. Maximum carriage speed (non-tandem carriage) is 500 knots. Maximum release speed (tandem and non-tandem) is 475 knots. Carriage load factor remains unchanged. Maximum dive angle is 60 degrees. With one station selected, there is no release interval limitations. With two or more stations selected, select either .10 SEC or .14 SEC INTVL if the ripple release mode is used. During flights of 2½ hours duration or longer, 475 knots should not be exceeded. During flights of shorter duration, the maximum airspeed should not be used for more than 30 minutes total. If one steel clip is used in lieu of Fahnstock Clips, the maximum carriage speed is 550 knots. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.

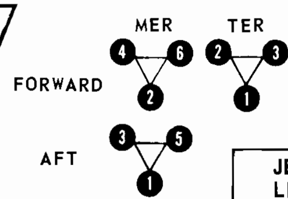
F4-516-14

Figure 5-11 (Sheet 14 of 38)

EXTERNAL STORES LIMITATIONS



GP BOMBS AND LAND MINES



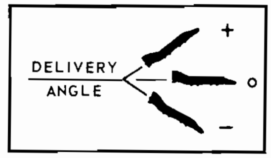
JETTISON 1G LEVEL FLIGHT

STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M	
MK82 Snakeye I, MK82 Snakeye I (LD) Bomb and MK36 Destructor Maximum Load: Single - 24 Ripple - 19	MER (Shifted Fwd)	Single Release Mode Only						550	1.1	+5.0 -1.0	+4.0 0.0	150	1/2	175 E 375	450 375 Single Speed	1.1 1.1	
	TER							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	550 500	1.1 1.1	
	MER (Shifted Fwd)	Single or Ripple Release Mode						550	1.1	+5.0 -1.0	+4.0 0.0	150	1/2	175 E 375	450 375 Single Speed	1.1 1.1	
								550	1.1	+5.0 -1.0	+4.0 0.0	120	1/2	175	450	1.1	
	TER	Ripple						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	550 500	1.1 1.1	
MK 83 LDGP Bomb Maximum Load- 13	MER (Outboard Shifted Aft)							550	1.1	+5.0 -1.0	+4.0 0.0	120	1/2	175	450	1.1	A
	(Centerline Shifted Fwd)							550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	175 E 325	450 325 Single Speed	1.1 1.1	
	TER							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	550 500	1.1 1.1	
MK 84 LDGP Bomb	MAU-12B/A							600	1.1	+5.5 -2.0	+4.4 0.0	150	FULL	175	600	1.1	B
	AERO-27/A or BRU-5/A							600	1.1	+5.5 -3.0	+4.4 0.0	150	FULL	175	600	1.1	
MK 84 LDGP W/M-1 Fuze Extenders	MAU-12B/A							550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	175	550	1.1	C
	AERO-27/A or BRU-5/A																

F4-516-15

Figure 5-11 (Sheet 15 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

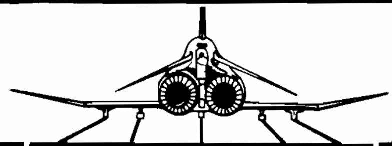
	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
	NA	NA	NA	NA	+5.0	175	550* 500	1.1* 0.95	Level to −60°	● To preclude bomb-to-bomb collision during ripple release, select both stations one and nine and select either .10 SEC or .14 SEC INTVL setting. Selecting only one outboard station for ripple release is prohibited. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Simultaneous release of MK 36 and MK 82 Snakeye I munitions from the inboard TER's and centerline MER is prohibited. * MK 82 Snakeye I (LD) Low Drag.
A	NA	NA	NA	NA	+5.0	175	550	1.1	+60° to −60°	● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations. ● The MK 83 LDGP bomb may be carried with 18-inch, 24-inch, or 36-inch M-1 fuze extenders on aircraft station five (MER stations one, four, and five), on aircraft station two (TER station one and two), and on aircraft station eight (TER station one and three). Maximum carriage speed (tandem carriage) is 475 knots. Maximum carriage speed (non-tandem carriage) is 500 knots. Maximum release speed (tandem and non-tandem) is 475 knots. Carriage load factor remains unchanged. Maximum dive angle is 60 degrees. With one station selected there is no release interval limitation. With two or more stations selected, select either .10 SEC or .14 SEC INTVL if the ripple release mode is used. During flights of 2½ hours duration or longer, 465 knots should not be exceeded. During flights of shorter duration, the maximum airspeed should not be used for more than 30 minutes total. If one steel clip is used in lieu of Fahnstock Clips, the maximum carriage speed is 550 knots.
B	NA	NA	NA	NA	+4.0	175	600	1.1	+60° to −60°	● If gross weight is over 41,000 lbs. refer to Acceleration Limitations Chart. ● Jettison acceleration same as release.
C	NA	NA	NA	NA	+4.0	175	550	1.1	+60° to −60°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations. ● Jettison acceleration same as release. ● The 18-inch, 24-inch, and 36-inch M-1 fuze extenders are authorized.

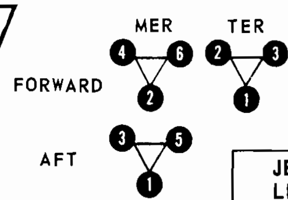
F4-516-16

Figure 5-11 (Sheet 16 of 38)

EXTERNAL STORES LIMITATIONS

FIRE BOMBS





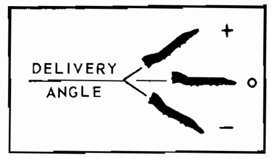
JETTISON 1G LEVEL FLIGHT

STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M	
BLU-1/B, BLU-1B/B, Fire Bomb (Unfinned) Maximum Load-11	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	340	400	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	90	1/2	275	450	1.1	
													E 275	375	1.1	
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275 E 300	550 500	1.1 1.1	
	MAU-12B/A						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	1.1	A
BLU-27A/B, BLU-27/B Fire Bomb (Unfinned) Maximum Load-11	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	90	1/2	275	450	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0			E 275	375	1.1	
	TER						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	550	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2	E 300	500	1.1	
	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	340	400	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2				B
BLU-27A/B, BLU-27/B Fire Bomb (Finned) Maximum Load-4	MER (Shifted Aft)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	525	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2	E 275	350	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	250	525	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2				C
BLU-52/B (Finned BLU-1/B CS-1 Filled) Maximum Load-4	MER (Shifted Aft)						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	525	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2	E 275	375	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	250	525	1.1	
							600	1.3	+3.0 0.0	+2.4 0.0	90	1/2				
	MAU-12B/A						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	1.1	D
BLU-76/B Fire Bomb Maximum Load-3	AERO 27/A or BRU-5/A						500	0.90	+4.0 -1.0	+3.2 0.0	120	FULL	200	500	0.90	
	MAU-12B/A															

F4-516-17

Figure 5-11 (Sheet 17 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



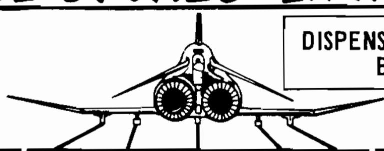
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
	NA	NA	NA	NA	1	250	550	1.1	+30° to −10°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
	NA	NA	NA	NA	1	250 E 310	450 435	1.1 1.1		
	NA	NA	NA	NA	1	175 E 250	550 500	1.1 1.1		
	NA	NA	NA	NA	1	175	550	1.1		
A										
	NA	NA	NA	NA	+2.0	250 E 310	450 435	1.1 1.1	+30° to −10°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
	NA	NA	NA	NA	+2.0	175 E 250	550 500	1.1 1.1		
	NA	NA	NA	NA	+3.0	250	550	1.1		
B										
	NA	NA	NA	NA	+2.0	175	600	1.3	+30° to −30°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
	NA	NA	NA	NA	+3.0	175	600	1.3	+10° to −20°	
C										
	NA	NA	NA	NA	+2.0	175	550	1.1	+20° to −15°	● MER: Minimum Release Interval Setting is 100 msec. ● MAU-12 B/A: Single, Pairs, Ripple, any Interval Setting. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
D										
	NA	NA	NA	NA	1	200	500	0.9	Level to −60°	● Maximum sink rate when landing with one, two, or three BLU-76/B's is 8 fps. ● With two or three BLU-76/B's, ensure forward CG limits are not exceeded for takeoff, carriage, and landing. ● If gross weight is over 56,000 lbs, refer to Accelerations Limitations Chart

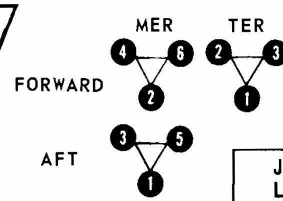
F4-516-18

Figure 5-11 (Sheet 18 of 38)

EXTERNAL STORES LIMITATIONS



DISPENSERS AND CLUSTER BOMB UNITS



STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON (JETTISON 1G LEVEL FLIGHT) MIN KNOTS	MAX KNOTS	M
CBU-1/A CBU-1A/A Dispenser and Bomb	MER (Shifted Fwd)	FULL						550	1.1	+5.0 −1.0	+4.0 0.0	120	½	275	275 Single Speed	1.1
Maximum Load–4		EMPTY						550	1.1	+5.0 −1.0	+4.0 0.0	120	½	300	300 Single Speed	1.1
CBU-2/A CBU-2A/A CBU-2B/A CBU-2C/A CBU-12/A CBU-9/A CBU-46/A Dispenser and Bomb	MER (Shifted Fwd)	FULL						550	1.1	+5.0 −1.0	+4.0 0.0	90	½	275 E 325	375 325 Single Speed	1.1 1.1
		FULL						550	1.1	+5.0 −1.0	+4.0 0.0	120	½	275	350	1.1
		EMPTY						550	1.1	+5.0 −1.0	+4.0 0.0	90	½	275 E NE	375 NE	1.1 NE
Maximum Load–5		EMPTY						550	1.1	+5.0 −1.0	+4.0 0.0	120	½	300	300 Single Speed	1.1
CBU-24/B CBU-29/B CBU-49/B CBU-24A/B CBU-29A/B CBU-49A/B CBU-24B/B CBU-29B/B CBU-49B/B CBU-52/B CBU-53/B CBU-54/B Dispenser and Bomb (Cluster Bomb)	MER (Shifted Fwd)							550 650	1.1 1.3	+5.0 −1.0 +3.0 0.0	+4.0 0.0 +2.4 0.0	150	½	300 E 350	500 350 Single Speed	1.1 1.1
	TER							550 650	1.1 1.3	+5.0 −1.0 +3.0 0.0	+4.0 0.0 +2.4 0.0	120 90	FULL ½	175 E 225	650 500	1.3 1.1
Maximum Load–17	MER (Shifted Fwd)							550 650	1.1 1.3	+5.0 −1.0 +3.0 0.0	+4.0 0.0 +2.4 0.0	120	½	375	500	1.1

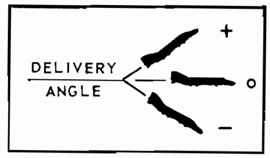
A

B

F4–516–19

Figure 5-11 (Sheet 19 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



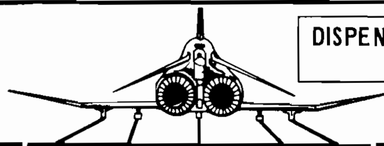
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

	EMPLOYMENT MAX ACCEL G	EMPLOYMENT MIN KNOTS	EMPLOYMENT MAXIMUM KNOTS	EMPLOYMENT MAXIMUM M	RELEASE MAX ACCEL G	RELEASE MIN KNOTS	RELEASE MAXIMUM KNOTS	RELEASE MAXIMUM M	DELIVERY ANGLE	REMARKS
	1	450	550	1.1	1	275	550	1.1	EMPLOY 0° to −30° RELEASE Level	● A ballast ring must be installed on all dispensers. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended; however, dispensers and rocket pods must be full. * SUU-7 dispensers that have ballast bands can be expected to safely separate from aircraft stations one and nine when released in 1G, straight and level flight. Release from the bottom aft MER Stations between 475 and 550 knots, as close as possible to 515 knots. Release from the outboard MER stations between 375 and 475 knots, as close as possible to 415 knots. ● Tube extensions are required on all dispensers.
	NA	NA	NA	NA	1	*	*	1.1	Level	
A	1	450	550	1.1	1	275	550	1.1	EMPLOY 0° to −30° RELEASE Level	● A ballast ring must be installed on all dispensers, except CBU-2C/A and CBU-46/A. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended; however, dispensers and rocket pods must be full. * SUU-7 dispensers that have ballast bands can be expected to safely separate from aircraft stations one and nine when released in 1G straight and level flight. Release from the bottom aft MER stations between 475 and 550 knots, as close as possible to 515 knots. Release from the outboard MER stations between 375 and 475 knots as close as possible to 415 knots. ● Tube extensions are required on all -2 dispensers. ● CBU-46/A. Jettison full or empty dispensers on STA 1/9 at 300 knots. Dispense in 1G level flight only. Release empty outboard aft dispensers on STA 1/9 at 375 to 450 knots (best speed 415 knots). Release empty bottom aft dispensers on STA 1/9 at 475 to 550 knots (best speed 515 knots).
	NA	NA	NA	NA	1	275 E 325	550 500	1.1 1.1	Level	
	NA	NA	NA	NA	1	*	*	1.1	Level	
B	NA	NA	NA	NA	+4.0	175	550	1.1	+50° to −60°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● (STA 2/8): Release in single mode or ripple release. Ripple release in 1G level or dive flight only.
					+3.0	175	650	1.3		
	NA	NA	NA	NA	−4.0	175	550	1.1	+30° to −60°	
					+3.0	175	600	1.3		

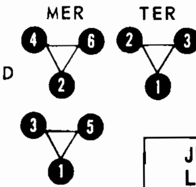
F4-516-20

Figure 5-11 (Sheet 20 of 38)

EXTERNAL STORES LIMITATIONS



DISPENSERS AND CLUSTER BOMB UNITS



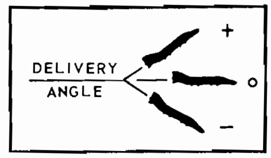
JETTISON 1G LEVEL FLIGHT

STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M
UNFINNED CBU-7/A, CBU-28/A, CBU-30/A, CBU-38/A, Maximum Load – 18	MER (Shifted Fwd)	FULL						550	0.9	+5.0 -1.0	+4.0 0.0	120	1/2	285	420	0.9
								550	0.9	+5.0 -1.0	+4.0 0.0	150	FULL	250	450	0.9
	TER							550	0.9	+5.0 -1.0	+4.0 0.0	120	FULL	250	530	0.9
	MER (Shifted (Fwd)	EMPTY						550	0.9	+5.0 -1.0	+4.0 0.0	120	1/2	410	410 Single Speed	0.9
								550	0.9	+5.0 -1.0	+4.0 0.0	150	FULL	NE	NE	NE
	TER							550	0.9	+5.0 -1.0	+4.0 0.0	120	FULL	250	535	0.9

F4-516-21

Figure 5-11 (Sheet 21 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



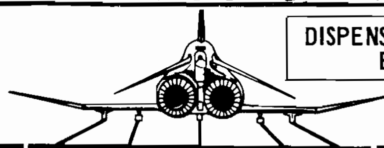
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
1	175	550	0.9	1	250	465	0.9	EMPLOY Level to −45° ✱ Level ✱✱ RELEASE Level	● F-4E. (STA 2, 5 & 8) Not Established. ● Special fuel sequencing required on F-4C/D aircraft. Refer to section VII. ● To preclude possible munition collision between adjacent CBU-7/A dispensers, the 50-millisecond dispenser release interval may be used only when a single aircraft station is selected or when aircraft stations 1 and 9 or 2 and 8 are selected. ● CBU-7/A dispenser may be released from the TER on aircraft stations 2 and 8 only in the single release mode. ● Release or jettison of empty dispensers from the MER on aircraft stations 1 and 9 is prohibited above 22,000 feet. ● When the CBU-30/A is flown and fired, the SUU-13/A dispenser shall be released or jettisoned before landing. This is to preclude return to base of any non-ejected or partially-ejected munitions. ✱CBU-38/A ✱✱CBU-7/A, -28/A, -30/A
1	175	550	0.9	1	175	500	0.9		
1	175	550	0.9	1	250	500	0.9		
NA	NA	NA	NA	1	410	410 Single Speed	0.9		
NA	NA	NA	NA	1	325	400	0.9		
NA	NA	NA	NA	1	360	400	0.9		

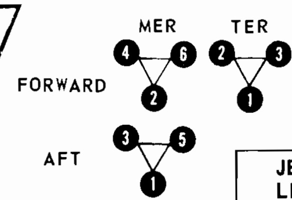
F4-516-22

Figure 5-11 (Sheet 22 of 38)

EXTERNAL STORES LIMITATIONS



DISPENSERS AND CLUSTER BOMB UNITS

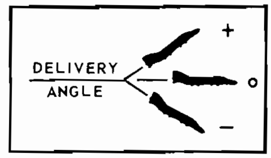


STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	MAX KNOTS	M
FINNED CBU-33/A, CBU-34/A, CBU-42/A Maximum Load - 13	MER (Shifted Aft)	FULL						550	1.1	+4.0 -1.0	+3.2 0.0	90	1/2	410	500	1.1
								650	1.3	+3.0 0.0	+2.4 0.0	90	1/2			
	MER (Shifted Fwd)	FULL						550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	400	460	1.1
								650	1.3	+3.0 0.0	+2.4 0.0	150	FULL			
	TER	FULL						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	400	550	1.1
								650	1.3	+3.0 0.0	+2.4 0.0	90	1/2			
	MER (Shifted Aft)	EMPTY						550	1.1	+4.0 -1.0	+3.2 0.0	90	1/2	430	480	1.1
								650	1.3	+3.0 0.0	+2.4 0.0	90	1/2			
	MER (Shifted Fwd)	EMPTY						550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	400	460	1.1
								650	1.3	+3.0 0.0	+2.4 0.0	150	FULL			
	TER	EMPTY						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	400	550	1.1
								650	1.3	+3.0 0.0	+2.4 0.0	90	1/2			
ROCKEYE II Mk 20 Mod 2 Dispenser Maximum Load -12	MER (Shifted Fwd)							550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	460	460 Single Speed	NE
								650	1.3	+3.0 0.0	+2.4 0.0					
	TER							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	400	400 Single Speed	NE
								650	1.3	+3.0 0.0	+2.4 0.0					

F4-516-23

Figure 5-11 (Sheet 23 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings–level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

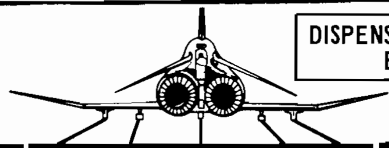
EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
1	175	550	1.1	1	420	550	1.1	EMPLOY Level TO – 45° * Level ** RELEASE Level	● F-4E. (STA 2, 5 & 8) Not Established. ● Special fuel sequencing required on F-4C/D aircraft. Refer to section VII. ● Use of speed brakes is not permitted when stores are carried on the outboard stations. ● If gross weight is over 45,000 lbs. refer to Acceleration Limitations chart. ● Dispensing interval: CBU–33/A: 0.061 to 0.300 second. CBU–34/A, –42/A: 0.200 to 0.500 second. * CBU–33/A, –42/A. ** CBU–34/A
1	175	550	1.1	1	325	550	1.1		
1	175	550	1.1	1	325	550	1.1		
NA	NA	NA	NA	1	430	450	1.1		
NA	NA	NA	NA	1	325	550	1.1		
NA	NA	NA	NA	1	325	550	1.1		
A NA	NA	NA	NA	4.0	400	550	1.1	Level to –45°	● F–4E. (STA 5): Not Established ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.

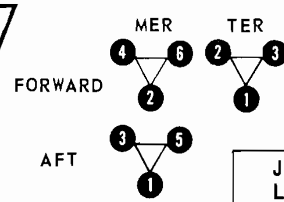
F4–516–24

Figure 5-11 (Sheet 24 of 38)

EXTERNAL STORES LIMITATIONS

DISPENSERS AND CLUSTER BOMB UNITS



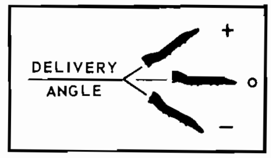


STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	MAX KNOTS	M	
SUU-20/A SUU-20A/A Dispenser with MK 106, BDU-33/B -33A/B,-33B/B	MAU-12B/A						550	1.2	+5.0 -2.0	+4.0 0.0	120	FULL	375	375 Single Speed	NA	
							650	1.3	+3.0 0.0	+2.4 0.0						A
SUU-21/A Dispenser with MK 106, BDU-33/B, -33A/B,-33B/B	Aero 27 A or BRU-5 A						550	1.3	+6.5 -3.0	+5.2 0.0	150	FULL	Not Jettisonable			
	MAU-12B/A						550	1.1	+5.5 -1.0	+4.4 0.0	150	FULL	NE	NE	NE	
	MAU-12B/A						550	1.1	+5.5 -1.0	+4.0 0.0	150	FULL	NE	NE	NE	B
SUU-41B/A CDU-4/B or -14/B CDU-5/B or -10/B SUU-42A/A																C

Figure 5-11 (Sheet 25 of 38)

F4-516-25

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

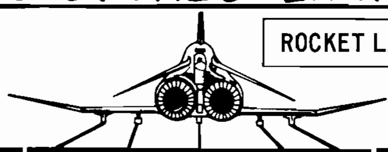
	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	MAXIMUM M	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	MAXIMUM M		
A	+4.0	ROCKETS 300 BOMBS 300	ROCKETS 450 BOMBS 550	0.9	NA	NA	NA	NA	EMPLOY +60° to −60° RELEASE Level	● Either 14 or 30-inch suspension hooks may be used. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
	+6.5	NE	550	1.3	NA	NA	NA	NA	NE	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart.
	+5.5	NE	550	1.1	NA	NA	NA	NA	NE	● STA 2 8. Requires pylon and dispenser modification.
B	+5.5	NE	550	1.1	NA	NA	NA	NA	NE	● If gross weight is over 41,000 lbs, refer to Acceleration Limitations Chart.
C										● F-4D only. ● Refer to T.O. 1F-4C-34-1-3 for all limitations.

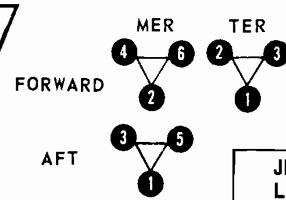
F4-516-26

Figure 5-11 (Sheet 26 of 38)

EXTERNAL STORES LIMITATIONS

ROCKET LAUNCHERS (FFAR)



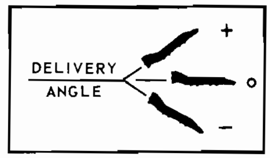


STORE	SUSPENSION		STATION LOADING 1	STATION LOADING 2	STATION LOADING 5	STATION LOADING 8	STATION LOADING 9	CARRIAGE AIRSPEED KNOTS	CARRIAGE AIRSPEED MACH	CARRIAGE ACCEL G SYM.	CARRIAGE ACCEL G UNSYM.	CARRIAGE ROLL RATE DEG/SEC	CARRIAGE STICK THROW	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	JETTISON 1G LEVEL FLIGHT JETTISON MAX KNOTS	JETTISON 1G LEVEL FLIGHT JETTISON MAX M
LAU-3/A Rocket Launcher Maximum Load–15	MER (Shifted Aft)	FULL						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	160	275	1.1
								550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	160 E 200 Single Speed	275 200	1.1 NE
	TER							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	450 400	1.1 1.1
	MAU-12B/A **							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	250	500	1.1
								550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	450	1.1
	MER (Shifted Aft)	EMPTY						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	250	275	1.1
								550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	160 E 200 Single Speed	275 200	1.1 NE
				*		*		550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	450 400	1.1 1.1
	MAU–12B/A **							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	550	0.9

F4–516–27

Figure 5-11 (Sheet 27 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings–level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable
NE, Not Established
F–4E Only
Aircraft Limits

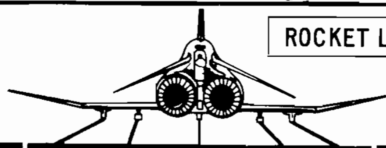
EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
+5.0	300	450	0.9	1	175	275	0.9	EMPLOY 0° to –60° RELEASE Level	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Nosecone and/or tailcone failure can be expected at speeds above 400 knots. ● When carrying tanks or weapons on stations 1 and/or 9, do not release rocket pods (either full or empty) from the outboard shoulder of TER's on stations 2 and 8. ● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended; however, dispensers and rocket pods must be full. ● Speed brakes must be retracted when launching from stations 2 and 8. ● If AIM–7 missiles are installed at the forward fuselage stations (4 & 6), do not launch rockets from the forward shoulders of the MER on centerline station 5. ✱✱ Single carriage on MAU–12B/A pylon is authorized only for modified LAU–3/A launchers that have a shorting pin on the side of the launcher. ✱ Release Not Established.
+5.0	300	450	0.9	1	175 E 225	475 400	0.9 0.9		
+5.0	300	450	0.9	1	250	500	1.1		
+5.0	300	450	0.9	1	175	450	1.1		
NA	NA	NA	NA	1	300	350	0.9	Level	
NA	NA	NA	NA	1	300 E 225	350 375	0.9 0.9		
NA	NA	NA	NA	1	300 E 350	550 500	0.9 0.9		
NA	NA	NA	NA	1	175	550	0.9		

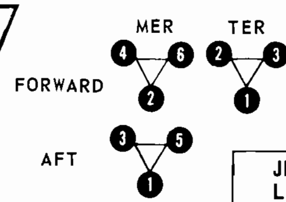
F4-516-28

Figure 5-11 (Sheet 28 of 38)

EXTERNAL STORES LIMITATIONS

ROCKET LAUNCHERS (FFAR)



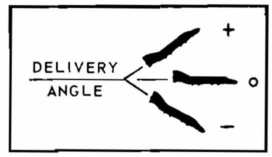


STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON (JETTISON 1G LEVEL FLIGHT) MIN KNOTS	MAX KNOTS	M
LAU-32A/A, LAU-32B/A, LAU-59/A Rocket Launcher Maximum Load-15	MER (Shifted Aft)	FULL						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	160	275	1.1
								550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	160 E 225	275 225	1.1 NE
														Single Speed		
	TER	FULL						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	450 400	1.1 1.1
	MER (Shifted Aft)	EMPTY						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	250	275	1.1
								550	1.1	+5.0 -1.0	+4.0 0.0	150	3/4	160 E 225	275 225	1.1 NE
														Single Speed		
	TER	EMPTY						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175 E 225	450 400	1.1 1.1
LAU-59/A Rocket Launcher Maximum Load-2	MAU- 12B/A			*		*		550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	350 E 400	475 425	0.75 0.75

F4-516-29

Figure 5-11 (Sheet 29 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



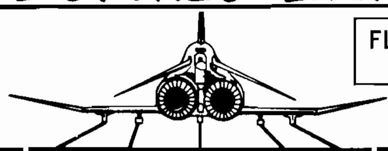
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
+5.0	300	450	1.1	1	175	275	0.9	EMPLOY 0° to -60° RELEASE Level	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Nosecone and/or tailcone failure can be expected at speeds above 400 knots. ● When carrying tanks or weapons on stations 1 and/or 9, do not release rocket pods (either full or empty) from the outboard shoulder of TER's on stations 2 and 8. ● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended; however, dispensers and rocket pods must be full. ● Speed brakes must be retracted when launching from stations 2 and 8. ● If AIM-7 missiles are installed at the forward fuselage stations (4 & 6), do not launch rockets from the forward shoulders of the MER on centerline station 5. ✱ Jettison/Release below 10,000 feet.
+5.0	300	450	1.1		160	275	0.9		
+5.0	300	450	1.1		175 E 225	475 400	0.9 0.9		
NA	NA	NA	NA	1	300	350	1.1	Level	
NA	NA	NA	NA		300 E 275	350 325	1.1 0.9		
NA	NA	NA	NA		300 E 350	550 500	1.1 0.9		
+5.0	300	550	1.1	1	350 E 400	475 425	0.75 0.75	Level to -50°	

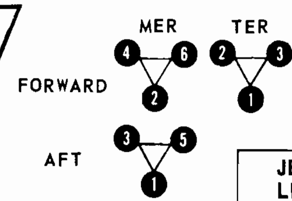
F4-516-30

Figure 5-11 (Sheet 30 of 38)

EXTERNAL STORES LIMITATIONS



FLARE DISPENSERS AND FLARES



JETTISON 1G LEVEL FLIGHT

STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M	
SUU-25A/A Flare Dispenser With MK24 or LUU-1/B, -2/B, -5/B Maximum Load-7	MER (Shifted Fwd)						500	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	200	300	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	350	450	1.1	A
SUU-25B/A Flare Dispenser With MK24 or LUU-1/B, -2/B, -5/B Maximum Load-6	MAU-12B/A						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	250	440	0.72	
	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	150	FULL	200	300	1.1	
							550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	400	450	1.1	B
SUU-25C/A Flare Disp. With MK-24 or LUU-1/B, -2/B, -5/B Maximum Load-6	MAU-12B/A						550	0.9	+5.0 -1.0	+4.0 0.0	120	FULL	325	550	0.9	
	MER (Shifted Fwd)						550	0.9	+5.0 -1.0	+4.0 0.0	120	FULL	400	450	0.9	
							550	0.9	+5.0 -1.0	+4.0 0.0	150	FULL	200	300	0.9	C
SUU-42/A Dispenser with MK24 Flare or LUU-1/B, -2/B, -5/B Max Load-2	MAU-12B/A						550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	175	600	1.1	
							650	1.3	+3.0 0.0	+2.4 0.0						D
MLU-32/B99 Briteye Flare Maximum Load-10	MER (Shifted Fwd)						550	1.1	+5.0 -1.0	+4.0 0.0	120	3/4	NE	NE	NE	
	TER															E

F4-516-31

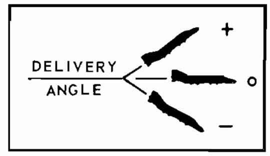
Figure 5-11 (Sheet 31 of 38)

▶ The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.

▶ Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.

▶ Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.

▶ Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable

NE, Not Established

F-4E Only

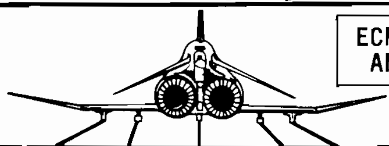
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
A	1	275	550	1.1	1	275	375	1.1	EMPLOY and RELEASE Level	● If the situation warrants, store(s) may be jettisoned with flaps partially or fully extended; however dispensers and rocket pods must be full. ● F-4E. (STA 5): Jettison, employment and release limits not established. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
	1	275	550	1.1	1	350	450	1.1		
B	1	275	550	0.9	1	250	440	0.72	EMPLOY and RELEASE Level	● Release and Jettison Full or Empty. If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● F-4E. (STA 5): Jettison, employment and release limits not establish. ● (STA 1/9): Full dispensers on MER may be jettisoned with flaps partially or fully extended. ● It is recommended that the free fall settings be kept as low as possible (3000 feet and below) to assure a high reliability of the LUU-2/B flare when dispensing at higher airspeeds (400 KCAS and above). ✱ Release not recommended.
	1	275	550	1.1	1	250 (FULL) 400 (EMPTY)	510	0.83		
	1	275	500	1.1	✱	✱	✱	✱		
C	1	275	550	0.9	1	325	550	0.9	EMPLOY and RELEASE Level	● F-4E (STA 5): Not Established ● Release Full and Empty dispensers. ● If gross weight is over 45,000 lbs. refer to Acceleration Limitations chart.
	1	275	550	0.9	1	325	500	0.84		
D	1	275	550	1.1	1	175	600	1.1	EMPLOY and RELEASE Level	● The MK 24 flare is unstable between employment speeds from 400 to 450 knots and should be avoided. ● (LUU-1/B): Employment 275 to 475 knots or 1.1 Mach. Ripple dispensing not authorized. ● If gross wt is over 45,000 lbs, refer to Acceleration Limitations Chart. ● F-4D. For employment limits of other items dispensed from the SUU-42/A, refer to T.O. 1F-4C-34-1-3.
E	NA	NA	NA	NA	1	250	550	1.1	Level	● Use single release mode only. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.

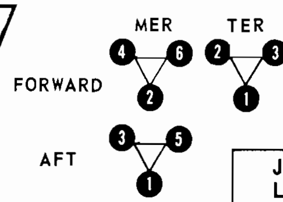
F4-516-32

Figure 5-11 (Sheet 32 of 38)

EXTERNAL STORES LIMITATIONS



ECM PODS, GUN PODS AND SPRAY TANKS



JETTISON 1G LEVEL FLIGHT

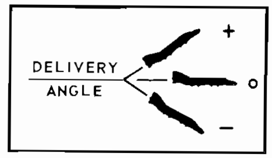
STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON MIN KNOTS	MAX KNOTS	M
ALQ-71/QRC-160A-1. ALQ-72/QRC-160A-2. ALQ-87/QRC-160A-8. ECM Pods	MAU-12B/A					●	✈	✈	+6.0 -3.0	+4.8 0.0	200	FULL	Below 25,000 feet 385; Above 25,000 feet 410	385 Single Speed; 410 Single Speed	NE; 1.1
	MAU-12B/A		●		●		✈	✈	+6.0 -3.0	+4.8 0.0	✈	FULL	Below 25,000 feet 385; Above 25,000 feet 410	385 Single Speed; 410 Single Speed	NE; 1.1
ALQ-71/QRC-160A-1. ALQ-72/QRC-160A-2. ALQ-87/QRC-160A-8. ALQ-101. ALQ-71(V)-3. QRC-335A (V)-3. ECM Pods.	MAU-12B/A		●		●		✈	✈	+6.0 -3.0	+4.8 0.0	✈	FULL	Below 25,000 feet 385; Above 25,000 feet 410	385* Single Speed; 410* Single Speed	NE; 1.1
		MISSILE STATIONS	3	4	6	7									
	Missile Well Adapter	FWD		●	● **		✈	✈	✈	✈	✈	FULL	NA	NA	NA

STORE	SUSPENSION	1	2°	5	8	9	KNOTS	MACH	SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	MIN KNOTS	MAX KNOTS	M	
SUU-16/A, SUU-23/A Gun Pod Maximum Load-3	MAU-12B/A	●				●	✈	✈	+6.0 -3.0	+4.8 0.0	200	FULL	175	275	1.1	
	℄ Adapter			●			✈	✈	✈	✈	270	FULL	175	275	1.1	
	MAU-12B/A		●		●		—	—	—	—	—	—	—	—	—	A
A/B 45Y-2 Spray Tank	Aero 27/A or BRU-5/A			●			550	1.1	+5.0 -1.0	+4.0 0.0	90	1/2	175	550	1.1	
	MAU-12B/A	●				●							E 175	500	1.1	B
A/B 45 Y-4 Spray Tank	AERO 27/A or BRU-5/A			●			550; **650**	1.1; **1.3**	+5.0 -1.0; **+3.0 0.0**	+4.0 0.0; **+2.4 0.0**	150	FULL	450	450 Single Speed	1.1	
	MAU-12B/A	●				●	550; **650**	1.1; **1.3**	+5.0 -1.0; **+3.0 0.0**	+4.0 0.0; **+2.4 0.0**	120	FULL				C
TMU-28/B PAU-7/A (Modified TMU-28/B) Spray Tank Maximum Load-2	MAU-12B/A	●				●	550	1.1	+5.0 -1.0	+4.0 0.0	120	FULL	275	500	1.1	

F4-516-33

Figure 5-11 (Sheet 33 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

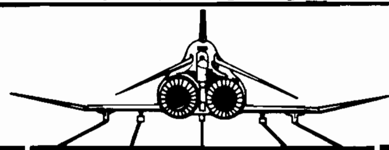
EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	M	MAX ACCEL G	MIN KNOTS	MAXIMUM KNOTS	M		
NA	NA	NA	NA	NA	NA	NA	NA	NA	● Carriage speed may be reduced by ECM pod ram air turbine temperature limit. Refer to ECM Pod Airspeed Envelope. ● If gross weight is over 37,500 lbs. refer to Acceleration Limitations Chart.
NA	NA	NA	NA	NA	NA	NA	NA	NA	● F-4D after T.O. 1F-4-821 and T.O. 1F-4D-538. ● F-4E after T.O. 1F-4-821. ● Carriage speed may be reduced by ECM pod ram air turbine temperature limit. Refer to ECM Pod Airspeed Envelope. ● If gross weight is over 37,500 lbs. refer to Acceleration Limitations Chart.
NA	NA	NA	NA	NA	NA	NA	NA	NA	* QRC-335A(V)-3 Pod only: 500 Knots single speed (Jettison must be accomplished with 0 ejection force). ** QRC-335A(V)-3 is not carried on this station on F-4E. ● F-4C after T.O. 1F-4C-598. ● F-4D after T.O. 1F-4D-547. ● F-4E after T.O. 1F-4E-531. ● If gross weight is over 37,500 lbs. refer to Acceleration Limitations Chart.

					NA	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● F-4E. (STA 5): Jettison limits not established.
	—	—	—	—	—	—	—	—	—	● Authorization for carriage on stations 2 and 8 has been canceled pending final certification.
A	1	175	550	1.1	NA	NA	NA	NA	Level	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Jettison full or empty.
B	NE	NE	NE	NE	NA	NA	NA	NA	NE	● Jettison with spray tank full or empty during 1G level flight. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
C	1*	300*	550*	0.95*	1	275	500	1.1	NE	● Jettison and Release: 1G level flight. With tank full, nozzle shall be retracted; or with tank empty, nozzle shall be extended. ● Lower tail fins must be removed. ● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. * PAU-7/A Only, TMU-28/B Not Established.

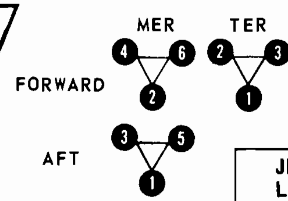
F4-516-34

Figure 5-11 (Sheet 34 of 38)

EXTERNAL STORES LIMITATIONS



TOW TARGET SYSTEMS

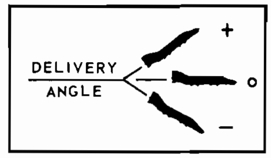


STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON (JETTISON 1G LEVEL FLIGHT) MIN KNOTS	MAX KNOTS	M	
Modified A/A 37U-15 Tow Target System	Tow Target Adapter / Target Stowed						250 *	NE	+1.5 +0.5	NA	**	**	NA	NA	NA	
Maximum Load-1 Configuration limited to: Tow target only; or tow target, wing tank, and/or centerline tank.	Target Deployment						NA	NA	NA	NA	*	*	NA	NA	NA	
	Target Towed						500	1.1	+5.0 −1.0	NA	*	*	NA	NA	NA	
	Target Released						500	1.1	+5.0 −1.0	+4.0 0.0	120	1/2	NA	NA	NA	A
RMU-8/A Reel-Launcher (Target Stowed)	Aero 27/A or BRU-5/A						500	0.9	NE	NE	NE	NE	NE	NE	NE	B

F4-516-35

Figure 5-11 (Sheet 35 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



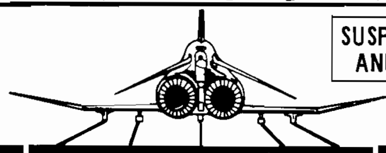
NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
	NA	NA	NA	NA	NA	NA	NA	NA	NA	✱ 275 knots is permissable under non-turbulent flight conditions. Only gradual co-ordinated turns (max bank angle of 20°) are permitted. ✱✱ 1/2 stick throw toward heavy wing is permitted. Sideslips should be avoided.
	NA	NA	NA	NA	1.0	200	220	NA	Level	✱1.0G, straight and level flight.
	+5.0	NE	500	1.1	NA	NA	NA	NA	NE	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ✱ Only gradual coordinated turns are permitted.
	NA	NA	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● After tow cable is cut.
A										
	NE	NE	NE	NE	NA	NA	NA	NA	NE	● Refer to T.O. 1F-4C-34-1-1 for RMU-8/A operating limitations.
B										

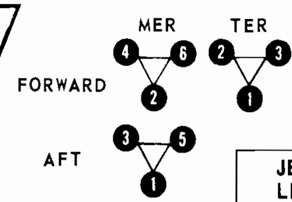
F4-516-36

Figure 5-11 (Sheet 36 of 38)

EXTERNAL STORES LIMITATIONS



SUSPENSION EQUIPMENT AND MISCELLANEOUS

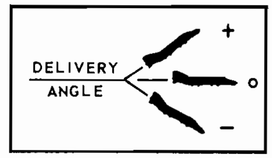


STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	ROLL RATE DEG/SEC	STICK THROW	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	MAX KNOTS	M	
ADSID (Coin No. 1) ADSID(TC-425)																
CTU-1/A Supply Container Maximum Load-3	MER (Shifted Fwd)			*			400	0.95	+5.0 −1.0	+4.0 0.0	150	FULL	NE	NE	NE	A
Empty MER Maximum Load-3	MAU-12B/A												350	550	1.1	B
	℄ Adapter												275	550	1.1	
													E NE	NE	NE	
Empty TER Maximum Load-2	MAU-12B/A												175 E225	550 475	1.1 1.1	C
Empty Aim-4D Launchers	MAU-12B/A												NA	NA	NA	D
AAVS TYPE IV CAMERA POD	MER (Shifted Aft)						550	1.3	+5.0 -1.0	+4.0 0.0	150	FULL	NE	NE	NE	E
	TER															
	MER (Shifted Fwd)						600	1.3	+3.0 0.0	+2.4 0.0	120	1/2	NE	NE	NE	
	MAU-12B/A						550	1.3	+5.0 -1.0	+4.0 0.0	150	FULL	NE	NE	NE	
	AERO-27/A or BRU-5A						650	1.6	+3.0 0.0	+2.4 0.0						
																F

F4-516-37

Figure 5-11 (Sheet 37 of 38)

- The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings-level straight line flight path is maintained prior to release or employment.
- Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.
- Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.
- Speeds or G quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.



NA, Not Applicable
NE, Not Established
F-4E Only
Aircraft Limits

	EMPLOYMENT				RELEASE				DELIVERY ANGLE	REMARKS
	MAX	MIN	MAXIMUM		MAX	MIN	MAXIMUM			
	ACCEL G	KNOTS	KNOTS	M	ACCEL G	KNOTS	KNOTS	M		
A										● Refer to T.O. 1F-4D-2-31. ● F-4D only.
B	NA	NA	NA	NA	1	300	425	0.75	Level	✱ F-4C/D. Either forward MER shoulder may be used. ● F-4E. (STA 5) Not Established. ● Release 300 feet AGL or higher for chute function.
C	NA	NA	NA	NA	NA	NA	NA	NA	NA	● Do not simultaneously jettison an empty and a loaded outboard MER when the maximum jettison speed of the loaded MER is less than 350 Knots. ● If the MER on stations 5 is mounted on the aft position, maximum jettison speed is reduced to 450 KCAS.
D	NA	NA	NA	NA	NA	NA	NA	NA	NA	
E	NA	NA	NA	NA	NA	NA	NA	NA	NA	● F-4D/E Only.
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	● On all stations on the F-4C/D and aircraft stations 1 and 9 on the F-4E, separation should be as near 325 KCAS as possible in 1G straight and level flight. No speed has been established for aircraft stations 2, 5, and 8 for the F-4E.
	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	NA	NA	NA	NA	NA	NA	NA	NA	NA	

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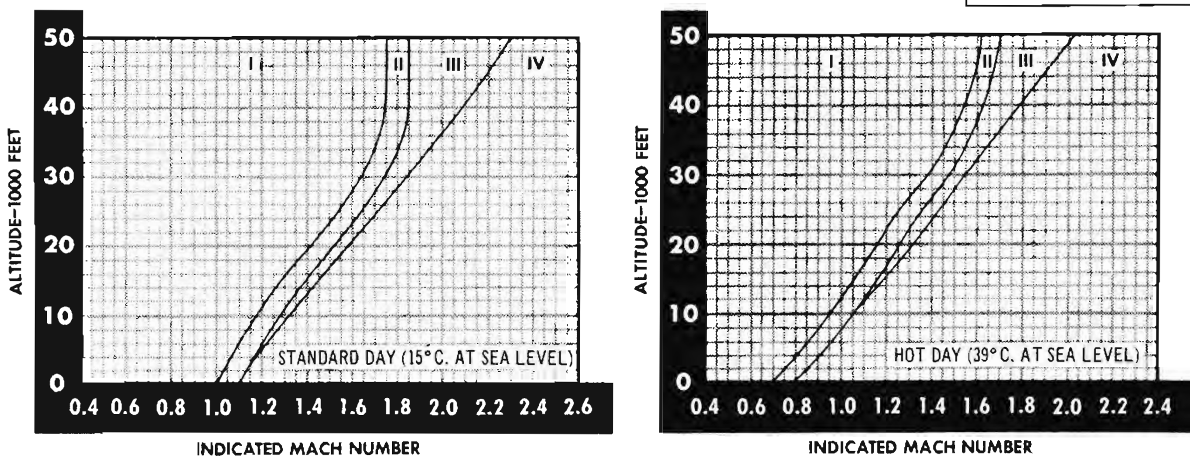
Figure 5-11 (Sheet 38 of 38)

AIM-9B, -9E AIRSPEED LIMITATIONS

MK 8 MOD 0/1/2 WARHEAD ONLY

Note

THE MK 8 MOD 3 WARHEAD IS UNRESTRICTED.



ZONE I – NO RESTRICTIONS.

ZONE II – REPEATED EXCURSIONS OF NO MORE THAN 10 MINUTES EACH IS PERMITTED.

ZONE III – REPEATED EXCURSIONS OF NO MORE THAN 5 MINUTES EACH IS PERMITTED. INSPECTION OF WARHEADS IS RECOMMENDED AFTER EACH FLIGHT INVOLVING EXCURSIONS INTO ZONES II AND III.

ZONE IV – AVOID.

IF LIMITATIONS OF ZONES II, III, AND IV ARE VIOLATED THE WARHEAD SHOULD BE DESTROYED BY JETTISONING THE MISSILE IF POSSIBLE. LANDINGS CAN BE MADE WITH LOW ORDER RISK IF JETTISONING IS NOT POSSIBLE.

THESE LIMITATIONS DO NOT APPLY TO AIRCRAFT CLIMB SCHEDULES, INCLUDING MAXIMUM PERFORMANCE.

F4-517

Figure 5-12

ECM POD AIRSPEED ENVELOPE

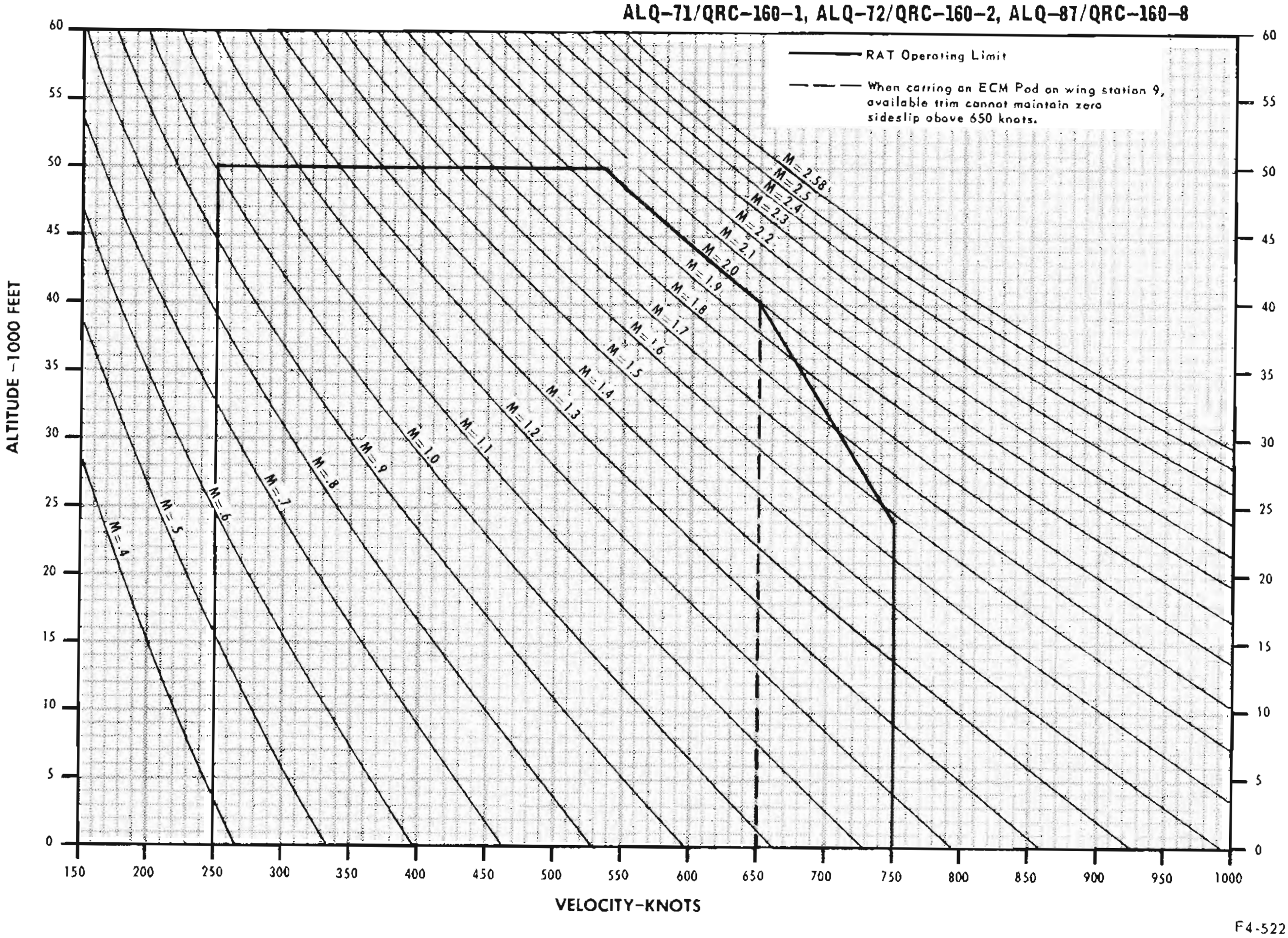


Figure 5-13

SECTION VI FLIGHT CHARACTERISTICS

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Note

All information in this section is based on flight test data. Revised or additional information will be supplied in subsequent revisions as it becomes available.

ANGLE OF ATTACK

Angle of attack (AOA) is of major importance in the F-4, particularly during maneuvering and in low speed flight. AOA is defined as the angle formed by the chord line of the wing and the aircraft flight path (relative wind). At constant flight conditions, the indicated AOA will increase approximately 3 units in the F-4C/D and 1 unit in the F-4E when the nose gear is extended; retracting the gear produces a corresponding decrease in indication. A change in airflow pattern over the AOA probe caused by the nose gear door is responsible for this AOA change. All references to indicated AOA take this factor into consideration. An error in AOA indication can also be induced as a result of sideslipping the aircraft. This proportional error is approximately 2 units for a low speed, full rudder sideslip. Right rudder sideslips produce AOA indications that are higher than actual for F-4C/D, and lower than actual for F-4E aircraft. The reverse is true for left rudder sideslips. The difference is due to AOA probe location.

LOW ANGLE OF ATTACK MANEUVERING

Drag is at a minimum at approximately 5 units angle of attack (nearly zero G). To achieve maximum performance acceleration, a 5-unit angle of attack pushover will provide minimum drag and allow gravity to enhance aircraft acceleration. This technique provides the minimum time, fuel, and distance to accelerate from subsonic Mach numbers to the optimum supersonic climb schedule.

MEDIUM ANGLE OF ATTACK MANEUVERING

Maneuvering at an AOA from 5 to 15 units will produce normal response to control movement.

HIGH ANGLE OF ATTACK MANEUVERING

Above 15 units AOA, the response and flight characteristics begin to exhibit the changes expected in swept-wing high performance aircraft. The primary roll-yaw flight characteristics at high AOA are dihedral effect (roll due to yaw) and adverse yaw (yaw due to aileron deflection).

Dihedral Effect

Dihedral effect is the roll caused by sideslip. Attempts to yaw the airplane with rudder will produce roll in the same direction as the rudder input as well as an increase in AOA. The use of rudder is the best and safest means of rolling the aircraft at high AOA. While the rudder should be used to coordinate maneuvering and roll the aircraft in this regime, it must be used judiciously, since accompanying increases in AOA may lead to loss of control. Rudder roll performance decreases above 20 units AOA, resulting in roll hesitations.

Adverse Yaw

At high AOA's, attempts to roll the airplane with aileron result in yaw opposite to the direction of the intended turn or roll. This yaw is partially produced by the drag of the down going aileron; and the dihedral effect, in turn, inhibits the roll. Adverse yaw is more severe at high AOA's, and aileron inputs provide very low roll rates. At very high AOA's near stall, aileron inputs cause increased adverse yaw and a roll opposite to that intended. The natural tendency to raise the wing with aileron should be avoided. A large aileron deflection at the point of departure from controlled flight will increase the probability of spin entry.

PITCH CONTROL AT LOW SPEEDS

The control of AOA at slow speeds is difficult because stick forces are lighter and aircraft stability is reduced. The AOA indicator is the primary recovery instrument when confronted with a condition of low airspeed and high pitch attitude. A smooth pushover to 5 to 10 units AOA will unload the airplane and prevent a stall. Recovery can be accomplished safely at any speed which will provide stabilator effectiveness (ability to control pitch attitude). Smooth control of AOA is required, and no attempt to control bank angle or yaw should be made until 5 to 10 units is established.

MAXIMUM PERFORMANCE MANEUVERING

The factors that determine maximum performance maneuvering capability are structural limitations, stabilator effectiveness, and aerodynamic limitations. Structural limitations are outlined in section V. F-4E aircraft can be maneuvered to higher indicated AOA than can the F-4C/D at comparable CG locations. The limit of stabilator effectiveness occurs at supersonic Mach numbers at high altitude where full aft stick can be attained without reaching either aerodynamic or structural limits. Aerodynamic limitations are primarily a function of angle of attack. Subsonic maximum performance turns are achieved by maintaining 19 to 20 units AOA while utilizing afterburner as required. At AOA's higher than 19 to 20 units, the aircraft loses lift, and turning performance is degraded. Avoiding adverse yaw is of paramount importance in high AOA maneuvering. If a high AOA must be maintained and a roll is necessary, rudder must be used to produce roll. During maximum performance maneuvering, higher roll rates may be achieved by momentarily unloading the airplane (reducing AOA to between 5 and 10 units); utilizing aileron to roll to the desired bank angle; then neutralizing aileron and reestablishing the required angle of attack. Ailerons should be neutralized prior to reestablishing a high angle of attack.

WARNING

Nose rise can occur during high AOA maneuvering. This is characterized by a reduction or reversal of stick forces and can result in inadvertent increase in AOA and possible overstressing of the aircraft or loss of control.

LANDING

The optimum indicated AOA for approach is 19.2 units, and is adequate for all gross weight and flap configurations. No adjustment is required for gusting crosswinds, runway conditions, or weather. During single-engine half-flap approaches, 17 units AOA should be maintained on final approach (to maintain adequate excess thrust).

HANDLING QUALITIES

A large variation in handling qualities exists throughout the flight envelope. Consideration must be given in Mach number, CG position, indicated airspeed, AOA, and external store loading.

SUBSONIC REGION

Takeoff Configuration

The full aft stick takeoff technique provides the lowest nosewheel lift-off speed. Nosewheel lift-off speeds will normally be lower than computed takeoff speeds (refer to Performance Data Manual); however, with a forward CG position it is possible to have nosewheel lift-off speeds which exceed computed takeoff speeds. With aft CG locations high rotation rates can be achieved, and caution should be exercised to avoid over-rotation. In computing CG for takeoff, allowance must be made for a forward CG shift during ground operation. This forward movement is approximately 1 percent MAC for every 1000 pounds of internal fuel used. In the forward CG range, nosewheel lift-off speed is increased approximately 4 to 5 knots for each 1 percent of forward CG movement.

Landing Configuration

In the landing configuration, pitch or airspeed changes require few, if any, trim changes to relieve stick pressures. This is due to control system friction and poor stick centering. Landings at aft CG positions require more attention to AOA control than landing with a forward CG. This is due to increased stick sensitivity and a mild nose rise tendency at about 18 units AOA. Since full flaps and ground effect decrease stabilator effectiveness, the aft stick stop may be bumped during landing. Stabilator effectiveness is not sufficient to hold the nose up after touchdown. Aileron and rudder response in the landing configuration is good; however, adverse yaw produces a decrease in roll response due to strong dihedral effect. Rudder can be used to provide roll due to dihedral effect. The aileron-rudder interconnect feeds in rudder automatically to improve roll performance and turn coordination.

Clean Configuration

Control effectiveness is good in the clean configuration. Roll rate capability is quite high, and coordinated turns can be made without the use of rudder at 12 units AOA or less. When adverse yaw is experienced the yaw stability augmentation is relatively effective in returning the ball to center.

TRANSONIC REGION

High Altitude

In the transonic region, stabilator effectiveness is somewhat reduced, resulting in slightly higher stick forces. A nose-rise tendency occurs during transonic maneuvering above 10 units AOA. This will appear as a relatively abrupt decrease in stick force required per G.

WARNING

Caution should be used when maneuvering in the transonic speed range because the nose-rise tendency could lead to aircraft overstress or loss of control.

Transition from supersonic to subsonic speeds while holding G's on the aircraft results in a mild to moderate nose rise (dig in) which can be relatively abrupt, particularly at high G's. Speed brakes can increase the nose-rise tendency during transition from transonic to subsonic speeds. Aileron roll performance in the transonic region is about the same as in the subsonic region. Roll rate resulting from full aileron is much too great for any practical use.

Low Altitude

The transonic nose-rise tendency during maneuvering or decelerating turns at high altitude are also evident at low altitude. Aircraft overstress is more probable at low altitude. The high stabilator effectiveness results in high pitch sensitivity and possible over-control. It may be possible to create a rapid pitch oscillation if the AC's response becomes out of phase with the aircraft motion. Such a condition is commonly known as pilot-induced oscillation (PIO). The pitch stability augmentation must be used when flying at high speeds and low altitudes to reduce the PIO tendency. An out-of-trim condition is conducive to PIO. Therefore, it is advisable to trim out the pitch forces during a rapid acceleration at low altitudes. The standard and most effective recovery technique from a pilot-induced oscillation is to release the controls. If the altitude of a mission is such that it would not be desirable to release the controls, recovery from a PIO can be accomplished by making the arm and body as rigid as possible while holding the stick in the approximate trim position or applying a slightly positive G loading. Afterburner shutdown at high indicated airspeeds can also produce a pitch transient. It is advisable to lock the shoulder harness when flying under conditions of high speed and low altitude. The body, from the lap belt up, could become the forcing function during an inadvertent pitch input if the shoulder harness is unlocked.

WARNING

A pilot-induced oscillation can result if abrupt power or pitch changes are made while operating in the transonic region at low altitude.

SUPERSONIC REGION

As Mach number is increased in the supersonic region, stabilator effectiveness decreases somewhat. Maneuvering stick forces are high. Maneuvering capability is limited by stabilator effectiveness at the higher Mach numbers and altitudes; for example, full aft stick at Mach 2 at 50,000 feet will produce about 3.5 G's, while full aft stick at Mach 1.5 at 36,000 feet will produce about 5 G's. More maneuvering capability is available at aft CG conditions than at forward CG conditions. No abnormal control problems exist during supersonic flight. Roll rate, although decreasing with Mach number, remains adequate out to limit Mach numbers.

EFFECT OF EXTERNAL STORES

The addition of external stores generally increases pitch sensitivity and nose-rise tendencies (refer to CG Limitation, section V). In addition, inertial effects are evidenced during abrupt maneuvers especially at high AOA's. The most noticeable inertial effect takes place during rolling maneuvers. It takes longer to build up a given roll rate, but once the rate is established, it takes longer to stop. This inertial effect results in less wing rock when approaching the stall. Most high speed flight restrictions with external stores are based on structural considerations.

FLIGHT WITH ASYMMETRIC LOADING

Takeoff

Takeoff with asymmetric loads equivalent to one full external wing tank can be made. Recommended techniques are essentially the same as for crosswind operation. A strong turning moment into the heavy wing will exist during takeoff roll and will increase during rapid accelerations. Nose gear steering and rudder (when rudder becomes effective) should be used for directional control. As the aircraft breaks ground, it will tend to roll into the heavy wing if not previously trimmed to counteract the asymmetric condition. Approximately 5 degrees aileron (3 seconds trimming from neutral) away from the heavy wing is sufficient for asymmetric loads equivalent to one full external wing tank. Abrupt liftoffs should be avoided. Establish an attitude and allow the aircraft to fly itself off using rudder and aileron as required.

Landing

Landing with asymmetric loads equivalent to one full external wing tank can be made. Recommended techniques are essentially the same as for crosswind operation. A straight-in pattern avoiding abrupt or accelerated maneuvers is recommended. To determine approach speed and AOA, establish the landing configuration and slow to a speed at which full aileron trim will hold wings level. This should result in 16 to 17 units AOA for an asymmetric load equivalent to one full external wing tank. A check for roll capability by applying additional aileron to pick up the heavy wing should be made. This AOA should be maintained during the approach and touchdown. An abrupt flare will cause a strong roll into the heavy wing. During landing roll, the aircraft may turn away from the heavy wing as brakes are applied. This can be controlled by rudder and nose gear steering.

Go-Around

If a go-around is necessary from an established final, abrupt stick movement should be avoided. Power should be advanced to military and the nose smoothly raised to the desired attitude. When no longer in a descent, the gear may be retracted: however, flap retraction should be delayed until at least 200 knots has been attained. Rudder and afterburner may be required to maintain wings level flight.

Maneuvering

There will be a rapid build-up of asymmetric forces during maneuvering. Roll tendencies increase with load factor, whereas control of this roll is a function of airspeed. Loss of roll control can occur at angles of attack well below buffet and stall. Use of excessive aileron will produce adverse yaw. Control can be regained only by reducing AOA. The rolling moment produced by failure of one internal wing tank to transfer will be essentially undetectable in 1 G flight. At higher load factors this rolling moment will be more significant. Every assymmetric condition has airspeed and load factor combinations beyond which control cannot be maintained. Control can be regained only by an increase in airspeed and/or reduction of AOA.

WARNING

Smooth control inputs should be used with asymmetric loads. Rapid inputs will result in abrupt rolloffs at high angles of attack. An AOA of 16 units should not be exceeded when maneuvering with the equivalent of one full external wing tank asymmetry. If an abrupt roll occurs due to an asymmetric load, immediately reduce AOA, since the combination of high AOA and adverse yaw can lead to loss of control. If a departure occurs, spin entry is highly probable.

STALLS

A stall, as discussed in this Flight Manual, is defined as a breakdown in directional stability (i.e., nose slicing). Characteristics normally experienced while approaching a stall include buffet onset, nose rise, and wing rock. These characteristics and the violence of the stall itself are dependent upon the external loading, CG location, and control technique. They are not entirely predictable or repeatable.

CRUISE/COMBAT CONFIGURATION

1-G Stalls

Generally, 1 G stalls are preceded by a wide band of buffet warning; however, in F-4E aircraft the onset of buffet and the buffet intensities are reduced at all angles of attack compared to the F-4C/D. Onset of buffet normally occurs approximately 40 knots before the stall (around 14 units AOA), and increases from light to moderate preceding the stall. A reduction in buffet level near stall is possible and a complete absence of buffet has been experienced during some 1 G stalls. The rudder pedal shaker will activate at 22.3 units angle of attack; however, it may not be recognizable due to airframe buffet. Wing rock generally is unpredictable, but starts about 10 knots prior to the stall and can progress to as much as ± 30 degrees of bank at the stall. If aileron and rudder inputs are avoided during any stall or stall approach, wing rock onset may be delayed or may not occur at all. The angle of attack at stall will normally vary between 26 and 30 units. The stall is characterized by a yawing (nose slicing) motion in either direction caused by a loss of directional stability. If nose slicing is experienced, recovery should be initiated immediately to prevent a departure from controlled flight and possible spin entry. Recovery, if initiated rapidly, is effected by positioning the stick forward (5 to 10 units angle of attack) while maintaining neutral ailerons and rudder. Wing rock may continue during recovery until the angle of attack is reduced below 15 to 20 units. Also refer to Stall Characteristics charts (figures 6-1 and 6-2).

Accelerated Stalls

Accelerated stalls normally are preceded by moderate buffet increasing progressively to heavy buffet prior to the stall. Rapid application of aft stick will result in immediate, heavy buffet as the airplane stalls. Wing rock is unpredictable, but generally starts around 22 to 25 units AOA. The angle of attack at the stall is between 26 and 30 units. Rapidly entered accelerated stalls may occur at lower indicated angles of attack. Applying full aft stick will result in a departure and probable spin entry. Prompt neutralization of controls will generally effect recovery from accelerated stall approaches. Control of angle of attack with stick position is of paramount importance to effect recovery from the stall. Oscillations in roll and yaw which may be present during recovery should be allowed to damp themselves out and should not be countered with aileron or rudder.

WARNING

The use of aileron or excessive rudder when approaching either a 1 G or accelerated stall condition will produce yaw and increase AOA. This increases the probability of loss of control. Left aileron produces a right yaw, and right aileron produces left yaw.

Inverted Stalls

An inverted stall (negative angle of attack) can be entered with abrupt application of full forward stick. Light to moderate buffet will occur at the stall and there are no distinct yaw or roll tendencies. Recovery from the inverted stall is effected by relaxing the forward stick pressure and maintaining an angle of attack between 5 to 10 units until recovered.

Landing Configuration Stalls

Note

Do not practice stall approaches in the landing configuration above 10,000 feet. The effectiveness of the BLC system and the engine bleed pressures decrease with altitude. In addition, the use of BLC above 10,000 feet may cause the systems using bleed air to become inoperative.

Stall approaches in the landing configuration are safe, with satisfactory control about all axes up to 24 to 25 units angle of attack except at aft CG positions where sensitive pitch control is experienced. In the landing configuration, the aircraft will generally stall at higher AOA than in the cruise configuration; however, nose slicing can occur as low as 26 units AOA. In the approach to stall, onset of wing rock may occur as low as 23 units AOA and is more prevalent than in the cruise configuration. Artificial stall warning is

STALL CHARACTERISTICS F-4C D

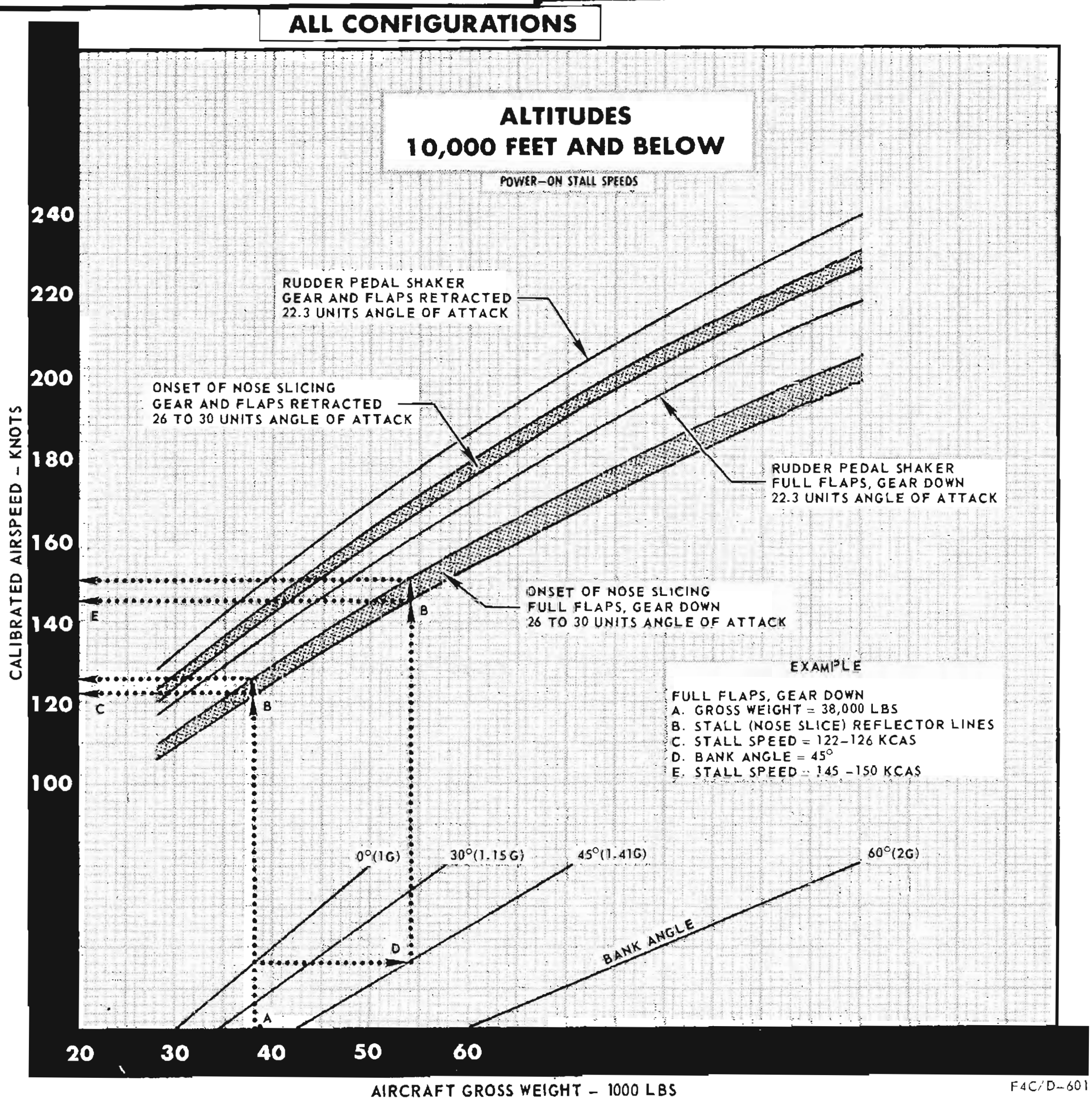

Figure 6-1

in the form of the rudder pedal shaker set at 22.3 units angle of attack regardless of gear or flap positions. Approaching the stall, the airplane exhibits a slight nose rise (a reduction in the stick force required to hold pitch attitude). The magnitude of this stick force lightening is a function of the center of gravity position (aft CG gives lighter forces). Wing rock usually increases in intensity as angle of attack is increased, but seldom exceeds ± 40 degrees bank angle at the stall. If bank angles in excess of 30 degrees or nose slicing are experienced, the stall approach should be discontinued. There is virtually no increase in airframe buffet during stall approaches and only light to moderate buffet will be experienced at the stall. Recovery is effected by placing the stick forward to reduce AOA, and advancing the throttles to military thrust. Recovery attitude may be as much as 30 degrees nosedown, and care should be taken not to exceed gear down airspeed limits. Stalls with one-half or full flaps display essentially identical characteristics.

STALL CHARACTERISTICS F-4E

ALL CONFIGURATIONS

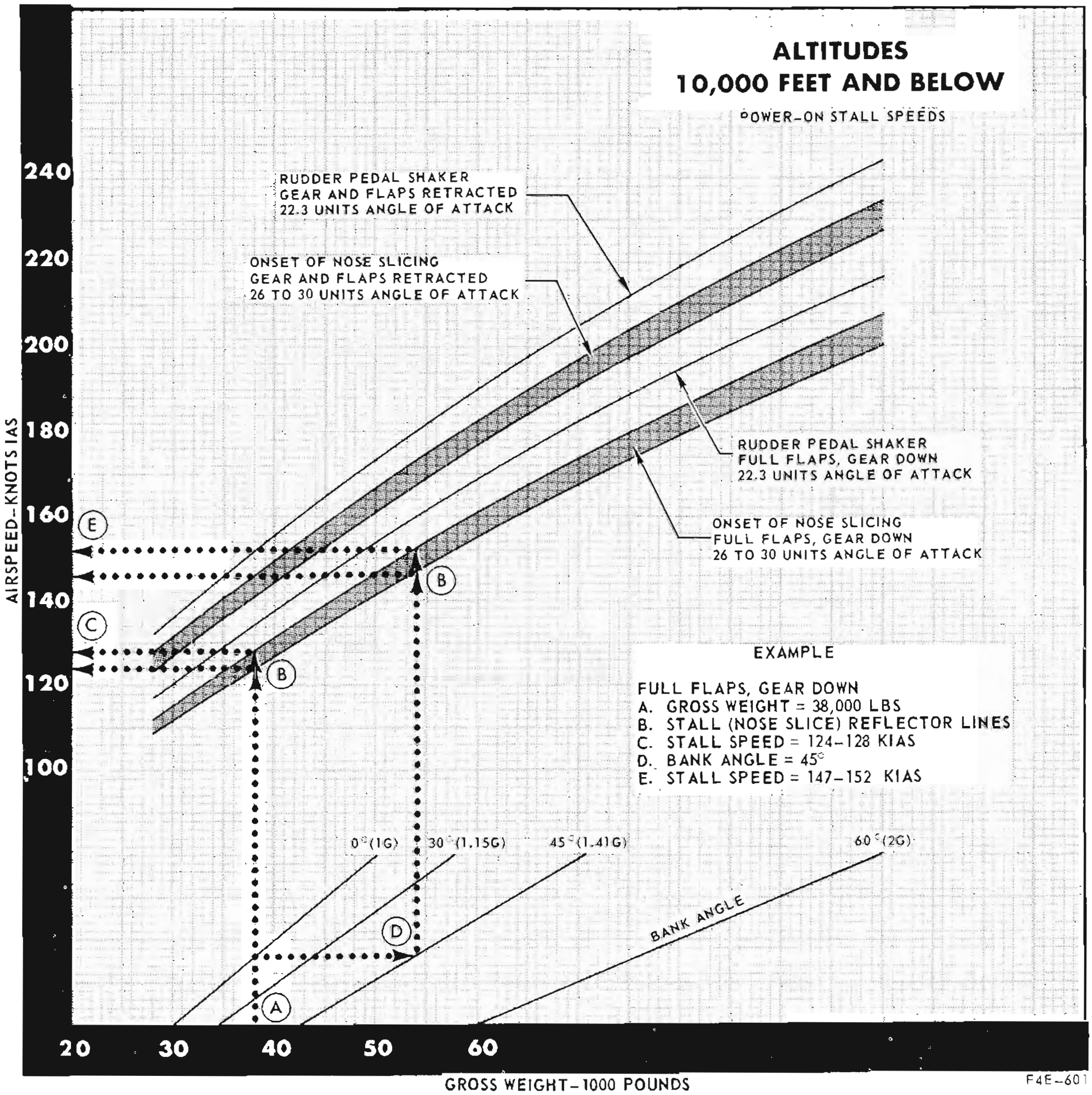

Figure 6-2

WARNING

Do not depend on the wing rock or buffet for natural stall warning. In any configuration or loading, it is possible to approach 26 to 30 units AOA without any wing rock or buffet, at which time loss of control may result. Loss of at least 3000 feet altitude should be anticipated.

DEPARTURES

Post-stall gyrations are uncontrolled aircraft motions following aggravated stall penetrations. They are best described as uncontrolled motions about any or all axes following a departure from controlled flight. Post-stall gyrations are caused by excessive AOA and can be prevented only by proper control of angle of attack. Directional stability deteriorates and goes negative at high AOA. Without directional stability, the aircraft will depart regardless of aileron or rudder position. Misapplication of lateral/directional controls may tend to aggravate the departure; however, the aircraft can depart and enter a spin with neutral ailerons and rudder. Departure and spin susceptibility is greater in the high subsonic and transonic (0.8 to 1.0) Mach regime. The severity of the departure is dependent upon the aircraft loading, airspeed, Mach number, and type of entry and is not predictable. Normally, the AC will sense a buildup of side forces in the cockpit just prior to a departure. The AOA at departure is dependent upon the configuration; the more external stores, the lower the AOA at departure. The departure is characterized by a nose rise followed by an immediate yaw with a roll in the direction of yaw.

RECOVERY CHARACTERISTICS AND TECHNIQUES

At the first indication of departure, the ailerons and rudder should be neutralized while moving the stick smoothly forward (full forward if necessary). Recovery from most out-of-control situations will be effected rapidly with forward stick, in some cases before reaching the full forward position. The throttles should be retarded to idle to reduce the possibility of engine flameout unless at low altitude where thrust may be needed for recovery, and the probability of flameout is reduced. The drag chute will effect recovery from most departures and should be deployed without hesitation if the aircraft does not recover rapidly with full forward stick.

Large oscillations in pitch, roll and yaw may be present as the aircraft unloads (zero or negative G) during the recovery. This unloading, using forward stick, is the best means of reducing these oscillations and is a positive indication that recovery is imminent. To preclude pitching back into another out-of-control condition, forward stick should be maintained until all oscillations stop. No attempt should be made to fly AOA while large roll and yaw motions are present because the AOA probe gives erroneous information under these conditions. The aircraft may enter a series of uncommanded rapid rolls as it recovers and accelerates. While AOA will indicate less than 30 units, the rudder and ailerons are ineffective in stopping these recovery rolls. These rolls should not be mistaken for a spin and will cease within two or three rolls. Once all oscillations have stopped, normal throttle and control use will be effective for regaining the desired flight attitude. Do not exceed buffet onset during the dive recovery or 19 units maximum AOA if at low altitude. It is normally not necessary to jettison the drag chute since it will fail and streamline behind the aircraft as speed builds up. Refer to figure 6-3 for a summary of out-of-control recovery techniques.

SPINS

Spins have been entered from level flight stalls and tactical maneuvers including accelerated turns, reversals, and vertical and inverted climbs and dives. Departure and spin characteristics have been investigated over operational CG positions at Stability Indexes ranging from zero to 180. Asymmetric configurations up to the maximum allowable (one full 370-gallon external wing tank) have also been tested. Spin progression can be defined in two phases: incipient and developed. The incipient phase is the initial phase characterized by irregular oscillations about all three axes. The developed spin is attained when equilibrium conditions are approached and the oscillations are more or less consistent about all three axes from one turn to the next.

Note

The Out-of-Control procedure will recover the aircraft from nearly all spins regardless of CG position or external store loading. While the rudder is relatively ineffective in a spin, applying full aileron in the direction of the spin will effect a more rapid recovery. Aileron should not be applied, however, until the AC has ascertained that a spin condition exists. Visual cues outside the cockpit, an excessive yaw rate, and the turn needle (not the ball) should all be used to verify a spin condition and the spin direction. The turn needle will always be pegged in the spin direction. AOA is not a primary indication to determine a spin condition as the AOA probe gives erroneous information when large roll and yaw motions are present. The AOA indicator may show less than 30 units and even below 15 units momentarily during a spin; however, the AOA indicator will be 30 units during most of an upright spin. Even if the indicated AOA comes down during an out-of-control condition, the stick should remain forward until the aircraft unloads and yaw and roll motions cease.

CAUTION

External stores should be retained if a spin is entered. Jettisoning stores is not required for spin recovery and will only increase the risk of aircraft damage due to probable aircraft-store collision.

UPRIGHT SPINS

Recoverable Mode (Oscillatory)

The oscillatory mode is by far the most prevalent spin mode of the aircraft, and an aerodynamic recovery can always be accomplished if altitude conditions permit. This spin may oscillate rather violently in pitch, roll, and yaw, especially during the first few turns. The severity and magnitude of the oscillations are dependent upon the entry conditions and aircraft loading. External stores, particularly asymmetric loadings, will cause the spin to be more oscillatory. The pitch attitude may initially vary from greater than 90 degrees nose low to 60 degrees above the horizon until steady state conditions are approached. The oscillations in yaw rate can vary between 20 and 100 degrees per second and roll oscillations can be

OUT-OF-CONTROL RECOVERY

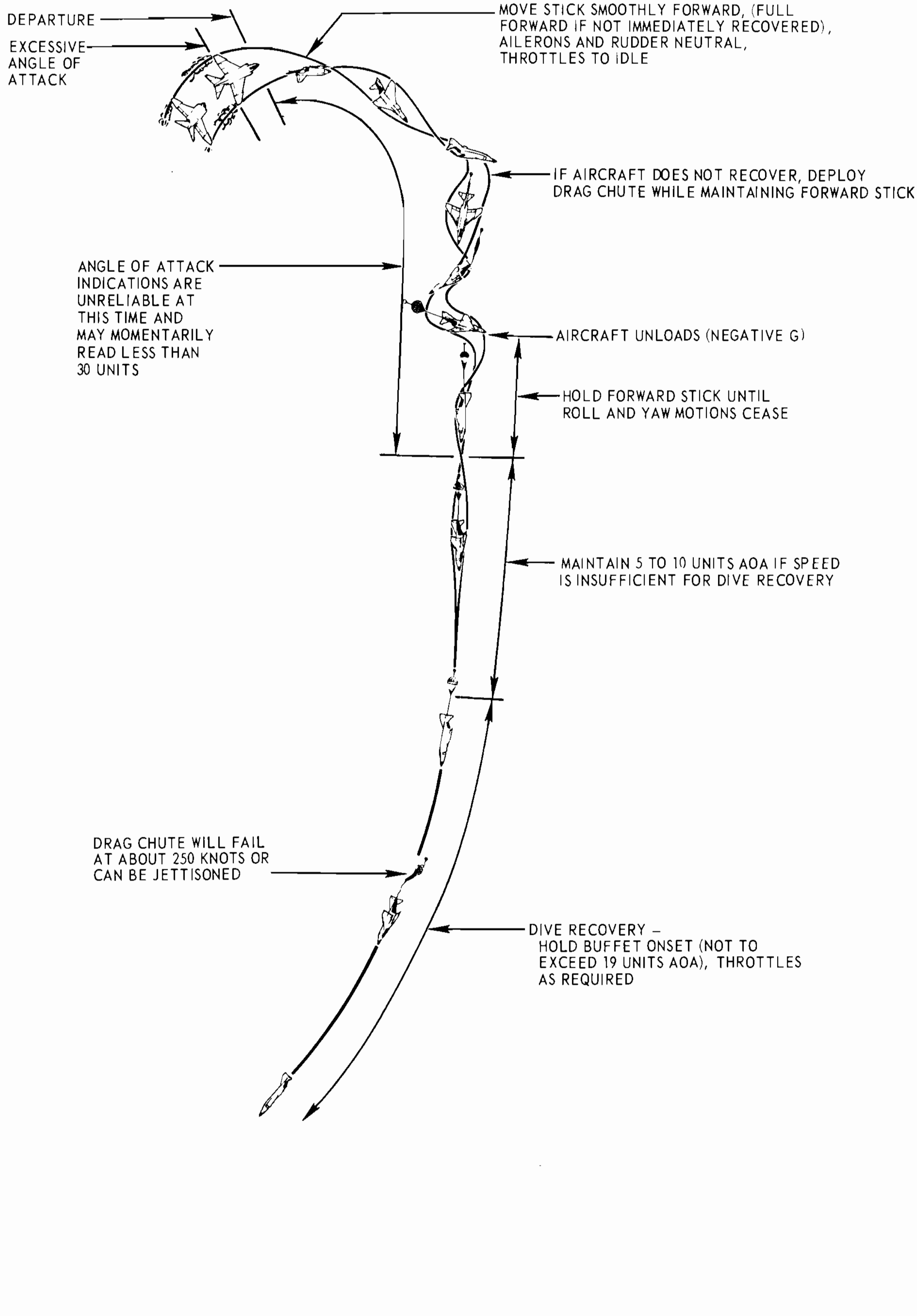

Figure 6-3

as much as ± 60 degrees of bank angle. Bank angle changes opposite to the spin direction (e.g., rolling left in a right spin) can be confusing when trying to determine the spin direction. The spin direction can be determined by observing the arc made by the nose of the airplane across the ground or horizon, but the spin direction should be verified by checking the turn needle. In the clean configuration the aircraft spins more steeply (at a lower AOA) with relatively mild oscillations about all axes. The drag chute is an effective recovery device. In the clean configuration, spin susceptibility is reduced and recovery characteristics are enhanced with the inboard pylons installed. As external stores are added, the spin becomes more oscillatory, the aircraft spins at a higher nominal angle of attack, and the drag chute becomes less effective for recovery. Cockpit accelerations vary with the magnitude of the oscillations and may become somewhat uncomfortable in asymmetric configurations. The yaw rate will decrease and then increase at least once a turn (airplane tends to hesitate briefly and then wrap back up in yaw). Bank angle is also quite oscillatory. These oscillations are quite noticeable and indicate that the aircraft is not in a flat spin. The altitude loss in an oscillatory spin will average 1500 to 2000 feet per turn.

While the drag chute may be completely ineffective in a highly oscillatory spin, aerodynamic recovery can be accomplished within several turns. As forward stick and/or forward stick and aileron start to recover the aircraft, the magnitude of the oscillations will increase. The most violent oscillations and the most uncomfortable portion of the spin will generally occur as the aircraft unloads (zero to negative G) during recovery. This unloading using forward stick is the best means of reducing these oscillations and is a positive indication that recovery is imminent.

Reversals (changing spin direction) are rare using forward stick for spin recovery. If a reversal should occur, maintain forward stick and re-apply aileron with the spin. When the aircraft unloads and yaw rate decreases, the ailerons should be neutralized; however, forward stick should be maintained until all oscillations cease to preclude pitching back into another out-of-control condition. The timing involved in detecting recovery using forward stick and aileron is not critical. The unloading at recovery will, in most cases, be rather abrupt. As the aircraft recovers and accelerates, it may enter a series of rapid rolls. While AOA will indicate less than 30 units, the rudder and aileron are relatively ineffective in stopping these recovery rolls. These rolls should not be mistaken for a spin or spin reversal, and will cease within 2 or 3 rolls.

The drag chute becomes more effective as the aircraft unloads and will quickly reduce the recovery oscillations. After recovery (aircraft unloaded and oscillations stopped), thrust should be applied and the dive recovery accomplished by holding buffet onset, or 19 units maximum, if at low altitude, until level. Refer to figure 6-4 for a summary of spin recovery techniques.

Non-Recoverable Mode

There have been isolated cases of upright spins progressing rapidly into a flat mode. The flat spin can develop within one or two turns after a departure from controlled flight; however, it is doubtful that an oscillatory spin will go flat if forward stick is maintained. The characteristics of the flat spin mode are quite different from those of the oscillatory mode. Once the flat spin is developed, oscillations in pitch and roll will not be noticeable. Yaw rate will increase rapidly to 80 degrees per second or higher and there will be no hesitations in yaw during each turn. The flat spin is very smooth and the only accelerations on the crew will be a push forward (1 to 1.5 G). The altitude loss in a flat spin will average between 1000 and 1800 feet per turn. Recovery from a flat spin cannot be accomplished by either aerodynamic controls or the drag chute.

INVERTED SPINS

Inverted spin entry is unlikely. The inverted spin is characterized by negative G, an angle of attack of zero units, and is less oscillatory than the upright oscillatory spin. Spin direction can be determined by the yawing motion of the aircraft and the deflection of the turn needle. Recovery from inverted spins can be accomplished rapidly with neutral ailerons and rudder. The Out-of-Control procedure will recover the aircraft from an inverted spin. When roll and yaw oscillations cease, normal control of AOA can be regained. Maintain 5 to 10 units AOA until sufficient speed for dive recovery is attained.

ENGINE EFFECTS

If the engines are at high power settings, a flameout of one or both engines will probably occur at or just after departure. At initial departure from controlled flight, the AC should retard the throttles to idle if altitude conditions permit. This normally will prevent engine stalls or flameouts and retain hydraulic and electric power during the post stall gyration or spin. Should a flameout occur, an airstart can be obtained with the throttles at idle even during a spin. If both engines flameout and an airstart is not obtained, electrical power will be lost within 3 to 4 turns and normal operation of flight controls will deteriorate after approximately 4 turns and will be lost shortly thereafter. The RAT (F-4C/D aircraft) will not be effective in a spin, but will be an immediate aid for electrical power after recovery.

ZOOM CLIMB

A zoom climb can be performed by accelerating to a high energy condition and then slowly rotating to a pitch attitude higher than normal climb. Pitch angles in excess of 60° detract from the zoom climb capability and produce more uncomfortable recovery conditions. During a zoom climb to altitudes above 65,000 feet, the EGT must be monitored. Afterburner blowout will usually occur around 67,000 to 70,000 feet. When the afterburners blow out, the

SPIN RECOVERY

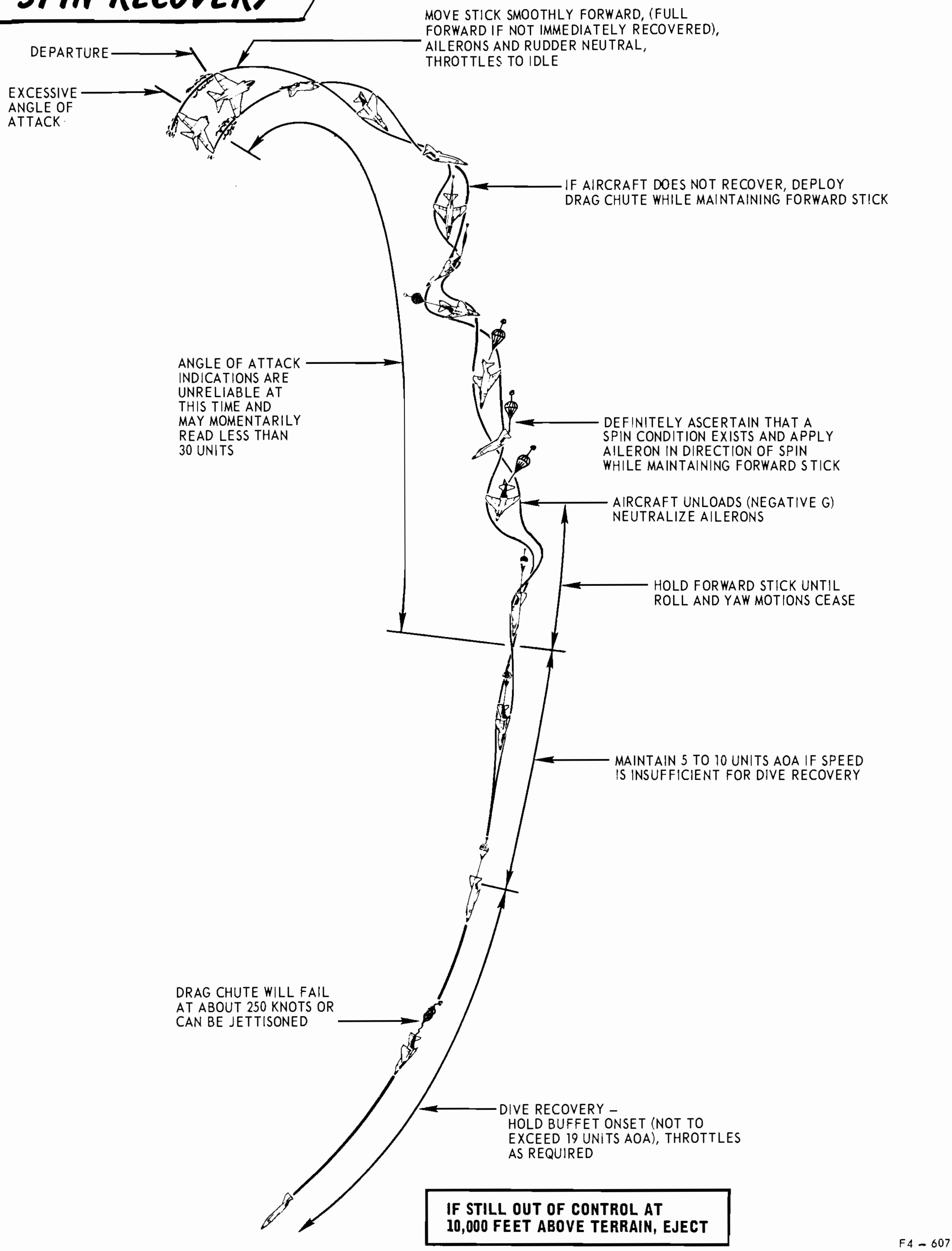

Figure 6-4

throttles should be taken out of the afterburner range to preclude unexpected or hard light-offs during descent. Above 70, 000 feet, the engines will have to be shut down if they tend to over-speed or over-temp. Engine windmill speed at altitudes above 70, 000 feet are high enough to maintain some cockpit pressurization and normal electrical power. Stabilator effectiveness will decrease noticeably above 50, 000 feet and an increased amount of aft stick will be required to hold a given pitch attitude. Zoom climb recovery can be initiated at any time during the zoom maneuver by relaxing back pressure on the control stick and flying the aircraft over the top at a G loading which will prevent stall. Maintaining a constant value of angle of attack between 5 and 10 units will properly decrease G with decreasing airspeed during the recovery while still maintaining a safe positive G loading on the aircraft. Negative G recoveries are not recommended due to aircraft and physiological limitations and lack of aircrew ability to detect impending stall. Two basic methods of recovering from the zoom climb are possible. A wings-level recovery can be effected by smoothly decreasing angle of attack to the minimum positive G value and holding this until the aircraft is diving. An inverted recovery can be effected by controlling angle of attack while rolling the aircraft to inverted and then increasing angle of attack to produce the maximum G loading on the aircraft. A comparison of the two techniques shows that the positive G loading on the aircraft assists the recovery trajectory in the inverted case whereas it detracts from the recovery trajectory in the wings level case. The resulting flatter trajectory of the wings-level recovery produces a lower minimum airspeed and higher maximum altitude over the top in addition to a longer overall recovery time. Although the inverted recovery is superior from the standpoint of speed, altitude, and exposure time, it exhibits certain risks due to the capabilities required to properly control the angle of attack during the rolling maneuvers. All zoom climb recoveries demand smooth coordinated control action. The angle of attack indication is the primary recovery aid regardless of recovery method. As speed decreases, the stabilator required to develop a given pitch command increases. Higher than normal stick displacement and rates will be necessary to command or hold angle of attack at very low speeds. Inadvertent pitch inputs due to abrupt roll action or AC's inattention to required pitch control can quickly put the aircraft in a stalled condition. Zoom climb recoveries initiated from indicated airspeeds in excess of 250 knots can be made inverted or wings-level. For the wings-level recovery, smoothly reduce angle of attack to 5 units and hold this value until the aircraft is in a recovery dive and speed has increased through 250 knots. Attempts to hasten the recovery by pushing over to a value below 5 units of angle of attack produces negative G on the aircraft and possible stall. Precise roll attitude is not important during the recovery. Any aileron used to correct or maintain roll attitudes should be smooth and coordinated. For the inverted recovery, smoothly reduce angle of attack to 5 units and, holding this value, smoothly roll the aircraft to inverted. Increase and hold angle of attack at 10 units to produce maximum safe G loading on the aircraft. When the aircraft is in an inverted recovery dive, the roll to wings-level must again be accomplished with smooth slow control action while holding angle of attack between 5-10 units. As before, angle of attack should be maintained in the recovery dive until airspeed builds up to 250 knots. Zoom climb recoveries initiated at indicated airspeeds less than 250 knots should be accomplished with the AC's sole attention devoted to proper control of angle of attack between 5-10 units. Roll attitude should be completely ignored with aileron and rudder held generally neutral to maintain coordinated flight. If the AC becomes confused or disoriented during any recovery, he should immediately concentrate only on angle of attack and ignore all other parameters. If angle of attack is maintained between 5-10 units, the aircraft will recover safely to nose-down accelerating condition regardless of roll attitude.

SECTION VII SYSTEMS OPERATION

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ENGINE OPERATING CHARACTERISTICS

The engine has several characteristics that will be expanded upon as this write-up progresses. These characteristics are utilized to achieve optimum engine performance in all flight conditions without exceeding the operating limits of the engine.

T2 RESET

During high compressor inlet temperature operation (high speed flight), engine idle speed is rescheduled upward to maintain sufficient airflow to prevent compressor stall. As compressor inlet temperature increases from 56°C ± 5 to 108°C ± 5, engine idle speed is raised from normal idle (65 percent) to 100 percent regardless of the throttle position. To reduce engine idle speed once it has been reset, compressor inlet temperature must be reduced. This is effected by retarding the throttles out of afterburner to reduce thrust. Thrust can be further reduced by retarding the throttles below the military position so that the exhaust nozzles open, lowering exhaust gas velocity and temperature. As thrust decreases, compressor inlet temperature decreases as a result of lower airspeed, and engine speed control is returned to the throttle. T-2 reset may also occur during ground operation when hot exhaust gases from other aircraft are directed at the intake of the affected engine.

T2 CUTBACK

When the compressor inlet temperature (T_2) falls below +45°C, the maximum engine rpm is limited to prevent excessive mass airflow through the engine. The rpm maximum speed reduction starts at +45°C and is reduced until at -54°C the maximum rpm is approximately 91.5 percent.

T5 RESET

The engine incorporates an exhaust gas temperature (T_5) reset during military and full afterburner operation. This T_5 reset occurs at the same point as T_2 cutback, and reduces EGT at the same time that T_2 cutback is reducing rpm. As a result of T_5 reset, the engines run at lower EGT's, operate with larger nozzle areas, provide less net thrust and consume less fuel while operating in the speed cutback region at low compressor inlet temperature conditions.

AUTO-ACCELERATION

If the auxiliary air doors fail to open when the landing gear is lowered, there is a possibility that the engines may automatically accelerate up to 100% rpm. A utility hydraulic system failure renders the variable bypass bellmouth and auxiliary air doors inoperative. Operation of an engine with an open variable bypass bellmouth and closed auxiliary air doors will allow engine compartment secondary air to recirculate to the engine inlet. During low altitude or ground operation, the temperature of the recirculating air may be high enough to initiate T_2 reset. When T_2 reset is initiated the engine(s) will auto-accelerate. The auto-accelerated engine(s) can be shut down, if on the ground, by placing the throttle to OFF. If engine operation is required, the thrust output can be regulated by modulation of the engine throttle. Modulation of the engine throttles will re-position the exhaust nozzles. However, the engine rpm will not be affected.

RAMP SCHEDULING

Ramps begin scheduling at +52°C total temperature and stop at +146°C total temperature. The following schedule is representative of ramp extension:

RAMP SCHEDULE

40,000 FEET

OAT °C	RAMPS BEGIN TO EXTEND AT APPROX.
-40	1.40
-45	1.45
-50	1.50
-55	1.55
-60	1.60
-65	1.65
-70	1.70

ENGINE OPERATING ENVELOPE

The engine operating envelopes (figure 7-1) show pertinent engine operating data for an ICAO Standard Day. The various envelopes are plotted to show an approximate area of operation; therefore, air-starts, afterburner light-offs, minimum airspeed operation, etc. may occur, depending on prevailing flight conditions, on either side of the plotted operational area. However, under 1 G level flight conditions, satisfactory engine operations can be expected within the plotted envelopes. The transient operation zone (Mach 2.0 to 2.4) and the maximum engine operation curve are standard day airspeed restrictions and are shown for reference only. In all cases the Airplane Speed Restriction Chart and Engine Airspeed Limit Chart in section V of this manual shall take precedence over any or all operations shown herein.

ENGINE OPERATING ENVELOPES

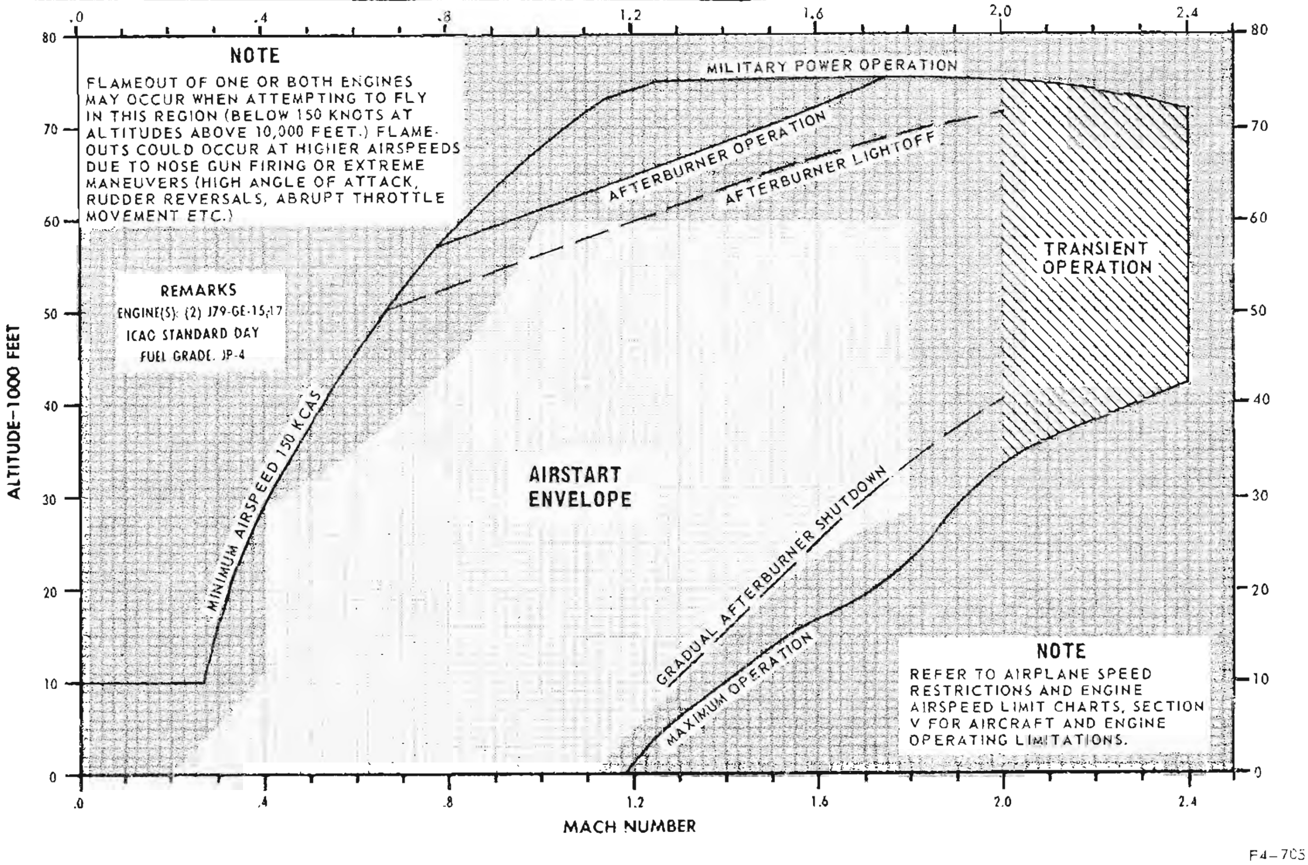


Figure 7-1

Note

When firing the nose gun during maneuvering flight at very high altitudes (especially during high AOA), engine flameout may occur due to gun-gas ingestion. At the first indication of stall/flameout, depress ignition button while moving throttle to OFF and then back to any position beyond IDLE. Attempting an airstart without cycling the throttle to OFF will probably result in a hung start.

ENGINE STARTER OPERATION

The engine starting system utilizes a turbine type cartridge/pneumatic starter unit, mounted on the accessory gear box of each engine. These units provide starting capabilities with either the pneumatic starting unit, (type MA-1A or equivalent), or with a MXU-4/A solid propellant cartridge. Electrical power for starting may be supplied by an external electrical power unit or the aircraft battery.

STARTER CARTRIDGES

The MXU-4/A and MXU-4A/A engine starter cartridges are used for automatic starting of turbojet engines. Spare cartridges, two per aircraft, are stored behind access doors 137, left and right.

Note

- No more than two cartridge start cycles can be performed within 5 minutes in any 60 minute period. If cartridge and pneumatic starts are interspersed, the total number of cycles is limited to three in any 15 minute period and first condition applies.
- Stored cartridges are limited to a maximum of four captive flights. Cartridges which exceed this limitation must be removed for Explosive Ordnance Disposal.

WARNING

Under no circumstances should electrical contacts of the starter cartridge be brought in contact with the surface of an aircraft.

CARTRIDGE START MALFUNCTIONS

Malfunctions encountered with the starting cartridges, while not common, may be classed as either a hangfire or a misfire. The AC must be able to differentiate between the two, so that proper action may be taken to expeditiously start the aircraft while maintaining the prescribed high level of safety for personnel.

Hangfire

A hangfire is defined as a cartridge malfunction causing the main propellant grain either not to burn or only partially ignite. In either case the ignitor squib will fire, as evidenced by a small amount of smoke at the starter exhaust, accompanied by a brief engine rotation to a low rpm. When the main propellant grain partially ignites, it may smolder until enough pressure is built up in the starter breech for complete ignition to occur. The smoldering may last from 1/2 minute to 2-1/2 minutes. When this type of hangfire occurs, discontinue the start by moving the throttle to OFF and releasing the ignition button. Remain alert for ignition of the main propellant grain, as evidenced by engine rotational acceleration, and initiate starting procedures as applicable, once sustained rotation is assured. When the main propellant grain fails to ignite, discontinue the start by moving the throttle to OFF, releasing the ignition button and moving the engine master switch to OFF. Wait 5 minutes from the time all evidence of burning has ceased, then remove the cartridge, observing all applicable safety precautions. Reload the starter with another cartridge and again initiate the start procedures. Hangfires are usually associated with extremely low cartridge soak temperatures (-65°F).

WARNING

- Because of the uncertainty of knowing when a hangfire cartridge will fire, all personnel must remain clear and no attempt should be made to remove the cartridge for 5 minutes.
- Do not attempt to perform any work on the right engine starter with the left engine running, since any interruption of electrical power while the utility hydraulic system is pressurized will cause the auxiliary air doors to close forcefully and could cause injury.

Misfire

A misfire is defined as a failure of the cartridge ignitor squib to fire. This may be caused by a failure of the electrical ignition system, failure of the cartridge squib, or no contact between the cartridge ground clips and the starter. A misfire may be detected by the absence of engine rotation and the absence of smoke at the starter exhaust door. When a misfire develops, discontinue the start by moving the throttle(s) to OFF, releasing the ignition button and moving the engine master switch(s) to OFF. Disconnect all electrical power. Wait at least 5 minutes before attempting to remove the misfire cartridge. Remove the misfired cartridge, observing all applicable safety precautions. Inspect the cartridge ground clips to insure that they have been bent up sufficiently to make contact. Insure that the safety clip has been removed. If no obvious correctable fault can be found with the misfired cartridge, obtain a new cartridge. Reload the starter and initiate the start procedure again.

WARNING

Do not attempt to perform any work on the right engine starter with the left engine running, since any interruption of electrical power with the utility hydraulic systems pressurized will cause the auxiliary air doors to close forcefully, and could cause injury.

FUEL WEIGHT VARIATIONS

It may be noticed that fuel quantity indications vary from day-to-day, even though the airplane is serviced with the same total number of gallons of fuel. These variations between fuel quantity and weight, are a source of considerable difficulty in the accurate determination of aircraft performance. The factors that cause the fuel weight to change, in respect to a constant quantity, are temperature effects and specific density tolerances. Fuel production specifications for JP-4, permit the specific density to range from 6.2 to 6.7 pounds per gallon at standard day conditions, or a maximum of one-half pound per gallon. It can be seen that the usable fuselage fuel, as indicated on the tape portion of the quantity indicator, can vary as much as 671 pounds (F-4C) or 630 pounds (F-4D/E), and the total usable fuel (all internal tanks) as indicated on the counter portion of the quantity indicator, can vary as much as 986 pounds (F-4C) or 945 pounds (F-4D/E), depending on specific density tolerances alone. Added to the specific density variations, is the effect of temperature. For each change in the fuel temperature of one degree fahrenheit, the fuel density varies inversely by 0.055 percent. Therefore with the additional weight variations caused by temperature changes, a wide range of fuel weights for the same quantity can be realized. For example, if the fuselage cells were filled with JP-4 manufactured at the low end of the specific density scale (6.2 pounds per gallon), and the fuel temperature was 105 degrees, the tape portion of the quantity indicator would show 8119 pounds (F-4C) or 7617 pounds (F-4D/E) of usable fuselage fuel. However, if the fuselage cells were filled with JP-4 manufactured at the high end of the specific density scale (6.7 pounds per gallon), and the fuel temperature was 15 degrees, the tape portion of the fuel quantity indicator would show 9193 pounds (F-4C) or 8624 pounds (F-4D/E) of usable fuselage fuel. While it is not expected that a clinical study of the fuel density be made prior to each flight, it should be remembered that the engine fuel control schedules fuel in pounds, not gallons. Figure 7-2, Fuel Weight Variations, illustrates the mean, maximum, and minimum fuel weights in relation to specific density and temperature.

WHEEL BRAKE OPERATION

The brakes are conventionally operated by toe action on the rudder pedals which meters utility hydraulic pressure to the brakes. Pedal force is proportional to the pressure at the brake, making braking effort fully definable from the cockpit. The brakes are capable of absorbing the energy of a maximum gross weight abort from takeoff speed without the drag chute. Maximum braking after a normal landing (up to 46,000 pounds gross weight) will not overheat the brakes or tires. The tires are protected by fuze plugs which will allow the tire to slowly go flat, should the brake/tire/wheel combination reach critical temperatures. Under conditions of braking without anti-skid protection, caution must be exercised to prevent skidding a wheel. At the higher speeds, and particularly under wet or icy conditions, the wheel can be locked with relatively low applied brake pressures. Very light braking should be applied initially; slowly increasing pedal force as speed decreases. Any time a skid is sensed, brake pressure should be momentarily fully relieved to allow the locked wheel(s) to come back up to speed and nose gear steering should be utilized to regain and maintain directional control. Differential braking cannot correct for swerving or fishtailing conditions caused by wheel-skid. This becomes particularly significant since the aircraft tends to swerve away from the locked wheel which requires the corrective action of releasing the brake that the AC would instinctively want to apply. Minimum tire and brake wear will result from good taxi and landing practices. Taxi speed should be held down, particularly during turns, and maximum use of nose gear steering should be employed. Landings should be made from "on speed" final approaches and full utilization should be made of drag chute, flaps and full aft stick to help decelerate the aircraft. The anti-skid system should be utilized at all times to protect against inadvertently locking a wheel, or wheels, during braking. The anti-skid system is completely passive unless the wheel is approaching skid; therefore, under conditions of normal braking, it has no effect on the amount of brake the AC applies. If maximum deceleration is desired, the anti-skid system can be utilized to maintain the wheel at the optimum deceleration point. In this case, the AC must apply sufficient brake pressure to insure anti-skid cycling and allow the anti-skid system to reduce applied pressure to proper valves. Full pedal appli-

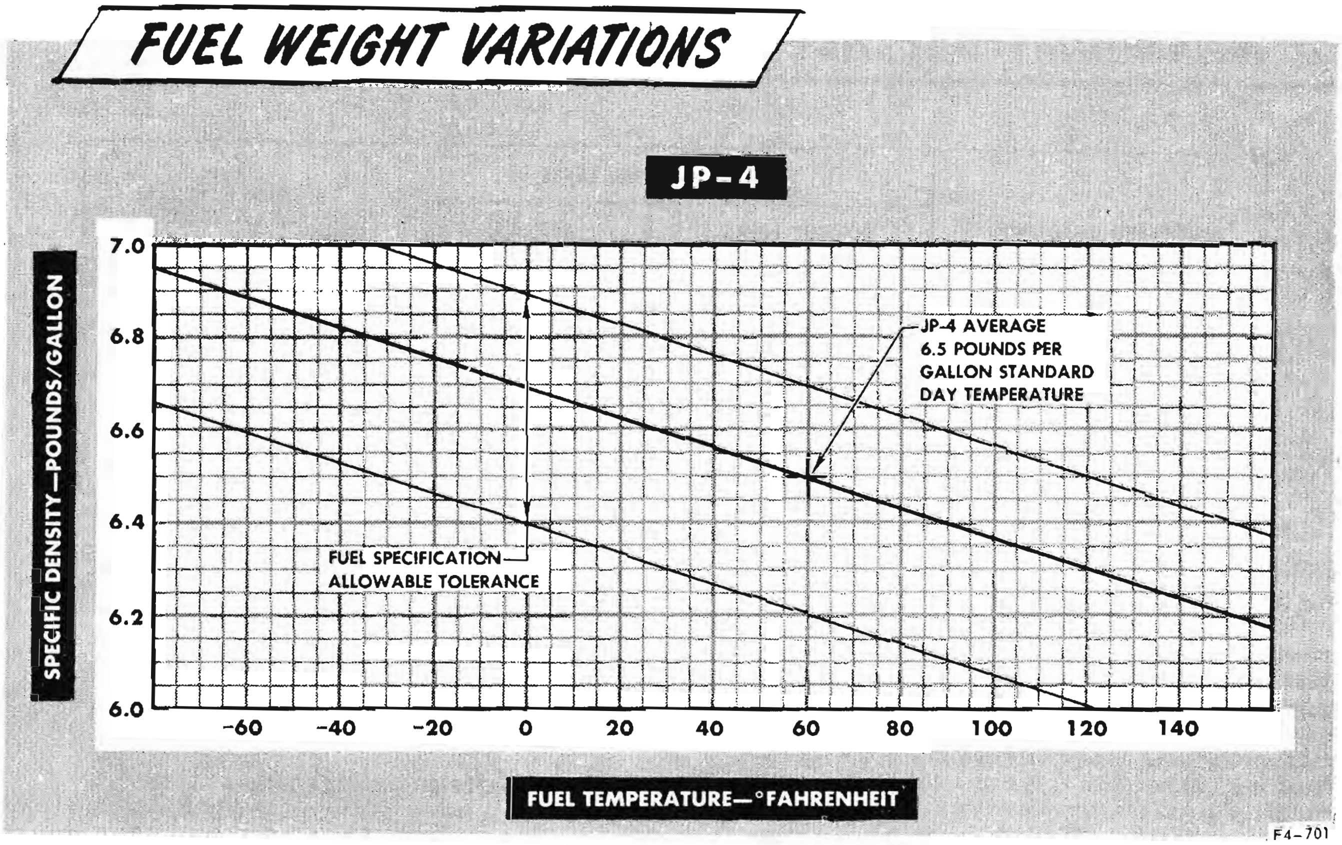


Figure 7-2

cation, or any amount of pedal which will produce anti-skid action, will provide maximum wheel braking for the existing conditions. A minimum roll landing using the anti-skid system can be accomplished from a normal touchdown and drag chute deployment followed by full brake pedal deflection with the stick full aft and nose gear steering engaged. Less than full pedal can be used, if desired, as long as there is sufficient brake pressure to keep the anti-skid system active. Cycling of the anti-skid system can be detected by a change in longitudinal deceleration; however, cycling of the anti-skid system may not be apparent when braking at high speeds; i.e., immediately after landing, wet runway, etc. Nose gear steering should be used throughout the landing roll for directional control since use of brakes for this purpose would detract from the over-all braking on the aircraft.

CAUTION

- Anti-skid protection is not available until the wheels have initially come up to speed. Do not land with brake pedals depressed. In addition, anti-skid protection is not available below approximately 10-20 knots.

- If it is suspected that the brakes have been used excessively, and are in a heated condition, the airplane should not be taxied into a crowded parking area. Peak temperatures occur in the wheel brake assembly from 15 to 30 minutes after maximum braking. To prevent brake fire and possible tire explosion, the specified procedures for cooling brakes should be followed. To allow sufficient cooling, a minimum of 15 minutes should elapse between landings when the landing gear remains down and a minimum of 30 minutes between landings when the landing gear is retracted. Additional time should be allowed for cooling if brakes are used for steering, crosswind taxiing operation, or a series of landings.

STORES JETTISON SYSTEMS

Provisions are incorporated to allow the flight crew to jettison most of the stores carried on the airplane. The jettisoning chart, section III of this manual shows the correct method of jettisoning the stores. For those stores requiring that the front cockpit gear handle be up, or down with the weight off the gear, the circuits are wired through parallel safety switches, one located on the left main landing gear scissor switch and one located in each landing gear handle. The scissors switch on the landing gear is "open" when weight is on the gear, interrupting the jettison circuits. When the oleo strut is extended, the scissors switch closes and the jettison circuits become "hot". When the gear is retracted, the shrinker strut shortens the oleo strut as in the weight-on condition

MAXIMUM FUSELAGE FUEL FOR DISPENSING

F-4C D

DOWNWARD-EJECTING CBU DISPENSERS	WITH EXTERNAL TANKS				WITHOUT EXTERNAL TANKS AND WITH STATIONS 1 & 9 LOADED	
	WITHOUT TANKS 5/6 LOCKOUT		WITH TANKS 5/6 LOCKOUT			
	F-4C	F-4D	F-4C	F-4D	F-4C	F-4D
Finned CBU-34/A or -42/A	5000	4700	5900	5400	4500	4000
Finned CBU-33/A	5400	4500	6000	5300	4600	4200
Unfinned CBU-7/A or -38/A	5100	5000	6000	5400	4800	4400
Unfinned CBU-28/A or -30/A	6600	6100	6800	6200	5900	5300

F4C/D-706

Figure 7-3

and opens the scissors switch. However, the safety switch in the landing gear handle is "closed" when the handle is in the UP position making the jettison circuits hot, (providing the rear cockpit emergency extension handle is IN) regardless of the position of the landing gear. The weight must be off the landing gear or the gear handle must be in the UP position (rear cockpit handle IN) in order to use the center station jettison switch, the external tanks emergency release button, the ECM jettison switch, and the missile jettison switch on F-4D aircraft after T.O. 1F-4D-508 and all F-4E aircraft. The external wing tanks jettison switch, and the missile jettison switch on all F-4C aircraft, and F-4D aircraft before T.O. 1F-4D-508, are hot any time power is on the airplane. Also refer to the External Stores Limitations chart section V.

SPECIAL FUEL SEQUENCING (F-4C/D)

To assure minimum acceptable stability while carrying downward-ejecting-type CBU dispensers, a special fuel sequencing procedure is required. Holding internal wing fuel while burning fuselage fuel down to the stated maximum (figure 7-3) shifts the CG sufficiently forward to produce an adequate static margin for the associated configuration. After the acceptable forward CG position has been attained, avoid all actions that would tend to shift the CG aft: e.g., launching the forward fuselage missiles, deselecting the tanks 5/6 lockout switch, etc. The associated fuel quantity shown in figure 7-3 represents the maximum permissible fuselage fuel aboard to permit dispensing ordnance or carrying the empty CBU. Do not permit transferred fuel to replenish the fuselage cells to a quantity higher than that stated.

Note

- Special fuel sequencing is not required when stations 1 and 9 are empty and external fuel is not carried.
- Air refueling is not permitted with empty CBU on stations 2 and 8.
- Only one type of the downward-ejecting dispensers may be carried per flight.
- It is recommended that stations 1 and 9 be dispensed first.

FUEL SEQUENCING PROCEDURES

To provide a simplified and all-inclusive fuel sequencing criteria, these procedures and the limiting fuel quantities in figure 7-3 are based on the most critical configuration. Less restrictive fuel quantities may be observed if additional fuel management is utilized. Refer to the Basic Weight Checklist and Loading Data manual, T.O. 1F-4C-5 or T.O. 1F-4D-5, for more detailed information.

With External Tanks

1. Tanks 5/6 lockout switch - AS DESIRED
2. External fuel transfer switch - CENTER OR OUTBD
3. Internal wing transfer switch - STOP TRANS
4. Dispensing may begin at stated tape reading. Refer to figure 7-3 to obtain maximum allowable fuselage fuel quantity for applicable configuration (aircraft model, with or without tanks 5/6 locked out, armament loading).

Note

Without tanks 5/6 locked out, the maximum allowable fuselage fuel quantity reading will not occur until after all external fuel has been transferred.

5. Transfer all external fuel.
6. External fuel transfer switch - OFF
7. With tanks 5/6 locked out, internal wing fuel transfer may begin.
8. Without tanks 5/6 locked out, continue holding internal wing fuel until 4000 pounds of fuselage fuel is indicated.

Without External Tanks and With Stations 1 and 9 Loaded-

1. Internal wing transfer switch - STOP TRANS
2. Dispensing may begin at stated tape reading. Refer to figure 7-3 to obtain maximum allowable fuselage fuel quantity for applicable configuration (aircraft model and armament loading).
3. Internal wing fuel transfer may begin at tape reading of 4000 pounds.

CG TRAVEL DUE TO FUEL CONSUMPTION

On F-4C/D aircraft after T.O. 1F-4-773, the tanks 5/6 lockout feature provides an option of preventing external fuel from transferring into fuselage cells 5 and 6. Without tanks 5/6 locked out, transferred external fuel replenishes the fuel transferred/consumed from fuselage cells 1 thru 6. This, in effect, results in consuming external fuel only while maintaining the fuselage cells full until after the external tanks are empty. With tanks 5/6 locked out, external fuel is transferred (at approximately 15 psi) into cells 1 and 3 while fuel from cells 5 and 6 is being transferred (at approximately 30 psi) into cells 1 and 4. The combined result is that fuel is being transferred from cells 5 and 6 and from the external tank(s) at approximately the same rate. Locking out cells 5 and 6 permits these two aft cells to be emptied earlier, thereby increasing the rate of forward CG travel. As shown in the CG Travel Due to Fuel Consumption charts (figures 7-4 thru 7-6, CG position does not move forward until fuselage fuel is being transferred and consumed. The charts for F-4C/D aircraft also show the relationship of CG travel with and without utilization of the tanks 5/6 lockout feature. As illustrated for the two-tank configuration without tanks 5/6 locked out, CG position travels forward until airplane lift-off, then travels aft as external fuel refills the fuselage cells. When the external tanks are empty (fuselage cells still full), the CG has traveled only approximately 0.4% MAC forward of its initial position at engine start. With tanks 5/6 locked out, CG position continues (after airplane lift-off) its forward travel rate until cells 5 and 6 are empty, then at a reduced rate until the external tanks are empty. At this point, approximately 2830 pounds of fuselage fuel (cells 5 and 6) will have been consumed and the CG will have traveled approximately 4.8% MAC forward of its initial position at engine start. Without tanks 5/6 locked out, external tanks are emptied at the highest possible rate, but forward CG travel is greatly reduced. With tanks 5/6 locked out, forward CG travel rate is favorably increased, but more time is required to empty the external tanks (i.e., time will be equal to inflight consumption of approximately 2830 pounds of fuselage fuel).

C.G. TRAVEL DUE TO FUEL CONSUMPTION F-4C

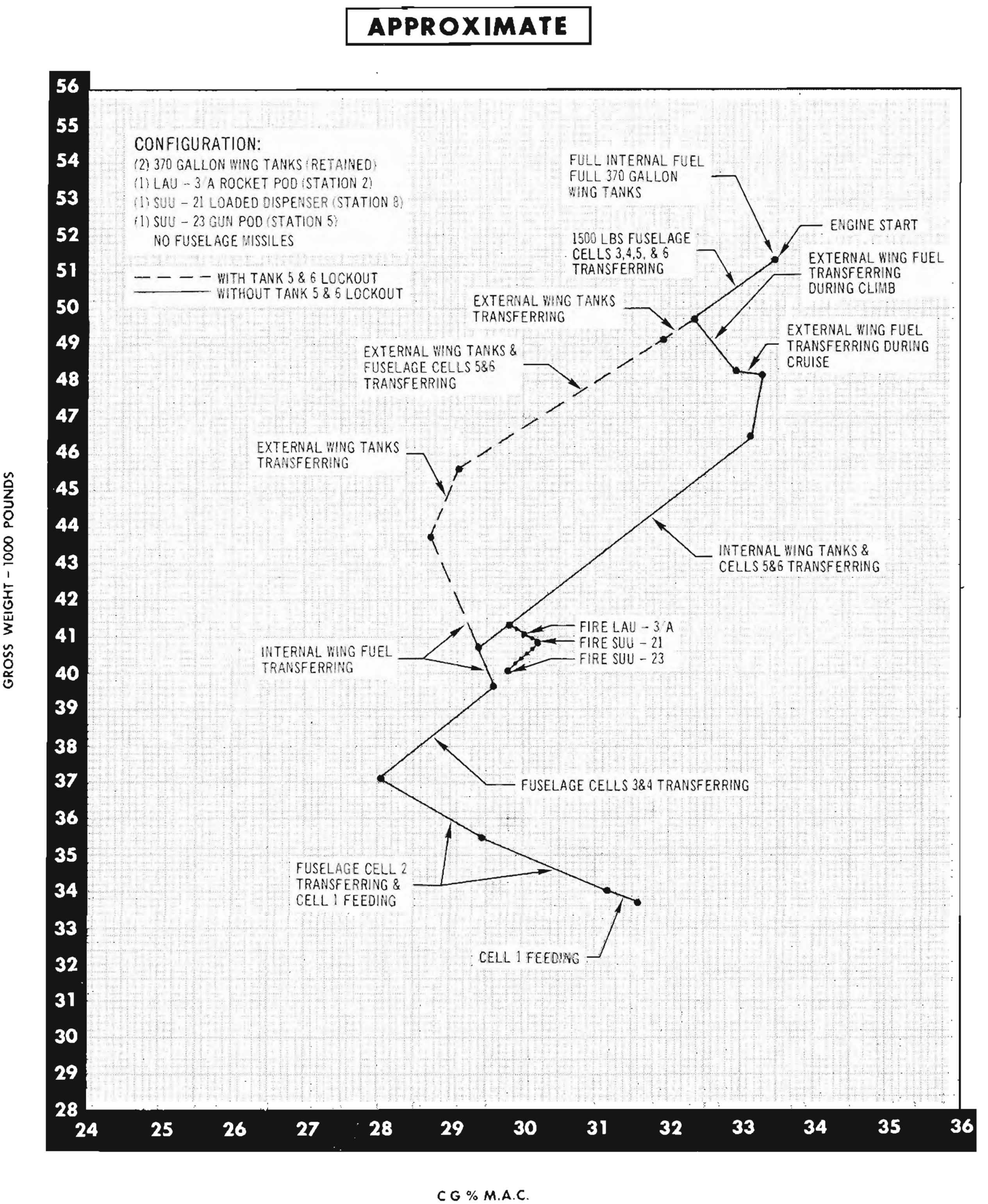


Figure 7-4

CG TRAVEL DUE TO FUEL CONSUMPTION F-4D

APPROXIMATE

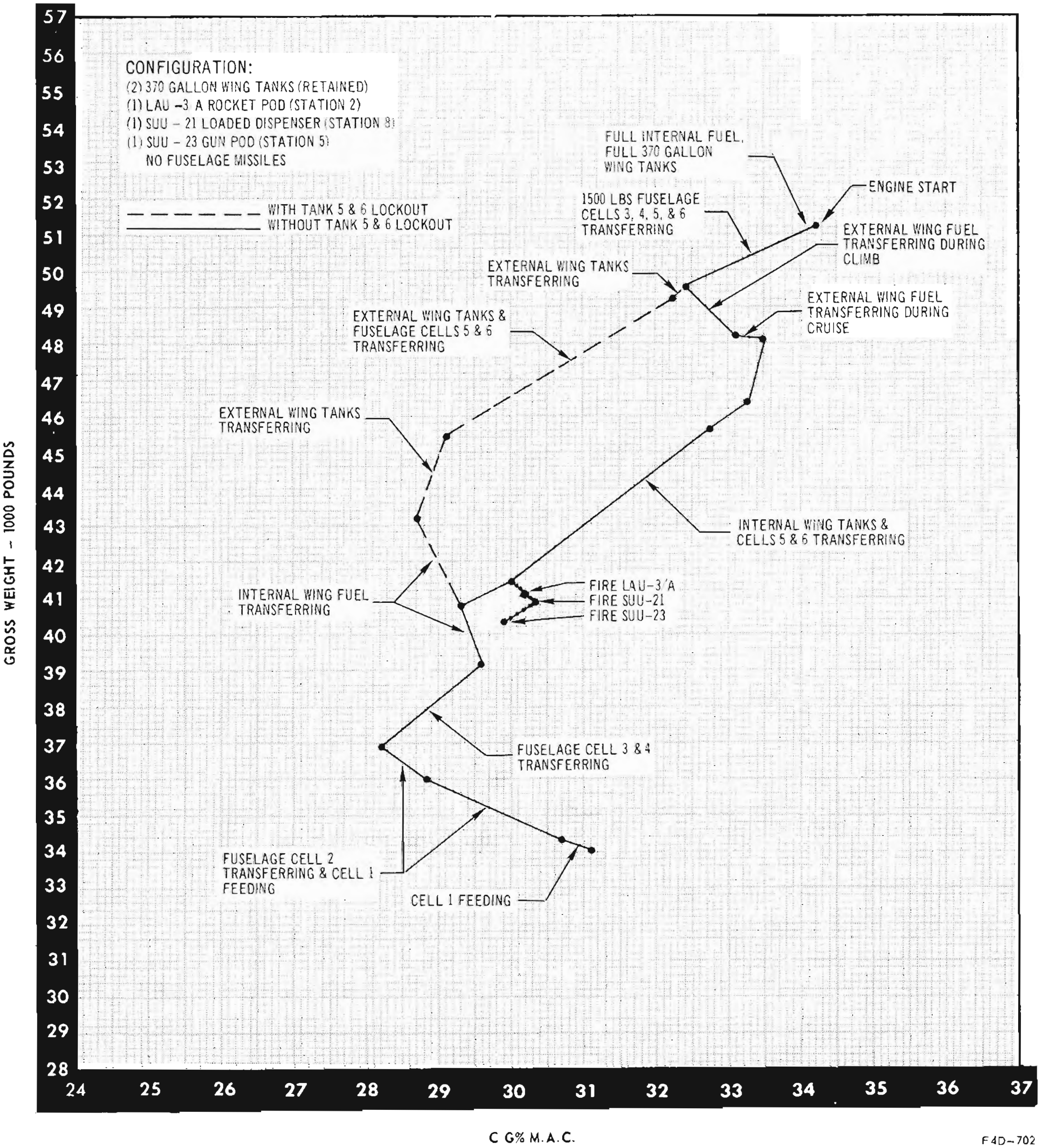
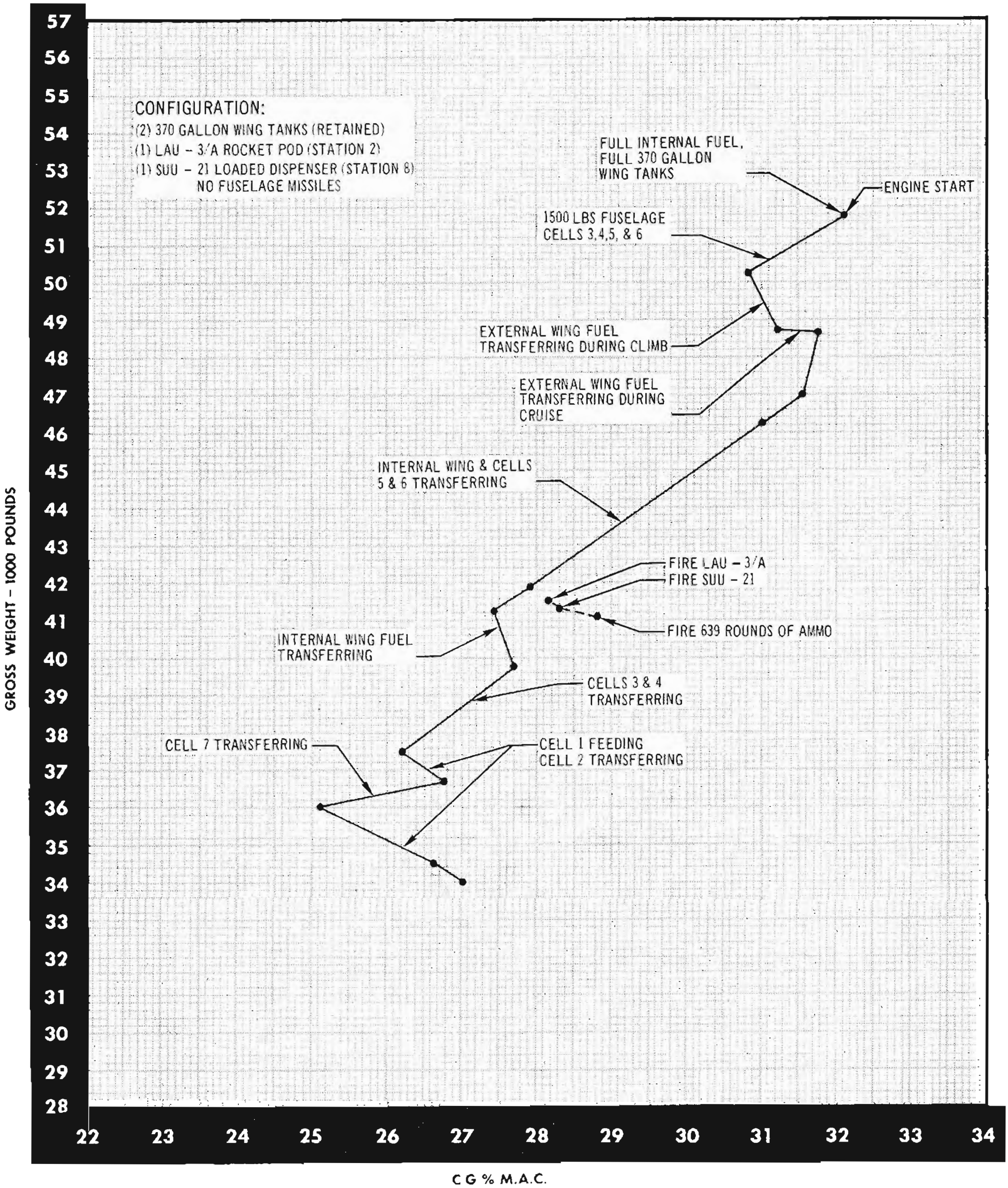


Figure 7-5

C.G. TRAVEL DUE TO FUEL CONSUMPTION

F-4E

APPROXIMATE



F4E-702

Figure 7-6

SECTION VIII CREW DUTIES

GENERAL AIRCREW RESPONSIBILITIES

The safe operation of the aircraft is the responsibility of both aircrew members. The flight manual and checklist is based on a definite division of responsibilities between cockpits. Each aircrew member should have a thorough working knowledge of Aircraft Systems, Normal/Emergency Procedures, Operating Limitations, and Aircraft Flight Characteristics.

CREWMEMBER IN COMMAND OF AIRCRAFT

The primary responsibility of the crewmember in command of the aircraft is to ensure mission accomplishment within acceptable safety limits. Specific responsibilities are:

a. Conduct adequate integral aircrew briefings to ensure definite division of responsibility during flight.
b. Accomplish Normal/Emergency Procedures as outlined in this manual.
c. Operation of the aircraft within published operating and structural design limitations.
d. Ensure use of abbreviated checklist on all flights.

CREWMEMBER IN CONTROL OF AIRCRAFT

The crewmember actually in control of the aircraft is responsible for flying the aircraft and operating auxiliary equipment under his control in accordance with this manual. Those procedures requiring immediate response will be accomplished as required, however, aircrew member not in control of the aircraft will be required to read the procedure from the checklist when time and circumstances permit. The crewmember in control of the aircraft will call for checklist items when required during flight profile.

CREWMEMBER NOT IN CONTROL OF AIRCRAFT

The crewmember not in control of the aircraft shares overall responsibility for the safe accomplishment of the mission. In addition, he is responsible for operating auxiliary equipment under his control in accordance with this manual. Specifically, his responsibilities are:

a. Perform navigational duties as required.
b. Assist other aircrew member in monitoring flight progress.
c. Initiate required inflight checklist items when not called for by crewmember in control of aircraft.
d. Monitor instruments during all climbs and descents and all other phases of flight when time permits.
e. Clear the flight area whenever possible.

SECTION IX ALL WEATHER OPERATION

TABLE OF CONTENTS

This section provides information for operation during conditions of instrument flight, flight in turbulent air, various penetration/approach procedures, and extreme temperature conditions. These are procedures that differ from, or are in addition to, those contained in the normal operating procedures covered in section II.

INSTRUMENT FLIGHT PROCEDURES

This all weather aircraft is designed to perform operational missions in all extremes of weather. Rapid acceleration rates and high pitch angles during climb, dictate some modification of standard instrument procedures.

Note

When flight through clouds, precipitation, or visible moisture is anticipated:
a. Pitot heat switch - ON
b. Engine anti-icing switch - DE-ICE
Upon reaching clear air:
c. Pitot heat switch - OFF
d. Engine anti-icing switch - NORMAL

INSTRUMENT TAKEOFF

An instrument takeoff is the same as a normal takeoff.

INSTRUMENT CLIMB (MIL THRUST)

An instrument mil thrust climb is the same as a normal mil thrust climb.

INSTRUMENT CLIMB (MAX THRUST)

An instrument A/B climb is the same as a normal A/B climb.

HOLDING/LOITER

Holding patterns or loitering flight may be flown at most altitudes at 280 knots, using approximately 30° of bank.

INSTRUMENT DESCENT

See figure 9-1 for typical penetration pattern. If descent through precipitation or clouds is anticipated:

1. Defog/Footheat handle - DEFOG
2. Anti-ice switch - DE-ICE
3. Pitot heat switch - ON
4. Pressure altimeter - SET
5. Radar Altimeter - SET TO MINIMUM APPROACH ALTITUDE

Note

Do not reduce thrust below 80% rpm to ensure adequate windshield defogging/rain removal/engine anti-ice effectiveness. If the throttle is retarded to idle in heavy precipitation a lower than normal idle rpm indication may be noted.

GCA (PAR) APPROACH

See figure 9-2 for closed GCA (PAR) pattern.

1. Descend to GCA pick-up altitude and transition to landing configuration approximately 10 miles out on final or base leg (as appropriate).
2. Maintain on speed angle of attack.

When directed to commence descent -

3. Retard power to approximately 82-84% rpm.
4. Adjust power as necessary to maintain 600-800 feet per minute rate of descent, or, as directed.

A straight-in tacan penetration followed by a GCA final requires approximately 500-800 pounds of fuel. A missed approach followed by a second GCA requires an additional 1000 pounds of fuel.

CIRCLING APPROACH

Recommended approach from TACAN gate inbound, for a circling TACAN approach, is 180 knots with gear and flaps extended.

MISSED APPROACH PROCEDURES

1. Throttles - MILITARY
2. Gear - UP
3. Flaps - UP (minimum of 180 knots.)
4. Power as required to maintain 230 knots and maintain a 1500 to 2000 feet per minute climb.
5. Follow published missed approach procedures.

JET PENETRATION

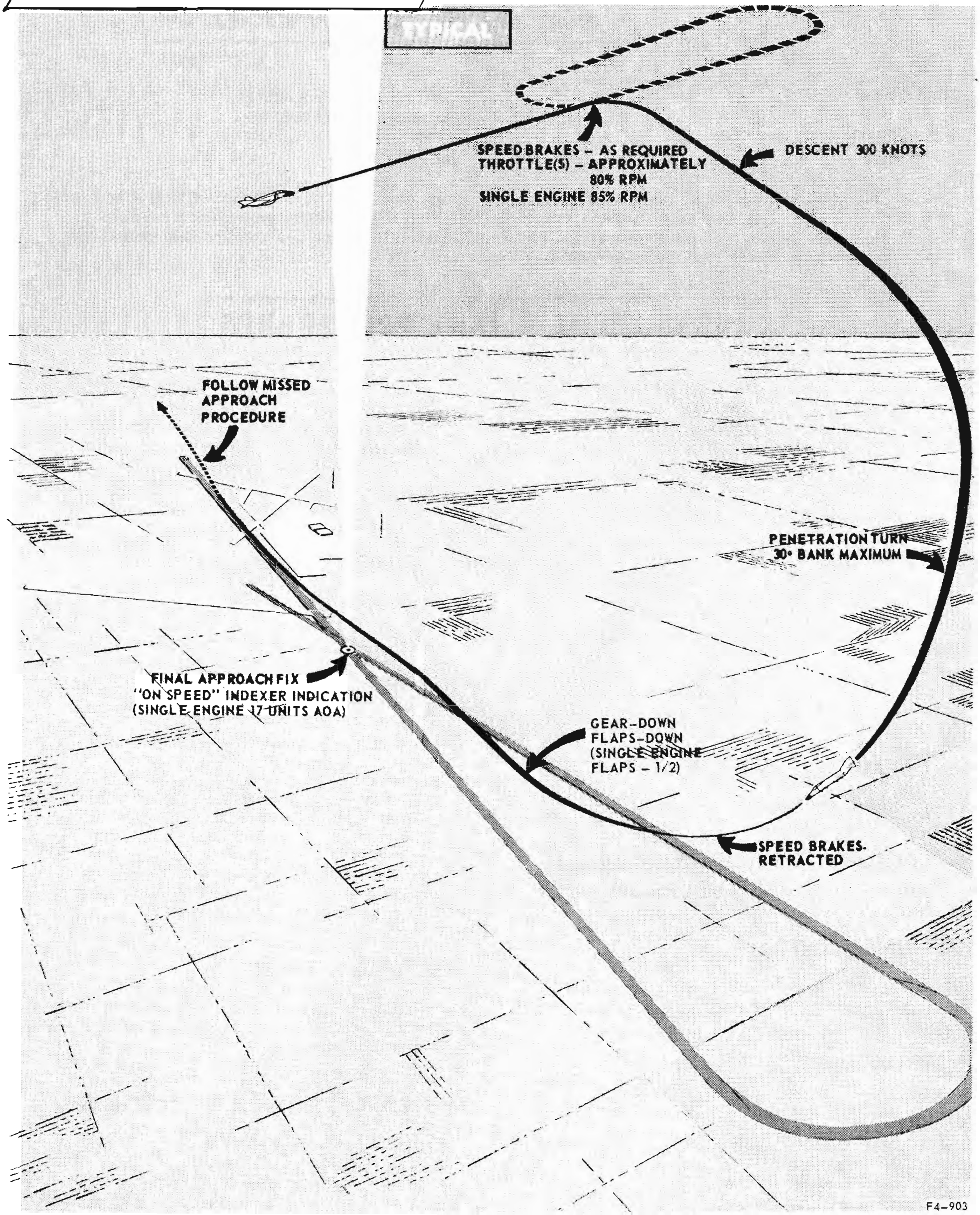


Figure 9-1

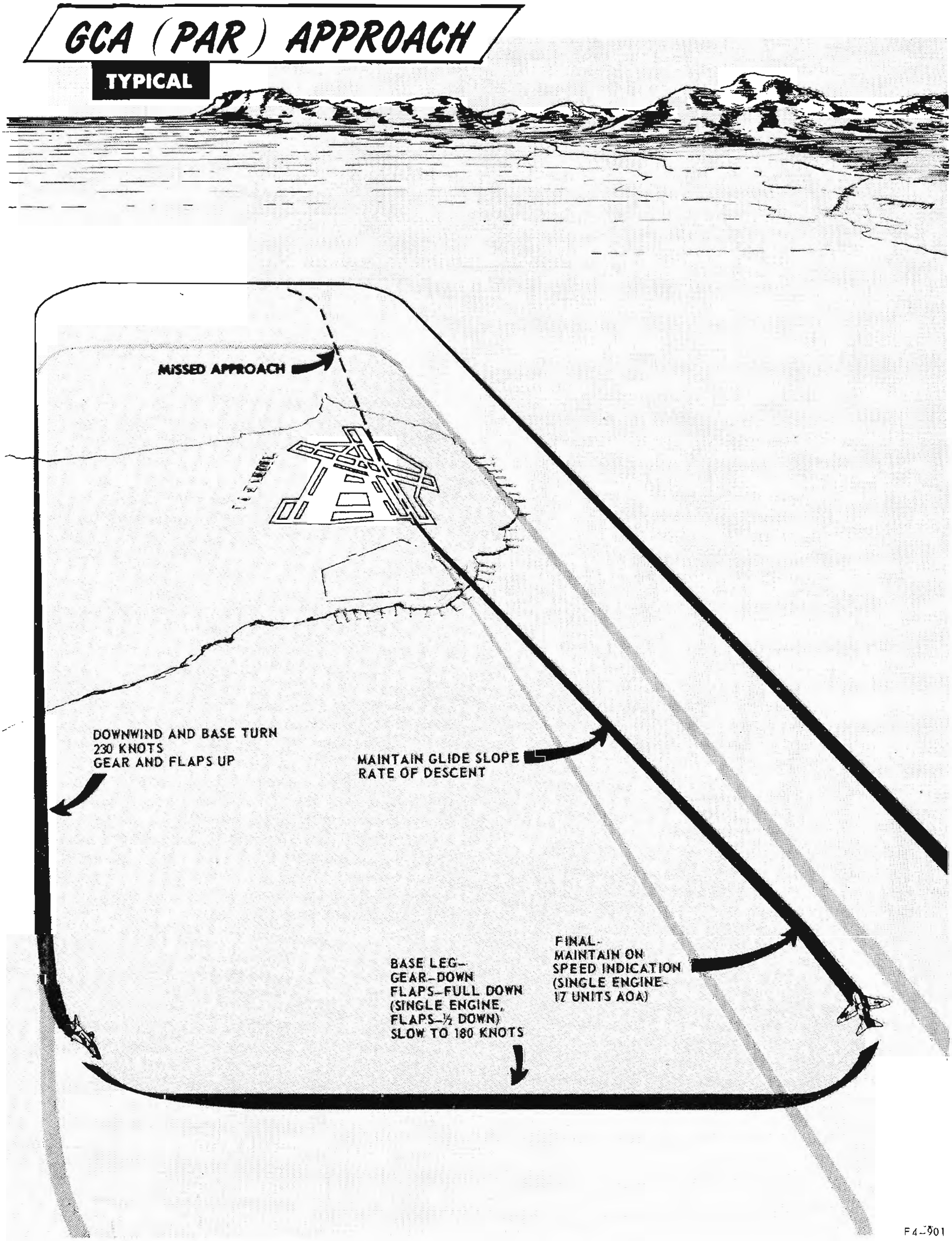

GCA (PAR) APPROACH
TYPICAL
MISSED APPROACH
DOWNWIND AND BASE TURN
230 KNOTS
GEAR AND FLAPS UP
MAINTAIN GLIDE SLOPE
RATE OF DESCENT
BASE LEG-
GEAR-DOWN
FLAPS-FULL DOWN
(SINGLE ENGINE,
FLAPS-½ DOWN)
SLOW TO 180 KNOTS
FINAL-
MAINTAIN ON
SPEED INDICATION
(SINGLE ENGINE-
17 UNITS AOA)

Figure 9-2

NIGHT FLYING

ON ENTERING AIRCRAFT

1. Interior lighting - CHECK
2. Emergency floodlights - CHECK
3. Navigation lights and exterior lights - CHECK
4. Landing and taxi lights - CHECK

DURING FLIGHT

Note

During instrument conditions, exterior lights should be on STEADY due to vertigo inducing effect of flashing light reflections from surrounding clouds.

COLD WEATHER PROCEDURES

BEFORE ENTERING COCKPIT

The entire aircraft should be free of snow, ice, and frost collections. These conditions are a major flight hazard and result in a loss of lift and increased stall speeds. They must be removed before flight, but do not chip or scrape away ice as damage to aircraft may result. Special emphasis must be placed on the following:

1. Shock struts, pitot tube, fuel vents, and actuating cylinders are free of ice or dirt.
2. Fuel drain cocks free of ice and insure that all pneumatic bottles have been adequately serviced.
3. All exterior covers and BLC duct tape (if applied) removed.
4. Closely inspect the nozzle shroud flaps for any signs of ice deposits. If any ice is present apply heat to the nozzle control feedback housing area for 5 to 10 minutes just prior to engine start.

CAUTION

If the aircraft has been exposed to precipitation and freezing temperatures ice may accumulate in the BLC ducts and valves. Actuation of the flaps before the ice is thawed will result in BLC valve or actuating rod failure.

Note

- If the aircraft has been parked with flaps up and exposed to precipitation and freezing temperatures without protective covering for the BLC ducts and valves, it may be necessary to move the aircraft to a thawing environment to insure complete removal of ice accumulations in the BLC valves. Running the engines prior to flap extension is not an adequate procedure to prevent BLC valve damage.

- If the aircraft has been parked with the flaps extended the BLC should be checked by the ground crew after engine start before actuating the flaps.

INTERIOR CHECK

In temperatures below 0°F, difficulty may be experienced when connecting the oxygen mask hose to the T-connector, due to a stiff O-ring in the T-connector. Application of a small amount of heat to the T-connector will alleviate this problem. Also, if the oxygen mask is not fastened, keep it well clear of the face to prevent freezing of the inhalation valves.

ENGINE START

During pneumatic engine start operation, depress ignition buttons at approximately 6% rpm; however, do not advance the throttles until approximately 10% rpm is reached. During cartridge start operation, press ignition buttons approximately 5 seconds before advancing throttles. Depressing the ignition buttons prior to throttle advance will dry out the igniter plugs, thereby enhancing a successful start. If any abnormal sounds or noises are present during starting, discontinue starting and apply intake duct preheating for 10 to 15 minutes. Immediately after starting the engine at extremely low temperatures, the engine oil pressure indication will become excessive and may peg out at 100 + psi. When this condition occurs, allow the oil to warm up and the pressure to drop below 50 psi before placing the generator control switch to GEN ON.

CAUTION

- Ensure that GEN OUT and BUS TIE OPEN lights go out. The maximum amount of time that the engine can run at 100 psi oil pressure before discontinuing the start is 2 minutes when the temperature is below 0°F and 4 minutes when the temperature is below -30°F.

- Starting the engines with the flaps extended increases the probability of a hot start. If the EGT exceeds operating limits, move the throttle to OFF and windmill the engine for 20 seconds.

Note

In extremely cold weather, the throttle linkage is very stiff and both hands may be required to move the throttles out of the OFF position.

WARM-UP AND GROUND CHECK

During cold weather operation, a BLC MALFUNCTION light with the flaps in any position other than up, indicates that the flap-up limit switches are not returning to their normal open position. By cycling the flaps three or four times to allow circulating hydraulic fluid to warm the actuator, the switches may be freed so that the BLC malfunction indicating system will function normally. If the fire control system has been exposed to ambient temperatures of -20 F or below for periods of 12 hours or more, except a 4 to 5 minute extension of warm-up time. During the initital BIT check the V_C gap will appear at 0200 rather than 0300. Radar magnetron current will be 0.2 to 0.3 units high when first turned on. It will gradually return to normal as the equipment warms up. Extended INS warm-up and gyro compass alignment times (10 to 15 minutes) can be expected when ambient temperatures below 10 F exist. Ensure all instruments are allowed an adequate warm-up period and are operating normally before takeoff.

Note

Due to system stiffness in extremely cold weather, full lateral stick throw may not be possible even with both hands on the control stick. Repeated control cycling will alleviate the stiffness somewhat, but control feel may not return to normal until after approximately 1 hour of system operation.

TAXIING

Avoid taxiing in deep or rutted snow since frozen brakes will likely result. Also, increase space between aircraft while taxiing at sub-freezing temperatures, to insure safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice blown by the jet blast of a preceding aircraft.

BEFORE TAKEOFF

The thrust developed by the engine in low temperature is noticeably greater and brake demands will be greater to hold position; however, when operating with maximum engine compressor bleed air (flaps down and cockpit pressurized) in outside air temperatures of -34.5 F and below, rapid throttle bursts may result in an rpm hang-up. If engine icing conditions are anticipated, place the engine anti-ice switch in the DE-ICE position and place the pitot heat switch ON.

TAKEOFF

Note

- When operating from runways which are covered with excessive water, snow or slush, high-speed aborts may result in engine flame-out due to precipitation ingestion. The probability of flame-out is highest when throttles are chopped from afterburner to IDLE at speeds above 100 knots. With a double flame-out, normal braking, anti-skid protection, and nose gear steering will be lost. After takeoff from runways covered with snow or slush, packed snow/slush in the auxiliary air door area may make throttle movement difficult until the snow/slush can be melted.
- If inflight freezing within the longitudinal control system is experienced, excessive stick forces may be required to move the control stick. Normal airplane control is available but requires higher initial force inputs. Normal control forces should return at lower (warmer) altitudes.

LANDING

As soon as practicable after the landing roll the flaps should be placed in the full UP position. This will shut off the BLC air which otherwise causes the loose snow to swirl and be drawn in through the auxiliary air doors and pass along the engine. If this happens, the snow melts and deposits of ice form shortly after engine shutdown. The ice can cause binding of the nozzle feedback housing and possibly result in nozzle failure upon the next engine start.

CAUTION

Visibility may be reduced when throttles are brought back to IDLE.

AFTER LANDING

When wearing bulky arctic survival clothing and winter flying gloves, rapid egress from the cockpit by disconnecting the torso harness will be impeded due to the inability to see the connectors and by a degraded sense of touch. During operations where the temperature is below freezing with heavy rain, or expected to drop below freezing with heavy rain, the aircraft should be parked with wings spread.

BEFORE LEAVING AIRCRAFT

Leave canopy open, unless weather prevents, to permit circulation. This helps prevent canopy cracking from differential cooling and decreases windshield and canopy frosting. Also check that all protective covers are installed.

HOT WEATHER PROCEDURES

CAUTION

Do not attempt takeoff or engine operation in a sand storm or dust storm, if avoidable. Park aircraft crosswind and shut down engine to prevent sand or dirt from damaging engine.

TURBULENCE AND THUNDERSTORMS

WARNING

- The following factors, singly or in combination, could cause engine flame-outs:
- Penetration of cumulus build-ups with associated high moisture content.
- Engine icing of either nose cowl or inlet guide vanes.
- Turbulence associated with penetration can result in extreme angles of attack which may cause marginal engine performance.
- Above 40,000 feet, the surge margin of the engine is reduced and there is poor air distribution across the face of the compressor.
- In view of the above, the pilot should avoid areas of turbulent air, hail storms, or thunderstorms, whenever possible, because of the increased danger of engine flame-out. If these areas cannot be avoided, the engine anti-icing system should be turned on prior to weather penetration. EGT gages should be monitored continuously during weather penetration. A rise of EGT is an indication of engine icing. The engine anti-icing systems prevent the formation of ice and is not a de-icer. Whenever possible, icing conditions should be anticipated in advance and the anti-icing system should be turned on to warm up the engine air inlet.

PENETRATION

The basic structure of the aircraft is capable of withstanding the accelerations and gust loadings associated with the largest thunderstorms at subsonic airspeed. Supersonic thunderstorm penetrations have not been investigated to date. The aircraft is exceptionally stable and comparatively easy to control in the severe turbulence; however, the effects of turbulence becomes noticeably more abrupt and uncomfortable at airspeeds above optimum cruise and below 35,000 feet. The aircraft is not displaced significantly from the intended flight path and desired heading. Attitude can be maintained with reasonable accuracy.

PENETRATION AIRSPEED

The optimum thunderstorm penetration speed is 300 knots. Afterburner may be necessary to maintain this airspeed above 35,000 feet.

Note

Optimum thunderstorm penetration airspeed is a compromise between pilot comfort, controllability, structural stress (due to gust loads and impact precipitation), and engine inlet air distortion. At high airspeeds, aircrew discomfort and structural stress are greater. At slow speeds, controllability is somwhat sacrificed and inlet airflow distortion (due to turbulence) may induce compressor stalls and/or engine flameout.

APPROACHING THE STORM

If storm cannot be seen, it may be located by use of radar. Establish the recommended penetration airspeed and perform or check the following:

1. Adjust throttle to maintain desired penetration speed.
2. Pitot heat switch - ON
3. Engine anti-icing switch - DE-ICE
4. Autopilot - OFF
5. Lower seat

If night penetration -

6. White floodlights - ON
7. Instrument lights - FULL BRIGHT
8. Console lights - FULL BRIGHT

CAUTION

Do not try to top thunderstorms at subsonic speeds above 40,000 feet. The stall margin of both the airframe and engines becomes critical in this region. Flight through a thunderstorm at the proper airspeeds is much more advantageous than floundering into the storm at a dangerously slow airspeed while attempting to reach the top.

IN THE STORM

1. Maintain a normal instrument scan with added emphasis on the attitude indicator (ADI). Attempt to maintain attitude, and accept altitude and airspeed fluctuations.

CAUTION

- If compressor stall or engine stagnation develops, retard throttle to idle momentarily, then attempt to regain normal engine operation by advancing the throttle. If the stall persists, shut down the engine and attempt a relight. If engine remains stagnated at reduced power, and EGT is within limits, maintain reduced power until clear of the thunderstorm.
- The angle of attack probe may become distorted by impact ice and/or hail, which may result in actuation of the rudder pedal shaker (stall warning device). Pulling the angle of attack heater circuit breaker (zone C7 No. 3 panel) will disable the rudder pedal shaker.

ICE AND RAIN

BEFORE TAXIING

Before taxiing prior to severe weather flight, the engine anti-ice system should be checked as follows:

1. Engine rpm - IDLE
2. Anti-ice switch - DE-ICE

Note

If an anti-ice light cannot be illuminated at idle advance engine to 80% rpm or higher.

3. EGT - CHECK
   Check for rise in EGT of approximately 10°C.
4. Fuel flow - CHECK
   Check for slight increase in fuel flow.
5. Anti-ice switch - OFF

INFLIGHT

The possibility of engine and/or airframe icing is always present when the aircraft is operating under instrument conditions. Icing is most likely to occur when takeoffs must be made into low clouds with temperature at or near freezing. Normal flight operations are carried on above the serious icing levels and the aircraft's high performance capabilities will usually enable the AC to move out of the dangerous areas quickly. When an icing condition is encountered, immediate action should be taken to avoid further accumulation. Flight through ice and/or rain requires no special technique; however, certain aircraft systems do require particular attention. These systems are engine anti-ice, windshield rain removal, longitudinal feel, and ADC:

Note

Selection of lower antenna may reduce static caused by heavy precipitation.

ENGINE ANTI-ICE SYSTEM

There is no immediate indication during flight of engine icing, such as decreased power or reduction in fuel flow; however, as ice build-up becomes critical, fuel flow will decrease, EGT will increase, and there will be a noticeable power loss. Therefore, the engine anti-ice system should be used whenever icing conditions are anticipated. Anti-ice system operation can be noted by an increase in EGT and fuel flow when the system is actuated. After clearing all precipitation and clouds, turn the anti-ice switch off. Unnecessary use of engine anti-ice air produces the following adverse effects:

a. Probable compressor front end damage at high supersonic speeds.
b. Probable decrease in compressor stall margin.
c. Slightly increased fuel consumption.

WINDSHIELD RAIN REMOVAL

The following precautions should be observed when contemplating the use of the windshield rain removal system.

1. Do not operate on a dry windshield.
2. Turn the system OFF immediately if WINDSHIELD TEMP HI indicator light illuminates.
3. Do not operate above Mach 1.0.

STABILATOR FEEL AND TRIM

When flying through areas of precipitation; partial or complete failure of the longitudinal control artificial feel system may result due to ice and/or water blockage of the bellows ram air line. If this condition occurs, excessive stick force will be required to maintain the desired aircraft attitude. Since sudden longitudinal trim changes may occur several minutes after flying through freezing precipitation, especially during descent to altitudes below the freezing level. the application of corrective longitudinal trim when a blocked bellows inlet is suspected is not recommended. A heater has been incorporated in the longitudinal feel system bellows inlet. The heater is turned on when the pitot heat switch is moved to the ON position.

CAUTION

If ice and/or water blockage of the artificial feel bellows ram air line is suspected, longitudinal trim should not be applied to relieve control stick force. due to intermittent nature of the failure and suddenness of return to normal. Instead. use extra effort on stick to maintain desired airplane attitude.

AIR DATA COMPUTER

The air data computer may malfunction during flight through ice and/or rain due to impact forces imposed by water and ice on the ADC total temperature sensor. A momentarily flashing DUCT TEMP HI warning light usually indicates that the sensor probe has been blocked or shorted by ice accumulation. A sensor probe that has completely failed will be evidenced by a continuously flashing DUCT TEMP HI warning light. These total temperature malfunctions result in erroneous true airspeed signals to the navigation computer. and cyclic operation of the intake duct ramps at all airspeeds. A malfunction in the ADC may also be caused by rain and/or ice impact damage to the angle of attack probe. The probe may become fixed at its extreme limits. thereby actuating the rudder pedal shaker. If the above malfunctions occur proceed as follows:

If DUCT TEMP HI light flashes intermittently or continously -

1. Decelerate as rapidly as practical to subsonic flight.
2. Maintain normal subsonic cruise airspeeds.

In F4C/D aircraft, an erroneous and erratic angle of attack system will also result in erroneous airspeed and altimeter indications since static pressure is corrected for angle of attack in the ADC system. These errors will become significantly larger at supersonic speeds.

If erratic or erroneous airspeed, vertical velocity or altimeter indications are suspected -

1. Static pressure correction switch - OFF

GLOSSARY

AC	Aircraft Commander, Aerodynamic center, or Aircraft
ac	Alternating current
ACP	Aircraft Communications Procedures
ADCS	Air Data Computer Set
ADI	Attitude Director Indicator
ADIZ	Air Defense Identification Zone
AFC	Automatic Frequency Control
AFCS	Automatic Flight Control System
AGS	Automatic Gain Control
AI	Airborne Intercept
AJB	Airborne, Electro-Mechanical, Bombing
AMCS	Airborne Missile Control System
AOA	Angle of Attack
APA	Airborne, Radar, Auxiliary Assembly
APN	Airborne, Radar, Navigational Aid
APQ	Airborne, Radar, Special Purpose
ARI	Aileron Rudder Interconnect
ARTC	Air Route Traffic Control
ARC	Airborne, Radio, Control
ASA	Airborne, Special Type, Auxiliary Assembly
ASE	Allowable Steering Error
ASN	Airborne, Special Type, Navigational Aid
ASQ	Airborne, Special Type, Combination of Purposes
ATC	Air Traffic Control
AWW	Airborne, Armament, Control
AR	Air Refueling
BDHI	Bearing Distance Heading Indicator
BINGO	Return to this channel (radio). Return fuel state
BIT	Built-In-Test
BLC	Boundary Layer Control
BST	Boresight
Buster	Full Military Power
CAT	Clear Air Turbulence
CADC	Central Air Data Computer
CAP	Combat Air Patrol
CAS	Calibrated Air Speed
CG	Center of Gravity
Charlie Time	Expected time over ramp
CIC	Combat Information Center
CIT	Compressor Inlet Temperature
CNI	Communication Navigation Identification
COT	Cockpit Orientation Trainer
cps	Cycles per second
CSD	Constant Speed Drive
cw	Continuous Wave
dc	Direct current
DCU	Douglas Control Unit
DME	Distance Measuring Equipment
DOG RADIAL	An assigned radial on which to set up a holding pattern
DR	Dead Reckoning
EAS	Equivalent Airspeed
EAT	Estimated Approach Time
ECCM	Electronic Counter-Countermeasure(s)
ECM	Electronic Countermeasure(s)
EGT	Exhaust Gas Temperature
FAM	Familiarization
FL	Flight Level
G	Gravity
Gate	Maximum Power
GCA	Ground Control Approach

GCI	Ground Control Intercept
gpm	Gallon per minute
Hangfire	A delay or failure of an article of ordinance after being triggered
Hang Start	A start that results in a stagnated rpm 2nd temperature
Hot Start	A start that exceeds normal starting temperatures
HSI	Horizontal Situation Indicator
Hz	Hertz
IP	Identification Point
IAS	Indicated Airspeed
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules or In Flight Refueling
ILS	Instrument Landing System
IR	Infrared
I/P	Identification of Position
JANAP	Joint Army Navy Airforce Publication
JP	Jet Propulsion
Judy	Radar contact with target, taking over intercept
KTS	Knots
LABS	Low Altitude Bombing System
LE	Leading Edge
LID	Limited Instrument Departure
LOX	Liquid Oxygen
lpm	Liters per minute
MAC	Mean Aerodynamic Chord
MIL	Military
MIM	Maintenance Instruction Manual
Misfire	A permanent failure of an article of ordinance being triggered
MSL	Mean Seal Level
N/A	Not applicable
N/E	Not established
NMPP	Nautical Miles Per Pound
OAT	Outside Air Temperature
OMNI	Omni Directional Range
PC	Power Control
Pigeons	Bearing and distance
PMBR	Practice Multiple Bomb Rack
PPS	Pulses per seconds
prf	Pulse repetition frequency
psi	Pounds per square inch
Punch	Target detected, aircraft still under ground control
q	Dynamic Pressure, psf
RADAR	Radio Detection and Ranging
RAT	Ram Air Turbine
RCR	Runway Condition Reading
rf	Radio Frequency
RF	Reconnaissance - Fighter
rpm	Revolutions Per Minute
SAR	Sea Air Rescue
SID	Standard Instrument Departure
SIF	Selective Identification Feature
SPC	Static Pressure Compensator
TACAN	Tactical Air Navigation
TAS	True Airspeed
TE	Trailing Edge
TMN	True Mach Number
Trap	Arrested Landing
UHF	Ultra High Frequency
VFR	Visual Flight Rules
VHF	Very High Frequency
Vn	Velocity Acceleration Relationship
VORTAC	Very High Frequency - Omni Range and Tactical Air Navigation
WST	Weapons System Trainer

ALPHABETICAL INDEX

Note

All text and illustration numbers in this alphabetical index refer to page numbers, not paragraph or figure numbers.

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FOLDOUT ILLUSTRATIONS

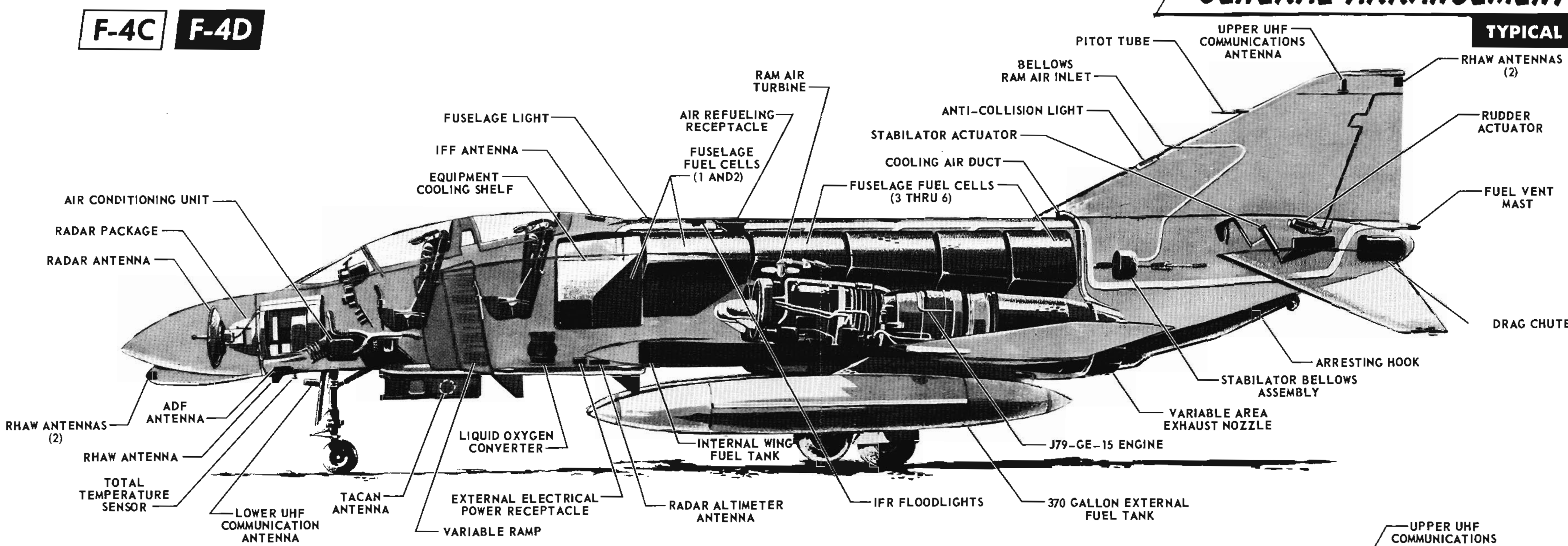
TABLE OF CONTENTS

GENERAL

The illustrations listed in the table of contents have been removed from section I. redesigned, and reinserted into this newly created section. These illustrations in some cases have been combined and in all cases have been made into foldout pages. The purpose of this change in Flight Manual format is to make the subject illustrations always available for quick and ready reference while reading the associated text.

GENERAL ARRANGEMENT

TYPICAL



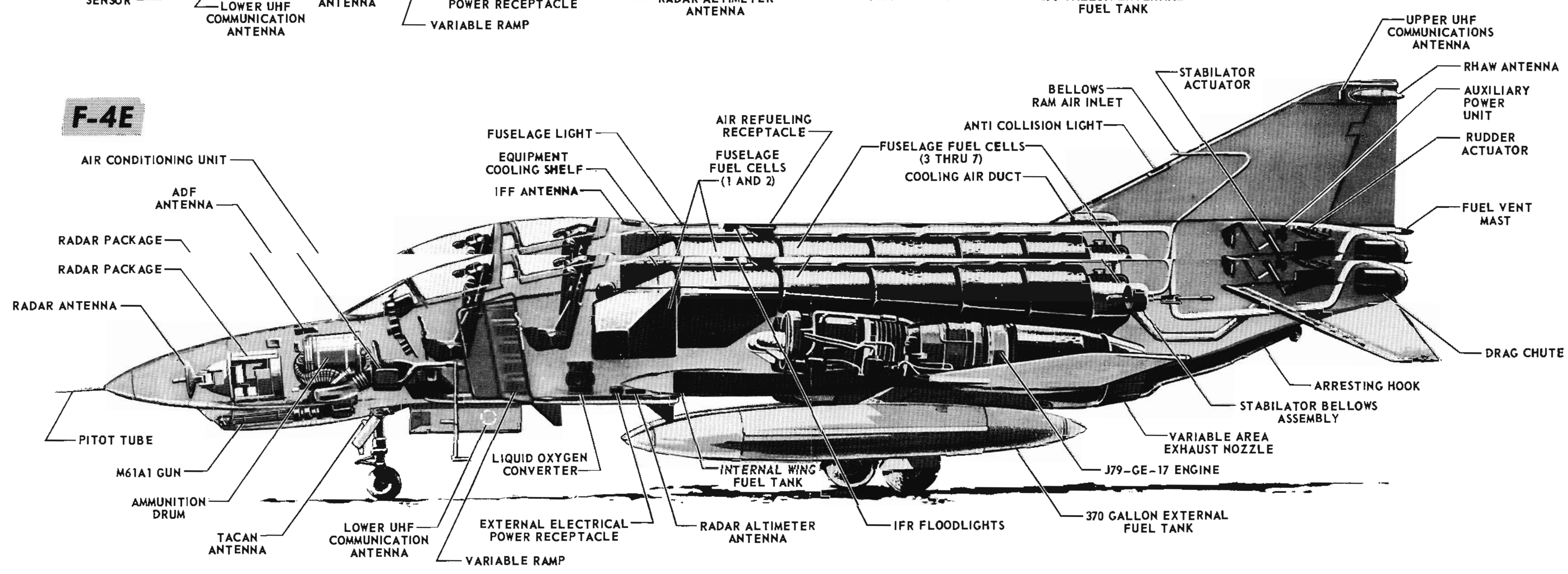
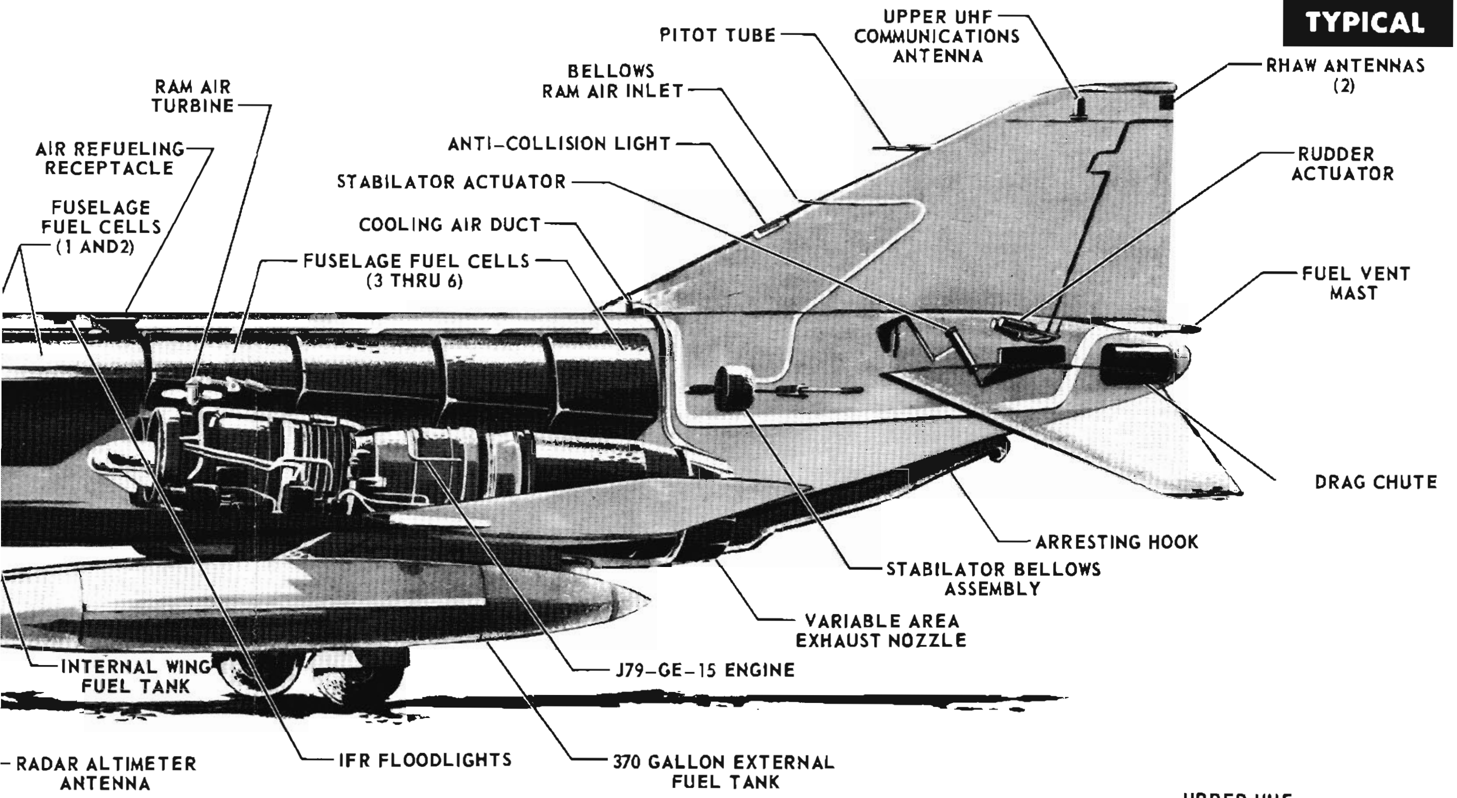
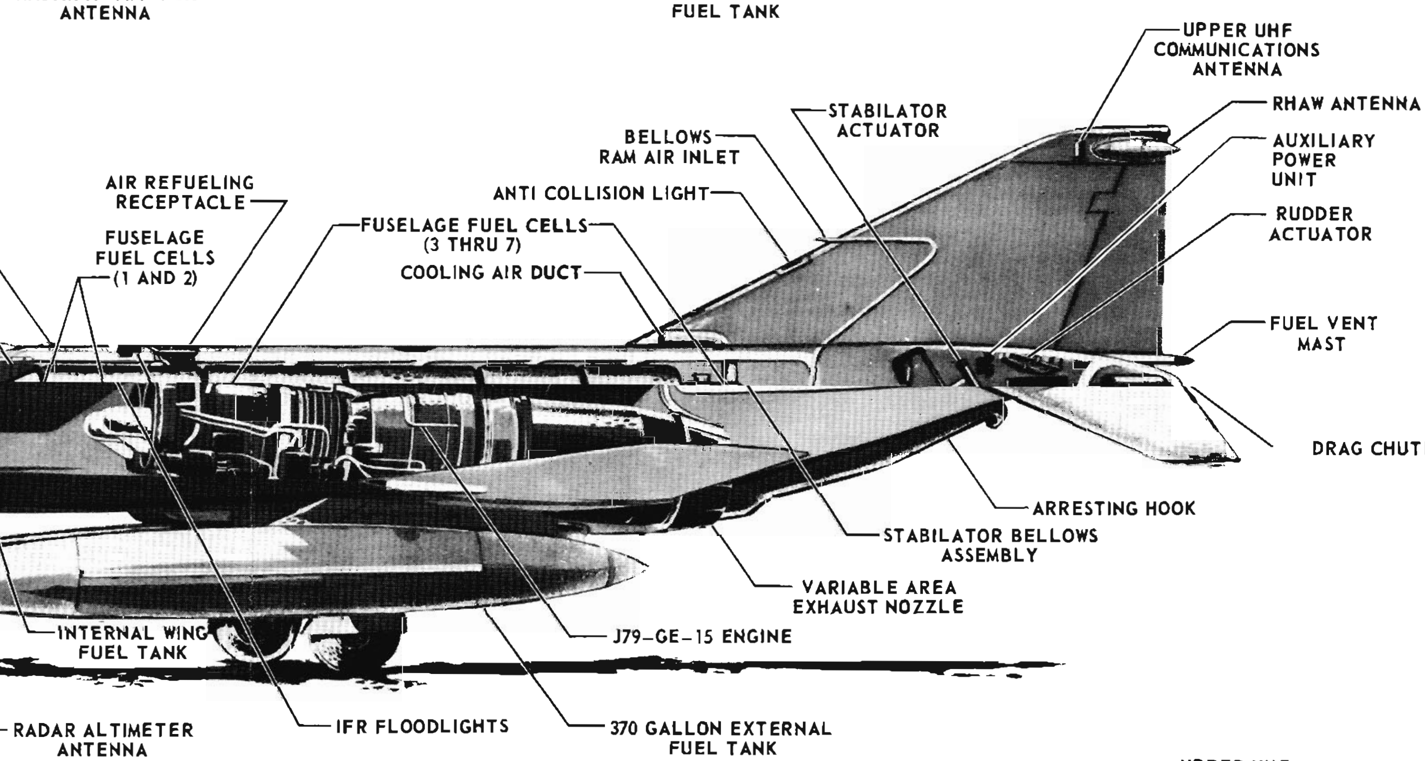


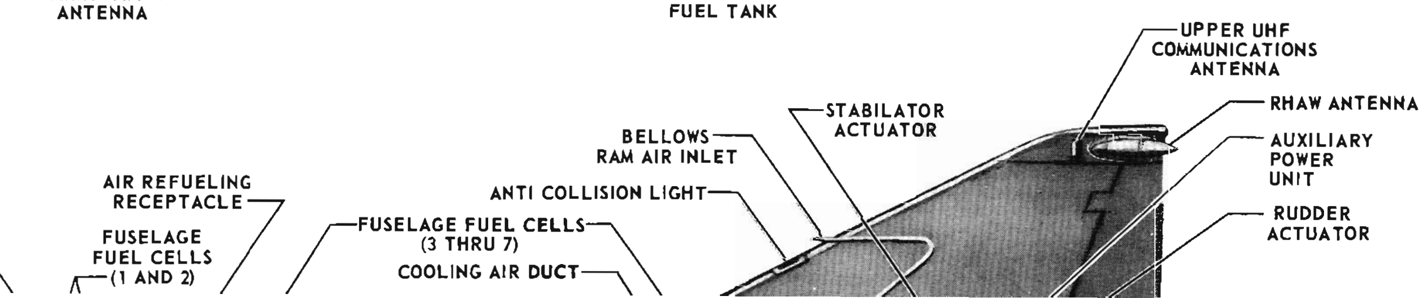
Figure FO-1

GENERAL ARRANGEMENT

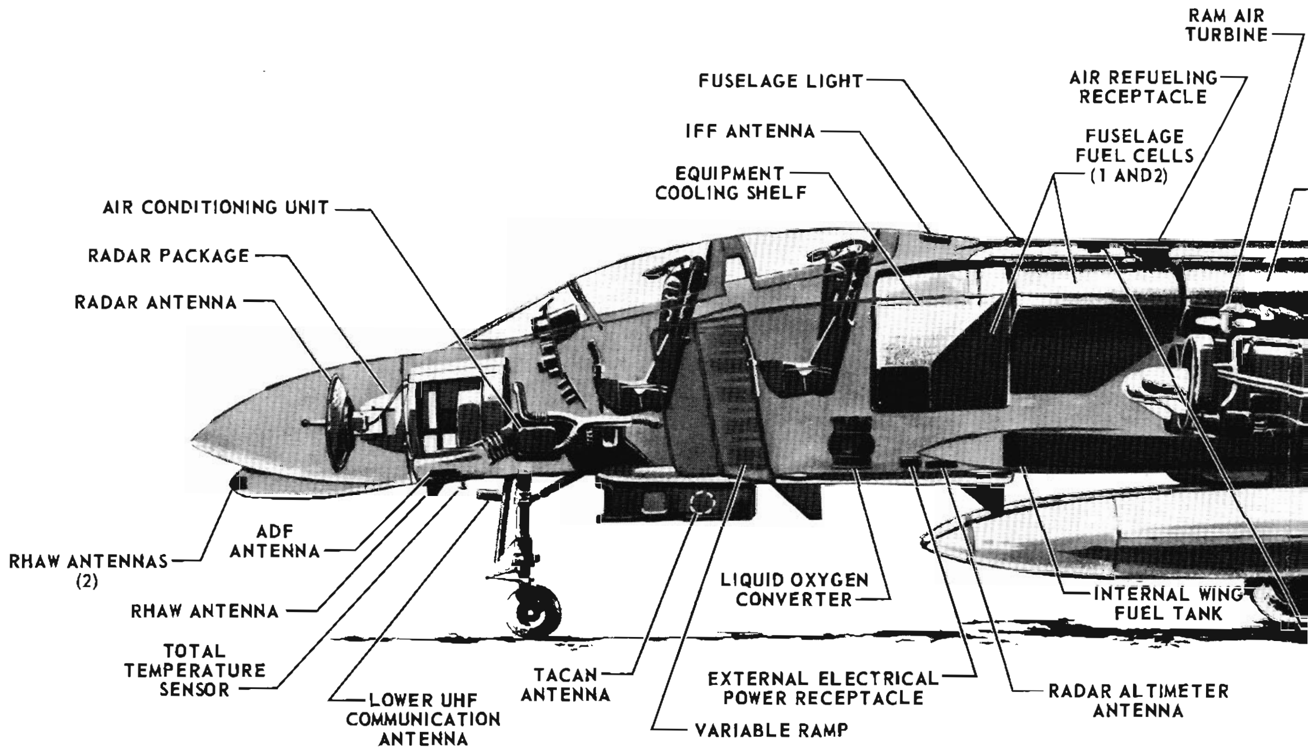
TYPICAL







F-4C **F-4D**



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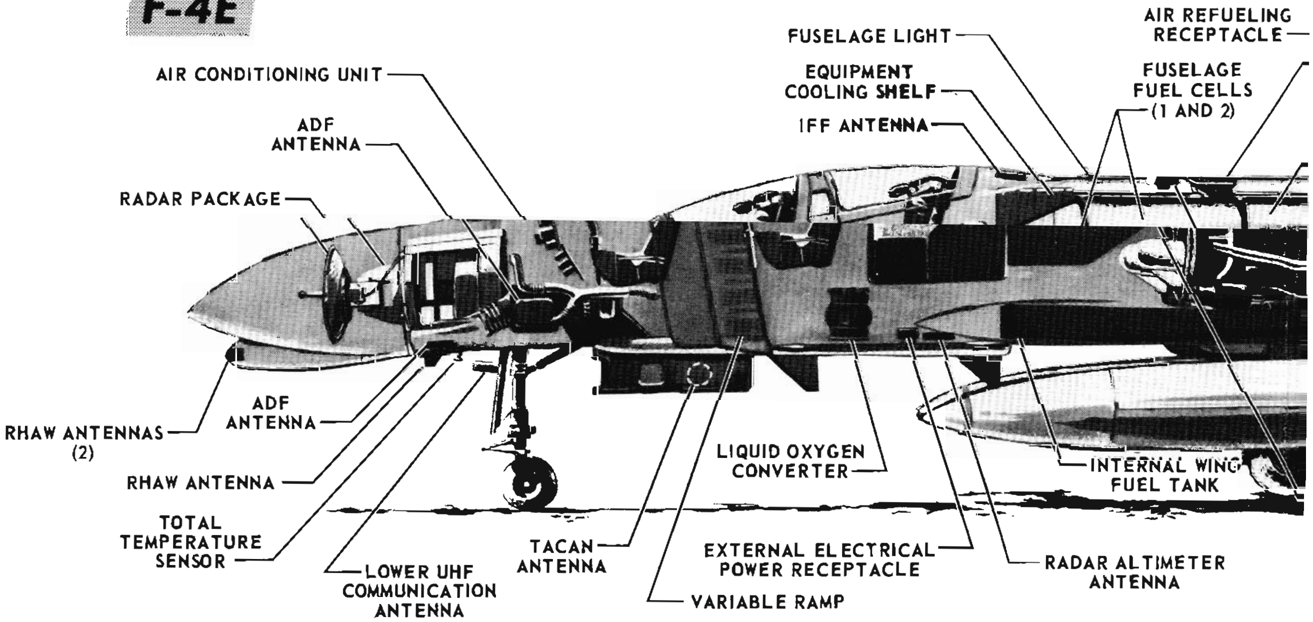

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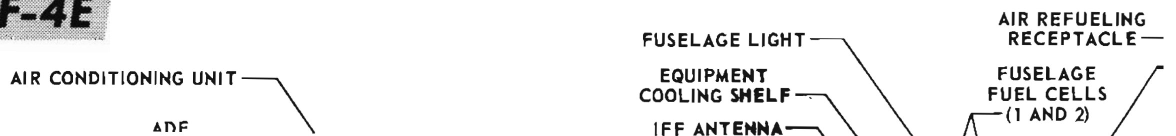


AIRPLANE AND ENGINE FUEL SYSTEM

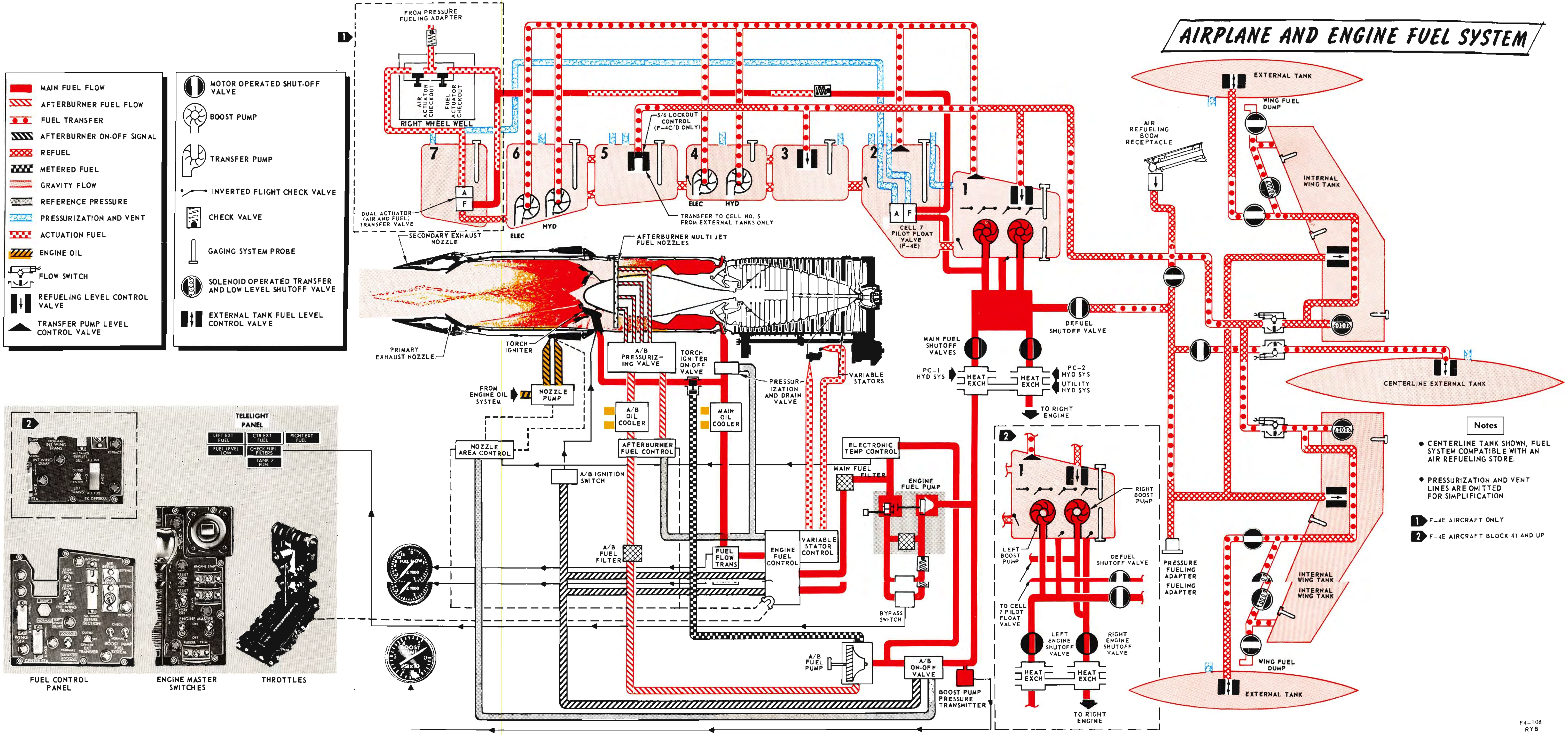
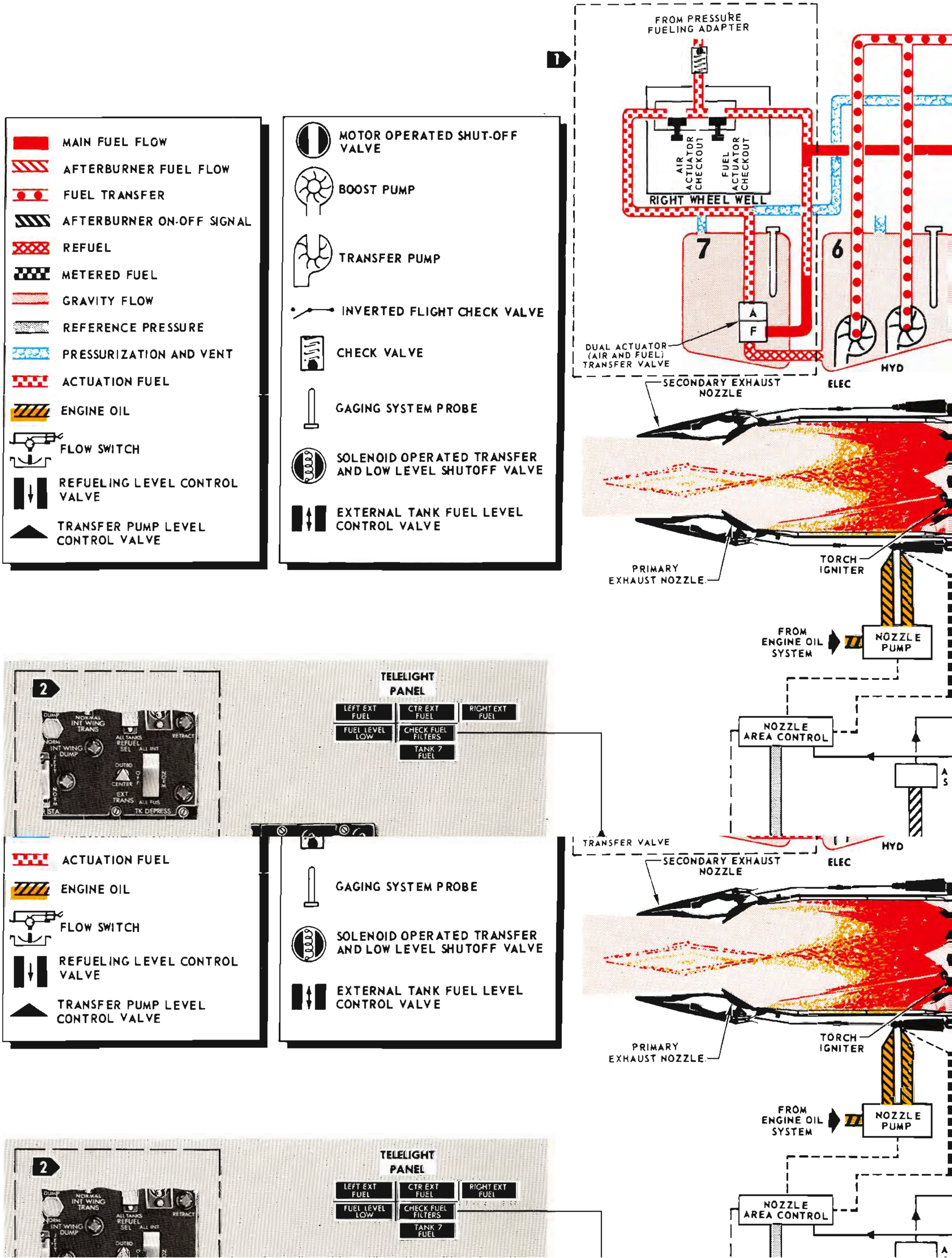


Figure FO-2


MAIN FUEL FLOW
AFTERBURNER FUEL FLOW
FUEL TRANSFER
AFTERBURNER ON-OFF SIGNAL
REFUEL
METERED FUEL
GRAVITY FLOW
REFERENCE PRESSURE
PRESSURIZATION AND VENT
ACTUATION FUEL
ENGINE OIL
FLOW SWITCH
REFUELING LEVEL CONTROL VALVE
TRANSFER PUMP LEVEL CONTROL VALVE
MOTOR OPERATED SHUT-OFF VALVE
BOOST PUMP
TRANSFER PUMP
INVERTED FLIGHT CHECK VALVE
CHECK VALVE
GAGING SYSTEM PROBE
SOLENOID OPERATED TRANSFER AND LOW LEVEL SHUTOFF VALVE
EXTERNAL TANK FUEL LEVEL CONTROL VALVE
1
FROM PRESSURE FUELING ADAPTER
AIR ACTUATOR CHECKOUT
FUEL ACTUATOR CHECKOUT
RIGHT WHEEL WELL
7
6
A
F
DUAL ACTUATOR (AIR AND FUEL) TRANSFER VALVE
HYD
ELEC
SECONDARY EXHAUST NOZZLE
PRIMARY EXHAUST NOZZLE
TORCH IGNITER
FROM ENGINE OIL SYSTEM
NOZZLE PUMP
NOZZLE AREA CONTROL
2
NORMAL INT WING TRANS
DUMP
NORM
INT WING DUMP
ALL TANKS REFUEL SEL
ALL INT
RETRACT
OUTBD
CENTER
EXT TRANS
ALL FUS
TK DEPRESS
STA
TELELIGHT PANEL
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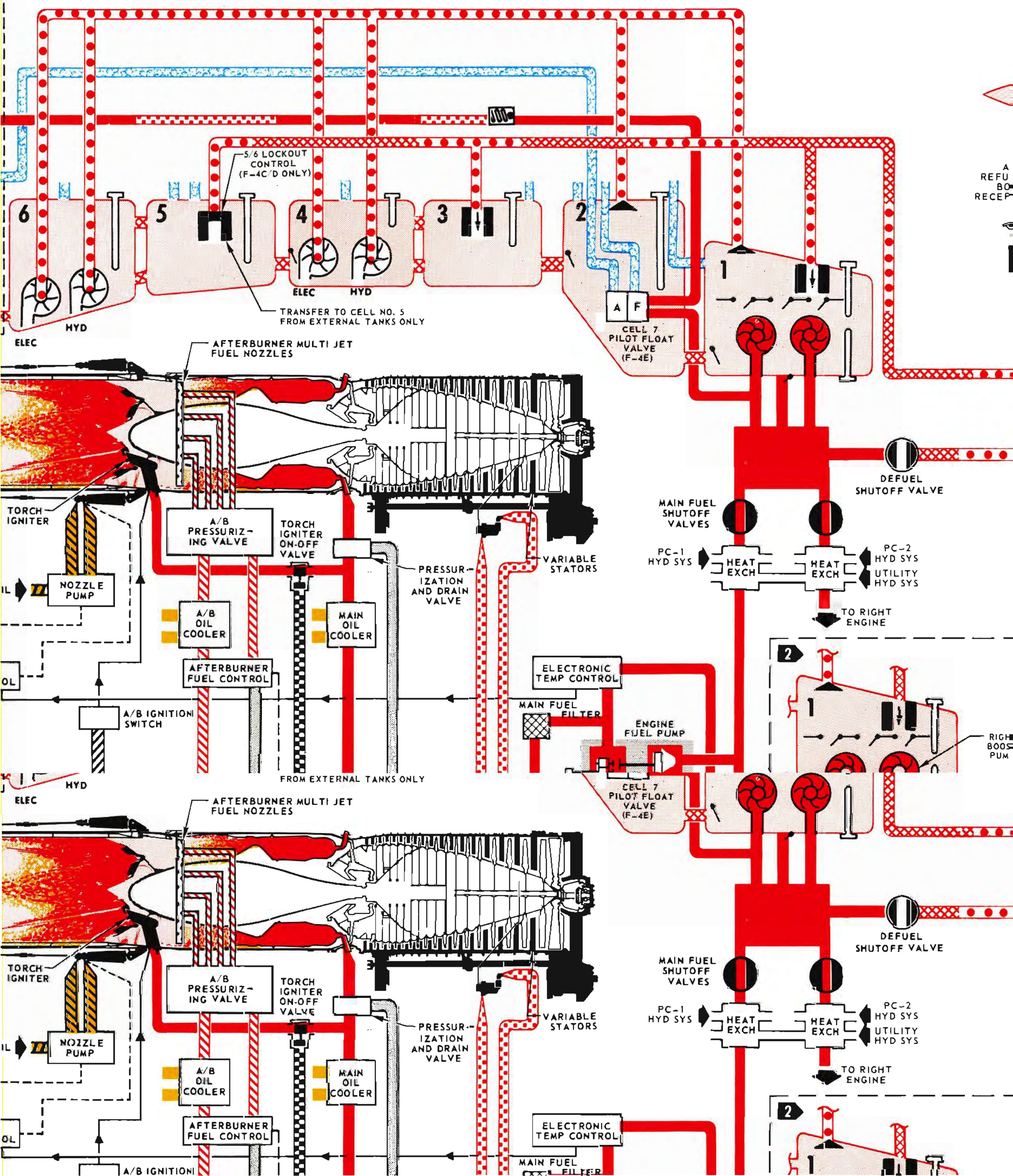
CHECK FUEL FILTERS
TANK 7 FUEL
TRANSFER VALVE



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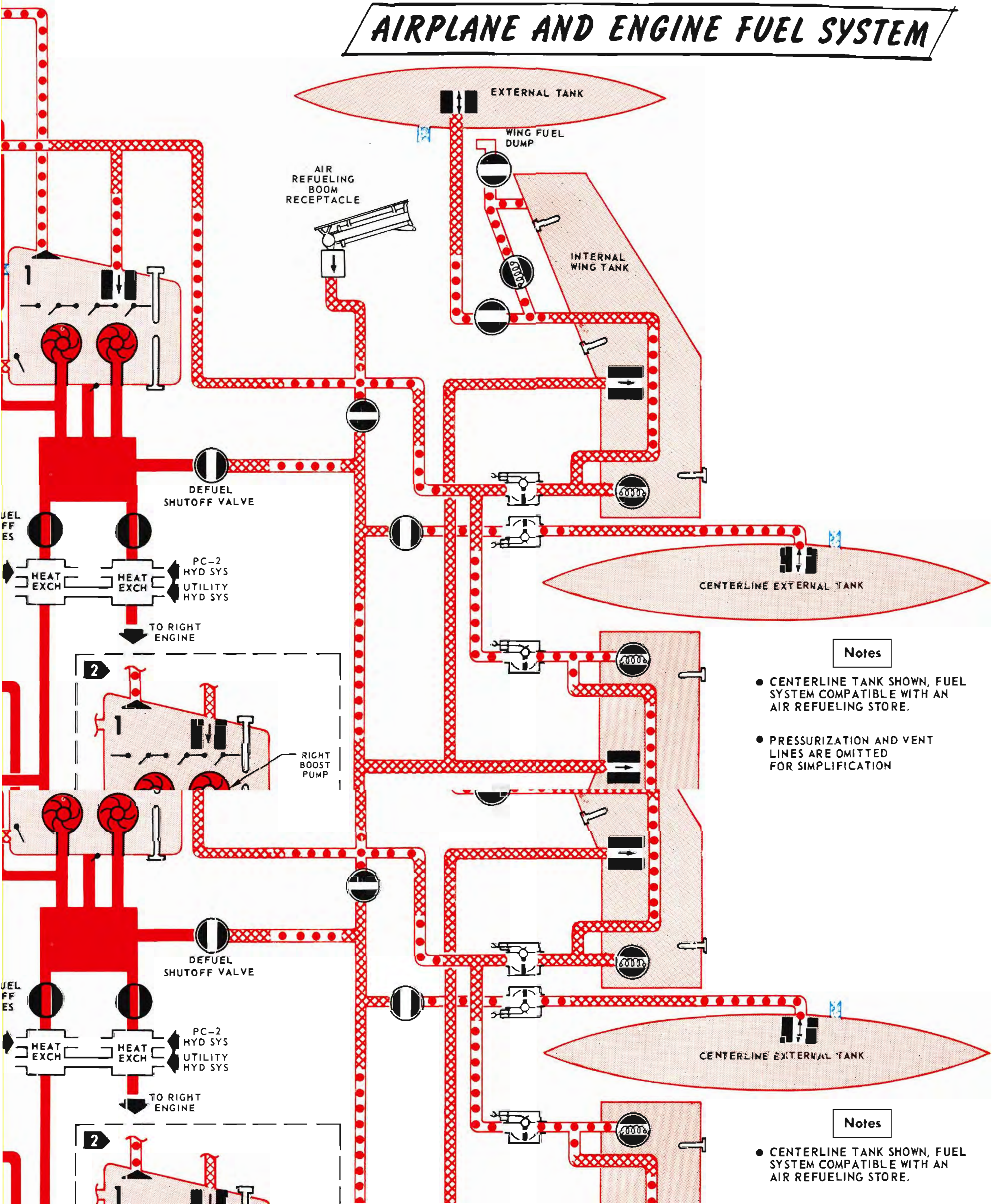
2
1
5/6 LOCKOUT CONTROL (F-4C/D ONLY)
ELEC
HYD
TRANSFER TO CELL NO. 5 FROM EXTERNAL TANKS ONLY
A F
CELL 7 PILOT FLOAT VALVE (F-4E)
AFTERBURNER MULTI JET FUEL NOZZLES
DEFUEL SHUTOFF VALVE
MAIN FUEL SHUTOFF VALVES
PC-1 HYD SYS
HEAT EXCH
HEAT EXCH
PC-2 HYD SYS
UTILITY HYD SYS
TO RIGHT ENGINE
TORCH IGNITER
A/B PRESSURIZ-ING VALVE
TORCH IGNITER ON-OFF VALVE
PRESSUR-IZATION AND DRAIN VALVE
VARIABLE STATORS
NOZZLE PUMP
A/B OIL COOLER
MAIN OIL COOLER
AFTERBURNER FUEL CONTROL
ELECTRONIC TEMP CONTROL
MAIN FUEL FILTER
ENGINE FUEL PUMP
A/B IGNITION SWITCH
2

AIRPLANE AND ENGINE FUEL SYSTEM



Notes

- CENTERLINE TANK SHOWN, FUEL SYSTEM COMPATIBLE WITH AN AIR REFUELING STORE.
- PRESSURIZATION AND VENT LINES ARE OMITTED FOR SIMPLIFICATION

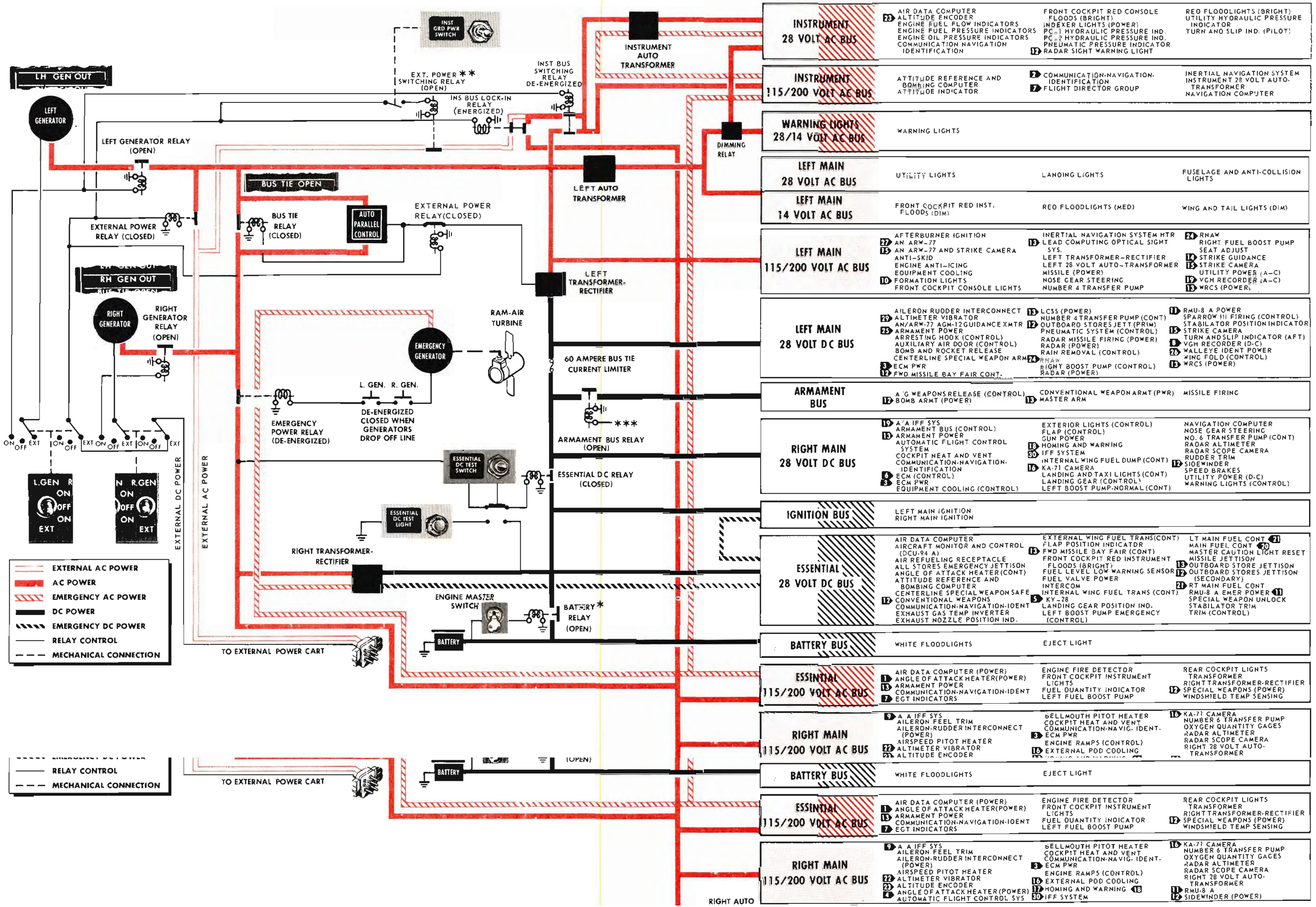
Notes

- CENTERLINE TANK SHOWN, FUEL SYSTEM COMPATIBLE WITH AN AIR REFUELING STORE.

ELECTRICAL SYSTEM

EXTERNAL POWER APPLIED

F-4C D



RELAY CONTROL
MECHANICAL CONNECTION
TO EXTERNAL POWER CART
BATTERY
BATTERY BUS
ESSENTIAL 115/200 VOLT AC BUS
RIGHT MAIN 115/200 VOLT AC BUS

* BATTERY RELAY IS ENERGIZED WHEN EITHER ENGINE MASTER SWITCH IS ON AND THE RAM AIR TURBINE IS NOT OPERATING, OR WHEN THE GROUND REFUELING CONTROL SWITCH IS IN THE REFUEL OR DEFUEL POSITION.

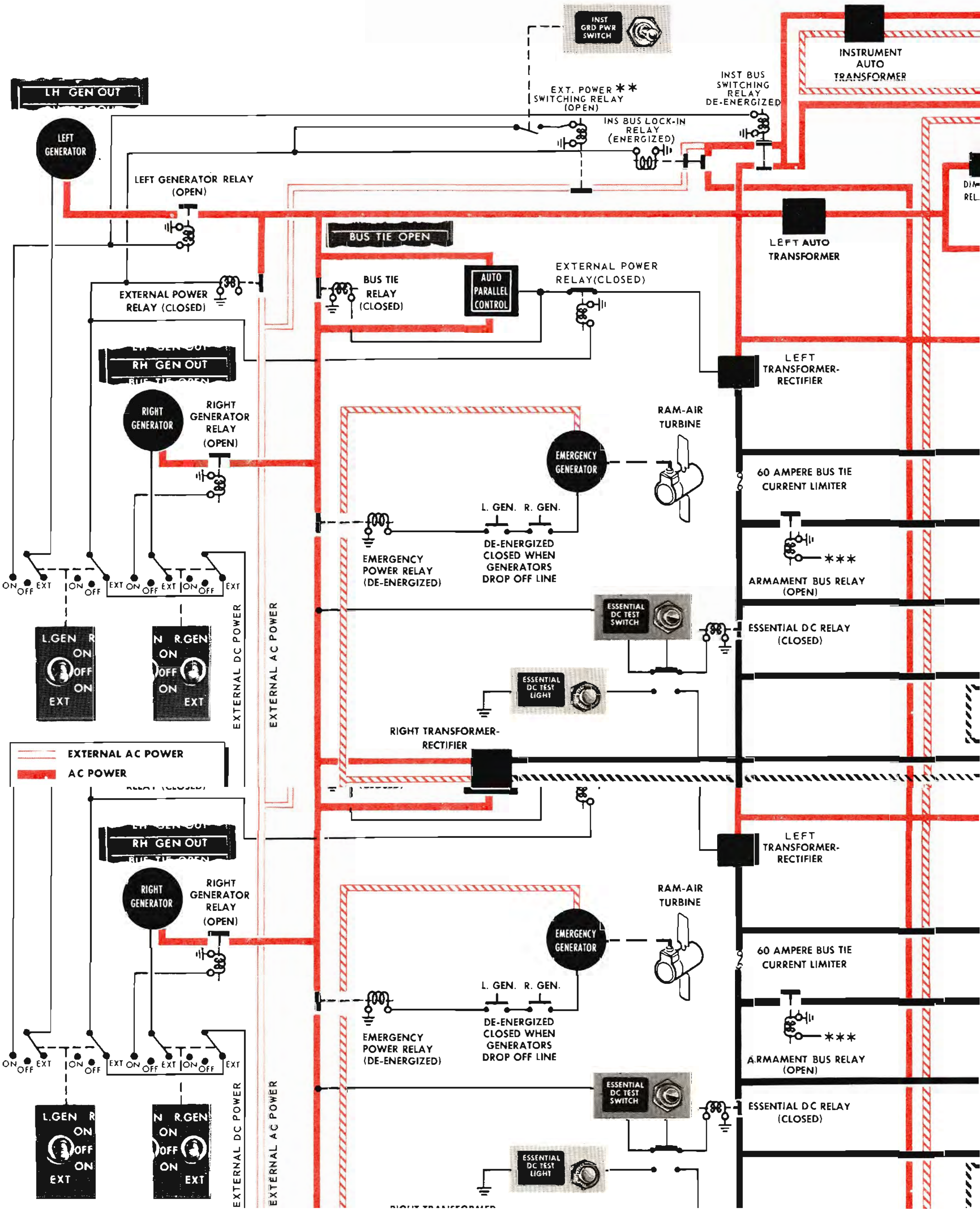
** WITH EXTERNAL POWER APPLIED (NO GENERATORS OPERATING), AND THE INSTRUMENT GROUND POWER SWITCH ACTUATED, THE INSTRUMENT BUSES WILL REMAIN ENERGIZED EVEN IF A GENERATOR CONTROL SWITCH(ES) IS PLACED OUT OF THE EXT POSITION (ALL MAJOR BUSES DE-ENERGIZED). THIS IS DUE TO HOLDING CIRCUITRY (NOT SHOWN) FOR THE EXTERNAL POWER SWITCHING RELAY AND THE INSTRUMENT BUS LOCK-IN RELAY. THE INSTRUMENT BUSES THEN CAN BE DE-ENERGIZED BY PLACING THE INSTRUMENT GROUND POWER SWITCH TO THE DE-ENERGIZED POSITION.

*** ARMAMENT RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.

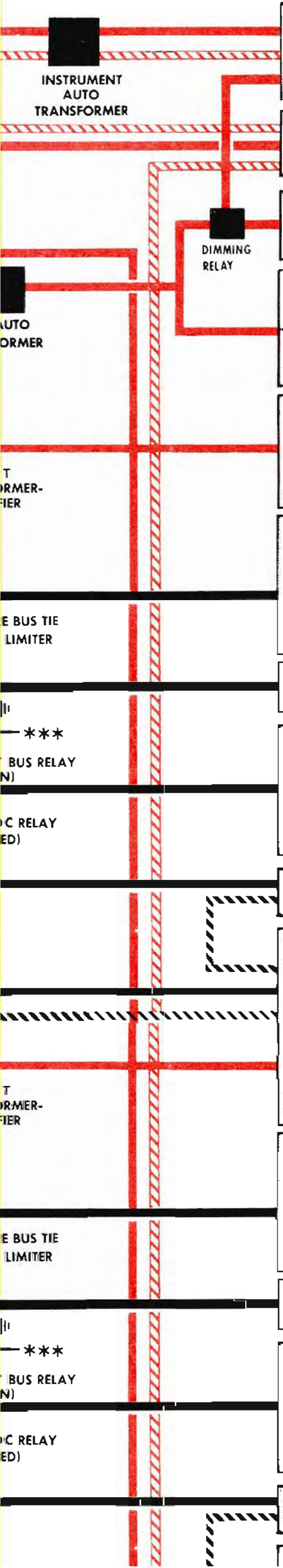
1. F-4C BLK 15 THRU F-4C BLK 17.
2. F-4C BLK 15 THRU F-4C BLK 19.
2. F-4C AFTER T.O. 1F-4C-598 OR F-4D AFTER T.O. 1F-4D-547.
4. F-4C BLK 19 AND UP, AND F-4C BLK 15 THRU 18 AFTER T.O. 1F-4C-598.
5. AFTER T.O. 1F-4-755
6. F-4C BLK 19 AND UP.
7. F-4C BLK 20 AND UP.
8. F-4C BLK 21 AND UP.
9. AFTER T.O. 1F-4-753
10. AFTER T.O. 1F-4-776
11. F-4C BLK 24 AND UP, AND F-4C BLK 15 THRU F-4C BLK 23 AFTER T.O. 1F-4C-522.
12. F-4C ONLY.
13. F-4D ONLY.
14. ALL F-4D'S; AND ALL F-4C'S AFTER T.O. 1F-4C-523.
15. F-4C BLK 15 THRU 23 AFTER T.O. 1F-4C-539.
16. F-4C BLK 20 THRU 25 AFTER T.O. 1F-4C-547, OR BLK 23 AFTER T.O. 1F-4C-548.
17. F-4C BLK 20 THRU 25 AFTER T.O. 1F-4C-576, OR BLK 23 AFTER T.O. 1F-4C-548.
18. F-4C BLK 23 AFTER T.O. 1F-4C-548.
19. F-4C BLK 21 AND UP, AND F-4D BLK 24 THRU 27 BEFORE T.O. 1F-4-645.
20. F-4C BLK 15 THRU 21 BEFORE T.O. 1F-4-618.
21. ALL F-4D'S; F-4C BLK 22 AND UP, AND F-4C BLK 15 THRU 21 AFTER T.O. 1F-4-618.
22. ALL F-4C'S; F-4D BLK 24 THRU 29.
23. F-4D BLK 30 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-754.
24. F-4D BLK 32 AND UP, AND F-4D BLK 24 THRU 31 AFTER T.O. 1F-4D-512.
25. F-4D BLK 24 THRU AIRCRAFT 65-721.
26. F-4D BLK 28 AIRCRAFT 65-722 THRU 65-727 AND F-4D BLK 30 AND UP.
27. F-4D AND F-4C BLKS 24 AND 25, AND F-4C BLKS 15 THRU 23 BEFORE T.O. 1F-4C-539.
28.
29. F-4D BLK 30 AND UP.

22. ALL F-4C'S; F-4D BLK 24 THRU 29.
23. F-4D BLK 30 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-754.
24. F-4D BLK 32 AND UP, AND F-4D BLK 24 THRU 31 AFTER T.O. 1F-4D-512.
25. F-4D BLK 24 THRU AIRCRAFT 65-721.
26. F-4D BLK 28 AIRCRAFT 65-722 THRU 65-727 AND F-4D BLK 30 AND UP.
27. F-4D AND F-4C BLKS 24 AND 25, AND F-4C BLKS 15 THRU 23 BEFORE T.O. 1F-4C-539.
28.
29. F-4D BLK 30 AND UP.

30. F-4C BLK 25, 64-928 ONLY.



INST GRD PWR SWITCH
INSTRUMENT AUTO TRANSFORMER
LH GEN OUT
EXT. POWER ** SWITCHING RELAY (OPEN)
INST BUS SWITCHING RELAY DE-ENERGIZED
INS BUS LOCK-IN RELAY (ENERGIZED)
LEFT GENERATOR
LEFT GENERATOR RELAY (OPEN)
BUS TIE OPEN
LEFT AUTO TRANSFORMER
EXTERNAL POWER RELAY (CLOSED)
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
EXTERNAL POWER RELAY(CLOSED)
RH GEN OUT
LEFT TRANSFORMER-RECTIFIER
RIGHT GENERATOR
RIGHT GENERATOR RELAY (OPEN)
RAM-AIR TURBINE
EMERGENCY GENERATOR
60 AMPERE BUS TIE CURRENT LIMITER
L. GEN.
R. GEN.
EMERGENCY POWER RELAY (DE-ENERGIZED)
DE-ENERGIZED CLOSED WHEN GENERATORS DROP OFF LINE
***
ARMAMENT BUS RELAY (OPEN)
ON
OFF
EXT
L.GEN
R.GEN
ESSENTIAL DC TEST SWITCH
ESSENTIAL DC RELAY (CLOSED)
ESSENTIAL DC TEST LIGHT
EXTERNAL DC POWER
EXTERNAL AC POWER
RIGHT TRANSFORMER-RECTIFIER
AC POWER



Bus			
INSTRUMENT 28 VOLT AC BUS	AIR DATA COMPUTER 23 ALTITUDE ENCODER ENGINE FUEL FLOW INDICATORS ENGINE FUEL PRESSURE INDICATORS ENGINE OIL PRESSURE INDICATORS COMMUNICATION NAVIGATION IDENTIFICATION	FRONT COCKPIT RED CONSOLE FLOODS (BRIGHT) INDEXER LIGHTS (POWER) PC-1 HYDRAULIC PRESSURE IND. PC-2 HYDRAULIC PRESSURE IND. PNEUMATIC PRESSURE INDICATOR 12 RADAR SIGHT WARNING LIGHT	RED FLOODLIGHTS (BRIGHT) UTILITY HYDRAULIC PRESSURE INDICATOR TURN AND SLIP IND. (PILOT)
INSTRUMENT 115/200 VOLT AC BUS	ATTITUDE REFERENCE AND BOMBING COMPUTER ATTITUDE INDICATOR	2 COMMUNICATION-NAVIGATION-IDENTIFICATION 7 FLIGHT DIRECTOR GROUP	INERTIAL NAVIGATION SYSTEM INSTRUMENT 28 VOLT AUTO-TRANSFORMER NAVIGATION COMPUTER
WARNING LIGHTS 28/14 VOLT AC BUS	WARNING LIGHTS		
LEFT MAIN 28 VOLT AC BUS	UTILITY LIGHTS	LANDING LIGHTS	FUSELAGE AND ANTI-COLLISION LIGHTS
LEFT MAIN 14 VOLT AC BUS	FRONT COCKPIT RED INST. FLOODS (DIM)	RED FLOODLIGHTS (MED)	WING AND TAIL LIGHTS (DIM)
LEFT MAIN 115/200 VOLT AC BUS	AFTERBURNER IGNITION 27 AN ARW-77 15 AN ARW-77 AND STRIKE CAMERA ANTI-SKID ENGINE ANTI-ICING EQUIPMENT COOLING 10 FORMATION LIGHTS FRONT COCKPIT CONSOLE LIGHTS	INERTIAL NAVIGATION SYSTEM HTR 13 LEAD COMPUTING OPTICAL SIGHT SYS. LEFT TRANSFORMER-RECTIFIER LEFT 28 VOLT AUTO-TRANSFORMER MISSILE (POWER) NOSE GEAR STEERING NUMBER 4 TRANSFER PUMP	24 RHAW RIGHT FUEL BOOST PUMP SEAT ADJUST 14 STRIKE GUIDANCE 15 STRIKE CAMERA UTILITY POWER (A-C) 19 VGH RECORDER (A-C) 13 WRCS (POWER)
LEFT MAIN 28 VOLT DC BUS	AILERON RUDDER INTERCONNECT 29 ALTIMETER VIBRATOR AN/ARW-77 AGM-12 GUIDANCE XMTR 25 ARMAMENT POWER ARRESTING HOOK (CONTROL) AUXILIARY AIR DOOR (CONTROL) BOMB AND ROCKET RELEASE CENTERLINE SPECIAL WEAPON ARM 3 ECM PWR 12 FWD MISSILE BAY FAIR CONT.	13 LCSS (POWER) NUMBER 4 TRANSFER PUMP (CONT) 12 OUTBOARD STORES JETT (PRIM) PNEUMATIC SYSTEM (CONTROL) RADAR MISSILE FIRING (POWER) RADAR (POWER) RAIN REMOVAL (CONTROL) 24 RHAW RIGHT BOOST PUMP (CONTROL) RADAR (POWER)	11 RMU-8 A POWER SPARROW III FIRING (CONTROL) STABILATOR POSITION INDICATOR 15 STRIKE CAMERA TURN AND SLIP INDICATOR (AFT) 8 VGH RECORDER (D-C) 26 WALLEYE IDENT POWER WING FOLD (CONTROL) 13 WRCS (POWER)
ARMAMENT BUS	A/G WEAPONS RELEASE (CONTROL) 12 BOMB ARM (POWER)	CONVENTIONAL WEAPON ARMT (PWR) 13 MASTER ARM	MISSILE FIRING
RIGHT MAIN 28 VOLT DC BUS	10 A/A IFF SYS ARMAMENT BUS (CONTROL) 13 ARMAMENT POWER AUTOMATIC FLIGHT CONTROL SYSTEM COCKPIT HEAT AND VENT COMMUNICATION-NAVIGATION-IDENTIFICATION 6 ECM (CONTROL) 3 ECM PWR EQUIPMENT COOLING (CONTROL)	EXTERIOR LIGHTS (CONTROL) FLAP (CONTROL) GUN POWER 18 HOMING AND WARNING 30 IFF SYSTEM INTERNAL WING FUEL DUMP (CONT) 16 KA-71 CAMERA LANDING AND TAXI LIGHTS (CONT) LANDING GEAR (CONTROL) LEFT BOOST PUMP-NORMAL (CONT)	NAVIGATION COMPUTER NOSE GEAR STEERING NO. 6 TRANSFER PUMP (CONT) RADAR ALTIMETER RADAR SCOPE CAMERA RUDDER TRIM 12 SIDEWINDER SPEED BRAKES UTILITY POWER (D-C) WARNING LIGHTS (CONTROL)
IGNITION BUS	LEFT MAIN IGNITION RIGHT MAIN IGNITION		
ESSENTIAL 28 VOLT DC BUS	AIR DATA COMPUTER AIRCRAFT MONITOR AND CONTROL (DCU-94 A) AIR REFUELING RECEPTACLE ALL STORES EMERGENCY JETTISON ANGLE OF ATTACK HEATER (CONT) ATTITUDE REFERENCE AND BOMBING COMPUTER	EXTERNAL WING FUEL TRANS(CONT) FLAP POSITION INDICATOR 13 FWD MISSILE BAY FAIR (CONT) FRONT COCKPIT RED INSTRUMENT FLOODS (BRIGHT) FUEL LEVEL LOW WARNING SENSOR FUEL VALVE POWER INTERCOM	LT MAIN FUEL CONT 21 MAIN FUEL CONT 20 MASTER CAUTION LIGHT RESET MISSILE JETTISON 13 OUTBOARD STORE JETTISON 12 OUTBOARD STORES JETTISON (SECONDARY) 21 RT MAIN FUEL CONT

Bus			
LEFT MAIN 115/200 VOLT AC BUS	27 AN ARW-77 15 AN ARW-77 AND STRIKE CAMERA ANTI-SKID ENGINE ANTI-ICING EQUIPMENT COOLING 10 FORMATION LIGHTS FRONT COCKPIT CONSOLE LIGHTS	13 LEAD COMPUTING OPTICAL SIGHT SYS. LEFT TRANSFORMER-RECTIFIER LEFT 28 VOLT AUTO-TRANSFORMER MISSILE (POWER) NOSE GEAR STEERING NUMBER 4 TRANSFER PUMP	RIGHT FUEL BOOST PUMP SEAT ADJUST 14 STRIKE GUIDANCE 15 STRIKE CAMERA UTILITY POWER (A-C) 19 VGH RECORDER (A-C) 13 WRCS (POWER)
LEFT MAIN 28 VOLT DC BUS	AILERON RUDDER INTERCONNECT 29 ALTIMETER VIBRATOR AN/ARW-77 AGM-12 GUIDANCE XMTR 25 ARMAMENT POWER ARRESTING HOOK (CONTROL) AUXILIARY AIR DOOR (CONTROL) BOMB AND ROCKET RELEASE CENTERLINE SPECIAL WEAPON ARM 3 ECM PWR 12 FWD MISSILE BAY FAIR CONT.	13 LCSS (POWER) NUMBER 4 TRANSFER PUMP (CONT) 12 OUTBOARD STORES JETT (PRIM) PNEUMATIC SYSTEM (CONTROL) RADAR MISSILE FIRING (POWER) RADAR (POWER) RAIN REMOVAL (CONTROL) 24 RHAW RIGHT BOOST PUMP (CONTROL) RADAR (POWER)	11 RMU-8 A POWER SPARROW III FIRING (CONTROL) STABILATOR POSITION INDICATOR 15 STRIKE CAMERA TURN AND SLIP INDICATOR (AFT) 8 VGH RECORDER (D-C) 26 WALLEYE IDENT POWER WING FOLD (CONTROL) 13 WRCS (POWER)
ARMAMENT BUS	A/G WEAPONS RELEASE (CONTROL) 12 BOMB ARM (POWER)	CONVENTIONAL WEAPON ARMT (PWR) 13 MASTER ARM	MISSILE FIRING
RIGHT MAIN 28 VOLT DC BUS	10 A/A IFF SYS ARMAMENT BUS (CONTROL) 13 ARMAMENT POWER AUTOMATIC FLIGHT CONTROL SYSTEM COCKPIT HEAT AND VENT COMMUNICATION-NAVIGATION-IDENTIFICATION 6 ECM (CONTROL) 3 ECM PWR EQUIPMENT COOLING (CONTROL)	EXTERIOR LIGHTS (CONTROL) FLAP (CONTROL) GUN POWER 18 HOMING AND WARNING 30 IFF SYSTEM INTERNAL WING FUEL DUMP (CONT) 16 KA-71 CAMERA LANDING AND TAXI LIGHTS (CONT) LANDING GEAR (CONTROL) LEFT BOOST PUMP-NORMAL (CONT)	NAVIGATION COMPUTER NOSE GEAR STEERING NO. 6 TRANSFER PUMP (CONT) RADAR ALTIMETER RADAR SCOPE CAMERA RUDDER TRIM 12 SIDEWINDER SPEED BRAKES UTILITY POWER (D-C) WARNING LIGHTS (CONTROL)
IGNITION BUS	LEFT MAIN IGNITION RIGHT MAIN IGNITION		
	AIR DATA COMPUTER AIRCRAFT MONITOR AND CONTROL	EXTERNAL WING FUEL TRANS(CONT) FLAP POSITION INDICATOR	LT MAIN FUEL CONT 21 MAIN FUEL CONT 20

ELECTRICAL SYSTEM

EXTERNAL POWER APPLIED

F-4C D

RED FLOODLIGHTS (BRIGHT)
UTILITY HYDRAULIC PRESSURE INDICATOR
TURN AND SLIP IND. (PILOT)

INERTIAL NAVIGATION SYSTEM
INSTRUMENT 28 VOLT AUTO-TRANSFORMER
NAVIGATION COMPUTER

FUSELAGE AND ANTI-COLLISION LIGHTS

WING AND TAIL LIGHTS (DIM)

24 RHAW
RIGHT FUEL BOOST PUMP
SEAT ADJUST
14 STRIKE GUIDANCE
15 STRIKE CAMERA
UTILITY POWER (A-C)
19 VGH RECORDER (A-C)
13 WRCS (POWER)

11 RMU-8 A POWER
SPARROW III FIRING (CONTROL)
STABILATOR POSITION INDICATOR
15 STRIKE CAMERA
TURN AND SLIP INDICATOR (AFT)
8 VGH RECORDER (D-C)
26 WALLEYE IDENT POWER
WING FOLD (CONTROL)
13 WRCS (POWER)

MISSILE FIRING

NAVIGATION COMPUTER
NOSE GEAR STEERING
NO. 6 TRANSFER PUMP (CONT)
RADAR ALTIMETER
RADAR SCOPE CAMERA
RUDDER TRIM
12 SIDEWINDER
SPEED BRAKES
UTILITY POWER (D-C)
WARNING LIGHTS (CONTROL)

LT MAIN FUEL CONT 21
MAIN FUEL CONT 20
MASTER CAUTION LIGHT RESET
MISSILE JETTISON
13 OUTBOARD STORE JETTISON
12 OUTBOARD STORES JETTISON (SECONDARY)
21 RT MAIN FUEL CONT

* BATTERY RELAY IS ENERGIZED WHEN EITHER ENGINE MASTER SWITCH IS ON AND THE RAM AIR TURBINE IS NOT OPERATING, OR WHEN THE GROUND REFUELING CONTROL SWITCH IS IN THE REFUEL OR DEFUEL POSITION.

** WITH EXTERNAL POWER APPLIED (NO GENERATORS OPERATING), AND THE INSTRUMENT GROUND POWER SWITCH ACTUATED, THE INSTRUMENT BUSES WILL REMAIN ENERGIZED EVEN IF A GENERATOR CONTROL SWITCH(ES) IS PLACED OUT OF THE EXT POSITION (ALL MAJOR BUSES DE-ENERGIZED). THIS IS DUE TO HOLDING CIRCUITRY (NOT SHOWN) FOR THE EXTERNAL POWER SWITCHING RELAY AND THE INSTRUMENT BUS LOCK-IN RELAY. THE INSTRUMENT BUSES THEN CAN BE DE-ENERGIZED BY PLACING THE INSTRUMENT GROUND POWER SWITCH TO THE DE-ENERGIZED POSITION.

*** ARMAMENT RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.

1 F-4C BLK 15 THRU F-4C BLK 17.
2 F-4C BLK 15 THRU F-4C BLK 19.
3 F-4C AFTER T.O. 1F-4C-598 OR F-4D AFTER T.O. 1F-4D-547.
4 F-4C BLK 19 AND UP, AND F-4C BLK 15 THRU 18 AFTER T.O. 1F-4C-598.
5 AFTER T.O. 1F-4-755
6 F-4C BLK 19 AND UP.
7 F-4C BLK 20 AND UP.
8 F-4C BLK 21 AND UP.
9 AFTER T.O. 1F-4-753
10 AFTER T.O. 1F-4-776
11 F-4C BLK 24 AND UP, AND F-4C BLK 15 THRU F-4C BLK 23 AFTER T.O. 1F-4C-522.
12 F-4C ONLY.
13 F-4D ONLY.
14 ALL F-4D'S; AND ALL F-4C'S AFTER T.O. 1F-4C-523.
15 F-4C BLK 15 THRU 23 AFTER T.O. 1F-4C-539.
16 F-4C BLK 20 THRU 25 AFTER T.O. 1F-4C-547, OR BLK 23 AFTER T.O. 1F-4C-548.
17 F-4C BLK 20 THRU 25 AFTER T.O. 1F-4C-576, OR BLK 23 AFTER T.O. 1F-4C-548.
18 F-4C BLK 23 AFTER T.O. 1F-4C-548.
19 F-4C BLK 21 AND UP, AND F-4D BLK 24 THRU 27 BEFORE

INSTRUMENT BUSES THEN CAN BE DE-ENERGIZED BY PLACING THE INSTRUMENT GROUND POWER SWITCH TO THE DE-ENERGIZED POSITION.

*** ARMAMENT RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.

24 RHAW
RIGHT FUEL BOOST PUMP
SEAT ADJUST
14 STRIKE GUIDANCE
15 STRIKE CAMERA
UTILITY POWER (A-C)
19 VGH RECORDER (A-C)
13 WRCS (POWER)

11 RMU-8 A POWER
SPARROW III FIRING (CONTROL)
STABILATOR POSITION INDICATOR
15 STRIKE CAMERA
TURN AND SLIP INDICATOR (AFT)
8 VGH RECORDER (D-C)
26 WALLEYE IDENT POWER
WING FOLD (CONTROL)
13 WRCS (POWER)

MISSILE FIRING

NAVIGATION COMPUTER
NOSE GEAR STEERING
NO. 6 TRANSFER PUMP (CONT)
RADAR ALTIMETER
RADAR SCOPE CAMERA
RUDDER TRIM
12 SIDEWINDER
SPEED BRAKES
UTILITY POWER (D-C)
WARNING LIGHTS (CONTROL)

LT MAIN FUEL CONT 21

1 F-4C BLK 15 THRU F-4C BLK 17.
2 F-4C BLK 15 THRU F-4C BLK 19.
3 F-4C AFTER T.O. 1F-4C-598 OR F-4D AFTER T.O. 1F-4D-547.
4 F-4C BLK 19 AND UP, AND F-4C BLK 15 THRU 18 AFTER T.O. 1F-4C-598.
5 AFTER T.O. 1F-4-755
6 F-4C BLK 19 AND UP.
7 F-4C BLK 20 AND UP.
8 F-4C BLK 21 AND UP.
9 AFTER T.O. 1F-4-753
10 AFTER T.O. 1F-4-776
11 F-4C BLK 24 AND UP, AND F-4C BLK 15 THRU F-4C BLK 23 AFTER T.O. 1F-4C-522.
12 F-4C ONLY.
13 F-4D ONLY.
14 ALL F-4D'S; AND ALL F-4C'S AFTER T.O. 1F-4C-523.
15 F-4C BLK 15 THRU 23 AFTER T.O. 1F-4C-539.
16 F-4C BLK 20 THRU 25 AFTER T.O. 1F-4C-547, OR BLK 23 AFTER T.O. 1F-4C-548.

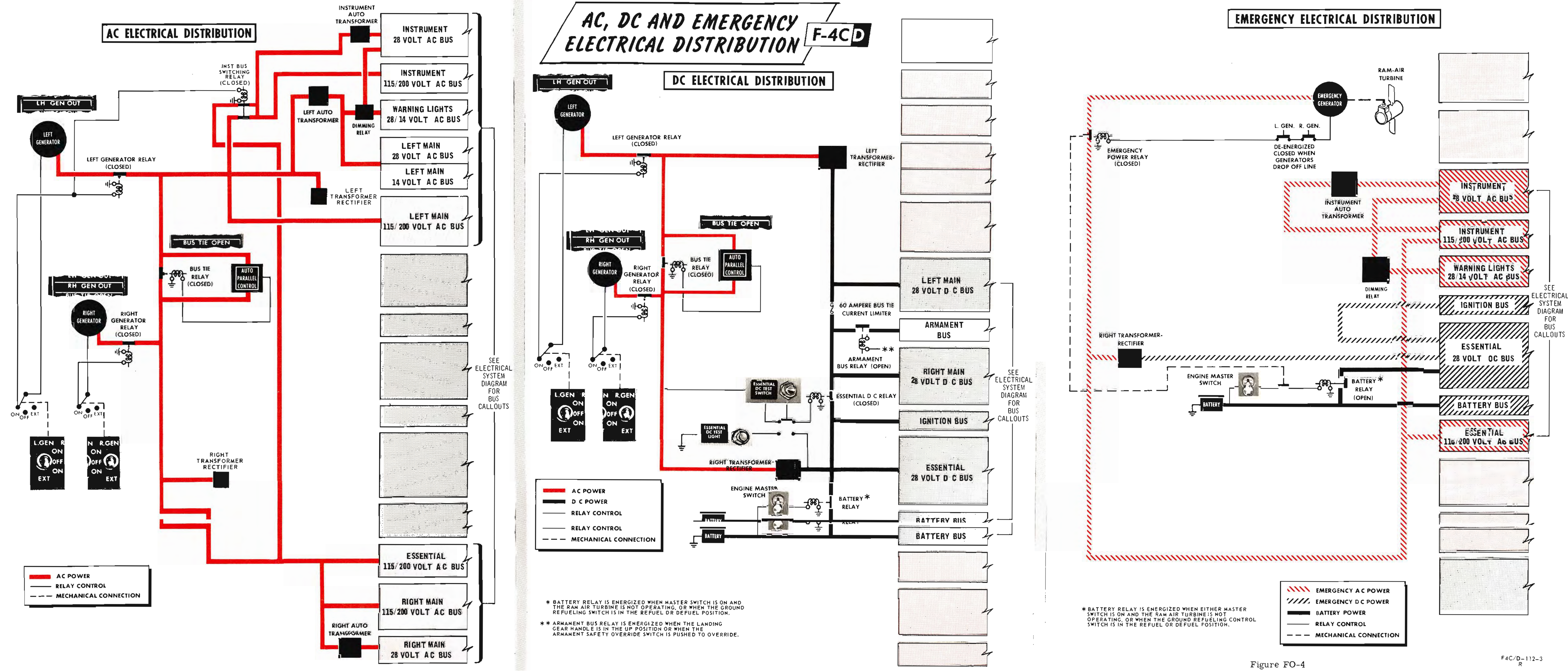
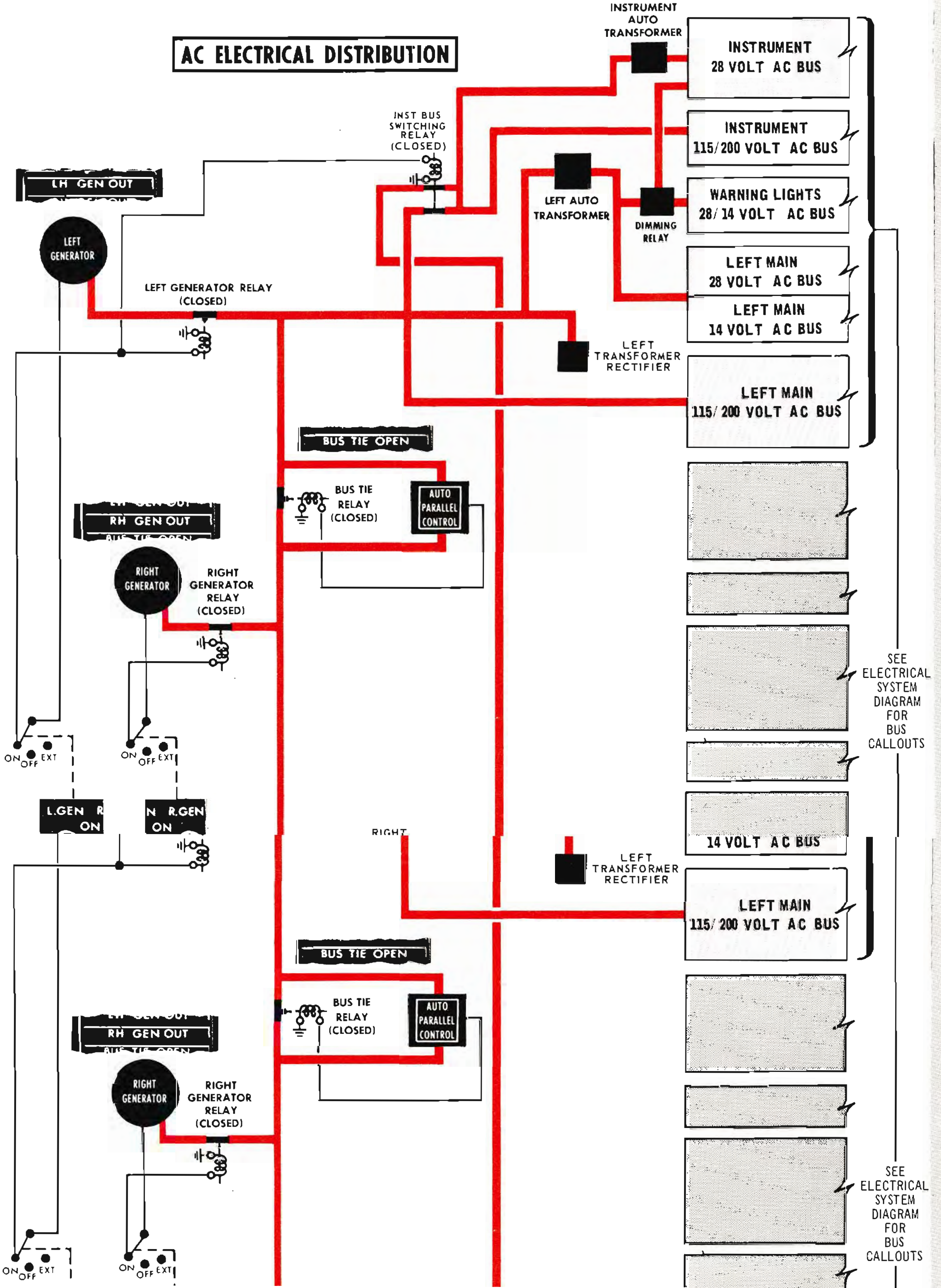

AC, DC AND EMERGENCY ELECTRICAL DISTRIBUTION F-4C D
AC ELECTRICAL DISTRIBUTION
LH GEN OUT
LEFT GENERATOR
LEFT GENERATOR RELAY (CLOSED)
INST BUS SWITCHING RELAY (CLOSED)
INSTRUMENT AUTO TRANSFORMER
INSTRUMENT 28 VOLT AC BUS
INSTRUMENT 115/200 VOLT AC BUS
LEFT AUTO TRANSFORMER
DIMMING RELAY
WARNING LIGHTS 28/14 VOLT AC BUS
LEFT MAIN 28 VOLT AC BUS
LEFT MAIN 14 VOLT AC BUS
LEFT TRANSFORMER RECTIFIER
LEFT MAIN 115/200 VOLT AC BUS
BUS TIE OPEN
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
RH GEN OUT
RIGHT GENERATOR
RIGHT GENERATOR RELAY (CLOSED)
ON OFF EXT
L.GEN R ON OFF ON EXT
N R.GEN ON OFF ON EXT
RIGHT TRANSFORMER RECTIFIER
SEE ELECTRICAL SYSTEM DIAGRAM FOR BUS CALLOUTS
ESSENTIAL 115/200 VOLT AC BUS
RIGHT MAIN 115/200 VOLT AC BUS
RIGHT AUTO TRANSFORMER
RIGHT MAIN 28 VOLT AC BUS
AC POWER
RELAY CONTROL
MECHANICAL CONNECTION
DC ELECTRICAL DISTRIBUTION
LH GEN OUT
LEFT GENERATOR
LEFT GENERATOR RELAY (CLOSED)
LEFT TRANSFORMER-RECTIFIER
BUS TIE OPEN
RH GEN OUT
RIGHT GENERATOR
RIGHT GENERATOR RELAY (CLOSED)
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
LEFT MAIN 28 VOLT D C BUS
60 AMPERE BUS TIE CURRENT LIMITER
ARMAMENT BUS
ARMAMENT BUS RELAY (OPEN)
RIGHT MAIN 28 VOLT D C BUS
ESSENTIAL DC TEST SWITCH
ESSENTIAL D C RELAY (CLOSED)
ESSENTIAL DC TEST LIGHT
IGNITION BUS
RIGHT TRANSFORMER-RECTIFIER
ESSENTIAL 28 VOLT D C BUS
ENGINE MASTER SWITCH
BATTERY* RELAY
BATTERY BUS
BATTERY
SEE ELECTRICAL SYSTEM DIAGRAM FOR BUS CALLOUTS
AC POWER
D C POWER
RELAY CONTROL
RELAY CONTROL
MECHANICAL CONNECTION
* BATTERY RELAY IS ENERGIZED WHEN MASTER SWITCH IS ON AND THE RAM AIR TURBINE IS NOT OPERATING, OR WHEN THE GROUND REFUELING SWITCH IS IN THE REFUEL OR DEFUEL POSITION.
** ARMAMENT BUS RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.
EMERGENCY ELECTRICAL DISTRIBUTION
RAM-AIR TURBINE
EMERGENCY GENERATOR
L. GEN. R. GEN.
DE-ENERGIZED CLOSED WHEN GENERATORS DROP OFF LINE
EMERGENCY POWER RELAY (CLOSED)
INSTRUMENT AUTO TRANSFORMER
INSTRUMENT 28 VOLT AC BUS
INSTRUMENT 115/200 VOLT AC BUS
DIMMING RELAY
WARNING LIGHTS 28/14 VOLT AC BUS
IGNITION BUS
RIGHT TRANSFORMER-RECTIFIER
ESSENTIAL 28 VOLT DC BUS
ENGINE MASTER SWITCH
BATTERY* RELAY (OPEN)
BATTERY
BATTERY BUS
ESSENTIAL 115/200 VOLT AC BUS
SEE ELECTRICAL SYSTEM DIAGRAM FOR BUS CALLOUTS
* BATTERY RELAY IS ENERGIZED WHEN EITHER MASTER SWITCH IS ON AND THE RAM AIR TURBINE IS NOT OPERATING, OR WHEN THE GROUND REFUELING CONTROL SWITCH IS IN THE REFUEL OR DEFUEL POSITION.
EMERGENCY A C POWER
EMERGENCY D C POWER
BATTERY POWER
RELAY CONTROL
MECHANICAL CONNECTION
F4C/D-112-3

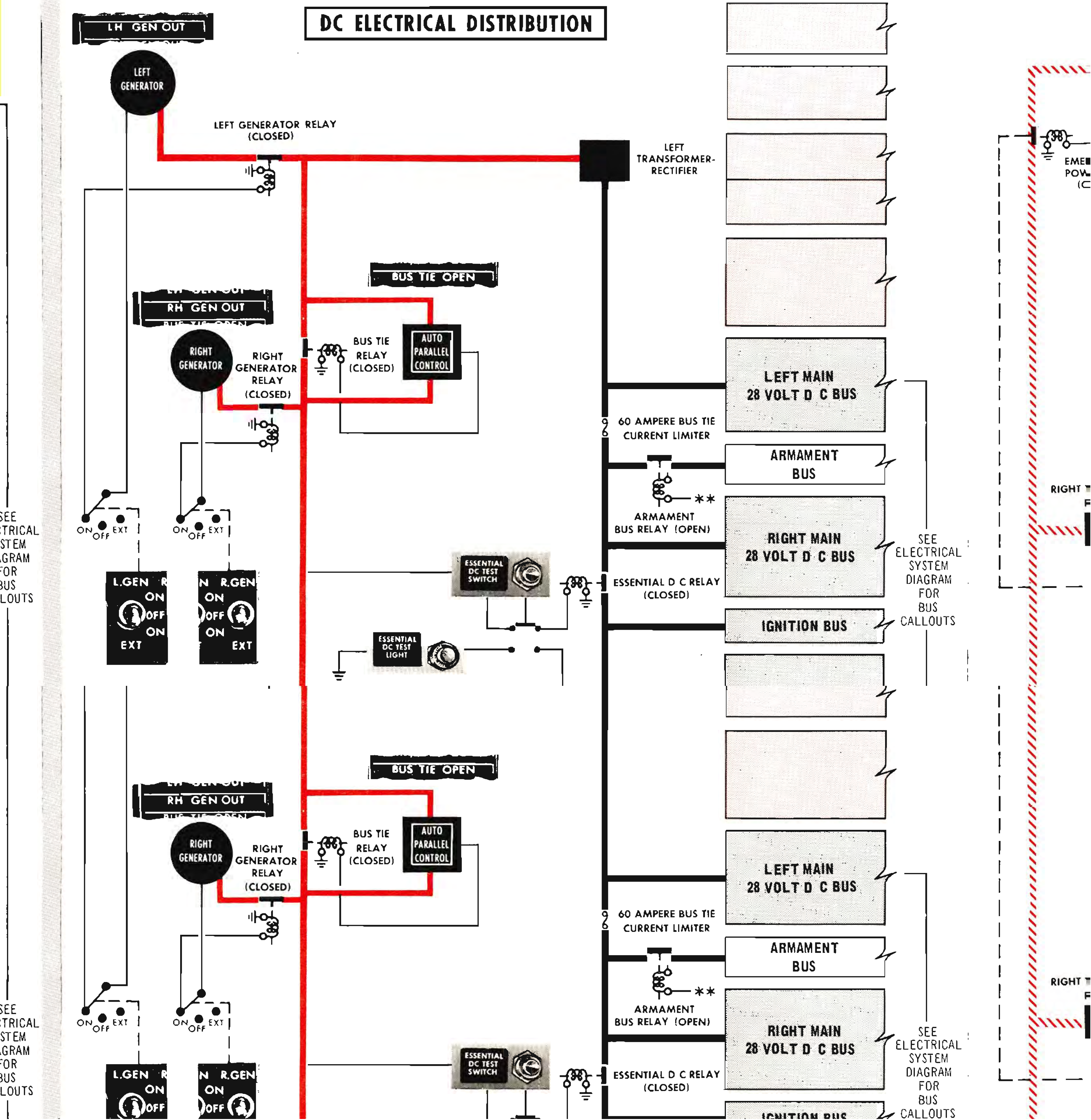
Figure FO-4

AC ELECTRICAL DISTRIBUTION

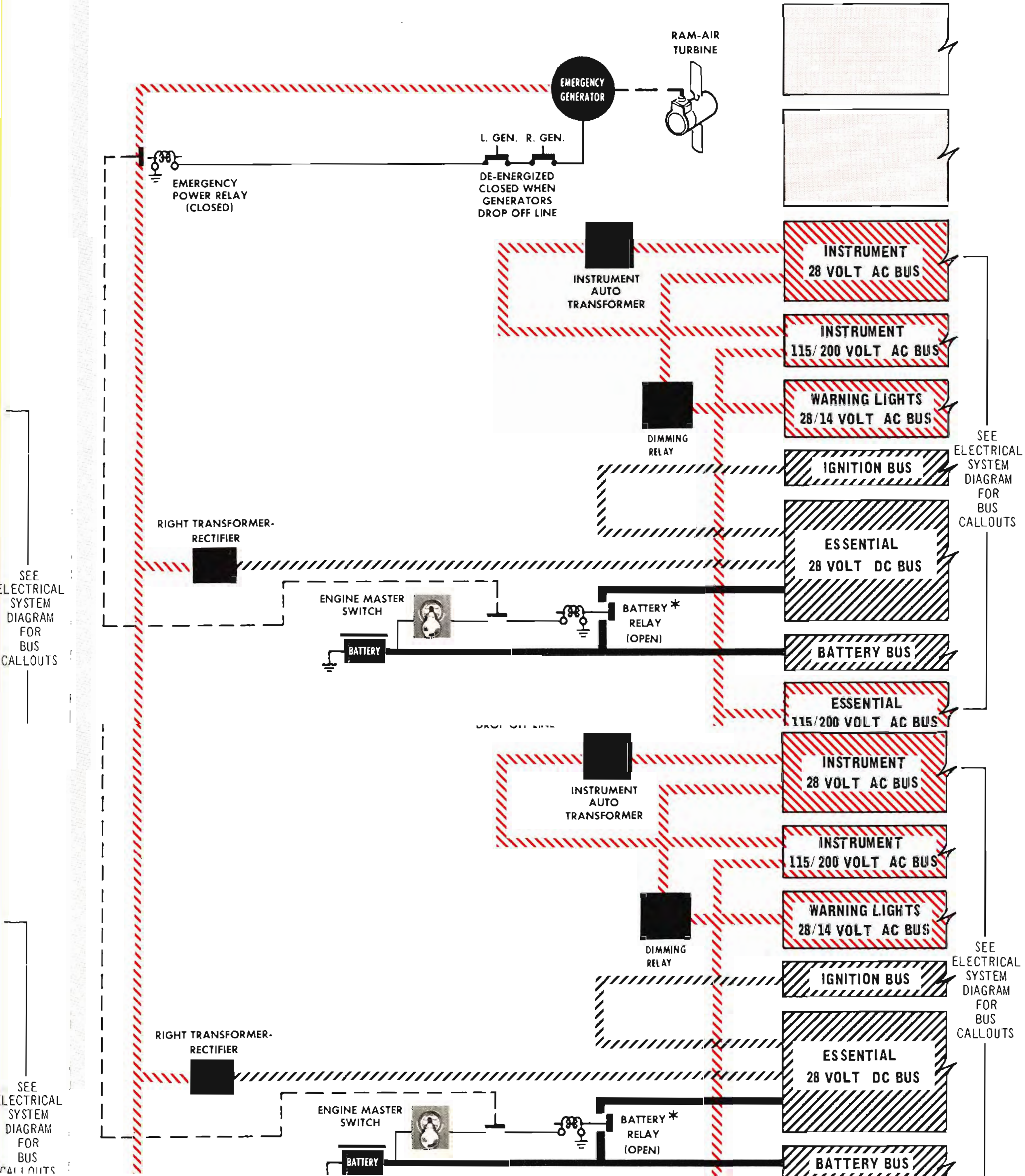


AC, DC AND EMERGENCY ELECTRICAL DISTRIBUTION F-4CD

DC ELECTRICAL DISTRIBUTION

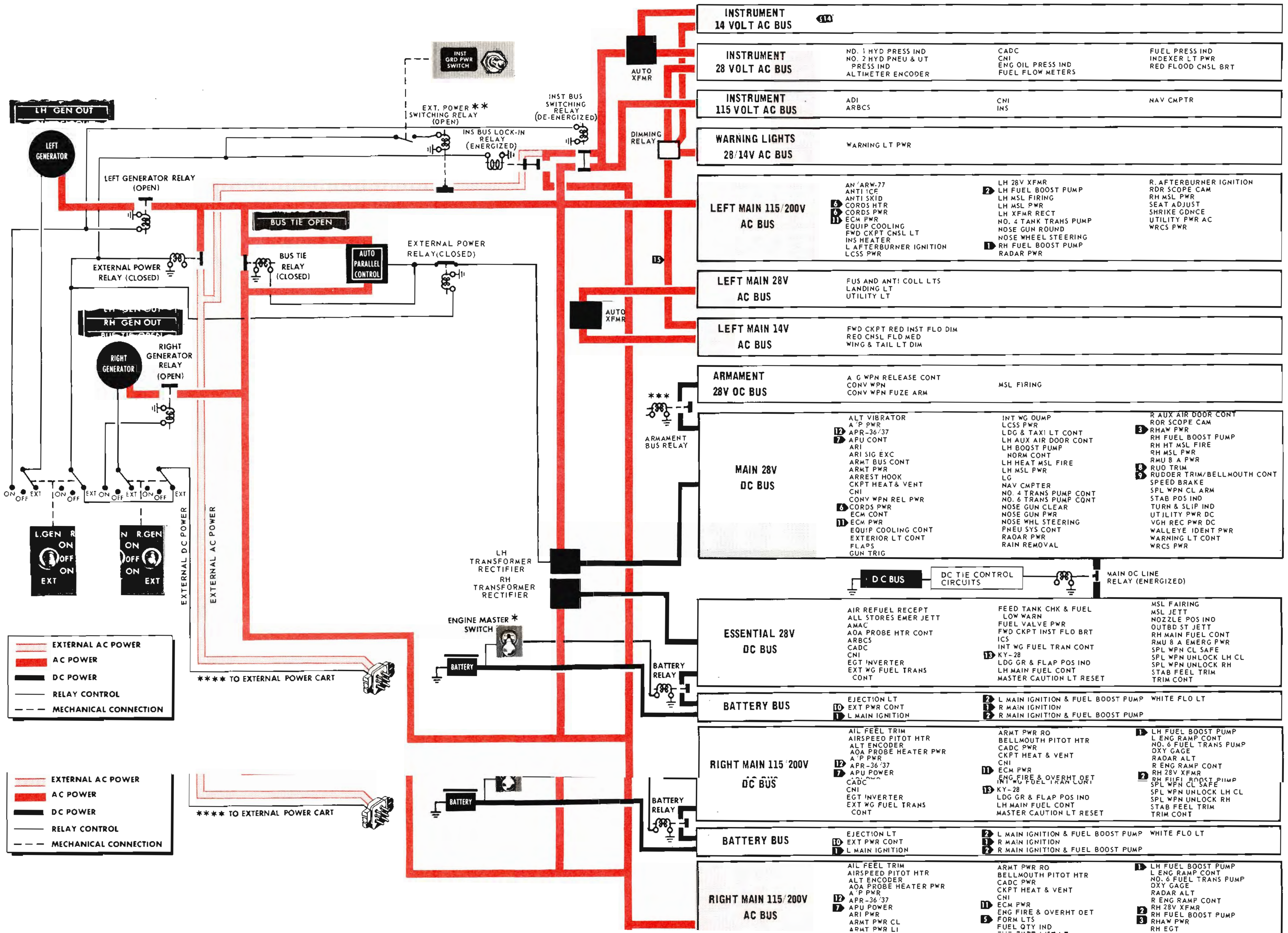


EMERGENCY ELECTRICAL DISTRIBUTION



ELECTRICAL SYSTEM F-4E

EXTERNAL POWER APPLIED



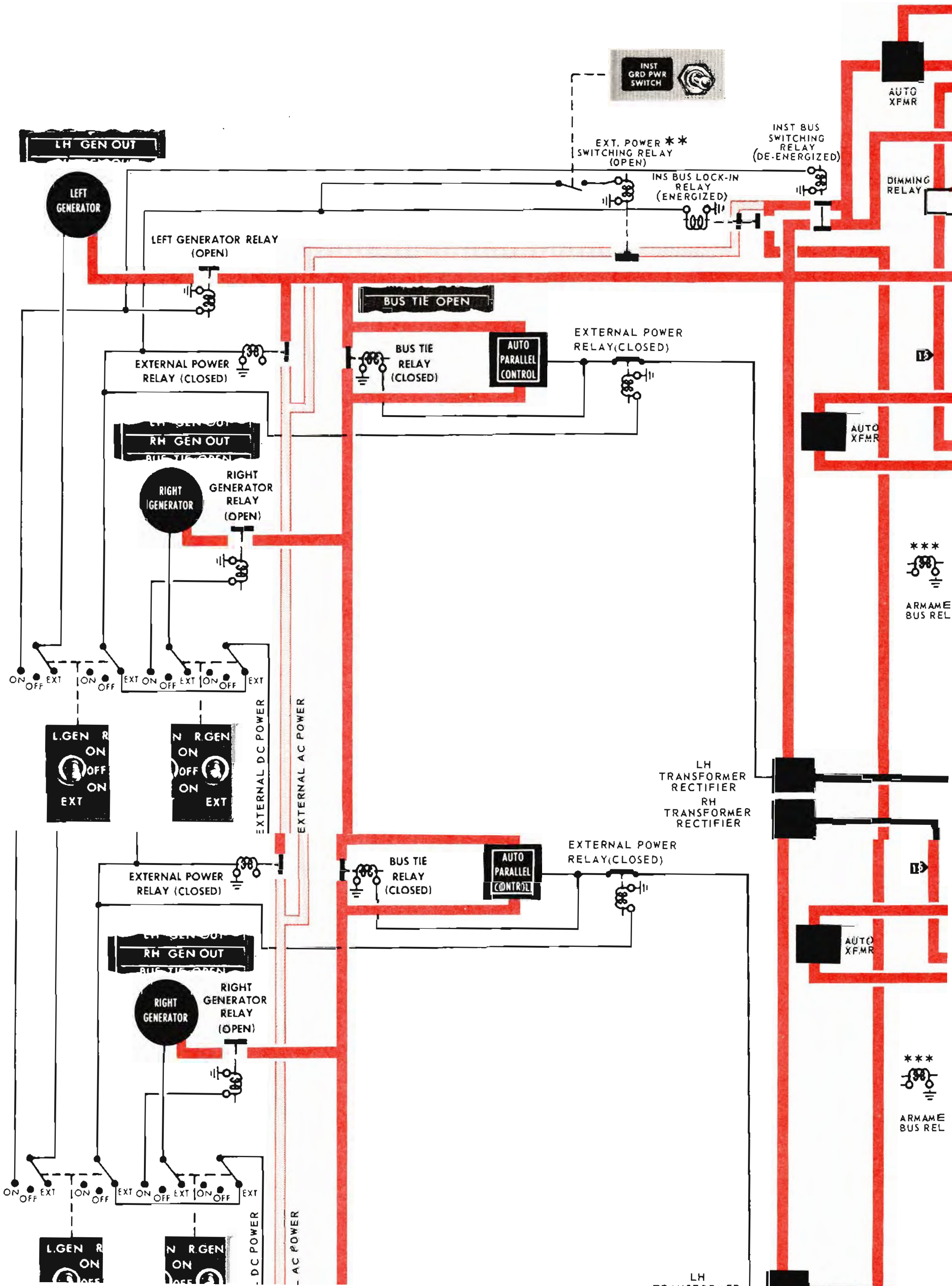
* BATTERY RELAY IS ENERGIZED WHEN EITHER ENGINE MASTER SWITCH IS ON, OR WHEN THE GROUND REFUELING CONTROL SWITCH IS IN THE REFUEL OR DEFUEL POSITION.

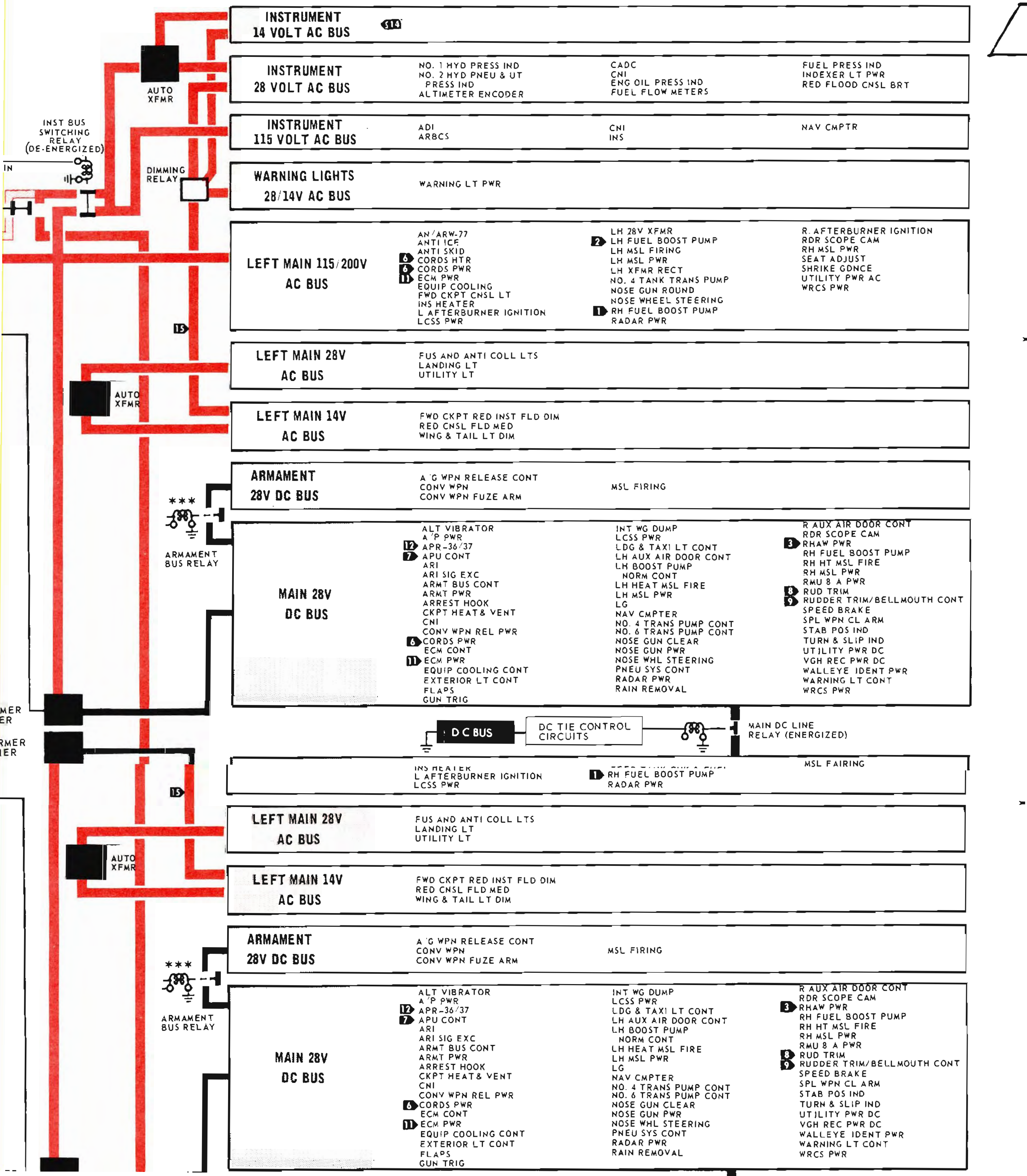
** WITH EXTERNAL POWER APPLIED (NO GENERATORS OPERATING), AND THE INSTRUMENT GROUND POWER SWITCH ACTUATED, THE INSTRUMENT BUSES WILL REMAIN ENERGIZED EVEN IF A GENERATOR CONTROL SWITCH(ES) IS PLACED OUT OF THE EXT POSITION (ALL MAJOR BUSES DE-ENERGIZED). THIS IS DUE TO HOLDING CIRCUITRY (NOT SHOWN) FOR THE EXTERNAL POWER SWITCHING RELAY AND THE INSTRUMENT BUS LOCK-IN RELAY. THE INSTRUMENT BUSES THEN CAN BE DE-ENERGIZED BY PLACING THE INSTRUMENT GROUND POWER SWITCH TO THE DE-ENERGIZED POSITION.

*** ARMAMENT RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.

**** BLK 39 AND UP, DC CONTROL POWER FOR EXTERNAL POWER PROVIDED BY BATTERY BUS.

1 AIRCRAFT BLK 31 THRU 40
2 AIRCRAFT BLK 41 AND UP
3 AIRCRAFT BLK 33 66-368 THRU BLK 41
4 AIRCRAFT BLK 34 AND UP
5 AIRCRAFT BLK 38 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-776
6 AIRCRAFT BLK 31 THRU 38
7 AIRCRAFT BLK 40 AND UP
8 AIRCRAFT BLK 31 THRU 34 BEFORE T.O. 1F-4E-517
9 AIRCRAFT BLK 35 AND UP, AND ALL OTHERS AFTER T.O. 1F-4E-517
10 AIRCRAFT BLK 39 AND UP
11 AIRCRAFT AFTER T.O. 1F-4E-531
12 AIRCRAFT BLK 42 AND UP, AND 67-342 THRU 68-538 AFTER T.O. 1F-4E-518
13 AIRCRAFT AFTER T.O. 1F-4E-532
14 AIRCRAFT BLK 44 AND UP
15 AIRCRAFT BLK 31 THRU 43


INST GRD PWR SWITCH
AUTO XFMR
LH GEN OUT
EXT. POWER ** SWITCHING RELAY (OPEN)
INST BUS SWITCHING RELAY (DE-ENERGIZED)
INS BUS LOCK-IN RELAY (ENERGIZED)
DIMMING RELAY
LEFT GENERATOR
LEFT GENERATOR RELAY (OPEN)
BUS TIE OPEN
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
EXTERNAL POWER RELAY (CLOSED)
EXTERNAL POWER RELAY (CLOSED)
RH GEN OUT
RIGHT GENERATOR
RIGHT GENERATOR RELAY (OPEN)
AUTO XFMR
***
ARMAME BUS REL
ON OFF EXT ON OFF EXT ON OFF EXT ON OFF EXT
L.GEN ON OFF ON EXT
R.GEN ON OFF ON EXT
EXTERNAL DC POWER
EXTERNAL AC POWER
LH TRANSFORMER RECTIFIER
RH TRANSFORMER RECTIFIER
EXTERNAL POWER RELAY(CLOSED)
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
EXTERNAL POWER RELAY (CLOSED)
RH GEN OUT
RIGHT GENERATOR
RIGHT GENERATOR RELAY (OPEN)
AUTO XFMR
***
ARMAME BUS REL
ON OFF EXT ON OFF EXT ON OFF EXT ON OFF EXT
L.GEN ON
R.GEN ON
DC POWER
AC POWER
LH



INSTRUMENT 14 VOLT AC BUS
S14
INSTRUMENT 28 VOLT AC BUS
NO. 1 HYD PRESS IND
NO. 2 HYD PNEU & UT PRESS IND
ALTIMETER ENCODER
CADC
CNI
ENG OIL PRESS IND
FUEL FLOW METERS
FUEL PRESS IND
INDEXER LT PWR
RED FLOOD CNSL BRT
AUTO XFMR
INST BUS SWITCHING RELAY (DE-ENERGIZED)
INSTRUMENT 115 VOLT AC BUS
ADI
ARBCS
CNI
INS
NAV CMPTR
DIMMING RELAY
WARNING LIGHTS 28/14V AC BUS
WARNING LT PWR
LEFT MAIN 115/200V AC BUS
AN/ARW-77
ANTI ICE
ANTI SKID
6 CORDS HTR
6 CORDS PWR
11 ECM PWR
EQUIP COOLING
FWD CKPT CNSL LT
INS HEATER
L AFTERBURNER IGNITION
LCSS PWR
LH 28V XFMR
2 LH FUEL BOOST PUMP
LH MSL FIRING
LH MSL PWR
LH XFMR RECT
NO. 4 TANK TRANS PUMP
NOSE GUN ROUND
NOSE WHEEL STEERING
1 RH FUEL BOOST PUMP
RADAR PWR
R. AFTERBURNER IGNITION
RDR SCOPE CAM
RH MSL PWR
SEAT ADJUST
SHRIKE GDNCE
UTILITY PWR AC
WRCS PWR
15
LEFT MAIN 28V AC BUS
FUS AND ANTI COLL LTS
LANDING LT
UTILITY LT
AUTO XFMR
LEFT MAIN 14V AC BUS
FWD CKPT RED INST FLD DIM
RED CNSL FLD MED
WING & TAIL LT DIM
ARMAMENT 28V DC BUS
A/G WPN RELEASE CONT
CONV WPN
CONV WPN FUZE ARM
MSL FIRING
***
ARMAMENT BUS RELAY
MAIN 28V DC BUS
ALT VIBRATOR
A/P PWR
12 APR-36/37
7 APU CONT
ARI
ARI SIG EXC
ARMT BUS CONT
ARMT PWR
ARREST HOOK
CKPT HEAT & VENT
CNI
CONV WPN REL PWR
6 CORDS PWR
ECM CONT
11 ECM PWR
EQUIP COOLING CONT
EXTERIOR LT CONT
FLAPS
GUN TRIG
INT WG DUMP
LCSS PWR
LDG & TAXI LT CONT
LH AUX AIR DOOR CONT
LH BOOST PUMP NORM CONT
LH HEAT MSL FIRE
LH MSL PWR
LG
NAV CMPTER
NO. 4 TRANS PUMP CONT
NO. 6 TRANS PUMP CONT
NOSE GUN CLEAR
NOSE GUN PWR
NOSE WHL STEERING
PNEU SYS CONT
RADAR PWR
RAIN REMOVAL
R AUX AIR DOOR CONT
RDR SCOPE CAM
3 RHAW PWR
RH FUEL BOOST PUMP
RH HT MSL FIRE
RH MSL PWR
RMU 8 A PWR
8 RUD TRIM
9 RUDDER TRIM/BELLMOUTH CONT
SPEED BRAKE
SPL WPN CL ARM
STAB POS IND
TURN & SLIP IND
UTILITY PWR DC
VGH REC PWR DC
WALLEYE IDENT PWR
WARNING LT CONT
WRCS PWR
DC BUS
DC TIE CONTROL CIRCUITS
MAIN DC LINE RELAY (ENERGIZED)

ELECTRICAL SYSTEM F-4E

EXTERNAL POWER APPLIED

CADC
CNI
ENG OIL PRESS IND
FUEL FLOW METERS
FUEL PRESS IND
INDEXER LT PWR
RED FLOOD CNSL BRT

CNI
INS
NAV CMPTR

LH 28V XFMR
2 LH FUEL BOOST PUMP
LH MSL FIRING
LH MSL PWR
LH XFMR RECT
NO. 4 TANK TRANS PUMP
NOSE GUN ROUND
NOSE WHEEL STEERING
1 RH FUEL BOOST PUMP
RADAR PWR
R. AFTERBURNER IGNITION
RDR SCOPE CAM
RH MSL PWR
SEAT ADJUST
SHRIKE GDNCE
UTILITY PWR AC
WRCS PWR

MSL FIRING

INT WG DUMP
LCSS PWR
LDG & TAXI LT CONT
LH AUX AIR DOOR CONT
LH BOOST PUMP
NORM CONT
LH HEAT MSL FIRE
LH MSL PWR
LG
NAV CMPTER
NO. 4 TRANS PUMP CONT
NO. 6 TRANS PUMP CONT
NOSE GUN CLEAR
NOSE GUN PWR
NOSE WHL STEERING
PNEU SYS CONT
RADAR PWR
RAIN REMOVAL
R AUX AIR DOOR CONT
RDR SCOPE CAM
3 RHAW PWR
RH FUEL BOOST PUMP
RH HT MSL FIRE
RH MSL PWR
RMU 8-A PWR
8 RUD TRIM
9 RUDDER TRIM/BELLMOUTH CONT
SPEED BRAKE
SPL WPN CL ARM
STAB POS IND
TURN & SLIP IND
UTILITY PWR DC
VGH REC PWR DC
WALLEYE IDENT PWR
WARNING LT CONT
WRCS PWR

CONTROL
S
MAIN DC LINE
RELAY (ENERGIZED)

* BATTERY RELAY IS ENERGIZED WHEN EITHER ENGINE MASTER SWITCH IS ON, OR WHEN THE GROUND REFUELING CONTROL SWITCH IS IN THE REFUEL OR DEFUEL POSITION.

** WITH EXTERNAL POWER APPLIED (NO GENERATORS OPERATING), AND THE INSTRUMENT GROUND POWER SWITCH ACTUATED, THE INSTRUMENT BUSES WILL REMAIN ENERGIZED EVEN IF A GENERATOR CONTROL SWITCH(ES) IS PLACED OUT OF THE EXT POSITION (ALL MAJOR BUSES DE-ENERGIZED). THIS IS DUE TO HOLDING CIRCUITRY (NOT SHOWN) FOR THE EXTERNAL POWER SWITCHING RELAY AND THE INSTRUMENT BUS LOCK-IN RELAY. THE INSTRUMENT BUSES THEN CAN BE DE-ENERGIZED BY PLACING THE INSTRUMENT GROUND POWER SWITCH TO THE DE-ENERGIZED POSITION.

*** ARMAMENT RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.

**** BLK 39 AND UP, DC CONTROL POWER FOR EXTERNAL POWER PROVIDED BY BATTERY BUS.

1 AIRCRAFT BLK 31 THRU 40
2 AIRCRAFT BLK 41 AND UP
3 AIRCRAFT BLK 33 66-368 THRU BLK 41
4 AIRCRAFT BLK 34 AND UP
5 AIRCRAFT BLK 38 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-776
6 AIRCRAFT BLK 31 THRU 38
7 AIRCRAFT BLK 40 AND UP
8 AIRCRAFT BLK 31 THRU 34 BEFORE T.O. 1F-4E-517
9 AIRCRAFT BLK 35 AND UP, AND ALL OTHERS AFTER T.O. 1F-4E-517
10 AIRCRAFT BLK 39 AND UP
11 AIRCRAFT AFTER T.O. 1F-4E-531
12 AIRCRAFT BLK 42 AND UP, AND 67-342 THRU 68-538 AFTER T.O. 1F-4E-518
13 AIRCRAFT AFTER T.O. 1F-4E-532
14 AIRCRAFT BLK 44 AND UP
15 AIRCRAFT BLK 31 THRU 43

MSL FAIRING
1 RH FUEL BOOST PUMP
RADAR PWR

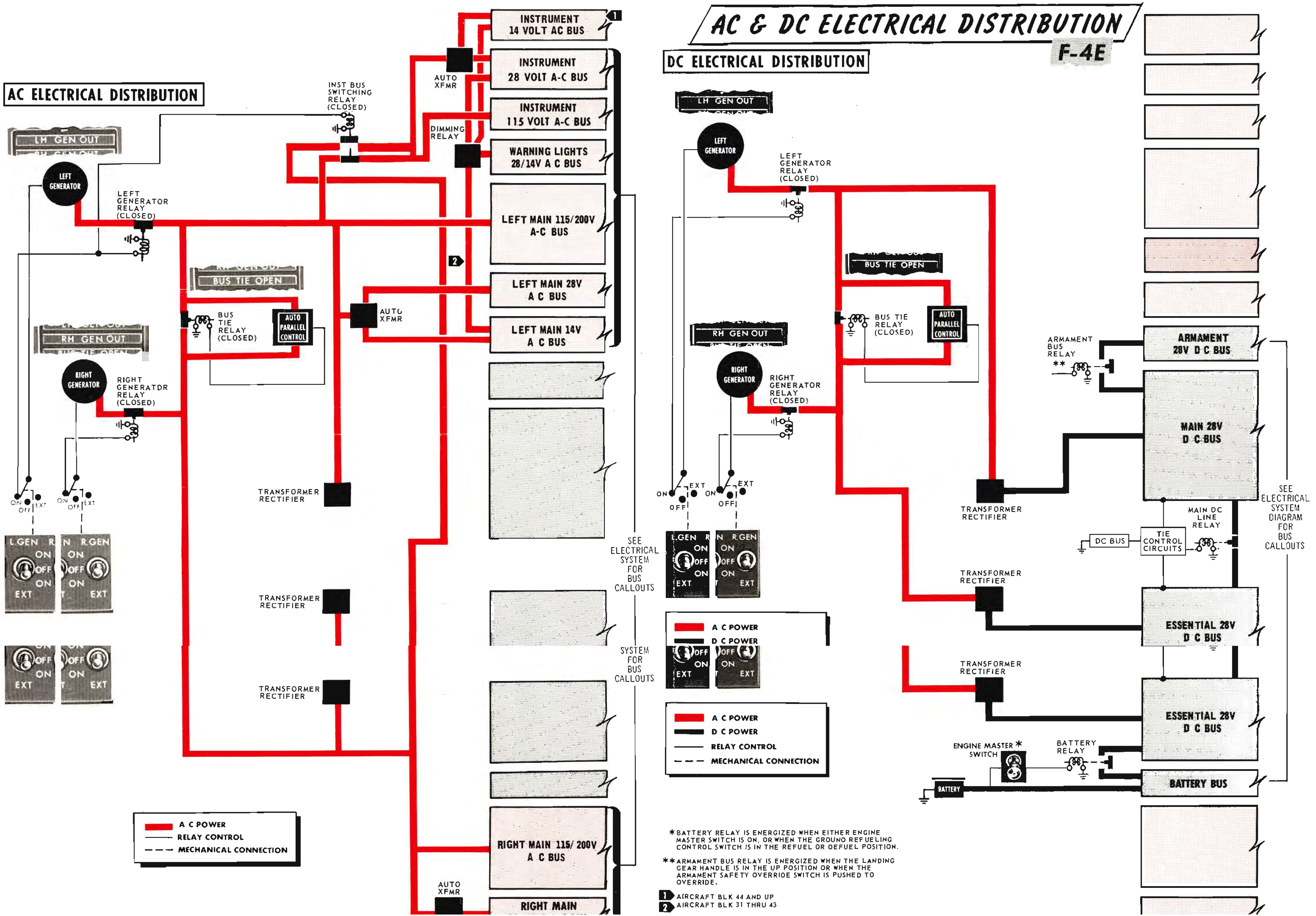
GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.

**** BLK 39 AND UP, DC CONTROL POWER FOR EXTERNAL POWER PROVIDED BY BATTERY BUS.

1 AIRCRAFT BLK 31 THRU 40
2 AIRCRAFT BLK 41 AND UP
3 AIRCRAFT BLK 33 66-368 THRU BLK 41
4 AIRCRAFT BLK 34 AND UP
5 AIRCRAFT BLK 38 AND UP, AND ALL OTHERS AFTER T.O. 1F-4-776
6 AIRCRAFT BLK 31 THRU 38
7 AIRCRAFT BLK 40 AND UP
8 AIRCRAFT BLK 31 THRU 34 BEFORE T.O. 1F-4E-517
9 AIRCRAFT BLK 35 AND UP, AND ALL OTHERS AFTER T.O. 1F-4E-517
10 AIRCRAFT BLK 39 AND UP
11 AIRCRAFT AFTER T.O. 1F-4E-531
12 AIRCRAFT BLK 42 AND UP, AND 67-342 THRU 68-538 AFTER T.O. 1F-4E-518
13 AIRCRAFT AFTER T.O. 1F-4E-532
14 AIRCRAFT BLK 44 AND UP
15 AIRCRAFT BLK 31 THRU 43

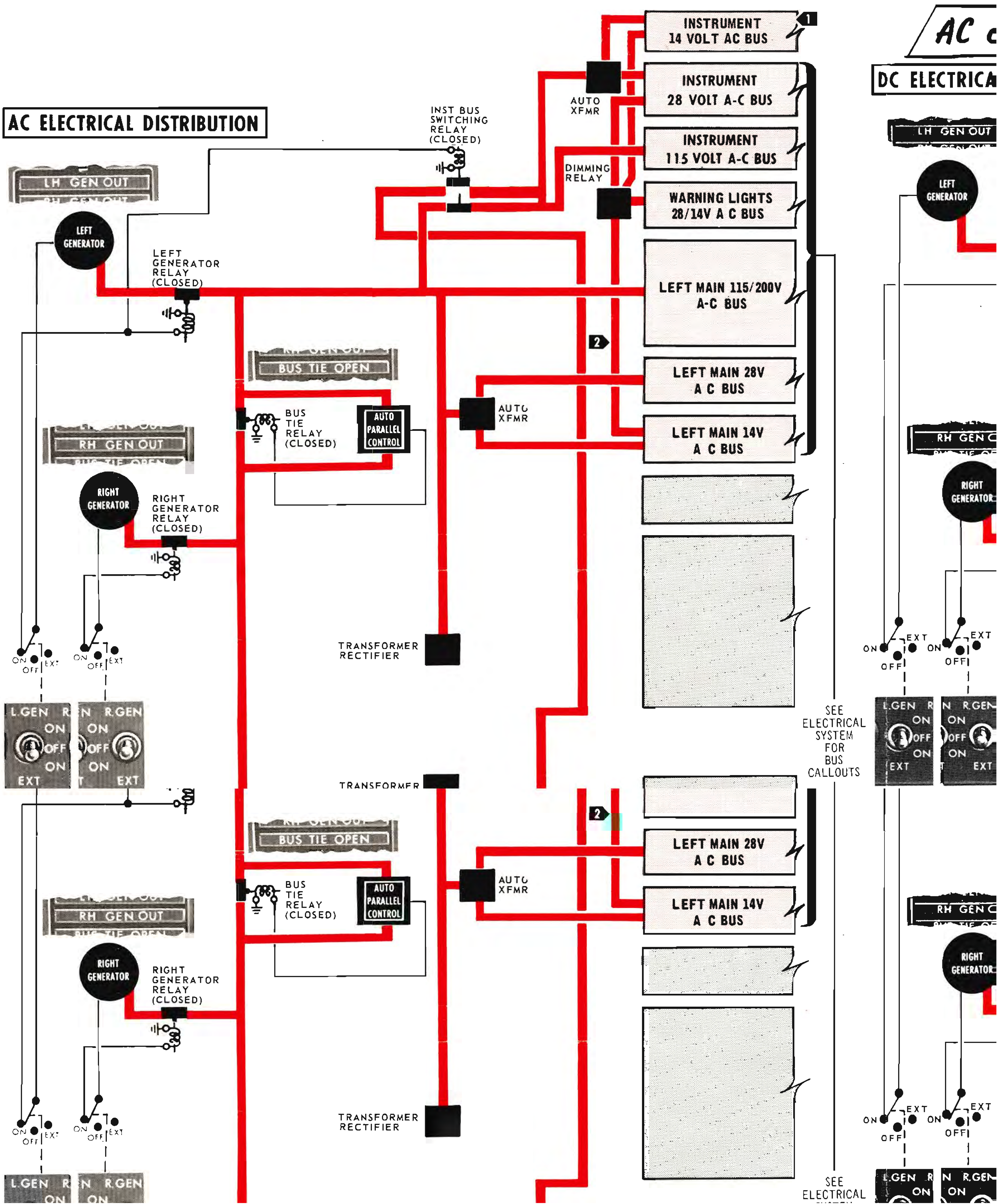
MSL FIRING

INT WG DUMP
LCSS PWR
LDG & TAXI LT CONT
LH AUX AIR DOOR CONT
LH BOOST PUMP
NORM CONT
LH HEAT MSL FIRE
LH MSL PWR
LG
NAV CMPTER
NO. 4 TRANS PUMP CONT
NO. 6 TRANS PUMP CONT
NOSE GUN CLEAR
NOSE GUN PWR
NOSE WHL STEERING
PNEU SYS CONT
RADAR PWR
RAIN REMOVAL
R AUX AIR DOOR CONT
RDR SCOPE CAM
3 RHAW PWR
RH FUEL BOOST PUMP
RH HT MSL FIRE
RH MSL PWR
RMU 8-A PWR
8 RUD TRIM
9 RUDDER TRIM/BELLMOUTH CONT
SPEED BRAKE
SPL WPN CL ARM
STAB POS IND
TURN & SLIP IND
UTILITY PWR DC
VGH REC PWR DC
WALLEYE IDENT PWR
WARNING LT CONT
WRCS PWR



AC & DC ELECTRICAL DISTRIBUTION
F-4E
AC ELECTRICAL DISTRIBUTION
LH GEN OUT
LEFT GENERATOR
LEFT GENERATOR RELAY (CLOSED)
BUS TIE OPEN
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
RH GEN OUT
RIGHT GENERATOR
RIGHT GENERATOR RELAY (CLOSED)
ON OFF EXT
L GEN
R GEN
ON
OFF
ON
EXT
INST BUS SWITCHING RELAY (CLOSED)
AUTO XFMR
DIMMING RELAY
INSTRUMENT 14 VOLT AC BUS
INSTRUMENT 28 VOLT A-C BUS
INSTRUMENT 115 VOLT A-C BUS
WARNING LIGHTS 28/14V A C BUS
LEFT MAIN 115/200V A-C BUS
LEFT MAIN 28V A C BUS
LEFT MAIN 14V A C BUS
TRANSFORMER RECTIFIER
SEE ELECTRICAL SYSTEM FOR BUS CALLOUTS
RIGHT MAIN 115/200V A C BUS
RIGHT MAIN
A C POWER
RELAY CONTROL
MECHANICAL CONNECTION
DC ELECTRICAL DISTRIBUTION
LH GEN OUT
LEFT GENERATOR
LEFT GENERATOR RELAY (CLOSED)
BUS TIE OPEN
BUS TIE RELAY (CLOSED)
AUTO PARALLEL CONTROL
RH GEN OUT
RIGHT GENERATOR
RIGHT GENERATOR RELAY (CLOSED)
ON OFF EXT
A C POWER
D C POWER
RELAY CONTROL
MECHANICAL CONNECTION
ARMAMENT BUS RELAY
**
ARMAMENT 28V D C BUS
MAIN 28V D C BUS
TRANSFORMER RECTIFIER
MAIN DC LINE RELAY
DC BUS
TIE CONTROL CIRCUITS
SEE ELECTRICAL SYSTEM DIAGRAM FOR BUS CALLOUTS
ESSENTIAL 28V D C BUS
ENGINE MASTER SWITCH *
BATTERY RELAY
BATTERY
BATTERY BUS
*BATTERY RELAY IS ENERGIZED WHEN EITHER ENGINE MASTER SWITCH IS ON, OR WHEN THE GROUND REFUELING CONTROL SWITCH IS IN THE REFUEL OR DEFUEL POSITION.
**ARMAMENT BUS RELAY IS ENERGIZED WHEN THE LANDING GEAR HANDLE IS IN THE UP POSITION OR WHEN THE ARMAMENT SAFETY OVERRIDE SWITCH IS PUSHED TO OVERRIDE.
1 AIRCRAFT BLK 44 AND UP
2 AIRCRAFT BLK 31 THRU 43

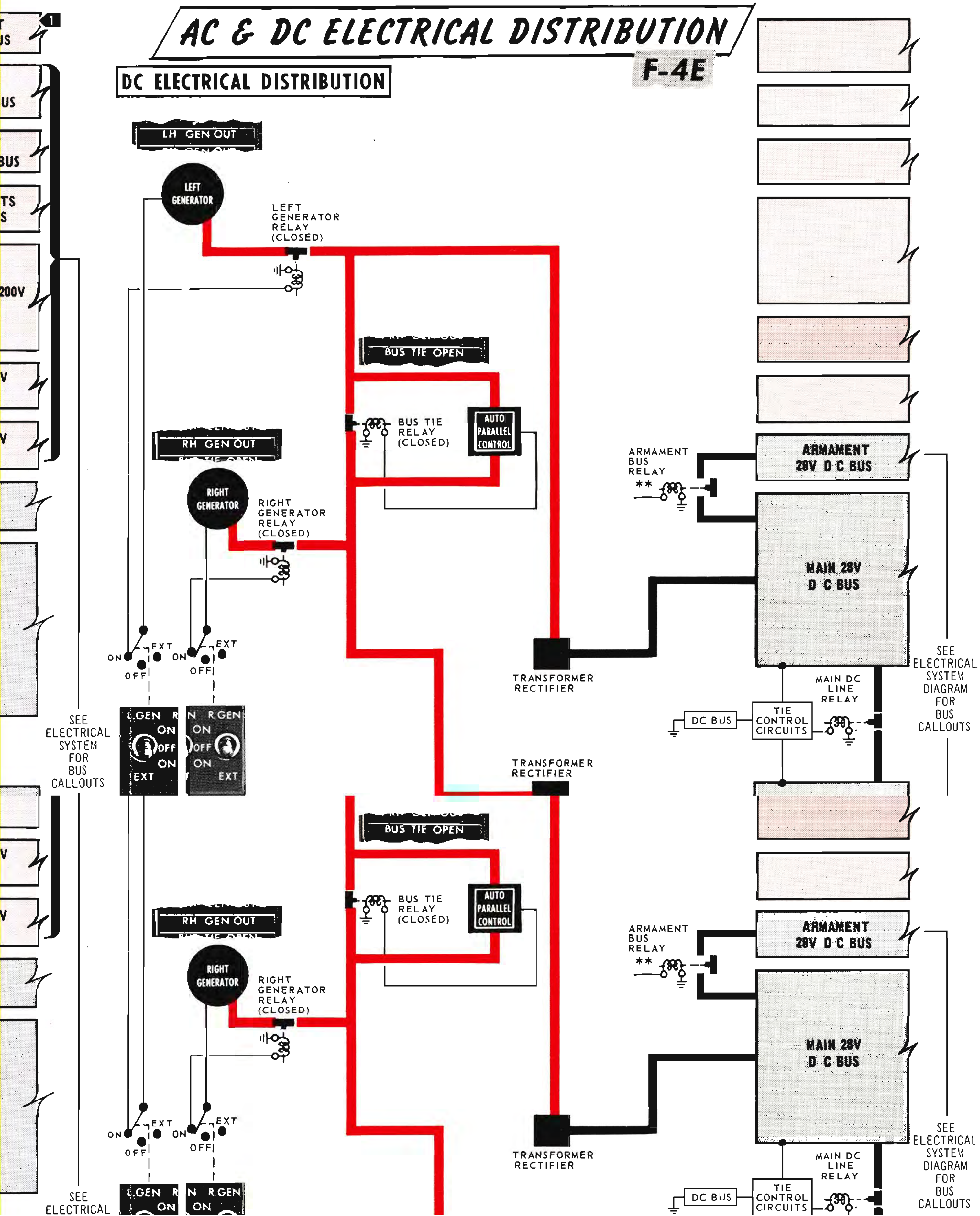
AC ELECTRICAL DISTRIBUTION



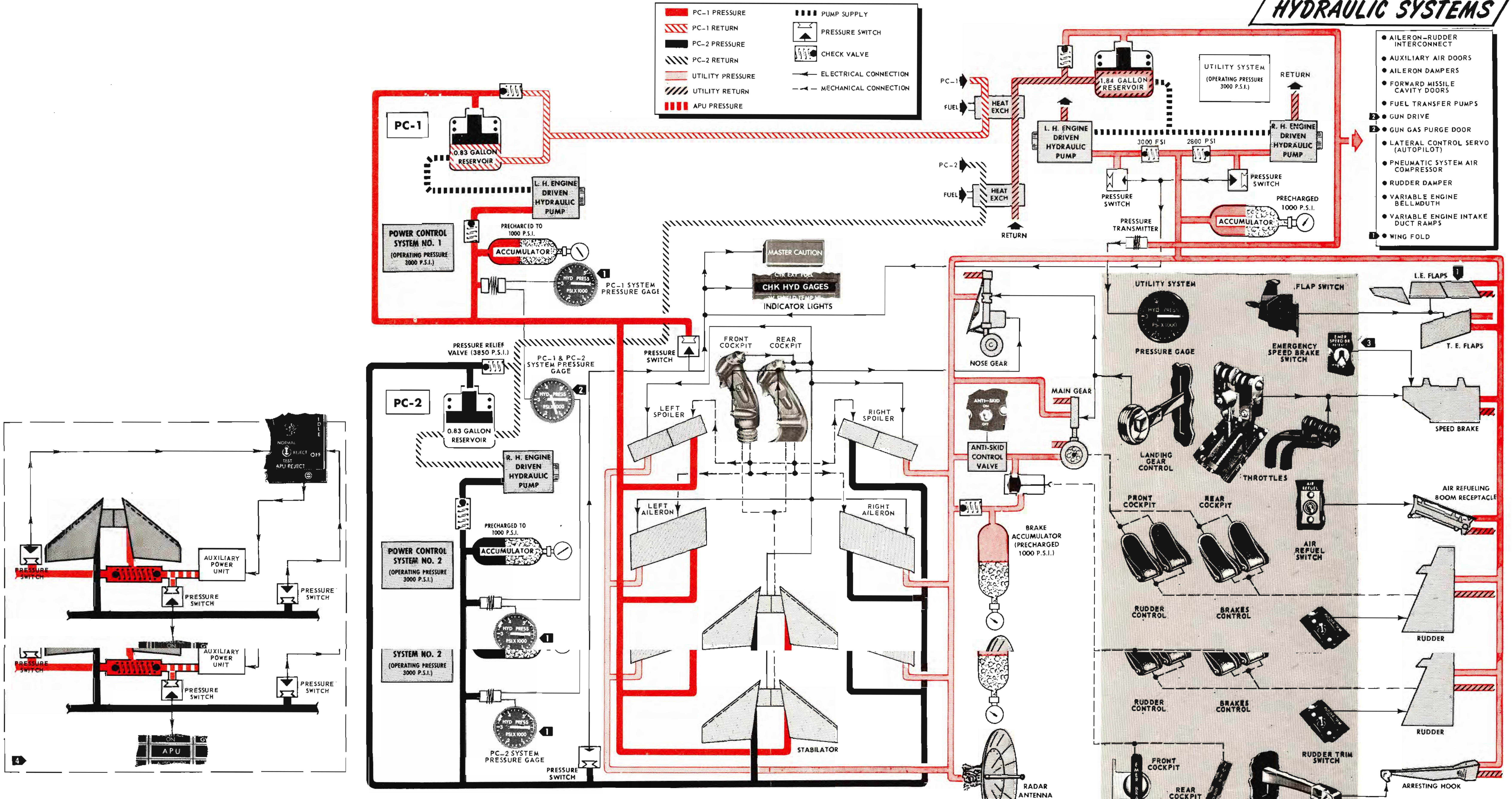
AC & DC ELECTRICAL DISTRIBUTION

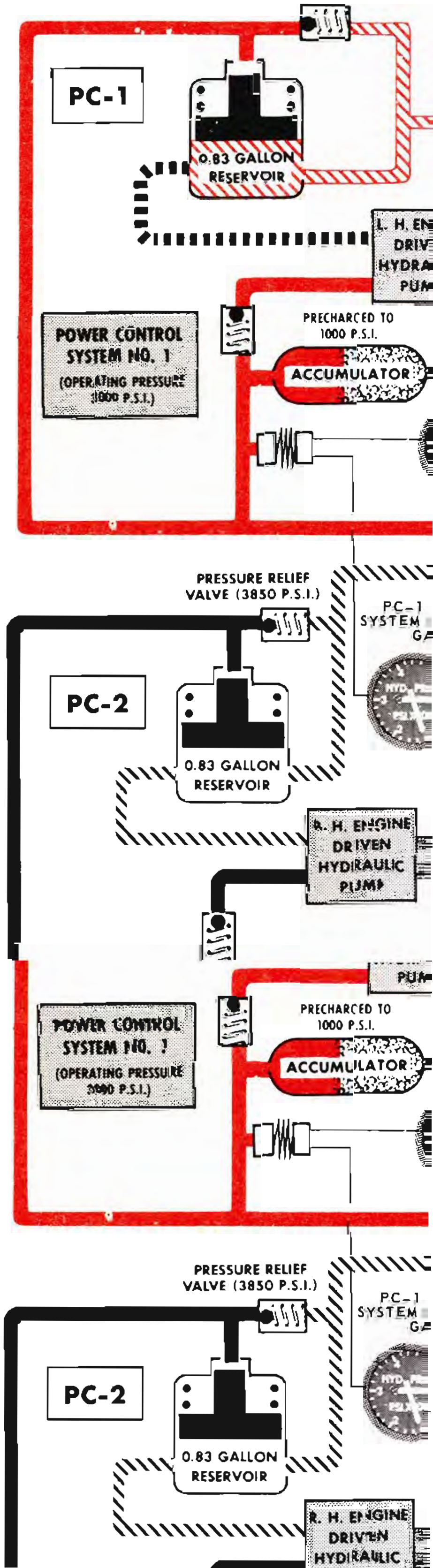
F-4E

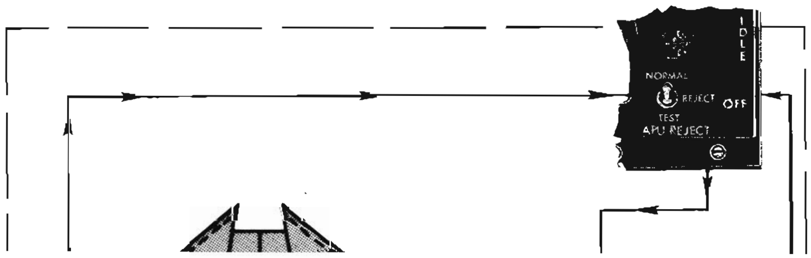
DC ELECTRICAL DISTRIBUTION

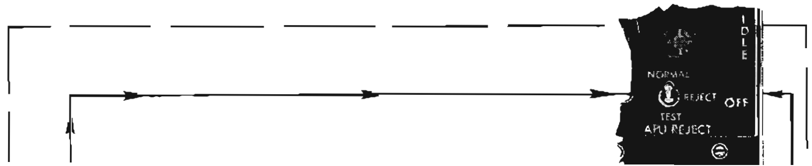


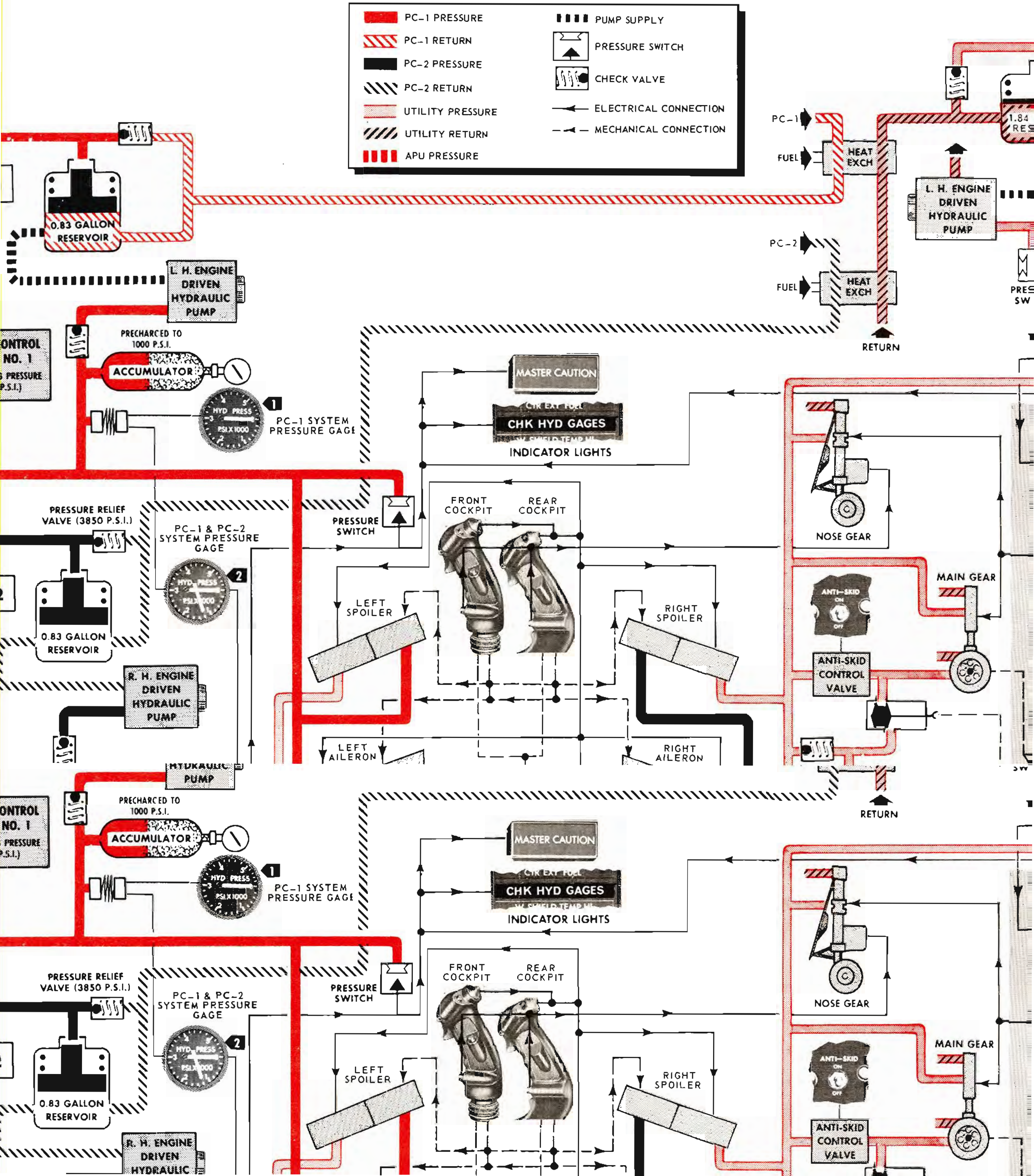
HYDRAULIC SYSTEMS



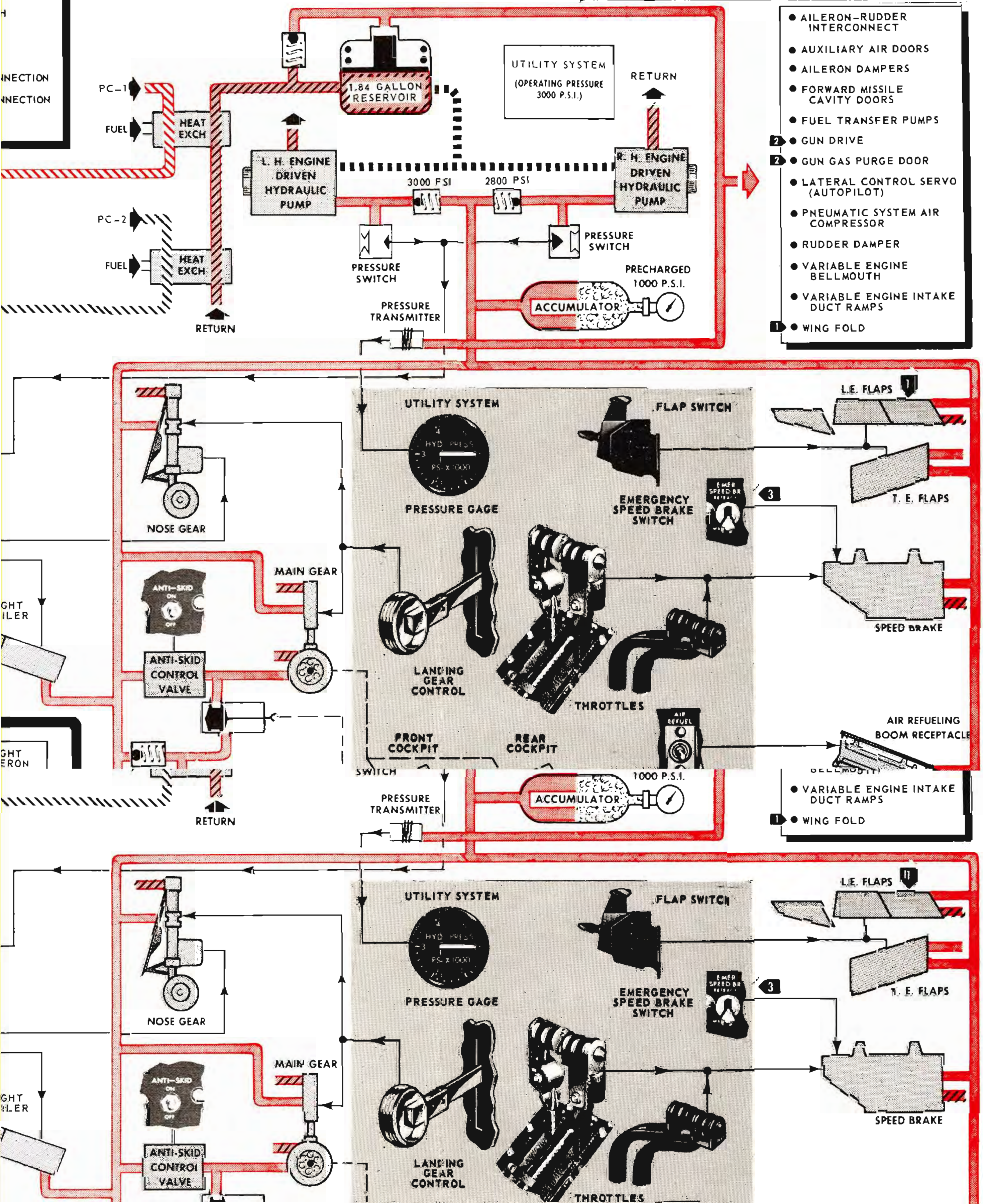

PC-1
0.83 GALLON
RESERVOIR
POWER CONTROL
SYSTEM NO. 1
PRECHARGED TO
1000 P.S.I.
ACCUMULATOR
PRESSURE RELIEF
VALVE (3850 P.S.I.)
PC-2
0.83 GALLON
RESERVOIR
R. H. ENGINE
DRIVEN
HYDRAULIC
PUMP
POWER CONTROL
SYSTEM NO. 1
PRECHARGED TO
1000 P.S.I.
ACCUMULATOR
PRESSURE RELIEF
VALVE (3850 P.S.I.)
PC-2
0.83 GALLON
RESERVOIR
R. H. ENGINE
DRIVEN
HYDRAULIC


IDLE
NORMAL
REJECT
OFF
TEST
APU REJECT


IDLE
NORMAL
REJECT
OFF
TEST
APU REJECT


PC-1 PRESSURE
PC-1 RETURN
PC-2 PRESSURE
PC-2 RETURN
UTILITY PRESSURE
UTILITY RETURN
APU PRESSURE
PUMP SUPPLY
PRESSURE SWITCH
CHECK VALVE
ELECTRICAL CONNECTION
MECHANICAL CONNECTION
0.83 GALLON RESERVOIR
L. H. ENGINE DRIVEN HYDRAULIC PUMP
PC-1
FUEL
HEAT EXCH
PC-2
RETURN
1.84
PRECHARGED TO 1000 P.S.I.
ACCUMULATOR
PC-1 SYSTEM PRESSURE GAGE
HYD PRESS
PSI X 1000
MASTER CAUTION
CHK HYD GAGES
INDICATOR LIGHTS
NOSE GEAR
MAIN GEAR
PRESSURE RELIEF VALVE (3850 P.S.I.)
PC-1 & PC-2 SYSTEM PRESSURE GAGE
PRESSURE SWITCH
FRONT COCKPIT
REAR COCKPIT
LEFT SPOILER
RIGHT SPOILER
ANTI-SKID
ON
OFF
ANTI-SKID CONTROL VALVE
R. H. ENGINE DRIVEN HYDRAULIC PUMP
LEFT AILERON
RIGHT AILERON

HYDRAULIC SYSTEMS



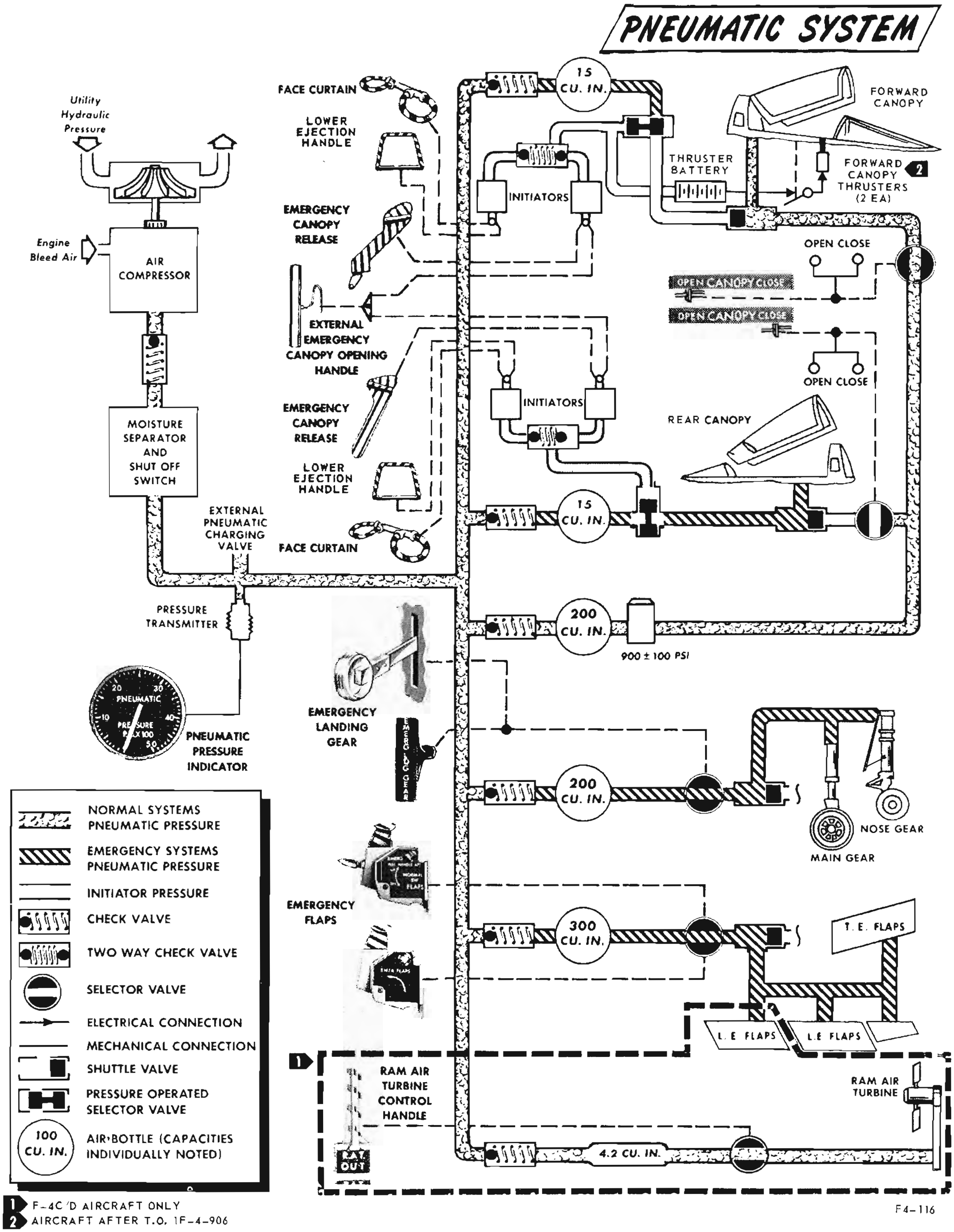
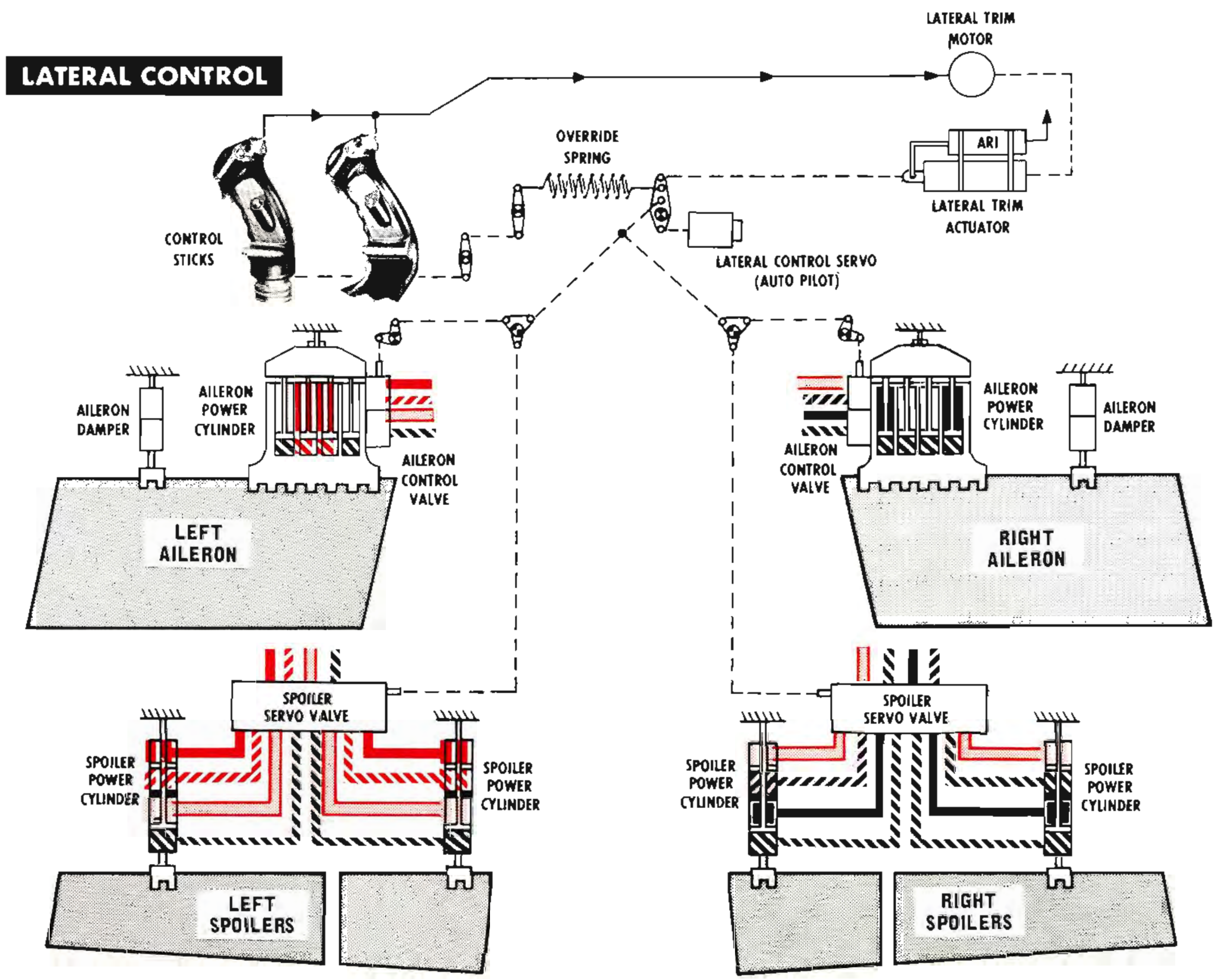

PNEUMATIC SYSTEM
Utility Hydraulic Pressure
Engine Bleed Air
AIR COMPRESSOR
MOISTURE SEPARATOR AND SHUT OFF SWITCH
EXTERNAL PNEUMATIC CHARGING VALVE
PRESSURE TRANSMITTER
PNEUMATIC PRESSURE INDICATOR
FACE CURTAIN
LOWER EJECTION HANDLE
EMERGENCY CANOPY RELEASE
EXTERNAL EMERGENCY CANOPY OPENING HANDLE
INITIATORS
15 CU. IN.
THRUSTER BATTERY
FORWARD CANOPY
FORWARD CANOPY THRUSTERS (2 EA)
OPEN CLOSE
OPEN CANOPY CLOSE
REAR CANOPY
200 CU. IN.
900 ± 100 PSI
EMERGENCY LANDING GEAR
NOSE GEAR
MAIN GEAR
EMERGENCY FLAPS
300 CU. IN.
T. E. FLAPS
L. E FLAPS
RAM AIR TURBINE CONTROL HANDLE
RAM AIR TURBINE
4.2 CU. IN.
NORMAL SYSTEMS PNEUMATIC PRESSURE
EMERGENCY SYSTEMS PNEUMATIC PRESSURE
INITIATOR PRESSURE
CHECK VALVE
TWO WAY CHECK VALVE
SELECTOR VALVE
ELECTRICAL CONNECTION
MECHANICAL CONNECTION
SHUTTLE VALVE
PRESSURE OPERATED SELECTOR VALVE
100 CU. IN. AIR BOTTLE (CAPACITIES INDIVIDUALLY NOTED)
1 F-4C/D AIRCRAFT ONLY
2 AIRCRAFT AFTER T.O. 1F-4-906
F4-116

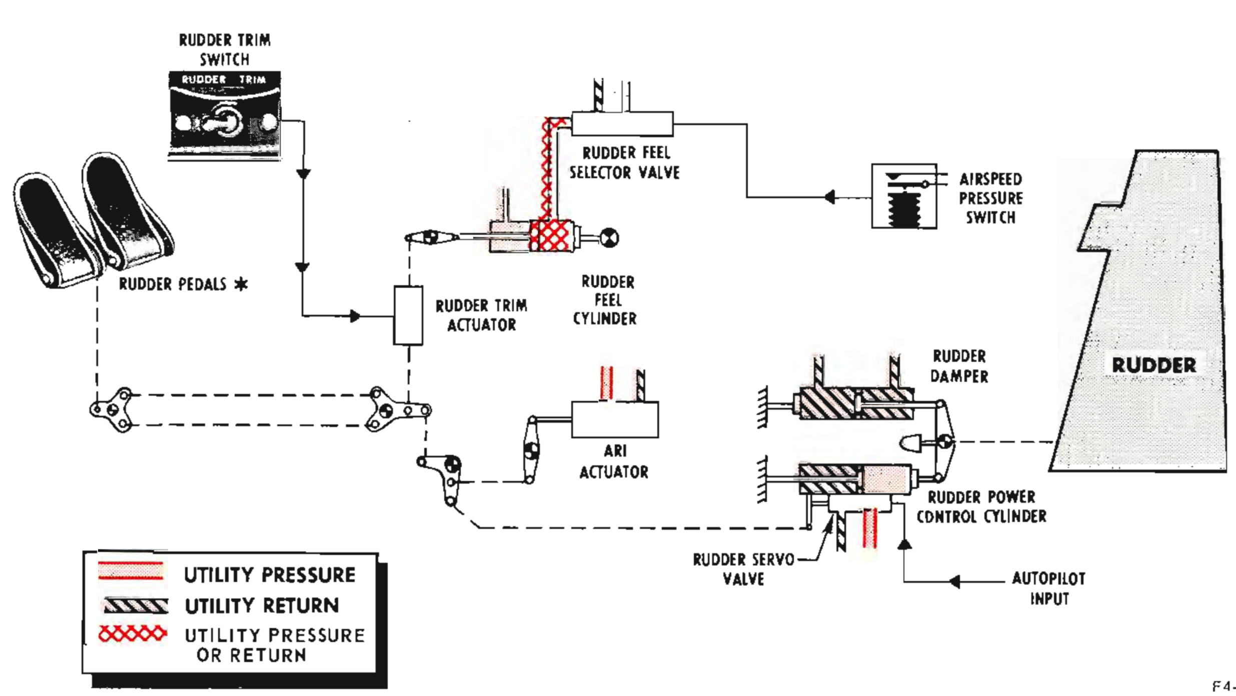
Figure FO-8

FLIGHT CONTROL SYSTEMS

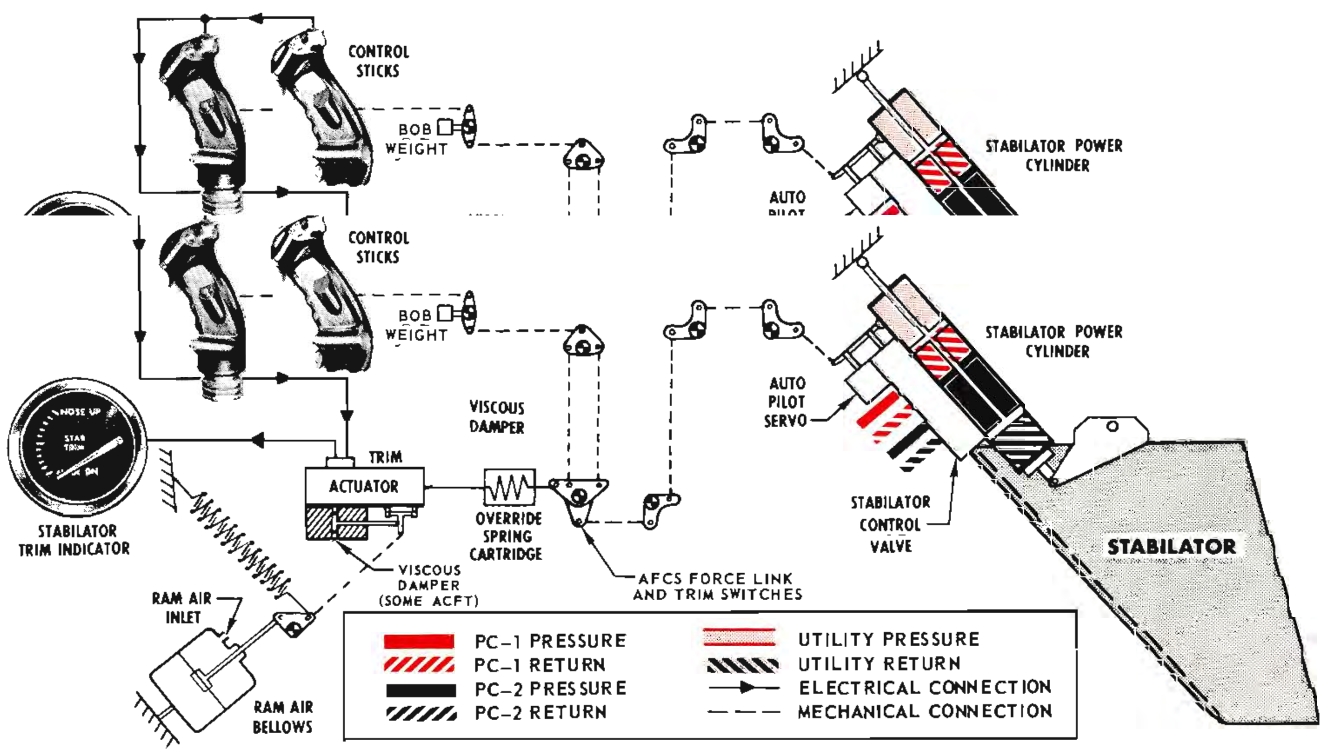
LATERAL CONTROL



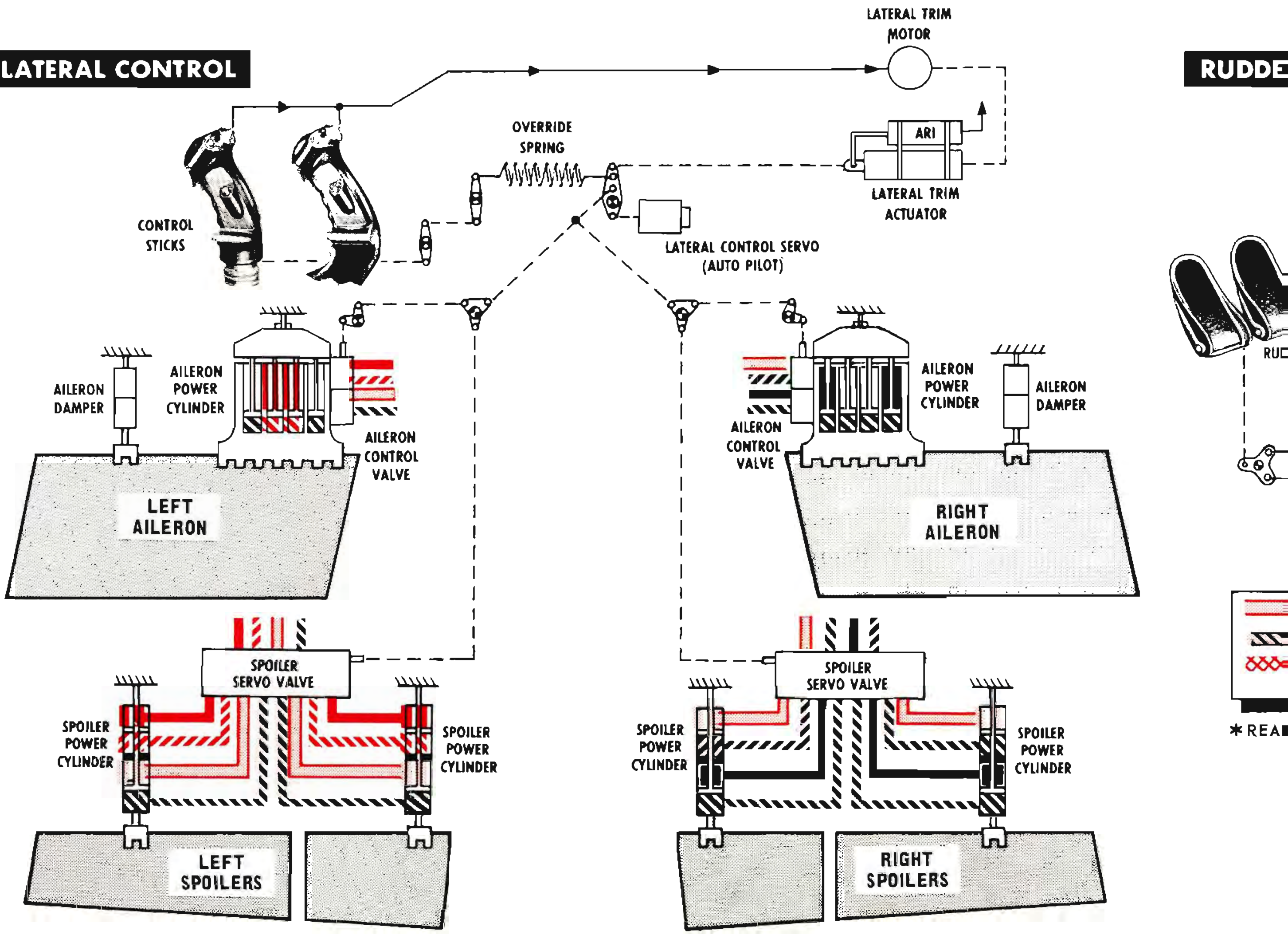
RUDDER CONTROL



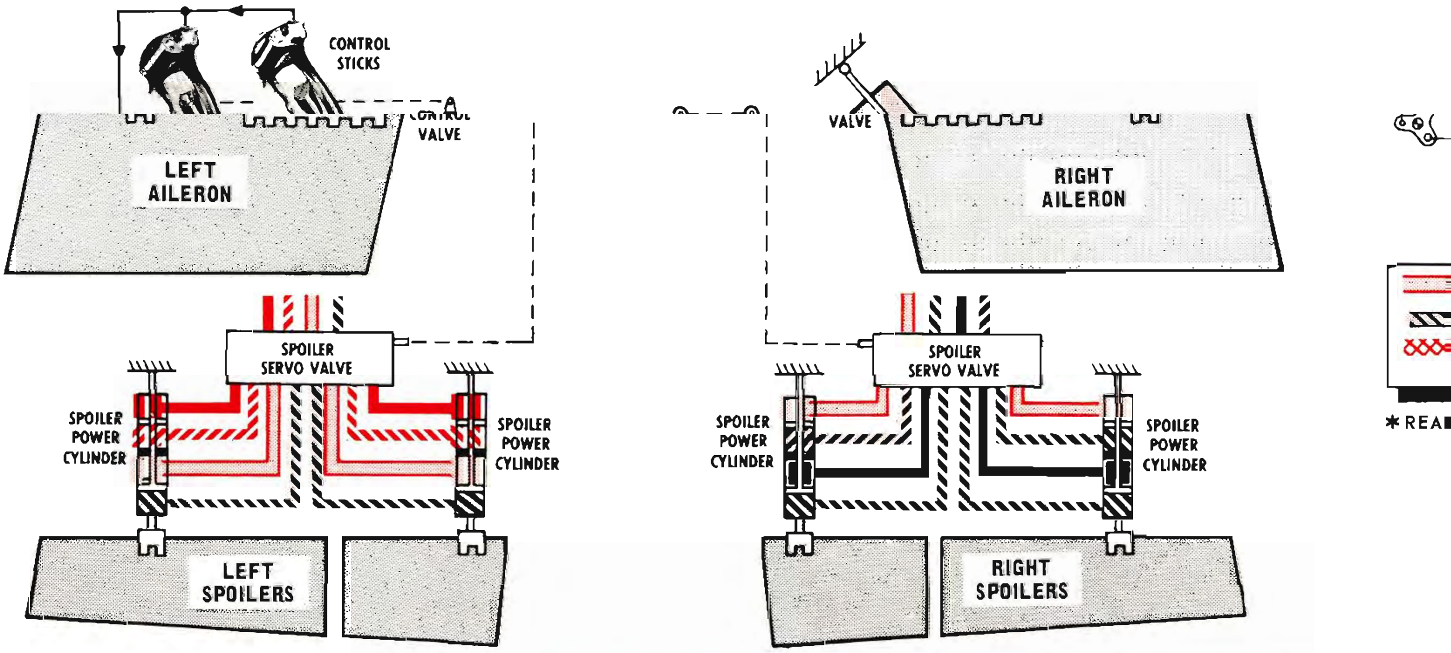
STABILATOR CONTROL



LATERAL CONTROL



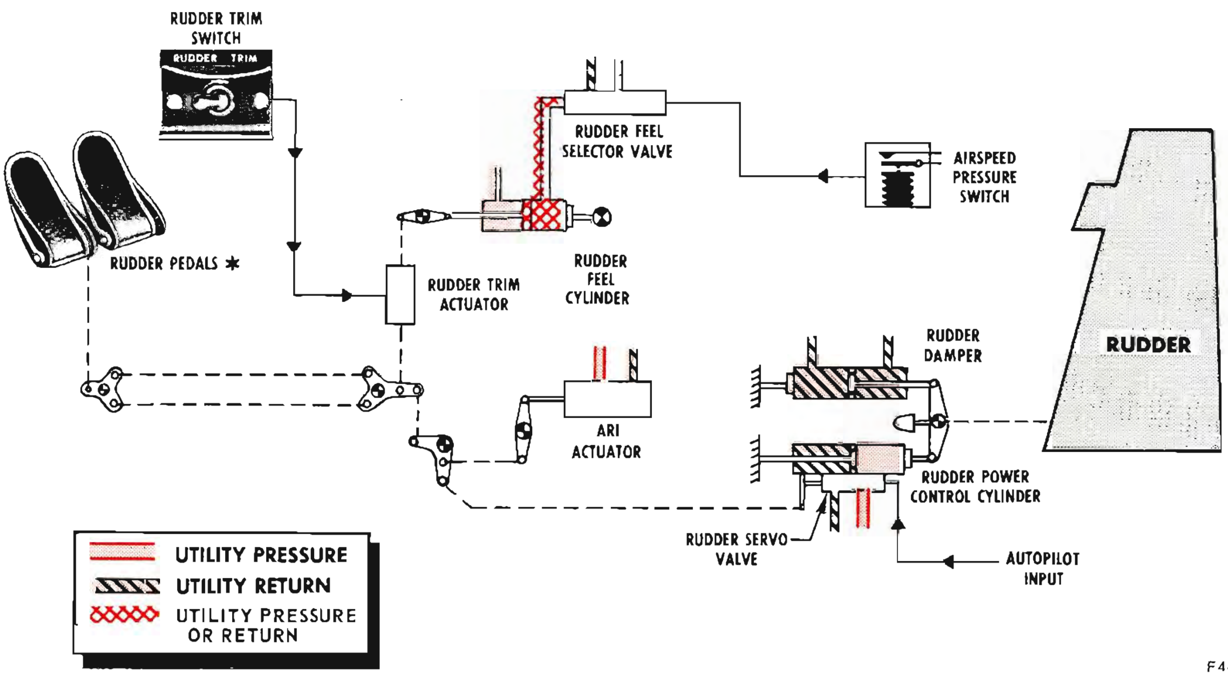
STABILATOR CONTROL



STABILATOR CONTROL

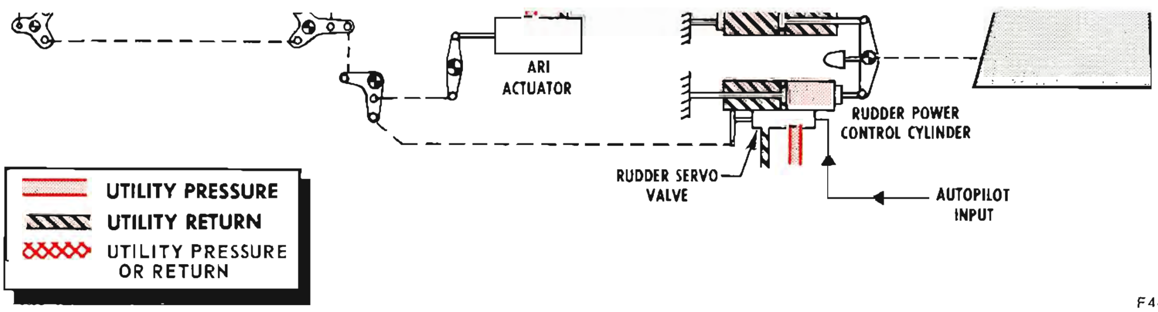
FLIGHT CONTROL SYSTEMS

RUDDER CONTROL



F4-118 R

*REAR COCKPIT RUDDER PEDALS NOT SHOWN


ARI ACTUATOR
RUDDER POWER CONTROL CYLINDER
RUDDER SERVO VALVE
AUTOPILOT INPUT
UTILITY PRESSURE
UTILITY RETURN
UTILITY PRESSURE OR RETURN

F4-118 R

*REAR COCKPIT RUDDER PEDALS NOT SHOWN

MK H7 EJECTION SEAT

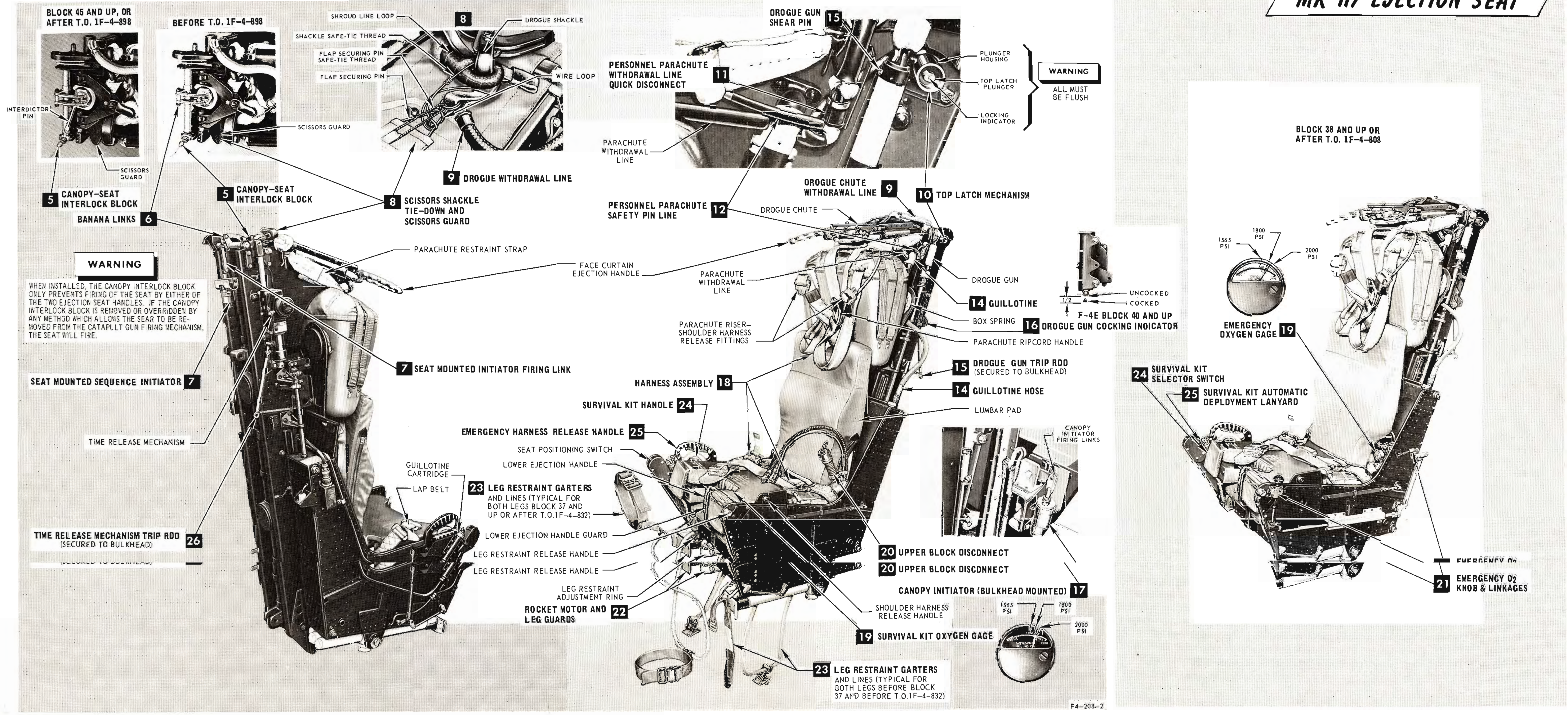
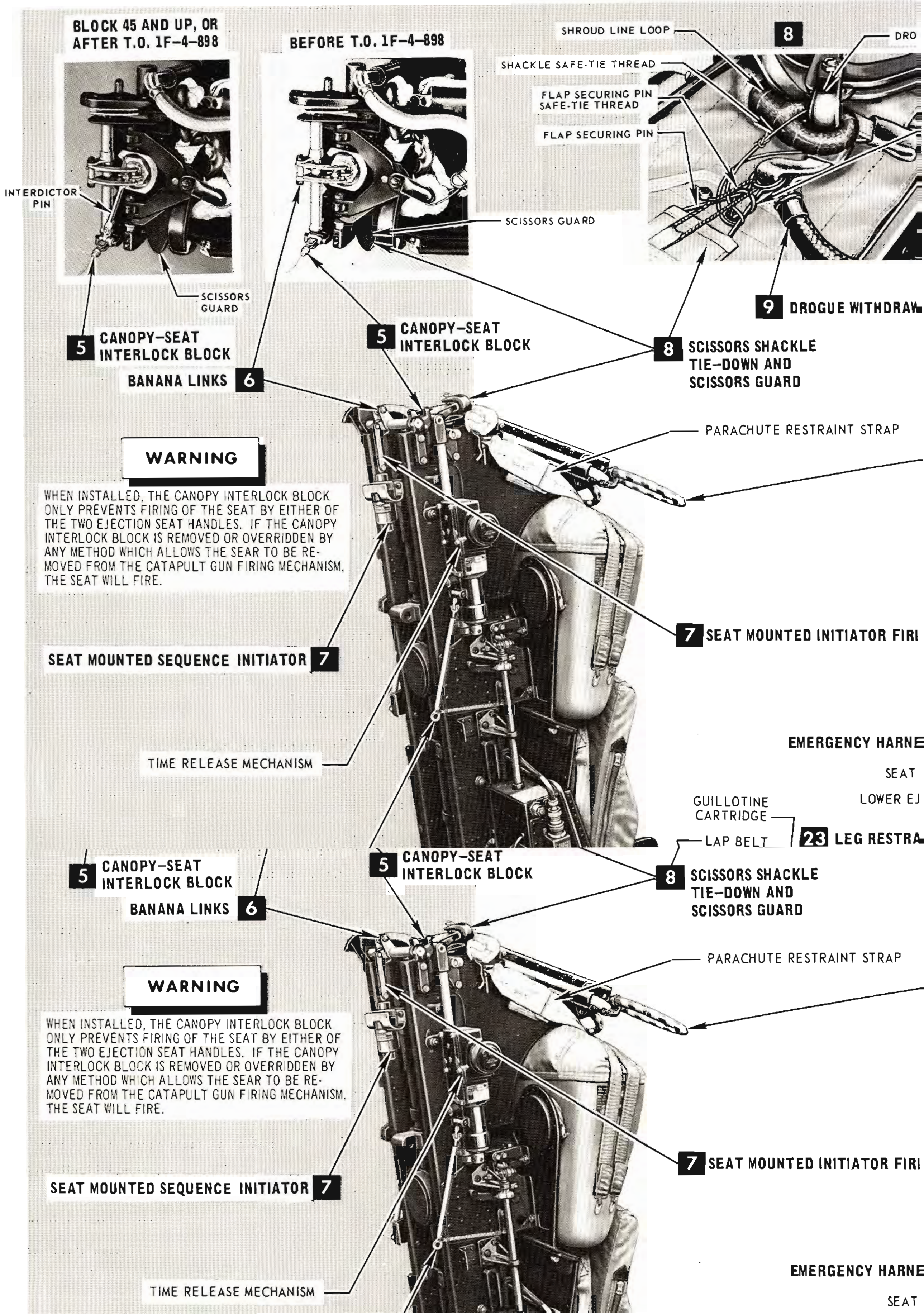
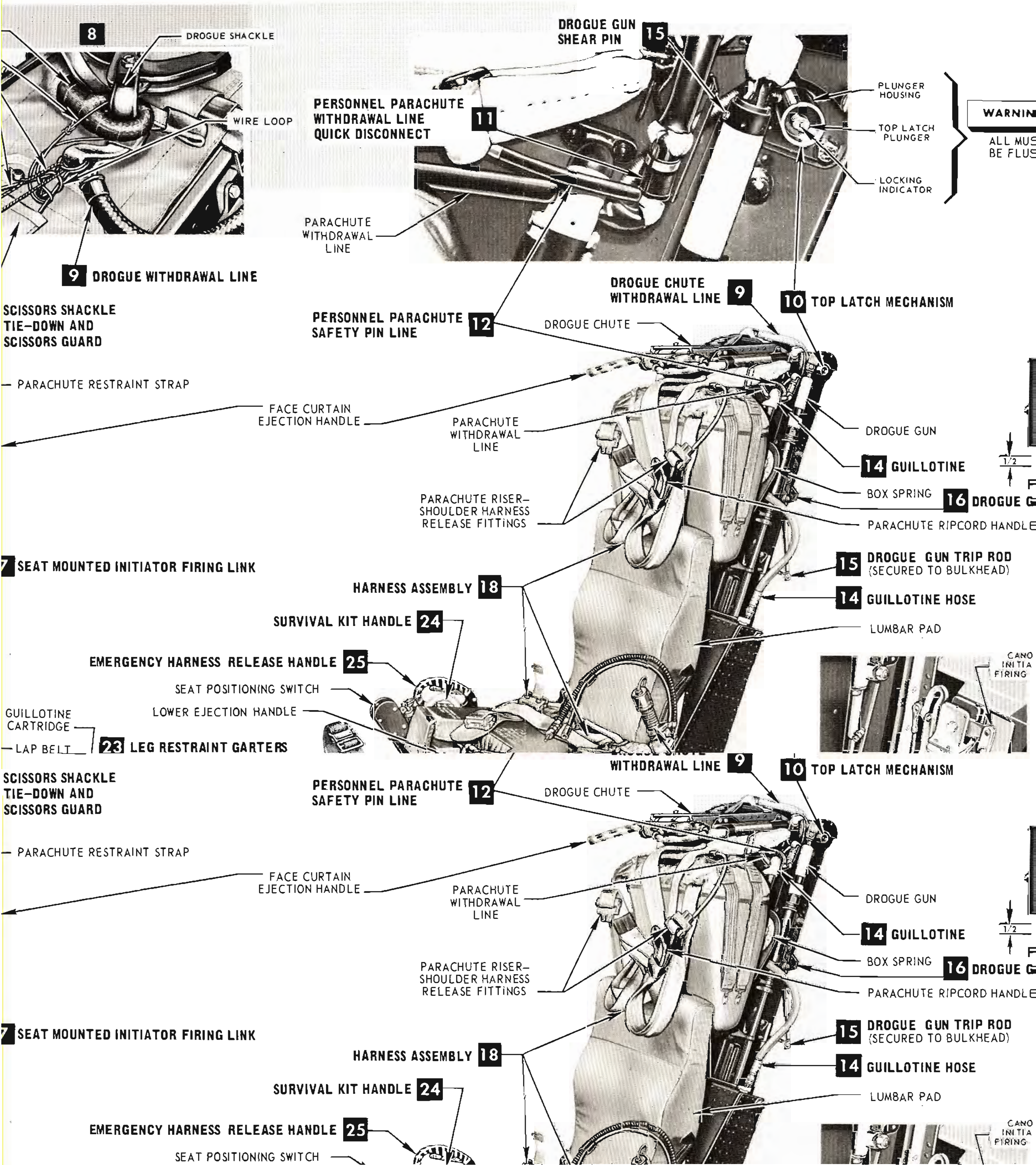


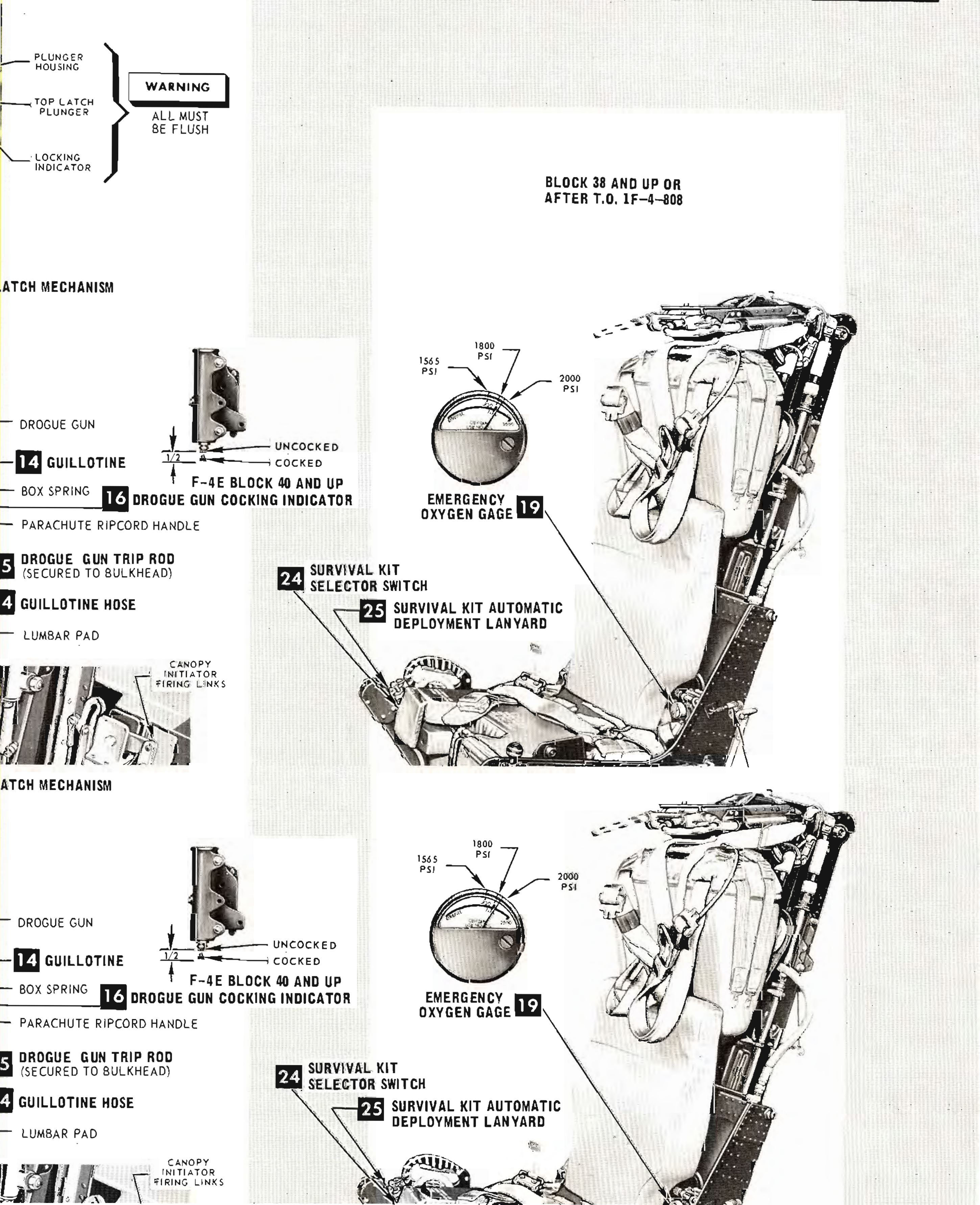
Figure FO-10


BLOCK 45 AND UP, OR AFTER T.O. 1F-4-898
BEFORE T.O. 1F-4-898
INTERDICTOR PIN
SCISSORS GUARD
SCISSORS GUARD
SHROUD LINE LOOP
SHACKLE SAFE-TIE THREAD
FLAP SECURING PIN SAFE-TIE THREAD
FLAP SECURING PIN
8
DRO
9 DROGUE WITHDRAW
5 CANOPY–SEAT INTERLOCK BLOCK
5 CANOPY–SEAT INTERLOCK BLOCK
BANANA LINKS 6
8 SCISSORS SHACKLE TIE–DOWN AND SCISSORS GUARD
PARACHUTE RESTRAINT STRAP
WARNING
WHEN INSTALLED, THE CANOPY INTERLOCK BLOCK ONLY PREVENTS FIRING OF THE SEAT BY EITHER OF THE TWO EJECTION SEAT HANDLES. IF THE CANOPY INTERLOCK BLOCK IS REMOVED OR OVERRIDDEN BY ANY METHOD WHICH ALLOWS THE SEAR TO BE REMOVED FROM THE CATAPULT GUN FIRING MECHANISM, THE SEAT WILL FIRE.
7 SEAT MOUNTED INITIATOR FIRI
SEAT MOUNTED SEQUENCE INITIATOR 7
TIME RELEASE MECHANISM
EMERGENCY HARNE
SEAT
LOWER EJ
GUILLOTINE CARTRIDGE
LAP BELT
23 LEG RESTRA
5 CANOPY–SEAT INTERLOCK BLOCK
5 CANOPY–SEAT INTERLOCK BLOCK
BANANA LINKS 6
8 SCISSORS SHACKLE TIE–DOWN AND SCISSORS GUARD
PARACHUTE RESTRAINT STRAP
WARNING
WHEN INSTALLED, THE CANOPY INTERLOCK BLOCK ONLY PREVENTS FIRING OF THE SEAT BY EITHER OF THE TWO EJECTION SEAT HANDLES. IF THE CANOPY INTERLOCK BLOCK IS REMOVED OR OVERRIDDEN BY ANY METHOD WHICH ALLOWS THE SEAR TO BE REMOVED FROM THE CATAPULT GUN FIRING MECHANISM, THE SEAT WILL FIRE.
7 SEAT MOUNTED INITIATOR FIRI
SEAT MOUNTED SEQUENCE INITIATOR 7
TIME RELEASE MECHANISM
EMERGENCY HARNE
SEAT



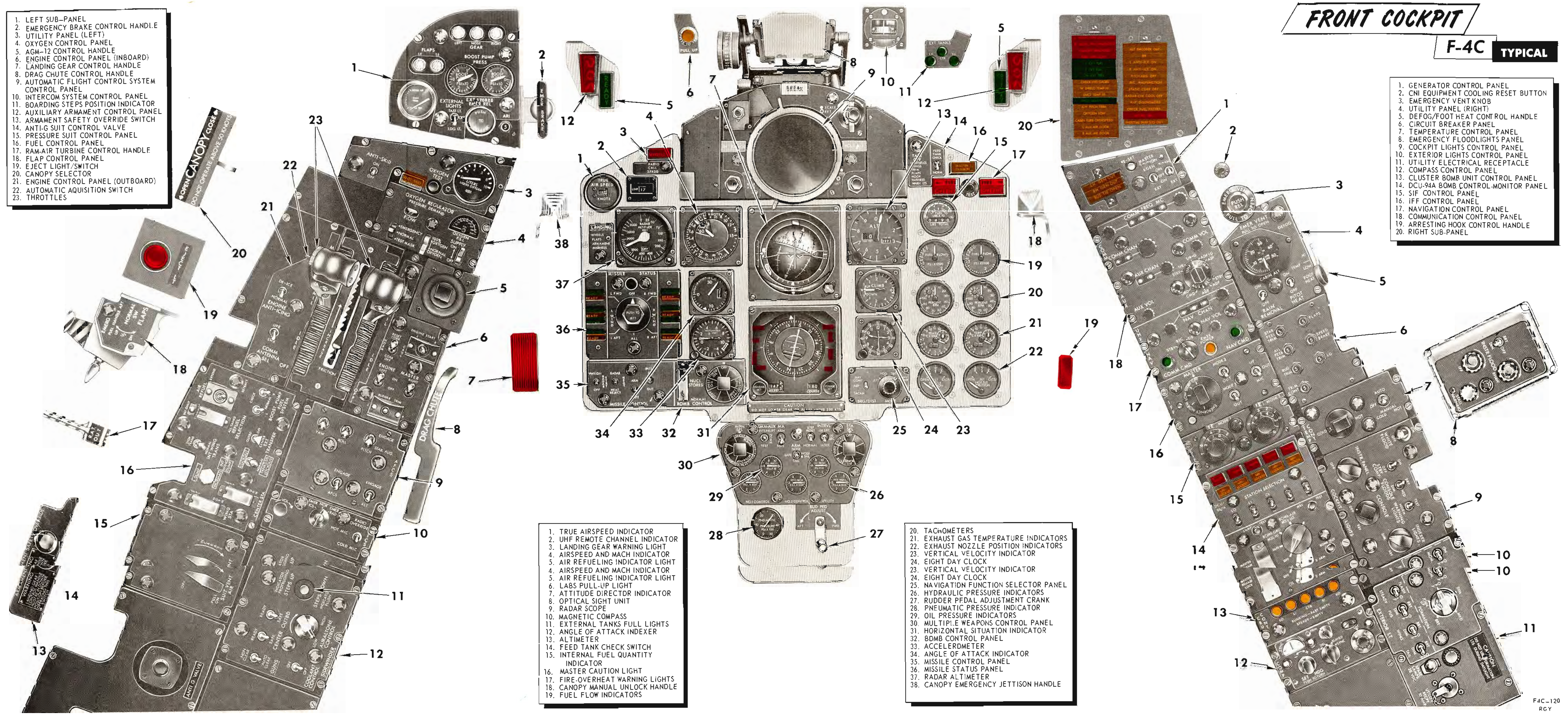
8
DROGUE SHACKLE
WIRE LOOP
9 DROGUE WITHDRAWAL LINE
SCISSORS SHACKLE TIE-DOWN AND SCISSORS GUARD
PARACHUTE RESTRAINT STRAP
DROGUE GUN SHEAR PIN
15
PERSONNEL PARACHUTE WITHDRAWAL LINE QUICK DISCONNECT
11
PARACHUTE WITHDRAWAL LINE
PLUNGER HOUSING
TOP LATCH PLUNGER
LOCKING INDICATOR
WARNIN
ALL MUS BE FLUS
DROGUE CHUTE WITHDRAWAL LINE
9
10 TOP LATCH MECHANISM
PERSONNEL PARACHUTE SAFETY PIN LINE
12
DROGUE CHUTE
FACE CURTAIN EJECTION HANDLE
PARACHUTE WITHDRAWAL LINE
DROGUE GUN
14 GUILLOTINE
BOX SPRING
16 DROGUE G
PARACHUTE RISER-SHOULDER HARNESS RELEASE FITTINGS
PARACHUTE RIPCORD HANDLE
7 SEAT MOUNTED INITIATOR FIRING LINK
15 DROGUE GUN TRIP ROD (SECURED TO BULKHEAD)
HARNESS ASSEMBLY 18
14 GUILLOTINE HOSE
SURVIVAL KIT HANDLE 24
LUMBAR PAD
EMERGENCY HARNESS RELEASE HANDLE 25
SEAT POSITIONING SWITCH
LOWER EJECTION HANDLE
GUILLOTINE CARTRIDGE
LAP BELT
23 LEG RESTRAINT GARTERS
1/2
F
CANO INITIA FIRING

MK H7 EJECTION SEAT



FRONT COCKPIT

F-4C TYPICAL



1. LEFT SUB-PANEL
2. EMERGENCY BRAKE CONTROL HANDLE
3. UTILITY PANEL (LEFT)
4. OXYGEN CONTROL PANEL
5. AGM-12 CONTROL HANDLE
6. ENGINE CONTROL PANEL (INBOARD)
7. LANDING GEAR CONTROL HANDLE
8. DRAG CHUTE CONTROL HANDLE
9. AUTOMATIC FLIGHT CONTROL SYSTEM CONTROL PANEL
10. INTERCOM SYSTEM CONTROL PANEL
11. BOARDING STEPS POSITION INDICATOR
12. AUXILIARY ARMAMENT CONTROL PANEL
13. ARMAMENT SAFETY OVERRIDE SWITCH
14. ANTI-G SUIT CONTROL VALVE
15. PRESSURE SUIT CONTROL PANEL
16. FUEL CONTROL PANEL
17. RAM-AIR TURBINE CONTROL HANDLE
18. FLAP CONTROL PANEL
19. EJECT LIGHT/SWITCH
20. CANOPY SELECTOR
21. ENGINE CONTROL PANEL (OUTBOARD)
22. AUTOMATIC AQUISITION SWITCH
23. THROTTLES

1. TRUE AIRSPEED INDICATOR
2. UHF REMOTE CHANNEL INDICATOR
3. LANDING GEAR WARNING LIGHT
4. AIRSPEED AND MACH INDICATOR
5. AIR REFUELING INDICATOR LIGHT
4. AIRSPEED AND MACH INDICATOR
5. AIR REFUELING INDICATOR LIGHT
6. LABS PULL-UP LIGHT
7. ATTITUDE DIRECTOR INDICATOR
8. OPTICAL SIGHT UNIT
9. RADAR SCOPE
10. MAGNETIC COMPASS
11. EXTERNAL TANKS FULL LIGHTS
12. ANGLE OF ATTACK INDEXER
13. ALTIMETER
14. FEED TANK CHECK SWITCH
15. INTERNAL FUEL QUANTITY INDICATOR
16. MASTER CAUTION LIGHT
17. FIRE-OVERHEAT WARNING LIGHTS
18. CANOPY MANUAL UNLOCK HANDLE
19. FUEL FLOW INDICATORS

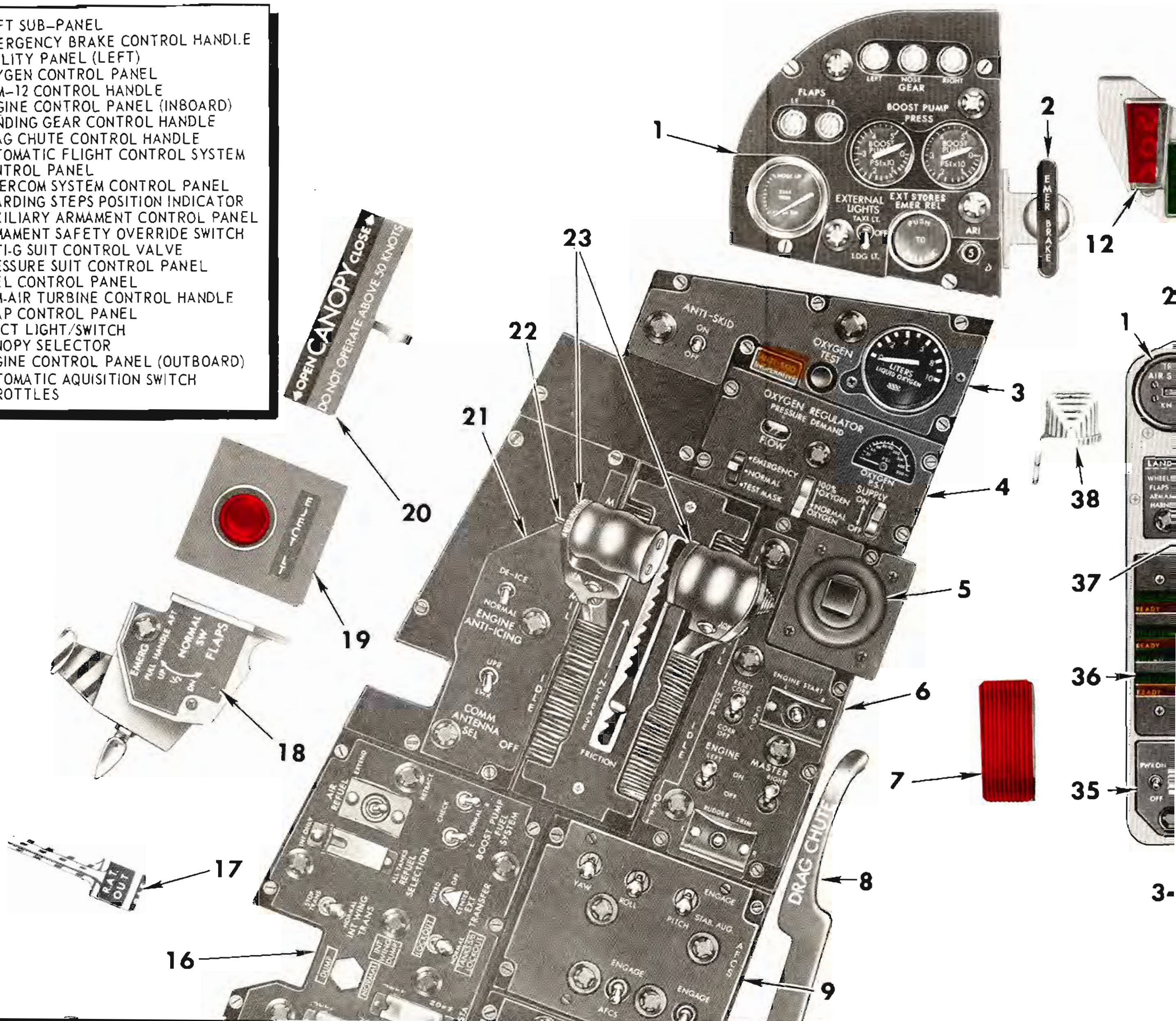
20. TACHOMETERS
21. EXHAUST GAS TEMPERATURE INDICATORS
22. EXHAUST NOZZLE POSITION INDICATORS
23. VERTICAL VELOCITY INDICATOR
24. EIGHT DAY CLOCK
23. VERTICAL VELOCITY INDICATOR
24. EIGHT DAY CLOCK
25. NAVIGATION FUNCTION SELECTOR PANEL
26. HYDRAULIC PRESSURE INDICATORS
27. RUDDER PEDAL ADJUSTMENT CRANK
28. PNEUMATIC PRESSURE INDICATOR
29. OIL PRESSURE INDICATORS
30. MULTIPLE WEAPONS CONTROL PANEL
31. HORIZONTAL SITUATION INDICATOR
32. BOMB CONTROL PANEL
33. ACCELEROMETER
34. ANGLE OF ATTACK INDICATOR
35. MISSILE CONTROL PANEL
36. MISSILE STATUS PANEL
37. RADAR ALTIMETER
38. CANOPY EMERGENCY JETTISON HANDLE

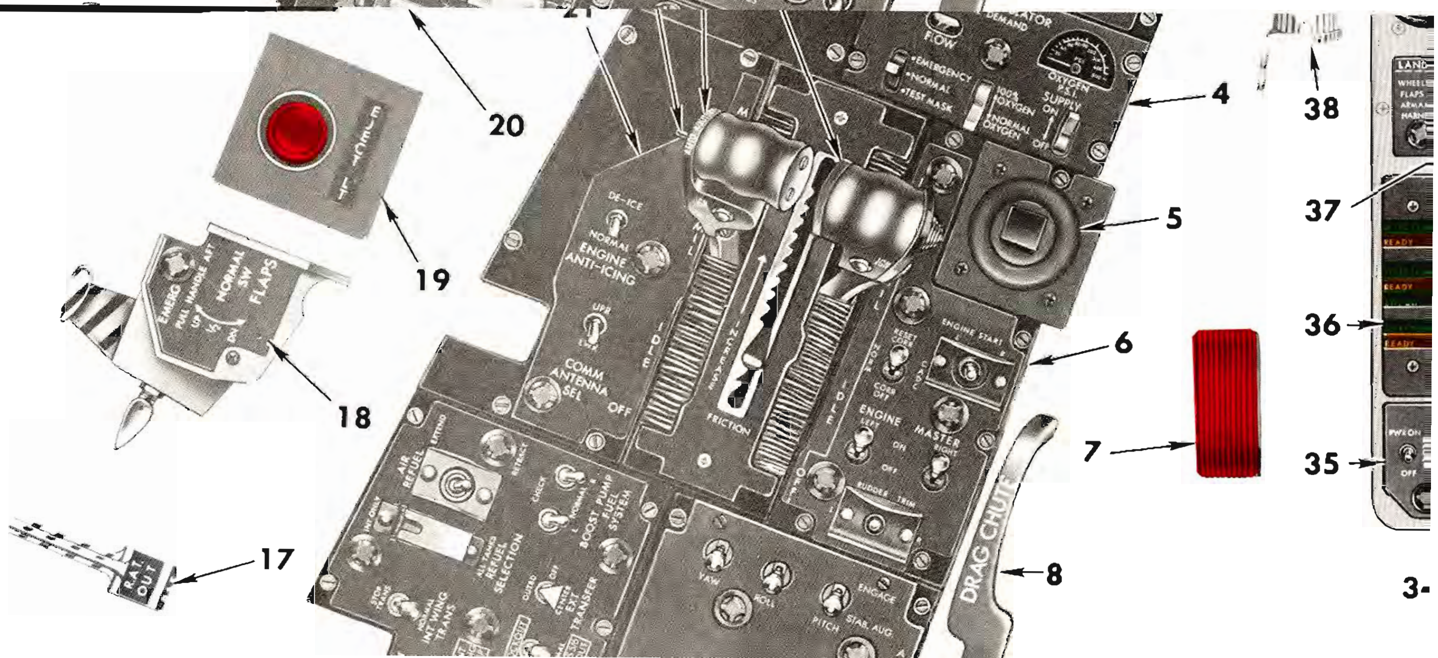
1. GENERATOR CONTROL PANEL
2. CNI EQUIPMENT COOLING RESET BUTTON
3. EMERGENCY VENT KNOB
4. UTILITY PANEL (RIGHT)
5. DEFOG/FOOT HEAT CONTROL HANDLE
6. CIRCUIT BREAKER PANEL
7. TEMPERATURE CONTROL PANEL
8. EMERGENCY FLOODLIGHTS PANEL
9. COCKPIT LIGHTS CONTROL PANEL
10. EXTERIOR LIGHTS CONTROL PANEL
11. UTILITY ELECTRICAL RECEPTACLE
12. COMPASS CONTROL PANEL
13. CLUSTER BOMB UNIT CONTROL PANEL
14. DCU-94A BOMB CONTROL-MONITOR PANEL
15. SIF CONTROL PANEL
16. IFF CONTROL PANEL
17. NAVIGATION CONTROL PANEL
18. COMMUNICATION CONTROL PANEL
19. ARRESTING HOOK CONTROL HANDLE
20. RIGHT SUB-PANEL

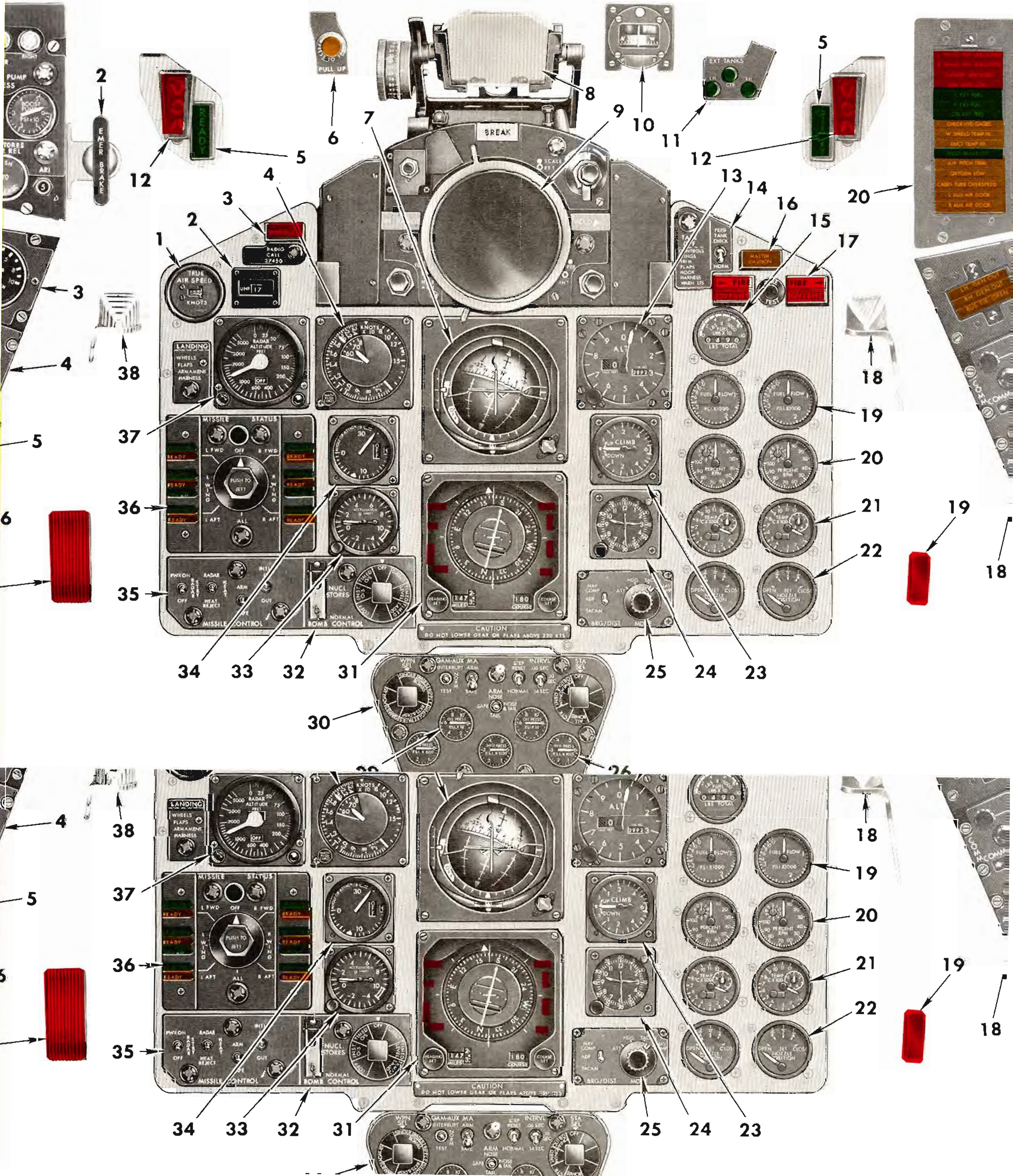
F4C-120
RGY

Figure FO-11

1. LEFT SUB–PANEL
2. EMERGENCY BRAKE CONTROL HANDLE
3. UTILITY PANEL (LEFT)
4. OXYGEN CONTROL PANEL
5. AGM–12 CONTROL HANDLE
6. ENGINE CONTROL PANEL (INBOARD)
7. LANDING GEAR CONTROL HANDLE
8. DRAG CHUTE CONTROL HANDLE
9. AUTOMATIC FLIGHT CONTROL SYSTEM CONTROL PANEL
10. INTERCOM SYSTEM CONTROL PANEL
11. BOARDING STEPS POSITION INDICATOR
12. AUXILIARY ARMAMENT CONTROL PANEL
13. ARMAMENT SAFETY OVERRIDE SWITCH
14. ANTI-G SUIT CONTROL VALVE
15. PRESSURE SUIT CONTROL PANEL
16. FUEL CONTROL PANEL
17. RAM-AIR TURBINE CONTROL HANDLE
18. FLAP CONTROL PANEL
19. EJECT LIGHT/SWITCH
20. CANOPY SELECTOR
21. ENGINE CONTROL PANEL (OUTBOARD)
22. AUTOMATIC AQUISITION SWITCH
23. THROTTLES







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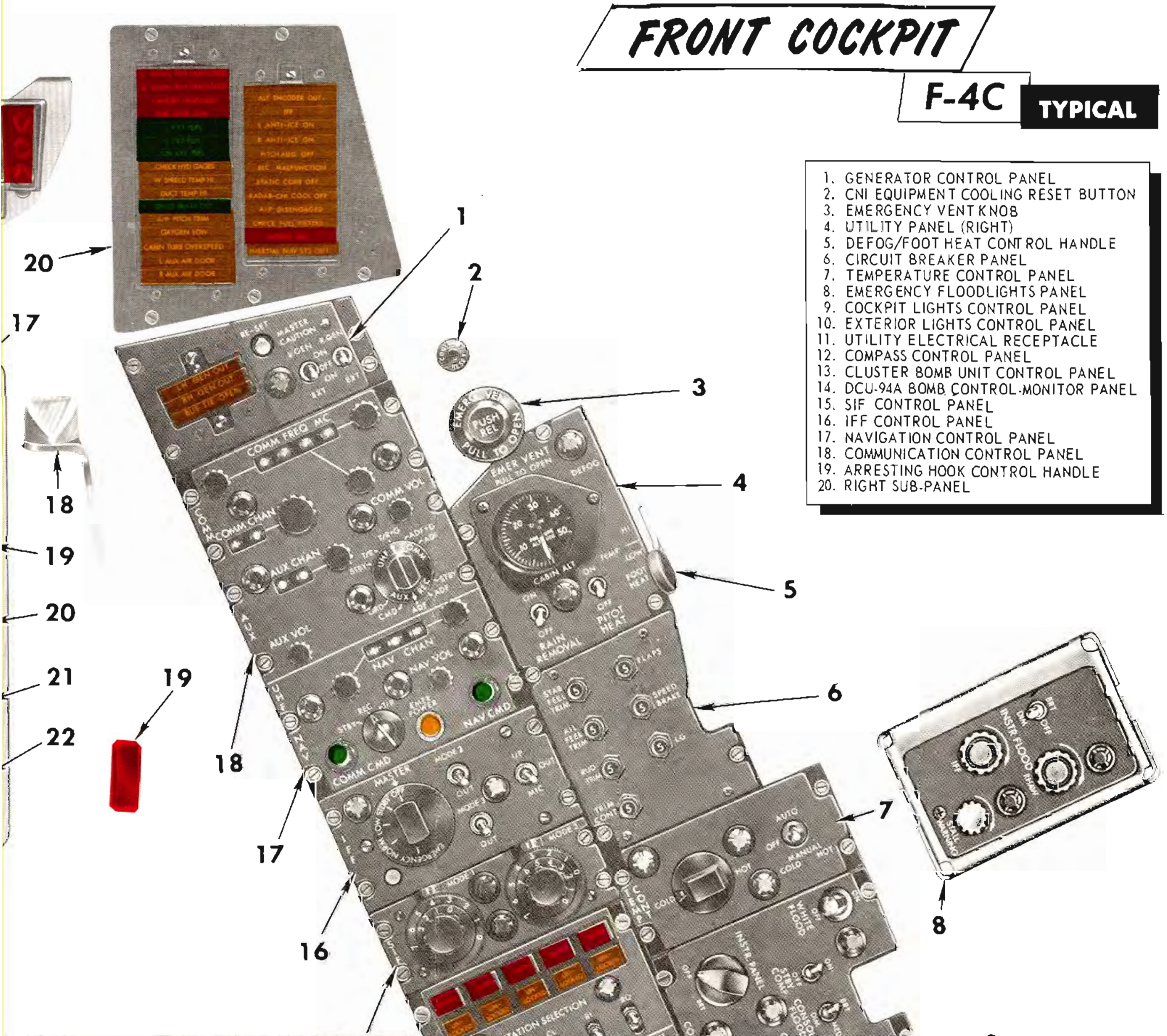
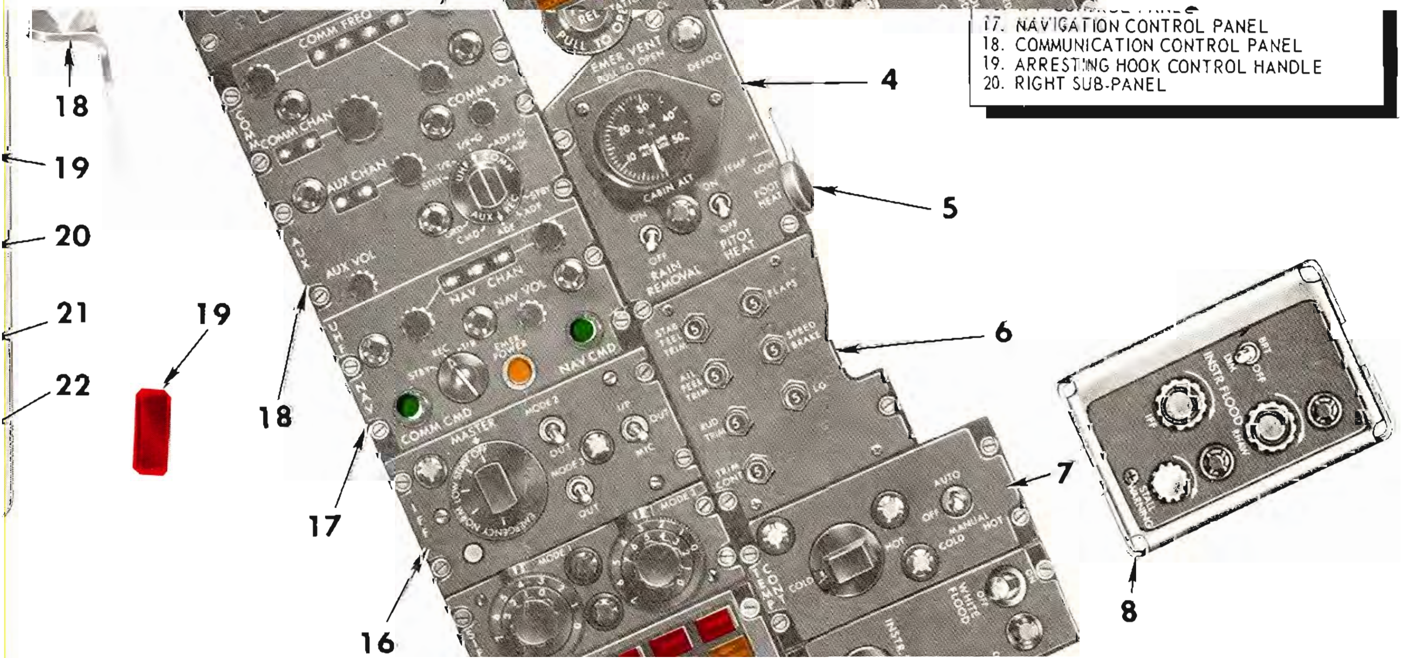
BREAK
PULL UP
EXT TANKS
EMER BRAKE
READY
TRUE AIR SPEED
KNOTS
RADIO CALL
LANDING
WHEELS
FLAPS
ARMAMENT
HARNESS
MISSILE STATUS
PUSH TO JETT
MISSILE CONTROL
BOMB CONTROL
NUCL STORES
NORMAL
MASTER CAUTION
FIRE
CLIMB
DOWN
ALT
FUEL FLOW
PERCENT RPM
LBS TOTAL
CAUTION
DO NOT LOWER GEAR OR FLAPS ABOVE 250 KTS
HEADING SET
COURSE SET
MILES
COURSE
BRG/DIST
TACAN
WPN SEL
GAM-AUX MA
INTERRUPT
ARM
TEST
SAFE
STEP RESET
NORMAL
INTRVL
STA SEL

FRONT COCKPIT

F-4C TYPICAL



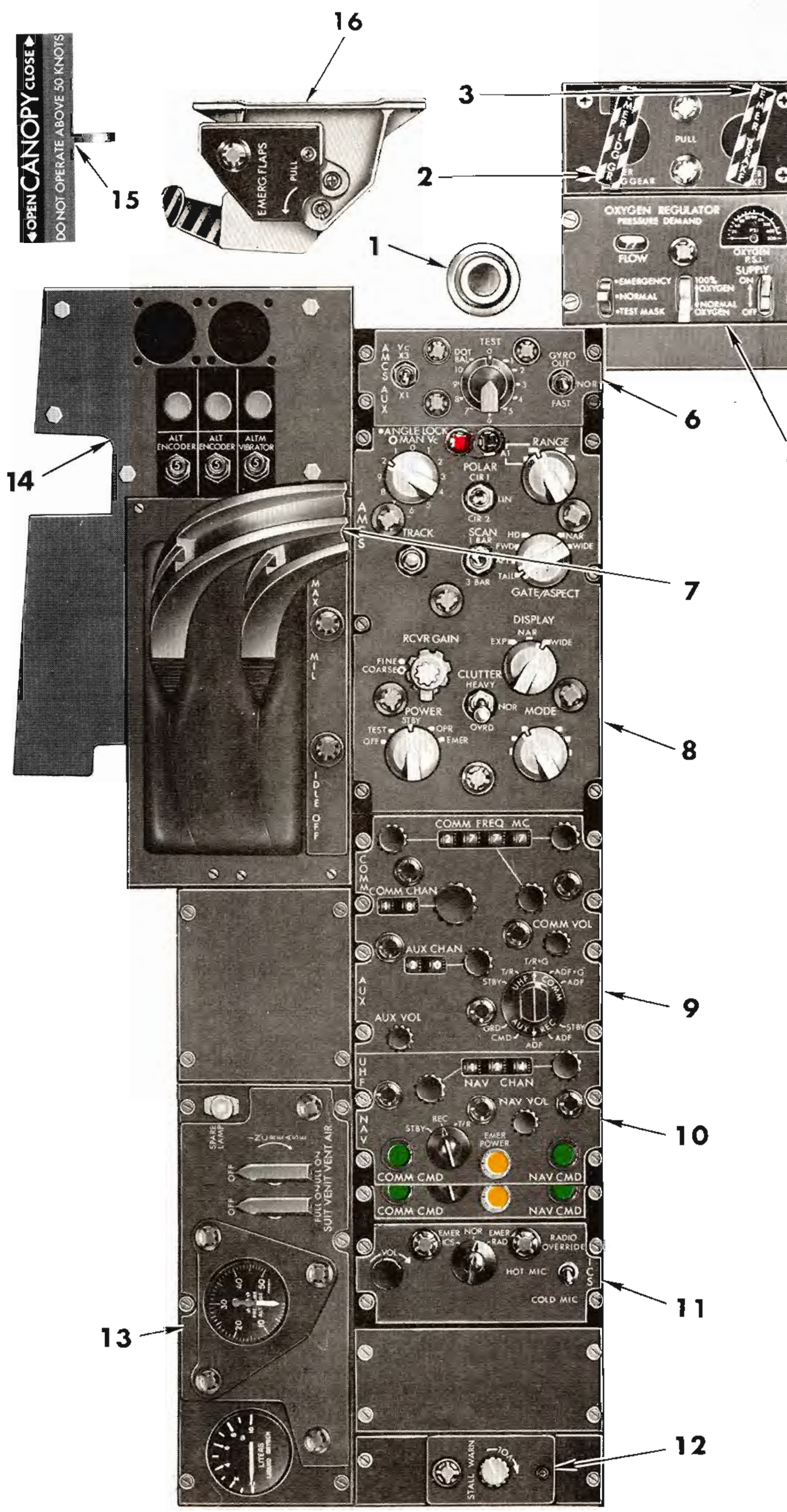
1. GENERATOR CONTROL PANEL
2. CNI EQUIPMENT COOLING RESET BUTTON
3. EMERGENCY VENT KNOB
4. UTILITY PANEL (RIGHT)
5. DEFOG/FOOT HEAT CONTROL HANDLE
6. CIRCUIT BREAKER PANEL
7. TEMPERATURE CONTROL PANEL
8. EMERGENCY FLOODLIGHTS PANEL
9. COCKPIT LIGHTS CONTROL PANEL
10. EXTERIOR LIGHTS CONTROL PANEL
11. UTILITY ELECTRICAL RECEPTACLE
12. COMPASS CONTROL PANEL
13. CLUSTER BOMB UNIT CONTROL PANEL
14. DCU-94A BOMB CONTROL-MONITOR PANEL
15. SIF CONTROL PANEL
16. IFF CONTROL PANEL
17. NAVIGATION CONTROL PANEL
18. COMMUNICATION CONTROL PANEL
19. ARRESTING HOOK CONTROL HANDLE
20. RIGHT SUB-PANEL

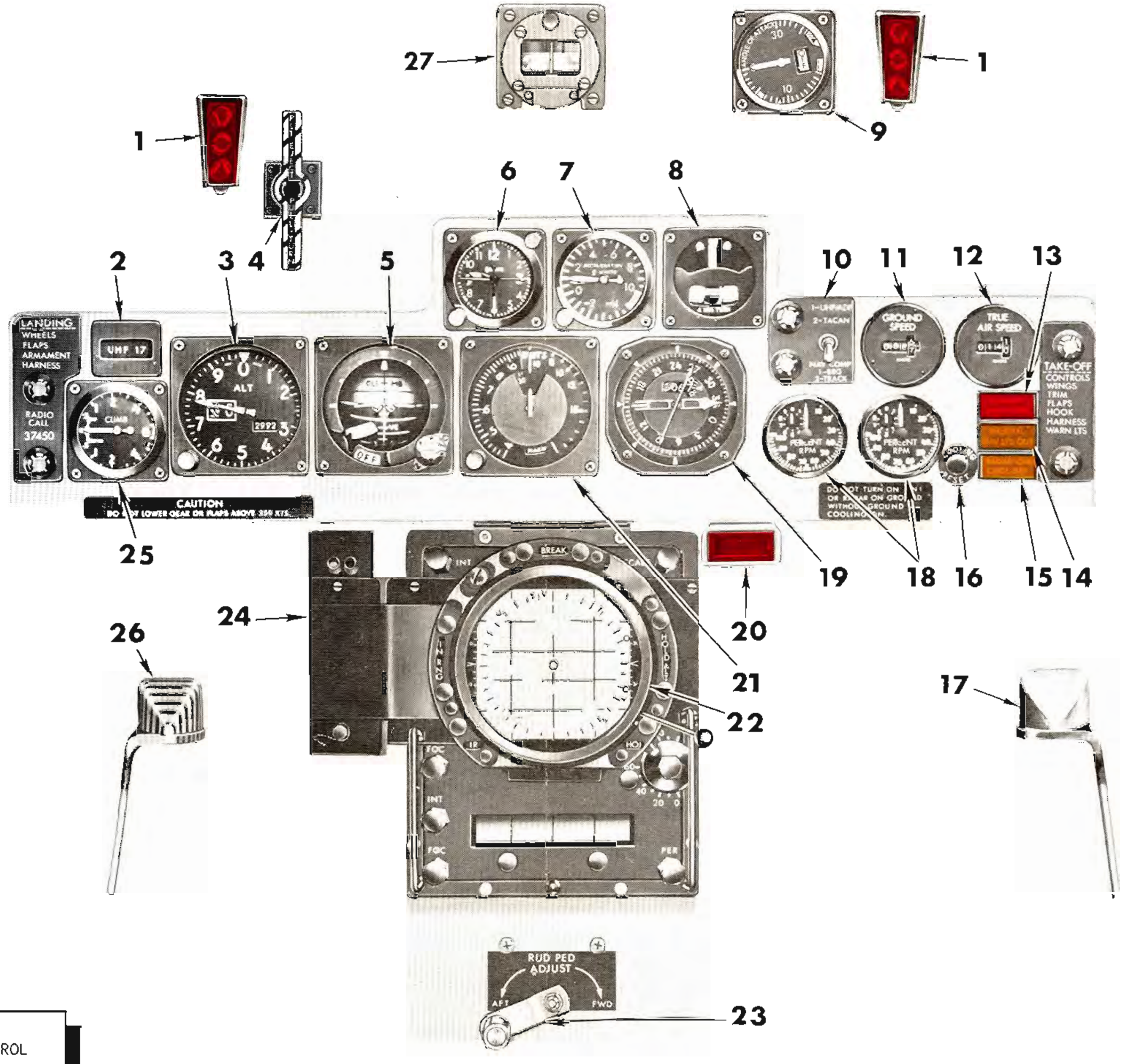


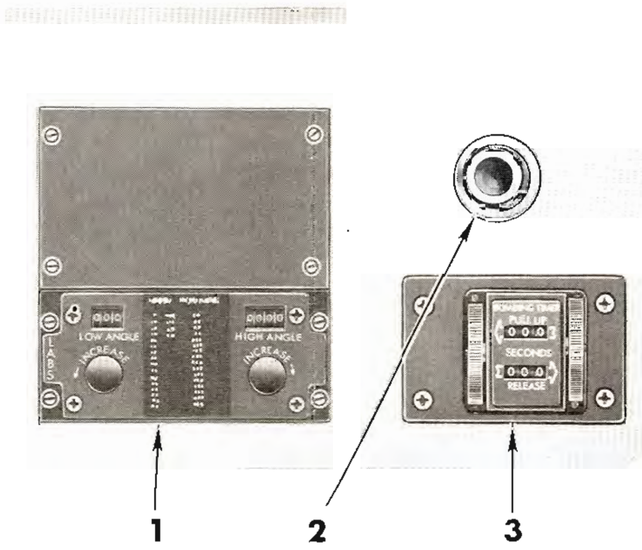
17. NAVIGATION CONTROL PANEL
18. COMMUNICATION CONTROL PANEL
19. ARRESTING HOOK CONTROL HANDLE
20. RIGHT SUB-PANEL

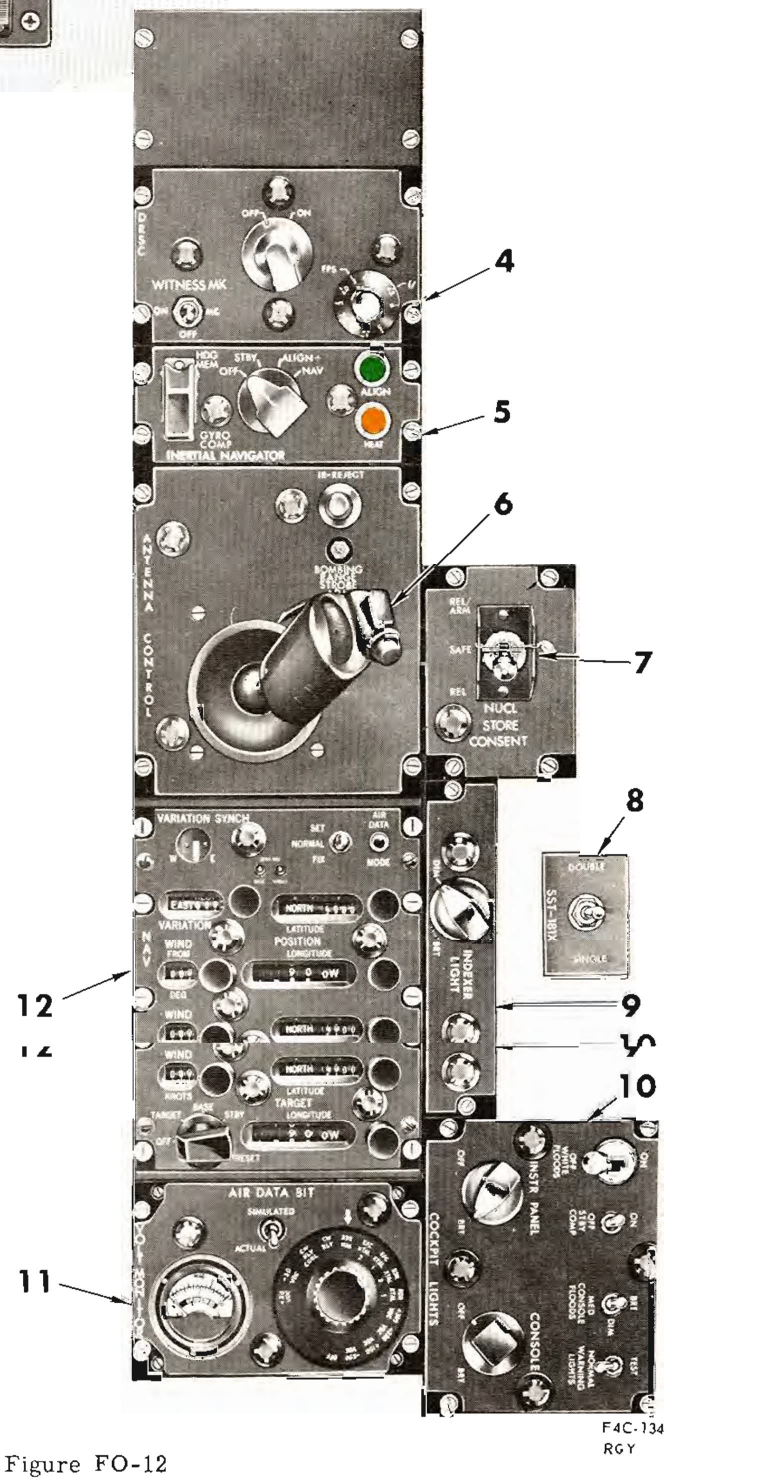
REAR COCKPIT F-4C

TYPICAL









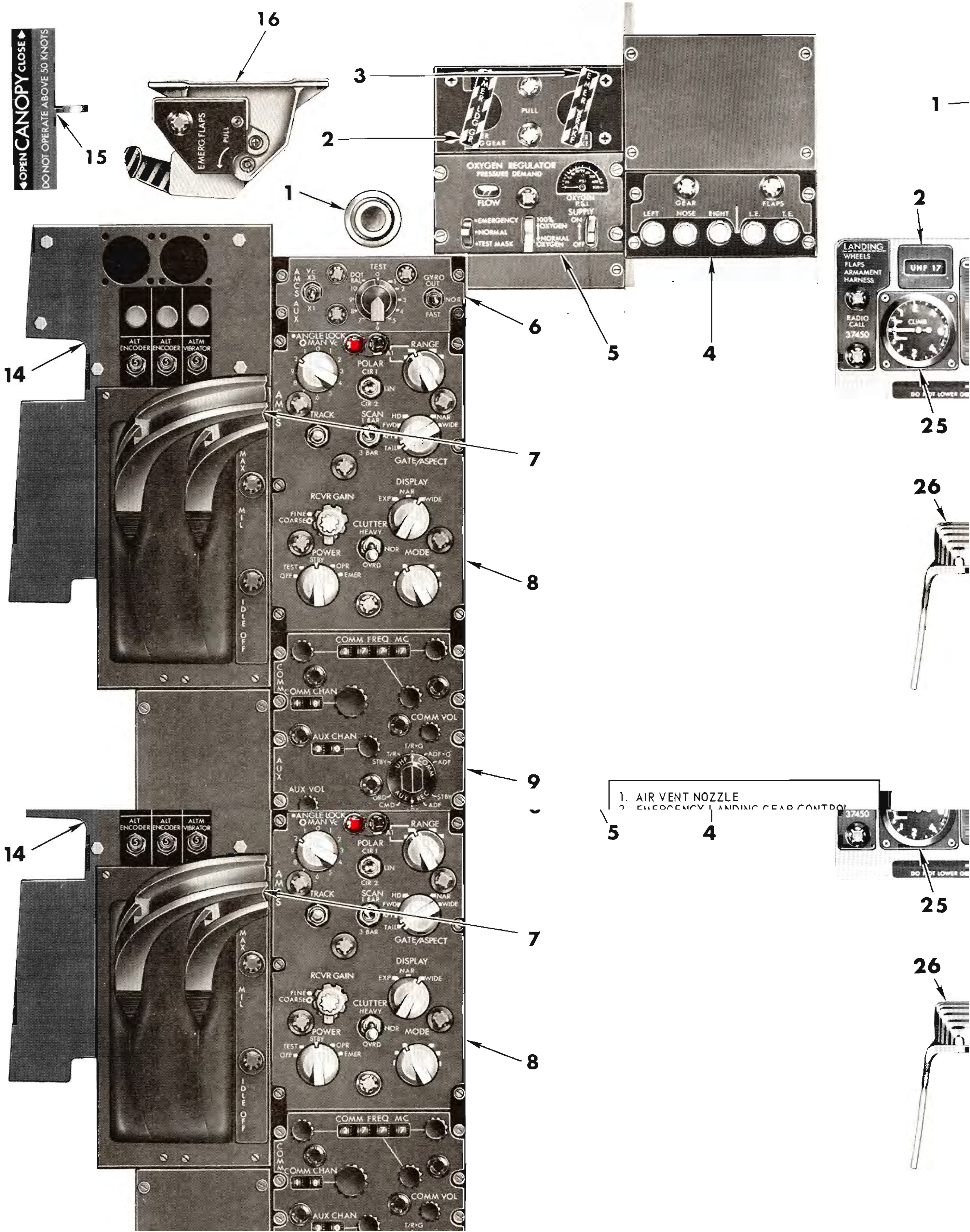
1. AIR VENT NOZZLE
2. EMERGENCY LANDING GEAR CONTROL HANDLE
3. EMERGENCY BRAKE CONTROL HANDLE
4. LANDING GEAR - FLAP INDICATOR PANEL
5. OXYGEN CONTROL PANEL
6. AUXILIARY RADAR CONTROL PANEL
7. THROTTLES
8. RADAR CONTROL PANEL
9. COMMUNICATION CONTROL PANEL
8. RADAR CONTROL PANEL
9. COMMUNICATION CONTROL PANEL
10. NAVIGATION CONTROL PANEL
11. INTERCOM CONTROL PANEL
12. STALL WARNING TONE CONTROL PANEL
13. PRESSURE SUIT CONTROL PANEL
14. CIRCUIT BREAKER PANEL NO. 5
15. CANOPY SELECTOR
16. EMERGENCY FLAP CONTROL PANEL

1. ANGLE OF ATTACK INDEXER
2. UHF CHANNEL REMOTE INDICATOR
3. ALTIMETER
4. COMMAND SELECTOR VALVE
3. ALTIMETER
4. COMMAND SELECTOR VALVE
5. ATTITUDE INDICATOR
6. EIGHT DAY CLOCK
7. ACCELEROMETER
8. TURN AND SLIP INDICATOR
9. ANGLE OF ATTACK INDICATOR
10. NAVIGATION FUNCTION SELECTOR PANEL
11. GROUND SPEED INDICATOR
12. TRUE AIRSPEED INDICATOR
13. CANOPY UNLOCKED WARNING LIGHT
14. INERTIAL NAVIGATOR OUT WARNING LIGHT
15. RADAR–CNI COOL OFF WARNING LIGHT
16. RADAR–CNI COOLING RESET BUTTON
17. CANOPY MANUAL UNLOCK HANDLE
18. TACHOMETERS
17. CANOPY MANUAL UNLOCK HANDLE
18. TACHOMETERS
19. BEARING–DISTANCE–HEADING INDICATOR
20. EJECT LIGHT
21. AIRSPEED–MACH INDICATOR
22. RADAR SCOPE
23. RUDDER PEDAL ADJUSTMENT CRANK
24. DIRECT READING SCOPE CAMERA
25. VERTICAL VELOCITY INDICATOR
26. CANOPY EMERGENCY JETTISON HANDLE
27. STANDBY MAGNETIC COMPASS

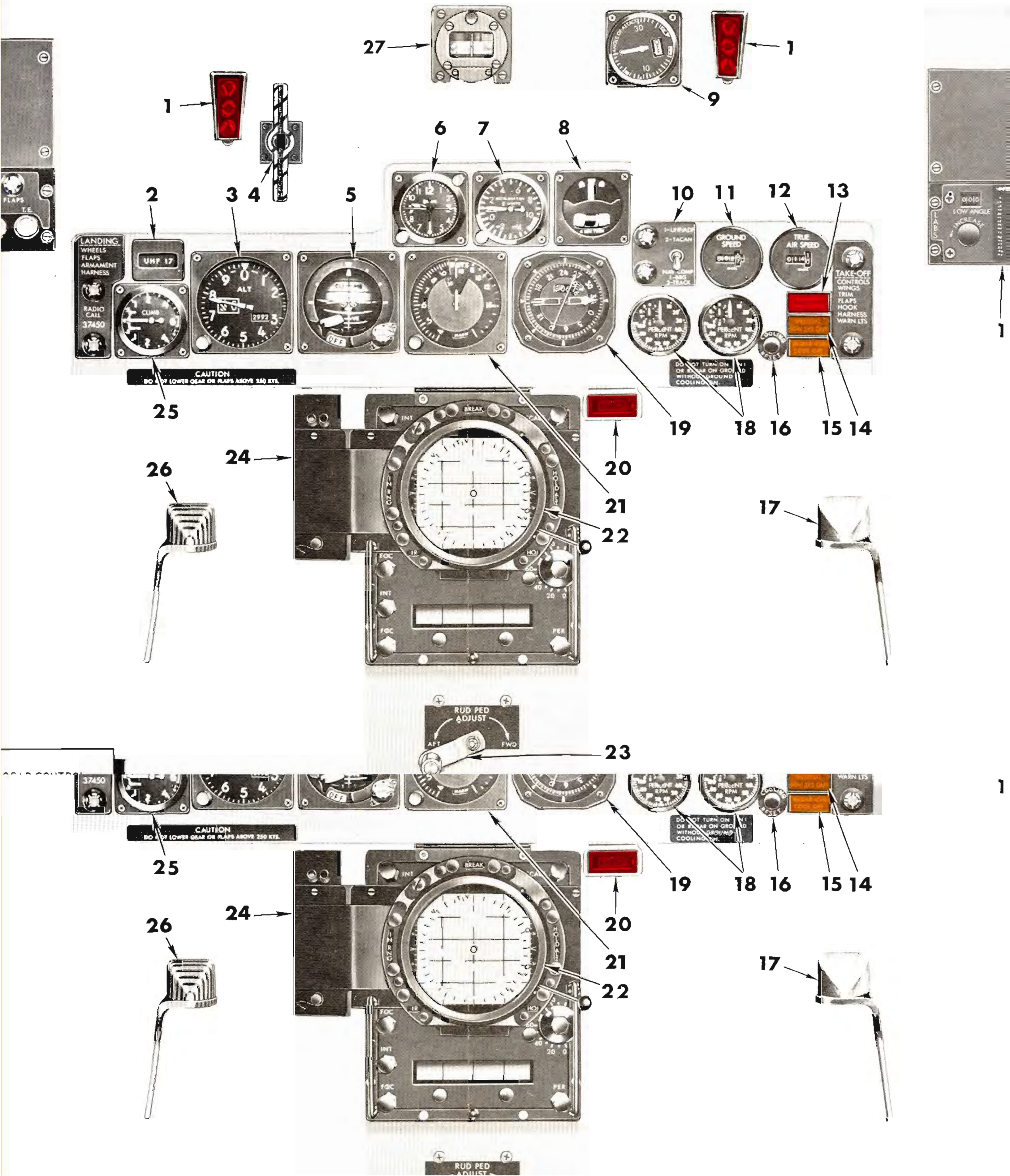
1. LABS RELEASE ANGLE CONTROL PANEL
2. AIR VENT NOZZLE
3. BOMBING TIMER CONTROL PANEL
4. DIRECT RADAR SCOPE CAMERA CONTROL PANEL
5. INERTIAL NAVIGATOR CONTROL PANEL
6. RADAR ANTENNA CONTROL HANDLE
5. INERTIAL NAVIGATOR CONTROL PANEL
6. RADAR ANTENNA CONTROL HANDLE
7. NUCLEAR CONSENT SWITCH
8. SST-181X PULSE SELECTOR SWITCH
9. INDEXER LIGHT CONTROL PANEL
10. COCKPIT LIGHTS CONTROL PANEL
11. VOLTAGE MONITOR PANEL
12. NAVIGATION CONTROL PANEL

F4C-134
RGY

Figure FO-12



1. AIR VENT NOZZLE
2. EMERGENCY LANDING GEAR CONTROL



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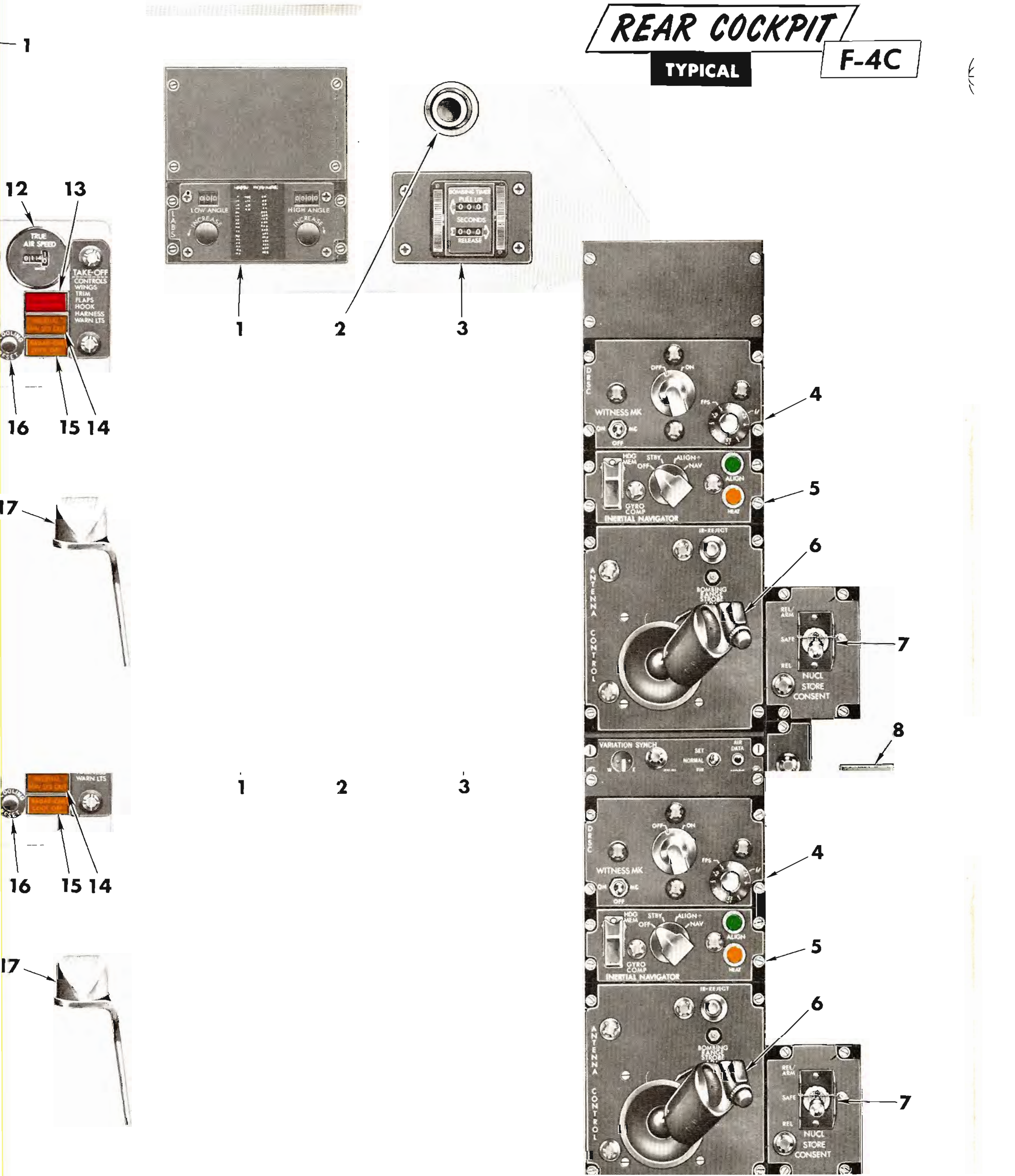
LANDING
WHEELS
FLAPS
ARMAMENT
HARNESS
RADIO CALL
37450
UHF 17
ALT
CLIMB
GROUND SPEED
TRUE AIR SPEED
PERCENT RPM
TAKE-OFF
CONTROLS
WINGS
TRIM
FLAPS
HOOK
HARNESS
WARN LTS
LOW ANGLE
INCREASE
FLAPS
CAUTION
BREAK
RUD PED
ADJUST
AFT
FWD


REAR COCKPIT
TYPICAL
F-4C
TRUE AIR SPEED
TAKE-OFF
CONTROLS
WINGS
TRIM
FLAPS
HOOK
HARNESS
WARN LTS
LABS
LOW ANGLE
HIGH ANGLE
INCREASE
BOMBING TIMER
PULL UP
SECONDS
RELEASE
DRSC
OFF
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FPS
HDG MEM
STBY
ALIGN
NAV
GYRO COMP
INERTIAL NAVIGATOR
HEAT
IR-REJECT
BOMBING RANGE STROBE
ANTENNA CONTROL
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CIRCUIT BREAKERS-REAR COCKPIT F-4C

TYPICAL

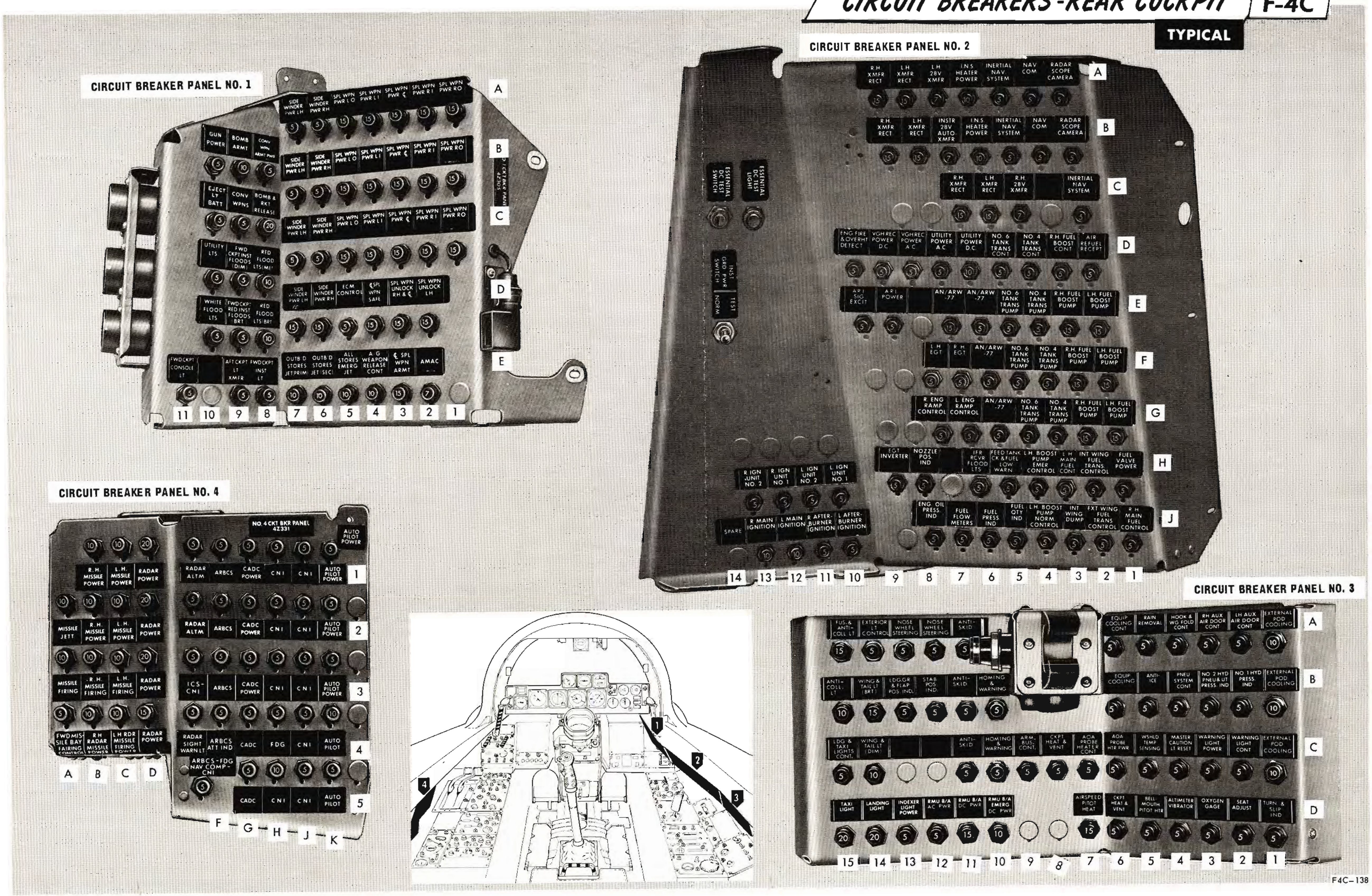
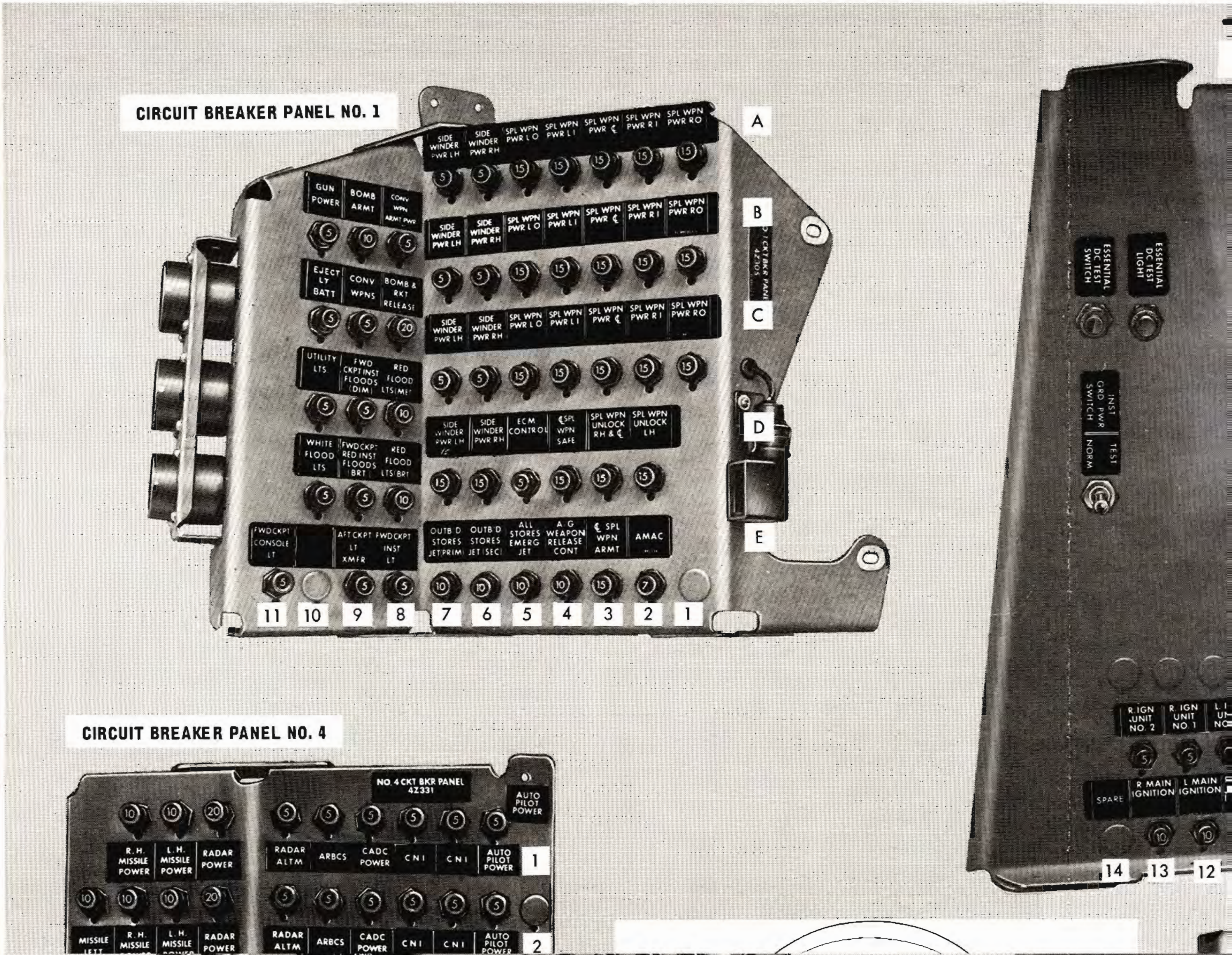


Figure FO-13


CIRCUIT BREAKER PANEL NO. 1
A
B
C
D
E
GUN POWER
BOMB ARMT
EJECT LT BATT
CONV WPNS
BOMB & RKT RELEASE
UTILITY LTS
FWD CKPT INST FLOODS (DIM)
RED FLOOD LTS (MED)
WHITE FLOOD LTS
FWD CKPT RED INST FLOODS (BRT)
RED FLOOD LTS (BRT)
FWD CKPT CONSOLE LT
AFT CKPT LT XMFR
FWD CKPT INST LT
SIDE WINDER PWR LH
SIDE WINDER PWR RH
SPL WPN PWR LO
SPL WPN PWR LI
SPL WPN PWR ℄
SPL WPN PWR RI
SPL WPN PWR RO
ECM CONTROL
℄ SPL WPN SAFE
SPL WPN UNLOCK RH & ℄
SPL WPN UNLOCK LH
OUTB'D STORES JET (PRIM)
OUTB'D STORES JET (SEC)
ALL STORES EMERG JET
A-G WEAPON RELEASE CONT
℄ SPL WPN ARMT
AMAC
11
10
9
8
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ESSENTIAL DC TEST SWITCH
ESSENTIAL DC TEST LIGHT
INST GRD PWR SWITCH
NORM
TEST
R IGN UNIT NO. 2
R IGN UNIT NO. 1
SPARE
R MAIN IGNITION
L MAIN IGNITION
14
13
12
CIRCUIT BREAKER PANEL NO. 4
NO. 4 CKT BKR PANEL 4Z331
AUTO PILOT POWER
R.H. MISSILE POWER
L.H. MISSILE POWER
RADAR POWER
RADAR ALTM
ARBCS
CADC POWER
CNI
CNI
AUTO PILOT POWER
1
MISSILE LEFT
R.H. MISSILE POWER
L.H. MISSILE POWER
RADAR POWER
RADAR ALTM
ARBCS
CADC POWER
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CNI
AUTO PILOT POWER
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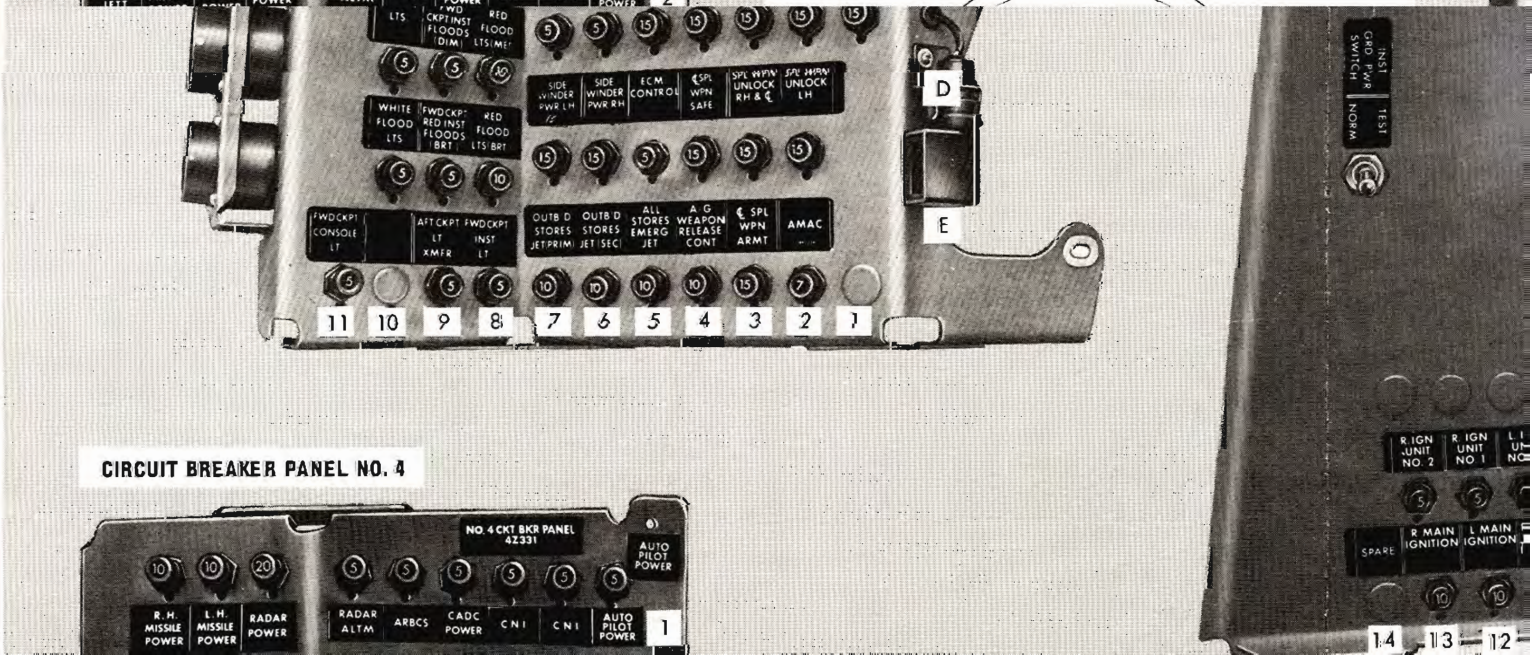
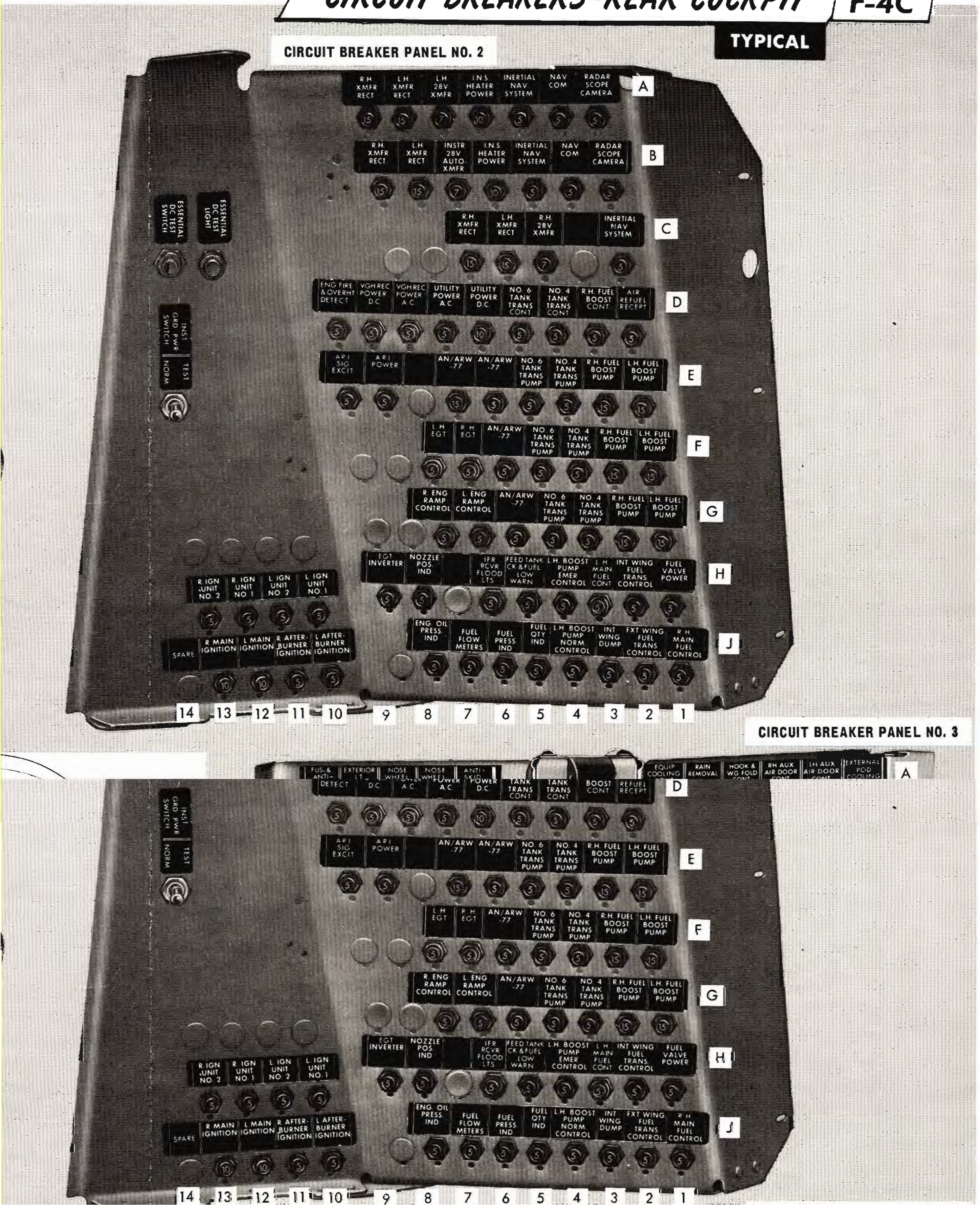


CIRCUIT BREAKERS-REAR COCKPIT

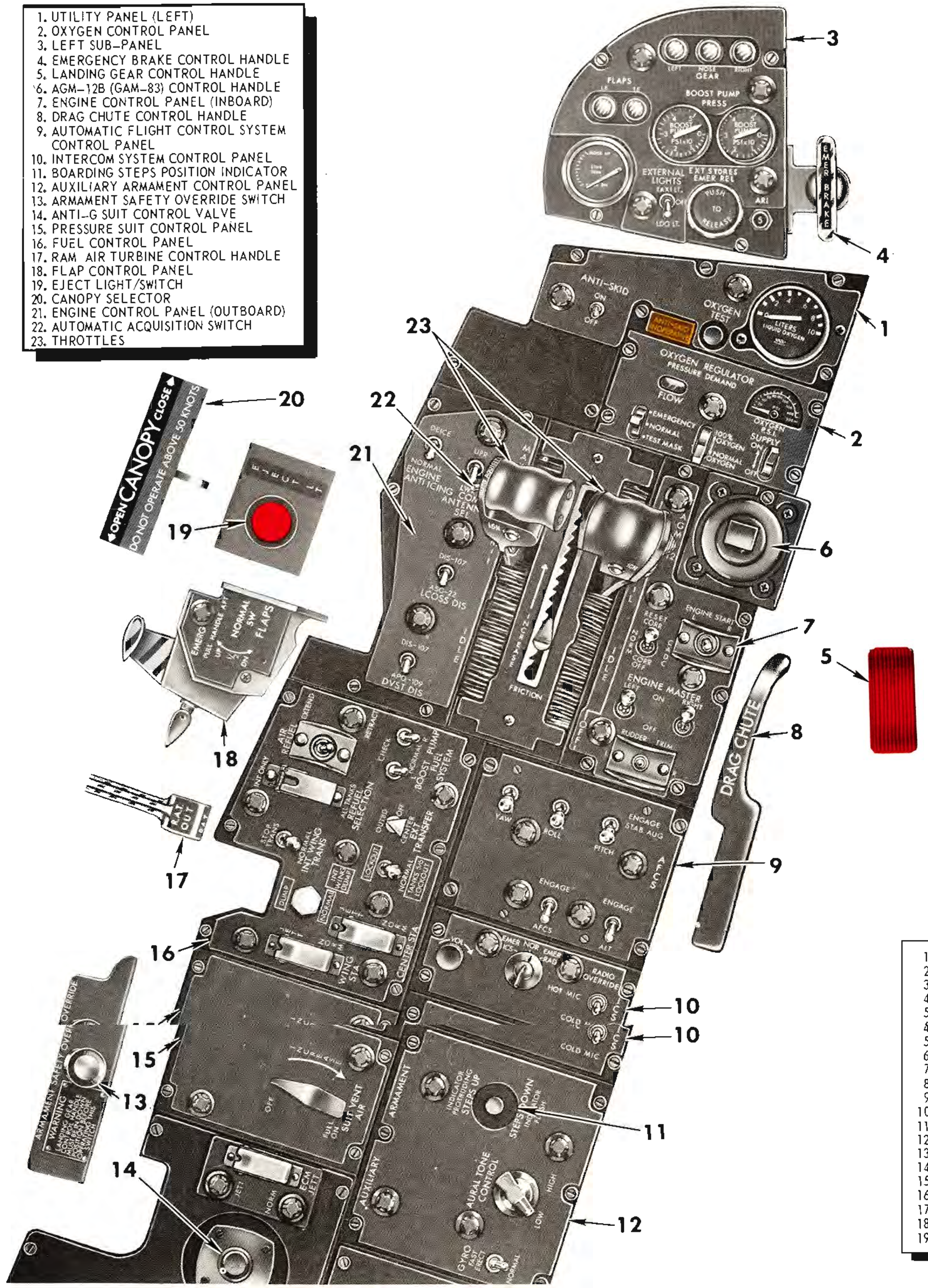
F-4C

TYPICAL

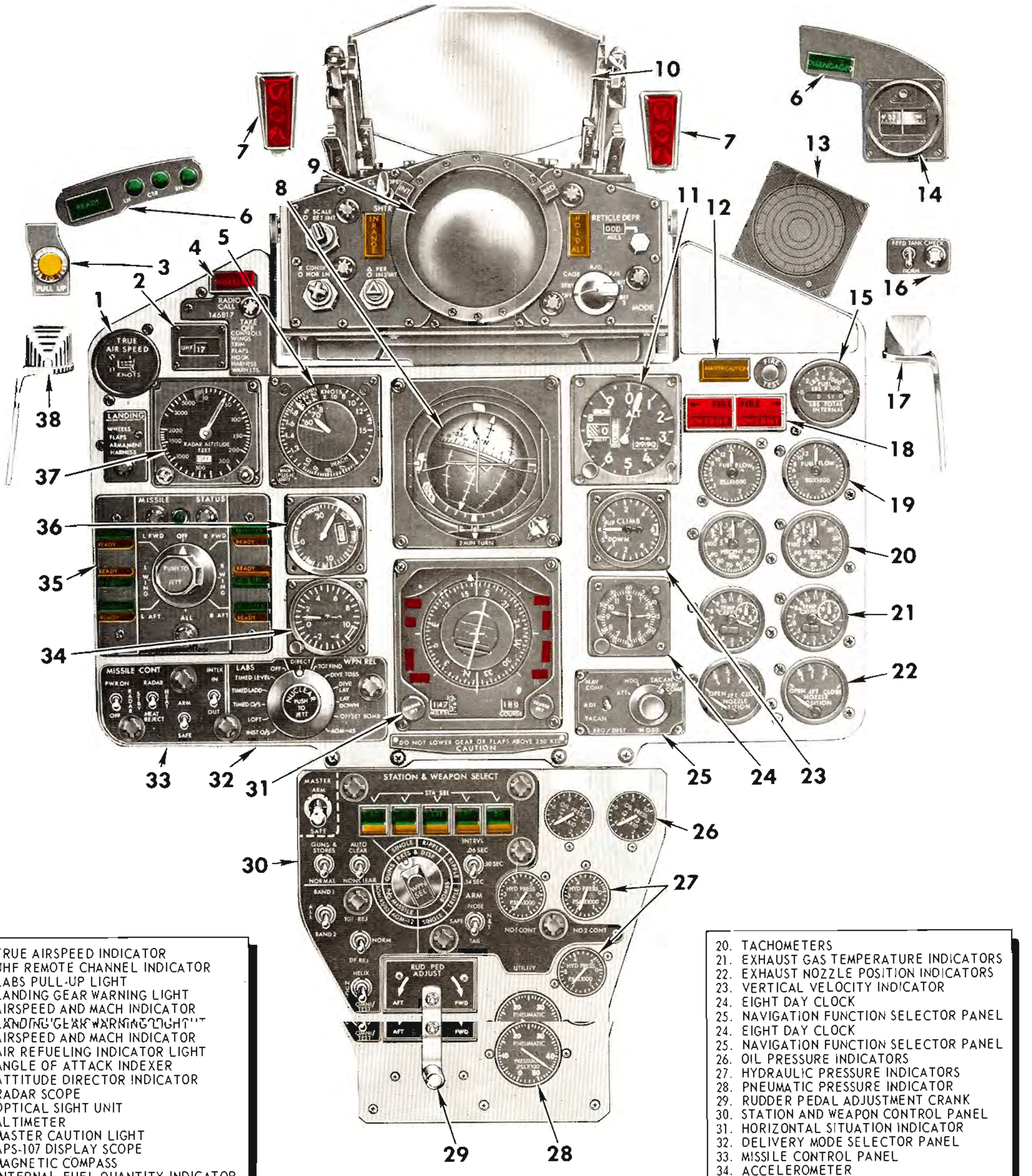


FRONT COCKPIT F-4D

TYPICAL

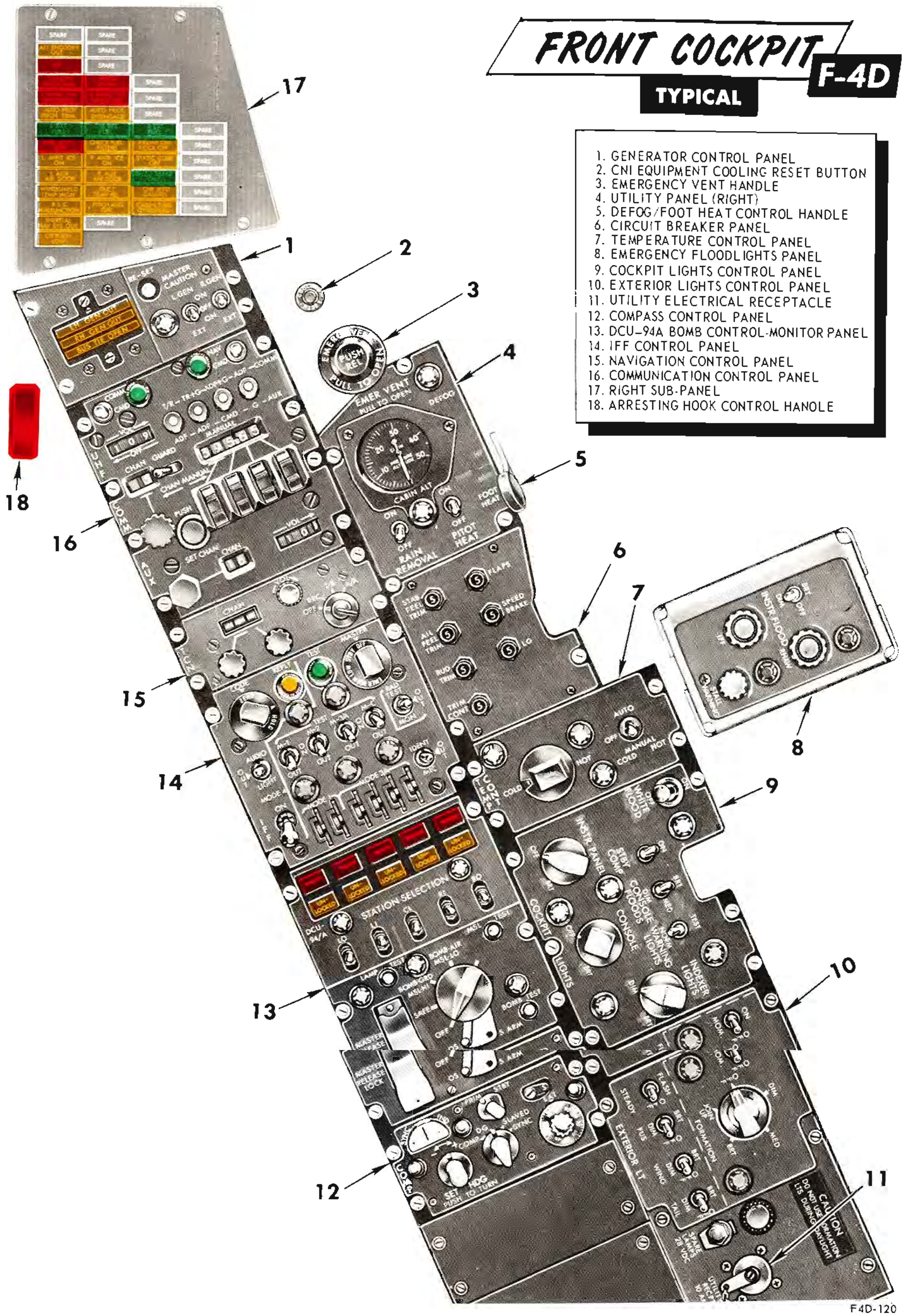


1. UTILITY PANEL (LEFT)
2. OXYGEN CONTROL PANEL
3. LEFT SUB-PANEL
4. EMERGENCY BRAKE CONTROL HANDLE
5. LANDING GEAR CONTROL HANDLE
6. AGM-12B (GAM-83) CONTROL HANDLE
7. ENGINE CONTROL PANEL (INBOARD)
8. DRAG CHUTE CONTROL HANDLE
9. AUTOMATIC FLIGHT CONTROL SYSTEM CONTROL PANEL
10. INTERCOM SYSTEM CONTROL PANEL
11. BOARDING STEPS POSITION INDICATOR
12. AUXILIARY ARMAMENT CONTROL PANEL
13. ARMAMENT SAFETY OVERRIDE SWITCH
14. ANTI-G SUIT CONTROL VALVE
15. PRESSURE SUIT CONTROL PANEL
16. FUEL CONTROL PANEL
17. RAM AIR TURBINE CONTROL HANDLE
18. FLAP CONTROL PANEL
19. EJECT LIGHT/SWITCH
20. CANOPY SELECTOR
21. ENGINE CONTROL PANEL (OUTBOARD)
22. AUTOMATIC ACQUISITION SWITCH
23. THROTTLES



1. TRUE AIRSPEED INDICATOR
2. UHF REMOTE CHANNEL INDICATOR
3. LABS PULL-UP LIGHT
4. LANDING GEAR WARNING LIGHT
5. AIRSPEED AND MACH INDICATOR
4. LANDING GEAR WARNING LIGHT
5. AIRSPEED AND MACH INDICATOR
6. AIR REFUELING INDICATOR LIGHT
7. ANGLE OF ATTACK INDEXER
8. ATTITUDE DIRECTOR INDICATOR
9. RADAR SCOPE
10. OPTICAL SIGHT UNIT
11. ALTIMETER
12. MASTER CAUTION LIGHT
13. APS-107 DISPLAY SCOPE
14. MAGNETIC COMPASS
15. INTERNAL FUEL QUANTITY INDICATOR
16. FEED TANK CHECK SWITCH
17. CANOPY MANUAL UNLOCK HANDLE
18. FIRE-OVERHEAT WARNING LIGHTS
19. FUEL FLOW INDICATORS

20. TACHOMETERS
21. EXHAUST GAS TEMPERATURE INDICATORS
22. EXHAUST NOZZLE POSITION INDICATORS
23. VERTICAL VELOCITY INDICATOR
24. EIGHT DAY CLOCK
25. NAVIGATION FUNCTION SELECTOR PANEL
24. EIGHT DAY CLOCK
25. NAVIGATION FUNCTION SELECTOR PANEL
26. OIL PRESSURE INDICATORS
27. HYDRAULIC PRESSURE INDICATORS
28. PNEUMATIC PRESSURE INDICATOR
29. RUDDER PEDAL ADJUSTMENT CRANK
30. STATION AND WEAPON CONTROL PANEL
31. HORIZONTAL SITUATION INDICATOR
32. DELIVERY MODE SELECTOR PANEL
33. MISSILE CONTROL PANEL
34. ACCELEROMETER
35. MISSILE STATUS PANEL
36. ANGLE OF ATTACK INDICATOR
37. RADAR ALTIMETER
38. CANOPY EMERGENCY JETTISON HANDLE

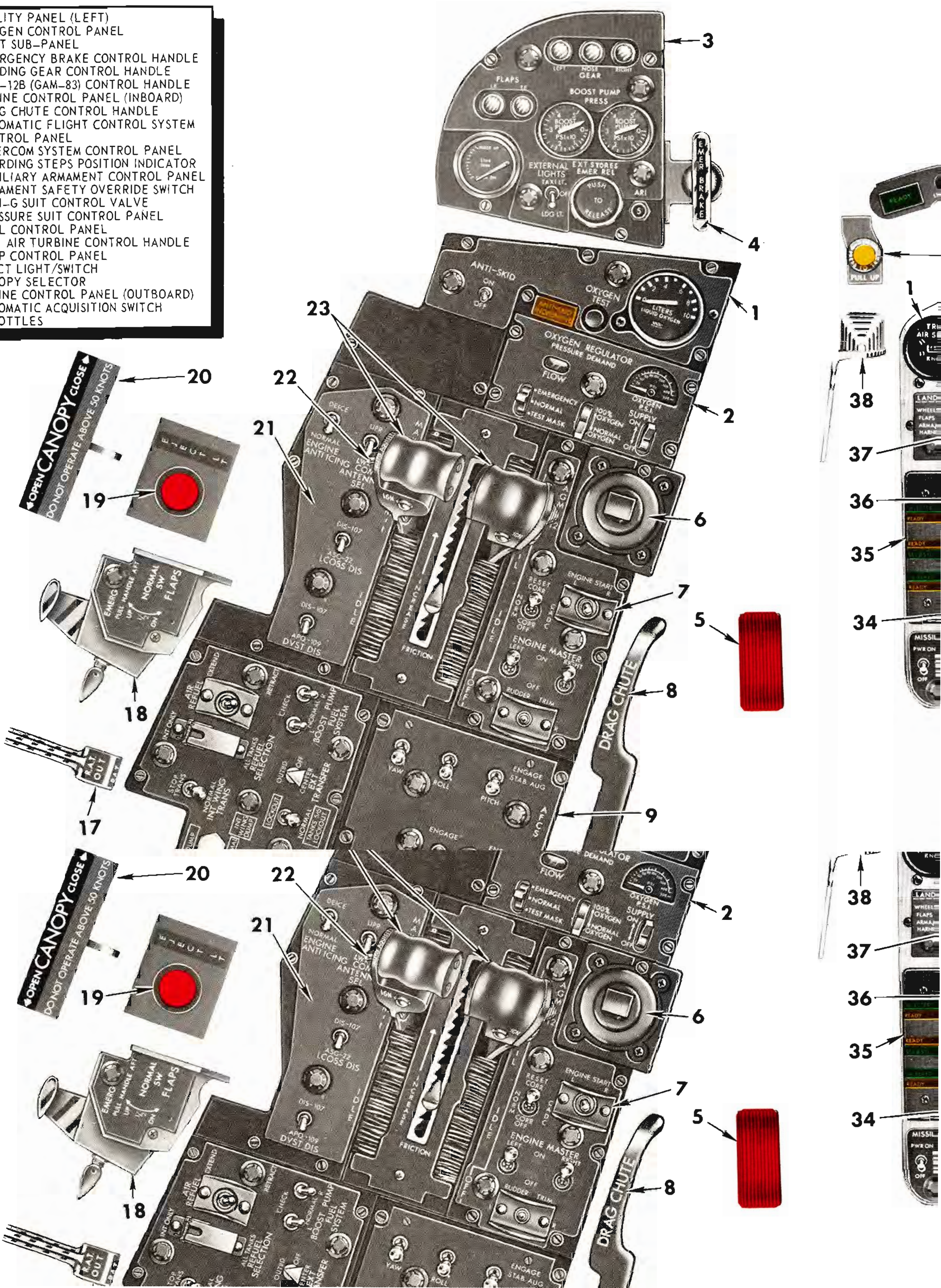


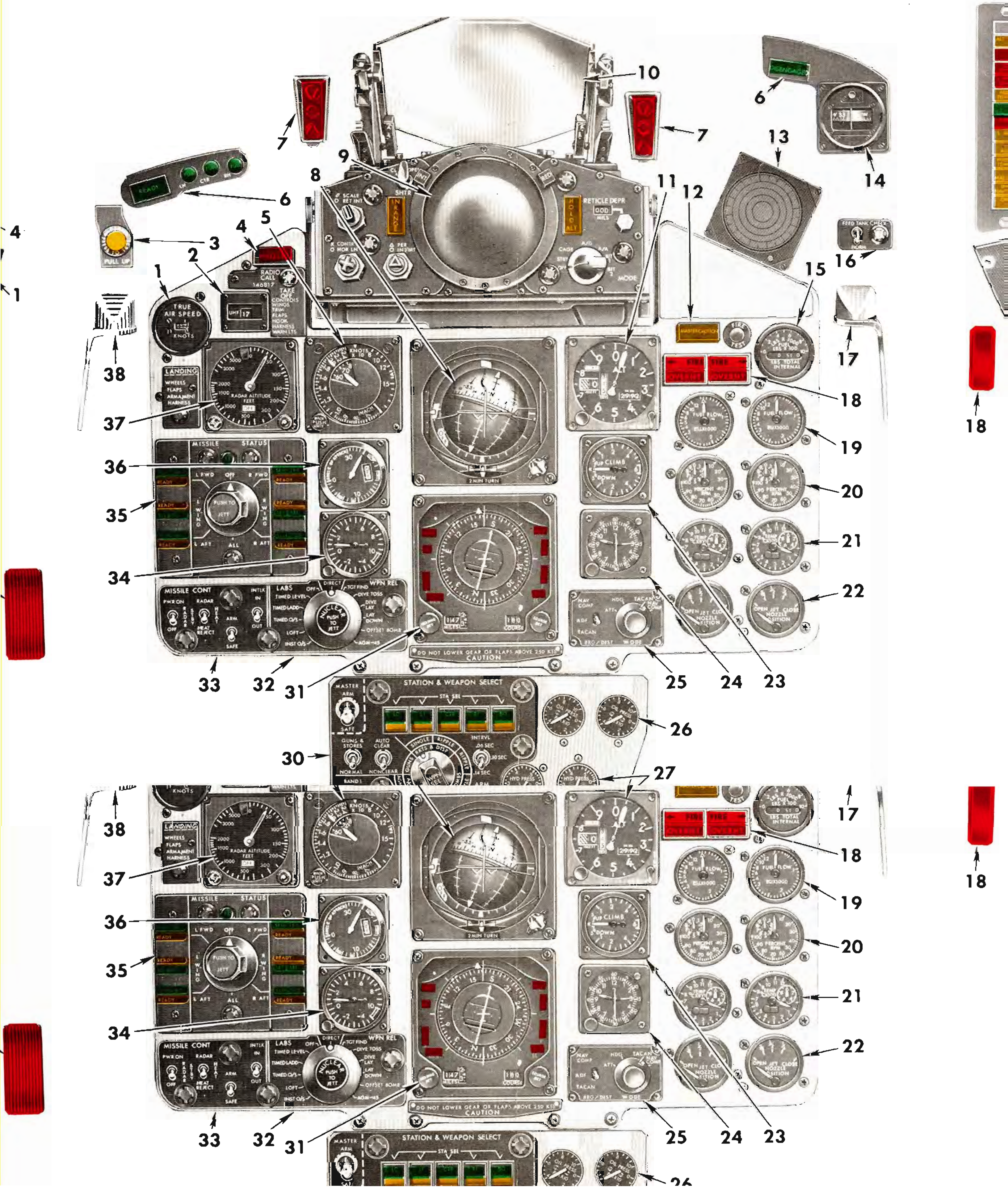
1. GENERATOR CONTROL PANEL
2. CNI EQUIPMENT COOLING RESET BUTTON
3. EMERGENCY VENT HANDLE
4. UTILITY PANEL (RIGHT)
5. DEFOG/FOOT HEAT CONTROL HANDLE
6. CIRCUIT BREAKER PANEL
7. TEMPERATURE CONTROL PANEL
8. EMERGENCY FLOODLIGHTS PANEL
9. COCKPIT LIGHTS CONTROL PANEL
10. EXTERIOR LIGHTS CONTROL PANEL
11. UTILITY ELECTRICAL RECEPTACLE
12. COMPASS CONTROL PANEL
13. DCU-94A BOMB CONTROL-MONITOR PANEL
14. IFF CONTROL PANEL
15. NAVIGATION CONTROL PANEL
16. COMMUNICATION CONTROL PANEL
17. RIGHT SUB-PANEL
18. ARRESTING HOOK CONTROL HANDLE

F4D-120 RGY

Figure FO-14

1. UTILITY PANEL (LEFT)
2. OXYGEN CONTROL PANEL
3. LEFT SUB-PANEL
4. EMERGENCY BRAKE CONTROL HANDLE
5. LANDING GEAR CONTROL HANDLE
6. AGM-12B (GAM-83) CONTROL HANDLE
7. ENGINE CONTROL PANEL (INBOARD)
8. DRAG CHUTE CONTROL HANDLE
9. AUTOMATIC FLIGHT CONTROL SYSTEM CONTROL PANEL
10. INTERCOM SYSTEM CONTROL PANEL
11. BOARDING STEPS POSITION INDICATOR
12. AUXILIARY ARMAMENT CONTROL PANEL
13. ARMAMENT SAFETY OVERRIDE SWITCH
14. ANTI-G SUIT CONTROL VALVE
15. PRESSURE SUIT CONTROL PANEL
16. FUEL CONTROL PANEL
17. RAM AIR TURBINE CONTROL HANDLE
18. FLAP CONTROL PANEL
19. EJECT LIGHT/SWITCH
20. CANOPY SELECTOR
21. ENGINE CONTROL PANEL (OUTBOARD)
22. AUTOMATIC ACQUISITION SWITCH
23. THROTTLES





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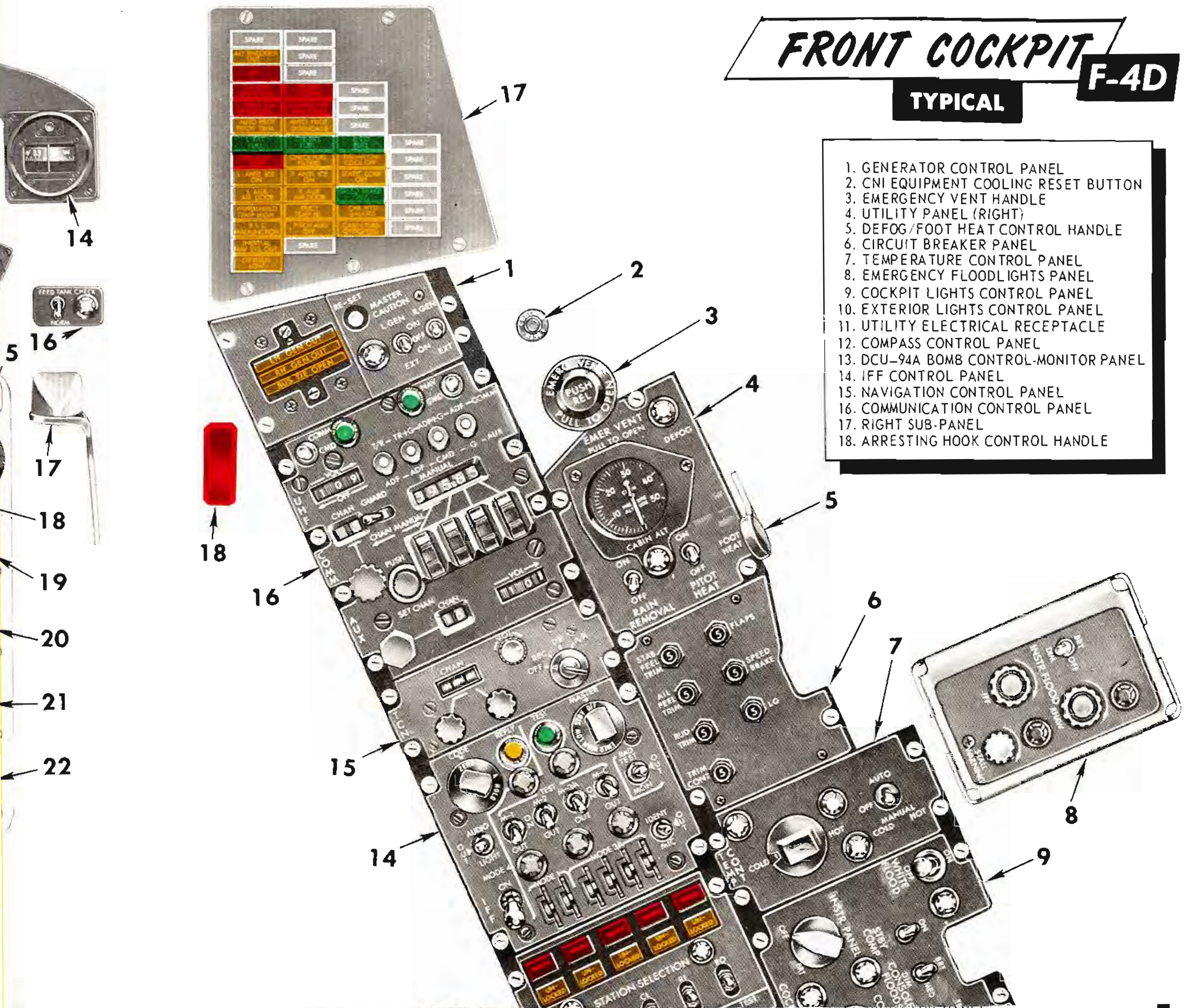
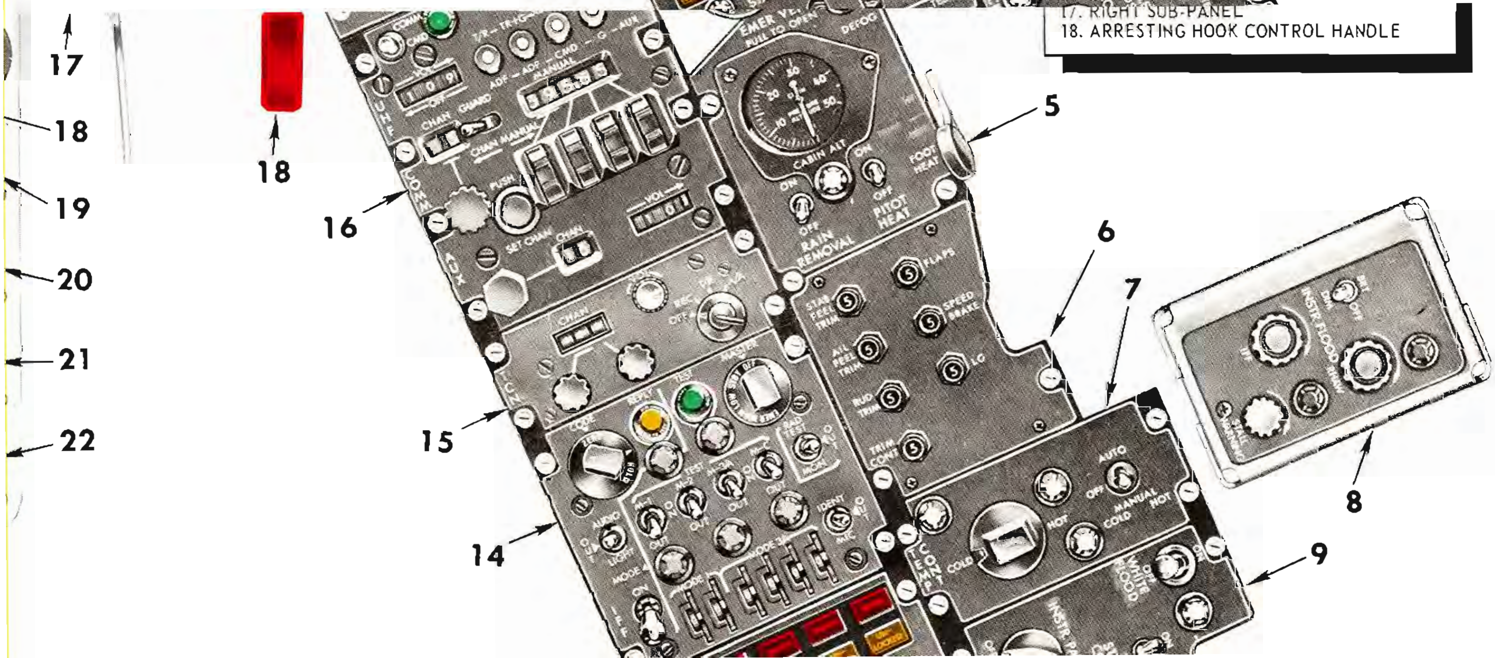
FRONT COCKPIT F-4D

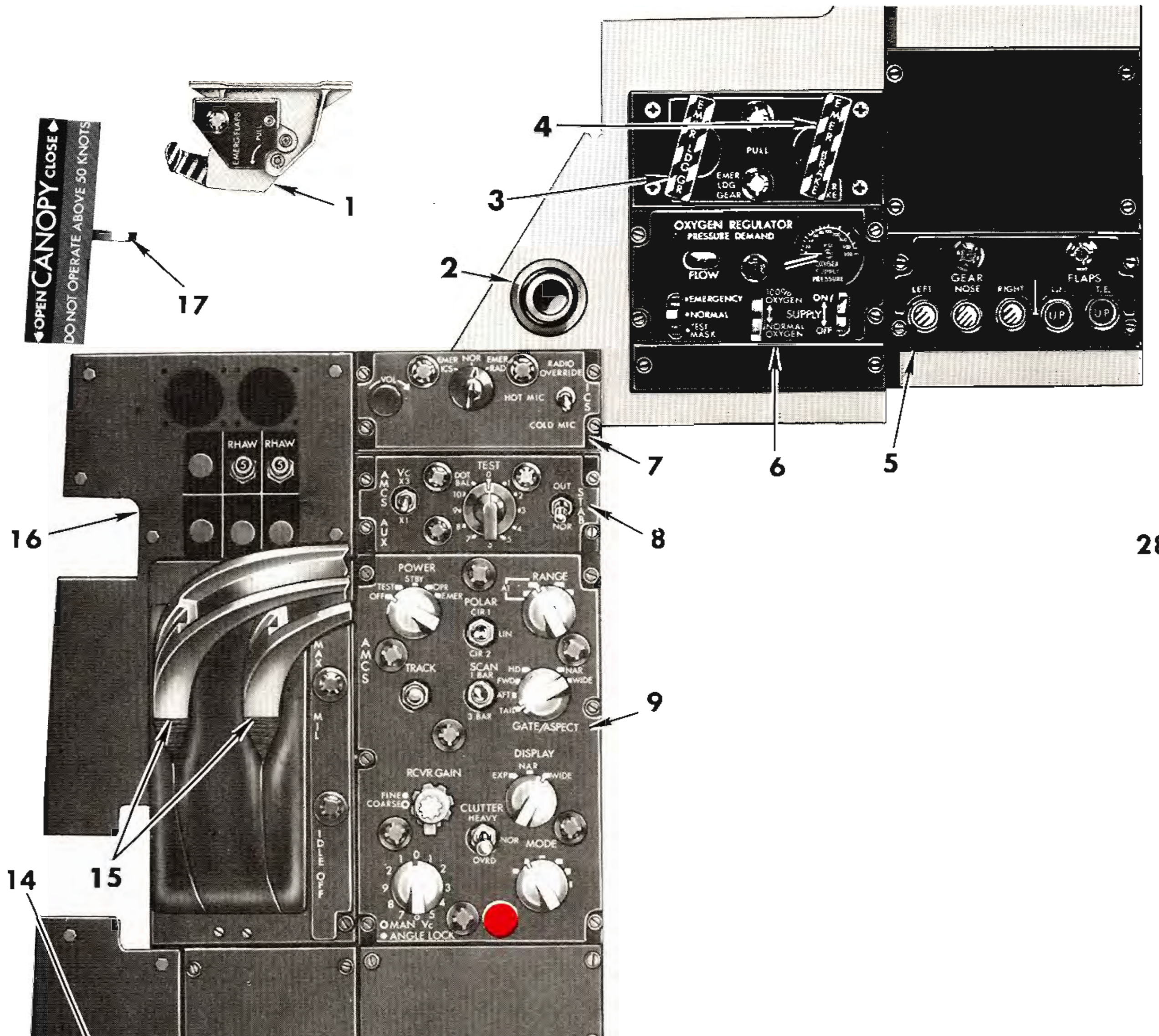
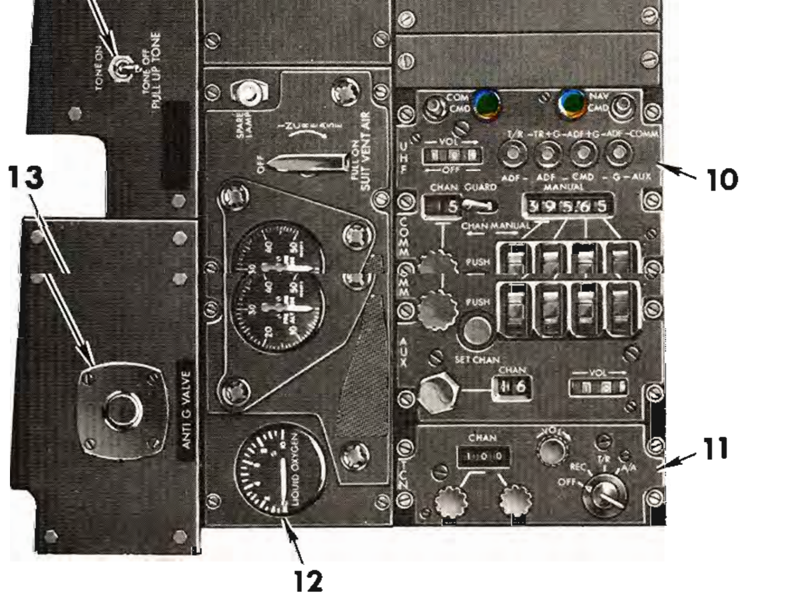
TYPICAL

1. GENERATOR CONTROL PANEL
2. CNI EQUIPMENT COOLING RESET BUTTON
3. EMERGENCY VENT HANDLE
4. UTILITY PANEL (RIGHT)
5. DEFOG/FOOT HEAT CONTROL HANDLE
6. CIRCUIT BREAKER PANEL
7. TEMPERATURE CONTROL PANEL
8. EMERGENCY FLOODLIGHTS PANEL
9. COCKPIT LIGHTS CONTROL PANEL
10. EXTERIOR LIGHTS CONTROL PANEL
11. UTILITY ELECTRICAL RECEPTACLE
12. COMPASS CONTROL PANEL
13. DCU–94A BOMB CONTROL-MONITOR PANEL
14. IFF CONTROL PANEL
15. NAVIGATION CONTROL PANEL
16. COMMUNICATION CONTROL PANEL
17. RIGHT SUB-PANEL
18. ARRESTING HOOK CONTROL HANDLE

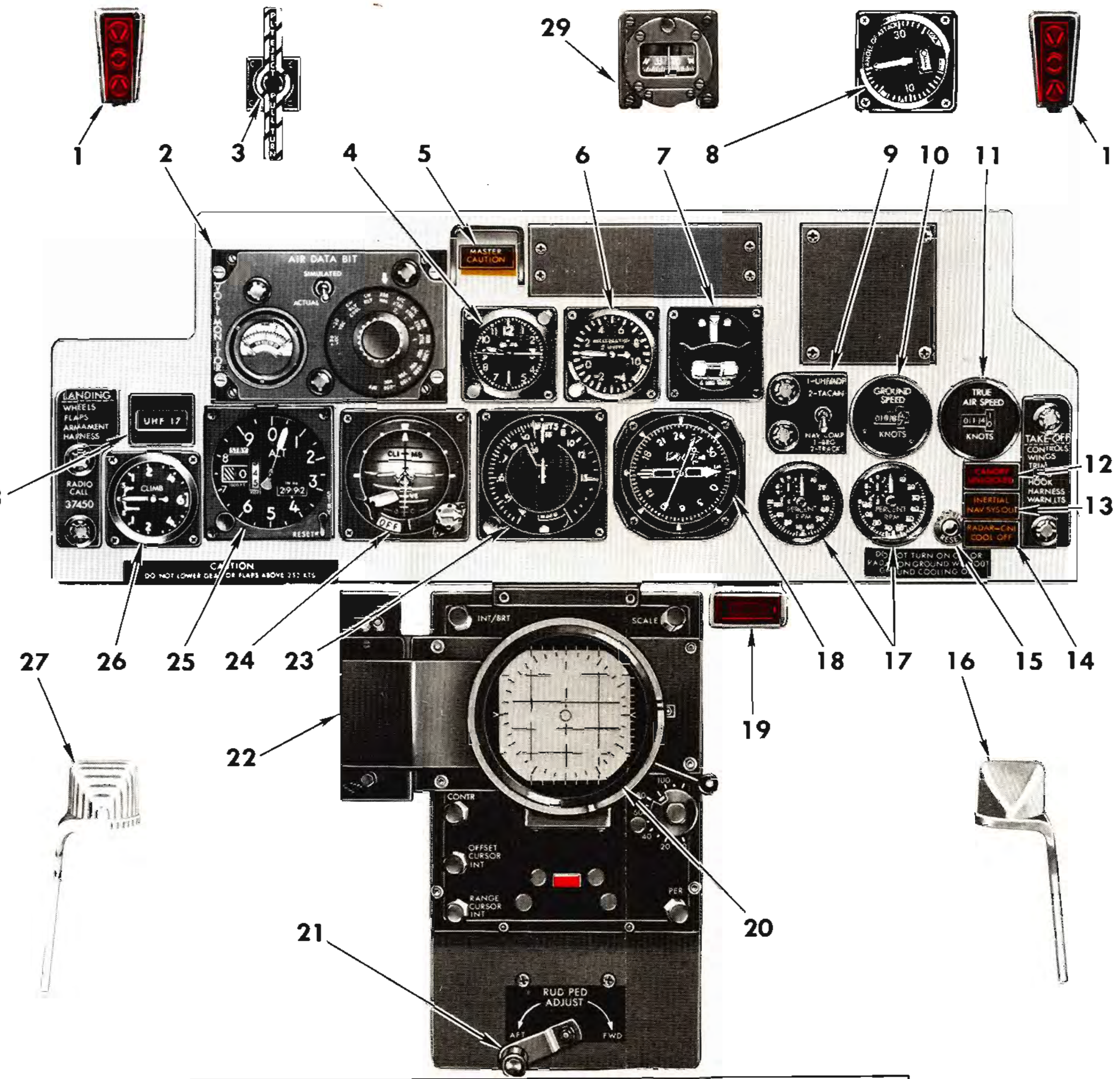


17. RIGHT SUB-PANEL
18. ARRESTING HOOK CONTROL HANDLE

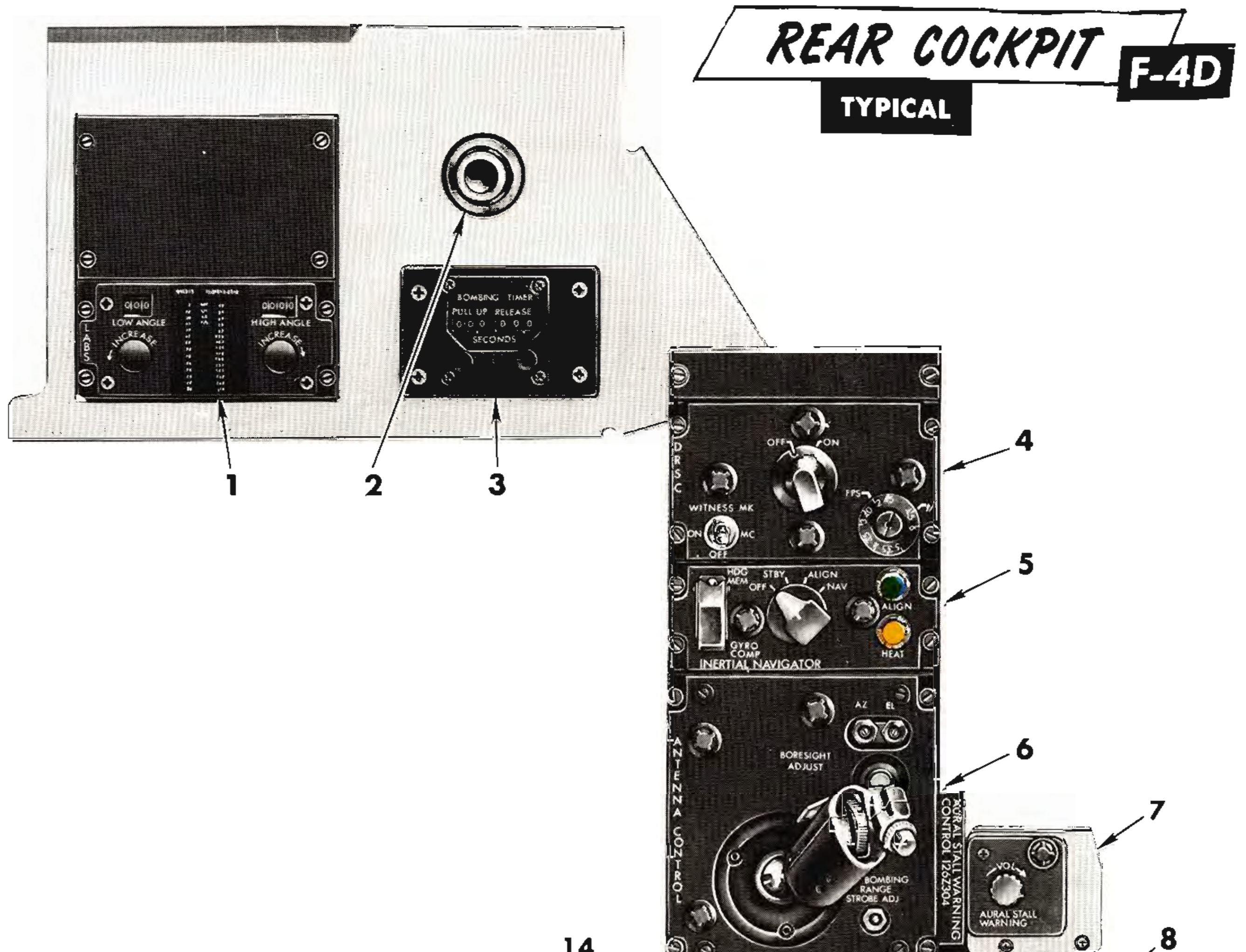


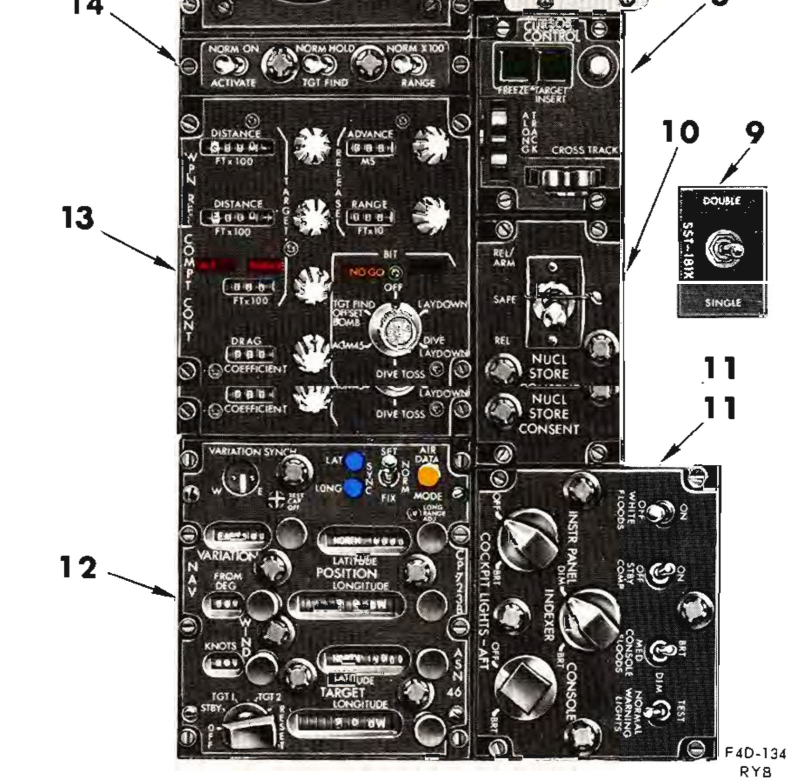



1. EMERGENCY FLAP CONTROL PANEL
2. AIR VENT NOZZLE
3. EMERGENCY LANDING GEAR CONTROL HANDLE
4. EMERGENCY BRAKE CONTROL HANDLE
5. LANDING GEAR - FLAP INDICATOR PANEL
6. OXYGEN CONTROL PANEL
7. INTERCOM CONTROL PANEL
8. AUXILIARY RADAR CONTROL PANEL
9. RADAR CONTROL PANEL
10. COMMUNICATION CONTROL PANEL
11. NAVIGATION CONTROL PANEL
10. COMMUNICATION CONTROL PANEL
11. NAVIGATION CONTROL PANEL
12. PRESSURE SUIT CONTROL PANEL
13. ANTI G SUIT CONTROL VALVE
14. PULL UP TONE CUTOUT SWITCH
15. THROTTLES
16. CIRCUIT BREAKER PANEL NO. 5
17. CANOPY SELECTOR



1. ANGLE OF ATTACK INDEXER
2. VOLT MONITOR PANEL
3. COMMAND SELECTOR VALVE (EJECTION)
4. EIGHT DAY CLOCK
5. MASTER CAUTION LIGHT
4. EIGHT DAY CLOCK
5. MASTER CAUTION LIGHT
6. ACCELEROMETER
7. TURN AND SLIP INDICATOR
8. ANGLE OF ATTACK INDICATOR
9. NAVIGATION FUNCTION SELECTOR PANEL
10. GROUND SPEED INDICATOR
11. TRUE AIRSPEED INDICATOR
12. CANOPY UNLOCKED WARNING LIGHT
13. INERTIAL NAVIGATOR OUT WARNING LIGHT
14. RADAR–CNI COOL OFF WARNING LIGHT
15. RADAR–CNI COOLING RESET BUTTON
16. CANOPY MANUAL UNLOCK HANDLE
17. TACHOMETERS
18. BEARING-DISTANCE-HEADING INDICATOR
19. EJECT LIGHT
20. RADAR SCOPE
19. EJECT LIGHT
20. RADAR SCOPE
21. RUDDER PEDAL ADJUSTMENT CRANK
22. DIRECT READING SCOPE CAMERA
23. AIRSPEED-MACH INDICATOR
24. ATTITUDE INDICATOR
25. ALTIMETER
26. VERTICAL VELOCITY INDICATOR
27. CANOPY EMERGENCY JETTISON HANDLE
28. UHF CHANNEL REMOTE INDICATOR
29. STANDBY MAGNETIC COMPASS

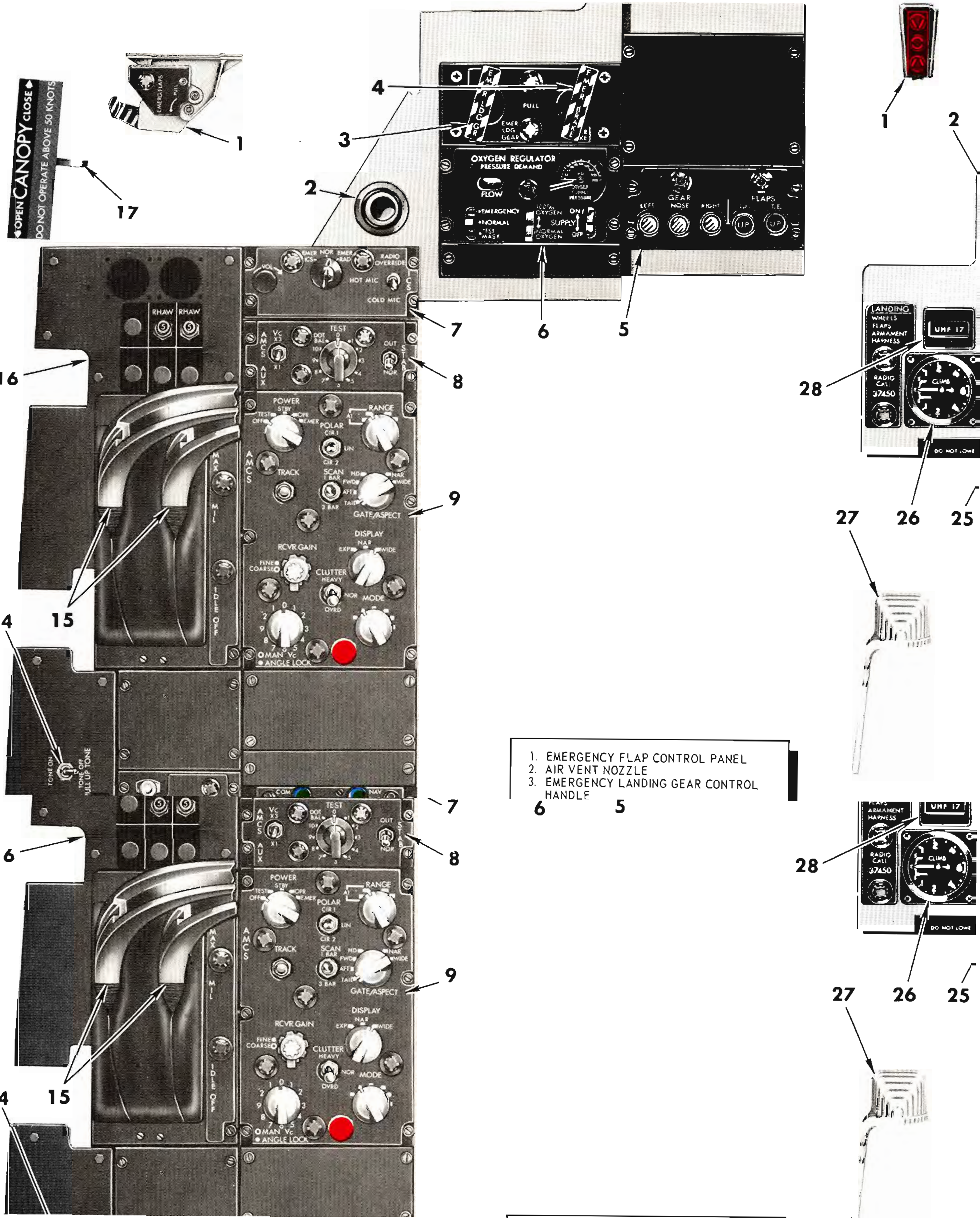




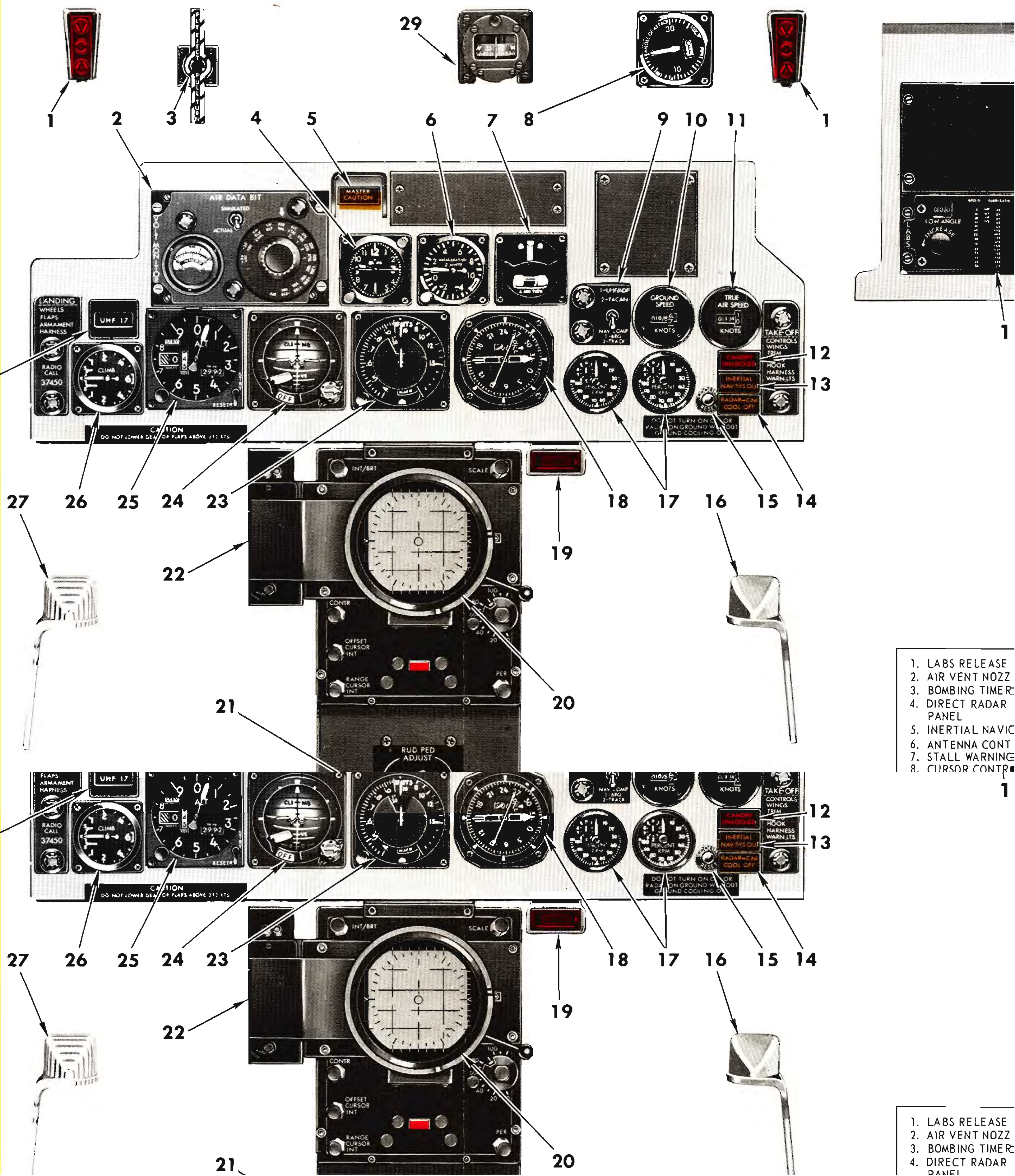
1. LABS RELEASE ANGLE CONTROL PANEL
2. AIR VENT NOZZLE
3. BOMBING TIMER CONTROL PANEL
4. DIRECT RADAR SCOPE CAMERA CONTROL PANEL
5. INERTIAL NAVIGATOR CONTROL PANEL
6. ANTENNA CONTROL PANEL
7. STALL WARNING TONE CONTROL PANEL
8. CURSOR CONTROL PANEL
9. SST-181X PULSE SELECTOR SWITCH
10. NUCLEAR STORE CONSENT SWITCH
11. COCKPIT LIGHTS CONTROL PANEL
12. NAVIGATION CONTROL PANEL
13. WEAPONS RELEASE COMPUTER CONTROL PANEL
14. WEAPON DELIVERY PANEL
14. WEAPON DELIVERY PANEL

F4D-134
RYB

Figure FO-15



1. EMERGENCY FLAP CONTROL PANEL
2. AIR VENT NOZZLE
3. EMERGENCY LANDING GEAR CONTROL HANDLE

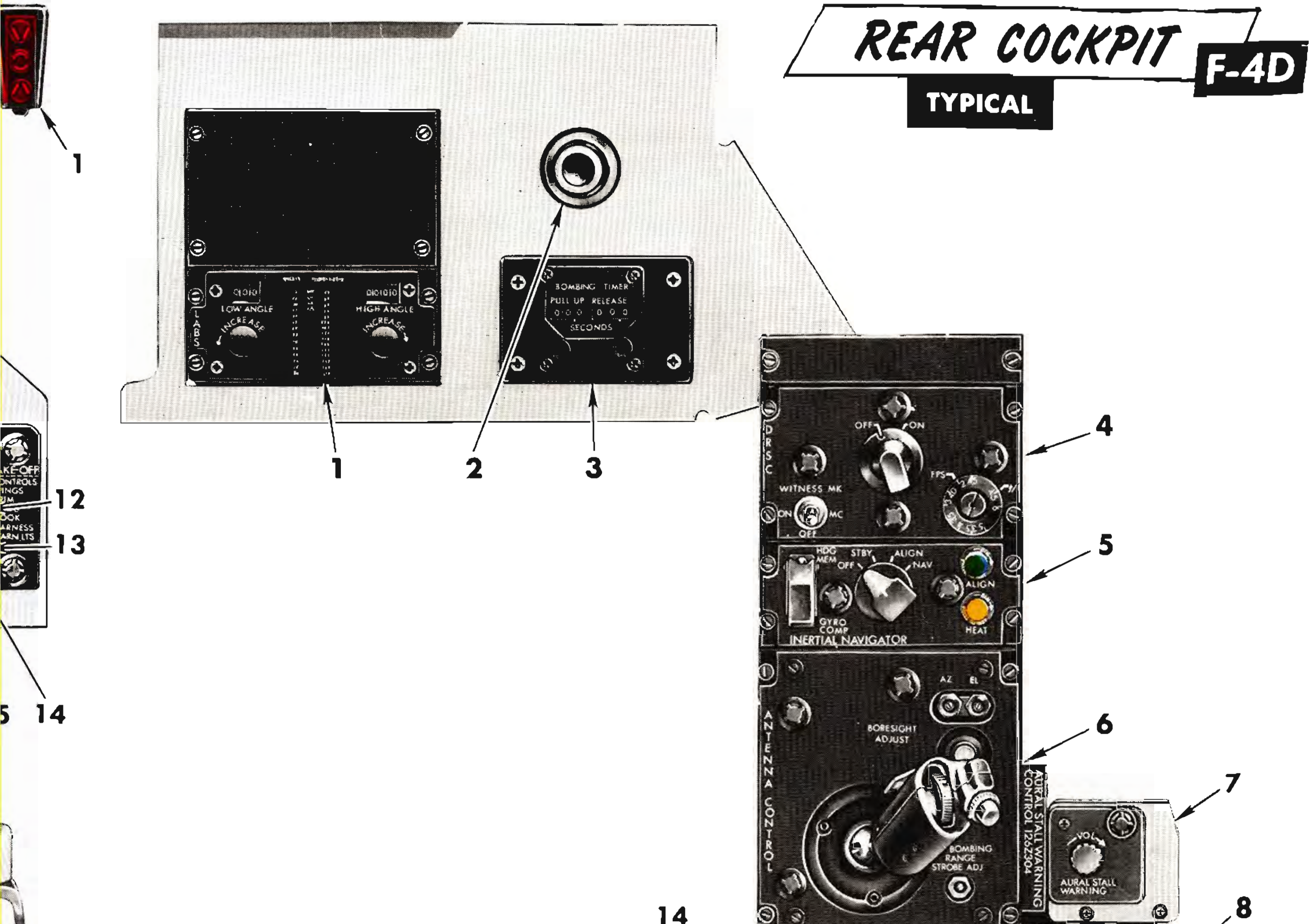


1. LABS RELEASE
2. AIR VENT NOZZ
3. BOMBING TIMER
4. DIRECT RADAR PANEL
5. INERTIAL NAVIC
6. ANTENNA CONT
7. STALL WARNING
8. CURSOR CONTR

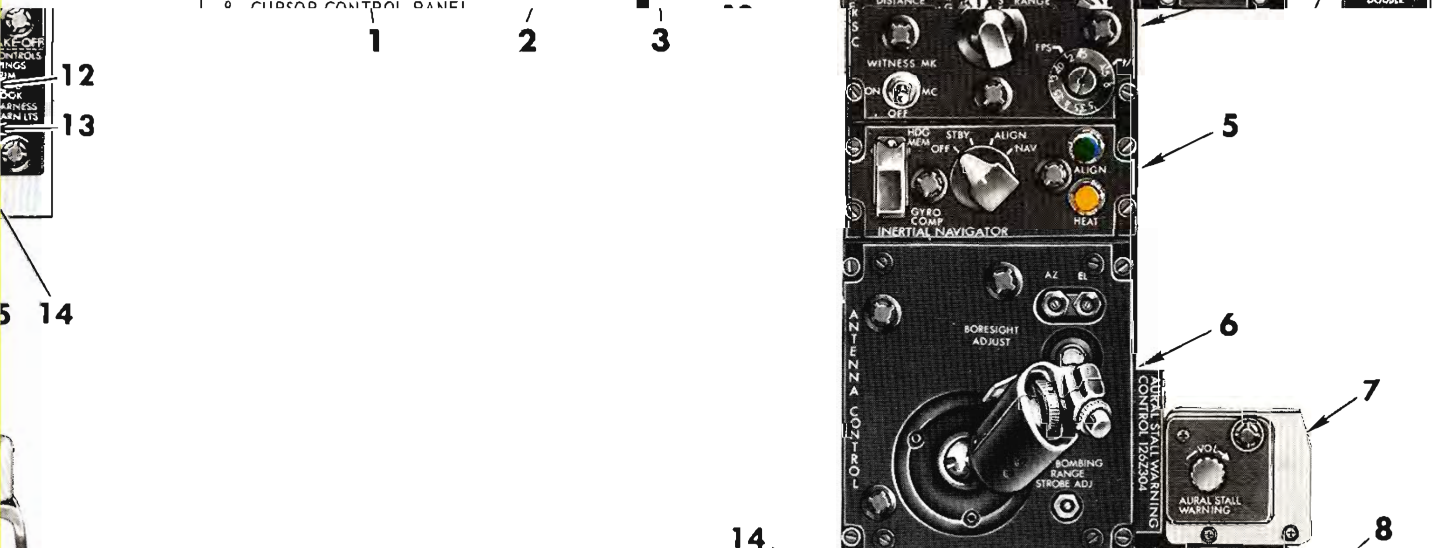
1. LABS RELEASE
2. AIR VENT NOZZ
3. BOMBING TIMER
4. DIRECT RADAR PANEL

REAR COCKPIT F-4D

TYPICAL



1. LABS RELEASE ANGLE CONTROL PANEL
2. AIR VENT NOZZLE
3. BOMBING TIMER CONTROL PANEL
4. DIRECT RADAR SCOPE CAMERA CONTROL PANEL
5. INERTIAL NAVIGATOR CONTROL PANEL
6. ANTENNA CONTROL PANEL
7. STALL WARNING TONE CONTROL PANEL
8. CURSOR CONTROL PANEL



1. LABS RELEASE ANGLE CONTROL PANEL
2. AIR VENT NOZZLE
3. BOMBING TIMER CONTROL PANEL
4. DIRECT RADAR SCOPE CAMERA CONTROL PANEL

CIRCUIT BREAKERS-REAR COCKPIT

F-4D

TYPICAL

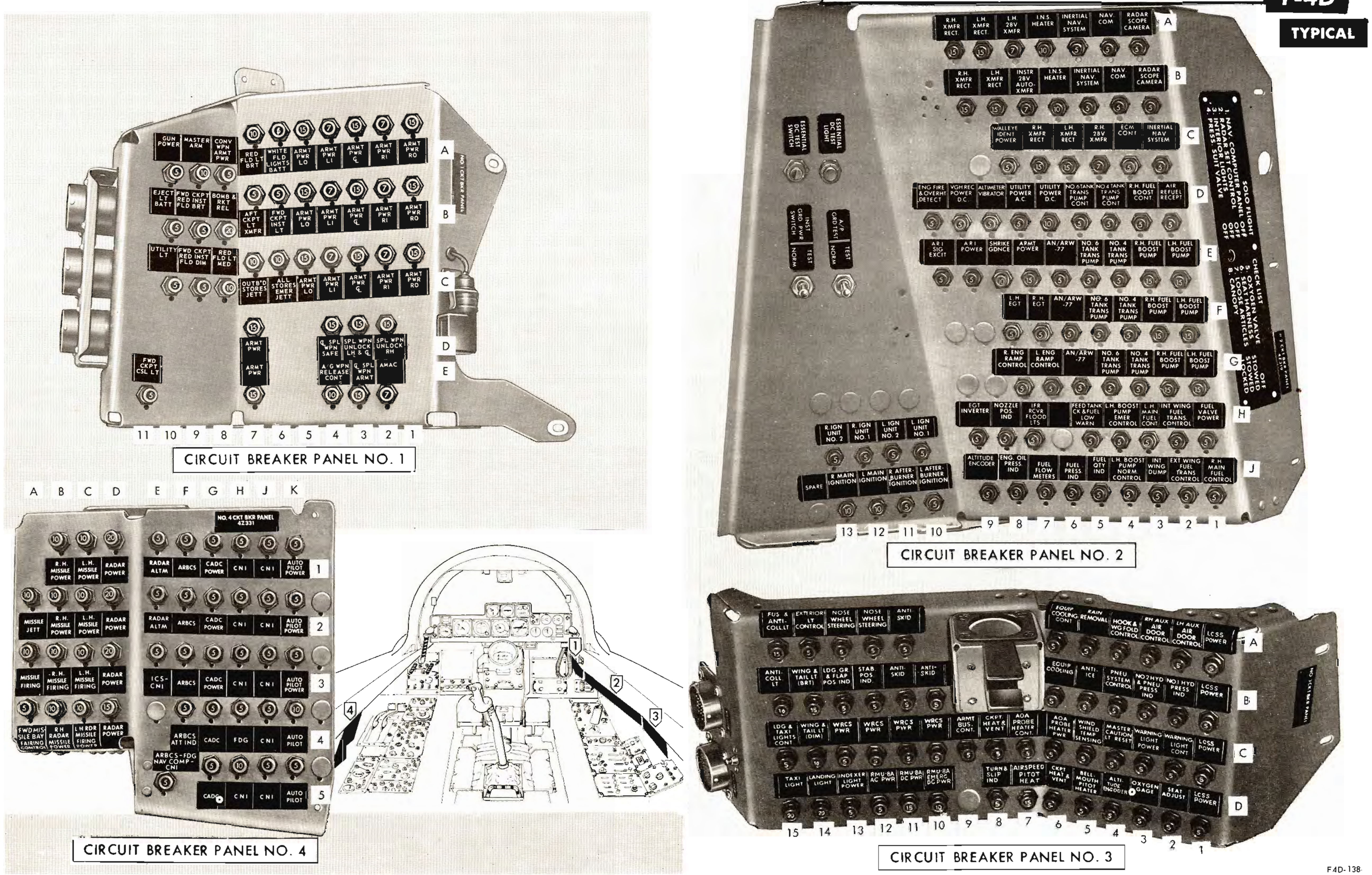
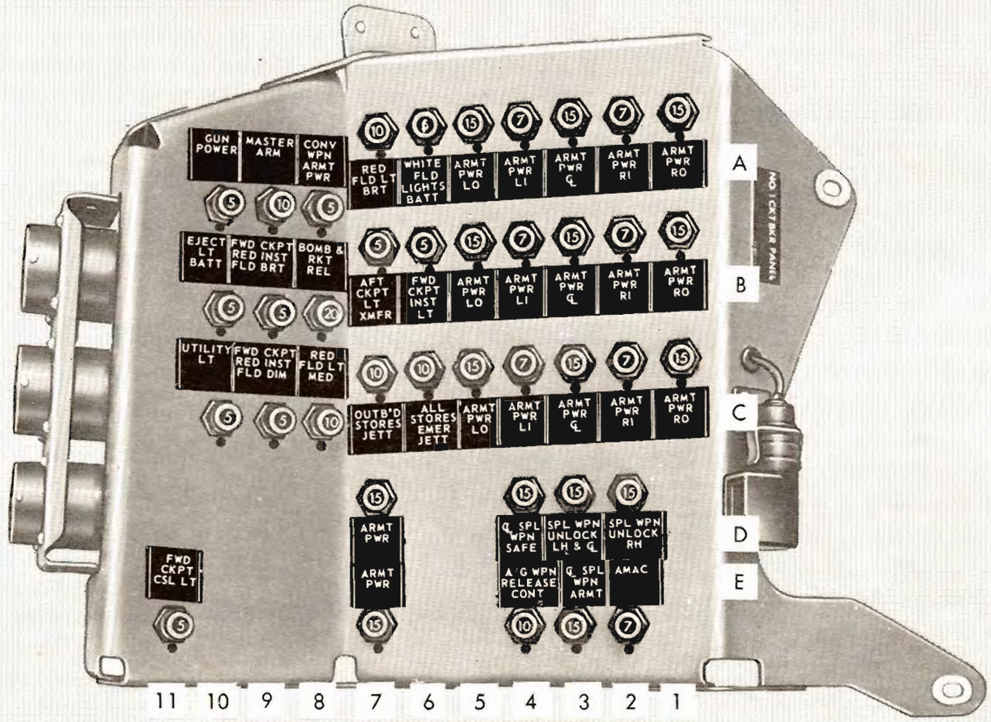
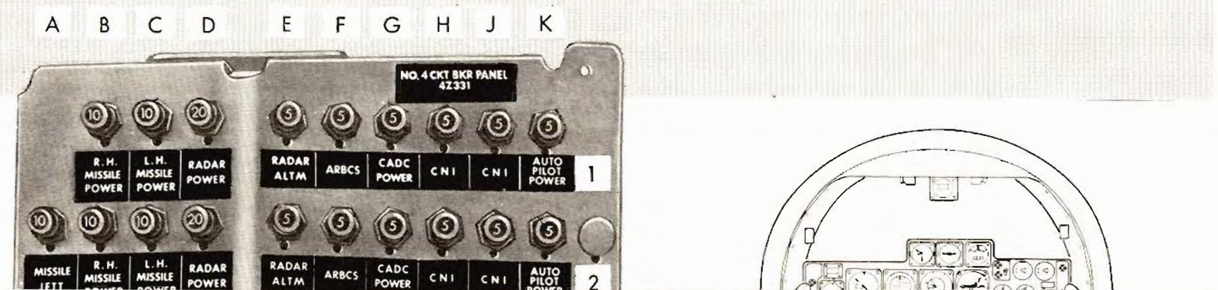
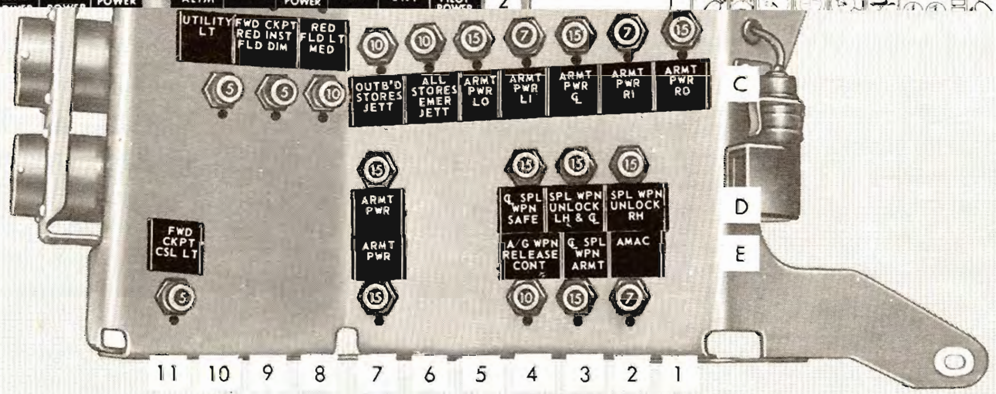


Figure FO-16

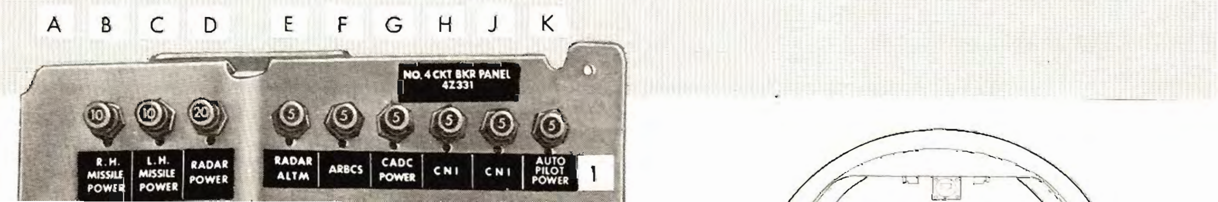


CIRCUIT BREAKER PANEL NO. 1





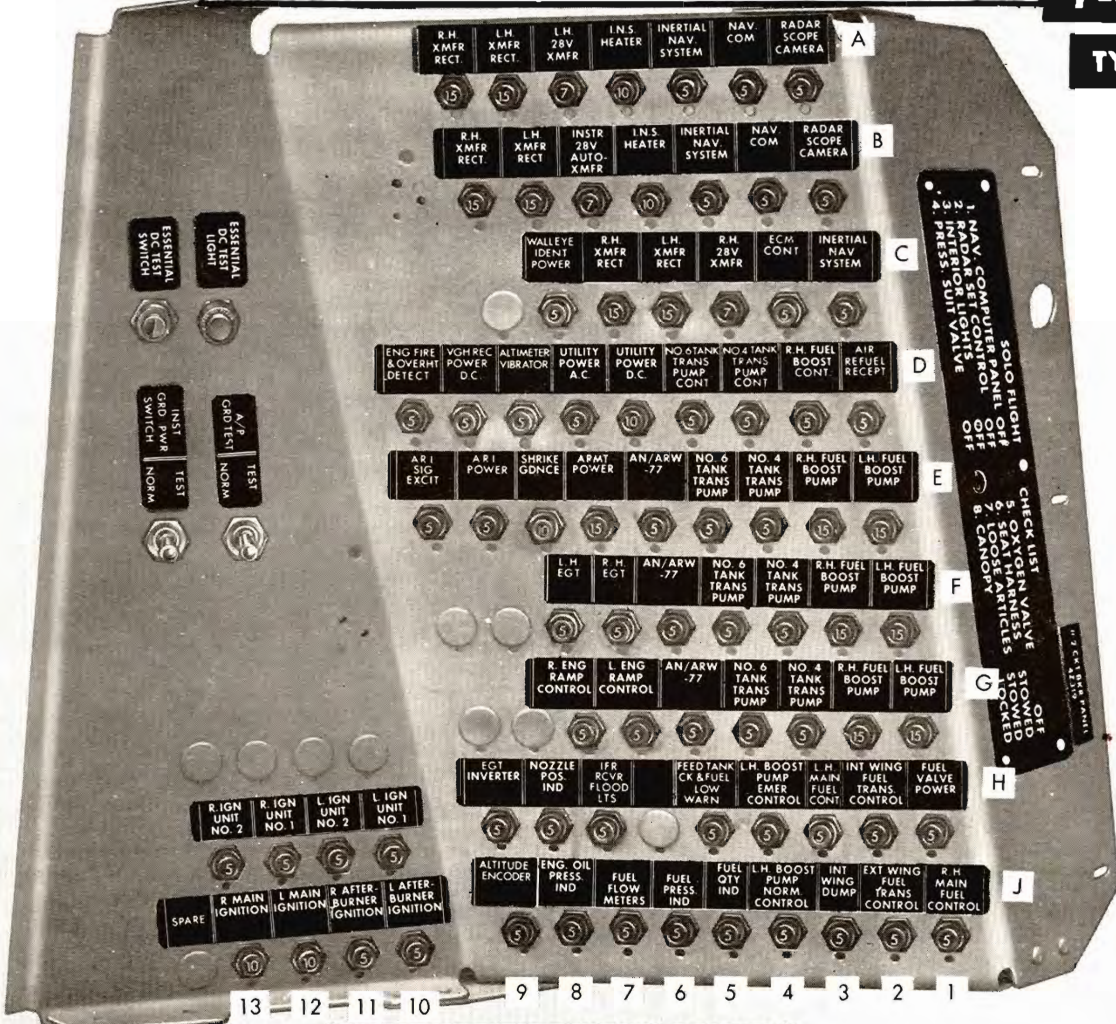
CIRCUIT BREAKER PANEL NO. 1



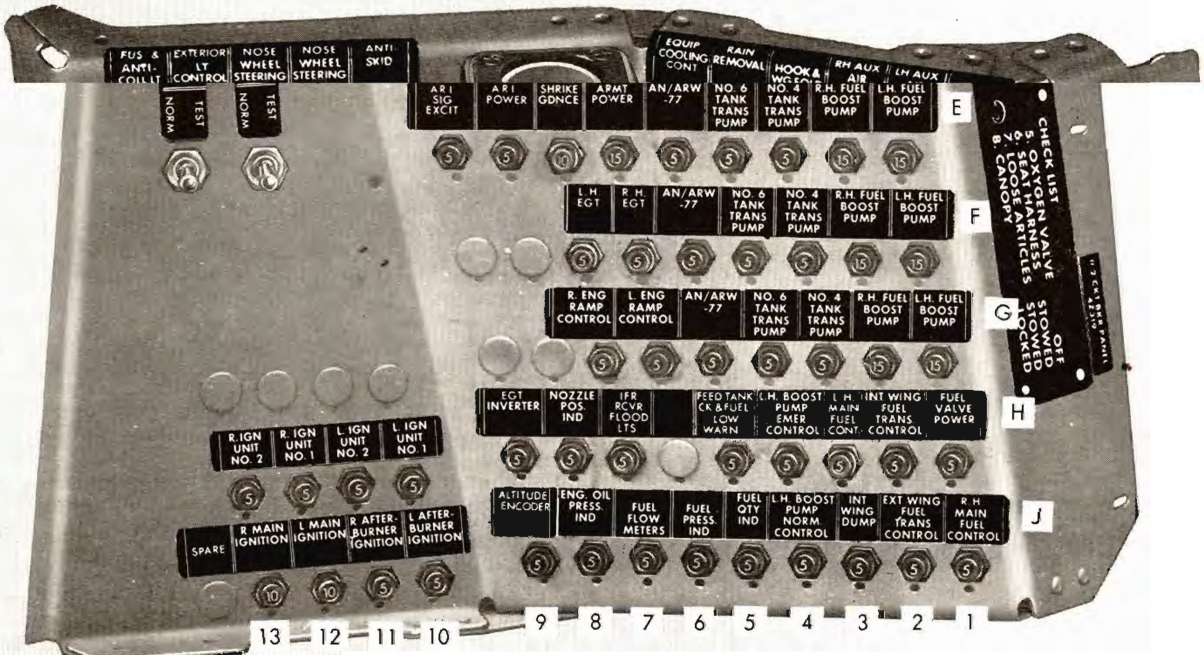
CIRCUIT BREAKERS-REAR COCKPIT

F-4D

TYPICAL



CIRCUIT BREAKER PANEL NO. 2



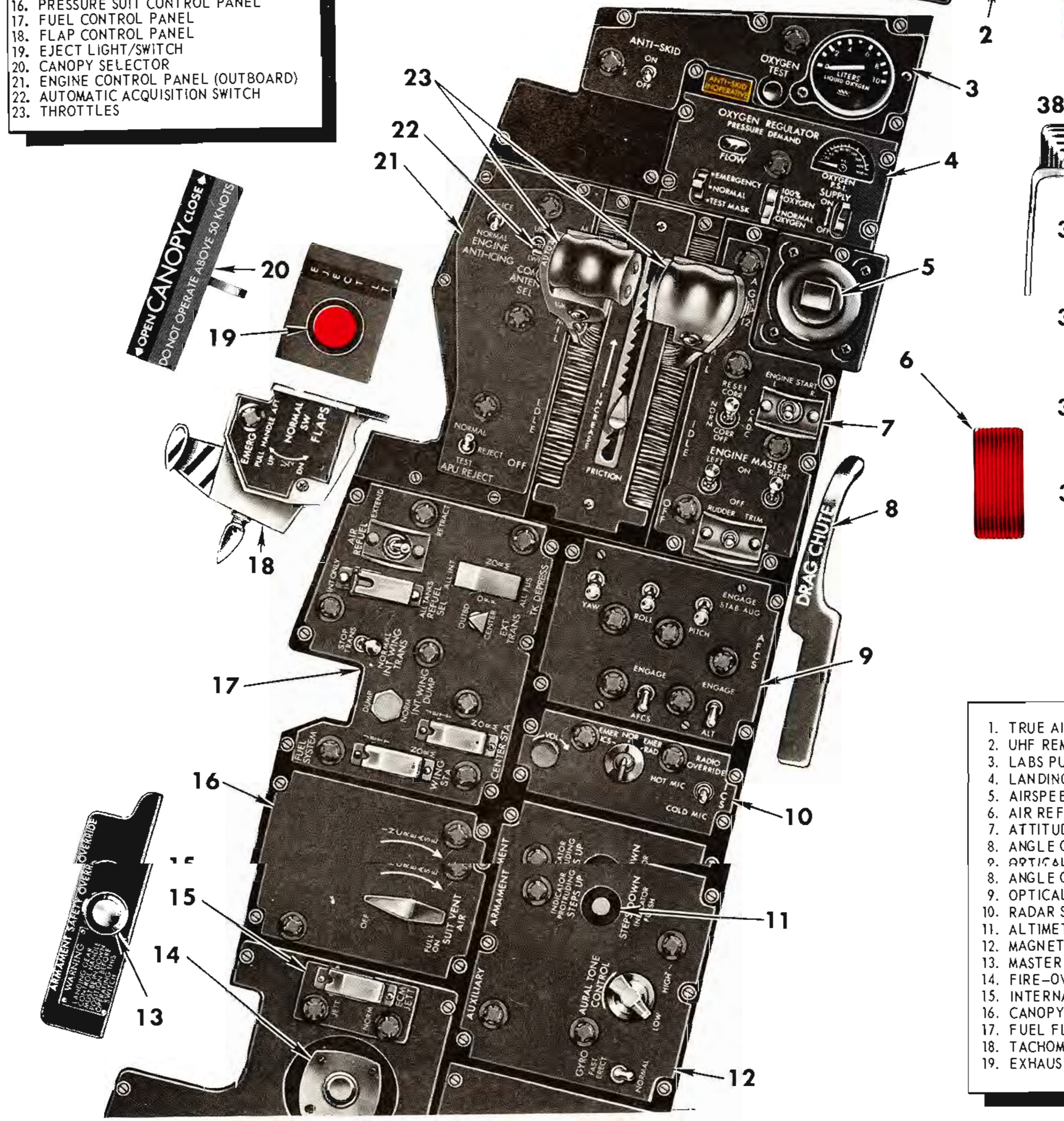
CIRCUIT BREAKER PANEL NO. 2

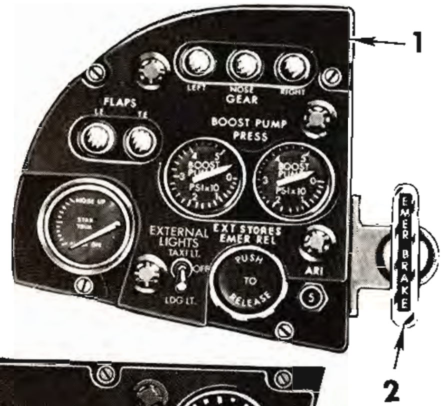
FRONT COCKPIT

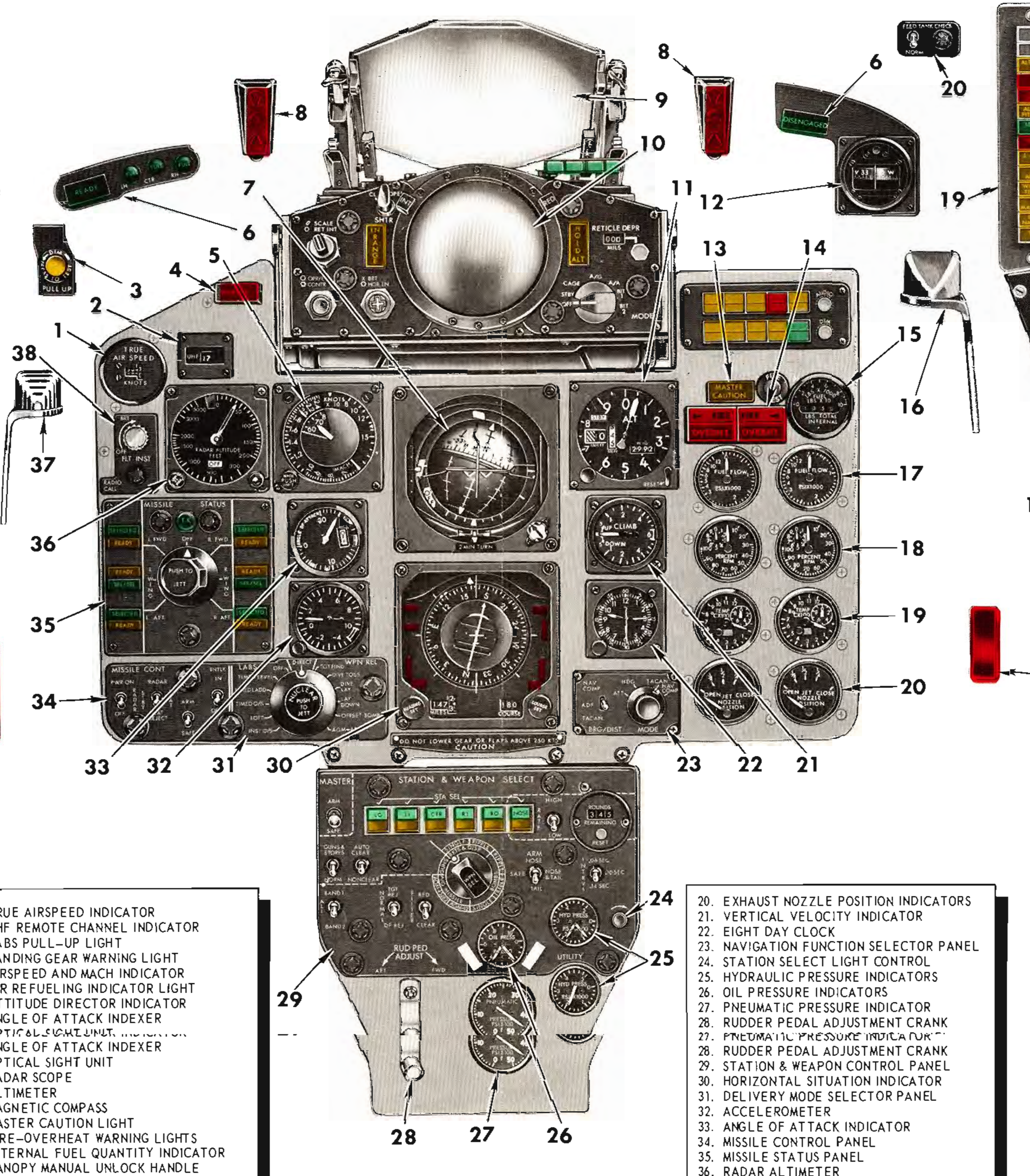
TYPICAL

F-4E

1. LEFT SUB-PANEL
2. EMERGENCY BRAKE CONTROL HANDLE
3. UTILITY PANEL (LEFT)
4. OXYGEN CONTROL PANEL
5. AGM-12B (GAM-83) CONTROL HANDLE
6. LANDING GEAR CONTROL HANDLE
7. ENGINE CONTROL PANEL (INBOARD)
8. DRAG CHUTE CONTROL HANDLE
9. AUTOMATIC FLIGHT CONTROL SYSTEM CONTROL PANEL
10. INTERCOM SYSTEM CONTROL PANEL
11. BOARDING STEPS POSITION INDICATOR
12. AUXILIARY ARMAMENT CONTROL PANEL
13. ARMAMENT SAFETY OVERRIDE SWITCH
14. ANTI-G SUIT CONTROL VALVE
15. ECM POD JETTISON SWITCH
16. PRESSURE SUIT CONTROL PANEL
17. FUEL CONTROL PANEL
18. FLAP CONTROL PANEL
19. EJECT LIGHT/SWITCH
20. CANOPY SELECTOR
21. ENGINE CONTROL PANEL (OUTBOARD)
22. AUTOMATIC ACQUISITION SWITCH
23. THROTTLES



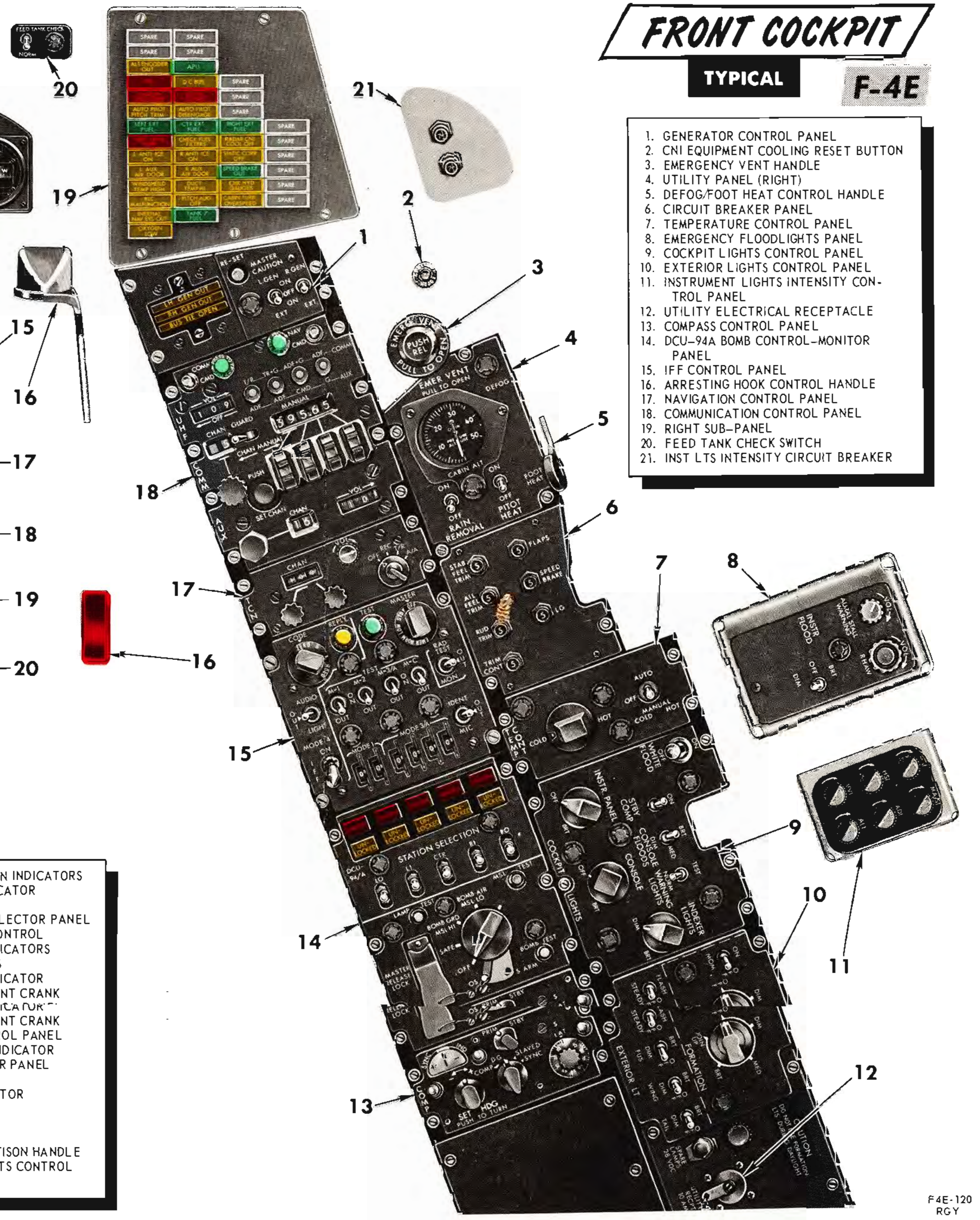




1. TRUE AIRSPEED INDICATOR
2. UHF REMOTE CHANNEL INDICATOR
3. LABS PULL-UP LIGHT
4. LANDING GEAR WARNING LIGHT
5. AIRSPEED AND MACH INDICATOR
6. AIR REFUELING INDICATOR LIGHT
7. ATTITUDE DIRECTOR INDICATOR
8. ANGLE OF ATTACK INDEXER
9. OPTICAL SIGHT UNIT
8. ANGLE OF ATTACK INDEXER
9. OPTICAL SIGHT UNIT
10. RADAR SCOPE
11. ALTIMETER
12. MAGNETIC COMPASS
13. MASTER CAUTION LIGHT
14. FIRE-OVERHEAT WARNING LIGHTS
15. INTERNAL FUEL QUANTITY INDICATOR
16. CANOPY MANUAL UNLOCK HANDLE
17. FUEL FLOW INDICATORS
18. TACHOMETERS
19. EXHAUST GAS TEMPERATURE INDICATORS

20. EXHAUST NOZZLE POSITION INDICATORS
21. VERTICAL VELOCITY INDICATOR
22. EIGHT DAY CLOCK
23. NAVIGATION FUNCTION SELECTOR PANEL
24. STATION SELECT LIGHT CONTROL
25. HYDRAULIC PRESSURE INDICATORS
26. OIL PRESSURE INDICATORS
27. PNEUMATIC PRESSURE INDICATOR
28. RUDDER PEDAL ADJUSTMENT CRANK
27. PNEUMATIC PRESSURE INDICATOR
28. RUDDER PEDAL ADJUSTMENT CRANK
29. STATION & WEAPON CONTROL PANEL
30. HORIZONTAL SITUATION INDICATOR
31. DELIVERY MODE SELECTOR PANEL
32. ACCELEROMETER
33. ANGLE OF ATTACK INDICATOR
34. MISSILE CONTROL PANEL
35. MISSILE STATUS PANEL
36. RADAR ALTIMETER
37. CANOPY EMERGENCY JETTISON HANDLE
38. FLIGHT INSTRUMENT LIGHTS CONTROL PANEL

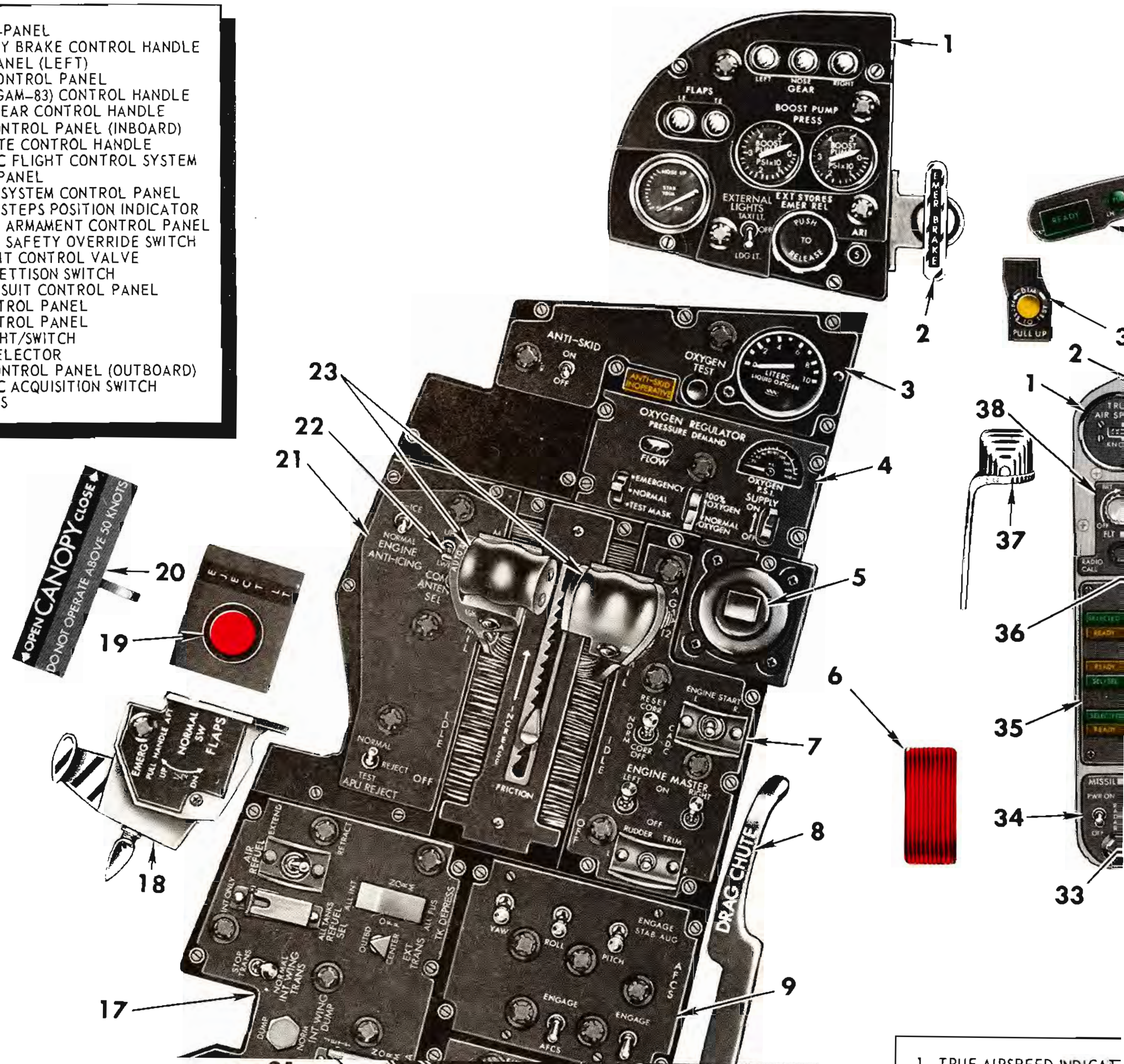
1. GENERATOR CONTROL PANEL
2. CNI EQUIPMENT COOLING RESET BUTTON
3. EMERGENCY VENT HANDLE
4. UTILITY PANEL (RIGHT)
5. DEFOG/FOOT HEAT CONTROL HANDLE
6. CIRCUIT BREAKER PANEL
7. TEMPERATURE CONTROL PANEL
8. EMERGENCY FLOODLIGHTS PANEL
9. COCKPIT LIGHTS CONTROL PANEL
10. EXTERIOR LIGHTS CONTROL PANEL
11. INSTRUMENT LIGHTS INTENSITY CONTROL PANEL
12. UTILITY ELECTRICAL RECEPTACLE
13. COMPASS CONTROL PANEL
14. DCU-94A BOMB CONTROL-MONITOR PANEL
15. IFF CONTROL PANEL
16. ARRESTING HOOK CONTROL HANDLE
17. NAVIGATION CONTROL PANEL
18. COMMUNICATION CONTROL PANEL
19. RIGHT SUB-PANEL
20. FEED TANK CHECK SWITCH
21. INST LTS INTENSITY CIRCUIT BREAKER

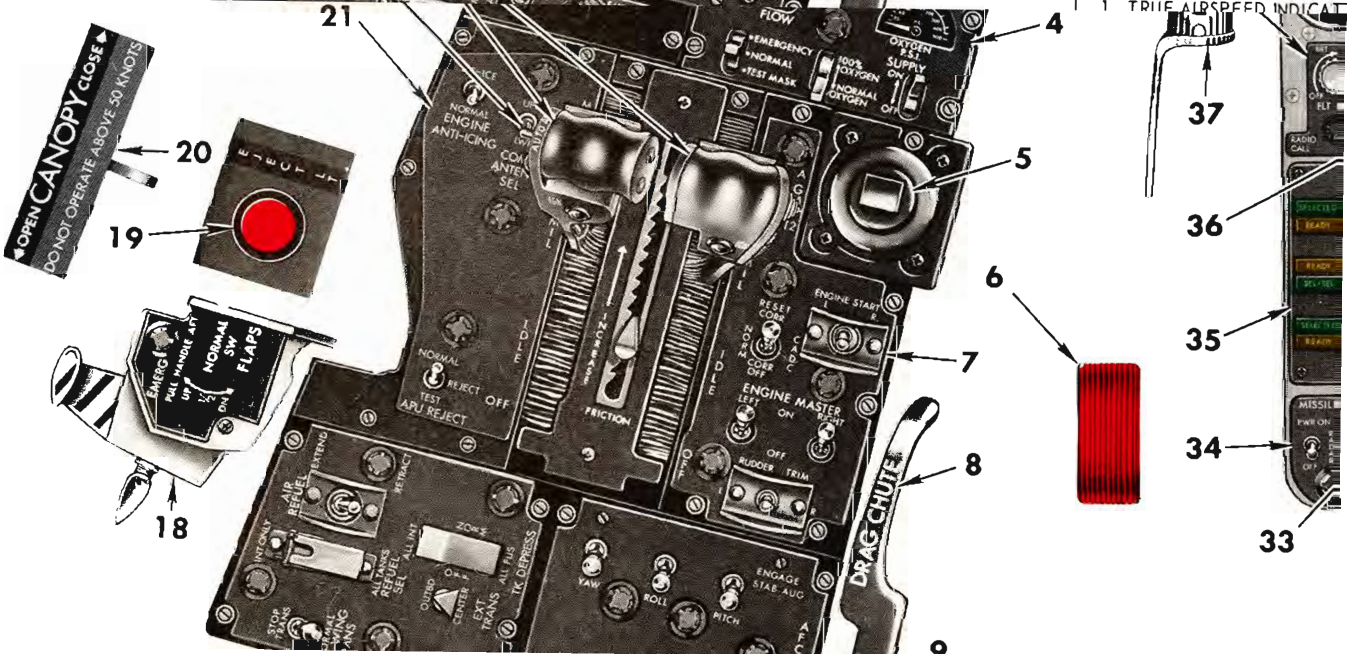


F4E-120
RGY

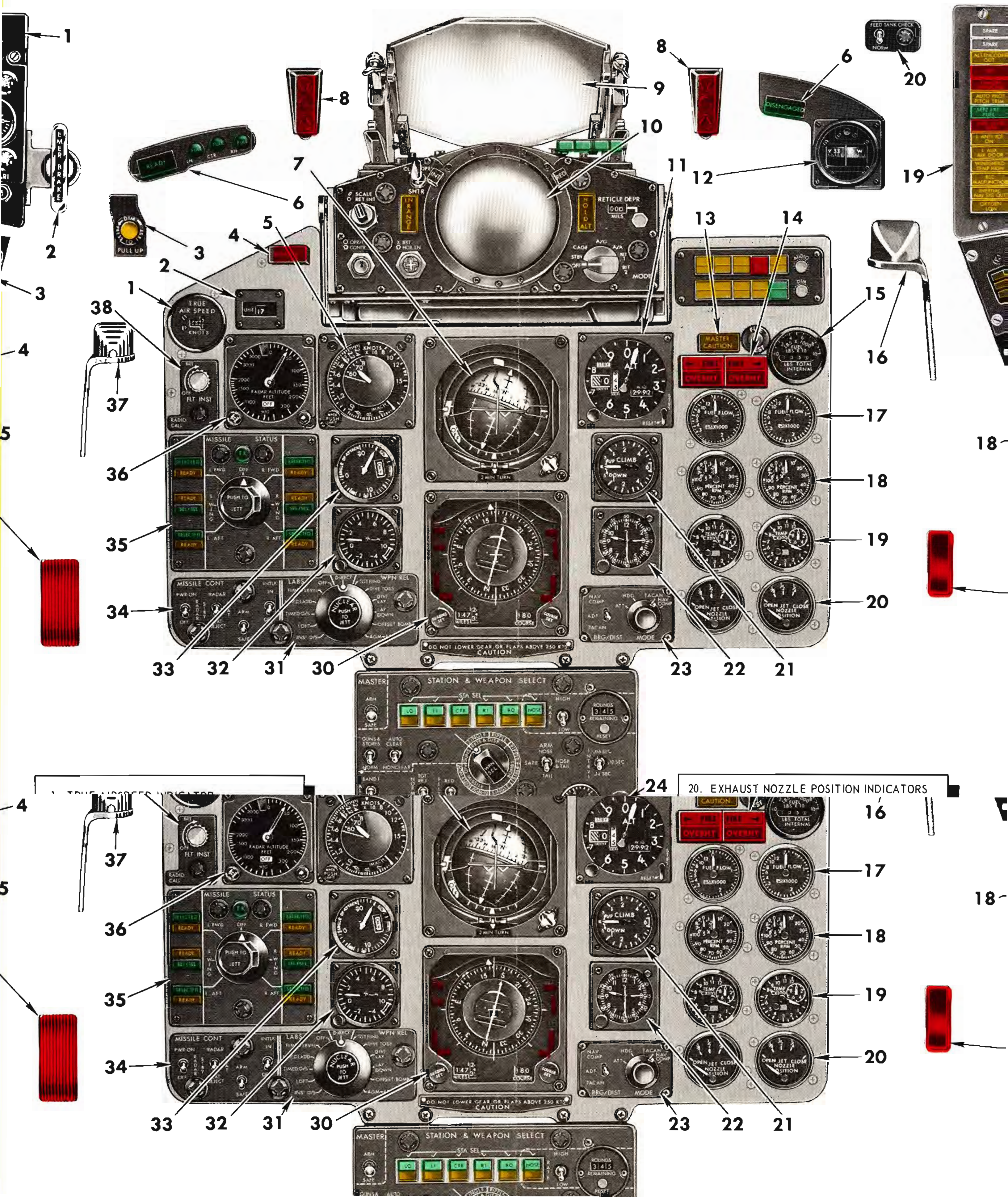
Figure FO-17

1. LEFT SUB-PANEL
2. EMERGENCY BRAKE CONTROL HANDLE
3. UTILITY PANEL (LEFT)
4. OXYGEN CONTROL PANEL
5. AGM-12B (GAM-83) CONTROL HANDLE
6. LANDING GEAR CONTROL HANDLE
7. ENGINE CONTROL PANEL (INBOARD)
8. DRAG CHUTE CONTROL HANDLE
9. AUTOMATIC FLIGHT CONTROL SYSTEM CONTROL PANEL
10. INTERCOM SYSTEM CONTROL PANEL
11. BOARDING STEPS POSITION INDICATOR
12. AUXILIARY ARMAMENT CONTROL PANEL
13. ARMAMENT SAFETY OVERRIDE SWITCH
14. ANTI-G SUIT CONTROL VALVE
15. ECM POD JETTISON SWITCH
16. PRESSURE SUIT CONTROL PANEL
17. FUEL CONTROL PANEL
18. FLAP CONTROL PANEL
19. EJECT LIGHT/SWITCH
20. CANOPY SELECTOR
21. ENGINE CONTROL PANEL (OUTBOARD)
22. AUTOMATIC ACQUISITION SWITCH
23. THROTTLES





1. TRUE AIRSPEED INDICAT

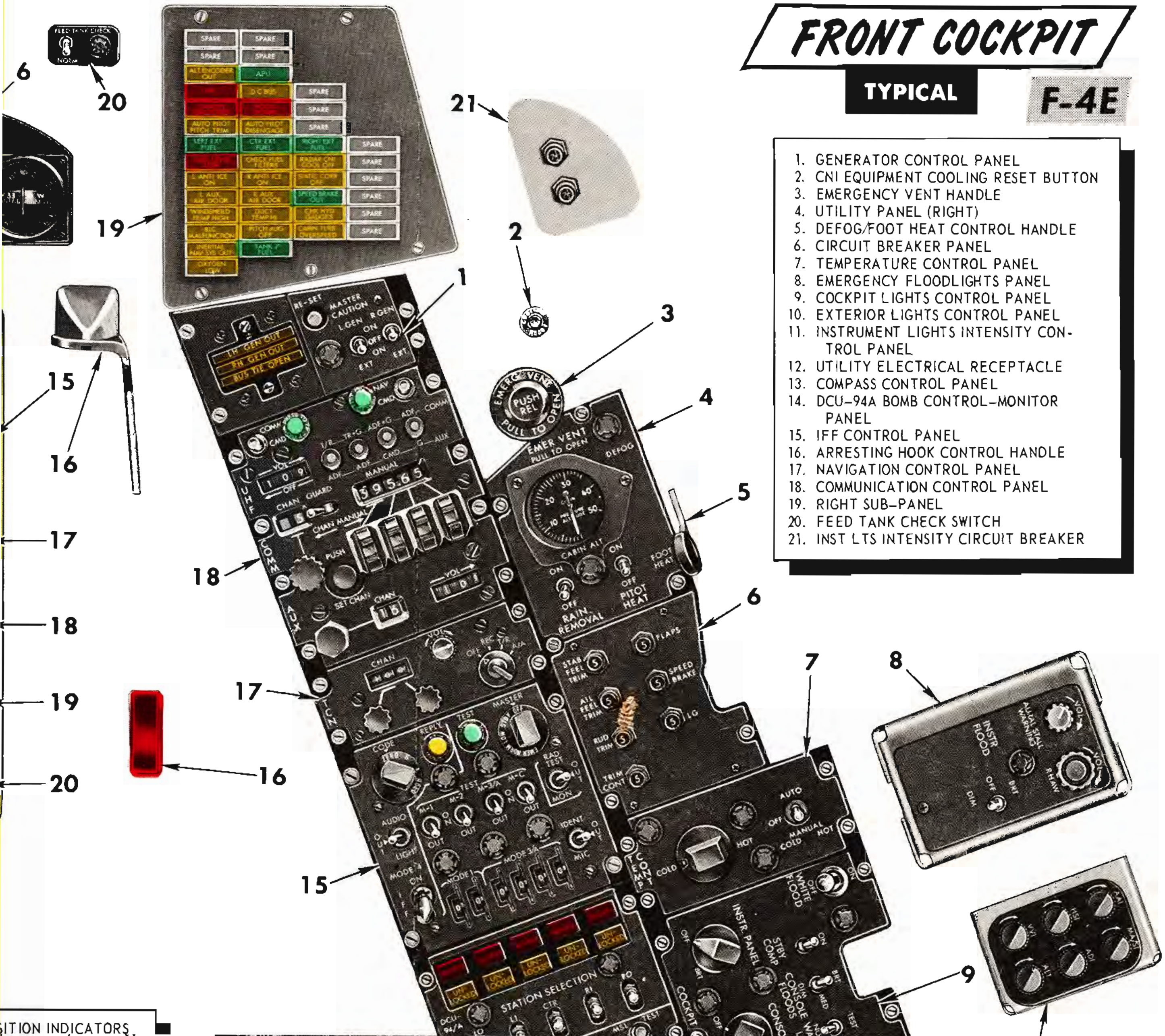


20. EXHAUST NOZZLE POSITION INDICATORS

FRONT COCKPIT

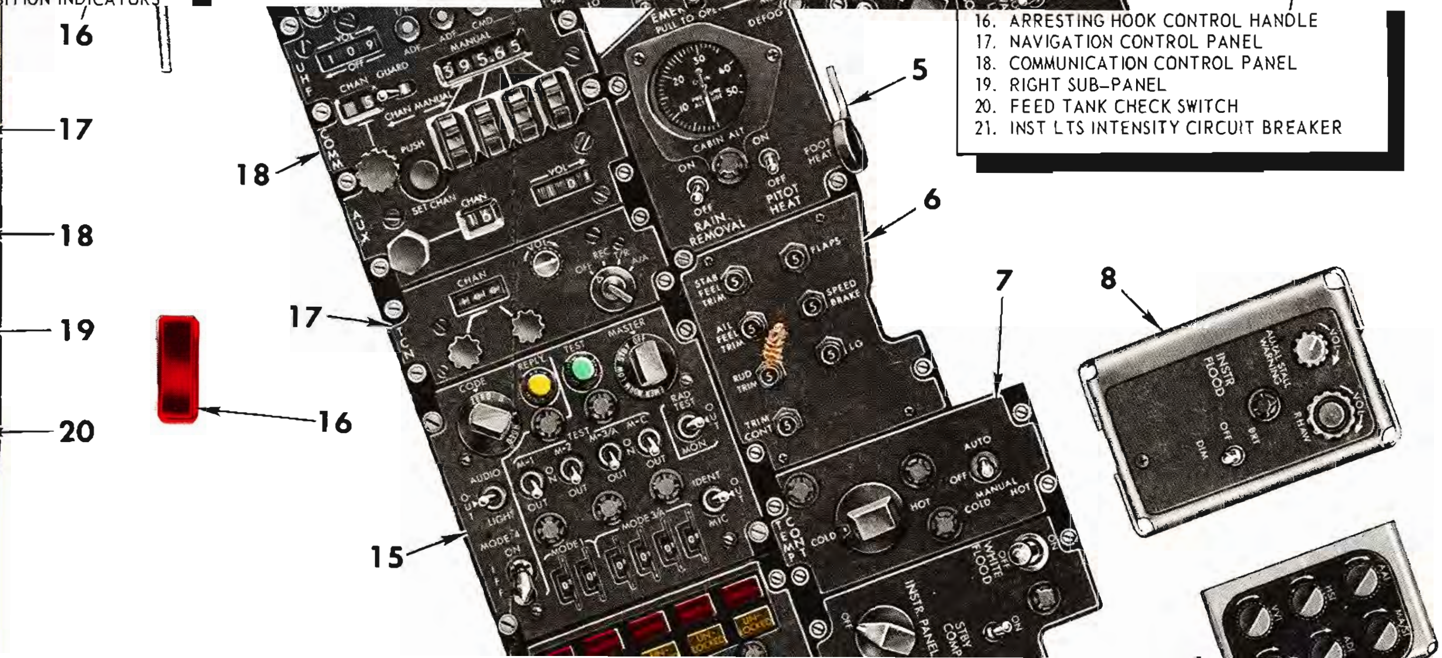
TYPICAL

F-4E

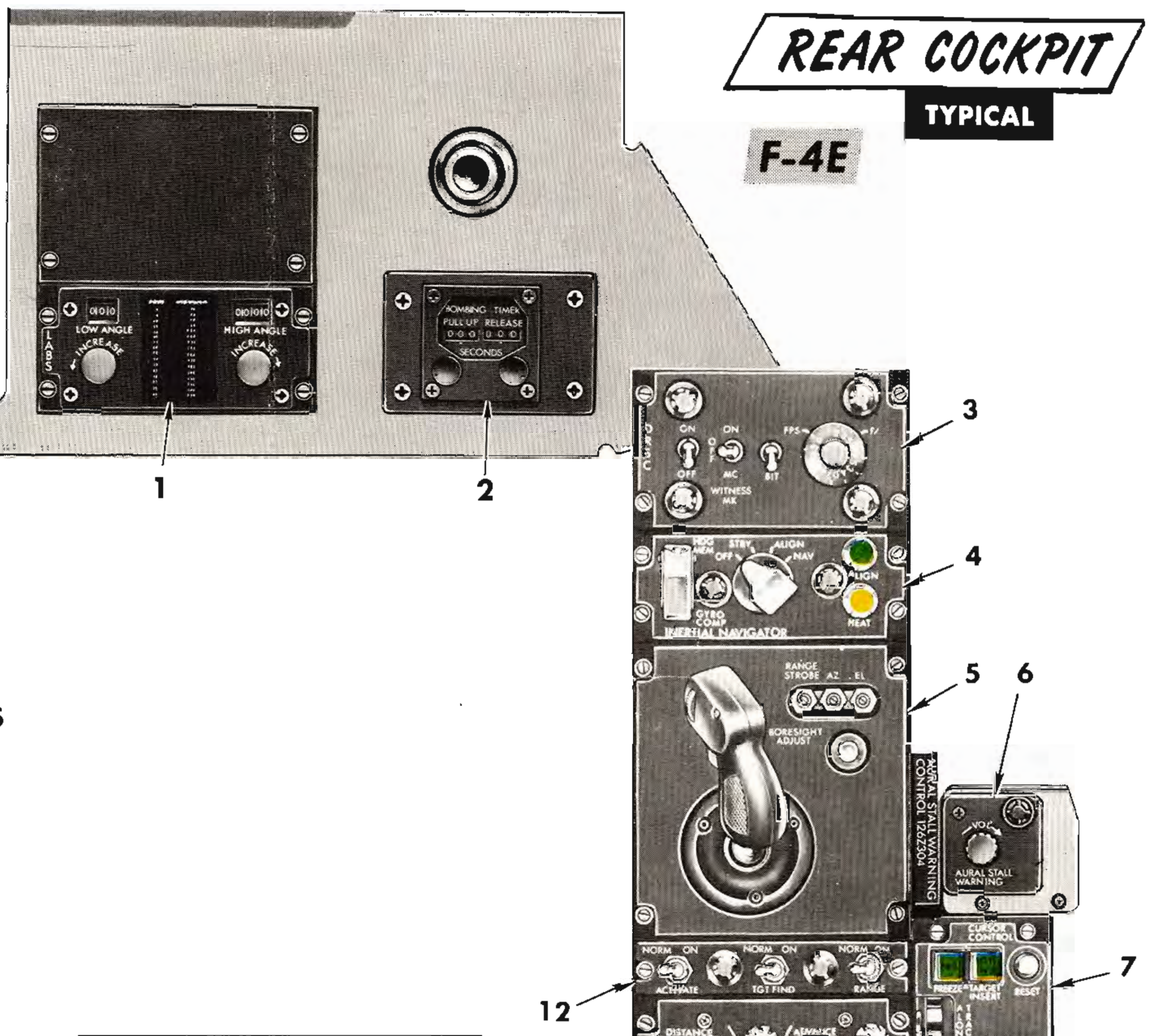


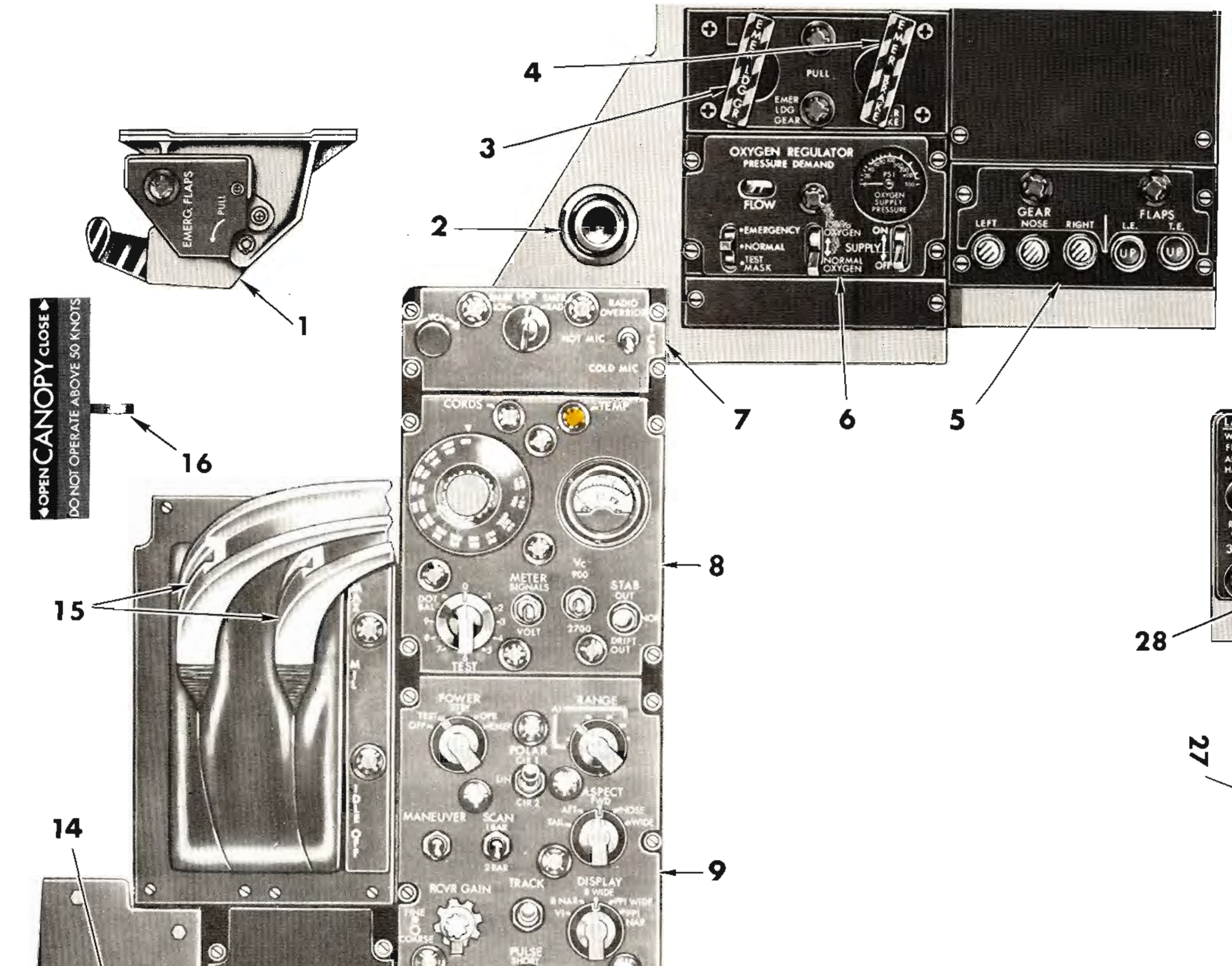
1. GENERATOR CONTROL PANEL
2. CNI EQUIPMENT COOLING RESET BUTTON
3. EMERGENCY VENT HANDLE
4. UTILITY PANEL (RIGHT)
5. DEFOG/FOOT HEAT CONTROL HANDLE
6. CIRCUIT BREAKER PANEL
7. TEMPERATURE CONTROL PANEL
8. EMERGENCY FLOODLIGHTS PANEL
9. COCKPIT LIGHTS CONTROL PANEL
10. EXTERIOR LIGHTS CONTROL PANEL
11. INSTRUMENT LIGHTS INTENSITY CONTROL PANEL
12. UTILITY ELECTRICAL RECEPTACLE
13. COMPASS CONTROL PANEL
14. DCU-94A BOMB CONTROL-MONITOR PANEL
15. IFF CONTROL PANEL
16. ARRESTING HOOK CONTROL HANDLE
17. NAVIGATION CONTROL PANEL
18. COMMUNICATION CONTROL PANEL
19. RIGHT SUB-PANEL
20. FEED TANK CHECK SWITCH
21. INST LTS INTENSITY CIRCUIT BREAKER

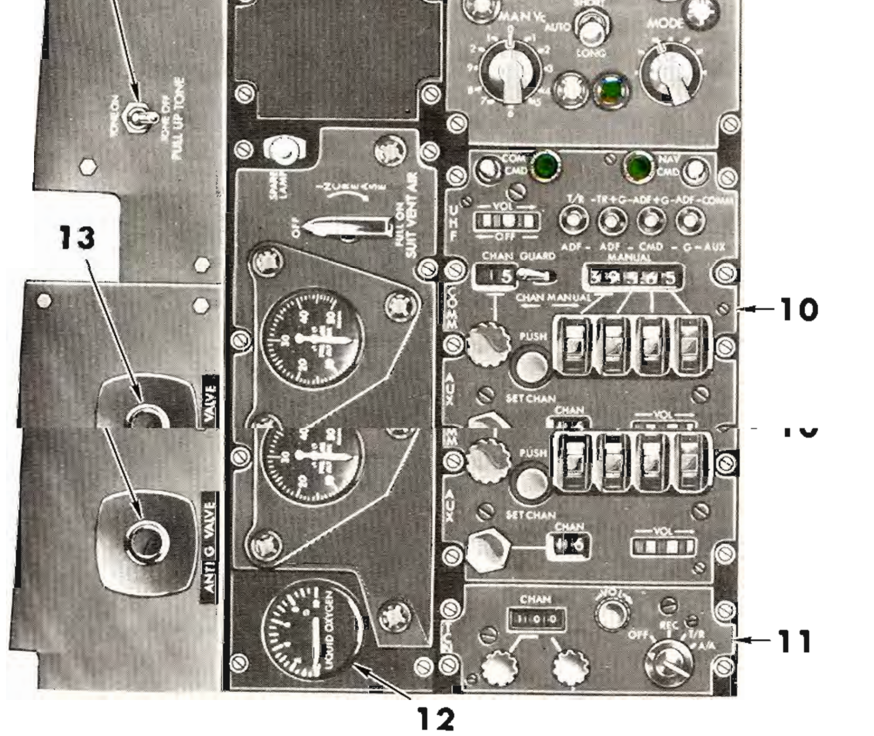
ITION INDICATORS

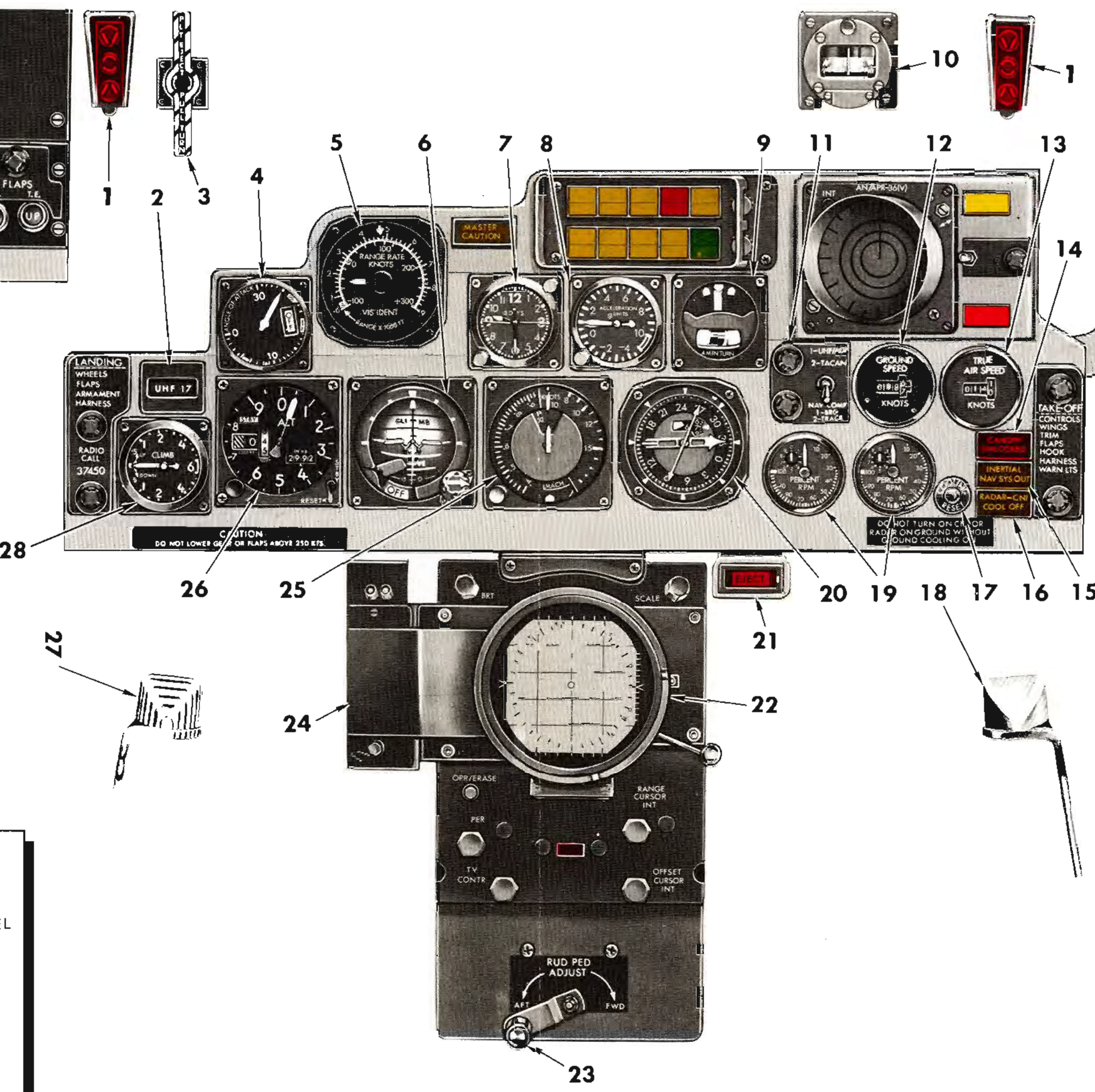


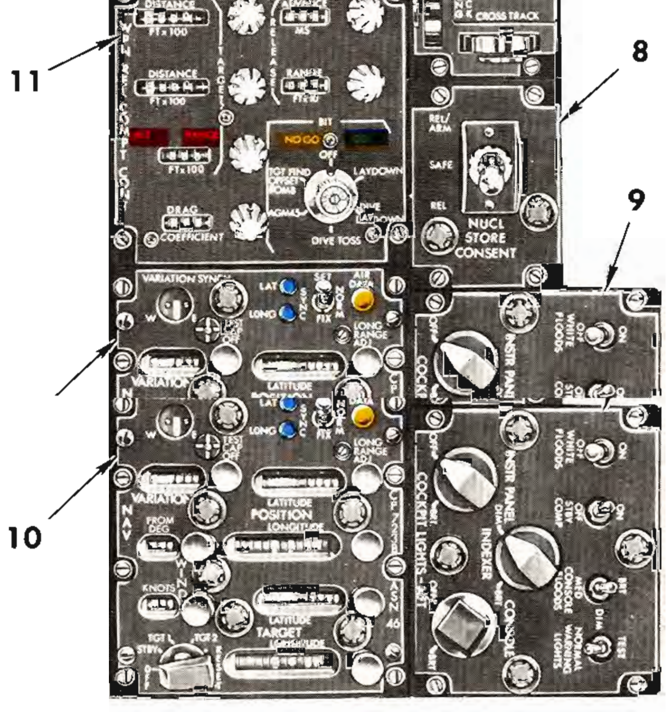
16. ARRESTING HOOK CONTROL HANDLE
17. NAVIGATION CONTROL PANEL
18. COMMUNICATION CONTROL PANEL
19. RIGHT SUB-PANEL
20. FEED TANK CHECK SWITCH
21. INST LTS INTENSITY CIRCUIT BREAKER











1. EMERGENCY FLAP CONTROL PANEL
2. AIR VENT NOZZLE
3. EMERGENCY LANDING GEAR CONTROL HANDLE
4. EMERGENCY BRAKE CONTROL HANDLE
5. LANDING GEAR - FLAP INDICATOR PANEL
6. OXYGEN CONTROL PANEL
7. INTERCOM CONTROL PANEL
8. CONTROL-MONITOR PANEL
9. RADAR CONTROL PANEL
10. COMMUNICATION CONTROL PANEL
11. NAVIGATION CONTROL PANEL
12. PRESSURE SUIT CONTROL PANEL
13. ANTI G SUIT CONTROL VALVE
14. PULL UP TONE CUTOUT SWITCH
15. THROTTLES
16. CANOPY SELECTOR

14. PULL UP TONE CUTOUT SWITCH
15. THROTTLES
16. CANOPY SELECTOR

1. ANGLE OF ATTACK INDEXER
2. UHF CHANNEL REMOTE INDICATOR
15. INERTIAL NAVIGATOR OUT WARNING LIGHT
16. RADAR-CNI COOL OFF WARNING LIGHT

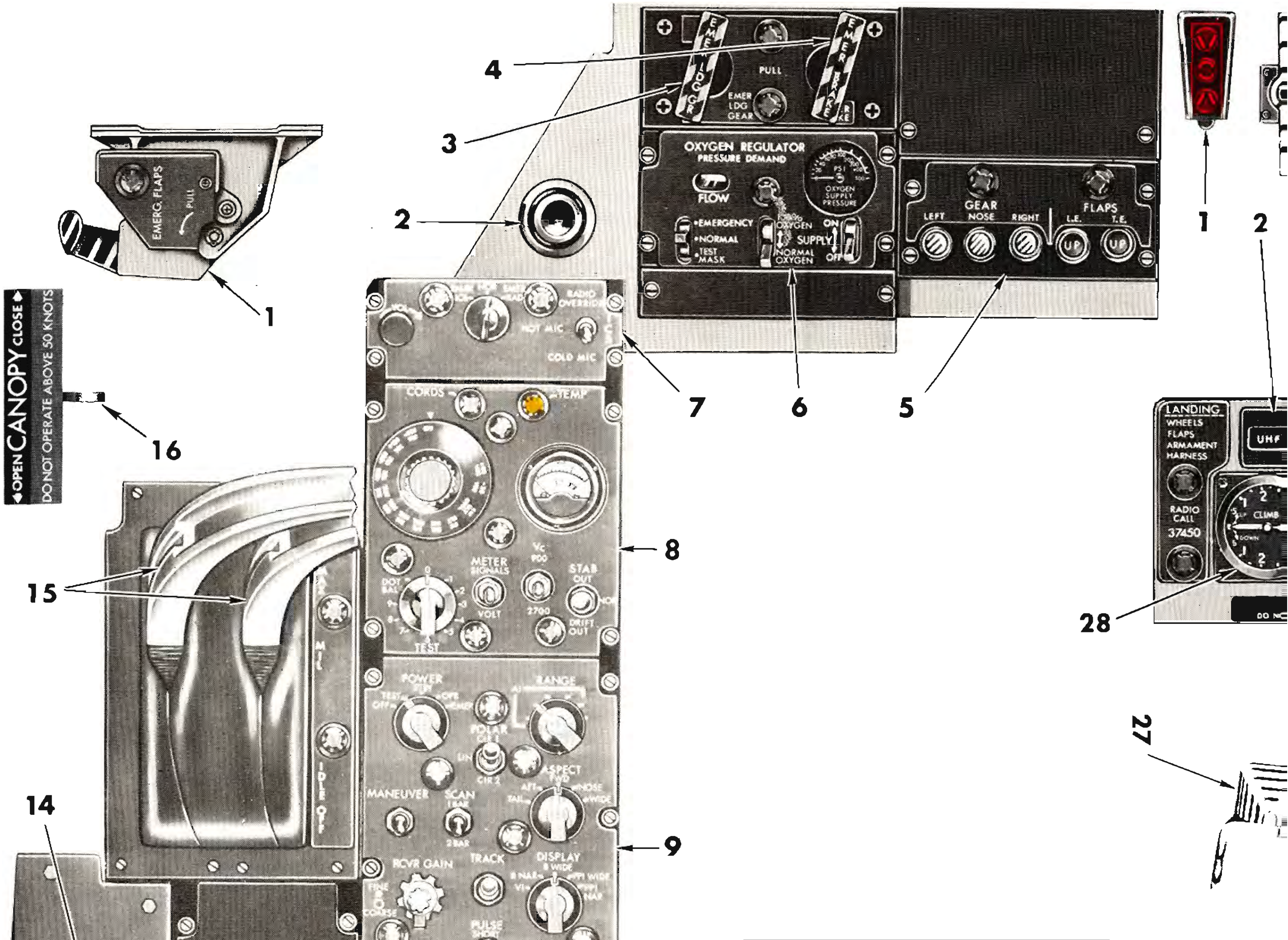
1. ANGLE OF ATTACK INDEXER
2. UHF CHANNEL REMOTE INDICATOR
3. COMMAND SELECTOR VALVE
4. ANGLE OF ATTACK INDICATOR
5. RANGE INDICATOR
6. ATTITUDE INDICATOR
7. EIGHT DAY CLOCK
8. ACCELEROMETER
9. TURN AND SLIP INDICATOR
10. STANDBY MAGNETIC COMPASS
11. NAVIGATION FUNCTION SELECTOR PANEL
12. GROUND SPEED INDICATOR
13. TRUE AIRSPEED INDICATOR
14. CANOPY UNLOCKED WARNING LIGHT
15. INERTIAL NAVIGATOR OUT WARNING LIGHT
16. RADAR-CNI COOL OFF WARNING LIGHT
17. RADAR-CNI COOLING RESET BUTTON
18. CANOPY MANUAL UNLOCK HANDLE
19. TACHOMETERS
20. BEARING-DISTANCE-HEADING INDICATOR
21. EJECT LIGHT
22. RADAR SCOPE
23. RUDDER PEDAL ADJUSTMENT CRANK
24. DIRECT READING SCOPE CAMERA
25. AIRSPEED-MACH INDICATOR
26. ALTIMETER
27. CANOPY EMERGENCY JETTISON HANDLE
28. VERTICAL VELOCITY INDICATOR

1. LABS RELEASE ANGLE CONTROL PANEL
2. BOMBING TIMER CONTROL PANEL
3. DIRECT RADAR SCOPE CAMERA CONTROL PANEL
4. INERTIAL NAVIGATOR CONTROL PANEL
5. ANTENNA CONTROL PANEL
6. STALL WARNING TONE CONTROL PANEL
7. CURSOR CONTROL PANEL
8. NUCLEAR STORE CONSENT SWITCH
9. COCKPIT LIGHTS CONTROL PANEL
10. NAVIGATION CONTROL PANEL
11. WEAPONS RELEASE COMPUTER CONTROL PANEL
12. WEAPON DELIVERY PANEL

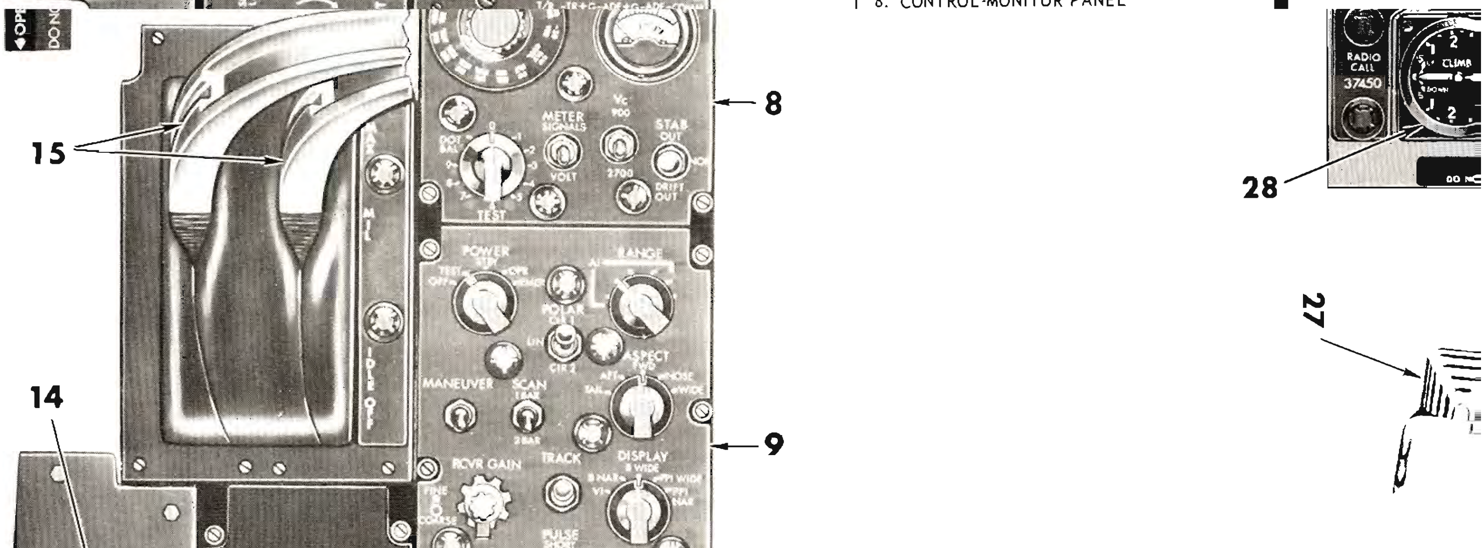
12. WEAPON DELIVERY PANEL

F4E-134
RY8

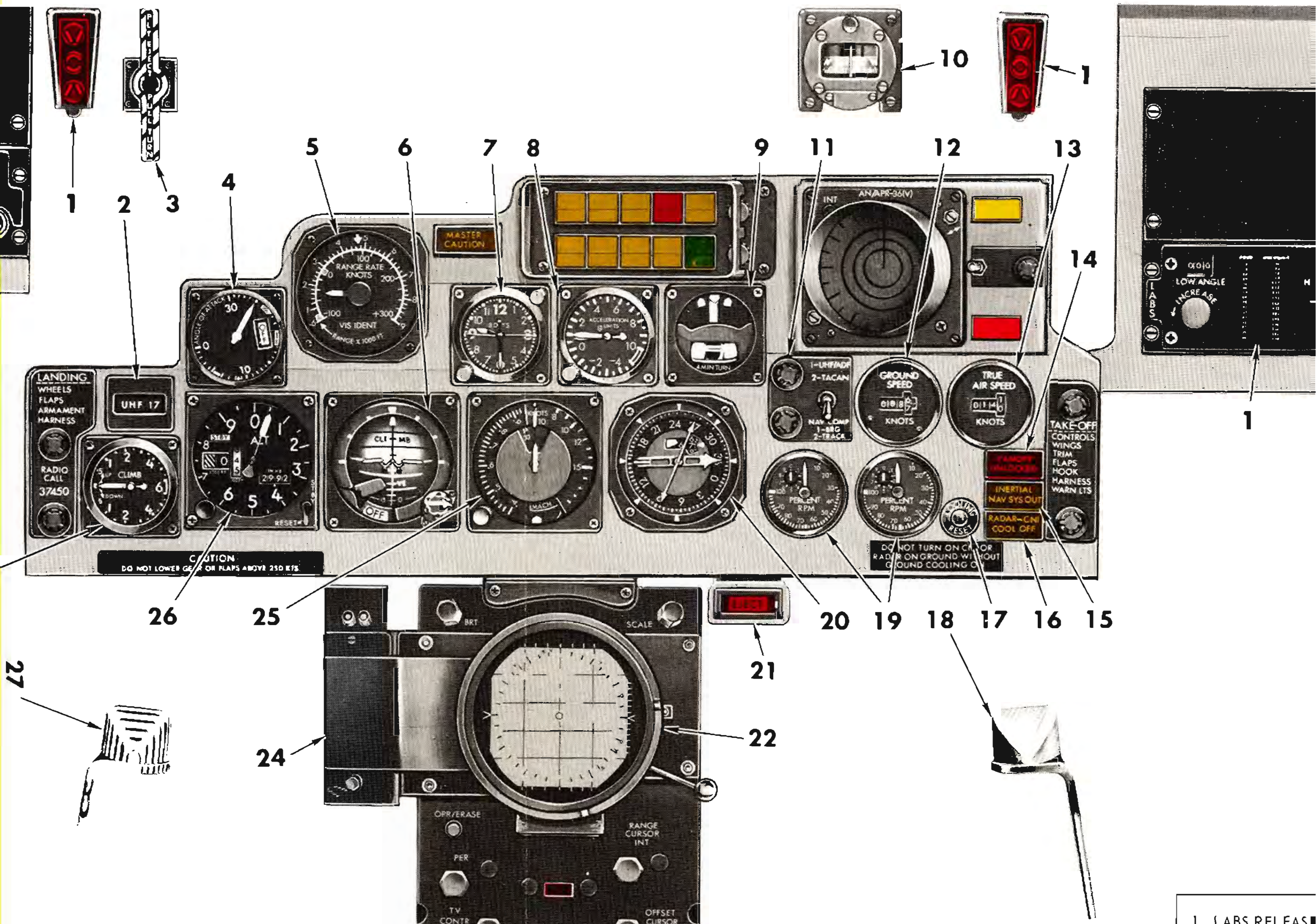
Figure FO-18



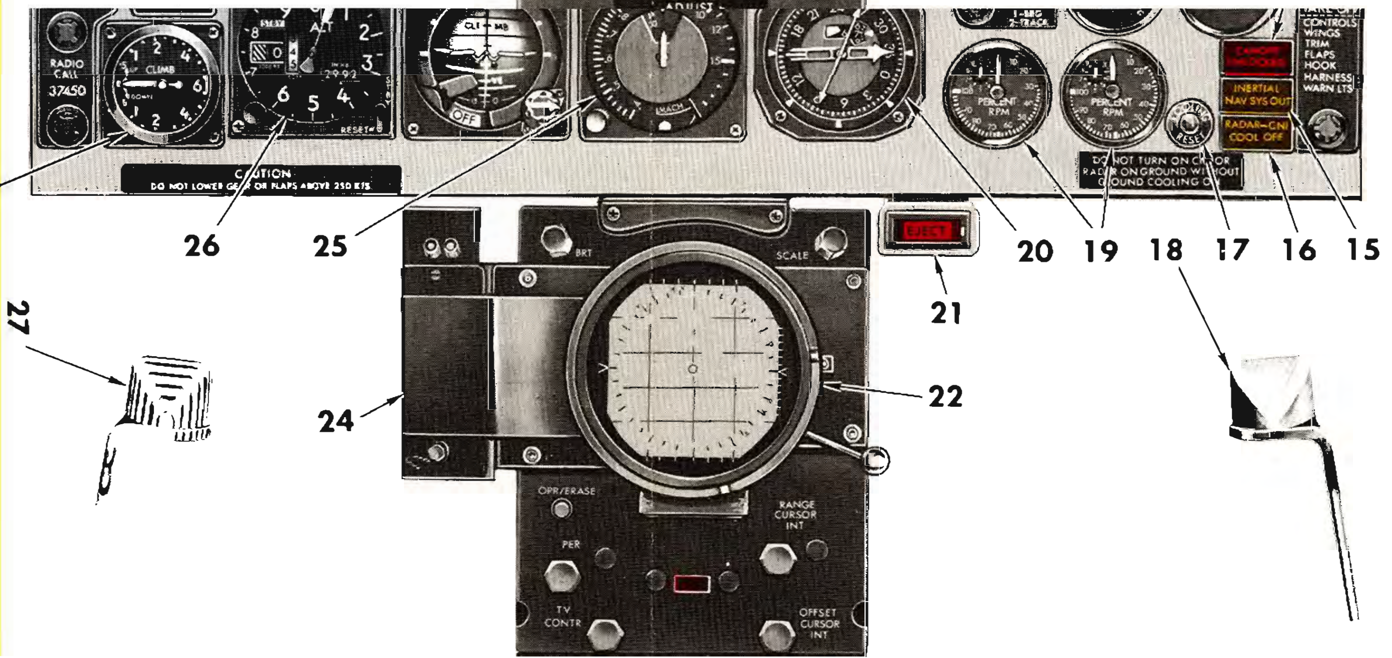
1. EMERGENCY FLAP CONTROL PANEL
2. AIR VENT NOZZLE
3. EMERGENCY LANDING GEAR CONTROL HANDLE
4. EMERGENCY BRAKE CONTROL HANDLE
5. LANDING GEAR - FLAP INDICATOR PANEL
6. OXYGEN CONTROL PANEL
7. INTERCOM CONTROL PANEL
8. CONTROL-MONITOR PANEL



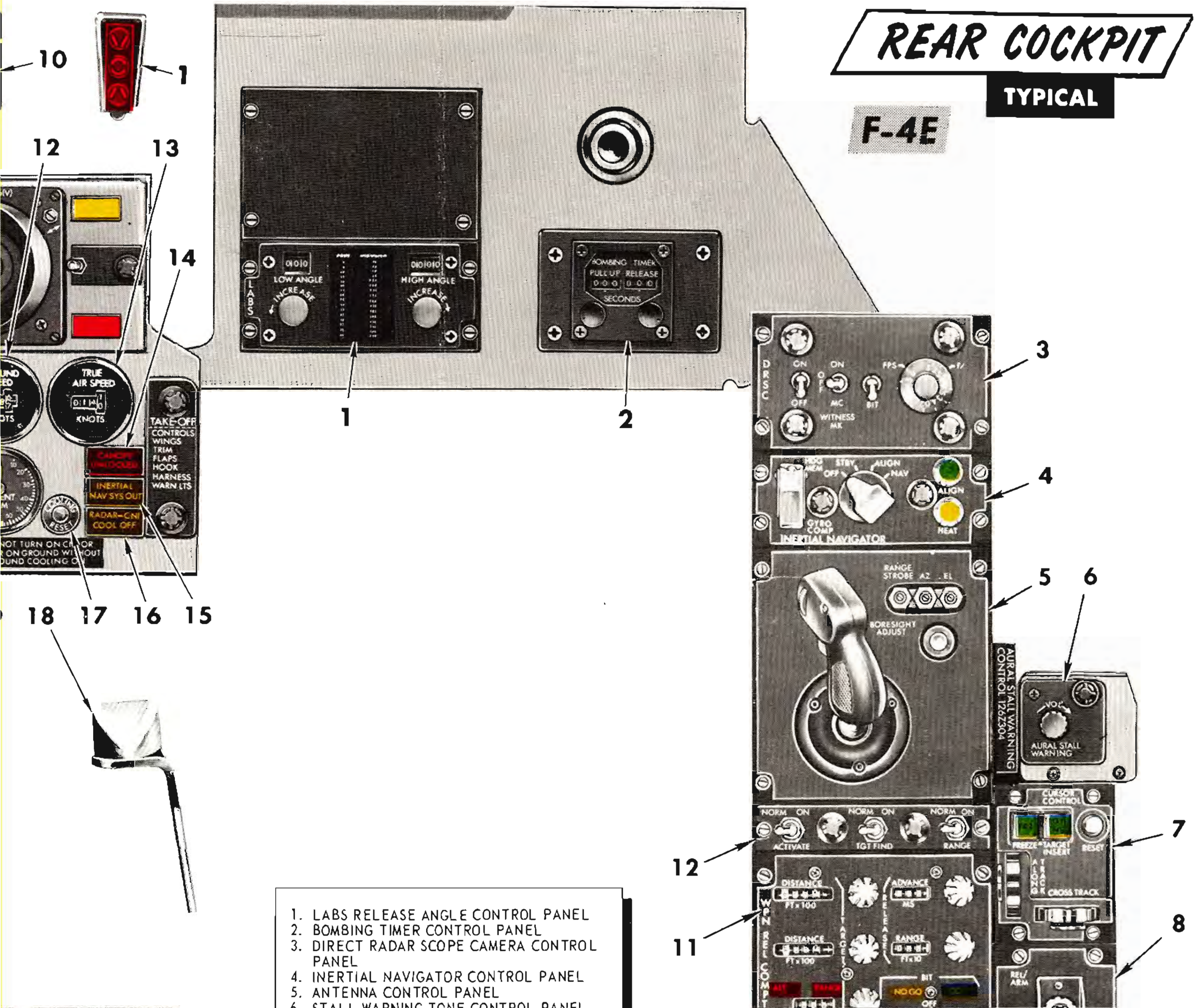
1. EMERGENCY FLAP CONTROL PANEL
2. AIR VENT NOZZLE
3. EMERGENCY LANDING GEAR CONTROL HANDLE
4. EMERGENCY BRAKE CONTROL HANDLE



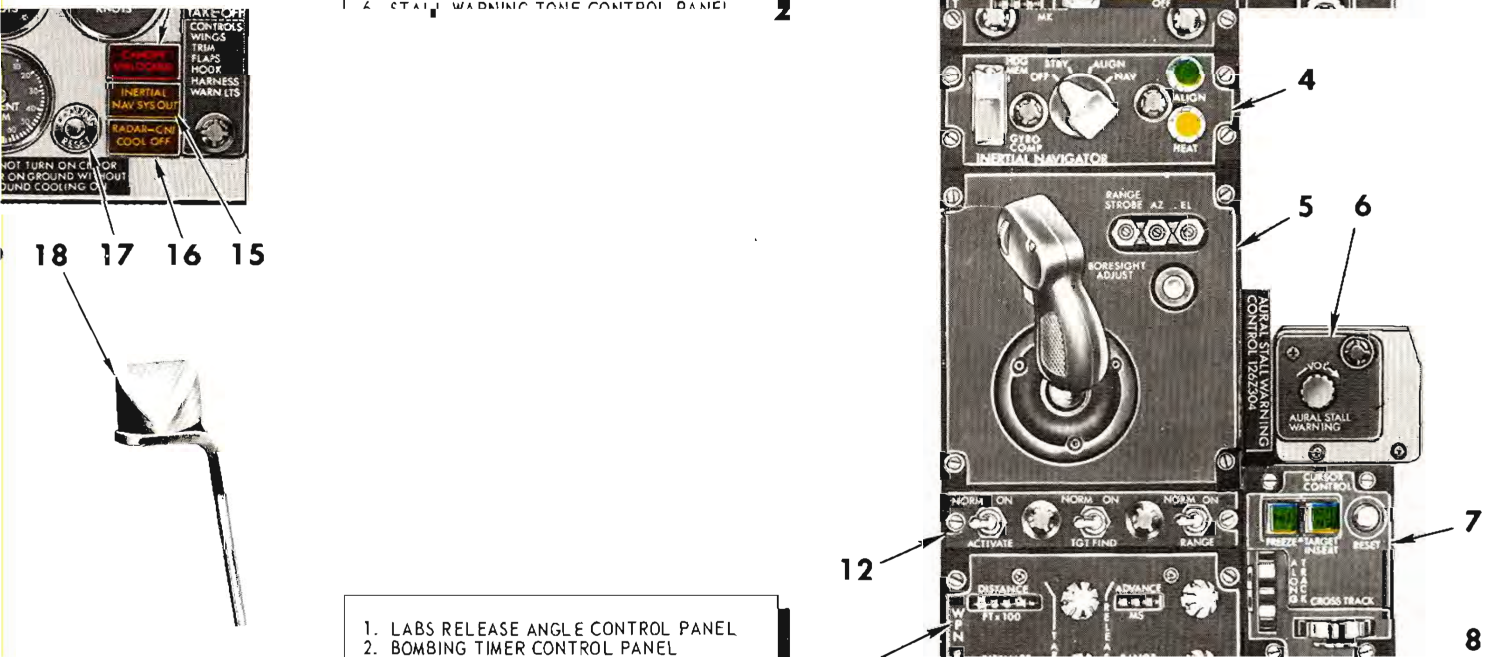
1. LABS RELEAS
2. BOMBING TIME
3. DIRECT RADAF PANEL
4. INERTIAL NAV
5. ANTENNA CON
6. STALL WARNIN



1. LABS RELEAS
2. BOMBING TIME



1. LABS RELEASE ANGLE CONTROL PANEL
2. BOMBING TIMER CONTROL PANEL
3. DIRECT RADAR SCOPE CAMERA CONTROL PANEL
4. INERTIAL NAVIGATOR CONTROL PANEL
5. ANTENNA CONTROL PANEL
6. STALL WARNING TONE CONTROL PANEL



1. LABS RELEASE ANGLE CONTROL PANEL
2. BOMBING TIMER CONTROL PANEL

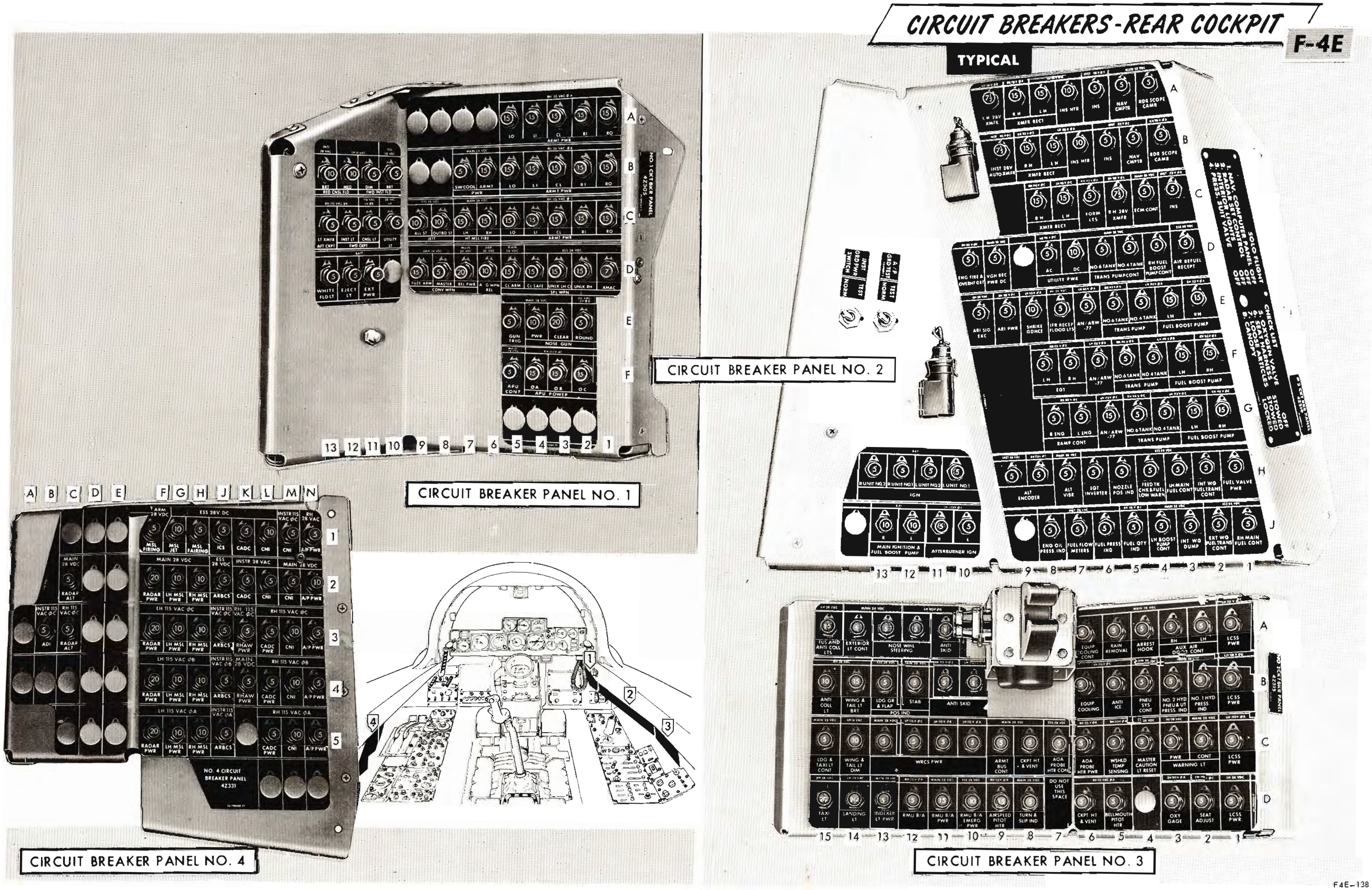
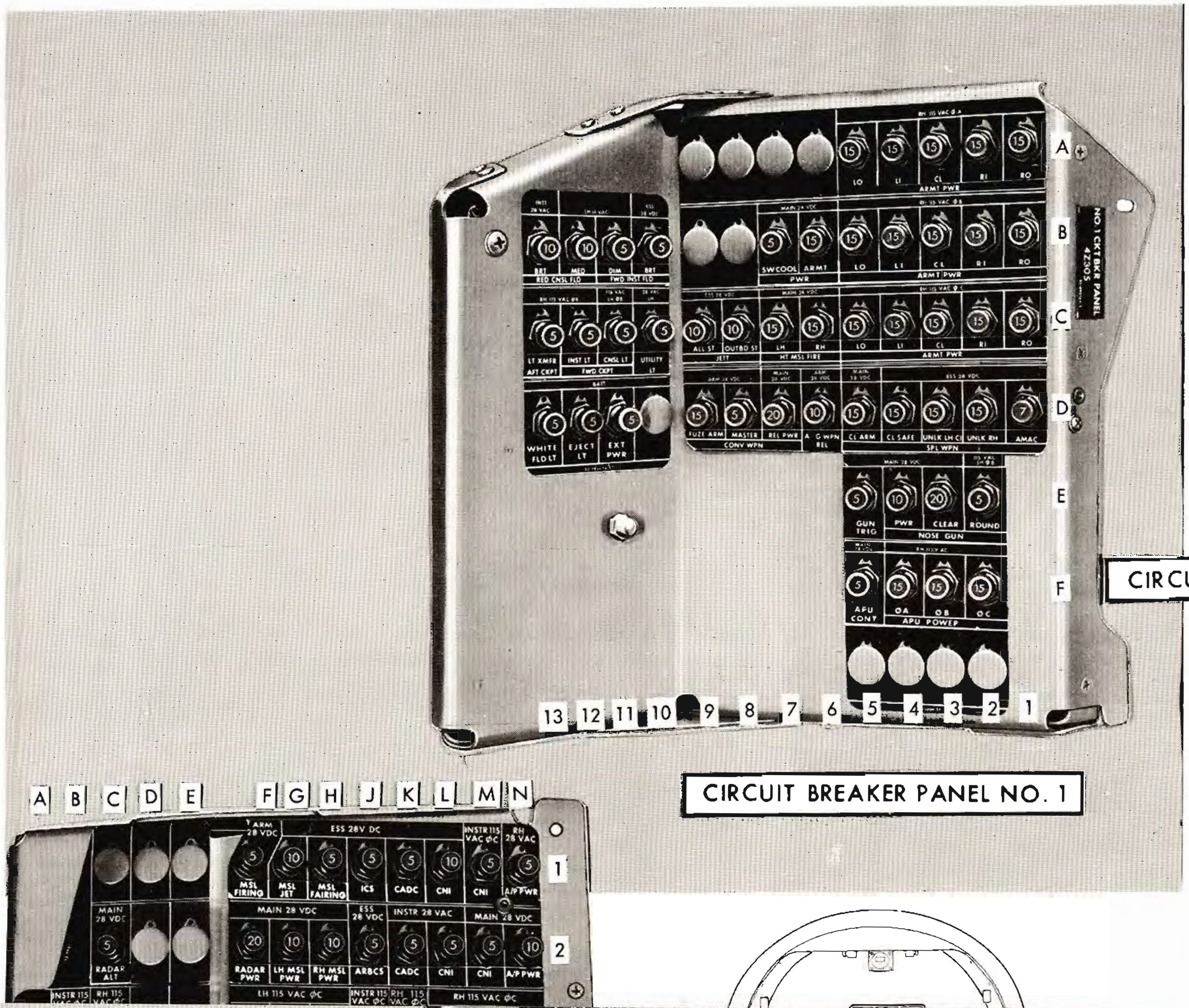
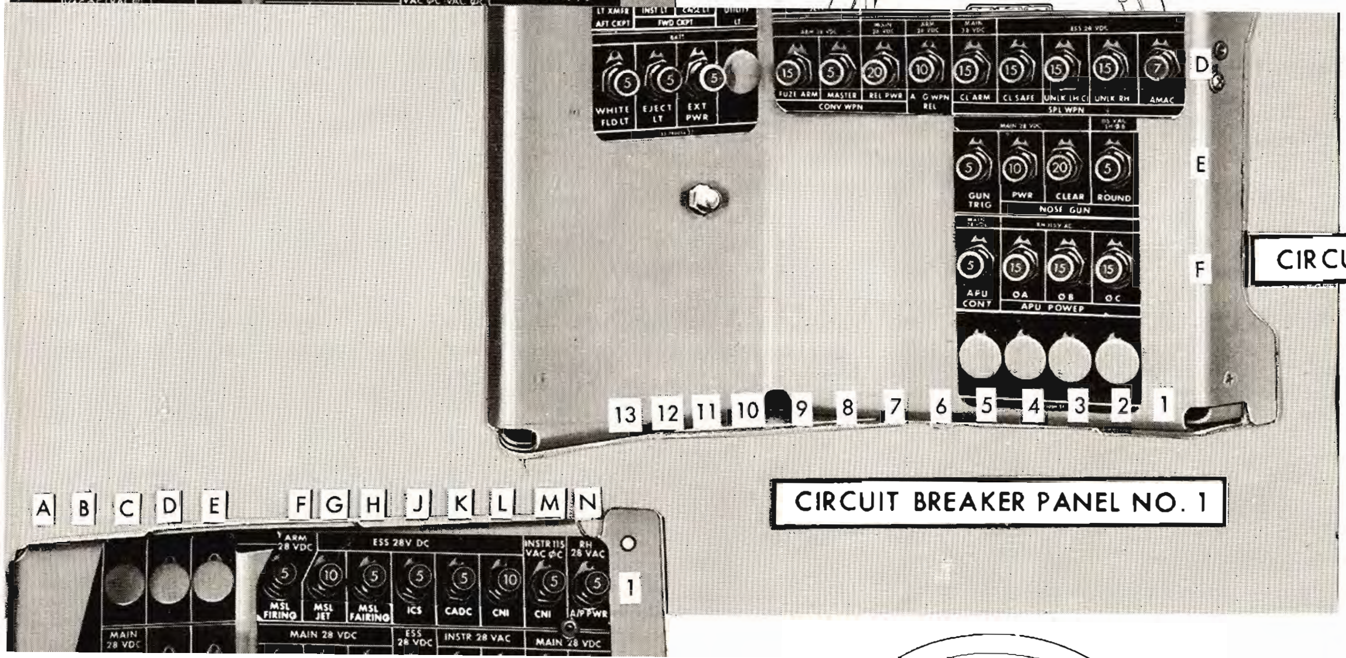

CIRCUIT BREAKERS-REAR COCKPIT
F-4E
TYPICAL
CIRCUIT BREAKER PANEL NO. 1
CIRCUIT BREAKER PANEL NO. 2
CIRCUIT BREAKER PANEL NO. 3
CIRCUIT BREAKER PANEL NO. 4
F4E-138

Figure FO-19



CIRCUIT BREAKER PANEL NO. 1

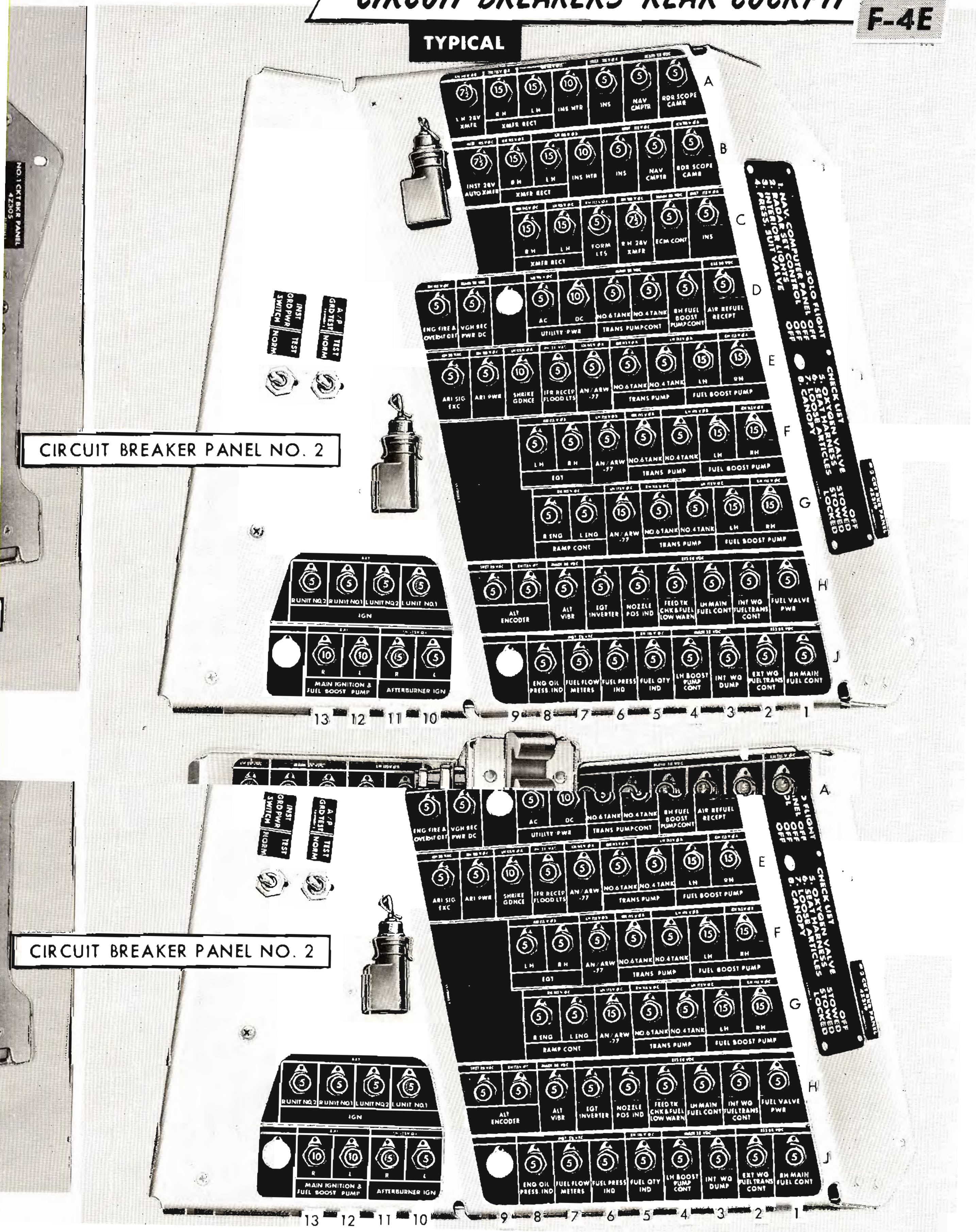


CIRCUIT BREAKER PANEL NO. 1

CIRCUIT BREAKERS-REAR COCKPIT

F-4E

TYPICAL



APPENDIX B PERFORMANCE DATA F-4E

The appendix is divided into parts, as outlined below, to present the performance data in proper sequence for preflight planning. Each part contains descriptive text and sample problems for the applicable charts.

F4E-APTC

PART 1 INTRODUCTION

TABLE OF CONTENTS

Charts

DRAG INDEX SYSTEM

Most of the charts utilize the drag index system to effectively present the many combinations of weight/ drag effects on performance. The Airplane Loading chart (figure B1-1) contains the drag number and weight of each externally carried store and its associated suspension equipment. The drag index for a specific configuration may be found by multiplying the number of stores carried by its drag number, and adding the drag number of the applicable suspension equipment. The total drag index may then be used to enter the planning data charts. Charts applicable for all loads and configurations are labeled ALL DRAG INDEXES. Charts labeled INDIVIDUAL DRAG INDEXES contain data for a range of drag numbers; i.e., individual curves/columns for a specific drag number. Supersonic data is not compatible to the drag index system; therefore, each chart is labeled for a specific configuration.

Sample Problem

Configuration 6 - MK81 general purpose bombs on station 1 & 9 (3 each station)

6 - MK81 general purpose bombs on station 5

6 - LAU-3/A rocket launchers with nose and tail cones (full) on stations 2 & 8 (3 each station)

A.	MK81 drag number	0.8 x 12 = 9.6
B.	MK81 suspension equipment station 1 & 9	10.1 x 2 = 20.2
	station 5	10.0 x 1 = 10.0
C.	LAU-3/A drag number	4.2 x 6 = 25.2
D.	LAU-3/A suspension equipment station 2 & 8	6.8 x 2 = 13.6
E.	Total drag index	78.6

STABILITY INDEX SYSTEM

With the many possible external loading configurations and their resulting aerodynamic effects, it is possible to load the airplane past the aft CG limit. Adding wing-mounted stores tends to shift the aerodynamic center forward toward the CG of the aircraft, thereby reducing the longitudinal maneuvering stability of the aircraft. To assure an acceptable static margin, it is necessary to consider stability effects in conjunction with CG location. Each wing-mounted store and its associated suspension equipment is assigned a unit stability number (B1-2) corresponding to its aerodynamic effect. Each stability index (sum of stability numbers) has a corresponding aft CG limit. After the loading configuration has been determined, refer to the Stability Numbers chart (figure B1-2) and determine the airplane stability index. Enter the Aft CG Limits chart (figure B1-3) with the airplane stability index to obtain maximum allowable aft CG location. The CG location is determined by using Weight and Balance Clearance Form F in conjunction with the Handbook of Weight and Balance Data, T.O. 1-1B-40.

Note

- In some cases where the originally desired configuration is not within the allowable envelope, an acceptable static margin may be achieved through rearrangement of wing-mounted stores.
- Unit stability numbers are assigned for single mounted and cluster mounted weapons. The cluster mounted unit stability number will be used when at least two weapons are mounted abreast of each other on the same rack, with each weapon being assigned this number. Tandem-mounted weapons count as a single weapon.
- Fuselage-mounted stores are not used in determining airplane stability index but they are used in computing takeoff CG location.

Sample Problem

Note

The following example is based on the aircraft operating weight plus a full internal fuel load (44,150 pounds). The external loading is the same as used in determining the drag index.

A.	MK81 (cluster mounted - stations 1 & 9)	2.4 x 4 = 9.6
B.	MK81 (suspension equipment)	11.4 x 2 = 22.8

C.	LAU-3/A (cluster mounted - stations 2 & 8)	13.5 x 6 = 81.0
D.	LAU-3/A (suspension equipment)	13.5 x 2 = 27.0
E.	Stability Index	140.4
F.	Aft CG limit based on stability index	33.5% MAC
G.	Takeoff gross weight	52,817 Lbs.
H.	Aircraft CG location	29.6% MAC

Result - airplane CG within limits.

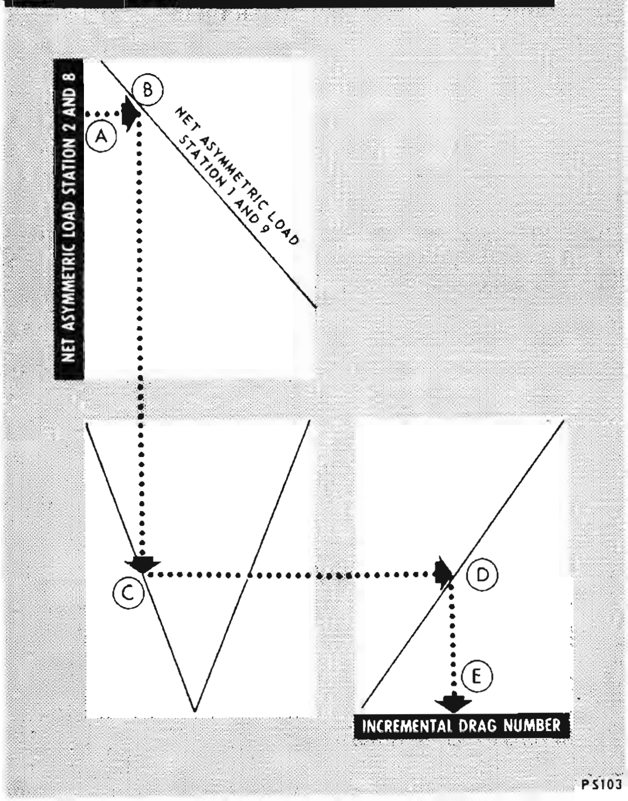
DRAG DUE TO ASYMMETRIC LOADING

This chart (figure B1-4) provides the drag number due to trimming asymmetric store loading. The drag number is added to the computed drag of the airplane to obtain the drag index. This chart is unlike the Airplane Loading chart in that the drag varies with Mach number and altitude.

USE

Find the net asymmetric load on stations 2 and 8 (left vertical axis) by subtracting the lighter from the heavier weight. Attach to this net load the position, RWH (right wing heavy) or LWH (left wing heavy) as applicable. In the same manner, find the net asymmetric load on stations 1 and 9 (diagonal parallel lines). Enter the chart with the net asymmetric load for stations 2 and 8 (RWH or LWH). Proceed horizontally to the right to the net asymmetric load on stations 1 and 9 (RWH or LWH). Proceed vertically downward to the applicable altitude, horizontally to the right to the applicable Mach number, and then vertically downward to obtain the incremental drag number.

SAMPLE DRAG DUE TO ASYMMETRIC LOADING



Sample Problem

A. Load on station 2 = 1000 Lbs.
   Load on station 8 = 3000 Lbs.
   Net asymmetric load on stations 2 & 8 = 2000 Lbs. RWH
B. Load on station 1 = 2500 Lbs.
   Load on station 9 = 2000 Lbs.
   Net asymmetric load on stations 1 & 9 = 500 Lbs. LWH

C.	Altitude	25,000 Feet
D.	Mach number	0.7
E.	Incremental drag number	5.25

AIRSPEED CONVERSION

The Airspeed Conversion chart, (figure B1-8) provides a means of converting calibrated airspeed to true Mach number and true airspeed.

INDICATED AIRSPEED

Indicated airspeed (IAS) is the uncorrected airspeed read directly from the indicator.

CALIBRATED AIRSPEED

Calibrated airspeed (CAS) is indicated airspeed corrected for static source error.

EQUIVALENT AIRSPEED

Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility. There is no provision made for reading equivalent airspeed.

TRUE AIRSPEED

True airspeed (TAS) is equivalent airspeed corrected for density altitude. Refer to the Airspeed Conversion charts (figure B1-8).

AIRSPEED POSITION ERROR CORRECTION

These charts (figures B1-9 and B1-10) provide the means to correct indicated airspeed and Mach number to calibrated and true values respectfully.

Sample Problem

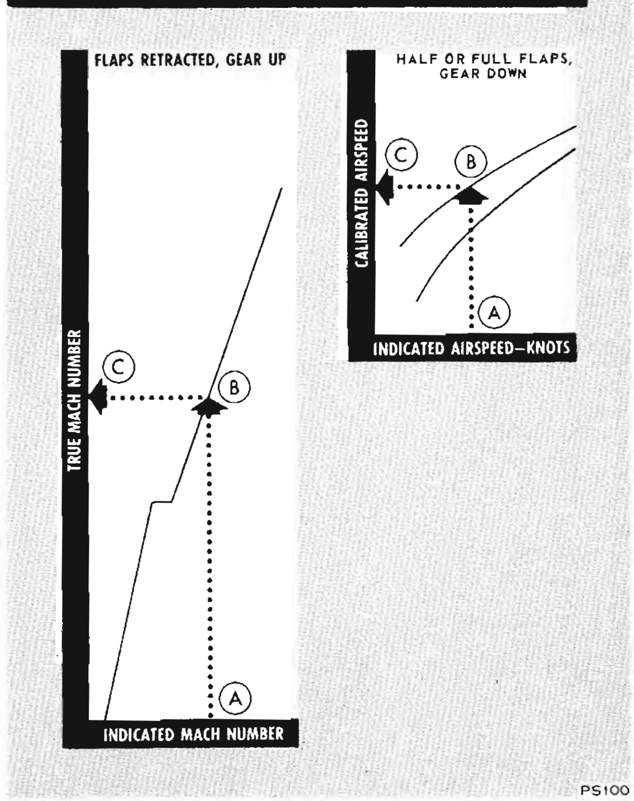
Configuration: Full Flaps, Gear Down

A.	Indicated airspeed	180 Kts.
B.	Gross weight reflector line	40,000 Lbs.
C.	Calibrated airspeed	178 Kts.

Configuration: Flaps Up, Gear Up

A.	Indicated Mach number	1.1
B.	40,000-foot reflector line	
C.	True Mach number	1.08

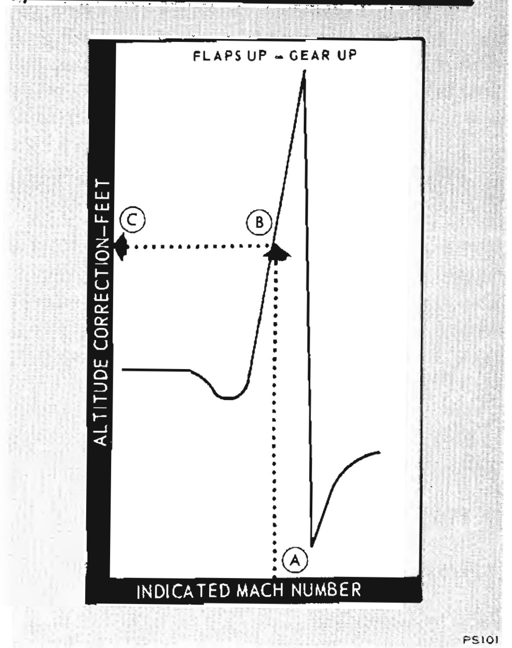
SAMPLE AIRSPEED POSITION ERROR CORRECTION



ALTIMETER POSITION ERROR CORRECTION

This chart (figure B1-11) provides altimeter error corrections for given Mach numbers at various altitudes. An altitude correction factor is included for landing configurations.

SAMPLE ALTIMETER POSITION ERROR CORRECTION



Sample Problem

Flaps Retracted, Gear up

A.	Indicated Mach number	1.4
B.	Assigned altitude	40,000 Ft.
C.	Δ H correction	75 Ft.
D.	Indicated altitude necessary to maintain assigned altitude (B+C)	40,075 Ft.

ALTIMETER LAG CHART

These charts (figures B1-12 and B1-13) provide a means of obtaining the altimeter lag (difference between indicated altitude and actual altitude) resulting from diving flight. Data is provided for dive angles up to 60° and airspeeds up to 600 knots TAS.

USE

Enter the chart with dive airspeed, and project horizontally to the right to intersect the dive angle curve. From this point, project vertically downward to read the resulting altimeter lag. Add the altimeter lag data to desired/required pullout altitude to obtain indicated altitude for pullout.

Sample Problem

Aircraft with SPC Inoperative

1.	Dive airspeed (TAS)	400 Kts.
2.	Dive angle	45°
3.	Altimeter lag	1,120 Ft.

WIND COMPONENTS CHART

A standard Wind Components chart (figure B1-14) is included. It is used primarily for breaking a forecast wind down into crosswind and headwind components for takeoff computations. It may, however, be used whenever wind component information is desired.

USE

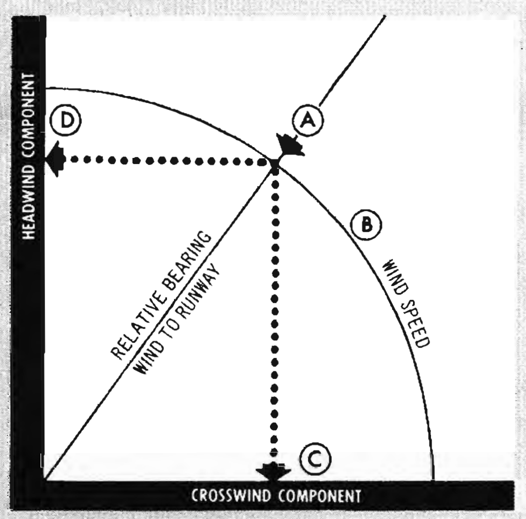
Reduce the reported wind direction to a relative bearing by determining the difference between the wind direction and runway heading. Enter the chart with the relative bearing. Move along the relative bearing to intercept the wind speed arc. From this point, descend vertically downward to read the crosswind component. From the intersection of bearing and wind speed, project horizontally to the left to read headwind component.

Sample Problem

Reported wind 050/35, runway heading 030

A.	Relative bearing	20
B.	Intersect windspeed arc	35 Kts.
C.	Crosswind component	12 Kts.
D.	Headwind component	33 Kts.

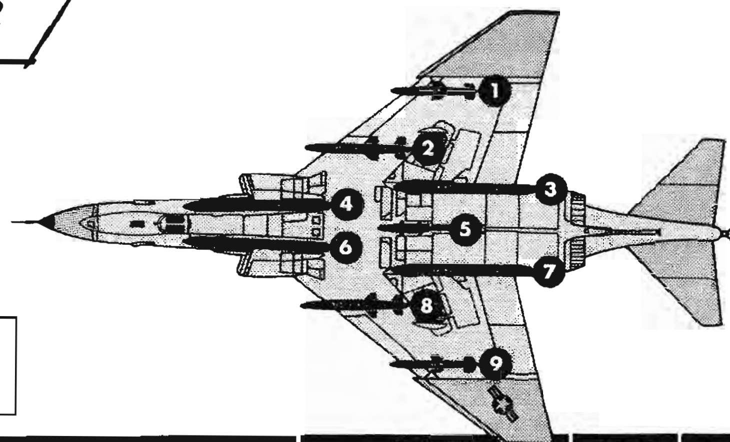
SAMPLE WIND COMPONENTS



F-4E

AIRPLANE LOADING

AIRPLANE OPERATING WEIGHT (Basic airplane plus weight of oil, and two crew members) .... 31,250 pounds (Block 38 aircraft)
AIRPLANE BASIC TAKEOFF WEIGHT (Airplanes operating weight plus full internal fuel load) .... 44,150 pounds (Block 38 aircraft)



WARNING

FOR PRECISE BASIC WEIGHT, EXTERNAL STORE AND ATTACHMENT INFORMATION, REFER TO CHARTS C AND E OF THE WEIGHT AND BALANCE DATA HANDBOOK (T.O. 1-1B-40) FOR THE PARTICULAR AIRPLANE.

STORE	SUSPENSION EQUIPMENT	STATION 1	2	3	4	5	6	7	8	9	WEIGHT PER STATION	DRAG PER STATION
600-GAL EXT. TANK SUU-21/A DISPENSER, SPL WPN, RMU-8/A MK 84 LDGP BOMB, M118 GP BOMB	AERO 27A EJECTOR RACK BRU-5/A (MODIFIED AERO 27A EJECTOR RACK)					X					51 45	N/A
370-GAL EXT. TANK (MAC)	WING TANK PYLON	X								X	92	See Sheet 2
ALL QRC-160 ECM PODS	OUTBOARD ARMAMENT PYLON									X	190	2.1
AIM-9 MISSILES	INBOARD ARMAMENT PYLON AND TWO LAU-7/A MISSILE LAUNCHERS		X						X		438	3.4
AGM-12B MISSILES	OUTBOARD ARMAMENT PYLON AND LAU-34/A MISSILE LAUNCHER	X								X	276	3.4
	INBOARD ARMAMENT PYLON AND LAU-34/A MISSILE LAUNCHER		X						X		350	4.0
AGM-12C AND -12E MISSILES, B57 SPECIAL WPN, MK 1 MOD 0 WPN SUU-21/A DISPENSER QRC 160-1 & -8 PODS	INBOARD ARMAMENT PYLON		X						X		264	2.6
AGM-45A MISSILES	OUTBOARD ARMAMENT PYLON AND LAU-34/A MISSILE LAUNCHER	X								X	276	3.4
	INBOARD PYLON AND LAU-34/A MISSILE LAUNCHER		X						X		350	4.0
SUU-16/A AND SUU-23/A GUN POD	AERO 27A EJECTOR RACK,CENTERLINE MER ADAPTER,AND SWAYBRACE ADAPTERS					X					122	3.9
	OUTBOARD ARMAMENT PYLON	X								X	190	2.1
CONVENTIONAL WEAPONS	OUTBOARD ARMAMENT PYLON AND OUTBOARD MER	X								X	405	10.1
	OUTBOARD ARMAMENT PYLON (SINGLE CARRIAGE)	X								X	190	2.1
	INBOARD ARMAMENT PYLON AND TER		X						X		359	6.8
	INBOARD ARMAMENT PYLON (SINGLE CARRIAGE)		X						X		264	2.6
	AERO 27A EJECTOR RACK AND CENTERLINE MER WITH ADAPTER					X					321	10.0
SPECIAL WEAPON or SUU-21/A DISPENSER	OUTBOARD ARMAMENT PYLON	X									190	2.1
MK 1 MOD 0 WPN A/B 45Y-2, & -4 SPRAY TANK TMU-28/A SPRAY TANK	OUTBOARD ARMAMENT PYLON	X								X	190	2.1
AIM-4D MISSILES	INBOARD ARMAMENT PYLON AND INBOARD LAUNCHER		X						X		356	3.2
	INBOARD ARMAMENT PYLON AND INBOARD AND LOWER LAUNCHERS		X						X		416	3.7
A/A 37A-15 TOW TARGET	OUTBOARD ARMAMENT PYLON AND ADAPTER	X									333	N/E

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Figure B1-1 (Sheet 1)

STORE	WEIGHT PER STORE (POUNDS)	DRAG PER STORE
MAC 370-GAL EXT TANK WITH PYLON & UNUSABLE FUEL	340	4.8
MAC 370-GAL EXT TANK WITH FULL FUEL	2745	4.8
SGT FLETCHER 370-GAL EXT TANK WITH UNUSABLE FUEL	308	6.4
SGT FLETCHER 370-GAL EXT TANK WITH FULL FUEL	2713	6.4
MAC 600-GAL EXT TANK WITH UNUSABLE FUEL	249	9.6
MAC 600-GAL EXT TANK WITH FULL FUEL	4149	9.6
ROYAL JET 600-GAL EXT TANK WITH UNUSABLE FULL	304	9.6
ROYAL JET 600-GAL EXT TANK WITH FULL FUEL	4204	9.6
A/A 37U-15 TOW TARGET SYSTEM	845	N/E
A/B 45Y-2 SPRAY TANK	775 (FULL) 475 (EMPTY)	4.7
A/B 45Y-4 SPRAY TANK	761 (FULL) 524 (EMPTY)	4.8
AGM-12B MISSILE (LIQUID PROPELLANT)	580	1.1
AGM-12B MISSILE (SOLID PROPELLANT)	567	1.1
AGM-12C MISSILE	1779	4.7
AGM-12E MISSILE	1714	4.7
AGM-45A MISSILE	400	2.3
AIM-4D MISSILE	134	1.5
AIM-7D MISSILE (FUSELAGE MOUNTED)	402	1.3
AIM-7E MISSILE (FUSELAGE MOUNTED)	455	1.3
AIM-9B MISSILE	164	1.3
ALQ-71/QRC-160-1	203	2.0
ALQ-72/QRC-160-2	185	2.4
ALQ-87/QRC-160-8	269	2.8
B28EX SPECIAL STORE	2027	4.1
B28RE SPECIAL STORE	2170	4.1
B43 SPECIAL STORE WITH MOD 0 NOSE	2060	4.1
B43 SPECIAL STORE WITH MOD 1 NOSE	2120	4.1
B57 SPECIAL STORE	500	2.2
B61 SPECIAL STORE	708	2.2
BLU-1/B OR BLU-1B/B FIRE BOMB (UNFINNED)	865	3.4
BLU-27/B FIRE BOMB (FINNED)	868	3.8
BLU-27/B FIRE BOMB (UNFINNED)	850	3.4
BLU-52/B BOMB	375	3.8
CBU-1/A OR CBU-1A/A DISPENSER	779 (FULL) 151 (EMPTY)	3.3
CBU-2/A DISPENSER	779 (FULL) 151 (EMPTY)	3.3
CBU-2A/A DISPENSER	858 (FULL) 151 (EMPTY)	3.3
CBU-2B/A OR CBU-2C/A DISPENSER	870 (FULL) 158 (EMPTY)	3.3
CBU-9/A DISPENSER	688 (FULL) 158 (EMPTY)	3.3
CBU-12/A DISPENSER	650 (FULL) 158 (EMPTY)	3.3
CBU-24A/B OR CBU-29A/B DISPENSER	825	4.2
CBU-24/B OR CBU-29/B DISPENSER	811	4.2
CBU-24B/B OR CBU-29B/B DISPENSER	832	4.6
CBU-49B/B, CBU-52/B, CBU-53/B, OR CBU-54/B DISPENSER	839	4.6
CBU-46/A DISPENSER	890 (FULL) 158 (EMPTY)	3.3
CBU-49/B DISPENSER	818	4.2
CBU-49A/B DISPENSER	823	4.2
CTU-1/A SUPPLY CONTAINER	215 (EMPTY)	4.9

N/E-NOT ESTABLISHED F-FULL E-EMPTY

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Figure B1-1 (Sheet 2)

STORE		WEIGHT PER STORE (POUNDS)	DRAG PER STORE
SUU-42/A FLARE DISPENSER (WITH 16 MK24 FLARES)		821 (FULL) 383 (EMPTY)	6.5
LAU-3/A ROCKET POD	WITH NOSE & TAIL CONES (FULL) WITHOUT NOSE CONE & WITH TAIL CONE (FULL) WITHOUT NOSE & TAIL CONES (FULL) WITHOUT NOSE & TAIL CONES (EMPTY)	427 425 423 71	4.2 12.2 13.5 5.7
LAU-32A/ OR LAU-59/A ROCKET POD		173 (FULL) 49 (EMPTY)	F-2.0 E-4.5
M129E1 LEAFLET BOMB		200	4.2
M117 GENERAL PURPOSE BOMB		820	4.2
M117 GENERAL PURPOSE BOMB WITH MAU-103/B FIN		806	4.4
M117 (RETARDED) GENERAL PURPOSE BOMB OR M117D (DESTRUCTOR)		880	6.3
M118 GENERAL PURPOSE BOMB		3020	10.1
MC-1 GAS BOMB		720	4.2
MK 1 MOD 0 GUIDED WEAPON		1108	3.6
MK 36 MOD 0 DESTRUCTOR		572	2.4
MK 81 GENERAL PURPOSE BOMB		260	0.8
MK 82 GENERAL PURPOSE BOMB		531	1.1
MK 82 SNAKEYE I BOMB		560	2.4
MK 83 GENERAL PURPOSE BOMB		985	1.8
MK 84 GENERAL PURPOSE BOMB		1970	3.4
MLU-32/B99 BRITEYE FLARE		154	1.9
RMU-8/A REEL LAUNCHER		900	6.4
RMU-8/A REEL LAUNCHER WITH TDU-22 TARGET AND TOW CABLE		1815	N/E
SUU-16/A GUN POD (50 ROUNDS AMMO)		1042	8.1
SUU-16/A GUN POD (FULLY LOADED)		1702	8.1
SUU-20/A PRACTICE BOMB/ROCKET DISPENSER		451 (FULL) 240 (EMPTY)	F-3.1 E-3.7
SUU-21/A PRACTICE BOMB DISPENSER WITH SIX BDU-33/B		622 (FULL) 470 (EMPTY)	3.3
SUU-21/A PRACTICE BOMB DISPENSER WITH SIX BDU-23/B		622 (FULL) 470 (EMPTY)	3.3
SUU-21/A PRACTICE BOMB DISPENSER WITH SIX MK 106		500 (FULL) 470 (EMPTY)	3.3
SUU-23/A GUN POD (50 ROUNDS AMMO)		1080	8.1
SUU-23/A GUN POD (FULLY LOADED)		1739	8.1
SUU-25B/A FLARE DISPENSER		360 (FULL) 157 (EMPTY)	10.0
SUU-25/A FLARE DISPENSER		315	10.0
TMU-28/B SPRAY TANK		1923 (FULL) 567 (EMPTY)	4.9
CBU-39/A DISPENSER CBU-40/A DISPENSER SUU-42/A DISPENSER SUU-41A/A DISPENSER	REFER TO T.O. 1F-4C-34-1-3 FOR STORE WEIGHT AND DRAG NUMBER.		
ADSID COIN NO. 1 ADSID TC-425	REFER TO T.O. 1F-4D-2-31 FOR STORE WEIGHT AND DRAG NUMBER.		
NOSE GUN AMMO (639 ROUNDS PRIOR TO FIRING)		373	—
NOSE GUN AMMO (639 ROUNDS AFTER FIRING)		169	—
LAU-32B/A ROCKET POD		179 (FULL) 49 (EMPTY)	F-2.0 E-4.5

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Figure B1-1 (Sheet 3)

STABILITY NUMBERS

WING MOUNTED WEAPONS WING STATION 1, 2, 8 or 9

STORE	SINGLE MOUNTED (One weapon at a station)	CLUSTER MOUNTED (Two or more weapons at a station)
	UNIT STABILITY NUMBER	
A/A 37U-15 TOW TARGET	N/E	N/A
A/B 45Y-2 SPRAY TANK	16.2	N/A
A/B 45Y-4 SPRAY TANK	15.0	N/A
ADSID COIN NO. 1 OR ADSID TC-425	REFER TO T.O. 1F-4D-2-31	
AGM-12B MISSILE	5.8	N/A
AGM-12C OR AGM-12E MISSILE	12.3	N/A
AGM-45 MISSILE	2.7	N/A
AIM-4D MISSILE	2.0	2.0
AIM-9B MISSILE	1.0	1.4
ALQ-71 (QRC-160-1, ALQ-72 (QRC-160-2, OR ALQ-87 (QRC-160-8 ECM POD	4.4	N/A
B28 BOMB	11.2	N/A
B43 BOMB	9.2	N/A
B57 BOMB	4.9	N/A
B61 BOMB	2.5	N/A
BLU-1/B, BLU-1B/B, OR BLU-27/B FIRE BOMB	14.0	18.7
BLU-52/B BOMB	14.0	18.7
CBU-1/A, CBU-1A/A, CBU-2/A, CBU-2A/A, CBU-2B/A, CBU-2C/A, CBU-9/A, OR CBU-12/A DISPENSER	10.0	13.3
CBU-24A/B, CBU-24B/B, CBU-24/B, CBU-29A/B, CBU-29B/B, CBU-29/B, CBU-49/B, CBU-49A/B CBU-49B/B, CBU-52/B, CBU-53/B, OR CBU-54/B DISPENSER	7.4	9.9
CBU-39/A OR CBU-40/A DISPENSER	REFER TO T.O. 1F-4C-34-1-3	
CTU-1/A CONTAINER	N/E	N/A
LAU-3/A ROCKET POD	10.1	13.5
LAU-32A/A, LAU-59/A OR LAU-32B/A ROCKET POD	3.9	5.2
M117 GP, RE BOMB, OR M117D	7.3	9.7
M117 GP BOMB (MAU-103/B FIN)	7.5	10.0
M129E1 LEAFLET BOMB	7.3	9.7
MC-1 GAS BOMB	7.3	9.7
MK 1 MOD 0 GUIDED WEAPON	9.2	N/A
MK 36 MOD 0 DESTRUCTOR	2.8	3.7
MK 81 GP BOMB	1.8	2.4
MK 82 GP OR SNAKEYE BOMB	2.8	3.7
MK 83 GP BOMB	4.6	6.1
MK 84 GP BOMB	7.2	N/A
MLU-10/B LAND MINE	2.9	3.9
MLU-32/B99 BRITEYE FLARE	2.8	3.8
SUU-16/A OR SUU-23/A GUN POD	19.8	N/A
SUU-20/A DISPENSER	N/E	N/A
SUU-21/A DISPENSER	7.4	N/A
SUU-25/A FLARE DISPENSER	8.0	10.6
SUU-41A/A DISPENSER	REFER TO T.O. 1F-4C-34-1-3	
SUU-42/A DISPENSER (WITH MK 24 FLARES)	14.0	N/A
TMU-28/B SPRAY TANK	18.0	N/A
WING TANK AND PYLON (WITHOUT WEAPONS INSTALLED ON STATIONS 2 & 8)	20.0	N/A
(WITH WEAPONS INSTALLED ON STATIONS 2 & 8)	29.8	N/A
(WITH AIM-4D MISSILES/LAUNCHERS INSTALLED ON STATIONS 2 & 8)	44.0	N/A

WING MOUNTED SUSPENSION EQUIPMENT

WING STATION 2 or 8	UNIT STABILITY NUMBER
INBOARD ARMAMENT PYLON (MAU-12B/A)	6.9
INBOARD ARMAMENT PYLON + TER RACK	13.5
INBOARD ARMAMENT PYLON + LAU-7/A GUIDED MISSILE LAUNCHER	9.1
INBOARD ARMAMENT PYLON + LAU-34/A GUIDED MISSILE LAUNCHER	9.3
INBOARD ARMAMENT PYLON + AIM-4D LAUNCHER (SINGLE MISSILE)	8.2
INBOARD ARMAMENT PYLON + AIM-4D LAUNCHER (TWO MISSILES)	9.5

WING STATION 1 or 9	UNIT STABILITY NUMBER
OUTBOARD ARMAMENT PYLON (MAU-12B/A)	4.3
OUTBOARD ARMAMENT PYLON + MER RACK	11.4
OUTBOARD ARMAMENT PYLON + LAU-34/A GUIDED MISSILE LAUNCHER	6.8

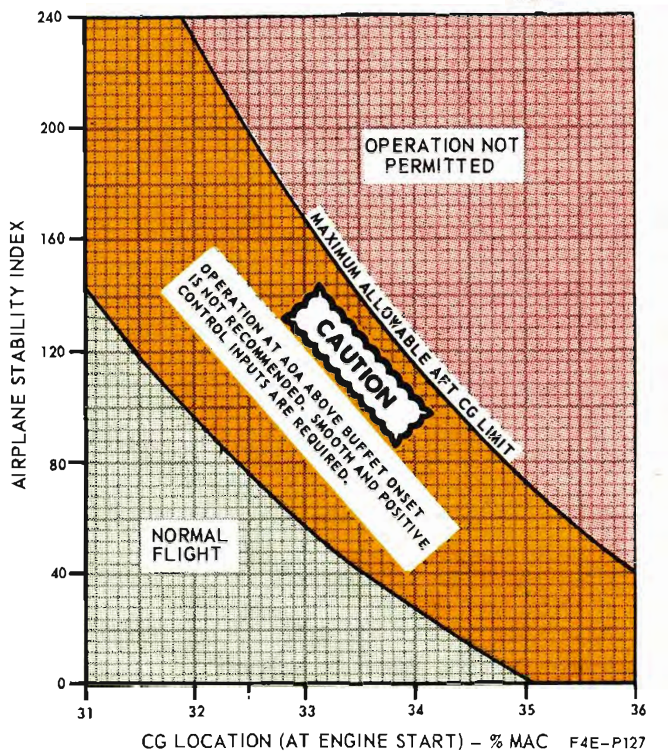
Notes:
1. TANDEM-MOUNTED WEAPONS COUNT AS A SINGLE WEAPON.
2. N/E – NOT ESTABLISHED
   N/A – NOT APPLICABLE

F4E-T120

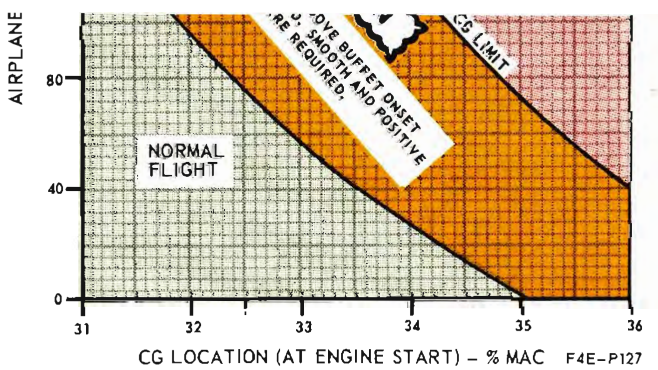
Figure B1-2

AFT CG LIMITS

F-4E



F4E-P127
RGY



F4E-P127
RGY

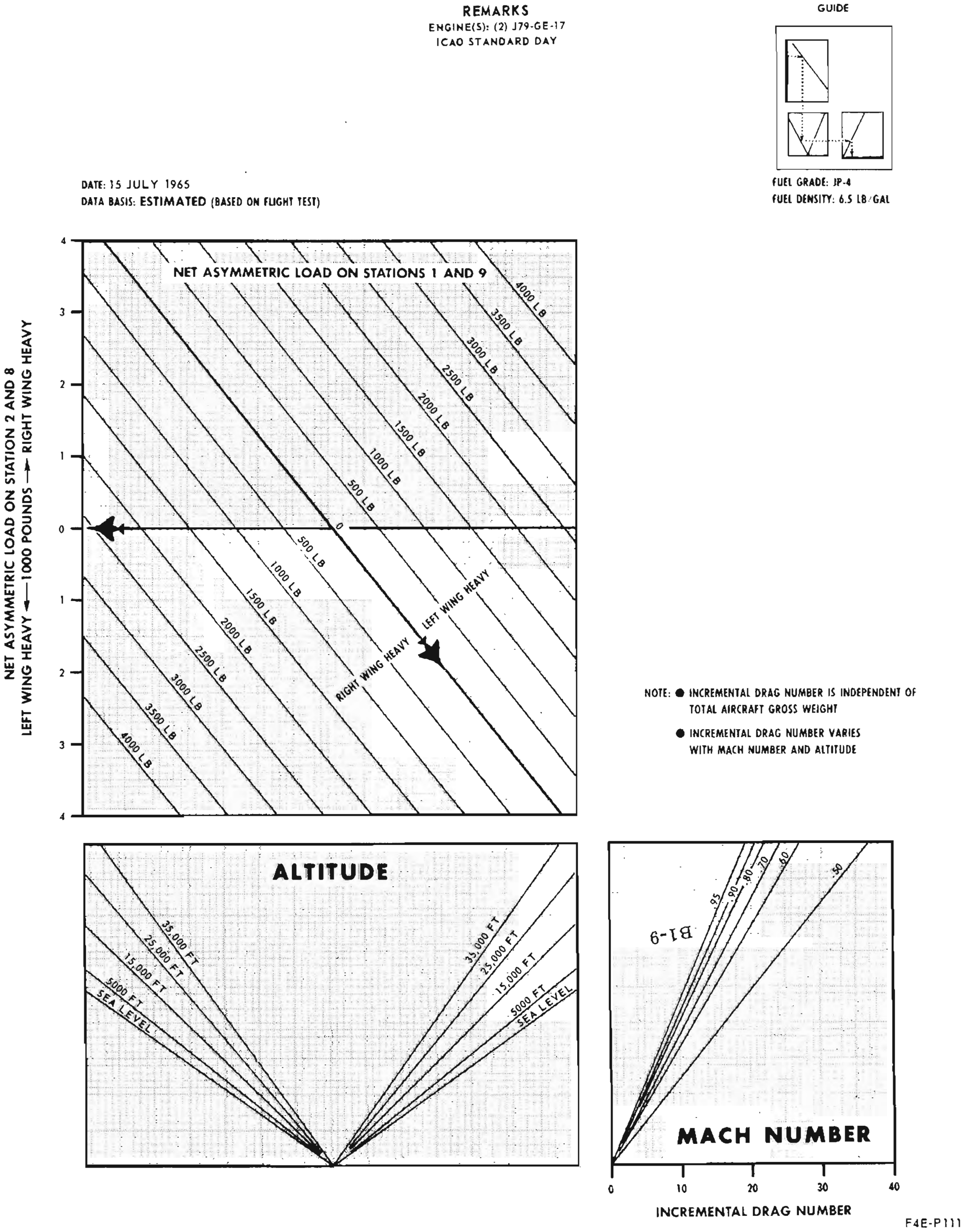
F-4E

DRAG DUE TO ASYMMETRIC LOADING

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 15 JULY 1965
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



NOTE: ● INCREMENTAL DRAG NUMBER IS INDEPENDENT OF TOTAL AIRCRAFT GROSS WEIGHT
● INCREMENTAL DRAG NUMBER VARIES WITH MACH NUMBER AND ALTITUDE

Figure B1-4

F-4E
STANDARD ATMOSPHERE TABLE

STANDARD SEA LEVEL AIR:
T=15°C.
P=29.921 INCHES OF Hg.

W=.07651 POUNDS/CUBIC FOOT ρ_0=.002378 SLUGS/CUBIC FOOT
1" OF Hg.=70.732 POUNDS/SQUARE FOOT=0.4912 POUND/SQUARE INCH
a_0=1116 FEET/SECOND

ALTITUDE FEET	DENSITY RATIO ρ/ρ_0	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE		SPEED OF SOUND RATIO a/a_0	PRESSURE	
			DEG. C	DEG. F		IN. OF Hg	RATIO P/P_0
0	1.0000	1.0000	15.000	59.000	1.000	29.92	1.0000
1000	.9710	1.0148	13.019	55.434	.997	28.86	.9644
2000	.9428	1.0299	11.038	51.868	.993	27.82	.9298
3000	.9151	1.0454	9.056	48.301	.990	26.81	.8962
4000	.8881	1.0611	7.075	44.735	.986	25.84	.8636
5000	.8616	1.0773	5.094	41.169	.983	24.89	.8320
6000	.8358	1.0938	3.113	37.603	.979	23.98	.8013
7000	.8106	1.1107	1.132	34.037	.976	23.09	.7716
8000	.7859	1.1280	-0.850	30.471	.972	22.22	.7427
9000	.7619	1.1456	-2.831	26.904	.968	21.38	.7147
10,000	.7384	1.1637	-4.812	23.338	.965	20.58	.6876
11,000	.7154	1.1822	-6.793	19.772	.962	19.79	.6614
12,000	.6931	1.2012	-8.774	16.206	.958	19.03	.6359
13,000	.6712	1.2206	-10.756	12.640	.954	18.29	.6112
14,000	.6499	1.2404	-12.737	9.074	.950	17.57	.5873
15,000	.6291	1.2608	-14.718	5.507	.947	16.88	.5642
16,000	.6088	1.2816	-16.699	1.941	.943	16.21	.5418
17,000	.5891	1.3029	-18.680	-1.625	.940	15.56	.5202
18,000	.5698	1.3247	-20.662	-5.191	.936	14.94	.4992
19,000	.5509	1.3473	-22.643	-8.757	.932	14.33	.4790
20,000	.5327	1.3701	-24.624	-12.323	.929	13.75	.4594
21,000	.5148	1.3937	-26.605	-15.890	.925	13.18	.4405
22,000	.4974	1.4179	-28.586	-19.456	.922	12.63	.4222
23,000	.4805	1.4426	-30.568	-23.022	.917	12.10	.4045
24,000	.4640	1.4681	-32.549	-26.588	.914	11.59	.3874
25,000	.4480	1.4940	-34.530	-30.154	.910	11.10	.3709
26,000	.4323	1.5209	-36.511	-33.720	.906	10.62	.3550
27,000	.4171	1.5484	-38.493	-37.287	.903	10.16	.3397
28,000	.4023	1.5768	-40.474	-40.853	.899	9.720	.3248
29,000	.3879	1.6056	-42.455	-44.419	.895	9.293	.3106
30,000	.3740	1.6352	-44.436	-47.985	.891	8.880	.2968
31,000	.3603	1.6659	-46.417	-51.551	.887	8.483	.2834
32,000	.3472	1.6971	-48.399	-55.117	.883	8.101	.2707
33,000	.3343	1.7295	-50.379	-58.684	.879	7.732	.2583
34,000	.3218	1.7628	-52.361	-62.250	.875	7.377	.2465
35,000	.3098	1.7966	-54.342	-65.816	.871	7.036	.2352
36,000	.2962	1.8374	-55.000	-67.000	.870	6.708	.2242
37,000	.2824	1.8818	-55.000	-67.000	.870	6.395	.2137
38,000	.2692	1.9273	-55.000	-67.000	.870	6.096	.2037
39,000	.2566	1.9738	-55.000	-67.000	.870	5.812	.1943
40,000	.2447	2.0215	-55.000	-67.000	.870	5.541	.1852
41,000	.2332	2.0707	-55.000	-67.000	.870	5.283	.1765
42,000	.2224	2.1207	-55.000	-67.000	.870	5.036	.1683
43,000	.2120	2.1719	-55.000	-67.000	.870	4.802	.1605
44,000	.2021	2.2244	-55.000	-67.000	.870	4.578	.1530
45,000	.1926	2.2785	-55.000	-67.000	.870	4.364	.1458
46,000	.1837	2.3332	-55.000	-67.000	.870	4.160	.1391
47,000	.1751	2.3893	-55.000	-67.000	.870	3.966	.1325
48,000	.1669	2.4478	-55.000	-67.000	.870	3.781	.1264
49,000	.1591	2.5071	-55.000	-67.000	.870	3.604	.1205
50,000	.1517	2.5675	-55.000	-67.000	.870	3.436	.1149

F4E-P101

Figure B1-5

F-4E

TEMPERATURE CONVERSION

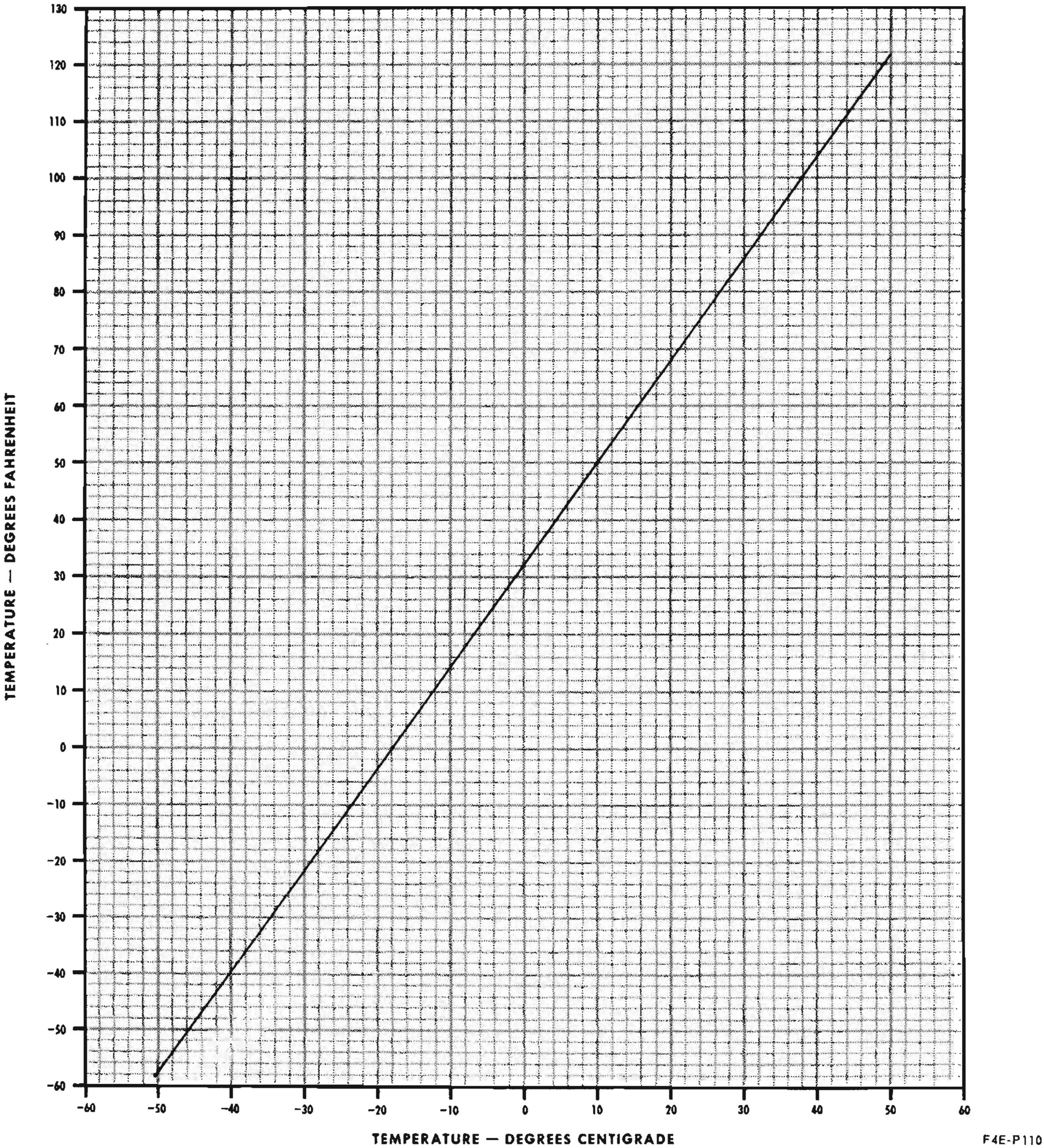


Figure B1-6

F-4E

ANGLE OF ATTACK CONVERSIONS

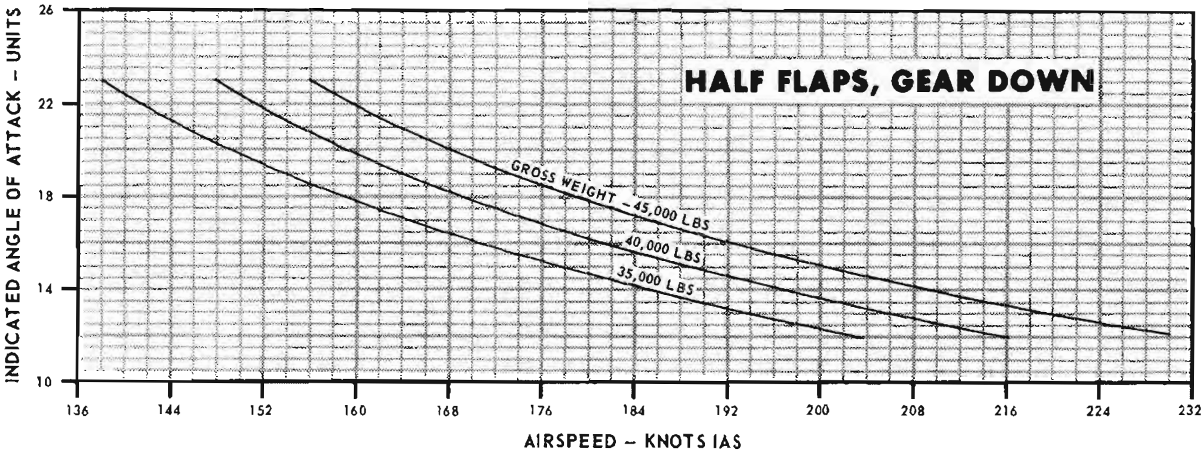
1 G LEVEL FLIGHT

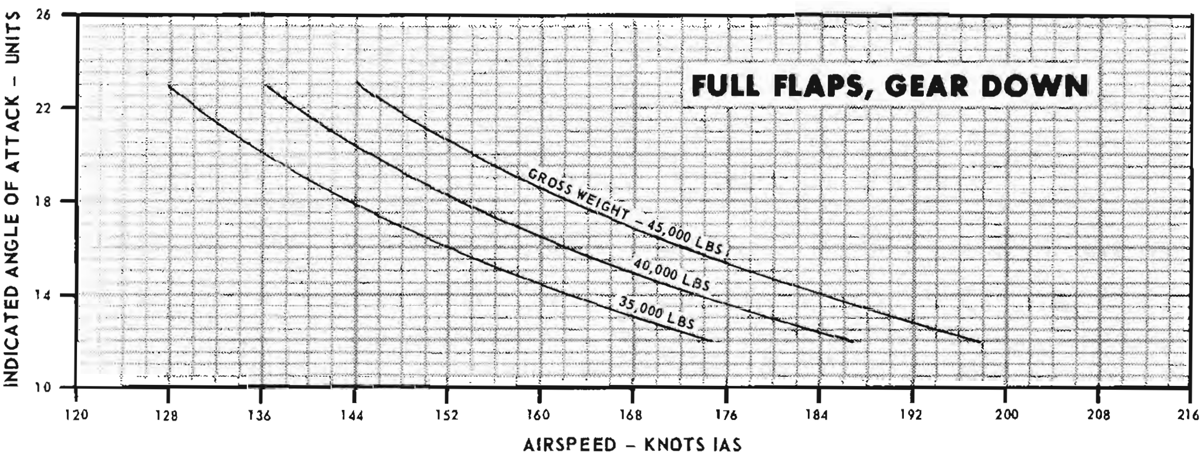
AIRPLANE CONFIGURATION
GEAR AND FLAPS
AS NOTED

REMARKS
ENGINE(S): (2) J79-GE-17

DATE: 1 FEBRUARY 1970
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



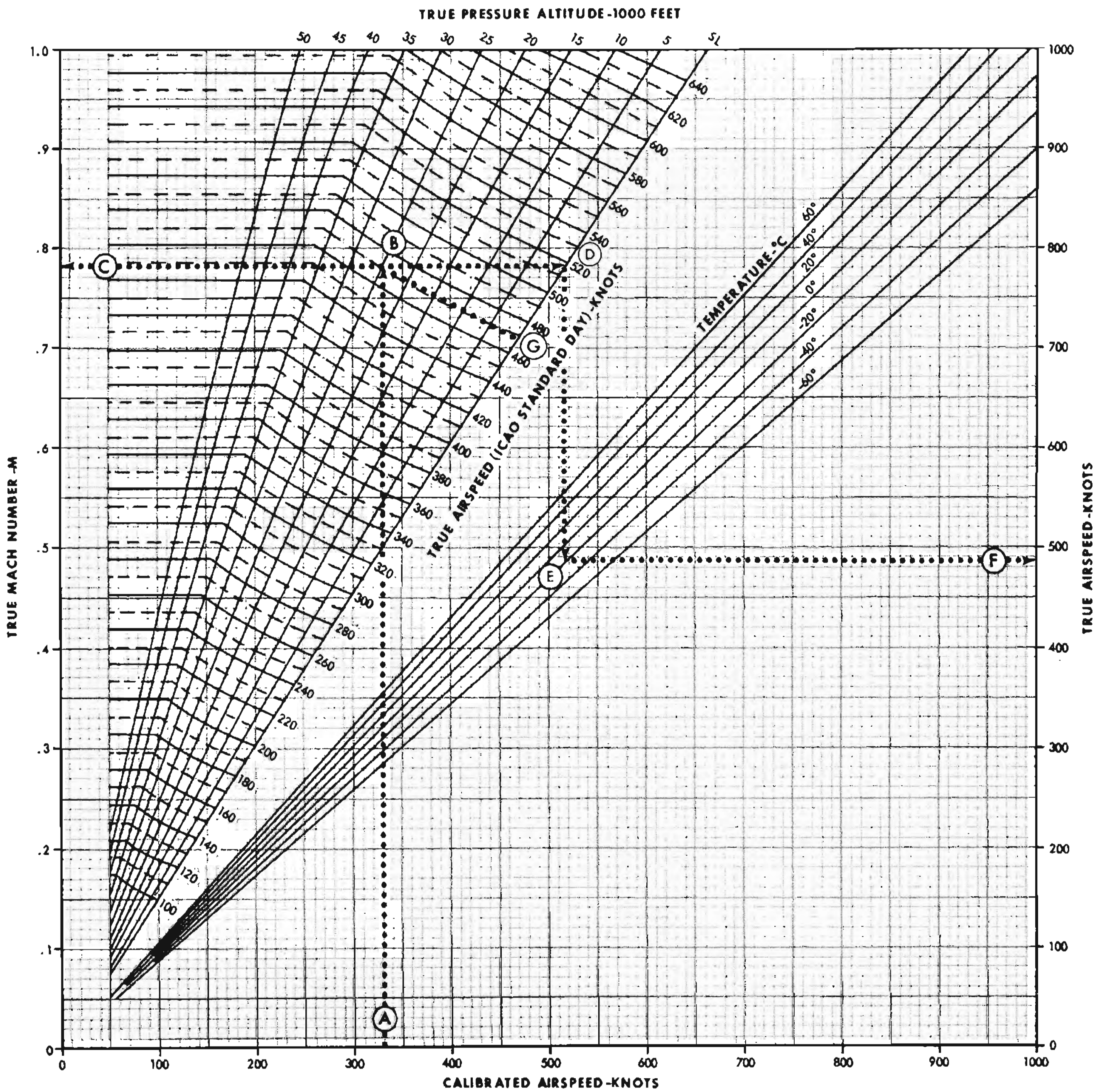


F4E-P126

Figure B1-7

F-4E

AIRSPEED CONVERSION



EXAMPLE

A = CAS = 330 KNOTS
B = ALTITUDE = 25,000 FEET
C = MACH = .782
D = SEA LEVEL LINE
E = TEMPERATURE = −20°C
F = TAS = 486 KNOTS
G = TAS (STANDARD DAY) = 472 KNOTS

F4E–P102–1

Figure B1-8 (Sheet 1)

F-4E

AIRSPEED CONVERSION

HIGH MACH

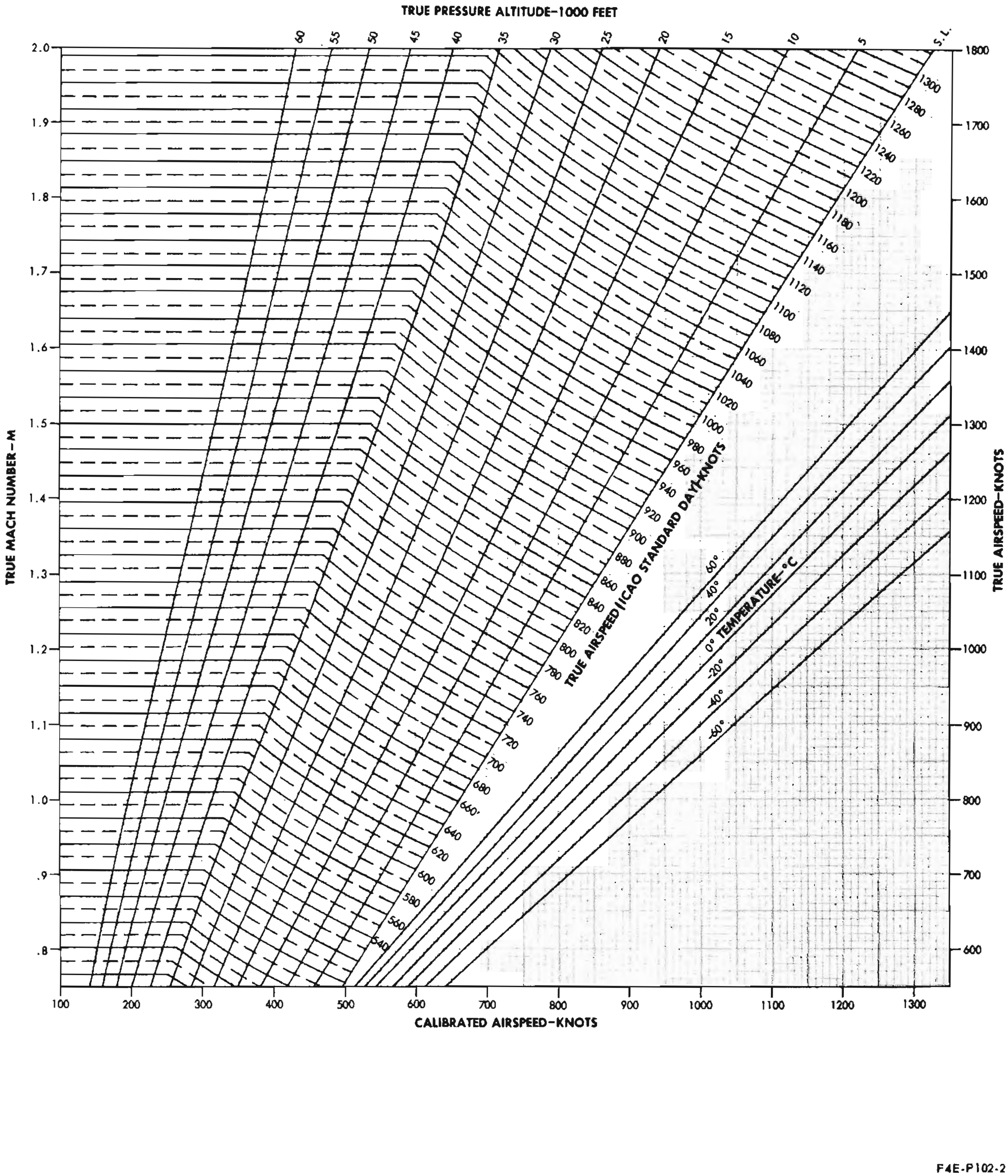


Figure B1-8 (Sheet 2)

F-4E

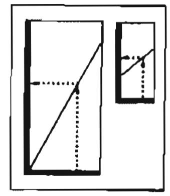
AIRSPEED POSITION ERROR CORRECTION

AIRPLANE CONFIGURATION
ALL DRAG INDEXES
FLAPS AND GEAR AS NOTED

REMARKS

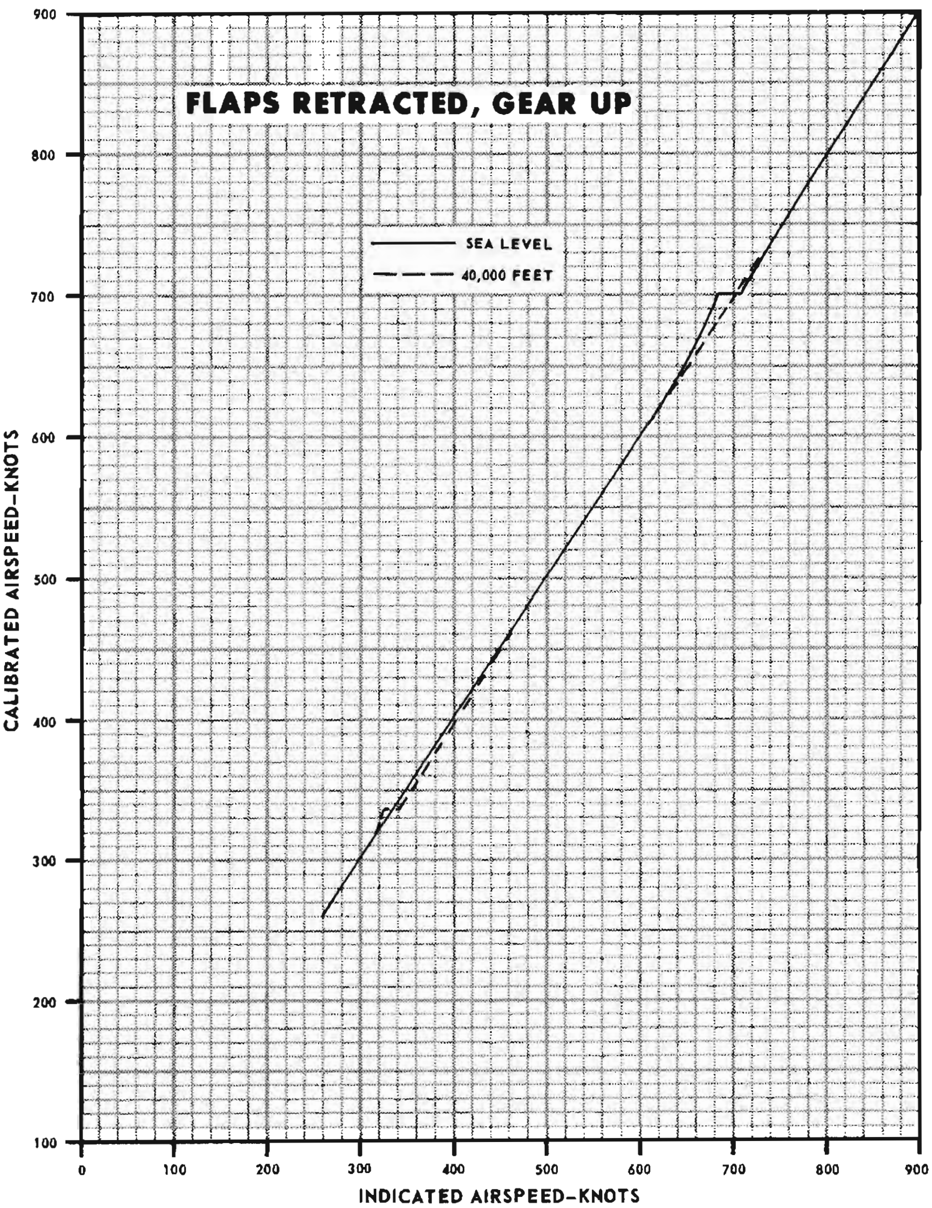
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

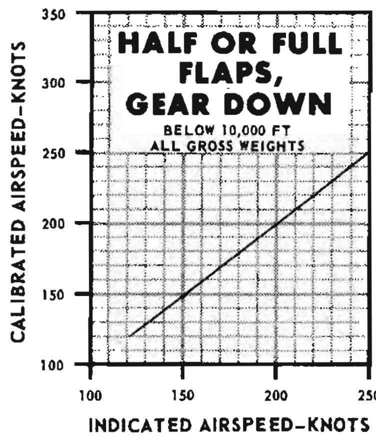
GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P121

Figure B1-9

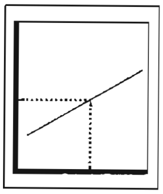
F-4E

AIRSPEED POSITION ERROR CORRECTION

AIRPLANE CONFIGURATION
ALL DRAG INDEXES
FLAPS RETRACTED, GEAR UP

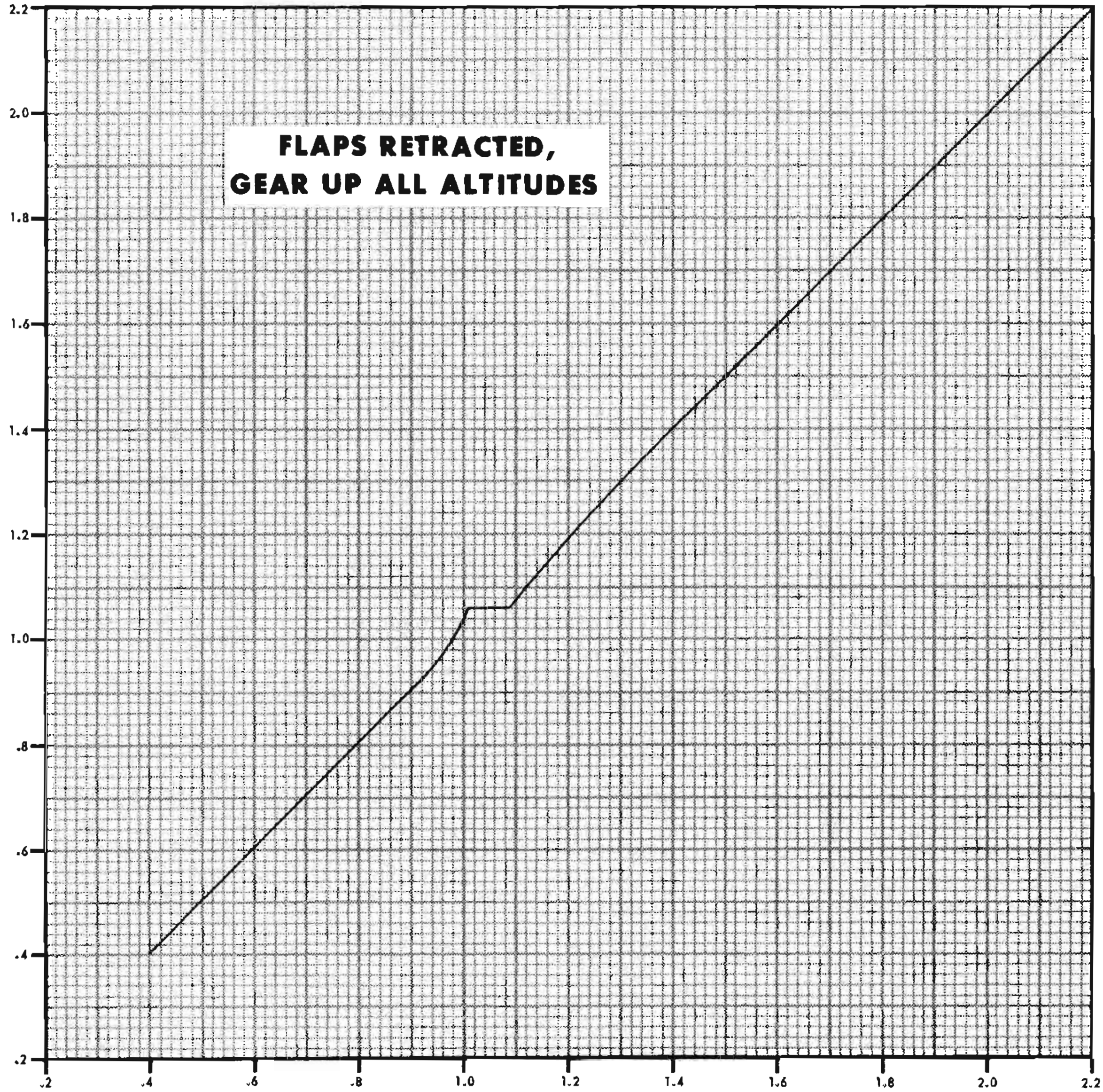
REMARKS
ENGINE(S): (2) J79-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P122

Figure B1-10

F-4E

ALTIMETER POSITION ERROR CORRECTION

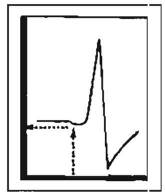
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
FLAPS AND GEAR AS NOTED.

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

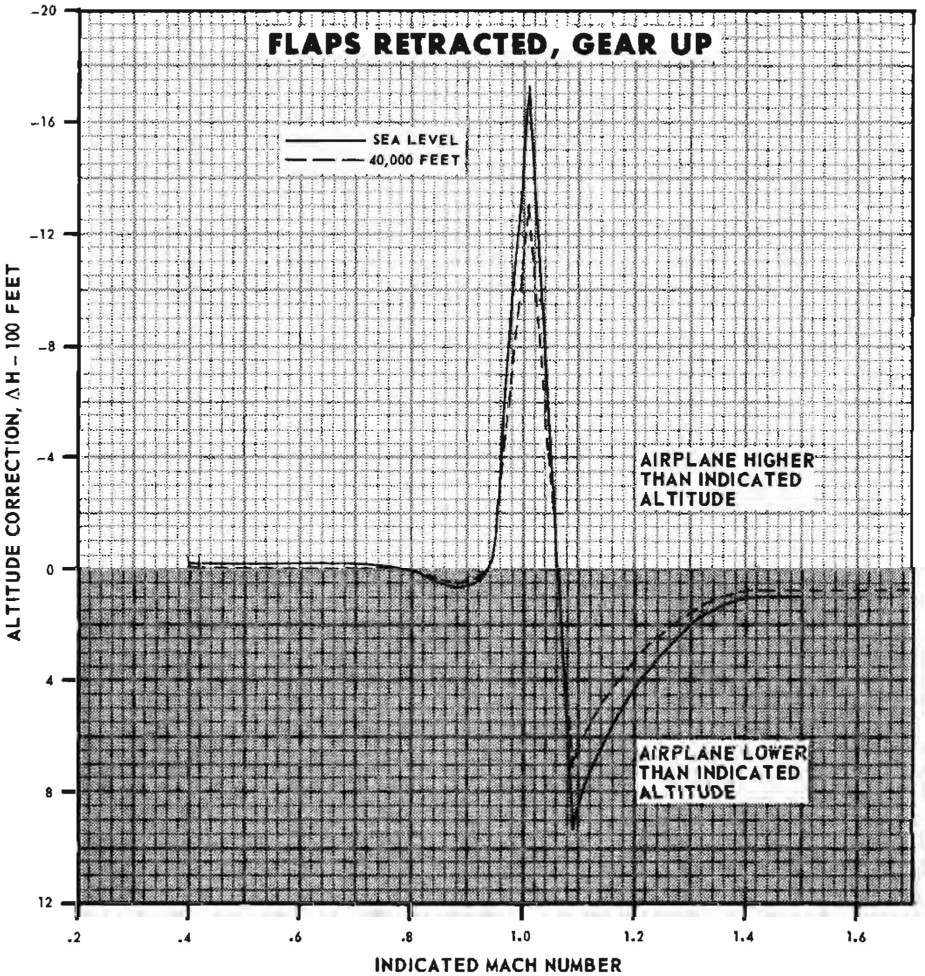
NOTE
ASSIGNED ALTITUDE + ΔH = INDICATED ALTITUDE. FLY INDICATED ALTITUDE

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



HALF OR FULL FLAPS, GEAR DOWN

BELOW 10,000 FEET
ALL GROSS WEIGHTS:

ADD 25 FEET TO ASSIGNED ALTITUDE TO OBTAIN INDICATED ALTITUDE.

F4E-P123

Figure B1-11

F-4E

ALTIMETER LAG

AIRPLANE CONFIGURATION
ALL DRAG INDEXES

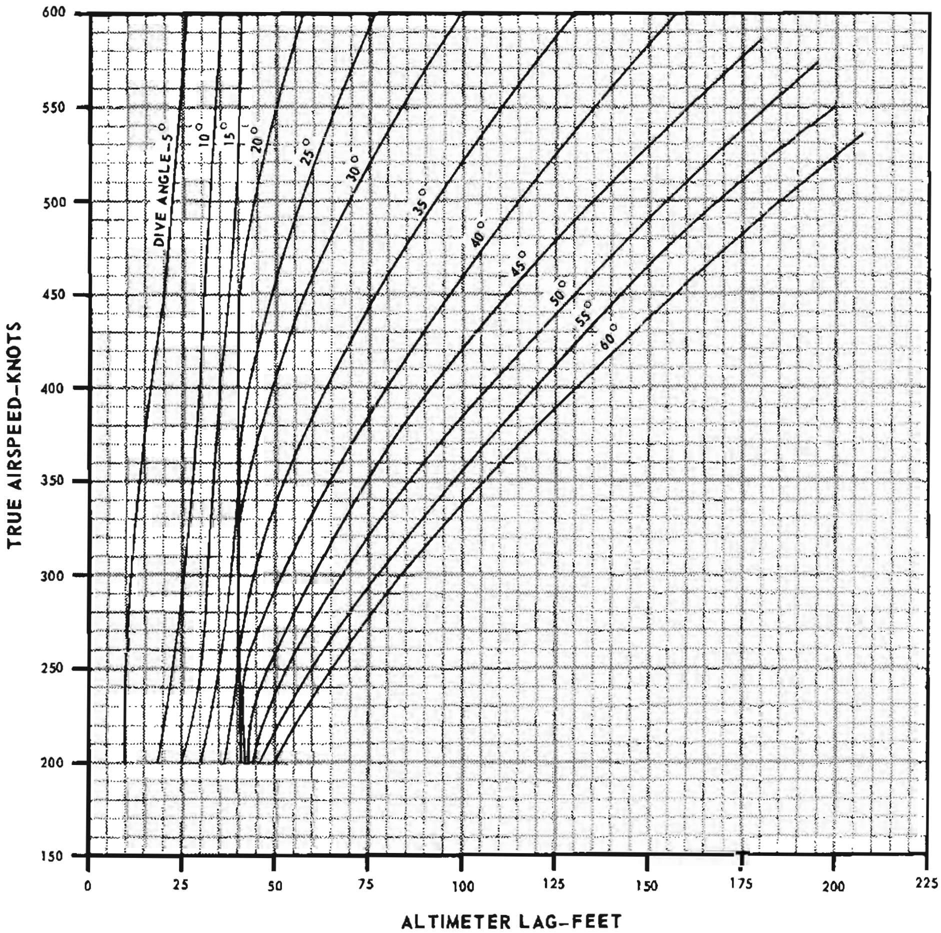
REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE

AIRCRAFT WITH SPC OPERATIVE

DATE: 15 DECEMBER 1968
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P124

Figure B1-12

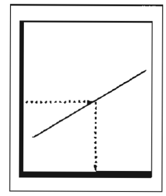
F-4E

ALTIMETER LAG

AIRPLANE CONFIGURATION
ALL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

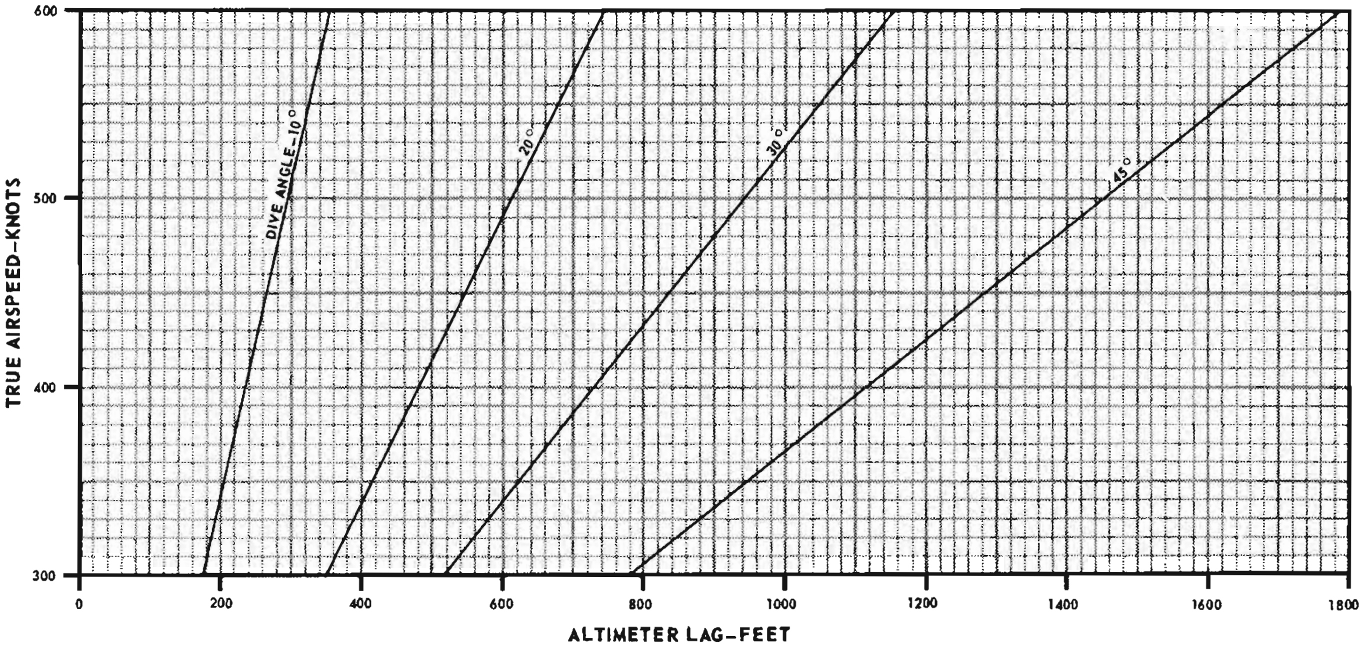
GUIDE



AIRCRAFT WITH SPC INOPERATIVE

DATE: 15 DECEMBER 1968
DATA BASIS: USAF FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

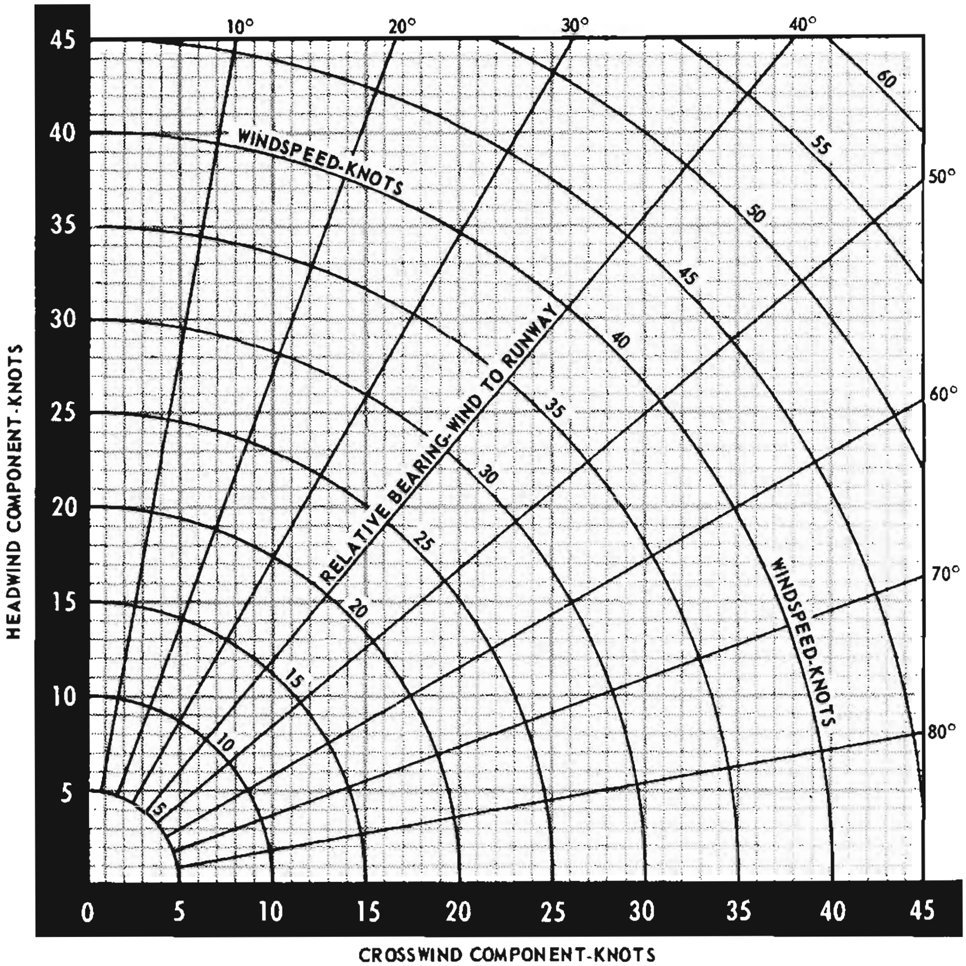


F4E-P125

Figure B1-13

F-4E

WIND COMPONENTS



NOTE

THIS IS NOT TO BE USED AS A GROUND CONTROLLABILITY CHART.

F4E-P108

Figure B1-14

PART 2 TAKE-OFF

TABLE OF CONTENTS

Charts

DEFINITIONS OF TERMS USED

REFUSAL SPEED

Refusal speed is the maximum speed to which the aircraft can accelerate and then stop within the available runway length.

REFUSAL DISTANCE

Refusal distance is the distance required to accelerate to refusal speed under normal conditions.

CRITICAL ENGINE FAILURE SPEED

The critical engine failure speed is the speed at which the aircraft, after an engine failure, will accelerate to takeoff in the same distance required to decelerate to a complete stop. If engine failure occurs at a lower speed, a shorter distance is required to stop than to takeoff, while engine failure at a higher speed results in a shorter distance to takeoff than to stop.

CRITICAL FIELD LENGTH

The critical field length is the total runway length required to accelerate the aircraft, experience an engine failure, and then either take off with the remaining engine or decelerate the aircraft to a complete stop. The critical field length may be no greater than the length of the available runway.

CHECKLIST TAKEOFF DATA

A two-page nomogram is used to present takeoff data in the checklist. The Total Thrust chart is bounded by scales of runway temperature and pressure altitude with the readout scale presenting the total thrust available. The Takeoff Roll chart is bounded by vertical scales of total thrust available and gross weight with the readout scale presenting the takeoff distance. Takeoff speeds are also shown on gross weight scale.

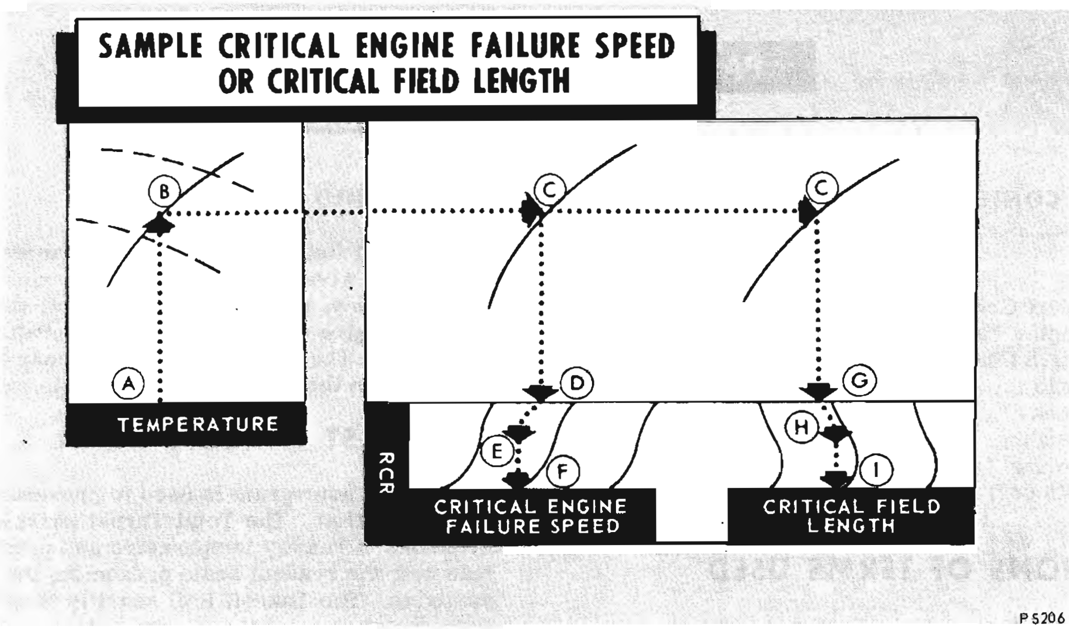
USE

To find total thrust available, mark the existing runway temperature on the left scale and the field elevation on the right scale. Plot a straight line between these two points and read total thrust available for the temperature/elevation condition. To find the takeoff distance, mark the total thrust available (obtained from preceding chart) on the left scale and the takeoff gross weight on the right scale. Note takeoff speed corresponding to gross weight. Plot a straight line between these two marked points and read resulting takeoff distance for the thrust/weight condition.

TAKEOFF PLANNING CHARTS

TAKEOFF-ABORT CRITERIA

This chart (figure B2-1) provides the pilot with an integrated picture of the takeoff planning criteria.



CRITICAL ENGINE FAILURE SPEED OR CRITICAL FIELD LENGTH CHART

These charts (figures B2-2 and B2-3) are used to determine the critical engine failure speed and corresponding critical field length under conditions of maximum or military thrust and with or without the drag chute deployed. Single-engine takeoff/climb-out limits for gross weights above 40,000 pounds are cross-plotted on the pressure altitude graph. If the combined temperature and pressure altitude point falls above the interpolated limit curve for a particular gross weight, a single-engine takeoff/climb-out cannot be effected.

USE

Enter the chart at the applicable temperature and project vertically to intersect the pressure altitude. (Note single-engine takeoff and climb-out limit.) Then proceed horizontally to the right and intersect both series of gross weight curves. From the intersection of the gross weight curve in the first series, project vertically downward to the base line. From this point, parallel the closest guide line to the RCR factor, then project vertically downward to read critical engine failure speed. From the intersection of the gross weight curve in the second series, project vertically downward to the base line. From this point, again parallel the closest guide line to the RCR factor and further downward to read critical field length. Refer to the Wind Effects on Takeoff chart, this part, to determine wind effects on critical field length.

Sample Problem

Maximum Thrust, Without Drag Chute

A. Temperature	20°C
B. Pressure altitude	2000 Ft.
C. Gross weight (intersect both series of curves)	50,000 Lbs.
D. RCR base line	
E. RCR factor	15
F. Critical engine failure speed	86 Kts.
G. RCR base line	
H. RCR factor	15
I. Critical field length	7500 Ft.

DENSITY RATIO CHART

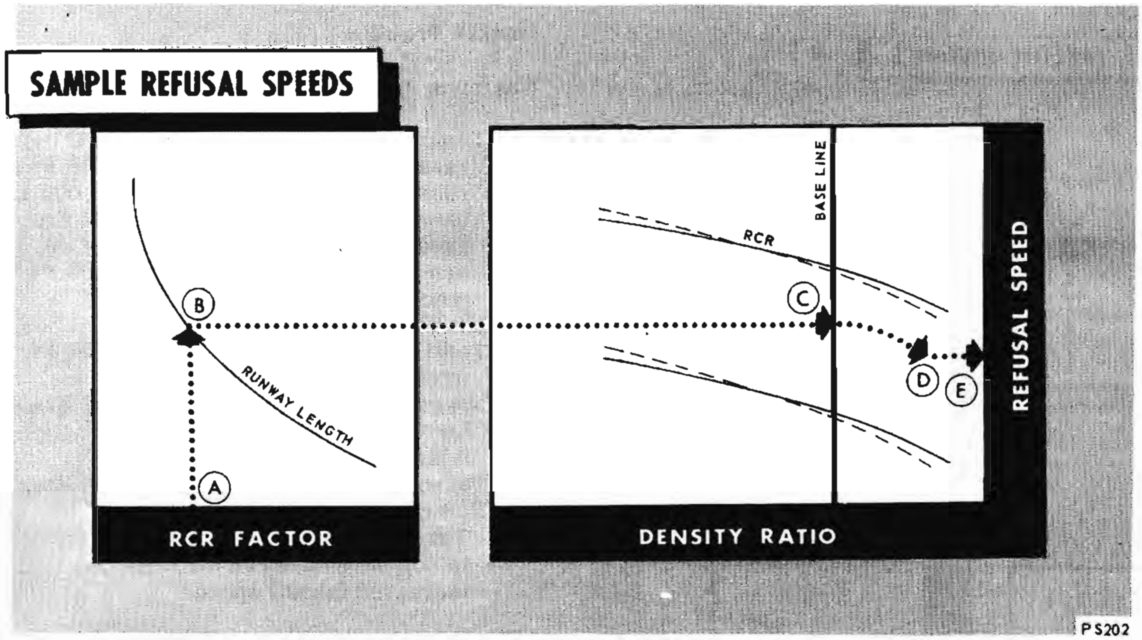
This chart (figure B2-4) provides density ratio values for various combinations of pressure altitude and temperature. Density ratio is required for determining refusal speed.

USE

Enter the chart with the pressure altitude and project horizontally to the right to intersect the appropriate temperature curve. From this intersection, project vertically downward to read density ratio.

Sample Problem

A. Pressure altitude	5000 Ft.
B. Temperature	0°C
C. Density ratio	0.88



REFUSAL SPEED CHARTS

These charts (figures B2-5 thru B2-8) are used to determine refusal speed under conditions of maximum or military thrust and with or without drag chute deployment. Separate plots are utilized to present the three takeoff gross weights. Under conditions of high density ratio and gross weight, the critical engine failure speed may approach or exceed refusal speed.

Note

These charts are based on a no-wind condition.

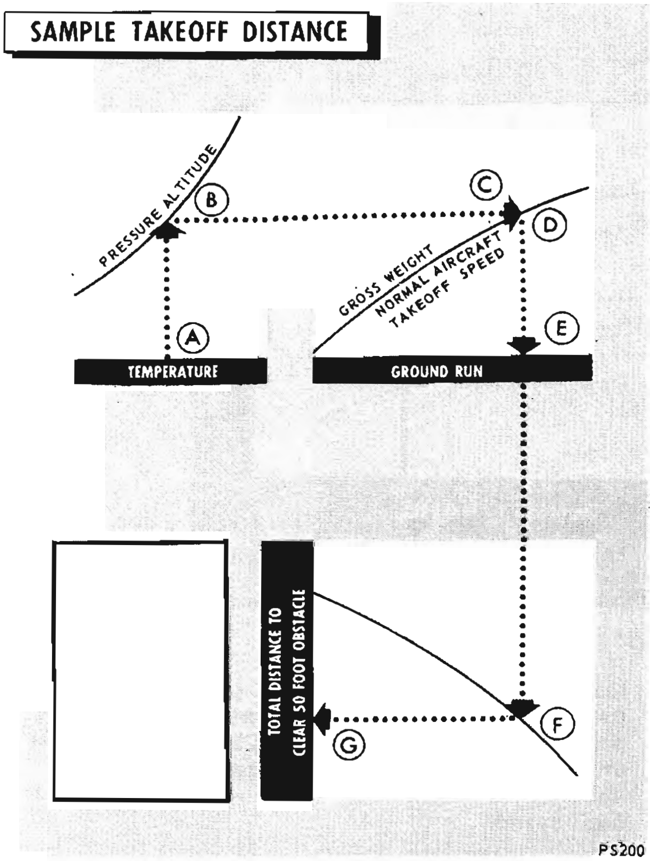
USE

Enter the chart at the applicable RCR factor and proceed vertically to intersect the available runway length. From this intersection, proceed horizontally to the right and intersect the base line. From this point, parallel the applicable RCR guide line (right or left) to the previously computed density ratio. Then project horizontally to the right and read refusal speed.

Sample Problem

Maximum Thrust, Without Drag Chute, 40,000 Lbs, Gross Weight.

A. RCR factor	23
B. Available runway length	8000 Ft.
C. RCR base line	
D. Density ratio (previously computed)	0.88
E. Refusal speed	107 Kts.



TAKEOFF DISTANCE CHARTS

These charts (figures B2-9 and B2-10) are used to determine the normal ground run distance, and the total distance required to clear a 50-foot obstacle. Separate charts are provided for maximum and military thrust. The takeoff speeds shown for various takeoff gross weights on the ground run plot are based on a normal aircraft takeoff and do not take aircraft CG location into consideration. A table has been provided to show nosewheel lift-off speed with the corresponding aircraft takeoff speed for various gross weight and CG combinations.

USE

Enter the chart at the applicable temperature and proceed vertically to intersect the pressure altitude. From this point, proceed horizontally to right and intersect the takeoff weight line (note normal aircraft takeoff speed). Then descend vertically to read normal ground run distance. To find the total distance required to clear a 50-foot obstacle, continue downward to the reflector line and project horizontally to the left scale. If the takeoff speed shown in the table is approximately 10 knots higher than the normal takeoff speed, refer to the Velocity During Takeoff Ground Run chart to adjust the takeoff ground run. Refer to the Wind Effects on Takeoff chart, this part, to determine wind effects on these distances.

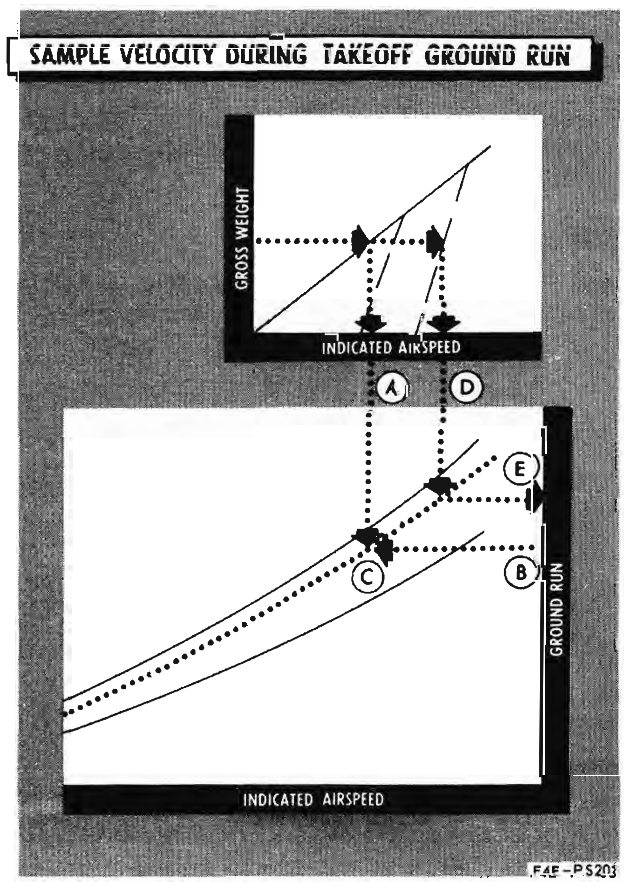
Sample Problem

Maximum Thrust.

A. Temperature	20°C
B. Pressure altitude	2000 Ft.
C. Gross weight	55,000 Lbs.
D. Normal aircraft takeoff speed	177 Kts.
E. Normal Ground run distance	3850 Ft.
F. Intersect reflector line	
G. Total distance required to clear 50-foot obstacle	4900 Ft.
H. Nosewheel lift-off speed for CG of 27% MAC (from table)	167 Kts.
I. Takeoff Speed (from table)	188 Kts.
J. Refer to Velocity During Takeoff Ground Run chart to adjust Ground run for increased takeoff speed.	

VELOCITY DURING TAKEOFF GROUND RUN CHARTS

These charts (figures B2-11 and B2-12) provide takeoff speeds for various gross weights and CG locations, and are used primarily to adjust takeoff distances resulting from adverse conditions of high gross weight and forward CG. The charts can also be used to obtain any line distance and speed relationship during takeoff ground run.



USE

To find takeoff speeds for various gross weight and CG combinations, enter the upper plot with the applicable gross weight and proceed horizontally to the right and intersect the applicable CG line. From this point, descend vertically and read takeoff airspeed. To adjust ground run computed on Takeoff Distance charts, enter with the normal aircraft takeoff speed (from ground run plot) and descend vertically. Re-enter the chart at the ground run scale with the computed normal ground run and proceed horizontally to the left and intersect line projected from takeoff speed scale.

From this intersection, parallel nearest acceleration guide line. Re-enter with the tabulated takeoff speed, and descend vertically to intersect newly plotted acceleration guide line. From this intersection, proceed horizontally to the right and read adjusted ground run.

Sample Problem

A. Normal aircraft takeoff speed (from Takeoff Distance chart)	177 Kts.
B. Normal ground run (from Takeoff Distance chart)	3850 Ft.
C. Parallel acceleration guide line	
D. Tabulated takeoff speed	188 Kts.
E. Adjusted ground run	4375 Ft.

WIND EFFECTS ON TAKEOFF CHART

This chart (figure B2-13) provides the capability of adjusting the previously computed critical field length and takeoff ground run distance for wind effects.

USE

Enter the chart with the previously determined effective wind velocity (headwind or tailwind) and project horizontally to the right and intersect the previously computed aircraft velocity (critical engine failure speed or takeoff speed). From this point, descend vertically to intersect previously computed distance (critical field length or takeoff ground run). At this point of intersection, project horizontally to the left to read distance adjusted for wind effect.

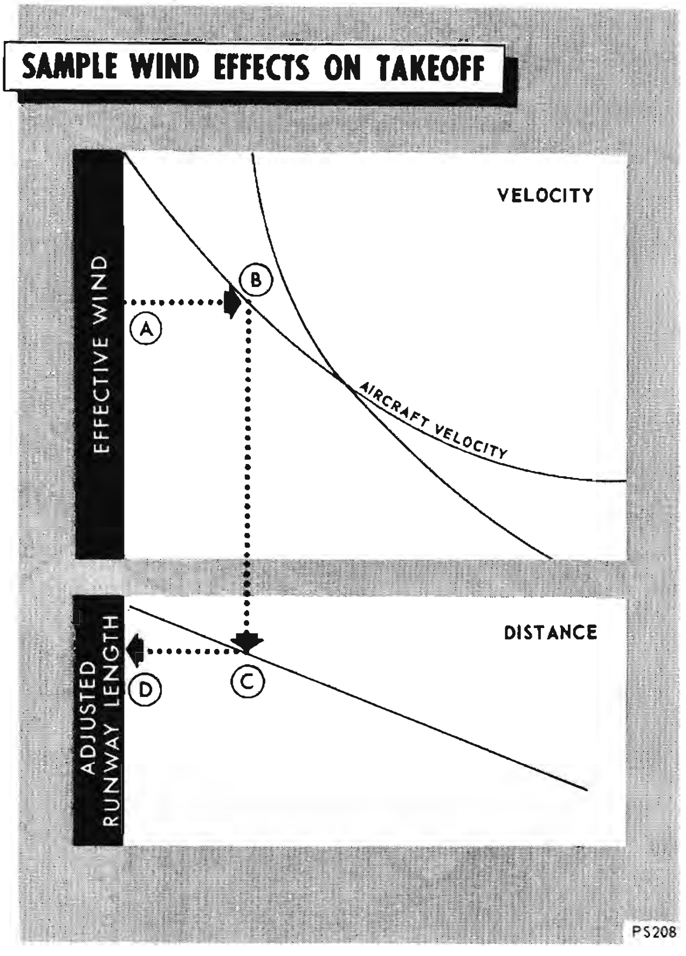
Sample Problem

Critical Field Length - With Wind

A. Effective wind (headwind)	25 Kts.
B. Critical engine failure speed (previously computed)	86 Kts.
C. Critical field length (without wind)	7500 Ft.
D. Critical field length (with wind)	3700 Ft.

Takeoff Ground Run - With Wind

A. Effective wind (headwind)	25 Kts.
B. Takeoff speed (previously computed)	188 Kts.
C. Ground run distance (without wind)	4375 Ft.
D. Ground run distance (with wind)	3700 Ft.



F-4E

TAKEOFF ABORT CRITERIA

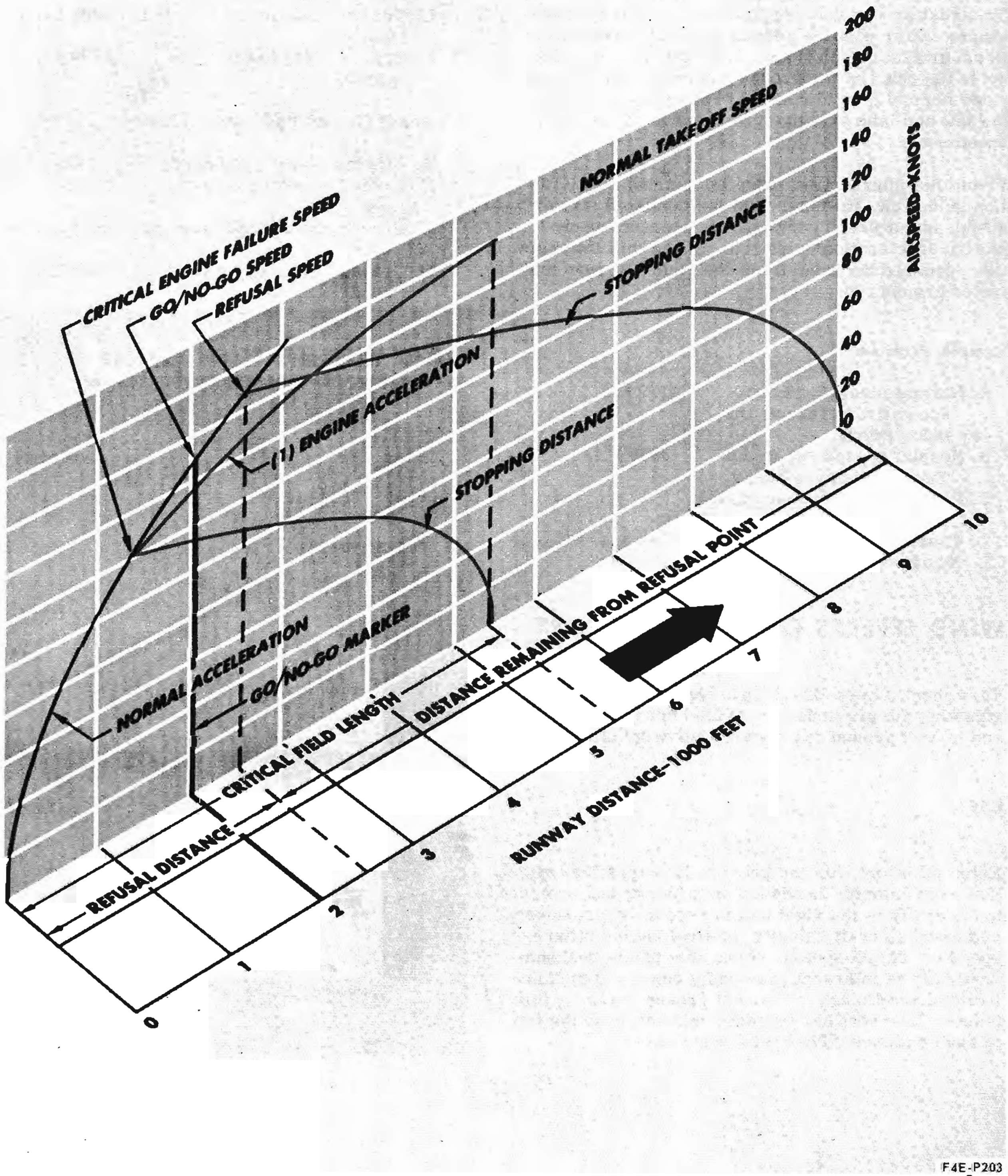


Figure B2-1

F-4E
CRITICAL ENGINE FAILURE SPEED OR CRITICAL FIELD LENGTH

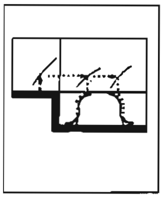
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
½ FLAPS

MAXIMUM THRUST

REMARKS
ENGINE(S): (2) J79-GE-17

NOTE
SINGLE-ENGINE TAKEOFF/CLIMB-OUT CAPABILITY IS CRITICAL WITH HIGH GROSS WEIGHT AT LOW DENSITY RATIOS.

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

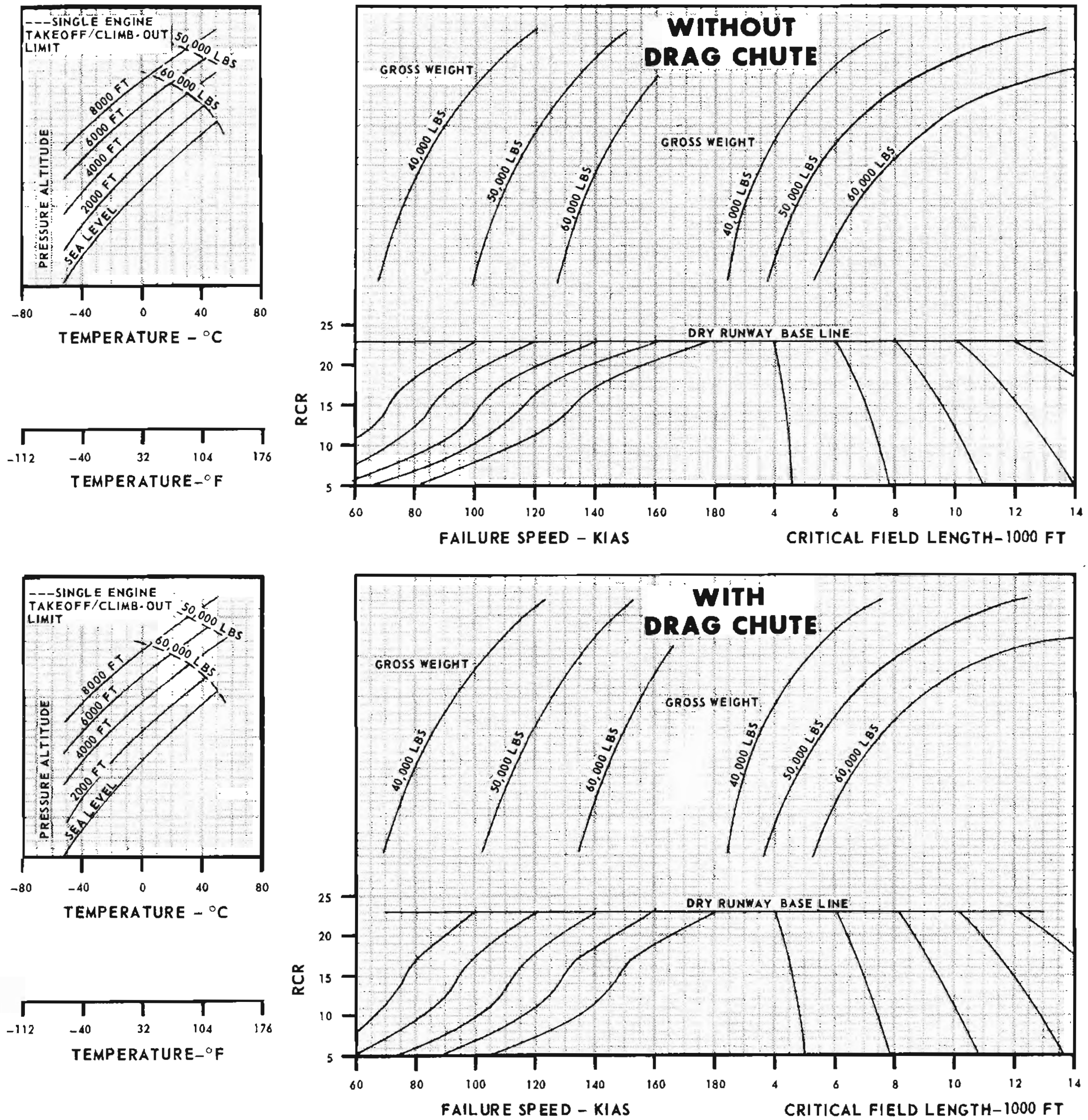


Figure B2-2

F-4E

CRITICAL ENGINE FAILURE SPEED OR CRITICAL FIELD LENGTH

MILITARY THRUST

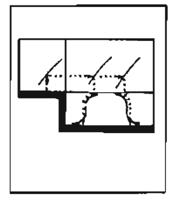
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
½ FLAPS

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

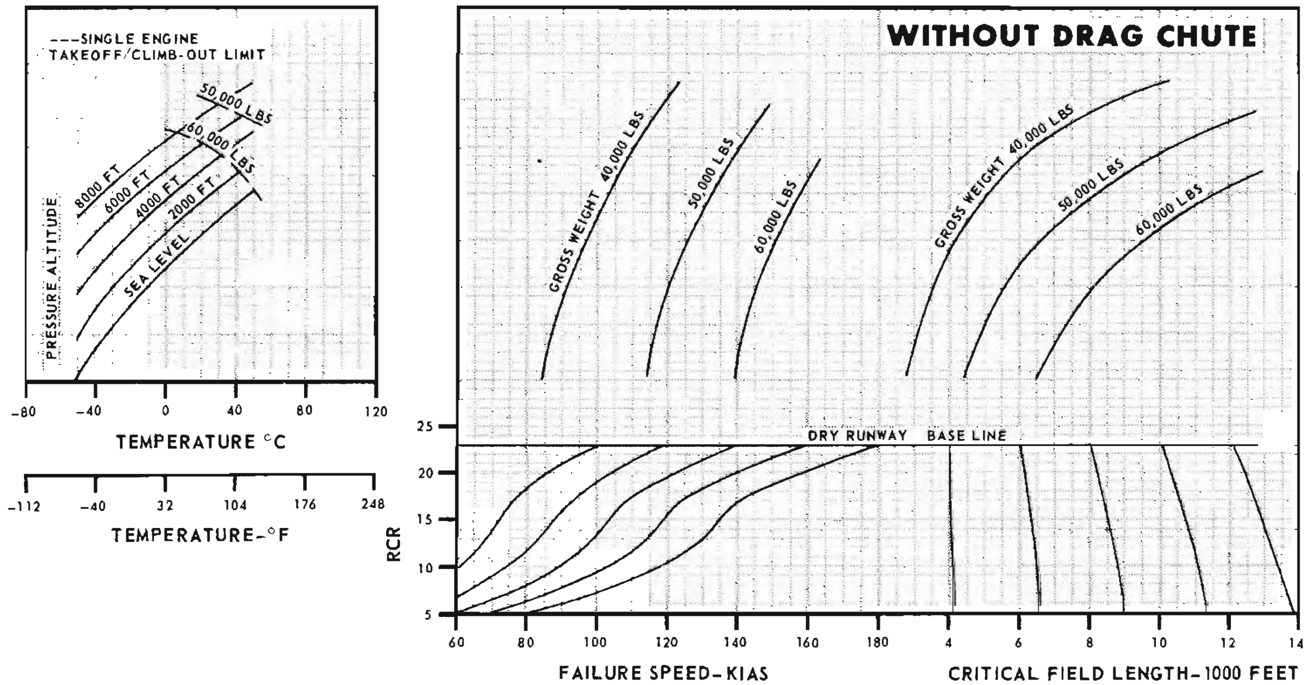
REMARKS
ENGINE(S): (2) J79-GE-17

NOTES
- SINGLE-ENGINE TAKEOFF WITH AFTERBURNER IGNITED ON OPERATING ENGINE AFTER FAILURE.
- SINGLE-ENGINE TAKEOFF/CLIMB-OUT CAPABILITY IS CRITICAL WITH HIGH GROSS WEIGHT AT LOW DENSITY RATIOS.

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



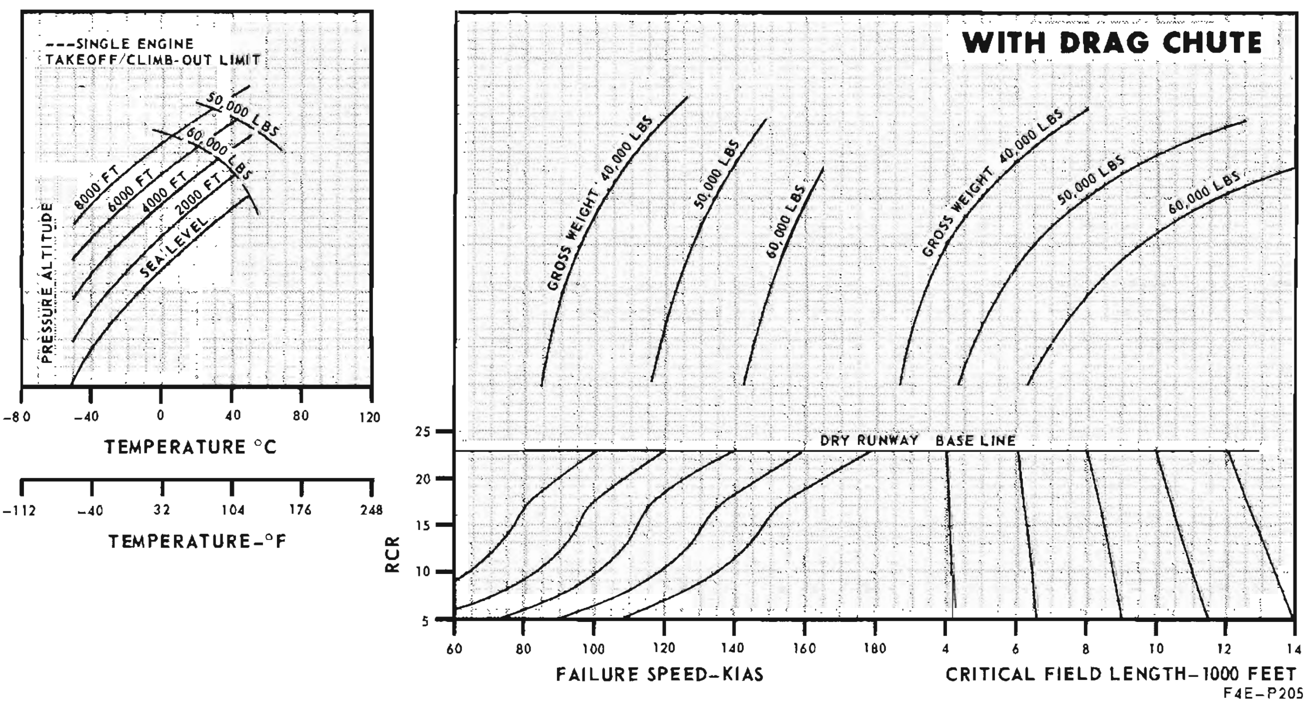


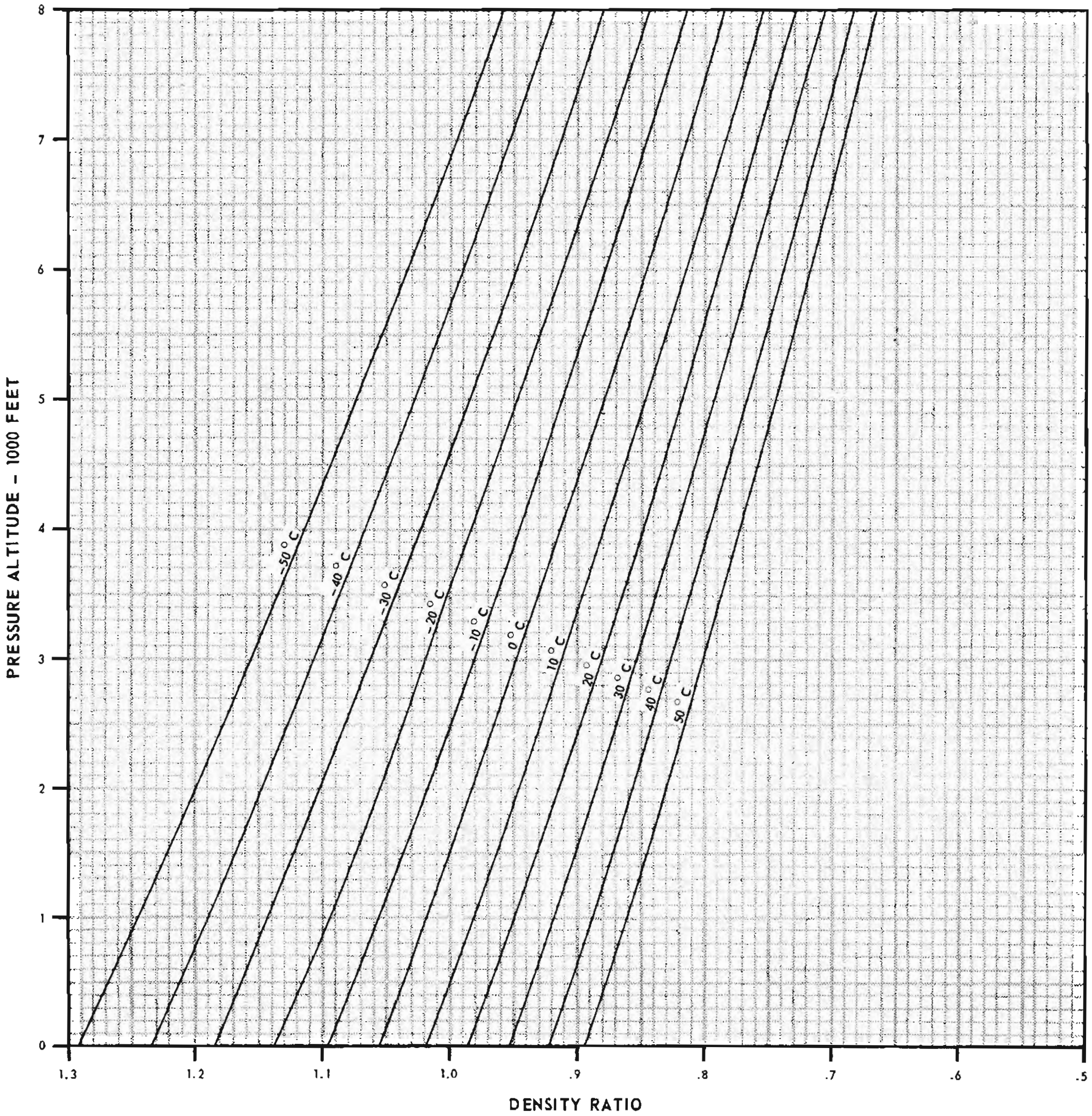
Figure B2-3

F-4E
DENSITY RATIO

AIRPLANE CONFIGURATION
ALL DRAG INDEXES

GUIDE

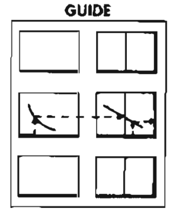
DATE: 1 FEBRUARY 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)



F4E-P227

Figure B2-4

F-4E
REFUSAL SPEED
MAXIMUM THRUST-WITHOUT DRAG CHUTE



AIRPLANE CONFIGURATION

1/2 FLAPS, GEAR DOWN
ALL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17

NOTE

DATA BASED ON NO-WIND CONDITION

DATE: 1 MARCH 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

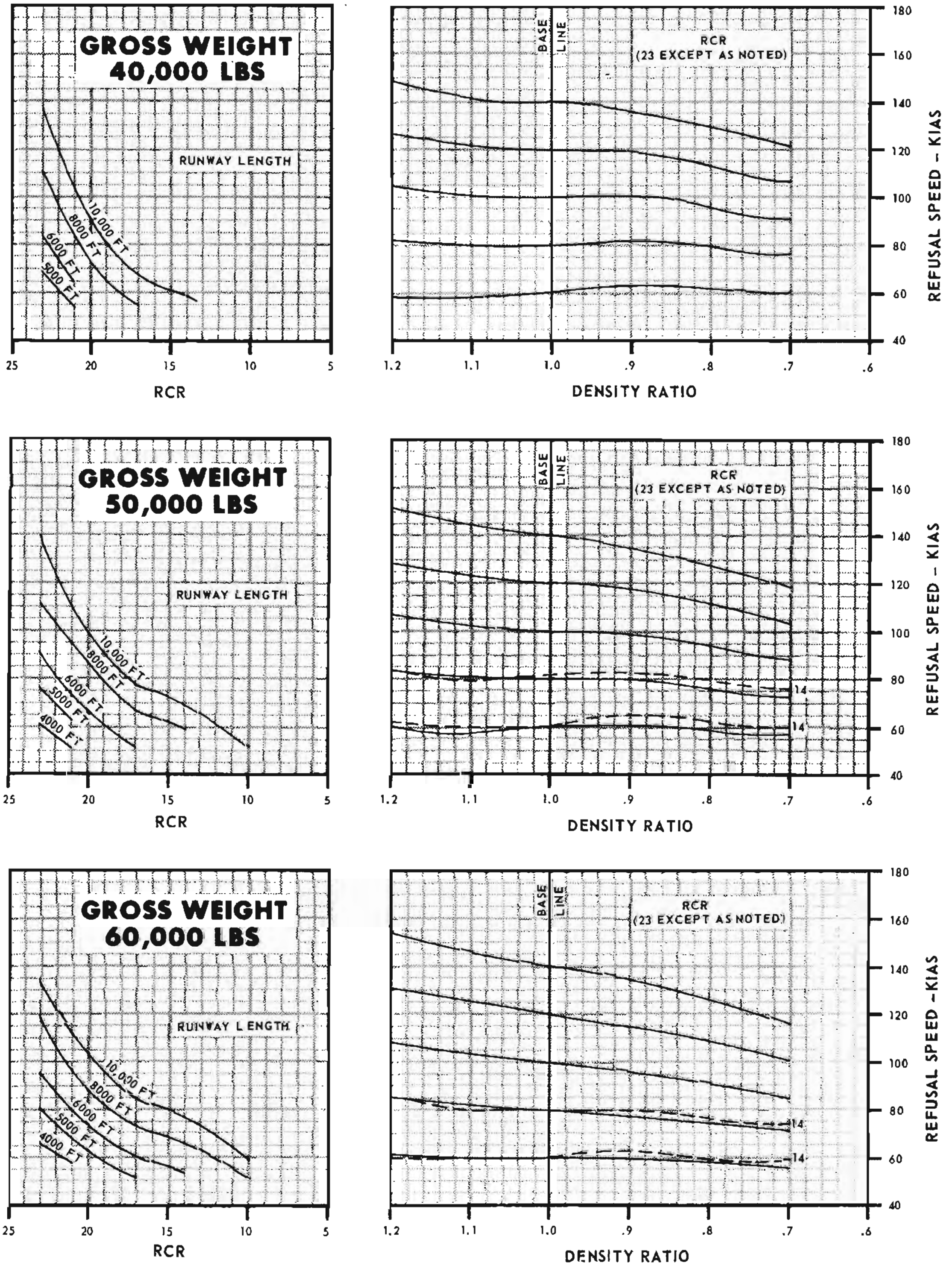


Figure B2-5

F-4E

REFUSAL SPEED

MILITARY THRUST-WITH DRAG CHUTE

AIRPLANE CONFIGURATION

1/2 FLAPS, GEAR DOWN
ALL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17

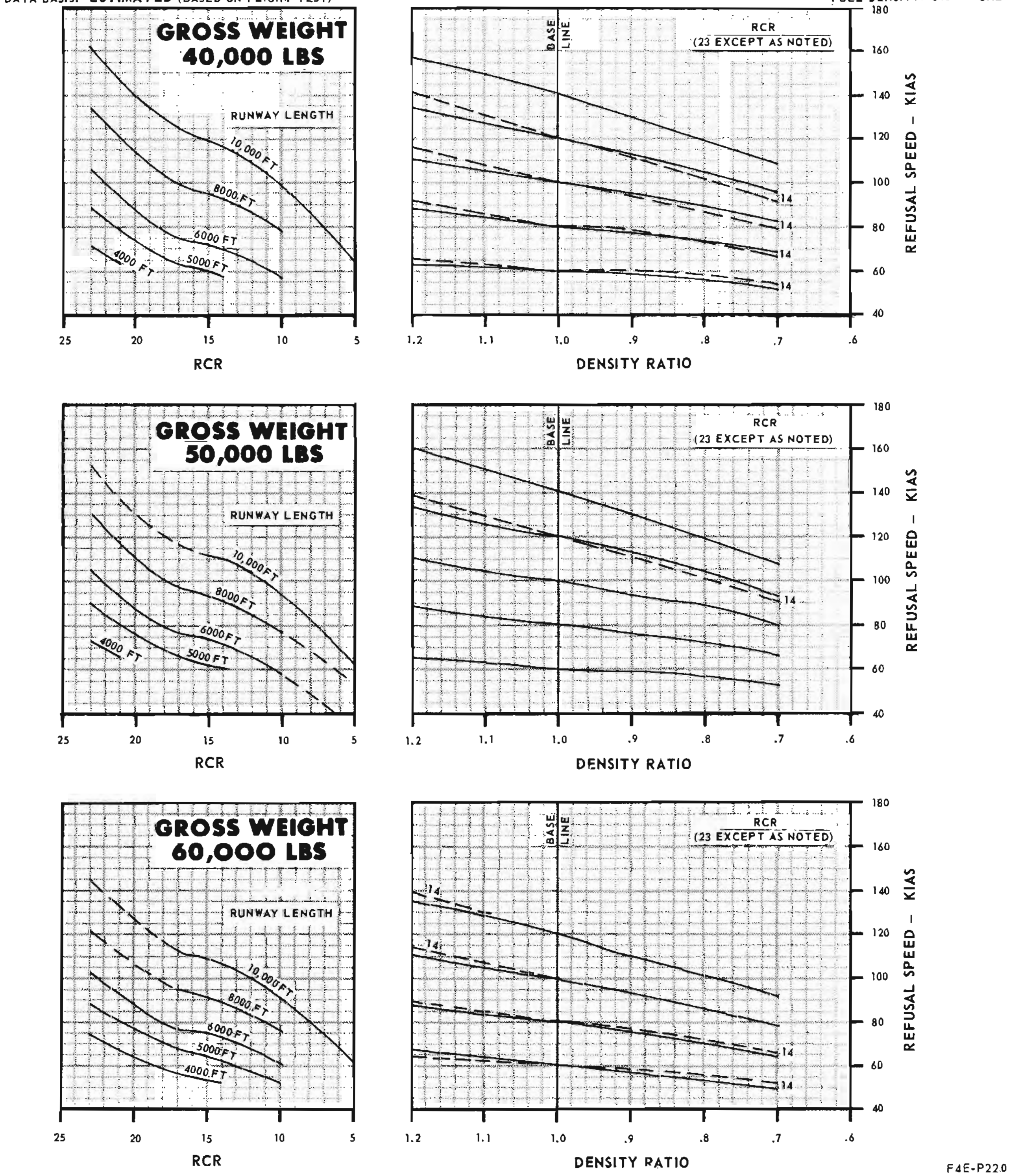
NOTE

DATA BASED ON NO-WIND CONDITION

DATE: 1 MARCH 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

GUIDE

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P220

Figure B2-8

F-4E

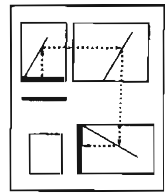
TAKEOFF DISTANCE

MAXIMUM THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
1/2 FLAPS, GEAR DOWN
ALL DRAG INDEXES

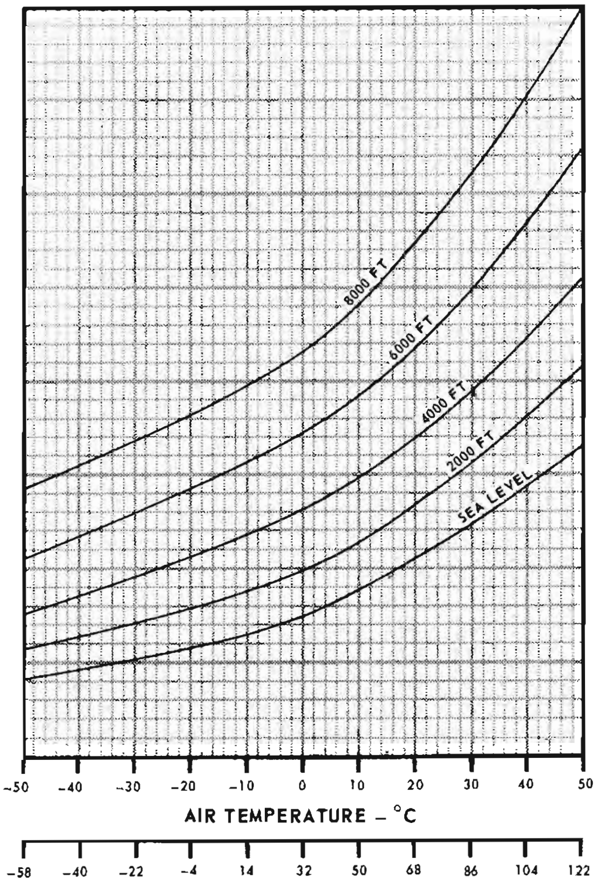
REMARKS
ENGINE(S): (2) J79-GE-17

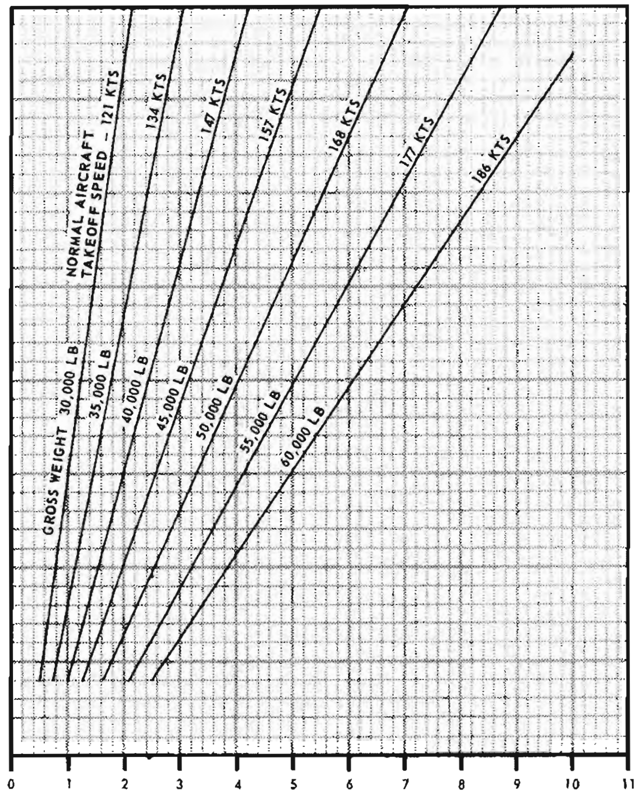
GUIDE



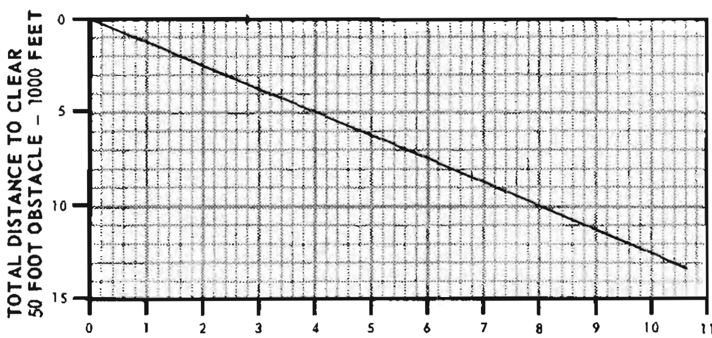
DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





NOSEWHEEL LIFT-OFF SPEED/TAKEOFF SPEED				
GW \ CG	27	29	31	33
30	123 / 162	117 / 156	111 / 150	105 / 144
35	133 / 167	127 / 161	121 / 155	115 / 148
40	143 / 173	136 / 166	129 / 159	123 / 153
45	151 / 178	144 / 171	137 / 164	131 / 158
50	159 / 183	152 / 176	145 / 169	138 / 168
55	167 / 188	160 / 182	153 / 177	145 / 177
60	175 / 192	168 / 186	160 / 185	152 / 185



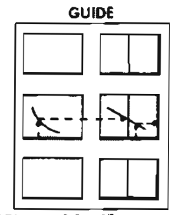
F4E–P201

Figure B2-9

F-4E

REFUSAL SPEED

MAXIMUM THRUST-WITH DRAG CHUTE



AIRPLANE CONFIGURATION

1/2 FLAPS, GEAR DOWN
ALL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17

NOTE

DATA BASED ON NO-WIND CONDITION

DATE: 1 MARCH 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

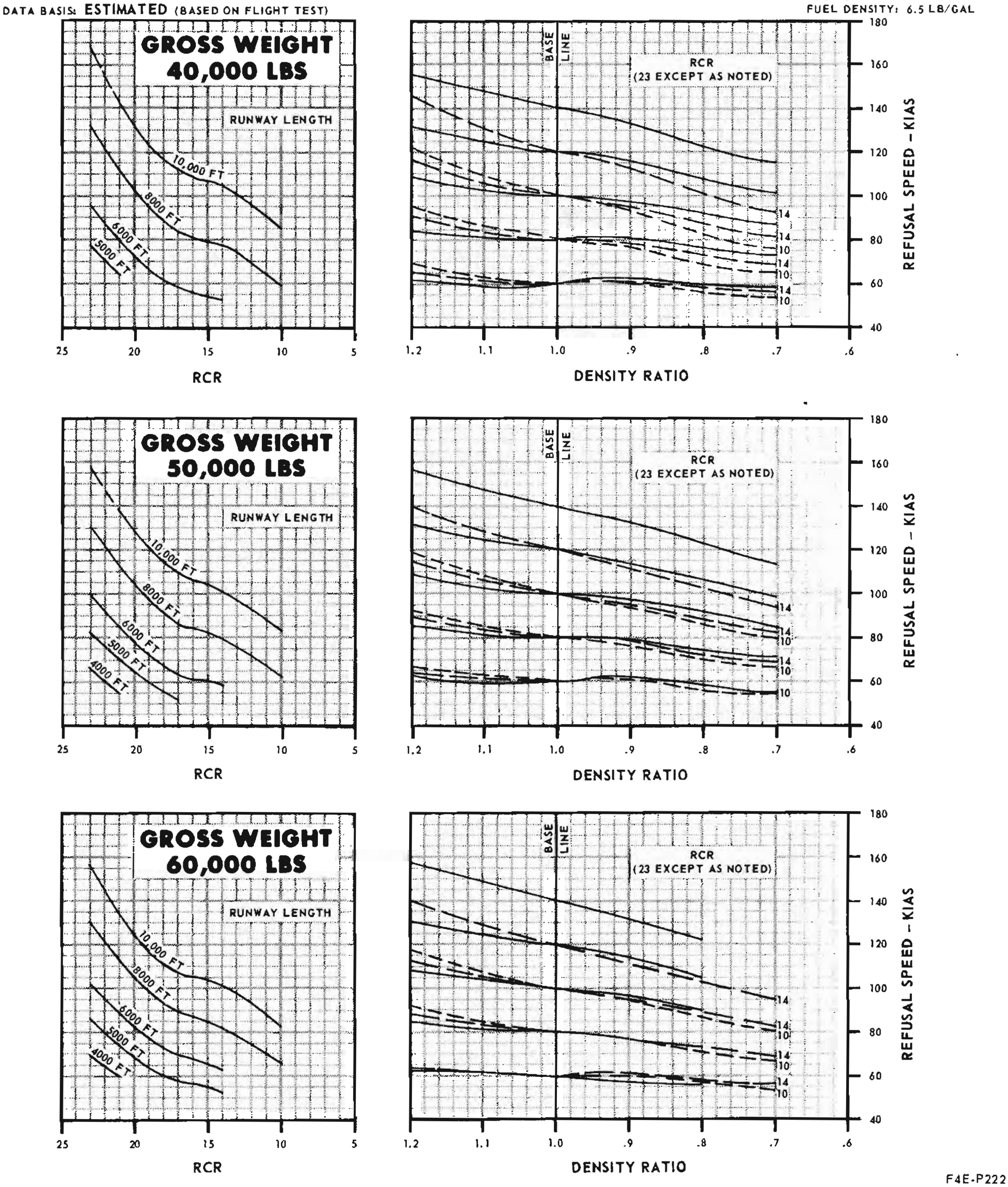


Figure B2-6

F-4E

REFUSAL SPEED

MILITARY THRUST-WITHOUT DRAG CHUTE

AIRPLANE CONFIGURATION

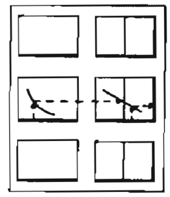
1/2 FLAPS, GEAR DOWN
ALL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17

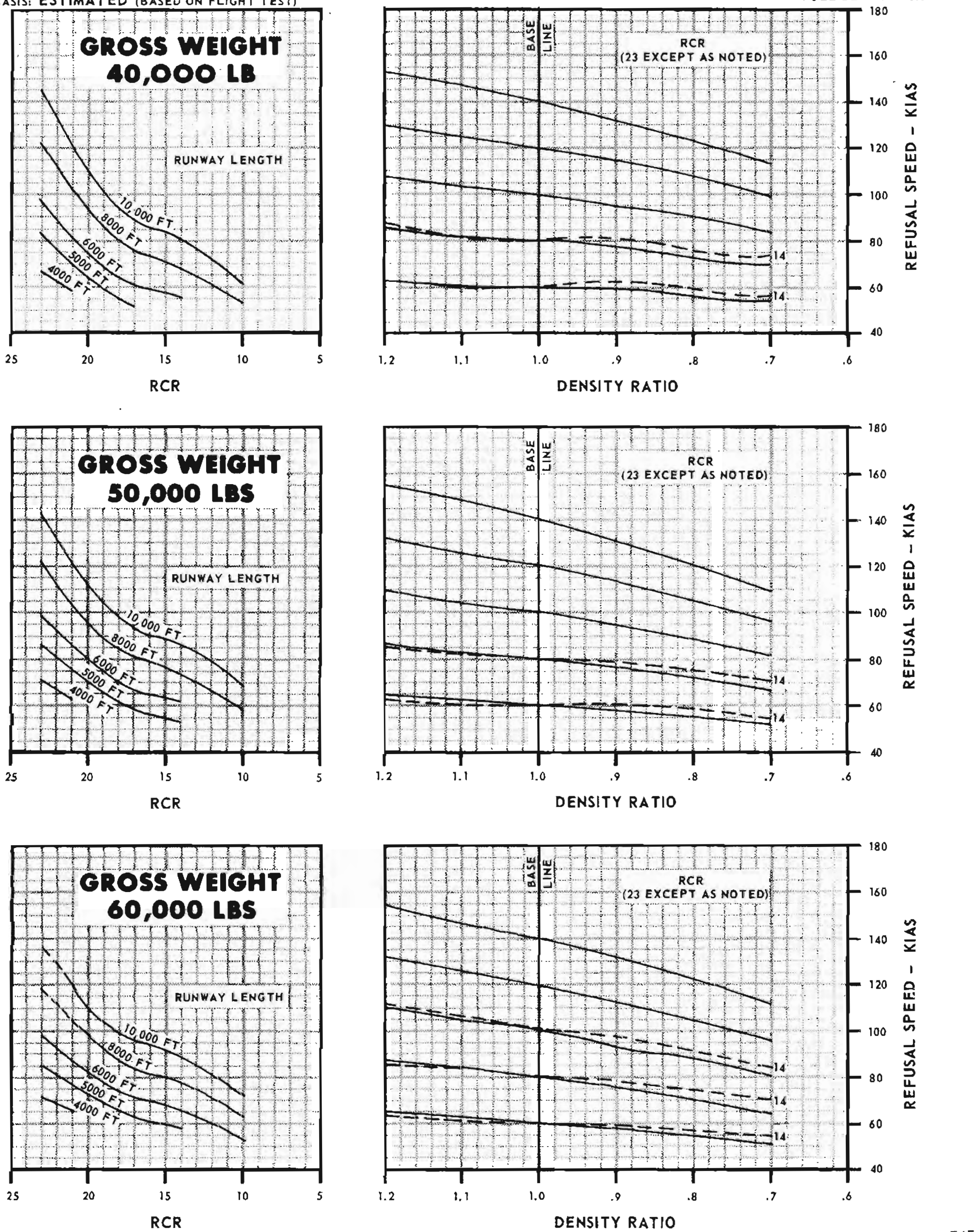
NOTE

DATA BASED ON NO-WIND CONDITION



DATE: 1 MARCH 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P221

Figure B2-7

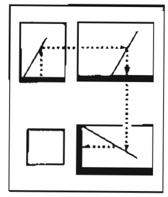
F-4E

TAKEOFF DISTANCE
MILITARY THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
1/2 FLAPS, GEAR DOWN
ALL DRAG INDEXES

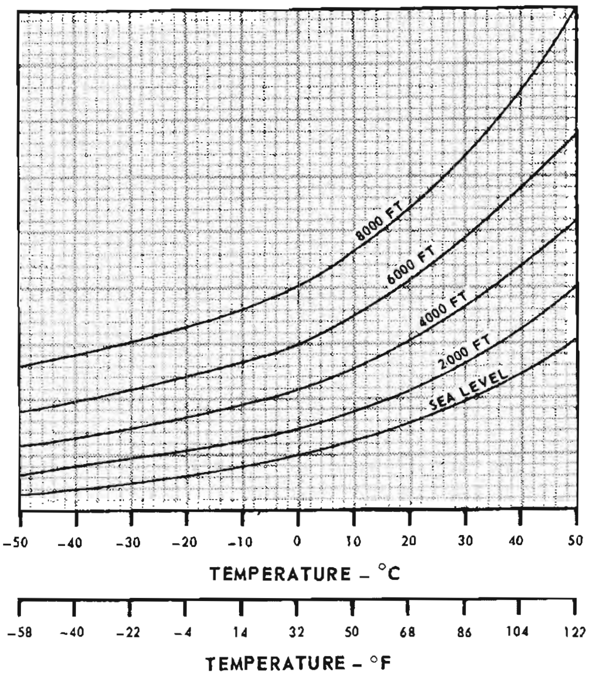
REMARKS
ENGINE(S): (2) J79-GE-17

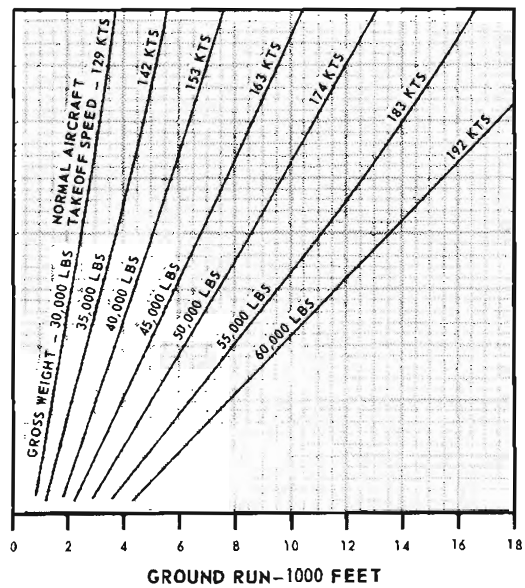
GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

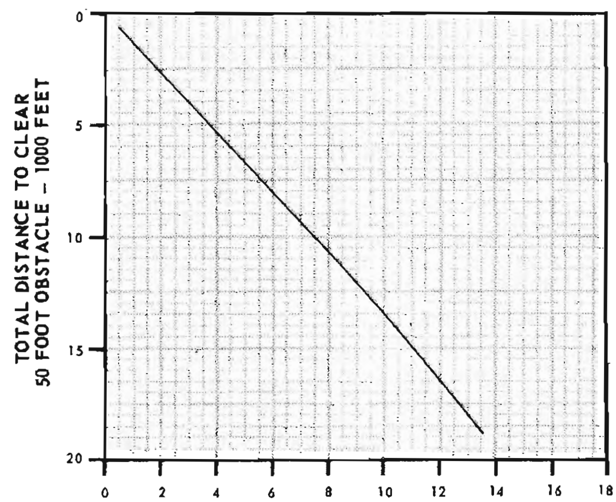
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





NOSEWHEEL LIFT-OFF SPEED/TAKEOFF SPEED

GW \ CG	27	29	31	33
30	123 / 149	117 / 143	111 / 137	105 / 131
35	133 / 156	127 / 149	121 / 143	115 / 139
40	143 / 163	136 / 156	129 / 151	123 / 151
45	151 / 168	144 / 162	137 / 162	131 / 162
50	159 / 175	152 / 173	145 / 173	138 / 173
55	167 / 183	160 / 183	153 / 183	145 / 183
60	175 / 191	168 / 191	160 / 191	152 / 191



F4E–P202

Figure B2-10

F-4E

VELOCITY DURING TAKEOFF GROUND RUN

MAXIMUM THRUST
HARD DRY RUNWAY

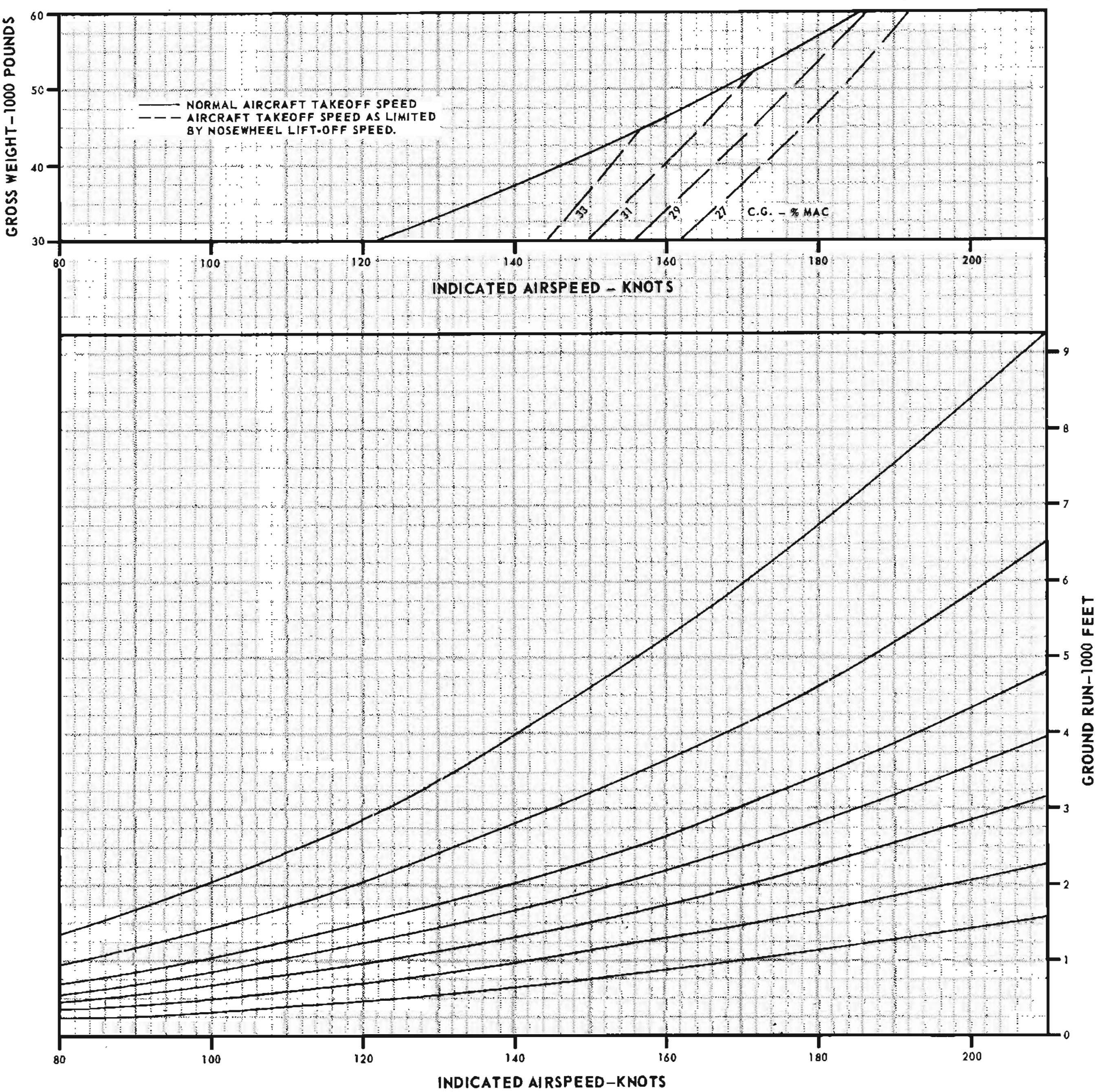
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
1/2 FLAPS GEAR DOWN

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P208

Figure B2-11

F-4E

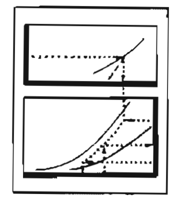
VELOCITY DURING TAKEOFF GROUND RUN

MILITARY THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
ALL DRAG INDEXES
1/2 FLAPS, GEAR DOWN

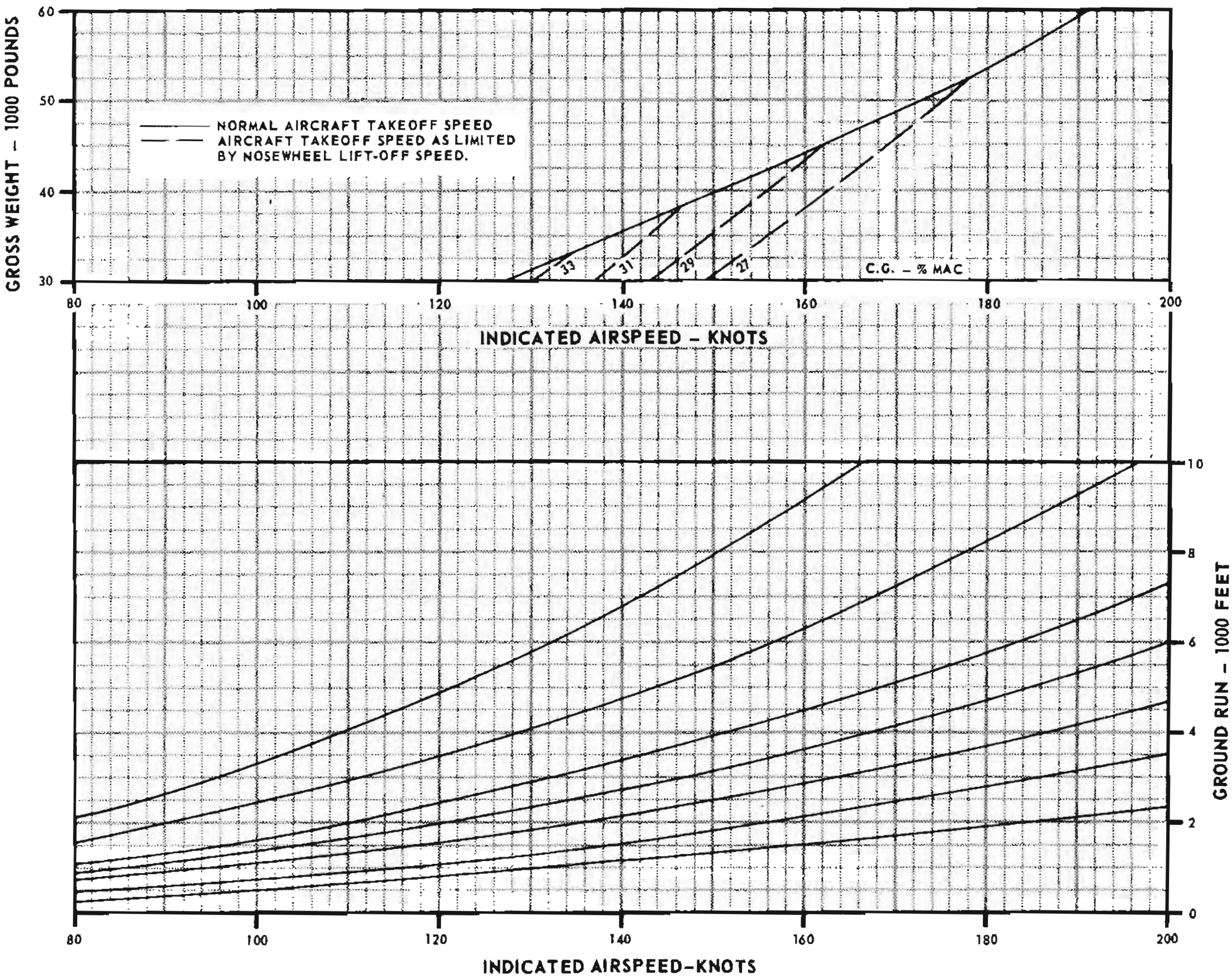
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P209

Figure B2-12

F-4E

WIND EFFECTS ON TAKEOFF

AIRPLANE CONFIGURATION

ALL DRAG INDEXES
1/2 FLAPS

DATE: 1 FEBRUARY 1969
DATA BASIS: FLIGHT TEST

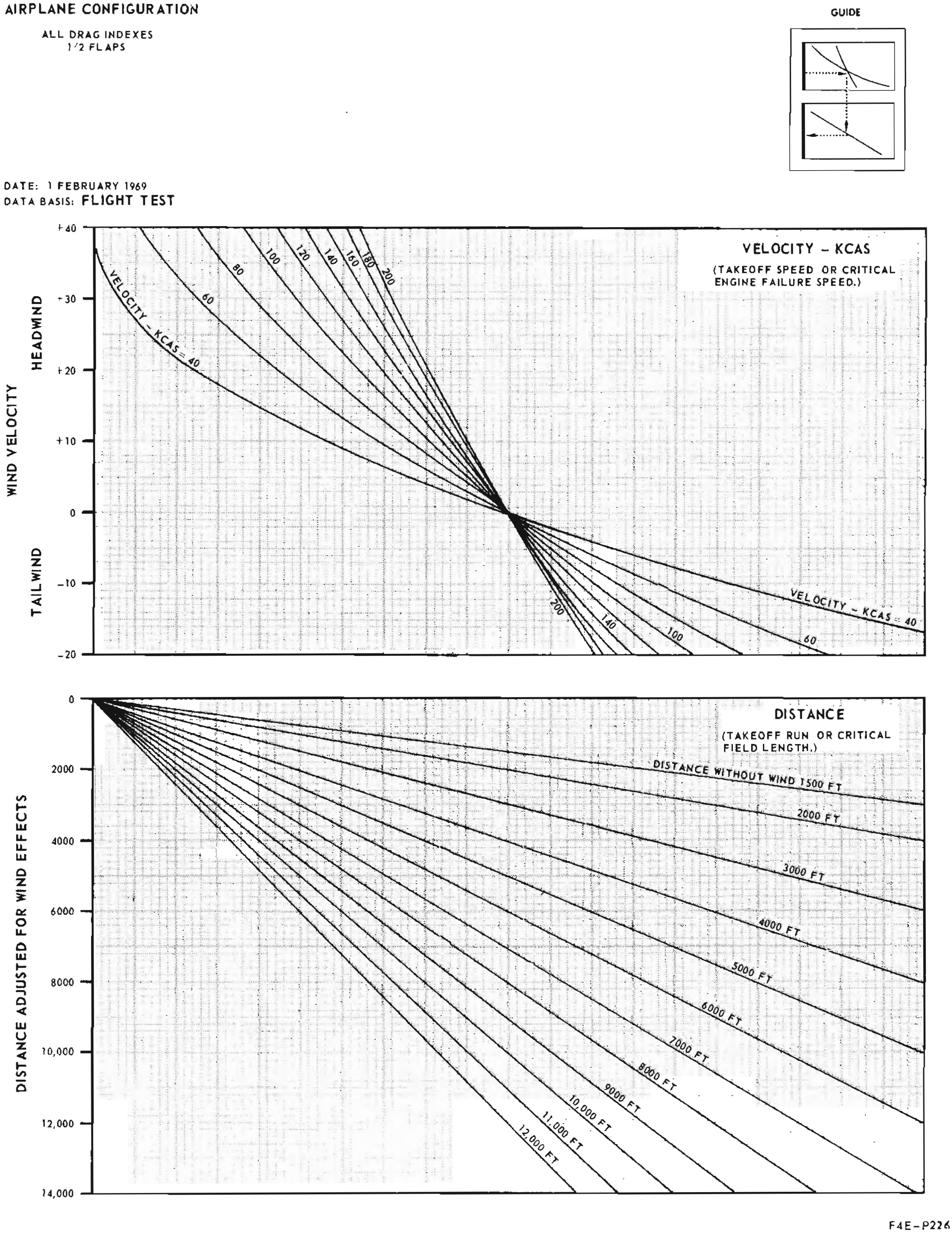


Figure B2-13

PART 3 CLIMB

TABLE OF CONTENTS

Charts

CLIMB CHARTS

Two series of charts are presented, one for military and one for maximum thrust climb schedules (figures B3-1 and B3-2). Each series includes charts for determining time, distance covered and fuel used while in the climb, and tables for determining climb indicated airspeed and Mach number. Preclimb requirements are included in a table that presents time, fuel, and distance to intercept the climb schedule after takeoff. Time, fuel, and distance for a simplified military thrust climb are presented in figure B3-3. This data is based on climbing at 350 knots until interception of optimum cruise Mach number, then maintaining cruise Mach to cruise altitude.

USE

Tables

Enter the Climb Speed Schedule tables corresponding to the climb thrust and the computed drag index. Read the column of indicated airspeeds and the Mach numbers to be used during climb. Determine the preclimb fuel, distance, and time to climb schedule which corresponds to the applicable takeoff and acceleration options.

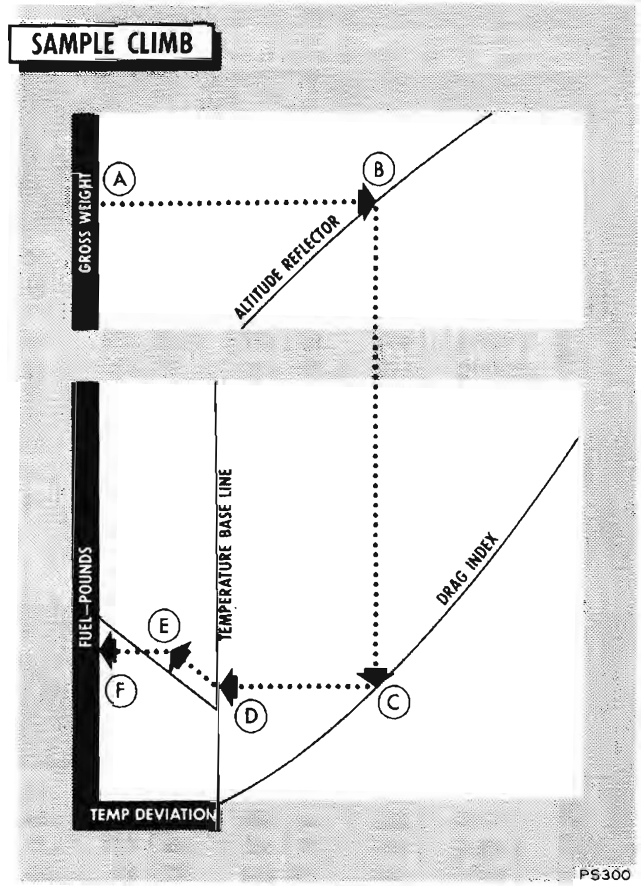
Charts

The method of presenting data on the time, distance, and fuel charts is identical, and the use of all three charts will be undertaken simultaneously here. Enter the charts with the initial climb gross weight. Project horizontally to the right and intersect the assigned cruise altitude, or the optimum cruise altitude for the computed drag index. Project vertically downward to intersect the applicable drag index line, then project horizontally to the left to the temperature base line (corresponds to ICAO Standard Day (°C)). Parallel the applicable guide line (hotter or colder) to intersect a vertical grid line corresponding to the degree of deviation between forecast flight temperature and standard ICAO day temperature. From this point continue horizontally to the left to read the planning data.

Sample Problem

Fuel Required - Military Thrust

A.	Gross weight	50,000 Lbs.
B.	Cruise altitude	30,000 Ft.
C.	Drag index	60.0
D.	Temperature base line	
E.	Temperature deviation	+5°C
F.	Fuel required	1550 Lbs.
G.	Time to climb	6.4 Mins.
H.	Distance	48 Nautical Miles



COMBAT CEILING CHARTS

These charts (figures B3-4 and B3-5) present the military and maximum thrust combat ceiling for both two engine and single engine operations and for various combinations of gross weight and drag index.

USE

Enter the applicable graph with estimated gross weight at end of climb. Project vertically upward to intersect applicable drag index, then horizontally to the left to the temperature base line (corresponds to ICAO Standard Day (°C)). From this point, parallel the applicable guide line (hotter or colder) to intersect a vertical grid line corresponding to the degree of deviation between altitude at end of climb and standard day temperature. From this point continue horizontally to the left to read combat ceiling.

Sample Problem

Combat ceiling - Maximum Thrust - (2) Engines

A.	Gross weight at end of climb	45,000 Lbs.
B.	Drag index	40
C.	Temperature base line	
D.	Temperature deviation	+8°C
E.	Combat ceiling	47,900 Ft.

[redacted]

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

CLIMB SPEED SCHEDULE

MAXIMUM THRUST

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	DRAG INDEX													
	0		10		20		30		40		50		60	
ALTITUDE	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH
S. L.	600	.91	598	.91	596	.90	588	.89	580	.88	575	.87	569	.86
5000	562	.92	560	.92	557	.91	550	.90	543	.89	537	.88	530	.87
10000	525	.93	519	.92	514	.91	511	.91	508	.90	501	.89	494	.88
15000	481	.93	479	.93	476	.92	469	.91	462	.90	460	.89	459	.89
20000	440	.93	438	.93	435	.92	432	.91	429	.91	426	.90	423	.90
25000	404	.94	398	.93	392	.92	390	.91	388	.91	385	.90	383	.90
30000	363	.94	361	.93	359	.93	357	.92	354	.92	352	.91	350	.91
35000	327	.94	325	.93	322	.93	320	.92	319	.92	317	.91	315	.91
40000	295	.95	291	.94	288	.93	286	.92	285	.92	285	.92	285	.92
45000	264	.95	262	.94	260	.94	258	.93	257	.93	255	.92	253	.92

	DRAG INDEX															
	70		80		90		100		110		120		130		140	
ALTITUDE	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH
S. L.	563	.85	556	.84	540	.82	525	.80	515	.78	505	.76	490	.74	476	.72
5000	525	.86	520	.85	510	.84	500	.82	488	.80	475	.78	467	.77	458	.75
10000	488	.87	482	.86	477	.85	471	.84	463	.83	454	.81	443	.79	431	.77
15000	455	.88	450	.87	444	.86	438	.85	429	.83	420	.82	412	.80	405	.79
20000	418	.89	413	.88	408	.87	403	.86	399	.85	395	.84	390	.83	385	.82
25000	381	.89	379	.89	376	.88	374	.88	368	.87	363	.86	356	.84	350	.83
30000	348	.90	347	.90	345	.89	342	.89	338	.88	334	.87	330	.86	325	.85
35000	312	.90	310	.90	310	.90	310	.90	306	.89	303	.88	301	.87	300	.87
40000	285	.92	285	.92	283	.91	281	.91	279	.90	277	.90	276	.89	275	.89
45000	-	-		-	-	-		-	-	-		-	-	-		-

TAKEOFF ALLOWANCES & ACCELERATION TO CLIMB SPEED

START - 65 LBS /ENG

RUNUP 50 LBS /ENG

TAXI - 21 LB /MIN /ENG

	BRAKE RELEASE TO CLIMB SPEED MAX T. O. MAX ACCEL TO MAX CLIMB SPEED
FUEL - LBS	1225
DIST. - N M	5.0
TIME - MIN	1.0

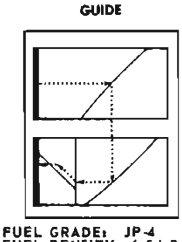
F4E-T301-1

Figure B3-1 (Sheet 1)

F-4E

TIME TO CLIMB

MAXIMUM THRUST



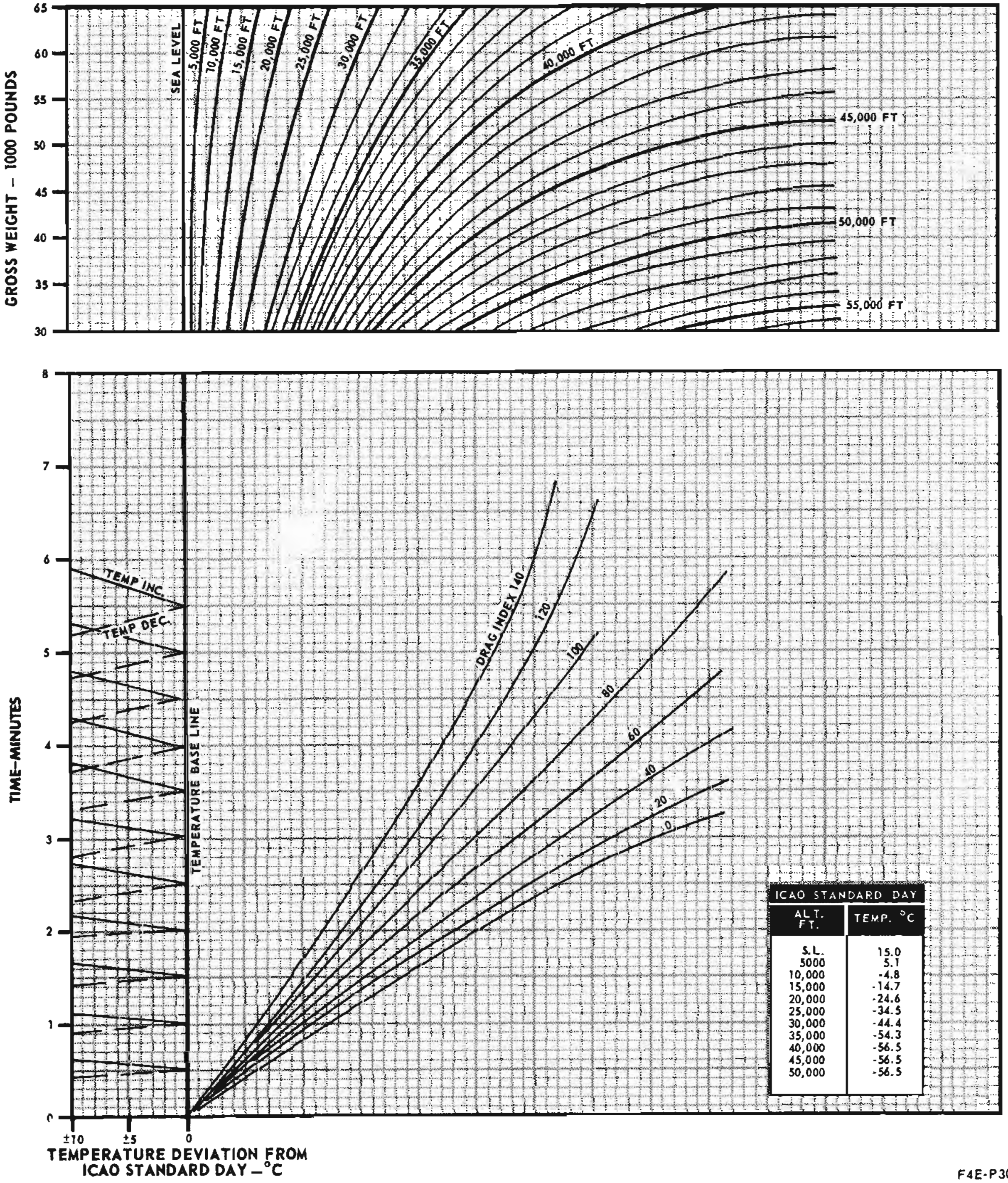
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

NOTE
CRUISE ALTITUDE AT END OF CLIMB MUST BE READ ON THE CONSTANT ALTITUDE CRUISE CHART

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)



ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P301-2

Figure B3-1 (Sheet 2)

F-4E

FUEL REQUIRED TO CLIMB

MAXIMUM THRUST

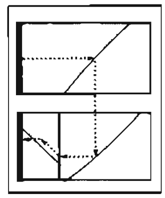
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S):(2) J79-GE-17

NOTES

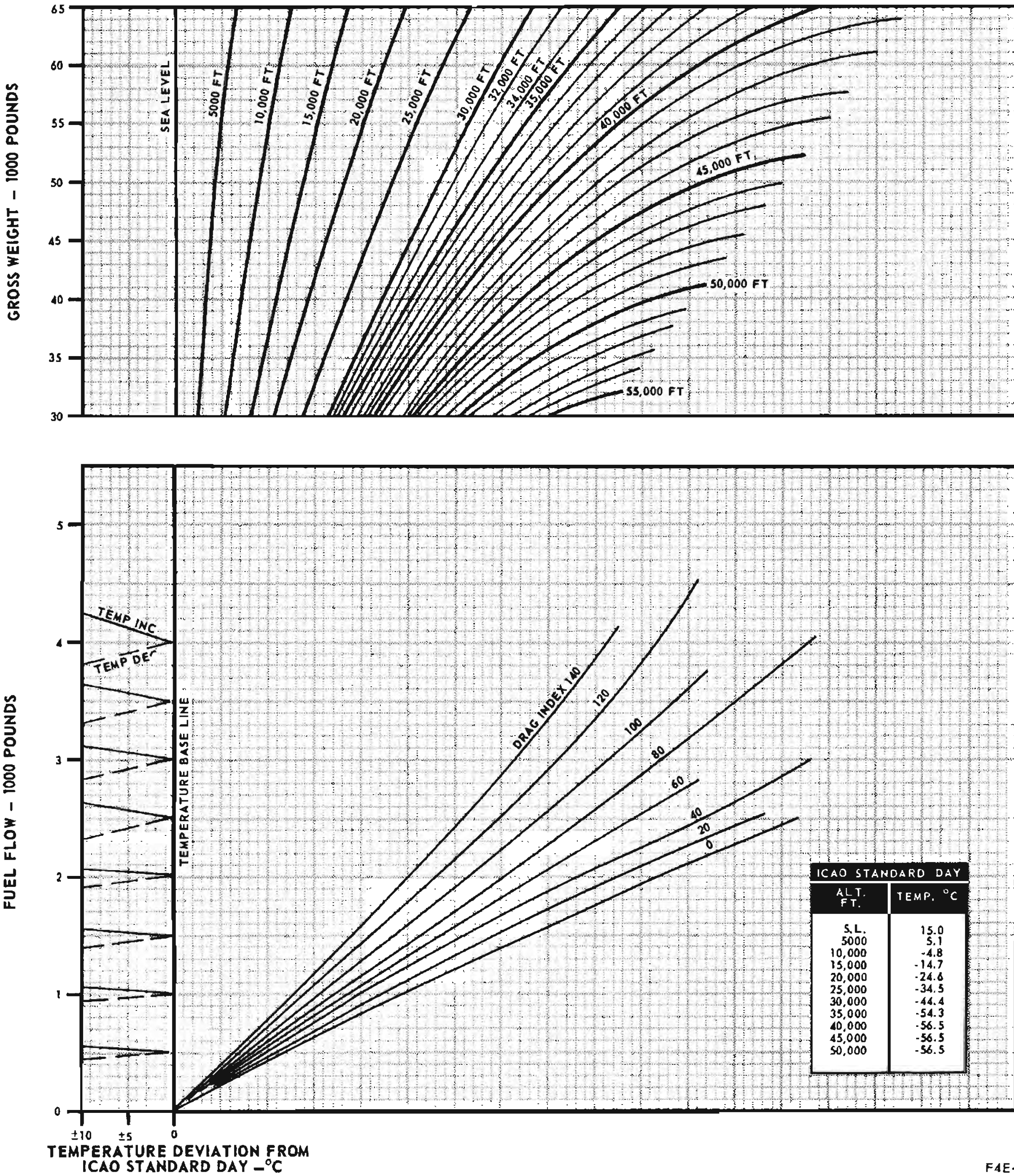
CRUISE ALTITUDE AT END OF CLIMB MUST BE READ ON THE CONSTANT ALTITUDE CRUISE CHART.

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P301-3

Figure B3-1 (Sheet 3)

F-4E

DISTANCE REQUIRED TO CLIMB

MAXIMUM THRUST

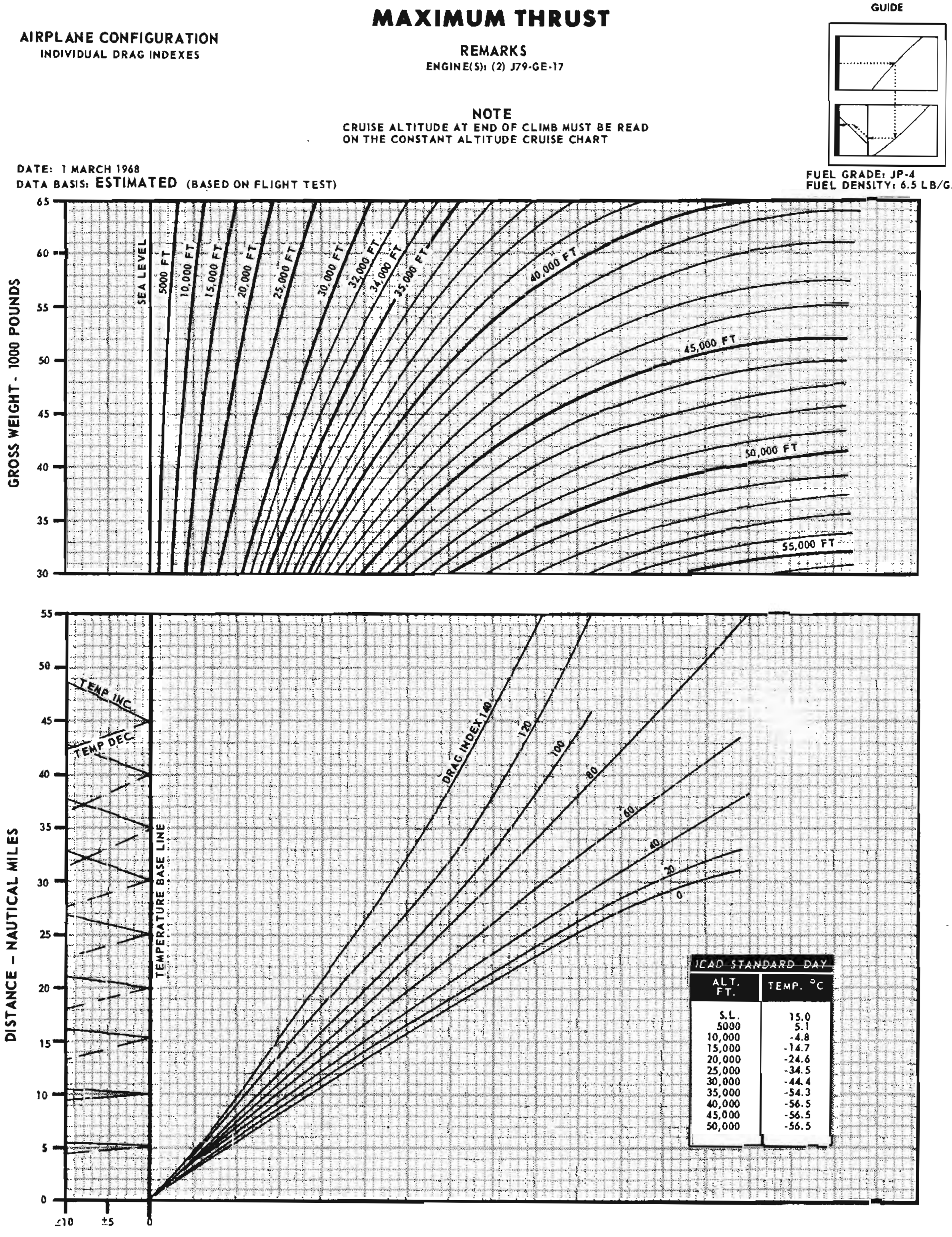
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

NOTE
CRUISE ALTITUDE AT END OF CLIMB MUST BE READ ON THE CONSTANT ALTITUDE CRUISE CHART

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P301-4

Figure B3-1 (Sheet 4)

F-4E

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

CLIMB SPEED SCHEDULE

MILITARY THRUST

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

ALTITUDE	DRAG INDEX 0		10		20		30		40		50		60	
	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH
S. L.	490	.74	472	.71	455	.69	435	.66	415	.63	396	.60	377	.57
5000	475	.78	462	.76	450	.74	431	.71	412	.68	398	.65	383	.63
10000	454	.81	442	.79	431	.77	420	.75	409	.73	395	.70	380	.68
15000	427	.83	421	.82	416	.81	404	.79	393	.77	381	.74	369	.72
20000	400	.85	395	.84	390	.83	382	.81	374	.80	364	.78	354	.76
25000	369	.87	364	.86	360	.85	355	.84	350	.83	344	.81	338	.80
30000	337	.88	333	.87	330	.86	327	.85	325	.85	321	.84	317	.83
35000	307	.89	305	.88	303	.88	299	.87	295	.86	293	.85	291	.85
40000	277	.90	273	.89	270	.88	269	.87	268	.87	-	-	-	-
45000	246	.90	242	.89	-	-	-	-	-	-	-	-		-

ALTITUDE	DRAG INDEX 70		80		90		100		110		120		130		140	
	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH	KIAS	MACH
S. L.	370	.56	362	.55	354	.53	346	.52	336	.50	326	.49	322	.48	319	.48
5000	373	.61	364	.60	354	.58	345	.57	332	.55	320	.53	317	.52	315	.52
10000	368	.66	356	.64	348	.62	340	.61	331	.59	322	.58	316	.57	310	.56
15000	358	.70	350	.69	340	.67	330	.65	322	.63	314	.62	308	.61	303	.60
20000	347	.74	340	.73	330	.71	320	.69	315	.68	310	.67	302	.65	295	.64
25000	331	.78	325	.77	315	.75	306	.73	301	.72	296	.71	288	.69	280	.67
30000	313	.82	309	.81	298	.78	287	.76	-	-	-	-	-	-	-	-
35000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TAKEOFF ALLOWANCES & ACCELERATION TO CLIMB SPEED

START - 65 LBS /ENG

RUNUP 50 LBS /ENG

TAXI - 21 LB /MIN /ENG

BRAKE RELEASE TO CLIMB SPEED	MIL T.O. MIL ACCEL TO MIL CLIMB SPEED	MAX T.O. MIL ACCEL TO MIL CLIMB SPEED	MAX T.O. MAX ACCEL TO MIL CLIMB SPEED
FUEL - LBS	525	725	925
DIST. - N M	6.0	5.3	3.0
TIME - MIN	1.7	1.3	.8

F4E-T302-1

Figure B3-2 (Sheet 1)

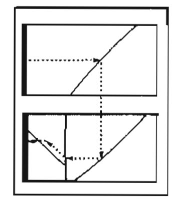
F-4E
TIME TO CLIMB
MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

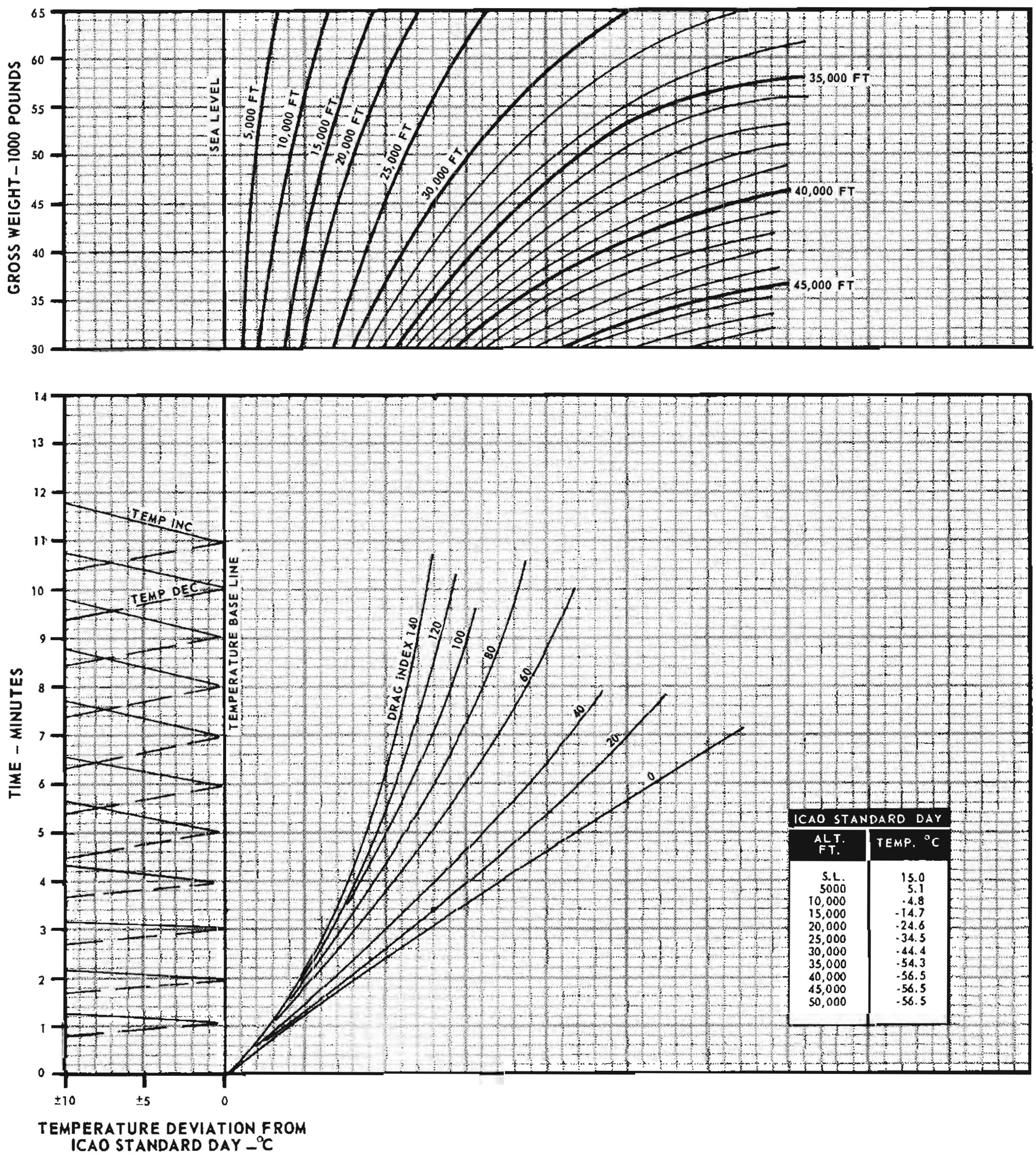
NOTE
CRUISE ALTITUDE AT END OF CLIMB MUST BE READ ON THE CONSTANT ALTITUDE CRUISE CHART

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P302-2

Figure B3-2 (Sheet 2)

F-4E

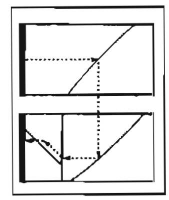
FUEL REQUIRED TO CLIMB

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE

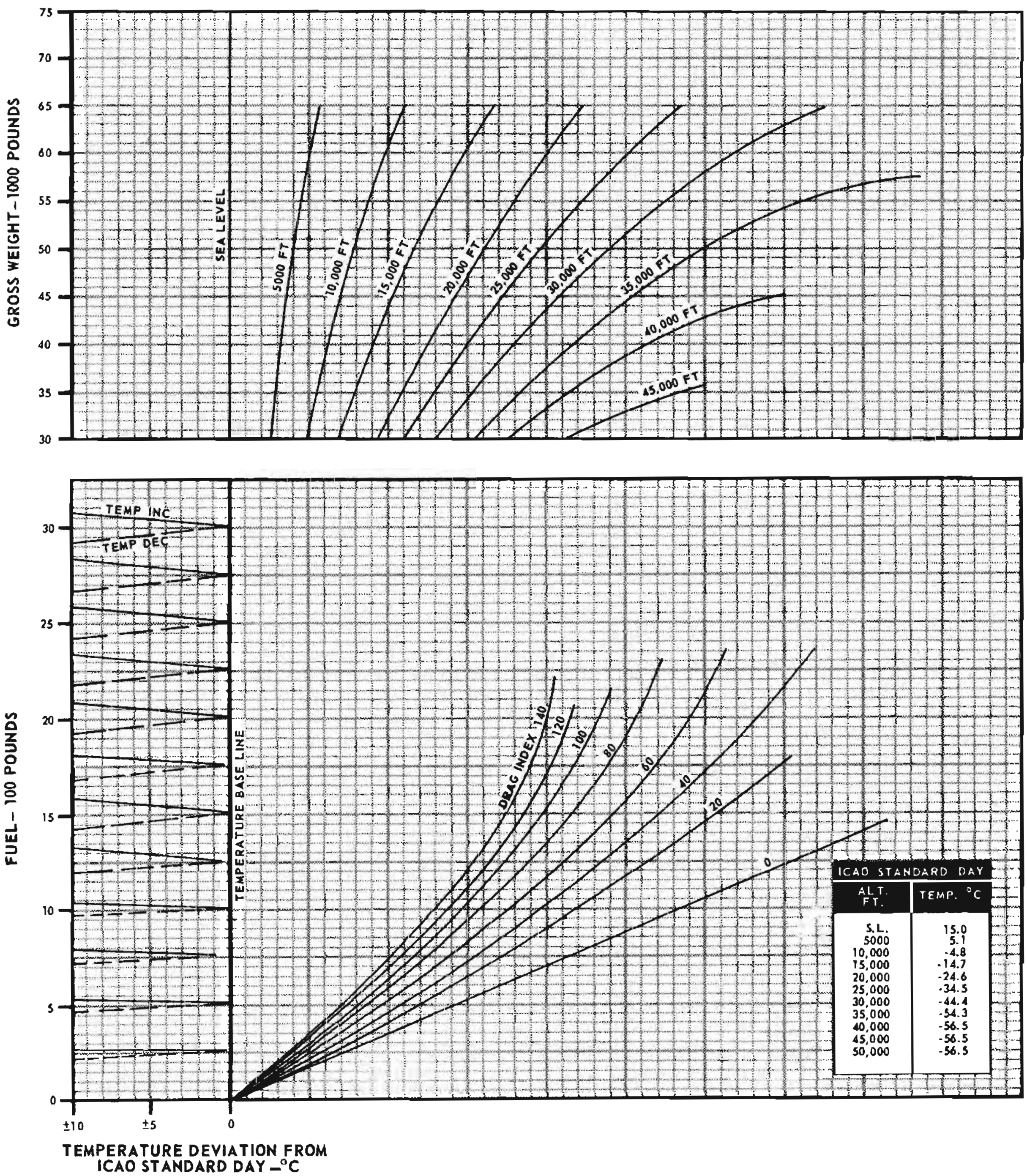


NOTES

CRUISE ALTITUDE AT END OF CLIMB MUST BE READ ON THE CONSTANT ALTITUDE CRUISE CHART.

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P302-3

Figure B3-2 (Sheet 3)

F-4E

DISTANCE REQUIRED TO CLIMB

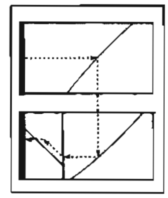
MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

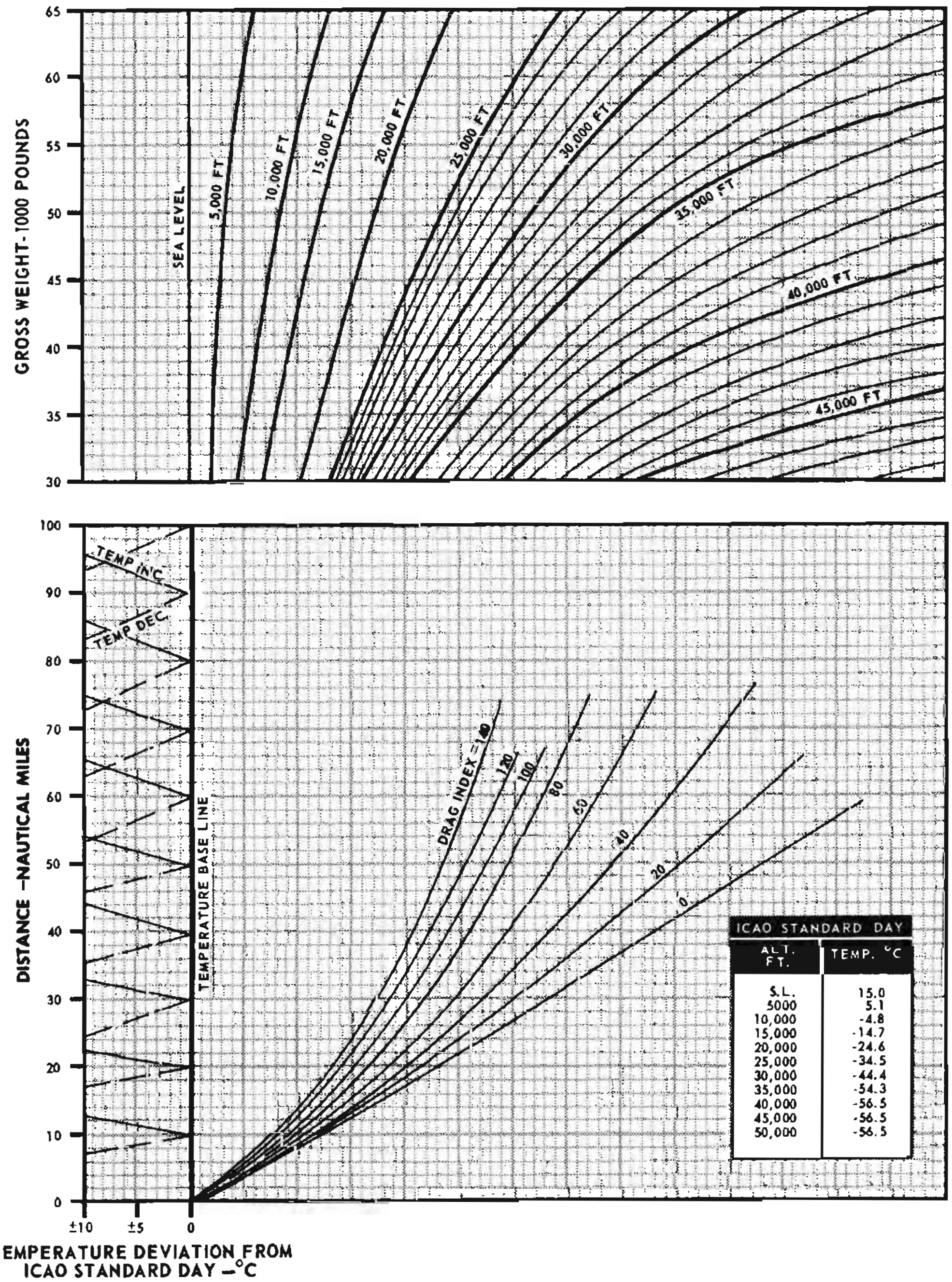
NOTE
CRUISE ALTITUDE AT END OF CLIMB MUST BE READ ON THE CONSTANT ALTITUDE CRUISE CHART

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P302-4

Figure B3-2 (Sheet 4)

F-4E

TIME TO CLIMB

350 KIAS-MILITARY THRUST

AIRPLANE CONFIGURATION

INDIVIDUAL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17

NOTE

DATA BASED ON 350-KNOT CLIMB UNTIL INTERCEPTION OF OPTIMUM CRUISE MACH/TAS, THEN MAINTAIN CRUISE MACH TO CRUISE ALTITUDE. REFER TO PART 4 TO OBTAIN CRUISE ALTITUDES.

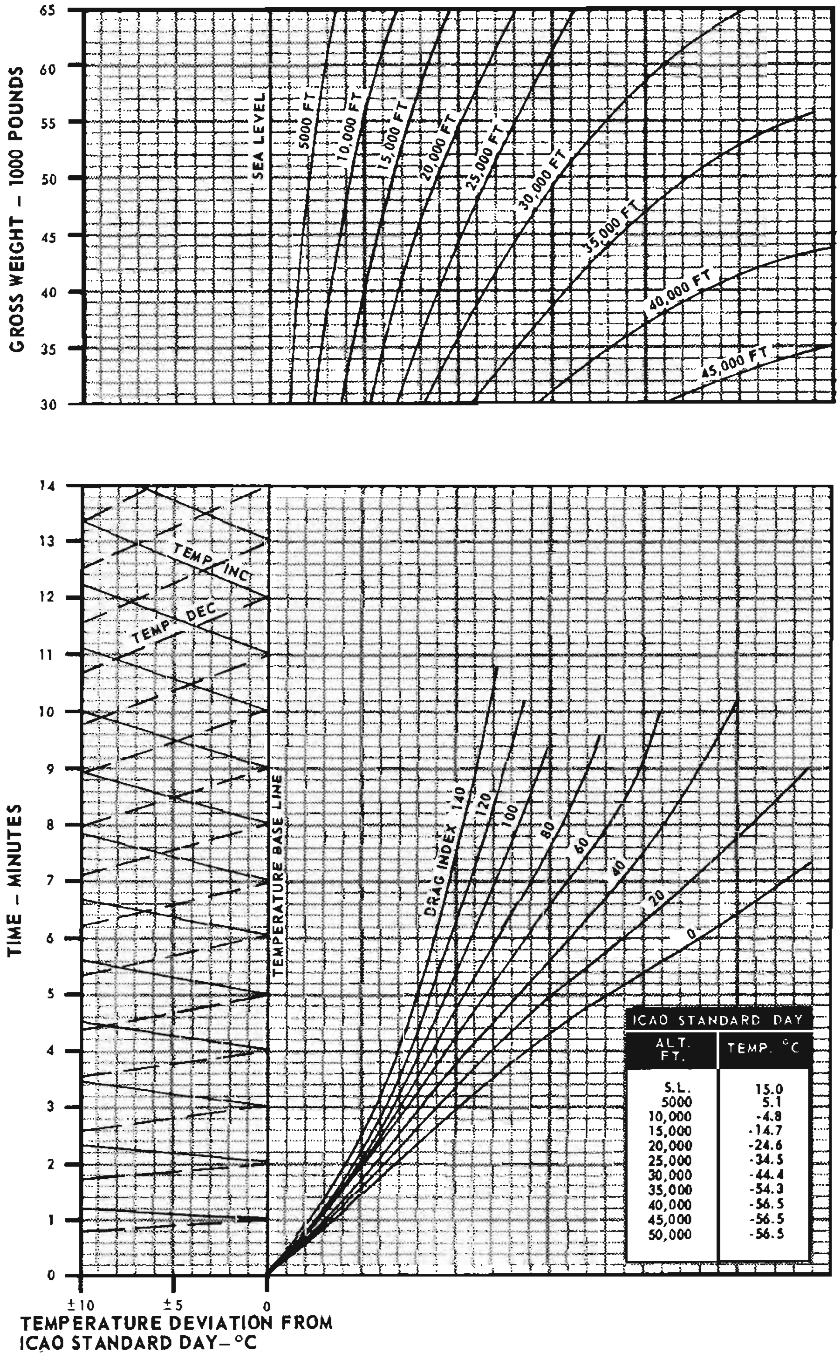
GUIDE

DATE: 1 MARCH 1968

DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4

FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E–P332–1

Figure B3-3 (Sheet 1)

F-4E

FUEL REQUIRED TO CLIMB

350 KIAS-MILITARY THRUST

AIRPLANE CONFIGURATION

INDIVIDUAL DRAG INDEXES

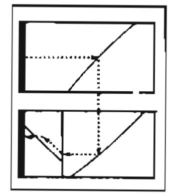
REMARKS

ENGINE(S): (2) J79-GE-17

NOTE

DATA BASED ON 350-KNOT CLIMB UNTIL INTERCEPTION OF OPTIMUM CRUISE MACH/ TAS, THEN MAINTAIN CRUISE MACH TO CRUISE ALTITUDE. REFER TO PART 4 TO OBTAIN CRUISE ALTITUDES.

GUIDE

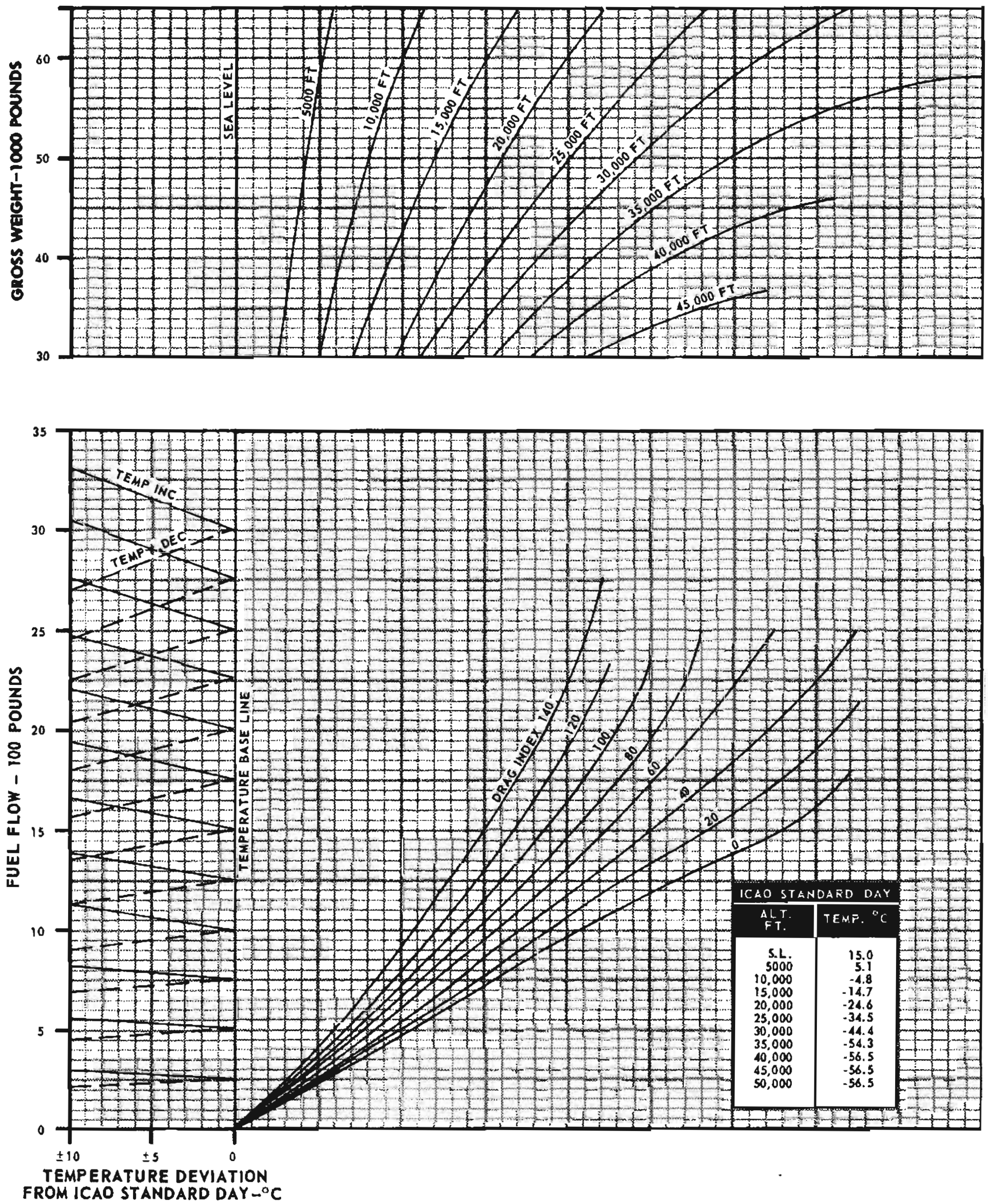


DATE: 1 MARCH 1968

DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4

FUEL DENSITY: 6.5 LB/GAL



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P332-2

Figure B3-3 (Sheet 2)

F-4E

DISTANCE REQUIRED TO CLIMB

350 KIAS-MILITARY THRUST

AIRPLANE CONFIGURATION

INDIVIDUAL DRAG INDEXES

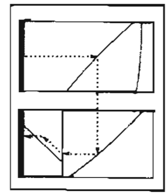
REMARKS

ENGINE(S): (2) J79-GE-17

NOTE

DATA BASED ON 350-KNOT CLIMB UNTIL INTERCEPTION OF OPTIMUM CRUISE MACH/TAS, THEN MAINTAIN CRUISE MACH TO CRUISE ALTITUDE. REFER TO PART 4 TO OBTAIN CRUISE ALTITUDES.

GUIDE

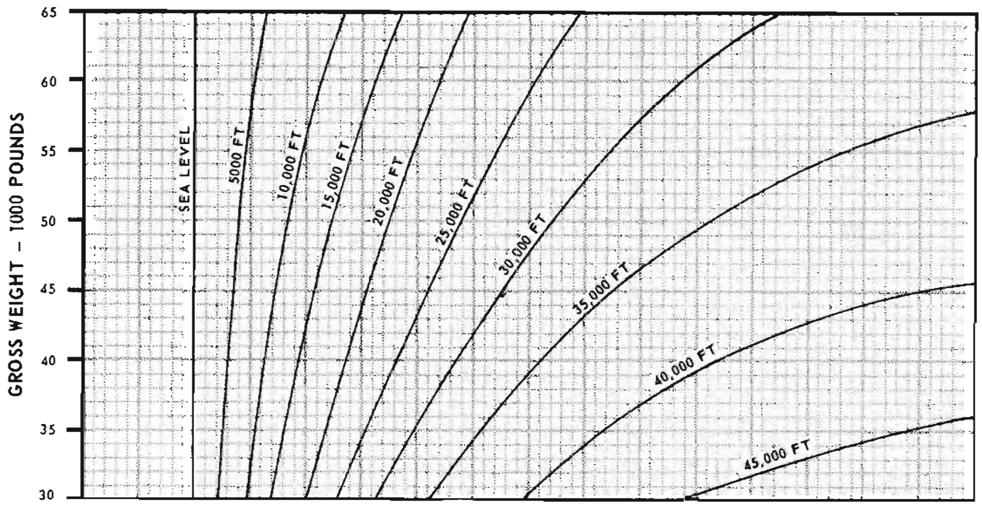


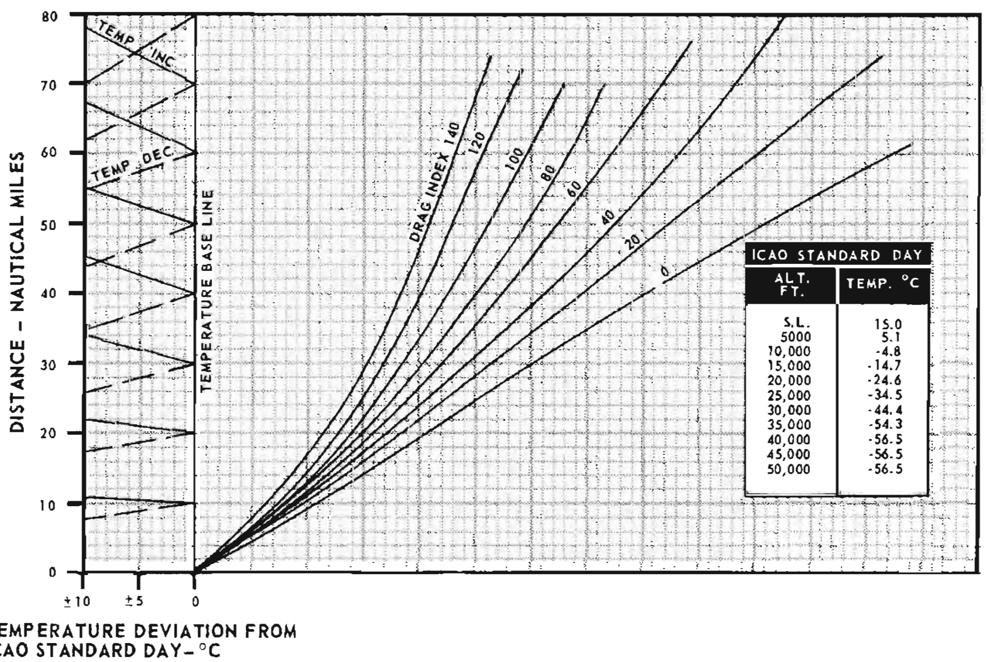
DATE: 1 MARCH 1968

DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4

FUEL DENSITY: 6.5 LB/GAL





ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

F4E-P332-3

Figure B3-3 (Sheet 3)

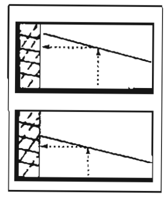
F-4E
COMBAT CEILING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

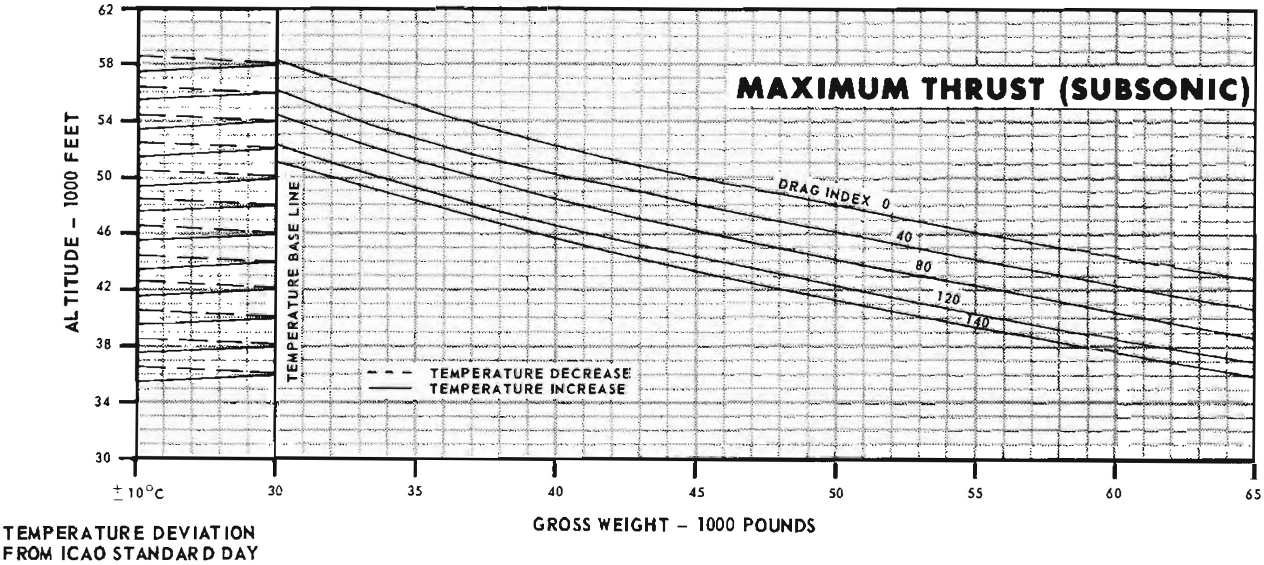


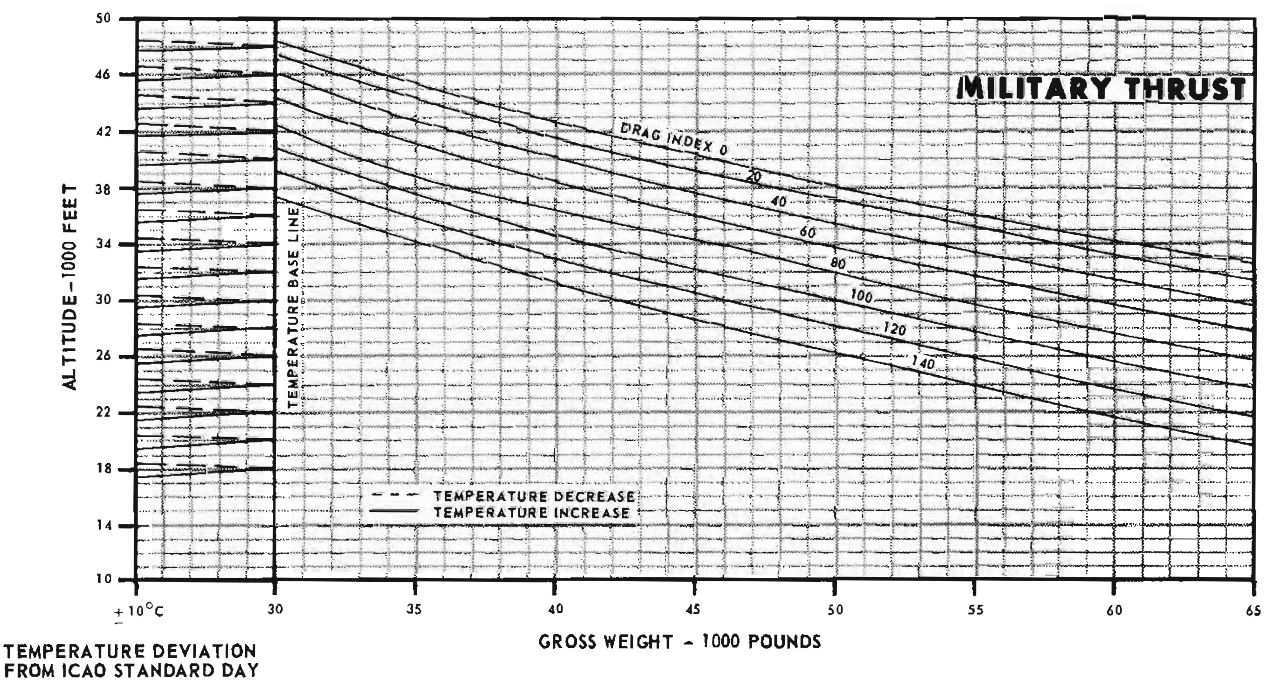
NOTE

COMBAT CEILING IS THE PRESSURE ALTITUDE AT WHICH THE AIRCRAFT CAN CLIMB AT A MAXIMUM RATE OF 500 FEET PER MINUTE.

DATE: 1 JULY 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB GAL





F4E-P303

Figure B3-4

F-4E

COMBAT CEILING
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

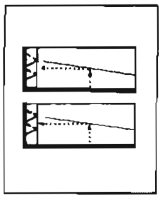
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

INOPERATIVE ENGINE WINDMILLING

NOTE

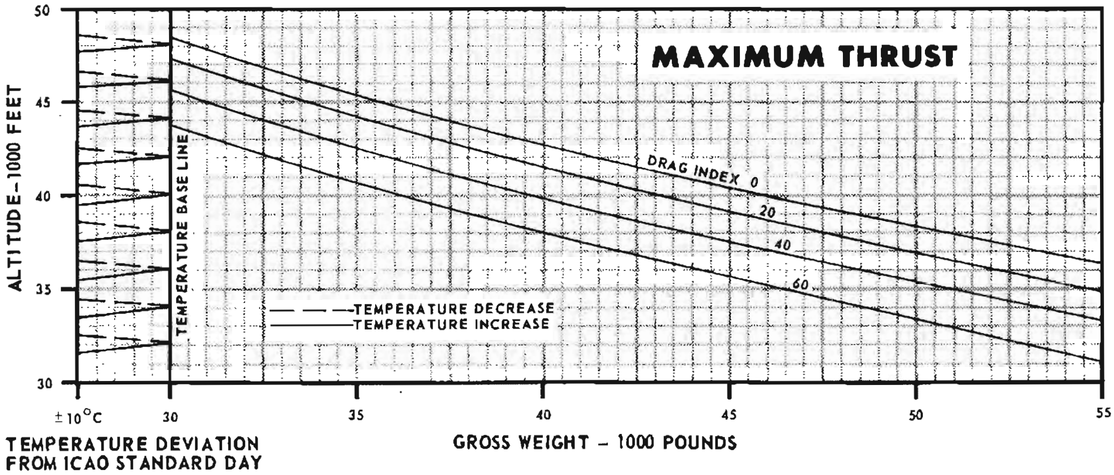
COMBAT CEILING IS THE PRESSURE ALTITUDE AT WHICH THE AIRCRAFT CAN CLIMB AT A MAXIMUM RATE OF 500 FEET PER MINUTE

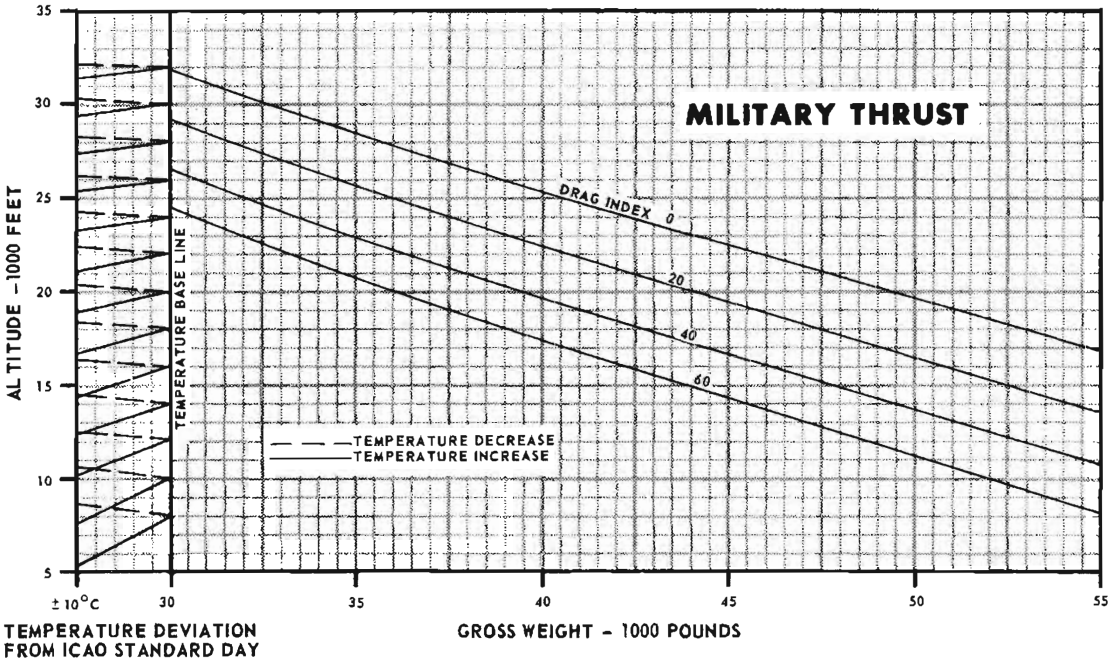
GUIDE



DATE: 1 JULY 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P309

Figure B3-5

PART 4 RANGE

TABLE OF CONTENTS

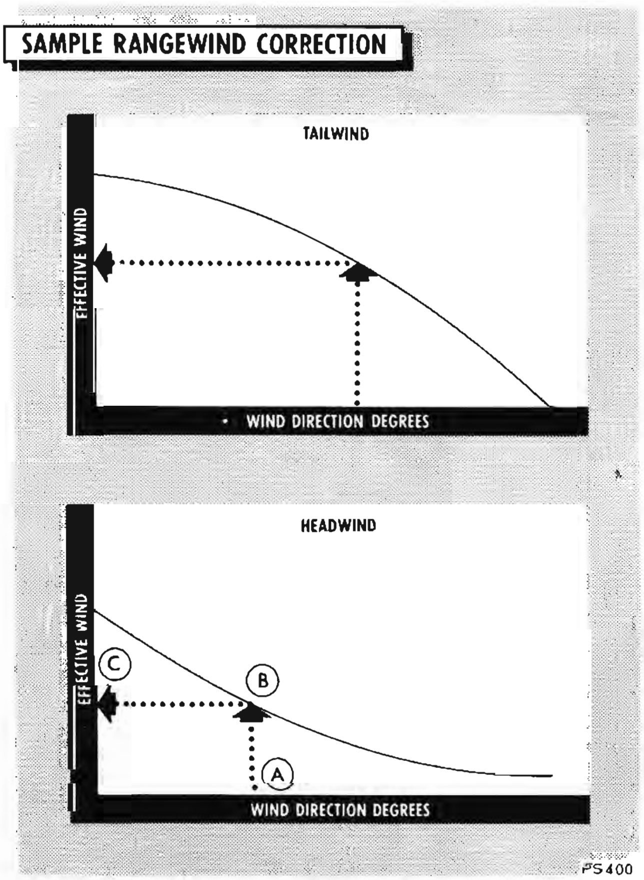
Charts

RANGEWIND CORRECTION

This chart (figure B4-1) provides a means of correcting computed range (specific or total) for existing wind effect. The presented range factors consider wind speeds up to 150 knots (TAS) from any relative wind direction for airplane speeds of 200 to 1300 knots (TAS).

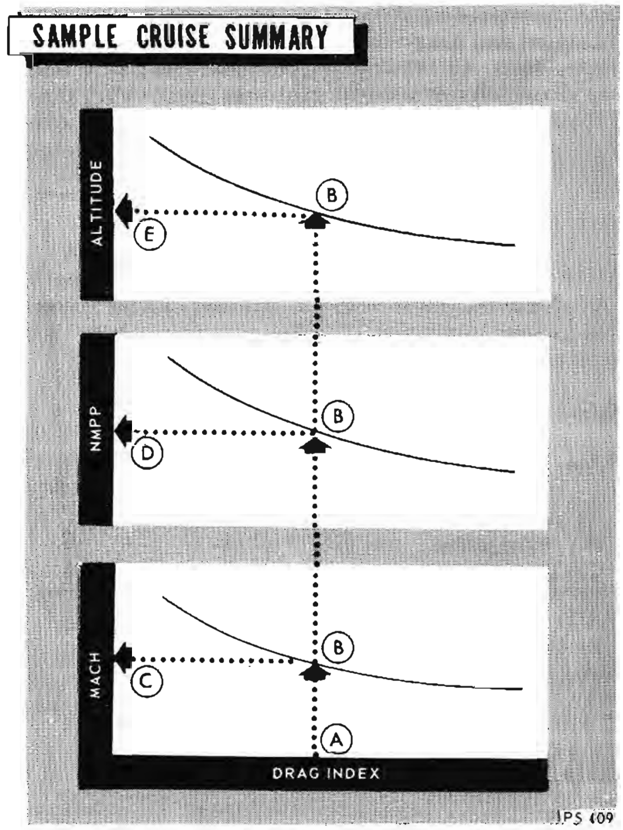
USE

Determine the relative wind direction by subtracting the aircraft heading from the forecast wind direction. If the aircraft heading is greater than the forecast wind direction, add 360° to wind direction and then perform the subtraction. Enter the chart with relative wind direction and proceed vertically to the interpolated wind speed. From this point, project horizontally to intersect the airplane true airspeed and reflect to the lower scale to read the range factor. Multiply computed range by this range factor to find range as affected by wind.



Sample Problem

A.	Relative wind direction	150°
B.	Wind speed	125 Kts.
C.	Airplane speed (TAS)	400 Kts.
D.	Range factor	1.25



CRUISE SUMMARY

These charts (figures B4-2 and B4-3) present optimum cruise data for both two-engine and single-engine operation. The charts depict cruise altitude, specific range (in nautical miles per pound) and cruise Mach number for all gross weights and drag indexes.

USE

Enter the chart with the previously computed drag index, and project vertically to intersect the gross weight curves of all three plots. At the intersection of the appropriate gross weight curves, reflect horizontally to the left and read cruise Mach number, specific range in nautical miles per pound, and cruise altitude.

Sample Problem

(2) Engines

A. Drag index	20
B. Gross weight	40,000 Lbs.
C. Mach number	0.88
D. Specific range	0.10 NMPP
E. Cruise altitude	36,000 Ft.

LOW ALTITUDE CRUISE TABLES

These tables (figures B4-4 thru B4-9) present total fuel flow values for various combinations of cruise airspeed and drag index at altitudes of Sea Level, 4000, 8000, 12,000 and 16,000 feet. Separate tables are provided for several gross weights. Fuel flow values are tabulated for ICAO Standard Day; however, correction factors are given for non-standard temperatures.

USE

After selecting the applicable table for gross weight and altitudes, enter with the desired cruise airspeed and project horizontally to the applicable drag index column. Read total fuel flow for a standard day.

Sample Problem

Gross weight 50,000 Lbs, Sea Level (15°C).

A. Airspeed	540 KTAS
B. Drag index	20.0
C. Fuel flow	15,428 PPH
D. Non-standard day temperature	-20°
E. Correction factor	0.937
F. Fuel flow for non-standard day (E x C)	14,456 PPH

HIGH ALTITUDE CRUISE TABLES

These charts (figures B4-10 thru B4-14) present total fuel flow values for various combinations of cruise Mach and drag index at altitudes of 20,000 feet thru 40,000 feet in 5000 foot increments. Separate charts are provided for several gross weights. Fuel flow values are tabulated for ICAO Standard Day; however, correction factors are given for non-standard temperatures.

USF

After selecting the applicable chart for gross weight and altitudes, enter with the desired cruise Mach and project horizontally to the applicable drag index column. Read total fuel flow for a standard day.

Sample Problem

Gross weight 40,000 Lbs, Altitude 35,000 ft., (-55°C).

A. Mach	.85
B. Drag index	20.0
C. Fuel flow	4892 PPH
D. Non-standard day temperature	-20°C
E. Correction factor	1.074
F. Fuel flow for non-standard day (E x C)	5254 PPH

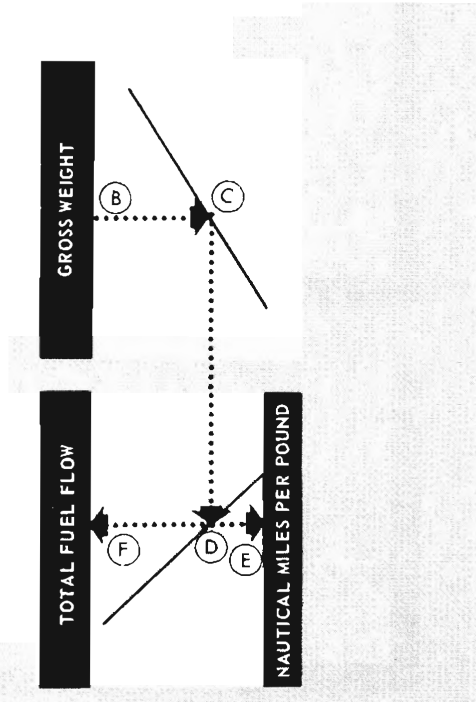
CONSTANT MACH/ALTITUDE CRUISE

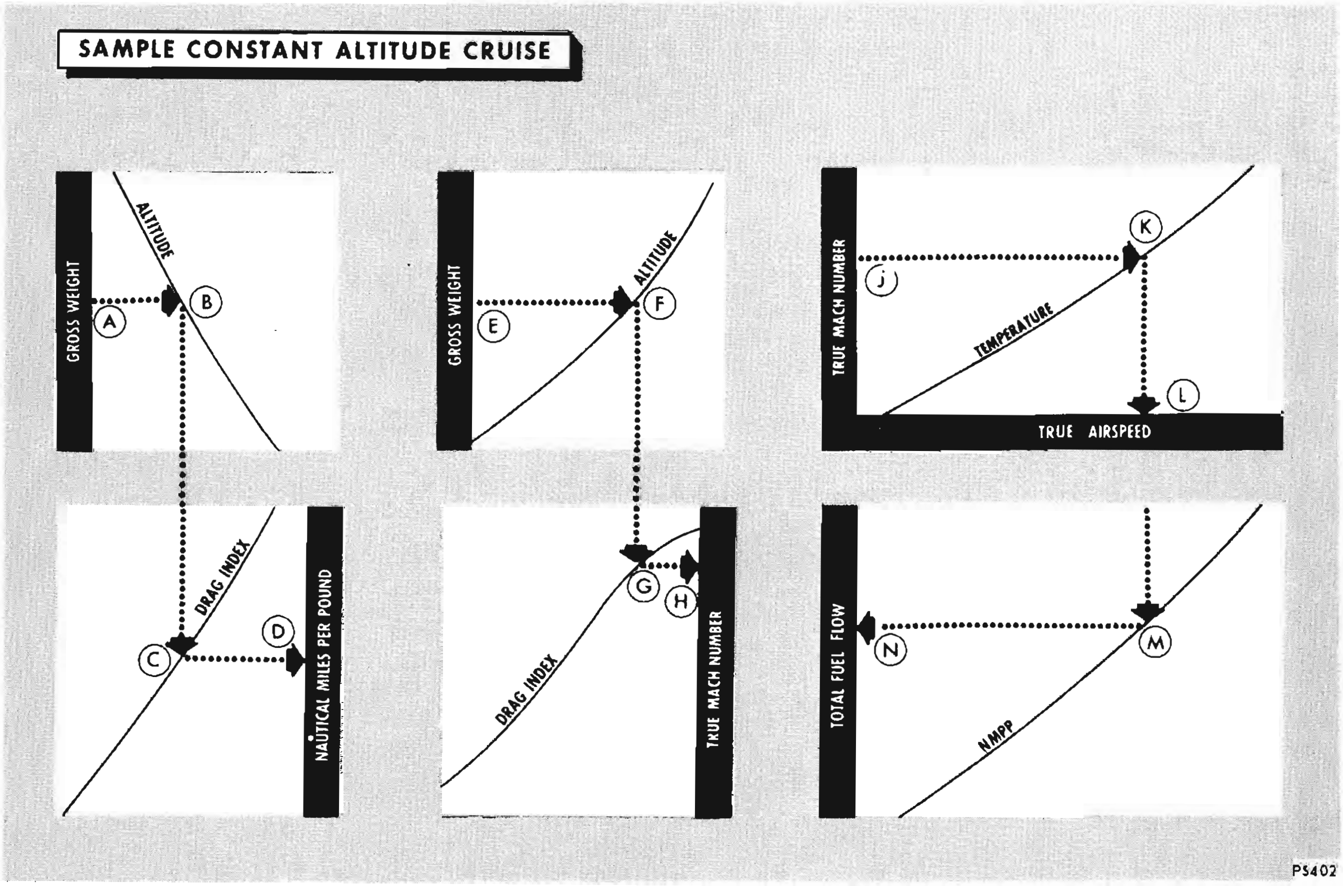
These charts (figures B4-15 thru B4-21) present nautical miles per pound and total fuel flow for normal two-engine and single engine operation, and various combinations of Mach number, gross weight, altitude, and drag index. This data is based on cruise at a constant Mach number and a constant altitude. Specifics are presented for 0°C; however, correction factors are provided for temperatures deviations.

USE

After selecting the desired cruise Mach, enter the chart with the estimated gross weight at end of climb. Project horizontally to the right to intersect the desired cruise altitude, then vertically downward to intersect the applicable drag index. From this point project horizontally to both sides of the graph and read nautical miles per pound and total fuel flow for 0°C temperature. If required, correct these values for the actual temperatures.

SAMPLE CONSTANT MACH/ALTITUDE CRUISE





Sample Problem

A. Mach number	0.85
B. Gross weight	40,000 Lbs.
C. Altitude	30,000 Ft.
D. Drag index	40
E. Nautical miles per pound	0.084
F. Total fuel flow	6550 PPH

CONSTANT ALTITUDE CRUISE

These charts (figures B4-22 thru B4-23) present the necessary planning data to set up optimum cruise schedules for normal two-engine and single engine operation, at a constant altitude. The recommended procedure is to use an average gross weight for a given leg of the mission. One way to find the average gross weight is to divide the mission into weight segments. With this method, readjust the cruise schedule each time a given amount of fuel is used. Subtract one-half of the fuel weight alloted for the first leg from the initial cruise gross weight. The remainder is the average gross weight for the leg. It is possible to obtain instantaneous data if desired.

USE

Enter the left side of sheet 1 with the average gross weight. Project horizontally to the right to intersect desired cruise altitude, and then vertically downward to the computed drag index, then horizontally to the right to obtain specific range (nautical miles per pound). Repeat these projections on the right side of sheet 1 to obtain optimum cruise Mach number for the desired altitude. Enter sheet 2 with the optimum cruise Mach number. Project horizontally to the right to intersect predicted flight-level temperature, then vertically downward to obtain corresponding true airspeed. Continue this projection vertically downward to intersect the interpolated specific range (obtained from sheet 1), then horizontally to the left to obtain total fuel flow required in pounds per hour.

Sample Problem

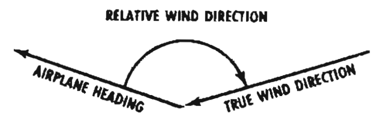
(2) Engines

A. Average gross weight for first leg	45,000 Lbs.
B. Cruise altitude	35,000 Ft.
C. Computed drag index	40.0
D. Specific range	0.080 NMPP
E. Gross weight	45,000 Lbs.
F. Altitude	35,000 Ft.
G. Drag index	40.0
H. True Mach number	0.87
J. True Mach number	0.87
K. Temperature at flight altitude	-40°C
L. True airspeed	519 Kts.
M. Specific range	0.08 NMPP
N. Total fuel flow	6500 PPH

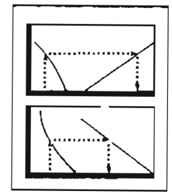
RANGEWIND CORRECTION

AIRPLANE CONFIGURATION

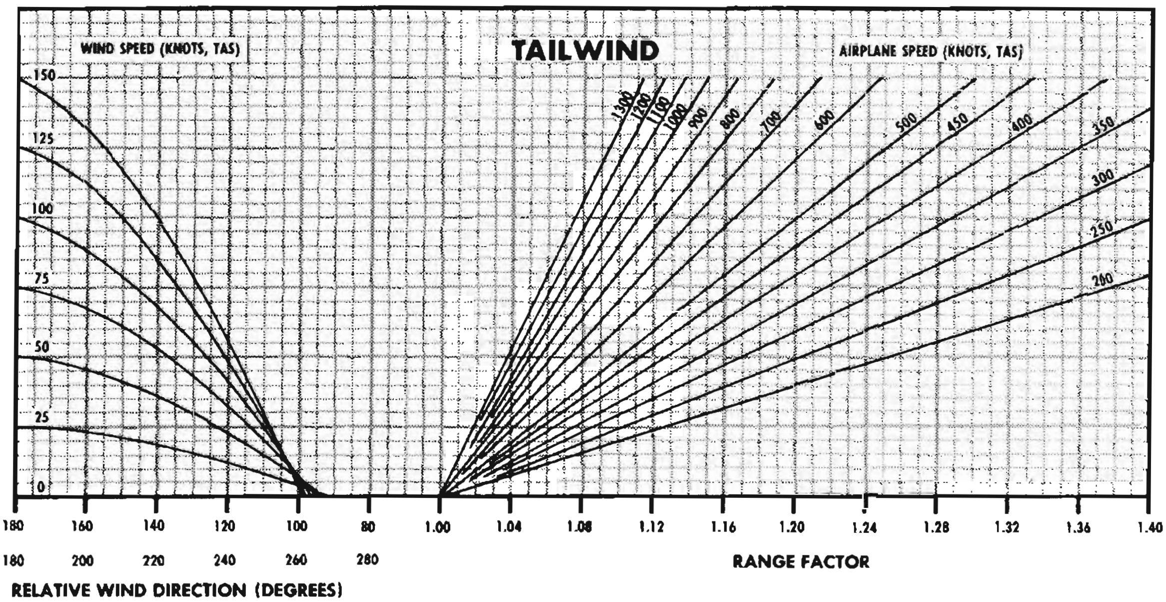
ALL CONFIGURATIONS

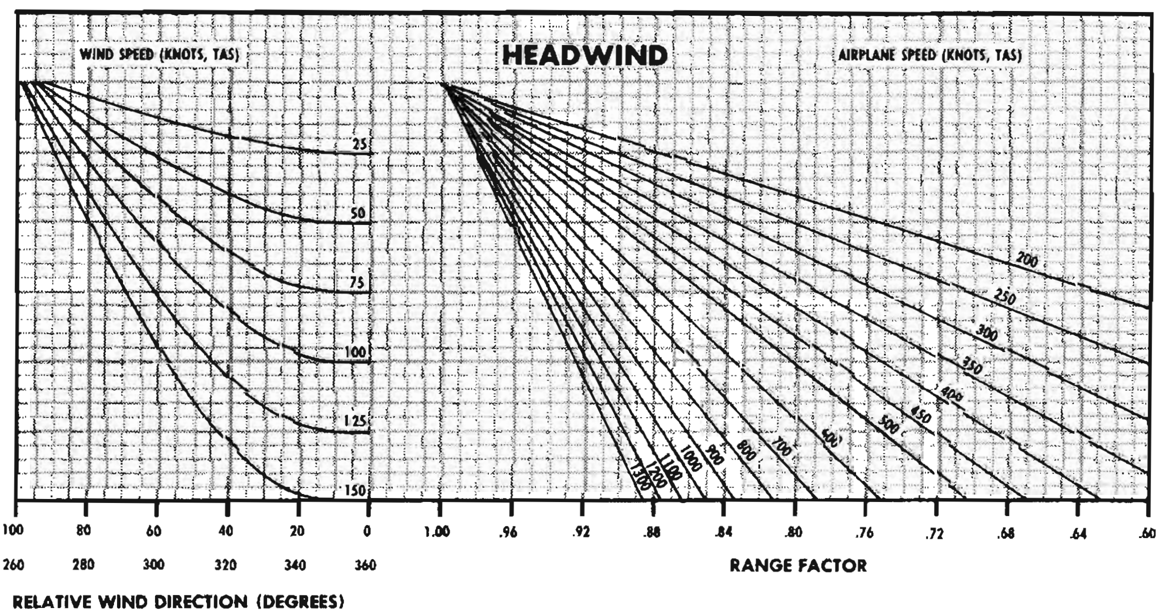


GUIDE



NOTE: RELATIVE WIND DIRECTION = ANGULAR DIFFERENCE MEASURED CLOCKWISE, BETWEEN AIRPLANE HEADING AND TRUE WIND DIRECTION





F4E-P401

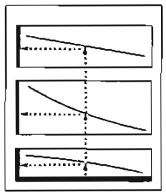
Figure B4-1

F-4E
CRUISE SUMMARY

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

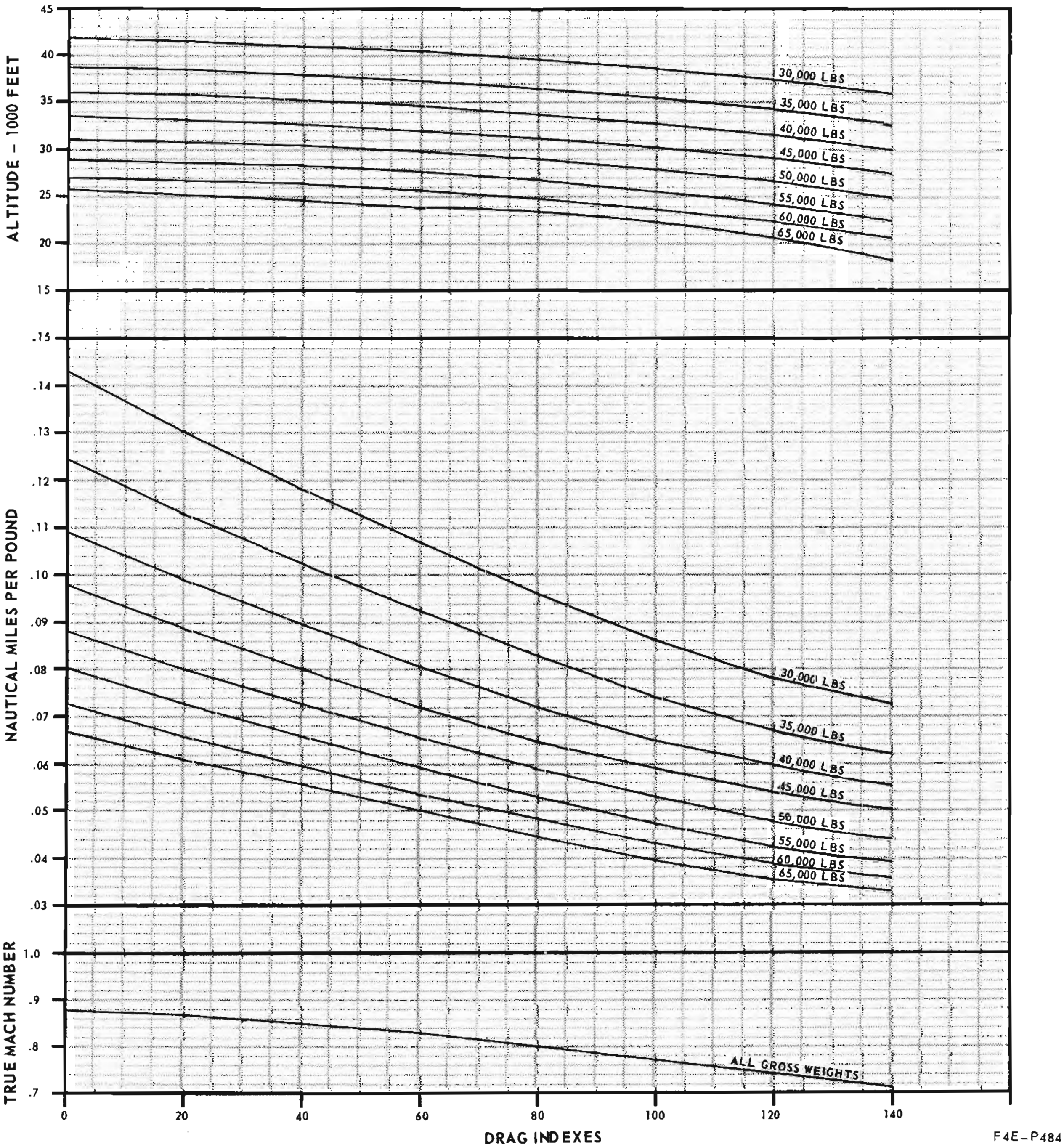


Figure B4-2

F-4E

CRUISE SUMMARY
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

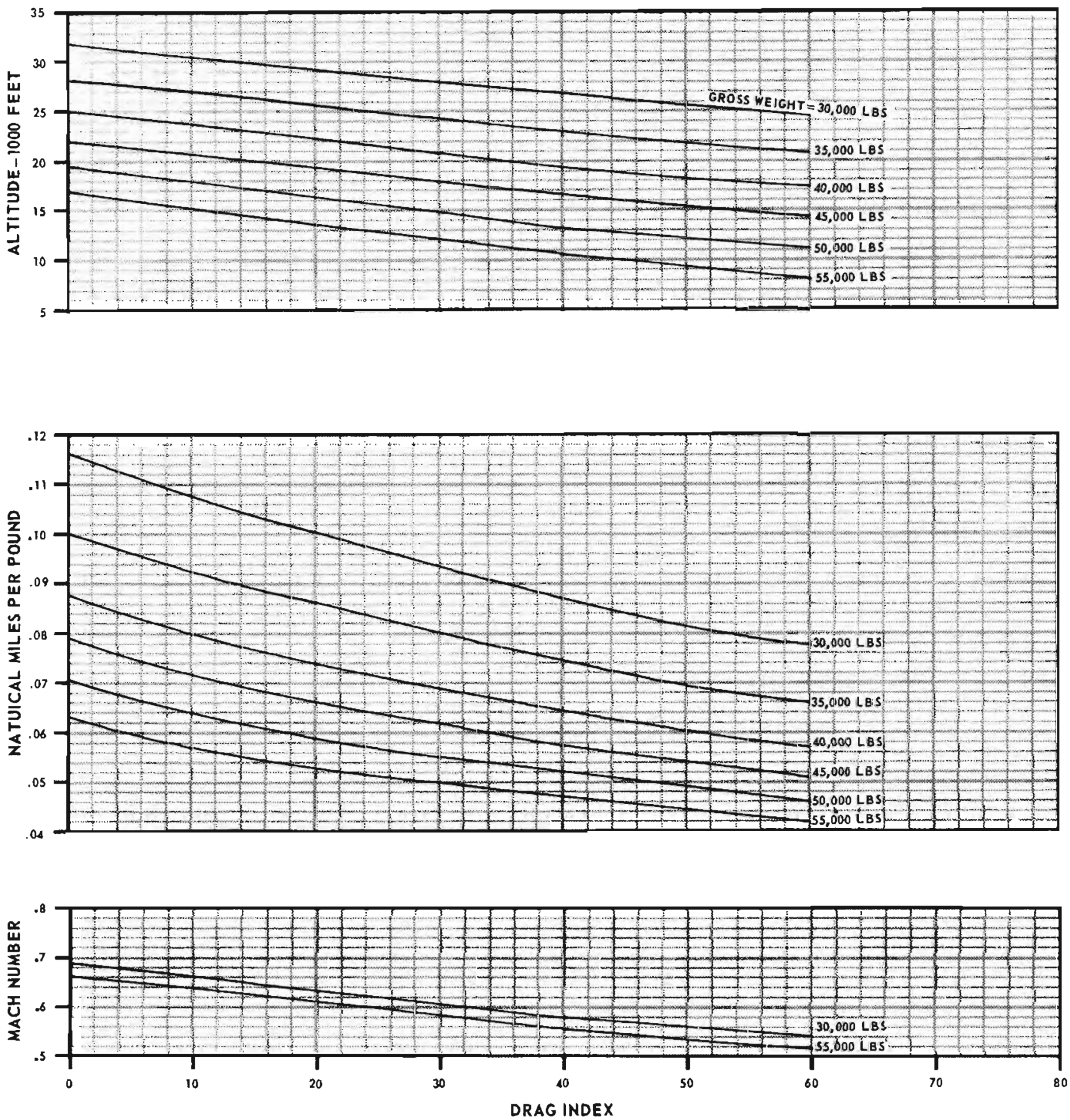
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING

NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING DRAG WILL INCREASE BY A FACTOR OF 3.

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P496

Figure B4-3

F-4E

LOW ALTITUDE CRUISE

GROSS WEIGHT – 35,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	KTAS	DRAG INDEX: TOTAL FUEL FLOW-LB/HR							TEMP. EFFECTS FACTOR	
		0	20	40	60	80	100	120	+10°C	—10°C
SEA LEVEL (15°C)	360.	6338.	7112.	7895.	8699.	9521.	10366.	11240.		
	420.	7978.	9094.	10232.	11420.	12627.	13997.	15296.	−40	.899
	480.	10052.	11619.	13192.	14945.	16832.	18732.	20742.	−20	.937
	540.	13132.	15229.	17331.	19868.	22738.			0	.973
	600.	17528.	20261.	24500.					20	1.008
	MIL	28468.	28239.	27892.	27535.	26977.	26359.	25765.	40	1.042
	VMAX	646.	633.	615.	597.	571.	544.	522.		
4,000 FEET (7°C)	360.	5693.	6370.	7083.	7784.	8516.	9266.	10046.		
	420.	7066.	8062.	9088.	10126.	11235.	12324.	13603.	−40	.913
	480.	8913.	10281.	11682.	13147.	14882.	16844.	18911.	−20	.949
	540.	11627.	13384.	15281.	17858.	20716.			0	.987
	600.	15876.	18642.	23330.					20	1.022
	MIL	26110.	25790.	25460.	24990.	24482.	23962.	23429.	40	1.057
	VMAX	643.	629.	614.	594.	512.	548.	524.		
8,000 FEET (-1°C)	360.	5109.	5700.	6319.	6959.	7588.	8243.	8945.		
	420.	6250.	7140.	8034.	8951.	9924.	10912.	11919.	−40	.925
	480.	7871.	9083.	10305.	11646.	13019.	14685.	16696.	−20	.963
	540.	10294.	11868.	13458.	15619.	18451.	21609.		0	1.001
	600.	14480.	17059.	21479.					20	1.037
	MIL	23665.	23258.	22966.	22527.	22157.	21708.	21303.	40	1.072
	VMAX	640.	624.	612.	592.	575.	552.	527.		
12,000 FEET (-9°C)	360.	4610.	5127.	5663.	6214.	6770.	7342.	7949.		
	420.	5555.	6321.	7105.	7917.	8772.	9644.	10551.	−40	.939
	480.	6981.	8026.	9104.	10274.	11496.	12797.	14376.	−20	.978
	540.	9104.	10469.	11916.	13814.	15777.	18930.		0	1.016
	600.	13132.	15589.	19541.					20	1.052
	MIL	21264.	20853.	20585.	20288.	20009.	19664.	19318.	40	1.088
	VMAX	636.	618.	606.	590.	574.	553.	531.		
16,000 FEET (-16°C)	360.	4187.	4638.	5099.	5576.	6064.	6555.	7077.		
	420.	4970.	5632.	6313.	6987.	7766.	8532.	9360.	−40	.953
	480.	6173.	7094.	8028.	9054.	10157.	11331.	12578.	−20	.993
	540.	8042.	9230.	10597.	12204.	13990.	16106.		0	1.032
	600.	12836.	15401.						20	1.069
	MIL	19130.	18675.	18473.	18294.	18068.	17827.	17476.	40	1.105
	VMAX	636.	613.	600.	589.	571.	555.	533.		

F4E–T495

Figure B4-4

F-4E

LOW ALTITUDE CRUISE

GROSS WEIGHT – 40,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	KTAS	DRAG INDEX	TOTAL FUEL FLOW-LB/HR						TEMP. EFFECTS FACTOR	
		0	20	40	60	80	100	120	+10°C	—10°C
SEA LEVEL (15°C)	360.	6519.	7304.	8084.	8887.	9711.	10558.	11438.		
	420.	8093.	9211.	10357.	11556.	12757.	14118.	15441.	−40	.899
	480.	10134.	11699.	13273.	15024.	16908.	18819.	20835.	−20	.937
	540.	13198.	15295.	17397.	19940.	22832.			0	.973
	600.	17649.	20368.	24656.					20	1.008
	MIL	28468.	28239.	27877.	27523.	26953.	26340.	25748.	40	1.042
	VMAX	646.	633.	614.	596.	570.	543.	518.		
4,000 FEET (7°C)	360.	5872.	6561.	7278.	7989.	8714.	9458.	10242.		
	420.	7191.	8187.	9216.	10257.	11372.	12455.	13744.	−40	.913
	480.	9044.	10396.	11809.	13274.	15017.	16974.	19028.	−20	.949
	540.	11690.	13451.	15347.	17943.	20796.			0	.987
	600.	15973.	18760.	23502.					20	1.022
	MIL	26110.	25774.	25441.	24976.	24464.	23931.	23412.	40	1.057
	VMAX	643.	628.	614.	593.	571.	547.	523.		
8,000 FEET (-1°C)	360.	5320.	5924.	6552.	7175.	7846.	8485.	9175.		
	420.	6412.	7311.	8217.	9132.	10104.	11094.	12092.	−40	.925
	480.	8002.	9221.	10450.	11777.	13174.	14858.	16873.	−20	.963
	540.	10375.	11959.	13550.	15715.	18592.			0	1.001
	600.	14594.	17177.	21663.					20	1.037
	MIL	23652.	23252.	22954.	22509.	22138.	21692.	21284.	40	1.072
	VMAX	639.	623.	611.	591.	573.	551.	526.		
12,000 FEET (-9°C)	360.	4838.	5361.	5908.	6461.	7011.	7624.	8210.		
	420.	5744.	6519.	7294.	8116.	8993.	9864.	10768.	−40	.939
	480.	7112.	8170.	9251.	10407.	11620.	12950.	14549.	−20	.978
	540.	9219.	10594.	12022.	13925.	15932.	19169.		0	1.106
	600.	13245.	15713.	19737.					20	1.052
	MIL	21233.	20845.	20572.	20274.	19998.	19645.	19297.	40	1.088
	VMAX	635.	618.	606.	590.	573.	552.	530.		
16,000 FEET (-16°C)	360.	4464.	4926.	5399.	5878.	6372.	6861.	7423.		
	420.	5179.	5844.	6529.	7204.	7979.	8772.	9608.	−40	.953
	480.	6332.	7239.	8175.	9204.	10317.	11486.	12769.	−20	.993
	540.	8194.	9374.	10740.	12354.	14147.	16333.		0	1.032
	600.	12975.	15560.						20	1.069
	MIL	19095.	18668.	18473.	18278.	18050.	17791.	17456.	40	1.105
	VMAX	634.	612.	600.	588.	570.	553.	532.		

F4E–T4003

Figure B4-5

F-4E

LOW ALTITUDE CRUISE

GROSS WEIGHT – 45,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	TEMP EFFECTS FACTOR + 10°C	— 10°C
		TOTAL FUEL FLOW LB/HR								
SEA LEVEL (15°C)	360.	6701.	7501.	8282.	9084.	9909.	10758.	11624.		
	420.	8206.	9331.	10485.	11694.	12890.	14241.	15588.	−40	.899
	480.	10262.	11825.	13401.	15147.	17028.	18938.	20982.	−20	.937
	540.	13264.	15361.	17464.	20012.	22927.			0	.973
	600.	17771.	20477.	24815.					20	1.008
	MIL	22451.	28239.	27878.	27514.	26940.	26320.	25715.	40	1.042
	VMAX	645.	633.	614.	596.	569.	542.	517.		
4,000 FEET (7°C)	360.	6092.	6792.	7496.	8235.	8966.	9703.	10486.		
	420.	7358.	8363.	9395.	10440.	11562.	12637.	13932.	−40	.913
	480.	9170.	10534.	11962.	13427.	15179.	17130.	19168.	−20	.949
	540.	11754.	13518.	15413.	18029.	20876.			0	.987
	600.	16070.	18879.	23678.					20	1.022
	MIL	26092.	25774.	25432.	24976.	24443.	23914.	24753.	40	1.057
	VMAX	642.	628.	613.	593.	571.	546.	522.		
8,000 FEET (-1°C)	360.	5554.	6168.	6799.	7424.	8089.	8761.	9436.		
	420.	6611.	7496.	8415.	9342.	10317.	11306.	12310.	−40	.925
	480.	8138.	9364.	10600.	11903.	13332.	15034.	17054.	−20	.963
	540.	10494.	12092.	13685.	15855.	18800.			0	1.001
	600.	14684.	17297.	21850.					20	1.037
	MIL	23637.	23252.	22954.	22499.	22110.	21692.	21261.	40	1.072
	VMAX	638.	623.	611.	591.	572.	550.	525.		
12,000 FEET (-9°C)	360.	5122.	5658.	6208.	6765.	7333.	7921.	8556.		
	420.	5952.	6733.	7509.	8326.	9198.	10082.	10995.	−40	.939
	480.	7275.	8348.	9412.	10559.	11770.	13138.	14761.	−20	.978
	540.	9344.	10720.	12137.	14045.	16110.	19389.		0	1.016
	600.	13363.	15842.	19942.					20	1.052
	MIL	21198.	20828.	20572.	20262.	19986.	19623.	19277.	40	1.088
	VMAX	633.	617.	606.	588.	573.	550.	528.		
16,000 FEET (-16°C)	360.	4815.	5290.	5767.	6255.	6737.	7277.	7802.		
	420.	5434.	6110.	6798.	7490.	8256.	9040.	9899.	−40	.953
	480.	6527.	7428.	8364.	9398.	10522.	11685.	13015.	−20	.993
	540.	8351.	9506.	10887.	12508.	14309.	16567.		0	1.032
	600.	13182.	15794.						20	1.069
	MIL	19052.	18654.	18452.	18260.	18033.	17763.	17438.	40	1.105
	VMAX	632.	611.	599.	586.	569.	551.	531.		

F4E–T4004

Figure B4-6

F-4E
LOW ALTITUDE CRUISE

GROSS WEIGHT – 50,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	KTAS	DRAG INDEX / TOTAL FUEL FLOW LB/HR 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
SEA LEVEL (15°C)	360.	6926.	7718.	8521.	9332.	10157.	11008.	11854.		
	420.	8360.	9493.	10657.	11880.	13068.	14405.	15785.	−40	.899
	480.	10411.	11971.	13548.	15289.	17166.	19076.	21151.	−20	.937
	540.	13330.	15428.	17532.	20085.	23023.	27336.		0	.973
	600.	17877.	20586.	24976.					20	1.008
	MIL	28451.	28229.	27864.	27514.	26919.	29301.	25701.	40	1.042
	VMAX	645.	632.	613.	596.	568.	541.	516.		
4,000 FEET (7°C)	360.	6329.	7040.	7741.	8474.	9225.	9976.	10758		
	420.	7562.	8583.	9610.	10649.	11750.	12862.	14164.	−40	.913
	480.	9300.	10676.	12107.	13583.	15345.	17288.	19309.	−20	.949
	540.	11877.	13646.	15540.	18192.	21030.			0	.987
	600.	16169.	19000.	23855.					20	1.022
	MIL	26084.	25768.	25415.	24947.	24425.	23891.	23365.	40	1.057
	VMAX	642.	627.	612.	593.	569.	545.	520.		
8,000 FEET (-1°C)	360.	5842.	6462.	7092.	7746.	8392.	9064.	9770.		
	420.	6811.	7693.	8612.	9539.	10517.	11499.	12538.	−40	.925
	480.	8294.	9528.	10754.	12046.	13512.	15234.	17259.	−20	.963
	540.	10626.	12212.	13836.	16010.	19032.			0	1.001
	600.	14775.	17418.	22040.					20	1.037
	MIL	23616.	23230.	22938.	22478.	22081.	21657.	21246.	40	1.072
	VMAX	638.	622.	611.	590.	571.	549.	524.		
12,000 FEET (-9°C)	360.	5457.	6003.	6562.	7112.	7715.	8294.	8907.		
	420.	6215.	7004.	7793.	8601.	9464.	10344.	11246.	−40	.939
	480.	7464.	8530.	9599.	10755.	11962.	13375.	15031.	−20	.978
	540.	9473.	10836.	12253.	14167.	16293.	19575.		0	1.016
	600.	13559.	16056.	20285.					20	1.052
	MIL	21182.	20813.	20552.	20240.	19965.	19604.	19252.	40	1.088
	VMAX	633.	616.	605.	587.	571.	549.	526.		
16,000 FEET (-16°C)	360.	5252.	5732.	6217.	6700.	7224.	7744.	8312.		
	420.	5726.	6411.	7083.	7810.	8589.	9360.	10228.	−40	.953
	480.	6727.	7628.	8563.	9600.	10736.	11890.	13258.	−20	.993
	540.	8509.	9674.	11074.	12702.	14512.	16864.		0	1.032
	600.	13395.	16034.						20	1.069
	MIL	18990.	18635.	18440.	18236.	18018.	17729.	17381.	40	1.105
	VMAX	630.	610.	598.	585.	568.	549.	528.		

F4E–T4005

Figure B4-7

F-4E

LOW ALTITUDE CRUISE

GROSS WEIGHT – 55,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	KTAS	DRAG INDEX: TOTAL FUEL FLOW-LB/HR 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR + 10°C	— 10°C
SEA LEVEL (15°C)	360.	7172.	7951.	8755.	9578.	10423.	11290.	12112.		
	420.	8558.	9702.	10877.	12069.	13294.	14613.	16035.	–40	.899
	480.	10540.	12120.	13698.	15434.	17306.	19215.	21323.	–20	.937
	540.	13433.	15532.	17636.	20197.	23170.			0	.973
	600.	17977.	20697.	25139.					20	1.008
	MIL	28441.	28229.	27864.	27501.	26907.	26275.	25660.	40	1.042
	V_{MAX}	645.	632.	613.	595.	567.	540.	514.		
4,000 FEET (7°C)	360.	6610.	7325.	8045.	8767.	9510.	10275.	11084.		
	420.	7755.	8772.	9802.	10851.	11944.	13095.	14404.	–40	.913
	480.	9434.	10822.	12234.	13743.	15514.	17449.	19453.	–20	.949
	540.	12027.	13803.	15695.	18392.	21217.			0	.987
	600.	16269.	19122.	24036.					20	1.022
	MIL	26076.	25768.	25396.	24933.	24401.	23863.	23342.	40	1.057
	V_{MAX}	641.	627.	612.	592.	569.	544.	519.		
8,000 FEET (-1°C)	360.	6142.	6774.	7398.	8064.	8733.	9385.	10090.		
	420.	7071.	7960.	8879.	9803.	10785.	11755.	12843.	–40	.925
	480.	8505.	9734.	10946.	12237.	13752.	15501.	17531.	–20	.963
	540.	10762.	12331.	13989.	16169.	19269.			0	1.001
	600.	14936.	17632.	22377.					20	1.037
	MIL	23603.	23211.	22938.	22456.	22051.	21633.	21228.	40	1.072
	V_{MAX}	637.	622.	611.	589.	570.	548.	523.		
12,000 FEET (-9°C)	360.	5885.	6439.	6989.	7597.	8160.	8764.	9380.		
	420.	6475.	7253.	8075.	8897.	9749.	10624.	11512.	–40	.939
	480.	7650.	8721.	9793.	10957.	12161.	13597.	15312.	–20	.978
	540.	9617.	10966.	12383.	14302.	16497.			0	1.016
	600.	13762.	16277.						20	1.052
	MIL	21156.	20792.	20537.	20217.	19955.	19579.	19230.	40	1.088
	V_{MAX}	631.	616.	604.	586.	570.	548.	524.		
16,000 FEET (-16°C)	360.	5820.	6310.	6792.	7332.	7833.	8395.	8928.		
	420.	6077.	6767.	7452.	8164.	8955.	9759.	10646.	–40	.953
	480.	7021.	7941.	8873.	9915.	11059.	12206.	13618.	–20	.993
	540.	8712.	9890.	11313.	12951.	14771.	17245.		0	1.032
	600.	13615.	16281.						20	1.069
	MIL	18930.	18618.	18428.	18220.	17999.	17685.	17324.	40	1.105
	V_{MAX}	627.	609.	598.	583.	567.	546.	524.		

F4E–T4006

Figure B4-8

F-4E

HIGH ALTITUDE CRUISE

GROSS WEIGHT – 40,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 JULY 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

20,000 FEET (−25°C)

MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS °C	FACTOR
	TOTAL FUEL FLOW-LB/HR								
0.65	4502	5021	5547	6085	6632	7215	7832	−40	.968
0.70	4868	5485	6112	6740	7448	8160	8988	−20	1.008
0.75	5292	6015	6739	7508	8357	9299	10384	0	1.048
0.80	5931	6763	7577	8571	9648	10952	12232	20	1.085
0.85	6691	7611	8608	9955	11368	12986	15111	40	1.122
0.90	7800	8893	10415	12161	14235				
MIL	17294	16845	16602	16412	16149	15921	15489		
MMAX	1.0354	0.9878	0.9671	0.9509	0.9227	0.8985	0.8618		

25,000 FEET (−35°C)

MACH	0	20	40	60	80	100	120	°C	FACTOR
0.65	4159	4578	5005	5438	5881	6317	6789	−40	.988
0.70	4345	4840	5335	5852	6385	6920	7530	−20	1.029
0.75	4616	5189	5764	6379	7005	7708	8503	0	1.069
0.80	5063	5721	6369	7111	7924	8835	9921	20	1.108
0.85	5619	6355	7105	8118	9171	10429	11904	40	1.145
0.90	6476	7307	8472	9788	11262	13187			
MIL	15084	14360	14104	13905	13569	13247	12763		
MMAX	1.0531	0.9926	0.9708	0.9538	0.9269	0.9014	0.8629		

30,000 FEET (−44°C)

MACH	0	20	40	60	80	100	120	°C	FACTOR
0.65	4216	4546	4874	5210	5569	5957	6377	−40	1.009
0.70	4129	4518	4897	5288	5723	6188	6713	−20	1.051
0.75	4265	4708	5142	5617	6150	6723	7415	0	1.092
0.80	4512	5016	5518	6115	6756	7552	8509	20	1.131
0.85	4861	5430	6031	6816	7700	8708	9810	40	1.170
0.90	5473	6134	7036	8104	9232				
MIL	12611	11718	11450	11245	10903	10572	10086		
MMAX	1.0605	0.9910	0.9683	0.9509	0.9207	0.8918	0.8505		

35,000 FEET (−55°C)

MACH	0	20	40	60	80	100	120	°C	FACTOR
0.65	4978	5316	5679	6076	6492	6945		−40	1.032
0.70	4455	4781	5147	5535	6003	6479		−20	1.074
0.75	4314	4674	5053	5496	6030	6607		0	1.116
0.80	4303	4705	5116	5662	6301	7061		20	1.157
0.85	4440	4892	5388	6120	6922	7879		40	1.196
0.90	4858	5400	6192	7184	8233				
MIL	9871	9229	8965	8694	8434	7974			
MMAX	1.0397	0.9823	0.9591	0.9318	0.9036	0.8559			

40,000 FEET (−57°C)

MACH	0	20	40	60	80	100	120	°C	FACTOR
0.70	6575							−40	1.037
0.75	5288	5725	6209					−20	1.080
0.80	4835	5289	5771					0	1.122
0.85	4654	5108	5646					20	1.162
0.90	4829	5341	6184					40	1.202
MIL	7290	7064	6764						
MMAX	0.9887	0.9570	0.9150						

F4E–T4018

Figure B4-11

F-4E

HIGH ALTITUDE CRUISE

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 45,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 JULY 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS °C	FACTOR
		TOTAL FUEL FLOW-LB/HR								
20,000 FEET (−25°C)	0.65	4833	5360	5890	6431	6977	7578	8220	−40	.968
	0.70	5156	5781	6404	7024	7743	8501	9342	−20	1.008
	0.75	5566	6288	6991	7789	8666	9623	10746	0	1.048
	0.80	6133	6954	7799	8791	9875	11160	12493	20	1.085
	0.85	6903	7837	8836	10181	11603	13293		40	1.122
	0.90	7992	9078	10608	12385	14480				
	MIL	17248	16823	16584	16393	16125	15868	15435		
	MMAX	1.0301	0.9859	0.9656	0.9492	0.9201	0.8939	0.8571		
25,000 FEET (−35°C)	0.65	4694	5116	5544	5969	6402	6863	7367	−40	.988
	0.70	4754	5249	5751	6263	6779	7353	7988	−20	1.029
	0.75	4990	5567	6138	6725	7401	8119	8944	0	1.069
	0.80	5366	6014	6651	7432	8246	9174	10347	20	1.108
	0.85	5886	6621	7383	8405	9485	10788	12303	40	1.145
	0.90	6696	7538	8696	10030	11552				
	MIL	14997	14326	14069	13870	13503	13168	12662		
	MMAX	1.0459	0.9896	0.9678	0.9509	0.9217	0.8950	0.8549		
30,000 FEET (−44°C)	0.65	5055	5393	5748	6123	6545	7030	7492	−40	1.009
	0.70	4813	5193	5585	6020	6484	7023	7622	−20	1.051
	0.75	4797	5235	5682	6181	6733	7394	8178	0	1.092
	0.80	4920	5426	5927	6529	7246	8126	9044	20	1.131
	0.85	5234	5805	6404	7253	8194	9191		40	1.170
	0.90	5809	6463	7413	8509	9632				
	MIL	12410	11661	11392	11133	10802	10372	9780		
	MMAX	1.0451	0.9862	0.9634	0.9411	0.9118	0.8748	0.8214		
35,000 FEET (−55°C)	0.65	7094	7611	8649					−40	1.032
	0.70	5684	6126	6552	7049	7645			−20	1.074
	0.75	5154	5577	6050	6566	7202			0	1.116
	0.80	4992	5427	5929	6558	7333			20	1.157
	0.85	5013	5499	6071	6883	7805			40	1.196
	0.90	5339	5913	6780	7831					
	MIL	9575	9117	8855	8532	8052				
	MMAX	1.0131	0.9725	0.9492	0.9143	0.8640				
40,000 FEET (−57°C)	0.80	6492							−40	1.037
	0.85	5851	6481						−20	1.080
	0.90	5862	6541						0	1.122
	MIL	7082	6670						20	1.162
	MMAX	0.9595	0.9018						40	1.202

F4E-T4019

Figure B4-12

F-4E

LOW ALTITUDE CRUISE

GROSS WEIGHT – 60,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	–10°C
		TOTAL FUEL FLOW-LB/HR								
SEA LEVEL (15°C)	360.	7440.	8220.	9023.	9847.	10696.	11551.	12404.		
	420.	8765.	9915.	11076.	12262.	13528.	14827.	16239.	–40	.899
	480.	10672.	12274.	13852.	15581.	17448.	19357.	21497.	–20	.937
	540.	13570.	15670.	17774.	20345.	23365.			0	.973
	600.	18078.	20809.	25305.					20	1.008
	MIL	28441.	28215.	27835.	27477.	26891.	26246.	25633.	40	1.042
	VMAX	645.	632.	612.	594.	567.	539.	513.		
4,000 FEET (7°C)	360.	6914.	7614.	8350.	9102.	9834.	10596.	11380.		
	420.	7986.	9010.	10046.	11105.	12189.	13389.	14707.	–40	.913
	480.	9634.	11037.	12421.	13980.	15765.	17686.	19664.	–20	.949
	540.	12180.	13963.	15854.	18597.	21408.			0	.987
	600.	16418.	19304.	14306.					20	1.022
	MIL	26076.	25749.	25371.	24918.	24369.	23834.	23317.	40	1.057
	VMAX	641.	627.	610.	591.	567.	542.	518.		
8,000 FEET (-1°C)	360.	6577.	7199.	7874.	8512.	9177.	9865.	10566.		
	420.	7335.	8247.	9162.	10081.	11067.	12022.	13163.	–40	.925
	480.	8717.	9921.	11145.	12434.	13970.	15778.	17812.	–20	.963
	540.	10910.	12453.	14146.	16332.	19483.			0	1.001
	600.	15113.	17868.	22752.					20	1.037
	MIL	23583.	23198.	22887.	22432.	22025.	21612.	21166.	40	1.072
	VMAX	636.	621.	609.	588.	568.	546.	521.		
12,000 FEET (-9°C)	360.	6423.	6973.	7578.	8142.	8745.	9337.	9955.		
	420.	6831.	7611.	8425.	9248.	10118.	11002.	11885.	–40	.939
	480.	7899.	8976.	10051.	11226.	12422.	13889.	15683.	–20	.978
	540.	9829.	11183.	12601.	14527.	16841.			0	1.016
	600.	13971.	16506.						20	1.052
	MIL	21132.	20781.	20525.	20194.	19921.	19542.	19184.	40	1.088
	VMAX	630.	615.	604.	585.	569.	545.	521.		
16,000 FEET (-16°C)	360.	6532.	7030.	7560.	8081.	8615.	9165.	9782.		
	420.	6490.	7165.	7889.	8622.	9395.	10208.	11080.	–40	.953
	480.	7299.	8234.	9176.	10219.	11339.	12547.	14009.	–20	.993
	540.	8926.	10117.	11511.	13210.	15040.			0	1.032
	600.	13830.	16568.						20	1.068
	MIL	18872.	18602.	18411.	18189.	17976.	17643.	17251.	40	1.105
	VMAX	624.	608.	596.	581.	565.	543.	520.		

F4E–T4007

Figure B4-9

F-4E

HIGH ALTITUDE CRUISE

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 35,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 JULY 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

Altitude	MACH	TOTAL FUEL FLOW-LB/HR, DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS °C	FACTOR
20,000 FEET (–25°C)	0.65	4235	4739	5265	5796	6359	6905	7536	–40	.968
	0.70	4602	5211	5839	6478	7147	7865	8680	–20	1.008
	0.75	5106	5823	6548	7305	8154	9086	10146	0	1.048
	0.80	5736	6562	7367	8357	9423	10690	11982	20	1.085
	0.85	6561	7475	8471	9807	11225	12800	14889	40	1.122
	0.90	7631	8720	10243	11961	14015				
	MIL	17325	16866	16619	16426	16172	15952	15527		
	MMAX	1.0390	0.9895	0.9686	0.9522	0.9252	0.9014	0.8650		
25,000 FEET (–35°C)	0.65	3761	4161	4580	5007	5460	5904	6359	–40	.988
	0.70	4017	4500	4992	5512	6055	6577	7187	–20	1.029
	0.75	4340	4914	5484	6100	6726	7430	8191	0	1.069
	0.80	4810	5469	6124	6859	7671	8568	9588	20	1.108
	0.85	5417	6152	6903	7908	8941	10154	11613	40	1.145
	0.90	6268	7094	8247	9557	10991	12818			
	MIL	15173	14390	14128	13925	13618	13296	12843		
	MMAX	1.0606	0.9950	0.9728	0.9555	0.9308	0.9052	0.8693		
30,000 FEET (–44°C)	0.65	3585	3910	4238	4568	4912	5265	5646	–40	1.009
	0.70	3659	4038	4424	4816	5236	5670	6165	–20	1.051
	0.75	3859	4306	4744	5211	5723	6274	6903	0	1.092
	0.80	4161	4668	5170	5760	6382	7121	8009	20	1.131
	0.85	4564	5135	5733	6504	7349	8358	9451	40	1.170
	0.90	5210	5872	6749	7784	8898	10049			
	MIL	12768	11768	11498	11289	10987	10694	10231		
	MMAX	1.0725	0.9953	0.9723	0.9546	0.9281	0.9023	0.8628		
35,000 FEET (–55°C)	0.65	3826	4090	4367	4655	4984	5339	5742	–40	1.032
	0.70	3676	3968	4275	4600	4979	5392	5873	–20	1.074
	0.75	3682	4017	4363	4752	5195	5708	6306	0	1.116
	0.80	3793	4171	4561	5042	5597	6272	7059	20	1.157
	0.85	4026	4461	4937	5593	6327	7222		40	1.196
	0.90	4474	4983	5732	6611	7661				
	MIL	10108	9318	9052	8841	8556	8242	7761		
	MMAX	1.0610	0.9902	0.9668	0.9477	0.9169	0.8837	0.8331		
40,000 FEET (–57°C)	0.65	5373	5735	6106	6584				–40	1.037
	0.70	4351	4682	5052	5471	5895			–20	1.080
	0.75	3990	4301	4655	5085	5588			0	1.122
	0.80	3880	4213	4578	5083	5666			20	1.162
	0.85	3909	4278	4706	5344	6079			40	1.202
	0.90	4160	4602	5258	6132					
	MIL	7540	7181	7012	6748	6388				
	MMAX	1.0178	0.9734	0.9497	0.9128	0.8624				

F4E–T4017

Figure B4-10

F-4E

HIGH ALTITUDE CRUISE

GROSS WEIGHT – 50,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 JULY 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TOTAL FUEL FLOW-LB/HR							TEMP. EFFECTS	
	DRAG INDEX	0	20	40	60	80	100	120	°C	FACTOR
20,000 FEET (–25°C)	0.65	5290	5819	6356	6875	7481	8075	8748		
	0.70	5508	6137	6748	7404	8118	8890	9787	–40	.968
	0.75	5845	6570	7273	8070	8958	9955	11086	–20	1.008
	0.80	6414	7218	8061	9067	10196	11466	12877	0	1.048
	0.85	7103	8048	9047	10417	11848	13591		20	1.085
	0.90	8207	9293	10860	12677	14800			40	1.122
	MIL	17203	16800	16564	16361	16095	15802	15377		
	MMAX	1.0248	0.9839	0.9639	0.9456	0.9169	0.8884	0.8523		
25,000 FEET (–35°C)	0.65	5358	5788	6208	6619	7112	7580			
	0.70	5243	5744	6243	6722	7297	7879		–40	.988
	0.75	5416	5994	6547	7161	7831	8598		–20	1.029
	0.80	5745	6392	7016	7797	8648	9645	10884	0	1.069
	0.85	6190	6903	7693	8724	9850	11169		20	1.108
	0.90	6960	7821	8995	10375	11966			40	1.145
	MIL	14894	14286	14032	13799	13431	13036	12494		
	MMAX	1.0373	0.9862	0.9646	0.9452	0.9159	0.8846	0.8416		
30,000 FEET (–44°C)	0.65	6187	6597	7065	7479	7957	8474			
	0.70	5612	6038	6458	6953	7511	8138	8814	–40	1.009
	0.75	5462	5916	6383	6934	7579	8364		–20	1.051
	0.80	5477	5979	6490	7172	7978	8873		0	1.092
	0.85	5665	6242	6855	7761	8733	9749		20	1.131
	0.90	6213	6874	7866	8984	10094			40	1.170
	MIL	12203	11586	11320	10995	10684	10118	8961		
	MMAX	1.0292	0.9798	0.9572	0.9288	0.9014	0.8532	0.7380		
35,000 FEET (–55°C)	0.65									
	0.70	7690	8143						–40	1.032
	0.75	6423	6950	7559					–20	1.074
	0.80	5954	6486	7091	7876				0	1.116
	0.85	5775	6336	6999	7940				20	1.157
	0.90	6029	6673	7672					40	1.196
	MIL	9329	8980	8627	7999					
	MMAX	0.9911	0.9604	0.9245	0.8585					

F4E-T4020

Figure B4-13

F-4E
HIGH ALTITUDE CRUISE

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 55,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 JULY 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS °C	FACTOR
		TOTAL FUEL FLOW-LB/HR								
20,000 FEET (−25°C)	0.65	5820.	6357.	6876.	7456.	8045.	8688.	9413.		
	0.70	5921.	6551.	7155.	7824.	8587.	9384.	10306.	−40	.968
	0.75	6234.	6942.	7692.	8490.	9393.	10436.	11529.	−20	1.008
	0.80	6717.	7529.	8367.	9388.	10570.	11819.	13323.	0	1.048
	0.85	7359.	8306.	9320.	10737.	12179.	13975.		20	1.085
	0.90	8415.	9518.	11118.	12983.	15134.			40	1.122
	MIL	17156.	16772.	16536.	16313.	16061.	15731.	15274.		
	MMAX	1.0193	0.9816	0.9615	0.9405	0.9132	0.8823	0.8437		
25,000 FEET (−35°C)	0.65	6200.	6610.	7078.	7524.	8050.	8609.	9276.		
	0.70	5961.	6439.	6929.	7462.	8072.	8740.	9559.	−40	.988
	0.75	5976.	6532.	7098.	7728.	8455.	9284.	10295.	−20	1.029
	0.80	6160.	6785.	7459.	8243.	9113.	10221.	11411.	0	1.069
	0.85	6563.	7280.	8063.	9131.	10332.	11670.		20	1.108
	0.90	7303.	8159.	9382.	10809.	12504.			40	1.145
	MIL	14774.	14241.	13987.	13697.	13345.	12871.	12216.		
	MMAX	1.0272	0.9824	0.9608	0.9371	0.9091	0.8715	0.8195		
30,000 FEET (−44°C)	0.65	7961.	8454.	8949.	9505.					
	0.70	6736.	7242.	7766.	8389.	9000.			−40	1.009
	0.75	6257.	6748.	7302.	7948.	8680.			−20	1.051
	0.80	6130.	6646.	7240.	8025.	8866.			0	1.092
	0.85	6230.	6811.	7504.	8498.	9480.			20	1.131
	0.90	6666.	7392.	8435.	9559.				40	1.170
	MIL	11949.	11497.	11235.	10842.	10325.				
	MMAX	1.0096	0.9723	0.9500	0.9154	0.8709				
35,000 FEET (−55°C)	0.65									
	0.70								−40	1.032
	0.75	8441.							−20	1.074
	0.80	7379.	8044.						0	1.116
	0.85	6817.	7525.						20	1.157
	0.90	6947.	7695.						40	1.196
	MIL	9106.	8707.							
	MMAX	0.9715	0.9333							

F4E-T4021

Figure B4-14

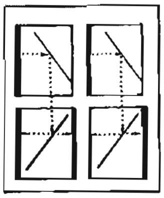
F-4E

CONSTANT MACH/ALTITUDE CRUISE

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE



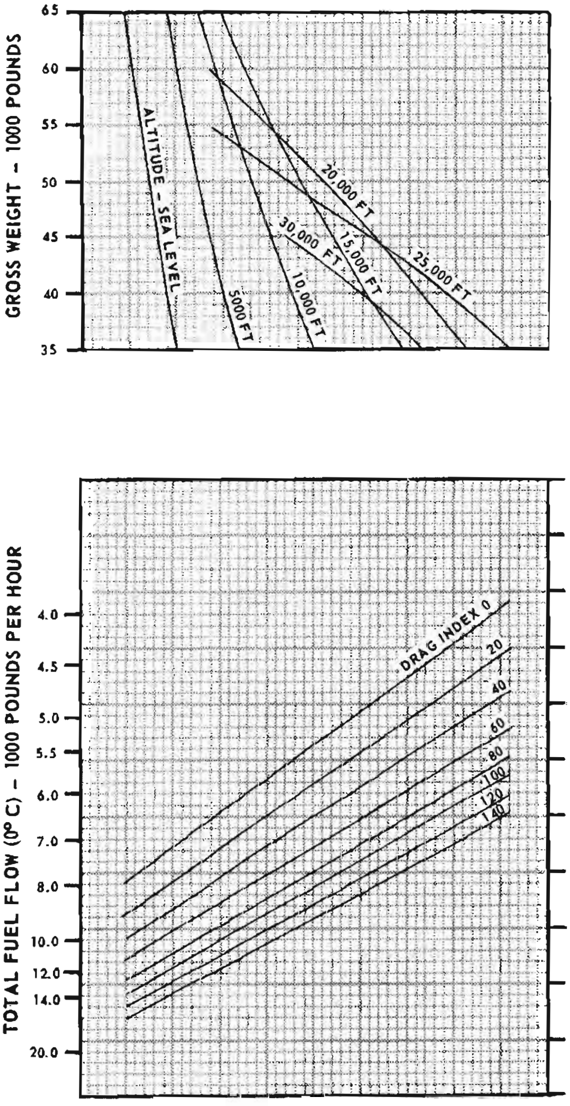
DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

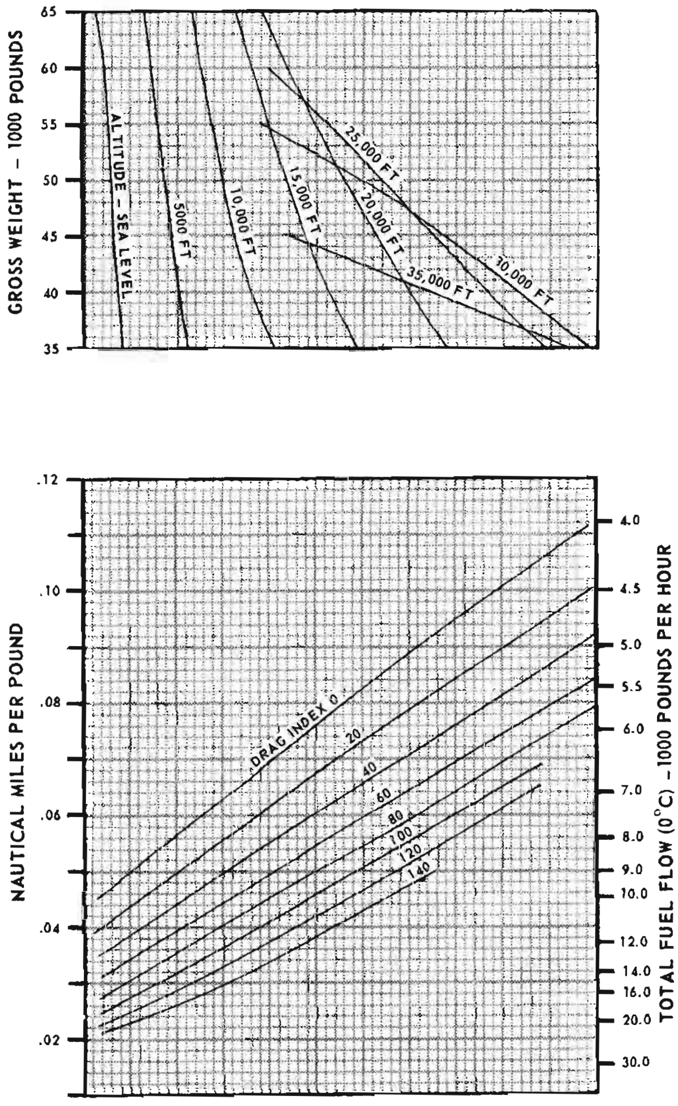
ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07

0.60 MACH CRUISE



0.70 MACH CRUISE



F4E-P492

Figure B4-15

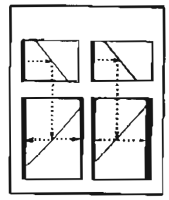
F-4E

CONSTANT MACH/ALTITUDE CRUISE

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE



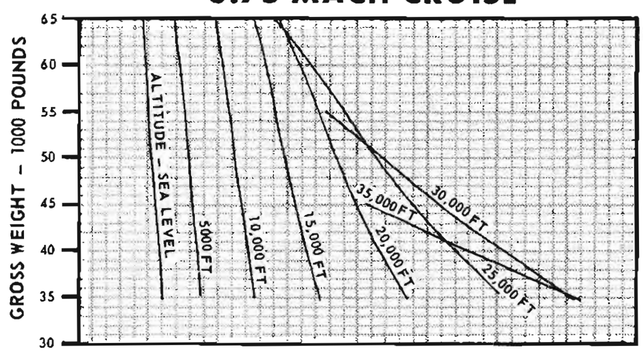
DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

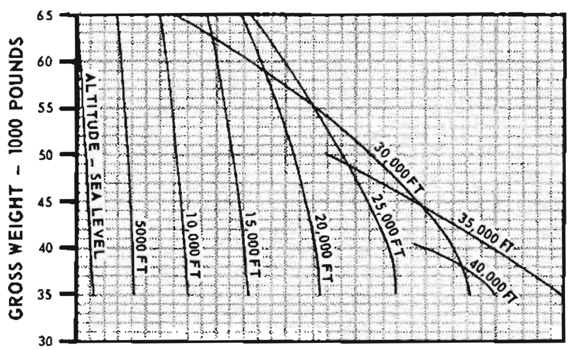
ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5

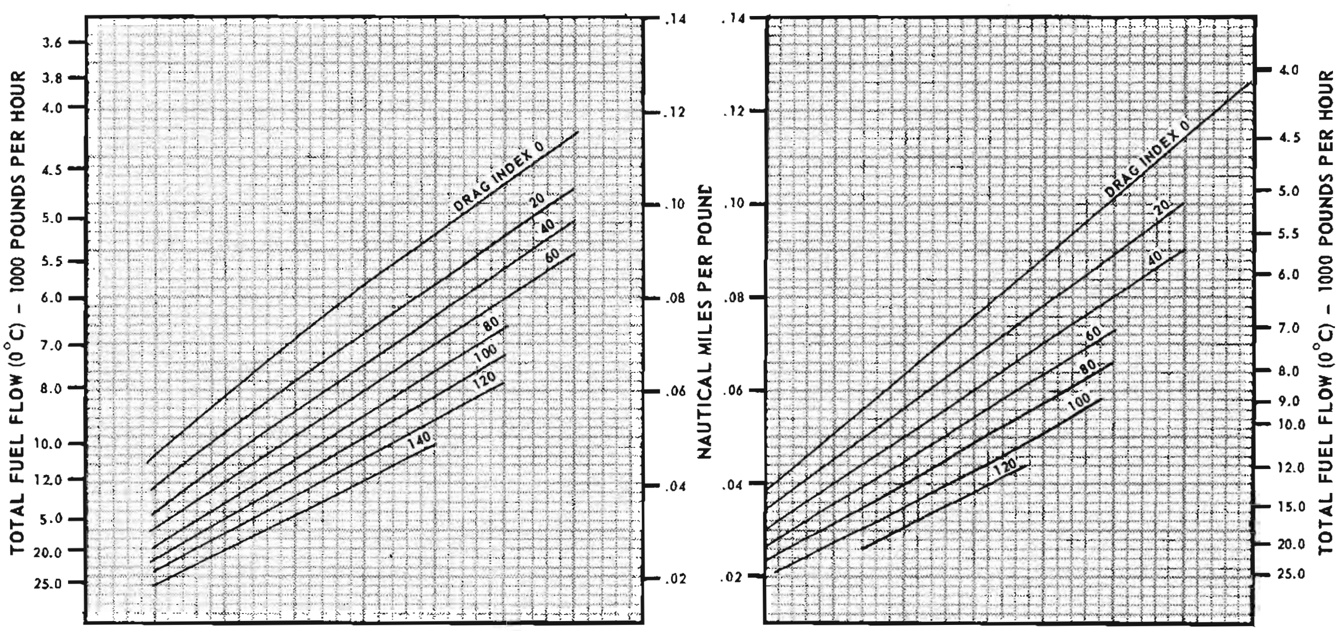
FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07

0.75 MACH CRUISE



0.80 MACH CRUISE





F4E–P493

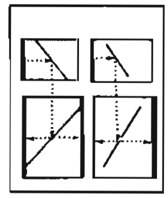
Figure B4-16

CONSTANT MACH/ALTITUDE CRUISE

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE



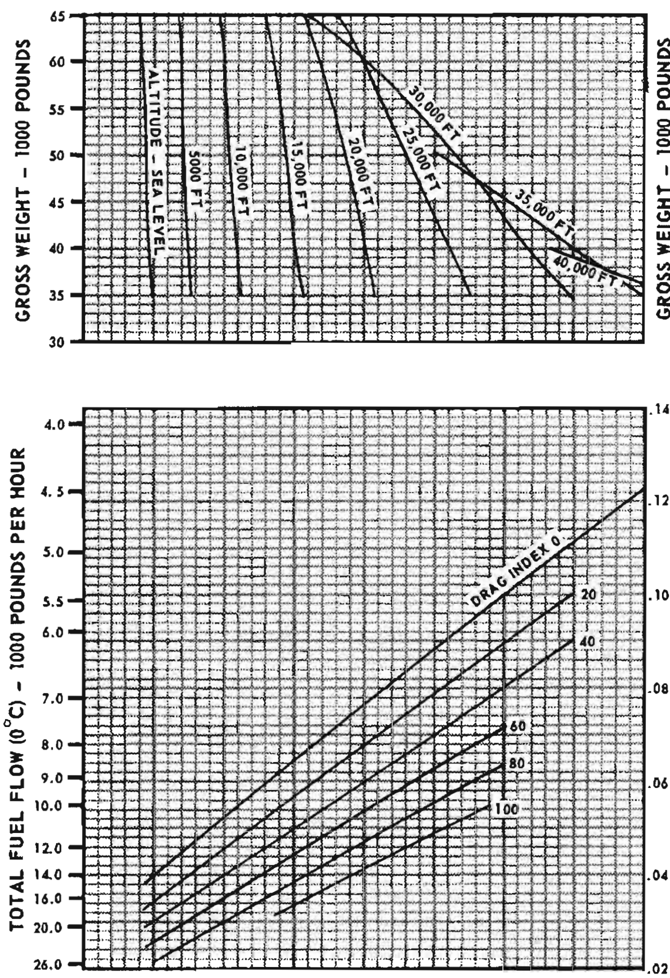
DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

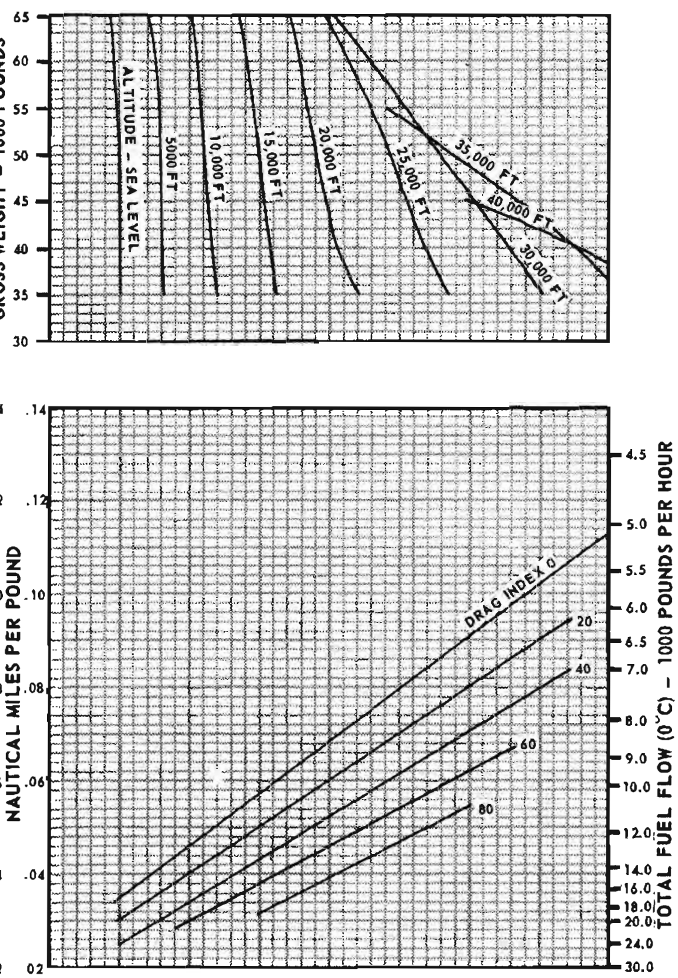
ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07

0.85 MACH CRUISE



0.90 MACH CRUISE



F4E-P494

Figure B4-17

F-4E

CONSTANT MACH/ALTITUDE CRUISE

ONE ENGINE OPERATING

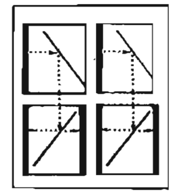
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

DATE: 1 AUGUST 1968
DATA BASIS: FLIGHT TEST

NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING, INCREASE DRAG BY 3.

GUIDE

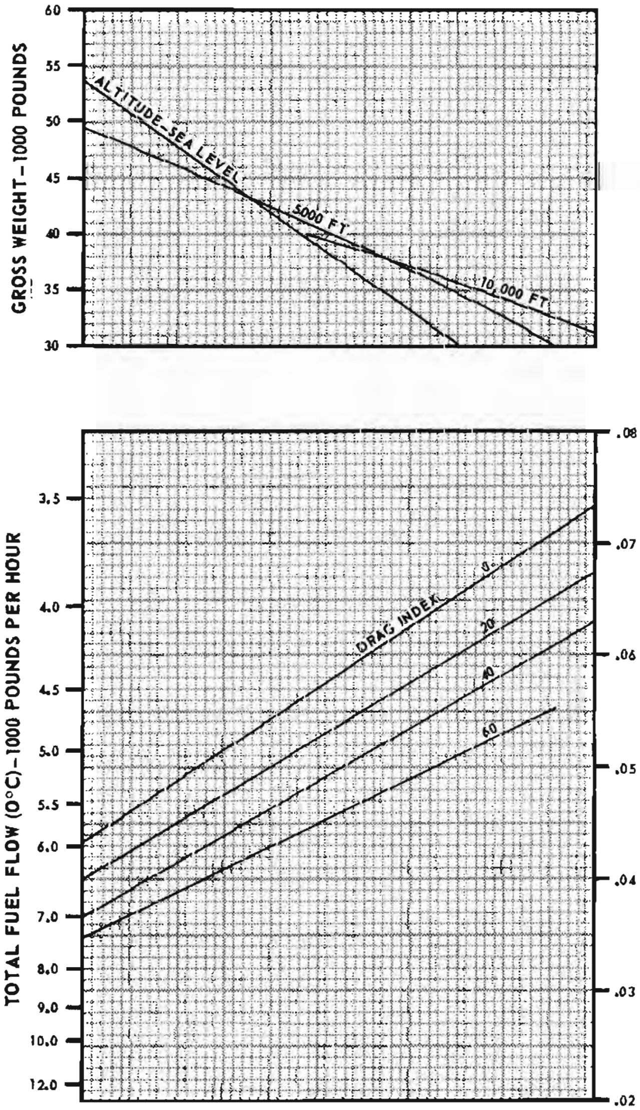


FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

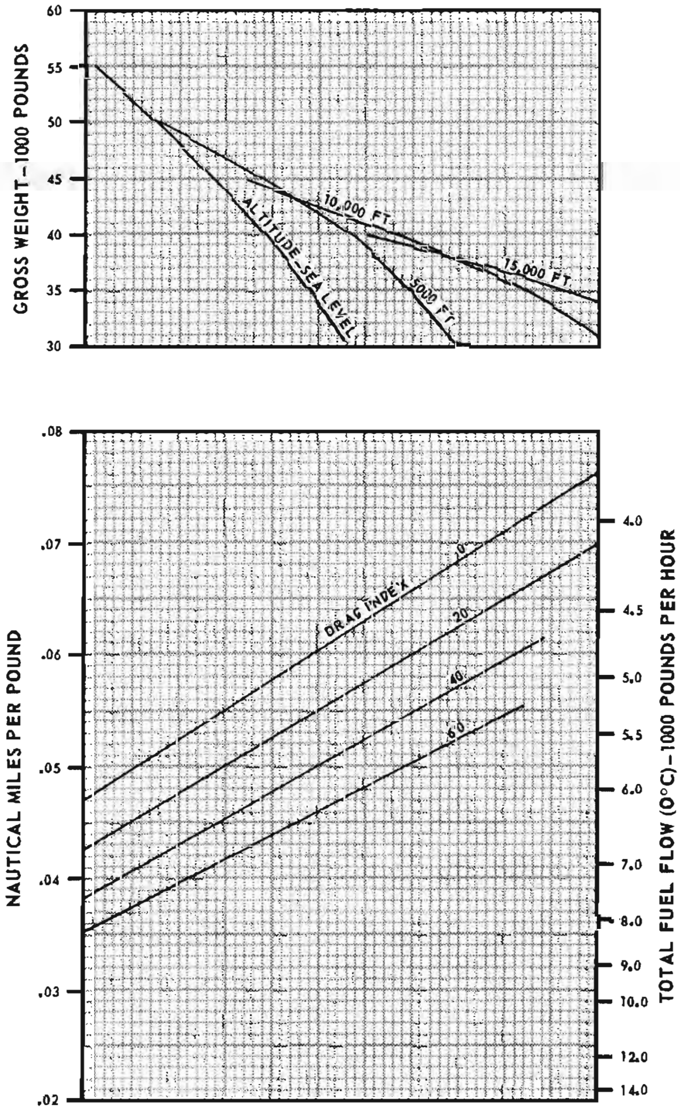
ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07

0.4 MACH CRUISE



0.45 MACH CRUISE



F4E-P497

Figure B4-18

F-4E

CONSTANT MACH/ALTITUDE CRUISE

ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

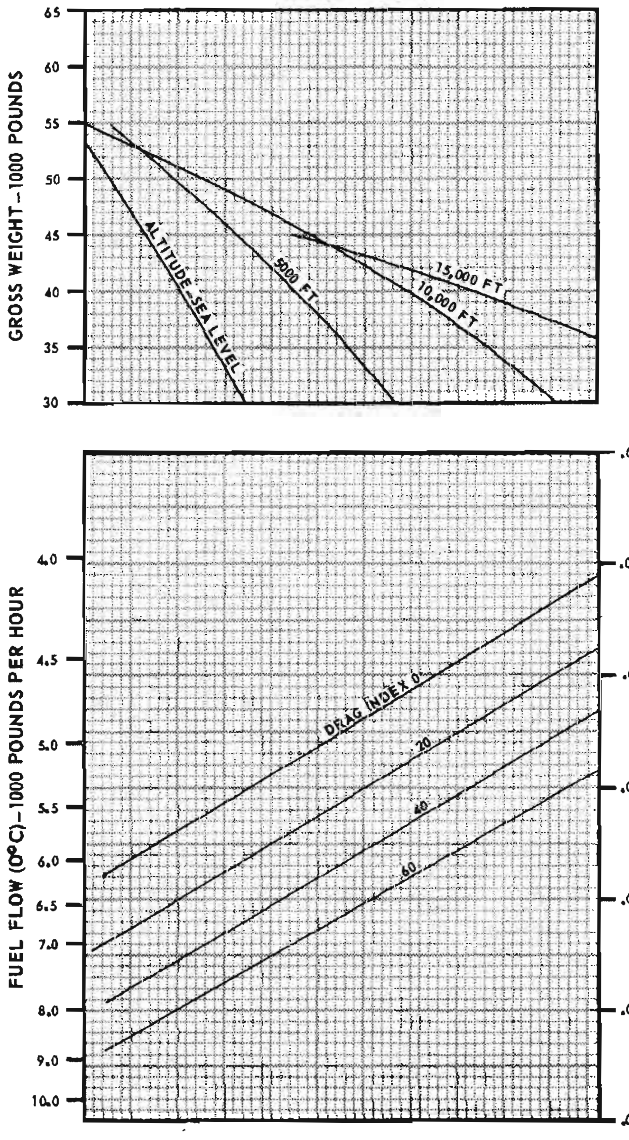
NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING DRAG WILL INCREASE BY A FACTOR OF 3.

GUIDE

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07



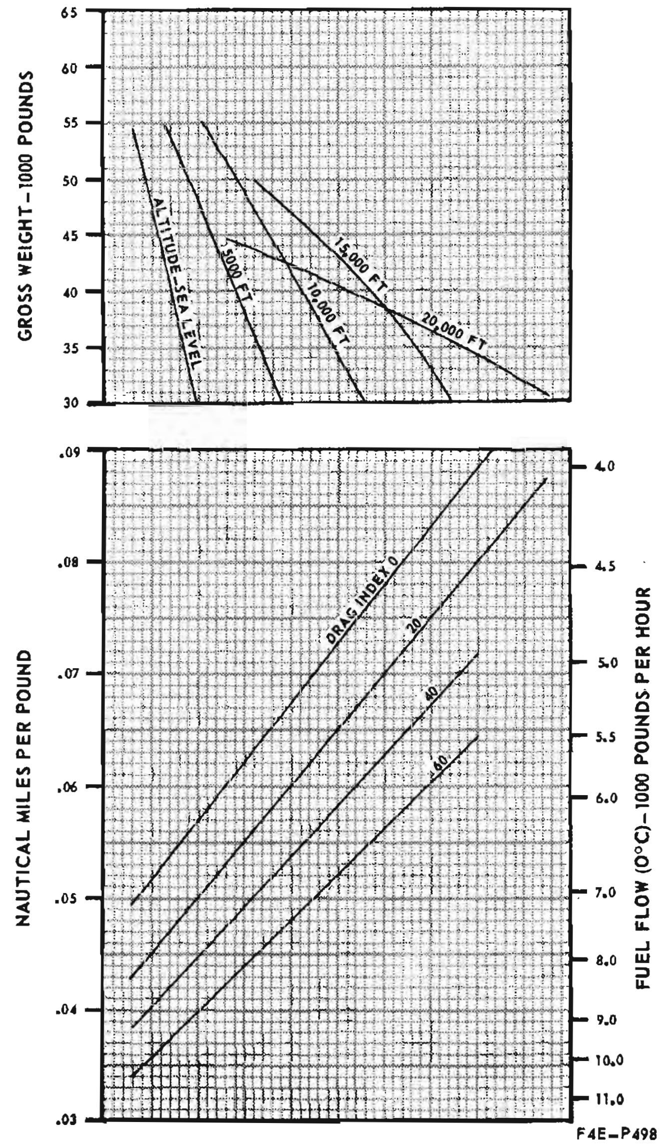


Figure B4-19

F-4E

CONSTANT MACH/ALTITUDE CRUISE

ONE ENGINE OPERATING

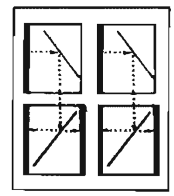
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING DRAG WILL INCREASE BY A FACTOR OF 3

GUIDE

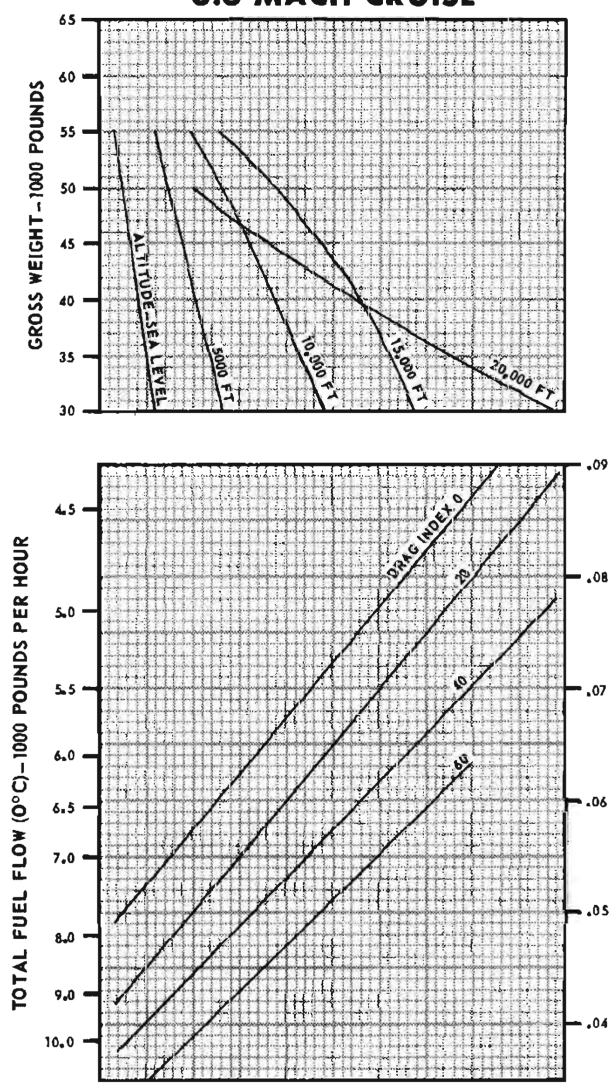


FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

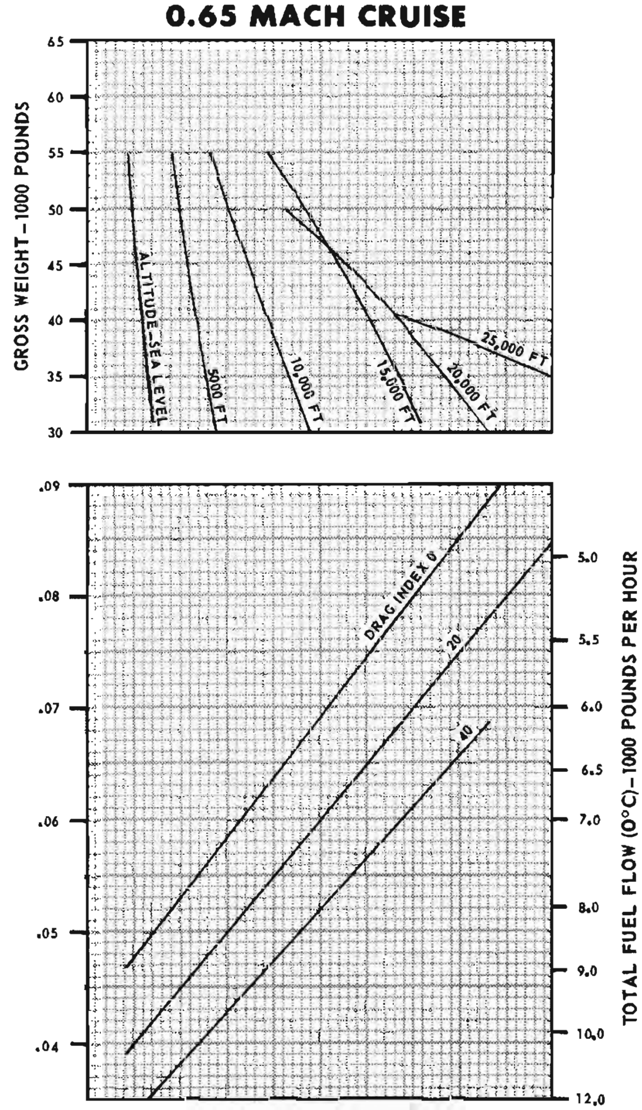
ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07

0.6 MACH CRUISE



0.65 MACH CRUISE



F4E-P499

Figure B4-20

F-4E

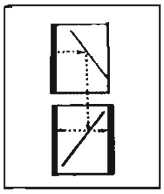
CONSTANT MACH/ALTITUDE CRUISE

ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

NOTE

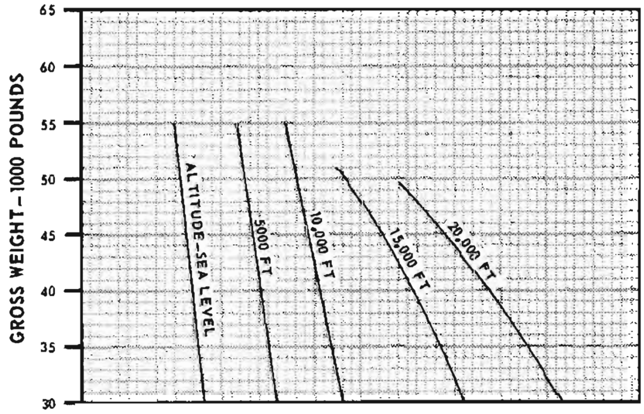
IF INOPERATIVE ENGINE IS NOT WINDMILLING DRAG WILL INCREASE BY A FACTOR OF 3.

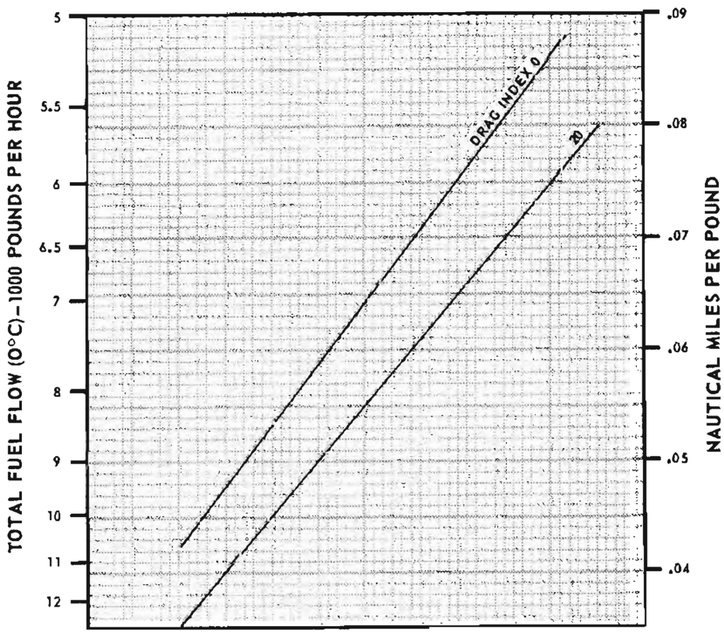
ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

FUEL FLOW CORRECTION FACTORS						
TEMPERATURE °C	-60	-40	-20	0	20	40
FUEL FLOW FACTOR	0.88	0.92	0.96	1.00	1.04	1.07

0.7 MACH CRUISE





F4E-P4011

Figure B4-21

F-4E

CONSTANT ALTITUDE CRUISE

LONG RANGE SPEED NAUTICAL MILES PER POUND AND MACH NUMBER

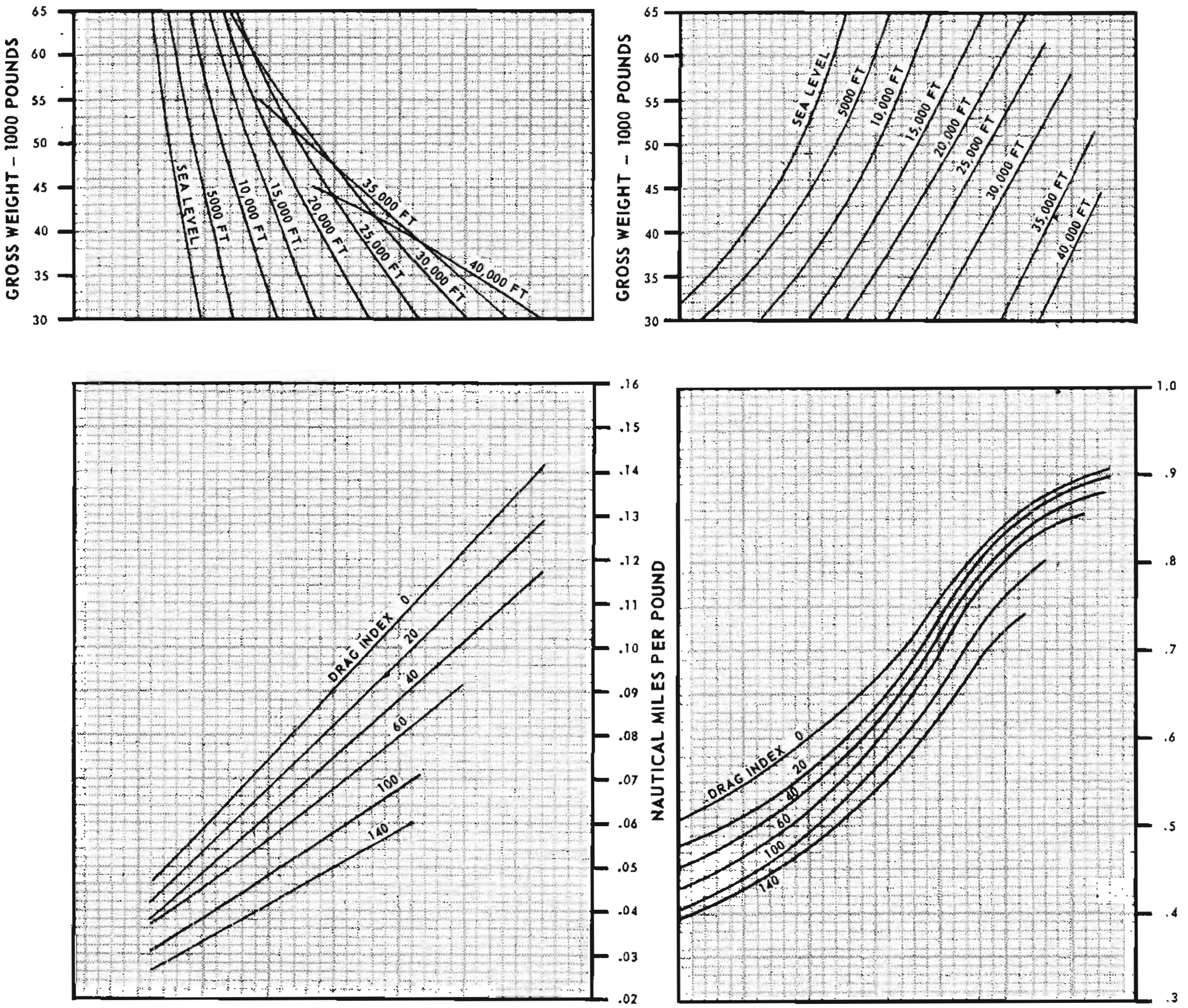
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE

DATE: 1 APRIL 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P402-1

Figure B4-22 (Sheet 1)

F-4E

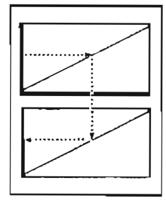
CONSTANT ALTITUDE CRUISE

LONG RANGE SPEED
TRUE AIRSPEED AND FUEL FLOW

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

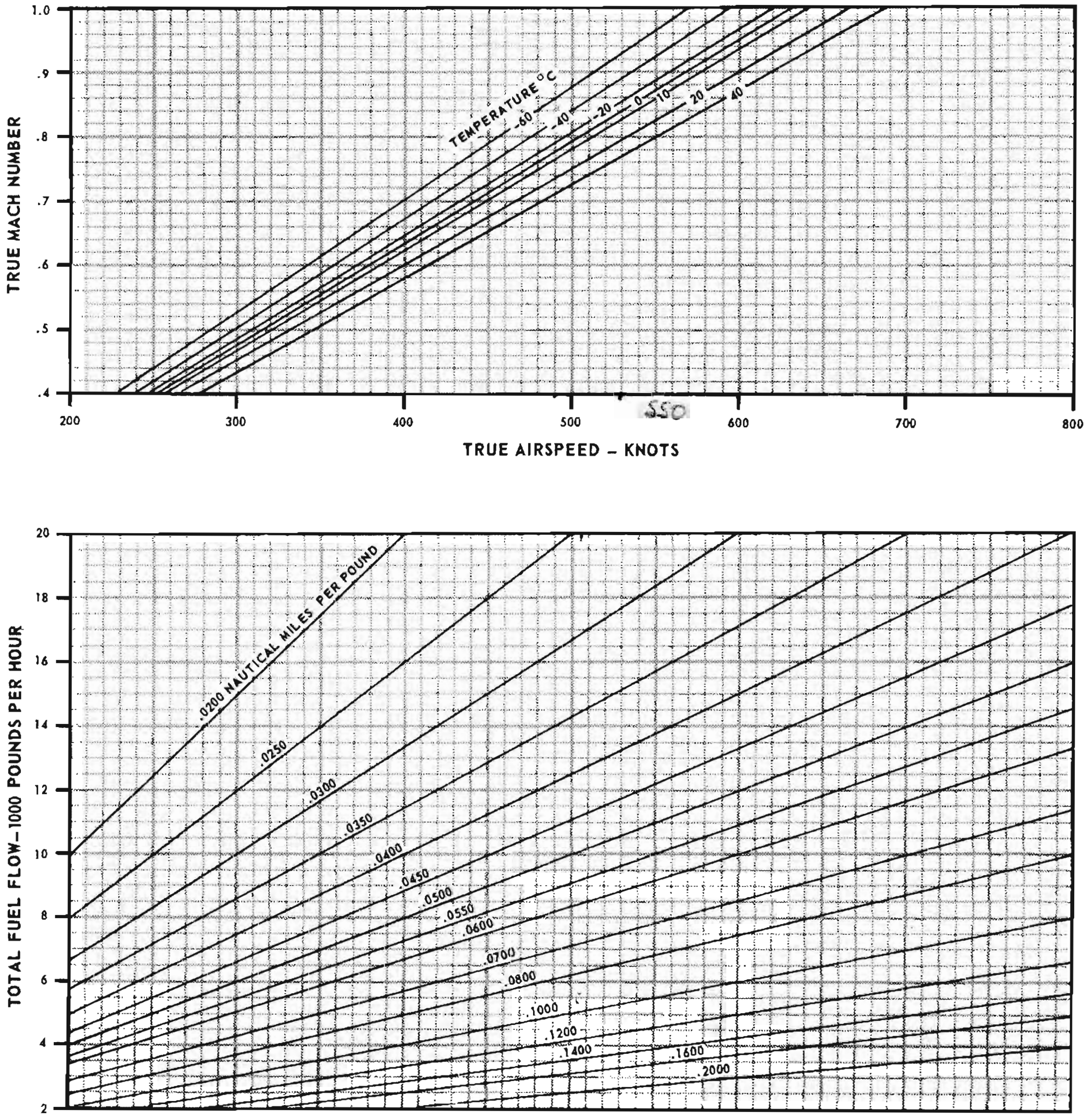
REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E–P402–2

Figure B4-22 (Sheet 2)

F-4E

CONSTANT ALTITUDE CRUISE

LONG RANGE SPEED
NAUTICAL MILES PER POUND
AND MACH NUMBER
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

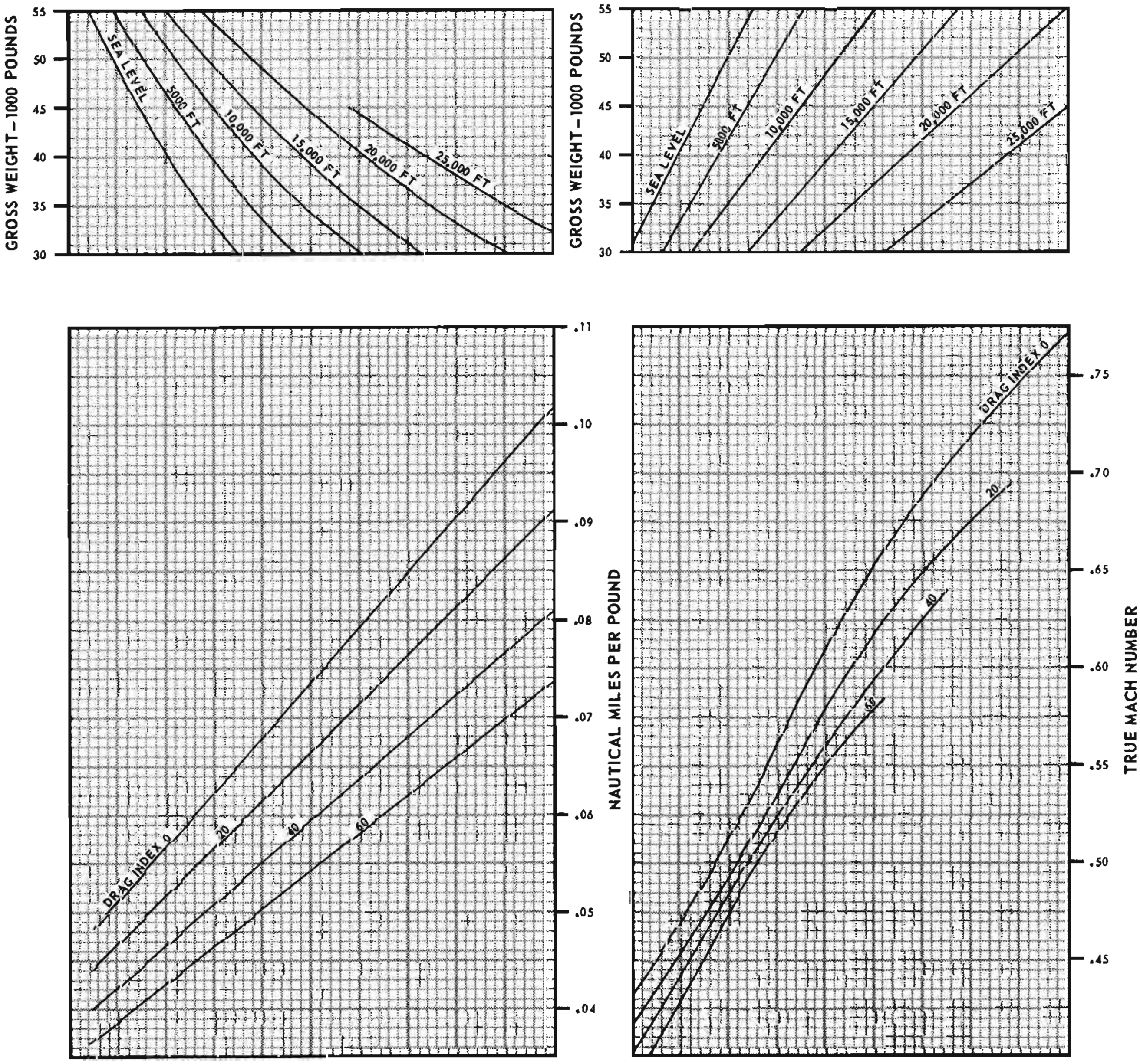
REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING, INCREASE DRAG BY 3

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P490-1

Figure B4-23 (Sheet 1)

F-4E

CONSTANT ALTITUDE CRUISE

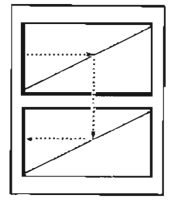
LONG RANGE SPEED
TRUE AIRSPEED AND FUEL FLOW
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

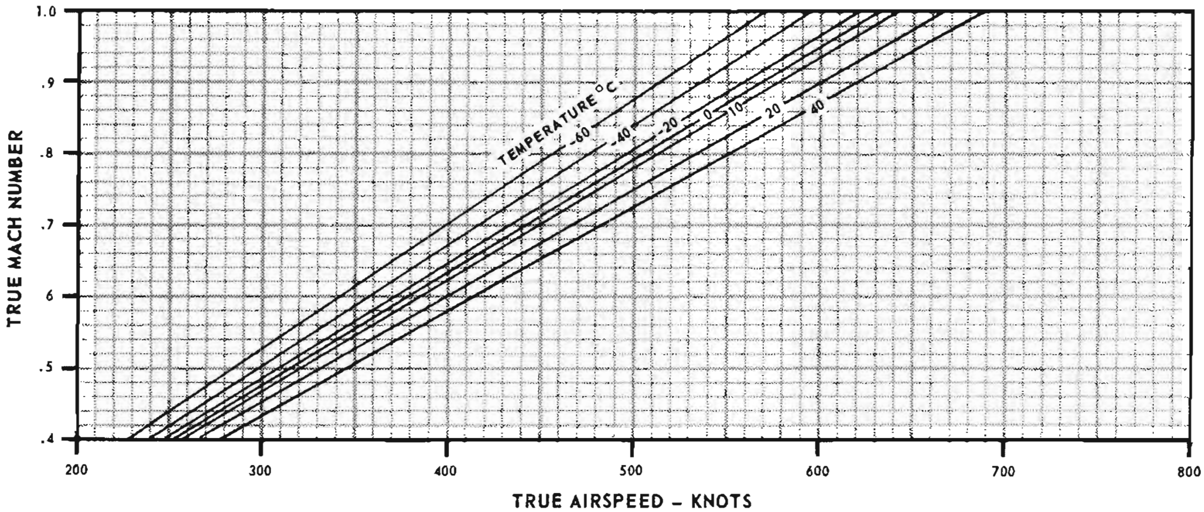
NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING, INCREASE DRAG BY 3.

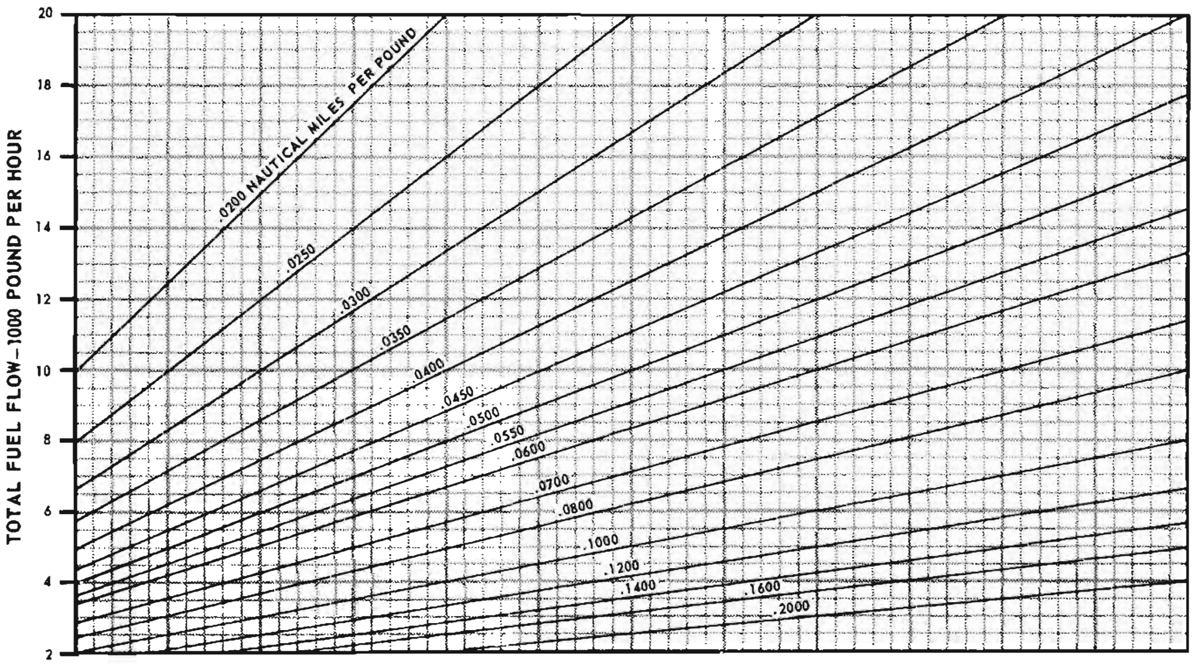
GUIDE



DATE: 15 AUGUST 1968
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P490-2

Figure B4-23 (Sheet 2)

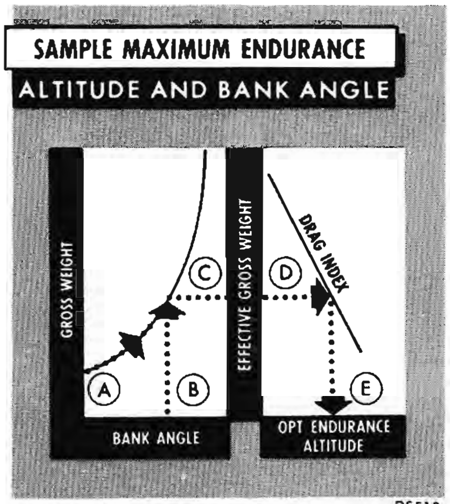
PART 5 ENDURANCE

MAXIMUM ENDURANCE CHARTS

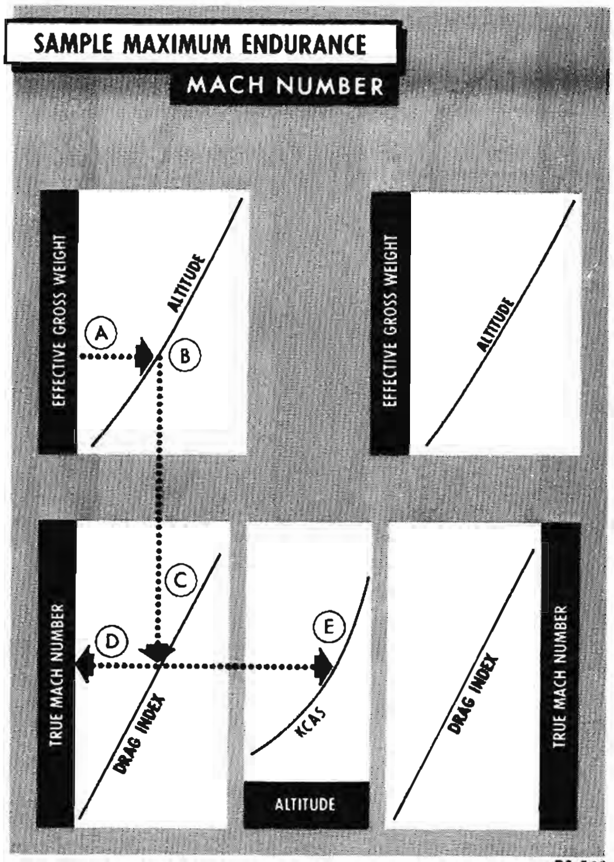
These charts (figure B5-1 thru B5-5) present optimum endurance altitude and maximum endurance specifics (fuel flow and Mach number) for all combinations of effective gross weight and altitude. Separate charts are included for single-engine operation.

USE

Enter the Altitude and Bank Angle chart with the average gross weight. If bank angles are to be considered, follow the gross weight curve until it intersects the bank angle to be used, then horizontally to the right to obtain effective gross weight. (If bank angles are not to be considered, enter the chart at the effective gross weight scale.) From this point proceed horizontally to the right and intersect the computed drag index. Reflect downward and read the optimum endurance altitude. Enter the Mach number plots with the effective gross weight, and proceed horizontally to intersect the optimum endurance altitude. Then descend downward and intersect the computed drag index and horizontally to read true Mach number. A further plot to read calibrated airspeed is also available. Enter the Fuel Flow plots with the effective gross weight, proceed horizontally to intersect the optimum endurance altitude. Reflect downward to the computed drag index, and then horizontally to read total fuel flow.



PS510



PS 508

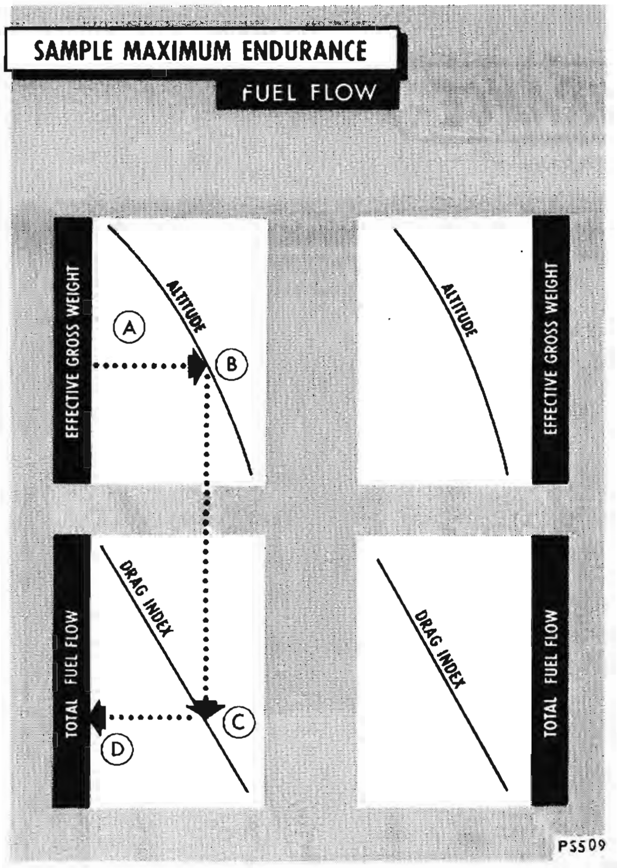
Sample Problem

Altitude and Bank Angle

A.	Gross weight	45,000 Lbs.
B.	Bank angle	20°
C.	Effective gross weight	48,000 Lbs.
D.	Drag index	40
E.	Optimum endurance altitude	21,200 Ft.

Mach Number

A.	Effective gross weight	48,000 Lbs.
B.	Endurance altitude	21,200 Ft.
C.	Drag index	40
D.	Mach number	0.615
E.	Airspeed (CAS)	280 Kts.



Fuel Flow

A.	Effective gross weight	48,000 Lbs.
B.	Endurance altitude	21,200 Ft.
C.	Drag index	40
D.	Fuel flow	6000 PPH

F-4E

MAXIMUM ENDURANCE

ALTITUDE AND BANK ANGLE

AIRPLANE CONFIGURATION

INDIVIDUAL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

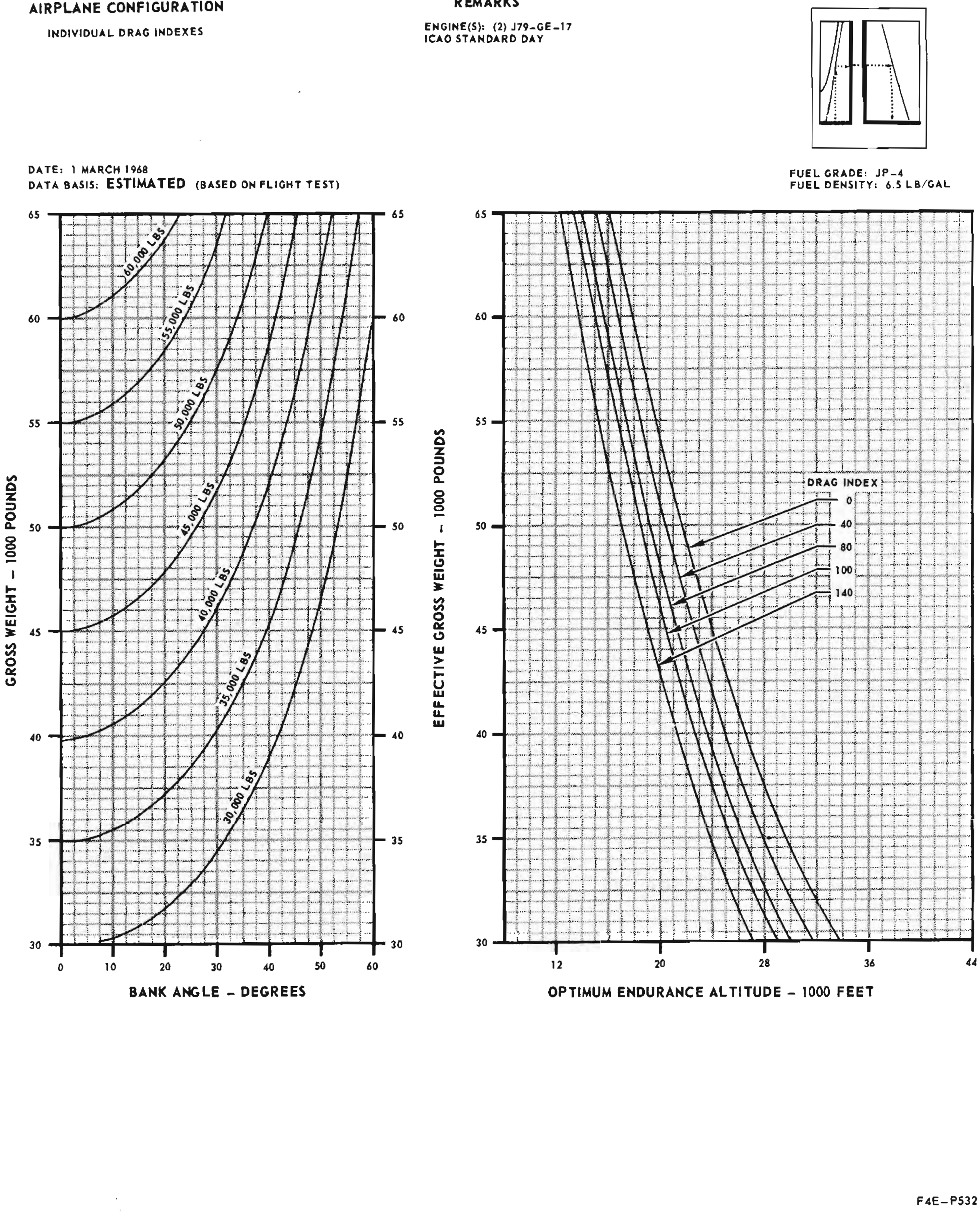


Figure B5-1

F-4E

MAXIMUM ENDURANCE

MACH NUMBER

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

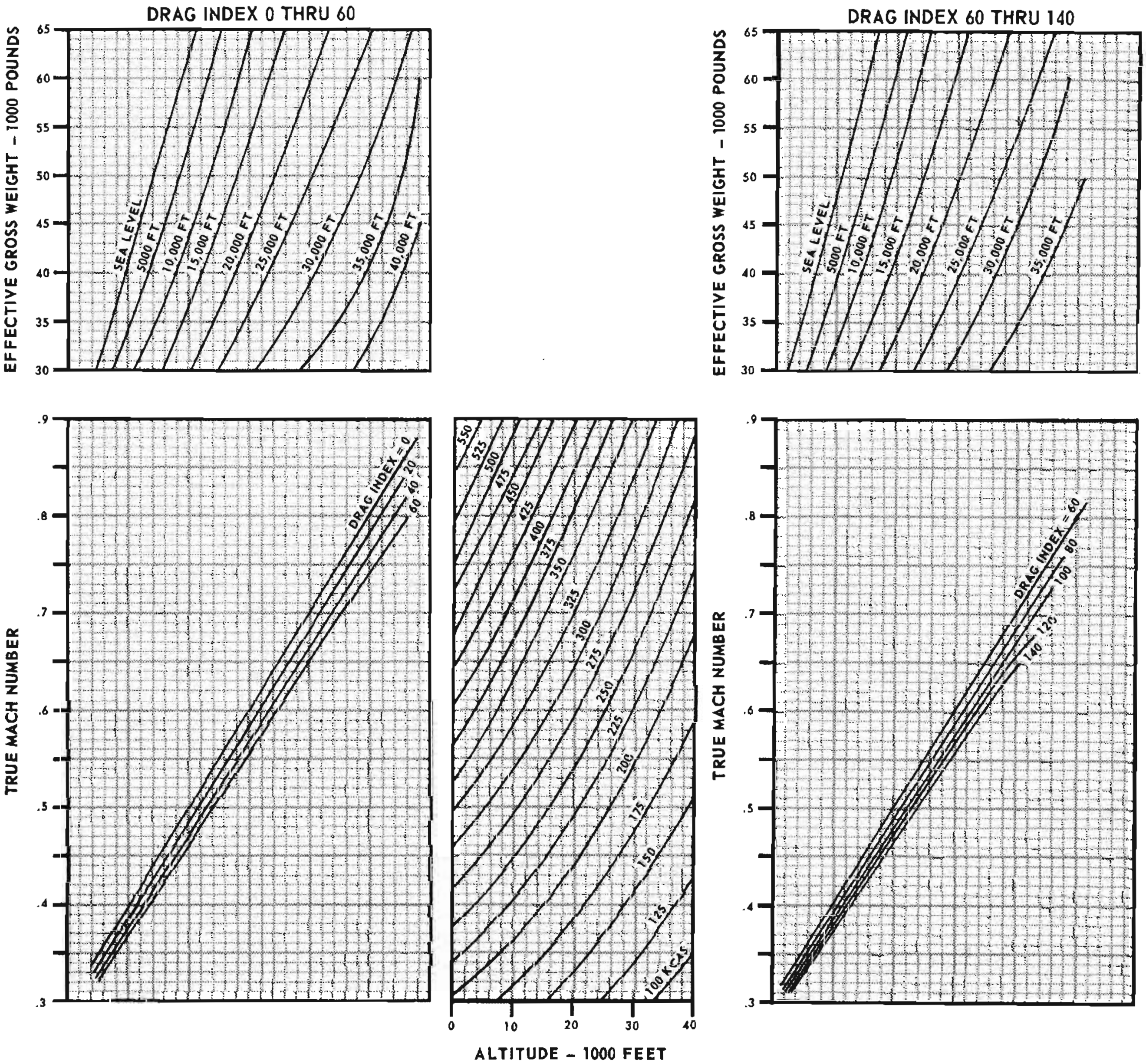


Figure B5-2

MAXIMUM ENDURANCE
FUEL FLOW

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
(0–60)

ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

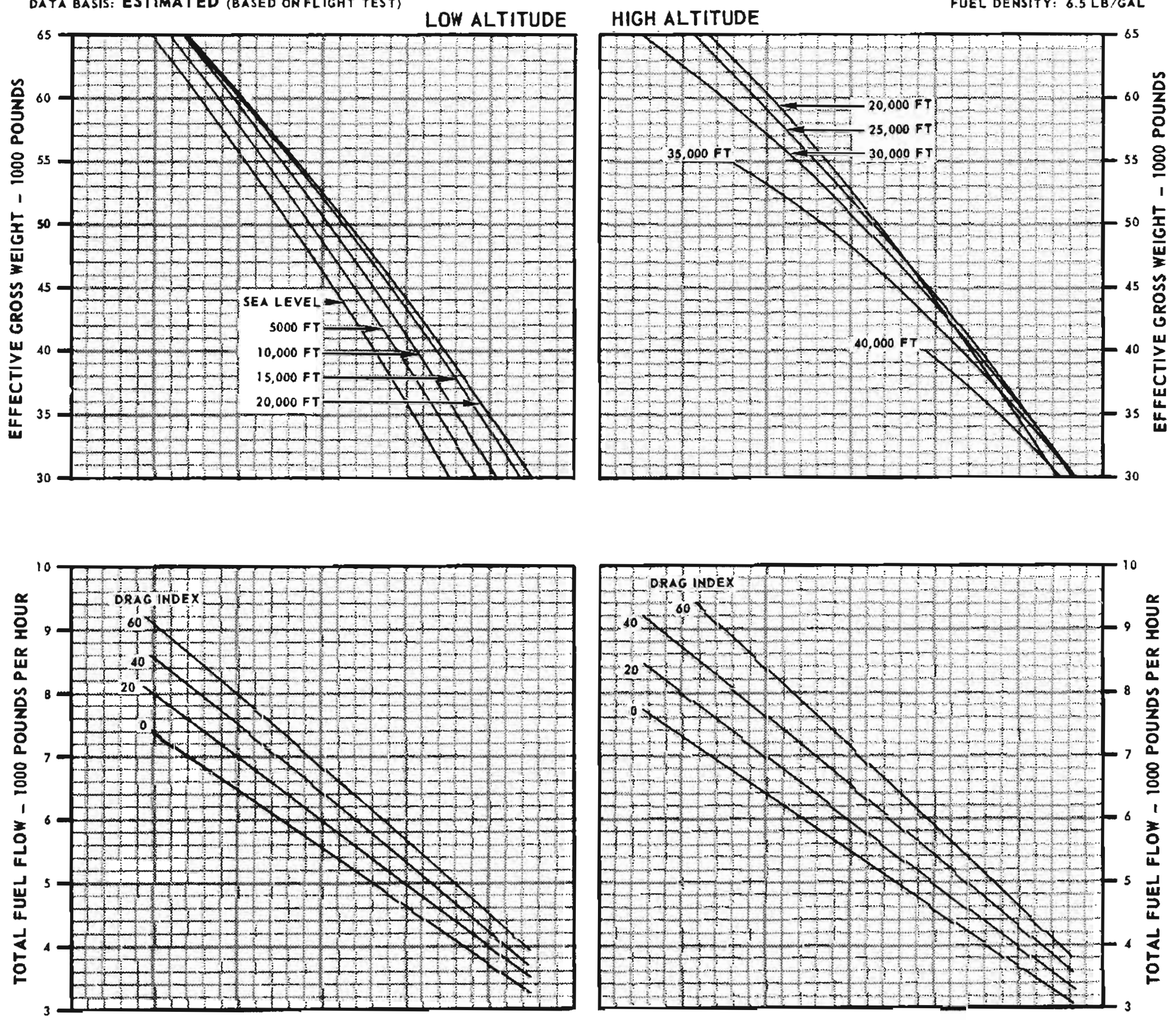
NOTE

TOTAL FUEL FLOW IS DIRECTLY PROPORTIONAL TO TEMPERATURE CHANGE, INCREASING OR DECREASING 2% FOR EACH 10°C INCREMENT FROM STANDARD DAY.

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P521

Figure B5-3

F-4E

MAXIMUM ENDURANCE
FUEL FLOW

AIRPLANE CONFIGURATION

INDIVIDUAL DRAG INDEXES
(60-140)

ICAO STANDARD DAY	
ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

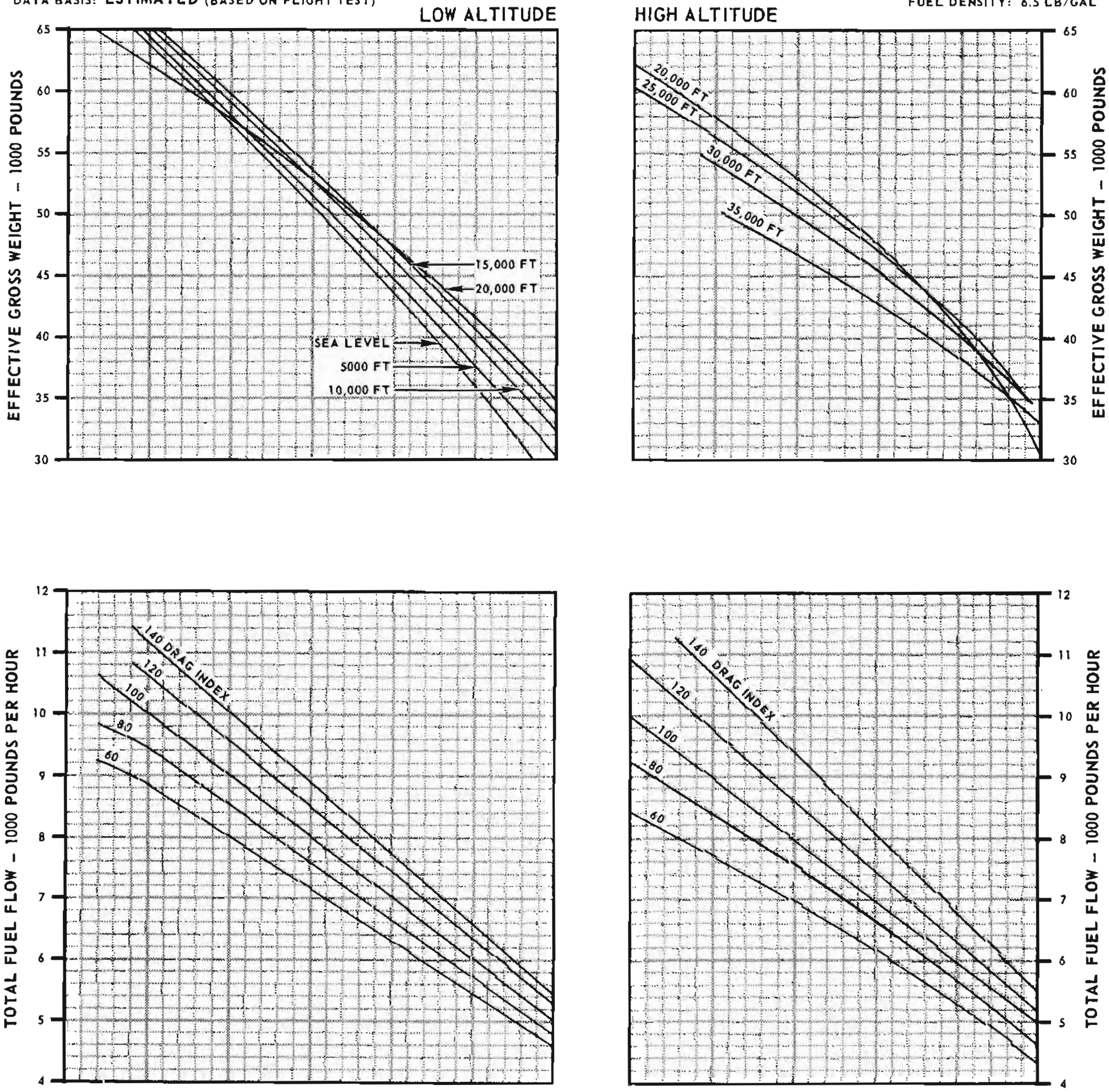
NOTE

TOTAL FUEL FLOW IS DIRECTLY PROPORTIONAL TO TEMPERATURE CHANGE, INCREASING OR DECREASING 2% FOR EACH 10°C INCREMENT FROM STANDARD DAY.

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P522

Figure B5-4

[redacted]

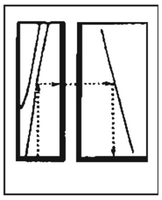
MAXIMUM ENDURANCE

ALTITUDE AND BANK ANGLE
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
INOPERATIVE ENGINE WINDMILLING

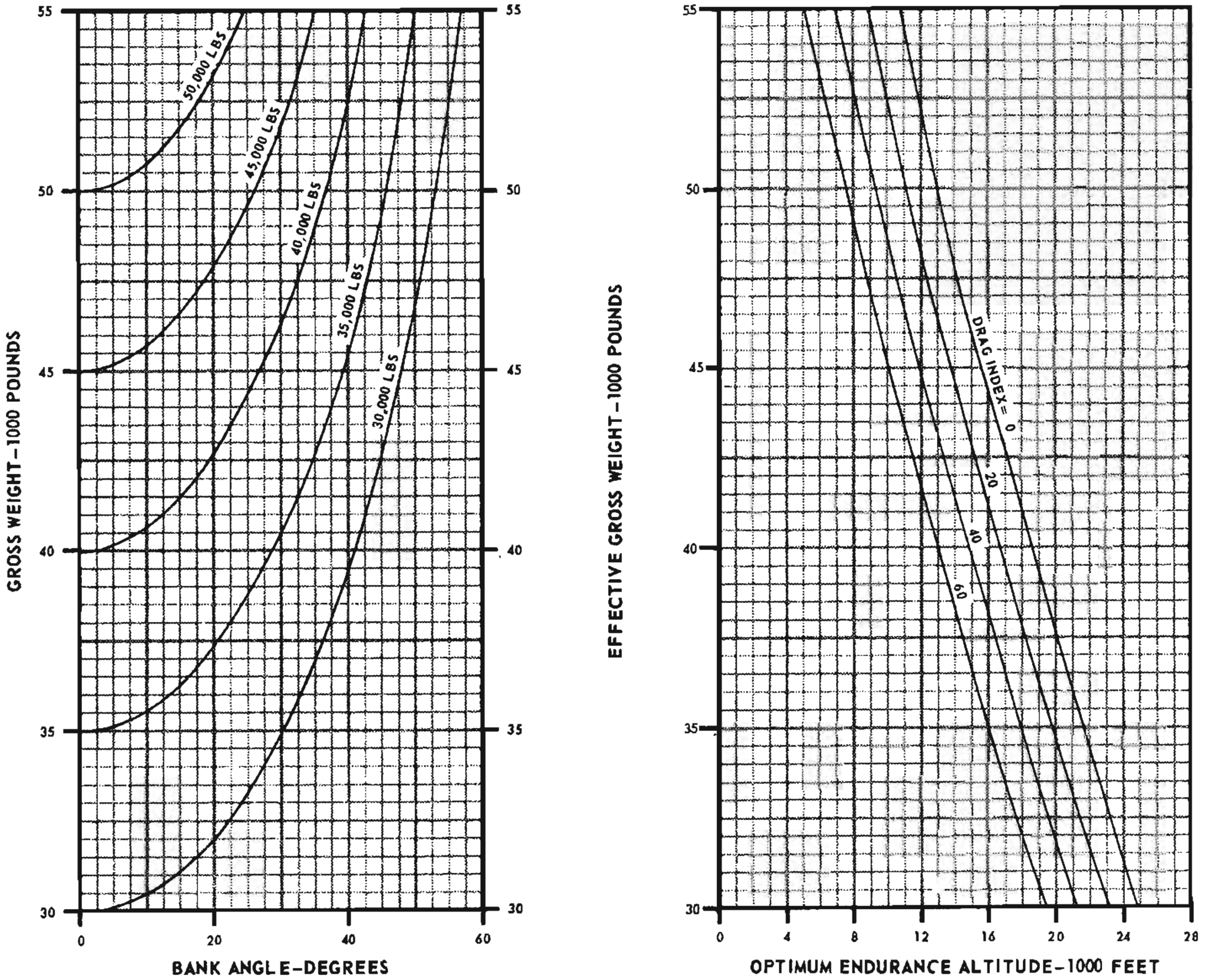
GUIDE



NOTE
IF INOPERATIVE ENGINE IS NOT WINDMILLING DRAG WILL INCREASE BY A FACTOR OF 3

DATE: 1 AUGUST 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P535

Figure B5-5

F-4E

MAXIMUM ENDURANCE

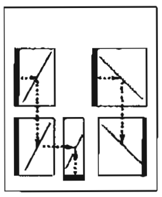
MACH NUMBER AND FUEL FLOW
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING

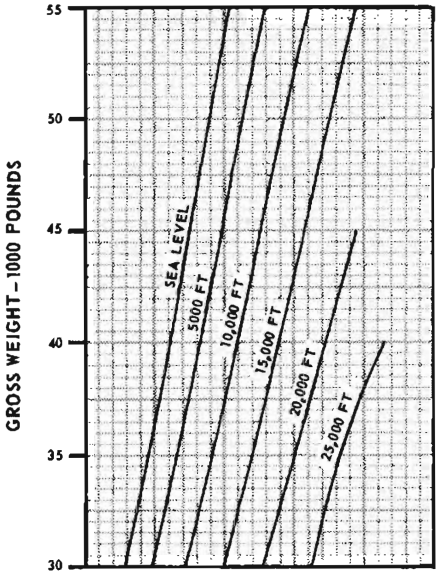
NOTE
- IF INOPERATIVE ENGINE IS NOT WINDMILLING DRAG WILL INCREASE BY A FACTOR OF 3.
- TOTAL FUEL FLOW IS DIRECTLY PROPORTIONAL TO TEMPERATURE CHANGE, INCREASING OR DECREASING 2% FOR EACH 10°C INCREMENT FROM STANDARD DAY.

GUIDE



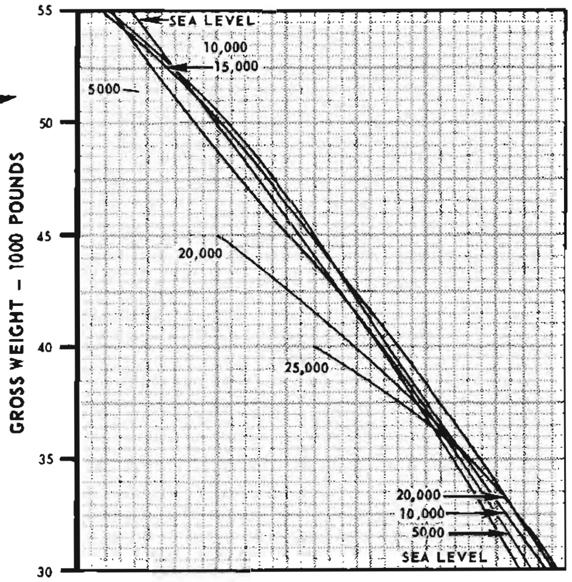
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

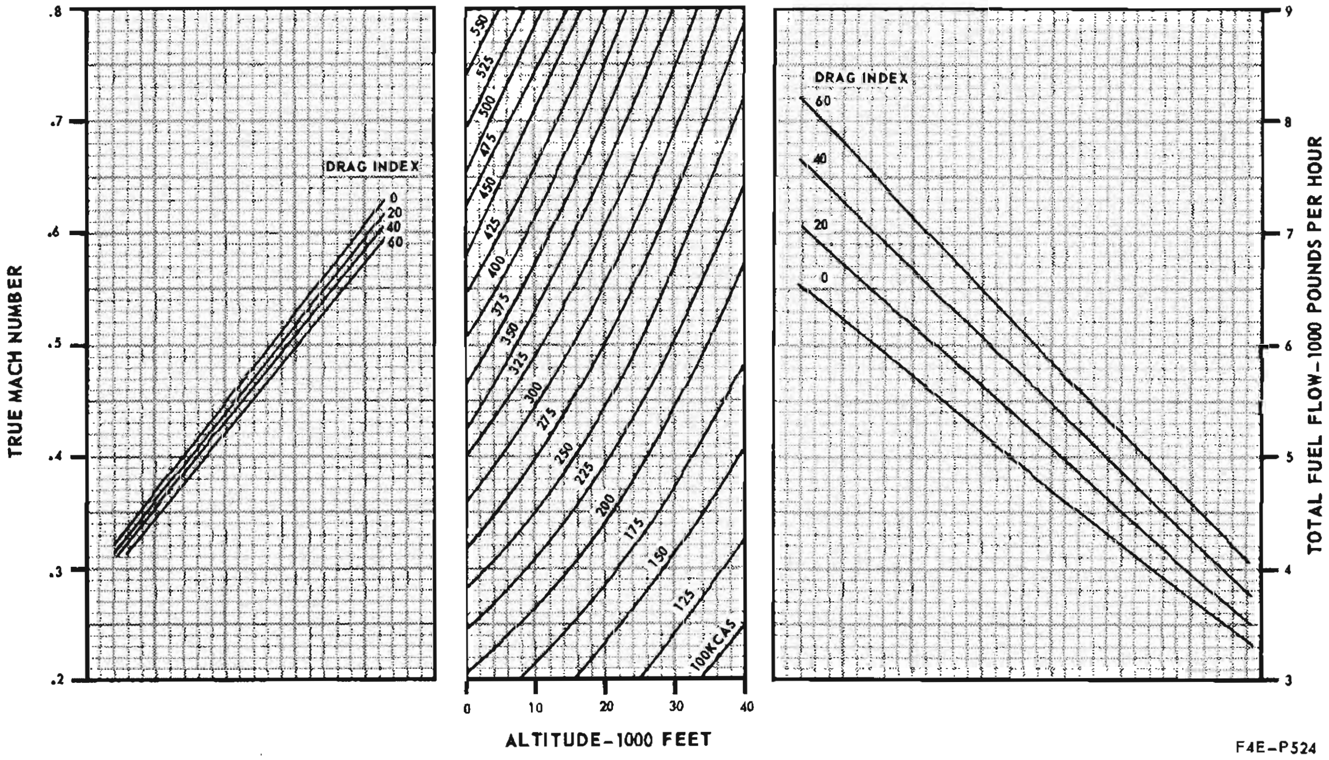
DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)



ICAO STANDARD DAY

ALT. FT.	TEMP. °C
S.L.	15.0
5000	5.1
10,000	-4.8
15,000	-14.7
20,000	-24.6
25,000	-34.5
30,000	-44.4
35,000	-54.3
40,000	-56.5
45,000	-56.5
50,000	-56.5





F4E-P524

Figure B5-6

PART 6 AIR REFUELING

Refer to Air Refueling Manual, T.O. 1-1C-1-8.

PART 7 DESCENT

DESCENT

The descent charts (figure B7-1 thru B7-6) present distance, time, fuel used, and Mach number in the descent. Incremental data may be obtained for distance, time, and fuel by subtracting data corresponding to level-off altitude from the data for the original cruising altitude.

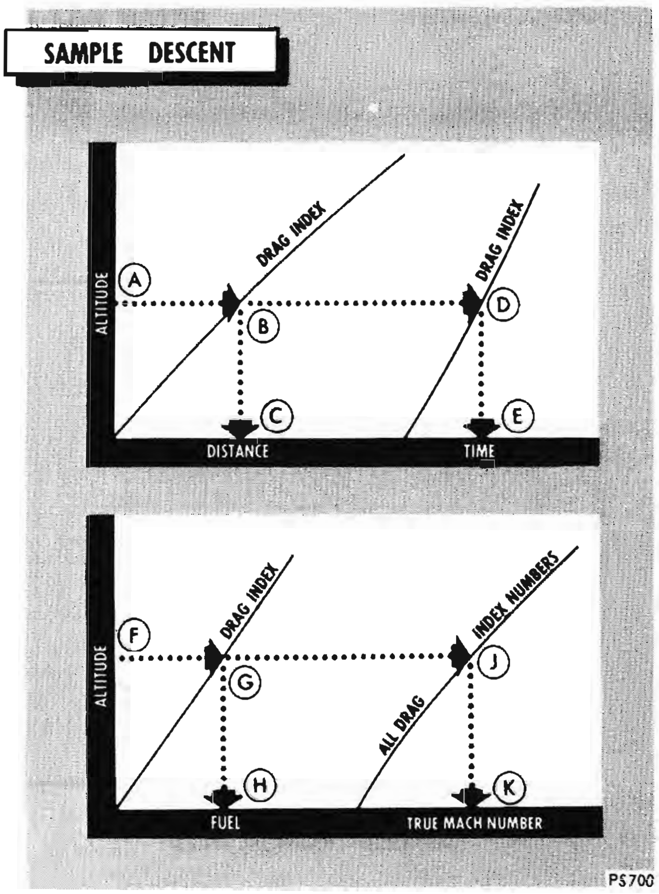
USE

Enter the upper plot of the appropriate chart at the cruising flight level, project horizontally to the right to intersect both drag reflectors at the applicable computed drag index. From the first intersection, project vertically downward to intersect and read the distance. From the second intersection, project vertically downward to intersect and read time to descend. Enter the lower plot with the cruising altitude and proceed horizontally to the right to intersect the drag reflector at the applicable computed drag index on the fuel graph. Continue horizontally to the right to intersect the single drag reflector on the Mach number graph. From the intersection on the fuel graph, project vertically downward to intersect and read fuel required. From the intersection at the single drag reflector on the Mach number graph, project vertically downward to intersect and read Mach number.

Sample Problem

Descent (idle thrust), 250 KIAS

A.	Altitude	30,000 Ft.
B.	Computed drag index	40.0
C.	Distance	44 Miles
D.	Computed drag index	40.0
E.	Time required	8.5 Min.



F.	Altitude	30,000 Ft.
G.	Computed drag index	40.0
H.	Fuel required	200 Lbs.
J.	Single drag reflector	
K.	Mach number	0.67 Mach

F-4E

DESCENT

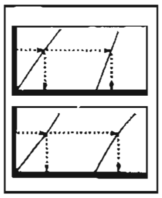
250 KIAS-IDLE THRUST
MAXIMUM RANGE
SPEED BRAKES RETRACTED

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
ALL GROSS WEIGHTS
ICAO STANDARD DAY

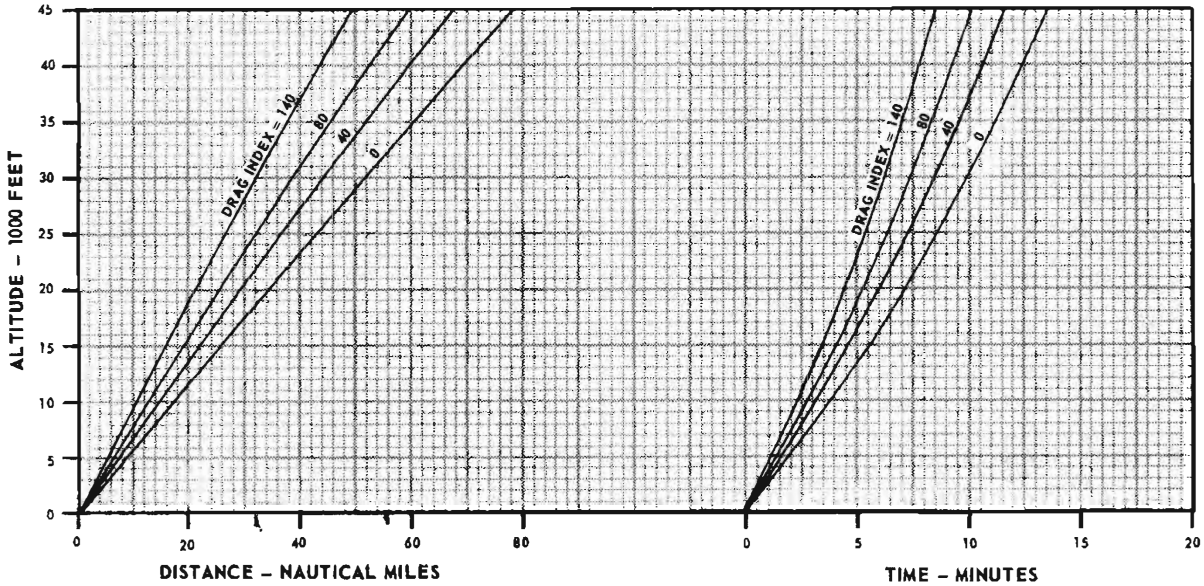
27

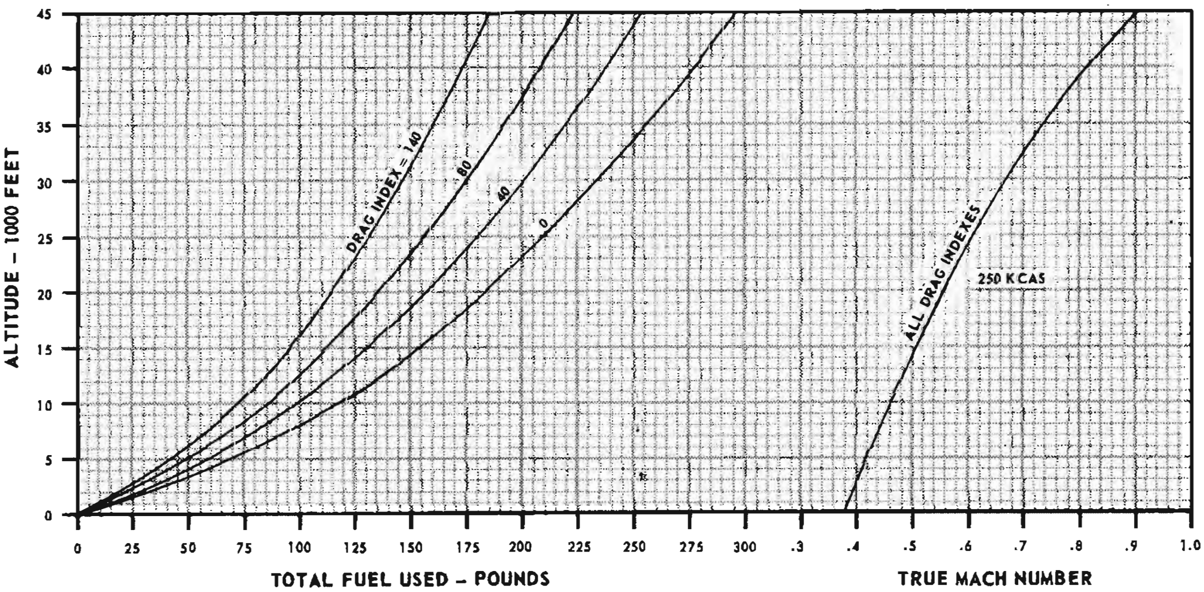
GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P700

Figure B7-1

F-4E

DESCENT

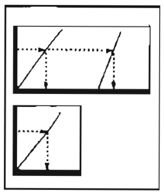
0.8 MACH-IDLE THRUST
SPEED BRAKES EXTENDED

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS

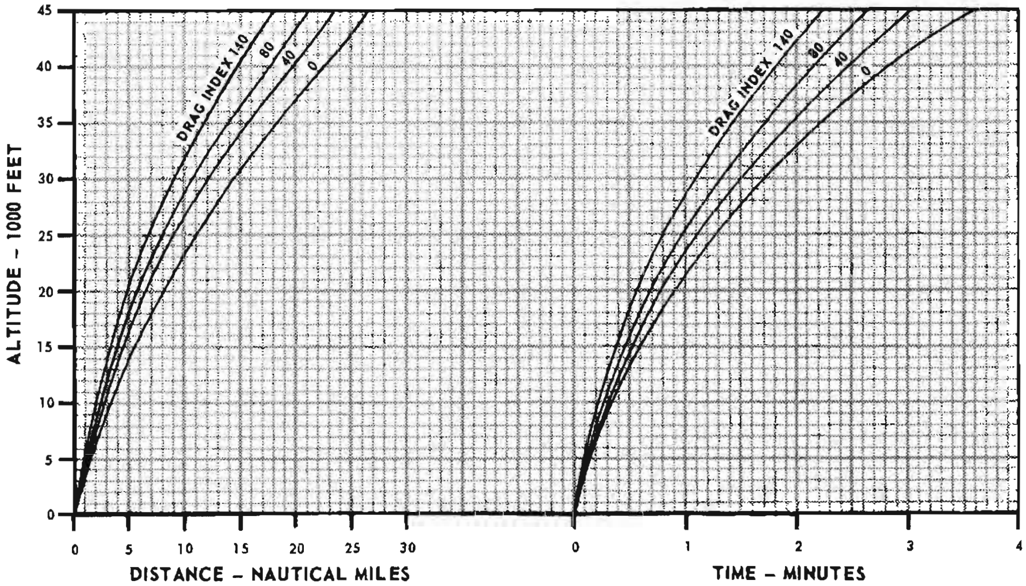
ENGINE(S): (2) J79-GE-17
ALL GROSS WEIGHTS
ICAO STANDARD DAY

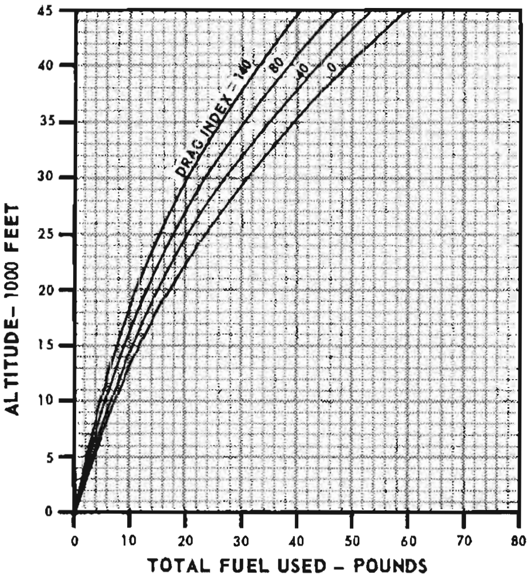
GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P706

Figure B7-2

F-4E

DESCENT

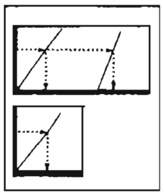
0.8 MACH-IDLE THRUST
SPEED BRAKES RETRACTED

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS

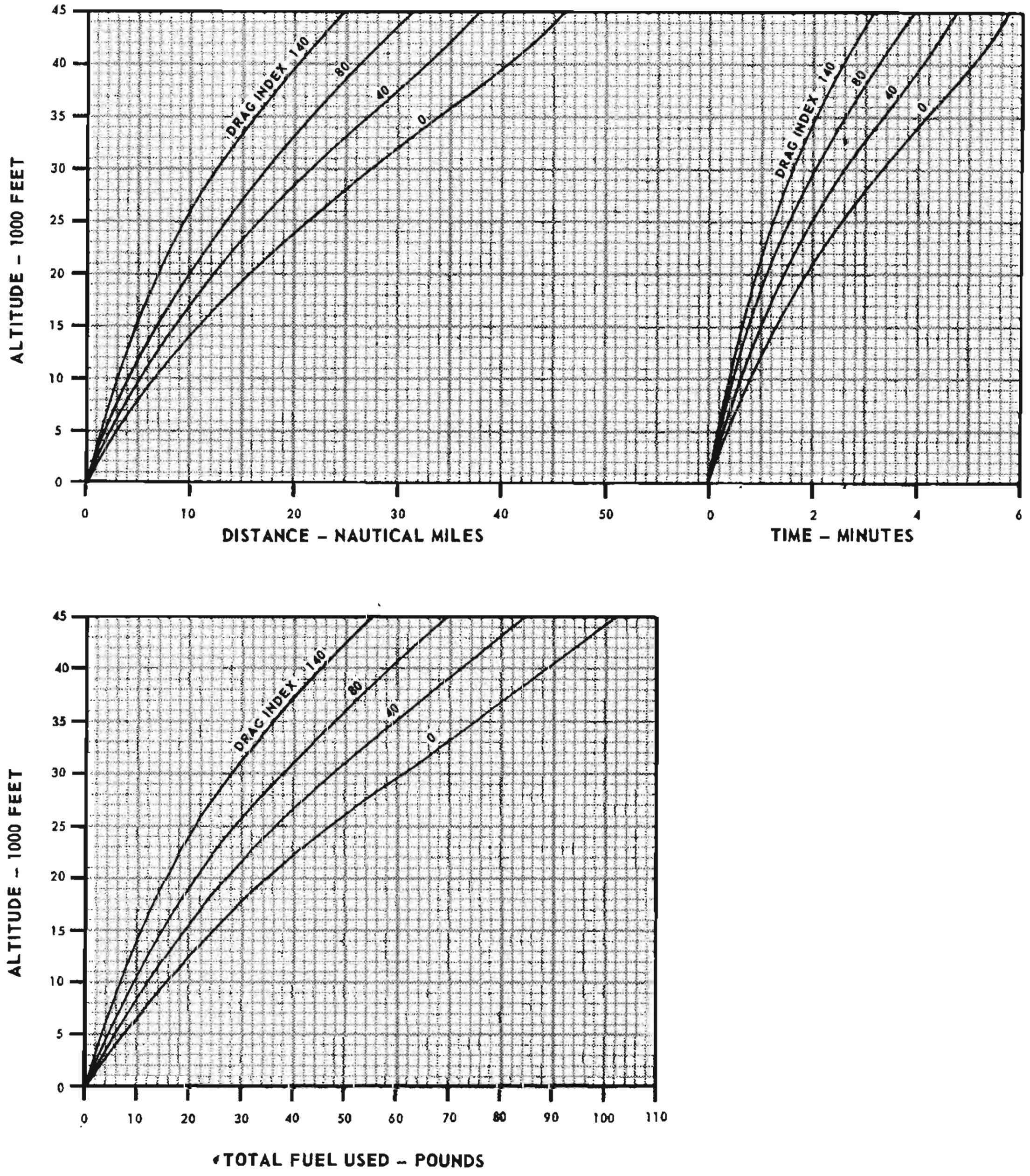
ENGINE(S): (2) J79-GE-17
ALL GROSS WEIGHTS
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P707

Figure B7-3

F-4E

DESCENT

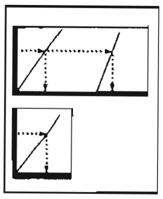
0.8 MACH-80% RPM
SPEED BRAKES EXTENDED

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS

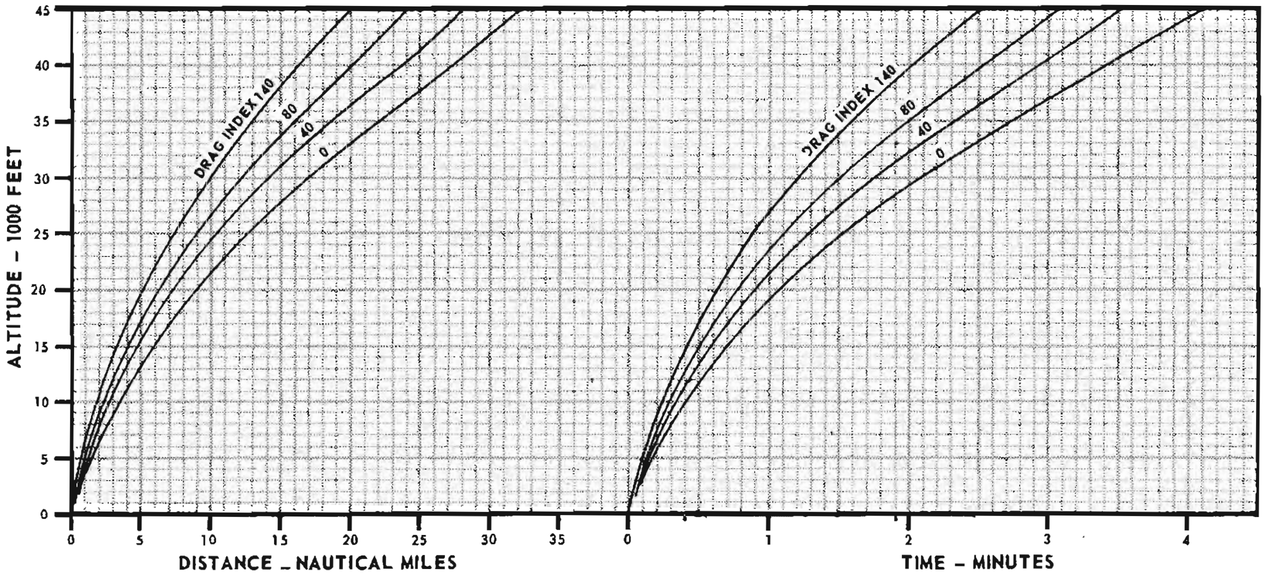
ENGINE(S): (2) J79-GE-17
ALL GROSS WEIGHTS
ICAO STANDARD DAY

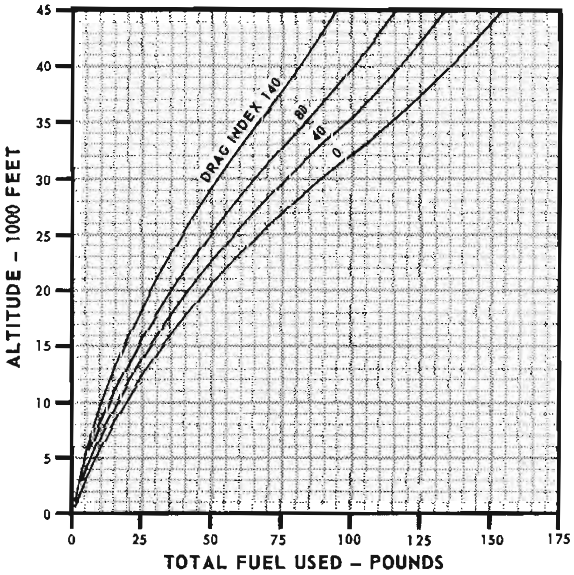
GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P708

Figure B7-4

F-4E

DESCENT

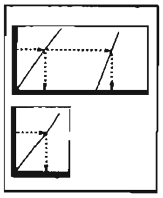
0.8 MACH-80% RPM
SPEED BRAKES RETRACTED

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) J79-GE-17
ALL GROSS WEIGHTS
ICAO STANDARD DAY

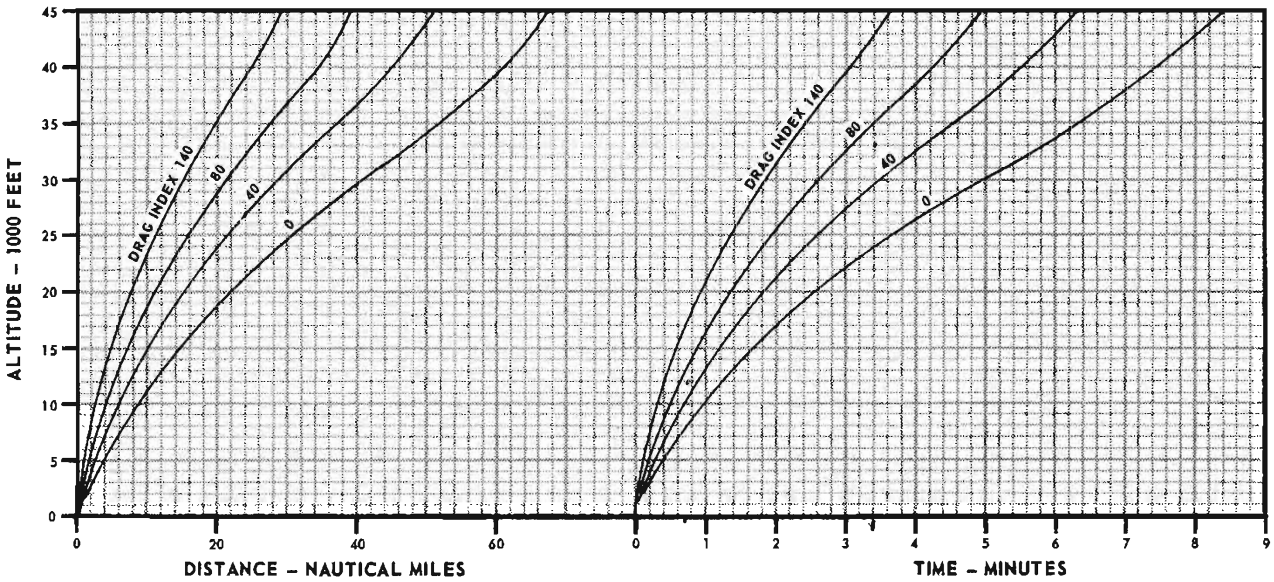
2.8

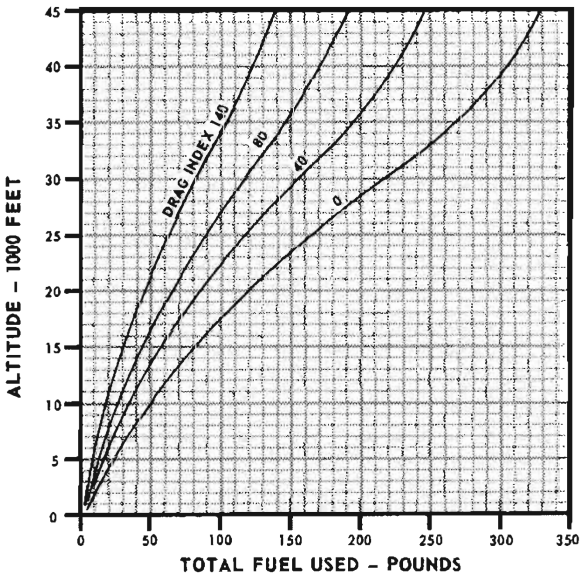
GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P709

Figure B7-5

F-4E

DESCENT

280 KIAS-80% RPM
SPEED BRAKES EXTENDED

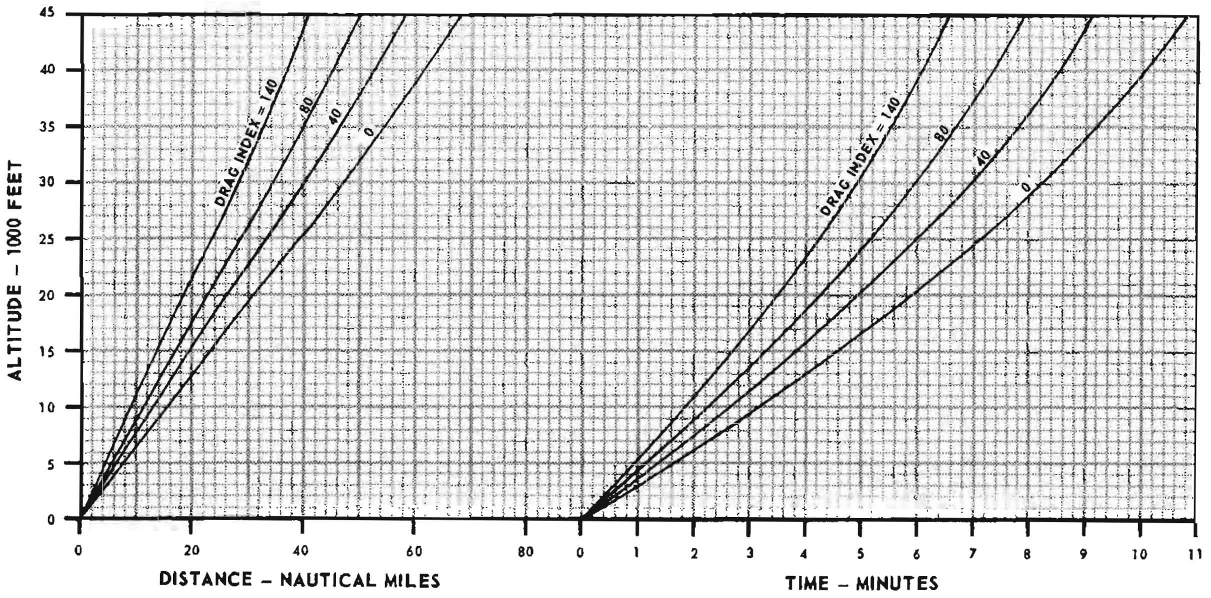
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

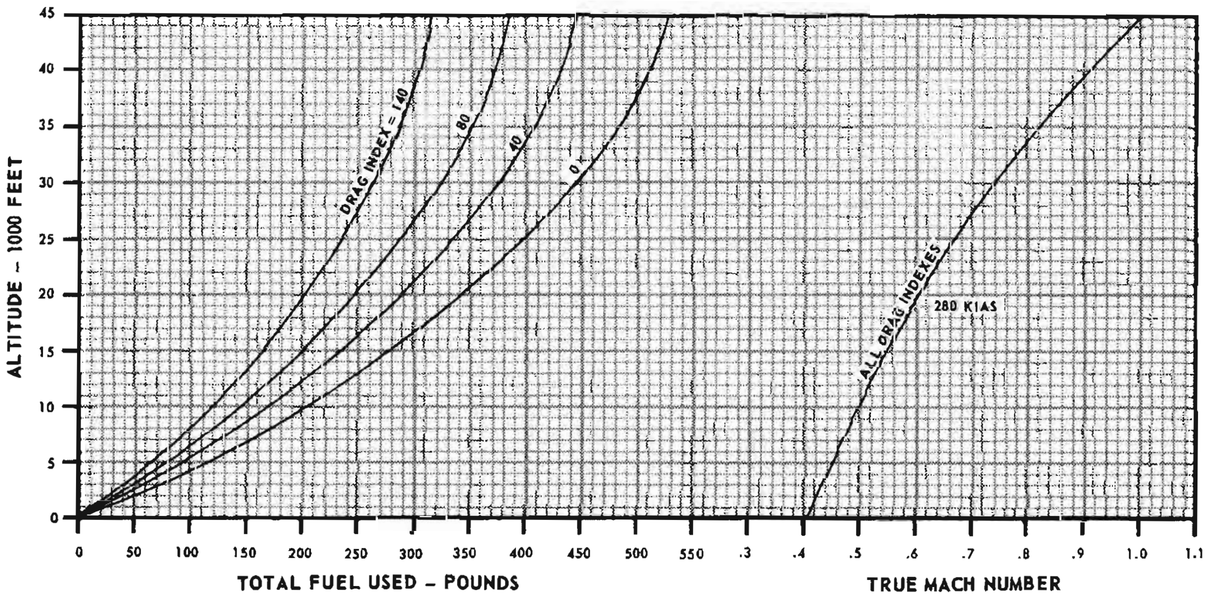
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY
ALL GROSS WEIGHTS

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P703

Figure B7-6

PART 8 LANDING

CHECKLIST LANDING DATA

Three charts provide landing data in the checklist. The Landing Density Index chart is bounded by vertical scales of runway temperature and pressure altitude with the readout scale presenting the landing density index. The Landing Roll chart is bounded by scales of density index and gross weight with the readout scale presenting landing distance for a dry runway with or without the drag chute deployed. Final approach speeds are also shown for corresponding gross weights. A tabular chart is provided to adjust the landing distance for other than dry runway conditions.

USE

To find landing density index, mark the applicable runway temperature on the left scale and the applicable field elevation on the right scale. Plot a straight line between these two points and read the landing density index on the inner scale. To find the landing distance for a dry runway, mark the landing density index (from first chart) on the left scale and the landing gross weight on the right scale. Note final approach speed corresponding to gross weight. Plot a straight line between these two points and read landing distance on the inner scale (with or without drag chute deployed). To adjust landing distance for conditions other than a dry runway, enter the RCR Effects table with the computed dry runway landing distance. Then proceed across the table to the applicable RCR factor and read the adjusted landing distance.

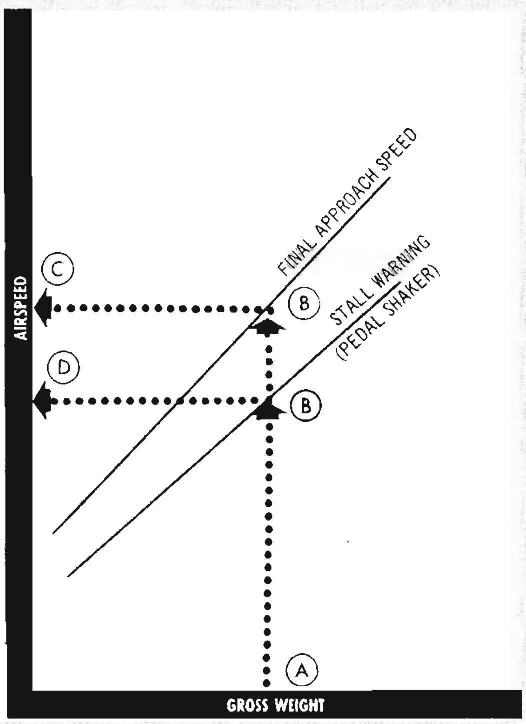
LANDING SPEEDS CHART

The Landing Speeds chart (figure B8-1) shows recommended approach and stall warning speed curves for the various gross weights of the aircraft.

USE

Enter the chart at estimated landing gross weight. Proceed vertically to the reflector lines and project horizontally to the left scale to read recommended approach and stall warning speed.

SAMPLE LANDING SPEEDS



PS800

Sample Problem

Configuration: Full flaps, gear down

A.	Estimated landing gross weight	32, 000 Lbs.
B.	Intersect both reflector lines	
C.	Recommended approach speed (IAS)	138 Kts.
D.	Stall warning speed	128 Kts.

MINIMUM LANDING ROLL DISTANCE CHART

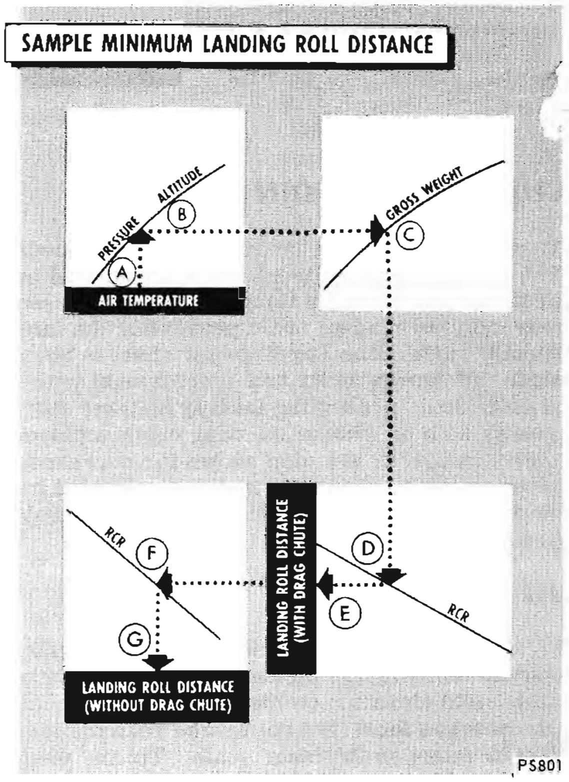
Landing roll distance information is provided in this chart (figure B8-2). The variables of temperature, altitude, gross weight, runway condition reading (RCR), and drag chute are taken into consideration.

USE

Enter the chart with the runway temperature and project vertically upward to the correct pressure altitude. From this point, proceed horizontally to the right to the landing gross weight. From this point, descend vertically to the appropriate runway condition reading (RCR) and then horizontally to the left to read landing roll distance with drag chute. If the landing is to be made without the drag chute, continue further to the left to the appropriate RCR reflector and then proceed down to read the landing roll distance. If the landing is to be made over a 50-foot obstacle, add 1000 feet to the landing roll distance. If field RCR factors are not available, use RCR 23 for dry, RCR 14 for wet and RCR 5 for icy runway conditions.

Sample Problem

A.	Temperature	15°C
B.	Pressure altitude	2000 Ft.
C.	Gross weight	30, 000 Lbs.
D.	RCR	14
E.	Landing roll distance	5400 Ft.



If operating without drag chute:

F.	RCR	14
G.	Landing roll distance	7700 Ft.

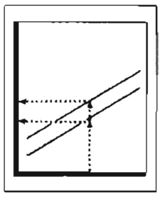
F-4E

LANDING SPEEDS

AIRPLANE CONFIGURATION
ALL DRAG INDEXES
FULL FLAPS, GEAR DOWN

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

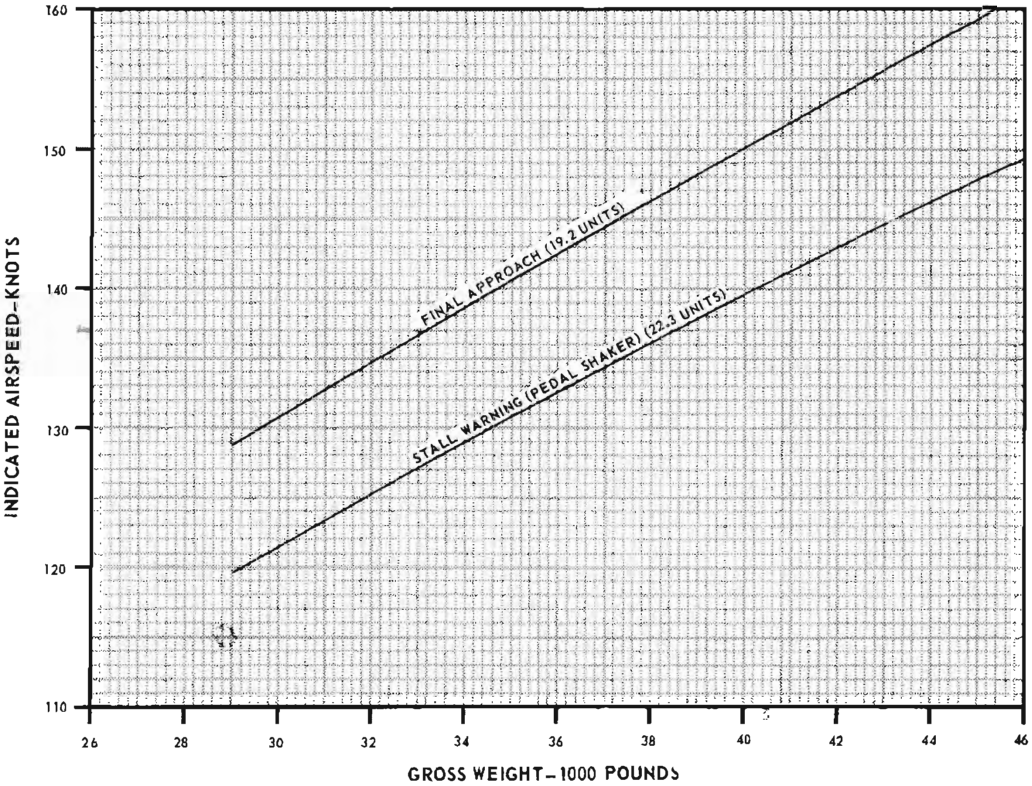
GUIDE



DATE: 1 FEBRUARY 1970
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

138



F4E-P800

Figure B8-1

F-4E

MINIMUM LANDING ROLL DISTANCE

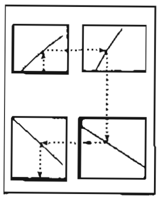
IDLE THRUST

REMARKS

ENGINE(S): (2) J79-GE-17

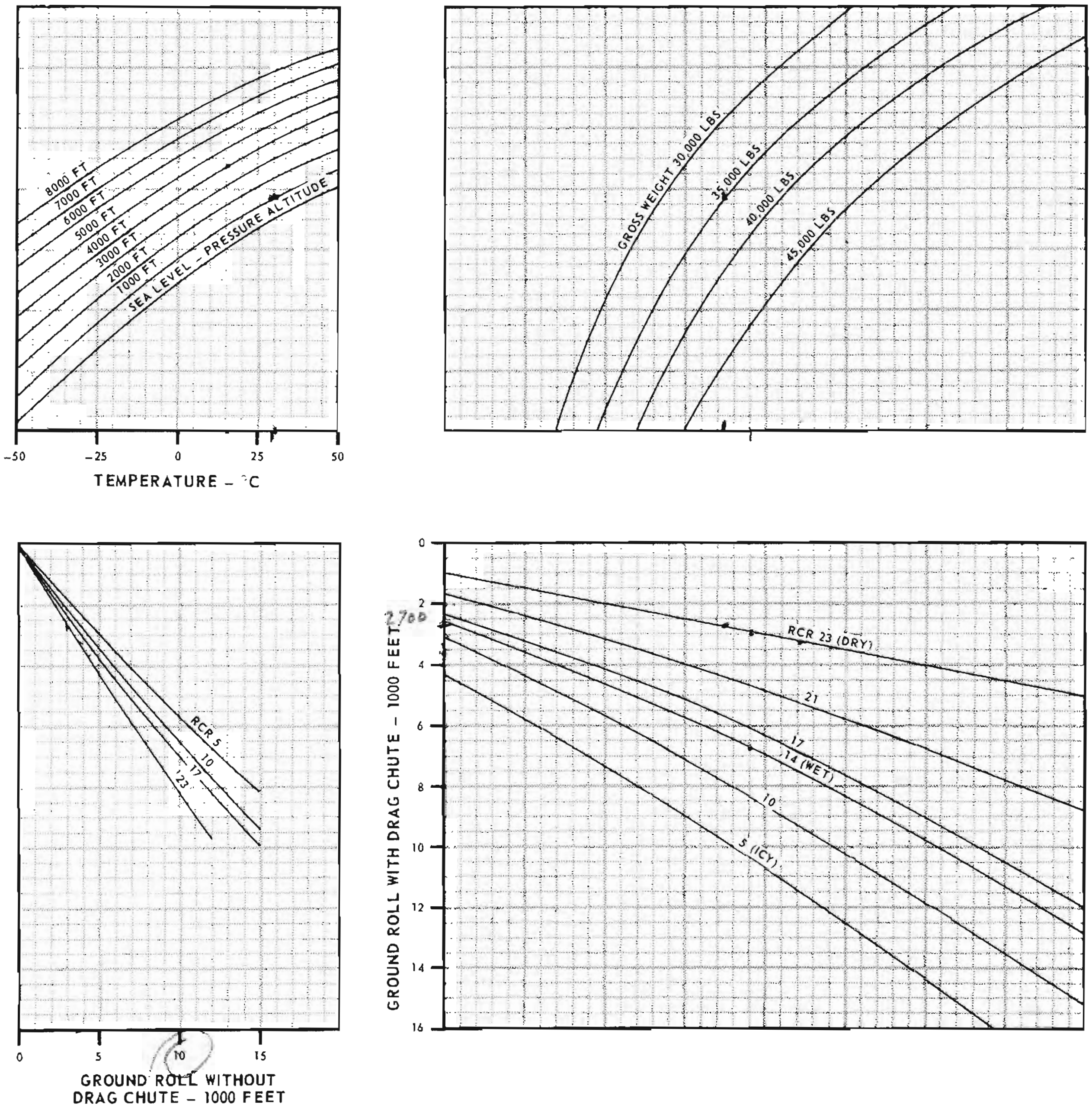
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
FLAPS EXTENDED, GEAR DOWN
DRAG CHUTE DEPLOYED

GUIDE



DATE: 1 APRIL 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P802

Figure B8-2

☆ U.S. GOVERNMENT PRINTING OFFICE: 1970— 392-033/1331

PART 9 COMBAT PERFORMANCE

TABLE OF CONTENTS

Charts

COMBAT FUEL FLOW CHARTS

These charts (figures B9-1 thru B9-3) present the specific fuel flow and general thrust setting to maintain a constant Mach number for an ICAO standard day and standard day +10°C at all altitudes between sea level and 50,000 feet. Each chart is plotted for a specific configuration. The fuel flow values are based on a stabilized level flight condition and do not represent the fuel flow required to accelerate to a given Mach number.

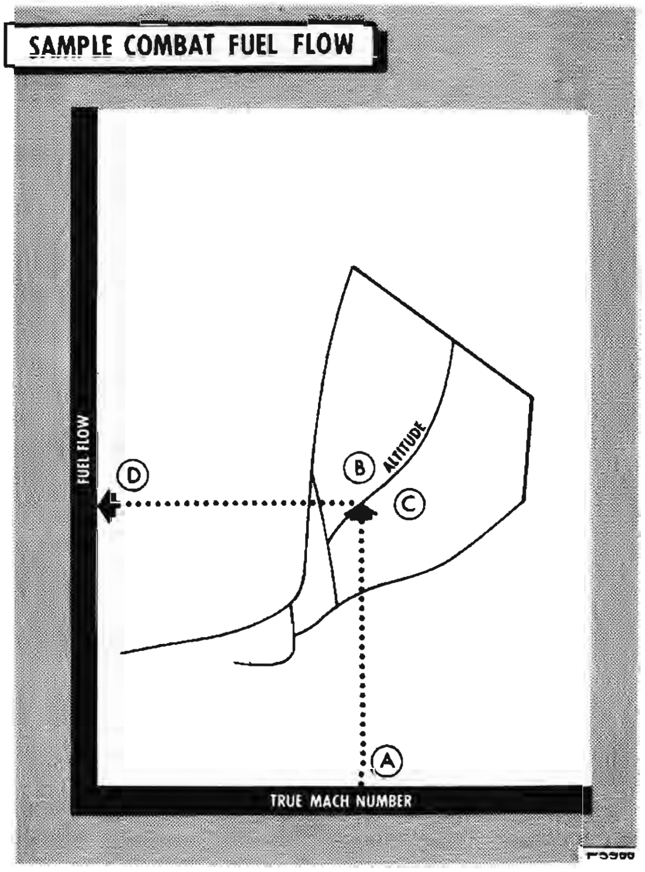
USE

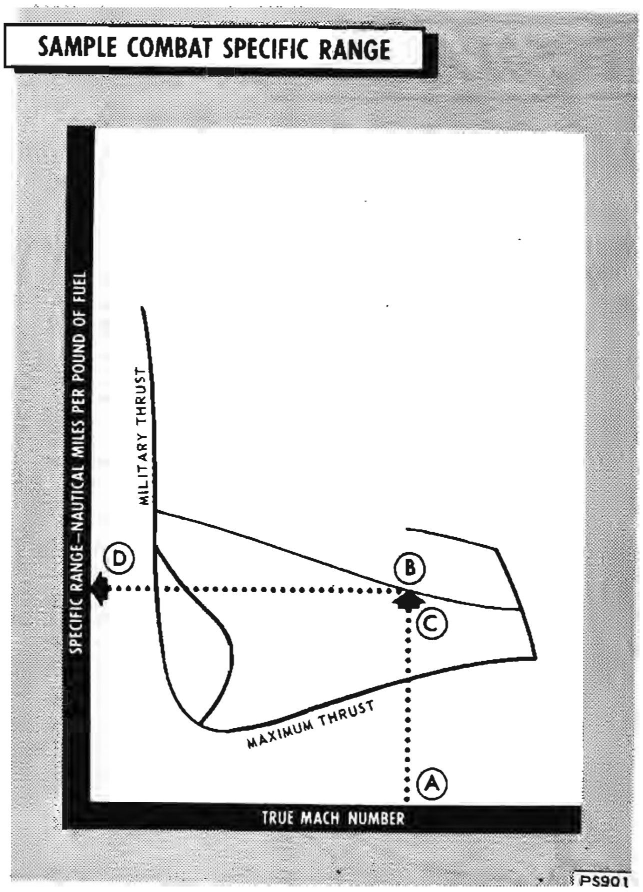
Enter the chart corresponding to the aircraft configuration with the desired Mach number for stabilized level flight. Proceed vertically upward to the selected flight altitude. Note the general thrust setting required, and then project horizontally to the left to read fuel flow.

Sample Problem

Configuration: (4) AIM-7 Missiles

A. Desired Mach number 1.5
B. Altitude 25,000 Ft.
C. Power setting required Modulated Afterburners
D. Total fuel flow 810 PPM





COMBAT SPECIFIC RANGE

These charts (figures B9-4 thru B9-6) present the specific range and the general power settings required to maintain a constant Mach number for an ICAO standard day and standard day +10°C at all altitudes from sea level to 50, 000 feet. The specific range values are based on a stabilized level flight condition and do not represent the fuel flow required to accelerate to a given Mach number.

USE

Enter the chart corresponding to the aircraft configuration with the desired Mach number for stabilized level flight. Proceed vertically upward to the selected flight altitude. Note the general thrust setting required, and then project horizontally left to obtain the specific range.

Sample Problem

Configuration: (4) AIM-7 Missiles and (2) Wing Tanks

A.	Desired Mach number	1.5
B.	Altitude	30, 000 Ft.
C.	Thrust required	Modulated Afterburners
D.	Specific range	0.018 NMPP

SUPERSONIC MAXIMUM THRUST CLIMB CHARTS

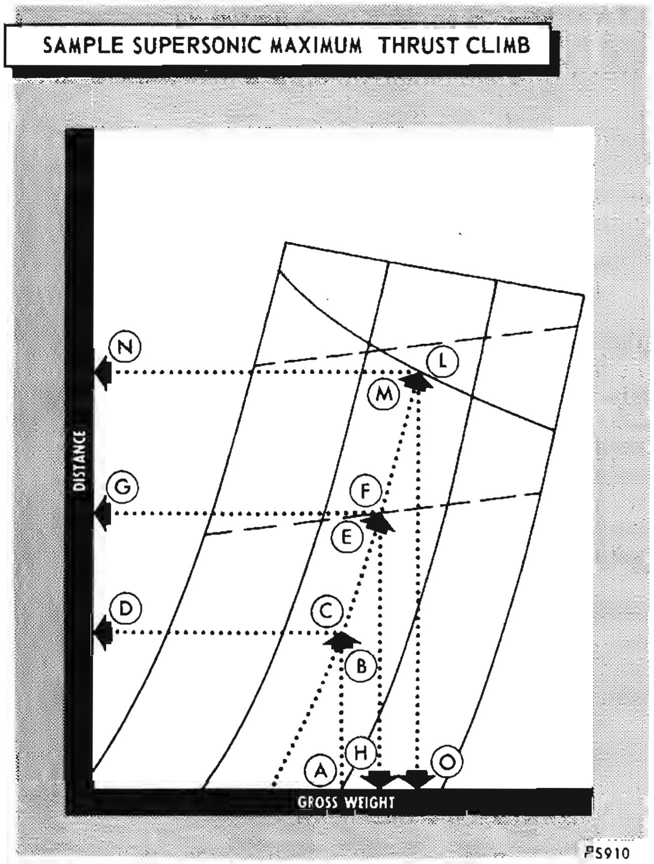
These charts (figures B9-7 thru B9-11) are plotted for supersonic maximum thrust climb from 35, 000 feet to the supersonic combat ceiling. Distance traveled in the climb is plotted against gross weight, with guide lines provided to show the weight reduction as the climb progresses. The time to distance/altitude relationship is superimposed on the plot. Level flight acceleration data is provided which includes time, fuel used (gross weight change), and distance required to accelerate from the subsonic to the supersonic climb Mach number at 35, 000 feet. If supersonic climb is contemplated, acceleration at 35, 000 feet followed by the climb is recommended, since acceleration to supersonic Mach numbers at this altitude provides for the optimum performance capability.

Note

If ramp cycling occurs during supersonic climb, the climb schedule Mach number can be increased until the cycling stops. This produces an insignificant degradation in climb performance.

USE

Enter the chart with the gross weight and proceed vertically to the initial Mach number and note the corresponding distance and time. Proceed parallel to the guide lines to the desired supersonic climb Mach number (end of acceleration). Project both vertically downward and horizontally to the left from this point to read gross weight and distance traveled, also note the time. From these values, subtract the distance, weight, and time corresponding to the initial Mach number to determine the distance, fuel, and time required to accelerate. From the climb Mach number gross weight intersection, (start of climb) proceed parallel along the guide lines to the desired altitude. Obtain the distance, gross weight, and time for this point. Subtract from this data the corresponding values at the start of climb to obtain the distance traveled, the weight change (fuel used), and the time required to complete the climb. If total distance, fuel, and time are desired, add the climb and acceleration values together.



Sample Problem

Configuration: (4) AIM-7

A. Initial gross weight	40,000 Lbs.
B. Initial Mach number	1.2
C. Time corresponding to initial Mach number	0.6 Mins.
D. Distance corresponding to initial Mach number	6 Miles
E. Climb Mach number	1.76
F. Time at end of acceleration	1.8 Mins.
G. Distance at end of acceleration	23 Miles
H. Gross weight at end of acceleration	39,000 Lbs.
I. Time required for acceleration (F-C)	1.2 Mins.
J. Fuel required for acceleration (A-H)	1000 Lbs.
K. Distance required for acceleration (G-D)	17 Miles
L. Altitude at end of climb	50,000 Ft.
M. Time at end of climb	2.8 Mins.
N. Distance at end of climb	39.9 Miles
O. Gross weight at end of climb	38,200 Lbs.
P. Time required for climb (M-F)	1.0 Mins.
Q. Distance required for climb (N-G)	16.9 Miles
R. Fuel required for climb (H-O)	800 Lbs.
S. Total time required to accelerate and climb (I+P)	2.2 Mins.
T. Total distance required to accelerate and climb (K+Q)	33.9 Miles
U. Total fuel required to accelerate and climb (J+R)	1800 Lbs.

LOW ALTITUDE ACCELERATIONS

These charts (figures B9-12 thru B9-23) present time and fuel required to accelerate from 0.5 to 0.9 Mach at altitudes of Sea Level, 2000, 4000, and 6000 feet. Separate charts are provided for several gross weights and for both maximum and military thrust. The time and fuel values are tabulated for ICAO Standard Day conditions.

USE

After selecting the applicable chart for thrust, gross weight, and altitude, enter with the Mach number desired at end of acceleration and project horizontally to the applicable drag index column. Read time/fuel required to accelerate from 0.5 Mach.

ACCELERATION CHARTS

These charts (figures B9-24 thru B9-65) show the relationship of time, distance, and fuel required for level flight maximum or military thrust accelerations. The data is presented for various altitudes and configurations.

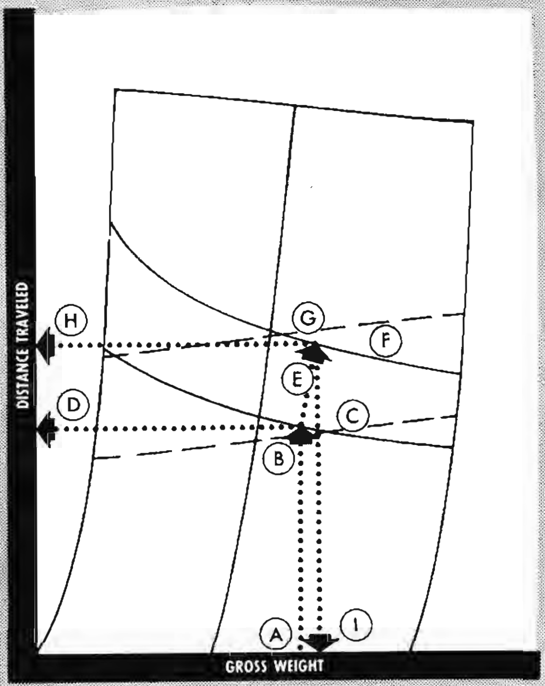
WARNING

Refer to section V for external stores operating limitations.

USE

Enter the applicable chart with the aircraft gross weight. Proceed vertically upward to the initial Mach number and note the time. Project horizontally and note the distance. From the initial Mach number, proceed parallel to the guide lines to the Mach number desired at the end of acceleration. At this point note the time, then project horizontally and vertically and note the distance and gross weight. From this data, subtract the time, distance, and weight corresponding to the initial Mach number to determine the time, distance, and fuel required for acceleration.

SAMPLE ACCELERATION



PS902

Sample Problem

Configuration: (4) AIM-7 Missiles, 10,000 feet

A.	Gross weight	40,000 Lbs.
B.	Initial Mach number	1.0
C.	Time	0.47 Mins
D.	Distance	3.6 Miles
E.	Parallel guide lines	
F.	Desired Mach number	1.20
G.	Time corresponding to new Mach number	0.74 Mins
H.	Distance corresponding to new Mach number	6.8 Miles
I.	Gross Weight corresponding to new Mach number	39,600 Lbs.
J.	Time required for acceleration (G-C)	0.27 Mins
K.	Distance required for acceleration (H-D)	3.2 Miles
L.	Fuel required for acceleration (A-I)	400 Lbs.

LEVEL FLIGHT ENVELOPE

These charts (figures B9-66 and B9-67) present the aircraft level flight speed envelope for various configurations and average combat gross weights. Parameters of the envelopes extend from buffet onset to V_{max} throughout the altitude range. Maximum Mach number curves for additional aircraft configurations are plotted within the envelopes.

WARNING

Refer to section V for external stores operating limitations.

USE

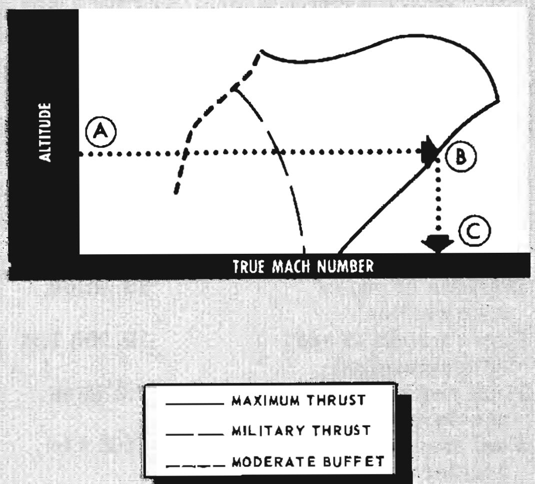
Enter the appropriate chart with the desired combat altitude. Proceed horizontally to intersect the applicable configuration power curve. From this point proceed vertically downward to read the maximum attainable Mach number in level flight.

Sample Problem

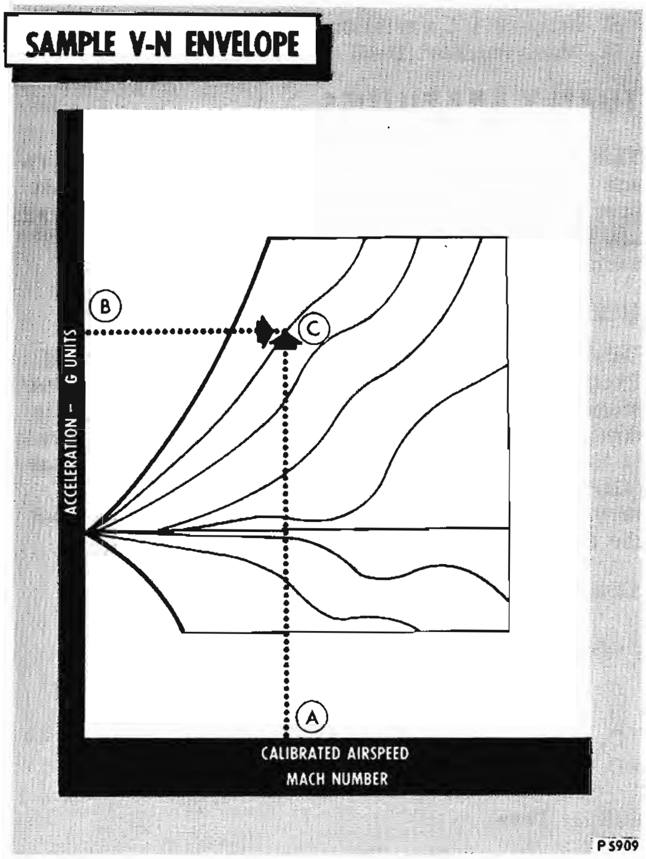
Configuration: (4) AIM-7 Missiles

A.	Combat altitude	36,000 Ft.
B.	Airplane complete load	(4) AIM-7 Missiles and (1) ℄ Tank
C.	Maximum attainable Mach number	2.06

SAMPLE LEVEL FLIGHT ENVELOPE



PS904



V-N ENVELOPE

The Symmetrical Flight V-N Envelopes (figures B9-68 thru B9-71) are a graphical presentation of airspeed versus acceleration with lines of indicated angle of attack superimposed. The data is supplied for two different gross weights at four altitudes. The charts may be used to determine the allowable maximum symmetrical maneuvering capability of the airplane as well as the indicated angle of attack for any desired G. The charts may be considered to be linear between altitudes for all practical purposes, provided the interpolation is carried out for a constant airspeed.

USE

To find the allowable maximum symmetrical performance capability, enter the chart with the indicated airspeed and proceed vertically to the stall boundary (positive or negative G) or the maximum allowable acceleration (upper and lower) as applicable. From these intersections, project horizontally to the left to read the positive and negative G obtainable in the case of the stall boundaries, or the upper and lower maximum allowable G for the selected gross weight. To find the AOA for a given condition of G and airspeed or Mach number, enter the appropriate chart with these parameters. Project horizontally to the right from the load factor and vertically upward from the airspeed. At the intersection of these two projections, read the indicated angle of attack.

Sample Problem

5000 Ft.; Gross Weight-37, 500 pounds.

A.	Speed (IAS)	550 kts.
B.	Load factor	5 G
C.	Angle-of-attack	8.6 units

DIVE RECOVERY CHARTS

These charts, (figures B9-72 thru B9-75) present the airplanes dive recovery capability for various speeds (subsonic and supersonic), altitudes and dive angles at 16 units and 19 units AOA.

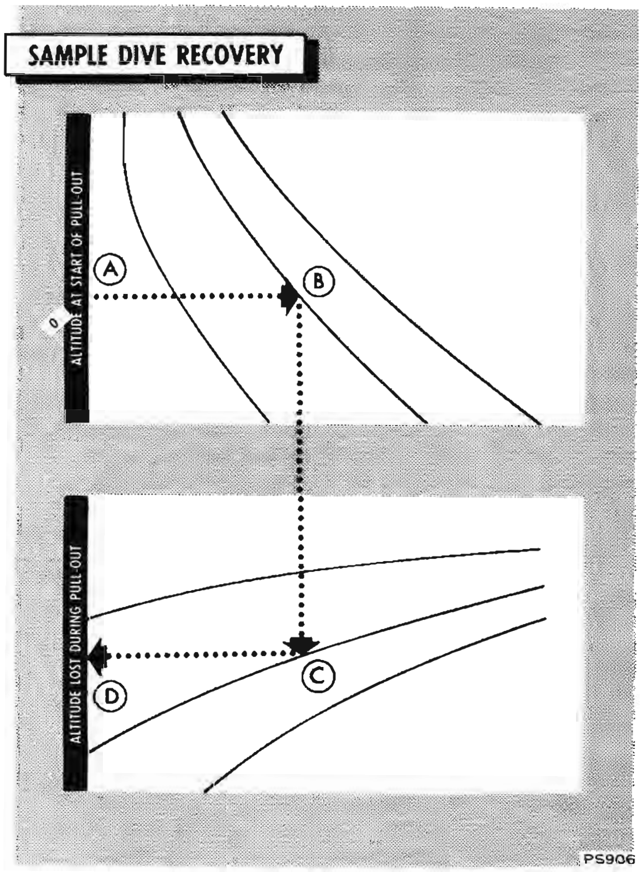
USE

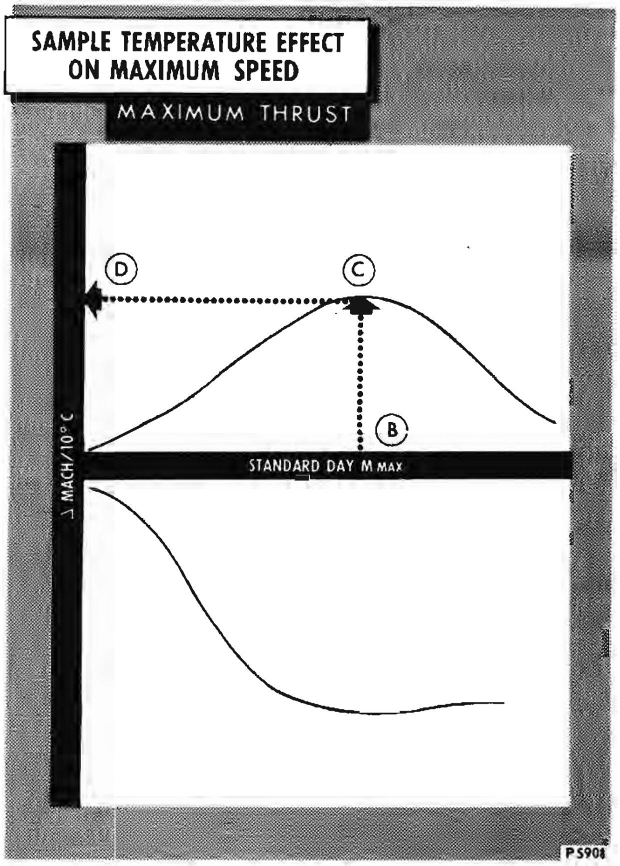
Enter the applicable chart at the start of the pull-out, and project horizontally to intersect the Mach number at the start of the pull-out. From this point, descend vertically and intersect the dive angle at the start of pull-out, then proceed horizontally to the left to read altitude lost during pull-out.

Sample Problem

Configuration: (4) AIM-7 Missiles - 16 Units AOA (Supersonic)

A.	Altitude at start of pull-out	40,000 Ft.
B.	Mach number at start of pull-out	1.5 Mach
C.	Dive angle at start of pull-out	70°
D.	Altitude loss during constant 16 unit AOA pull-out	13,200 Ft.





TEMPERATURE EFFECT ON MAXIMUM SPEED

This chart (figure B9-76) shows the effect of non-standard day temperatures on the maximum speed at maximum thrust. The speed variation is read out as the change in Mach number (Δ Mach) for a 10°C variation in temperature (hot or cold) from standard day.

USE

Determine the temperature variation from standard day for the desired altitude. M_{max} may be obtained from the Maximum Thrust Acceleration charts. Enter the chart at the standard day M_{max} line. Proceed vertically into either the Hot or Cold Day plot depending on the temperature variation. Continue vertically to the selected altitude, then proceed horizontally to the left to read Δ Mach. When the temperature variation differs from 10°C, simply divide the variation by 10 to reduce it to a decimal. Then multiply the Δ Mach by the decimal to obtain the Δ Mach for a specific situation.

Sample Problem

Find Δ Mach for a standard day M_{max} of 1.8 at 30,000 feet. Forecast flight level temperature is -46.8°C.

A.	Temperature variation	-2.4°C
B.	Standard day M_{max}	1.8 Mach
C.	Altitude	30,000 Ft.
D.	Mach/10°C variation	.16 Mach
E.	Mach/2.4°C variation	.04 Mach
F.	Mach number (B+E)	1.84 Mach

TURN CAPABILITIES

This chart (figure B9-77) presents the radius of turn and the rate of turn for a constant altitude, constant speed turn. Turn data is available for various speeds and bank angles. Load factor is also included for each bank angle.

USE

Enter the radius of turn plot with the true airspeed. Proceed horizontally to the right to the desired bank angle. Note the load factor, then proceed vertically downward and read the radius of turn. Enter the rate of turn plot with the true airspeed. Proceed horizontally to the right to the bank angle, note the load factor and then proceed vertically downward to read the rate of turn.

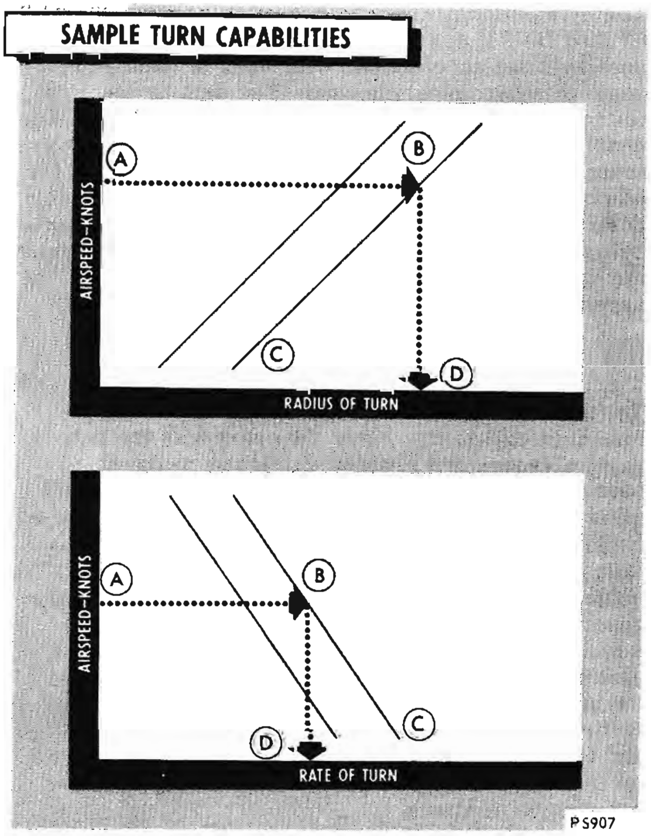
Sample Problem

Radius of Turn

A.	True airspeed	420 Kts.
B.	Bank angle	60°
C.	Load factor	2.0 G
D.	Radius of Turn	9000 Ft.

Rate of Turn

A.	True airspeed	420 Kts.
B.	Bank angle	60°
C.	Load factor	2.0 G
D.	Rate of turn	4.5°/sec.



SUSTAINED G TURN CAPABILITIES

These charts (figures B9-78 and B9-79) present the minimum radius of turn and corresponding maximum rate of turn and load factor for two different configurations and combat gross weights. The charts are plotted for various constant airspeeds and altitudes from sea level to 45,000 feet. Bank angles are also shown with the corresponding load factor.

USE

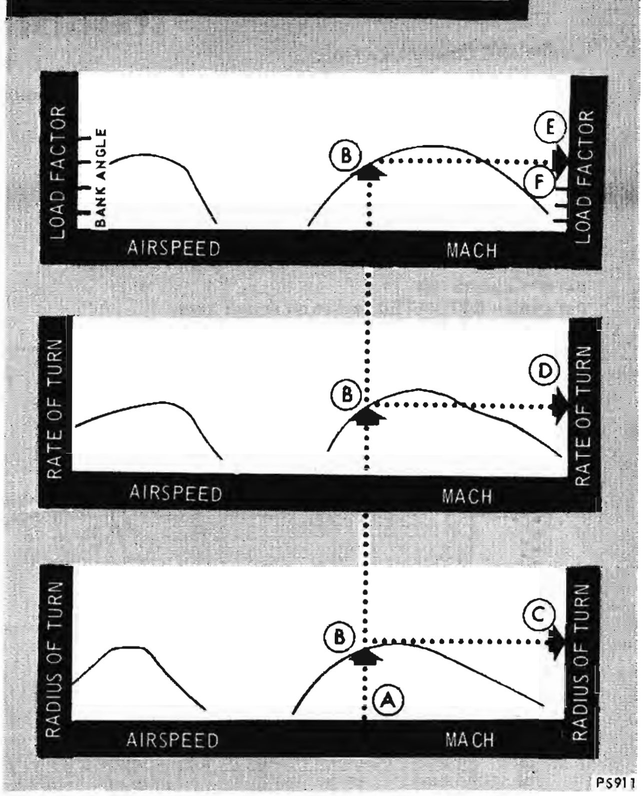
Enter the chart with the applicable airspeed or Mach number and proceed vertically to intersect the applicable altitude in each of the three plots. From these intersections, proceed horizontally to the left or right and read the minimum radius of turn, maximum rate of turn and maximum load factor attainable.

Sample Problem

Configuration: (4) AIM-7 - Gross Weight 40,925 lbs.

A.	Mach	0.80
B.	Altitude	35,000 Ft.
C.	Minimum radius of turn	2 NM
D.	Maximum rate of turn	3.6 degrees/sec
E.	Maximum sustained load factor	1.8 G
F.	Bank angle	56°

SAMPLE SUSTAINED G TURN CAPABILITIES



F-4E

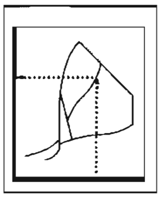
COMBAT FUEL FLOW

STABILIZED LEVEL FLIGHT

AIRPLANE CONFIGURATION
(4) AIM-7E

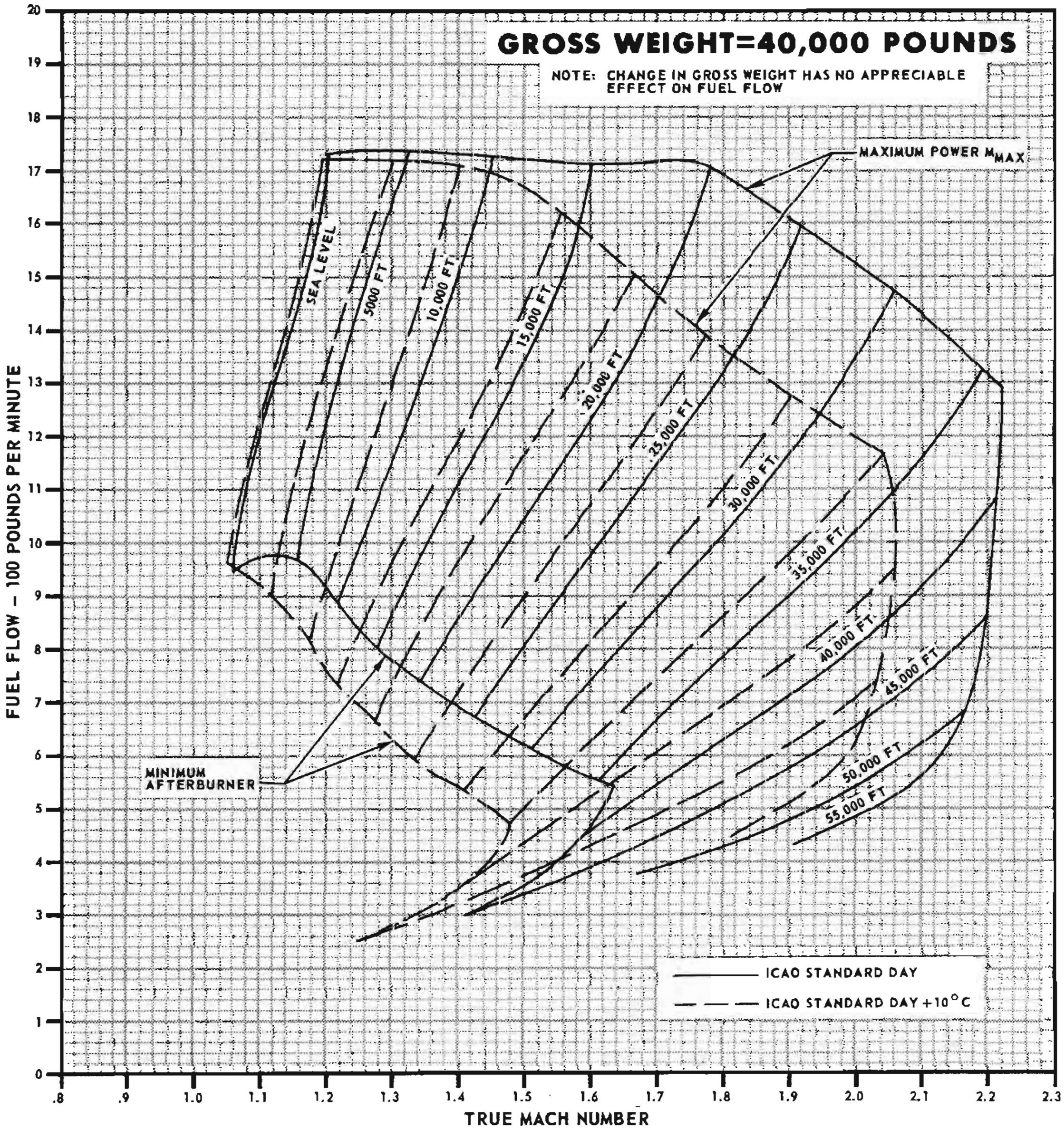
REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P900

Figure B9-1

F-4E

COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT

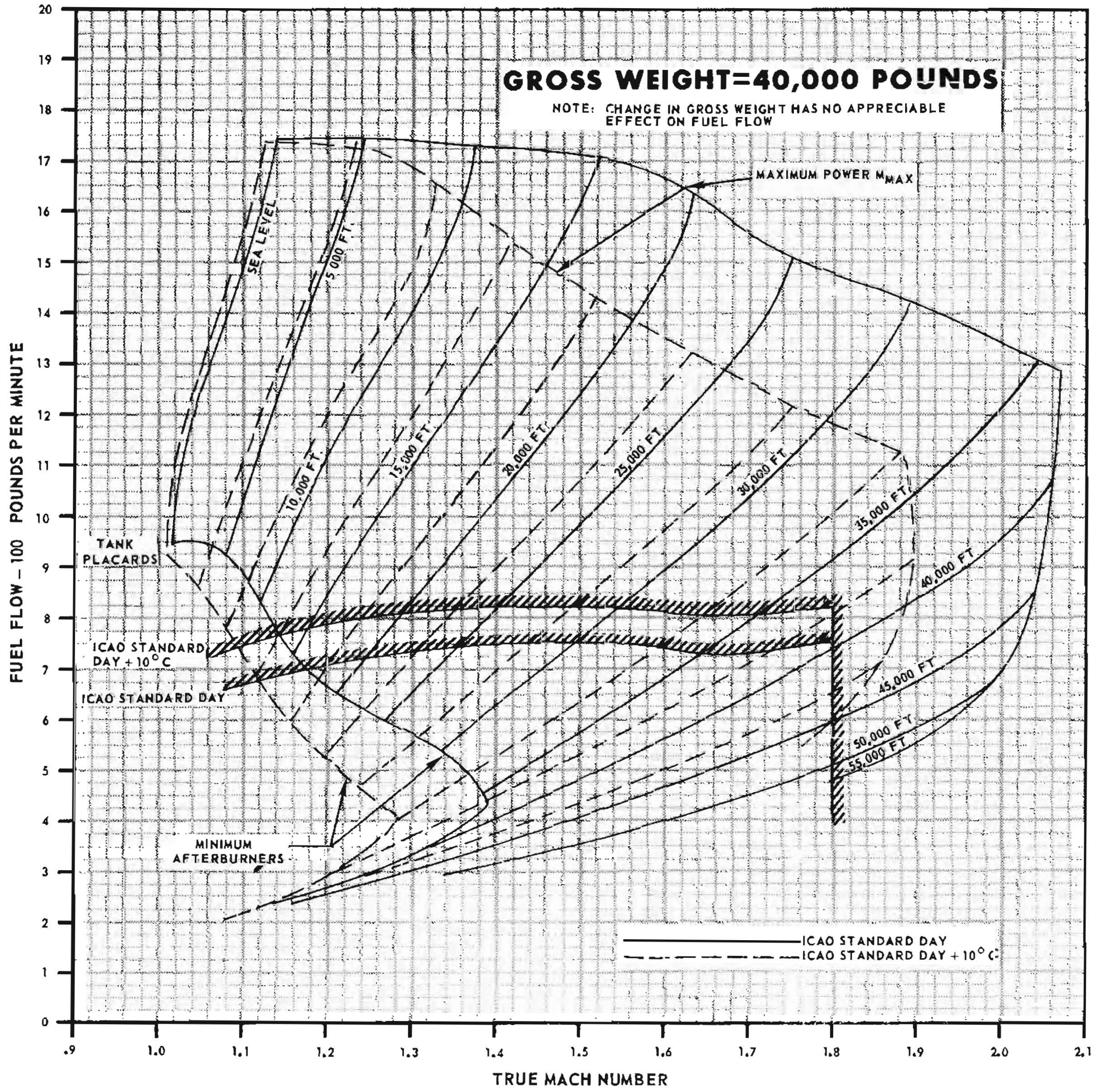
AIRPLANE CONFIGURATION
(4) AIM-7E AND (1) ℄ TANK

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P902

Figure B9-2

F-4E

COMBAT FUEL FLOW

STABILIZED LEVEL FLIGHT

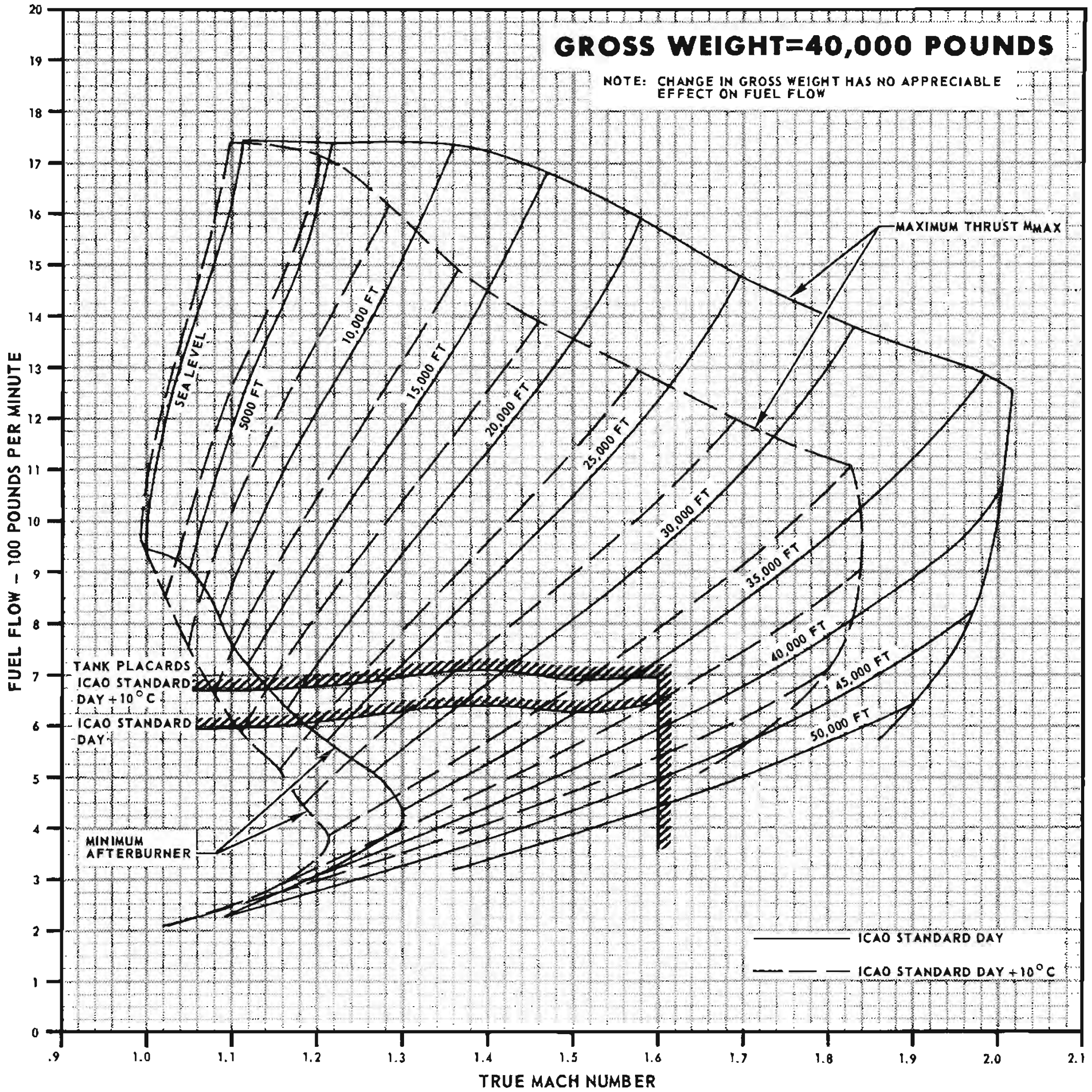
AIRPLANE CONFIGURATION
(4) AIM-7E AND (2) WING TANKS

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E P904

Figure B9-3

F-4E

COMBAT SPECIFIC RANGE

STABILIZED LEVEL FLIGHT

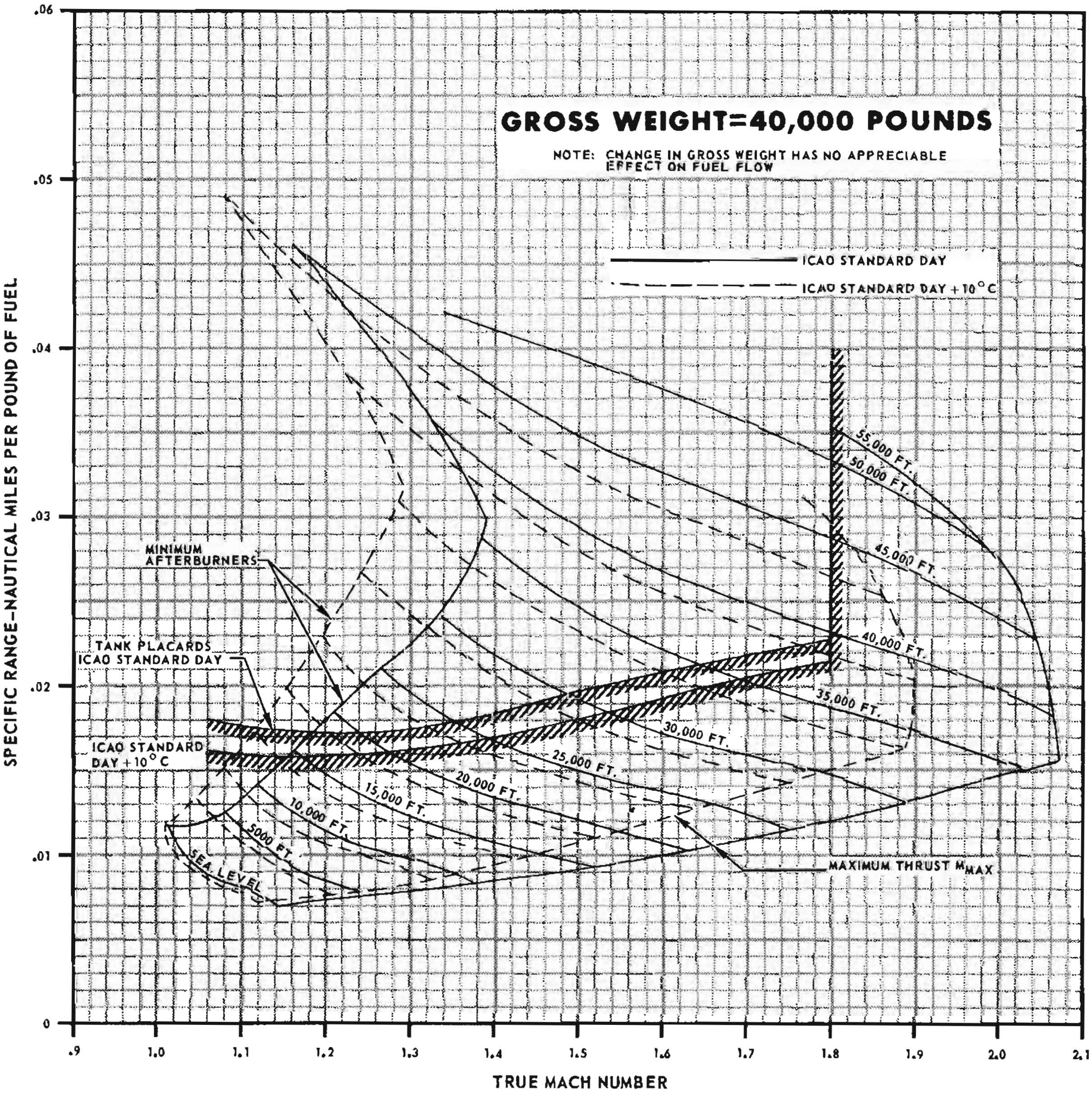
AIRPLANE CONFIGURATION
(4) AIM-7E AND (1) ℄ TANK

REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P903

Figure B9-4

F-4E

COMBAT SPECIFIC RANGE
STABILIZED LEVEL FLIGHT

AIRPLANE CONFIGURATION
(4) AIM-7E
AND (2) WING TANKS

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ONFLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

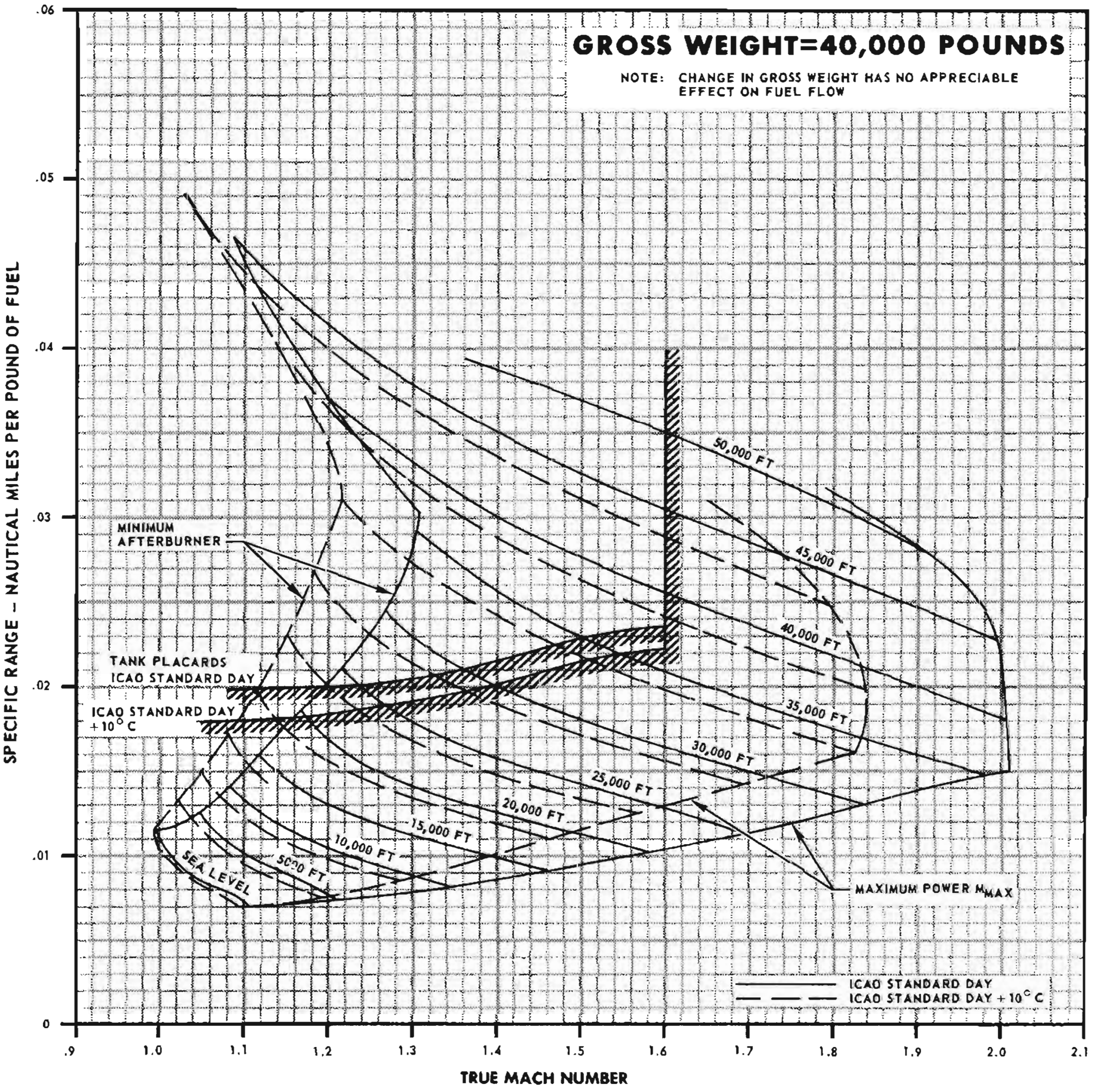


Figure B9-5

F-4E

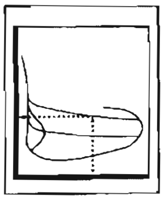
COMBAT SPECIFIC RANGE

STABILIZED LEVEL FLIGHT

AIRPLANE CONFIGURATION
(4) AIM-7E

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



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DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

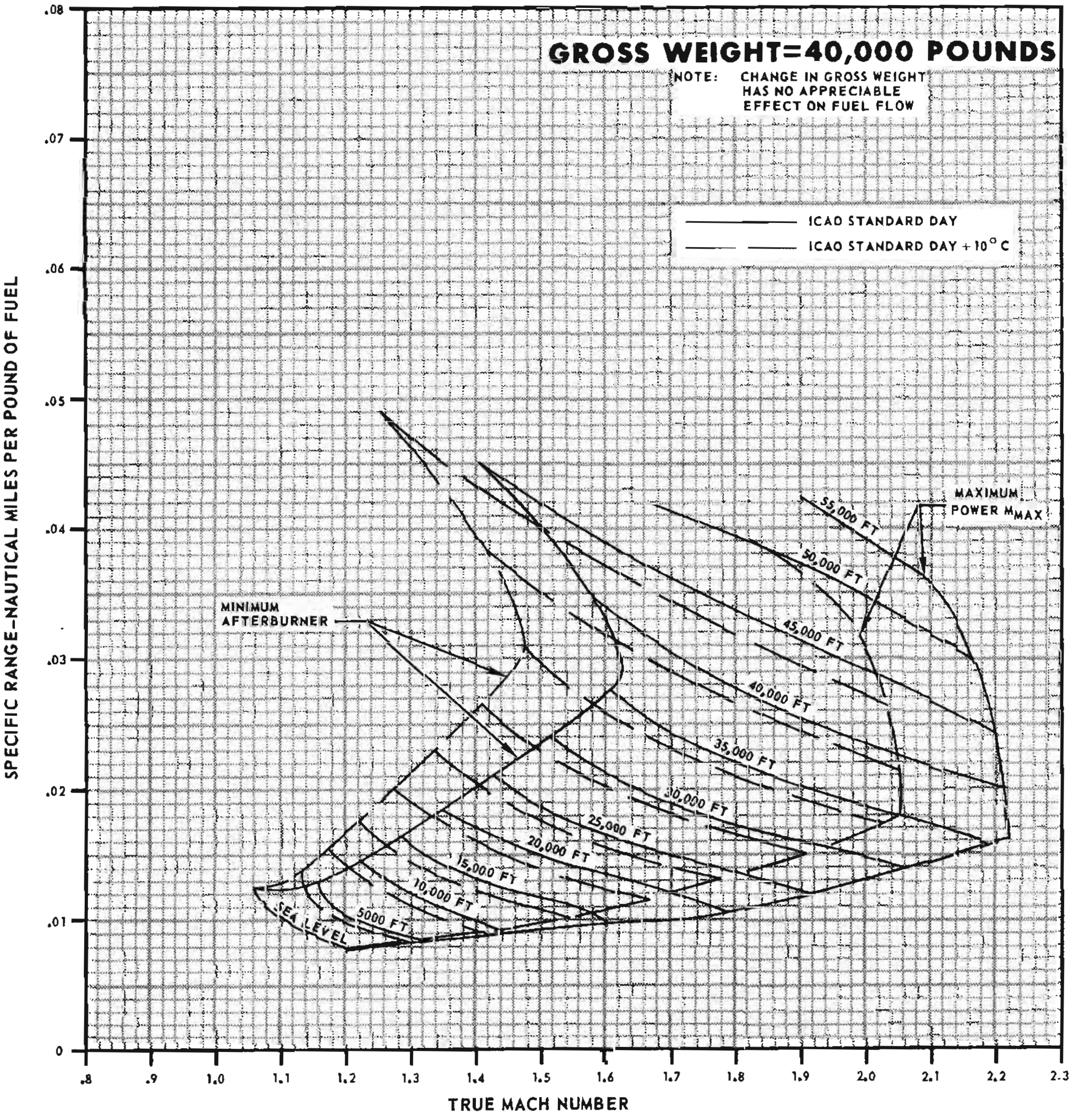


Figure B9-6

F-4E

SUPERSONIC MAXIMUM THRUST CLIMB

AIRPLANE CONFIGURATION

(4) AIM-7E

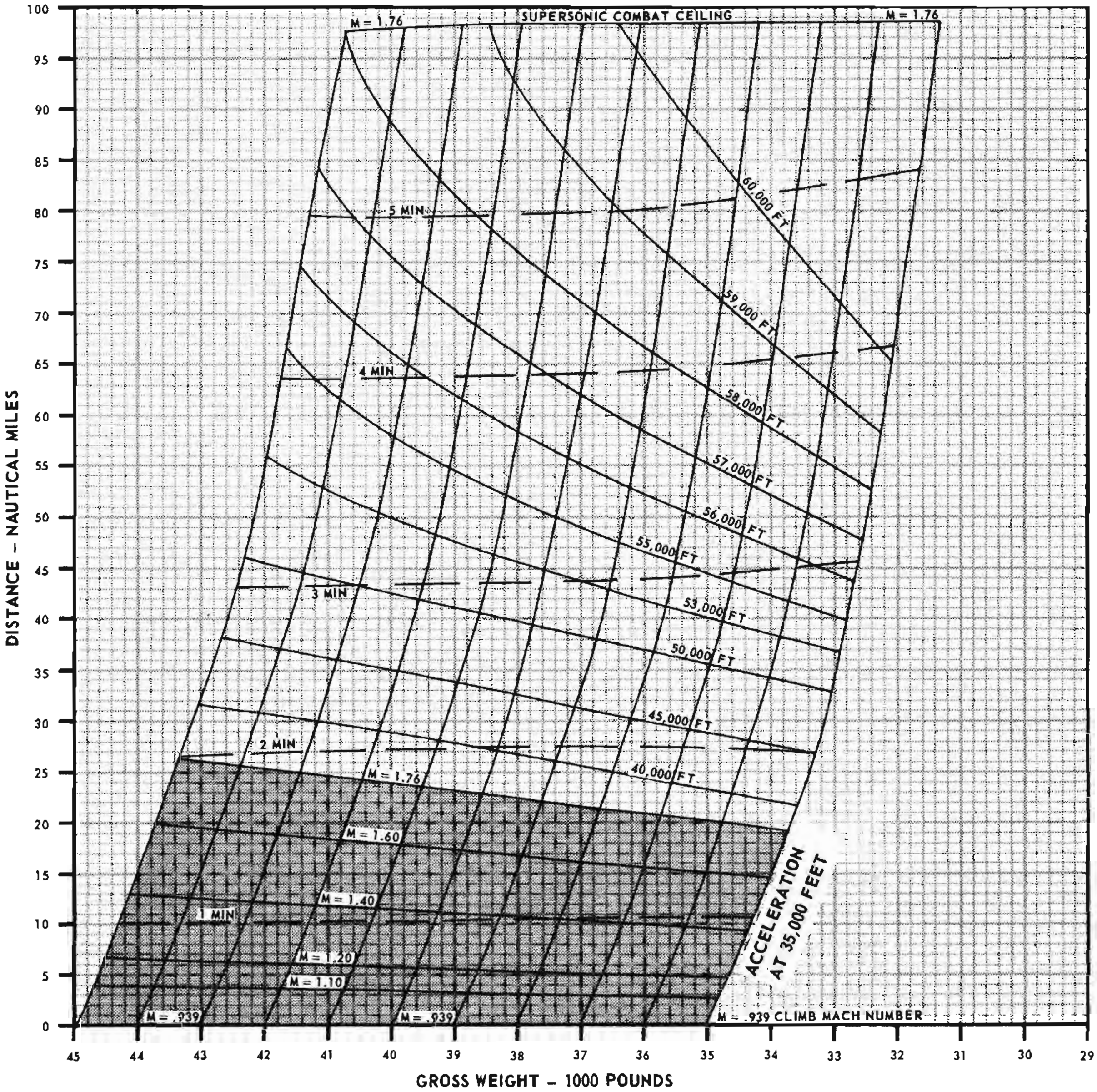
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9022

Figure B9-7

F-4E

SUPERSONIC MAXIMUM THRUST CLIMB

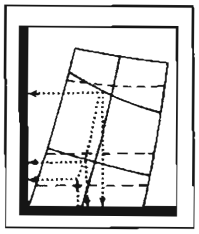
AIRPLANE CONFIGURATION
(4) AIM-7E AND (1) ℄ TANK

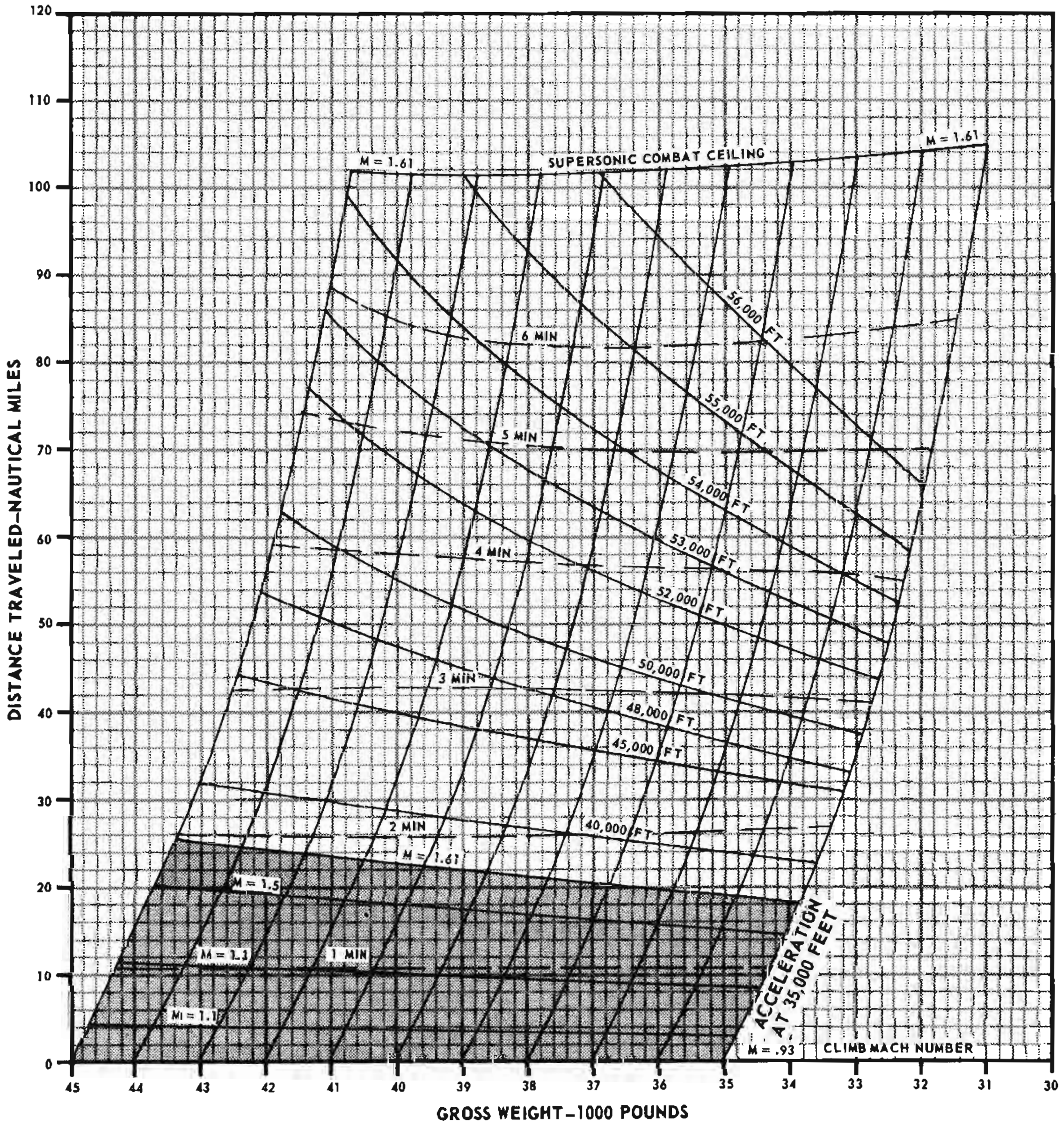
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P9023

Figure B9-8

F-4E

SUPERSONIC MAXIMUM THRUST CLIMB

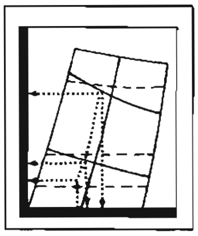
AIRPLANE CONFIGURATION

(4) AIM-7E, (4) AIM-4D AND (1) ℄ TANK

REMARKS

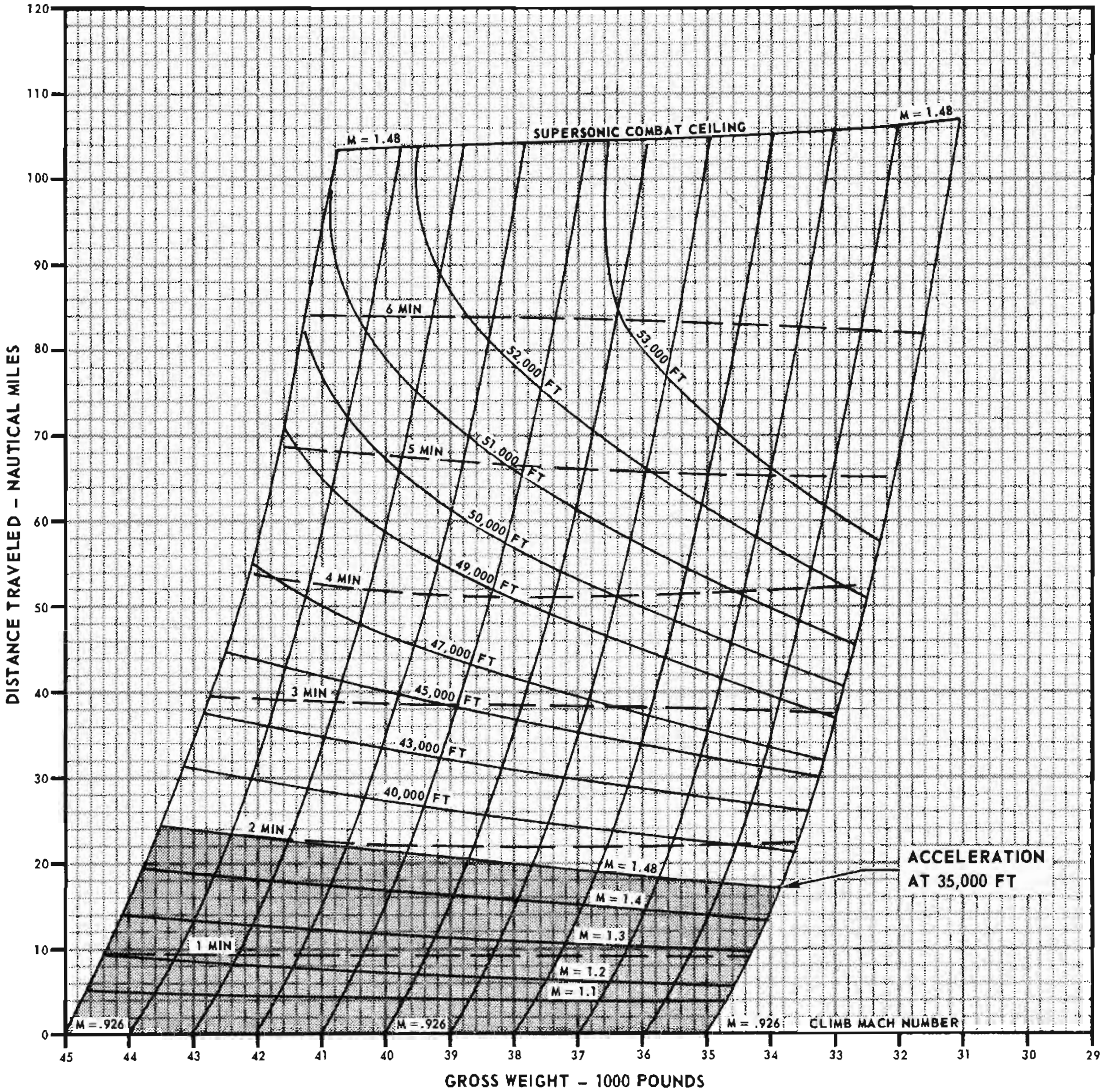
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9024

Figure B9-9

F-4E

SUPERSONIC MAXIMUM THRUST CLIMB

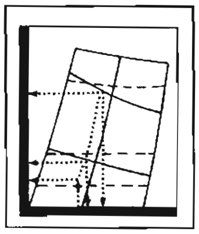
AIRPLANE CONFIGURATION

(4) AIM-7E AND
(2) WING TANKS

REMARKS

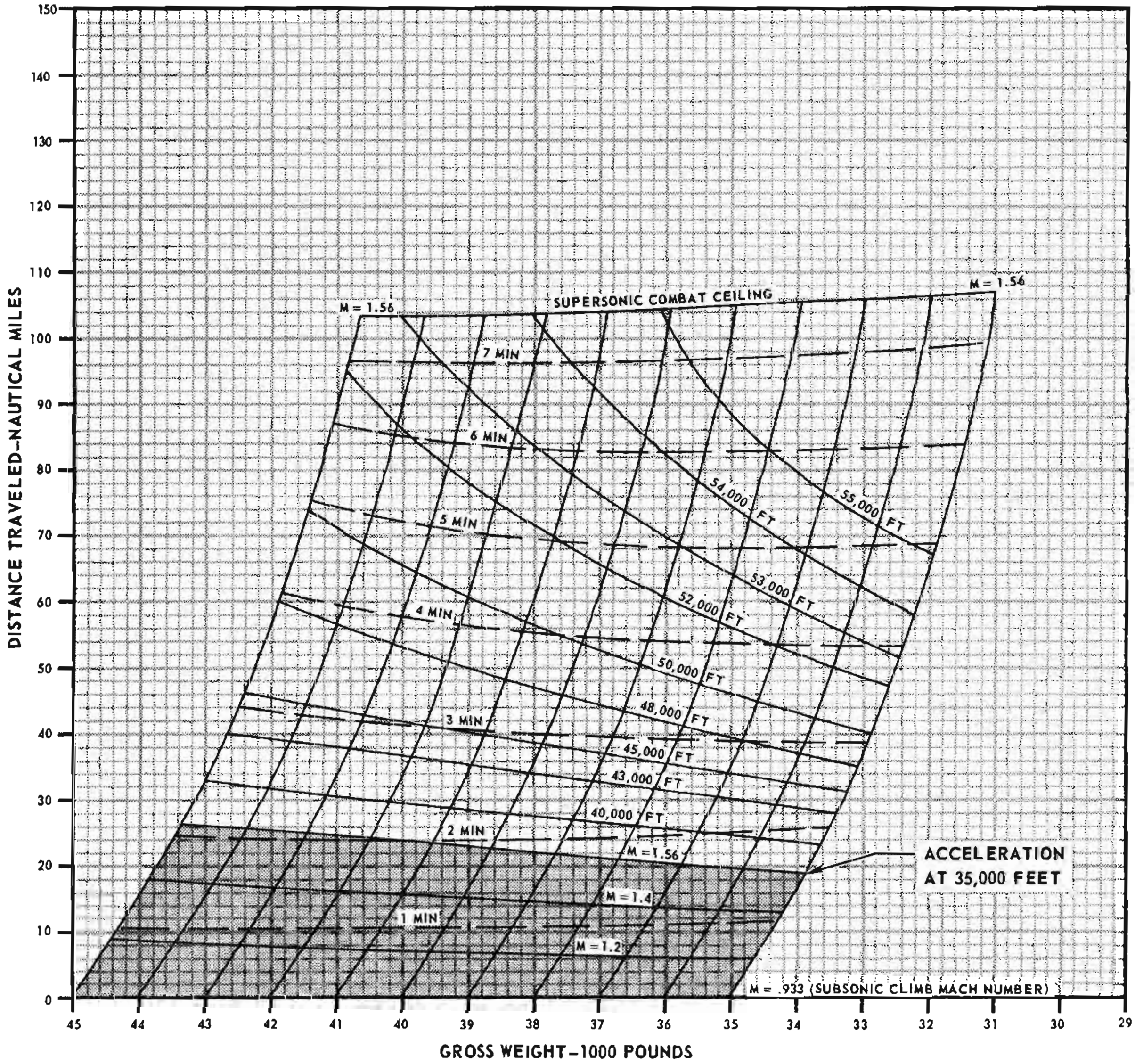
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E–P9025

Figure B9-10

F-4E

SUPERSONIC MAXIMUM THRUST CLIMB

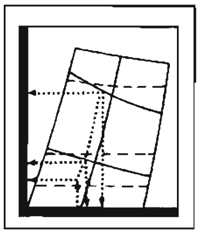
AIRPLANE CONFIGURATION

(4) AIM-7E AND
(4) AIM-4D

REMARKS

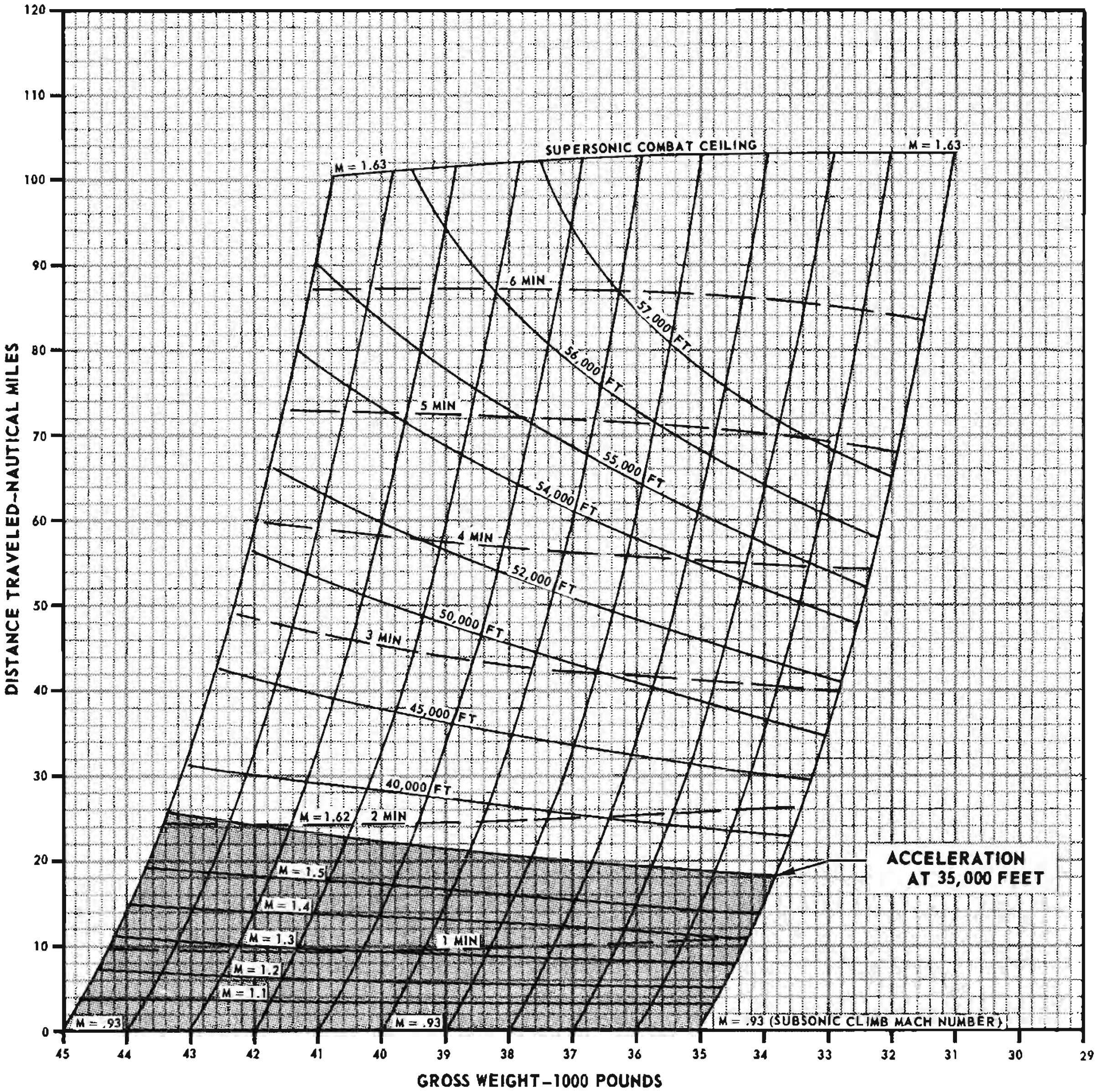
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9026

Figure B9-11

F-4E

LOW ALTITUDE ACCELERATION

MAXIMUM THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 35,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
		TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS)								
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.03/ 46	.03/ 47	.04/ 49	.04/ 50	.04/ 52	.04/ 53	.04/ 55	1.09/1.05	.90/.93
	.6	.07/ 91	.07/ 94	.07/ 97	.07/100	.07/103	.08/107	.08/111	1.09/1.05	.90/.93
	.65	.10/137	.10/142	.10/146	.11/152	.11/157	.12/163	.12/170	1.09/1.06	.90/.93
	.7	.13/184	.13/191	.14/198	.14/205	.15/214	.16/223	.16/234	1.10/1.06	.90/.93
	.75	.16/232	.17/240	.17/250	.18/261	.19/273	.20/287	.21/302	1.10/1.06	.90/.92
	.8	.19/280	.20/291	.21/304	.22/318	.23/335	.24/355	.26/378	1.11/1.07	.90/.92
	.85	.22/328	.23/343	.24/359	.25/379	.27/402	.28/429	.31/464	1.11/1.07	.89/.92
	.9	.25/378	.26/396	.27/417	.29/443	.31/475	.34/515	.37/567	1.12/1.08	.89/.92
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.03/ 45	.04/ 46	.04/ 47	.04/ 48	.04/ 50	.04/ 51	.04/ 53	1.09/1.05	.90/.93
	.6	.07/ 89	.07/ 92	.07/ 94	.07/ 97	.08/100	.08/104	.08/107	1.09/1.05	.90/.93
	.65	.10/134	.10/139	.11/143	.11/148	.12/153	.12/159	.12/165	1.09/1.06	.90/.93
	.7	.13/180	.14/186	.14/193	.15/200	.15/208	.16/217	.17/227	1.10/1.06	.90/.93
	.75	.16/227	.17/235	.18/244	.18/254	.19/266	.20/278	.21/293	1.10/1.06	.90/.92
	.8	.20/274	.20/285	.21/296	.22/310	.23/326	.25/344	.26/366	1.11/1.07	.90/.92
	.85	.23/321	.24/335	.25/350	.26/369	.27/390	.29/416	.31/448	1.11/1.07	.89/.92
	.9	.26/370	.27/387	.28/407	.30/432	.32/461	.34/498	.37/546	1.12/1.08	.89/.92
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.04/ 43	.04/ 45	.04/ 46	.04/ 47	.04/ 48	.04/ 50	.04/ 51	1.09/1.05	.90/.93
	.6	.07/ 87	.07/ 90	.07/ 92	.08/ 95	.08/ 98	.08/101	.08/104	1.09/1.05	.90/.93
	.65	.10/131	.11/135	.11/140	.11/144	.12/149	.12/154	.13/160	1.09/1.06	.90/.93
	.7	.14/176	.14/182	.15/188	.15/195	.16/202	.16/211	.17/220	1.10/1.06	.90/.93
	.75	.17/222	.18/230	.18/238	.19/248	.20/258	.21/270	.22/284	1.10/1.06	.90/.92
	.8	.20/268	.21/278	.22/289	.23/302	.24/317	.25/334	.27/354	1.11/1.07	.90/.92
	.85	.23/314	.24/327	.26/342	.27/359	.28/379	.30/403	.32/432	1.11/1.07	.89/.92
	.9	.27/362	.28/378	.29/397	.31/420	.33/448	.35/482	.38/525	1.12/1.08	.89/.92
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.04/ 43	.04/ 44	.04/ 45	.04/ 46	.04/ 47	.04/ 48	.04/ 50	1.09/1.05	.90/.93
	.6	.07/ 86	.08/ 88	.08/ 90	.08/ 93	.08/ 96	.08/ 99	.09/120	1.09/1.05	.90/.93
	.65	.11/129	.11/133	.12/137	.12/141	.12/146	.13/151	.13/156	1.09/1.06	.90/.93
	.7	.14/173	.15/178	.15/184	.16/191	.16/198	.17/205	.18/214	1.10/1.06	.90/.93
	.75	.18/217	.18/225	.19/233	.20/242	.20/252	.21/263	.22/276	1.10/1.06	.90/.92
	.8	.21/262	.22/272	.23/283	.24/295	.25/309	.26/325	.28/343	1.11/1.07	.90/.92
	.85	.24/308	.25/320	.26/334	.28/350	.29/369	.31/391	.33/418	1.11/1.07	.89/.92
	.9	.28/354	.29/369	.30/387	.32/409	.34/435	.36/467	.39/507	1.12/1.08	.89/.92

F4E-T9016

Figure B9-12

F-4E

LOW ALTITUDE ACCELERATION

MAXIMUM THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT - 40,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS). DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.04/ 53	.04/ 54	.04/ 56	.04/ 58	.04/ 59	.04/ 61	.05/ 63	1.09/1.05	.93/.90
	.6	.08/105	.08/108	.08/111	.08/115	.08/119	.09/123	.09/127	1.09/1.05	.93/.90
	.65	.11/158	.12/163	.12/168	.12/174	.13/181	.13/188	.14/196	1.09/1.06	.93/.90
	.7	.15/211	.15/219	.16/227	.16/236	.17/246	.18/256	.19/269	1.10/1.06	.93/.90
	.75	.18/266	.19/276	.20/287	.21/299	.22/313	.23/329	.24/348	1.10/1.06	.92/.90
	.8	.22/321	.23/334	.24/349	.25/365	.26/385	.28/407	.29/434	1.11 /1.07	.92/.90
	.85	.25/377	.26/393	.28/412	.29/435	.31/461	.33/493	.35/533	1.11 /1.07	.92/.89
	.9	.28/433	.30/454	.31/478	.33/509	.36/545	.38/591	.42/651	1.12/1.08	.92/.89
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.04/ 51	.04/ 53	.04/ 54	.04/ 56	.04/ 57	.04/ 59	.05/ 61	1.09/1.05	.93/.90
	.6	.08/103	.08/106	.08/109	.08/112	.09/116	.09/120	.09/124	1.09/1.05	.93/.90
	.65	.12/154	.12/159	.12/165	.13/170	.13/176	.14/183	.14/190	1.09/1.06	.93/.90
	.7	.15/207	.16/214	.16/222	.17/230	.18/239	.18/249	.19/261	1.10/1.06	.93/.90
	.75	.19/260	.20/270	.20/280	.21/292	.22/305	.23/320	.24/337	1.10/1.06	.92/.90
	.8	.22/314	.23/327	.24/341	.26/356	.27/374	.28/395	.30/420	1.11 /1.07	.92/.90
	.85	.26/369	.27/385	.28/402	.30/423	.32/448	.34/478	.36/515	1.11 /1.07	.92/.89
	.9	.29/424	.31/444	.32/467	.34/496	.36/530	.39/572	.43/627	1.12/1.08	.92/.89
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.04/ 50	.04/ 51	.04/ 53	.04/ 54	.04/ 56	.05/ 57	.05/ 59	1.09/1.05	.93/.90
	.6	.08/100	.08/103	.08/106	.09/109	.09/113	.09/116	.10/120	1.09/1.05	.93/.90
	.65	.12/151	.12/156	.13/161	.13/166	.14/172	.14/178	.15/185	1.09/1.06	.93/.90
	.7	.16/203	.16/209	.17/217	.18/224	.18/233	.19/242	.20/253	1.10/1.06	.93/.90
	.75	.20/255	.20/264	.21/274	.22/285	.23/297	.24/311	.25/327	1.10/1.06	.92/.90
	.8	.23/307	.24/319	.25/332	.26/347	.28/364	.29/384	.31/407	1.11 /1.07	.92/.90
	.85	.27/361	.28/376	.29/393	.31/413	.32/436	.34/463	.37/497	1.11 /1.07	.92/.89
	.9	.30/415	.32/434	.33/456	.35/483	.38/515	.40/554	.44/604	1.12/1.08	.92/.89
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.04/ 49	.04/ 50	.04/ 52	.05/ 53	.05/ 54	.05/ 56	.05/ 58	1.09/1.05	.93/.90
	.6	.08/ 99	.09/101	.09/104	.09/107	.09/110	.10/114	.10/118	1.09/1.05	.93/.90
	.65	.12/148	.13/153	.13/158	.14/163	.14/168	.15/174	.15/180	1.09/1.06	.93/.90
	.7	.16/199	.17/205	.18/212	.18/220	.19/228	.20/237	.20/247	1.10/1.06	.93/.90
	.75	.20/250	.21/259	.22/268	.23/278	.24/290	.25/303	.26/318	1.10/1.06	.92/.90
	.8	.24/301	.25/313	.26/325	.27/339	.28/355	.30/374	.32/395	1.11 /1.07	.92/.90
	.85	.28/354	.29/368	.30/384	.32/403	.34/425	.36/450	.38/482	1.11 /1.07	.92/.89
	.9	.32/407	.33/425	.35/445	.36/471	.39/500	.42/537	.45/583	1.12/1.08	.92/.89

F4E-T9017

Figure B9-13

F-4E

LOW ALTITUDE ACCELERATION

MAXIMUM THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 45,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS)							TEMP. EFFECTS FACTOR	
			0	20	40	60	80	100	120	+10°C	−10°C
SEA LEVEL (15°C)	.5		.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55		.04/ 60	.04/ 62	.05/ 63	.05/ 65	.05/ 67	.05/ 69	.05/ 72	1.09/1.05	.90/.93
	.6		.08/119	.09/112	.09/126	.09/130	.10/135	.10/139	.10/145	1.09/1.05	.90/.93
	.65		.13/179	.13/184	.14/191	.14/197	.14/205	.15/213	.16/222	1.09/1.06	.90/.93
	.7		.17/239	.17/248	.18/257	.19/267	.19/278	.20/290	.21/304	1.10/1.06	.90/.93
	.75		.21/301	.22/312	.22/325	.23/339	.24/355	.26/373	.27/394	1.10/1.06	.90/.92
	.8		.25/363	.26/378	.27/394	.28/413	.30/435	.31/461	.33/492	1.11/1.07	.90/.92
	.85		.28/425	.30/445	.31/466	.33/491	.35/522	.37/558	.40/603	1.11/1.07	.89/.92
	.9		.32/489	.34/513	.35/541	.38/575	.40/617	.44/669	.48/737	1.12/1.08	.89/.92
2000 FEET (11°C)	.5		.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55		.04/ 58	.05/ 60	.05/ 62	.05/ 63	.05/ 65	.05/ 67	.05/ 69	1.09/1.05	.90/.93
	.6		.09/116	.09/120	.09/123	.10/127	.10/131	.10/136	.11/141	1.09/1.05	.90/.93
	.65		.13/175	.14/181	.14/186	.14/193	.15/200	.16/207	.16/216	1.09/1.06	.90/.93
	.7		.17/234	.18/242	.18/251	.19/261	.20/271	.21/283	.22/296	1.10/1.06	.90/.93
	.75		.21/295	.22/306	.23/318	.24/331	.25/346	.26/363	.28/382	1.10/1.06	.90/.92
	.8		.25/355	.26/370	.28/385	.29/403	.30/424	.32/448	.34/476	1.11/1.07	.90/.92
	.85		.29/417	.31/435	.32/455	.34/479	.36/507	.38/541	.41/583	1.11/1.07	.89/.92
	.9		.33/480	.35/502	.36/528	.39/561	.41/599	.44/647	.49/710	1.12/1.08	.89/.92
4000 FEET (7°C)	.5		.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55		.05/ 57	.05/ 58	.05/ 60	.05/ 62	.05/ 63	.05/ 65	.06/ 67	1.09/1.05	.90/.93
	.6		.09/114	.09/117	.10/120	.10/124	.10/128	.11/132	.11/137	1.09/1.05	.90/.93
	.65		.14/171	.14/177	.14/182	.15/188	.15/195	.16/202	.17/210	1.09/1.06	.90/.93
	.7		.18/230	.18/237	.19/246	.20/254	.21/264	.22/275	.22/287	1.10/1.06	.90/.93
	.75		.22/288	.23/299	.24/310	.25/323	.26/337	.27/353	.28/371	1.10/1.06	.90/.92
	.8		.26/348	.27/362	.28/376	.30/393	.31/413	.33/435	.35/462	1.11/1.07	.90/.92
	.85		.30/408	.32/425	.33/444	.35/467	.37/494	.39/525	.42/564	1.11/1.07	.89/.92
	.9		.34/470	.36/491	.38/516	.40/546	.42/583	.46/627	.50/685	1.12/1.08	.89/.92
6000 FEET (3°C)	.5		.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55		.05/ 56	.05/ 57	.05/ 59	.05/ 60	.05/ 62	.06/ 64	.06/ 66	1.09/1.05	.90/.93
	.6		.10/112	.10/115	.10/118	.10/122	.11/126	.11/130	.11/134	1.09/1.05	.90/.93
	.65		.14/169	.15/174	.15/179	.16/185	.16/191	.17/198	.17/205	1.09/1.06	.90/.93
	.7		.19/226	.19/233	.20/241	.21/249	.21/259	.22/269	.23/281	1.10/1.06	.90/.93
	.75		.23/283	.24/293	.25/304	.26/316	.27/329	.28/344	.29/361	1.10/1.06	.90/.92
	.8		.28/342	.28/354	.30/369	.31/385	.32/403	.34/424	.36/449	1.11/1.07	.90/.92
	.85		.32/400	.33/417	.34/435	.36/456	.38/481	.40/511	.43/546	1.11/1.07	.89/.92
	.9		.36/460	.37/481	.39/504	.41/533	.44/567	.47/609	.51/662	1.12/1.08	.89/.92

F4E-T9018

Figure B9-14

F-4E

LOW ALTITUDE ACCELERATION

MAXIMUM THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 50,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS)							TEMP. EFFECTS FACTOR	
		DRAG INDEX 0	20	40	60	80	100	120	+10°C	−10°C
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.05/ 67	.05/ 69	.05/ 71	.05/ 73	.06/ 76	.06/ 78	.06/ 81	1.09/1.05	.90/.93
	.6	.10/133	.10/137	.10/141	.11/146	.11/151	.11/156	.12/162	1.09/1.05	.90/.93
	.65	.14/200	.15/206	.15/213	.16/221	.16/229	.17/238	.18/248	1.09/1.06	.90/.93
	.7	.19/267	.19/277	.20/287	.21/299	.22/311	.23/325	.24/341	1.10/1.06	.90/.93
	.75	.23/336	.24/349	.25/363	.26/379	.27/397	.29/417	.30/441	1.10/1.06	.90/.92
	.8	.28/405	.29/422	.30/441	.31/462	.33/487	.35/516	.37/550	1.11/1.07	.90/.92
	.85	.32/475	.33/497	.35/520	.37/549	.39/583	.41/624	.45/674	1.11/1.07	.89/.92
	.9	.36/546	.38/573	.40/604	.42/643	.45/689	.49/748	.54/825	1.12/1.08	.89/.92
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.05/ 66	.05/ 67	.05/ 69	.06/ 71	.06/ 73	.06/ 76	.06/ 78	1.09/1.05	.90/.93
	.6	.10/130	.10/134	.10/138	.11/143	.11/147	.12/152	.12/158	1.09/1.05	.90/.93
	.65	.15/196	.15/202	.16/209	.16/216	.17/224	.17/233	.18/242	1.09/1.06	.90/.93
	.7	.19/262	.20/272	.21/281	.22/292	.22/304	.23/317	.24/332	1.10/1.06	.90/.93
	.75	.24/330	.25/342	.26/355	.27/370	.28/387	.30/406	.31/428	1.10/1.06	.90/.92
	.8	.28/397	.30/413	.31/431	.32/451	.34/475	.36/501	.38/534	1.1/1.07	.90/.92
	.85	.33/466	.34/486	.36/509	.38/536	.40/568	.42/606	.46/652	1.11/1.07	.89/.92
	.9	.37/536	.39/561	.41/590	.43/627	.46/670	.50/724	.54/795	1.12/1.08	.89/.92
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.05/ 64	.05/ 66	.06/ 67	.06/ 69	.06/ 71	.06/ 73	.06/ 76	1.09/1.05	.90/.93
	.6	.10/128	.10/131	.11/135	.11/139	.12/144	.12/149	.12/154	1.09/1.05	.90/.93
	.65	.15/192	.16/198	.16/204	.17/211	.17/219	.18/227	.19/236	1.09/1.06	.90/.93
	.7	.20/257	.21/266	.22/275	.22/285	.23/296	.24/309	.25/323	1.10/1.06	.90/.93
	.75	.25/323	.26/335	.27/347	.28/362	.29/377	.30/395	.32/416	1.10/1.06	.90/.92
	.8	.30/389	.31/405	.32/421	.33/440	.35/462	.37/488	.39/517	1.11/1.07	.90/.92
	.85	.34/457	.36/476	.37/497	.39/523	.41/553	.44/588	.47/632	1.11/1.07	.89/.92
	.9	.39/525	.40/549	.42/576	.45/611	.48/652	.51/702	.56/767	1.12/1.08	.89/.92
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.05/ 63	.06/ 65	.06/ 66	.06/ 68	.06/ 70	.06/ 72	.06/ 74	1.09/1.05	.90/.93
	.6	.11/126	.11/130	.11/133	.12/137	.12/141	.12/146	.13/151	1.09/1.05	.90/.93
	.65	.16/189	.16/195	.17/201	.17/208	.18/215	.19/223	.19/231	1.09/1.06	.90/.93
	.7	.21/253	.22/262	.22/270	.23/280	.24/291	.25/302	.26/316	1.10/1.06	.90/.93
	.75	.26/318	.27/329	.28/341	.29/354	.30/370	.32/386	.33/406	1.10/1.06	.90/.92
	.8	.31/383	.32/397	.33/413	.35/431	.36/452	.38/476	.40/504	1.11/1.07	.90/.92
	.85	.36/448	.37/467	.38/487	.40/511	.43/539	.45/572	.48/613	11.1/1.07	.89/.92
	.9	.40/515	.42/538	.44/564	.46/597	.49/635	.53/682	.57/742	1.12/1.08	.89/.92

F4E-T9019

Figure B9-15

F-4E
LOW ALTITUDE ACCELERATION
MAXIMUM THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 55,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS). DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.05/ 75	.06/ 77	.06/ 79	.06/ 82	.06/ 84	.06/ 87	.06/ 90	1.09/1.05	.90/.93
	.6	.11/148	.11/152	.11/157	.12/162	.12/168	.12/174	.13/180	1.09/1.05	.90/.93
	.65	.16/222	.16/229	.17/237	.17/245	.18/255	.19/265	.20/276	1.09/1.06	.90/.93
	.7	.21/296	.22/307	.22/319	.23/331	.24/345	.25/361	.26/378	1.10/1.06	.90/.93
	.75	.26/372	.27/387	.28/403	.29/420	.30/440	.32/463	.34/489	1.10/1.06	.90/.92
	.8	.30/448	.32/467	.33/488	.35/512	.36/539	.39/572	.41/610	1.11/1.07	.90/.92
	.85	.35/526	.37/550	.38/576	.40/608	.43/646	.46/691	.50/747	1.11/1.07	.89/.92
	.9	.40/604	.42/634	.44/668	.46/711	.50/763	.54/828	.59/914	1.12/1.08	.89/.92
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.06/ 73	.06/ 75	.06/ 77	.06/ 79	.06/ 82	.06/ 84	.07/ 87	1.09/1.05	.90/.93
	.6	.11/145	.11/149	.12/154	.12/159	.12/164	.13/170	.13/176	1.09/1.05	.90/.93
	.65	.16/218	.17/225	.17/232	.18/240	.19/249	.19/259	.20/269	1.09/1.06	.90/.93
	.7	.22/291	.22/301	.23/312	.24/324	.25/337	.26/352	.27/369	1.10/1.06	.90/.93
	.75	.27/365	.28/379	.29/394	.30/411	.31/430	.33/451	.34/475	1.10/1.06	.90/.92
	.8	.32/440	.33/458	.34/478	.36/500	.38/526	.40/556	.42/592	1.11/1.07	.90/.92
	.85	.36/516	.38/538	.40/563	.42/594	.44/629	.47/671	.51/724	1.11/1.07	.89/.92
	.9	.41/593	.43/621	.45/653	.48/694	.51/743	.55/803	.60/881	1.12/1.08	.89/.92
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.06/ 71	.06/ 73	.06/ 75	.06/ 77	.06/ 80	.07/ 82	.07/ 84	1.09/1.05	.90/.93
	.6	.11/142	.12/146	.12/151	.12/155	.13/160	.13/166	.14/171	1.09/1.05	.90/.93
	.65	.17/214	.17/220	.18/228	.19/235	.19/244	.20/253	.21/263	1.09/1.06	.90/.93
	.7	.22/286	.23/295	.24/306	.25/317	.26/330	.27/344	.28/359	1.10/1.06	.90/.93
	.75	.28/358	.29/372	.30/386	.31/402	.32/420	.34/439	.36/463	1.10/1.06	.90/.92
	.8	.33/432	.34/449	.35/468	.37/489	.39/513	.41/542	.43/575	1.11/1.07	.90/.92
	.85	.38/506	.39/528	.41/551	.43/580	.46/613	.48/653	.52/701	1.11/1.07	.89/.92
	.9	.43/582	.45/608	.47/639	.50/677	.53/723	.57/779	.62/851	1.12/1.08	.89/.92
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.06/ 70	.06/ 72	.06/ 74	.07/ 76	.07/ 78	.07/ 81	.07/ 83	1.09/1.05	.90/.93
	.6	.12/140	.12/144	.13/149	.13/153	.13/158	.14/163	.14/169	1.09/1.05	.90/.93
	.65	.18/211	.18/217	.19/224	.19/232	.20/240	.21/248	.22/258	1.09/1.06	.90/.93
	.7	.23/282	.24/291	.25/301	.26/312	.27/324	.28/337	.29/352	1.10/1.06	.90/.93
	.75	.29/353	.30/366	.31/379	.32/394	.34/411	.35/430	.37/452	1.10/1.06	.90/.92
	.8	.34/425	.36/441	.37/459	.38/479	.40/502	.42/529	.45/560	1.11/1.07	.90/.92
	.85	.39/497	.41/518	.43/540	.45/568	.47/599	.50/636	.54/681	1.11/1.07	.89/.92
	.9	.44/571	.46/597	.49/626	.51/662	.55/705	.59/757	.64/824	1.12/1.08	.89/.92

F4E-T9020

Figure B9-16

F-4E

LOW ALTITUDE ACCELERATION
MAXIMUM THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 60,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS). DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.06/ 82	.06/ 85	.06/ 87	.06/ 90	.07/ 93	.07/ 96	.07/ 99	1.09/1.05	.93/.90
	.6	.12/163	.12/168	.12/173	.13/179	.13/185	.14/192	.14/199	1.09/1.05	.93/.90
	.65	.17/244	.18/252	.18/261	.19/270	.20/281	.21/292	.22/305	1.09/1.06	.93/.90
	.7	.23/326	.24/338	.24/351	.26/365	.27/380	.28/398	.29/417	1.10/1.06	.93/.90
	.75	.28/409	.29/425	.31/443	.32/462	.33/484	.35/509	.37/539	1.10/1.06	.92/.90
	.8	.33/493	.35/514	.36/536	.38/563	.40/593	.42/629	.45/671	1.11/1.07	.92/.90
	.85	.38/577	.40/603	.42/633	.44/668	.47/710	.50/760	.54/822	1.11/1.07	.92/.89
	.9	.44/663	.46/696	.48/733	.51/781	.55/838	.59/910	.65/1005	1.12/1.08	.92/.89
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.06/ 81	.06/ 83	.06/ 85	.07/ 88	.07/ 91	.07/ 93	.07/ 97	1.09/1.05	.93/.90
	.6	.12/160	.12/165	.13/170	.13/175	.14/181	.14/188	.15/195	1.09/1.05	.93/.90
	.65	.18/240	.18/248	.19/256	.20/265	.21/275	.21/286	.22/298	1.09/1.06	.93/.90
	.7	.24/321	.24/332	.25/344	.26/357	.27/372	.29/388	.30/407	1.10/1.06	.93/.90
	.75	.29/402	.30/417	.32/434	.33/452	.34/473	.36/497	.38/524	1.10/1.06	.92/.90
	.8	.35/484	.36/504	.38/526	.39/551	.41/579	.44/613	.46/652	1.11/1.07	.92/.90
	.85	.40/567	.42/592	.44/620	.46/653	.49/692	.52/739	.56/797	1.11/1.07	.92/.89
	.9	.45/651	.47/682	.50/718	.53/763	.56/817	.61/883	.66/970	1.12/1.08	.92/.89
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.06/ 79	.07/ 81	.07/ 83	.07/ 86	.07/ 88	.07/ 91	.08/ 94	1.09/1.05	.93/.90
	.6	.13/157	.13/162	.13/167	.14/172	.14/177	.15/184	.15/190	1.09/1.05	.93/.90
	.65	.19/236	.19/243	.20/251	.21/260	.21/269	.22/279	.23/291	1.09/1.06	.93/.90
	.7	.25/315	.25/326	.26/338	.27/350	.28/364	.30/380	.31/397	1.10/1.06	.93/.90
	.75	.30/395	.32/410	.33/425	.34/443	.36/463	.37/485	.39/511	1.10/1.06	.92/.90
	.8	.36/475	.38/494	.39/515	.41/539	.43/566	.45/597	.48/634	1.11/1.07	.92/.90
	.85	.42/557	.43/580	.45/607	.48/638	.50/675	.53/719	.57/773	1.11/1.07	.92/.89
	.9	.47/639	.49/669	.52/703	.55/745	.58/796	.62/858	.68/938	1.12/1.08	.92/.89
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.07/ 78	.07/ 80	.07/ 83	.07/ 85	.08/ 87	.08/ 90	.08/ 93	1.09/1.05	.93/.90
	.6	.13/156	.14/160	.14/165	.14/170	.15/176	.15/181	.16/188	1.09/1.05	.93/.90
	.65	.20/233	.20/241	.21/249	.22/257	.22/266	.23/276	.24/286	1.09/1.06	.93/.90
	.7	.26/311	.27/322	.28/333	.29/345	.30/359	.31/373	.32/390	1.10/1.06	.93/.90
	.75	.32/390	.33/404	.34/419	.36/436	.37/455	.39/476	.41/500	1.10/1.06	.92/.90
	.8	.38/468	.39/487	.41/506	.42/529	.45/555	.47/585	.50/620	1.11/1.07	.92/.90
	.85	.43/548	.45/571	.47/596	.50/626	.52/661	.55/702	.59/753	1.11/1.07	.92/.89
	.9	.49/629	.51/657	.54/690	.57/730	.60/778	.65/836	.70/910	1.12/1.08	.92/.89

F4E-T9027

Figure B9-17

F-4E

LOW ALTITUDE ACCELERATION

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 35,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
		TIME TO ACCELERATE (MIN)/FUEL TO ACCELERATE (LBS)								
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.06/ 23	.06/ 25	.07/ 26	.07/ 28	.08/ 29	.08/ 31	.09/ 34	1.14/1.07	.90/.93
	.6	.13/ 48	.13/ 51	.14/ 54	.15/ 58	.16/ 62	.18/ 67	.19/ 73	1.15/1.08	.90/.93
	.65	.19/ 75	.21/ 80	.22/ 85	.24/ 92	.26/100	.28/110	.32/123	1.15/1.09	.89/.92
	.7	.26/103	.28/111	.31/120	.34/131	.37/146	.42/164	.48/191	1.16/1.10	.88/.92
	.75	.34/133	.36/145	.40/159	.45/178	.51/203	.60/240	.76/306	1.17/1.11	.87/.92
	.8	.41/166	.46/184	.51/205	.58/236	.70/285	.94/384		1.18/1.12	.87/.91
	.85	.50/204	.56/229	.64/263	.78/322	1.09/457			1.19/1.13	.86/.91
	.9	.60/248	.68/285	.83/347	1.24/529				1.20/1.14	.86/.90
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.06/ 23	.07/ 24	.07/ 26	.08/ 27	.08/ 29	.08/ 31	.09/ 33	1.14/1.07	.90/.93
	.6	.13/ 48	.14/ 50	.15/ 53	.16/ 57	.17/ 61	.18/ 65	.19/ 71	1.15/1.08	.90/.93
	.65	.20/ 73	.21/ 78	.23/ 84	.24/ 90	.26/ 97	.29/107	.32/118	1.15/1.09	.89/.92
	.7	.27/101	.29/108	.31/117	.34/127	.38/140	.42/157	.48/180	1.16/1.10	.88/.92
	.75	.34/130	.37/141	.41/154	.45/171	.51/194	.59/226	.73/279	1.17/1.11	.87/.92
	.8	.42/162	.46/178	.52/198	.58/226	.69/268	.89/345		1.18/1.12	.87/.91
	.85	.51/199	.57/221	.64/252	.77/303	1.03/408			1.19/1.13	.86/.91
	.9	.61/240	.69/274	.82/329	1.15/467				1.20/1.14	.86/.90
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.07/ 23	.07/ 24	.07/ 25	.08/ 27	.08/ 28	.09/ 30	.09/ 32	1.14/1.07	.90/.93
	.6	.14/ 47	.14/ 50	.15/ 52	.16/ 56	.17/ 60	.18/ 64	.20/ 69	1.15/1.08	.90/.93
	.65	.20/ 72	.22/ 77	.23/ 82	.25/ 88	.27/ 95	.29/103	.32/113	1.15/1.09	.89/.92
	.7	.28/ 99	.30/106	.32/114	.35/124	.38/136	.42/151	.48/171	1.16/1.10	.88/.92
	.75	.35/127	.38/138	.42/150	.46/165	.51/185	.59/213	.71/258	1.17/1.11	.87/.92
	.8	.44/158	.48/173	.52/191	.59/216	.69/253	.86/316	1.40/522	1.18/1.12	.87/.91
	.85	.52/193	.58/214	.65/242	.77/287	.99/372			1.19/1.13	.86/.91
	.9	.62/233	.70/264	.82/313	1.10/423				1.20/1.14	.86/.90
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.07/ 23	.07/ 24	.08/ 25	.08/ 26	.08/ 28	.09/ 30	.10/ 32	1.14/1.07	.90/.93
	.6	.14/ 46	.15/ 49	.16/ 52	.17/ 55	.18/ 58	.19/ 63	.20/ 67	1.15/1.08	.90/.93
	.65	.21/ 71	.23/ 76	.24/ 80	.26/ 86	.28/ 93	.30/100	.33/110	1.15/1.09	.89/.92
	.7	.29/ 97	.31/104	.33/112	.36/121	.39/132	.43/145	.48/164	1.16/1.10	.88/.92
	.75	.37/125	.39/135	.43/146	.47/160	.52/179	.59/204	.70/241	1.17/1.11	.87/.92
	.8	.45/155	.49/169	.54/186	.60/208	.69/241	.84/294	1.16/410	1.18/1.12	.87/.91
	.85	.54/189	.59/208	.66/234	.77/273	.96/343	1.80/657		1.19/1.13	.86/.91
	.9	.64/227	.72/256	.83/299	1.07/389				1.20/1.14	.86/.90

F4E-T9010

Figure B9-18

F-4E

LOW ALTITUDE ACCELERATION

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT - 40,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
		TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS)								
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.07/ 27	.08/ 29	.08/ 30	.08/ 32	.09/ 34	.10/ 36	.10/ 39	1.14/1.07	.90/.93
	.6	.15/ 56	.15/ 59	.16/ 63	.18/ 67	.19/ 72	.20/ 78	.22/ 85	1.15/1.08	.90/.93
	.65	.22/ 86	.24/ 92	.26/ 99	.28/107	.30/116	.33/128	.37/143	1.15/1.09	.89/.92
	.7	.30/119	.33/128	.35/139	.39/152	.43/169	.49/191	.56/222	1.16/1.10	.88/.92
	.75	.39/153	.42/167	.46/184	.52/205	.59/235	.70/279	.89/357	1.17/1.11	.87/.92
	.8	.48/192	.52/212	.59/237	.67/273	.81/331	1.09/447		1.18/1.12	.87/.91
	.85	.58/235	.64/264	.74/303	.90/373	1.28/534			1.19/1.13	.86/.91
	.9	.69/285	.79/329	.96/402	1.45/621				1.20/1.14	.86/.90
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.07/ 27	.08/ 28	.08/ 30	.09/ 32	.09/ 33	.10/ 36	.11/ 38	1.14/1.07	.90/.93
	.6	.15/ 55	.16/ 58	.17/ 62	.18/ 66	.19/ 71	.21/ 76	.23/ 83	1.15/1.08	.90/.93
	.65	.23/ 85	.24/ 90	.26/ 97	.28/104	.30/113	.33/124	.37/137	1.15/1.09	.89/.92
	.7	.31/116	.33/125	.36/135	.39/147	.44/163	.49/183	.56/210	1.16/1.10	.88/.92
	.75	.40/150	.43/163	.47/178	.52/198	.59/225	.69/262	.85/326	1.17/1.11	.87/.92
	.8	.49/187	.54/206	.60/229	.68/261	.80/311	1.04/403		1.18/1.12	.87/.91
	.85	.59/229	.66/256	.74/291	.89/351	1.20/476			1.19/1.13	.86/.91
	.9	.70/277	.80/317	.95/381	1.35/546	1.45/584			1.20/1.14	.86/.90
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.08/ 27	.08/ 28	.08/ 30	.09/ 31	.10/ 33	.10/ 35	.11/ 37	1.14/1.07	.90/.93
	.6	.16/ 54	.16/ 58	.18/ 61	.19/ 65	.20/ 69	.21/ 74	.23/ 81	1.15/1.08	.90/.93
	.65	.24/ 84	.25/ 89	.27/ 95	.29/102	.31/110	.34/120	.38/132	1.15/1.09	.89/.92
	.7	.32/114	.34/123	.37/132	.40/143	.44/157	.49/175	.56/199	1.16/1.10	.88/.92
	.75	.41/147	.44/159	.48/173	.53/191	.60/215	.69/249	.83/301	1.17/1.11	.87/.92
	.8	.50/183	.55/200	.61/222	.68/251	.80/294	1.00/369	1.80/676	1.18/1.12	.87/.91
	.85	.60/223	.67/248	.76/280	.89/333	1.15/434			1.19/1.13	.86/.91
	.9	.72/270	.81/306	.96/363	1.29/494				1.20/1.14	.86/.90
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.08/ 27	.08/ 28	.09/ 29	.09/ 31	.10/ 33	.11/ 35	.11/ 37	1.14/1.07	.90/.93
	.6	.16/ 54	.17/ 57	.18/ 60	.19/ 64	.21/ 68	.22/ 73	.24/ 79	1.15/1.08	.90/.93
	.65	.25/ 83	.26/ 88	.28/ 93	.30/100	.32/108	.35/117	.38/129	1.15/1.09	.89/.92
	.7	.33/113	.36/121	.38/130	.41/140	.45/153	.50/170	.56/191	1.16/1.10	.88/.92
	.75	.42/145	.46/156	.50/170	.54/186	.61/208	.69/238	.82/283	1.17/1.11	.87/.92
	.8	.52/180	.56/196	.62/216	.70/242	.80/281	.98/344	1.43/504	1.18/1.12	.87/.91
	.85	.62/218	.69/241	.77/271	.90/318	1.12/400			1.19/1.13	.86/.91
	.9	.74/263	.83/296	.96/347	1.25/454				1.20/1.14	.86/.90

F4E-T9011

Figure B9-19

F-4E

LOW ALTITUDE ACCELERATION

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 45,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	TEMP. EFFECTS FACTOR −10°C
		TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS)								
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.08/ 31	.09/ 33	.09/ 35	.10/ 37	.10/ 39	.11/ 42	.12/ 45	1.14/1.07	.90/.93
	.6	.17/ 64	.18/ 67	.19/ 72	.20/ 77	.22/ 83	.23/ 90	.26/ 98	1.15/1.08	.90/.93
	.65	.25/ 98	.27/105	.29/113	.32/122	.34/133	.38/147	.42/164	1.15/1.09	.89/.92
	.7	.34/135	.37/146	.40/158	.44/173	.49/193	.56/219	.65/255	1.16/1.10	.88/.92
	.75	.44/174	.48/190	.53/209	.59/234	.67/269	.80/320	1.03/412	1.17/1.11	.87/.92
	.8	.54/218	.60/241	.67/270	.77/311	.93/378	1.26/515		1.18/1.12	.87/.91
	.85	.65/267	.73/300	.84/345	1.03/426	1.50/628			1.19/1.13	.86/.91
	.9	.78/324	.90/374	1.09/459	1.25/523				1.20/1.14	.86/.90
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.08/ 31	.09/ 32	.09/ 34	.10/ 36	.11/ 38	.11/ 41	.12/ 44	1.14/1.07	.90/.93
	.6	.17/ 63	.18/ 67	.19/ 71	.21/ 76	.22/ 81	.24/ 88	.26/ 95	1.15/1.08	.90/.93
	.65	.26/ 97	.28/103	.30/111	.32/119	.35/129	.38/142	.43/158	1.15/1.09	.89/.92
	.7	.36/133	.38/143	.41/154	.45/169	.50/186	.56/209	.64/241	1.16/1.10	.88/.92
	.75	.45/171	.49/186	.54/204	.60/226	.68/257	.79/301	.98/376	1.17/1.11	.87/.92
	.8	.56/213	.61/234	.68/261	.77/298	.92/356	1.19/464		1.18/1.12	.87/.91
	.85	.67/260	.75/291	.85/332	1.02/402	1.39/552			1.19/1.13	.86/.91
	.9	.80/315	.91/360	1.09/435	1.60/649				1.20/1.14	.86/.90
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.09/ 31	.09/ 32	.10/ 34	.10/ 36	.11/ 38	.12/ 40	.12/ 43	1.14/1.07	.90/.93
	.6	.18/ 62	.19/ 66	.20/ 70	.21/ 75	.23/ 80	.25/ 86	.27/ 93	1.15/1.08	.90/.93
	.65	.27/ 96	.29/102	.31/109	.33/117	.36/126	.39/138	.43/153	1.15/1.09	.89/.92
	.7	.37/131	.39/140	.42/151	.46/164	.51/181	.56/202	.64/230	1.16/1.10	.88/.92
	.75	.47/168	.51/182	.55/198	.61/219	.68/247	.79/286	.96/349	1.17/1.11	.87/.92
	.8	.57/209	.63/229	.69/253	.78/287	.92/338	1.16/426	2.56/967	1.18/1.12	.87/.91
	.85	.69/254	.76/283	.86/320	1.02/381	1.33/499			1.19/1.13	.86/.91
	.9	.82/307	.92/348	1.09/414	1.48/570				1.20/1.14	.86/.90
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.09/ 30	.10/ 32	.10/ 34	.11/ 36	.12/ 38	.12/ 40	.13/ 43	1.14/1.07	.90/.93
	.6	.19/ 62	.20/ 65	.21/ 69	.22/ 74	.24/ 79	.26/ 85	.28/ 91	1.15/1.08	.90/.93
	.65	.28/ 95	.30/101	.32/107	.34/115	.37/124	.40/135	.44/149	1.15/1.09	.89/.92
	.7	.38/129	.41/138	.44/149	.48/161	.52/176	.58/196	.65/222	1.16/1.10	.88/.92
	.75	.48/165	.52/179	.57/194	.62/214	.70/239	.80/274	.95/328	1.17/1.11	.87/.92
	.8	.59/205	.65/224	.71/247	.80/278	.93/323	1.14/397	1.72/611	1.18/1.12	.87/.91
	.85	.71/249	.78/276	.88/310	1.03/364	1.30/462			1.19/1.13	.86/.91
	.9	.84/300	.94/338	1.10/397	1.44/523				1.20/1.14	.86/.90

F4E-T9012

Figure B9-20

F-4E

LOW ALTITUDE ACCELERATION

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 50,000 POUND

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS). DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	−10°C
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.09/ 35	.10/ 37	.10/ 39	.11/ 42	.12/ 44	.12/ 47	.13/ 51	1.14/1.07	.90/.93
	.6	.19/ 72	.20/ 76	.21/ 81	.23/ 87	.24/ 94	.26/102	.29/111	1.15/1.08	.90/.93
	.65	.29/111	.31/118	.33/127	.36/138	.39/151	.43/166	.48/187	1.15/1.09	.89/.92
	.7	.39/152	.42/164	.46/178	.50/196	.56/218	.63/248	.74/290	1.16/1.10	.88/.92
	.75	.50/196	.54/214	.59/236	.66/264	.76/304	.91/363	1.19/478	1.17/1.11	.87/.92
	.8	.61/245	.67/271	.75/304	.87/352	1.05/428	1.47/602		1.18/1.12	.87/.91
	.85	.73/300	.82/338	.95/389	1.16/481	1.71/717			1.19/1.13	.86/.91
	.9	.88/364	1.01/420	1.23/517	2.34/1016				1.20/1.14	.86/.90
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.10/ 35	.10/ 37	.11/ 39	.11/ 41	.12/ 44	.13/ 47	.14/ 50	1.14/1.07	.90/.93
	.6	.19/ 71	.21/ 75	.22/ 80	.23/ 86	.25/ 92	.27/100	.30/109	1.15/1.08	.90/.93
	.65	.30/109	.32/117	.34/125	.36/135	.40/147	.44/162	.49/180	1.15/1.09	.89/.92
	.7	.40/150	.43/161	.47/175	.51/191	.56/211	.64/238	.73/276	1.16/1.10	.88/.92
	.75	.51/193	.55/210	.61/230	.68/256	.77/292	.90/343	1.13/431	1.17/1.11	.87/.92
	.8	.63/240	.69/264	.77/295	.88/338	1.04/404	1.38/538		1.18/1.12	.87/.91
	.85	.75/293	.84/328	.96/375	1.16/455	1.58/629			1.19/1.13	.86/.91
	.9	.90/355	1.02/406	1.23/491	1.82/743				1.20/1.14	.86/.90
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.10/ 35	.11/ 37	.11/ 39	.12/ 41	.12/ 43	.13/ 46	.14/ 50	1.14/1.07	.90/.93
	.6	.20/ 71	.21/ 75	.23/ 79	.24/ 85	.26/ 91	.28/ 98	.30/106	1.15/1.08	.90/.93
	.65	.31/108	.33/115	.35/123	.38/133	.41/144	.45/157	.49/174	1.15/1.09	.89/.92
	.7	.41/147	.44/158	.48/171	.52/186	.58/205	.64/230	.74/263	1.16/1.10	.88/.92
	.75	.53/189	.57/205	.62/224	.69/248	.78/281	.90/326	1.10/400	1.17/1.11	.87/.92
	.8	.65/235	.71/258	.78/286	.89/325	1.04/384	1.33/492		1.18/1.12	.87/.91
	.85	.78/286	.86/319	.97/361	1.16/432	1.52/572			1.19/1.13	.86/.91
	.9	.92/346	1.04/393	1.24/468	1.71/659				1.20/1.14	.86/.90
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 / 0	0 / 0
	.55	.11/ 35	.11/ 37	.12/ 39	.12/ 41	.13/ 43	.14/ 46	.15/ 49	1.14/1.07	.90/.93
	.6	.21/ 70	.22/ 75	.24/ 79	.25/ 84	.27/ 90	.29/ 97	.32/105	1.15/1.08	.90/.93
	.65	.32/108	.34/114	.36/122	.39/131	.42/142	.46/155	.51/171	1.15/1.09	.89/.92
	.7	.43/146	.46/157	.50/169	.54/183	.60/201	.66/224	.75/254	1.16/1.10	.88/.92
	.75	.55/187	.59/202	.64/220	.71/243	.80/273	.91/314	1.10/337	1.17/1.11	.87/.92
	.8	.67/232	.73/253	.81/280	.91/315	1.06/368	1.30/455	2.04/724	1.18/1.12	.87/.91
	.85	.80/281	.89/311	1.00/351	1.17/414	1.48/529			1.19/1.13	.86/.91
	.9	.95/338	1.07/382	1.25/449	1.65/601				1.20/1.14	.86/.90

F4E-T9013

Figure B9-21

F-4E

LOW ALTITUDE ACCELERATION

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 55,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	DRAG INDEX 0	20	40	60	80	100	120	TEMP. EFFECTS FACTOR +10°C	TEMP. EFFECTS FACTOR −10°C
		TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS).								
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.10/ 39	.11/ 41	.12/ 44	.12/ 47	.13/ 50	.14/ 54	.15/ 58	1.14/1.07	.90/.93
	.6	.21/ 80	.22/ 85	.24/ 91	.26/ 98	.28/106	.30/115	.33/126	1.15/1.08	.90/.93
	.65	.32/124	.34/132	.37/143	.40/155	.44/169	.48/188	.54/211	1.15/1.09	.89/.92
	.7	.43/170	.47/183	.51/200	.56/220	.62/245	.71/279	.84/329	1.16/1.10	.88/.92
	.75	.55/219	.60/239	.66/264	.74/296	.86/342	1.02/410	1.35/544	1.17/1.11	.87/.92
	.8	.68/273	.75/302	.84/340	.97/394	1.19/482	1.67/687		1.18/1.12	.87/.91
	.85	.82/334	.92/377	1.06/435	1.30/540	1.98/831			1.19/1.13	.86/.91
	.9	.98/406	1.12/469	1.38/579	3.66/1615				1.20/1.14	.86/.90
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.11/ 39	.11/ 41	.12/ 44	.13/ 46	.14/ 49	.15/ 53	.16/ 57	1.14/1.07	.90/.93
	.6	.22/ 80	.23/ 85	.25/ 90	.26/ 97	.28/104	.31/113	.34/123	1.15/1.08	.90/.93
	.65	.33/122	.35/131	.38/141	.41/152	.45/166	.49/183	.55/204	1.15/1.09	.89/.92
	.7	.45/167	.48/180	.52/196	.57/214	.64/238	.72/269	.83/312	1.16/1.10	.88/.92
	.75	.57/215	.62/234	.68/258	.76/287	.86/328	1.02/387	1.29/495	1.17/1.11	.87/.92
	.8	.70/268	.77/295	.86/330	.98/379	1.18/455	1.57/612		1.18/1.12	.87/.91
	.85	.84/327	.94/366	1.07/419	1.30/510	1.80/716			1.19/1.13	.86/.91
	.9	1.00/395	1.14/453	1.38/550	2.12/867				1.20/1.14	.86/.90
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.11/ 39	.12/ 41	.13/ 44	.13/ 46	.14/ 49	.15/ 53	.16/ 57	1.14/1.07	.90/.93
	.6	.23/ 80	.24/ 84	.26/ 90	.28/ 96	.30/103	.32/111	.35/121	1.15/1.08	.90/.93
	.65	.34/122	.37/130	.39/139	.42/150	.46/163	.51/179	.56/199	1.15/1.09	.89/.92
	.7	.46/166	.50/178	.54/193	.59/210	.65/232	.73/261	.84/300	1.16/1.10	.88/.92
	.75	.59/212	.64/230	.70/252	.78/280	.88/317	1.02/370	1.26/459	1.17/1.11	.87/.92
	.8	.72/263	.79/289	.88/321	1.00/366	1.18/433	1.52/560		1.18/1.12	.87/.91
	.85	.87/320	.96/357	1.09/405	1.30/486	1.73/650			1.19/1.13	.86/.91
	.9	1.03/386	1.17/440	1.39/525	1.95/749				1.20/1.14	.86/.90
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.12/ 39	.13/ 42	.13/ 44	.14/ 46	.15/ 49	.16/ 53	.17/ 57	1.14/1.07	.90/.93
	.6	.24/ 80	.26/ 84	.27/ 90	.29/ 96	.31/103	.33/111	.36/120	1.15/1.08	.90/.93
	.65	.36/121	.39/129	.41/138	.44/149	.48/161	.53/176	.58/195	1.15/1.09	.89/.92
	.7	.49/164	.52/177	.56/191	.61/207	.67/228	.75/255	.86/291	1.16/1.10	.88/.92
	.75	.62/210	.67/228	.73/248	.80/274	.90/309	1.04/357	1.26/434	1.17/1.11	.87/.92
	.8	.75/260	.82/284	.91/314	1.02/356	1.19/416	1.49/521	2.46/875	1.18/1.12	.87/.91
	.85	.90/315	.99/349	1.12/394	1.32/466	1.69/601			1.19/1.13	.86/.91
	.9	1.06/378	1.20/428	1.41/505	1.88/684				1.20/1.14	.86/.90

F4E-T9014

Figure B9-22

F-4E

LOW ALTITUDE ACCELERATION

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

GROSS WEIGHT – 60,000 POUNDS

REMARKS
ENGINES: (2) J79-GE-17

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

	MACH	TIME TO ACCELERATE (MIN.)/FUEL TO ACCELERATE (LBS)							TEMP. EFFECTS FACTOR	
		DRAG INDEX 0	20	40	60	80	100	120	+10°C	−10°C
SEA LEVEL (15°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.12/ 44	.12/ 46	.13/ 49	.14/ 52	.15/ 56	.16/ 60	.17/ 65	1.14/1.07	.90/.93
	.6	.23/ 89	.25/ 95	.26/102	.28/109	.31/118	.34/129	.37/142	1.15/1.08	.90/.93
	.65	.36/137	.38/147	.41/159	.45/173	.49/189	.54/210	.61/237	1.15/1.09	.89/.92
	.7	.48/188	.52/204	.57/222	.62/245	.70/274	.80/313	.94/370	1.16/1.10	.88/.92
	.75	.61/243	.67/265	.74/294	.83/330	.96/382	1.15/460	1.54/618	1.17/1.11	.87/.92
	.8	.75/302	.83/335	.94/377	1.08/438	1.32/539	1.92/788		1.18/1.12	.87/.91
	.85	.90/370	1.02/417	1.17/483	1.45/601	2.26/949			1.19/1.13	.86/.91
	.9	1.08/448	1.24/519	1.53/643					1.20/1.14	.86/.90
2000 FEET (11°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.12/ 44	.13/ 46	.14/ 49	.14/ 52	.15/ 56	.16/ 60	.18/ 65	1.14/1.07	.90/.93
	.6	.24/ 89	.26/ 95	.28/101	.30/109	.32/117	.35/127	.38/139	1.15/1.08	.90/.93
	.65	.37/136	.40/146	.42/157	.46/170	.50/186	.56/206	.62/231	1.15/1.09	.89/.92
	.7	.50/186	.54/201	.58/219	.64/240	.71/267	.81/303	.94/353	1.16/1.10	.88/.92
	.75	.63/239	.69/261	.76/287	.85/321	.97/368	1.15/436	1.47/563	1.17/1.11	.87/.92
	.8	.78/297	.86/328	.96/367	1.10/423	1.32/510	1.78/693		1.18/1.12	.87/.91
	.85	.93/362	1.04/406	1.19/466	1.45/570	2.06/819			1.19/1.13	.86/.91
	.9	1.11/438	1.27/503	1.53/612	2.43/992				1.20/1.14	.86/.90
4000 FEET (7°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.13/ 44	.14/ 47	.14/ 49	.15/ 52	.16/ 56	.17/ 60	.19/ 65	1.14/1.07	.90/.93
	.6	.26/ 89	.27/ 95	.29/101	.31/108	.33/116	.36/126	.39/138	1.15/1.08	.90/.93
	.65	.38/136	.41/145	.44/156	.48/168	.52/183	.57/202	.64/225	1.15/1.09	.89/.92
	.7	.52/185	.56/199	.60/216	.66/236	.73/261	.82/294	.95/340	1.16/1.10	.88/.92
	.75	.66/236	.71/257	.78/282	.87/313	.99/356	1.15/417	1.44/523	1.17/1.11	.87/.92
	.8	.80/293	.88/322	.98/358	1.12/409	1.32/487	1.72/634		1.18/1.12	.87/.91
	.85	.96/356	1.07/397	1.22/452	1.46/544	1.95/735			1.19/1.13	.86/.91
	.9	1.14/428	1.30/489	1.55/586	2.24/864				1.20/1.14	.86/.90
6000 FEET (3°C)	.5	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	.0 / 0	0 /0	0 / 0
	.55	.14/ 45	.14/ 47	.15/ 50	.16/ 53	.17/ 57	.19/ 61	.20/ 66	1.14/1.07	.90/.93
	.6	.27/ 90	.29/ 95	.31/102	.33/109	.35/117	.38/127	.42/138	1.15/1.08	.90/.93
	.65	.41/136	.44/146	.47/156	.50/168	.55/183	.60/201	.67/224	1.15/1.09	.89/.92
	.7	.55/184	.59/198	.64/215	.69/234	.76/258	.86/290	.98/332	1.16/1.10	.88/.92
	.75	.69/235	.75/255	.82/279	.90/309	1.02/349	1.18/405	1.44/497	1.17/1.11	.87/.92
	.8	.84/290	.92/318	1.02/352	1.15/400	1.35/470	1.69/593	3.02/1076	1.18/1.12	.87/.91
	.85	1.00/351	1.11/390	1.25/441	1.48/523	1.91/680			1.19/1.13	.86/.91
	.9	1.18/421	1.34/477	1.57/565	2.13/776				1.20/1.14	.86/.90

F4E-T9015

Figure B9-23

F-4E

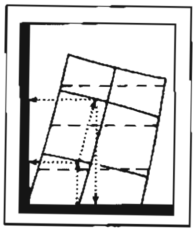
MAXIMUM THRUST ACCELERATION

10,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E

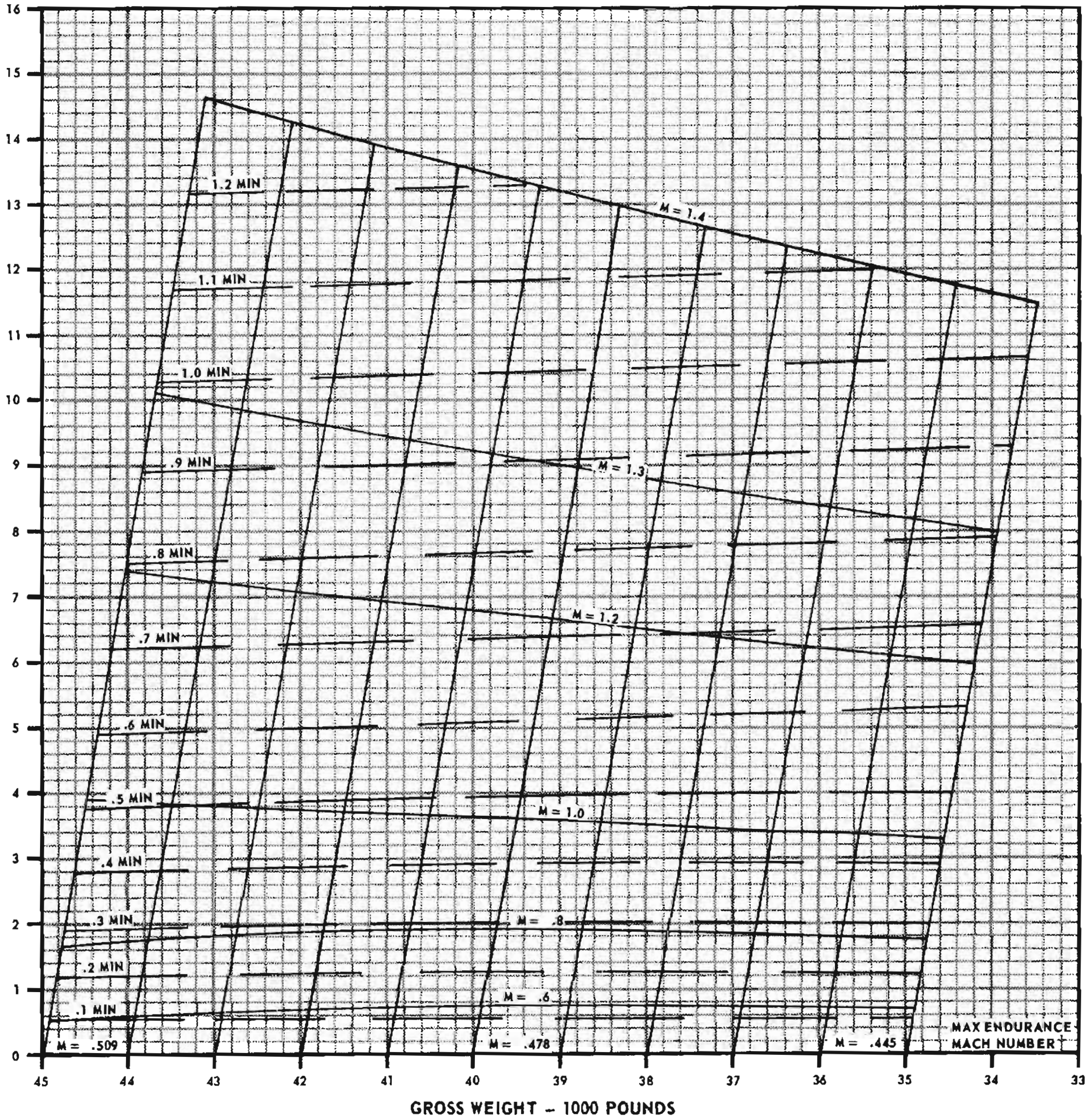
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P911

Figure B9-24

MAXIMUM THRUST ACCELERATION

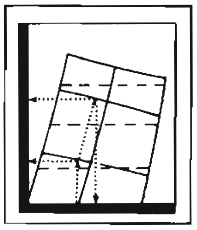
30,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E

REMARKS

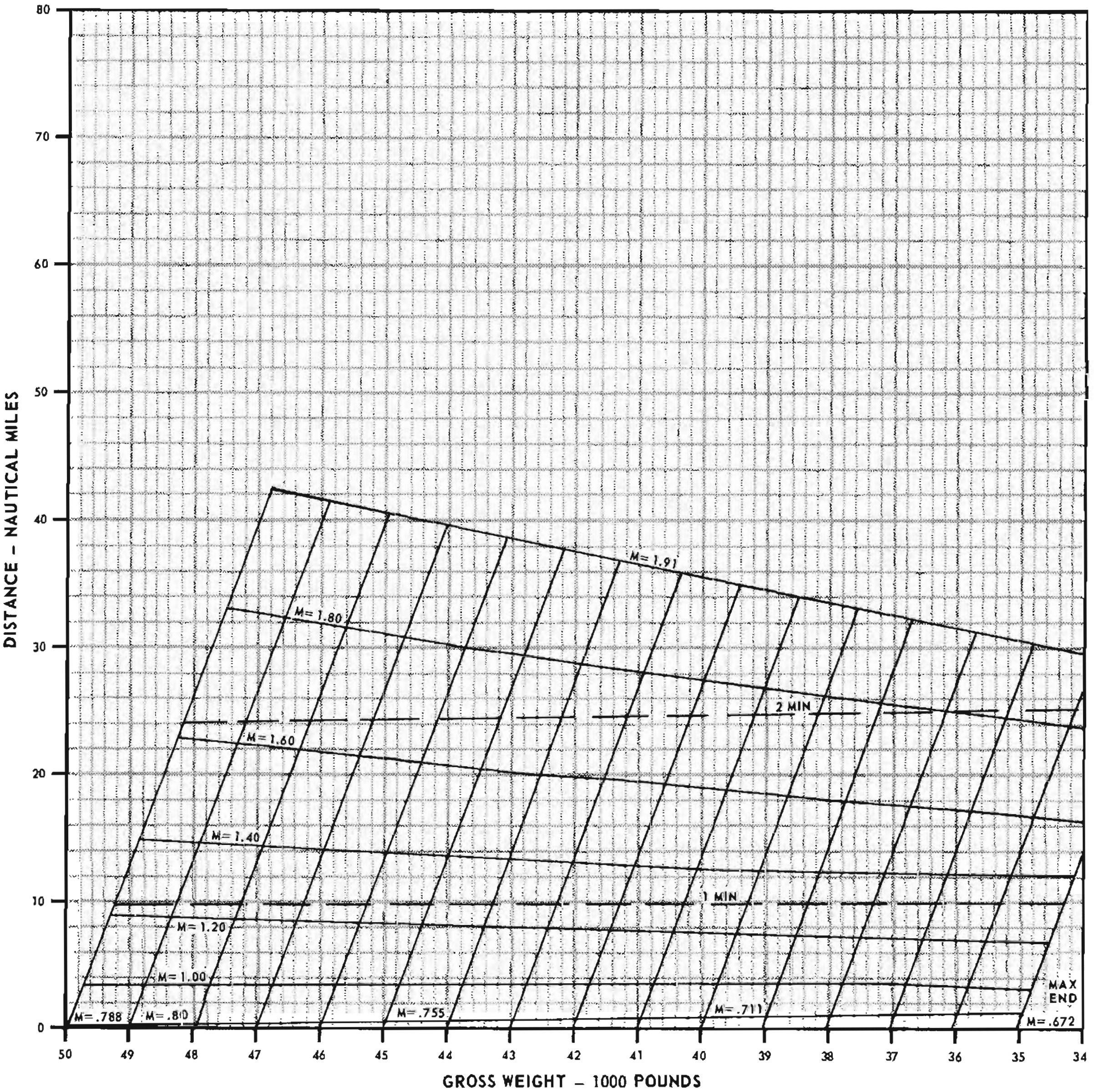
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P991

Figure B9-25

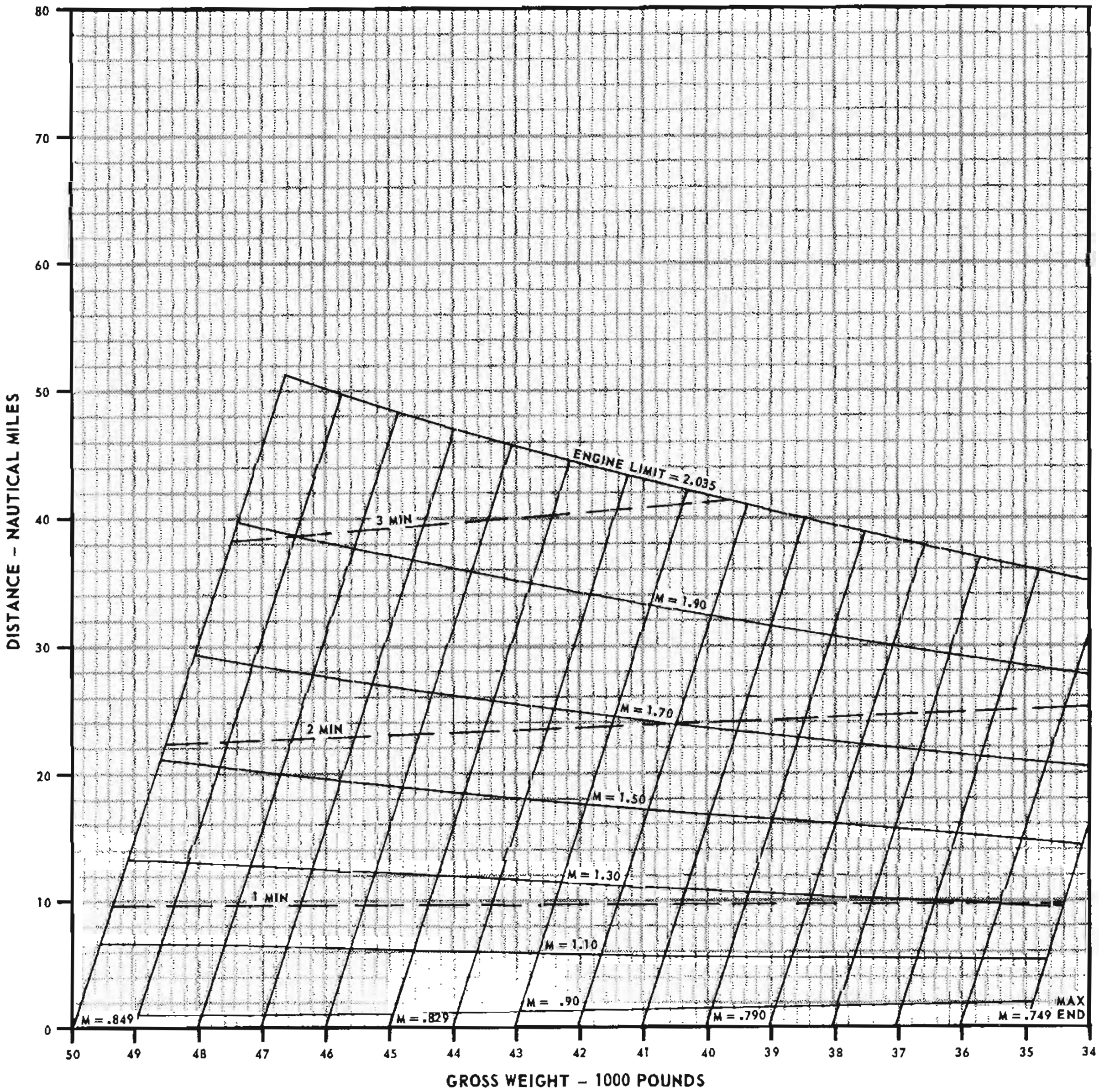
MAXIMUM THRUST ACCELERATION
35,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P912

Figure B9-26

F-4E

MAXIMUM THRUST ACCELERATION

40,000 FEET

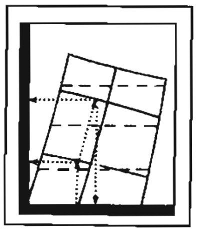
AIRPLANE CONFIGURATION

(4) AIM-7E

REMARKS

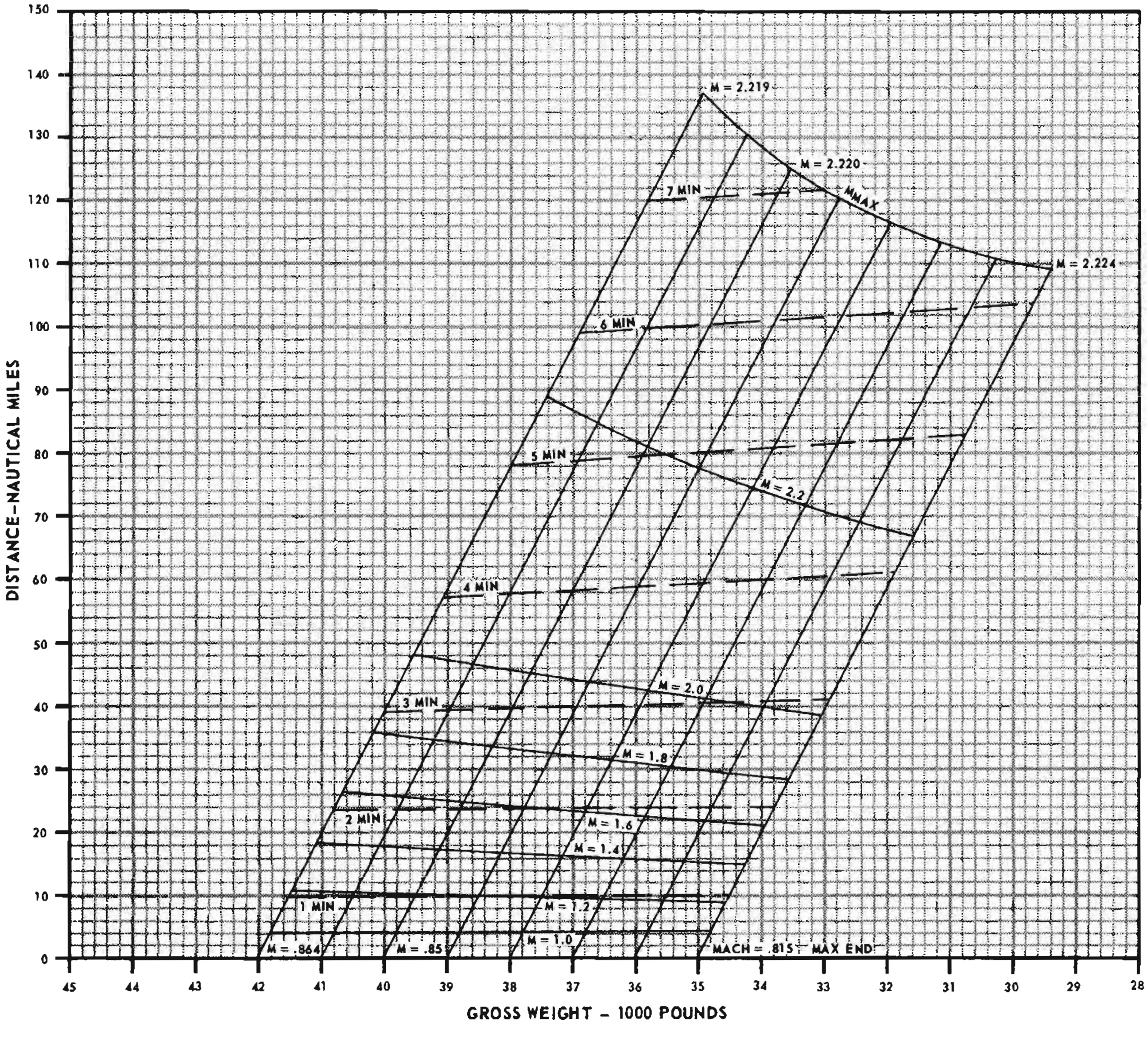
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E–P9049

Figure B9-27

F-4E

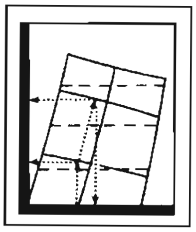
MAXIMUM THRUST ACCELERATION

45,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E

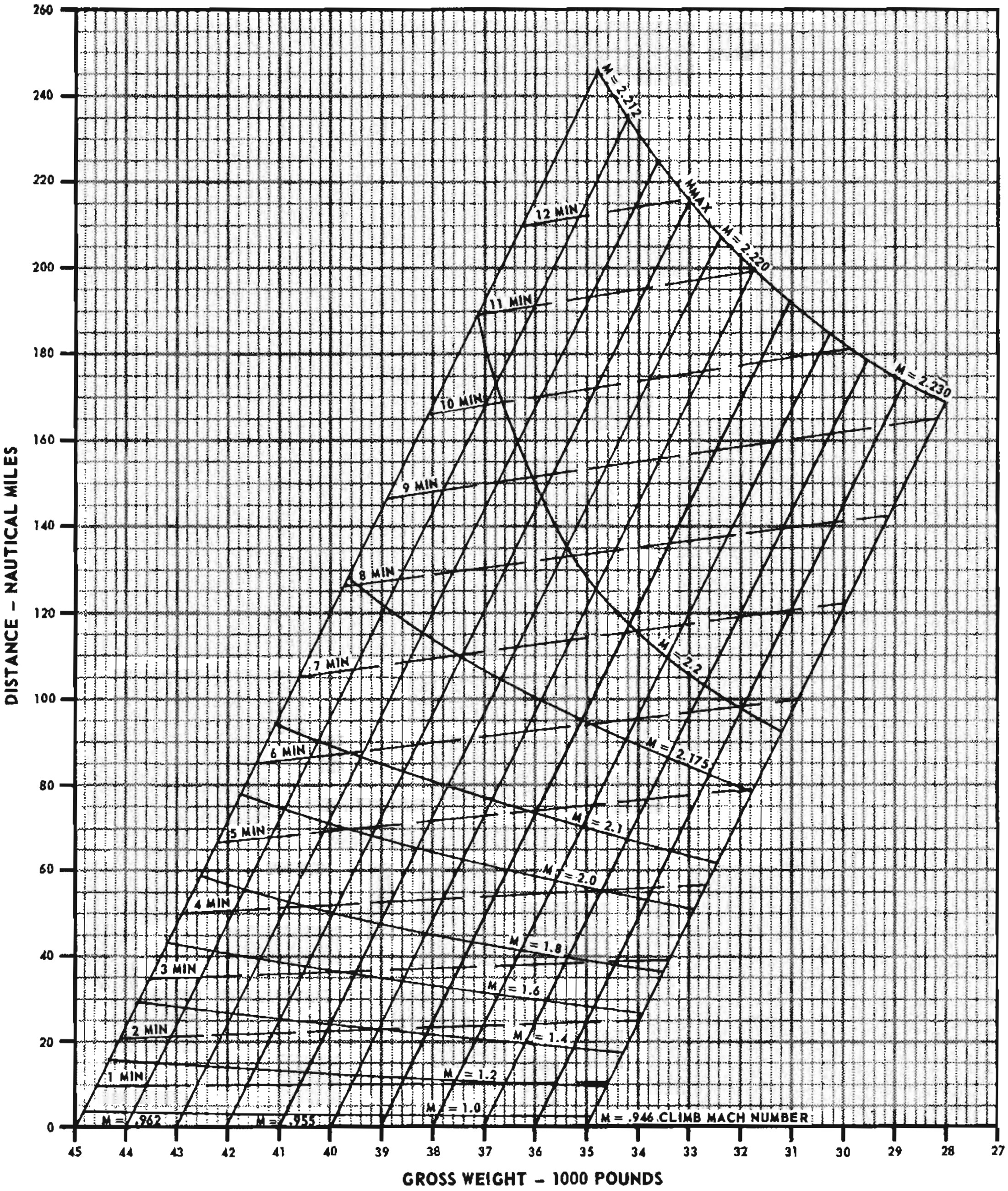
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P914

Figure B9-28

MAXIMUM THRUST ACCELERATION

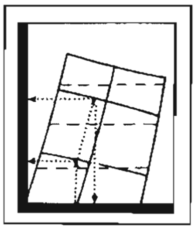
30,000 FEET

AIRPLANE CONFIGURATION
(1)B 28

REMARKS

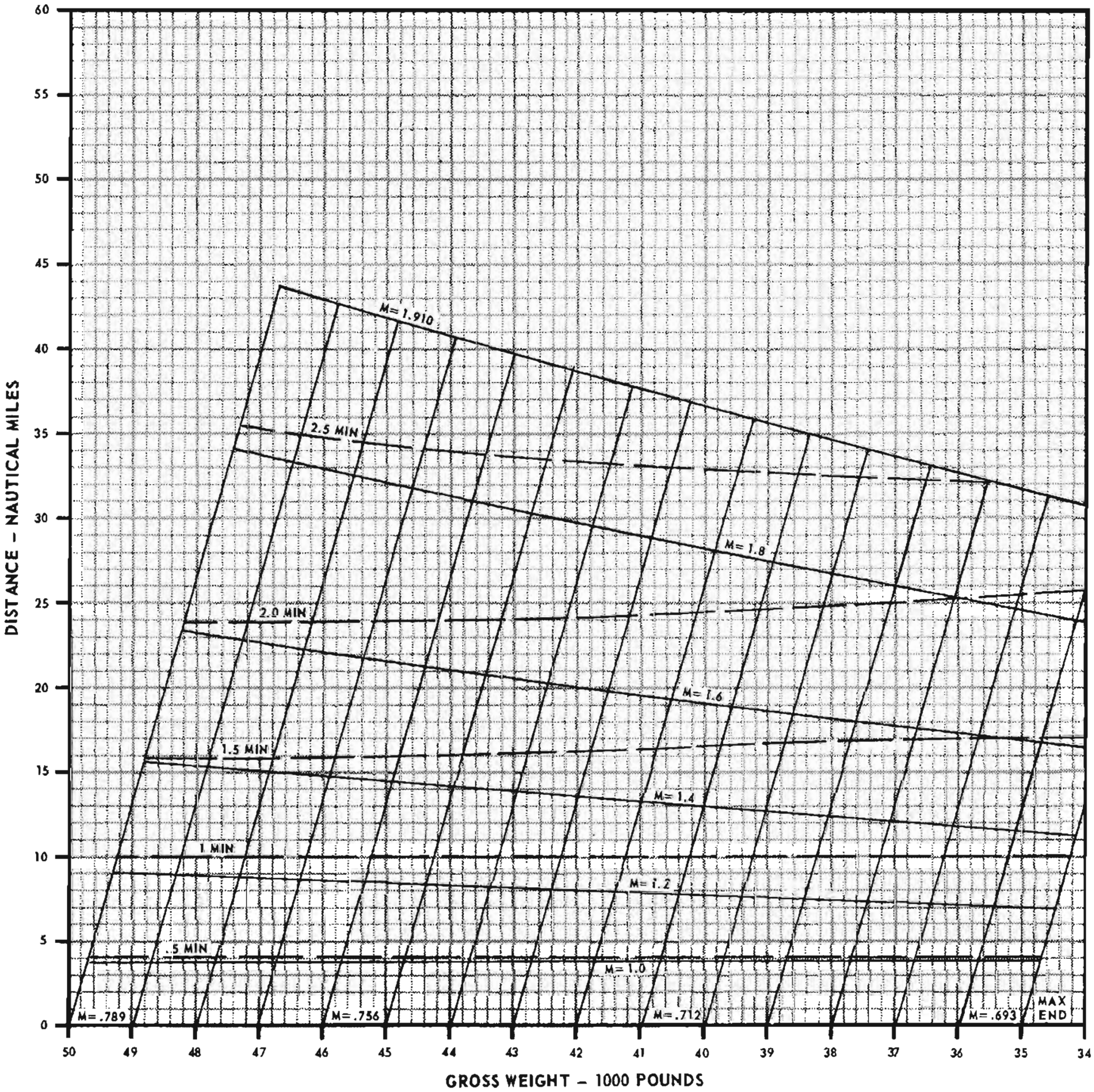
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9004

Figure B9-29

MAXIMUM THRUST ACCELERATION

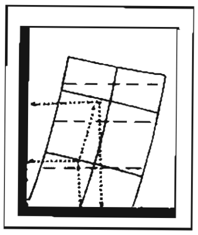
35,000 FEET

AIRPLANE CONFIGURATION
(1)B 28

REMARKS

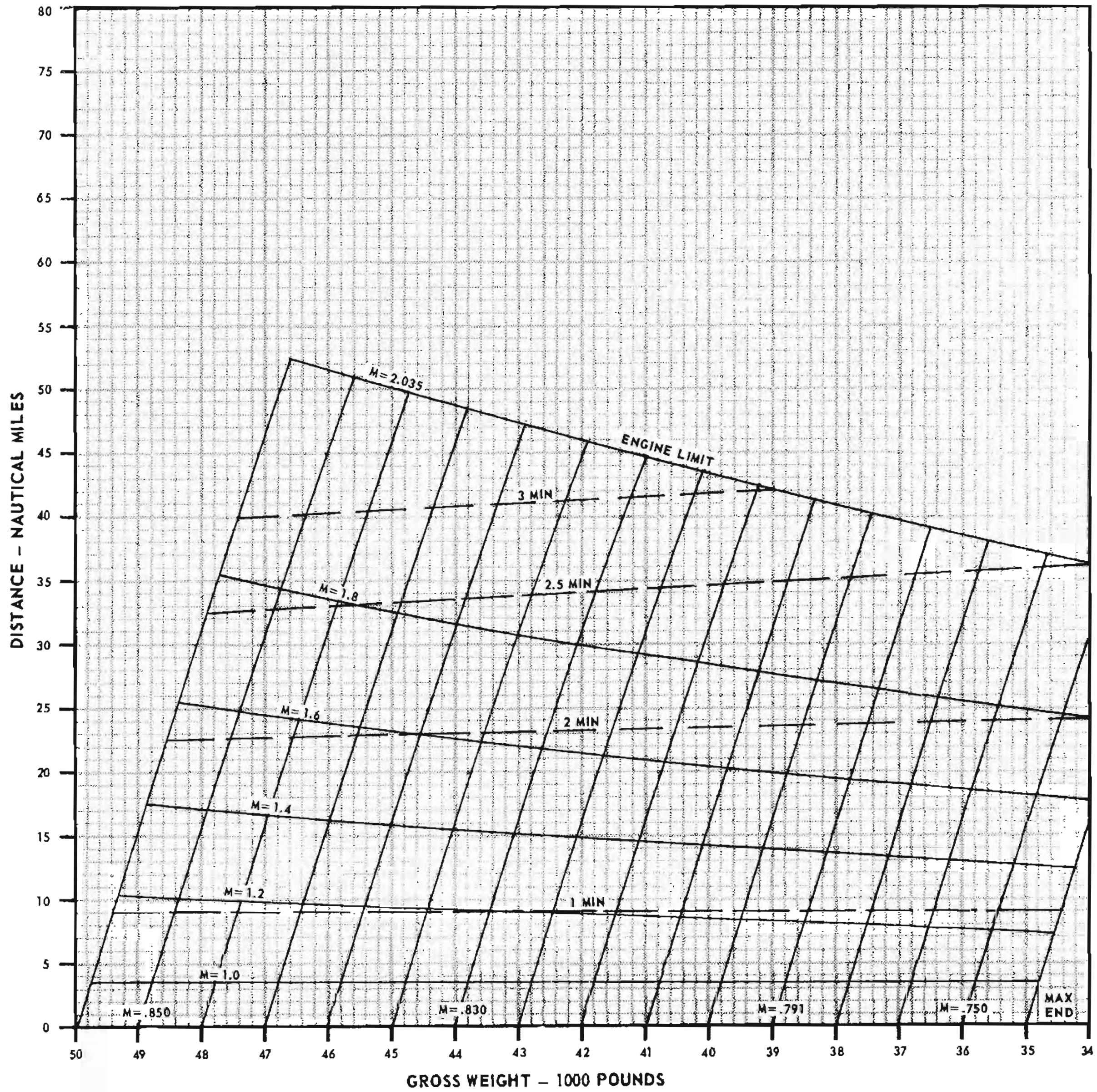
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P932

Figure B9-30

F-4E

MAXIMUM THRUST ACCELERATION

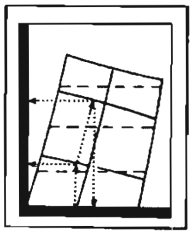
40,000 FEET

AIRPLANE CONFIGURATION
(1) B28

REMARKS

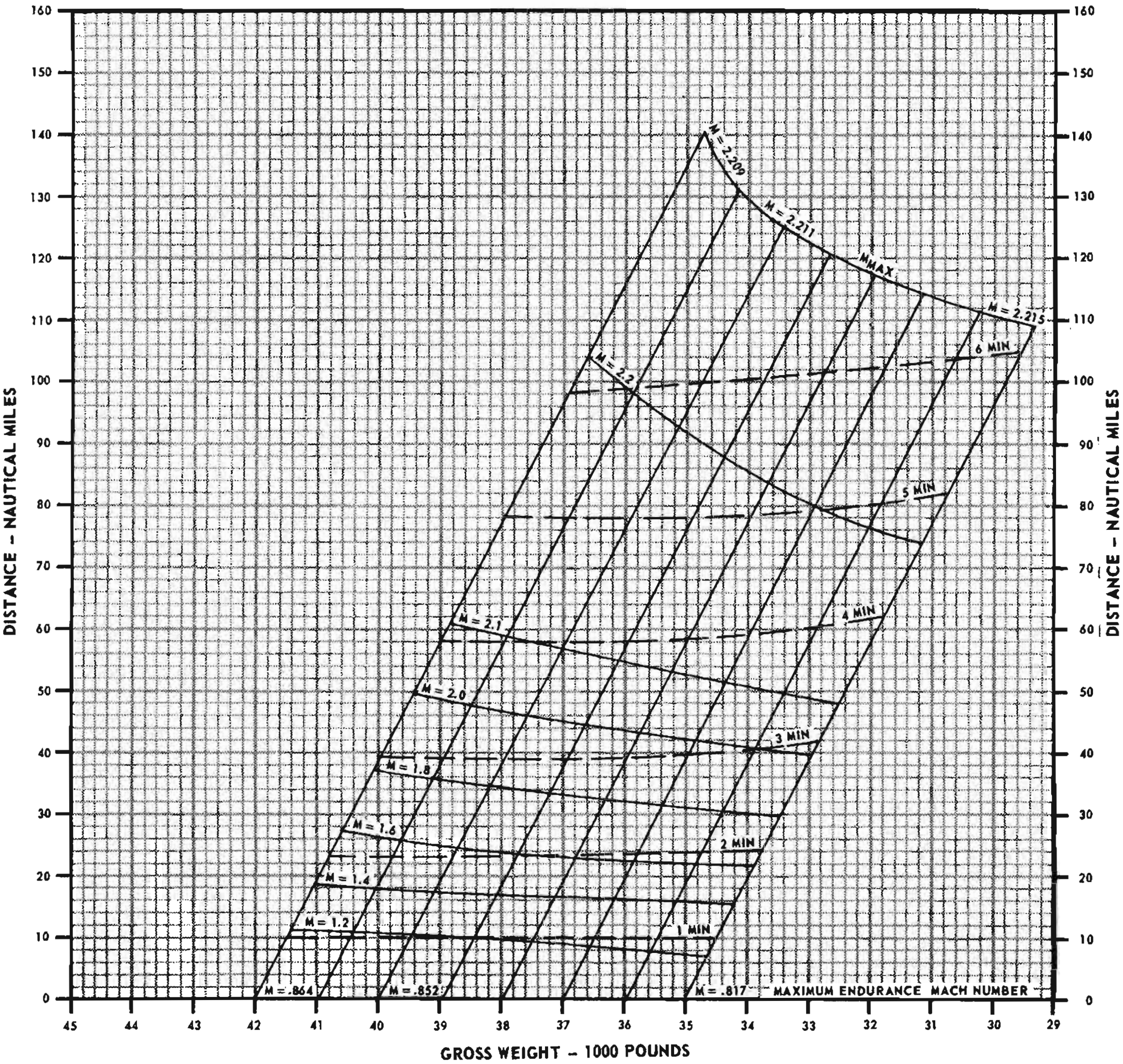
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P933

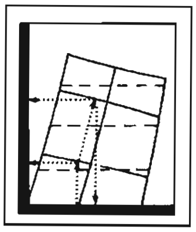
Figure B9-31

F-4E

MAXIMUM THRUST ACCELERATION

45,000 FEET

GUIDE

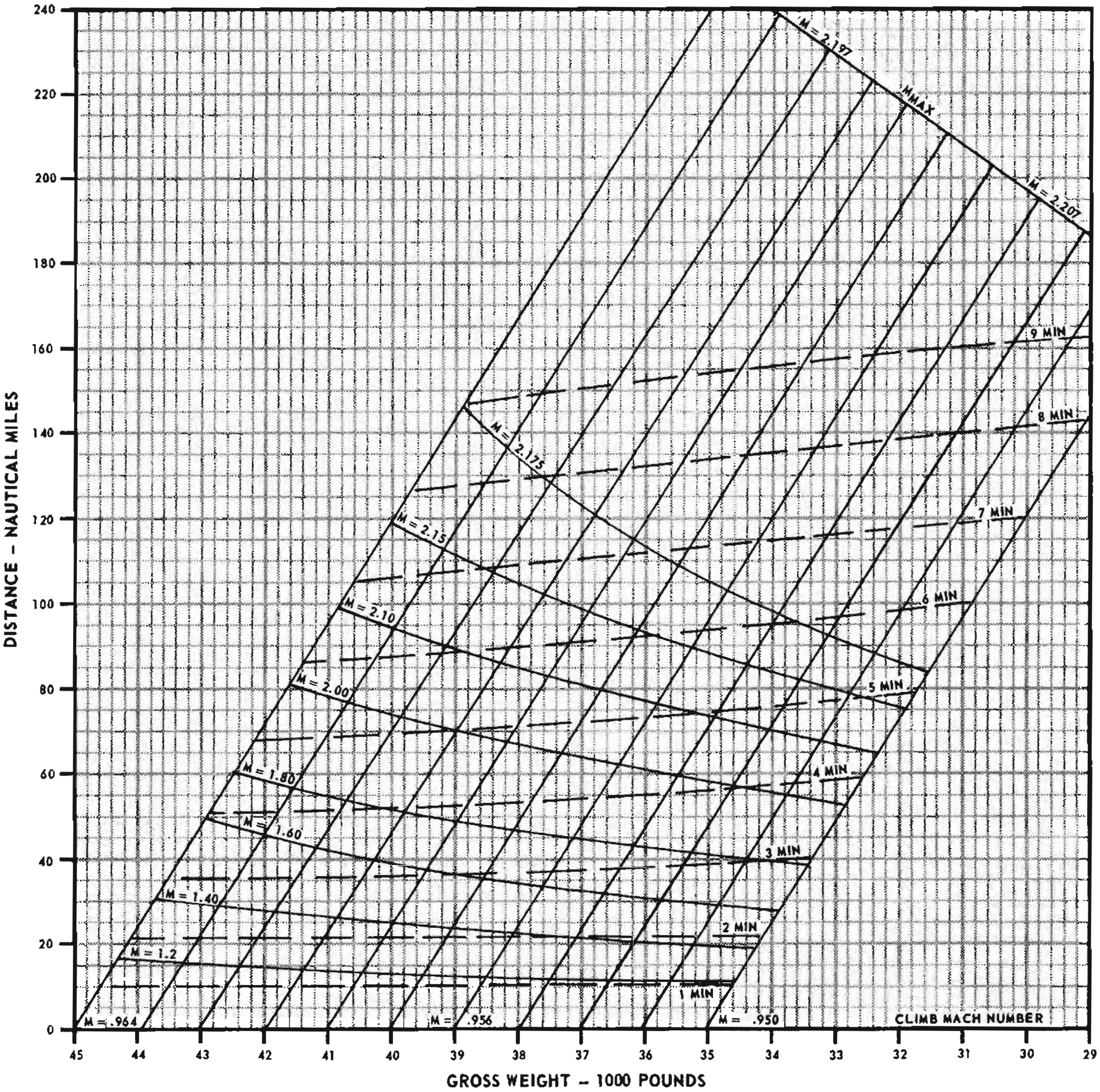


AIRPLANE CONFIGURATION
(1) B28

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P979

Figure B9-32

F-4E

MAXIMUM THRUST ACCELERATION

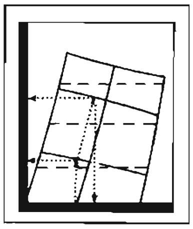
30,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E AND
(4) AIM-4D

REMARKS

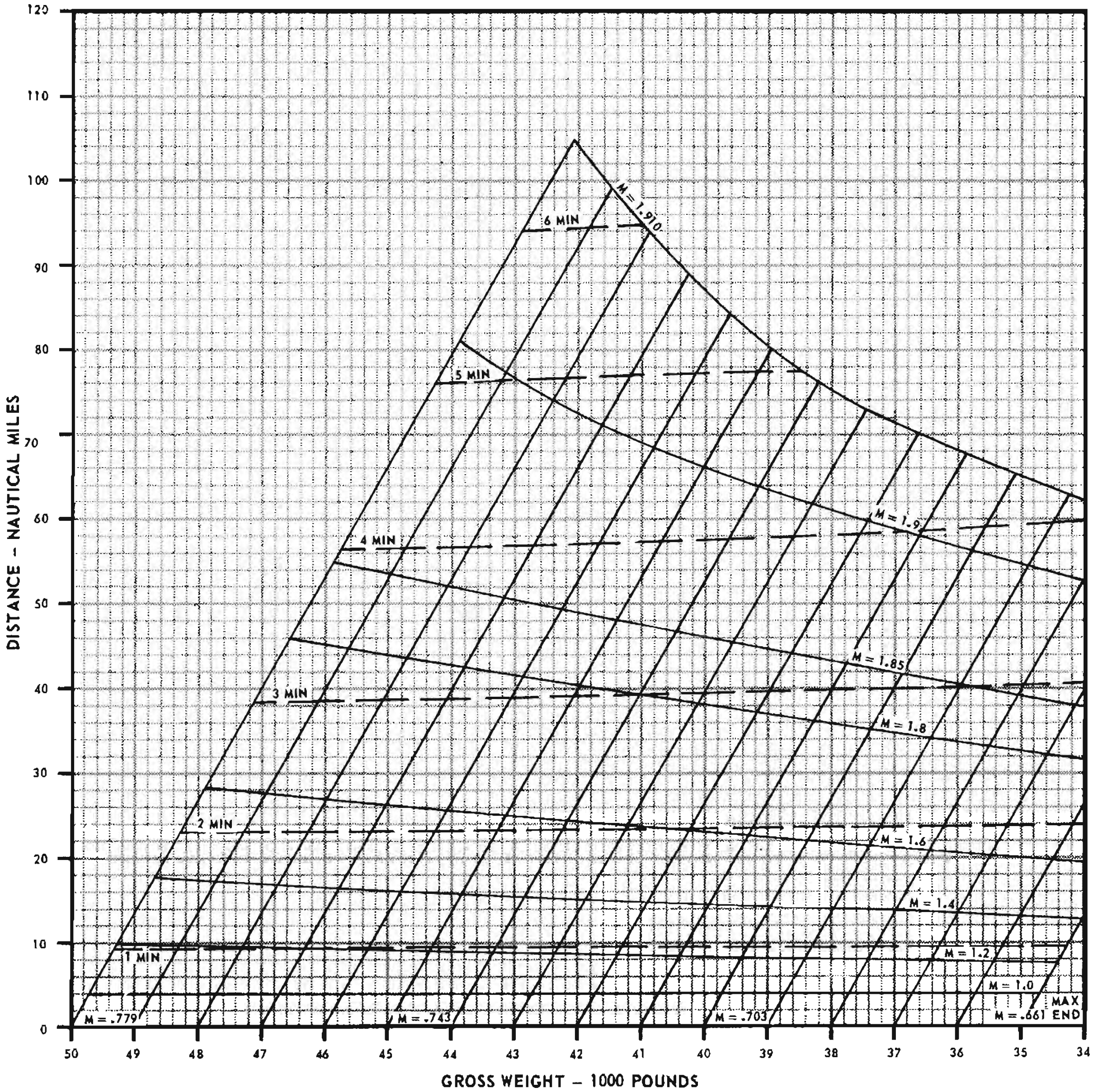
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9154

Figure B9-33

F-4E

MAXIMUM THRUST ACCELERATION

35,000 FEET

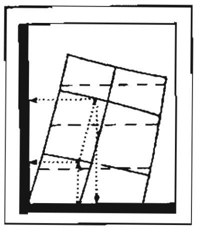
AIRPLANE CONFIGURATION
(4) AIM-7D/E AND
(4) AIM-4D

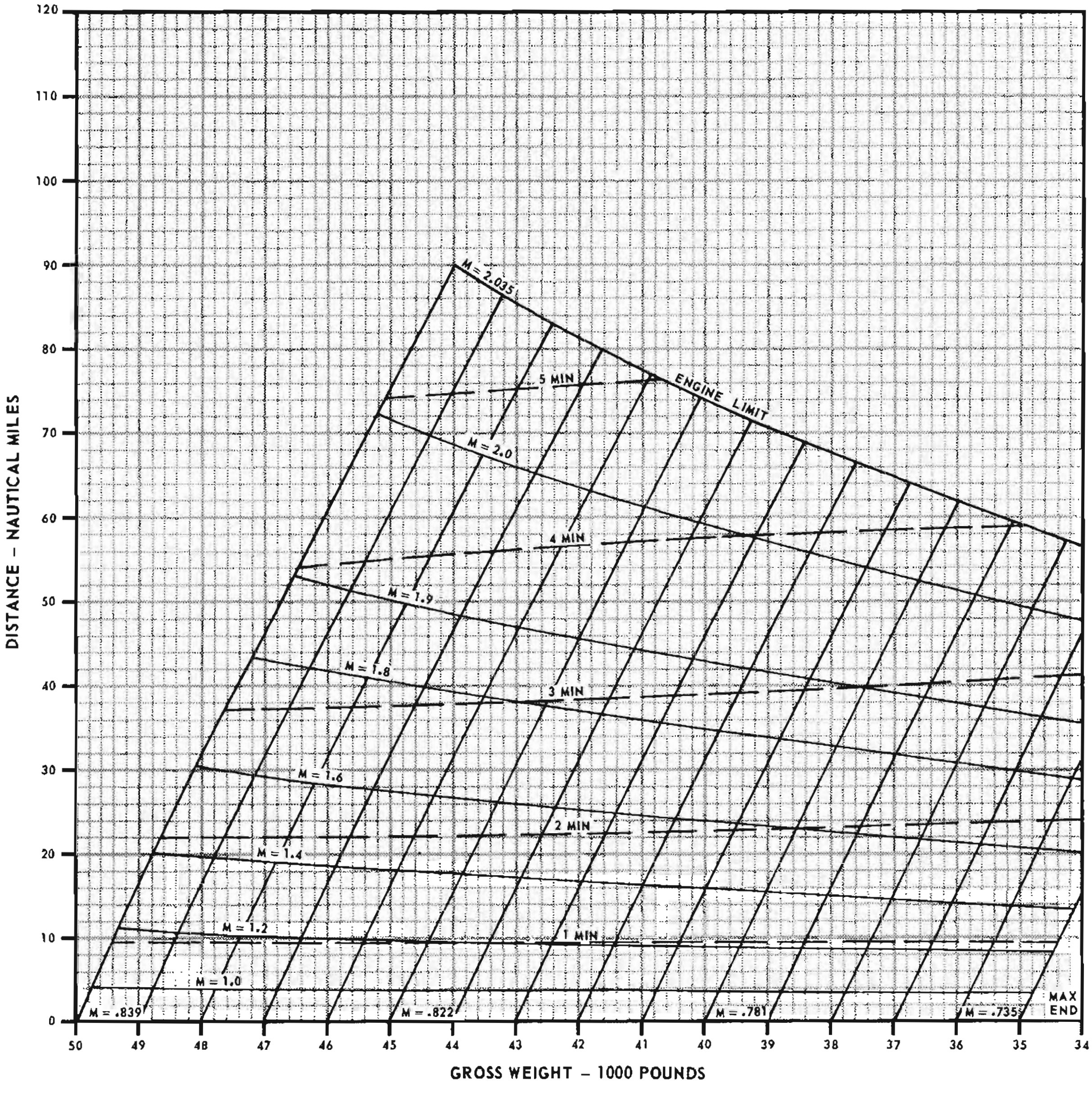
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P9155

Figure B9-34

F-4E

MAXIMUM THRUST ACCELERATION

40,000 FEET

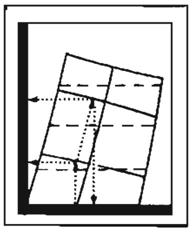
AIRPLANE CONFIGURATION

(4) AIM-7E AND (4) AIM-4D

REMARKS

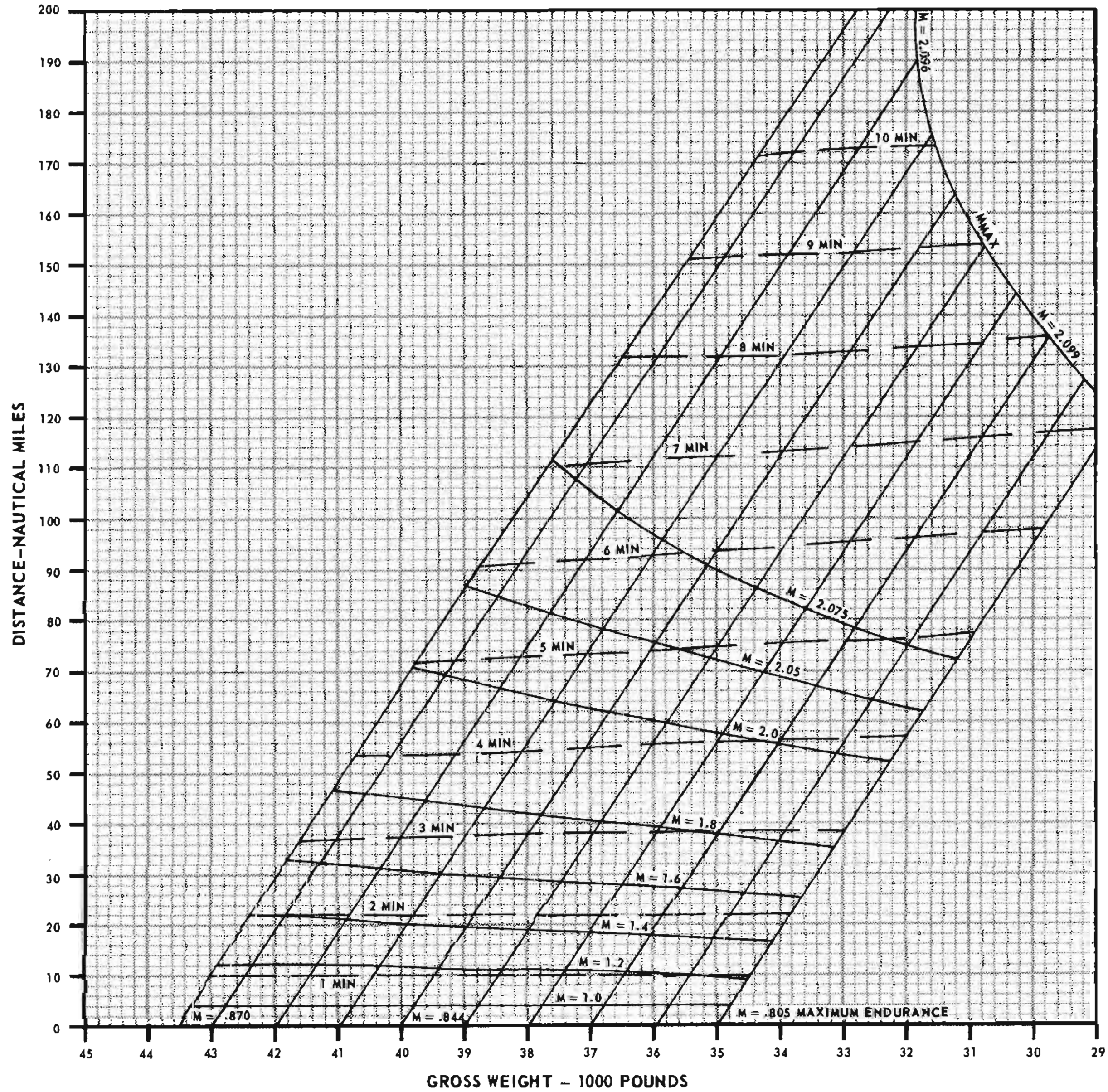
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9050

Figure B9-35

F-4E

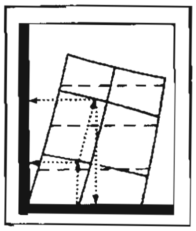
MAXIMUM THRUST ACCELERATION

45,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (4) AIM-4D

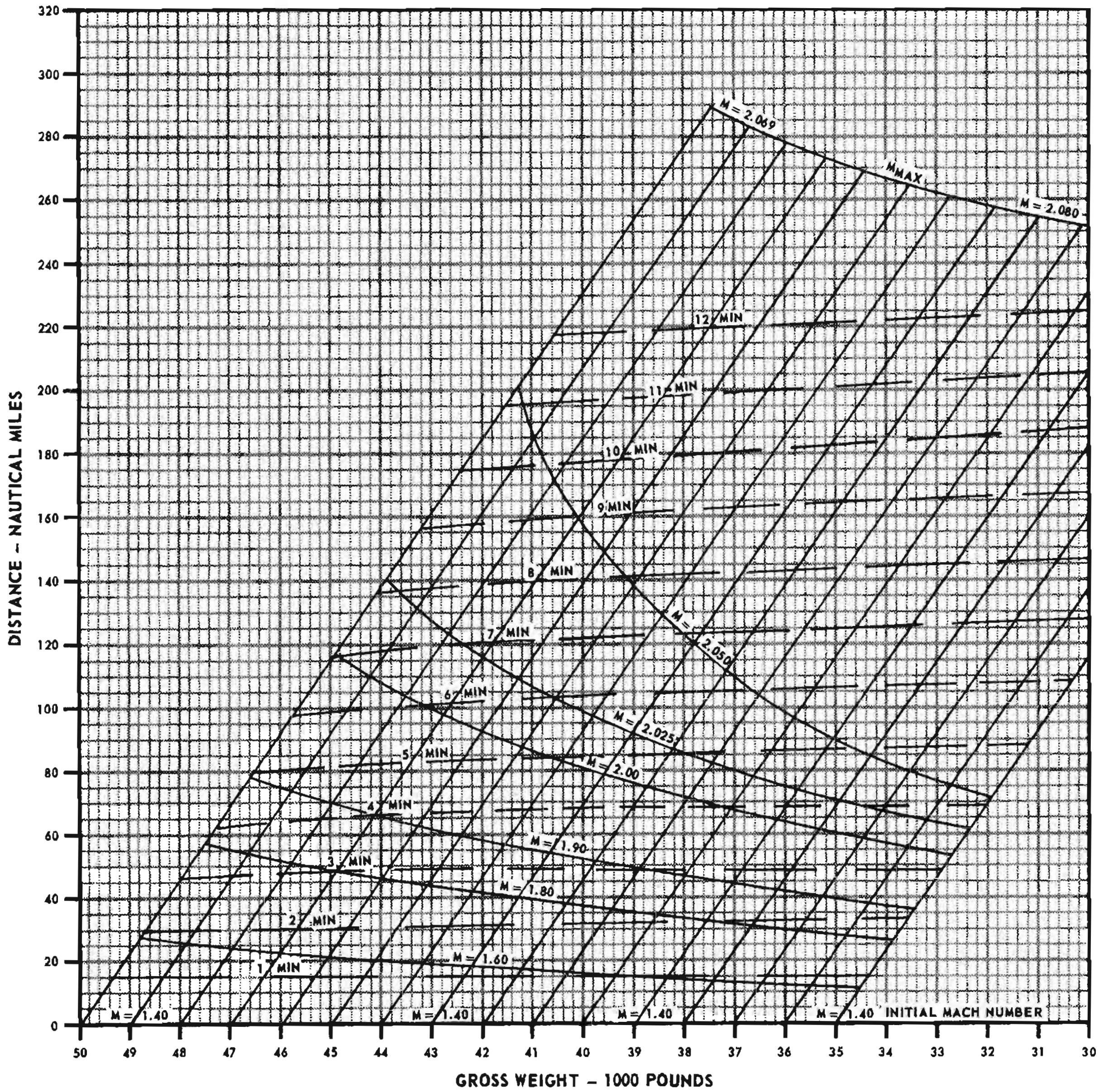
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E

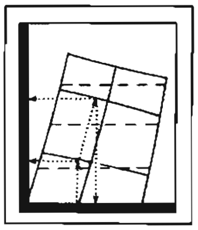
Figure B9-36

MAXIMUM THRUST ACCELERATION
30,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E AND
(1) ℄ TANK

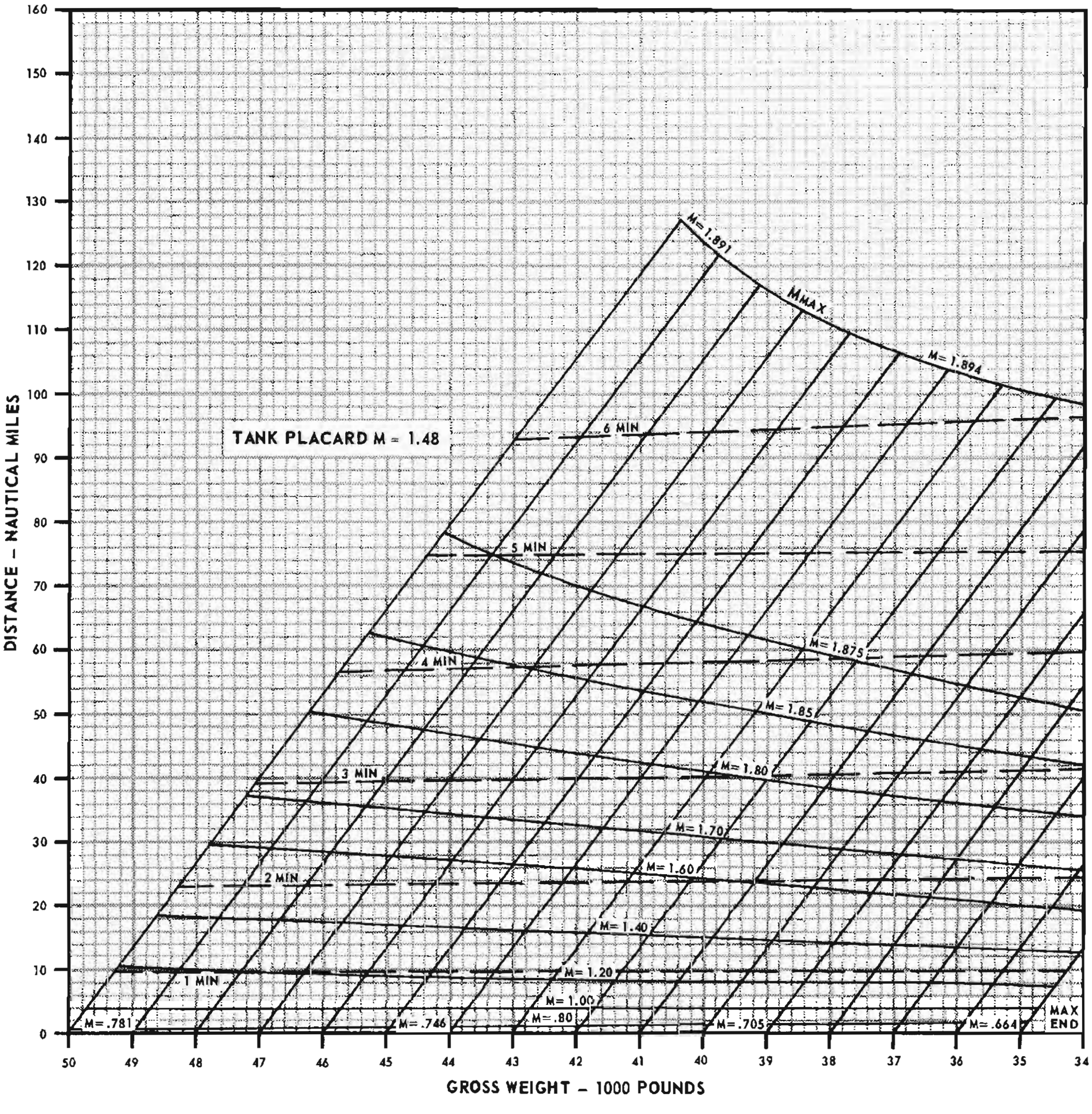
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P993

Figure B9-37

MAXIMUM THRUST ACCELERATION

35,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E AND
(1) ℄ TANK

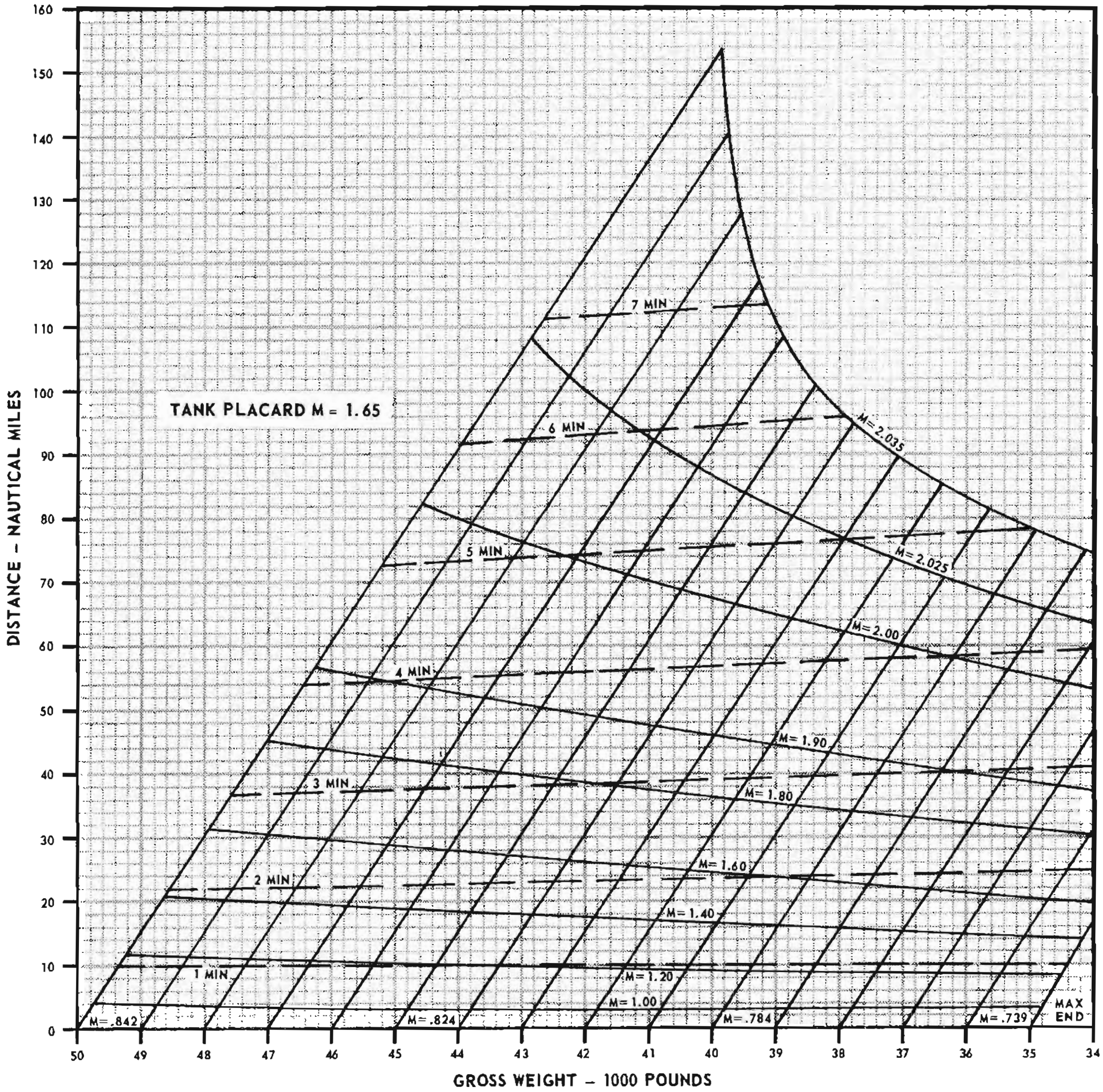
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 AUGUST 1969
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P916

Figure B9-38

F-4E

MAXIMUM THRUST ACCELERATION

45,000 FEET

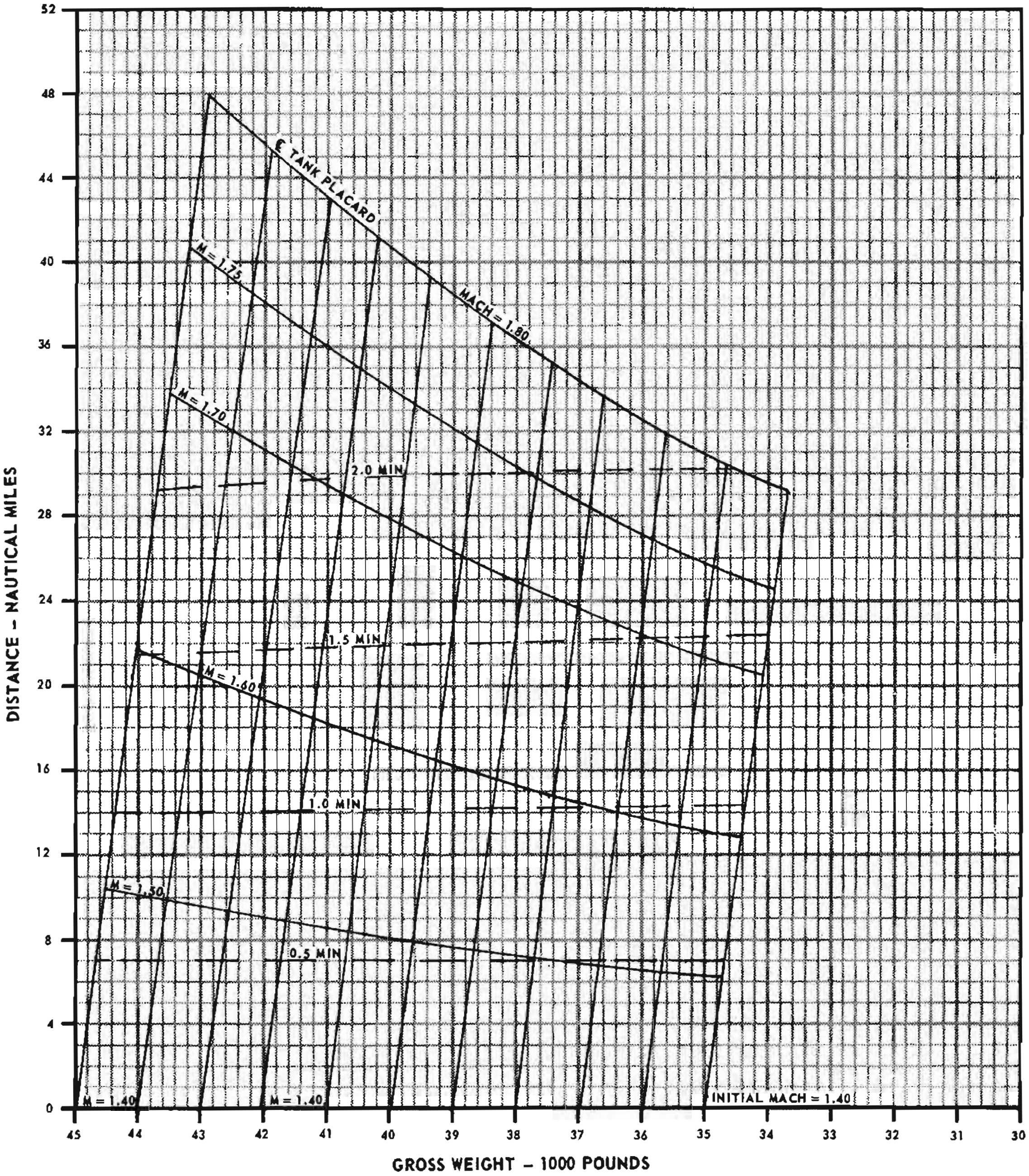
AIRPLANE CONFIGURATION
(4) AIM-7E AND (1) ℄ TANK

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P918

Figure B9-39

F-4E

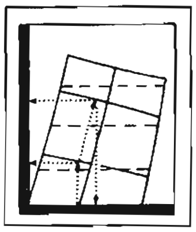
MAXIMUM THRUST ACCELERATION

40,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (1) ℄ TANK

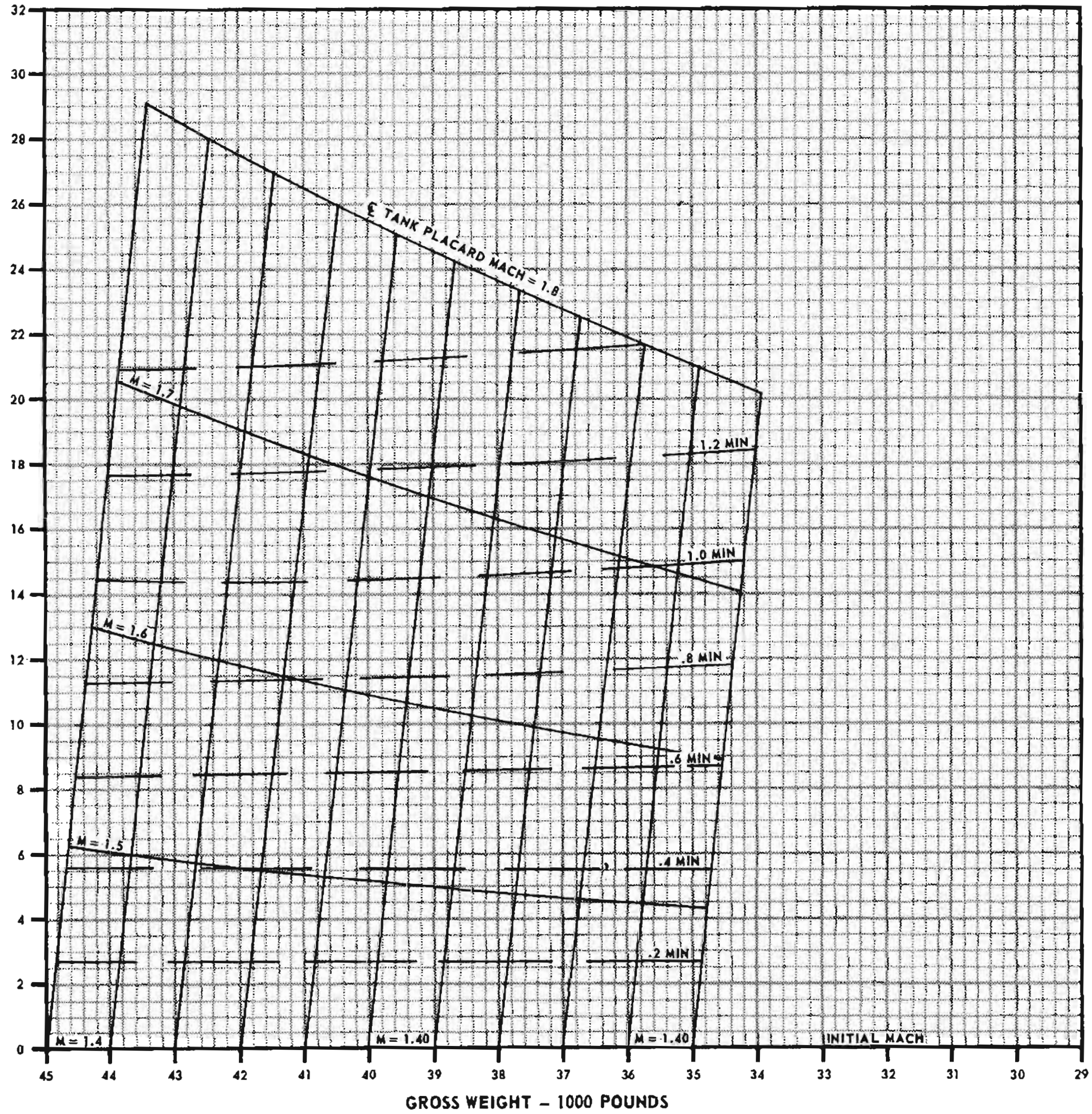
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P917

Figure B9-40

F-4E

MAXIMUM THRUST ACCELERATION

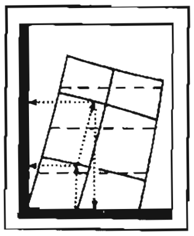
30,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E AND
(2) WING TANKS

REMARKS

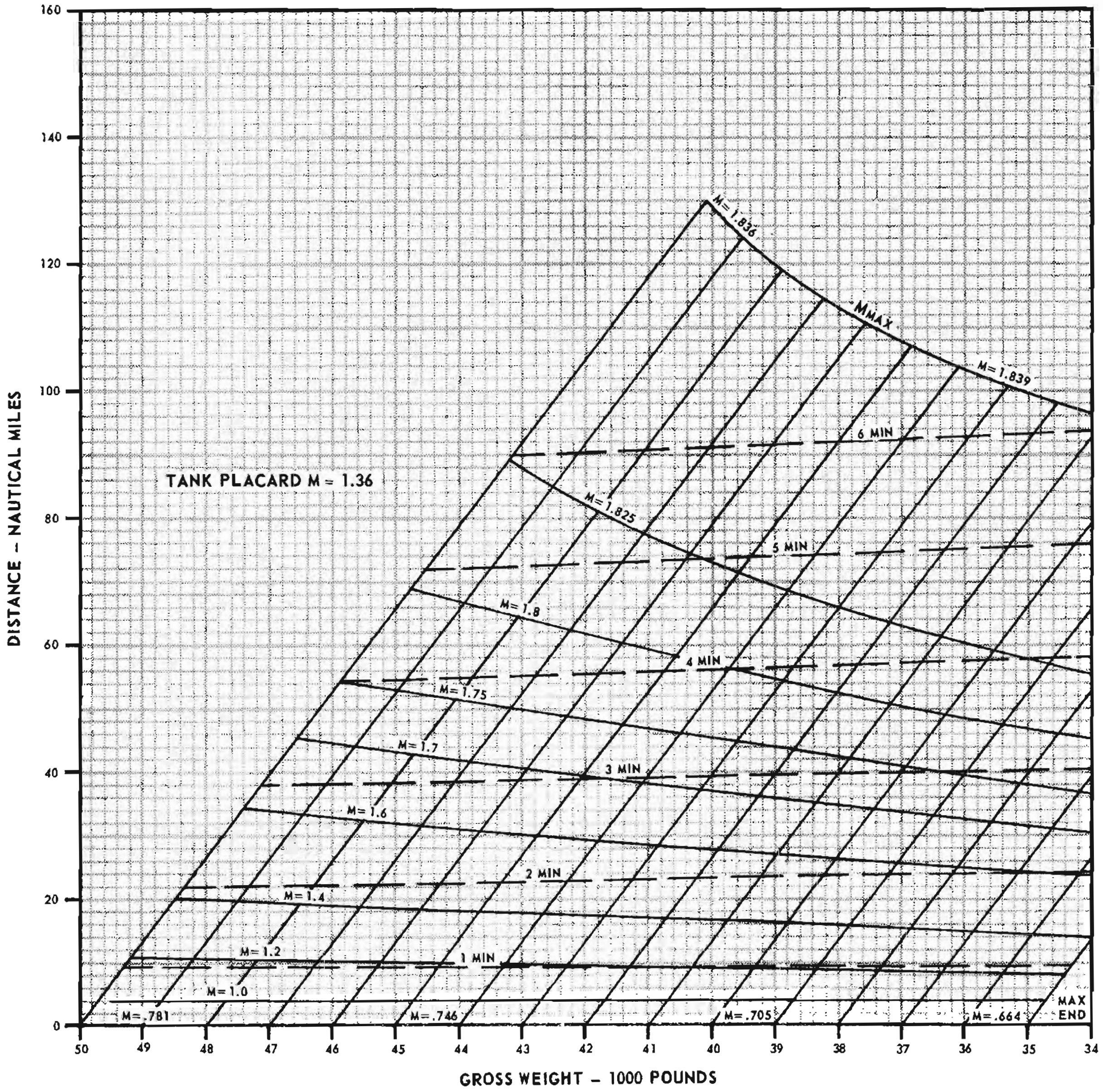
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P995

Figure B9-41

F-4E

MAXIMUM THRUST ACCELERATION

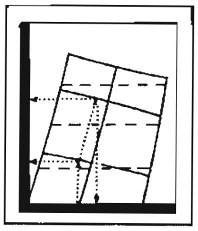
35,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E AND
(2) WING TANKS

REMARKS

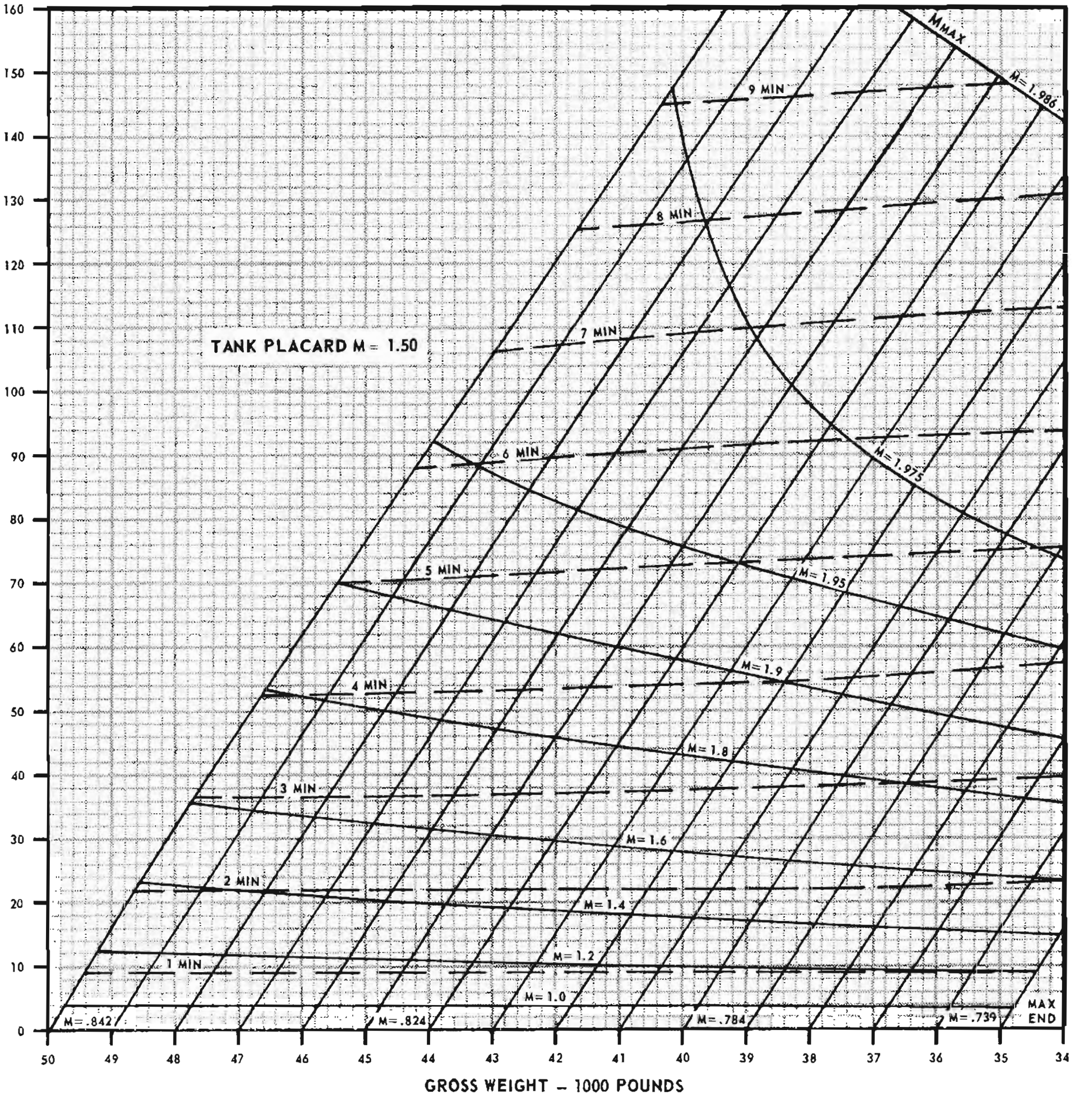
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P920

Figure B9-42

F-4E

MAXIMUM THRUST ACCELERATION

40,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (2) WING TANKS

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

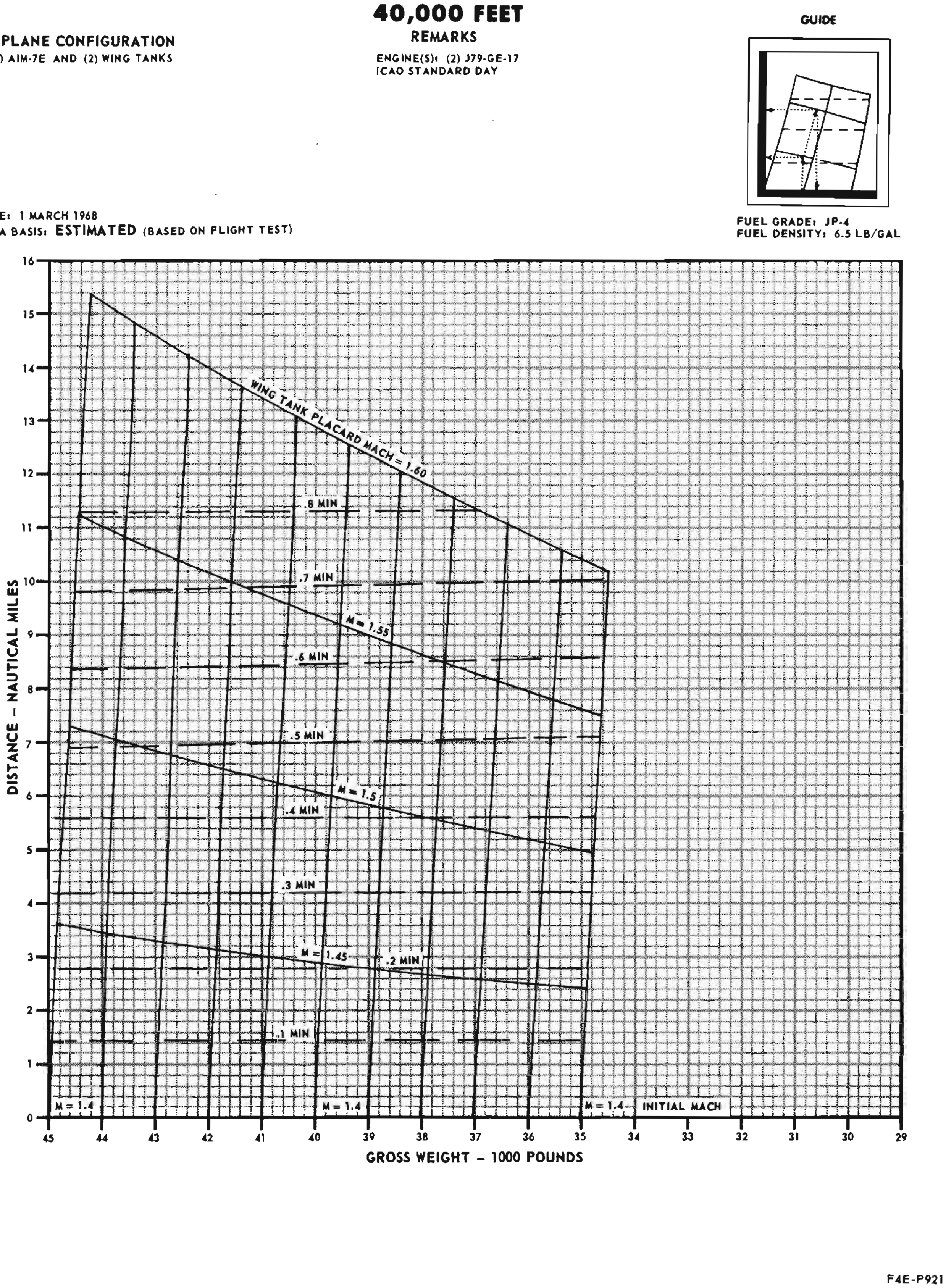


Figure B9-43

F-4E

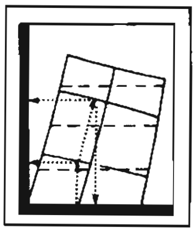
MAXIMUM THRUST ACCELERATION

45,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND 2 WING TANKS

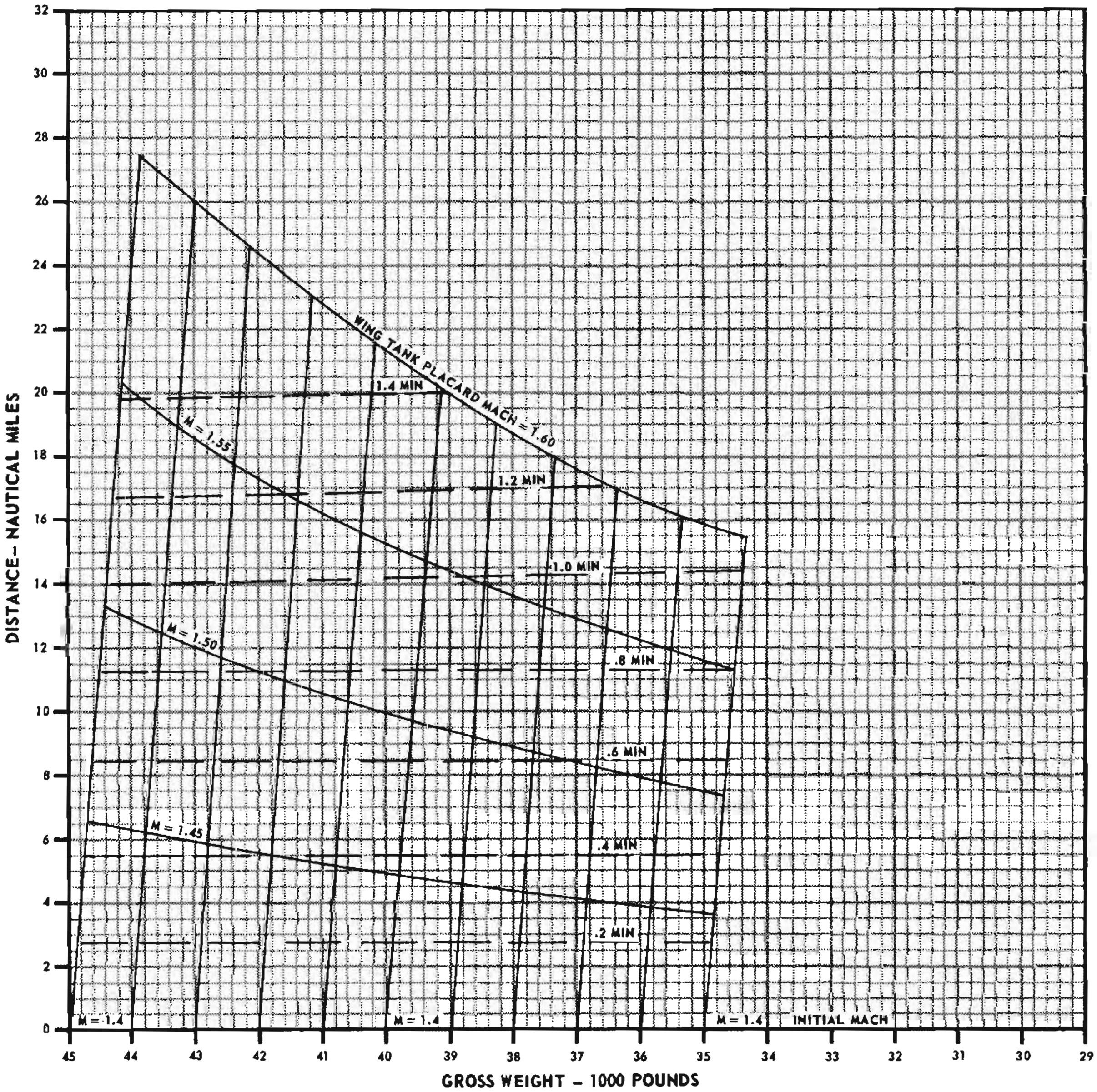
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P922

Figure B9-44

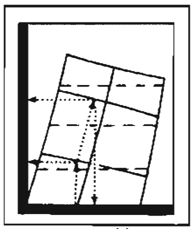
F-4E

MAXIMUM THRUST ACCELERATION
40,000 FEET

AIRPLANE CONFIGURATION
(1) B28 AND (2) WING TANKS

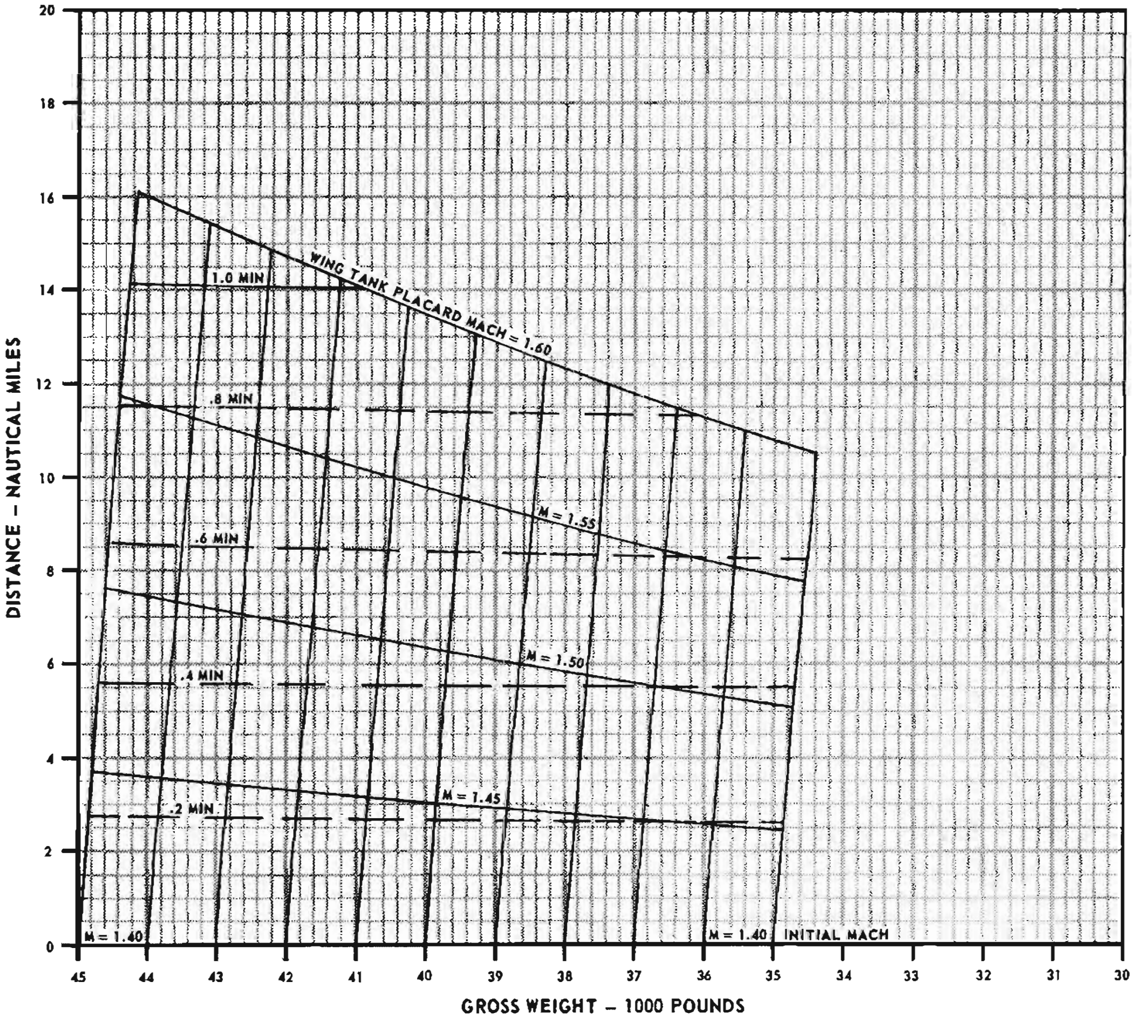
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)



F4E-P936

Figure B9-45

F-4E

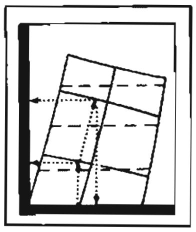
MAXIMUM THRUST ACCELERATION

45,000 FEET

AIRPLANE CONFIGURATION
(1) B28 AND (2) WING TANKS

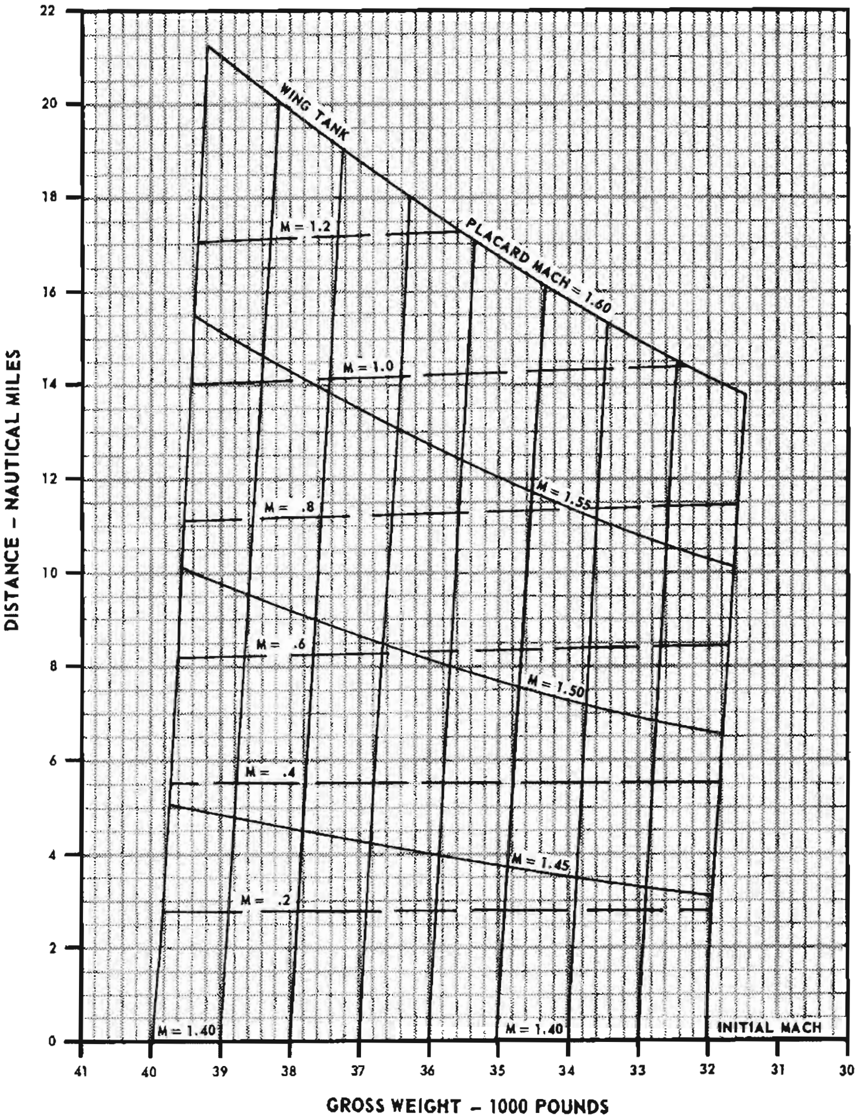
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)



F4E-P937

Figure B9-46

F-4E

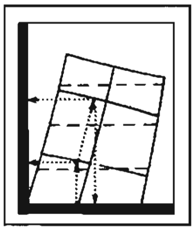
MAXIMUM THRUST ACCELERATION

40,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E, (4) AIM-4D
AND (1) ℄ TANK

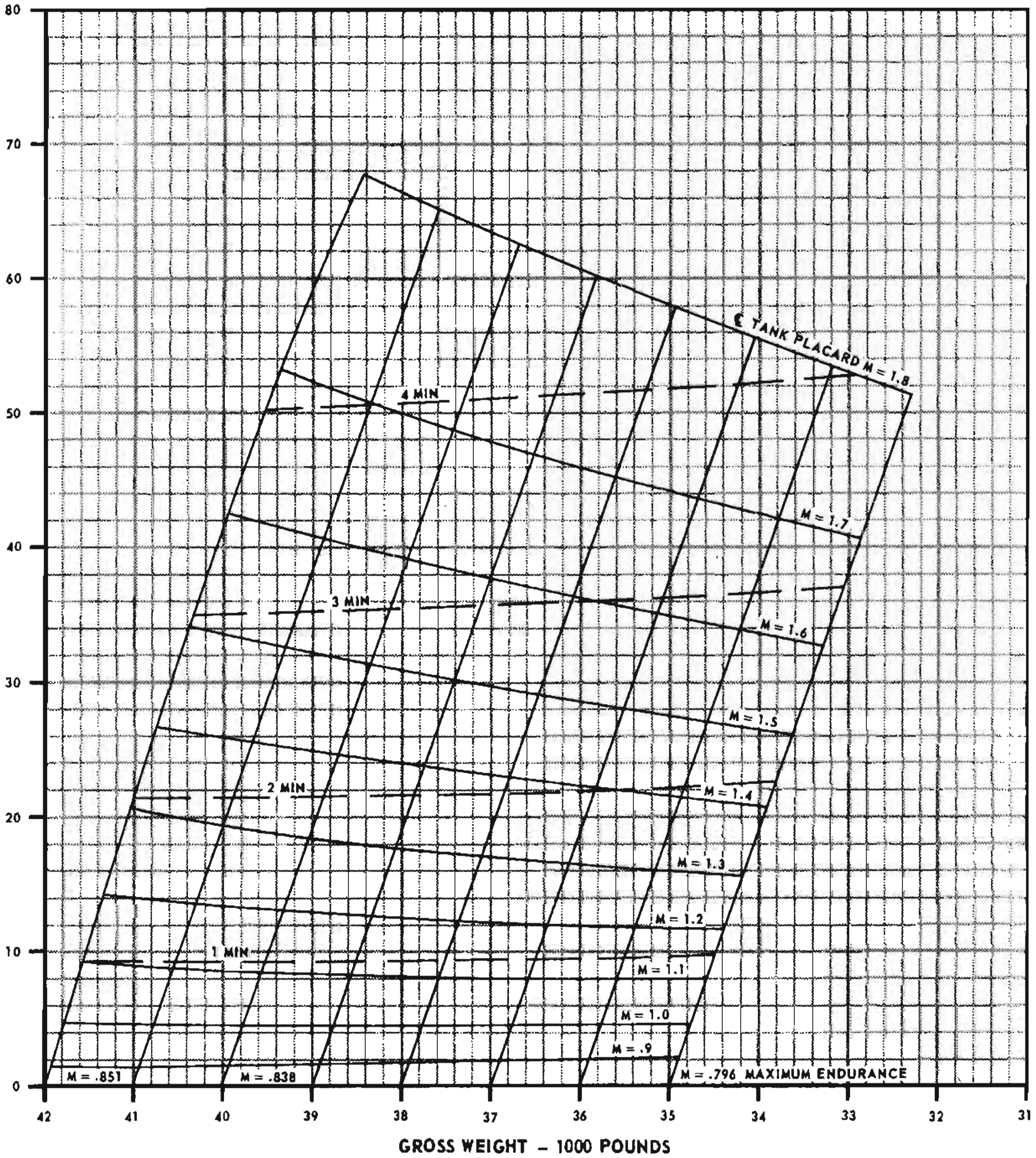
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9051

Figure B9-47

MAXIMUM THRUST ACCELERATION

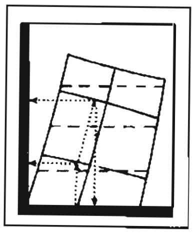
30,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E, (4) AIM-4D,
AND (1) ℄

REMARKS

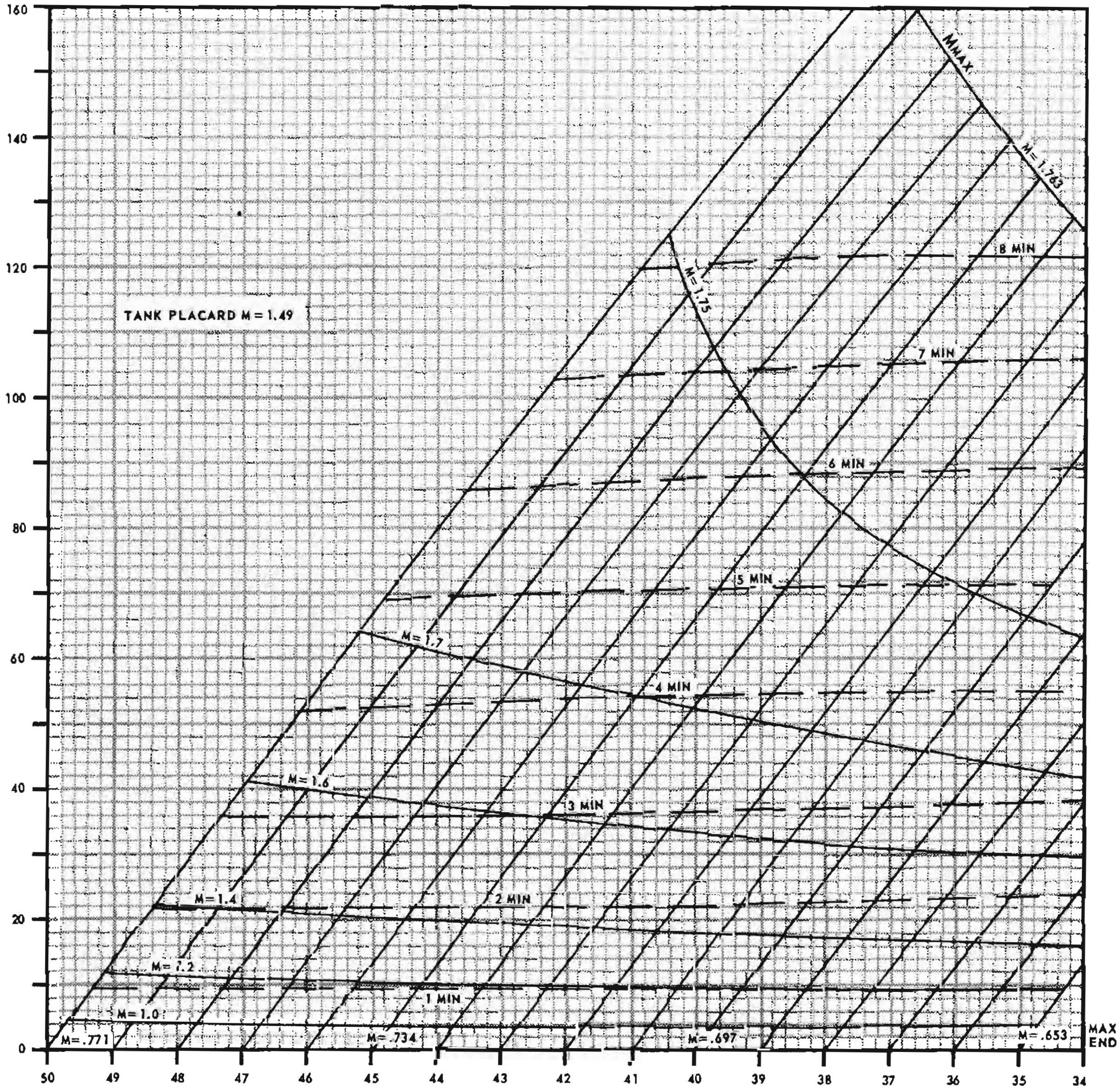
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHTTEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9156

Figure B9-48

F-4E

MAXIMUM THRUST ACCELERATION

35,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7D/E, (4) AIM-4D,
AND (1) ℄ TANK

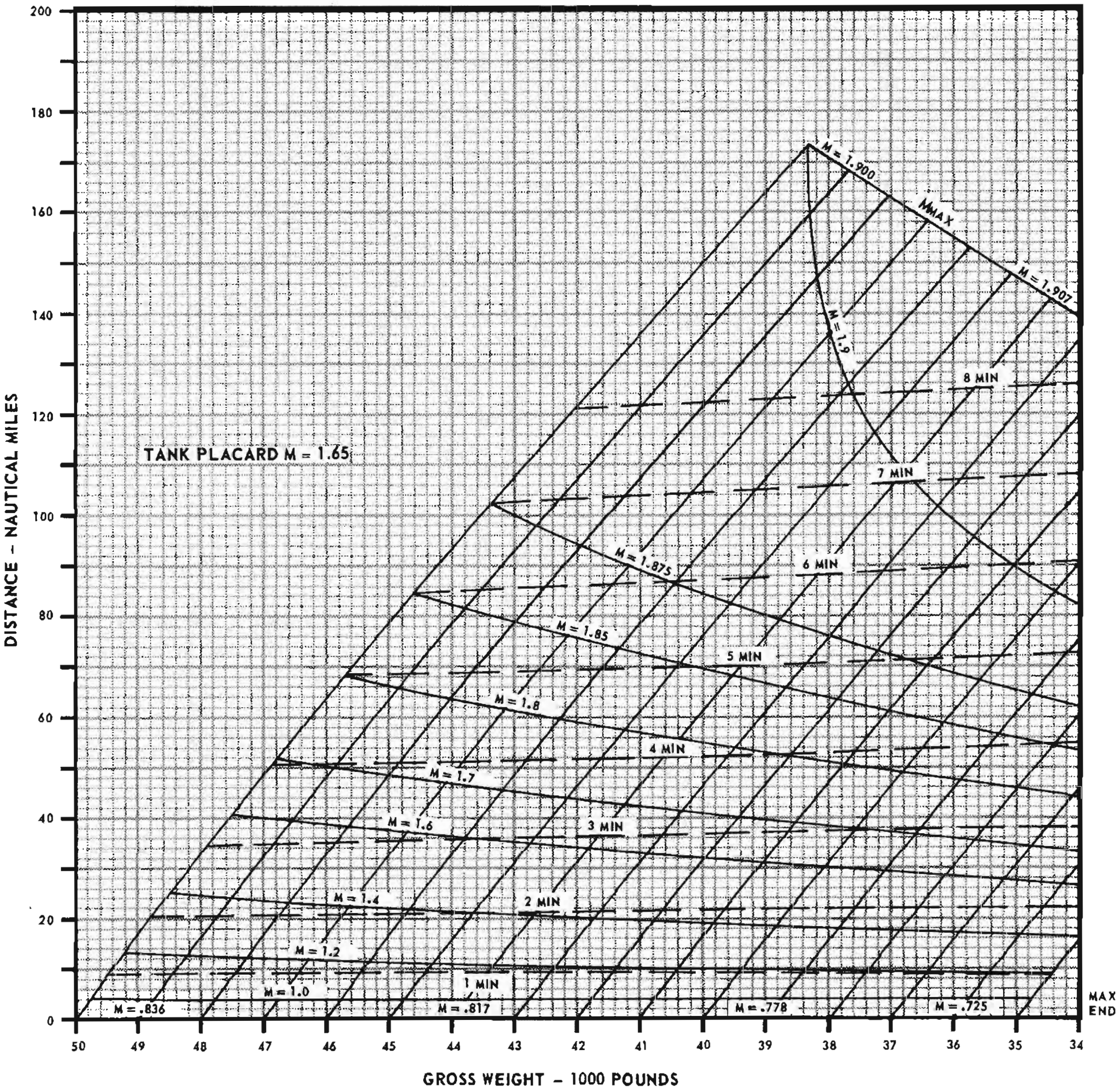
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 AUGUST 1969
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9157

Figure B9-49

F-4E

MAXIMUM THRUST ACCELERATION

45,000 FEET

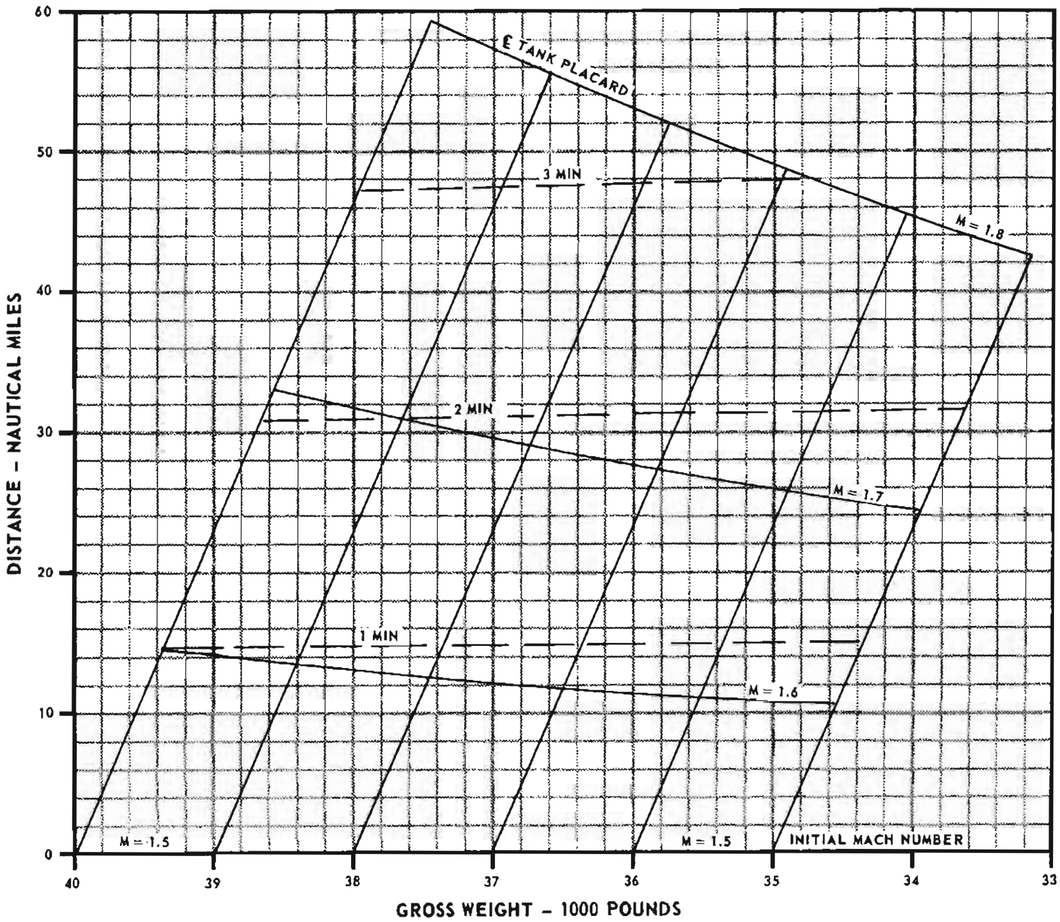
AIRPLANE CONFIGURATION
(4) AIM-7E, 4 AIM-4D
AND (1) ℄ TANK

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 1 MARCH 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9008

Figure B9-50

F-4E

MILITARY THRUST ACCELERATION

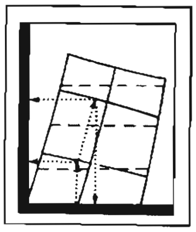
15,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E OR (1) B28

REMARKS

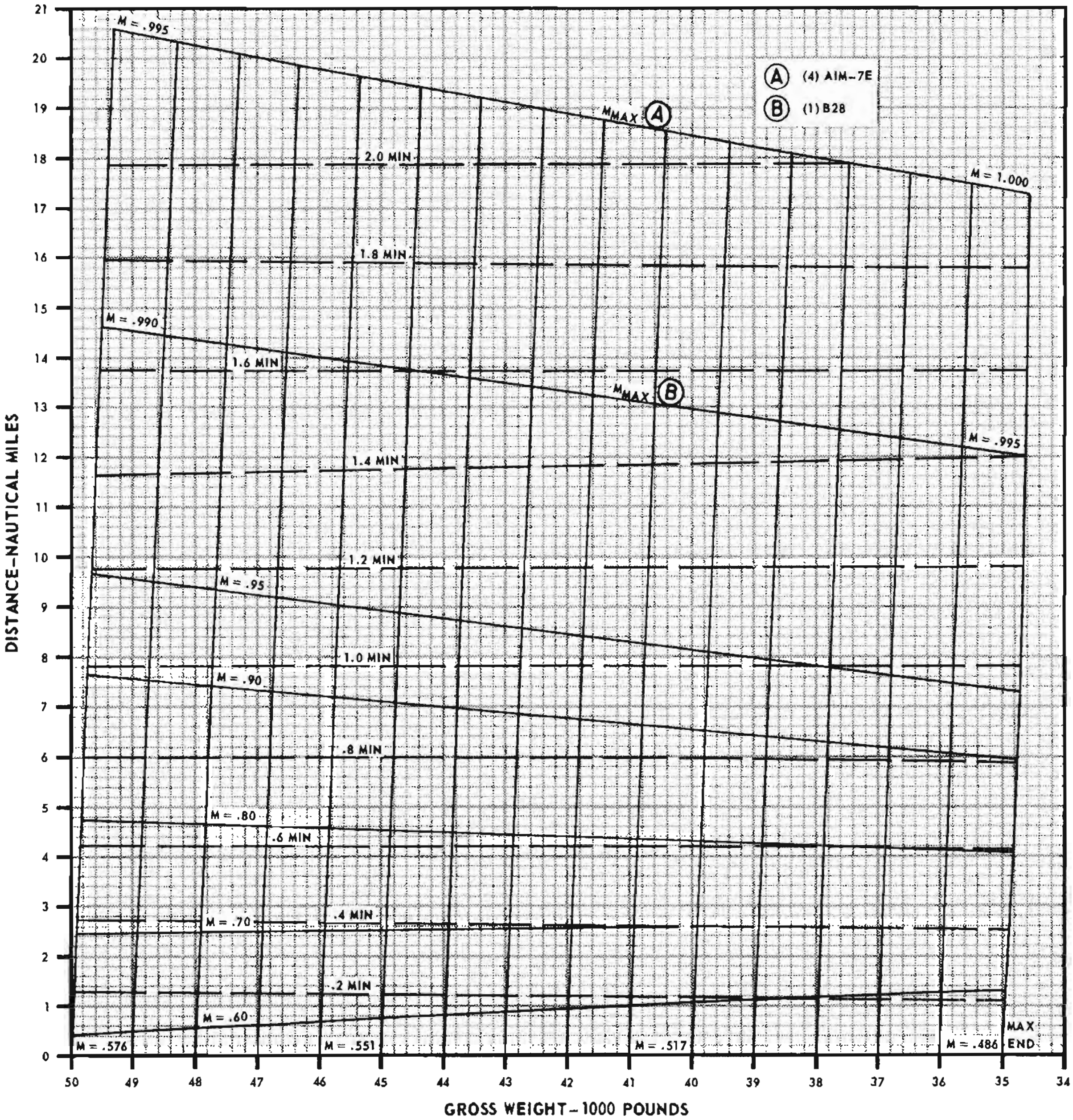
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P939

Figure B9-51

F-4E

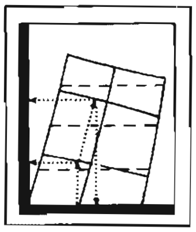
MILITARY THRUST ACCELERATION

25,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E OR (1) B28

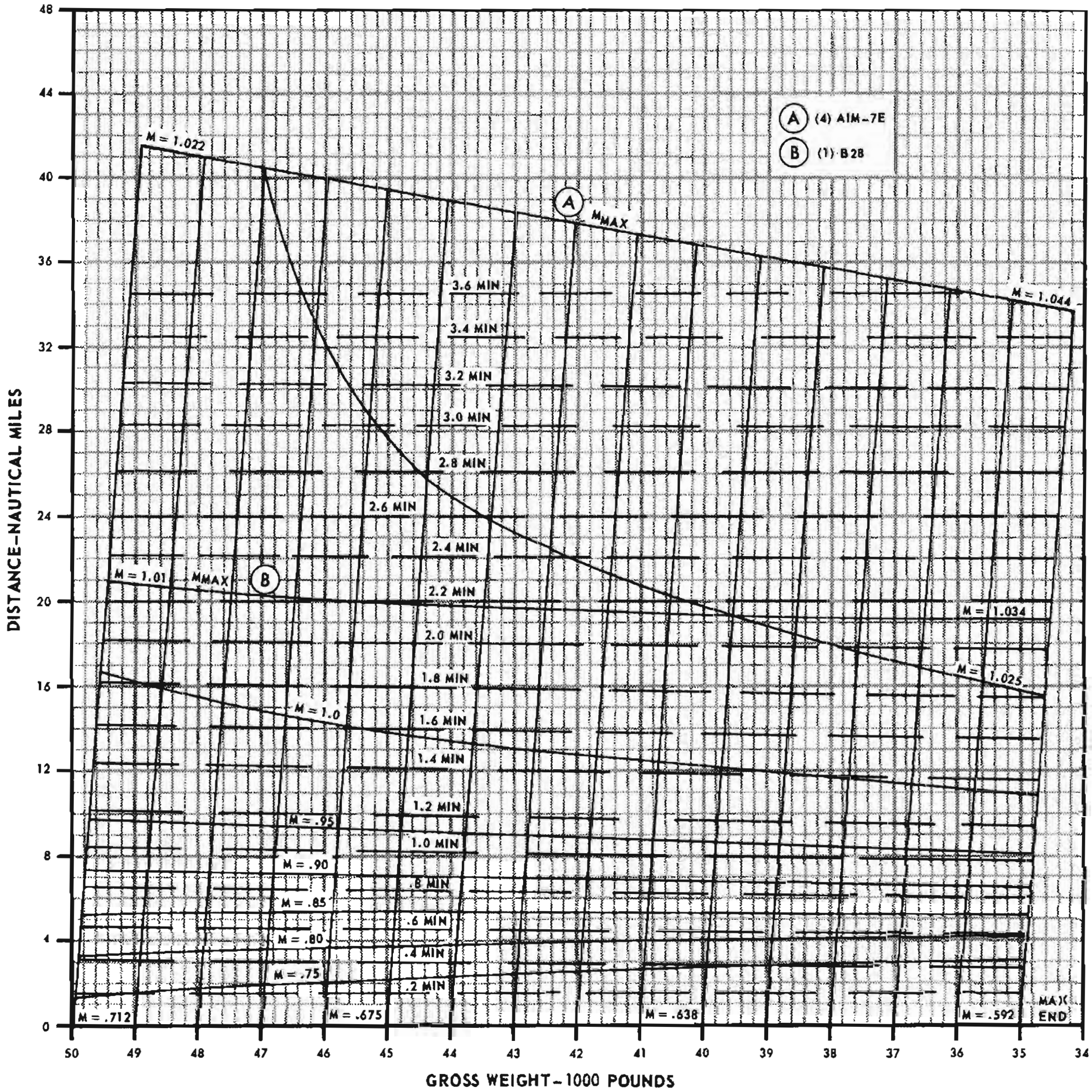
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P940

Figure B9-52

F-4E

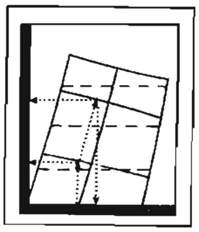
MILITARY THRUST ACCELERATION

35,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E OR (1) B28

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



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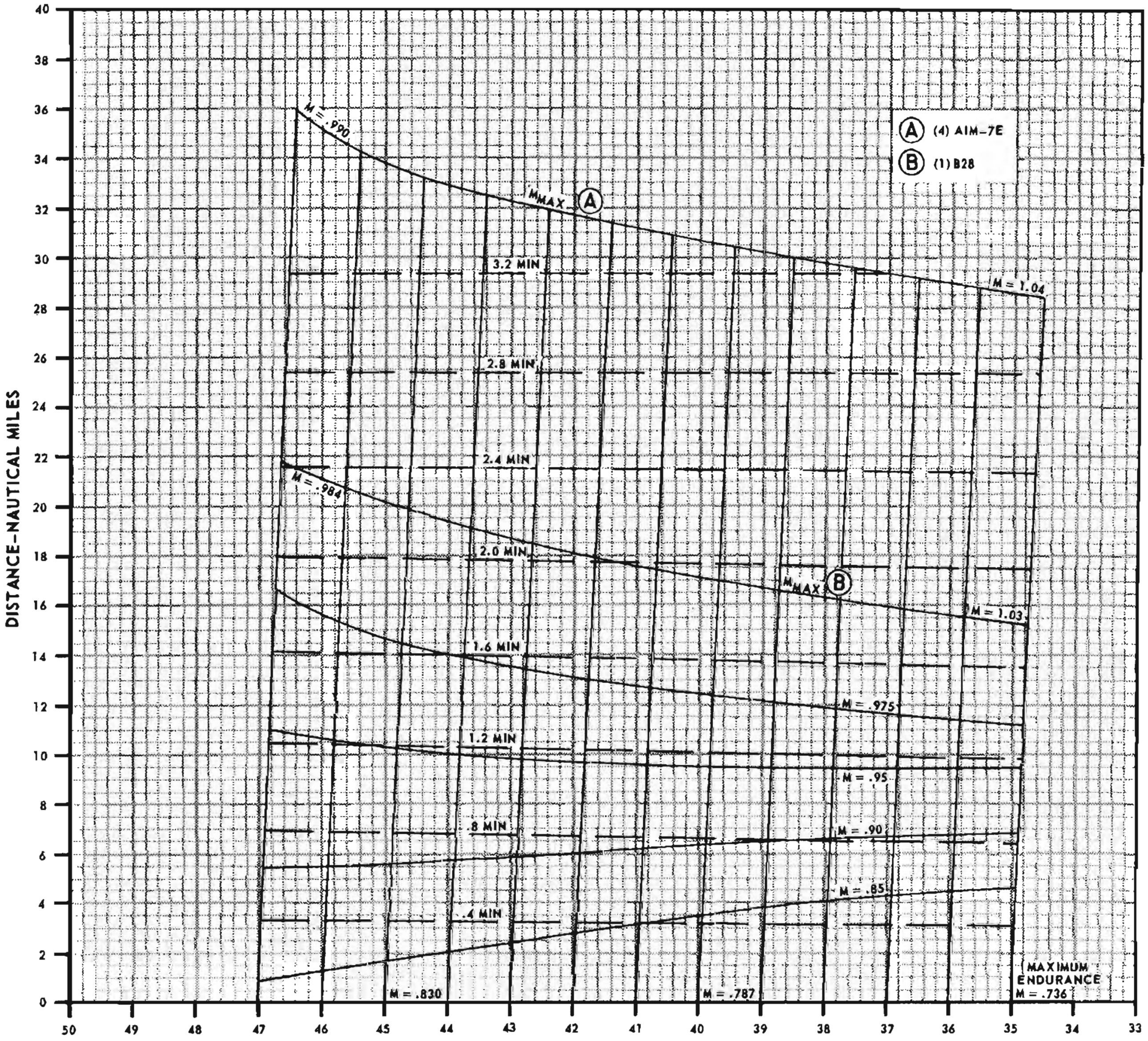
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P941

Figure B9-53

F-4E

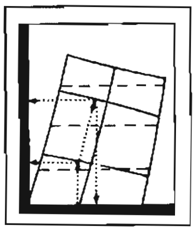
MILITARY THRUST ACCELERATION

15,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (4) AIM-4D

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
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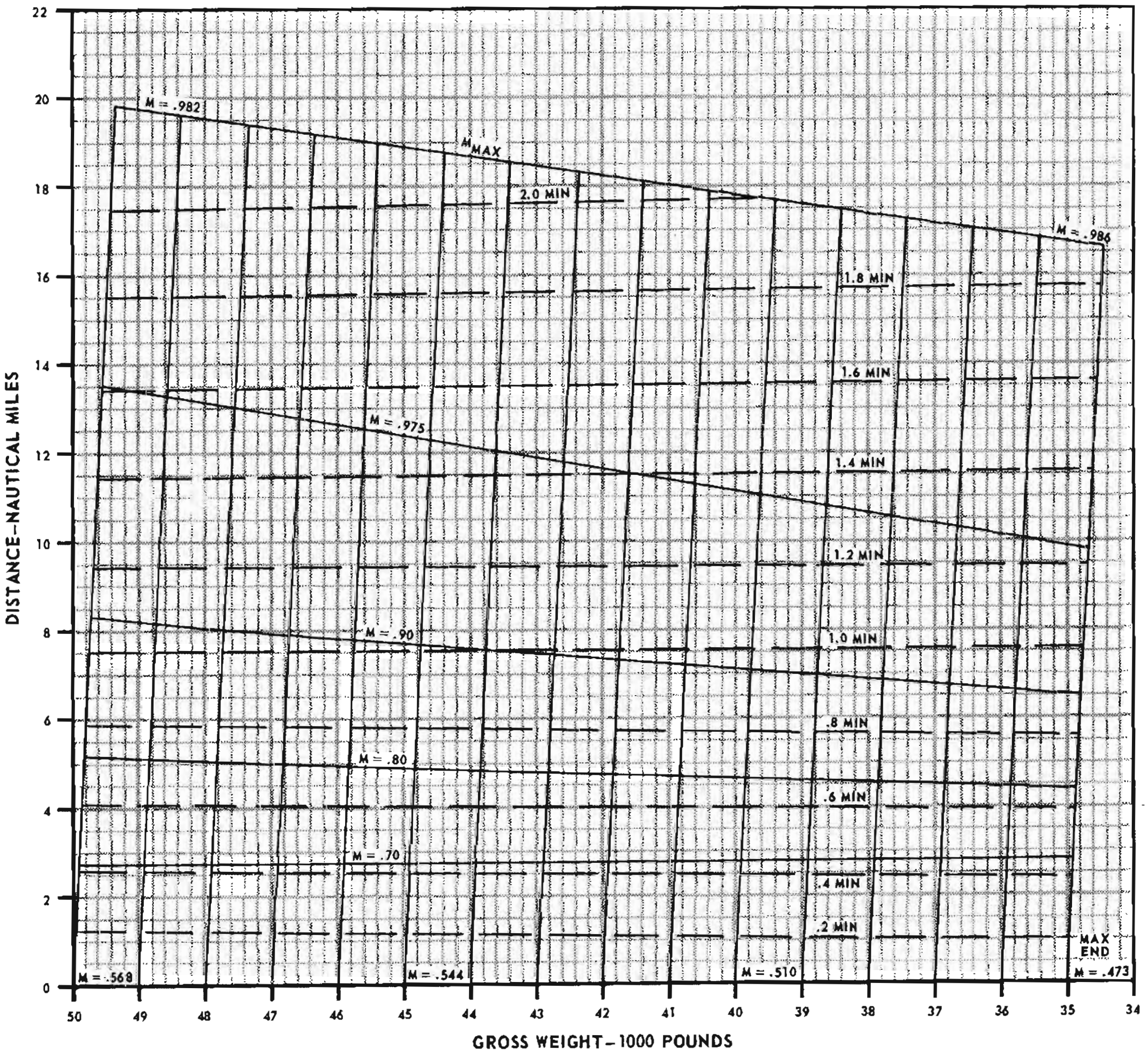
FUEL DENSITY: 6.5 LB/GAL



F4E-P9031

Figure B9-54

F-4E

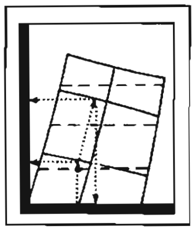
MILITARY THRUST ACCELERATION

25,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (4) AIM-4D

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
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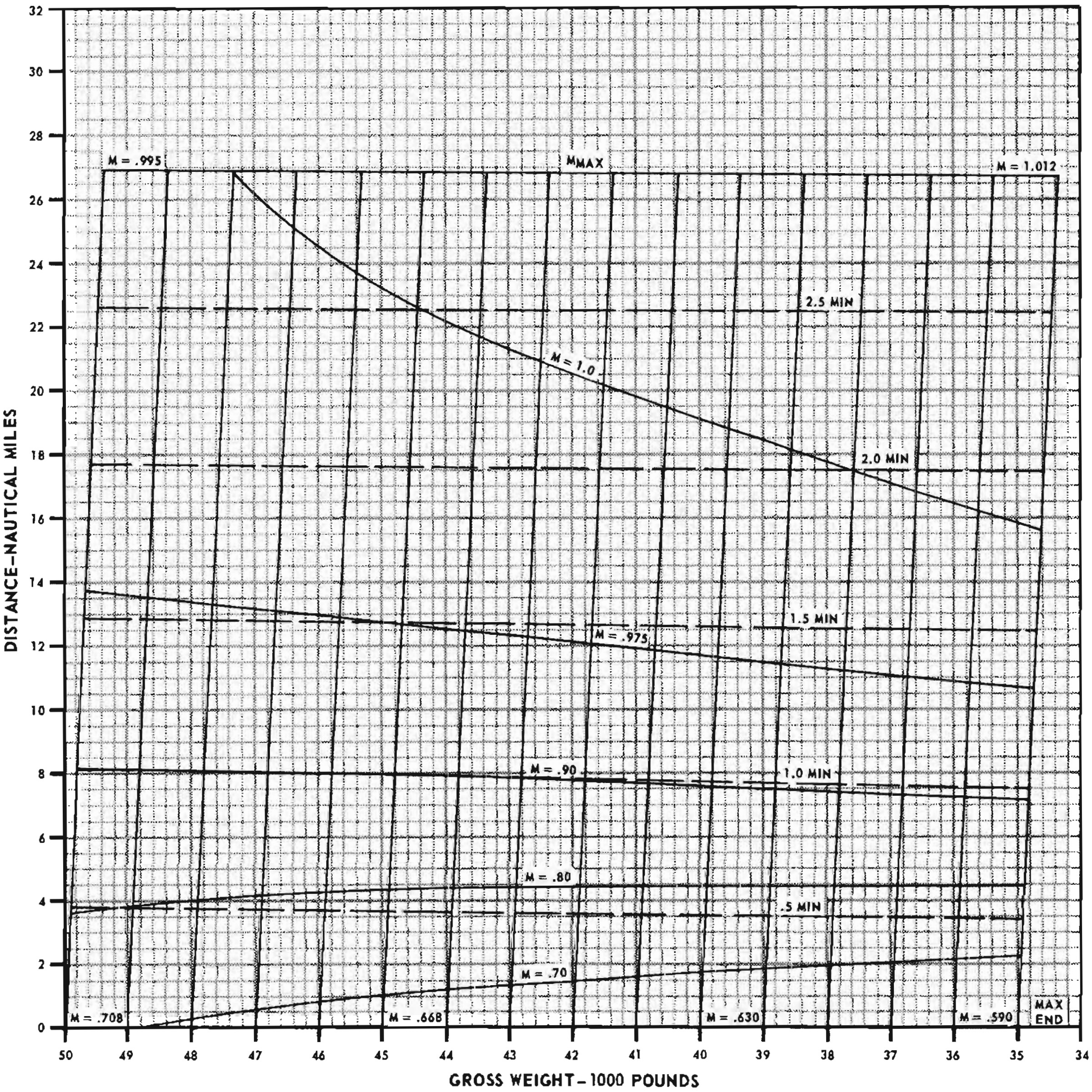
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9032

Figure B9-55

F-4E

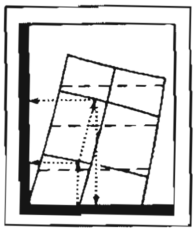
MILITARY THRUST ACCELERATION

35,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (4) AIM-4D

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
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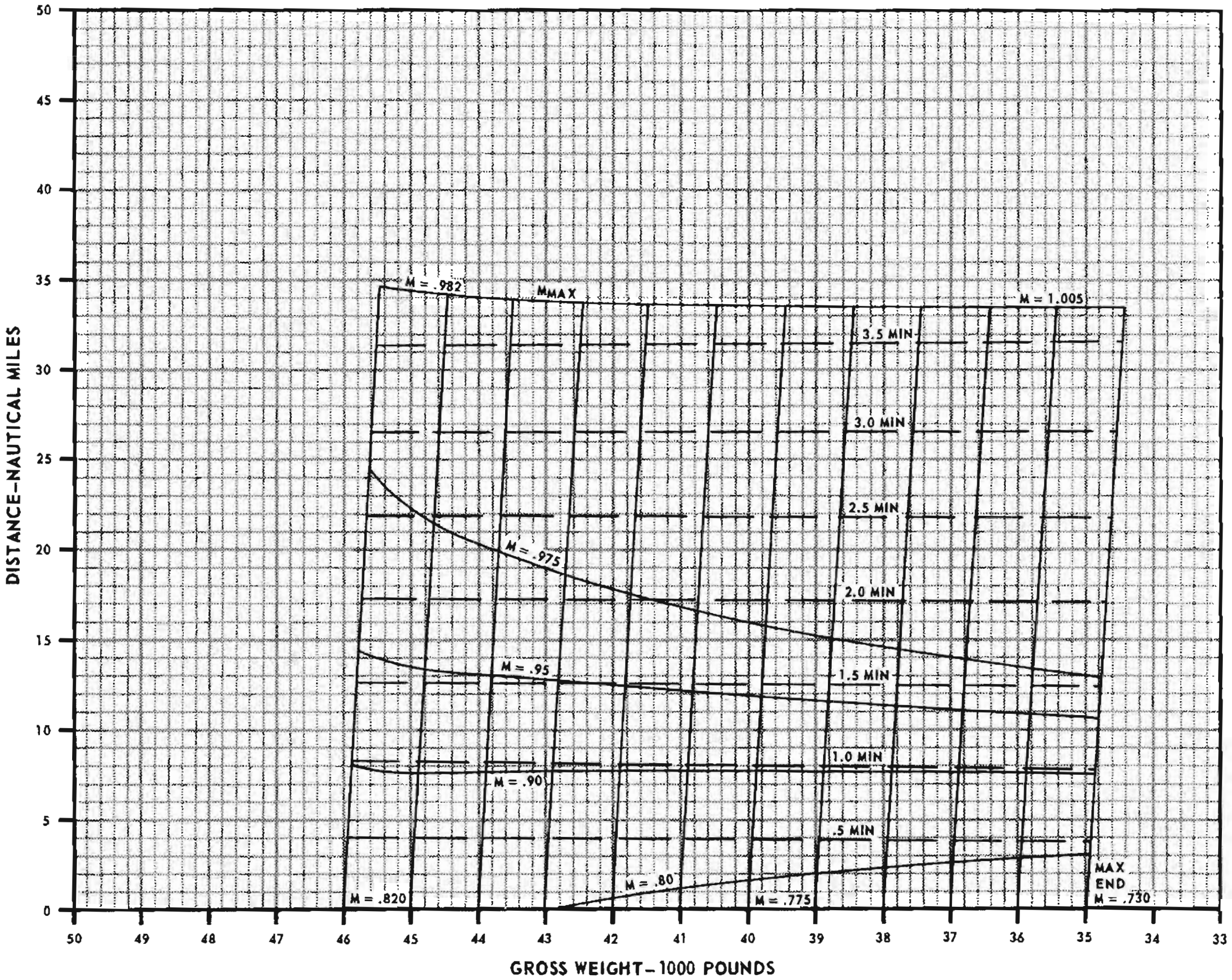


F4E-P9033

Figure B9-56

F-4E

MILITARY THRUST ACCELERATION

15,000 FEET

AIRPLANE CONFIGURATION

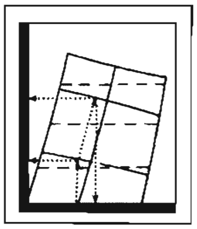
(4) AIM-7E, (1) ℄ TANK
OR
(4) AIM-7E, (2) WING TANKS
OR
(1) B28 AND (2) WING TANKS

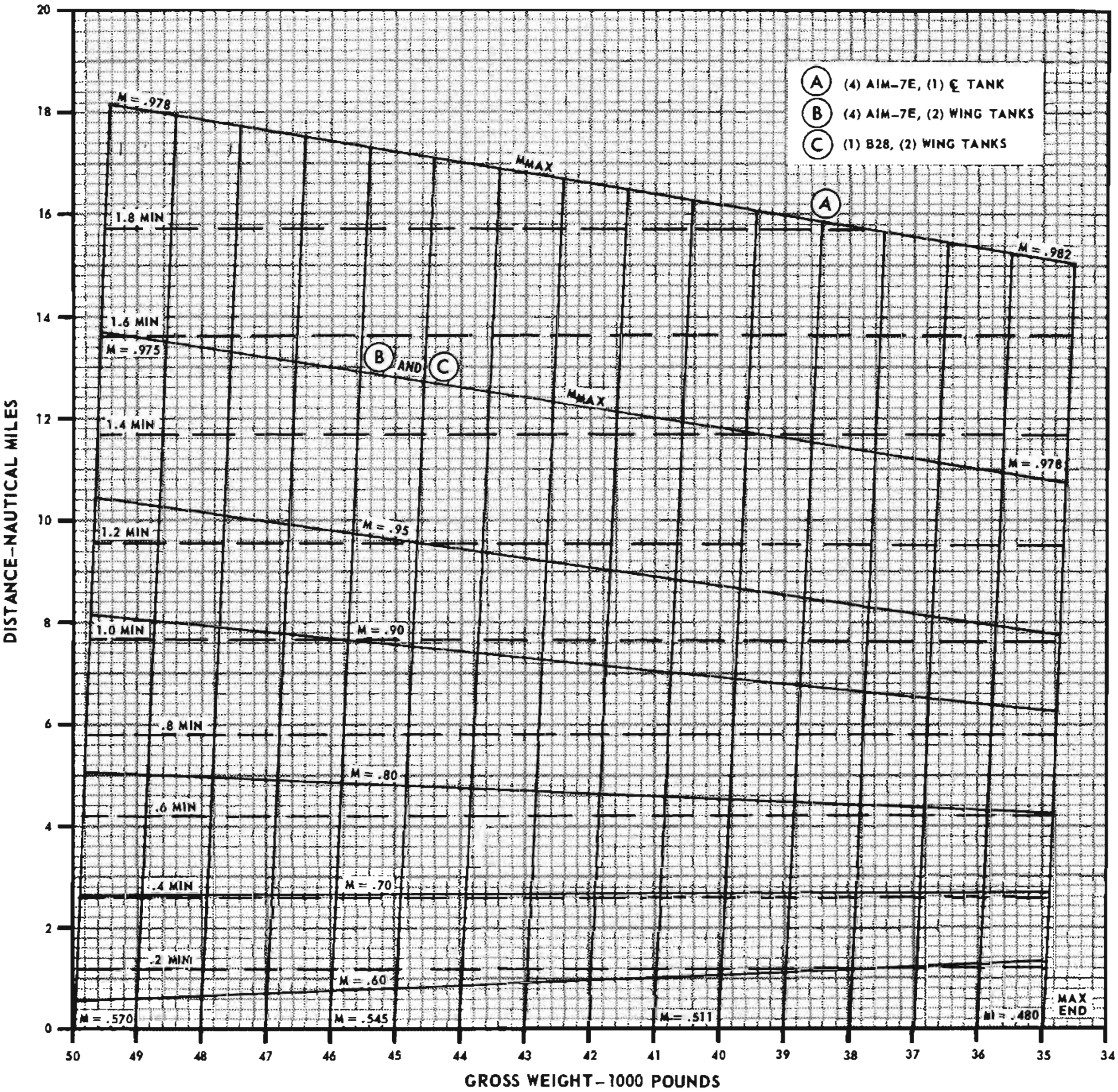
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P943

Figure B9-57

F-4E

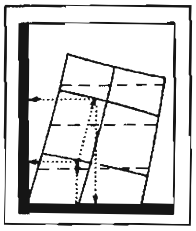
MILITARY THRUST ACCELERATION

25,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E AND (1) ℄ TANK
OR
(4) AIM-7E AND (2) WING TANKS
OR
(1) B28 AND (2) WING TANKS

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
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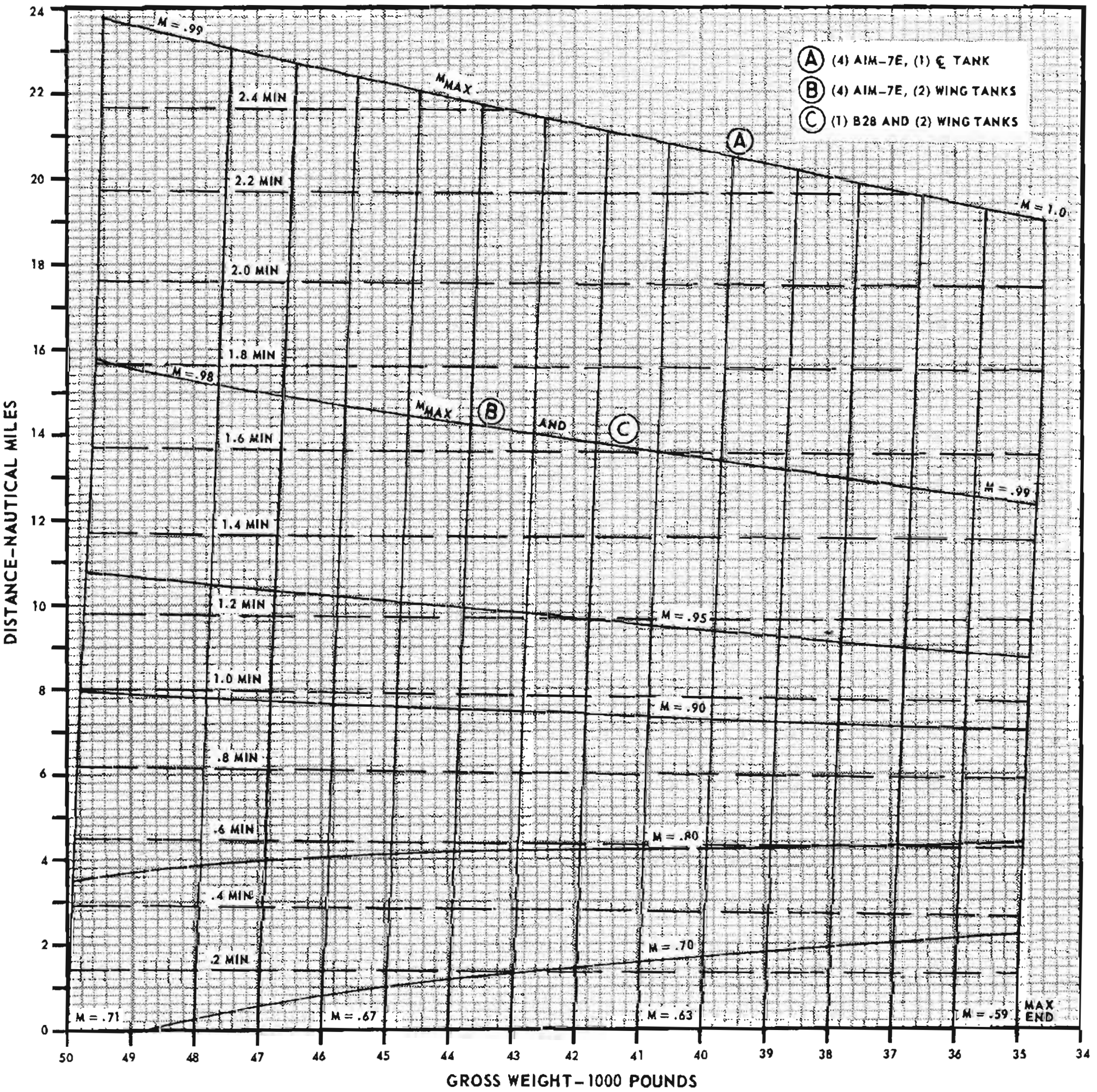
FUEL DENSITY: 6.5 LB/GAL



F4E-P944

Figure B9-58

F-4E

MILITARY THRUST ACCELERATION

35,000 FEET

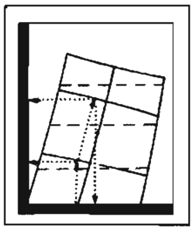
AIRPLANE CONFIGURATION

(4) AIM-7E, (1) ℄ TANK
OR
(4) AIM-7E, (2) WING TANKS
OR
(1) B28, (2) WING TANKS

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
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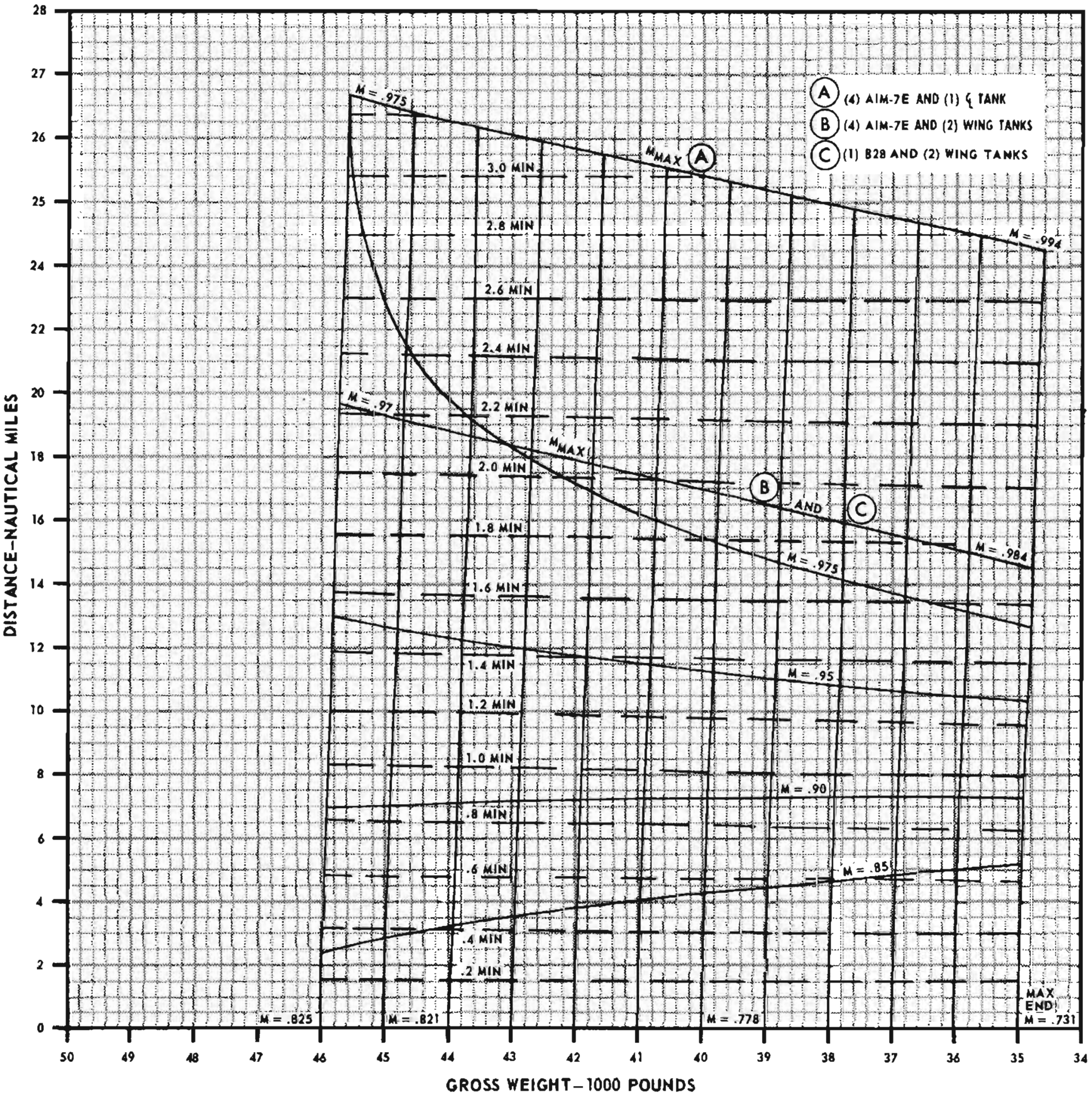
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E P945

Figure B9-59

F-4E

MILITARY THRUST ACCELERATION

15,000 FEET

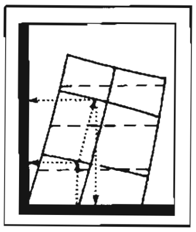
AIRPLANE CONFIGURATION

(4) AIM-7E, (1) ℄ TANK AND (2) WING TANKS

REMARKS

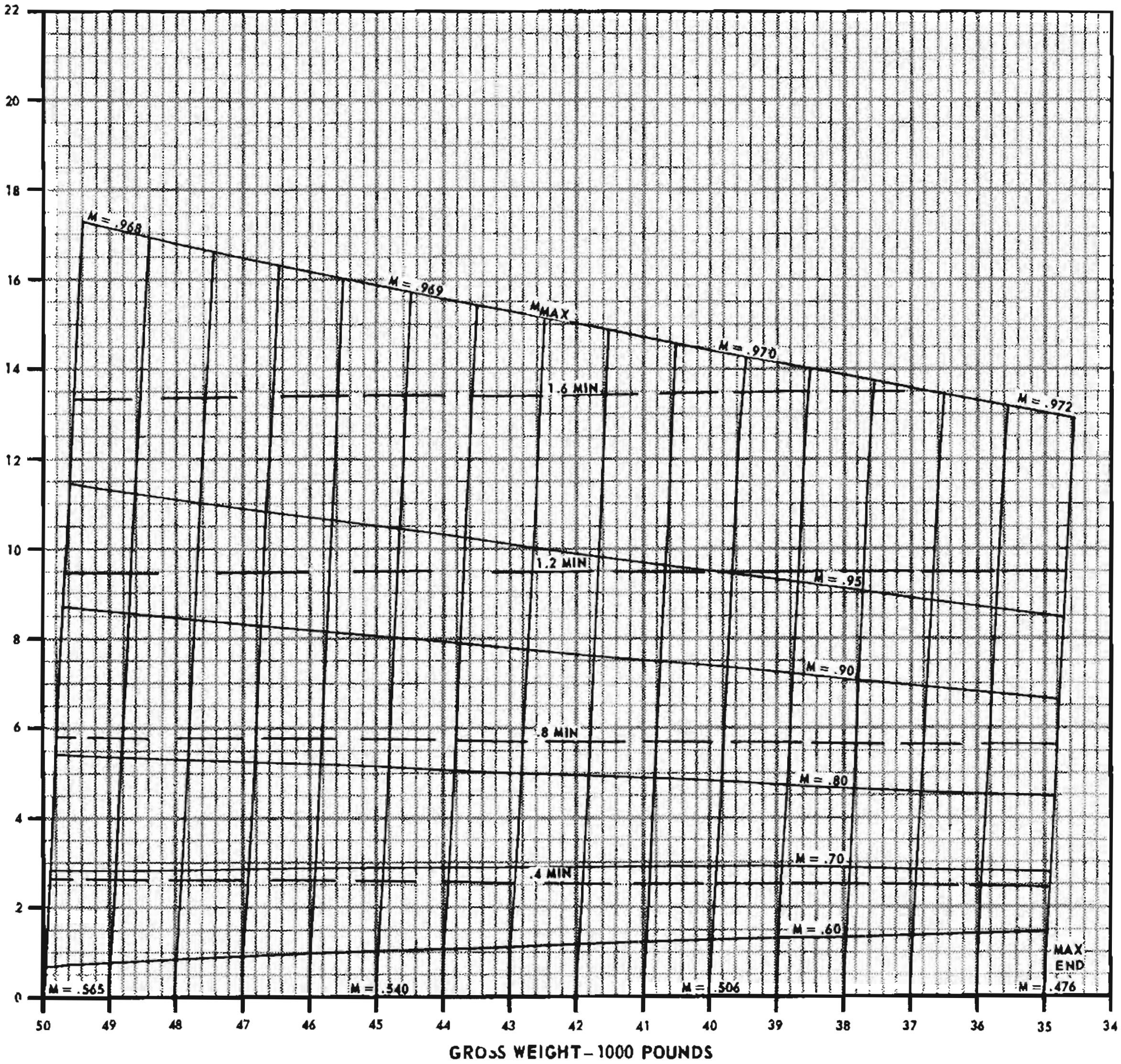
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P951

Figure B9-60

F-4E

MILITARY THRUST ACCELERATION

25,000 FEET

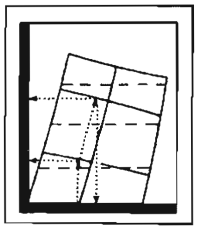
AIRPLANE CONFIGURATION

(4) AIM-7E, (1) ℄ TANK
AND (2) WING TANKS

REMARKS

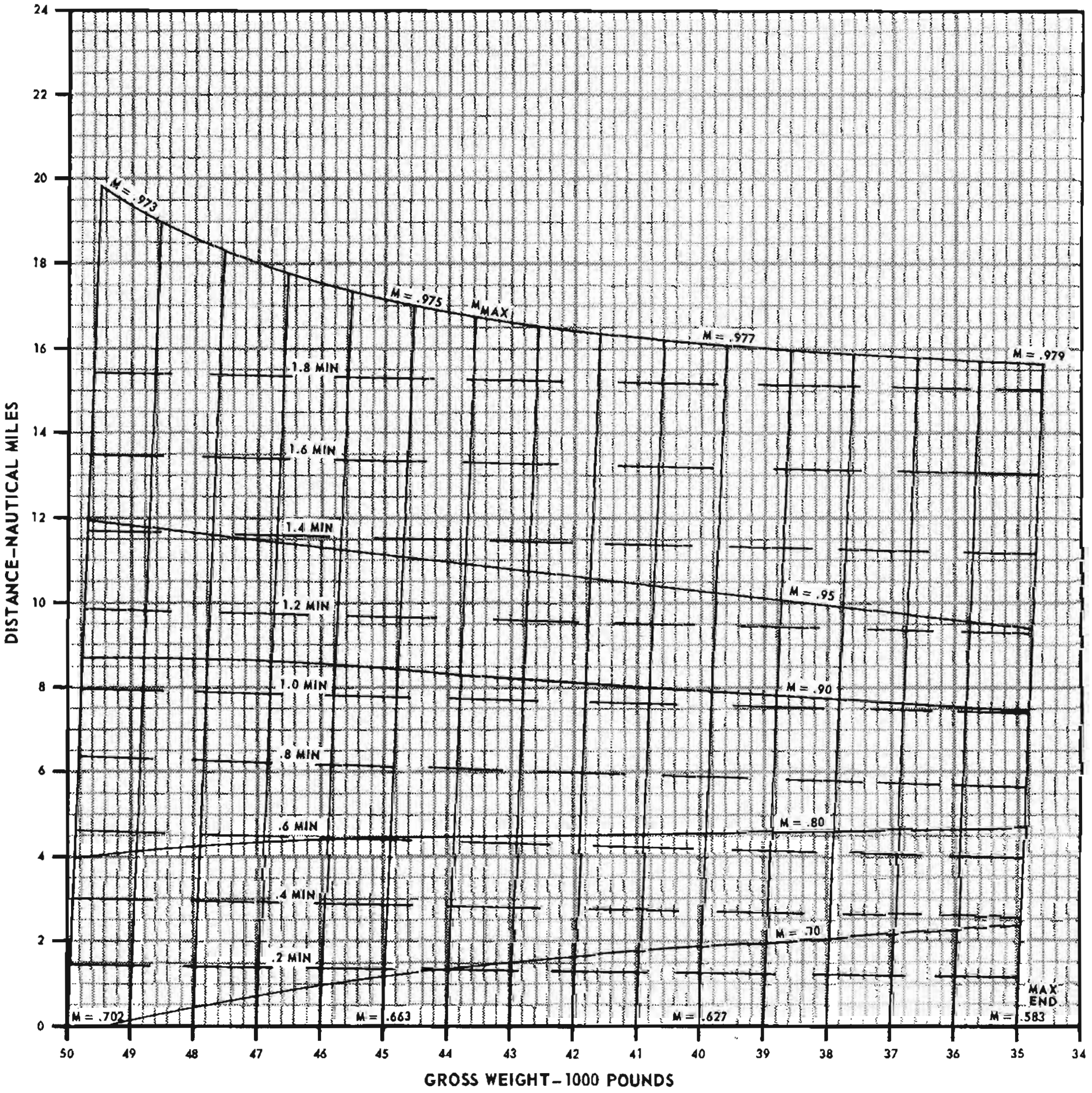
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P952

Figure B9-61

F-4E

MILITARY THRUST ACCELERATION

35,000 FEET

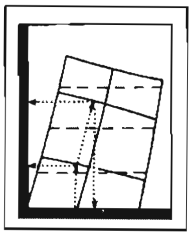
AIRPLANE CONFIGURATION

(4) AIM-7E, (1) ℄ TANK AND (2) WING TANKS

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
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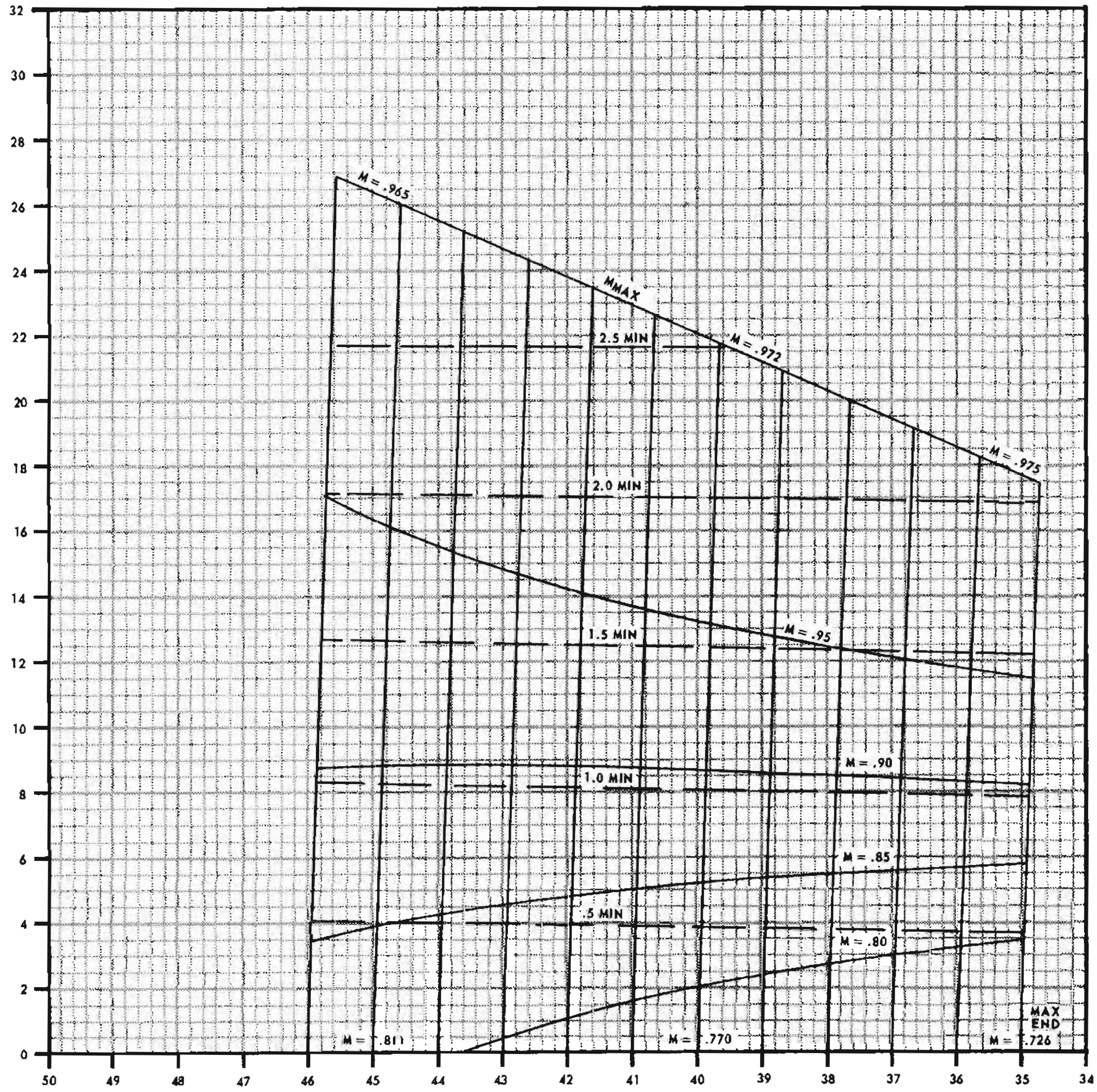
FUEL DENSITY: 6.5 LB/GAL



F4E-P953

Figure B9-62

F-4E

MILITARY THRUST ACCELERATION

15,000 FEET

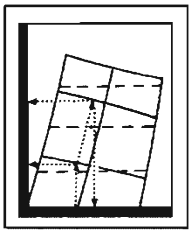
AIRPLANE CONFIGURATION

(4) AIM-7E, (4) AIM-4D
AND (1) ℄ TANK

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



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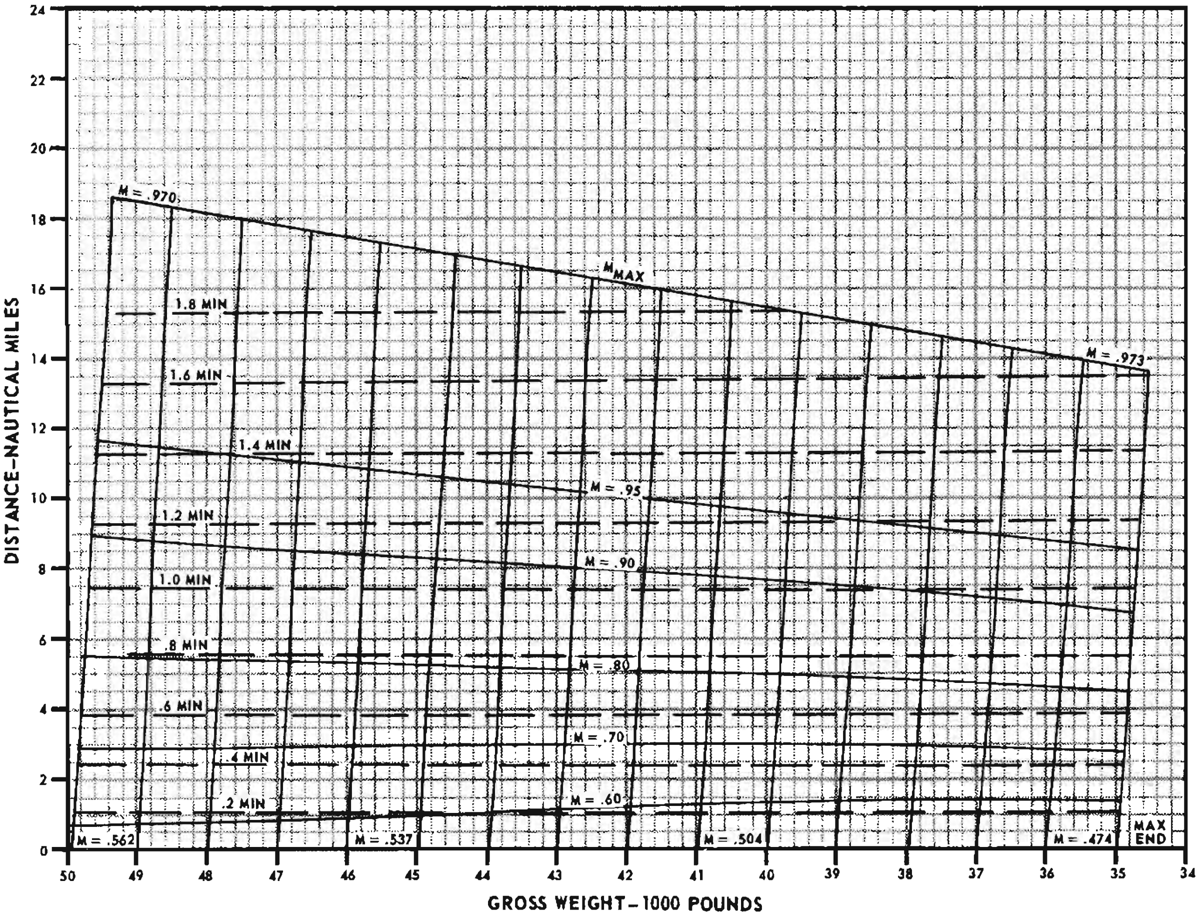
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9034

Figure B9-63

F-4E

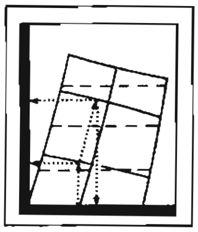
MILITARY THRUST ACCELERATION

25,000 FEET

AIRPLANE CONFIGURATION
(4) AIM-7E, (4) AIM-4D
AND (1) ℄ TANK

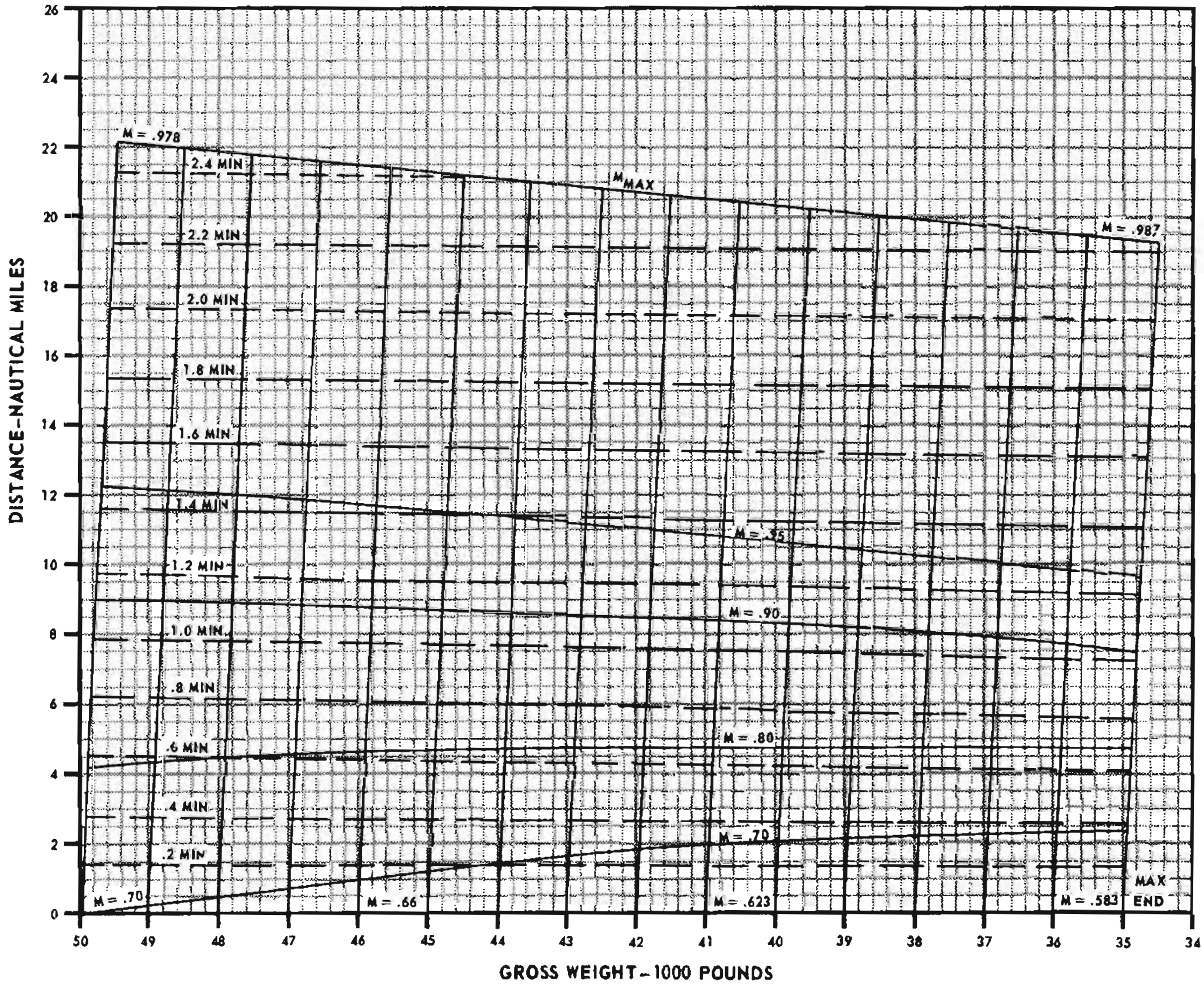
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9035

Figure B9-64

F-4E

MILITARY THRUST ACCELERATION

35,000 FEET

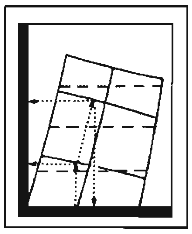
AIRPLANE CONFIGURATION

(4) AIM-7E, (4) AIM-4D AND (1) ℄ TANK

REMARKS

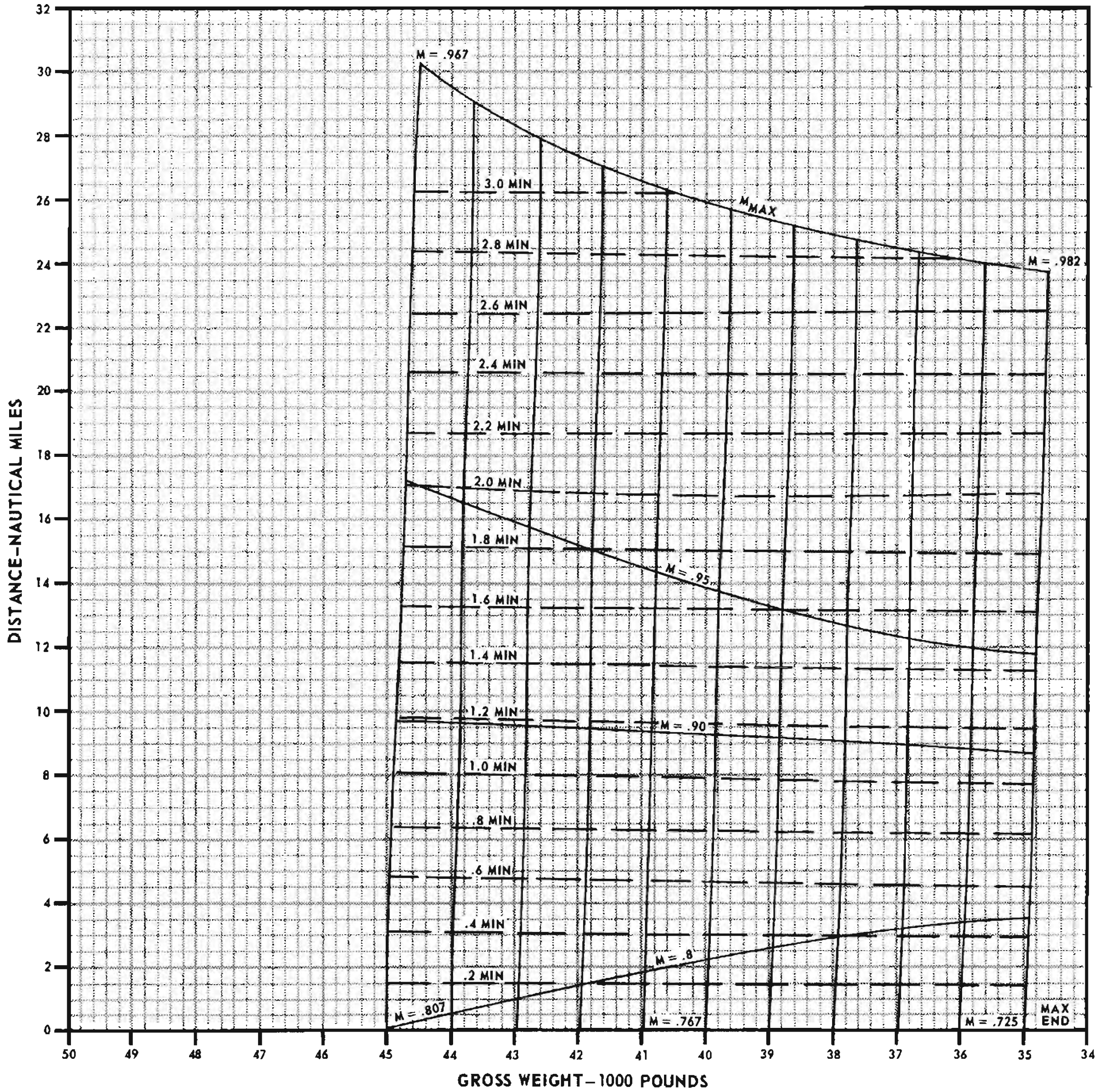
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9036

Figure B9-65

F-4E

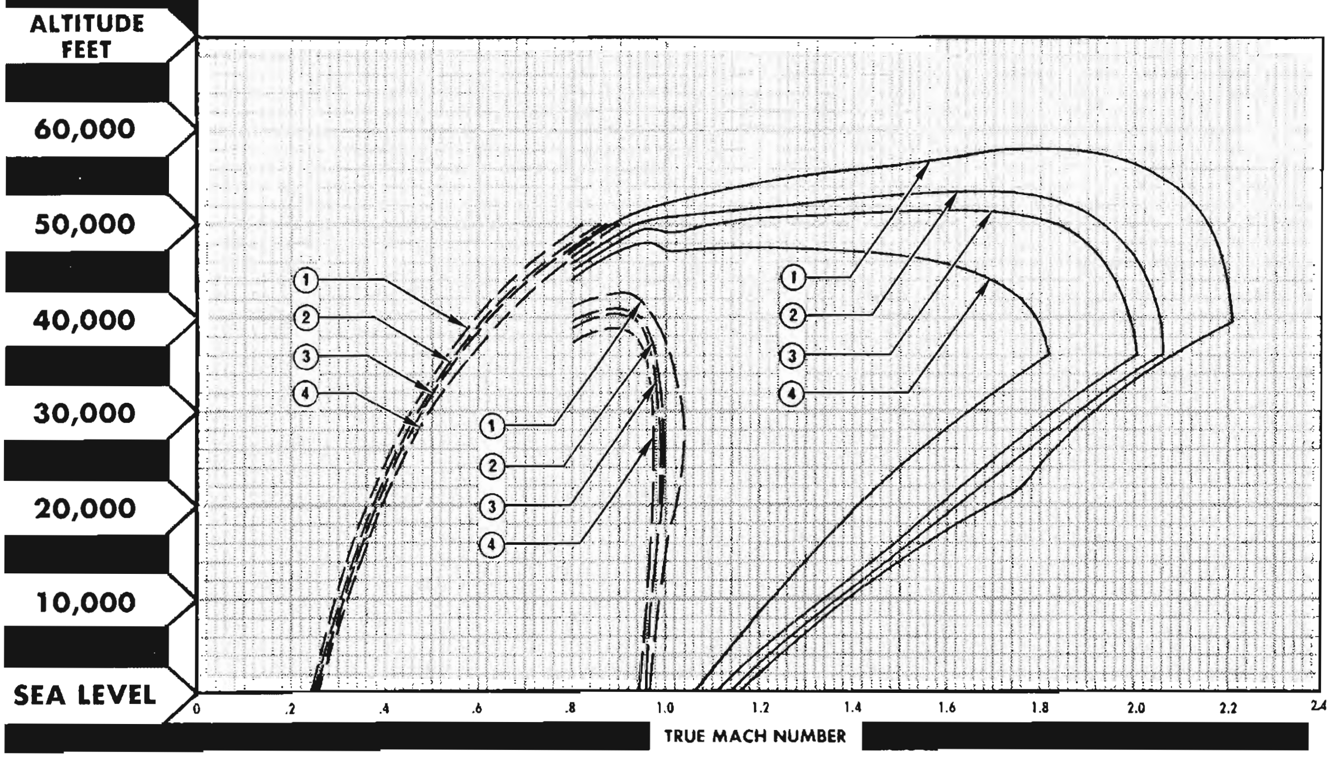
LEVEL FLIGHT ENVELOPE

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY
COMBAT GROSS WEIGHTS

CONFIGURATION: (4) AIM-7E

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



CURVE NO.	CONFIGURATION	GROSS WEIGHT
1	(4) AIM - 7E	41,109 LBS
2	(4) AIM - 7E, AND (1) ℄ TANK	43,749 LBS
3	(4) AIM - 7E, AND (2) WING TANKS	44,675 LBS
4	(4) AIM - 7E, (1) ℄ TANK, AND (2) WING TANKS	47,247 LBS

LEGEND

- ———— MAXIMUM THRUST
- — - — - MILITARY THRUST
- — — — — MODERATE BUFFET

F4E-P968

Figure B9-66

F-4E

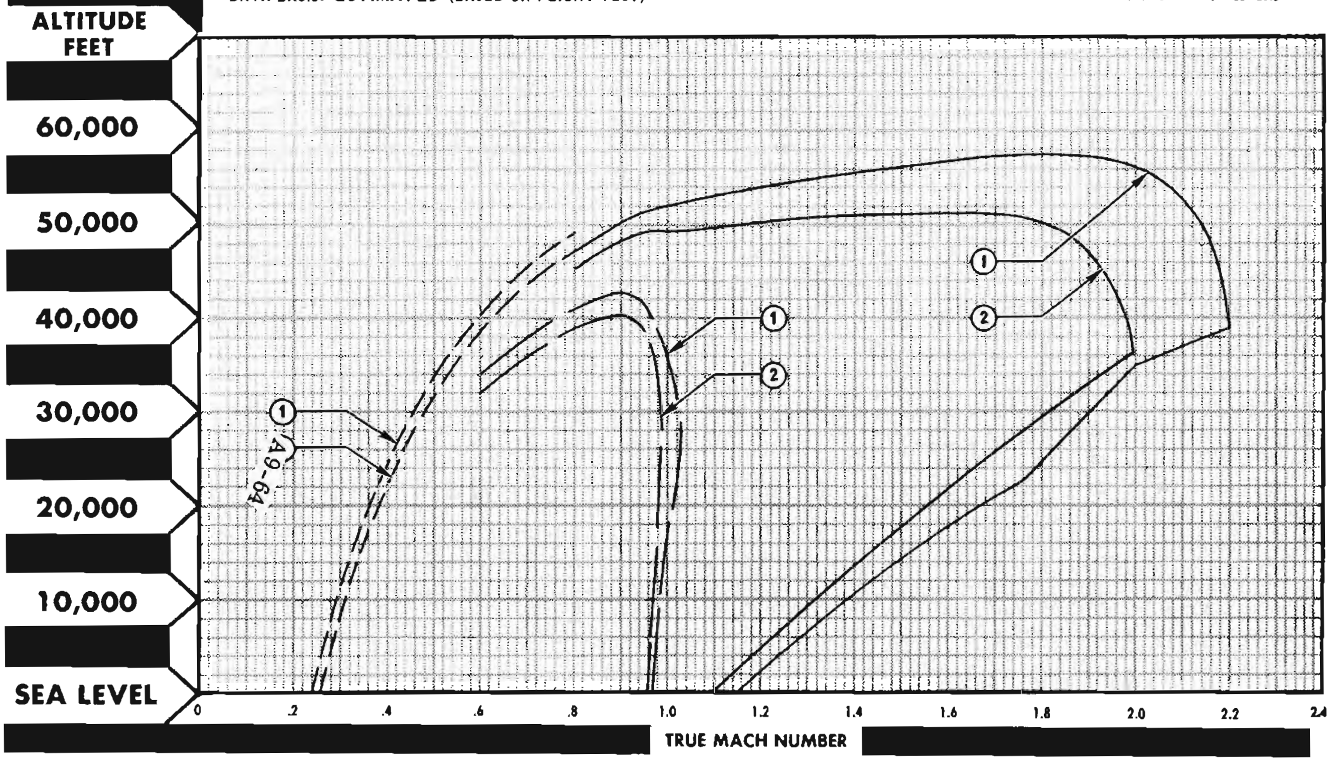
LEVEL FLIGHT ENVELOPE

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY
COMBAT GROSS WEIGHTS

CONFIGURATION: (1) B28

DATE: 1 MARCH 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



CURVE NO.	CONFIGURATION	GROSS WEIGHT
1	(1) B28	41,380 LBS
2	(1) B28 AND 2 WING TANKS	44,946 LBS

LEGEND
———— MAXIMUM THRUST
—— —— MILITARY THRUST
— — — — MODERATE BUFFET

4E-P969

Figure B9-67

V-N ENVELOPE
SYMMETRICAL FLIGHT

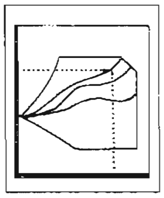
AIRPLANE CONFIGURATION
CLEAN
OR
(4) AIM-7D/E

GROSS WEIGHT – 37,500 POUNDS

REMARKS

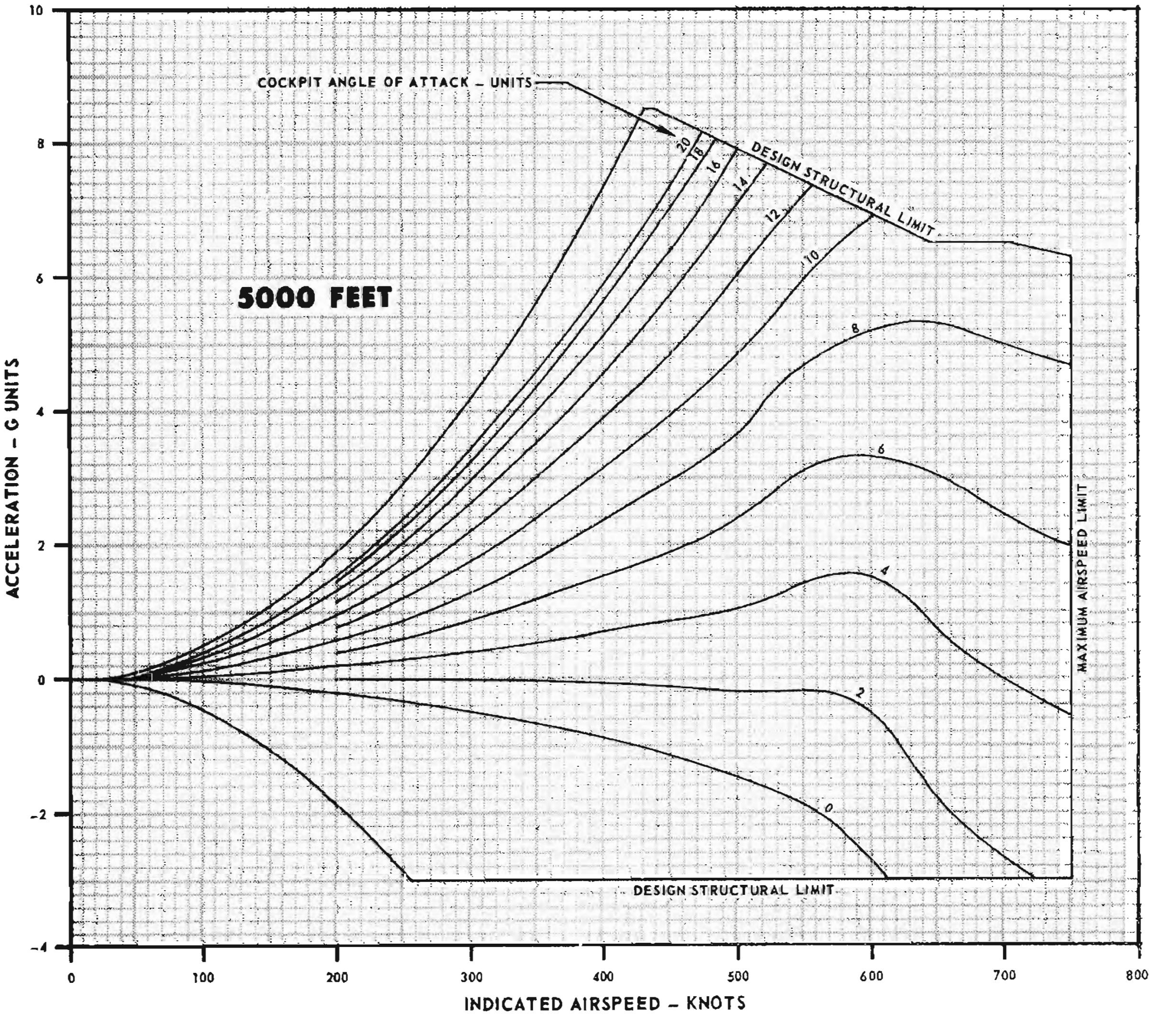
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 15 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P9158

Figure B9-68

F-4E

V-N ENVELOPE

SYMMETRICAL FLIGHT

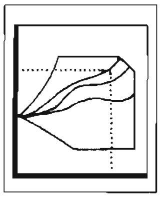
AIRPLANE CONFIGURATION
CLEAN
OR
(4) AIM-7D/E

GROSS WEIGHT – 37,500 POUNDS

REMARKS

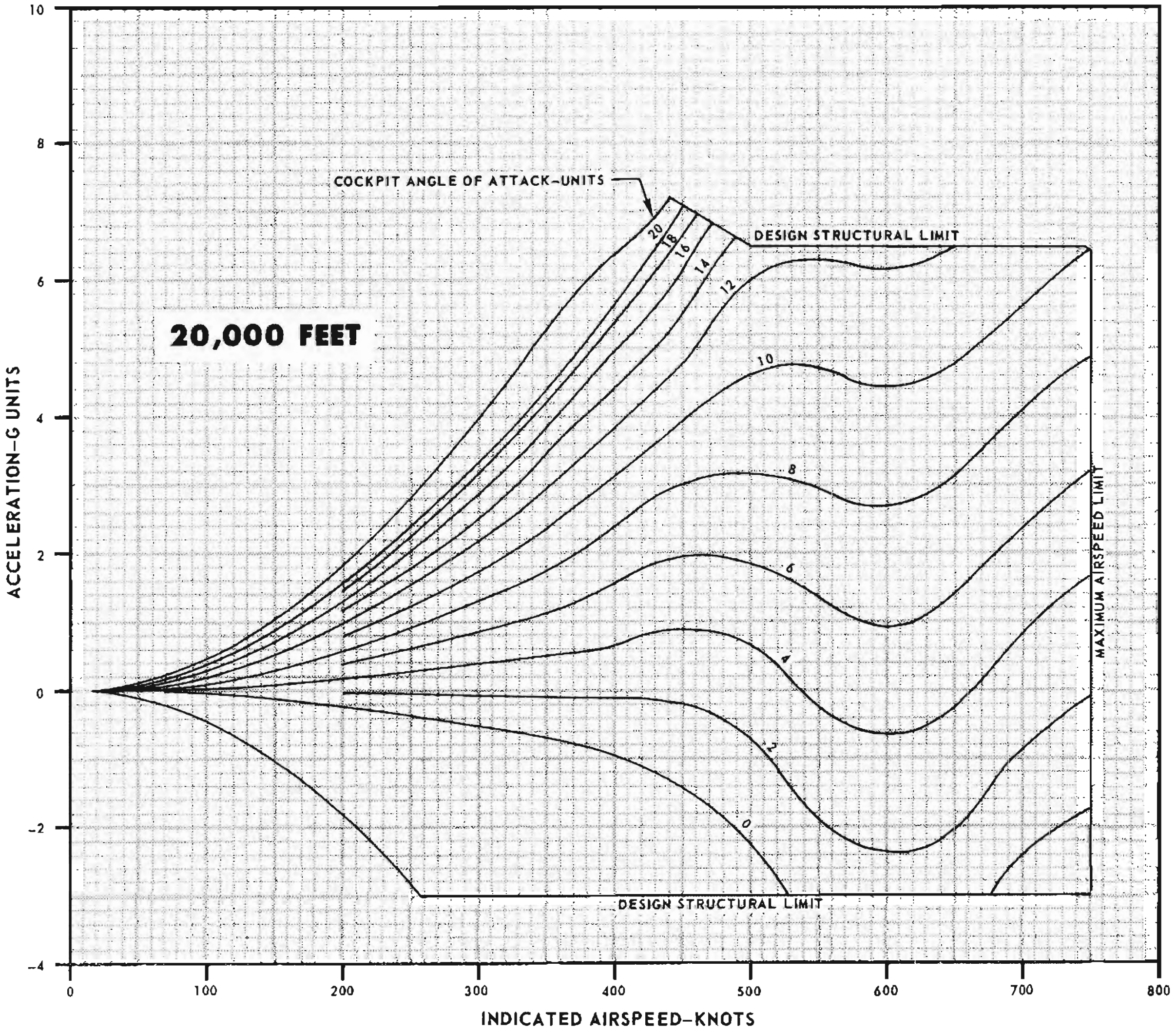
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 15 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P983

Figure B9-69

F-4E
V-N ENVELOPE
SYMMETRICAL FLIGHT

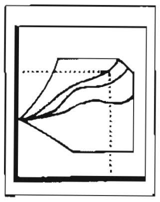
AIRPLANE CONFIGURATION
CLEAN
OR
(4) AIM-7D/E

GROSS WEIGHT-37,500 POUNDS

REMARKS

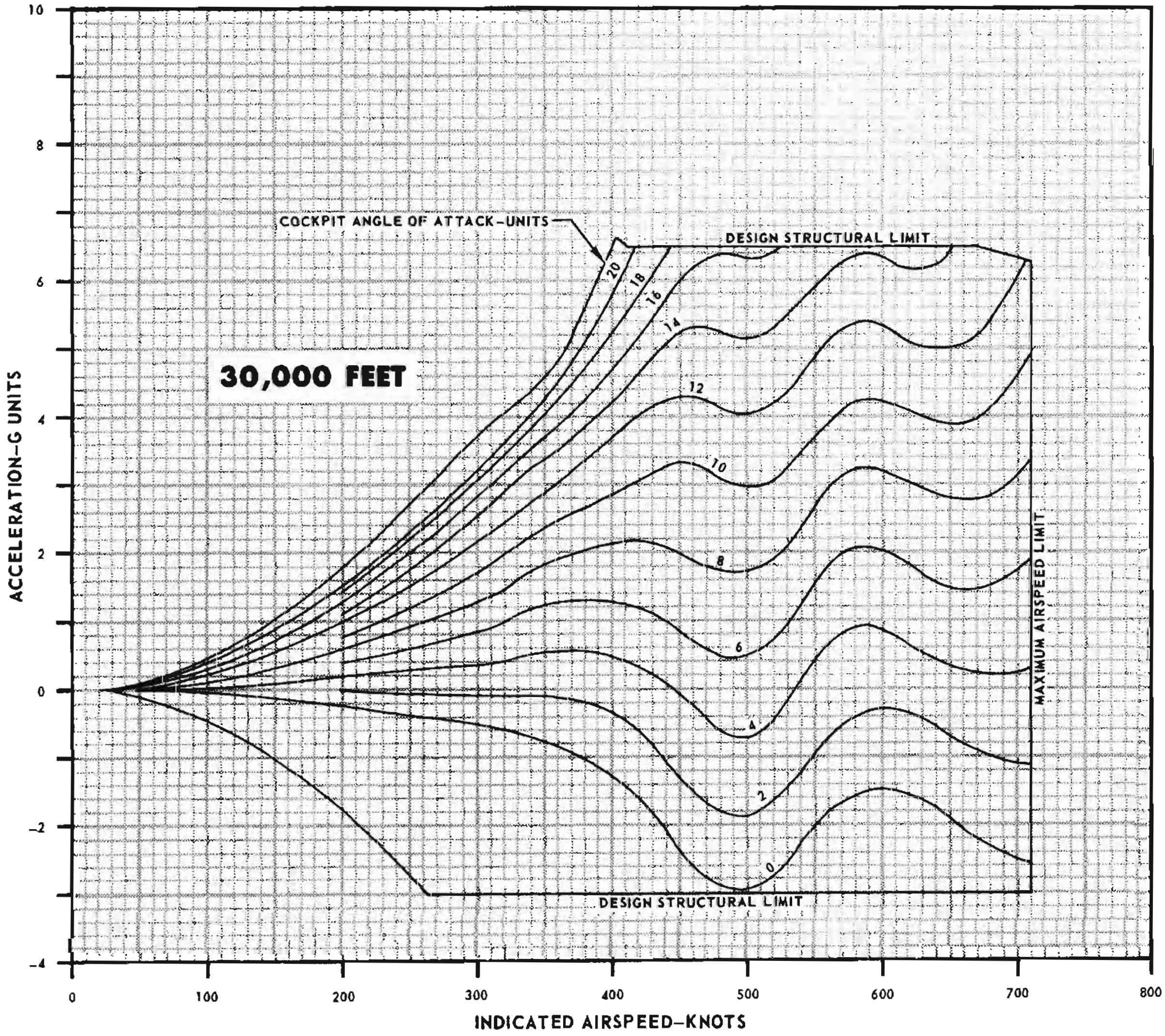
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE



DATE: 15 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P984

Figure B9-70

F-4E

V-N ENVELOPE

SYMMETRICAL FLIGHT

AIRPLANE CONFIGURATION
CLEAN
OR
(4) AIM-7D/E

GROSS WEIGHT - 37,500 POUNDS

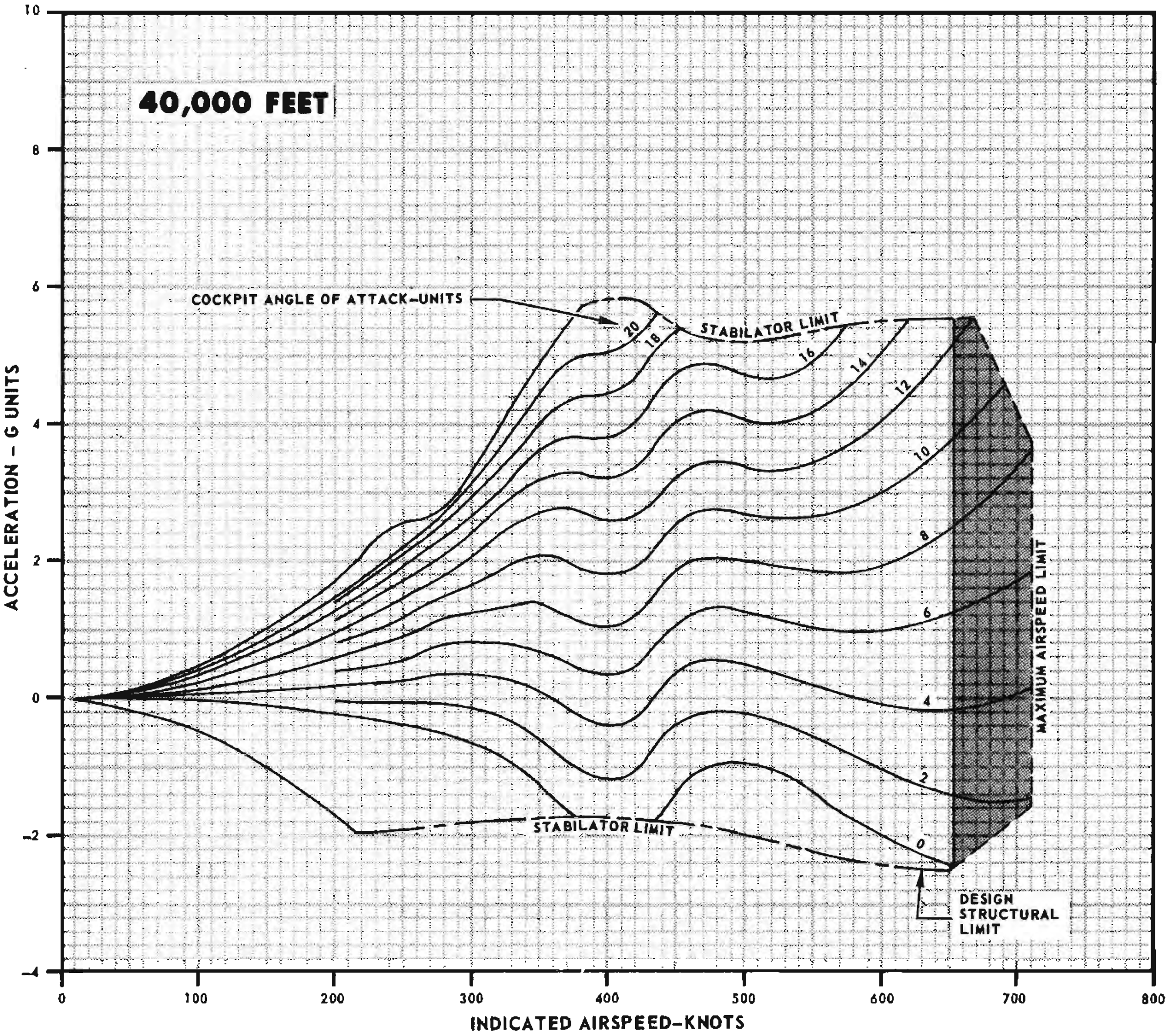
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

DATE: 15 AUGUST 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P985

Figure B9-71

F-4E

DIVE RECOVERY -16 UNITS AOA

SUBSONIC-SPEED BRAKES RETRACTED

GROSS WEIGHT 40,000 POUNDS

AIRPLANE CONFIGURATION
(4)AIM-7E

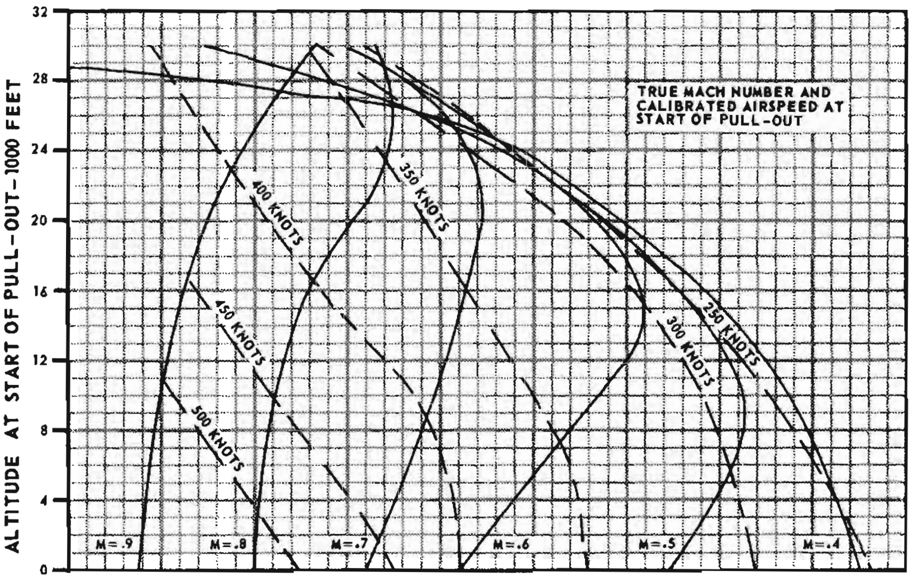
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

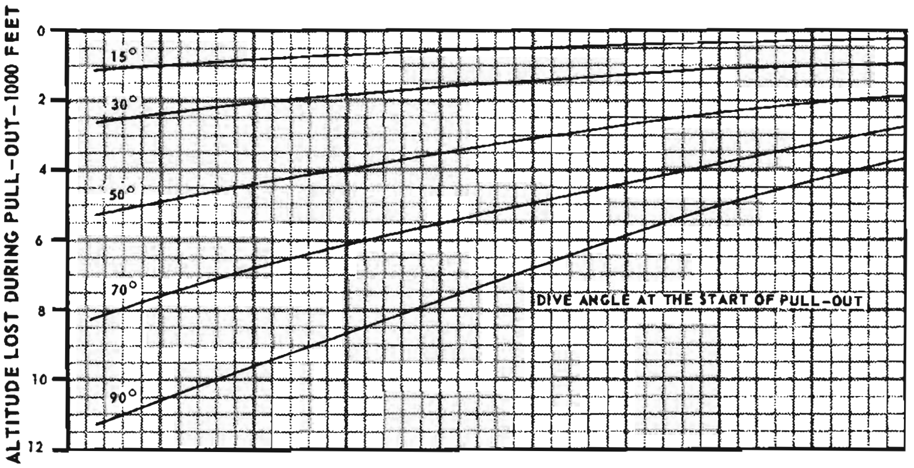
NOTES
1. ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST.
2. PULL-OUT BASED ON 1.0G PER SECOND ACCELERATION BUILDUP TO 19 UNITS (AOA), STABILATOR LIMIT OR 6.0G WHICHEVER OCCURS FIRST.

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P975

Figure B9-72

F-4E

DIVE RECOVERY -19 UNITS AOA

SUBSONIC-SPEED BRAKES RETRACTED

AIRPLANE CONFIGURATION
(4) AIM-7E

GROSS WEIGHT 40,000 POUNDS

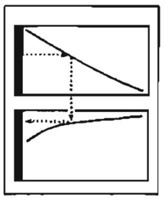
REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

NOTES

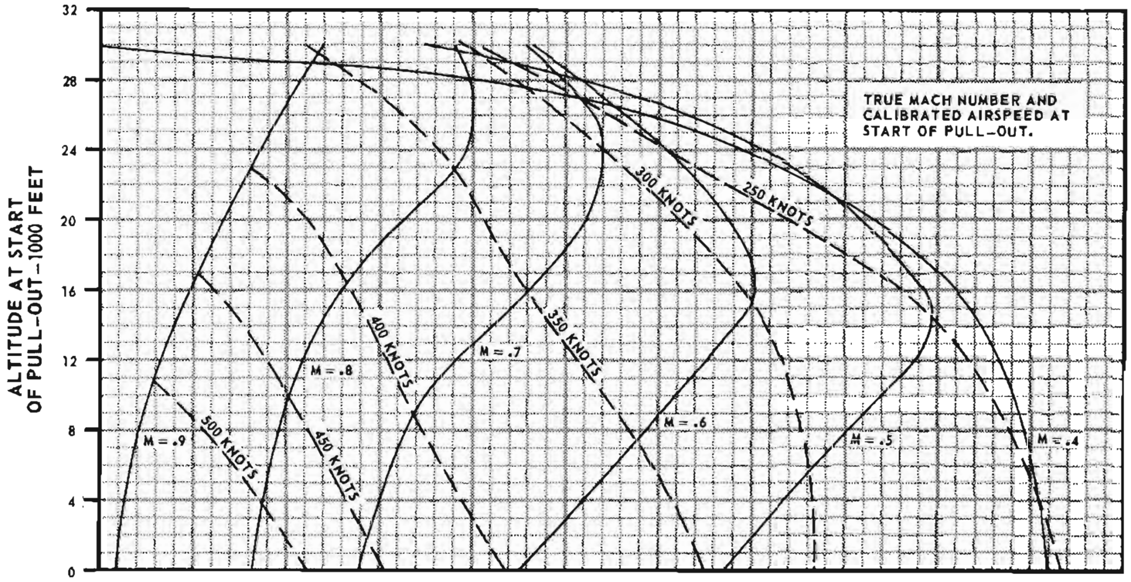
1. ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST.
2. PULLOUT BASED ON 1.0G PER SECOND ACCELERATION BUILDUP TO 19 UNITS (AOA), STABILATOR LIMIT OR 6.0G WHICHEVER OCCURS FIRST.

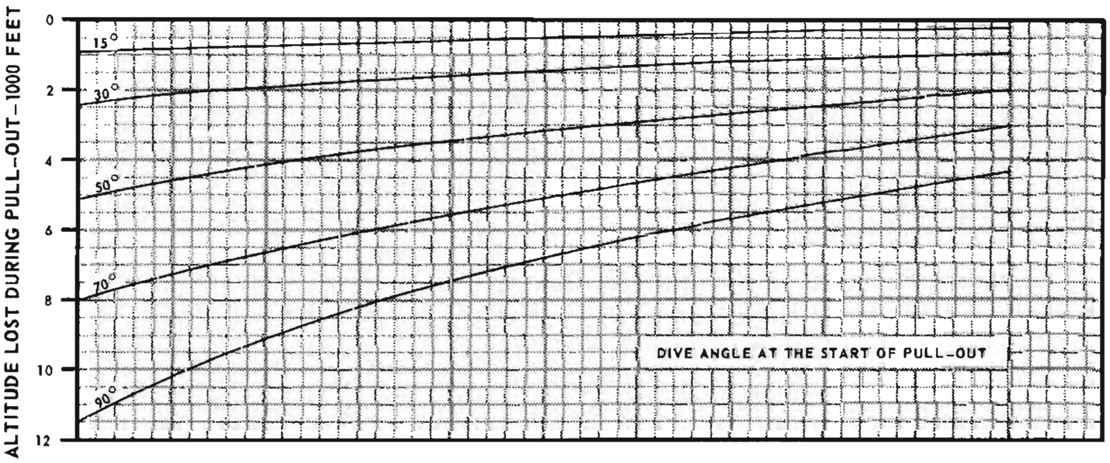
GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





F4E-P976

Figure B9-73

F-4E

DIVE RECOVERY -16 UNITS AOA

SUPERSONIC-SPEED BRAKES RETRACTED

AIRPLANE CONFIGURATION
(4) AIM-7E

GROSS WEIGHT 40,000 POUNDS

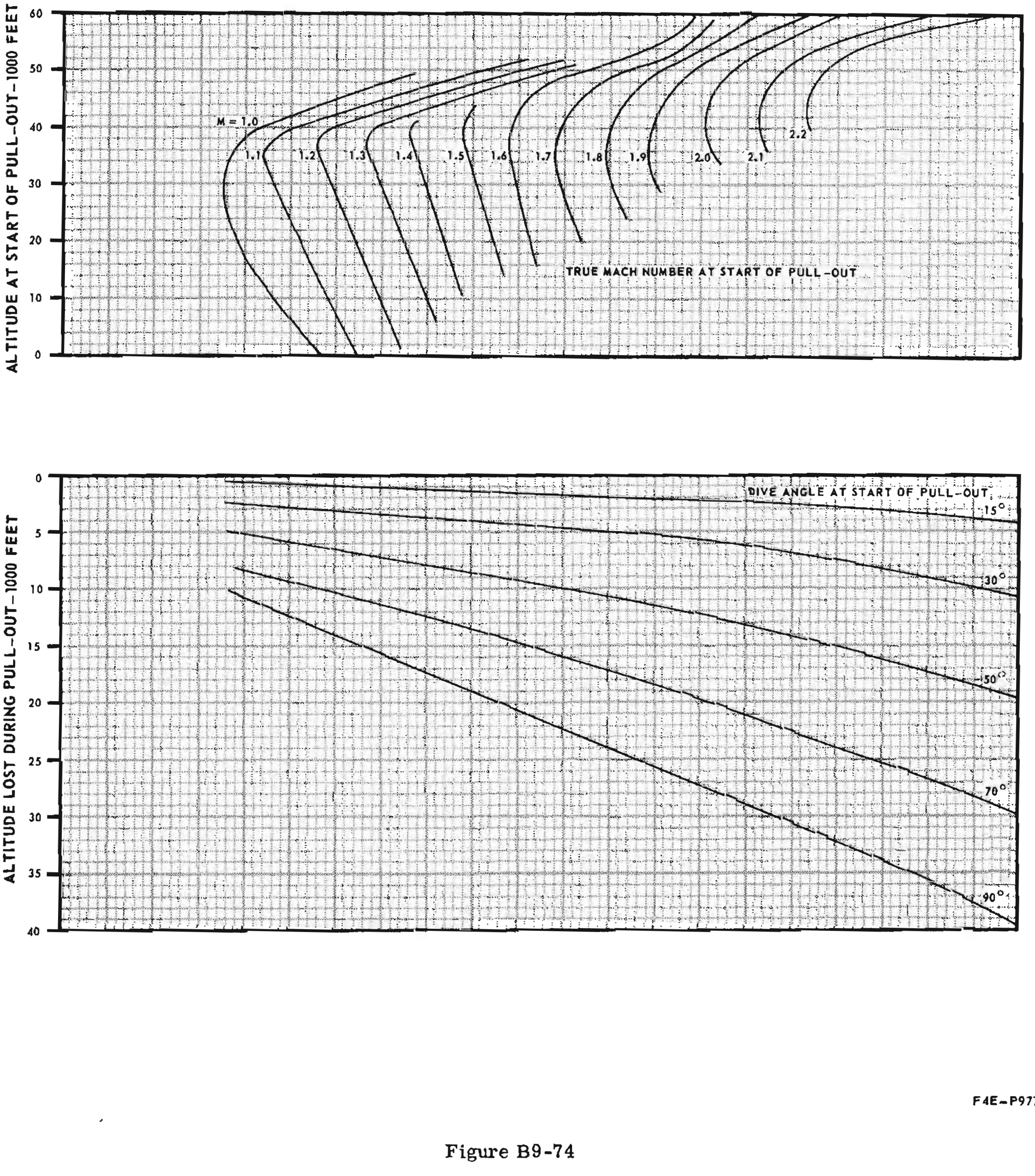
REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

NOTES
1. ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST.
2. PULLOUT BASED ON 1.0G PER SECOND ACCELERATION BUILDUP TO 19 UNITS (AOA), STABILATOR LIMIT OR 6.0G WHICHEVER OCCURS FIRST.

GUIDE

DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P977

Figure B9-74

F-4E

DIVE RECOVERY -19 UNITS AOA
SUPERSONIC-SPEED BRAKES RETRACTED

AIRPLANE CONFIGURATION
(4) AIM-7E

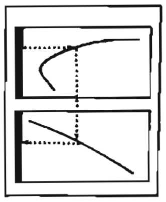
GROSS WEIGHT 40,000 POUNDS

REMARKS

ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

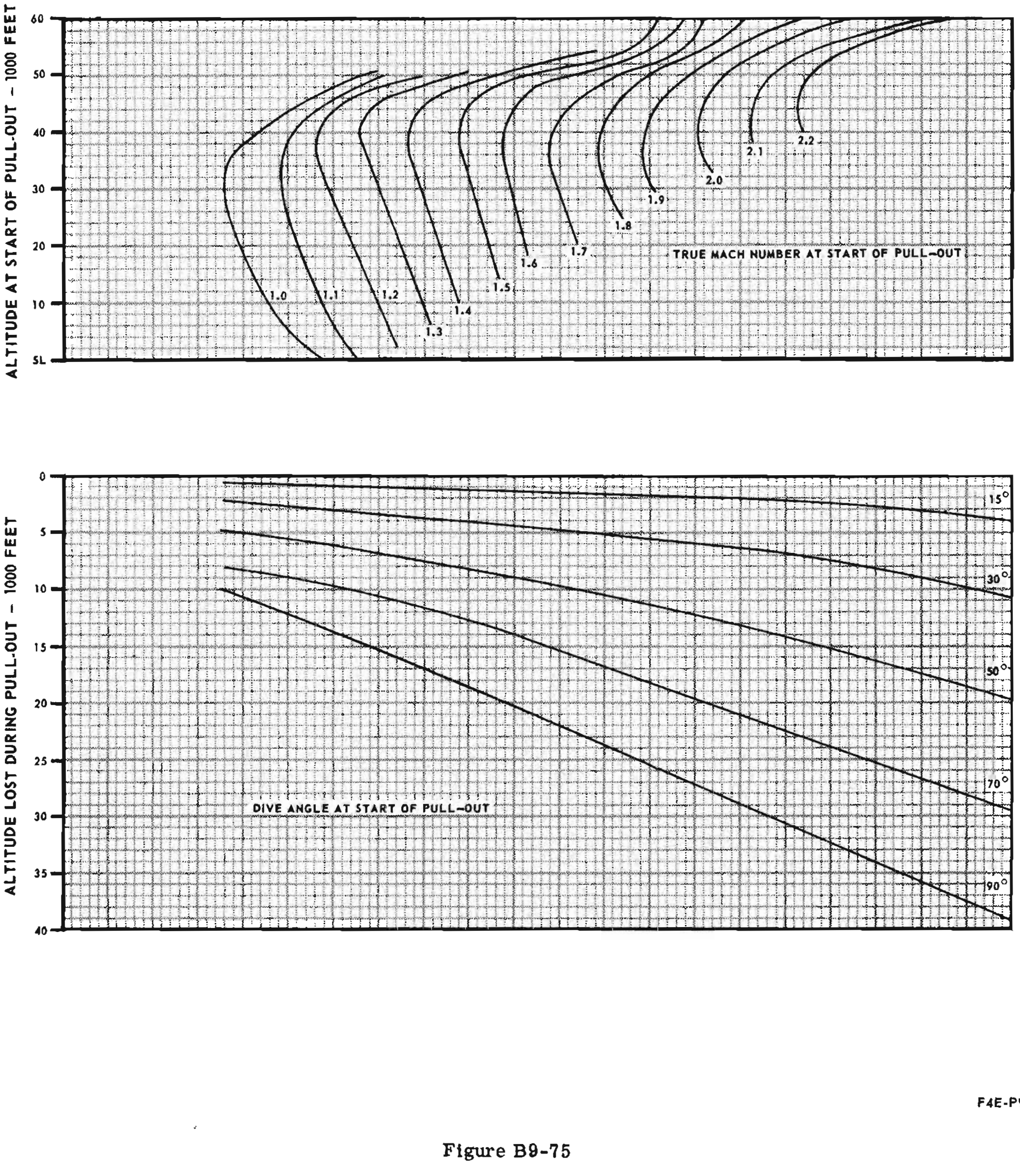
NOTES
1. ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST.
2. PULL-OUT BASED ON 1.0G PER SECOND ACCELERATION BUILDUP TO 19 UNITS (AOA), STABILATOR LIMIT OR 6.0G WHICHEVER OCCURS FIRST.

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P978

Figure B9-75

F-4E

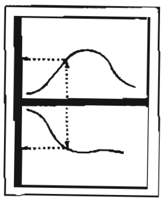
TEMPERATURE EFFECT ON MAXIMUM SPEED

MAXIMUM THRUST

AIRPLANE CONFIGURATION
ALL DRAG INDEXES

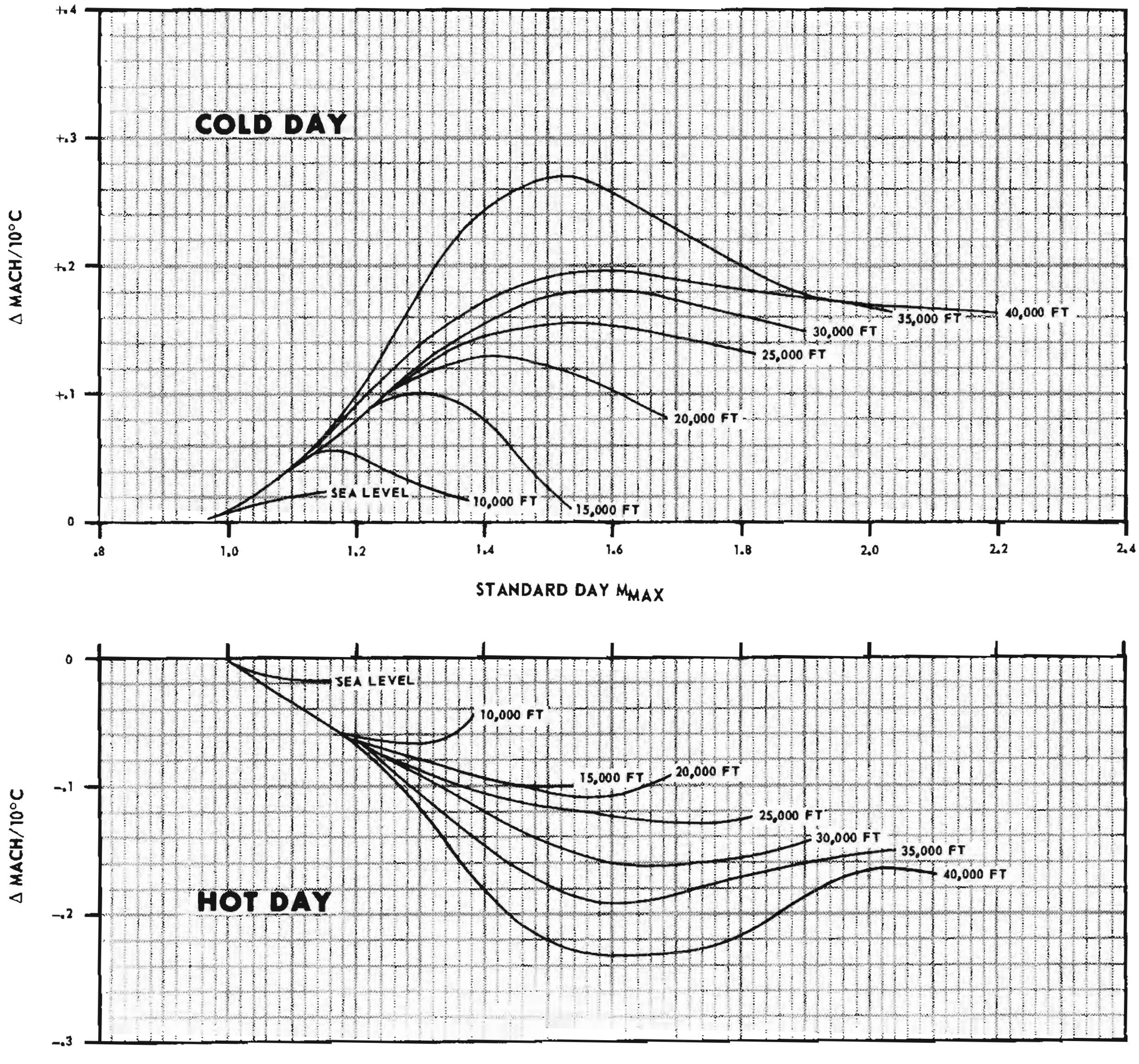
REMARKS
ENGINE(S): (2) J79-GE-17

GUIDE



DATE: 1 AUGUST 1968
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



F4E-P981

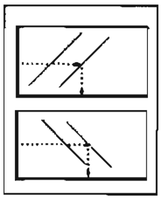
Figure B9-76

F-4E

TURN CAPABILITIES
CONSTANT SPEED AND ALTITUDE

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

GUIDE

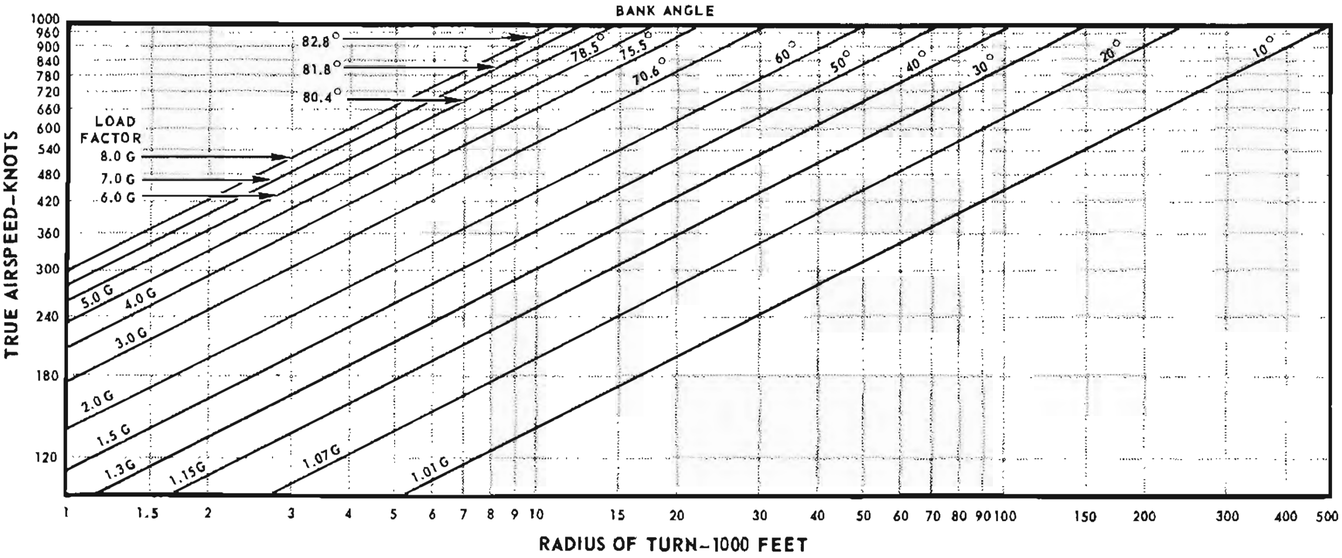


DATE: 1 AUGUST 1968
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5LB/GAL

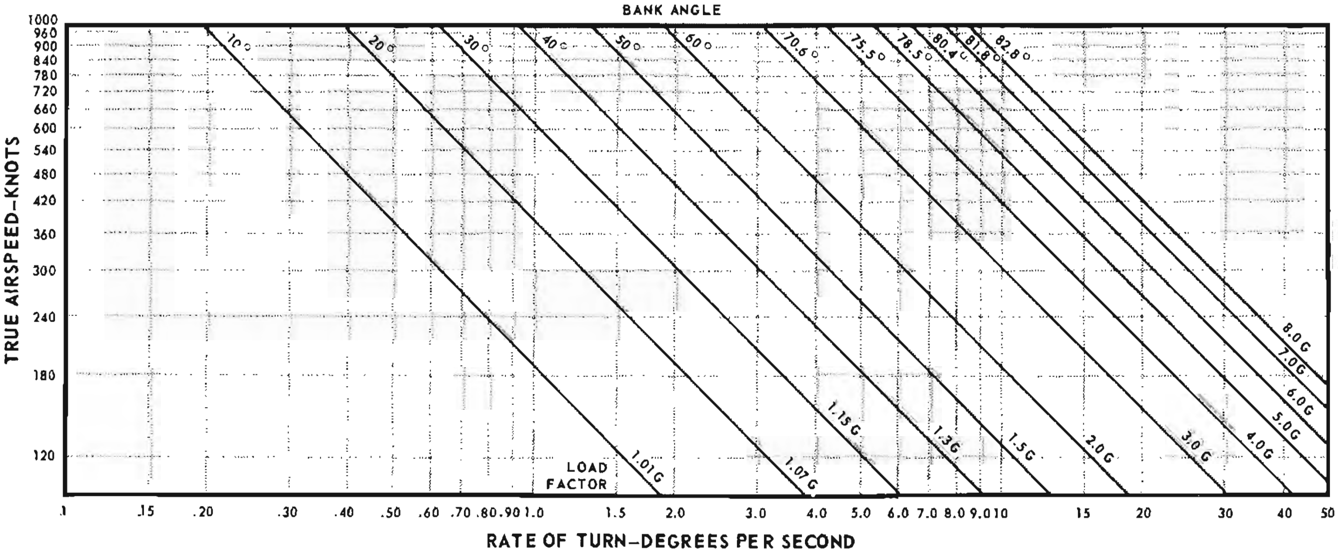
RADIUS OF TURN

BANK ANGLE



RATE OF TURN

BANK ANGLE



F4E-P980

Figure B9-77

F-4E

SUSTAINED G TURN CAPABILITIES

GROSS WEIGHT-40,925 POUNDS
MAXIMUM THRUST
CONSTANT SPEED AND ALTITUDE

AIRPLANE CONFIGURATION
(4) AIM-7

REMARKS
ENGINE(S): (2) J79-GE-17
ICAO STANDARD DAY

NOTE
MAXIMUM SPEED LIMITED BY ENGINE LIMIT

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

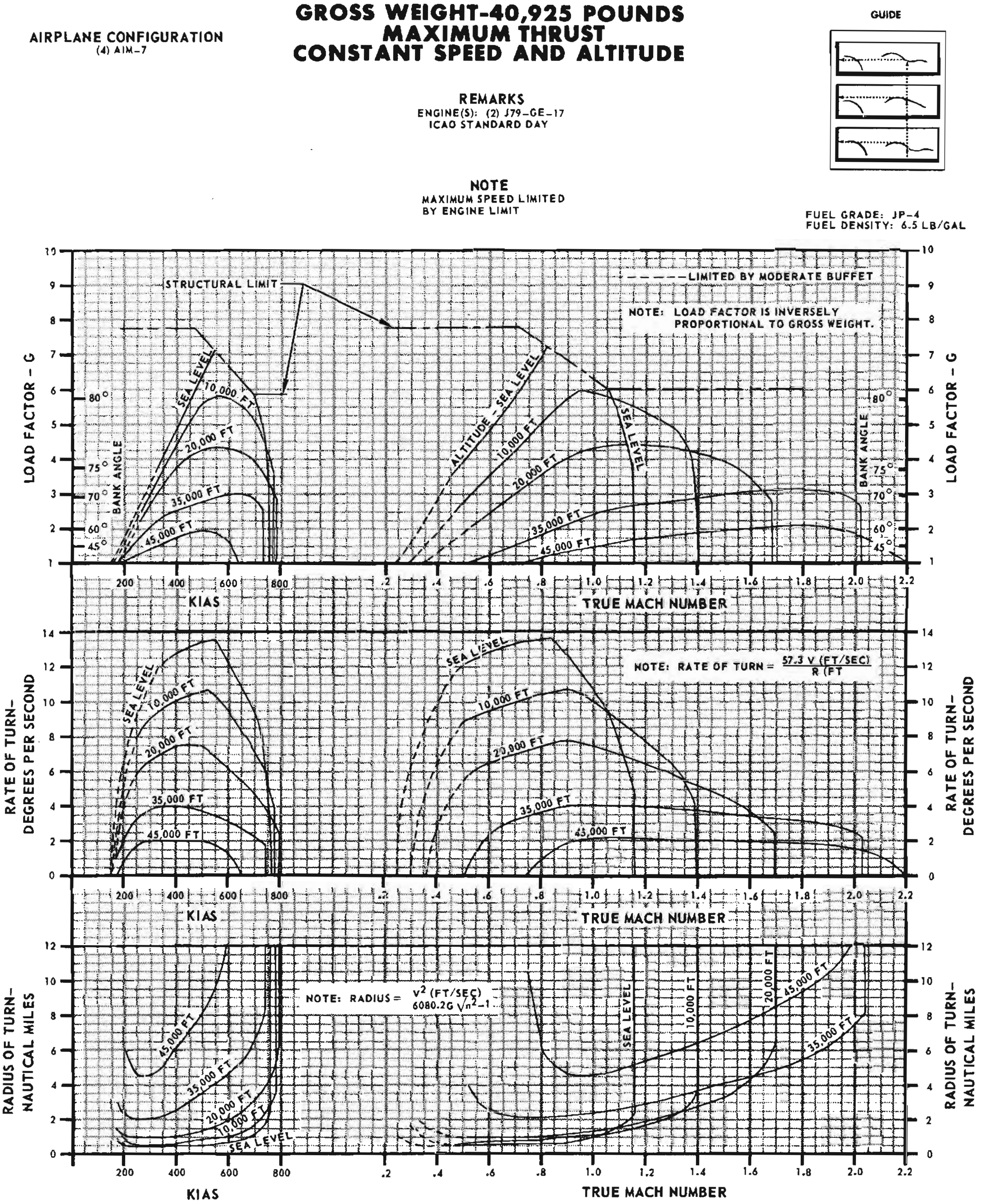


Figure B9-78

F-4E

SUSTAINED G TURN CAPABILITIES

GROSS WEIGHT-42,293 POUNDS-(4) AIM-7 AND (4) AIM-4
42,749 POUNDS-(4) AIM-7 AND (1) SUU-16

AIRPLANE CONFIGURATION
(4) AIM-7 AND (4) AIM-4
OR
(4) AIM-7 AND (1) SUU-16

MAXIMUM THRUST
CONSTANT SPEED AND ALTITUDE

REMARKS

ENGINE(S): (2) J79-GE-15
ICAO STANDARD DAY

NOTE
ACCELERATION PLACARD FOR
AIM-4 MISSILES = 6.0G

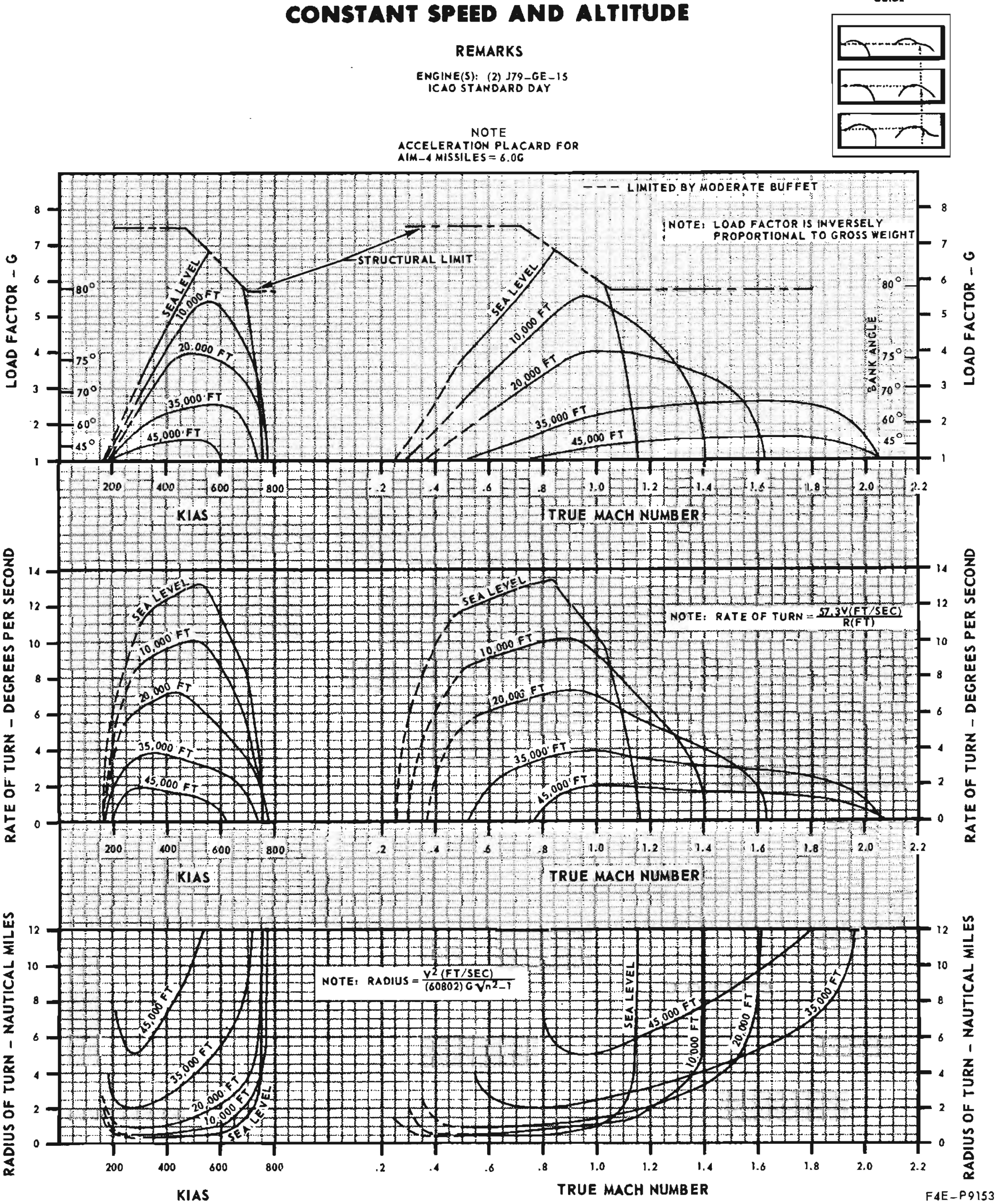


Figure B9-79

PART 10 MISSION PLANNING

This information will be supplied when available.

ALPHABETICAL INDEX

Note

All text and illustration numbers in this alphabetical index refer to page numbers, not paragraph or figure numbers.

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PERFORMANCE
FOR THE
F-4C & D
IS NOT AVALIBLE
AT THIS TIME