

**BY ORDER OF THE COMMANDER
EDWARDS AIR FORCE BASE**



**EDWARDS AIR FORCE BASE
INSTRUCTION 21-400**

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Maintenance

**MAINTENANCE PROCEDURES FOR F-16
AIRCRAFT, HIGH ANGLE-OF-ATTACK
(HIAOA) DEPARTURES**

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This publication implements Air Force Instruction (AFI) 11-2F-16 V3, *F-16 Operations Procedures*, and AFI 21-101_Air Force Materiel Command Supplement (AFMCSUP), *Aircraft and Equipment Maintenance Management*. This instruction establishes policies and procedures for the inspections and maintenance actions required on engines, fault light reporting and flight control systems on F-16 aircraft conducting high angle-of-attack (HiAOA) training flights. For HiAOA test programs, this instruction will govern aircraft maintenance procedures. This instruction is applicable to all F-16 aircraft and 412th Maintenance Group (MXG) organizations involved in HiAOA flights at Edwards Air Force Base. Refer recommended changes and questions about this publication to the OPR listed above using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate chain of command. This publication may not be supplemented. The OPR determines that no waivers may be granted for any part of the publication. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of in accordance with Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS). No Tiering Required at T-3 or below.

1. General: These procedures will minimize maintenance actions and establish standard inspections and documentation procedures for anomalies experienced during HiAOA flights.

2. Procedures.

2.1. For aircraft equipped with F100-220/F100-229 series engines accomplish the following:

2.1.1. All F100 engines used in HiAOA profiles will have a minimum of 1,000 cycles remaining on the core to time change. Engines will be bore scope inspected by the 412th Maintenance Squadron, Propulsion Flight within the previous 50 flight hours prior to HiAOA missions. The inspections will require the JFS door 3303 be opened and R/H ventral fin panel 4302 be removed. Conduct inspections on engines IAW TO 1F-16()-2-70FI-00-21, *Power Plant*, 2nd and 3rd stage fan (AP-1), 3rd stage fan and 4th stage core (AP-7), 12th and 13th stage core (AP-3) and 1st stage high pressure turbine (AP-4).

2.1.2. An engine diagnostic unit download will be accomplished by 445th Aircraft Maintenance Unit personnel after every HiAOA flight and screened for events or faults. Event 1020 (MFL/PFL 028) Engine Stall and Event 1190 (MFL/PFL 042) Low Main Oil Pressure are known anomalies that may occur during HiAOA maneuvers. If these are the only maintenance events or faults downloaded, the engine shall be considered serviceable and released for flight. Any other faults or events will be troubleshoot in accordance with the applicable technical orders.

2.1.3. The Propulsion Flight Chief will ensure proper monitoring of engine inspection results and review these results annually.

2.1.4. Engine stall anomalies occasionally occur on HiAOA training flights. A pilot-reported self-clearing engine stall will be documented on the aircraft AFTO Form 781A, *Maintenance Discrepancy and Work Document*, IAW TO 00-20-1, *Aerospace Equipment Maintenance Inspection Documentation, Policies, and Procedure* and in the Integrated Maintenance Data System (IMDS) as a CODE-2 discrepancy. Documentation will include aircraft tail number and engine serial number. It will not be used in repeat and/or recurring calculations.

2.1.5. Normal TO requirements will be followed if the engine has a non-recoverable stall during a HiAOA flight or if the pilot identifies the engine operation as unusual and/or extreme (the previous terms and the meanings will be determined by the aircrew experiencing the noted conditions) and makes the appropriate AFTO Form 781 series form entries. These anomalies will be documented in the IMDS as a CODE-3 discrepancy. The documentation will include aircraft tail number, engine serial number, maneuver number and description.

2.1.6. The Propulsion Flight Chief will review engine performance reported as unusual or extreme as described in paragraph 2.1.5. Engine performance will be evaluated using historical engine data and borescope results accomplished by the Propulsion Flight. The inspections will help determine health of the engine and potential for continued operation in HiAOA aircraft. Engines removed from HiAOA service will not reenter HiAOA service until repaired and/or adjusted and determined by the Propulsion Flight Chief as meeting all requirements for a HiAOA mission.

2.2. For aircraft equipped with F110-100/129 series engines accomplish the following (Note: No information from any portion of paragraph 2.1 applies to aircraft powered by F110-100/129 series engines.):

2.2.1. To reduce the probability of encountering the faults identified in paragraph 2.2.2, engine oil level should be kept at or above 43 (1/2 pints) on aircraft flying HiAOA missions.

2.2.2. During or just after inverted HiAOA departures, aircrew may encounter the following: MFL's 18 (1-15 AUG INHIB*CTRL) and/or 41 (1-38 A8 SCH*HYD/BE) on F110-100 engines. MFL's 18 (1-18 AUG INHIB*S/FLT) and/or 43 (1-43 A8 SL*ACT/H-PUMP) on F110-129 engines. These faults occur due to the engine hydraulic pump's inability to move the exhaust nozzle while the engine is being operated for extended periods in the near zero or negative "G" environment. The hydraulic pump feed port is in the lower portion of the oil tank and during near zero or negative "G" flight, oil collects in the top of the tank and is unable to reliably feed the hydraulic pump. Once the faults have occurred the DEC will no longer send a signal to the hydraulic pump to move the nozzle and when the aircraft returns to a positive "G" loading the lack of signal will cause the nozzle to move and stay in the full closed "Fail Safe" mode and Augmenter operation will be inhibited.

2.2.3. Corrective action for the condition described in paragraph 2.2.2. is to return the aircraft to level, 1"G" flight, stabilize for at least 10 seconds, cycle ENG CONT switch to SEC, hold for at least 10 seconds then move switch back to PRI. If the faults disappear, the mission can continue normally and no maintenance action other than downloading the faults will be required upon landing. If the faults persist or return excessively as determined by the pilot, follow flight manual instructions.

2.2.3.1. Pilots will document all cycles of the ENG CONT switch to SEC and back to PRI to clear nozzle and Mach Fail Faults as code 2.

2.2.4. Per L.M. Aero time limit for zero oil pressure during inverted departures with throttle at idle has been increased, via engineering disposition, to 2 minutes. No maintenance is required as long as the 2 minute time limit is not exceeded.

2.2.5. During or just after HiAOA departures, aircrew may encounter an MFL 17 (1-50 A/C SIG*MN) on F110-100 engines or an MFL 17 (1-17 A/C SIG*MN) on F110-129 engines. These faults occur due to the rapid and erratic speed changes involved in a HiAOA departure maneuver.

2.2.6. Corrective action for the conditions described in paragraph 2.2.5. is to recover the aircraft from the departure, stabilize for at least 10 seconds, cycle ENG CONT switch to SEC, hold for at least 10 seconds then move switch back to PRI. If the fault disappears the mission can continue normally and no maintenance action other than downloading the fault will be required upon landing. If the fault persists or returns excessively as determined by the pilot, follow flight manual instruction. Note: Cycling the engine control switch in-flight will cause an MFL 51 (1-48 SEC TRANSFER*BE) fault on a F110-100 and an MFL 14 (1-14 SEC TRANSFER*BE) fault on a F110-129 to be downloaded after flight. This is totally acceptable if the engine responded properly to the PRI / SEC / PRI switch movement while in-flight.

2.2.7. Document DEEC/NOZZLE reset using PRI/SEC/PRI cycle on AFTO 781A and in IMDS as Code-2 discrepancy. Documentation will include aircraft tail number, engine serial number, reason for and number of cycles.

2.3. For aircraft equipped with analog Flight Control System (FLCS) accomplish the following:

2.3.1. To ensure serviceability of the FLCS reset interlock circuitry, the system will be inspected within 25 flight hours prior to a HiAOA flight in accordance with M-Series Maintenance Checklist LCL-412TS-M-98-017. The FLCS reset interlock circuitry check is required in order to safely reset Dual FC and P, R, and Y light indications following HiAOA maneuvers. While HiAOA can be safely flown without this check, a Dual FC and P, R, or Y light will result in mission termination. It is 412 TW policy to perform this check for all HiAOA aircraft to avert any unnecessary maintenance and loss of training. The FLCS reset interlock circuitry will also be inspected any time the Flight Control Computer (FLCC), flight control panel or any connectors (associated with the system) are removed and replaced.

2.3.2. Flight control anomalies occasionally occur on HiAOA training flights. Resettable Axis (P, R and/or Y) and/or SERVO failure(s) that occur during departures will be documented on the AFTO Form 781A and in the IMDS as a CODE-2 discrepancy. Documentation will include aircraft tail number, FLCC and electronic component assembly (ECA) serial numbers.

2.3.3. Normal TO requirements IAW TO 1F-16()-2-27FI-00, *Series Fault Isolation*, and other local procedures, as determined by the MXG Commander, will be followed if the flight controls do not reset. These anomalies will be documented in IMDS as a CODE-3 discrepancy using the appropriate WUC. The documentation will include aircraft tail number, FLCC and ECA serial numbers maneuver number and maneuver description.

2.4. For aircraft equipped with digital FLCS paragraph 2.3. does not apply. Follow established TO procedures for any anomalies.

2.5. An emergency power unit monopropellant check will be performed within 180 days or within 100 flight hours prior to a HiAOA flight, whichever occurs first. If the aircraft is within 10 hours of phase inspection at the expiration of this currency, then flying may continue until phase without an additional monopropellant check.

2.6. A Power Drive Unit (PDU) oil level check will be performed every 7 days when the aircraft has flown a HiAOA sortie during this time period. In the event the aircraft has not flown a HiAOA sortie in the previous 7 days, the PDU oil check will revert to the aircraft's – 6 TOs, phase inspection requirement. The aircraft's AFTO Form 781K, *Aerospace Vehicle Inspection, Engine Data, Calendar Inspection and Delayed Discrepancy Document*, will be updated to the next 7-day calendar inspection with an INFO NOTE on the AFTO Form 781A stating "PDU oil check not required, aircraft has not flown HiAOA sorties during the last 7 days".

2.7. A post-flight battery inspection will be accomplished after every HiAOA sortie. This inspection only applies to aircraft not modified with the sealed lead acid battery and will include a visual check for leakage and a capacitance check.

2.8. Inspection intervals listed in paragraphs 2.5. through 2.7. will be documented on the aircraft AFTO Form 781K and in the IMDS.

2.9. In cases when an aircrew reports an unusual in-flight departure, the original Heads-Up Display tape (provided the tape is unclassified), along with the data downloaded from the propulsion and flight control systems, will be sent to the Lockheed-Martin Flight Control

Specialists for analysis to aid troubleshooting. Additionally, the maneuver number and description will be included as part of the maintenance debrief.

2.10. Flight Data Recorder (FDR)/Crash Survivable Flight Data Recorder (CSFDR) MFL's may be encountered by aircrew due to Hi AOA mission profiles.

2.10.1. The following FDR/CSFDR MFL's can be reset by the aircrew with no mission impact and no maintenance actions required: 024 Special Event, 060 FCS Caution / FLCS Reset Input, 061 FLCS Warning and 068 SEC / EEC Caution Light Input.

2.10.2. The following FDR/CSFDR MFL's are considered "special events" by tech data and cannot be reset by the aircrew: 084 Dual Fail / FLCS Warning Light, 091 ENG Stall / Stagnation, 092 AOA Departure, 094 FLCS Reset and 097 SEC Caution Light. System operation will rewrite itself after two events. The MFL's are generated by the mission profile and if verified with the aircrew no maintenance actions will be required.

MICHAEL T. BREWER, Brigadier General, USAF
Commander

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFI 11-2F-16 V3, *F-16 Operations Procedures*, 18 December 2013

AFI 21-101_AFMCSUP, *Aircraft and Equipment Maintenance Management*, 26 April 2012

TO 00-20-1, *Aerospace Equipment Maintenance Inspection Documentation, Policies, and Procedure*, 15 June 2013

TO 1F-16()-2-70FI-00-21, *Power Plant*, 1 January 2012

TO 1F-16()-2-27FI-00, *Series Fault Isolation – General*, 1 January 2012

Adopted Forms

AFTO Form 781A, *Maintenance Discrepancy and Work Document*

AFTO Form 781K, *Aerospace Vehicle Inspection*

Abbreviations and Acronyms

AFI—Air Force Instruction

AFMC—Air Force Materiel Command

AFRIMS—Air Force Records Information Management System

AFTO—Air Force Technical Order

ECA—Electronic Component Assembly

FDR/CSFDR—Flight Data Recorder/Crash Survivable Flight Data Recorder

FLCC—Flight Control Computer

FLCS—Flight Control System

HiAOA—High Angle-of-Attack

IMDS—Integrated Maintenance Data System

MFL—Maintenance Fault List

MXG—Maintenance Group

OPR—Office of Primary Responsibility

PDU—Power Drive Unit

RDS—Records Disposition Schedule

WUC—Work Unit Code