Powering Business Worldwide

Lockheed Martin F-16 Component and Systems Overview
Eaton's Aerospace Group Product Capabilities

Eaton is a world leader and premier innovator in aerospace and a key solutions provider for the F-16. Eaton contributes a broad array of cutting-edge products to support the aircraft's advanced requirements for hydraulic and fuel systems, motion control and engine solutions.

Eaton's products for the F-16 hydraulic system provide, store or control the aircraft's hydraulic power. They include the auxiliary power unit hydraulic pump, gun drive motor, engine hydraulic servo pump, reservoir valve, solenoid valves, a hydraulic flow regulator, a hydraulic flow limiter valve and relief valves.

For the F-16 fuel system, Eaton supplies a highly reliable, two-stage main engine fuel pump on the GE F110 engine that features centrifugal-boost and high-pressure gear stages, in addition to a fuel filter with an anti-drain valve and bypass indicator. Eaton's fuel transfer pump provides center of gravity control and fail-safe fuel feed as well as self-priming and vapor-elimination features. The aircraft's fuel flow proportioner consists of positive displacement vane pumps driven by a single hydraulic motor. It draws fuel equally from two separate tank systems for weight and balance and discharges through a single outlet port. Additional Eaton fuel content includes a boost pump and transfer pump, pressure and dump valves, shut-off valves, level control valves and fuel lines.

Eaton's product support for F-16 motion control includes a nosewheel steering controller equipped with electrical components that allow for higher-temperature operation and functionality, in addition to an enhanced failsafe circuit. Eaton's leading edge flap control valve is mated with a power-drive unit and controls flap movement. Constant movement is maintained to maximize performance throughout the full spectrum of the F-16's dynamic flight envelope with rapidly changing airspeeds and angles of attack. Additional motion-control products include main landing gear selector valve, pneumatic landing gear control valve, solenoid valve, rotary actuator, tail hook control valve and door control valve.

To support F-16 engine health, Eaton supplies an oil debris-monitoring chip collector designed to indicate an impending component failure. Its self-closing valve permits withdrawal of the magnetic probe and visual inspection of collected debris, with minimal fluid loss. Eaton's all-titanium Ryngl ok® fittings on the F-16 are the quickest, lightest and most reliable means of joining high-pressure hydraulic and fuel lines. Additional engine-solutions products include hose assemblies, couplings, fittings, clamps, tubes, valve cartridges, pressure switches, sight plugs and drain valves.

In addition to these systems and components, Eaton provides worldwide customer service and support for the F-16 community. Eaton is committed to servicing, supporting and enhancing products supplied to our customers and end users.

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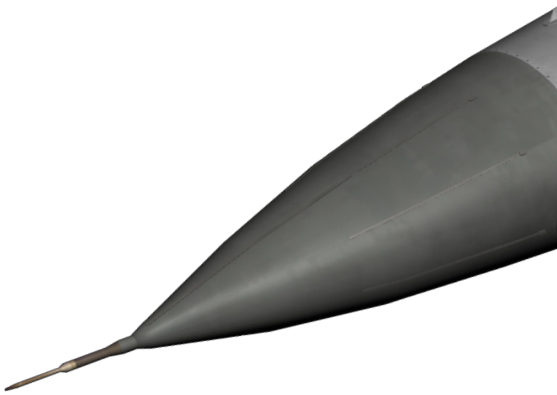
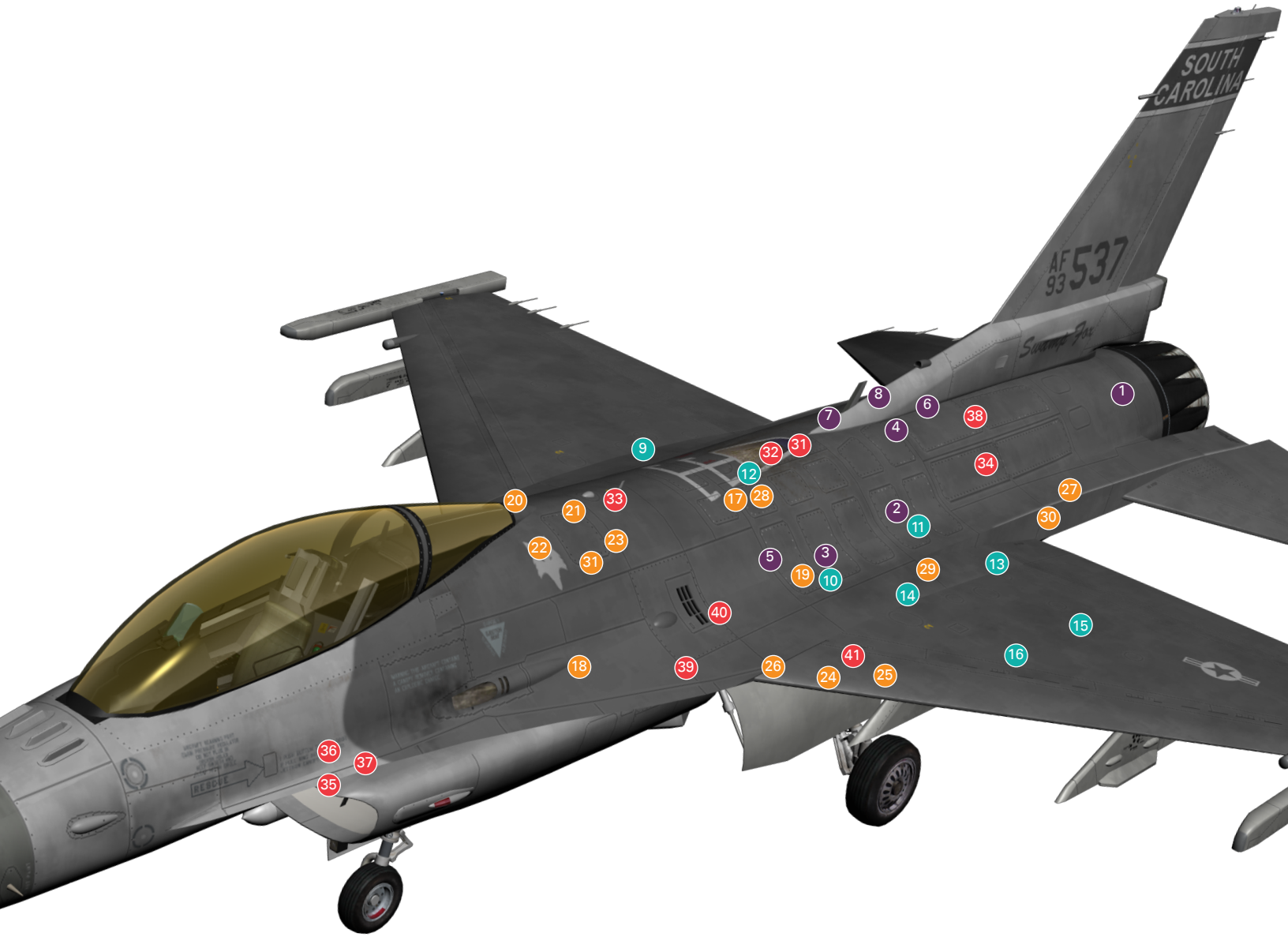


Lockheed Martin F-16 System Components



Engine Solutions

1. Seals
2. Couplings
3. Fittings
4. Clamps
5. Tubes
6 Chip Collectors
7. Sight Plugs
8. Drain Valves

Fuel Systems

9. Fuel Boost Pump
10. Fuel Transfer Pump
11. Main Engine Fuel Pump
12. Fuel Flow Proportioner
13. Fuel Pressure & Dump Valves
14. Fuel Shut-Off Valves
15. Fuel Level Control Valves
16. Fuel Line

Hydraulic Systems

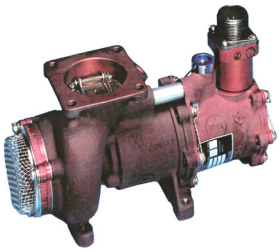
17. APU Hydraulic Pump
18. Gun Drive Motor
19. Engine Hydraulic Servo Pump
20. Reservoir Valve
21. Solenoid Valves
22. Hydraulic Flow Regulator
23. Hydraulic flow Limiter Valve
24. MLG Selector Valve
25. Pneumatic LG Control Valve
26. Soleniod Valve
27. Relief Valves
28. Hose Assemblies
29. Valve Cartridge
30. Pressure Switches

Motion Control

31. In-Flight Refueling Receptacle - Electro-Mechanical Actuator
32. In-Flight Refueling Receptacle - Controller
33. Ejection Seat Actuator
34. Rotary Actuator
35. Nose Wheel Steering Unit
36. Nose Wheel Valves
37. Nose Wheel Control Box
38. Tail Hook Control Valve
39. LEF Control Valve
40. Door Control Valve
41. Leading Edge Flap Control Valve

F-16 Main Engine Fuel Pump

Pressurized fuel is supplied to the fuel control by this highly reliable two stage pump with centrifugal boost stage and high pressure gear stage. Fuel supplied by the fuel booster pump enters the boost stage which increases the pressure to create a reliable feed to the gear stage. The gear stage increases pressure and fuel is directed to the fuel control system. Design features include a fuel filter with anti-drain valve and bypass indicator. The fuel pump incorporates an additional impending bypass indicator.



F-16 Fuel Transfer Pump

Pressurized fuel is moved to various tanks in the system by this centrifugal boost pump providing center of gravity control and fail-safe fuel feed. It operates at 200VAC, 400Hz and provides 37 gpm (140 L/min) at 14 psid (97 kPa). This pump incorporates self-priming and vapor elimination features.

F-16 Fuel Boost Pump

Pressurized fuel is supplied from the tank to the engine driven main fuel pump by this centrifugal boost pump. The dual inlet configuration allows feed at both positive and negative G situations. It operates at 200VAC, 400Hz and provides 73 gpm (276 L/min) at either 11 psid (76 kPa) or 17 psid (117kPa).

Fuel Flow Proportioner

Eaton's fuel flow proportioner consists of positive displacement vane pumps driven by a single hydraulic motor. It draws fuel equally from two separate tank systems for weight and balance and discharges through a single outlet port. The proportioner serves as a redundant backup to an electric motor-driven fuel boost pump.

Leading Edge Flap Control Valve

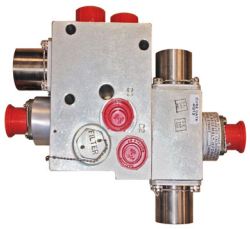
The Leading Edge Flap Control Valve is mated with a power drive unit and controls the movement of the leading edge flaps. The leading edge flaps are constantly moving to maximize performance throughout the full spectrum of the F-16's dynamic flight envelope with rapidly changing airspeeds and angles of attack (AOA). The 3000 psi (20,684 kPa) leading edge flaps have a flow rate of 16 gpm (60.5 lpm).

Tailhook Control Valve

The Tailhook Control Valve is used to control actuation of the tailhook in emergency situations when the aircraft must use the tailhook to catch a cable on the runway.

Nosewheel Steering Controller

The Nosewheel Steering Controller provides control to the nosewheel steering actuator, and the electrical components included in the controller allow for higher temperature operation and functionality. Included in the controller is an enhanced failsafe circuit.



Nosewheel Steering Control Valve

The Nosewheel Steering Control Valve provides hydraulic control to the nosewheel steering system. It has an operating pressure of 3000 psi (20,684 kPa) and 29 Vdc operating voltage.

Fuel Shutoff Valve

Eaton offers multiple fuel shutoff valves on the F-16 aircraft. Part number 60973-1 is an engine electronic control fuel shutoff valve that controls the flow of cooling fuel for the engine electronic fuel control system. The valve powers off when it reaches its commanded position. A manual override feature is provided. Part number 61078-1 is a manually operated fuel shutoff valve used on the F-16's external tank and is installed in the external fuel tank pylon. The valve is closed when it is desired to refuel the aircraft without fueling the external tank. Part number 6834 is a three-inch electric motor-operated shutoff valve that shuts off fuel flow to the engine. Features include bi-directional thermal relief valves.

Hydraulic Pressure Switch

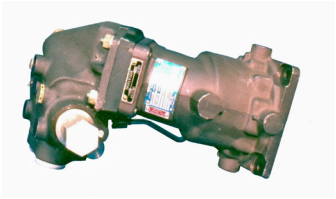
This small, lightweight, extremely reliable hydraulic pressure switch is used extensively in aerospace and is qualified for both commercial and military applications. These Eaton switches are designed to be used in any fluid that is compatible with stainless steel or aluminum. The pressure switch design incorporates a snap-action electrical microswitch which is actuated by a piston-sensing element.

Prismalite Sight Gauge

Eaton's sight gauges are available in many configurations to meet specialized level viewing needs. In addition to the conventional viewing glass, a high-contrast design provides superior readability for all fluids. Colorless or colored fluids are easily visible regardless of ambient light. This is made possible by a series of refraction grooves that allows the lens surface to reflect more than 90% of the incident light vs. 30-40% with conventional gauges.

Teflon® Hose Assemblies

Eaton's hose assemblies are utilized extensively throughout the F-16 aircraft. The assemblies can be found in the hydraulic system, the fuel system and lube oil system. Eaton provides 3,000 psi (20684 kPa) stainless steel braided Teflon® hose assemblies per AS1339 and 1500 psig (10342 kPa) rated Teflon hose assemblies per MIL-DTL-25579.



Gun Drive Motor

Eaton's model CMF1-095-8A motor package is used to drive the Gatling-type gun on fighter aircraft. The package employs a fixed displacement bent-axis piston motor that rotates the gun barrels at high speed for firing. The motor package is also equipped with a special valve head that contains mechanisms for controlling the operation of the gun, which includes starting and stopping and specially controlled deceleration to enable clearing live rounds from the gun.

Rynglok® R8 Fittings

Eaton's Rynglok R8 fittings are all titanium, axial swage fittings that provide the link to join fluid delivery tubing, while minimizing system weight. Fittings include permanent and Arc Seal® connections in straight elbow, and tee configurations. Rynglok is the quickest, lightest, and most reliable means of joining high pressure hydraulic, fuel or other rigid tube connections.

Self-Sealing Quick Disconnect Couplings

Eaton's Aeroquip 3200 series self-sealing quick disconnect couplings are 3000 psi (20,684 kPa). This allows for a quick connect and disconnect and positive action with valves opening simultaneously with locking action. It also prevents fluid loss during connect or disconnection, and there is no cavity to trap air, dirt or moisture.

Chip Collector

Located in the oil flow in an auxiliary gearbox, these collect ferrous particles that could indicate impending failure of the component. Its self-closing valve permits withdrawal of the magnetic probe and visual inspection of the collected debris, with minimal fluid loss.

Linear Actuator
(ACES II Ejection Seat)

Eaton's linear actuator, P/N J115103-517, is used to drive the ACES II ejection seat up and down to match crew requirements. The actuator is operated by a reversible electric motor driving a gear train and two Acme screw drives that extend and retract two barrel assemblies and provide up/down operation for the aircraft seat assembly. An internal motor brake holds the actuator in its operating position when power is removed.

Location	Cage Codes
Fuel & Motion Control Division	
Bedhamptom, England	K4413
Euclid, Ohio	59875
Inglewood, California	OCMF7
Irvine, California	86090
Jackson, Mississippi	62983 and 90166
Los Angeles , California	99643, 76050, 09790, and 52906
Titchfield, England	K2523, inclusive of U1918 and U9084

Fluid & Electrical Distribution Division	
Beltsville, Maryland	15284
Bethel, Connecticut	02750
Coignieres, France	F0562
East Providence, Rhode Island	77842
Gilching, Germany	C2178
Glenolden, Pennsylvania	97484, 16780
Grand Rapids, Michigan	17472, 99145, 09790, and 72121
Irvine, California	0DT23
Jackson, Michigan	00624
Redditch, England	U2569
Serres-Castet, France	FA9C4
Toccoa, Georgia	8W928

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