



AEROSPACE INFORMATION REPORT

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Superseding AIR5005

(R) Aerospace - Commercial Aircraft Hydraulic Systems

RATIONALE

AIR5005A has been reaffirmed to comply with the SAE five-year review policy.

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1. SCOPE

This SAE Aerospace Information Report (AIR) has been compiled to provide information on hydraulic systems fitted to commercial aircraft.

Data has been provided for following aircraft types:

- a. Wide body jet airliners
- b. Narrow body jet airliners
- c. Turboprop/commuter aircraft
- d. Business jet aircraft

The airliners that have been included in this document are generally in operational service with either airlines or cargo operators. Information on aircraft that have been retired from in-service use has been included for reference purposes. No information is presented for aircraft that are currently being developed.

The following information is provided for each aircraft

- Design requirements: Governing airworthiness regulations
- System pressure: Fluid power system operating pressure
- Hydraulic fluid: Type of fluid the hydraulic system uses
- Number of hydraulic systems: Number and identification of independent hydraulic systems
- System temperature: Minimum and maximum design operating temperatures
- Main hydraulic pump data: Flow, pressure, displacement
- Auxiliary pump data: System auxiliary pump or back-up data
- Hydraulic motor data: System hydraulic motor requirements
- Accumulator data: Usage, volume and precharge requirements
- Reservoir data: Type, volume and pressure
- Relief valve data: Usage, crack and reseal pressures, rated flow
- Filtration data: Usage, filtration rating
- Tubing data: Materials, sizes, wall thicknesses
- Fitting data: Type, size range, material
- Schematic diagram: System architecture, services supplied

NOTES

1. For some aircraft, the data is incomplete. This is due to difficulties in obtaining the data (particularly for the older aircraft presented in this report).
2. For some aircraft, the pumps may not be those as stated in this document. This is because when they are supplied by more than one vendor for a specific aircraft application, the pumps' displacement and running speed may differ.
3. Electric motor pumps are fixed frequency type unless otherwise stated.
4. The schematic diagrams for each aircraft have been simplified for clarity and ease of understanding. For example:
 - The return side of each system has not been shown
 - Specific features such as internal leak measuring systems are not shown
 - Single accumulators are shown at locations where multiple accumulators are usedHowever, the complete power generation system and elements of the supply system for each aircraft is shown using symbols in accordance with AS1290.
5. The filtration ratings that are presented in this report are the absolute rather than nominal ratings. However, it should be noted that there is no consistent definition of the absolute rating for the filters for the aircraft hydraulic systems that are described in this report.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this standard to the extent specified herein. The latest issue of the SAE documents shall apply. The applicable issue of the other documents shall be the issue in effect at the date of the purchase order. In the event of conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

ARP4386	Terminology and Definition for Aerospace Fluid Power, Actuation and Control Technologies
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AS1290	Graphic Symbols for Aircraft Hydraulic and Pneumatic Systems
AMS4071	Aluminum Alloy, Drawn, Round, Seamless Hydraulic Tubing 2.5Mg - 0.25Cr (5052-0) Annealed
AMS4083	Aluminum Alloy Tubing, Hydraulic, Seamless, Drawn, Round, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T6), Solution and Precipitation Heat Treated
AMS4928	Titanium Alloy Bars, Wire, Forgings, Rings, and Drawn Shapes 6Al - 4V Annealed
AMS4944	Titanium Alloy Tubing, Seamless, Hydraulic, 3.0Al-2.5V, Cold Worked, Stress Relieved

- AMS4945 Titanium Alloy Tubing, Seamless, Hydraulic 3Al-2.5V, Controlled Contractile Strain Ratio Cold Worked, Stress Relieved
- AMS5561 Steel, Corrosion and Heat-Resistant, Welded and Drawn or Seamless and Drawn Tubing 9.0Mn - 20Cr - 6.5Ni - 0.28N High-Pressure Hydraulic
- AMS5566 Steel, Corrosion Resistant, Seamless or Welded Hydraulic Tubing 19Cr - 10 Ni (SAE 30304) High Pressure, Cold Drawn

AMS-WW-T-700/4 Tube, Aluminum Alloy, Drawn, Seamless, 5052

AMS-WW-T-700/6 Tube, Aluminum Alloy, Drawn, Seamless, 6061

2.1.2 ADS Publications:

Available from ADS Group Ltd., Salamanca Square, 9 Albert Embankment, London, SE1 7SP, United Kingdom. Tel: +44 207-091-4500, www.sbac.co.uk.

AGS 1100 Pipe Couplings, Typical Joints

2.1.3 BSi Standards

Available from BSi Standards, BSI British Standards, 389 Chiswick High Road, London W4 4AL, United Kingdom, United Kingdom, Tel: +44 208-996-9001, www.bsi-global.com.

BS 1471 Specification for Wrought Aluminum And Aluminum Alloys for General Engineering Purposes - Drawn Tube

BS L56 Specification For Tube Of Aluminum - 2¼% Magnesium Alloy (Temper Designation - O) (Seamless Tested Hydraulically) (Not Exceeding 12 mm Wall Thickness)

BS T72-T73 Specifications For ¹⁸/₁₀ Chromium, Nickel Corrosion Resisting Steel Tube For Hydraulic Purposes (Niobium/Titanium Stabilized 550 MPa)

2.1.4 Civil Aviation Authority Documents

Available from Civil Aviation Authority, Aviation House, Gatwick Airport South, West Sussex RH6 0YR, United Kingdom. Tel: +44 129-356-7171, www.caa.co.uk.

BCAR Section D British Civil Airworthiness Requirements – Aeroplanes

Concorde TSS Standards

2.1.5 European Aviation Safety Agency Publications

Available from European Aviation Safety Agency, Postfach 10 12 53, D-50452 Cologne, Germany. Tel: 49 221-8999-0000, www.easa.eu.int.

CS-23 Certification Specifications for Normal, Utility, Aerobatic, and Commuter Category Aeroplanes

CS-25 Certification Specifications for Large Aeroplanes

2.1.6 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591. Tel: 866-835-5322, www.faa.gov.

14CFR Part 23 Code of Federal Regulations, Part 23 Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes

14CFR Part 25 Code of Federal Regulations, Part 25 Airworthiness Standards: Transport Category Airplanes

2.1.7 Joint Aviation Authorities Committee Publications

Available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado, 80112-5776. Tel: 1-800-854-7179 (inside USA and Canada) or 1-303-397-7956 (outside USA), <http://global.ihs.com>.

JAR 23 Joint Airworthiness Requirements, Normal, Utility, Aerobatic, and Commuter Category Aeroplanes

JAR 25 Joint Airworthiness Requirements, Large Aeroplanes

2.1.8 United Kingdom Ministry of Defence Procurement Executive Standards

Available from DStan, UK Defence Standardization, Kentigern House, 65 Brown Street, Glasgow G2 8EX, United Kingdom Tel: +44 141-224-2531, www.dstan.mod.uk.

DTD5016 35-45 Ton Chromium Nickel Corrosion Resisting Steel Solid Drawn Circular Tubes

DTD5019 Aluminum-Nickel-Silicon Brass Tubes

2.1.9 US Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch>.

MIL-PRF-5606 Hydraulic Fluid, Petroleum Base; Aircraft, Missile and Ordnance

MIL-T-6845 Tubing, Steel, Corrosion Resistant (530400), Aerospace Vehicle Hydraulic System $\frac{1}{8}$ Hard Condition

MIL-T-8504 Tubing, Steel, Corrosion Resistant (304), Aerospace Vehicle Hydraulic Systems, Annealed, Seamless and Welded

MIL-T-8808 Tubing, Steel, Corrosion Resistant (18-8 Stabilized), Aircraft Hydraulic Quality

MIL-PRF-83282 Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base; Aircraft,

MIL-PRF-87257 Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base; Aircraft

WW-T-787 Tubing, Aluminum Alloy 52S, Round, Seamless, Draw

NOTE: Many of these standards are obsolete or inactive for new designs. However, they were valid when the applicable hydraulic system was designed.

2.2 Definitions

Refer to ARP4386.

3. WIDE BODY JET AIRLINERS

TABLE 1 – WIDE BODY AIRCRAFT HYDRAULIC SYSTEM DATA

Aircraft	System Pressure	Number of Systems	Hydraulic Fluid	Main Pumps - Number/Type	Backup Pumps - Number/Type	Accumulators Number/Type	Reservoirs - Type
Airbus A300 B4/A300-600	3000 psi (20 690 kPa)	3	AS1241	4 - Engine driven pumps	3 - AC pumps 1 - RAT pump 2 - Power transfer units	3 - Bladder separator type	Air pressurized
Airbus A310-200/300	3000 psi (20 690 kPa)	3	AS1241	4 - Engine driven pumps	3 - AC pumps 1 - RAT pump 2 - Power transfer units	3 - Bladder separator type	Air pressurized
Airbus A330-200/300 A340-200/300	3000 psi (20 690 kPa)	3	AS1241	4 - Engine driven pumps	3 - AC pumps 1 - RAT pump	3 - Bladder separator type	Air pressurized
Airbus A340-500/600	3000 psi (20 690 kPa)	3	AS1241	4 - Engine driven pumps	3 - AC pumps 1 - RAT pump	3 - Bladder separator type	Air pressurized
Airbus A380-800	5080 psi (35 000 kPa)	2	AS1241	8 - Engine driven pumps	2 - AC pumps 3 - DC pumps (landing gear systems)	5 - Factory pre-charged, welded bellows	Air pressurized
Boeing 747-100/200/300	3000 psi (20 690 kPa)	4	AS1241	4 - Engine driven pumps	4 - Air Turbine Driven Pumps 3 - AC pumps 1 - Power Transfer Unit	4 - Piston Type	Air pressurized
Boeing 747-400	3000 psi (20 690 kPa)	4	AS1241	4 - Engine driven pumps	2 - Air Turbine Driven Pumps 3 - AC pumps	4 - Piston type	Air pressurized
Boeing 767-200/300/400	3000 psi (20 690 kPa)	3	AS1241	2 - Engine driven pumps 2 - AC pumps	2 - AC pumps 1 - Air Turbine Driven Pump 1 - RAT pump	3 - Piston type	Air pressurized

TABLE 1 (CONTINUED) – WIDE BODY AIRCRAFT HYDRAULIC SYSTEM DATA

Aircraft	System Pressure	Number of Systems	Hydraulic Fluid	Main Pumps - Number/Type	Backup Pumps - Number/Type	Accumulators Number/Type	Reservoirs - Type
Boeing 777-200/300	3000 psi (20 690 kPa)	3	AS1241	2 - Engine driven pumps 2 - AC pumps	2 - AC pumps 1 - Air Turbine Driven Pump 1 - RAT pump	3 – Piston type	Air pressurized
Boeing MD-11	3000 psi (20 690 kPa)	3	AS1241	6 - Engine driven pumps	2 - APU driven pumps 2 - AC pumps 4 - Power transfer units	3 – Piston type	Bootstrap
Lockheed L-1011-1/100/200/500	3000 psi (20 690 kPa)	4	AS1241	4 - Engine driven pumps	2 - AC pumps 1 - RAT pump 2 - Power transfer units 2 - Air Turbine Driven Pumps	2 – Piston type	Bootstrap
McDonnell Douglas DC-10-10/30/40	3000 psi (20 690 kPa)	3	AS1241	6 - Engine driven pumps	2 - APU driven pumps 2 - AC pumps 4 - Power transfer units	3 – Piston type	Bootstrap

- 3.1 Airbus A300B/A300-600
- 3.1.1 Design Requirements: 14CFR Part 25/JAR 25 requirements
- 3.1.2 System Pressure: 3000 psi (20 690 kPa)
- 3.1.3 Hydraulic Fluid: AS1241
- 3.1.4 Number of Hydraulic Systems: 3 – Blue System, Yellow System, Green System
- 3.1.5 System Temperature: -58 to +194 °F (-50 to +90 °C)
- 3.1.6 Main Hydraulic Pump Data
- 3.1.6.1 Engine Driven Pump: 4 per aircraft; 2 in Green System, 1 in Blue System, 1 in Yellow System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2950 psi (20 345 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3750 rpm
Rotation from Shaft End: Clockwise
- 3.1.7 Back-up Pump Data
- 3.1.7.1 AC Electric Motor Pump: 2 in Green System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2950 psi (20 345 kPa)
Displacement: 0.253 in³/rev (4.15 mL/rev)
Rated Speed: 7200 rpm
- 3.1.7.2 AC Electric Motor Pump: 1 in Yellow System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.65 gpm (13.8 L/min) at 2950 psi (20 345 kPa)
Displacement: 0.052 in³/rev (0.85 mL/rev)
Rated Speed: 7500 rpm
- 3.1.7.3 Ram Air Turbine Driven Pump: 1 in Yellow System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 13.6 gpm (51.9 L/min) at 2950 psi (20 345 kPa)
Displacement: 0.75 in³/rev (12.2 mL/rev)
Rated Speed: 5200 rpm
- 3.1.7.4 Power Transfer Unit: 2 per aircraft; 1 in Green System to power Yellow System, 1 in Green System to power Blue System
Type: Unidirectional fixed displacement hydraulic motor driving a fixed displacement pump
Rated Flow: 31.5 gpm (119 L/min)
Displacement: Motor - 1.519 in³/rev (24.89 mL/rev), pump - 1.318 in³/rev (21.6 mL/rev)
Rated Speed: 5600 rpm
- 3.1.7.5 Hand Pump: 1 in Yellow System to open cargo door
Pressure - Displacement: 725 - 3000 psi (5000 - 20 690 kPa); 0.6 in³ (10 mL)/cycle
- 3.1.7.6 Hand Pump: 1 to fill hydraulic systems
Pressure - Displacement: 500 - 725 psi (3 448 - 5000 kPa); 1.8 in³ (30 mL)/cycle

3.1.8 Hydraulic Motor Data

3.1.8.1 Constant Speed Motor Electrical Generator: 1 per aircraft (not fitted to all aircraft)

Type: Variable displacement

Displacement: 0.5 in³/rev (8.19 mL/rev)

Running Speed: 12 000 rpm

Flow at Rated Electrical Load/Pressure Differential: 16.6 gpm (62.5 L/min) at 2100 psi (14 483 kPa)

3.1.8.2 Flap Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.91 in³/rev (14.91 mL/rev)

Running Speed: 3350 rpm

Flow at Rated Pressure Differential: 27.5 gpm (104 L/min)

3.1.8.3 Slat Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.91 in³/rev (14.91 mL/rev)

Running Speed: 2850 rpm

Flow at Rated Pressure Differential: 23.8 gpm (90 L/min)

3.1.8.4 Tailplane Trim Actuator Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.55 in³/rev (9.01 mL/rev)

Running Speed: 5200 rpm

Flow at Rated Pressure Differential: 19.8 gpm (75 L/min)

3.1.9 Accumulator Data

3.1.9.1 Power Generation System: 3 per aircraft; 1 per system

Type: Spherical, membrane separator, gas charged

Volume: 60 in³ (1.0 L)

Precharge pressure: 1450 psi (10 000 kPa)

3.1.9.2 Braking System: 2 in Yellow System

Type: Spherical, membrane separator, gas charged

Volume: 195 in³ (3.2 L)

Precharge pressure: 1450 psi (10 000 kPa)

3.1.10 Reservoir Data

3.1.10.1 Green System

Type: Air pressurized

Volume: 10.6 gal (40 L)

Pressure: 51 psig (352 kPa)

3.1.10.2 Yellow System

Type: Air pressurized

Volume: 7.4 gal (28 L)

Pressure: 51 psig (352 kPa)

3.1.10.3 Blue System

Type: Air pressurized

Volume: 5.8 gal (22 L)

Pressure: 51 psig (352 kPa)

3.1.11 Relief Valve Data

3.1.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Cracking Pressure: 3400 - 3500 psi (23 448 - 24 1388 kPa)
Reseat Pressure: 3200 psi (22 069 kPa)
Rated Flow: 31.0 gpm (117 L/min)

3.1.11.2 Thermal Relief Valve: 1 per aircraft on alternate braking system
Cracking Pressure: 3800 psi (26 207 kPa)
Reseat Pressure: 3500 psi (24 138 kPa)
Rated Flow: 0.02 gpm (0.08 L/min)

3.1.11.3 Cargo Door System Relief Valve: 1 per aircraft
Cracking Pressure: 3450 psi (23 793 kPa)
Reseat Pressure: 3200 psi (22 069 kPa)
Rated Flow: 0.22 gpm (0.83 L/min)

3.1.12 Filtration

3.1.12.1 Pressure Filtration: 10 per aircraft
Location: 1 in each main pump, electric motor pump, power transfer unit and ram air turbine driven pump delivery line
Filtration Rating: 15 µm

3.1.12.2 Case Drain Filtration: 4 per aircraft
Location: 1 in each main pump line
Filtration Rating: 15 µm

3.1.12.3 Return Filtration: 3 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 3 µm

3.1.13 Tubing Data

3.1.13.1 High Pressure Lines
Material Specification: 21-6-9 corrosion resistant steel (CRES) per AMS5561
Diameters/Wall thicknesses 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.35/0.508 mm), 0.5/0.026 in (12.7/0.66 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (9.53/0.991 mm), 1.0/0.052 in (25.4/1.321 mm), 1.5/0.024 in (38.1/0.609 mm)

3.1.13.2 Low Pressure Lines
Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.35/0.889 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (9.53/0.889 mm), 1.0/0.048 in (25.4/1.219 mm), 1.5/0.035 in (38.1/0.889 mm)

3.1.14 Fitting Data

3.1.14.1 Separable Type: 24 degree flareless
Material: Stainless steel for high pressure, Aluminum alloy for low pressure
End Connections: Internal swage, external pressure swage

3.1.14.2 Permanent Type: Externally pressure swaged
Material: Stainless steel for high pressure, Aluminum alloy for low pressure

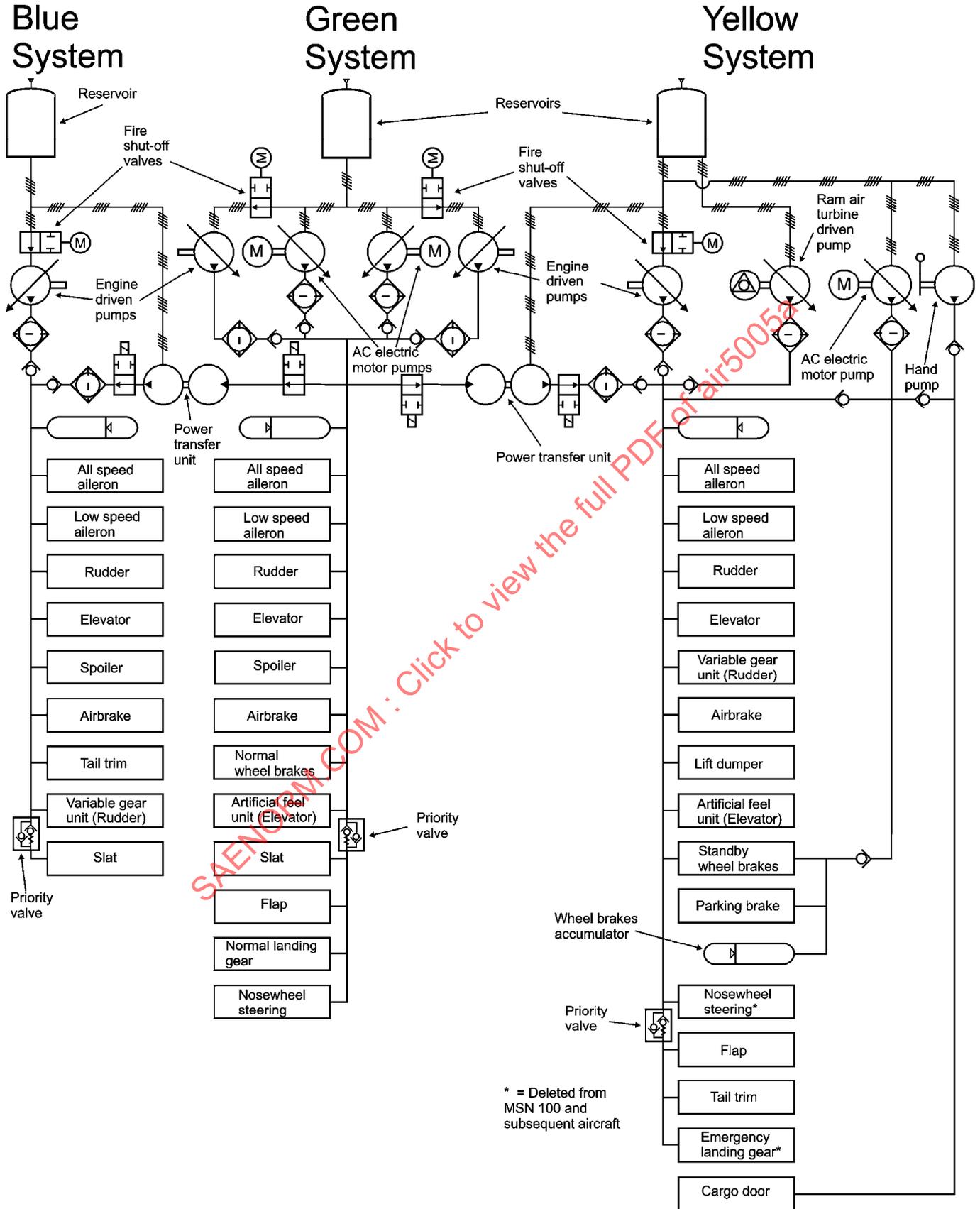


FIGURE 3.1.1 - AIRBUS A300B HYDRAULIC SYSTEM SCHEMATIC

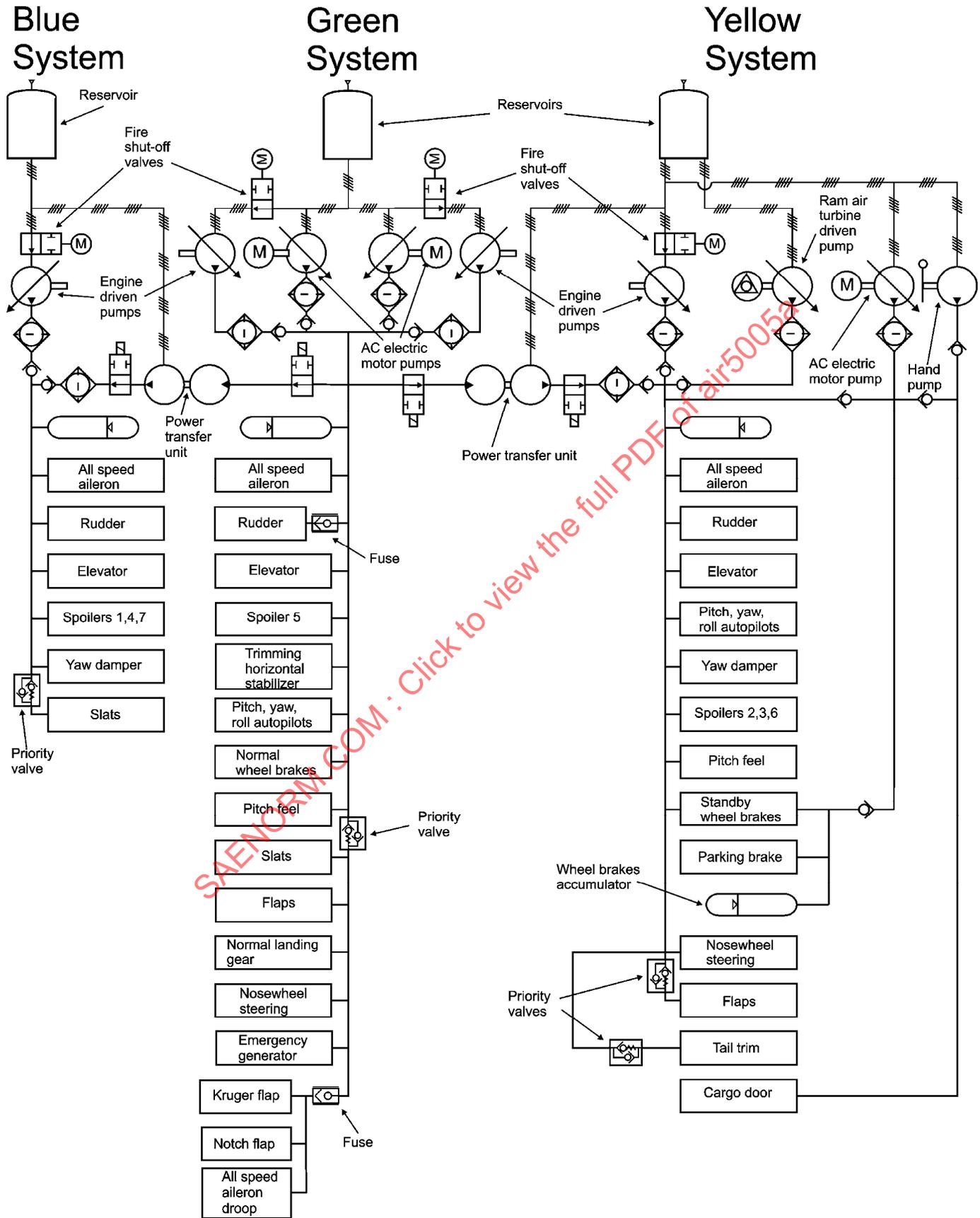


FIGURE 3.1.2 - AIRBUS A300-600 HYDRAULIC SYSTEM SCHEMATIC

3.2 Airbus A310-200/300

3.2.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

3.2.2 System Pressure: 3000 psi (20 690 kPa)

3.2.3 Hydraulic Fluid: AS1241

3.2.4 Number of Hydraulic Systems: 3 – Blue System, Yellow System, Green System

3.2.5 System Temperature: -58 to +194 °F (-50 to +90 °C)

3.2.6 Main Hydraulic Pump Data

3.2.6.1 Engine Driven Pump: 4 per aircraft; 2 in Green System, 1 in Blue System, 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2950 psi (20 345 kPa)

Displacement: 2.40 in³/rev (39.3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Clockwise

3.2.7 Back-up Pump Data

3.2.7.1 AC Electric Motor Pump: 2 in Green System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2950 psi (20 345 kPa)

Displacement: 0.253 in³/rev (4.15 mL/rev)

Rated Speed: 7200 rpm

3.2.7.2 AC Electric Motor Pump: 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 3.65 gpm (13.8 L/min) at 2950 psi (20 345 kPa)

Displacement: 0.052 in³/rev (0.85 mL/rev)

Rated Speed: 7500 rpm

3.2.7.3 Ram Air Turbine Driven Pump: 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 13.6 gpm (51.9 L/min) at 2950 psi (20 345 kPa)

Displacement: 0.75 in³/rev (12.2 mL/rev)

Rated Speed: 5200 rpm

3.2.7.4 Power Transfer Unit: 2 per aircraft; 1 in Green System to power Yellow System, 1 in Green System to power Blue System

Type: Unidirectional fixed displacement hydraulic motor driving a fixed displacement pump

Rated Flow: 31.5 gpm (119 L/min)

Displacement: Motor - 1.519 in³/rev (24.89 mL/rev), pump - 1.318 in³/rev (21.6 mL/rev)

Rated Speed: 5600 rpm

3.2.7.5 Hand Pump: 1 in Yellow System to open cargo door

Pressure - Displacement: 725 - 3000 psi (5000 - 20 690 kPa); 0.6 in³ (10 mL)/cycle

3.2.7.6 Hand Pump: 1 to fill hydraulic systems

Pressure - Displacement: 500 - 725 psi (3448 - 5000 kPa); 1.8 in³ (30 mL)/cycle

3.2.8 Hydraulic Motor Data

3.2.8.1 Constant Speed Motor Electrical Generator: 1 per aircraft (not fitted to all aircraft)

Type: Variable displacement

Displacement: 0.5 in³/rev (8.19 mL/rev)

Running Speed: 12 000 rpm

Flow at Rated Electrical Load/Pressure Differential: 16.6 gpm (62.5 L/min) at 2100 psi (14 483 kPa)

3.2.8.2 Flap Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.91 in³/rev (14.91 mL/rev)

Running Speed: 6370 rpm

Flow at Rated Pressure Differential: 25.0 gpm (95 L/min)

3.2.8.3 Slat Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.91 in³/rev (14.91 mL/rev)

Running Speed: 2360 rpm

Flow at Rated Pressure Differential: 11.5 gpm (44 L/min)

3.2.8.4 Tailplane Trim Actuator: 2 per aircraft

Type: Fixed displacement

Displacement: 0.91 in³/rev (14.91 mL/rev)

Running Speed: 2360 rpm

Flow at Rated Pressure Differential: 9.3 gpm (35.2 L/min)

3.2.9 Accumulator Data

3.2.9.1 Power Generation System: 3 per aircraft; 1 per system

Type: Spherical, membrane separator, gas charged

Volume: 60 in³ (1.0 L)

Precharge Pressure: 1450 psi (10 000 kPa)

3.2.9.2 Braking System: 2 in Yellow System

Type: Spherical, membrane separator, gas charged

Volume: 195 in³ (3.2 L)

Precharge Pressure: 1450 psi (10 000 kPa)

3.2.10 Reservoir Data

3.2.10.1 Green System

Type: Air pressurized

Volume: 10.6 gal (40 L)

Pressure: 51 psig (352 kPa)

3.2.10.2 Yellow System

Type: Air pressurized

Volume: 7.4 gal (28 L)

Pressure: 51 psig (352 kPa)

3.2.10.3 Blue System

Type: Air pressurized

Volume: 5.8 gal (22 L)

Pressure: 51 psig (352 kPa)

3.2.11 Relief Valve Data

3.2.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Cracking Pressure: 3400 - 3500 psi (23 448 - 24 1388 kPa)
Reseat Pressure: 3200 psi (22 069 kPa)
Rated Flow: 31.0 gpm (117 L/min)

3.2.11.2 Thermal Relief Valve: 1 per aircraft on alternate braking system
Cracking Pressure: 3800 psi (26 207 kPa)
Reseat Pressure: 3500 psi (24 138 kPa)
Rated Flow: 0.02 gpm (0.08 L/min)

3.2.11.3 Cargo Door System Relief Valve: 1 per aircraft
Cracking Pressure: 3450 psi (23 793 kPa)
Reseat Pressure: 3200 psi (22 069 kPa)
Rated Flow: 0.22 gpm (0.83 L/min)

3.2.12 Filtration

3.2.12.1 Pressure Filtration: 10 per aircraft
Location: 1 in each main pump, electric motor pump, power transfer unit and ram air turbine driven pump delivery line
Filtration Rating: 15 µm

3.2.12.2 Case Drain Filtration: 4 per aircraft
Location: 1 in each main pump line
Filtration Rating: 15 µm

3.2.12.3 Return Filtration: 3 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 3 µm

3.2.13 Tubing Data

3.2.13.1 High Pressure Lines
Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.35/0.508 mm), 0.5/0.026 in (12.7/0.66 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (9.53/0.991 mm), 1.0/0.052 in (25.4/1.321 mm), 1.5/0.024 in (38.1/0.609 mm)

3.2.13.2 Low Pressure Lines
Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.35/0.889 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (9.53/0.889 mm), 1.0/0.048 in (25.4/1.219 mm), 1.5/0.035 in (38.1/0.889 mm)

3.2.14 Fitting Data

3.2.14.1 Separable Type: 24 degree flareless
Material: Stainless steel for high pressure, Aluminum alloy for low pressure
End Connections: Internal swage, external pressure swage

3.2.14.2 Permanent Type
Externally pressure swaged
Material: Stainless steel for high pressure, Aluminum alloy for low pressure

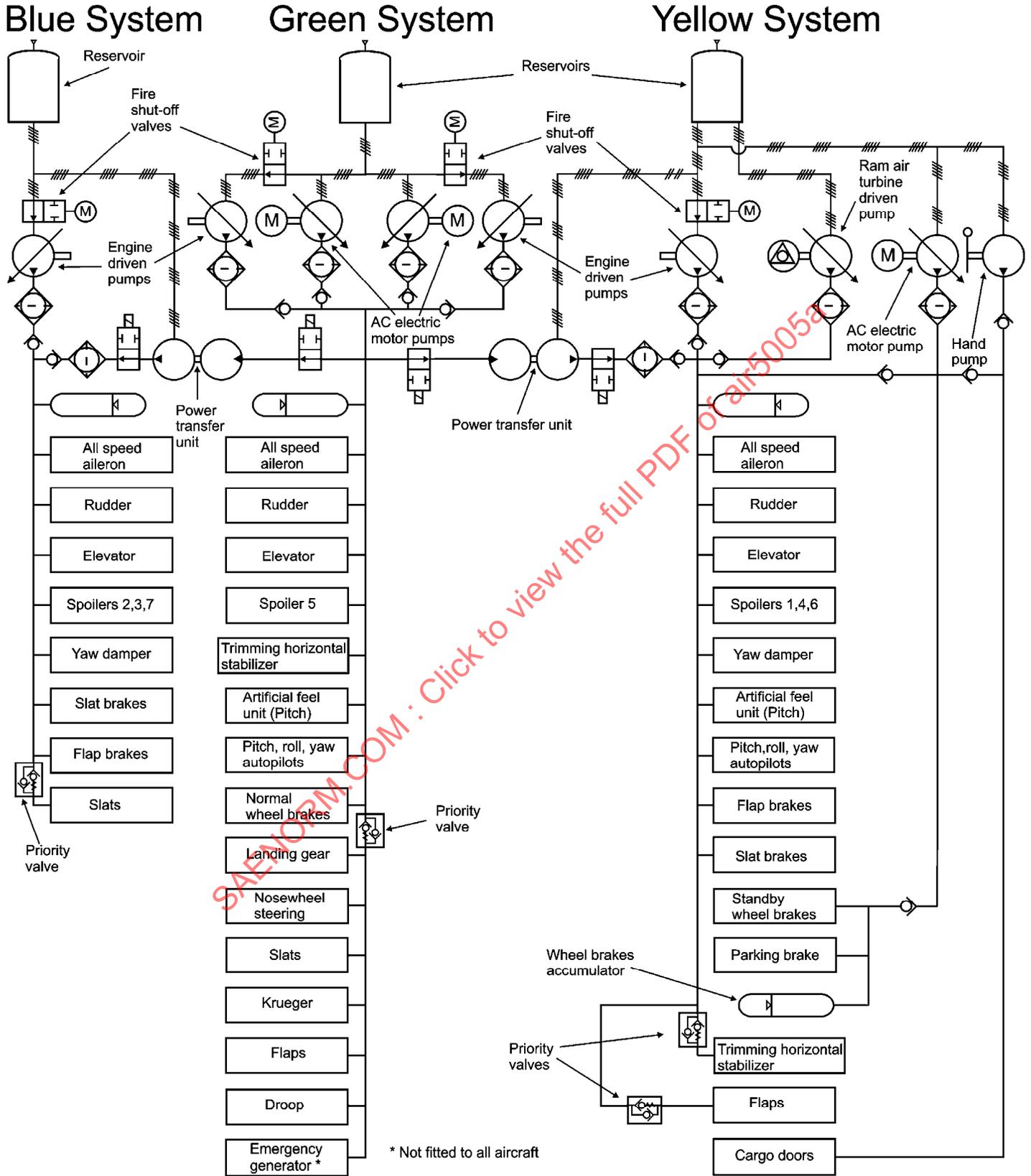


FIGURE 3.2 - AIRBUS A310-200/300 HYDRAULIC SYSTEM SCHEMATIC

3.3 Airbus A330-200/300/Airbus A340-200/300

3.3.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

3.3.2 System Pressure: 3000 psi (20 690 kPa)

3.3.3 Hydraulic Fluid: AS1241

3.3.4 Number of Hydraulic Systems: 3 – Blue System, Yellow System, Green System

3.3.5 System Temperature: -65 to +224 °F (-54 to +107 °C)

3.3.6 Main Hydraulic Pump Data

3.3.6.1 Engine Driven Pump: 4 per aircraft; 2 in Green System, 1 in Yellow System, 1 in Blue System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 46.2 gpm (175 L/min) at 2950 psi (20 345 kPa)
Displacement: 3.0 in³/rev (49.2 mL/rev)
Rated Speed: 3720 rpm
Rotation from Shaft End: Clockwise

3.3.7 Back-up Pump Data

3.3.7.1 AC Electric Motor Pump: 3 per aircraft; 1 in Green System, 1 in Yellow System, 1 in Blue System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 6.1 gpm (23 L/min) at 2840 psi (19 586 kPa); 8.5 gpm (32 L/min) at 2175 psi (15 000 kPa)
Displacement: 0.263 in³/rev (4.30 mL/rev)
Rated Speed: 7600 rpm

3.3.7.2 Ram Air Turbine Driven Pump: 1 in Green System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 21.3 gpm (80.0 L/min) at 2610 psi (18 000 kPa)
Displacement: 1.0 in³/rev (16.38 mL/rev)
Rated Speed: 5100 to 6350 rpm

3.3.7.3 Hand Pump: 1 in Yellow System to open cargo door

Pressure - Displacement: 2840 psi (19 600 kPa); 0.6 in³ (10 mL)/cycle

3.3.7.4 Hand Pump: 1 to fill hydraulic systems

Pressure - Displacement: 65 psi (450 kPa); 3.8 in³ (62 mL)/cycle

3.3.8 Hydraulic Motor Data

3.3.8.1 Flap Motor: 2 per aircraft

Type: Fixed displacement
Displacement: 0.91 in³/rev (14.91 mL/rev)
Running Speed: 5890 rpm
Flow at Rated Pressure Differential: 23.5 gpm (89 L/min)

3.3.8.2 Slat Motor: 2 per aircraft

Type: Fixed displacement
Displacement: 0.91 in³/rev (14.91 mL/rev)
Running Speed: 6370 rpm
Flow at Rated Pressure Differential: 25.0 gpm (95 L/min)

- 3.3.8.3 Trimming Horizontal Stabilizer Actuator: 2 per aircraft
Type: Fixed displacement
Displacement: 0.64 in³/rev (10.5 mL/rev)
Running Speed: 3800 rpm
Flow at Rated Pressure Differential: 12.9 gpm (49 L/min)
- 3.3.8.4 A330 Constant Speed Motor Electrical Generator: 1 per aircraft
Type: Variable displacement
Displacement: 0.49 in³/rev
Running Speed: 8000 rpm
Flow at Rated Electrical Load/Pressure Differential: 10.6 gpm (40 L/min) at 2160 psi (18 000 kPa)
- 3.3.8.5 A340 Constant Speed Motor Electrical Generator: 1 per aircraft
Type: Variable displacement
Displacement: 0.22 in³/rev
Running Speed: 12 000 rpm
Flow at Rated Electrical Load/Pressure Differential: 7.7 gpm (35 L/min) at 2465 psi (17 000 kPa)
- 3.3.9 Accumulator Data
- 3.3.9.1 Power Generation System: 3 per aircraft; 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 61 in³ (1.0 L)
Precharge Pressure: 1885 psi (13 000 kPa)
- 3.3.9.2 Braking System: 2 in Blue brake system
Type: Spherical, bladder separator, gas charged
Volume: 366 in³ (6.0 L)
Precharge Pressure: 1450 psi (10 000 kPa)
- 3.3.9.3 Braking System: 4 per aircraft; 2 in Green System Brake return; 2 in Yellow System Brake return
Type: Bladder, gas charged
Volume: 8 in³ (0.13 L)
Precharge Pressure: 174 psi (1200 kPa)
- 3.3.10 Reservoir Data
- 3.3.10.1 Green System
Type: Air pressurized
Volume: 13.8 gal (52 L)
Pressure: 51 psig (352 kPa)
- 3.3.10.2 Yellow System
Type: Air pressurized
Volume: 10.0 gal (38 L)
Pressure: 51 psig (352 kPa)
- 3.3.10.3 Blue System
Type: Air pressurized
Volume: 6.2 gal (23.5 L)
Pressure: 51 psig (352 kPa)

3.3.11 Relief Valve Data

3.3.11.1 Main System Relief Valve: 3 per aircraft; 1 per system

Cracking Pressure: 3437 psi (23 700 kPa)

Reseat Pressure: 3190 psi (22 000 kPa)

Rated Flow: 46.2 gpm (175 L/min)

3.3.11.2 Thermal Relief Valve: 1 per aircraft on alternate braking system

Cracking Pressure: 3800 psi (26 207 kPa)

Reseat Pressure: 3500 psi (24 138 kPa)

Rated Flow: 0.02 gpm (0.08 L/min)

3.3.12 Filtration

3.3.12.1 Pressure Filtration: 4 per aircraft

Location: 2 in Green System, 1 in Blue System, 1 in Yellow System delivery line

Filtration Rating: 15 µm

3.3.12.2 Case Drain Filtration: 4 per aircraft

Location: 1 in each main pump line

Filtration Rating: 15 µm

3.3.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 3 µm

3.3.13 Tubing Data

3.3.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)

3.3.13.2 Low Pressure Lines

3.3.13.2.1 Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.35/0.889 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (9.53/0.889 mm), 1.0/0.048 in (25.4/1.219 mm), 1.5/0.035 in (38.1/0.889 mm)

3.3.13.2.2 Material Specification: 21-6-9 CRES per AMS5561 (fire zones; tire burst areas, pipe diameter greater than 1 in. (25.4 mm))

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.35/0.508 mm), 0.5/0.026 in (12.7/0.66 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (9.53/0.991 mm), 1.0/0.052 in (25.4/1.321 mm), 1.5/0.024 in (38.1/0.609 mm)

3.3.13.2.3 Material Specification: Ti 3Al, 2.5V Titanium alloy per AMS4945 (nose and main landing gear bay, exposed areas, wing fuel tank)

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)

3.3.14 Fitting Data

- 3.3.14.1 Separable Type: 24 degree flareless
Material: Stainless steel for high pressure, Aluminum alloy for low pressure
End Connections: Internal swage, external pressure swage
- 3.3.14.2 Permanent Type: Externally pressure swaged
Material: Stainless steel for high pressure, Aluminum alloy for low pressure

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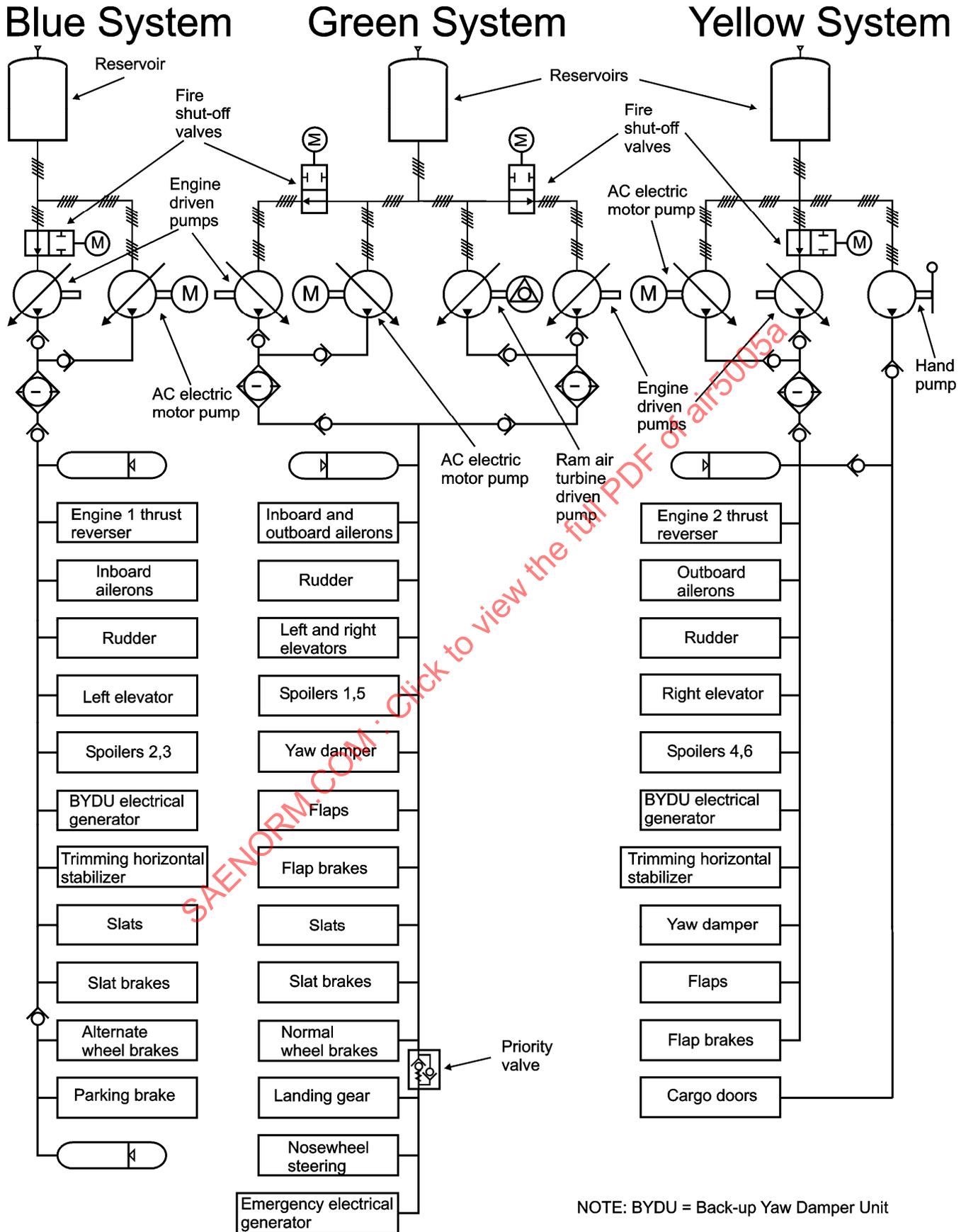


FIGURE 3.3.1 - AIRBUS A330-200/300 HYDRAULIC SYSTEM SCHEMATIC

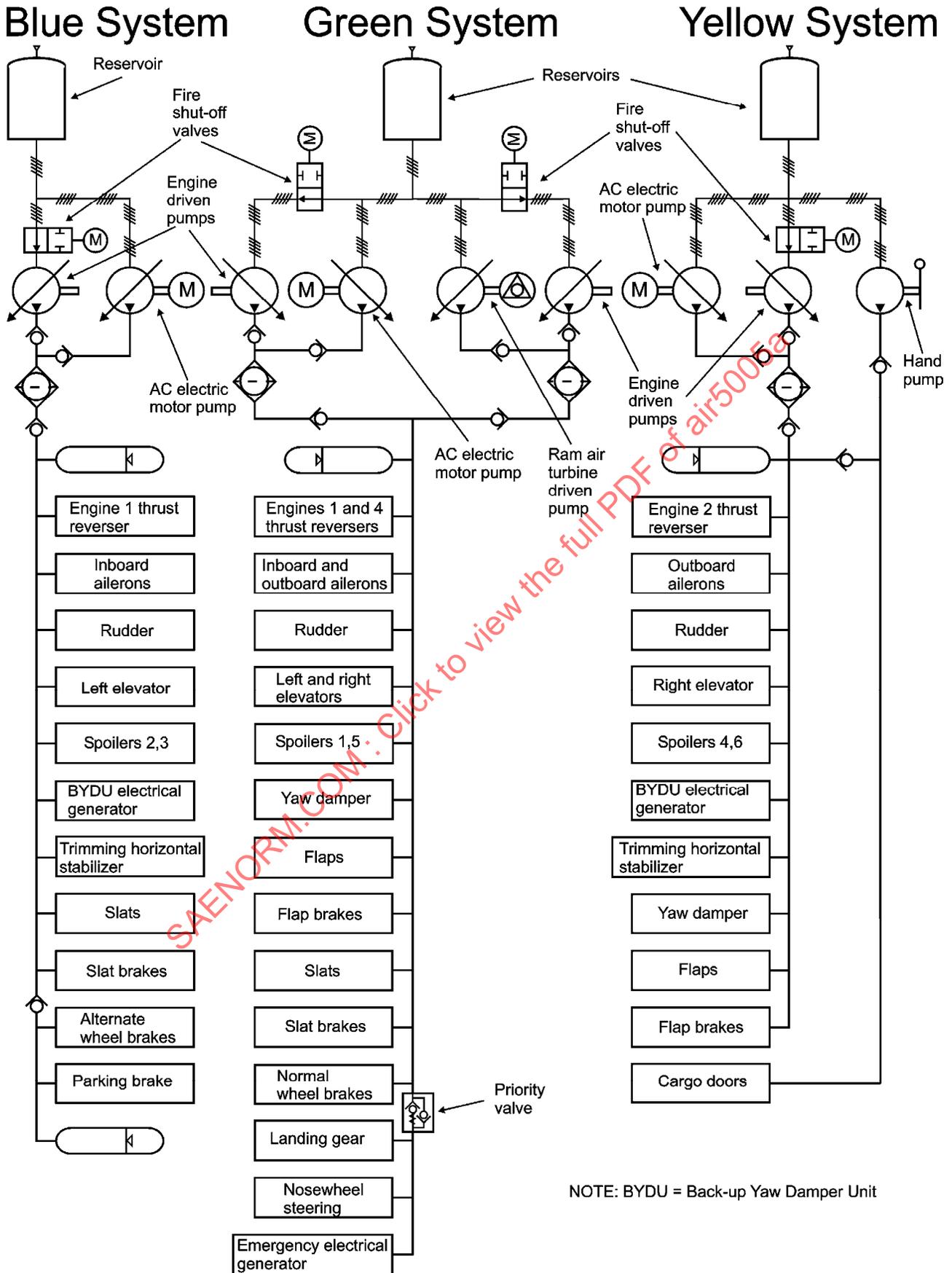


FIGURE 3.3.2 - AIRBUS A340-200/300 HYDRAULIC SYSTEM SCHEMATIC

3.4 Airbus A340-500/600

3.4.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

3.4.2 System Pressure: 3000 psi (20 690 kPa)

3.4.3 Hydraulic Fluid: AS1241

3.4.4 Number of Hydraulic Systems: 3 – Blue System, Yellow System, Green System

3.4.5 System Temperature: -65 to +224 °F (-54 to +107 °C)

3.4.6 Main Hydraulic Pump Data

3.4.6.1 Engine Driven Pump: 4 per aircraft; 2 in Green System, 1 in Yellow System, 1 in Blue System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 46.3 gpm (175 L/min) at 2854 psi (19 683 kPa)
Displacement: 3.0 in³/rev (49.2 mL/rev)
Rated Speed: 4980 rpm
Rotation from Shaft End: Clockwise

3.4.7 Back-up Pump Data

3.4.7.1 AC Electric Motor Pump: 3 per aircraft; 1 in Green System, 1 in Yellow System, 1 in Blue System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 6.1 gpm (23 L/min) at 2840 psi (19 586 kPa); 8.5 gpm (32 L/min) at 2175 psi (15 000 kPa)
Displacement: 0.263 in³/rev (4.30 mL/rev)
Rated Speed: 7600 rpm

3.4.7.2 Ram Air Turbine Driven Pump: 1 in Green System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 36.0 gpm (136.0 L/min) at 2610 psi (18 000 kPa)
Displacement: 1.0 in³/rev (16.38 mL/rev)
Rated Speed: 4850 to 6370 rpm

3.4.7.3 Hand Pump: 1 in Yellow System to open cargo door
Pressure - Displacement: 2840 psi (19 600 kPa); 0.6 in³ (10 mL)/cycle

3.4.7.4 Hand Pump: 1 to fill hydraulic systems
Pressure - Displacement: 65 psi (450 kPa); 3.8 in³ (62 mL)/cycle

3.4.8 Hydraulic Motor Data

3.4.8.1 Flap Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.91 in³/rev (14.91 mL/rev)
Running Speed: 5890 rpm
Flow at Rated Pressure Differential: 23.5 gpm (89 L/min)

3.4.8.2 Slat Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.91 in³/rev (14.91 mL/rev)
Running Speed: 6370 rpm
Flow at Rated Pressure Differential: 25.0 gpm (95 L/min)

- 3.4.8.3 Trimming Horizontal Stabilizer Actuator: 2 per aircraft
Type: Fixed displacement
Displacement: 0.68 in³/rev (11.1 mL/rev)
Running Speed: 6800 rpm
Flow at Rated Pressure Differential: 20.0 gpm (76 L/min)
- 3.4.8.4 Constant Speed Motor Electrical Generator: 1 per aircraft
Type: Variable displacement
Displacement: 0.22 in³/rev
Running Speed: 12 000 rpm
Flow at Rated Electrical Load/Pressure Differential: 7.7 gpm (35 L/min) at 2465 psi (17 000 kPa)
- 3.4.9 Accumulator Data
- 3.4.9.1 Power Generation System: 3 per aircraft; 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 61 in³ (1.0 L)
Precharge Pressure: 1885 psi (13 000 kPa)
- 3.4.9.2 Braking System: 2 in Blue brake system
Type: Spherical, bladder separator, gas charged
Volume: 366 in³ (6.0 L)
Precharge Pressure: 1450 psi (10 000 kPa)
- 3.4.9.3 Braking System: 6 per aircraft; 3 in Green System Brake return; 3 in Yellow System Brake return
Type: Bladder, gas charged
Volume: 8 in³ (0.13 L)
Precharge Pressure: 174 psi (1200 kPa)
- 3.4.10 Reservoir Data
- 3.4.10.1 Green System
Type: Air pressurized
Volume: 21.4 gal (81 L)
Pressure: 51 psig (352 kPa)
- 3.4.10.2 Yellow System
Type: Air pressurized
Volume: 9.3 gal (35 L)
Pressure: 51 psig (352 kPa)
- 3.4.10.3 Blue System
Type: Air pressurized
Volume: 9.3 gal (35 L)
Pressure: 51 psig (352 kPa)
- 3.4.11 Relief Valve Data
- 3.4.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Cracking Pressure: 3437 psi (23 700 kPa)
Reseat Pressure: 3190 psi (22 000 kPa)
Rated Flow: 46.2 gpm (175 L/min)

3.4.11.2 Thermal Relief Valve: 1 per aircraft on alternate braking system
Cracking Pressure: 3800 psi (26 207 kPa)
Reseat Pressure: 3500 psi (24 138 kPa)
Rated Flow: 0.02 gpm (0.08 L/min)

3.4.12 Filtration

3.4.12.1 Pressure Filtration: 4 per aircraft
Location: 2 in Green System, 1 in Blue System, 1 in Yellow System delivery line
Filtration Rating: 15 µm

3.4.12.2 Case Drain Filtration: 4 per aircraft
Location: 1 in each main pump line
Filtration Rating: 15 µm

3.4.12.3 Return Filtration: 3 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 3 µm

3.4.13 Tubing Data

3.4.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)

3.4.13.2 Low Pressure Lines

3.4.13.2.1 Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (9.53/0.889 mm), 1.0/0.048 in (25.4/1.219 mm), 1.5/0.035 in (38.1/0.889 mm)

3.4.13.2.2 Material Specification: 21-6-9 CRES per AMS5561 (fire zones; tire burst areas, pipe diameter greater than 1 in. (25.4 mm) in special areas)
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.5/0.026 in (12.7/0.66 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (9.53/0.991 mm), 1.0/0.052 in (25.4/1.321 mm), 1.25/0.024 in (31.75/0.609 mm), 1.5/0.024 in (38.1/0.609 mm)

3.4.13.2.3 Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945*
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)
*0.25 in and 0.375 in – normal applications; all other diameters for pipes used in fuel tanks

3.4.14 Fitting Data

3.4.14.1 Separable Type: 24 degree flareless
Material: Stainless steel and Titanium for high pressure, Aluminum alloy for low pressure
End Connections: Internal swage, external pressure swage

3.4.14.2 Permanent Type: Externally pressure swaged
Material: Stainless steel and Titanium for high pressure, Aluminum alloy for low pressure

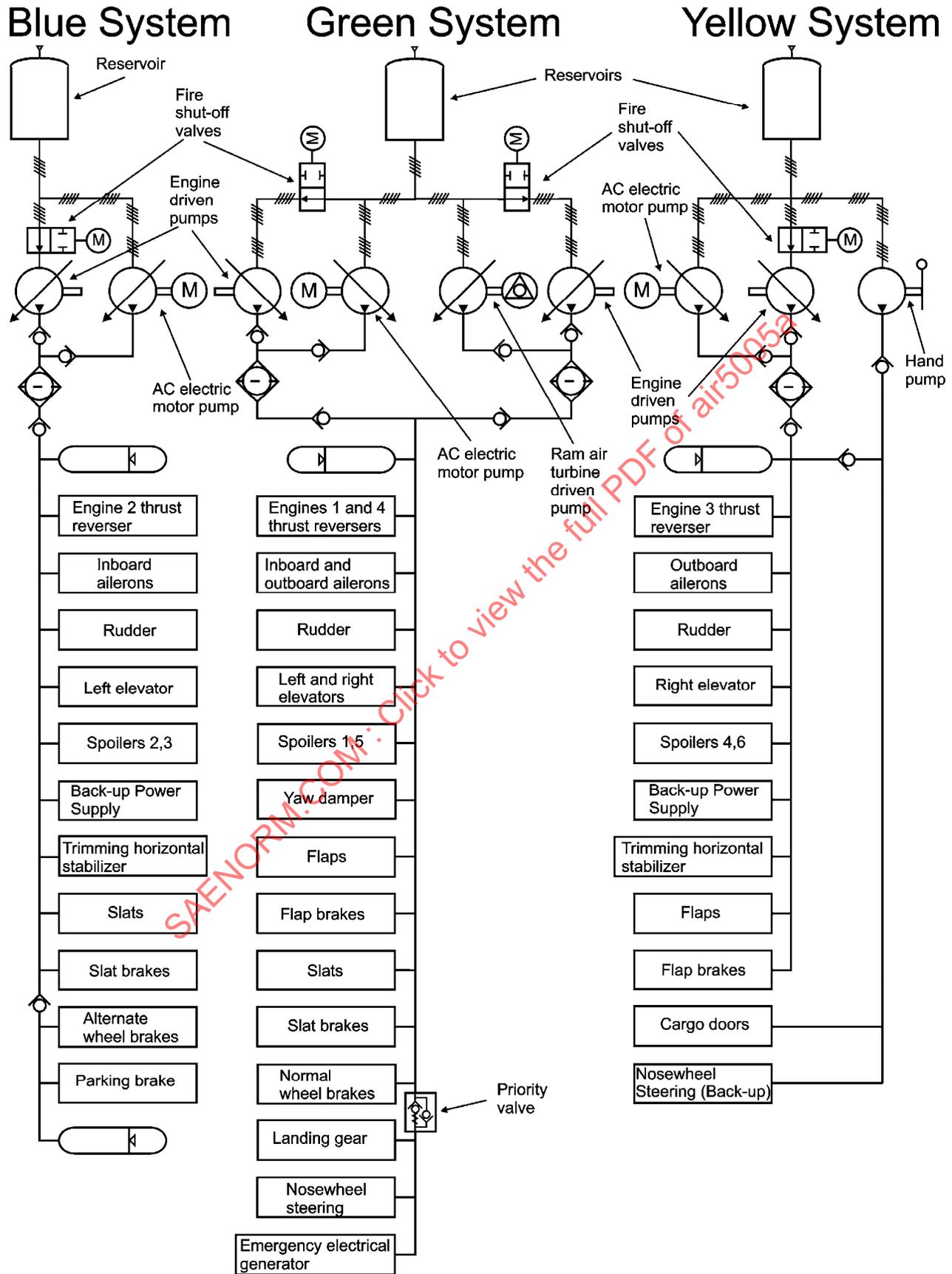


FIGURE 3.4 - AIRBUS A340-500/600 HYDRAULIC SYSTEM SCHEMATIC

3.5 Airbus A380-800

3.5.1 Design Requirements: 14CFR/CS-25 requirements

3.5.2 System Pressure: 5080 psi (35 000 kPa)

3.5.3 Hydraulic Fluid: AS1241

3.5.4 Number of Hydraulic Systems: 2 – Green System, Yellow System

3.5.5 System Temperature: -65 to +224 °F (-54 to +107 °C)

3.5.6 Main Hydraulic Pump Data

3.5.6.1 Engine driven pump: 8 per aircraft; 4 in Green System, 4 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 42.8 gpm (162 L/min) at 4780 psi (33 000 kPa)

Displacement: 2.9 in³/rev (47.0 mL/rev)

Rated Speed: 3775 rpm

Rotation from Shaft End: Clockwise

3.5.7 Back-up Pump Data

3.5.7.1 AC Electric Motor Pump: 4 per aircraft; 2 in Green System, 2 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Flow-Pressure: 6.0 gpm (22.5 L/min) at 4800 psi (33 000 kPa)

9.9 gpm (37.5 L/min) at 2900 psi (20 000 kPa)

Displacement: 0.35 in³/rev (5.73 mL/rev)

Rated Speed: 8000 rpm

3.5.7.2 DC Electric Motor Pump – Braking System: 2 per aircraft; 1 in Green System, 1 in Yellow System:

Type: Variable speed, fixed displacement, bent-axis piston

Rated Flow-Pressure: 2.0 gpm (7.6 L/min) at 4000 psi (27 582 kPa)

Displacement: 0.06 in³/rev (1.0 mL/rev)

Rated Speed: Up to 8000 rpm

3.5.7.3 DC Electric Motor Pump – Steering System: 1 per aircraft in Green System

Type: Variable speed, fixed displacement, bent-axis piston

Rated Flow-Pressure: 3.0 gpm (11.4 L/min) at 3500 psi (24 138 kPa)

Displacement: 0.06 in³/rev (1.0 mL/rev)

Rated Speed: Up to 12 000 rpm

3.5.7.4 Hand Pump: 1 in Yellow System to open cargo door

Pressure - Displacement: 2840 psi (19 600 kPa); 0.6 in³ (10 mL)/cycle

3.5.7.5 Hand Pump: 1 to fill hydraulic systems

Pressure - Displacement: 65 psi (450 kPa); 3.8 in³ (62 mL)/cycle

3.5.8 Hydraulic Motor Data

3.5.8.1 Flap motor: 2 per aircraft

Type: Variable displacement

Displacement: 1.71 in³/rev (28 mL/rev)

Running Speed: 5895 rpm

Flow at Rated Pressure Differential (peak at maximum operating torque): 21.1 gpm (80 L/min)

3.5.8.2 Slat motor: 1 per aircraft

Type: Variable displacement

Displacement: 0.75 in³/rev (12.28 mL/rev)

Running Speed: 4944 rpm

Flow at Rated Pressure Differential (peak at maximum operating torque): 13.2 gpm (50 L/min)

3.5.8.3 Horizontal Stabilizer Actuator Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.80 in³/rev (13.1 mL/rev)

Running Speed: 5060 rpm

Flow at Rated Pressure Differential: 16.4 gpm (62 L/min)

3.5.9 Accumulator Data

3.5.9.1 Power Generation System: 2 per aircraft; 1 per system

Type: Factory pre-charged, welded bellows

Volume: 1281 in³ (2.1 L)

Precharge Pressure: 2610 psi (17 995 kPa)

3.5.9.2 Braking System: 4 per aircraft; 2 per system

2 in Green brake system

Type: Factory pre-charged, welded bellows

Volume: 366 in³ (6.0 L)

Precharge Pressure: 2494 psi (17 200 kPa)

2 in Yellow brake system

Type: Factory pre-charged, welded bellows

Volume: 579 in³ (9.0 L)

Precharge Pressure: 2567 psi (17 700 kPa)

3.5.9.3 Braking System: 8 per aircraft; 4 in Green System Brake return; 4 in Yellow System Brake return

Type: Bladder, gas charged

Volume: 8 in³ (0.13 L)

Precharge Pressure: 174 psi (1200 kPa)

3.5.9.4 Nosewheel Steering System: 1 per aircraft

Type: Factory pre-charged, welded bellows

Volume: 500 in³ (8.2 L)

Precharge Pressure: 2755 psi (19 000 kPa)

3.5.10 Reservoir Data

3.5.10.1 Green System

Type: Air pressurized

Volume: 31.7 gal (120 L)

Pressure: 51 psig (352 kPa)

3.5.10.2 Yellow System

Type: Air pressurized

Volume: 10.0 gal (38 L)

Pressure: 51 psig (352 kPa)

3.5.10.3 Braking System: 2 per aircraft; 1 per system

Type: Factory pre-charged, welded bellows

Volume: 2.2 gal (8.5 L)

Precharge Pressure: 43.5 psi (300 kPa)

3.5.10.4 Nosewheel Steering System

Type: Factory pre-charged, welded bellows

Volume: 1.5 gal (5.5 L)

Precharge Pressure: 43.5 psi (300 kPa)

3.5.11 Relief Valve Data

3.5.11.1 Main System Relief Valve: 2 per aircraft; 1 per system

Cracking Pressure: 5662 psi (39 038 kPa)

Reseat Pressure: 5511 psi (37 997 kPa)

Rated Flow: 46.2 gpm (175 L/min)

3.5.11.2 Braking and Steering Sub-system Relief Valve: 3 per aircraft; 1 per system

Cracking Pressure: 5800 psi (40 000 kPa)

Reseat Pressure: 4901 psi (33 800 kPa)

Rated Flow: 3.2 gpm (12 L/min)

3.5.12 Filtration

3.5.12.1 Pressure Filtration

Location: 13 per aircraft; 5 in Green System, 5 in Yellow System; 1 in each Braking and Steering Sub-system delivery line

Filtration Rating: 15 μ m

3.5.12.2 Case Drain Filtration

Location: 10 per aircraft; 1 for each engine driven pump, 1 for the two EMP's per system

Filtration Rating: 15 μ m

3.5.12.3 Return Filtration

3.5.12.3.1 Main System:

Location: 2 per aircraft; 1 in each system return line upstream of each main system reservoir

Filtration Rating: 3 μ m

3.5.12.3.2 Braking and Steering Sub-system:

Location: 1 in each return line upstream of the sub-system reservoir

Filtration Rating: 5 μ m

3.5.13 Tubing Data

3.5.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.025 in (6.35/0.64 mm), 0.375/0.03 in (9.53/0.76 mm), 0.5/0.04 in (12.7/1.02 mm), 0.625/0.05 in (15.875/1.27 mm), 0.75/0.059 in (19.05/1.5 mm), 1.0/0.79 in (25.4/2.01 mm), 1.25/0.098 in (31.75/2.49 mm)

3.5.13.2 Low Pressure Lines

3.5.13.2.1 Material Specification: 6061-T6 (normal) Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.0/0.048 in (25.4/1.219 mm), 1.25/0.06 in (31.75/1.523 mm), 1.5/0.035 in (38.1/0.889 mm)

3.5.13.2.2 Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 1.25/0.024 in (31.75/0.609 mm), 1.5/0.024 in (38.1/0.609 mm)

3.5.13.2.3 Material Specification: Ti 3Al, 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.525/0.483 mm), 0.5/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.051 in (25.4/1.295 mm)

3.5.14 Fitting Data

3.5.14.1 Separable Type

24 degree flareless

Material: Titanium or stainless steel for high pressure, Aluminum alloy for low pressure

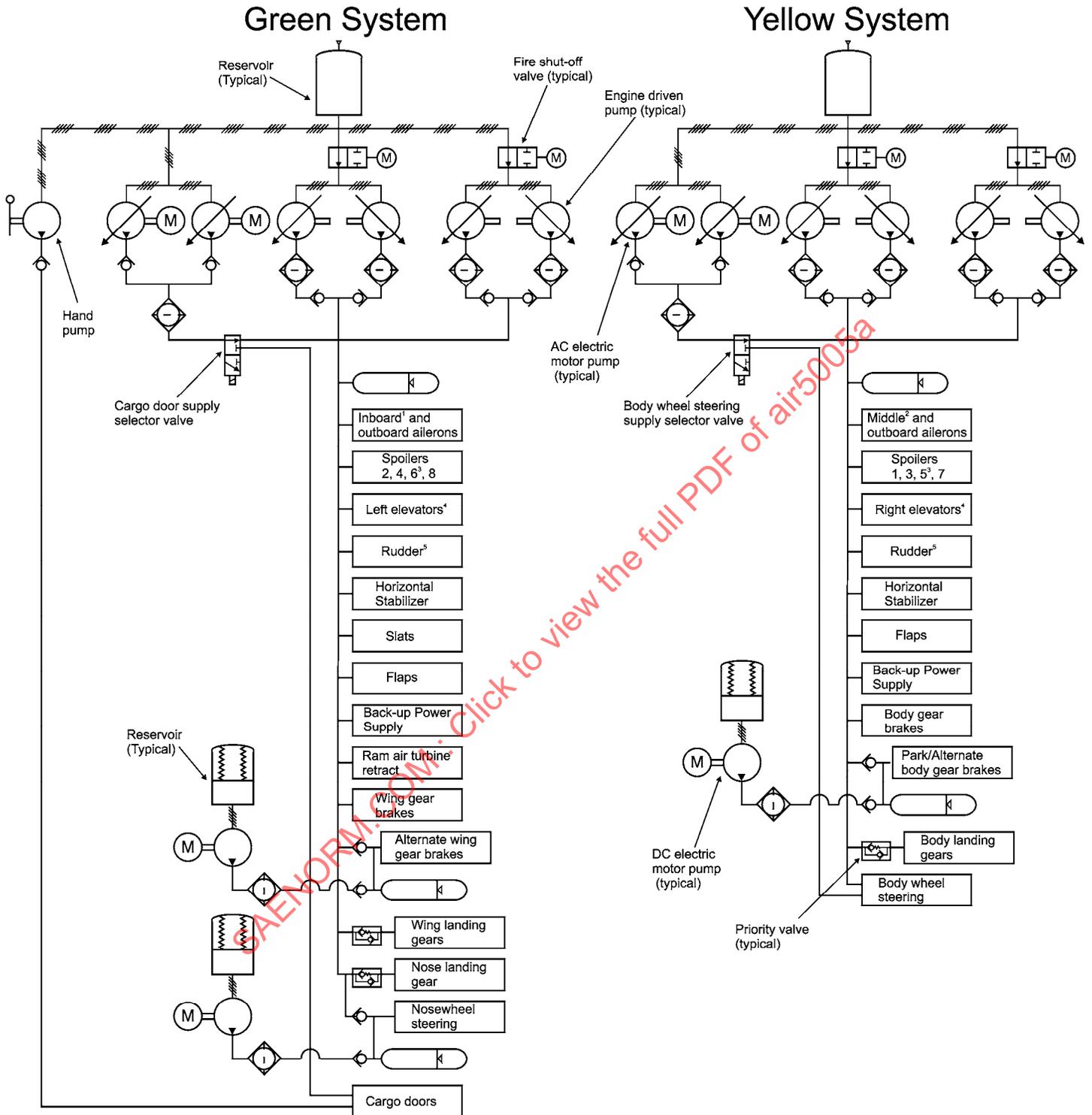
End Connections: Internal swage, external pressure swage

3.5.14.2 Permanent Type

Externally pressure swaged

Material: Titanium for high pressure, Aluminum alloy or stainless steel for low pressure

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Notes:

1. Inboard ailerons are backed up by EHA's
2. Middle ailerons are backed up by EHA's
3. Spoilers 5 and 6 are EHBA's
4. Inboard and outboard elevators are backed up by EHA's
5. All rudder actuators are EHBA's

FIGURE 3.5 - AIRBUS A380-800 HYDRAULIC SYSTEM SCHEMATIC

3.6 Boeing 747-100/200/300

3.6.1 Design Requirements: 14CFR Part 25 requirements

3.6.2 System Pressure: 3000 psi (20 690 kPa)

3.6.3 Hydraulic Fluid: AS1241

3.6.4 Number of Hydraulic Systems: 4 – System 1, System 2, System 3, System 4

3.6.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

3.6.6 Main Hydraulic Pump Data

- 3.6.6.1 Engine Driven Pump: 4 per aircraft; 1 in each system
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 655 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3750 rpm
Rotation from Shaft End: Counter clockwise

3.6.7 Back-up Pump Data

- 3.6.7.1 Air Turbine Driven Pump: 4 per aircraft; 1 in each system
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 32.0 gpm (121 L/min) at 2850 psi (19 655 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3250 rpm

- 3.6.7.2 AC Electric Motor Pump: 1 in System 4
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 6.0 gpm (22.7 L/min) at 2850 psi (19 655 kPa); 12.0 gpm (45.5 L/min) at 1200 psi (8276 kPa)
Displacement: 0.48 in³/rev (7.87 mL/rev)
Rated Speed: 8000 rpm

- 3.6.7.3 Power Transfer Unit: 1 in System 1 to drive Auxiliary Stabilizer Drive (Alternate source) in System 3
Type: Unidirectional fixed displacement bent axis piston motor and a fixed displacement bent axis piston pump
Rated Flow: 1.0 gpm (3.8 L/min) outlet flow with an input flow of 1.27 gpm (4.81 L/min)
Displacement: Motor - 0.095 in³/rev (1.56 mL/rev); pump - 0.080 in³/rev (1.31 mL/rev)
Rated Speed: 3000 rpm

3.6.8 Hydraulic Motor Data

- 3.6.8.1 Outboard Flap Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 1.52 in³/rev (24.91 mL/rev)
Running Speed: 3706 rpm for outboard flaps
Flow at Rated Pressure Differential: 25.8 gpm (97.7 L/min) at 3000 psi (20 690 kPa)
- 3.6.8.2 Inboard Flap Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 2.35 in³/rev (38.511 mL/rev)
Running Speed: 3424 rpm
Flow at Rated Pressure Differential: 36.8 gpm (139.3 L/min) at 3000 psi (20 690 kPa)

3.6.8.3 Stabilizer Drive Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.803 in³/rev (13.4 mL/rev)
Running Speed: 2320 rpm
Flow at Rated Pressure Differential: 8.8 gpm (33.3 L/min) at 3000 psi (20 690 kPa)

3.6.9 Accumulator Data

3.6.9.1 Braking System: 1 in System 4 Brake System
Type: Piston, gas charged
Volume: 200 in³ (3.48 L)
Precharge Pressure: 750 psi (5172 kPa)

3.6.9.2 Braking System: 3 in System 4 Brake Return
Type: Piston, gas charged
Volume: 25 in³ (0.41 L)
Precharge Pressure: 150 psi (1034 kPa)

3.6.10 Reservoir Data

3.6.10.1 System 1 and System 4
Type: Air pressurized
Full Volume: 10.6 gal (40.2 L)
Total Volume: 12.35 gal (46.8 L)
Pressure: 45 psig (310 kPa)

3.6.10.2 System 2 and System 3
Type: Air pressurized
Full Volume: 7.00 gal (26.5 L)
Total Volume: 8.00 gal (30.3 L)
Pressure: 45 psig (310 kPa)

3.6.11 Relief Valve Data

3.6.11.1 Main System Relief Valve: 4 per aircraft; 1 per system
Relief Pressure: 3400 - 3600 psi (23 448 - 24 828 kPa)
Reseat Pressure: Not known
Rated Flow: Not known

3.6.12 Filtration

3.6.12.1 Pressure Filtration: 9 per aircraft
Location: 1 in each main and auxiliary pump delivery line
Filtration Rating: 15 µm

3.6.12.2 Case Drain Filtration: 9 per aircraft
Location: 1 in each main and auxiliary pump line
Filtration Rating: 25 µm

3.6.12.3 Return Filtration: 4 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

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3.6.13 Tubing Data

3.6.13.1 High Pressure - Non-Fire Zones Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.051 in (25.4/1.295 mm), 1.25/0.058 in (31.75/1.47 mm)

3.6.13.2 High Pressure - Fire Zones Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm), 1.25/0.070 in (31.75/1.778 mm)

3.6.13.3 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm), 1.25/0.049 in (31.75/1.245 mm)

3.6.14 Fitting Data

3.6.14.1 Separable Type: 24 degree flareless

End Connections: Internal swage

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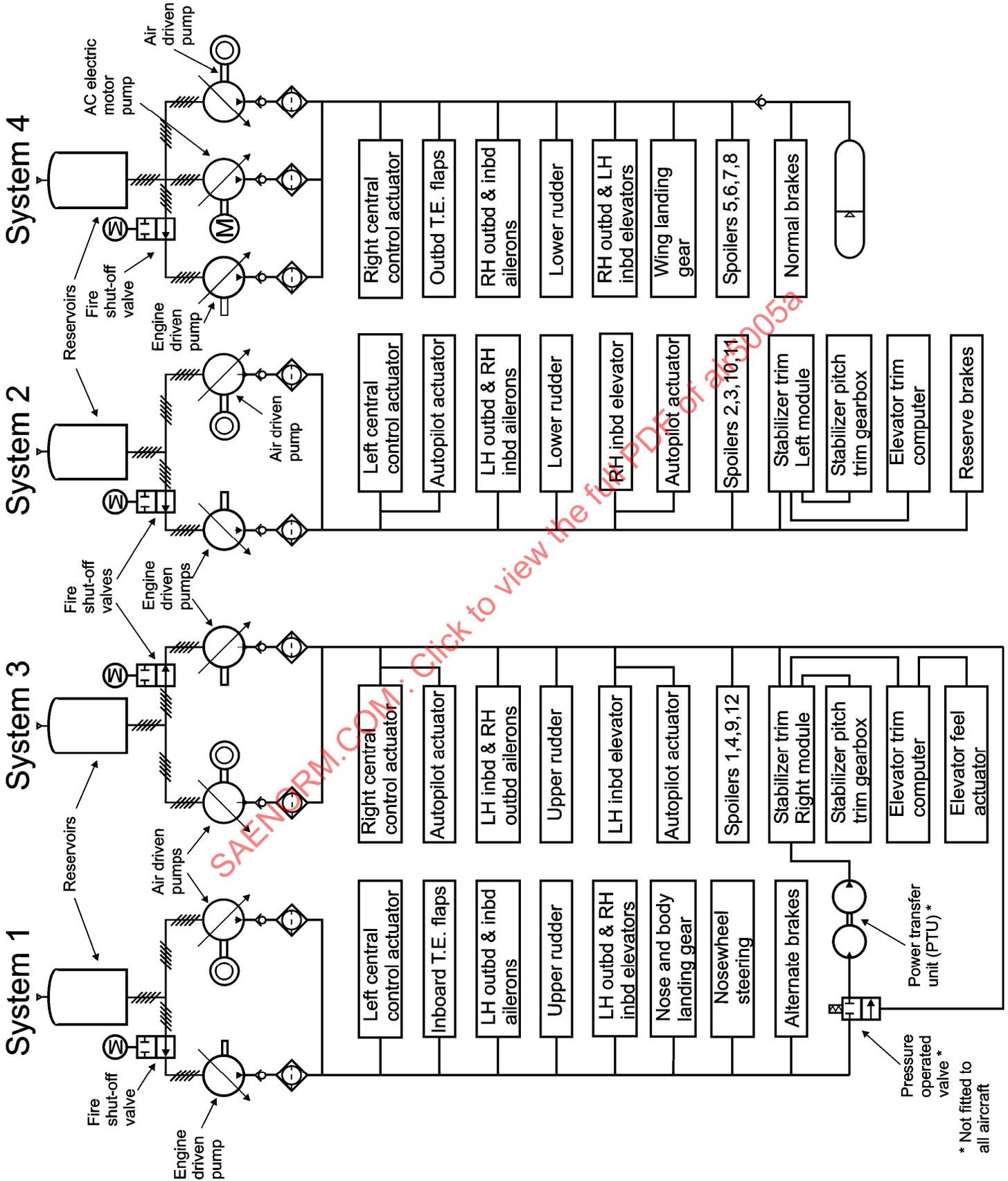


FIGURE 3.6 - BOEING 747-100/200/300 HYDRAULIC SYSTEM SCHEMATIC

3.7 Boeing 747-400

3.7.1 Design Requirements: 14CFR Part 25 requirements

3.7.2 System Pressure: 3000 psi (20 690 kPa)

3.7.3 Hydraulic Fluid: AS1241

3.7.4 Number of Hydraulic Systems: 4 - System 1, System 2, System 3, System 4

3.7.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

3.7.6 Main Hydraulic Pump Data

3.7.6.1 Engine Driven Pump: 4 per aircraft; 1 in each system
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 655 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3750 rpm
Rotation from Shaft End: Counter clockwise

3.7.7 Back-up Pump Data

3.7.7.1 Air Turbine Driven Pump: 2 per aircraft; 1 in System 1 and 1 in System 4
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 32.0 gpm (121 L/min) at 2850 psi (19 655 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3250 rpm

3.7.7.2 AC Electric Motor Pump: 1 in System 4
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 6.0 gpm (22.7 L/min) at 2850 psi (19 655 kPa); 12.0 gpm (45.5 L/min) at 1200 psi (8276 kPa)
Displacement: 0.48 in³/rev (7.87 mL/rev)
Rated Speed: 8000 rpm

3.7.7.3 AC Electric Motor Pump: 2 per aircraft; 1 in System 2 and 1 in System 3
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 7.0 gpm (26.5 L/min) at 2850 psi (19 655 kPa); 13.5 gpm (51.1 L/min) at 1500 psi (10 345 kPa)
Displacement: 0.56 in³/rev (9.18 mL/rev)
Rated Speed: 6000 rpm

3.7.8 Hydraulic Motor Data

3.7.8.1 Outboard Flap Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 1.52 in³/rev (24.91 mL/rev)
Running Speed: 3706 rpm for outboard flaps
Flow at Rated Pressure Differential: 25.8 gpm (97.7 L/min) at 3000 psi (20 690 kPa)

3.7.8.2 Inboard Flap Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 2.35 in³/rev (38.511 mL/rev)
Running Speed: 3424 rpm
Flow at Rated Pressure Differential: 36.8 gpm (139.3 L/min) at 3000 psi (20 690 kPa)

3.7.8.3 Stabilizer Drive Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.803 in³/rev (13.4 mL/rev)
Running Speed: 2320 rpm
Flow at Rated Pressure Differential: 8.8 gpm (33.3 L/min) at 3000 psi (20 690 kPa)

3.7.9 Accumulator Data

3.7.9.1 Braking System: 1 in System 4 Brake System
Type: Piston, gas charged
Volume: 200 in³ (3.58 L)
Precharge Pressure: 750 psi (5172 kPa)

3.7.9.2 Braking System: 3 in System 4 Brake Return
Type: Piston, gas charged
Volume: 25 in³ (0.41 L)
Precharge Pressure: 150 psi (1034 kPa)

3.7.10 Reservoir Data

3.7.10.1 System 1 and System 4
Type: Air pressurized
Full Volume: 10.6 gal (40.2 L)
Total Volume: 12.35 gal (46.8 L)
Pressure: 45 psig (6.5 kPa)

3.7.10.2 System 2 and System 3
Type: Air pressurized
Full Volume: 7.00 gal (26.5 L)
Total Volume: 8.00 gal (30.3 L)
Pressure: 45 psig (6.5 kPa)

3.7.11 Relief Valve Data

3.7.11.1 Main System Relief Valve: 4 per aircraft; 1 per system
Relief Pressure: 3400 - 3600 psi (23 448 - 24 828 kPa)
Reseat Pressure: Not known
Rated Flow: Not known

3.7.12 Filtration

3.7.12.1 Pressure Filtration: 9 per aircraft
Location: 1 in each main and auxiliary pump delivery line
Filtration Rating: 15 μm

3.7.12.2 Case Drain Filtration: 9 per aircraft
Location: 1 in each main and auxiliary pump line
Filtration Rating: 25 μm

3.7.12.3 Return Filtration: 4 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 15 μm

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3.7.13 Tubing Data

3.7.13.1 High Pressure - Non-Fire Zones Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.051 in (25.4/1.295 mm), 1.25/0.058 in (31.75/1.47 mm)

3.7.13.2 High Pressure - Fire Zones Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm), 1.25/0.070 in (31.75/1.778 mm)

3.7.13.3 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm), 1.25/0.049 in (31.75/1.245 mm)

3.7.14 Fitting Data

3.7.14.1 Separable Type: 24 degree flareless

End Connections: Internal swage

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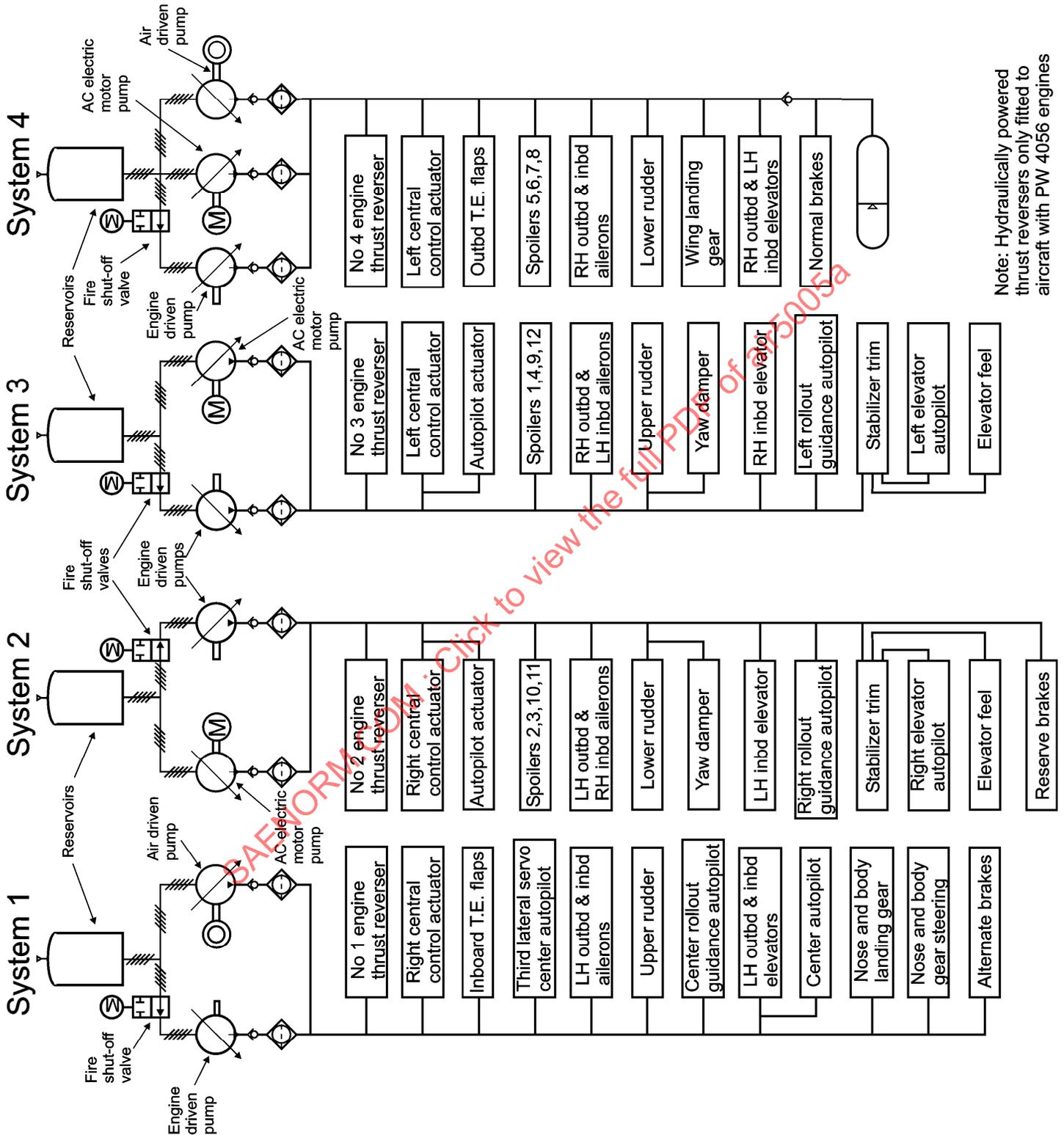


FIGURE 3.7 - BOEING 747-400 HYDRAULIC SYSTEM SCHEMATIC

3.8 Boeing 767-200/300/400

3.8.1 Design Requirements: 14CFR Part 25 requirements

3.8.2 System Pressure: 3000 psi (20 690 kPa)

3.8.3 Hydraulic Fluid: AS1241

3.8.4 Number of Hydraulic Systems: 3 - Left System, Center System, Right System

3.8.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

3.8.6 Main Hydraulic Pump Data

3.8.6.1 Engine Driven Pump: 2 per aircraft; 1 in Left System, 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 655 kPa)

Displacement: 2.40 in³/rev (39.3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

3.8.6.2 AC Electric Motor Pump: 2 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 7.0 gpm (26.5 L/min) at 2850 psi (19 655 kPa); 13.6 gpm (51.1 L/min) at 1500 psi (10 345 kPa)

Displacement: 0.56 in³/rev (9.18 mL/rev)

Rated Speed: 6000 rpm

3.8.7 Back-up Pump Data

3.8.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in Left System, 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 7.0 gpm (26.5 L/min) at 2850 psi (19 655 kPa); 13.6 gpm (51.1 L/min) at 1500 psi (10 345 kPa)

Displacement: 0.56 in³/rev (9.18 mL/rev)

Rated Speed: 6000 rpm

3.8.7.2 Air Turbine Driven Pump: 1 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37.0 gpm (140.2 L/min) at 2850 psi (19 655 kPa)

Displacement: 1.60 in³/rev (26.22 mL/rev)

Running Speed: 5000 rpm

3.8.7.3 Ram Air Turbine Driven Pump: 1 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 11.3 gpm (42.8 L/min) at 2140 psi (14 759 kPa)

Displacement: 0.78 in³/rev (12.78 mL/rev)

Running Speed: 4165 rpm

3.8.7.4 Power Transfer Unit: 1 in Right System to drive Trimming Horizontal Stabilizer (Alternate source)

Type: Unidirectional fixed displacement bent axis piston motor and a fixed displacement bent axis piston pump
Rated Flow: 2.7 gpm (10.3 L/min) outlet flow at 1250 psi (8261 kPa) with an input flow of 3.2 gpm (12.1 L/min) at 1600 psi (11 034 kPa)

Displacement: Motor - 0.095 in³/rev (1.557 mL/rev); Pump - 0.080 in³/rev (1.311 mL/rev)

Rated Speed: 7800 rpm

3.8.8 Hydraulic Motor Data

3.8.8.1 Flap Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 1.50 in³/rev (24.58 mL/rev)
Running Speed: 3500 rpm
Flow at Rated Pressure Differential: 22.7 gpm (85.9 L/min) at 2850 psi (19 655 kPa)

3.8.8.2 Outboard Leading Edge Slat Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 1.50 in³/rev (24.58 mL/rev)
Running Speed: 3500 rpm
Flow at Rated Pressure Differential: 22.7 gpm (85.9 L/min) at 2850 psi (19 655 kPa)

3.8.8.3 Inboard Leading Edge Slat Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 0.365 in³/rev (5.98 mL/rev)
Running Speed: 2600 rpm
Flow at Rated Pressure Differential: 3.9 gpm (14.8 L/min) at 2850 psi (19 655 kPa)

3.8.8.4 Stabilizer Drive Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.365 in³/rev (5.98 mL/rev)
Running Speed: 2600 rpm
Flow at Rated Pressure Differential: 3.9 gpm (14.8 L/min) at 2850 psi (19 655 kPa)

3.8.9 Accumulator Data

3.8.9.1 Braking System: 1 in Right System Brake System
Type: Piston, gas charged
Volume: 200 in³ (3.68 L)
Precharge Pressure: 1300 psi (8966 kPa)

3.8.9.2 Braking System: 2 in Right Brake Return System
Type: Piston, gas charged
Volume: 25 in³ (0.41 L)
Precharge Pressure: 150 psi (1034 kPa)

3.8.10 Reservoir Data

3.8.10.1 Left and Right Systems
Type: Air pressurized
Full Volume: 4.8 gal (18.8 L)
Total Volume: 6.8 gal (25.8 L)
Pressure: 40 psig (275 kPa)

3.8.10.2 Center System
Type: Air pressurized
Full Volume: 8.6 gal (32.6 L)
Total Volume: 12.3 gal (46.6 L)
Pressure: 40 psig (275 kPa)

3.8.11 Relief Valve Data

- 3.8.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Relief Pressure: 3400 - 3600 psi (23 448 - 24 828 kPa)
Reseat Pressure: Not known
Rated Flow: Not known

3.8.12 Filtration

- 3.8.12.1 Pressure Filtration: 7 per aircraft
Location: 1 in each main and auxiliary pump delivery line, except for Ram Air Turbine
Filtration Rating: 15 µm
Location: 1 in Ram Air Turbine delivery line
Filtration Rating: 25 µm

- 3.8.12.2 Case Drain Filtration: 8 per aircraft
Location: 1 in each main and auxiliary pump line, and in Ram Air Turbine line
Filtration Rating: 25 µm

- 3.8.12.3 Return Filtration: 3 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

3.8.13 Tubing Data

- 3.8.13.1 High Pressure - Non-Fire Zones Lines
Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.051 in (25.4/1.295 mm), 1.25/0.058 in (31.75/1.47 mm)
- 3.8.13.2 High Pressure - Fire Zones Lines
Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 cm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm), 1.25/0.070 in (31.75/1.778 mm)
- 3.8.13.3 Low Pressure Lines
Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm), 1.25/0.035 in (31.75/0.889 mm)

3.8.14 Fitting Data

- 3.8.14.1 Separable Type: 24 degree flareless
Material: Al, CRES and Titanium
End Connections: Internal swage, welded

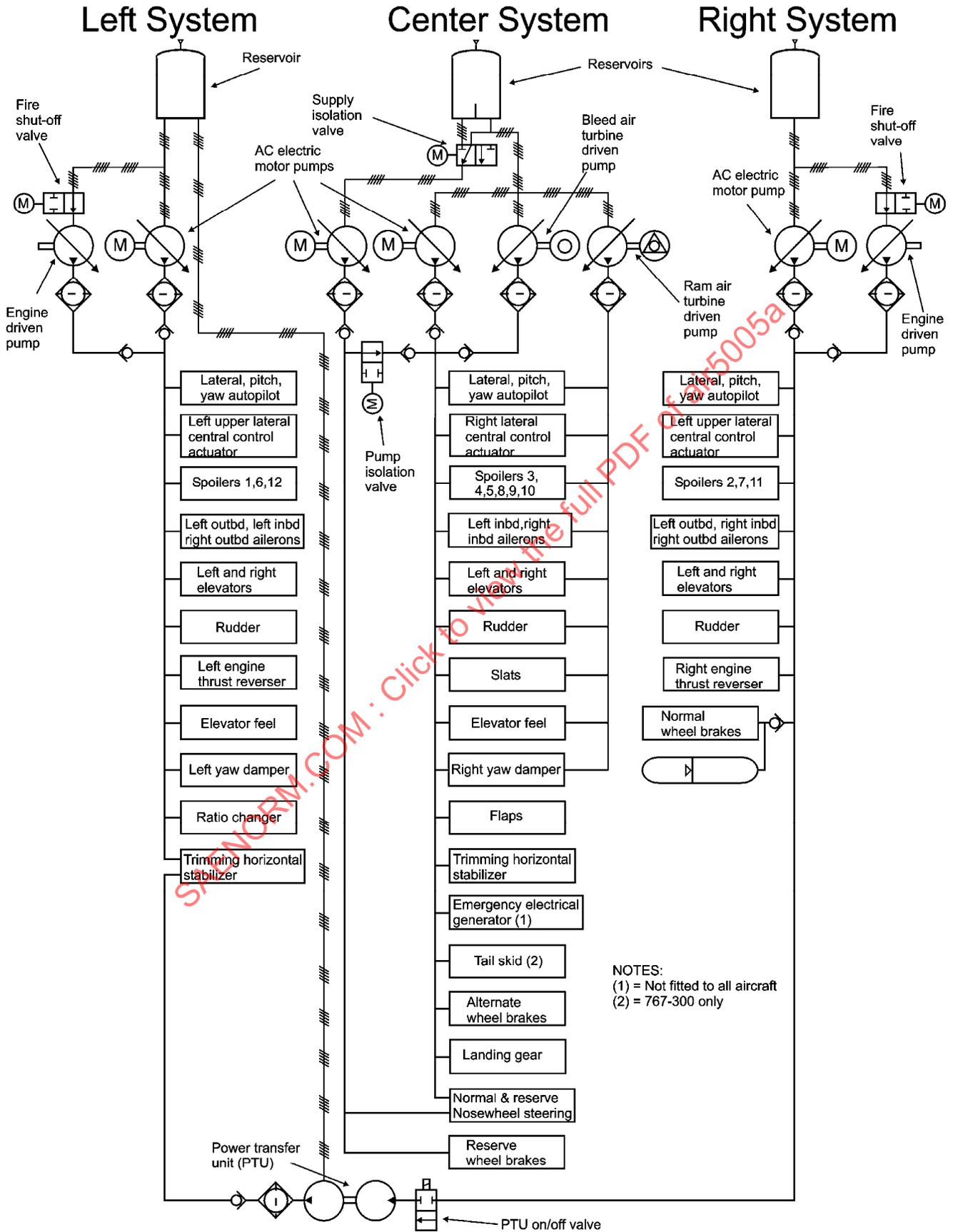


FIGURE 3.8 - BOEING 767-200/300/400 HYDRAULIC SYSTEM SCHEMATIC

3.9 Boeing 777-200/300

3.9.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

3.9.2 System Pressure: 3000 psi (20 690 kPa)

3.9.3 Hydraulic Fluid: AS1241

3.9.4 Number of Hydraulic Systems: 3 – Left System, Center System, Right System

3.9.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

3.9.6 Main Hydraulic Pump Data

3.9.6.1 Engine Driven Pump: 2 per aircraft; 1 in Left System; 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 48.0 gpm (142 L/min) at 2850 psi (19 655 kPa)

Displacement: 3.00 in³/rev (49.16 mL/rev)

Rated Speed: 3900 rpm

Rotation from Shaft End: Counter clockwise

3.9.6.2 AC Electric Motor Pump: 2 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 6.0 gpm (22.7 L/min) at 2850 psi (19 655 kPa); 12.0 gpm (45.4 L/min) at 1200 psi (8276 kPa)

Displacement: 0.38in³/rev (6.23 mL/rev)

Rated Speed: 8000 rpm

3.9.7 Back-up Pump Data

3.9.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in Left System; 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 6.0 gpm (22.7 L/min) at 2850 psi (19 655 kPa)

12.0 gpm (45.4 L/min) at 1200 psi (8276 kPa)

Displacement: 0.38in³/rev (6.23 mL/rev)

Rated Speed: 8000 rpm

3.9.7.2 Air Turbine Driven Pump: 2 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 53.0 gpm (200.0 L/min) at 2850 psi (19 655 kPa)

Displacement: 3.00 in³/rev (49.16 mL/rev)

Running Speed: 4315 rpm

3.9.7.3 Ram Air Turbine Driven Pump: 1 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 10.0 gpm (37.9 L/min) at 2850 psi (19 655 kPa)

20.0 gpm (75.8 L/min) at 1500 psi (10 345 kPa)

Displacement: 1.15 in³/rev (18.85 mL/rev)

Running Speed: 4500 rpm

3.9.8 Hydraulic Motor Data

- 3.9.8.1 Flap Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 2.35 in³/rev (38.52 mL/rev)
Running Speed: 2500 rpm
Flow at Rated Pressure Differential: 25 gpm (94.6 L/min)
- 3.9.8.2 Slat Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 2.35 in³/rev (38.52 mL/rev)
Running Speed: 3450 rpm
Flow at Rated Pressure Differential: 35 gpm (132.5 L/min)
- 3.9.8.3 Stabilizer Drive Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.80 in³/rev (1.31 mL/rev)
Running Speed: 2320 rpm
Flow at Rated Pressure Differential: 8.8 gpm (33.3 L/min)

3.9.9 Accumulator Data

- 3.9.9.1 Braking System: 1 in Right System Brake System
Type: Piston, gas charged
Volume: 400 in³ (6.56 L)
Precharge Pressure: 1300 psi (8966 kPa)
- 3.9.9.2 Braking System: 2 in Right System Brake Return
Type: Piston, gas charged
Volume: 25 in³ (0.41 L)
Precharge Pressure: 150 psi (1034 kPa)

3.9.10 Reservoir Data

- 3.9.10.1 Left and Right Systems
Type: Air pressurized
Full Volume: 7.4 gal (26.0 L)
Total Volume: 12.6 gal (47.7 L)
Pressure: 50 psig (345 kPa)
- 3.9.10.2 Center System
Type: Air pressurized
Full Volume: 11.0 gal (41.6 L)
Total Volume: 25.6 gal (96.9 L)
Pressure: 50 psig (345 kPa)

3.9.11 Relief Valve Data

- 3.9.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Relief Pressure: 3400 - 3600 psi (23 448 - 24 828 kPa)
Reseat Pressure: Not known
Rated Flow: Not known

3.9.12 Filtration

3.9.12.1 Pressure Filtration: 9 per aircraft

Location: 1 in each main, auxiliary pump and Ram Air Turbine delivery line

Filtration Rating: 15 µm

3.9.12.2 Case Drain Filtration: 9 per aircraft

Location: 1 in each main, auxiliary pump and Ram Air Turbine line

Filtration Rating: 25 µm

3.9.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 15 µm

3.9.13 Tubing Data

3.9.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.051 in (25.4/1.295 mm), 1.25/0.070 in (31.75/1.78 mm)

3.9.13.2 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm), 1.25/0.035 in (31.75/0.889 mm), 1.50/0.049 in (38.1/1.245 mm)

3.9.14 Fitting Data

3.9.14.1 Separable Type: 24 degree flareless

Material: Al, CRES and Titanium

End Connections: Internal swage, welded

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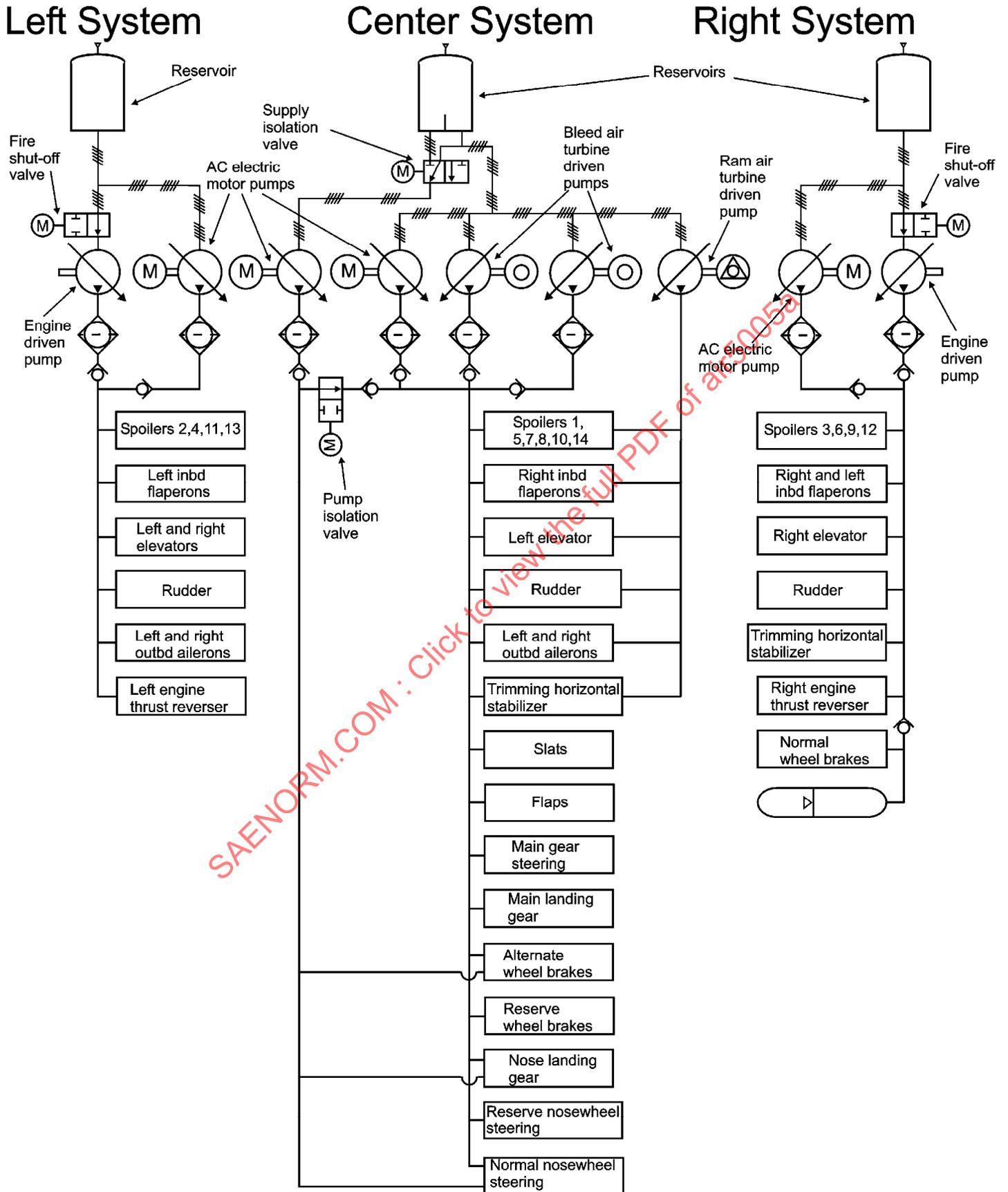


FIGURE 3.9 - BOEING 777-200/300 HYDRAULIC SYSTEM SCHEMATIC

3.10 Boeing MD-11

3.10.1 Design Requirements: 14CFR Part 25 requirements

3.10.2 System Pressure: 3000 psi (20 690 kPa)

3.10.3 Hydraulic Fluid: AS1241

3.10.4 Number of Hydraulic Systems: 3 - System 1, System 2, System 3

3.10.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

3.10.6 Main Hydraulic Pump Data

3.10.6.1 Engine Driven Pump: 6 per aircraft; 2 in System 1, 2 in System 2, 2 in System 3

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 651 kPa)

Displacement: 2.40 in³/rev (39.3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Clockwise

3.10.7 Back-up Pump Data

3.10.7.1 AC Electric Motor Pump: 2 in System 3

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa)

6.0 gpm (22.7 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.26 in³/rev (4.26 mL/rev)

Rated Speed: 7600 rpm

3.10.7.2 Power Transfer Unit: 2 per aircraft; 1 in System 1 to drive System 3 and vice-versa; 1 in System 2 to drive System 3 and vice-versa

Type: Bi-directional, fixed displacement inline axial piston motor pump driving/driven by a variable displacement inline axial piston motor pump

Rated Flow-Pressure: 28.0 gpm (106 L/min) at 2800 psi (19 310 kPa) to System 3

18.0 gpm (68.1 L/min) at 2700 psi (18 621 kPa) to System 1 or System 2

3.10.7.3 Power Transfer Unit: 2 per aircraft; 1 in System 3 to drive System 2 lower rudder; 1 in System 2 to drive System 1 trimming horizontal stabilizer

Type: Unidirectional, fixed displacement inline axial piston motor driving a fixed displacement inline axial piston pump

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2520 psi (17 379 kPa)

Displacement: 0.43 in³/rev (7.05 mL/rev)

Rated Speed: 4600 rpm

3.10.8 Hydraulic Motor Data

3.10.8.1 Horizontal Stabilizer Motor: 2 per aircraft

Type: Dual displacement inline piston

Displacement: High - 0.82 in³/rev (13.44 mL/rev), Low - 0.32 in³/rev (5.24 mL/rev)

Running Speed: At maximum displacement - 3460 rpm; at minimum displacement - 8600 rpm

Flow at Rated Pressure Differential: 13.1 gpm (49.6 L/min) at 2600 psid (17 931 kPa)

3.10.9 Accumulator Data

3.10.9.1 Power Generation System: 3 per aircraft; 1 per system
Type: Spherical, bladder separator, gas charged
Shell Volume: 198 in³ (3.8 L)
Precharge 1000 psi (6896 kPa)

3.10.9.2 Braking System: 6 per aircraft; 3 in System 1 Braking System: 3 in System 2 Braking System
Type: Spherical, bladder separator, gas charged
Shell Volume: 198 in³ (3.8 L)
Precharge 675 psi (4655 kPa)

3.10.10 Reservoir Data

3.10.10.1 System 1
Type: Hydraulically pressurized
Full Volume: 6.25 gal (23.7 L)
Total Volume: 12.0 gal (45.5 L)
Pressure: 60 psi (413 kPa)

3.10.10.2 System 2
Type: Hydraulically pressurized
Full Volume: 6.25 gal (23.7 L)
Total Volume: 12.0 gal (45.5 L)
Pressure: 60 psi (413 kPa)

3.10.10.3 System 3
Type: Hydraulically pressurized
Full Volume: 7.5 gal (28.4 L)
Total Volume: 12.0 gal (45.5 L)
Pressure: 60 psi (413 kPa)

3.10.11 Relief Valve Data

3.10.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Relief Pressure: 3600 psi (24 822 kPa)
Reseat Pressure: Not known
Rated Flow: 40 gpm (151 L/min) at 3700 psi (25 517 kPa)

3.10.12 Filtration

3.10.12.1 Pressure Filtration: 8 per aircraft
Location: 1 in each Engine Driven Pump: and AC pump delivery line
Filtration Rating: 15 µm

3.10.12.2 Case Drain Filtration: 6 per aircraft
Location: 1 in each Engine Driven Pump: line
Filtration Rating: 15 µm

3.10.12.3 Return Filtration: 6 per aircraft
Location: 2 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

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3.10.13 Tubing Data

3.10.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.312/0.020 in (7.93/0.5086 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.88/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.0512 in (25.4/1.295 mm)

3.10.13.2 Low Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.312/0.016 in (7.92/0.508 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.022 in (12.7/0.559 mm), 0.625/0.020 in (15.88/0.508 mm), 0.75/0.020 in (19.05/0.508mm), 1.00/0.028 in (25.4/0.711 mm), 1.25/0.035 in (31.75/0.889 mm)

3.10.13.2.1 Large Suction Lines

Material Specification: 6061-T4 Aluminum Alloy per AMS4083

Diameters/Wall Thicknesses: 1.00/0.035 in (25.4/0.889 mm), 1.25/0.035 in (31.75/0.889 mm)

3.10.13.2.2 Coiled Tubing Lines

Material Specification: Titanium Tube, Commercial Pure

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.042 in (9.53/1.067 mm), 0.50/0.056 in (12.7/1.422 mm), 0.625/0.071 in (15.88/1.803 mm)

3.10.14 Fitting Data

3.10.14.1 Separable Type: 24 degree flareless

Material: Titanium 6Al 4V per AMS4928, CRES 21-6-9 per AMS5561

End Connections: Brazed

3.10.14.2 Permanent Type: External pressure swage

Material: Titanium 6Al 4V per AMS4928, CRES 21-6-9 per AMS5561

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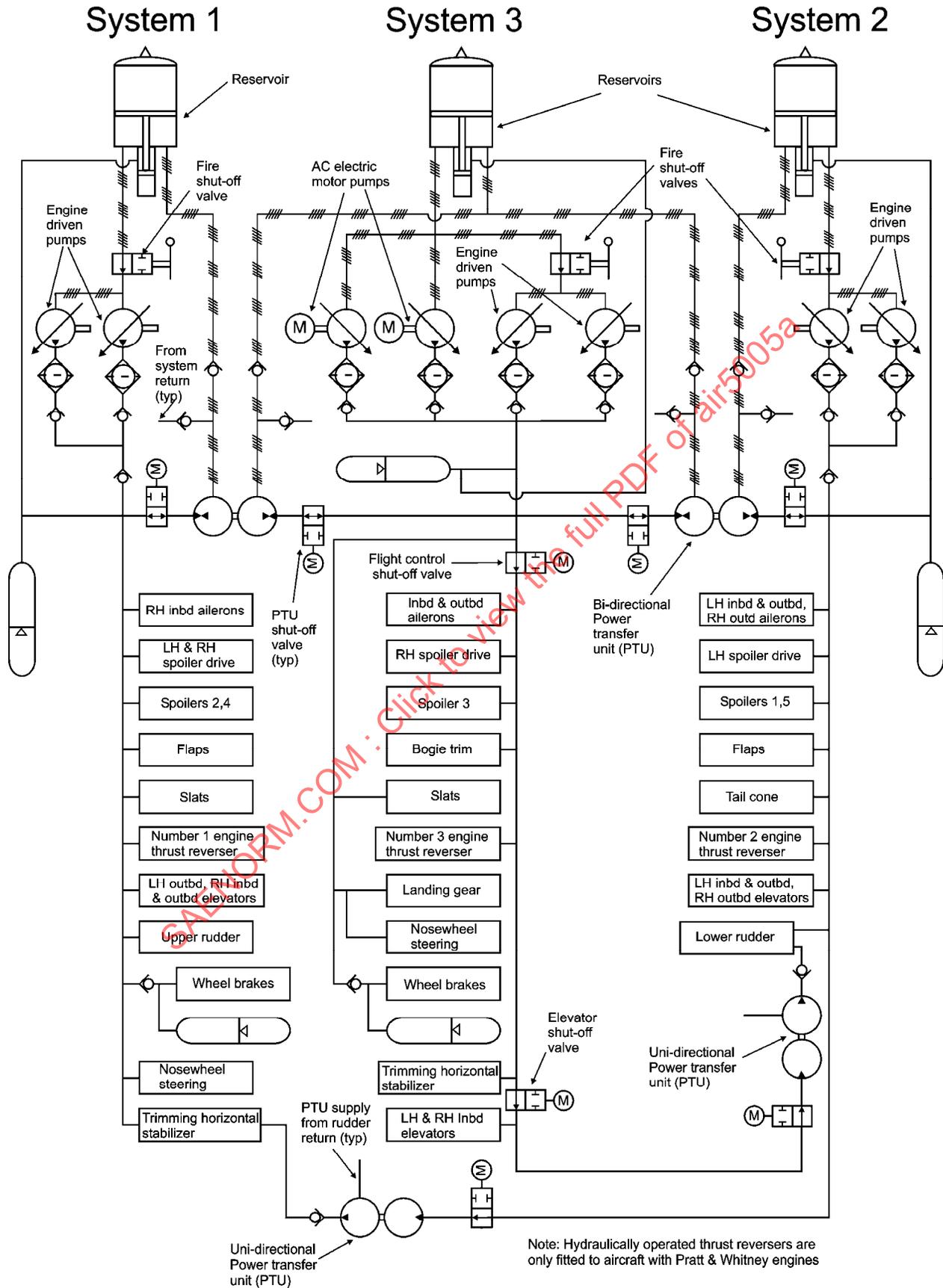


FIGURE 3.10 - BOEING MD-11 HYDRAULIC SYSTEM SCHEMATIC

3.11 Lockheed L-1011-1/100/200/500

3.11.1 Design Requirements: 14CFR Part 25 requirements

3.11.2 System Pressure: 3000 psi (20 690 kPa)

3.11.3 Hydraulic Fluid: AS1241

3.11.4 Number of Hydraulic Systems: 4 - System A, System B, System C, System D

3.11.5 System Temperature: Not known

3.11.6 Main Hydraulic Pump Data

3.11.6.1 Engine Driven Pump: 4 per aircraft; 1 in System A, 1 in System B, 1 in System C, 1 in System D

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 38.8 gpm (147 L/min) at 2850 psi (19 655 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3880 rpm
Rotation from Shaft End: Counter clockwise

3.11.7 Back-up Pump Data

3.11.7.1 Air Turbine Driven Pump: 2 per aircraft; 1 in System B, 1 in System C

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 655 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Running Speed: 3880 rpm

3.11.7.2 AC Electric Motor Pump: 2 per aircraft; 1 in System B, 1 in System C

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 10.5 gpm (39.8 L/min) at 1850 psi (12 759 kPa)
6.6 gpm (25.0 L/min) at 2800 psi (19 310 kPa)
Displacement: 0.22 in³/rev (3.10 mL/rev)
Running Speed: 11 300 rpm

3.11.7.3 Power Transfer Unit: 2 per aircraft; 1 in System C to drive System D; 1 in System B to drive System A

Type: Unidirectional, fixed displacement bent-axis axial piston motor driving a fixed displacement bent-axis axial piston pump
Rated Flow-Pressure: 32 gpm (121 L/min) at 2500 psi (17 241 kPa)
Displacement: 1.52 in³/rev (24.91 mL/rev)
Running Speed: 5600 rpm

3.11.7.4 Ram Air Turbine Driven Pump: 1 in System B

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 15.8 gpm (59.8 L/min)
Displacement: 0.75 in³/rev (12.29 mL/rev)
Running Speed: 5200 rpm

3.11.8 Hydraulic Motor Data

3.11.8.1 Slat Drive Motor: 2 per aircraft

Type: Fixed displacement
Displacement: 0.75 in³/rev (12.29 mL/rev)
Running Speed: 2900 rpm
Flow at Rated Pressure Differential: 8.5 gpm (32.2 L/min)

3.11.8.2 Trailing Edge Flap Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.44 in³/rev (7.21 mL/rev)
Running Speed: 7800 rpm
Flow at Rated Pressure Differential: 11.4 gpm (43.2 L/min)

3.11.9 Accumulator Data

3.11.9.1 Braking System: 1 in System B Braking System
Type: Piston, gas charged
Volume: 200 in³ (3.28 L)
Precharge Pressure: 1000 psi (6897 kPa)

3.11.9.2 Braking System: 1 in System C Braking System
Type: Piston, gas charged
Volume: 707 in³ (11.59 L)
Precharge Pressure: 750 psi (5172 kPa)

3.11.10 Reservoir Data

3.11.10.1 System A
Type: Hydraulically pressurized
Volume: 6 gal (22.9 L)
Pressure: 85 psi (586 kPa)

3.11.10.2 System B
Type: Hydraulically pressurized
Volume: 6 gal (22.9 L)
Pressure: 85 psi (586 kPa)

3.11.10.3 System C
Type: Hydraulically pressurized
Volume: 12 gal (45.7 L)
Pressure: 85 psi (586 kPa)

3.11.10.4 System D
Type: Hydraulically pressurized
Volume: 6 gal (22.9 L)
Pressure: 85 psi (586 kPa)

3.11.11 Relief Valve Data

3.11.11.1 Main System Relief Valve: 4 per aircraft; 1 per system
Relief Pressure: 3500 psi (24 138 kPa)
Reseat Pressure: Not known
Rated Flow: 40 gpm (152 L/min) at 3500 psi (24 138 kPa)

3.11.12 Filtration

3.11.12.1 Pressure Filtration: 11 per aircraft
Location: 1 in each pump delivery line
Filtration Rating: 15 µm

3.11.12.2 Case Drain Filtration: 11 per aircraft
Location: 1 in each pump line
Filtration Rating: 15 µm

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3.11.12.3 System Fill/Return Filtration: 4 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 3 µm

3.11.13 Tubing Data

3.11.13.1 High Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.312/0.020 in (7.93/0.508 mm), 0.375/0.028 in (9.525/0.0711 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.88/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm), 1.25/0.065 in (31.75/1.651 mm)

3.11.13.2 Low Pressure Lines: (Suction and return lines outside fire zones, landing gear and pressurized areas)

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.375/0.028 in (9.525/0.711 mm), 0.375/0.035 in (9.525/0.889 mm), 0.50/0.028 in (12.7/0.711 mm), 0.625/0.0350 in (15.88/0.889 mm), 0.75/0.028 in (19.05/0.711 mm), 0.75/0.042 in (19.05/1.067 mm), 1.00/0.049 in (25.4/1.245 mm), 1.125/0.065 in (28.58/1.651 mm), 1.125/0.028 in (28.58/0.889 mm) 1.25/0.032 in (31.75/0.813 mm), 1.50/0.028 in (31.75/0.889 mm)

3.11.13.3 Low Pressure Lines: (suction and return lines inside fire zones, landing gear and pressurized areas)

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.525/0.508 mm), 0.50/0.020 in (12.7/0.508 mm), 0.625/0.020 in (15.88/0.508 mm), 0.75/0.020 in (19.05/0.508 mm), 1.00/0.026 in (25.4/0.660 mm), 1.25/0.032 in (31.75/0.813 mm), 1.50/0.035 in (31.75/0.889 mm)

3.11.14 Fitting Data

3.11.14.1 Separable Type: 8 degree 30' Lip seal

Material: Steel, Aluminum alloy

End Connections: Brazed

3.11.14.2 Permanent Type: Brazed

Material: Steel, Aluminum alloy

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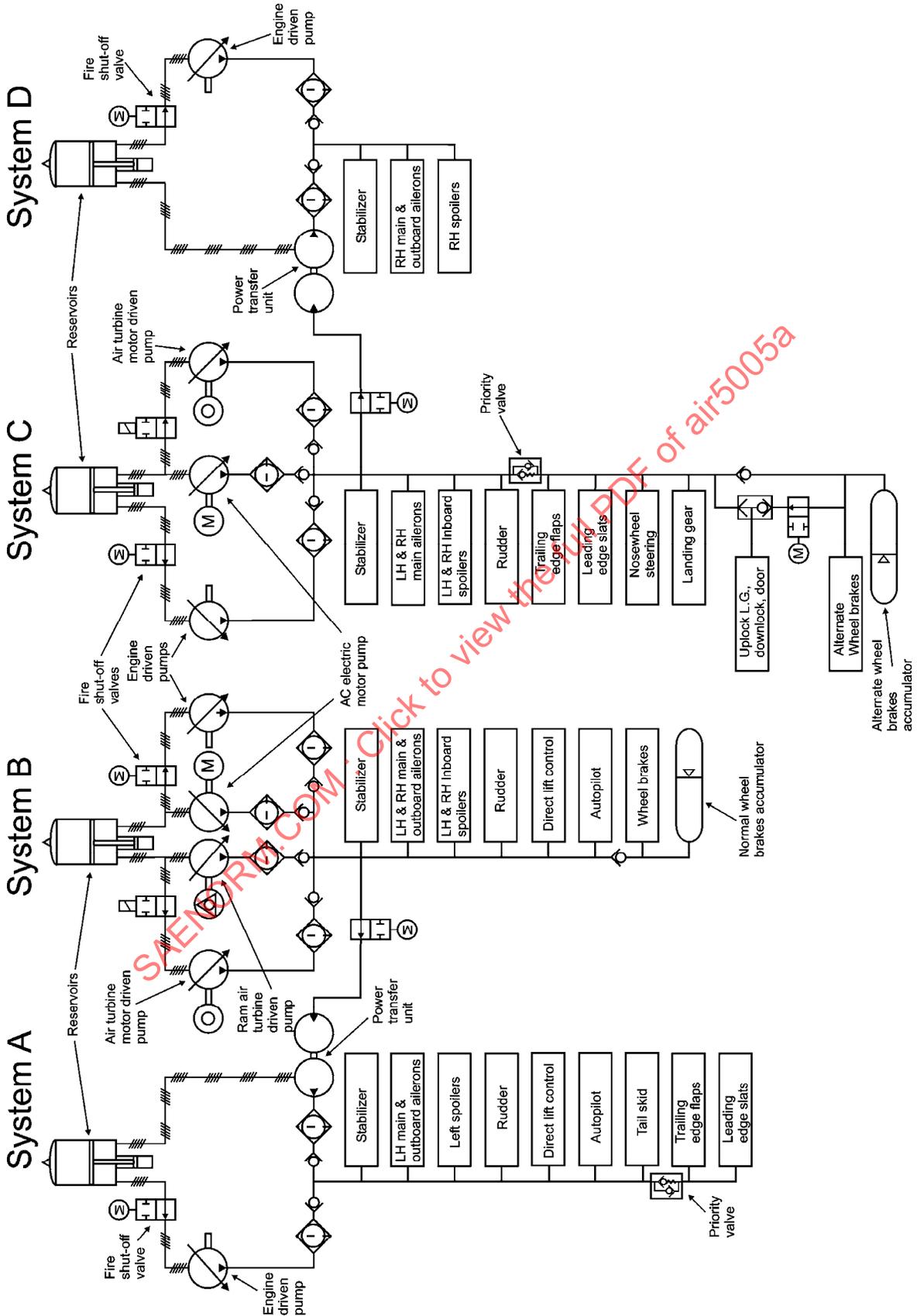


FIGURE 3.11 - LOCKHEED L.1011-1/100/200/500 HYDRAULIC SYSTEM SCHEMATIC

3.12 McDonnell Douglas DC-10-10/30/40

3.12.1 Design Requirements: 14CFR Part 25 requirements

3.12.2 System Pressure: 3000 psi (20 690 kPa)

3.12.3 Hydraulic Fluid: AS1241

3.12.4 Number of Hydraulic Systems: 3 - System 1, System 2, System 3

3.12.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

3.12.6 Main Hydraulic Pump Data

3.12.6.1 Engine Driven Pump: 6 per aircraft; 2 in System 1, 2 in System 2, 2 in System 3

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 651 kPa)

Displacement: 2.40 in³/rev (39.3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Clockwise

3.12.7 Back-up Pump Data

3.12.7.1 AC Electric Motor Pump: 2 in System 3

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa)

6.0 gpm (22.7 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.26 in³/rev (4.26 mL/rev)

Rated Speed: 7600 rpm

3.12.7.2 Power Transfer Unit: 2 per aircraft; 1 in System 1 to drive System 3 and vice-versa; 1 in System 2 to drive System 3 and vice-versa

Type: Bi-directional, fixed displacement inline axial piston motor pump driving/driven by a variable displacement inline axial piston motor pump

Rated Flow-Pressure: 28.0 gpm (106 L/min) at 2800 psi (19 310 kPa) to System 3

18.0 gpm (68.1 L/min) at 2700 psi (18 621 kPa) to System 1 or System 2

3.12.7.3 Power Transfer Unit: 2 per aircraft; 1 in System 3 to drive System 2 lower rudder; 1 in System 2 to drive System 1 trimming horizontal stabilizer

Type: Unidirectional, fixed displacement inline axial piston motor driving a fixed displacement inline axial piston pump

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2520 psi (17 379 kPa)

Displacement: 0.43 in³/rev (7.05 mL/rev)

Rated Speed: 4600 rpm

3.12.8 Hydraulic Motor Data

3.12.8.1 Horizontal Stabilizer Motor: 2 per aircraft

Type: Dual displacement inline piston

Displacement: High - 0.82 in³/rev (13.44 mL/rev), Low - 0.32 in³/rev (5.24 mL/rev)

Running Speed: At maximum displacement - 3460 rpm; at minimum displacement - 8600 rpm

Flow at Rated Pressure Differential: 13.1 gpm (49.6 L/min) at 2600 psid (17 931 kPa)

3.12.9 Accumulator Data

3.12.9.1 Power Generation System: 3 per aircraft; 1 per system
Type: Spherical, bladder separator, gas charged
Shell Volume: 198 in³ (3.8 L)
Precharge 1000 psi (6896 kPa)

3.12.9.2 Braking System: 2 per aircraft; 2 in System 1 Braking System: 2 in System 3 Braking System
Type: Spherical, bladder separator, gas charged
Shell Volume: 198 in³ (3.8 L)
Precharge 1000 psi (6896 kPa)

3.12.10 Reservoir Data

3.12.10.1 System 1
Type: Hydraulically pressurized
Full Volume: 5.25 gal (19.9 L)
Total Volume: 12.2 gal (45.52 L)
Pressure: 60 psi (413 kPa)

3.12.10.2 System 2
Type: Hydraulically pressurized
Full Volume: 4.5 gal (17.0 L)
Total Volume: 12.2 gal (45.52 L)
Pressure: 60 psi (413 kPa)

3.12.10.3 System 3
Type: Hydraulically pressurized
Full Volume: 6.75 gal (25.5 L)
Total Volume: 12.2 gal (45.52 L)
Pressure: 60 psi (413 kPa)

3.12.11 Relief Valve Data

3.12.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Relief Pressure: 3600 psi (24 822 kPa)
Reseat Pressure: Not known
Rated Flow: 40 gpm (151 L/min) at 3700 psi (25 517 kPa)

3.12.12 Filtration

3.12.12.1 Pressure Filtration: 8 per aircraft
Location: 1 in each Engine Driven Pump: and AC pump delivery line
Filtration Rating: 15 µm

3.12.12.2 Case Drain Filtration: 6 per aircraft
Location: 1 in each Engine Driven Pump: line
Filtration Rating: 15 µm

3.12.12.3 Return Filtration: 6 per aircraft
Location: 2 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

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3.12.13 Tubing Data

3.12.13.1 High Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.312/0.016 in (7.93/0.406 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.88/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.32 mm)

3.12.13.2 Low Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.312/0.016 in (7.92/0.406 mm), 0.375/0.016 in (9.525/0.0406 mm), 0.50/0.016 in (12.7/0.406 mm), 0.625/0.016 in (15.88/0.406 mm), 0.75/0.016 in (19.05/0.406 mm), 1.00/0.020 in (25.4/0.508 mm), 1.25/0.024 in (31.75/0.610 mm)

3.12.13.2.1 Large Suction Lines

Material Specification: 6061-T4 Aluminum Alloy per AMS4083

Diameters/Wall Thicknesses: 1.00/0.035 in (25.4/0.889 mm), 1.25/0.035 in (31.75/0.889 mm)

3.12.13.2.2 Coiled Tubing

Material Specification: 304 CRES per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.312/0.035 in (7.92/0.889 mm)

Material Specification: Titanium Tube, Commercial Pure

Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.065 in (12.7/1.651 mm), 0.625/0.072 in (15.88/1.829 mm)

3.12.14 Fitting Data

3.12.14.1 Separable Type: 24 degree flareless

Material: 21-6-9 CRES per AMS5561, Aluminum alloy 6061-T6

End Connections: Brazed on 21-6-9 CRES

3.12.14.2 Permanent Type External pressure swage

Material: 21-6-9 CRES per AMS5561, Aluminum alloy 6061-T6

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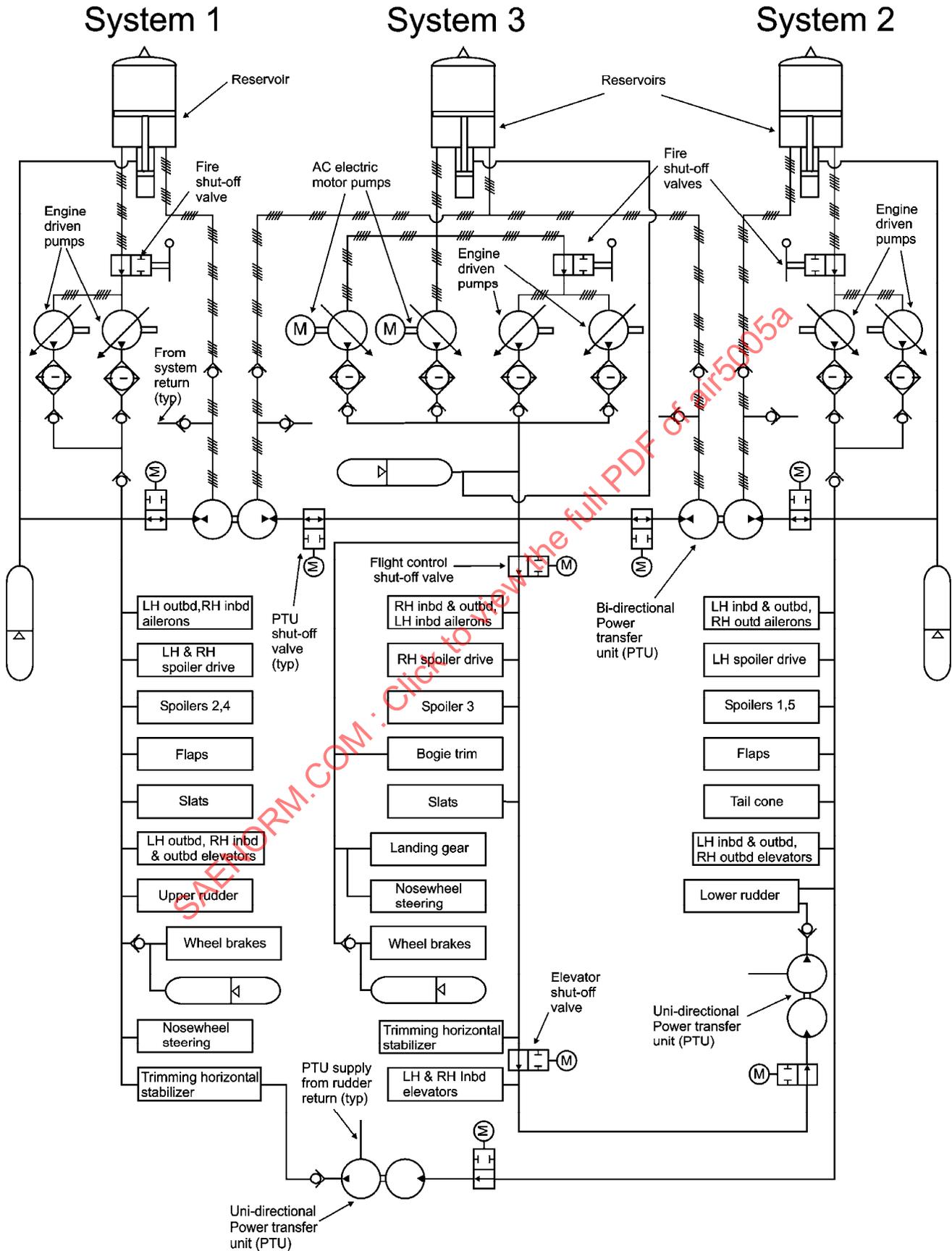


FIGURE 3.12 - MCDONNELL DOUGLAS DC-10-10/30/40 HYDRAULIC SYSTEM SCHEMATIC

4. NARROW BODY JET AIRLINERS

TABLE 2 – NARROW BODY JET AIRCRAFT HYDRAULIC SYSTEM DATA

Aircraft	System Pressure	Number of Systems	Hydraulic Fluid	Main Pumps – Number/Type	Backup Pumps – Number/Type	Accumulators – Number/Type	Reservoirs - Type
Aerospatiale/BAC Concorde	4000 psi (27 586 kPa)	3	Silicate-ester	6 – Engine driven pumps	2 - AC pumps 2 – RAT pumps	4 – Piston Type	Air pressurized - bellows
Airbus A318/A319/A320/A321	3000 psi (20 690 kPa)	3	AS1241	2 – Engine driven pumps 1 - AC pump	1 - AC pump 1 - Power Transfer Unit 1 – RAT pump	4 (8*) – Bladder separator Type * A320 only	Air pressurized
BAC 111-500	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps	2 - AC pumps 1 - DC pump	4 – Piston Type	Air pressurized
BAE Systems 146-100/200/300 Avro RJ70/85/100	3000 psi (20 690 kPa)	2	AS1241	2 – Engine driven pumps	1 - AC pump 1 - DC pump 1 - Power Transfer Unit	2 – Piston Type	Air pressurized
Boeing 707-120/320/420	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps	2 - AC pumps	3 – Piston Type;	Air pressurized
Boeing 717	3000 psi (20 690 kPa)	2	AS1241	2 – Engine driven pumps	1 - AC pump 1 - Power Transfer Unit	9 – Bladder Type	Bootstrap
Boeing 727-100/200	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps 2 - AC pumps	1 - AC pump 1 - Power Transfer Unit	2 – Piston Type	Air pressurized
Boeing 737-100/200	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps 2 - AC pumps	1 - AC pump	4 – Piston Type	Air pressurized
Boeing 737-300/400/500	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps	3 - AC pumps 1 - Power Transfer Unit	1 – Piston Type	Air pressurized
Boeing 737-600/700/800/900	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps	3 - AC pump 1 - Power Transfer Unit	1 – Piston Type	Air pressurized
Boeing 757-200/300	3000 psi (20 690 kPa)	3	AS1241	2 – Engine driven pumps 2 - AC pumps	2 - AC pumps 1 - Power Transfer Unit 1 – RAT pump	1 – Piston Type	Air pressurized

TABLE 2 (CONTINUED) – NARROW BODY JET AIRCRAFT HYDRAULIC SYSTEM DATA

Aircraft	System Pressure	Number of Systems	Hydraulic Fluid	Main Pumps – Number/Type	Backup Pumps – Number/Type	Accumulators – Number/Type	Reservoirs - Type
Boeing MD-81/82/83/87/88	3000 psi (20 690 kPa)	2	AS1241	2 – Engine driven pumps	1 - AC pump 1 - Power Transfer Unit	5 – Bladder Type	Bootstrap
Boeing MD-90-30	3000 psi (20 690 kPa)	2	AS1241	2 – Engine driven pumps	1 - AC pump 1 - Power Transfer Unit	9 – Bladder Type	Bootstrap
Bombardier CRJ 100/200	3000 psi (20 690 kPa)	3	AS1241	2 – Engine driven pumps 2 - AC pumps	2 - AC pumps	5 – Piston Type	Bootstrap
Bombardier CRJ 700/900	3000 psi (20 690 kPa)	3	AS1241	2 – Engine driven pumps 2 - AC pumps	2 - AC pumps	5 – Piston Type	Bootstrap
Embraer ERJ-135/140/145	3000 psi (20 690 kPa)	2	AS1241	2 – Engine driven pumps	2 - DC Pumps	2 – Piston Type	Bootstrap
Embraer ERJ-170/175/190/195	3000 psi (20 690 kPa)	3	AS1241	2 – Engine driven pumps 1 - AC pump	3 - AC pumps 1 - Power Transfer Unit	5 – Piston Type	Bootstrap
Fokker 70/100	3000 psi (20 690 kPa)	2	AS1241	4 – Engine driven pumps	2 - AC pumps	2 – Piston Type	Air pressurized
McDonnell Douglas DC-8-60/70	3000 psi (20 690 kPa)	1 + 2 Subsystems	AS1241	2 – Engine driven pumps	4 - AC pumps	11 – Bladder Type	Air pressurized; Bootstrap, Sump
McDonnell Douglas DC-9-10/20/30/40/50	3000 psi (20 690 kPa)	2	AS1241	2 – Engine driven pumps	1 - AC pump 1 - Power Transfer Unit	10 – Bladder Type 1 – Transfer Cylinder	Bootstrap

- 4.1 Aerospatiale/BAC Concorde
- 4.1.1 Design Requirements: Concorde TSS Standards
- 4.1.2 System Pressure: 4000 psi (27 586 kPa)
- 4.1.3 Hydraulic Fluid: Silicate-ester
- 4.1.4 Number of Hydraulic Systems: 3 - Blue System, Yellow System, Green System
- 4.1.5 System Temperature: -65 to +300 °F (-54 to +149 °C)
- 4.1.6 Main Hydraulic Pump Data
- 4.1.6.1 Engine Driven Pump: 4 per aircraft; 2 in Green System, 2 in Blue System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 33.8 gpm (128 L/min) at 3840 psi (26 500 kPa)
Displacement: 2.15 in³/rev (35.4 mL/rev)
Rated Speed: 3920 rpm
Rotation from Shaft End: Counter clockwise
- 4.1.6.2 Engine Driven Pump: 2 in Yellow System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 18.5 gpm (70 L/min) at 3840 psi (26 500 kPa)
Displacement: 1.18 in³/rev (19.3 mL/rev)
Rated Speed: 3920 rpm
Rotation from Shaft End: Clockwise
- 4.1.7 Back-up Pump Data
- 4.1.7.1 Ram Air Turbine Driven Pump: 1 in Green System (Emergency electrical generator supply)
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 15.5 gpm (59 L/min) at 3650 psi (25 172 kPa)
Displacement: 0.75 in³/rev (18.84 mL/rev)
Rated Speed: 5200 rpm
- 4.1.7.2 Ram Air Turbine Driven Pump: 1 in Yellow System (Flight controls supply)
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 12.1 gpm (46 L/min) at 3650 psi (25 172 kPa)
Displacement: 0.587 in³/rev (9.61 mL/rev)
Rated Speed: 5200 rpm
- 4.1.7.3 AC Electric Motor Pump: 2 per aircraft; 1 in Green/Yellow System; 1 in Blue/Yellow System (Ground use only)
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 0 gpm (0 L/min) at 3480 psi (24 000 kPa); 7.4 gpm (28 L/min) at 3335 psi (23 000 kPa)
Displacement: 0.23 in³/rev (3.77mL/rev)
Rated Speed: 7700 rpm

4.1.8 Hydraulic Motor Data

4.1.8.1 Fuel Transfer Pump Motor: 2 per aircraft

Type: Fixed displacement
Displacement: 0.043 in³/rev (0.70 mL/rev)
Running Speed: 6000 rpm
Flow at Rated Pressure Differential: 1.1 gpm (4.3 L/min)

4.1.8.2 Intake Ramp Door Actuator: 8 per aircraft

Type: Fixed displacement
Displacement: 0.53 in³/rev (8.7 mL/rev)
Running Speed: 7000 rpm
Flow at Rated Pressure Differential: 17.4 gpm (66 L/min)

4.1.8.3 Constant Speed Motor Electrical Generator: 1 per aircraft

Type: Variable displacement
Displacement: 1.10 in³/rev (18.0 mL/rev)
Running Speed: 8000 rpm
Flow at Rated Electrical Load/Pressure Differential: 28.0 gpm (127 L/min) at 3000 psi (20 690 kPa)

4.1.9 Accumulator Data

4.1.9.1 Power Generation System: 3 per aircraft; 1 per system

Type: Piston, gas charged
Volume: 122 in³ (2.0 L)
Precharge Pressure: 2300 psi (15 800 kPa)

4.1.9.2 Braking System: 1 in Yellow braking system

Type: Piston, gas charged
Volume: 358 in³ (5.9 L)
Precharge Pressure: 2300 psi (15 800 kPa)

4.1.10 Reservoir Data

4.1.10.1 Green System

Type: Metal bellows, air pressurized
Maximum Volume: 7.1 gal (27.1 L)
Full Volume: 4.0 gal (15.0 L)
Pressure: 65 psig (450 kPa)

4.1.10.2 Yellow System

Type: Metal bellows, air pressurized
Maximum Volume: 9.0 gal (34.0 L)
Full Volume: 5.8 gal (22.0 L)
Pressure: 65 psig (450 kPa)

4.1.10.3 Blue System

Type: Metal bellows, air pressurized
Maximum Volume: 4.1 gal (15.5 L)
Full Volume: 2.1 gal (8.0 L)
Pressure: 65 psig (450 kPa)

4.1.11 Relief Valve Data

4.1.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Cracking Pressure: 4756 psi (32 800 kPa)
Reseat Pressure: 4466 psi (30 800 kPa)
Rated Flow: 35 gpm (132 L/min)

4.1.11.2 Thermal Relief Valve: 1 in Yellow braking system
Cracking Pressure: 4756 psi (32 800 kPa)
Reseat Pressure: 4466 psi (30 800 kPa)
Rated Flow: 0.3 gpm (1 L/min)

4.1.12 Filtration

4.1.12.1 Pressure Filtration: 9 per aircraft
Location: 1 in each main and auxiliary pump delivery line
Filtration Rating: 10 µm

4.1.12.2 Case Drain Filtration: 9 per aircraft
Location: 1 in each main and auxiliary pump line
Filtration Rating: 50 µm

4.1.12.3 Return Filtration: 3 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 3 µm

4.1.13 Tubing Data

4.1.13.1 High Pressure Lines

4.1.13.1.1 Material Specification: Ti 3Al 2.5V Titanium alloy
Diameters/Wall Thicknesses: 0.188/0.018 in (4.775/0.457), 0.25/0.018 in (6.35/0.457 mm), 0.313/0.020 in (7.937/0.508 mm), 0.375/0.024 in (9.53/0.610 mm), 0.5/0.032 in (12.7/0.813 mm), 0.625/0.04 in (15.875/1.016 mm), 0.75/0.048 in (19.05/1.219 mm), 1.0/0.064 in (25.4/1.626 mm)

4.1.13.1.2 Material Specification: Stainless steel per AM350 (nacelle areas)
Diameters/Wall Thicknesses: 0.188/0.018 in (4.775/0.457), 0.25/0.018 in (6.35/0.457 mm), 0.313/0.022 in (7.937/0.559 mm), 0.375/0.024 in (9.53/0.610 mm), 0.5/0.032 in (12.7/0.813 mm), 0.625/0.048 in (15.875/1.219 mm), 0.75/0.056 in (19.05/1.422 mm)

4.1.13.2 Low Pressure Lines

4.1.13.2.1 Material Specification: Aluminum alloy per AG 4 MC
Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.313/0.028 in (7.94/0.711 mm), 0.375/0.028 in (9.35/0.711 mm), 0.5/0.032 in (12.7/0.813 mm), 0.625/0.036 in (15.875/0.914 mm), 0.75/0.036 in (9.53/0.914 mm), 1.0/0.036 in (25.4/0.914 mm), 1.25/0.036 in (31.75/0.914 mm), 1.5/0.036 in (38.1/0.914 mm)

4.1.13.2.2 Material Specification: Annealed steel per Z3CN18 (fire zones)
Diameters/Wall Thicknesses: 0.313/0.018 in (7.937/0.457 mm), 0.375/0.018 in (9.35/0.457 mm), 0.5/0.018 in (12.7/0.457 mm), 0.625/0.018 in (15.875/0.457 mm), 0.75/0.018 in (9.53/0.457 mm), 1.0/0.020 in (25.4/0.51 mm), 1.25/0.022 in (31.75/0.56 mm)

4.1.14 Fitting Data

4.1.14.1 Separable Type: Not known

Material: Stainless steel for high pressure, Aluminum alloy for low pressure

End Connections: Internal swage, external pressure swage

4.1.14.2 Permanent Type: Externally pressure swaged

Material: Stainless steel for high pressure, Aluminum alloy for low pressure

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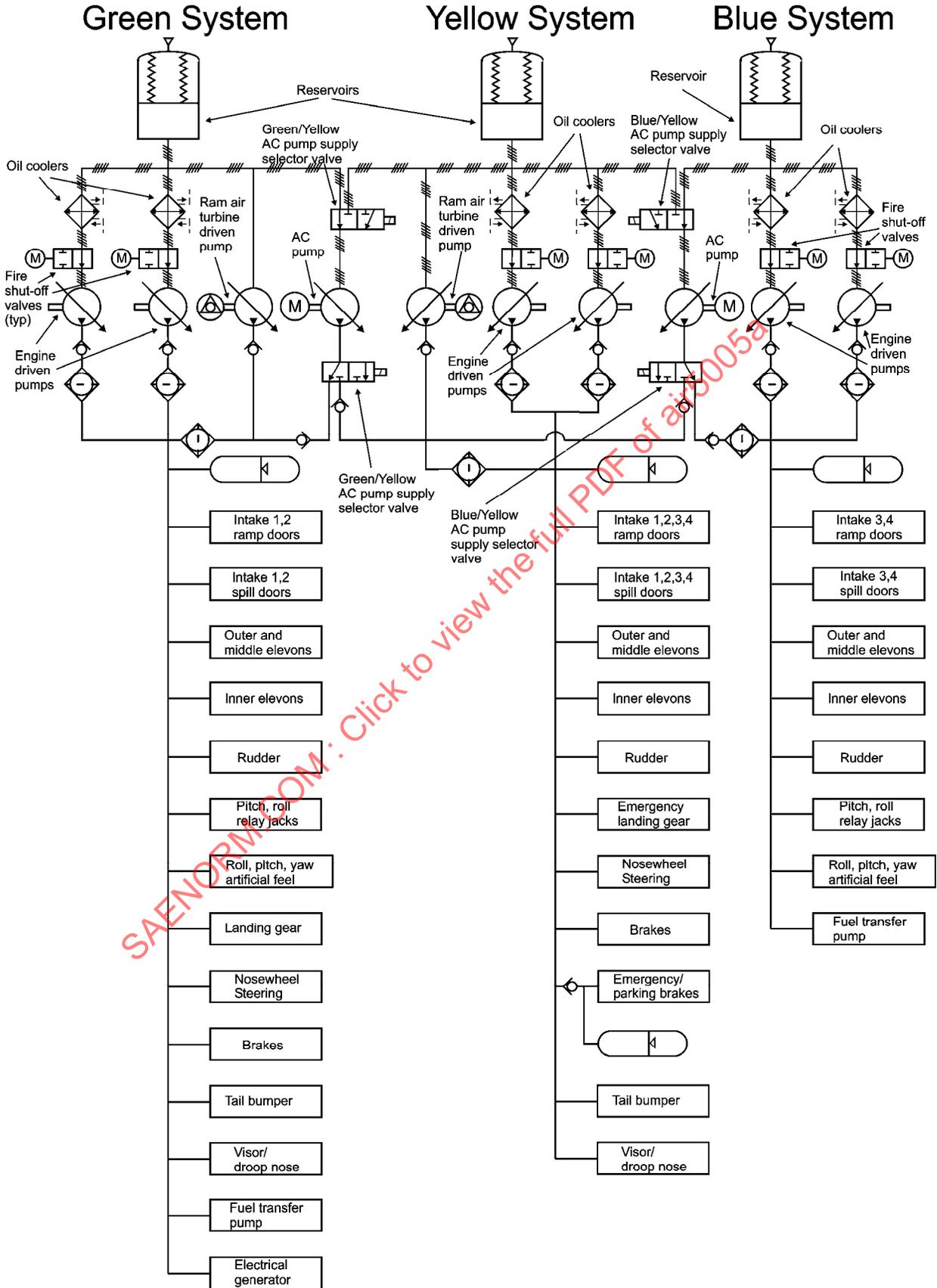


FIGURE 4.1 - AEROSPATIALE/BAC CONCORDE HYDRAULIC SYSTEM SCHEMATIC

4.2 Airbus A318/A319/A320/A321

4.2.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.2.2 System Pressure: 3000 psi (20 690 kPa)

4.2.3 Hydraulic Fluid: AS1241

4.2.4 Number of Hydraulic Systems: 3 – Blue System, Yellow System, Green System

4.2.5 System Temperature: -65 to +224 °F (-54 to +107 °C)

4.2.6 Main Hydraulic Pump Data

4.2.6.1 Engine Driven Pump: 2 per aircraft; 1 in Green System, 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 37 gpm (140 L/min) at 2950 psi (20 345 kPa)
Displacement: 2.40 in³/rev (39.3 mL/rev)
Rated Speed: 3720 rpm
Rotation from Shaft End: Clockwise

4.2.6.2 AC Electric Motor Pump: 1 in Blue System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 6.1 gpm (23 L/min) at 2840 psi (19 586 kPa); 8.5 gpm (32 L/min) at 2175 psi (15 000 kPa)
Displacement: 0.263 in³/rev (4.30 mL/rev)
Rated Speed: 7600 rpm

4.2.7 Back-up Pump Data

4.2.7.1 AC Electric Motor Pump: 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 6.1 gpm (23 L/min) at 2840 psi (19 586 kPa); 8.5 gpm (32 L/min) at 2175 psi (15 000 kPa)
Displacement: 0.263 in³/rev (4.30 mL/rev)
Rated Speed: 7600 rpm

4.2.7.2 Ram Air Turbine Driven Pump: 1 in Blue System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 15.3 gpm (58 L/min) at 2840 psi (19 586 kPa); 20.6 gpm (78 L/min) at 2175 psi (15 000 kPa)
Displacement: 1.15 in³/rev (18.84 mL/rev)
Rated Speed: 5400 rpm

4.2.7.3 Power Transfer Unit: 1 in Green System to power Yellow System or vice-versa

Type: Bi-directional fixed displacement bent axis piston hydraulic motor pump combined with a variable displacement inline piston motor pump
Rated Flow and Speed: Yellow to Green - 23.10 gpm (90 L/min) at 6962 rpm
Green to Yellow - 13.10 gpm (50 L/min) at 4909 rpm
Displacement: Fixed displacement motor - 0.815 in³/rev (13.106 mL/rev)
Variable displacement pump - 0.655 in³/rev (0.73 mL/rev) pump operation; 0.980 in³/rev (16.06 mL/rev) motor operation; 0.815 in³/rev (13.106 mL/rev) at neutral

4.2.7.4 Hand Pump: 1 in Yellow System to open cargo door

Pressure - Displacement: 500 - 725 psi (3 448 - 5 000 kPa); 1.8 in³ (30 mL)/cycle

- 4.2.7.5 Hand Pump: 1 in Green System to fill hydraulic systems
Pressure - Displacement: 725 - 3000 psi (5000 - 20 690 kPa); 0.6 in³ (10 mL)/cycle
- 4.2.8 Hydraulic Motor Data
- 4.2.8.1 Flap Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.33 in³/rev (5.41 mL/rev)
Running Speed: 3500 rpm
Flow at Rated Pressure Differential: 5.2 gpm (18.9 L/min)
- 4.2.8.2 Slat Motor: 2 per aircraft
Type: Fixed displacement
Displacement: 0.33 in³/rev (5.41 mL/rev)
Running Speed: 3500 rpm
Flow at Rated Pressure Differential: 5.2 gpm (18.9 L/min)
- 4.2.8.3 Trimming Horizontal Stabilizer Actuator: 2 per aircraft
Type: Fixed displacement
Displacement: 0.17 in³/rev (2.76 mL/rev)
Running Speed: 3600 rpm
Flow at Rated Pressure Differential: 6.1 gpm (22 L/min)
- 4.2.8.4 Constant Speed Motor Electrical Generator: 1 per aircraft
Type: Variable displacement
Displacement: 0.22 in³/rev (3.61 mL/rev)
Running Speed: 12000 rpm
Flow at Rated Electrical Load/Pressure Differential: 7.7 gpm (35 L/min) at 2465 psi (17 000 kPa)
- 4.2.9 Accumulator Data
- 4.2.9.1 Power Generation System: 3 per aircraft, 1 per system
Type: Bladder separator, gas charged
Volume: 60 in³ (1.0 L)
Precharge Pressure: 1885 psi (13 000 kPa)
- 4.2.9.2 Load Alleviation System 4 per aircraft (A320 only); 2 in Green System 2 in Yellow System
Type: Bladder separator, gas charged
Volume: 60 in³ (1.0 L)
Precharge Pressure: 1885 psi (13 000 kPa)
- 4.2.9.3 Braking System: 1 in Yellow System
Type: Bladder separator, gas charged
Volume: 366 in³ (6.0 L)
Precharge Pressure: 1450 psi (10 000 kPa)
- 4.2.10 Reservoir Data
- 4.2.10.1 Green System
Type: Air pressurized
Volume: 6.1 gal (23 L)
Pressure: 51 psig (352 kPa)
- 4.2.10.2 Yellow System
Type: Air pressurized
Volume: 5.3 gal (20 L)
Pressure: 51 psig (352 kPa)

4.2.10.3 Blue System

Type: Air pressurized
Volume: 2.6 gal (10 L)
Pressure: 51 psig (352 kPa)

4.2.11 Relief Valve Data

4.2.11.1 Main System Relief Valve: 3 per aircraft; 1 per system

Cracking Pressure: 3437 psi (23 700 kPa)
Reseat Pressure: 3190 psi (22 000 kPa)
Rated Flow: 37 gpm (140 L/min)

4.2.11.2 Thermal Relief Valve: 1 per aircraft on alternate braking system

Cracking Pressure: 3800 psi (26 207 kPa)
Reseat Pressure: 3500 psi (24 138 kPa)
Rated Flow: 0.02 gpm (0.08 L/min)

4.2.12 Filtration

4.2.12.1 Pressure Filtration: 4 per aircraft

Location: 1 in each system; Green brake system
Filtration Rating: 15 µm

4.2.12.2 Case Drain Filtration: 2 per aircraft

Location: 1 in each main pump line
Filtration Rating: 15 µm

4.2.12.3 Return Filtration: 3 per aircraft;

Location: 1 in each return line upstream of the reservoir
Filtration Rating: 3 µm

4.2.13 Tubing Data

4.2.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS 4945
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)

4.2.13.2 Low Pressure Lines

4.2.13.2.1 Material Specification: 6061-T6 Aluminum alloy per AMS 4083

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (9.53/0.889 mm), 1.0/0.048 in (25.4/1.219 mm), 1.5/0.035 in (38.1/0.889 mm)

4.2.13.2.2 Material Specification: 21-6-9 CRES per AMS 5561 (fire zones, tire burst areas, pipe diameter greater than 1 in (25.4 mm))

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.5/0.026 in (12.7/0.66 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (9.53/0.991 mm), 1.0/0.052 in (25.4/1.321 mm), 1.5/0.024 in (38.1/0.609 mm)

4.2.13.2.3 Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945 (Nose and main landing gear bay, exposed areas, wing fuel tank)
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)

4.2.14 Fitting Data

- 4.2.14.1 Separable Type: 24 degree flareless
Material: Stainless steel for high pressure, Aluminum alloy for low pressure
End Connections: Internal swage, external pressure swage
- 4.2.14.2 Permanent Type: Externally pressure swaged
Material: Stainless steel for high pressure, Aluminum alloy for low pressure

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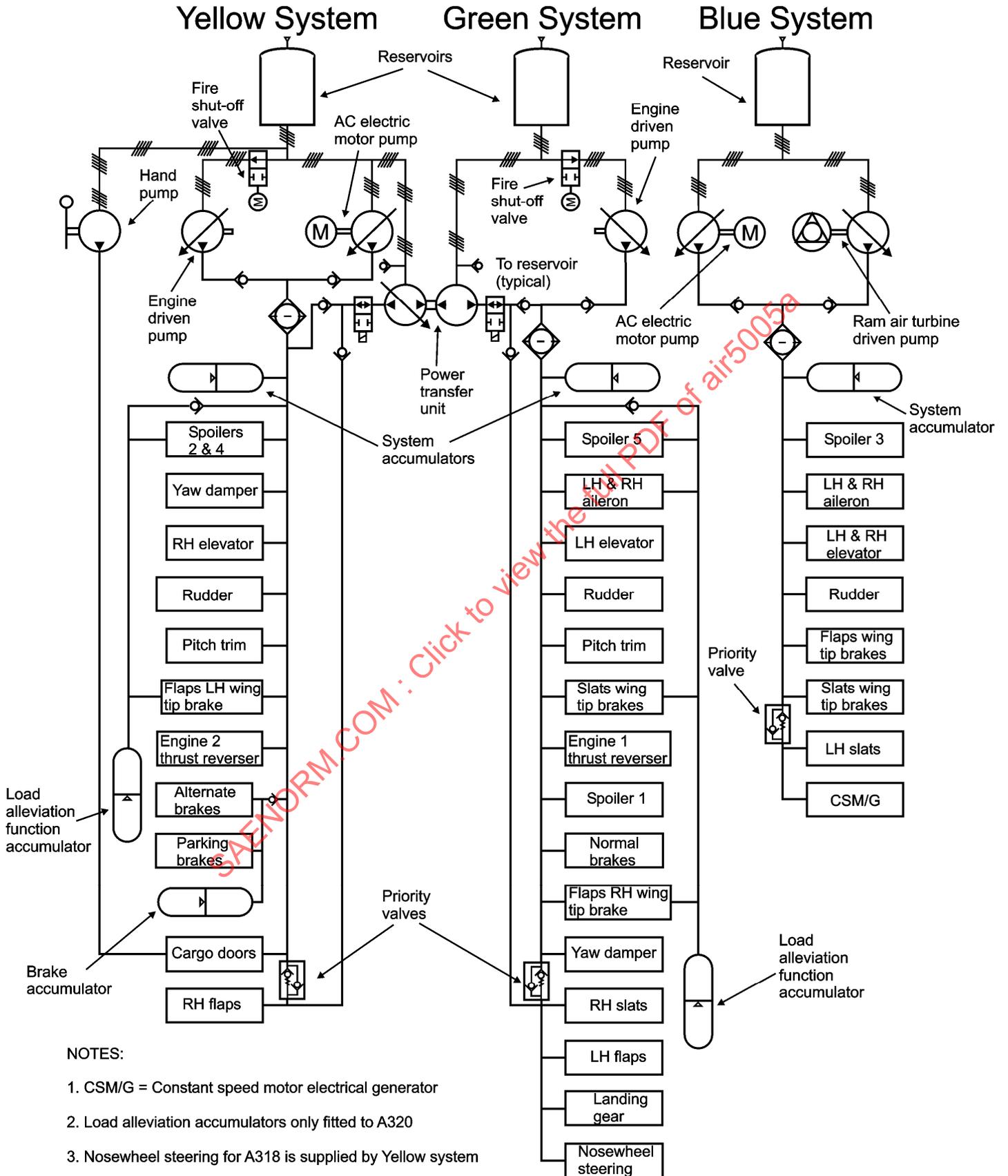


FIGURE 4.2 - AIRBUS A318/A319/A320/A321 HYDRAULIC SYSTEM SCHEMATIC

4.3 BAC 111-500

4.3.1 Design Requirements: BCAR Section D/14CFR Part 25 requirements

4.3.2 System Pressure: 3000 psi (20 690 kPa)

4.3.3 Hydraulic Fluid: AS1241

4.3.4 Number of Hydraulic Systems: 2 – No. 1 System, No. 2 System

4.3.5 System Temperature: -40 to +194 °F (-40 to +90 °C)

4.3.6 Main Hydraulic Pump Data

4.3.6.1 Engine Driven Pump: 2 per aircraft; 1 in No. 1 System, 1 in No. 2 System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 22.5 gpm (85.2 L/min) at 2950 psi (20 345 kPa)

Displacement: 1.60 in³/rev (26.2 3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise or clockwise (engine dependant)

4.3.7 Back-up Pump Data

4.3.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in No. 1 System, 1 in No. 2 System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 5.0 gpm (19 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.22 in³/rev (3.61 mL/rev)

Rated Speed: 7600 rpm

4.3.7.2 DC Electric Motor Pump: 1 in No. 2 System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 0.48 gpm (1.8 L/min) at 2950 psi (20 345 kPa)

Displacement: 0.07 in³/rev (1.15 mL/rev)

Rated Speed: 2000 rpm – pump, 8500 rpm - motor

4.3.8 Hydraulic Motor Data

4.3.8.1 Flap Motor: 2 per aircraft

Type: Fixed displacement

Displacement: Not known

Rated Speed: Not known

4.3.8.2 Tailplane Actuator Motor 2 per aircraft

Type: Fixed displacement

Displacement: Not known

Rated Speed: Not known

4.3.9 Accumulator Data

4.3.9.1 Power Generation System: 2 per aircraft; 1 per system

Type: Piston, gas charged

Volume: 97 in³ (1.6 L)

Precharge Pressure: 2000 psi (13 793 kPa)

- 4.3.9.2 Nosewheel Steering System: 1 in No. 1 System
Type: Piston, gas charged
Volume: 97 in³ (1.6 L)
Precharge Pressure: 1500 psi (0345 kPa)
- 4.3.9.3 Braking System: 1 in No. 2 System
Type: Piston, gas charged
Volume: 204 in³ (3.3 L)
Precharge Pressure: 1000 psi (6897 kPa)
- 4.3.9.4 Braking System: 1 in No. 2 System (standby brakes)
Type: Piston, gas charged
Volume: 97 in³ (1.6 L)
Precharge Pressure: 1500 psi (0345 kPa)
- 4.3.10 Reservoir Data
- 4.3.10.1 No.1 System
Type: Air pressurized
Volume: 3.3 gal (13 L)
Pressure: 38 psig (262 kPa)
- 4.3.10.2 No.2 System
Type: Air pressurized
Volume: 4.7 gal (18 L)
Pressure: 38 psig (262 kPa)
- 4.3.10.3 No.2 System Emergency
Type: Air pressurized
Volume: 1.4 gal (5 L)
Pressure: 38 psig (262 kPa)
- 4.3.11 Relief Valve Data
- 4.3.11.1 Main System Relief Valve: 2 per aircraft; 1 per system
Cracking Pressure: 3500 psi (24 138 kPa)
Reseat Pressure: 3400 psi (23 448 kPa)
Rated Flow: 21.6 gpm (82 L/min)
- 4.3.12 Filtration
- 4.3.12.1 Pressure Filtration: 5 per aircraft
Location: 1 in each pump delivery line
Filtration Rating: 15 µm
- 4.3.12.2 Case Drain Filtration: 2 per aircraft
Location: 1 in each EDP line
Filtration Rating: 15 µm
- 4.3.12.3 Return Filtration: 5 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 3 µm

4.3.13 Tubing Data

4.3.13.1 High Pressure Lines

Material Specification: 304 - 1/8 hard CRES per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.051 mm), 0.312/0.020 in (7.938/0.051 mm), 0.375/0.028 in (9.53/0.711 mm), 0.5/0.035 in (12.7/0.889 mm)

4.3.13.2 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS 4083

Diameters/Wall Thicknesses: 0.375/0.035 in (9.35/0.889 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 1.0/0.042 in (25.4/1.067 mm)

4.3.14 Fitting Data

4.3.14.1 Separable Type: 24 degree flareless

Material: Stainless steel for high pressure, Aluminum alloy for low pressure

End Connections: Bite type

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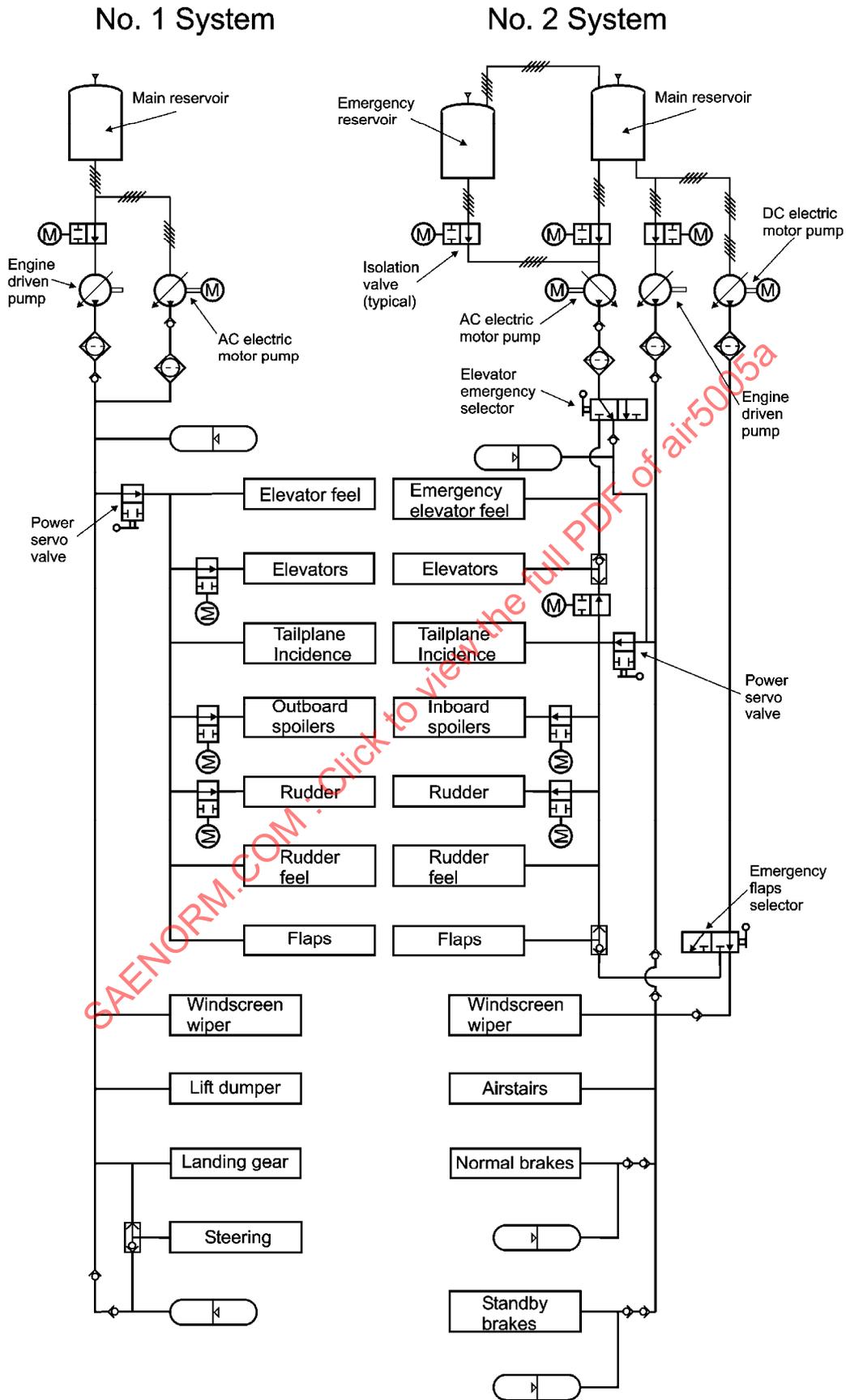


FIGURE 4.3 - BAC 111-500 HYDRAULIC SYSTEM SCHEMATIC

4.4 BAE Systems 146-100/200/300/Avro RJ70/85/100/115

4.4.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.4.2 System Pressure: 3000 psi (20 690 kPa)

4.4.3 Hydraulic Fluid: AS1241

4.4.4 Number of Hydraulic Systems: 2 - Green System, Yellow System

4.4.5 System Temperature: -65 to +194 °F (-54 to +90 °C)

4.4.6 Main Hydraulic Pump Data

4.4.6.1 Engine Driven Pump: 2 per aircraft; 1 in Green System 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Speed: 5000 rpm

Rotation from Shaft End: Clockwise

4.4.6.1.1 All BAE Systems 146 and Avro RJ aircraft up to mid 1997

Rated Flow-Pressure: 15.0 gpm (56.8 L/min) at 2950 psi (20 345 kPa)

Displacement: 0.75 in³/rev (12.29 mL/rev)

4.4.6.1.2 All Avro RJ aircraft since mid 1997

Rated Flow-Pressure: 20.5 gpm (77.5 L/min) at 2950 psi (20 345 kPa)

Displacement: 1.00 in³/rev (15.63 mL/rev)

4.4.7 Back-up Pump Data

4.4.7.1 AC Electric Motor Pump: 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa); 6.0 gpm (22.7 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.26 in³/rev (4.26 mL/rev)

Rated Speed: 7600 rpm

4.4.7.2 DC Electric Motor Pump 1 in Yellow System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 0.48 gpm (1.8 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.07 in³/rev (1.15 mL/rev)

Rated Speed: 2000 rpm

4.4.7.3 Power Transfer Unit: 1 in Yellow System to drive Green System

Type: Unidirectional fixed displacement inline piston motor driving a fixed displacement inline piston pump

Rated Flow-Pressure: 10.8 gpm (41.0 L/min) at 2205 psi (15 000 kPa)

Displacement: 0.55 in³/rev (9.0 mL/rev) pump and motor

Rated Speed: 4790 rpm

4.4.8 Hydraulic Motor Data

4.4.8.1 Flap Motor: 2 per aircraft

Type: Fixed displacement inline axial piston

Displacement: 0.15 in³/rev (2.46 mL/rev)

Running Speed: 4500 rpm

Flow at Rated Pressure Differential: 2.7 gpm (10.2 L/min)

- 4.4.8.2 Constant Speed Motor Electrical Generator: 1 per aircraft
Type: Variable displacement inline axial piston
Displacement: 0.25 in³/rev (4.10 mL/rev)
Running Speed: 12 000 rpm
Flow at Rated Pressure Differential: 10.0 gpm (37.9 L/min) at 2300 psi (15 862 kPa) - unit supplying 6 kVA with power factor = 1.0
- 4.4.8.3 Auxiliary Fuel Pump: 2 per aircraft
Type: Gear motor
Displacement: Not known
Running Speed: Not known
Flow at Rated Pressure Differential: 2.7 gpm (10.2 L/min)
- 4.4.9 Accumulator Data
- 4.4.9.1 Power Generation System: 1 in Green system
Type: Piston, gas charged
Volume: 114 in³ (1.87 L)
Precharge Pressure: 1000 psi (6 897 kPa)
- 4.4.9.2 Braking System: 1 in Yellow system
Type: Piston, gas charged
Volume: 114 in³ (1.87 L)
Precharge Pressure: 1000 psi (6 897 kPa)
- 4.4.10 Reservoir Data
- 4.4.10.1 Green System
Type: Air pressurized
Full Volume: 2.8 gal (10.7 L)
Total Volume: 4.1 gal (15.6 L)
Pressure: 50 psi (344.8 kPa)
- 4.4.10.2 Yellow System
Type: Air pressurized
Full Volume: 3.10 gal (11.9 L)
Total Volume: 4.1 gal (15.6 L)
Pressure: 50 psi (344.8 kPa)
- 4.4.11 Relief Valve Data
- 4.4.11.1 Main System Relief Valve: 2 per aircraft; 1 per system
Relief Pressure: 3850 psi (26 551 kPa)
Rated Flow: 15.0 gpm (56.8 L/min)
Reseat Pressure: 3200 psi (22 068 kPa)
- 4.4.11.2 DC Pump Relief Valve: 1 per aircraft in Yellow braking system
Relief Pressure: 3850 psi
Rated Flow: 0.5 gpm (1.9 L/min)
Reseat Pressure: 3200 psi (22 068 kPa)
- 4.4.12 Filtration
- 4.4.12.1 Pressure Filtration: 3 per aircraft
Location: 1 in Green System 1 in Yellow System; 1 in DC pump delivery line
Filtration Rating: 15 µm

4.4.12.2 Return Filtration: 2 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

4.4.13 Tubing Data

4.4.13.1 High Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.313/0.020 in (7.95/0.508 mm), 0.375/0.020 in (9.53/0.508 mm), 0.625/0.033 in (15.875/0.838 mm)

4.4.13.2 Low Pressure Lines

Material Specification: 6061-T6 Aluminum Alloy per AMS4083

Diameters/Wall Thicknesses: 0.313/0.035 in (7.95/0.889 mm), 0.375/0.035 in (9.53/0.889 mm) 0.50/0.035 in (12.7/0.889 mm), 1.00/0.035 in (25.4/0.889 mm)

4.4.14 Fitting Data

4.4.14.1 Separable Type: 24 degree flareless

Material: Al, CRES

End Connections: Internal swage

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Green System

Yellow System

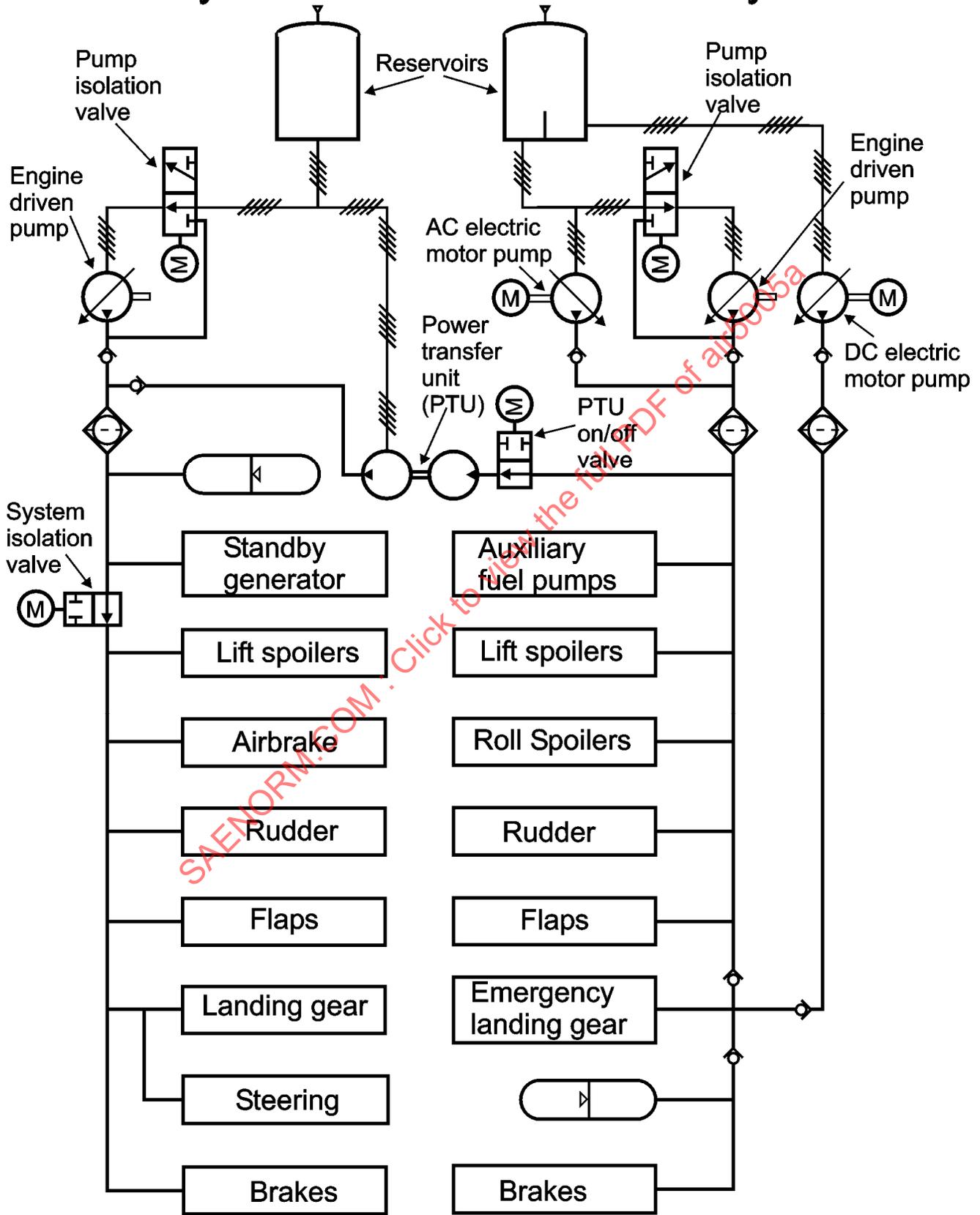


FIGURE 4.4 - BAE SYSTEMS 146-100/200/300/AVRO RJ70/85/100/115 HYDRAULIC SYSTEM SCHEMATIC

4.5 Boeing 707-120/320/420

4.5.1 Design Requirements: 14CFR Part 25 requirements

4.5.2 System Pressure: 3000 psi (20 690 kPa)

4.5.3 Hydraulic Fluid: AS1241

4.5.4 Number of Hydraulic Systems: 3 – Utility System, #1 Auxiliary System, #2 Auxiliary System

4.5.5 System Temperature: -65 to +230 °F (-54 to +110 °C)

4.5.6 Main Hydraulic Pump Data

4.5.6.1 Engine Driven Pump: 2 in Main System

Type: Variable displacement, pressure compensated, inline or bent-axis piston

Rated Flow-Pressure: 22.5 gpm (85.2 L/min) at 2850 psi (19 655 kPa)

Displacement: 1.60 in³/rev (26.2 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

4.5.7 Back-up Pump Data

4.5.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in #1 Auxiliary System, 1 in #2 Auxiliary System

Type: Variable displacement, pressure compensated, inline or yoke-type piston

Rated Flow-Pressure: 3.2 gpm (12.1 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.16 in³/rev (2.63 mL/rev)

Rated Speed: 5000 rpm

Note: This is a typical pump; data will vary with other pumps fitted

4.5.8 Hydraulic Motor Data

4.5.8.1 Flap Motor: 1 per aircraft

Type: Fixed displacement

Displacement: 0.598 in³/rev (9.8 mL/rev)

Running Speed: 3200 rpm

Flow at Rated Pressure Differential: 12.0 gpm (45.4 L/min) at 2850 psi (19 655 kPa)

4.5.9 Accumulator Data

4.5.9.1 Power Generation System: 1 in Utility system

Type: Piston, gas charged

Volume: 25 in³ (0.41 L)

Precharge Pressure: 2000 psi (13 793 kPa)

4.5.9.2 Power Generation System: 2 in Auxiliary system (combined)

Type: Piston, gas charged

Volume: 50 in³ (0.82 L)

Precharge Pressure: 1000 psi (6 897 kPa)

4.5.9.3 Braking System: 1 in Back-up system

Type: Piston, gas charged

Volume: 200 in³ (32.79 L)

Precharge Pressure: 750 psi (5172 kPa)

4.5.10 Reservoir Data

4.5.10.1 Main System

Type: Air pressurized
Volume: 5.4 gal (20.4 L)
Full Volume: 6.9 gal (26.1 L)
Pressure: 45 psig (310 kPa)

4.5.10.2 #1 Auxiliary System

Type: Air pressurized
Volume: 1.25 gal (4.7 L)
Pressure: 45 psig (310 kPa)

4.5.10.3 #2 Auxiliary System

Type: Air pressurized
Volume: 1.25 gal (4.7 L)
Pressure: 45 psig (310 kPa)

4.5.11 Relief Valve Data

4.5.11.1 Main System Relief Valve:

2 per aircraft 1 in Utility System; 1 in combined #1 and #2 Auxiliary System
Cracking Pressure: 3400 to 3600 psi (23 448 to 24 828 kPa)
Relief Pressure: Not known
Rated Flow: Not known
Reseat Pressure: Not known

4.5.12 Filtration

4.5.12.1 Pressure Filtration: 4 per aircraft

Location: 1 in each engine driven and electric motor pump delivery line
Filtration Rating: 15 µm

4.5.12.2 Case Drain Filtration: 2 per aircraft

Location: 1 in each Engine Driven Pump line
Filtration Rating: 25 µm

4.5.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

4.5.13 Tubing Data

4.5.13.1 High Pressure/Fire Zones Lines

Material Specification: AISI 304 CRES per MIL-T-6845 or (optional) AISI 304 CRES per AMS5566, AISI 304 CRES per MIL-T-8504 (annealed), AISI 321 CRES per MIL-T-8808 (annealed), AISI 347 CRES per MIL-T-8808 (annealed)
Diameters/Wall Thicknesses: 0.188/0.020 in (4.76/0.508 mm), 0.25/0.020 in (6.35/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.049 in (15.875/1.245 mm), 0.75/0.058 in (19.05/1.473 mm), 1.25/0.035 in (31.75/0.889 mm)

4.5.13.2 Low Pressure Lines

4.5.13.2.1 Material Specification: Up to and including tube diameters, 0.75 in (19.05 mm) 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.188/0.035 in (4.76/0.889 mm), 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm)

4.5.13.2.2 Material Specification: Diameters greater than 0.75 in (19.05 mm), 5052-0 Aluminum alloy per WW-T-787

Diameters/Wall Thicknesses: 1.25/0.035 in (31.75/0.889 mm)

4.5.14 Fitting Data

4.5.14.1 Separable Type: 24degree flareless or 37 degree flared (limited use)

Material: Aluminum and Corrosion Resistant Steel

End Connections: Bite type

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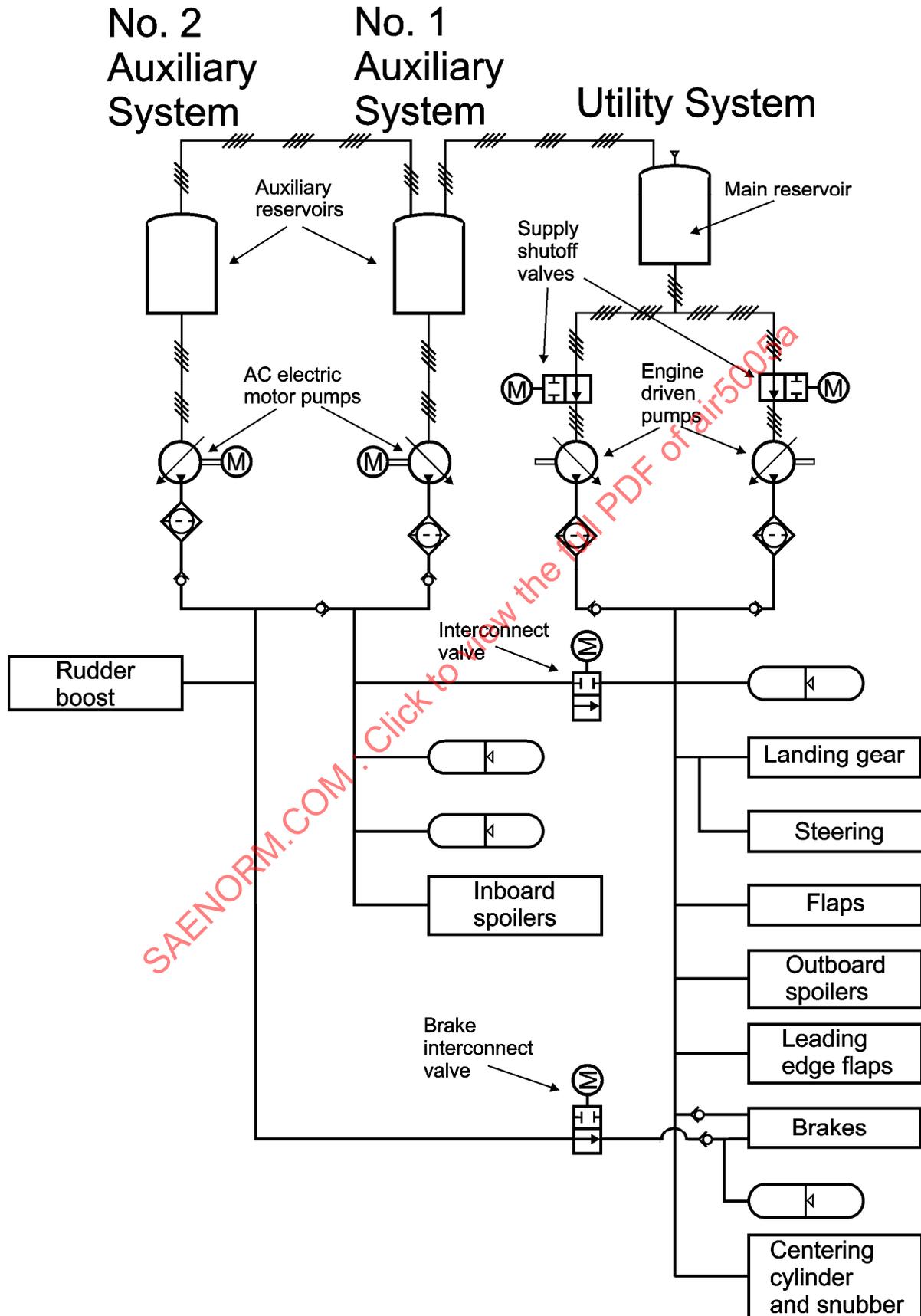


FIGURE 4.5 - BOEING 707-120/320/420 HYDRAULIC SYSTEM SCHEMATIC

4.6 Boeing 717-200

4.6.1 Design Requirements: 14CFR Part 25 requirements

4.6.2 System Pressure: 3000 psi (20 690 kPa)

4.6.3 Hydraulic Fluid: AS1241

4.6.4 Number of Hydraulic Systems: 2 - Left System, Right System

4.6.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

4.6.6 Main Hydraulic Pump Data

4.6.6.1 Engine driven pump:

2 per aircraft; 1 in Left System, 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 24.0 gpm (90.86 L/min) at 2850 psi (19 651 kPa)

Displacement: 1.60 in³/rev (26.22 mL/rev)

Rated Speed: 3600 rpm

Rotation from Shaft End: Counter clockwise

4.6.7 Back-up Pump Data

4.6.7.1 AC Electric Motor Pump: 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa)

6.0 gpm (22.7 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.26 in³/rev (4.26 mL/rev)

Rated Speed: 7600 rpm

4.6.7.2 Power Transfer Unit: 1 in Left System to power Right System or vice-versa

Type: Bi-directional fixed displacement inline piston motor pump driving/driven by a fixed displacement inline piston motor pump

Rated Flow-Pressure: 10.0 gpm (37.9 L/min)

Displacement: 0.56 in³/rev (9.18 mL/rev) pump and motor

4.6.7.3 Hand Pump: 2 per aircraft

Usage 1 in Left System, 1 in Right System, for System maintenance

4.6.8 Hydraulic Motor Data

None are fitted to this aircraft

4.6.9 Accumulator Data

4.6.9.1 Power Generation System: 2 per aircraft, 1 per system

Type: Spherical, bladder separator, gas charged

Volume: 198 in³ (3.2 L)

Precharge Pressure: 1500 psi (10 342 kPa)

4.6.9.2 Braking System: 2 per aircraft, 1 per system

Type: Spherical, bladder separator, gas charged

Volume: 198 in³ (3.2 L)

Precharge Pressure: 675 psi (4654 kPa)

- 4.6.9.3 Thrust Reverser System 2 per aircraft, 1 per system
 - Type: Spherical, bladder separator, gas charged
 - Volume: 198 in³ (3.2 L)
 - Precharge Pressure: 1000 psi (6895 kPa)

4.6.10 Reservoir Data

- 4.6.10.1 Left System
 - Type: Hydraulically pressurized
 - Full Volume: 4.3 gal (16.3 L)
 - Total Volume: 6.5 gal (24.6 L)
 - Pressure: 60 psi (413 kPa)

- 4.6.10.2 Right System
 - Type: Hydraulically pressurized
 - Full Volume: 4.8 gal (18.2 L)
 - Total Volume: 6.5 gal (24.6 L)
 - Pressure: 60 psi (413 kPa)

4.6.11 Relief Valve Data

- 4.6.11.1 Main System Relief Valve: 2 per aircraft; 1 per system
 - Relief Pressure: 3600 psi (24 822 kPa)
 - Rated Flow: 9 gpm (34 L/min)
 - Reseat Pressure: 200 psi (1379 kPa)

4.6.12 Filtration

- 4.6.12.1 Pressure Filtration: 2 per aircraft
 - Location: 1 in each Engine Driven Pump delivery line
 - Filtration Rating: 15 µm
- 4.6.12.2 Hand Pump: Filtration 2 per aircraft
 - Location: 1 in each pump delivery line (NOTE In Right System, it also functions as the AC pump pressure filter)
 - Filtration Rating: 15 µm
- 4.6.12.3 Case Drain Filtration: 2 per aircraft
 - Location: 1 for each Engine driven pump
 - Filtration: 15 µm
- 4.6.12.4 Return Filtration: 4 per aircraft
 - Location: 2 in each system return line upstream of the reservoir
 - Filtration Rating: 15 µm

4.6.13 Tubing Data

- 4.6.13.1 High Pressure Lines
 - Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945
 - Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.312/0.020 in (7.93/0.5086 mm), 0.375/0.020 in (9.525/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.88/0.813 mm)

4.6.13.2 Low Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.312/0.020 in (7.92/0.508 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.022 in (12.7/0.559 mm), 0.625/0.020 in (15.88/0.508 mm), 0.75/0.020 in (19.05/0.508mm), 1.00/0.028 in (25.4/0.711 mm)

4.6.13.3 Coiled Tubing Lines

Material Specification: Titanium, Cold-Drawn Pure

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.042 in (9.53/1.067 mm)

4.6.14 Fitting Data

4.6.14.1 Separable Type: 24 degree flareless

Material: Ti 6Al 4V Titanium alloy per AMS4928

End Connections: Brazed

4.6.14.2 Permanent Type: External pressure swage/brazed

Material: Ti 6Al 4V Titanium alloy per AMS4928

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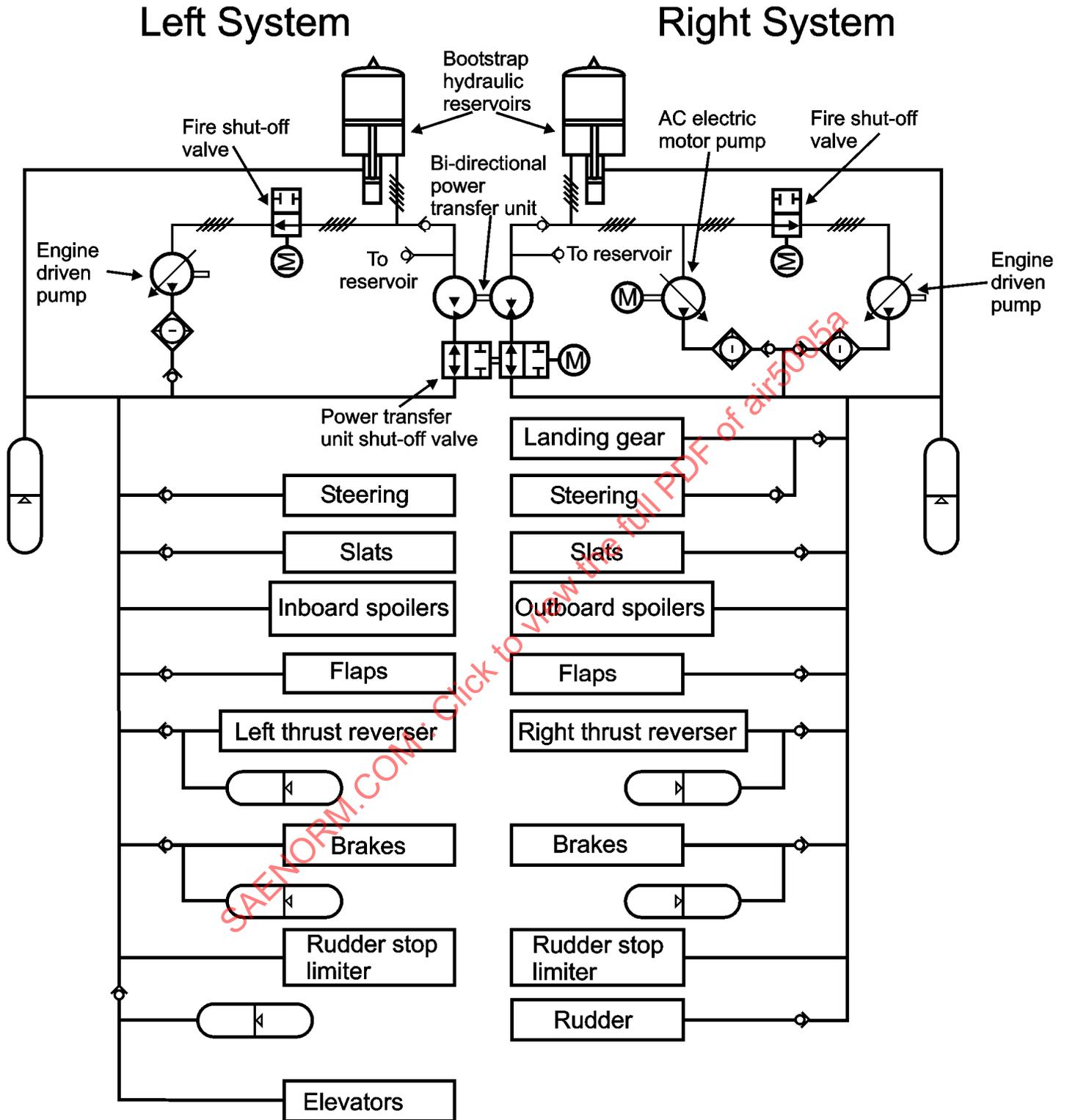


FIGURE 4.6 - BOEING 717-200 HYDRAULIC SYSTEM SCHEMATIC

4.7 Boeing 727-100/200

4.7.1 Design Requirements: 14CFR Part 25 requirements

4.7.2 System Pressure: 3000 psi (20 690 kPa)

4.7.3 Hydraulic Fluid: AS1241

4.7.4 Number of Hydraulic Systems: 3 - System A, System B, Standby System

4.7.5 System Temperature: -65 to +240 °F (-54 to +115 °C)

4.7.6 Main Hydraulic Pump Data

4.7.6.1 Engine Driven Pump: 2 in System A

Type: Variable displacement, Pressure compensated, inline or bent-axis piston

Rated Flow-Pressure: 22.5 gpm (85.2 L/min) at 2850 psi (19 655 kPa)

Displacement: 1.60 in³/rev (26.2 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

4.7.6.2 AC Electric Motor Pump: 2 in System B

Type: Variable displacement, Pressure compensated, inline or yoke-Type: piston

Rated Flow-Pressure: 5.7 gpm (21.6 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.41 in³/rev (6.72 mL/rev)

Rated Speed: 3200 rpm

Note: This is a typical pump, data will vary with other pumps fitted

4.7.7 Back-up Pump Data

4.7.7.1 AC Electric Motor Pump: 1 in Standby System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 3.10 gpm (12.1 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.16 in³/rev (2.62 mL/rev)

Rated Speed: 4500 rpm

4.7.7.2 Power Transfer Unit: 1 in Standby system to drive System B leading edge slats and flaps (alternate extend)

Type: Unidirectional fixed displacement bent axis piston motor and a fixed displacement bent axis piston pump

Rated Flow: 1.0 gpm (3.10 L/min) outlet flow with an input flow of 1.27 gpm (4.81 L/min)

Displacement: Motor - 0.095 in³/rev (1.56 mL/rev); Pump - 0.080 in³/rev (1.31 mL/rev)

Rated Speed: 3000 rpm

4.7.7.3 Hand Pump:

4.7.7.3.1 1 in System B to operate ventral stairs

Pressure - Displacement: 725 - 3000 psi (5000 - 20 690 kPa); 0.55 in³ (9 mL)/stroke

4.7.7.3.2 1 to fill hydraulic systems

Pressure - Displacement: 500 - 725 psi (3448 - 5000 kPa); 0.75 in³ (12.3 mL)/stroke

4.7.8 Hydraulic Motor Data

4.7.8.1 Inboard and Outboard Trailing Edge Flap Motors 2 per aircraft

Type: Fixed displacement

Displacement: 0.598 in³/rev (9.80 mL/rev)

Running Speed: 3280 rpm

Flow at Rated Pressure Differential: 12.0 gpm (45.5 L/min) at 2850 psi (19 655 kPa)

4.7.9 Accumulator Data

4.7.9.1 Power Generation System: 1 in System A

Type: Piston, gas charged

Volume: 25 in³ (0.41 L)

Precharge Pressure: 2000 psi (13 793 kPa)

4.7.9.2 Braking System: 1 in System B

Type: Piston, gas charged

Volume: 100 in³ (1.64 L)

Precharge Pressure: 1000 psi (6 897 kPa)

4.7.10 Reservoir Data

4.7.10.1 System A

Type: Air pressurized

Volume: 4.9 gal (18.6 L)

Pressure: 45 psig (310 kPa)

4.7.10.2 System B

Type: Air pressurized

Volume: 3.103 gal (11.9 L)

Pressure: 45 psig (310 kPa)

4.7.10.3 Standby System

Type: Air pressurized

Volume: 0.65 gal (2.5 L)

Pressure: 45 psig (310 kPa)

4.7.11 Relief Valve Data

4.7.11.1 Main System Relief Valve: 3 per aircraft; 1 per system

Cracking Pressure: 3400 to 3550 psi (23 448 to 24 483 kPa)

4.7.12 Filtration

4.7.12.1 Pressure Filtration: 5 per aircraft

Location: 1 in each engine driven and electric motor pump line

Filtration Rating: 15 µm

4.7.12.2 Case Drain Filtration: 5 per aircraft

Location: 1 in each engine driven and electric motor pump line

Filtration Rating: 25 µm

4.7.12.3 Return Filtration: 3 per aircraft

Location: 1 in each return line upstream of the reservoir

Filtration Rating: 3/15 µm System A (Dual stage); 15 µm System B, Standby

4.7.13 Tubing Data

4.7.13.1 High Pressure:/Fire Zones Lines

Material Specification: AISI 304 CRES per MIL-T-6845 or AISI 304 CRES per AMS5566 (optional)

Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.049 in (15.875/1.245 mm), 0.75/0.058 in (19.05/1.473 mm), 1.00/0.058 in (25.4/1.473 mm)

4.7.13.2 Low Pressure Lines

4.7.13.2.1 Material Specification: Up to and including tube diameters, 0.75 in (19.05 mm) 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.188/0.035 in (4.76/0.889 mm), 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm)

4.7.13.2.2 Material Specification: Diameters greater than 0.75 in (19.05 mm), 5052-0 Aluminum alloy per WW-T-787

Diameters/Wall Thicknesses: 1.00/0.035 in (25.4/0.889 mm)

4.7.14 Fitting Data

4.7.14.1 Separable Type: 24 degree flareless or 37 degree flared (limited use)

Material: Aluminum and Corrosion Resistant Steel

End Connections: Bite type

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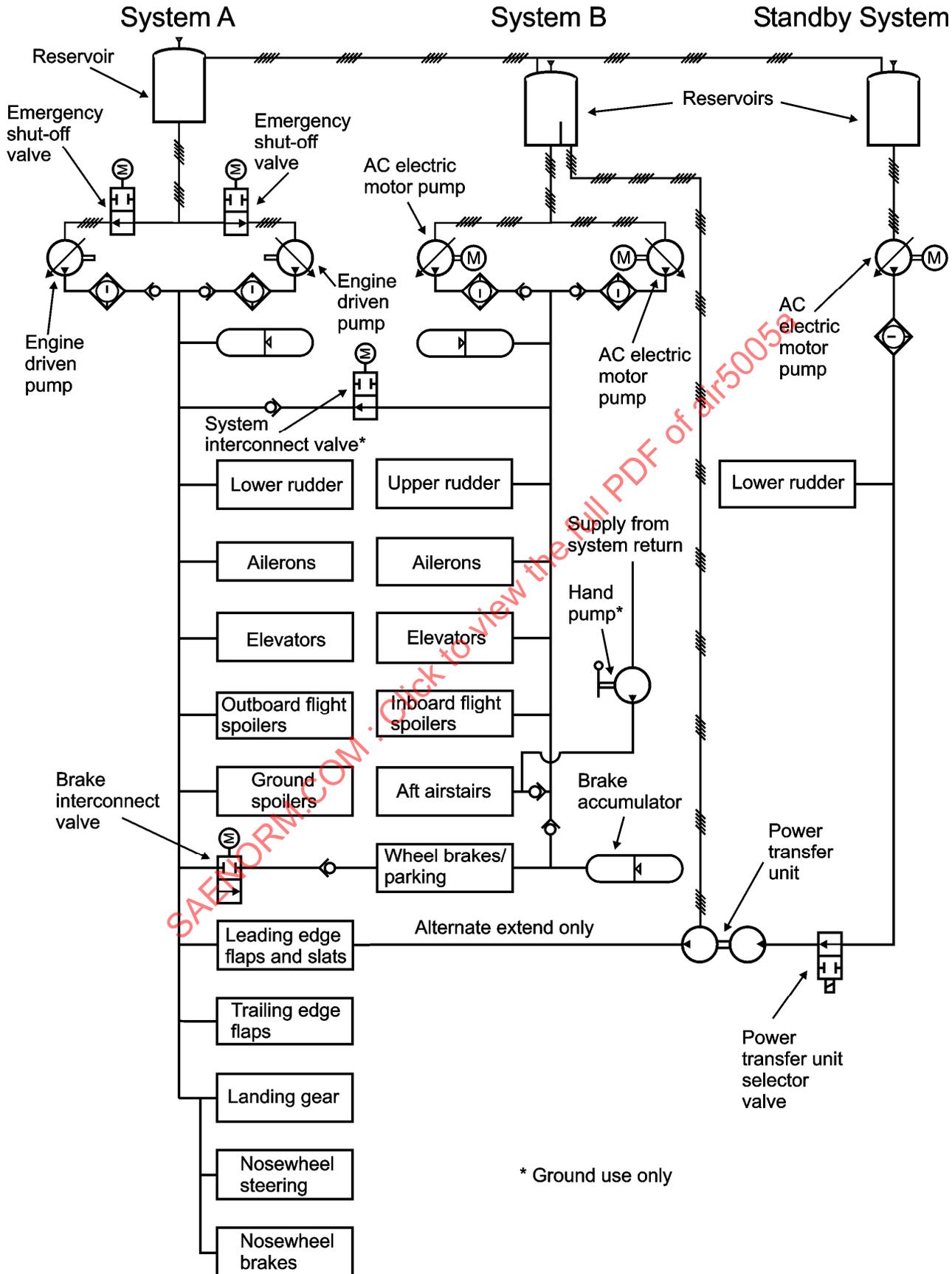


FIGURE 4.7 - BOEING 727-100/200 HYDRAULIC SYSTEM SCHEMATIC

4.8 Boeing 737-100/200

4.8.1 Design Requirements: 14CFR Part 25 requirements

4.8.2 System Pressure: 3000 psi (20 690 kPa)

4.8.3 Hydraulic Fluid: AS1241

4.8.4 Number of Hydraulic Systems: 3 - System A, System B, Standby System

4.8.5 System Temperature: -65 to +235 °F (-54 to +112 °C)

4.8.6 Main Hydraulic Pump Data

4.8.6.1 Engine Driven Pump: 2 in System A

Type: Variable displacement, Pressure compensated, inline or bent-axis piston

Rated Flow-Pressure: 22.5 gpm (85.2 L/min) at 2850 psi (19 655 kPa)

Displacement: 1.60 in³/rev (26.2 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

4.8.6.2 AC Electric Motor Pump: 2 in System B

Type: Variable displacement, Pressure compensated, inline or yoke Type: piston

Rated Flow-Pressure: 5.7 gpm (21.6 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.41 in³/rev (6.72 mL/rev)

Rated Speed: 3200 rpm

4.8.7 Back-up Pump Data

4.8.7.1 AC Electric Motor Pump: 1 in Standby System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 3.10 gpm (12.1 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.16 in³/rev (2.62 mL/rev)

Rated Speed: 4500 rpm

4.8.7.2 Hand Pump: 1 to fill hydraulic systems

Pressure - Displacement: 500 - 725 psi (3448 - 5000 kPa); 0.75 in³ (12.3 mL)/stroke

4.8.8 Hydraulic Motor Data

4.8.8.1 Trailing Edge Flap Motor: 1 per aircraft

Type: Fixed displacement

Displacement: 0.598 in³/rev (9.80 mL/rev)

Running Speed: 3280 rpm

Flow at Rated Pressure Differential: 9.7 gpm (36.7 L/min) at 2850 psi (19 655 kPa)

4.8.9 Accumulator Data

4.8.9.1 Braking System: 2 per aircraft; 1 in System A, 1 in System B

Type: Piston, gas charged

Volume: 50 in³ (0.82 L)

Precharge Pressure: 1000 psi (6 897 kPa)

4.8.9.2 Thrust Reverser System: 1 in System A
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 1000 psi (6 897 kPa)

4.8.10 Reservoir Data

4.8.10.1 System A
Type: Air pressurized
Volume: 4.1 gal (15.5 L)
Pressure: 45 psig (310 kPa)

4.8.10.2 System B
Type: Air pressurized
Volume: 1.3 gal (4.9 L)
Pressure: 45 psig (310 kPa)

4.8.10.3 Standby System
Type: Air pressurized
Volume: 1.9 gal (7.2 L)
Pressure: 45 psig (310 kPa)

4.8.11 Relief Valve Data

4.8.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Cracking Pressure: 3450 to 3550 psi (23 793 to 24 483 kPa)

4.8.12 Filtration

4.8.12.1 Pressure Filtration: 5 per aircraft
Location: 1 in each engine driven and electric motor pump delivery line
Filtration Rating: 15 µm

4.8.12.2 Case Drain Filtration: 5 per aircraft
Location: 1 in each engine driven and electric motor pump line
Filtration Rating: 25 µm

4.8.12.3 Return Filtration: 2 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 3/15 µm System A (Dual stage); 15 µm System B, Standby

4.8.13 Tubing Data

4.8.13.1 High Pressure:/Fire Zones Lines
Material Specification: AISI 304 CRES per AMS 5566*/21-6-9 CRES per AMS5561 or MIL-T-6845 (optional)
* Used on approximately first 200 aircraft only
Diameters/Wall Thicknesses: - AISI 304 or MIL-T-6845 0.25/0.020 in (6.35/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.049 in (15.875/1.245 mm)
Diameters/Wall Thicknesses: - 21-6-9 CRES 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm)

4.8.13.2 Low Pressure Lines

4.8.13.2.1 Material Specification: Up to and including tube diameters, 0.75 in (19.05 mm) 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.188/0.035 in (4.76/0.889 mm), 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm)

4.8.13.2.2 Material Specification: Diameters greater than 0.75 in (19.05 mm), 5052-0 Aluminum alloy per WW-T-787

Diameters/Wall Thicknesses: 1.00/0.035 in (25.4/0.889 mm)

4.8.14 Fitting Data

4.8.14.1 Separable Type: 24 degree flareless or 37 degree flared (limited use)

Material: Aluminum and Corrosion Resistant Steel

End Connections: Bite type

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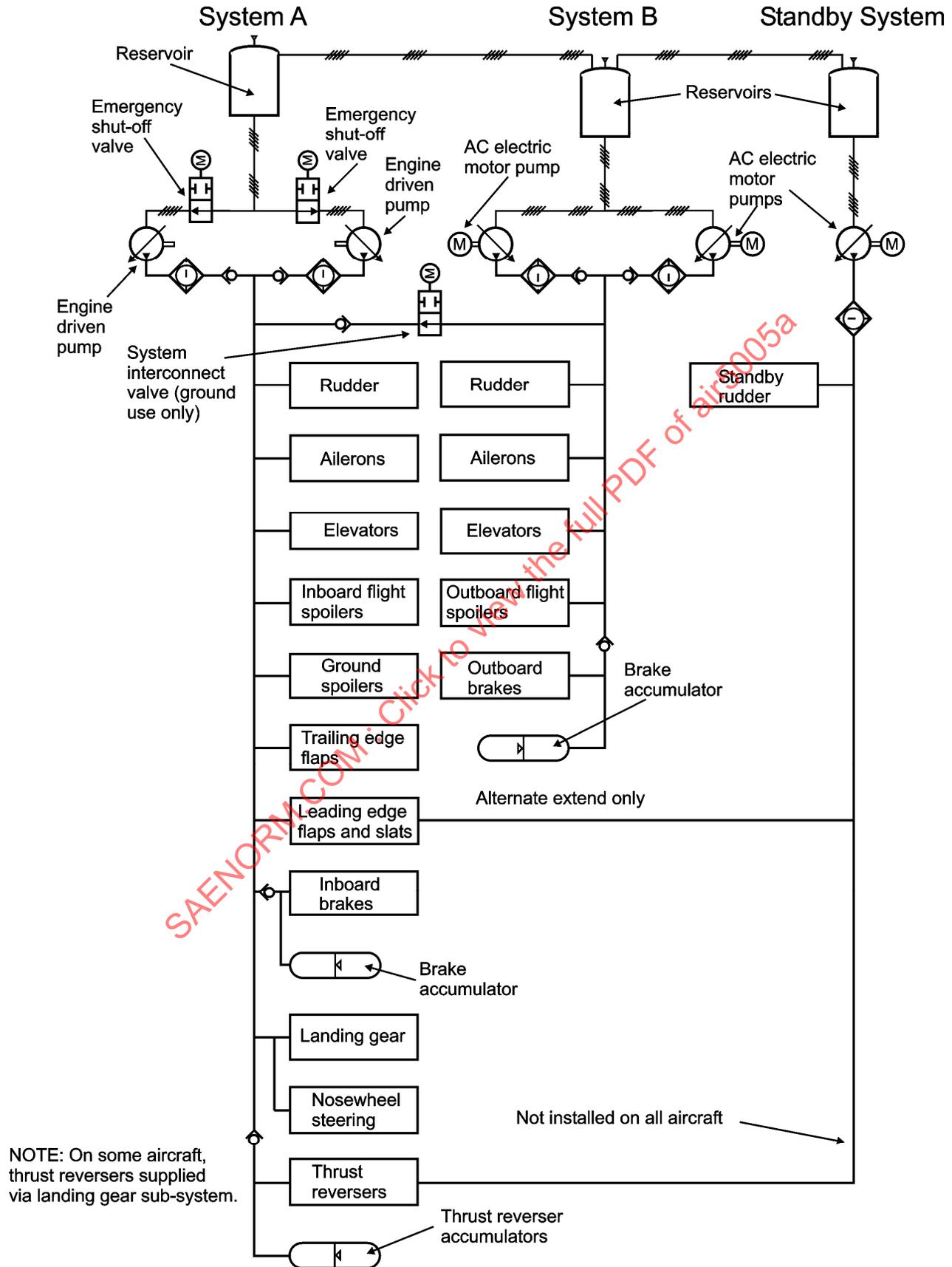


FIGURE 4.8 - BOEING 737-100/200 HYDRAULIC SYSTEM SCHEMATIC

4.9 Boeing 737-300/400/500

4.9.1 Design Requirements: 14CFR Part 25 requirements

4.9.2 System Pressure: 3000 psi (20 690 kPa)

4.9.3 Hydraulic Fluid: AS1241

4.9.4 Number of Hydraulic Systems: 3 - System A, System B, Standby System

4.9.5 System Temperature: -65 to +235 °F (-54 to +112 °C)

4.9.6 Main Hydraulic Pump Data

4.9.6.1 Engine Driven Pump: 2 per system; 1 in System A, 1 in System B
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 22.5 gpm (85.2 L/min) at 2850 psi (19 655 kPa)
Displacement: 1.60 in³/rev (26.2 mL/rev)
Rated Speed: 3750 rpm
Rotation from Shaft End: Counter clockwise

4.9.7 Back-up Pump Data

4.9.7.1 AC Electric Motor Pump: 2 per system; 1 in System A, 1 in System B
Type: Variable displacement, Pressure compensated, inline or yoke Type: piston
Rated Flow-Pressure: 5.7 gpm (21.6 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.41 in³/rev (6.72 mL/rev)
Rated Speed: 3200 rpm

4.9.7.2 AC Electric Motor Pump: 1 in Standby System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.10 gpm (12.1 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.16 in³/rev (2.62 mL/rev)
Rated Speed: 4500 rpm

4.9.7.3 Power Transfer Unit: 1 in System to drive System B leading edge autoslats (alternate operation)
Type: Unidirectional fixed displacement bent axis piston motor and a fixed displacement bent axis piston pump
Rated flow:/Pressure: 6.5 gpm (24.6 L/min) outlet flow at 2700 psi (18 621 kPa) with an input flow of 9.8 gpm (37.1 L/min) at 2400 psi (16 552 kPa)
Displacement: Motor – 0.31 in³/rev (5.08 mL/rev); Pump – 0.241 in³/rev (3.95 mL/rev)
Rated Speed: 12 000 rpm

4.9.7.4 Hand Pump: 1 to fill hydraulic systems
Pressure - Displacement: 500 - 725 psi (3448 - 5000 kPa); 0.75 in³ (12.3 mL)/stroke

4.9.8 Hydraulic Motor Data

4.9.8.1 Trailing Edge Flap Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 0.59 in³/rev (9.80 mL/rev)
Running Speed: 3280 rpm
Flow at Rated Pressure Differential: 9.7 gpm (36.7 L/min) at 2850 psi (19 655 kPa)

4.9.9 Accumulator Data

- 4.9.9.1 Braking System: 1 in System A
Type: Piston, gas charged
Volume: 50 in³ (3.108 L)
Precharge Pressure: 1000 psi (6897 kPa)

4.9.10 Reservoir Data

- 4.9.10.1 System A
Type: Air pressurized
Volume: 4.8 gal (18.2 L)
Pressure: 45 psig (310 kPa)
- 4.9.10.2 System B
Type: Air pressurized
Volume: 7.2 gal (27.3 L)
Pressure: 45 psig (310 kPa)
- 4.9.10.3 Standby System
Type: Air pressurized
Volume: 2.8 gal (10.6 L)
Pressure: 45 psig (310 kPa)

4.9.11 Relief Valve Data

- 4.9.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Cracking Pressure: 3450 to 3550 psi (23 793 to 24 483 kPa)

4.9.12 Filtration

- 4.9.12.1 Pressure Filtration: 6 per aircraft
Location: 1 in each engine driven and electric motor pump and Power Transfer Unit delivery line
Filtration Rating: 15 µm
- 4.9.12.2 Case Drain Filtration: 6 per aircraft
Location: 1 in each engine driven and electric motor pump and Power Transfer Unit line
Filtration Rating: 20 µm
- 4.9.12.3 Return Filtration: 3 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

4.9.13 Tubing Data

- 4.9.13.1 High Pressure:/Fire Zones Lines
Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm)
- 4.9.13.2 Low Pressure Lines
Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm)

4.9.14 Fitting Data

- 4.9.14.1 Separable Type: 24 degree flareless
Material: Aluminum and Corrosion Resistant Steel
End Connections: Internal pressure type

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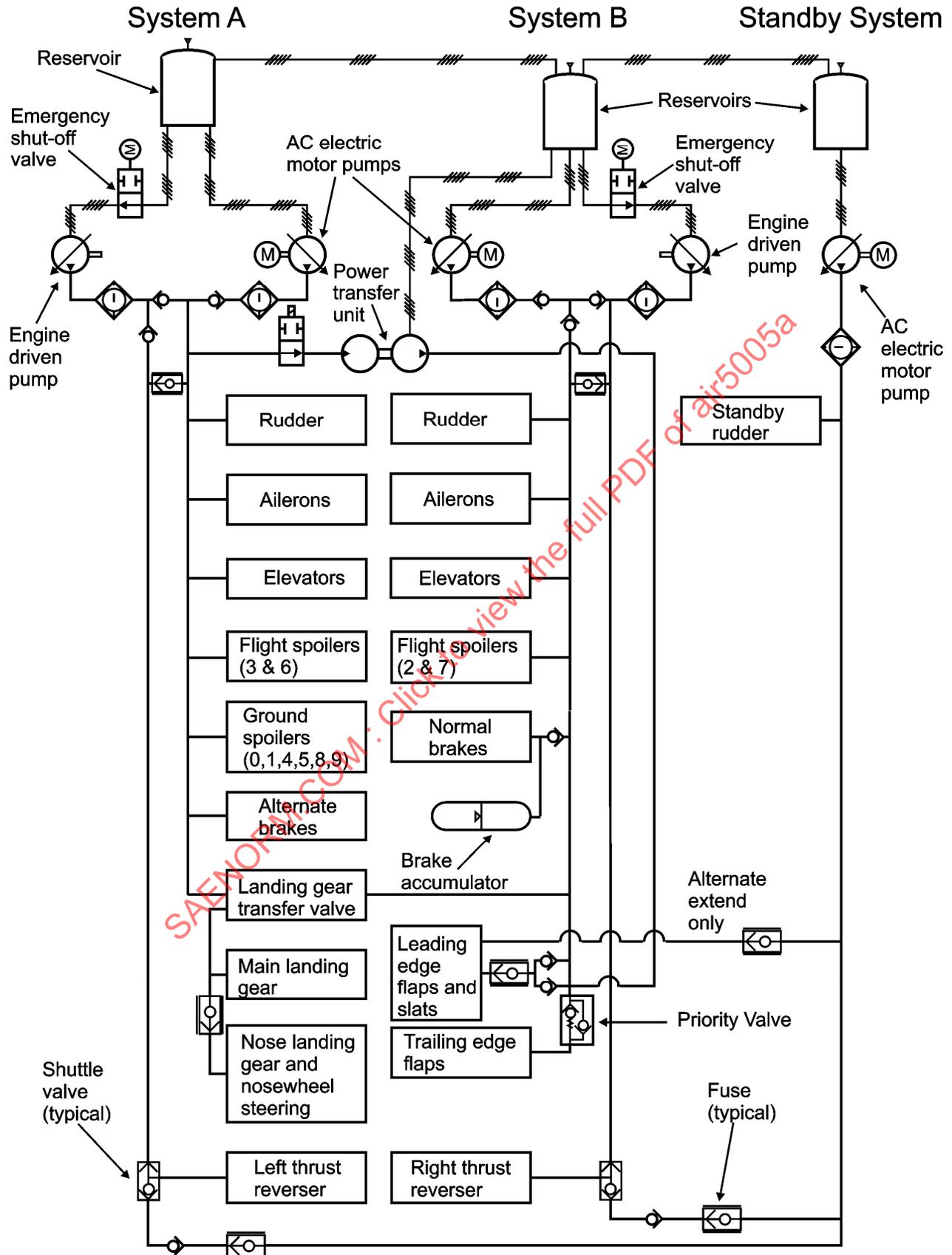


FIGURE 4.9 - BOEING 737-300/400/500 HYDRAULIC SYSTEM SCHEMATIC

4.10 Boeing 737-600/700/800/900

4.10.1 Design Requirements: 14CFR Part 25 requirements

4.10.2 System Pressure: 3000 psi (20 690 kPa)

4.10.3 Hydraulic Fluid: AS1241

4.10.4 Number of Hydraulic Systems: 3 - System A, System B, Standby System

4.10.5 System Temperature: -65 to +235 °F (-54 to +112 °C)

4.10.6 Main Hydraulic Pump Data

4.10.6.1 Engine driven pump

4.10.6.1.1 Boeing 737-600/700/800/900

2 per system; 1 in System A, 1 in System B

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37 gpm (140 L/min) at 2950 psi (20 345 kPa)

Displacement: 2.40 in³/rev (39.3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

4.10.6.1.2 Boeing 737-600 (Optional fit)

2 per system; 1 in System A, 1 in System B

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 22.5 gpm (85.2 L/min) at 2850 psi (19 655 kPa)

Displacement: 1.60 in³/rev (26.2 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

4.10.7 Back-up Pump Data

4.10.7.1 AC Electric Motor Pump: 2 per system; 1 in System A, 1 in System B

Type: Variable displacement, Pressure compensated, inline or yoke Type: piston

Rated Flow-Pressure: 5.7 gpm (21.6 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.41 in³/rev (6.72 mL/rev)

Rated Speed: 3200 rpm

4.10.7.2 AC Electric Motor Pump: 1 in Standby System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 3.10 gpm (12.1 L/min) at 2700 psi (18 621 kPa)

Displacement: 0.16 in³/rev (2.62 mL/rev)

Rated Speed: 4500 rpm

4.10.7.3 Power Transfer Unit: 1 in System to drive System B leading edge autoslats (alternate operation)

Type: Unidirectional fixed displacement bent axis piston motor and a fixed displacement bent axis piston pump

Rated flow:/Pressure: 6.5 gpm (24.6 L/min) outlet flow at 2700 psi (18 621 kPa) with an input flow of 9.8 gpm

(37.1 L/min) at 2400 psi (16 552 kPa)

Displacement: Motor – 0.31 in³/rev (5.08 mL/rev); Pump – 0.241 in³/rev (3.95 mL/rev)

Rated Speed: 12 000 rpm

4.10.7.4 Hand Pump:

1 to fill hydraulic systems

Pressure - Displacement: 500 - 725 psi (3448 - 5000 kPa); 0.75 in³ (12.3 mL)/stroke

4.10.8 Hydraulic Motor Data

4.10.8.1 Trailing Edge Flap Motor: 1 per aircraft

Type: Fixed displacement

Displacement: 0.59 in³/rev (9.80 mL/rev)

Running Speed: 3280 rpm

Flow at Rated Pressure Differential: 9.7 gpm (36.7 L/min) at 2850 psi (19 655 kPa)

4.10.9 Accumulator Data

4.10.9.1 Braking System: 1 in System A

Type: Piston, gas charged

Volume: 50 in³ (3.108 L)

Precharge Pressure: 1000 psi (6897 kPa)

4.10.10 Reservoir Data

4.10.10.1 System A

Type: Air pressurized

Volume: 5.85 gal (22.1 L)

Pressure: 45 psig (310 kPa)

4.10.10.2 System B

Type: Air pressurized

Volume: 8.3 gal (31.4 L)

Pressure: 45 psig (310 kPa)

4.10.10.3 Standby System

Type: Air pressurized

Volume: 3.45 gal (13.1 L)

Pressure: 45 psig (310 kPa)

4.10.11 Relief Valve Data

4.10.11.1 Main System Relief Valve: 3 per aircraft; 1 per system

Cracking Pressure: 3450 to 3550 psi (23 793 to 24 483 kPa)

4.10.12 Filtration

4.10.12.1 Pressure Filtration: 6 per aircraft

Location: 1 in each engine driven and electric motor pump and Power Transfer Unit delivery line

Filtration Rating: 15 µm

4.10.12.2 Case Drain Filtration: 6 per aircraft

Location: 1 in each engine driven and electric motor pump and Power Transfer Unit line

Filtration Rating: 20 µm

4.10.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 15 µm

4.10.13 Tubing Data

4.10.13.1 High Pressure

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm)

4.10.13.2 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm)

4.10.14 Fitting Data

4.10.14.1 Separable Type: 24 degree flareless

Material: Aluminum and Corrosion Resistant Steel
End Connections: Internal Pressure type

4.10.14.2 Permanent Type External swage type

Material: Aluminum and Corrosion Resistant Steel

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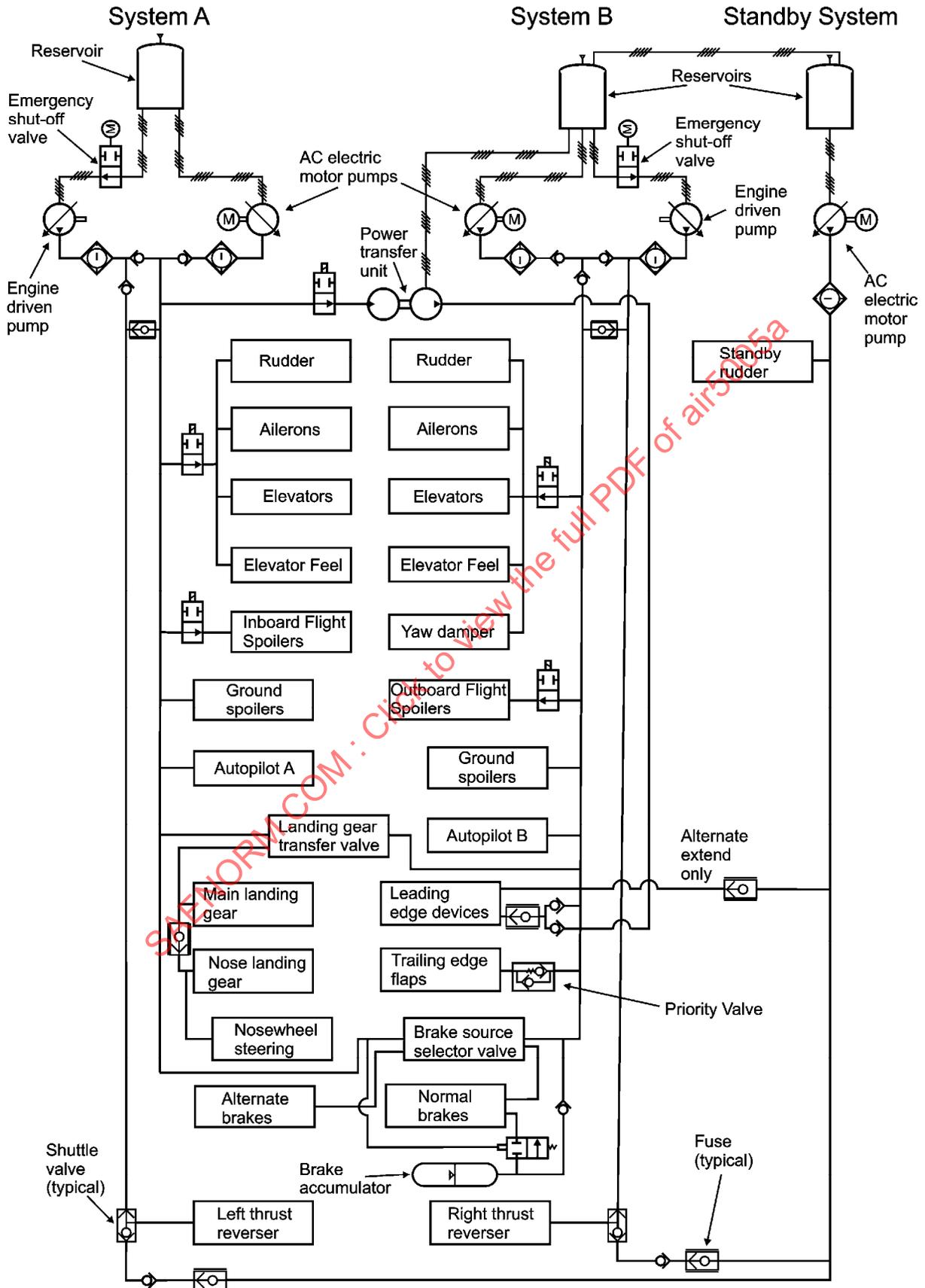


FIGURE 4.10 - BOEING 737-600/700/800/900 HYDRAULIC SYSTEM SCHEMATIC

4.11 Boeing 757-200/300

4.11.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.11.2 System Pressure: 3000 psi (20 690 kPa)

4.11.3 Hydraulic Fluid: AS1241

4.11.4 Number of Hydraulic Systems: 3 - Left System, Center System, Right System

4.11.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

4.11.6 Main Hydraulic Pump Data

4.11.6.1 Engine Driven Pump: 2 per aircraft; 1 in Left System, 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 37.5 gpm (142 L/min) at 2850 psi (19 655 kPa)

Displacement: 2.40 in³/rev (39.3 mL/rev)

Rated Speed: 3750 rpm

Rotation from Shaft End: Counter clockwise

4.11.6.2 AC Electric Motor Pump: 2 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 7.0 gpm (26.5 L/min) at 2850 psi (19 655 kPa)

13.10 gpm (51.1 L/min) at 1500 psi (10 345 kPa)

Displacement: 0.56 in³/rev (9.18 mL/rev)

Rated Speed: 6000 rpm

4.11.7 Back-up Pump Data

4.11.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in Left System, 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 7.0 gpm (26.5 L/min) at 2850 psi (19 655 kPa)

13.10 gpm (51.1 L/min) at 1500 psi (10 345 kPa)

Displacement: 0.56 in³/rev (9.18 mL/rev)

Rated Speed: 6000 rpm

4.11.7.2 Power Transfer Unit: 1 in Right System to drive Left System Landing Gear and Nosewheel Steering (Alternate source)

Type: Unidirectional fixed displacement bent axis piston motor and a fixed displacement inline piston pump

Rated Flow: - Pressure: characteristics 21.8 gpm (82.6 L/min) at 2175 psi (15 000 kPa) outlet flow with an input flow of 27.8 gpm (105 L/min) at 2680 psi (19 724 kPa)

Displacement: Motor - 1.52 in³/rev (24.91 mL/rev); Pump - 1.48 in³/rev (24.25 mL/rev)

Rated Speed: 3575 rpm

4.11.7.3 Ram Air Turbine Driven Pump: 1 in Center System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 11.3 gpm (42.8 L/min) at 2140 psi (14 759 kPa)

Displacement: 0.78 in³/rev (12.78 mL/rev)

Running Speed: 4750 rpm

4.11.7.4 DC Electric Motor Pump Emergency gear extension

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 0.25 gpm (0.66 L/min) at 2000 psi (13 793 kPa)

Displacement: 0.020 in³/rev (0.33 mL/rev)

Running Speed: 3400 – 3800 rpm

4.11.8 Hydraulic Motor Data

4.11.8.1 Flap Motor: 1 per aircraft

Type: Fixed displacement

Displacement: 0.598 in³/rev (9.80 mL/rev)

Running Speed: 3750 rpm

Flow at Rated Pressure Differential: 9.7 gpm (36.7 L/min) at 2850 psi (19 655 kPa)

4.11.8.2 Slat Motor: 1 per aircraft

Type: Fixed displacement

Displacement: 1.52 in³/rev (24.91 mL/rev)

Running Speed: 2700 rpm

Flow at Rated Pressure Differential: 17.8 gpm (67.4 L/min) at 2850 psi (19 655 kPa)

4.11.8.3 Stabilizer Drive Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.215 in³/rev (3.102 mL/rev)

Running Speed: 2700 rpm

Flow at Rated Pressure Differential: 2.5 gpm (9.47 L/min) at 2850 psi (19 655 kPa)

4.11.8.4 Constant Speed Electrical Generator Motor 1 per aircraft (EROPS only)

Type: Variable displacement

Displacement: 0.34 in³/rev (5.57 mL/rev)

Running Speed: 12 000 rpm

Flow at Rated Pressure Differential: 17.5 gpm

4.11.9 Accumulator Data

4.11.9.1 Braking System: 1 in Left System

Type: Piston, gas charged

Volume: 200 in³ (3.108 L)

Precharge Pressure: 1300 psi (8 966 kPa)

4.11.10 Reservoir Data

4.11.10.1 Left and Right Systems Type: Air pressurized

Full Volume: 6.6 gal (25.0 L)

Total Volume: 8.2 gal (31.1 L)

Pressure: 50 psig (344 kPa)

4.11.10.2 Center System Type: Air pressurized

Full Volume: 3.10 gal (13.10 L)

Total Volume: 4.4 gal (16.7 L)

Pressure: 50 psig (344 kPa)

4.11.11 Relief Valve Data

4.11.11.1 Main System Relief Valve:

3 per aircraft; 1 per system

Relief Pressure: 3400 - 3600 psi (23 448 - 24 828 kPa)

4.11.12 Filtration

4.11.12.1 Pressure Filtration: 7 per aircraft

Location: 1 in each main and auxiliary pump delivery line, except Ram Air Turbine driven pump

Filtration Rating: 15 µm

4.11.12.2 Pressure Filtration: 1 per aircraft

Location: Ram Air Turbine Driven Pump delivery line

Filtration Rating: 25 µm

4.11.12.3 Case Drain Filtration:

Location: 1 in each main and auxiliary pump, and in Ram Air Turbine Driven Pump line

Filtration Rating: 25 µm

4.11.12.4 Return Filtration:

Location: 3 per aircraft; 1 in each system return line upstream of the reservoir

Filtration Rating: 15 µm

4.11.13 Tubing Data

4.11.13.1 High Pressure: Non-Fire Zones Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.051 in (25.4/1.295 mm), 1.25/0.058 in (31.75/1.47 mm)

4.11.13.2 High Pressure: Non-Fire Zones Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.00/0.052 in (25.4/1.321 mm), 1.25/0.070 in (31.75/1.778 mm)

4.11.13.3 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm), 1.00/0.035 in (25.4/0.889 mm), 1.25/0.035 in (31.75/0.889 mm)

4.11.14 Fitting Data

4.11.14.1 Separable Type: 24 degree flareless

Material: Al, CRES and Titanium

End Connections: Internal swage, welded

4.11.14.2 Permanent Type

Material: Aluminum and Titanium

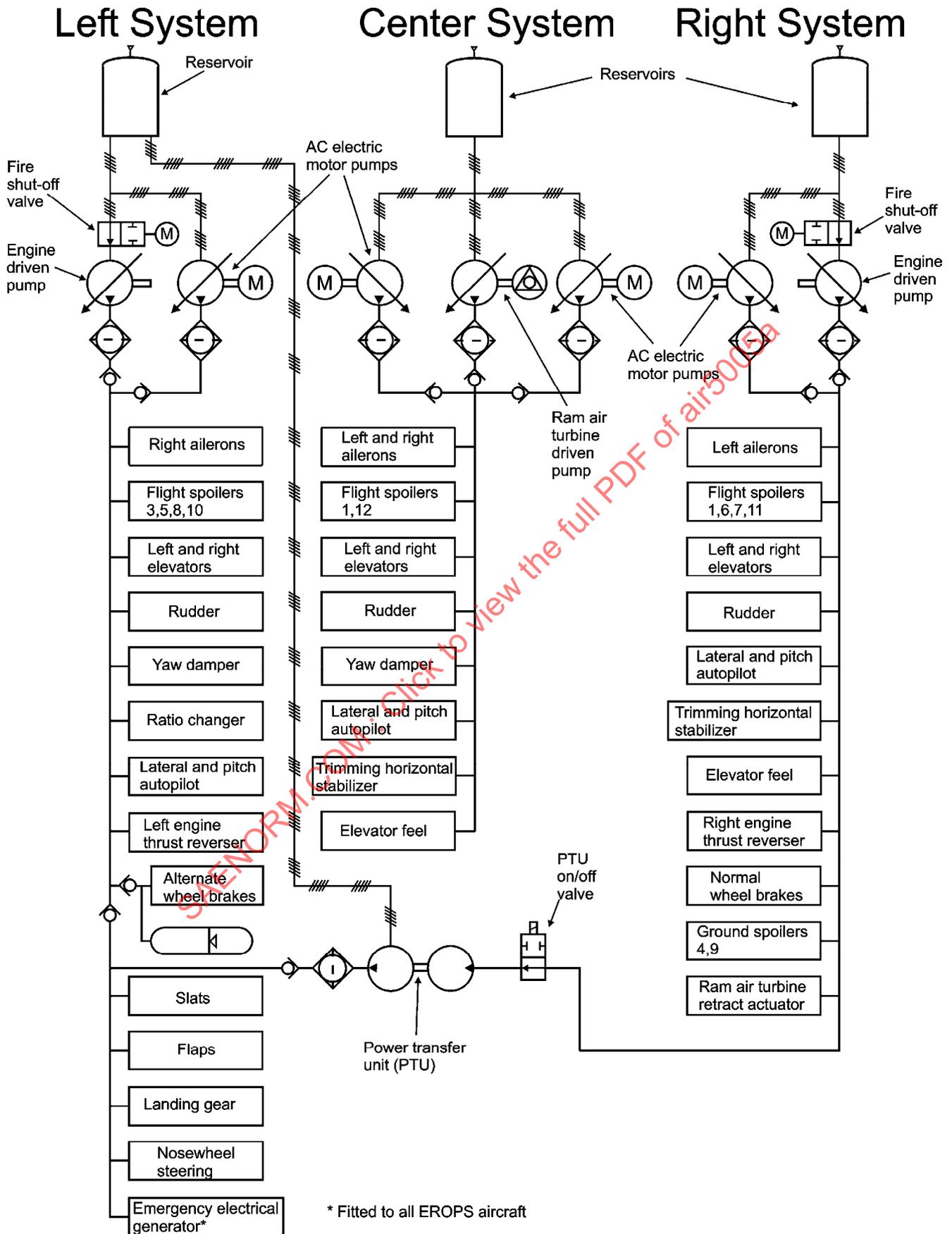


FIGURE 4.11 - BOEING 757-200/300 HYDRAULIC SYSTEM SCHEMATIC

4.12 Boeing MD-81/82/83/87/88

4.12.1 Design Requirements: 14CFR Part 25 requirements

4.12.2 System Pressure: 3000 psi (20 690 kPa)/1500 psi (10 345 kPa)*
* Lower Pressure: selected by flight crew, typically during cruise

4.12.3 Hydraulic Fluid: AS1241

4.12.4 Number of Hydraulic Systems: 2 - Left System, Right System

4.12.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

4.12.6 Main Hydraulic Pump Data

4.12.6.1 Engine Driven Pump: 2 per aircraft; 1 in Left System, 1 in Right System
Type: Variable displacement, Pressure compensated, bent-axis piston
Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.598 in³/rev (9.80 mL/rev)
Rated Speed: 3600 rpm
Rotation from Shaft End: Counter clockwise

4.12.7 Back-up Pump Data

4.12.7.1 AC Electric Motor Pump: 1 in Right System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 169 kPa)
6.0 gpm (22.7 L/min) at 2750 psi (18 961 kPa)
Displacement: 0.26 in³/rev (4.26 mL/rev)
Rated Speed: 7600 rpm

4.12.7.2 Power Transfer Unit: 1 in Left System to power Right System or vice-versa
Type: Bi-directional fixed displacement inline piston motor pump driving/driven by a fixed displacement inline piston motor pump
Rated Flow-Pressure: 10.0 gpm (37.9 L/min)
Displacement: 0.56 in³/rev (9.18 mL/rev) pump and motor

4.12.7.3 Hand Pump: 2 per aircraft
Usage: 1 in Left System, 1 in Right System, for System maintenance

4.12.8 Hydraulic Motor Data None are fitted to this aircraft

4.12.9 Accumulator Data

4.12.9.1 Brake System: 2 per aircraft, 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 198 in³ (3.2 L)
Precharge Pressure: 675 psi (4654 kPa)

4.12.9.2 Elevator Boost Subsystem: 1 in Left System
Type: Spherical, bladder separator, gas charged
Volume: 198 in³ (3.2 L)
Precharge Pressure: 2000 psi (13 790 kPa)

4.12.9.3 Thrust Reverser Subsystem: 2 per aircraft, 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 198 in³ (3.2 L)
Precharge Pressure: 1000 psi (6895 kPa)

4.12.9.4 Ventral Stairs: 1 in Right System
Type: Transfer cylinder (used as an accumulator), gas charged
Volume: 9.6 in³ (0.16 L)
Precharge Pressure: 2000 psi (13 790 kPa)

4.12.10 Reservoir Data

4.12.10.1 Left and Right Systems
Type: Hydraulically pressurized
Full Volume: 4.0 gal (15.3 L)
Total Volume: 4.8 gal (18.2 L)
Pressure: 30 psi (206 kPa)

4.12.11 Relief Valve Data

4.12.11.1 Main System Relief Valve: 2 per aircraft; 1 per system
Relief Pressure: 3600 psi (24 822 kPa)
Rated Flow: 9 gpm (34 L/min)
Reseat Pressure: 200 psi (1379 kPa)

4.12.12 Filtration

4.12.12.1 Pressure Filtration: 2 per aircraft
Location: 1 for each Engine Driven Pump delivery line
Filtration Rating: 15 µm

4.12.12.2 Case Drain Filtration: 2 per aircraft
Location: 1 for each Engine Driven Pump line
Filtration Rating: 15 µm

4.12.12.3 Return Filtration: 4 per aircraft
Location: 2 in each system return line upstream of the reservoir (NOTE: In Right system, it also functions as the AC pump case drain filter)
Filtration Rating: 15 µm

4.12.12.4 Hand Pump: Filtration 2 per aircraft;
Location: 1 for each system reservoir (NOTE: In the Right System, it also functions as the AC pump pressure filter)
Filtration Rating: 15 µm

4.12.13 Tubing Data

4.12.13.1 High Pressure Lines
Material Specification: 304 - 1/8 hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.313/0.020 in (7.95/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.9/1.07 mm)

4.12.13.2 Low Pressure Lines

4.12.13.2.1 Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.313/0.020 in (7.95/0.508 mm), 0.375/0.028 in (9.53/0.711 mm)

4.12.13.2.2 Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.50/0.042 in (12.7/1.07 mm), 0.625/0.058 in (15.9/1.47 mm), 0.75/0.049 in (19.1/1.24 mm), 1.0/0.065 in (25.4/1.65 mm)

4.12.13.3 Flexible Tubing (Coils)

Material Specification: Titanium tube, commercial pure

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.313/0.035 in (7.94/0.889 mm)

4.12.14 Fitting Data

4.12.14.1 Separable Type: 37 degree flared

Material: 304 CRES, Aluminum alloy 6061-T6

End Connections: Pipe flare

4.12.14.2 Permanent Type Pressure: swage/brazed

Material: 304 CRES, Aluminum alloy 6061-T6

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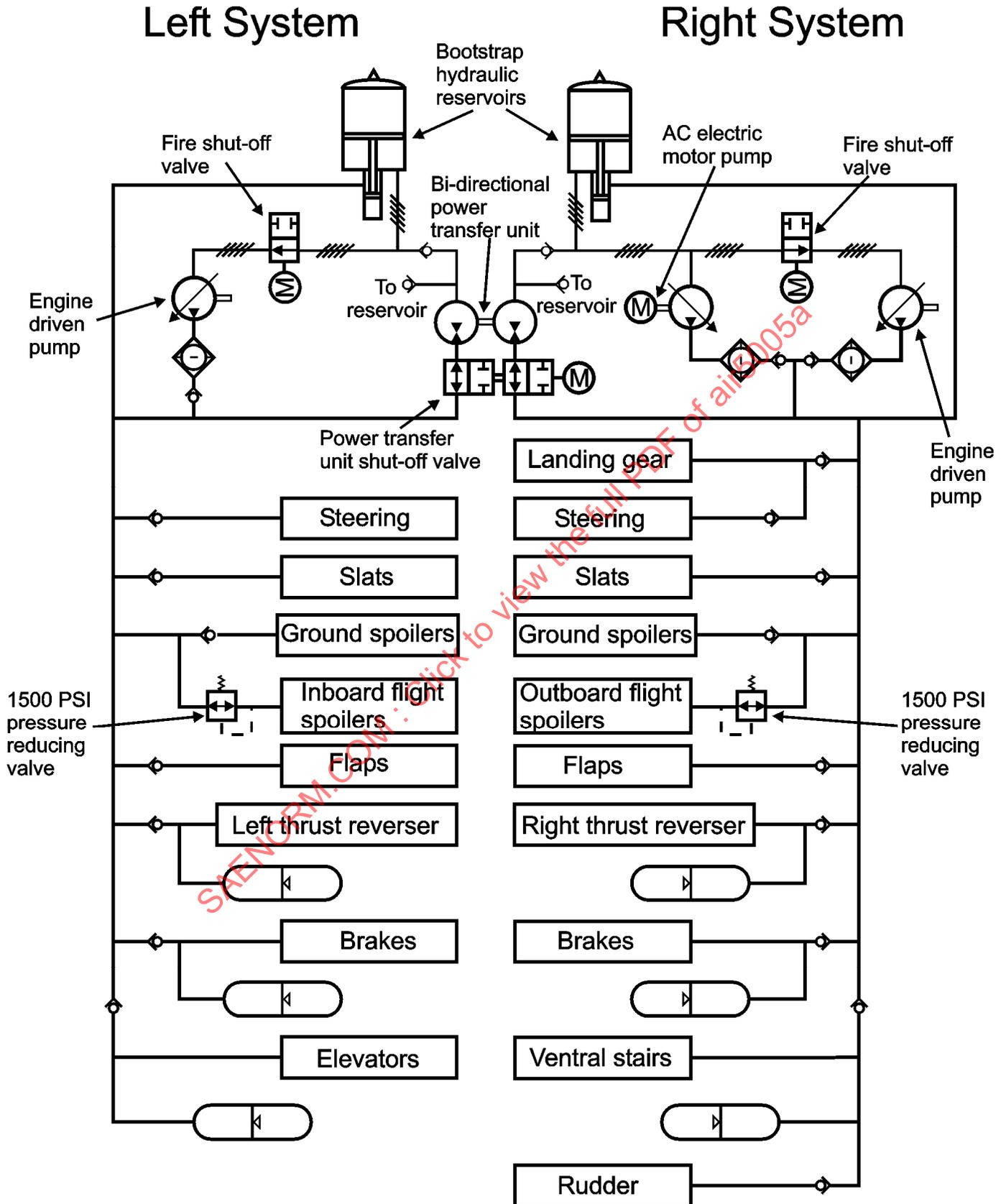


FIGURE 4.12 - BOEING MD-81/82/83/87/88 HYDRAULIC SYSTEM SCHEMATIC

4.13 Boeing MD-90-30

4.13.1 Design Requirements: 14CFR Part 25 requirements

4.13.2 System Pressure: 3000 psi (20 690 kPa)

4.13.3 Hydraulic Fluid: AS1241

4.13.4 Number of Hydraulic Systems: 2 - Left System, Right System

4.13.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

4.13.6 Main Hydraulic Pump Data

4.13.6.1 Engine Driven Pump: 2 per aircraft; 1 in Left System, 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 24.0 gpm (90.86 L/min) at 2850 psi (19 651 kPa)

Displacement: 1.60 in³/rev (26.22 mL/rev)

Rated Speed: 3600 rpm

Rotation from Shaft End: Counter clockwise

4.13.7 Back-up Pump Data

4.13.7.1 AC Electric Motor Pump: 1 in Right System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa)

6.0 gpm (22.7 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.26 in³/rev (4.26 mL/rev)

Rated Speed: 7600 rpm

4.13.7.2 Power Transfer Unit: 1 in Left System to power Right System or vice-versa

Type: Bi-directional fixed displacement inline piston motor pump driving/driven by a fixed displacement inline piston motor pump

Rated Flow-Pressure: 10.0 gpm (37.9 L/min)

Displacement: 0.56 in³/rev (9.18 mL/rev) pump and motor

4.13.7.3 Hand Pump: 2 per aircraft

Usage: 1 in Left System, 1 in Right System, for System maintenance

4.13.8 Hydraulic Motor Data

None are fitted to this aircraft

4.13.9 Accumulator Data

4.13.9.1 Power Generation System: 2 per aircraft, 1 per system

Type: Spherical, bladder separator, gas charged

Volume: 198 in³ (3.2 L)

Precharge Pressure: 1500 psi (10 342 kPa)

4.13.9.2 Braking System: 2 per aircraft, 1 per system

Type: Spherical, bladder separator, gas charged

Volume: 198 in³ (3.2 L)

Precharge Pressure: 675 psi (4654 kPa)

4.13.9.3 Thrust Reverser System: 2 per aircraft, 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 198 in³ (3.2 L)
Precharge Pressure: 1000 psi (6895 kPa)

4.13.10 Reservoir Data

4.13.10.1 Left System

Type: Hydraulically pressurized
Full Volume: 4.3 gal (16.3 L)
Total Volume: 6.5 gal (24.6 L)
Pressure: 60 psi (413 kPa)

4.13.10.2 Right System

Type: Hydraulically pressurized
Full Volume: 4.8 gal (18.2 L)
Total Volume: 6.5 gal (24.6 L)
Pressure: 60 psi (413 kPa)

4.13.11 Relief Valve Data

4.13.11.1 Main System Relief Valve: 2 per aircraft; 1 per system
Relief Pressure: 3600 psi (24 822 kPa)
Rated Flow: 9 gpm (34 L/min)
Reseat Pressure: 200 psi (1379 kPa)

4.13.12 Filtration

4.13.12.1 Pressure Filtration: 2 per aircraft

Location: 1 in each Engine Driven pump delivery line
Filtration Rating: 15 µm

4.13.12.2 Hand Pump: Filtration 2 per aircraft

Location: 1 in each pump delivery line (NOTE: In Right System, it also functions as AC pump pressure filter)
Filtration Rating: 15 µm

4.13.12.3 Case Drain Filtration: 2 per aircraft

Location: 1 for each Engine driven pump
Filtration Rating: 15 µm

4.13.12.4 Return Filtration: 4 per aircraft

Location: 2 in each system return line upstream of the reservoir
Filtration Rating: 15 µm

4.13.13 Tubing Data

4.13.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945
Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.312/0.020 in (7.93/0.5086 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (15.88/0.813 mm)

4.13.13.2 Low Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945
Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.312/0.020 in (7.92/0.508 mm), 0.375/0.020 in (9.525/0.0508 mm), 0.50/0.022 in (12.7/0.559 mm), 0.625/0.020 in (15.88/0.508 mm), 0.75/0.020 in (19.05/0.508 mm), 1.00/0.028 in (25.4/0.711 mm)

4.13.13.3 Coiled Tubing

Material Specification: Titanium, Cold-Drawn Pure

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.042 in (9.53/1.067 mm)

4.13.14 Fitting Data

4.13.14.1 Separable Type: 24 degree flareless

Material: Ti 6Al 4V Titanium alloy per AMS4928

End Connections: Brazed

4.13.14.2 Permanent Type External pressure swage/brazed

Material: Ti 6Al 4V Titanium alloy per AMS4928

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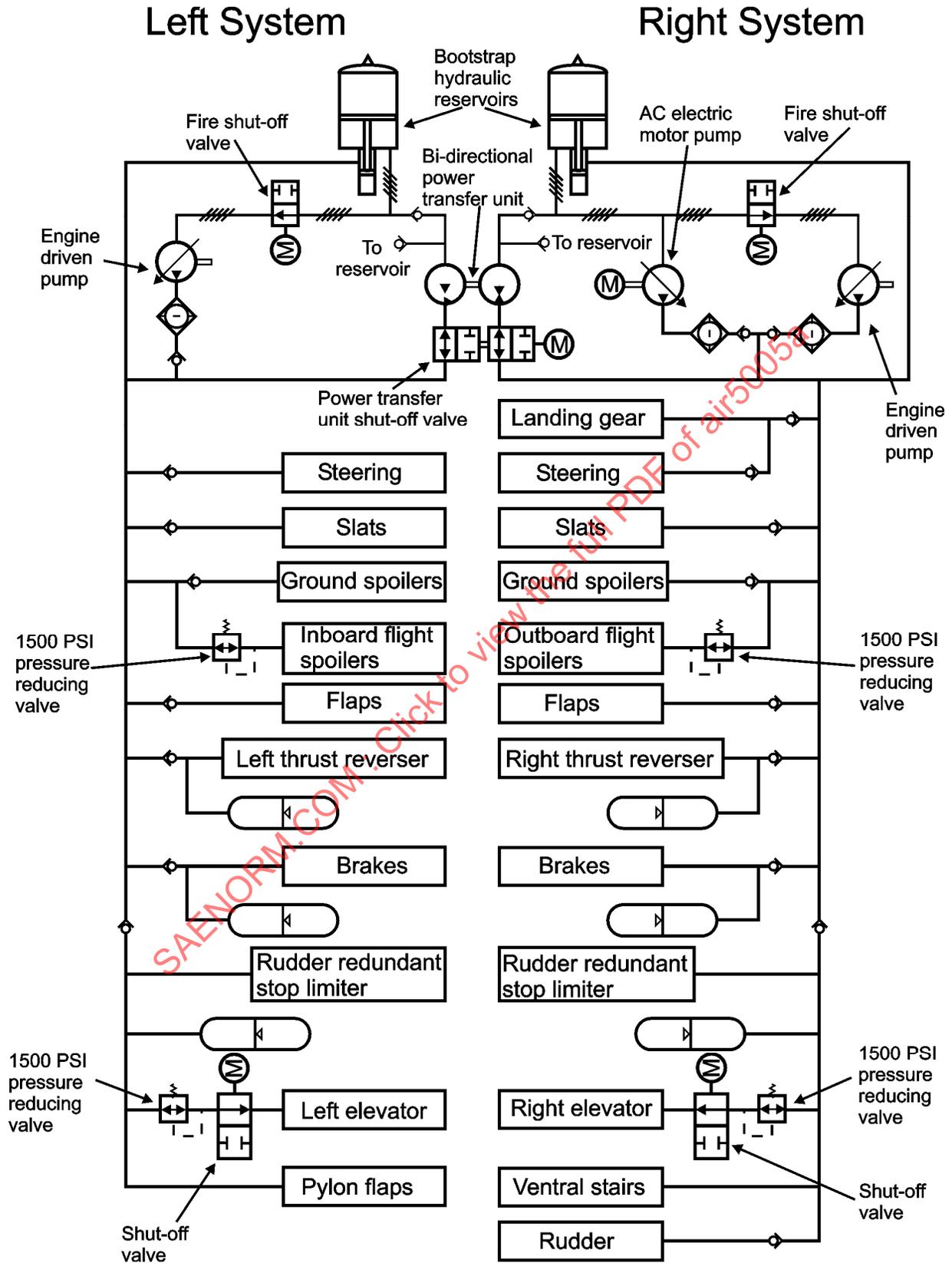


FIGURE 4.13 - BOEING MD-90-30 HYDRAULIC SYSTEM SCHEMATIC

4.14 Bombardier CRJ 100/200

4.14.1 Design Requirements: 14CFR Part 25 requirements

4.14.2 System Pressure: 3000 psi (20 690 kPa)

4.14.3 Hydraulic Fluid: AS1241

4.14.4 Number of Hydraulic Systems: 3 - System 1, System 2, System 3

4.14.5 System Temperature: -65 to +194 °F (-54 to +90 °C)

4.14.6 Main Hydraulic Pump Data

4.14.6.1 Engine Driven Pump: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 10.2 gpm (38.4 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.44 in³/rev (7.21 mL/rev)
Rated Speed: 5700 rpm
Rotation from Shaft End: Counter clockwise

4.14.6.2 AC Electric Motor Pump: 2 in System 3
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 4.1 gpm (15.5 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 8000 rpm

4.14.7 Back-up Pump Data

4.14.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 4.1 gpm (15.5 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 8000 rpm

4.14.8 Hydraulic Motor Data
None are fitted to this aircraft

4.14.9 Accumulator Data

4.14.9.1 Power Generation System: 2 per aircraft; 1 in System 1, 1 in System 3
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge 1500 psi (10 345 kPa)

4.14.9.2 Power Generation System: 1 in System 2
Type: Piston, gas charged
Volume: 100 in³ (1.64 L)
Precharge 1500 psi (10 345 kPa)

4.14.9.3 Braking System: 1 in System 2, 1 in System 3
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge 750 psi (517 kPa)

4.14.10 Reservoir Data

4.14.10.1 System 1

Type: Hydraulically pressurized

Volume: 0.6 gal (2.27 L)

Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure

4.14.10.2 System 2

Type: Hydraulically pressurized

Volume: 1.0 gal (3.10 L)

Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure

4.14.10.3 System 3

Type: Hydraulically pressurized

Volume: 3.0 gal (11.4 L)

Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure

4.14.11 Relief Valve Data

4.14.11.1 Main System Relief Valve: 3 per aircraft; 1 per system

Relief Pressure: 3500 psi (24 138 kPa)

Rated Flow: 10.2 gpm (38.6 L/min) at 3750 psi (25 862 kPa) maximum

4.14.12 Filtration

4.14.12.1 Pressure Filtration: 3 per aircraft

Location: 1 per system

Filtration Rating: 15 µm

4.14.12.2 Case Drain Filtration: 6 per aircraft

Location: 1 in each pump line

Filtration Rating: 15 µm

4.14.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 15 µm

4.14.13 Tubing Data

4.14.13.1 High Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.25/0.020 in (6.35/0.508 mm), 0.25/0.028 in (6.35/0.711 mm), 0.375/0.020 in (9.53/0.508 mm), 0.375/0.026 in (9.53/0.660 mm), 0.50/0.028 in (12.7/0.711 mm)

4.14.13.2 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.25/0.020 in (6.35/0.508 mm), 0.25/0.028 in (6.35/0.711 mm), 0.375/0.020 in (9.53/0.508 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.75/0.035 in (19.05/0.889 mm)

4.14.14 Fitting Data

4.14.14.1 Separable Type: 24 degree flareless

Material: Steel, Aluminum

End Connections: Internal swage

4.14.14.2 Permanent Type External swage

Material: Steel and Aluminum

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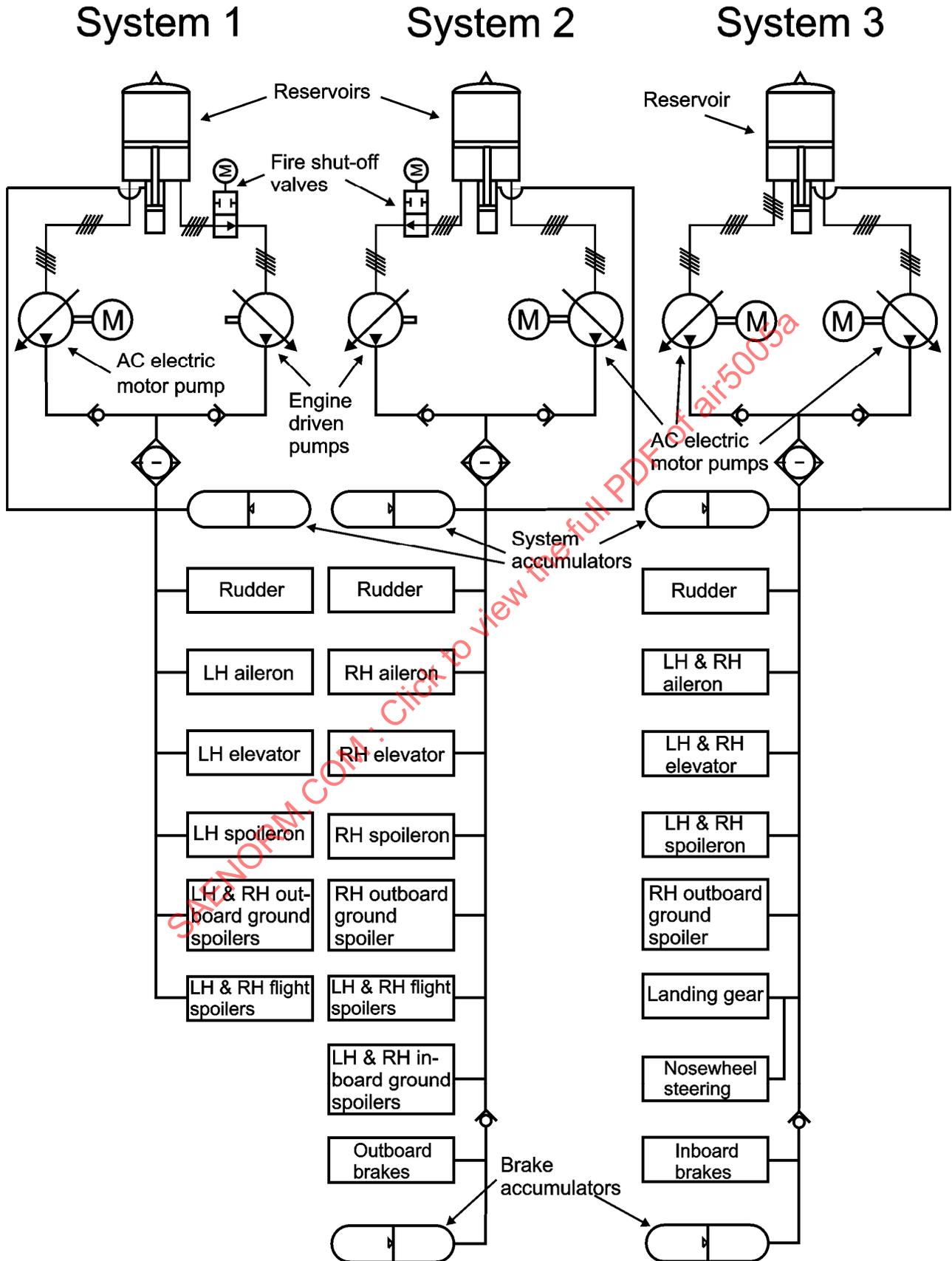


FIGURE 4.14 - BOMBARDIER CRJ 100/200 HYDRAULIC SYSTEM SCHEMATIC

4.15 Bombardier CRJ 700/900

4.15.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.15.2 System Pressure: 3000 psi (20 690 kPa)

4.15.3 Hydraulic Fluid: AS1241

4.15.4 Number of Hydraulic Systems: 3 - System 1, System 2, System 3

4.15.5 System Temperature: -65 to +160 °F, (-54 to +71 °C), up to 200 °F (104 °C) for 5 minutes

4.15.6 Main Hydraulic Pump Data

4.15.6.1 Engine Driven Pump: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 18.0 gpm (68.1 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.95 in³/rev (15.57 mL/rev)
Rated Speed: 4700 rpm
Rotation from Shaft End: Counter clockwise

4.15.6.2 AC Electric Motor Pump: 2 in System 3
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.7 gpm (14.0 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 7700 rpm

4.15.7 Back-up Pump Data

4.15.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.7 gpm (14.0 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 7700 rpm

4.15.8 Hydraulic Motor Data
None are fitted to this aircraft

4.15.9 Accumulator Data

4.15.9.1 Power Generation System: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 1500 psi (10 345 kPa)

4.15.9.2 Power Generation System: 1 in System 3
Type: Piston, gas charged
Volume: 100 in³ (1.64 L)
Precharge Pressure: 1500 psi (10 345 kPa)

4.15.9.3 Braking System: 2 per aircraft; 1 in System 2, 1 in System 3
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 600 psi (4138 kPa)

4.15.10 Reservoir Data

4.15.10.1 System 1

Type: Hydraulically pressurized

Volume: 1.6 gal (6.1 L)

Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure

4.15.10.2 System 2

Type: Hydraulically pressurized

Volume: 2.3 gal (8.6 L)

Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure

4.15.10.3 System 3

Type: Hydraulically pressurized

Volume: 2.3 gal (8.6 L)

Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure

4.15.11 Relief Valve Data

4.15.11.1 Main System Relief Valve: 3 per aircraft; 1 per system

Relief Pressure: 3500 psi (24 138 kPa)

Reseat Pressure: 3200 psi (22 063 kPa) minimum

Rated Flow: 18.0 gpm (68.1 L/min) at 3600 psi (24 826 kPa) maximum

4.15.12 Filtration

4.15.12.1 Pressure Filtration: 3 per aircraft

Location: 1 per system

Filtration Rating: 15 μ m

4.15.12.2 Case Drain Filtration: 6 per aircraft

Location: 1 in each pump line

Filtration Rating: 15 μ m

4.15.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 5 μ m

4.15.13 Tubing Data

4.15.13.1 High Pressure Lines

4.15.13.1.1 Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.675/0.032 in (17.15/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.051 in (25.4/1.295 mm)

4.15.13.1.2 Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.375/0.042 in (9.53/1.067 mm)

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4.15.13.2 Low Pressure Lines

4.15.13.2.1 Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (17.15/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.051 in (25.4/1.295 mm)

4.15.13.2.2 Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.375/0.042 in (9.53/1.067 mm)

4.15.14 Fitting Data

4.15.14.1 Separable Type: 24 degree flareless

Material: Steel

End Connections: Internal swage

4.15.14.2 Permanent Type External swage

Material: Steel

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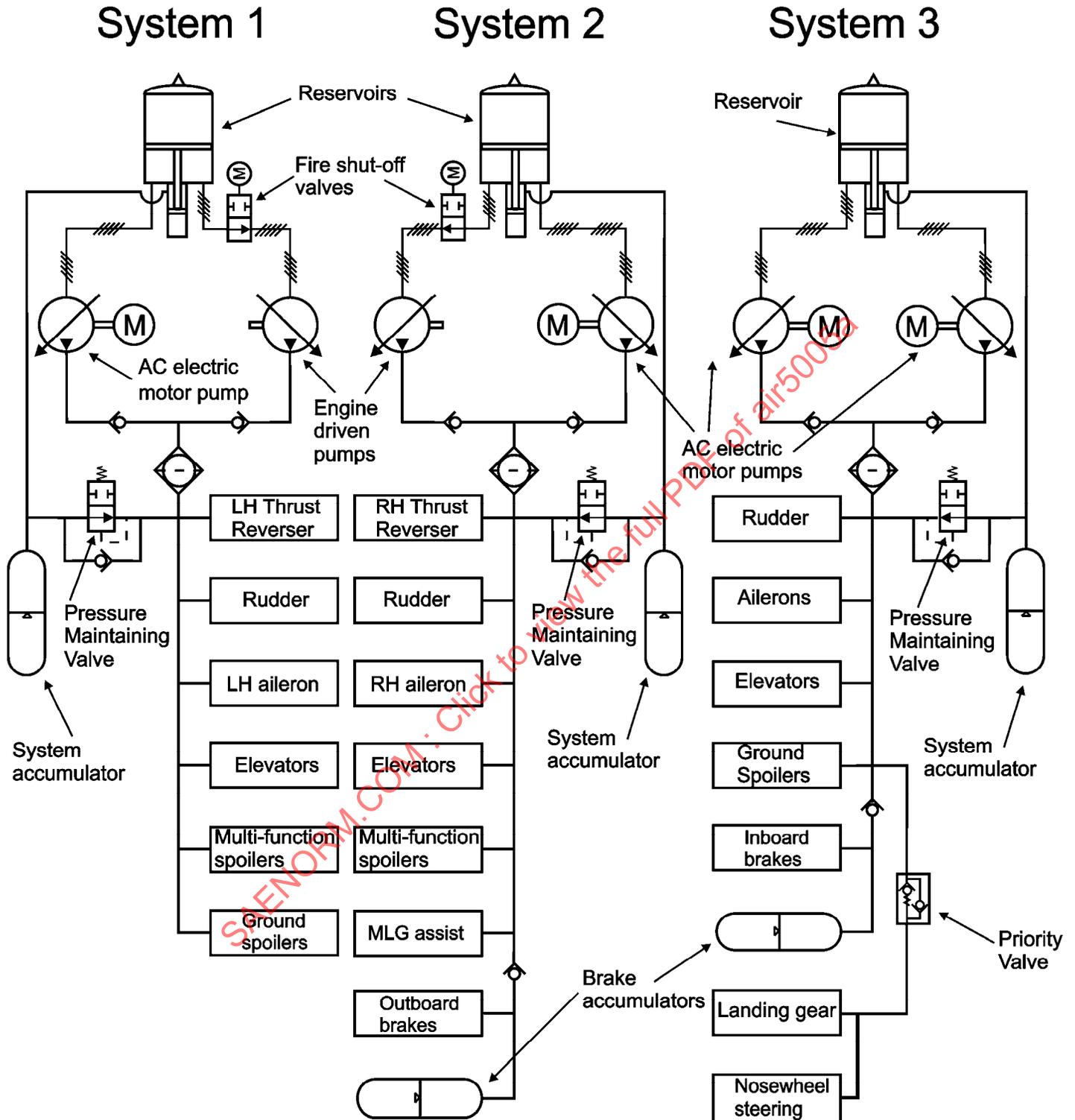


FIGURE 4.15 - BOMBARDIER REGIONAL JET 700/900 HYDRAULIC SYSTEM SCHEMATIC

4.16 Embraer ERJ-135/140/145

4.16.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.16.2 System Pressure: 3000 psi (20 690 kPa)

4.16.3 Hydraulic Fluid: AS1241

4.16.4 Number of Hydraulic Systems: 2 - System 1, System 2

4.16.5 System Temperature: -65 to 194 °F (-54 to 90 °C)

4.16.6 Main Hydraulic Pump Data

- 4.16.6.1 Engine Driven Pump: 2 per aircraft; 1 in System 1, 1 in System 2
 - Type: Variable displacement, pressure compensated, inline piston
 - Rated Flow-Pressure: 9.2 gpm (34.8 L/min) at 2850 psi (19 655 kPa)
 - Displacement: 0.32 in³/rev (5.24 mL/rev)
 - Rated Speed: 7500 rpm
 - Rotation from Shaft End: Clockwise

4.16.7 Back-up Pump Data

- 4.16.7.1 DC Electric Motor Pump 2 per aircraft; 1 in System 1, 1 in System 2
 - Type: Variable displacement, pressure compensated, inline piston
 - Rated Flow-Pressure: 1.5 gpm (6.06 L/min) at 2750 psi (18 966 kPa)
 - Displacement: 0.05 in³/rev (0.82 mL/rev)
 - Rated Speed: 7950 rpm

4.16.8 Hydraulic Motor Data

None are fitted to this aircraft

4.16.9 Accumulator Data

- 4.16.9.1 Landing Gear (Assists DC Pump to Retract Landing Gear)/Forward Door Actuation System: 1 in System 1
 - Type: Piston, gas charged
 - Volume: 200 in³ (3.28 L)
 - Precharge Pressure: 1500 psi (10 345 kPa)
- 4.16.9.2 Braking System: 1 in System 2
 - Type: Piston, gas charged
 - Volume: 100 in³ (1.64 L)
 - Precharge Pressure: 2000 psi (13 793 kPa)

4.16.10 Reservoir Data

4.16.10.1 System 1

- Type: Hydraulically pressurized
- Full Volume: 1.45 gal (5.5 L)
- Total Volume: 1.58 gal (6.0 L)
- Pressure: 40 psi (275 kPa)

4.16.10.2 System 2

Type: Hydraulically pressurized
Full Volume: 1.45 gal (5.5 L)
Total Volume: 1.58 gal (6.0 L)
Pressure: 40 psi (275 kPa)

4.16.11 Relief Valve Data

4.16.11.1 Main System Relief Valve: 2 per aircraft; 1 per system

Relief Pressure: 3650 psi (25 172 kPa)
Rated Flow: 9.0 gpm (34.1 L/min)
Reseat Pressure: 3300 psi (22 781 kPa)

4.16.12 Filtration

4.16.12.1 Pressure Filtration: 2 per aircraft

Location: 1 in each system
Filtration Rating: 5 μ m

4.16.12.2 Case Drain Filtration: 2 per aircraft

Location: 1 in each combined Engine Driven pump and DC pump line
Filtration Rating: 5 μ m

4.16.12.3 Return Filtration: 2 per aircraft

Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 5 μ m

4.16.13 Tubing Data

4.16.13.1 High Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.312/0.016 in (7.93/0.406 mm), 0.375/0.020 in (9.525/0.508 mm)

4.16.13.2 Low Pressure Lines

4.16.13.2.1 General

Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.028 in (12.7/0.711 mm), 0.625/0.035 in (15.875/0.889 mm)

4.16.13.2.2 Specific Lines – All tubing exposed on the landing gear or in the landing gear bay

Material Specification: 21-6-9 CRES per AMS5561

4.16.14 Fitting Data

4.16.14.1 Separable Type: 24 degree flareless

Material: CRES and Aluminum
End Connections: Internal swage

4.16.14.2 Permanent Type External swage

Material: CRES and Aluminum

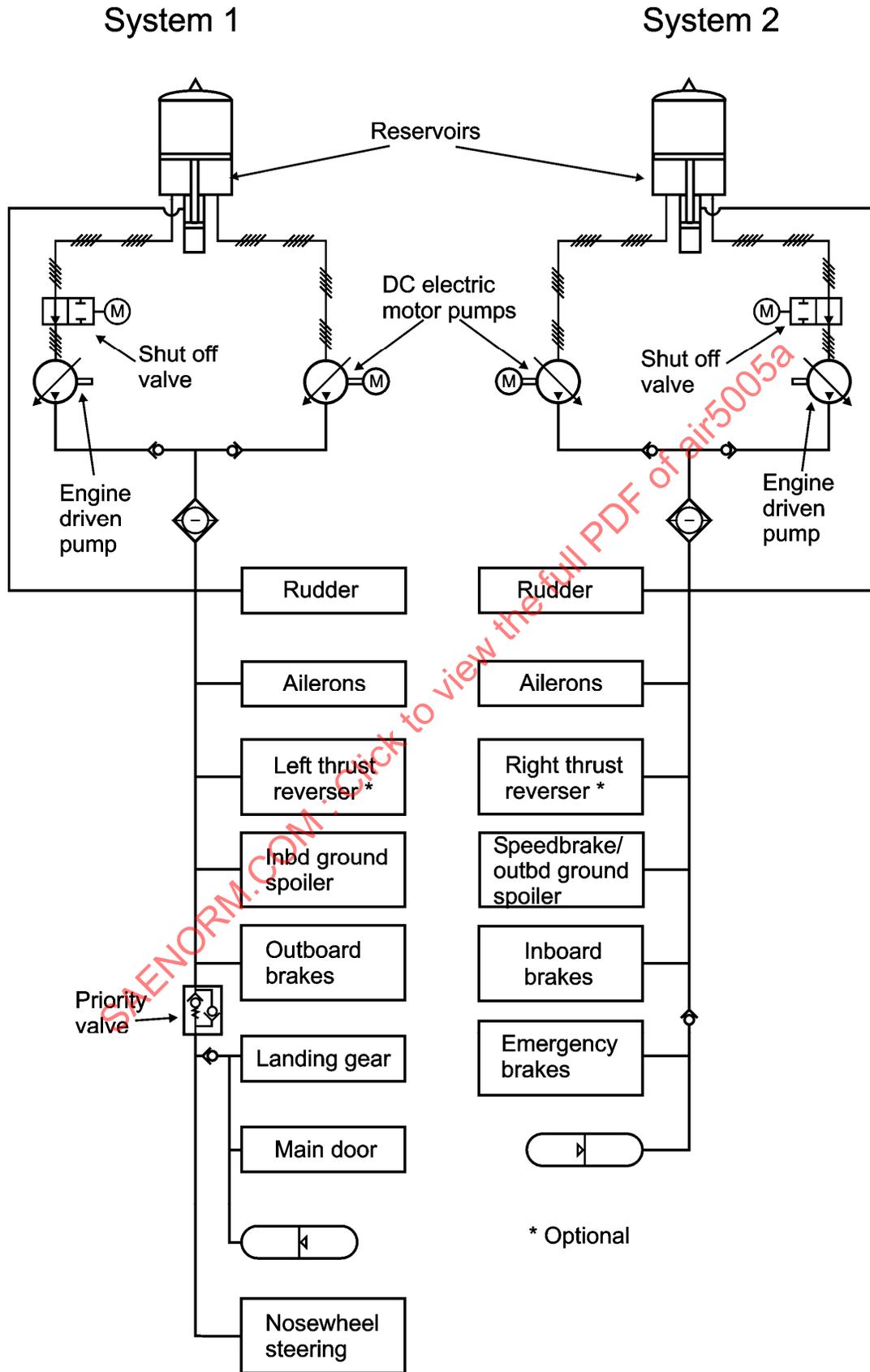


FIGURE 4.16 - EMBRAER ERJ-135/140/145 HYDRAULIC SYSTEM SCHEMATIC

4.17 Embraer ERJ-170/175/190/195

4.17.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.17.2 System Pressure: 3000 psi (20 690 kPa)

4.17.3 Hydraulic Fluid: AS1241

4.17.4 Number of Hydraulic Systems: 3 - System 1, System 2, System 3

4.17.5 System Temperature: -65 °F to +275 °F (-54 °C to +135 °C)

4.17.6 Main Hydraulic Pump Data

4.17.6.1 Engine Driven Pump: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 10.2 gpm (38.4 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.96 in³/rev (15.7 mL/rev)
Rated Speed: 4310 rpm
Rotation from Shaft End: Counter clockwise

4.17.6.2 AC Electric Motor Pump: 1 in System 3
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.7 gpm (14.0 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 7700 rpm

4.17.7 Back-up Pump Data

4.17.7.1 AC Electric Motor Pump: 3 per aircraft; 1 in System 1, 1 in System 2, 1 in System 3
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.7 gpm (14.0 L/min) at 2700 psi (18 621 kPa)
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 7700 rpm

4.17.7.2 Power Transfer Unit: 1 in System 1 to drive System 2
Type: Unidirectional fixed displacement inline piston motor driving a fixed displacement inline piston pump
Rated Flow-Pressure: 5.3 gpm (20.1 L/min) at 2200 psi (15 170 kPa)
Displacement: 0.31 in³/rev (5.1 mL/rev)
Rated Speed: 6560 rpm

4.17.8 Hydraulic Motor Data
None are fitted to this aircraft

4.17.9 Accumulator Data

4.17.9.1 Power Generation System: 1 in System 1
Type: Piston, gas charged
Volume: 100 in³ (1.64 L)
Precharge pressure: 1100 psi (7586 kPa)

- 4.17.9.2 Power Generation System: 1 in System 2
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge pressure: 1100 psi (7586 kPa)
- 4.17.9.3 Power Generation System: 1 in System 3
Type: Piston, gas charged
Volume: 160 in³ (2.62 L)
Precharge pressure: 1100 psi (7586 kPa)
- 4.17.9.4 Braking System: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Piston, gas charged
Volume: 100 in³ (1.64 L)
Precharge pressure: 575 psi (3964 kPa)
- 4.17.10 Reservoir Data
- 4.17.10.1 System 1
Type: Hydraulically pressurized
Volume: 3.2 gal (12.3 L)
Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure
- 4.17.10.1.1 System 2 (ERJ-170/175 only)
Type: Hydraulically pressurized
Volume: 3.2 gal (12.3 L)
Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure
- 4.17.10.1.2 System 2 (ERJ-190/195 only)
Type: Hydraulically pressurized
Volume: 3.9 gal (14.75 L)
Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure
- 4.17.10.2 System 3
Type: Hydraulically pressurized
Volume: 1.6 gal (6.2 L)
Pressure: 55 psi (379 kPa) at 3000 psi (20 690 kPa) system pressure
- 4.17.11 Relief Valve Data
- 4.17.11.1 Main System Relief Valve: 3 per aircraft; 1 per system
Relief Pressure: 3500 psi (24 138 kPa)
Reseat Pressure: 3200 psi (22 063 kPa) minimum
Rated Flow: 26.5 gpm (100.0 L/min) at 3600 psi (24 827 kPa) maximum
- 4.17.12 Filtration
- 4.17.12.1 Pressure Filtration: 3 per aircraft
Location: 1 per system
Filtration Rating: 5 µm
- 4.17.12.2 Case Drain Filtration: 5 per aircraft
Location: 2 in System 1, 2 in System 2 and 1 in System 3
Filtration Rating: 15 µm

4.17.12.3 Return Filtration: 3 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 5 μ m

4.17.13 Tubing Data

4.17.13.1 High Pressure Lines

4.17.13.2 Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4944 or AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.70/0.660 mm), 0.625/0.032 in (15.88/0.813 mm), 0.75/0.039 in (19.05/0.991 mm)

4.17.13.3 Low Pressure Lines

4.17.13.3.1 General

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.70/0.889 mm), 0.625/0.035 in (15.88/0.889 mm), 0.750/0.035 in (19.05/0.889 mm), 1.00/0.049 in (25.4/1.245 mm), 1.25/0.049 in (31.75/1.245 mm)*

*(ERJ-190/195 Only)

4.17.13.3.2 Specific Lines – All tubing installed in the engine fire zone, or exposed on the landing gear or in the landing gear bay

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.70/0.660 mm), 0.625/0.032 in (15.88/0.813 mm), 0.750/0.039 in (19.05/0.991 mm), 1/0.052 in (25.4/1.321 mm), 1.25/0.035 in (31.75/0.889 mm)*

*(ERJ-190/195 Only)

4.17.14 Fitting Data

4.17.14.1 Separable Type: 24 degree flareless

Material: Steel, Aluminum

End Connections: Internal swage

4.17.14.2 Permanent Type External swage

Material: Steel and Aluminum

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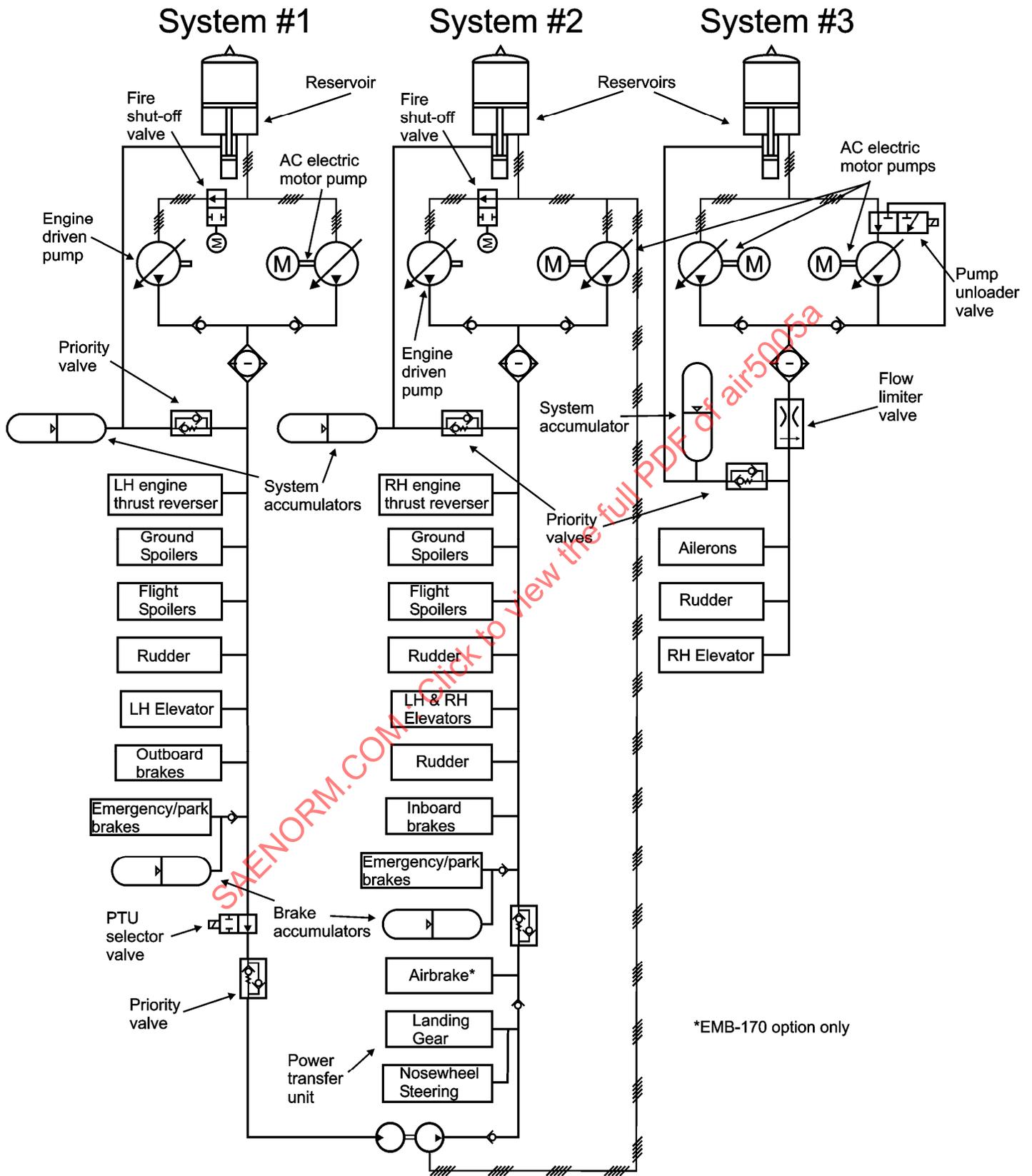


FIGURE 4.17 - EMBRAER ERJ-170/175/190/195 HYDRAULIC SYSTEM SCHEMATIC

4.18 Fokker F.70/100

4.18.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

4.18.2 System Pressure: 3000 psi (20 690 kPa)

4.18.3 Hydraulic Fluid: AS1241

4.18.4 Number of Hydraulic Systems: 2 - System 1, System 2

4.18.5 System Temperature: -65 to 212 °F (-54 to 100 °C)

4.18.6 Main Hydraulic Pump Data

4.18.6.1 Engine Driven Pump: 2 in System 1

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 16.1 gpm (60.9 L/min) at 2900 psi (20 000 kPa)

Displacement: 0.98 in³/rev (16.06 mL/rev)

Rated Speed: 4150 rpm

Rotation from Shaft End: Clockwise

4.18.6.2 Engine Driven Pump: 2 in System 2

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 5.0 gpm (18.9 L/min) at 2000 psi (20 000 kPa)

Displacement: 0.32 in³/rev (5.24 mL/rev)

Rated Speed: 3900 rpm

Rotation from Shaft End: Counter clockwise

4.18.7 Back-up Pump Data

4.18.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in System 1, 1 in System 2

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 1.6 gpm (6.06 L/min) at 2850 psi (19 655 kPa)

Displacement: 0.055 in³/rev (0.90 mL/rev)

Rated Speed: 7600 rpm

4.18.8 Hydraulic Motor Data

4.18.8.1 Flap Motor: 1 per aircraft

Type: Fixed displacement inline axial piston

Displacement: 0.14 in³/rev (2.29 mL/rev)

Running Speed: 8000 rpm

Flow at Rated Pressure Differential: 5.1 gpm (23.10 L/min)

4.18.8.2 Horizontal Stabilizer Motor: 2 per aircraft

Type: Fixed displacement bent-axis axial piston

Displacement: 0.216 in³/rev (3.104 mL/rev)

Running Speed: 6000 rpm maximum; average trim rate 600 to 1000 rpm

Flow at Rated Pressure Differential: 5.0 gpm (22.7 L/min) maximum; 0.5 to 1.0 gpm (2.3 to 4.5 L/min) average trim rate

4.18.9 Accumulator Data

4.18.9.1 Power Generation System: 2 per aircraft, 1 per system

Type: Piston, gas charged

Volume: 50 in³ (0.82 L)

Precharge Pressure: 1000 psi (6897 kPa)

4.18.9.2 Braking System: 1 in System 1

Type: Piston, gas charged

Volume: 200 in³ (3.108 L)

Precharge Pressure: 1000 psi (6897 kPa)

4.18.9.3 Lift Dump System: 2 in System 1

Type: Piston, gas charged

Volume: 200 in³ (3.108 L)

Precharge Pressure: 1600 psi (11 034 kPa)

4.18.10 Reservoir Data

4.18.10.1 System 1

Type: Air pressurized

Full Volume: 5.7 gal (21.7 L)

Total Volume: 6.9 gal (26.2 L)

Pressure: 40 psi (275 kPa)

4.18.10.2 System 2

Type: Air pressurized

Full Volume: 1.1 gal (4.2 L)

Total Volume: 1.3 gal (4.101 L)

Pressure: 40 psi (275 kPa)

4.18.11 Relief Valve Data

4.18.11.1 Main System Relief Valve: 4 per aircraft, 2 per system

4.18.11.1.1 System 1

Relief Pressure: 3500 psi (24 131 kPa)

Rated Flow: 17.0 gpm (77.3 L/min)

Reseat Pressure: 3300 psi (22 752 kPa)

4.18.11.2 System 2

Relief Pressure: 3500 psi (24 131 kPa)

Rated Flow: 5.5 gpm (25.0 L/min)

Reseat Pressure: 3300 psi (22 752 kPa)

4.18.12 Filtration

4.18.12.1 Pressure Filtration: 4 per aircraft

Location: 1 in each combined EDP and ACP delivery line, 1 in each dedicated EDP delivery line

Filtration Rating: 15 µm

4.18.12.2 Return Filtration: 2 per aircraft

Location: 1 in each system return line upstream of the reservoir

Filtration Rating: 3 µm

4.18.13 Tubing Data

4.18.13.1 High Pressure Lines

Material Specification: 304 - $\frac{1}{8}$ CRES per MIL-T-8504

Diameters/Wall Thicknesses: 0.188/0.020 in (4.775/0.508 mm), 0.25/0.020 in (6.35/0.508 mm), 0.313/0.020 in (7.938/0.508 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.035 in (12.70/0.889 mm), 0.625/0.042 in (15.875/1.067 mm)

4.18.13.2 Low Pressure Lines

4.18.13.2.1 Material Specification: 5052 Aluminum alloy per AMS-WW-T-700/4

Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.313/0.028 in (7.938/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.028 in (12.70/0.711 mm), 0.625/0.035 in (15.875/0.889 mm), 1.00/0.035 in (25.40/0.889 mm)

4.18.13.2.2 Material Specification: 6061-T6 Aluminum alloy per AMS4083 (post November 1992)

Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.313/0.028 in (7.938/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.028 in (12.70/0.711 mm), 0.625/0.035 in (15.875/0.889 mm), 1.00/0.035 in (25.40/0.889 mm)

4.18.13.2.3 Material Specification: 304 - $\frac{1}{8}$ CRES per MIL-T-8504

Diameters/Wall Thicknesses: 0.188/0.020 in (4.775/0.508 mm), 0.25/0.020 in (6.35/0.508 mm), 0.313/0.020 in (7.938/0.508 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.035 in (12.70/0.889 mm), 0.625/0.042 in (15.875/1.067 mm), 1.00/0.028 in (25.40/0.711 mm)

4.18.14 Fitting Data

4.18.14.1 Pre-November 1992

4.18.14.1.1 Separable Type: 37 degree flared

Material: Al, CRES

End Connections: Pipe flare

4.18.14.1.2 Post-November 1992

4.18.14.1.2.1 Separable Type: 24 degree flareless

Material: Al, CRES

End Connections: Internal swage

4.18.14.1.2.2 Permanent Type External swage

Material: Al, CRES

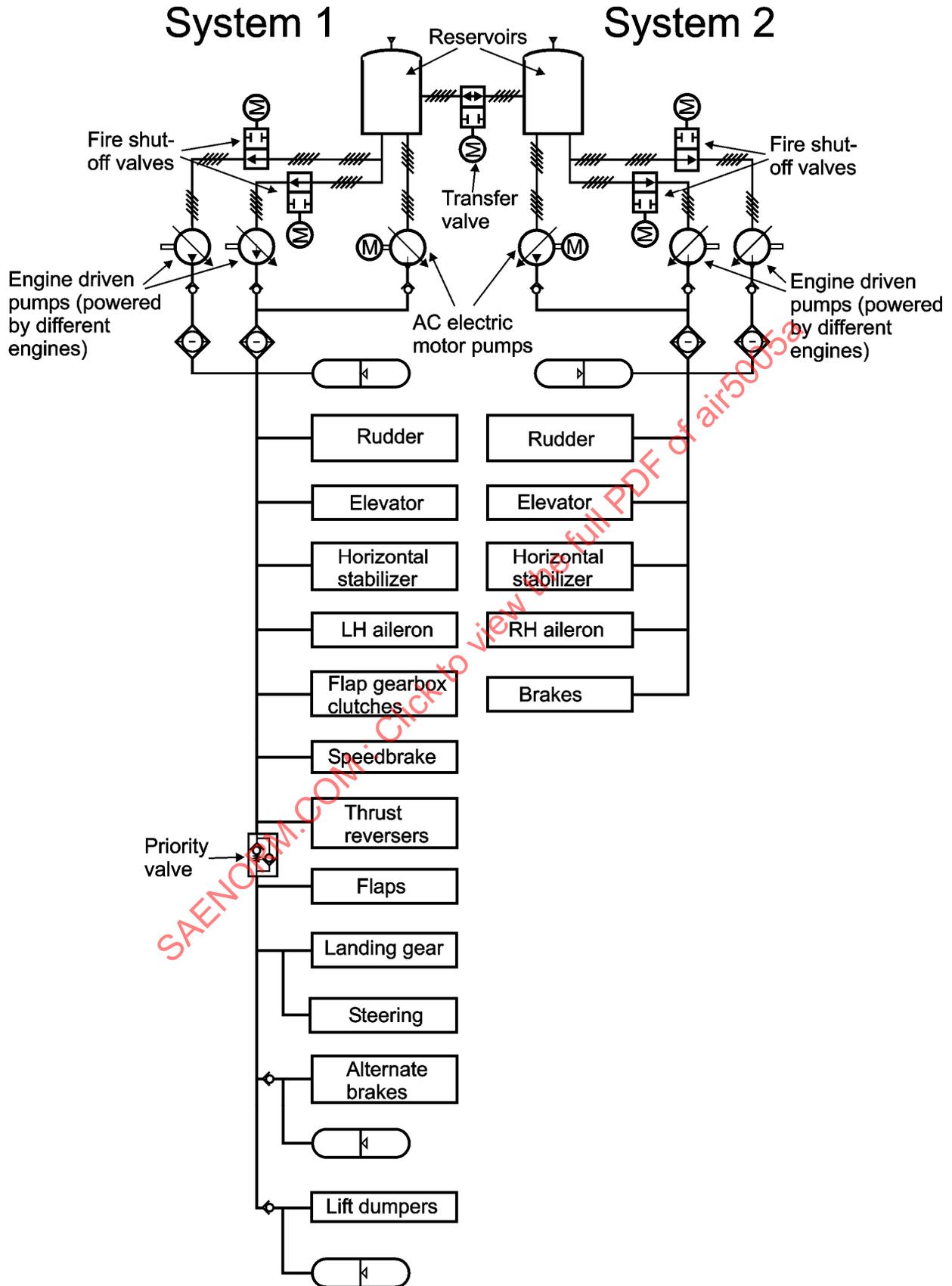


FIGURE 4.18 - FOKKER 70/100 HYDRAULIC SYSTEM SCHEMATIC

4.19 McDonnell Douglas DC-8-60/70

4.19.1 Design Requirements: 14CFR Part 25 requirements

4.19.2 System Pressure: 3000 psi (20 690 kPa)

4.19.3 Hydraulic Fluid: AS1241

4.19.4 Number of Hydraulic Systems: 1 - Main System

NOTE: The system incorporates major subsystems for Spoilers, Rudder (Standby) and Thrust Reversers

4.19.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

4.19.6 Main Hydraulic Pump Data

4.19.6.1 Engine Driven Pump: 2 in the Main System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 21.0 gpm (80 L/min) at 2800 psi (19 306 kPa)

Displacement: 1.159 in³/rev (19.0 mL/rev)

Rated Speed: 3500 rpm

Rotation from Shaft End: Counter clockwise

4.19.7 Back-up Pump Data

4.19.7.1 AC Electric Motor Pump: 4 per aircraft; 1 in Main system, 1 in Rudder Subsystem, 1 dedicated to Thrust Reversers, 1 in Spoiler Subsystem

Type: Variable displacement, Pressure compensated, bent-axis piston

Rated Flow-Pressure: 3.9 gpm (14.8 L/min) at 2700 psi (18 617 kPa)

Displacement: 0.22 in³/rev (3.60 mL/rev)

Rated Speed: 10 000 rpm

4.19.8 Hydraulic Motor Data

4.19.8.1 Horizontal Stabilizer Motor: 1 per aircraft

Type: Fixed displacement bent-axis piston

Displacement: 0.803 in³/rev (13.16 mL/rev)

Running Speed: 2820 rpm

Flow at Rated Pressure Differential: 9.3 gpm (35.3 L/min)

4.19.9 Accumulator Data

4.19.9.1 Power Generation System: 4 per aircraft; 1 in Main System, 1 in Rudder Subsystem, 2 in Thrust Reverser Subsystem

Type: Spherical, bladder separator, gas charged

Volume: 190 in³ (3.1 L)

Precharge Pressure: 1000 psi (6897 kPa)

4.19.9.2 Power Generation System: 1 in auxiliary pump sub-system

Type: Spherical, bladder separator, gas charged

Volume: 8.4 in³ (0.14 L)

Precharge Pressure: 1000 psi (6897 kPa)

- 4.19.9.3 Nosewheel Steering System 1 in Main System (reserve pressure:)
Type: Spherical, bladder separator, gas charged
Volume: 190 in³ (3.1 L)
Precharge Pressure: 500 psi (3448 kPa)
- 4.19.9.4 Nosewheel Steering System 1 in nosewheel steering anti-shimmy sub-system
Type: Spherical, bladder separator, gas charged
Volume: 23 in³ (0.89 L)
Precharge Pressure: 50 psi (345 kPa)
- 4.19.9.5 Braking System: 3 in braking sub-system
Type: Spherical, bladder separator, gas charged
Volume: 190 in³ (3.1 L)
Precharge Pressure: 700 psi (4826 kPa)
- 4.19.9.6 Horizontal Stabilizer Sub-System 1 per aircraft
Type: Spherical, bladder separator, gas charged
Volume: 54 in³ (0.89 L)
Precharge Pressure: 2000 psi (13 790 kPa)
- 4.19.10 Reservoir Data
- 4.19.10.1 Main System
Type: Pneumatically pressurized
Full Volume: 13.0 gal (49.3 L)
Total Volume: 14.4 gal (54.4 L)
Pressure: 30-35 psi (207-241 kPa)
- 4.19.10.2 Spoiler Sub-System
Type: Hydraulically pressurized
Full Volume: 1.2 gal (4.6 L)
Total Volume: 1.8 gal (6.9 L)
Pressure: 29 psi (200 kPa)
- 4.19.10.3 Rudder (Standby) Sub-System
Type: Sump (non-pressurized)
Total Volume: 1.1 gal (4.3 L)
- 4.19.10.4 Thrust Reverser Sub-System
Type: Sump (non-pressurized)
Total Volume: 2.4 gal (9.1 L)
- 4.19.10.5 Main System Emergency Reservoir
Type: Sump (non-pressurized)
Total Volume: 1.9 gal (7.4 L)
- 4.19.11 Relief Valve Data
- 4.19.11.1 Main System Relief Valve: 1 per aircraft
Relief Pressure: 3300 psi (27 754 kPa)
Rated Flow: 22.5 gpm (85.2 L/min) at 3500 psi (24 132 kPa)

4.19.11.2 Auxiliary/Sub-System Relief Valve 4 per aircraft; 1 in Spoilers subsystem, 1 in Rudder (Standby) subsystem, 1 in Thrust Reversers subsystem, 1 in auxiliary pump sub-system
Relief Pressure: 3300 psi (27 754 kPa)
Rated Flow: 3.5 gpm (13.3 L/min) at 3500 psi (24 132 kPa)

4.19.12 Filtration

4.19.12.1 Pressure Filtration: 6 per aircraft
Location: 1 in each Engine driven pump; AC Electric Motor Pump: delivery line and 1 in the empennage line supplying the horizontal stabilizer and rudder
Filtration Rating: 15 µm

4.19.12.2 Return Filtration: 1 per aircraft
Location: 1 in Main System reservoir
Filtration Rating: 15 µm

4.19.13 Tubing Data

4.19.13.1 High Pressure Lines
Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.313/0.020 in (7.95/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.88/1.07 mm)

4.19.13.2 Low Pressure Lines

4.19.13.2.1 Up to $\frac{3}{8}$ inch diameter and $\frac{3}{4}$ inch diameter
Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.250/0.016 in (6.35/0.406 mm), 0.250/0.020 in (6.35/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.750/0.049 in (19.1/1.24 mm)

4.19.13.2.2 Low Pressure Lines – all others

Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.50/0.028 in (12.7/0.711 mm), 0.625/0.035 in (15.9/0.889 mm), 0.625/0.049 in (15.9/1.24 mm), 1.25/0.022 in (31.8/0.559 mm), 1.50/0.022 in (38.1/0.559 mm)

4.19.13.3 Coiled Tubing

Material Specification: Titanium Tube, Commercial Pure
Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.313/0.035 in (7.94/0.889 mm)

4.19.14 Fitting Data

4.19.14.1 Separable Type: 24 degree flareless (37 degree flared optional)
Material: Al, CRES
End Connections: Brazed

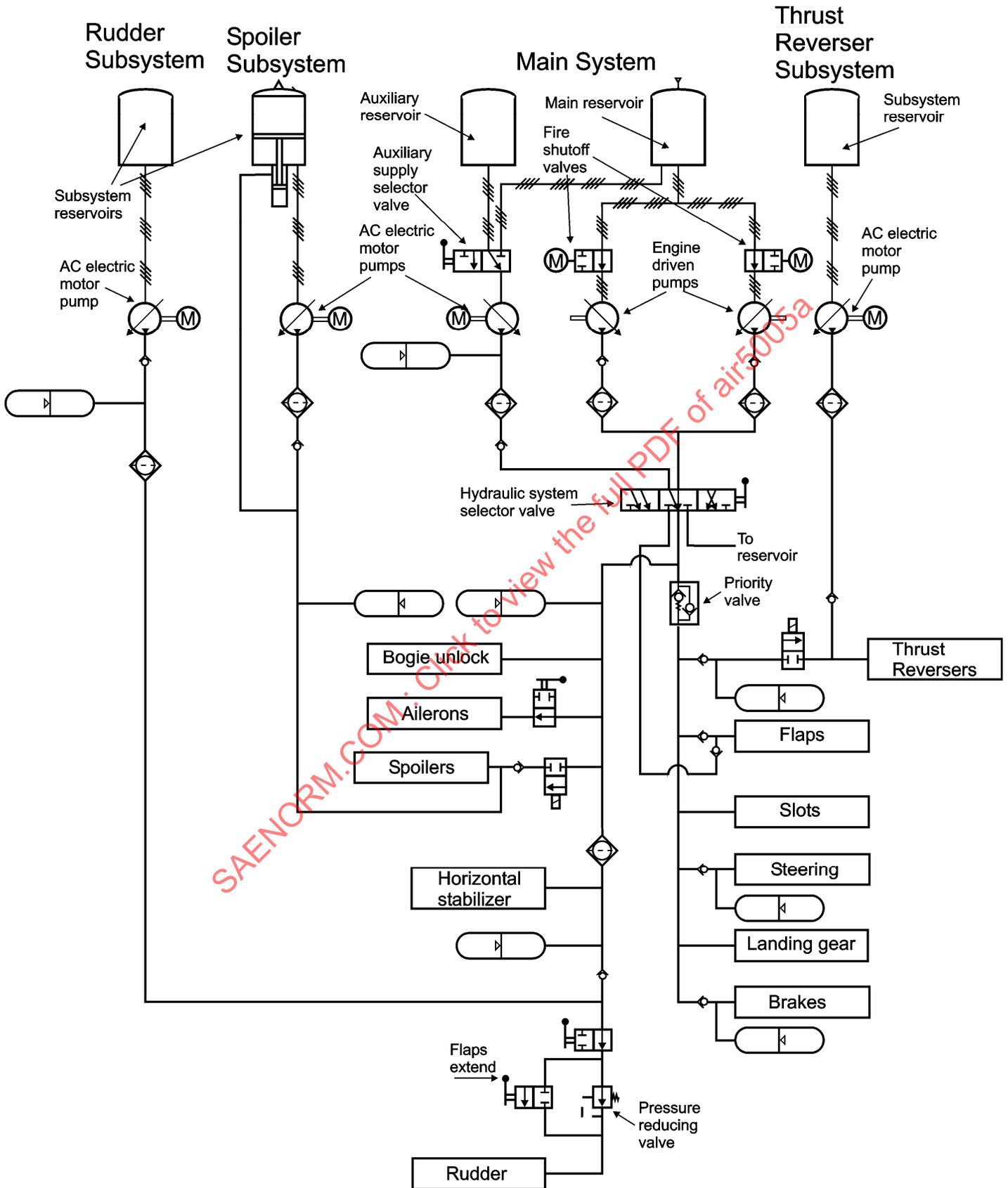


FIGURE 4.19 - MCDONNELL DOUGLAS DC-8-60/70 HYDRAULIC SYSTEM SCHEMATIC

4.20 McDonnell Douglas DC-9-10/20/30/40/50

4.20.1 Design Requirements: 14CFR Part 25 requirements

4.20.2 System Pressure: 3000 psi (20 690 kPa)/1500 psi (10 345 kPa)*
* Lower Pressure: selected by flight crew, typically during cruise

4.20.3 Hydraulic Fluid: AS1241

4.20.4 Number of Hydraulic Systems: 2 - Left System, Right System

4.20.5 System Temperature: -65 to +225 °F (-54 to +107 °C)

4.20.6 Main Hydraulic Pump Data

4.20.6.1 Engine Driven Pump: 2 per aircraft; 1 in Left System, 1 in Right System
Type: Variable displacement, Pressure compensated, bent-axis piston
Rated Flow-Pressure: 8.9 gpm (33.7 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.598 in³/rev (9.80 mL/rev)
Rated Speed: 3600 rpm
Rotation from Shaft End: Counter clockwise

4.20.7 Back-up Pump Data

4.20.7.1 AC Electric Motor Pump: 1 in Right system
Type: Variable displacement, Pressure compensated, bent-axis piston
Rated Flow-Pressure: 8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa)
Displacement: 0.598 in³/rev (9.80 mL/rev)
Rated Speed: 3200 rpm - pump; 11 300 rpm - motor (pump is driven via a gearbox)

4.20.7.2 Power Transfer Unit: 1 per aircraft; Right to Left System (full system); Left to Right System (Landing Gear only)
Type: Bi-directional fixed displacement bent-axis piston motor pump driving a fixed displacement bent-axis piston motor pump
Rated Flow-Pressure: 2.0 gpm (7.6 L/min) at 2350 psi (16 207 kPa) with an inlet flow of 2.2 gpm (8.33 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.095 in³/rev (1.56 mL/rev) pump and motor
Rated Speed: 5350 rpm

4.20.7.3 Hand Pump:
Usage: 2 per aircraft; 1 in Left System, 1 in Right System, for system maintenance

4.20.8 Hydraulic Motor Data
None are fitted to this aircraft

4.20.9 Accumulator Data

NOTE: Size and numbers off varies with aircraft series and serial number. The details below are for a typical aircraft.

4.20.9.1 Power Generation System: 2 per aircraft, 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 60 in³ (0.98 L)
Precharge Pressure: 1000 psi (6895 kPa)

- 4.20.9.2 Brake System: 4 per aircraft, 2 per system
Type: Spherical, bladder separator, gas charged
Volume: 60 in³ (0.98 L)
Precharge Pressure: 675 psi (4654 kPa)
- 4.20.9.3 Elevator Boost Sub-System: 1 in Left System
Type: Spherical, bladder separator, gas charged
Volume: 198 in³ (3.2 L)
Precharge Pressure: 2000 psi (13 790 kPa)
- 4.20.9.4 Elevator Return: 1 in Left System
Type: Spherical, bladder separator, gas charged
Volume: 60 in³ (0.98 L)
Precharge Pressure: 60 psi (414 kPa)
- 4.20.9.5 Thrust Reverser Sub-System: 2 per aircraft, 1 per system
Type: Spherical, bladder separator, gas charged
Volume: 60 in³ (0.98 L)
Precharge Pressure: 1000 psi (6895 kPa)
- 4.20.9.6 Ventral Stairs: 1 in Right System
Type: Transfer cylinder (used as an accumulator), gas charged
Volume: 9.6 in³ (0.16 L)
Precharge Pressure: 2000 psi (13 790 kPa)
- 4.20.10 Reservoir Data
- 4.20.10.1 Left and Right Systems
Type: Hydraulically pressurized
Full Volume: 4.0 gal (15.3 L)
Total Volume: 4.8 gal (18.2 L)
Pressure: 30 psi (206 kPa)
- 4.20.11 Relief Valve Data
- 4.20.11.1 Main System Relief Valve: 2 per aircraft, 1 per system
Relief Pressure: 3600 psi (24 822 kPa)
Rated Flow: 9 gpm (34 L/min)
Reseat Pressure: 200 psi (1379 kPa)
- 4.20.12 Filtration
- 4.20.12.1 Pressure Filtration: 2 per aircraft
Location: 1 for each Engine Driven pump delivery line
Filtration Rating: 15 µm
- 4.20.12.2 Case Drain Filtration: 2 per aircraft
Location: 1 for each Engine Driven Pump: line
Filtration Rating: 15 µm
- 4.20.12.3 Return Filtration: 2 per aircraft
Location: 1 in each system return line upstream of the reservoir (NOTE: In the Right System, it also functions as the AC pump case drain filter)
Filtration Rating: 15 µm

4.20.12.4 Hand Pump: Filtration 2 per aircraft

Location: 1 for each system reservoir (NOTE: In the Right System, it also functions as the AC pump pressure filter)

Filtration Rating: 15 µm

4.20.13 Tubing Data

4.20.13.1 High Pressure Lines

Material Specification: 304 - $\frac{1}{8}$ CRES hard per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.313/0.020 in (7.95/0.508 mm), 0.375/0.028 in (9.53/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.9/1.07 mm)

4.20.13.2 Low Pressure Lines

4.20.13.2.1 Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.313/0.020 in (7.95/0.508 mm), 0.375/0.028 in (9.53/0.711 mm)

4.20.13.2.2 Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.50/0.042 in (12.7/1.07 mm), 0.625/0.058 in (15.9/1.47 mm), 0.75/0.049 in (19.1/1.24 mm), 1.0/0.065 in (25.4/1.65 mm)

4.20.13.3 Flexible Tubing (Coils)

Material Specification: Titanium tube, commercial pure

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.313/0.035 in (7.94/0.889 mm)

4.20.14 Fitting Data

4.20.14.1 Separable Type: 37 degree flared (24 degree flareless optional)

Material: 304 CRES, Aluminum alloy 6061-T6

End Connections: Pipe flare, (pipe bite for flareless)

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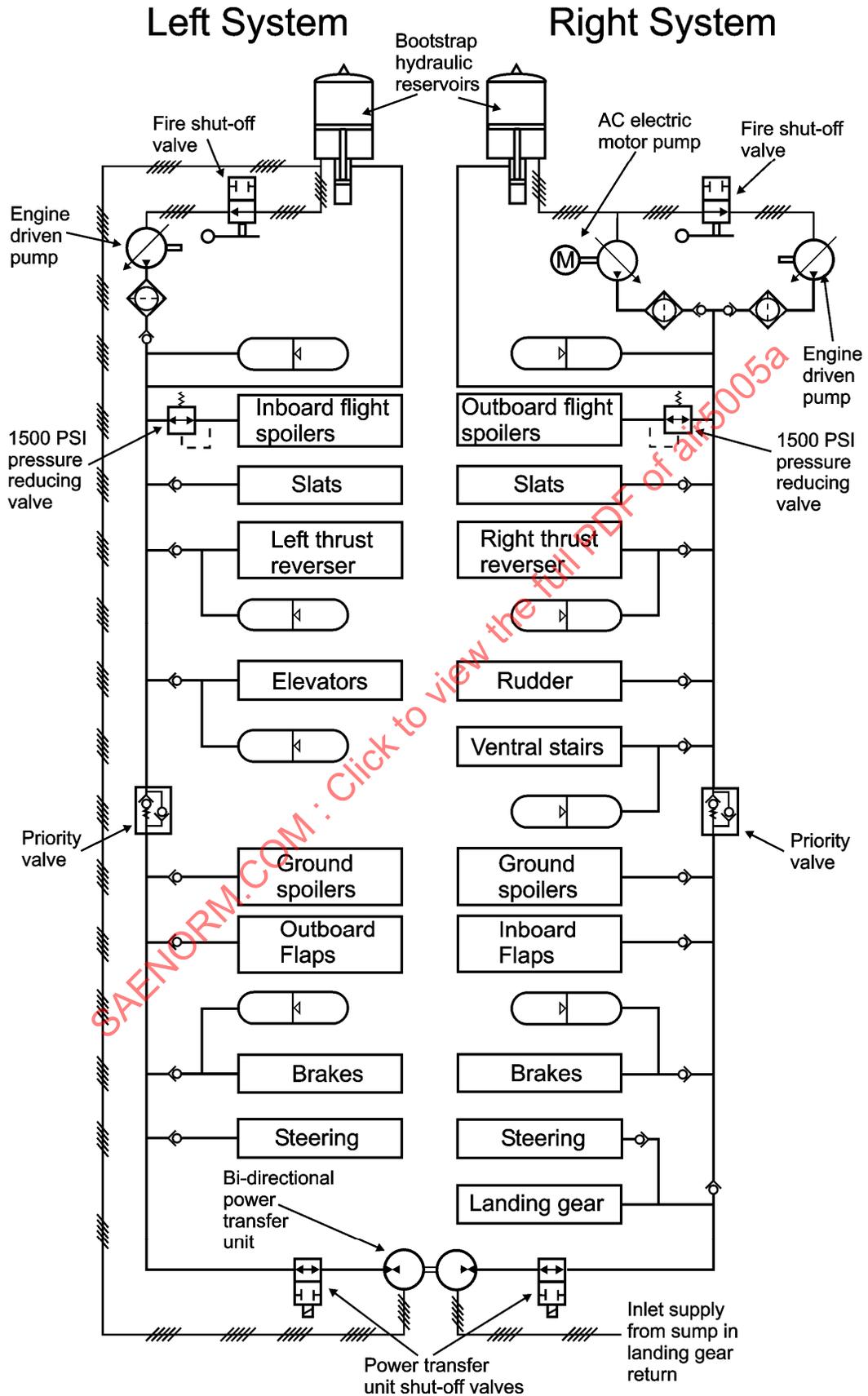


FIGURE 4.20 - MCDONNELL DOUGLAS DC-9-10/20/30/40/50 HYDRAULIC SYSTEM SCHEMATIC

5. TURBOPROP/COMMUTER AIRCRAFT

TABLE 3 – TURBOPROP/COMMUTER AIRCRAFT HYDRAULIC SYSTEM DATA

Aircraft	System Pressure	Number of Systems	Hydraulic Fluid	Main Pumps – Number/Type	Backup Pumps – Number/Type	Accumulators – Number/Type	Reservoirs - Type
ATR 42/ ATR 72	3000 psi (20 690 kPa)	2	AS1241	2 - AC pumps	1 - DC pump	4 - Bladder separator Type	Unpressurized
BAE Systems ATP/ Jetstream 61	2450 psi (16 897 kPa)	2	MIL-PRF-5606	2 – Engine driven pumps	1 - DC pump	3 – Piston Type	Air pressurized
BAE Systems Jetstream 31/32	2000 psi (13 793 kPa)	2	MIL-PRF-5606 MIL-PRF-83282	2 – Engine driven pumps	1 - Hand Pump	3 – Piston Type	Air pressurized
BAE Systems Jetstream 41	2000 psi (13 793 kPa)	2	MIL-PRF-5606 MIL-PRF-83282	2 – Engine driven pumps	1 - Hand Pump	3 – Piston Type	Air pressurized
Beechcraft 1900C/D	3000 psi (20 690 kPa)	1	MIL-PRF-5606	1 - DC pump	1 - Hand Pump	1 – Piston Type	Air pressurized
Bombardier DHC-8 Dash 8 Q100/200/300	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps	2 - AC pumps 1 – Power Transfer Unit 1 - Hand Pump	1 – Piston Type	Bootstrap
Bombardier DHC-8 Dash 8 Q400	3000 psi (20 690 kPa)	2 + standby	AS1241	2 – Engine driven pumps 1 - DC pump	1 - AC pump 1 – Power Transfer Unit 1 - Hand Pump	2 – Piston Type	Bootstrap
De Havilland DHC-7 Dash 7	3000 psi (20 690 kPa)	2 + standby	AS1241	4 – Engine driven pumps	1 - Hand Pump	1 – Piston Type	Bootstrap
Dornier 328	3000 psi (20 690 kPa)	2	MIL-PRF-5606	1 - AC pump	1 - DC pump 1 – Hand Pump	2 – Piston Type	Unpressurized

TABLE 3 (CONTINUED) – TURBOPROP/COMMUTER AIRCRAFT HYDRAULIC SYSTEM DATA

Aircraft	System Pressure:	Number of Systems	Hydraulic Fluid	Main Pumps – Number/Type	Backup Pumps – Number/Type	Accumulators – Number/Type	Reservoirs - Type
EADS CASA CN-235	3000 psi (20 690 kPa)	1	MIL-PRF-5606 MIL-PRF-83282	2 - DC pumps	None	2 – Piston Type	Bootstrap
Embraer EMB-110 Bandeirante	3000 psi (20 690 kPa)	2	MIL-PRF-5606 MIL-PRF-83282	2 – Engine driven pumps	1 – Hand Pump	2 – Piston Type	Unpressurized
Embraer EMB-120 Brasilia	3000 psi (20 690 kPa)	2	MIL-PRF-5606 MIL-PRF-83282	2 – Engine driven pumps	2 - DC pumps	4 – Piston Type	Air pressurized
Fairchild Metro	2000 psi (13 793 kPa)	2	MIL-PRF-83282	2 – Engine driven pumps	1 – Hand Pump	2 – Piston Type	Air pressurized
Fokker 50	3000 psi (20 690 kPa)	1	MIL-PRF-5606	2 – Engine driven pumps	1 - AC pump	2 – Piston Type	Air pressurized
Lockheed L. 188 Electra	3000 psi (20 690 kPa)	2	MIL-PRF-5606	3 - AC pumps	1 - DC pump	2 – Piston Type	Air pressurized
Saab 340	3000 psi (20 690 kPa)	1	MIL-PRF-5606	1 - DC pump	1 – Hand Pump	4 – Piston Type	Bootstrap + Unpressurized
Saab 2000	3000 psi (20 690 kPa)	3	MIL-PRF-5606	2 – Engine driven pumps	2 - AC pumps 1 - DC pump	5 – Piston Type	Bootstrap + Unpressurized
Shorts 360	3000 psi (20 690 kPa)	1	MIL-PRF-5606	2 – Engine driven pumps	None	3 – Piston Type	Air pressurized

5.1 ATR 42/ATR 72

5.1.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

5.1.2 System Pressure: 3000 psi (20 690 kPa)

5.1.3 Hydraulic Fluid: AS1241

5.1.4 Number of Hydraulic Systems: 2 - Green System; Blue System

5.1.5 System Temperature: -65 to 194 °F (-54 to 90 °C)

5.1.6 Main Hydraulic Pump Data

5.1.6.1 AC Electric Motor Pump: 2 per aircraft; 1 in each system
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 2.0 gpm (7.6 L/min) at 2500 psi (17 241 kPa)
Displacement: 0.050 in³/rev (0.819 mL/rev)
Rated Speed: 9700 rpm

5.1.7 Back-up Pump Data

5.1.7.1 DC Electric Motor Pump: 1 in Blue System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 0.50 gpm (1.9 L/min) at 2850 psi (19 615 kPa)
Displacement: 0.015 in³/rev (0.246 mL/rev)
Rated Speed: 8300 rpm

5.1.8 Hydraulic Motor Data
None are fitted to these aircraft

5.1.9 Accumulator Data

5.1.9.1 Power Generation System: 2 per aircraft; 1 in Green System, 1 in Blue System
Type: Spherical, bladder separator, gas charged
Volume: 73.2 in³ (1.2 L)
Precharge Pressure: 1450 psi (10 000 kPa)

5.1.9.2 Braking System: 1 in Blue System
Type: Spherical, bladder separator, gas charged
Volume: 12.2 in³ (0.2 L)
Precharge Pressure: 1450 psi (10 000 kPa)

5.1.10 Reservoir Data

5.1.10.1 Combined Green and Blue System Reservoir
Type: Unpressurized
Full Volume: 2.54 gal (9.60 L)
Total Volume: 3.12 gal (11.8 L)
Pressure: Atmospheric

5.1.11 Relief Valve Data

- 5.1.11.1 Main System Relief Valve: 2 per aircraft, 1 per system
 - Relief Pressure: 3550 psi (24 500 kPa)
 - Rated Flow: 2.4 gpm (9.1 L/min) at 3750 psi (25 862 kPa)
 - Reseat Pressure: 3150 psi (21 724 kPa)

5.1.12 Filtration

- 5.1.12.1 Pressure Filtration: 2 per aircraft
 - Location: 1 per system
 - Filtration Rating: 15 µm
- 5.1.12.2 Case Drain Filtration: 3 per aircraft
 - Location: 1 in each pump line
 - Filtration Rating: 15 µm
- 5.1.12.3 Return Filtration: 2 per aircraft
 - Location: 1 in each return line upstream of the reservoir
 - Filtration Rating: 5 µm

5.1.13 Tubing Data

- 5.1.13.1 High Pressure Lines
 - Material Specification: 21-6-9 CRES per AMS5561
 - Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm), 0.50/0.026 in (12.7/0.660 mm)
- 5.1.13.2 Low Pressure Lines
 - 5.1.13.2.1 Material Specification: 6061-T6 Aluminum alloy per AMS4083
 - Diameters/Wall Thicknesses: 0.375/0.035 in (9.53/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.75/0.035 in (9.53/0.889 mm)
 - 5.1.13.2.2 Material Specification: 21-6-9 CRES per AMS5561 (in unprotected areas in the landing gear bay wells)
 - Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.53/0.508 mm)

5.1.14 Fitting Data

- 5.1.14.1 Separable Type: 24 degree flareless
 - Material: Al, CRES
 - End Connections: Internal swage
- 5.1.14.2 Permanent Type: External swage
 - Material: Al, CRES

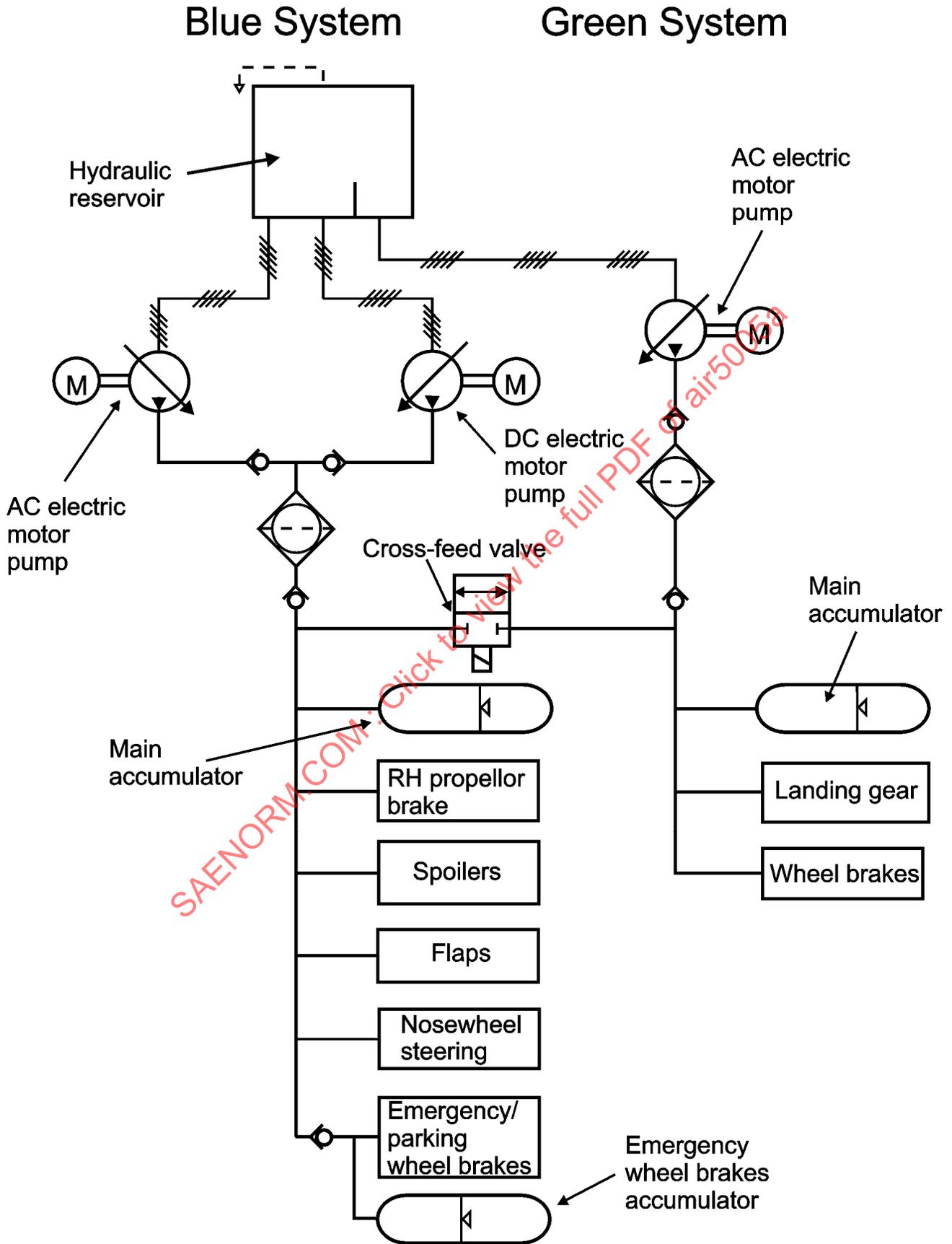


FIGURE 5.1 - ATR 42/ ATR 72 HYDRAULIC SYSTEM SCHEMATIC

5.2 BAE Systems ATP/Jetstream 61

5.2.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

5.2.2 System Pressure: 2450 psi (16 897 kPa)

5.2.3 Hydraulic Fluid: MIL-PRF-5606

5.2.4 Number of Hydraulic Systems: 2 - Main System; Auxiliary System

5.2.5 System Temperature: -58 to +194 °F (-50 to +90 °C)

5.2.6 Main Hydraulic Pump Data

5.2.6.1 Engine Driven Pump: 2 in Main System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 11.1 gpm (42.0 L/min) at 2350 psi (16 200 kPa)

Displacement: 0.52 in³/rev (8.5 mL/rev)

Rated Speed: 6000 rpm

Rotation from Shaft End: Counter clockwise

5.2.7 Back-up Pump Data

5.2.7.1 DC Electric Motor Pump 1 in Auxiliary System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 0.6 gpm (2.3 L/min)

Displacement: 0.09 in³/rev (1.5 mL/rev)

Rated Speed: 8000 rpm

5.2.8 Hydraulic Motor Data

None are fitted to this aircraft

5.2.9 Accumulator Data

5.2.9.1 Power Generation System: 1 in Main System

Type: Piston, gas charged

Volume: 63.0 in³ (1.03 L)

Precharge Pressure: 1300 psi (8 966 kPa)

5.2.9.2 Braking System: 2 in braking Sub-System

Type: Piston, gas charged

Volume: 63.0 in³ (1.03 L)

Precharge Pressure: 1300 psi (8 966 kPa)

5.2.10 Reservoir Data

5.2.10.1 Main System Reservoir

Type: Air pressurized

Full Volume: 2.8 gal (10.5 L)

Total Volume: 3.10 gal (13.10 L)

Pressure: 18 psi (124 kPa)

5.2.10.2 Auxiliary System Reservoir

Type: Air pressurized

Total Volume: 1.0 gal (3.10 L)

Pressure: 18 psi (124 kPa)

5.2.11 Relief Valve Data

- 5.2.11.1 Main System Relief Valve: 2 per aircraft, 1 per engine driven pump
Relief Pressure: 3300 psi (22 760 kPa)
Rated Flow: 12.0 gpm (45.3 L/min)
Reseat Pressure: 2000 psi (13 790 kPa)

5.2.12 Filtration

5.2.12.1 Main System

- 5.2.12.1.1 Pressure Filtration: 2 per aircraft
Location: 1 in each engine driven pump delivery line
Filtration Rating: 5 µm
- 5.2.12.1.2 Return Filtration: 2 per aircraft
Location: Return line upstream of the reservoir
Filtration Rating: 5 µm

5.2.12.2 Auxiliary System

- 5.2.12.2.1 Pressure Filtration: 1 per aircraft
Location: DC pump delivery line
Filtration Rating: 15 µm
- 5.2.12.2.2 Case Drain Filtration: 1 per aircraft
Location: Return line upstream of reservoir
Filtration Rating: 15 µm

5.2.13 Tubing Data

5.2.13.1 High Pressure Lines

Material Specification: CRES per BS T72/T73
Diameters/Wall Thicknesses: 0.188/0.016 in (4.76/0.406 mm), 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.525/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.88/0.838 mm), 0.75/0.039 in (19.05/0.991 mm)

5.2.13.2 Low Pressure Lines

Material Specification: Aluminum alloy per BS L56
Diameters/Wall Thicknesses: 0.25/0.022 in (6.35/0.559 mm), 0.375/0.035 in (9.525/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.88/0.889 mm)

5.2.14 Fitting Data

- 5.2.14.1 Separable Type: AGS 1100 flared
Material: Al, Stainless steel
End Connections: Pipe flare

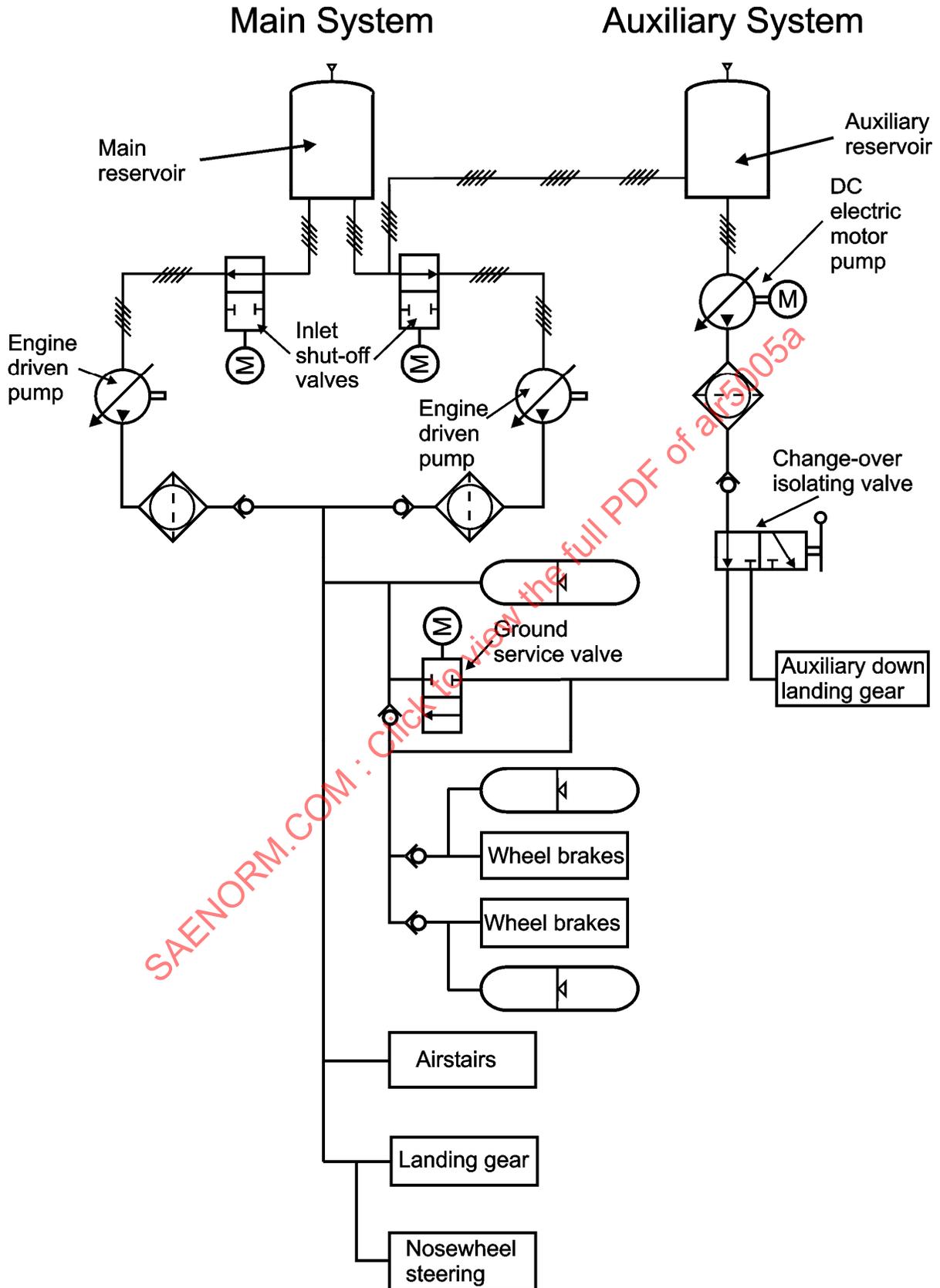


FIGURE 5.2 - BAE SYSTEMS ATP/JETSTREAM 61 HYDRAULIC SYSTEM SCHEMATIC

5.3 BAE Systems Jetstream 31/32

5.3.1 Design Requirements: 14CFR Part 25/JAR 23 requirements

5.3.2 System Pressure: 2000 psi (13 793 kPa)

5.3.3 Hydraulic Fluid: MIL-PRF-5606 or MIL-PRF-83282

5.3.4 Number of Hydraulic Systems: 2 - Main System; Emergency System

5.3.5 System Temperature: -67 to +194 °F (-55 to +90 °C)

5.3.6 Main Hydraulic Pump Data

5.3.6.1 Engine Driven Pump: 2 in Main System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 6.3 gpm (23.9 L/min) at 1850 psi (12 759 kPa)

Displacement: 0.34 in³/rev (5.57 mL/rev)

Rated Speed: 3960 rpm

Rotation from Shaft End: Clockwise

5.3.7 Back-up Pump Data

5.3.7.1 Hand Pump: 1 in Emergency system

Pressure - Flow characteristics

Maximum Pressure: 1500 psi (10 345 kPa) – Working

Maximum flow 1.5 in³ (24.6 mL) per double stroke

5.3.8 Hydraulic Motor Data

None are fitted to this aircraft

5.3.9 Accumulator Data

5.3.9.1 Power Generation System: 1 in Main System

Type: Piston, gas charged

Volume: 100 in³ (1.64 L)

Precharge Pressure: 500 psi (3448 kPa)

5.3.9.2 Braking Systems 2 in Main System

Type: Piston, gas charged

Volume: 40 in³ (0.65 L)

Precharge Pressure: 700 psi (4828 kPa)

5.3.10 Reservoir Data

5.3.10.1 Main and Emergency Reservoirs Combined in 1 unit

Type: Air pressurized

Full Volume: 3.2 gal (12.3 L)

Total Volume: 3.5 gal (13.4 L)

Pressure: Jetstream 31 - 18 psi (124 kPa); Jetstream 32 - 22 psi (151 kPa)

5.3.11 Relief Valve Data

- 5.3.11.1 Main System Relief Valve: 1 per aircraft
 - Relief Pressure: 2450 psi (17 517 kPa)
 - Rated Flow: 9.3 gpm (35.4 L/min)
 - Reseat Pressure: 2300 psi (15 862 kPa)

5.3.12 Filtration

5.3.12.1 Pressure Filtration:

- 5.3.12.1.1 Location: 1 in the combined EDPs' delivery line
 - Filtration Rating: 5 μ m

- 5.3.12.1.2 Location: 1 in the hand pump line
 - Filtration Rating: 45 μ m

5.3.12.2 Case Drain Filtration:

- Location: 1 in the combined EDPs' line
- Filtration Rating: 15 μ m

5.3.12.3 Return Filtration:

- Location: 1 in return line upstream of the reservoir
- Filtration Rating: 5 μ m

5.3.13 Tubing Data

5.3.13.1 High Pressure Lines

- Material Specification: Tungum to DTD5019 or Stainless Steel to DTD5016 (where fire resistance is required)
- Diameters/Wall Thicknesses: 0.188/0.022 in (4.76/0.559 mm), 0.25/0.022 in (6.35/0.559 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.036 in (12.7/0.914 mm)

5.3.13.2 Low Pressure Lines

- Material Specification: Aluminum alloy per BS L56
- Diameters/Wall Thicknesses: 0.50/0.036 in (12.7/0.914 mm), 0.625/0.036 in (15.88/0.914 mm), 0.75/0.036 in (19.1/0.914 mm), 1.0/0.048 in (25.4/1.219 mm)

5.3.14 Fitting Data

- 5.3.14.1 Separable Type: 37 degree flared
 - Material: Al, CRES
 - End Connections: Pipe flare

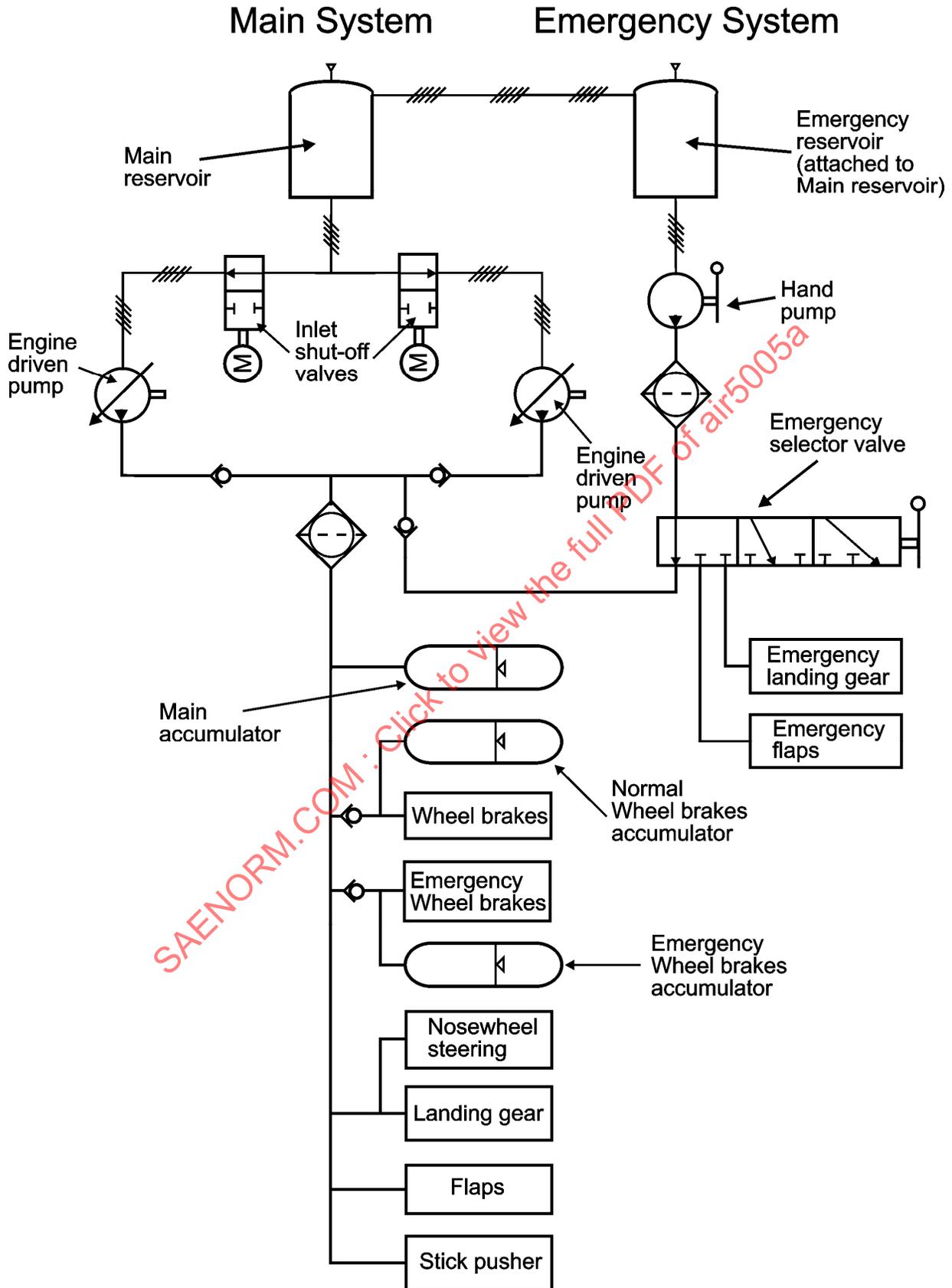


FIGURE 5.3 - BAE SYSTEMS JETSTREAM 31/32 HYDRAULIC SYSTEM SCHEMATIC

5.4 BAE Systems Jetstream 41

5.4.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

5.4.2 System Pressure: 2000 psi (13 793 kPa)

5.4.3 Hydraulic Fluid: MIL-PRF-5606 or MIL-PRF-83282

5.4.4 Number of Hydraulic Systems: 2 - Main System; Emergency System

5.4.5 System Temperature:

5.4.6 Main Hydraulic Pump Data

5.4.6.1 Engine Driven Pump: 2 in Main System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 6.3 gpm (23.9 L/min) at 1850 psi (12 759 kPa)

Displacement: 0.34 in³/rev (5.57 mL/rev)

Rated Speed: 3960 rpm

Rotation from Shaft End: Clockwise

5.4.7 Back-up Pump Data

5.4.7.1 Hand Pump 1 in Emergency system

Pressure - Flow characteristics

Maximum Pressure: 1500 psi (10 345 kPa) – Working

Maximum flow 1.5 in³ (24.6 mL) per double stroke

5.4.8 Hydraulic Motor Data

None are fitted to this aircraft

5.4.9 Accumulator Data

5.4.9.1 Power Generation System: 1 in Main System

Type: Piston, gas charged

Volume: 100 in³ (1.64 L)

Precharge Pressure: 500 psi (3448 kPa)

5.4.9.2 Braking System: 2 in main System

Type: Piston, gas charged

Volume: 40 in³ (0.65 L)

Precharge Pressure: 500 psi (3448 kPa)

5.4.10 Reservoir Data

5.4.10.1 Main and Emergency reservoirs combined

Type: Air pressurized

Full Volume: 3.5 gal (13.4 L)

Total Volume: 4.0 gal (15.2 L)

Pressure: 22 psi (152 kPa)

5.4.11 Relief Valve Data

- 5.4.11.1 Main System Relief Valve: 1 per aircraft
Relief Pressure: 2450 psi (17 517 kPa)
Rated Flow: 9.3 gpm (35.4 L/min)
Reseat Pressure: 2300 psi (15 862 kPa)

5.4.12 Filtration

5.4.12.1 Pressure Filtration

- 5.4.12.1.1 Location: 1 in the combined EDPs' delivery line
Filtration Rating: 5 µm

- 5.4.12.1.2 Location: 1 in the Hand Pump: delivery line
Filtration Rating: 45 µm

- 5.4.12.2 Case Drain Filtration: 2 per aircraft
Location: 1 per EDP
Filtration Rating: 15 µm

- 5.4.12.3 Return Filtration: 1 per aircraft
Location: Return line upstream of the reservoir
Filtration Rating: 5 µm

5.4.13 Tubing Data

5.4.13.1 High Pressure Lines

- 5.4.13.2 Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.188/0.016 in (4.76/0.406 mm), 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.525/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.88/0.838 mm), 0.75/0.039 in (19.05/0.991 mm)

5.4.13.3 Low Pressure Lines

- 5.4.13.3.1 Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.022 in (6.35/0.559 mm), 0.313/0.022 in (7.938/0.559 mm), 0.375/0.035 in (9.525/0.889 mm), 0.50/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.88/0.889 mm), 1.0/0.035 in (25.4/0.889 mm)
- 5.4.13.3.2 Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.625/0.033 in (15.88/0.838 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.052 in (25.4/1.321 mm)

5.4.14 Fitting Data

- 5.4.14.1 Separable Type: 24 degree flareless
Material: Al, CRES
End Connections: External swage
- 5.4.14.2 Permanent Type External swage
Material: Al, CRES

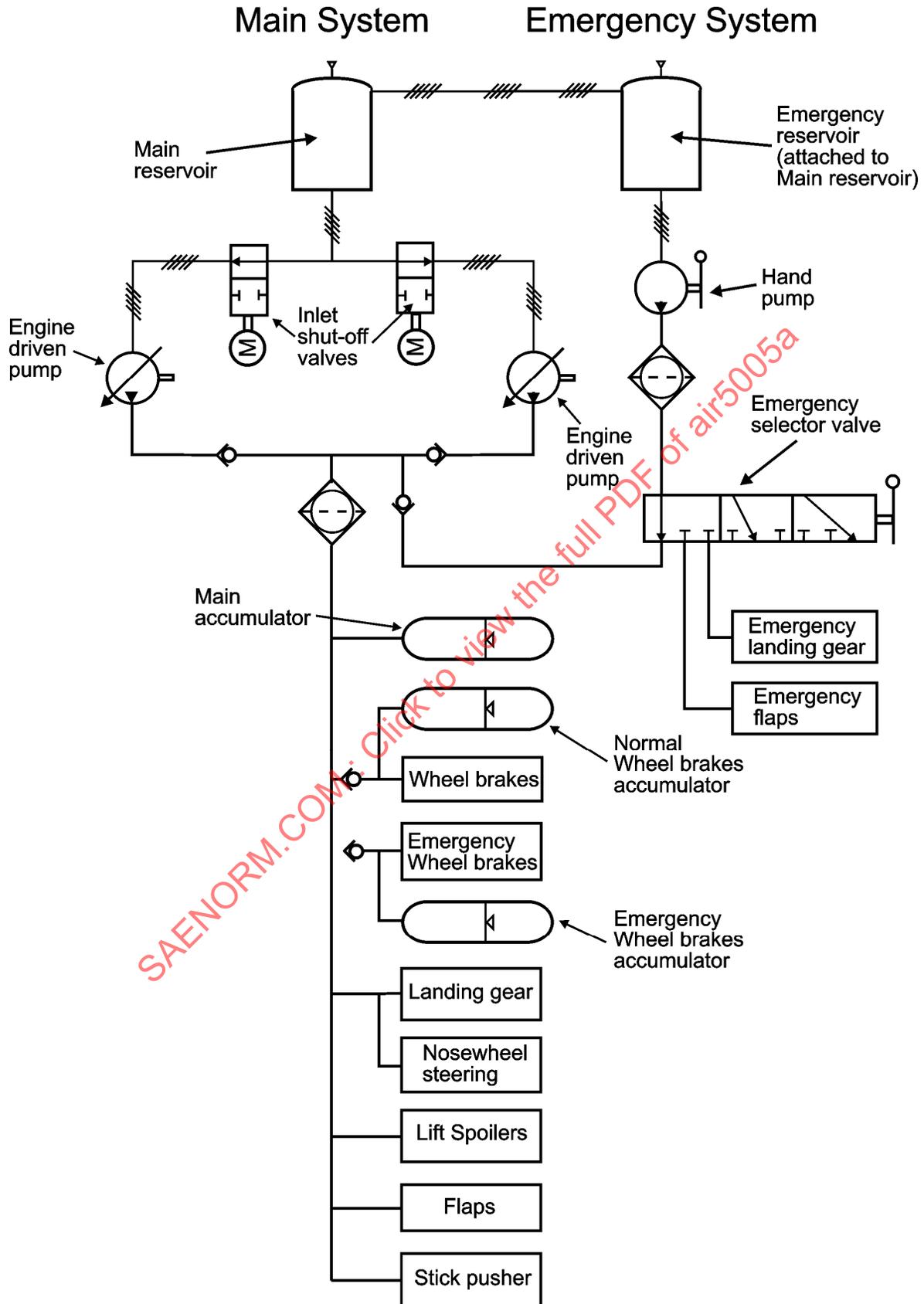


FIGURE 5.4 - BAE SYSTEMS JETSTREAM 41 HYDRAULIC SYSTEM

5.5 Beechcraft 1900C/D

5.5.1 Design Requirements: 14CFR 23 requirements

5.5.2 System Pressure: 3000 psi (20 690 kPa)

5.5.3 Hydraulic Fluid: MIL-PRF-5606

5.5.4 Number of Hydraulic Systems: 1

5.5.5 System Temperature: -65 to 160 °F (-54 to 71 °C)

5.5.6 Main Hydraulic Pump Data

5.5.6.1 DC Electric Motor Pump 1 per aircraft

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 3.10 gpm (12.1 L/min) at 1500 psi (10 345 kPa)

2.0 gpm (7.6 L/min) at 2750 psi (18 966 kPa)

Displacement: 0.11 in³/rev (1.803 mL/rev)

Rated Speed: 7200 rpm

5.5.7 Back-up Pump Data

5.5.7.1 Hand Pump:

Pressure -Displacement: rating 1500 psi (10 345 kPa); 1.1 in³ (18.03 mL) per stroke

5.5.8 Hydraulic Motor Data

None are fitted to aircraft

5.5.9 Accumulator Data

5.5.9.1 Power Generation System: 1 per aircraft

Type: Piston, gas charged

Volume: 11 in³ (180.3 mL)

Precharge Pressure: 800 psi (55.17 kPa)

5.5.10 Reservoir Data

5.5.10.1 Primary and Secondary Reservoirs Combined into one unit

Type: Air pressurized

Full Volume: 1.3 gal (4.9 L)

Total Volume: 1.6 gal (6.2 L)

Pressure: 18 psi (124 kPa)

5.5.11 Relief Valve Data

5.5.11.1 Main System Relief Valve: 1 per aircraft

Relief Pressure: 3250 psi (22 414 kPa)

Rated Flow: Not known

Reseat Pressure: 2900 psi (20 000 kPa)

5.5.12 Filtration

- 5.5.12.1 Return Filtration: 1 per aircraft
Location: Upstream of the reservoir
Filtration Rating: 10 μm

5.5.13 Tubing Data

- 5.5.13.1 High Pressure Lines
Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm); 0.375/0.028 in (9.525/0.711 mm)

- 5.5.13.2 Low Pressure Lines
Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.50/0.035 in (12.7/0.889 mm)

5.5.14 Fitting Data

- 5.5.14.1 Separable Type: 37 degree flared
Material: Al, CRES
End Connections: External swage
- 5.5.14.2 Permanent Type External swage
Material: Not known

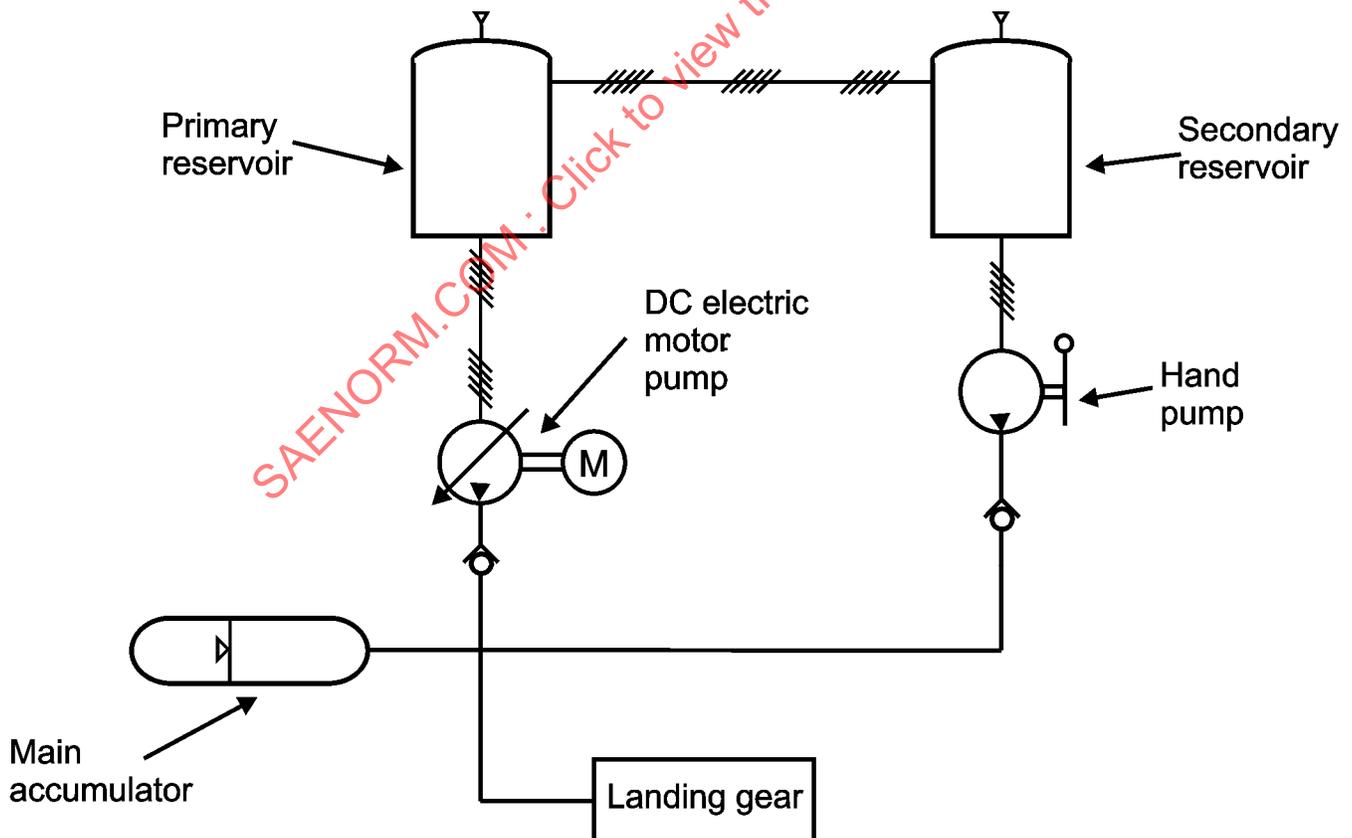


FIGURE 5.5 - BEECHCRAFT 1900C/D HYDRAULIC SYSTEM SCHEMATIC

5.6 Bombardier DHC-8 Dash 8 Q100/200/300

5.6.1 Design Requirements: 14CFR Part 25 requirements

5.6.2 System Pressure: 3000 psi (20 690 kPa)

5.6.3 Hydraulic Fluid: AS1241

5.6.4 Number of Hydraulic Systems: 3 - No. 1 Power System, No. 2 Power System, Auxiliary System

5.6.5 System Temperature: -65 to +200 °F (-54 to +93 °C)

5.6.6 Main Hydraulic Pump Data

- 5.6.6.1 Engine Driven Pump: 2 per aircraft; 1 in No. 1 Power System, 1 in No. 2 Power System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 10.0 gpm (37.8 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.32 in³/rev (5.24 mL/rev)
Rated Speed: 7514 rpm
Rotation from Shaft End: Counter clockwise

5.6.7 Back-up Pump Data

- 5.6.7.1 AC Electric Motor Pump: 2 per aircraft; 1 in No. 1 Power System, 1 in No. 2 Power System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 1.5 gpm (5.7 L/min) at 2750 psi (18 966 kPa)
Displacement: 0.052 in³/rev (0.852 mL/rev)
Rated Speed: 7200 rpm at 366 Hz electric supply frequency

- 5.6.7.2 Power Transfer Unit: 1 per aircraft; No. 1 Power System to supply No. 2 Power System
NOTE: For retrofit modification standard, PTU supplies landing gear only
Type: Fixed displacement motor driving a fixed displacement pump
Rated Flow-Pressure: 7.0 gpm (26.5 L/min) at 3000 psi (20 690 kPa)
Displacement: 0.365 in³/rev (5.981 mL/rev) - motor, 0.29 in³/rev (4.752 mL/rev) - pump
Rated Speed: 5600 rpm

- 5.6.7.3 Hand Pump: 2 per aircraft; 1 in Auxiliary System to deploy main landing gear (emergency extension); 1 in No.2 Power System to operate parking brake
Pressure - Displacement: 0.75 in³ (12.3 mL) per cycle

5.6.8 Hydraulic Motor Data

- 5.6.8.1 Flap Motor: 1 per aircraft
Type: Fixed displacement
Displacement: 0.172 in³/rev (2.819 mL/rev)
Running Speed: 4800 rpm
Flow at Rated Pressure Differential: 3.10 gpm (13.104 L/min) at 2450 psi (16 897 kPa)

5.6.9 Accumulator Data

- 5.6.9.1 Braking System: 1 in No. 2 Power System
Type: Piston, gas charged
Volume: 25 in³ (0.41 L)
Precharge Pressure: 1000 psi (6896 kPa)

5.6.10 Reservoir Data

5.6.10.1 No. 1 Power System

Type: Hydraulically pressurized
Total Volume: 0.7 gal (2.5 L)
Pressure: 40 psi (276 kPa)

5.6.10.2 No. 2 Power System

Type: Hydraulically pressurized
Total Volume: 1.3 gal (4.9 L)
Pressure: 40 psi (276 kPa)

5.6.10.3 Auxiliary System

Type: Unpressurized
Total Volume: 0.3 gal (1.18L)
Pressure: Unpressurized

5.6.11 Relief Valve Data

5.6.11.1 Main System Relief Valve: 2 per aircraft; 1 per system

Relief Pressure: 3600 psi (24 828 kPa)
Rated Flow: 10.0 gpm (54.5 L/min)
Reseat Pressure: 3150 psi (21 724 kPa)

5.6.12 Filtration

5.6.12.1 Pressure Filtration: 2 per aircraft

Location: 1 in each combined EDP and ACP delivery line
Filtration Rating: 15 µm

5.6.12.2 Case Drain Filtration: 2 per aircraft

Location: 1 in each combined EDP and ACP line
Filtration Rating: 15 µm

5.6.12.3 Return Filtration: 2 per aircraft

Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 5 µm

5.6.13 Tubing Data

5.6.13.1 High Pressure Lines

5.6.13.1.1 Material Specification: 6061 - T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.049 in (9.525/1.245 mm), 0.50/0.065 in (12.7/1.651 mm), 0.625/0.083 in (15.875/2.108 mm)

5.6.13.1.2 Material Specification: 304 - 1/8 hard CRES per MIL-T-8504

Diameters/Wall Thicknesses: 0.25/0.022 in (6.35/0.559 mm), 0.375/0.035 in (9.525/0.889 mm)

5.6.13.1.3 Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.525/0.508 mm), 0.50/0.026 in (12.7/0.660 mm)

5.6.13.2 Suction and Return Lines

5.6.13.2.1 Material Specification: 6061 - T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.028 in (12.7/0.711 mm), 0.625/0.035 (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm)

5.6.13.2.2 Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-8504

Diameters/Wall Thicknesses: 0.25/0.022 in (6.35/0.559 mm), 0.375/0.035 in (9.525/0.889 mm)

5.6.13.2.3 Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.020 in (9.525/0.508 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.033 in (15.875/0.838 mm), 0.750/0.039 in (19.05/0.911 mm)

5.6.14 Fitting Data

5.6.14.1 Separable Type: 37 degree flared

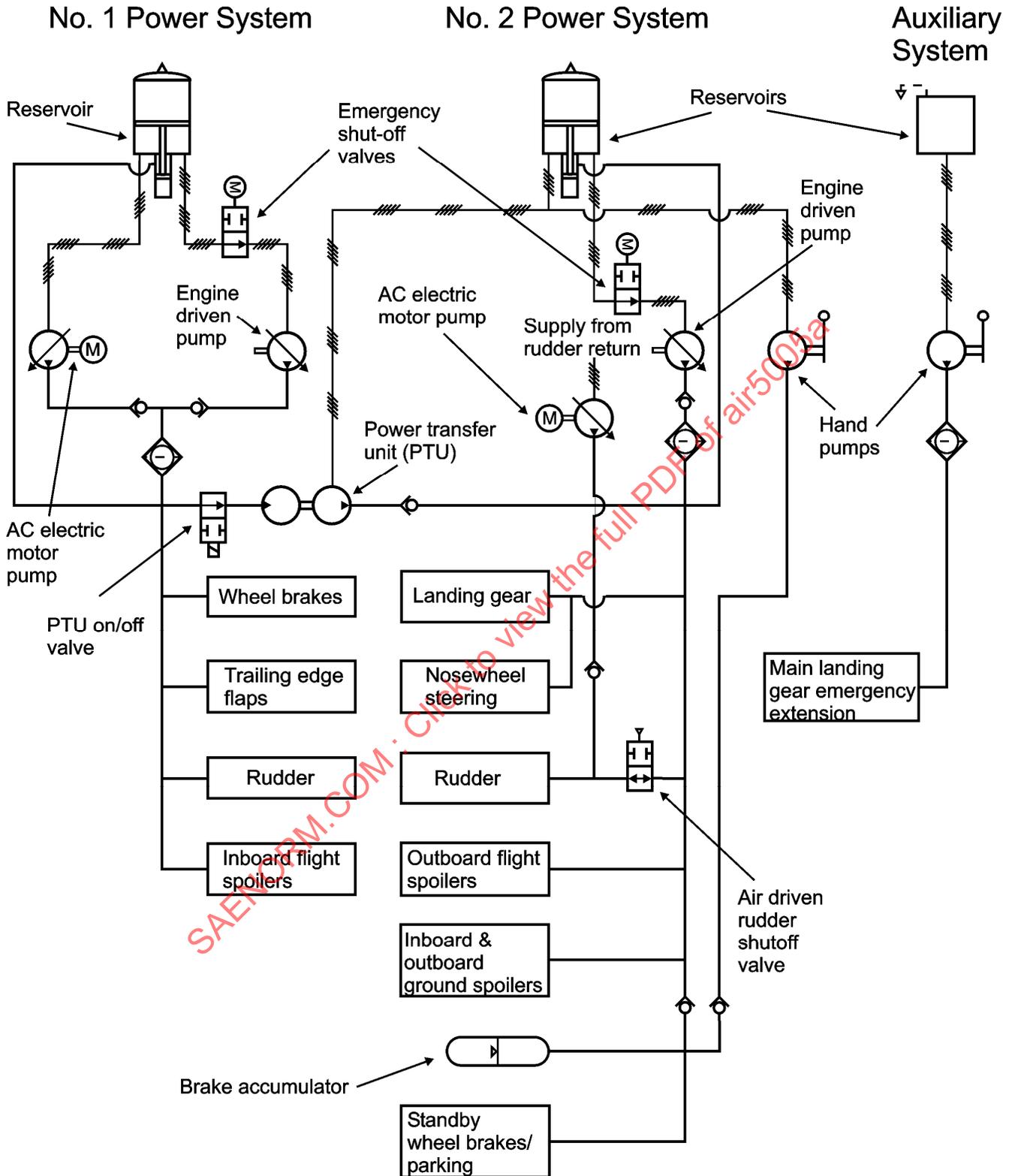
Material: Al, CRES

End Connections: Pipe flare

5.6.14.2 Permanent Type External swage

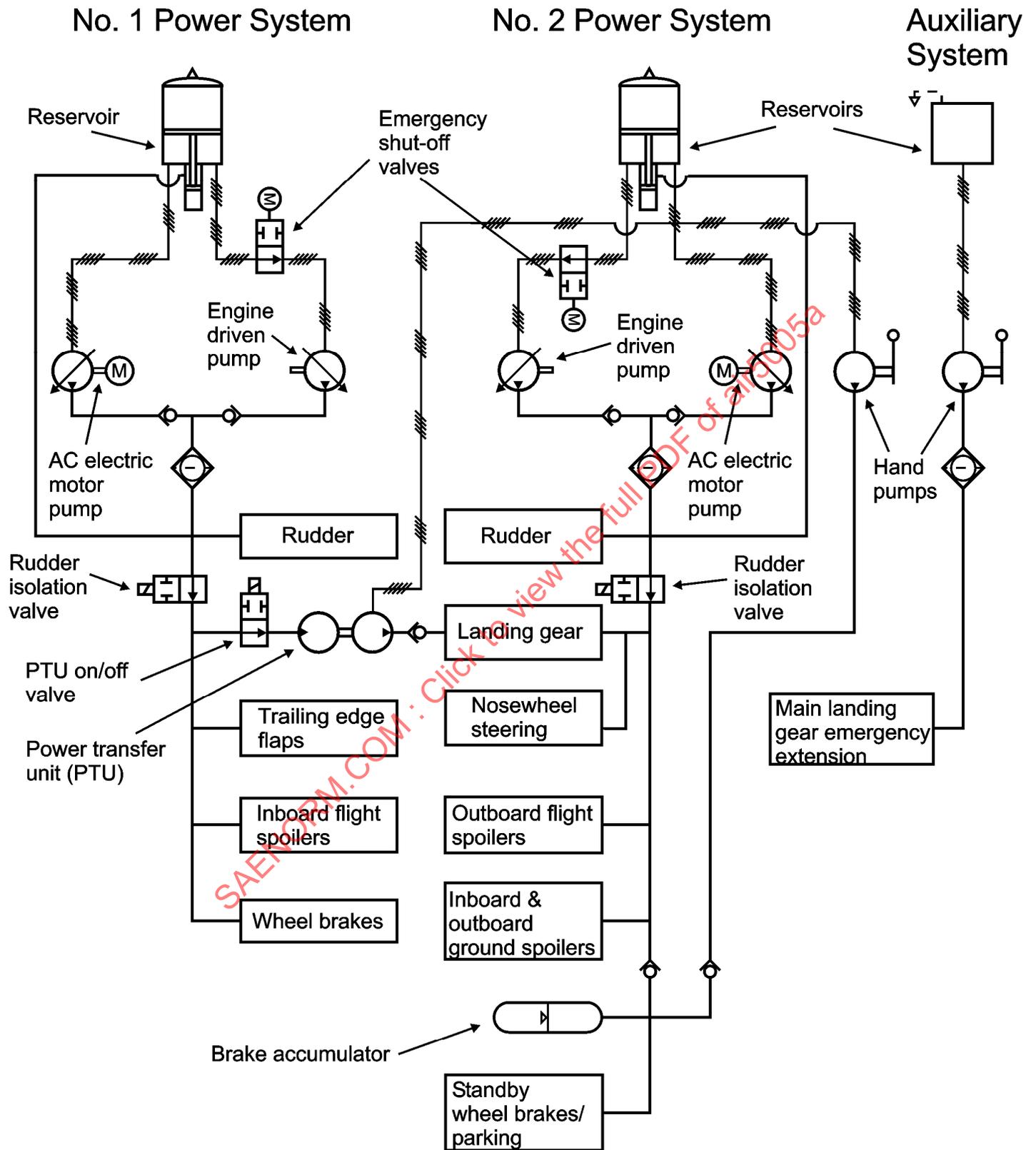
Material: CRES

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NOTE: Inboard and outboard ground spoilers fitted to Dash 8-100 only

FIGURE 5.6.1 - BOMBARDIER DHC-8 DASH 8 Q100/200/300 - CURRENT PRODUCTION STANDARD - HYDRAULIC SYSTEM SCHEMATIC



NOTE: Inboard and outboard ground spoilers fitted to Dash 8-100 only

FIGURE 5.6.2 - BOMBARDIER DHC-8 DASH 8 Q100/200/300 - IN-SERVICE RETROFIT STANDARD - HYDRAULIC SYSTEM SCHEMATIC

5.7 Bombardier DHC-8 Dash 8 Q400

5.7.1 Design Requirements: 14CFR Part 25 requirements

5.7.2 System Pressure: 3000 psi (20 690 kPa)

5.7.3 Hydraulic Fluid: AS1241

5.7.4 Number of Hydraulic Systems: 4 – System 1, System 2, System 3, Auxiliary System

5.7.5 System Temperature: -80 to +160 °F (-54 to +71 °C); up to +200 °F (104 °C) for 5 minutes

5.7.6 Main Hydraulic Pump Data

5.7.6.1 Engine Driven Pump: 2 per aircraft; 1 in System 1, 1 in System 2
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 25.5 gpm (96.5 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.95 in³/rev (15.57 mL/rev)
Rated Speed: 6432 rpm
Rotation from Shaft End: Counter clockwise

5.7.6.2 DC Electric Motor Pump: 1 per aircraft; 1 in System 3
Type: Fixed displacement driving an accumulator
Rated Flow-Pressure: 0.28 gpm (1.06 L/min) at 3100 psi (21 385 kPa)
Displacement: 0.008 in³/rev (0.131 mL/rev)
Rated Speed: 10 000 rpm

5.7.7 Back-up Pump Data

5.7.7.1 AC Variable Frequency (300-600 Hz) Electric Motor Pump: 1 per aircraft; 1 in System 1
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 3.0 gpm (11.4 L/min) at 2750 psi (18967 kPa) at 340 Hz
4.9 gpm (18.5 L/min) at 2750 psi (18967 kPa) at 560 Hz
Displacement: 0.12 in³/rev (1.97 mL/rev)
Rated Speed: 5700 rpm (at 300 Hz) to 11 400 rpm (at 600 Hz)

5.7.7.2 Power Transfer Unit: 1 per aircraft; System 1 to supply System 2
Type: Fixed displacement motor driving a fixed displacement pump
Rated Flow-Pressure: 16.6 gpm (62.8 L/min) at 1900 psi (13 100 kPa)
Displacement: 0.70 in³/rev (11.47 mL/rev) - motor, 0.67 in³/rev (10.98 mL/rev) - pump
Rated Speed: 6000 rpm

5.7.7.3 Hand Pump: 2 per aircraft; 1 in Auxiliary System to deploy main landing gear (emergency extension);
1 in System 2 to operate parking brake
Pressure - Displacement: 0.75 in³ (12.3 mL) per cycle

5.7.8 Hydraulic Motor Data

5.7.8.1 Flap Motor: 1 per aircraft
No data available

5.7.9 Accumulator Data

5.7.9.1 Power Generation System: 1 in System 3
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 1900 psi (13 104 kPa)

5.7.9.2 Braking System: 1 in System 2
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 500 psi (3447 kPa)

5.7.10 Reservoir Data

5.7.10.1 System 1
Type: Hydraulically pressurized
Total Volume: 2.12 gal (8.03 L, 490 in³)
Pressure: 55 psi (379 kPa) at 2950 psi (20 346 kPa) system pressure

5.7.10.2 System 2
Type: Hydraulically pressurized
Total Volume: 3.16 gal (11.96 L, 730 in³)
Pressure: 55 psi (379 kPa) at 2950 psi (20 346 kPa) system pressure

5.7.10.3 System 3
Type: Hydraulically pressurized
Total Volume: 0.65 gal (2.46 L, 150 in³)
Pressure: 55 psi (379 kPa) at 2950 psi (20 346 kPa) system pressure

5.7.10.4 Auxiliary System
Type: Unpressurized
Total Volume: 0.3 gal (1.18L)
Pressure: Atmospheric

5.7.11 Relief Valve Data

5.7.11.1 Main System Relief Valve: 2 per aircraft; 1 for System 1 and 1 for System 2
Relief Pressure: 3600 psi (24 828 kPa)
Reseat Pressure: 3200 psi (22 063 kPa) minimum
Rated Flow: 26.5 gpm (100.3 L/min) at 3600 psi (24 829 kPa) maximum

5.7.12 Filtration

5.7.12.1 Pressure Filtration: 3 per aircraft
Location: 1 in each system
Filtration Rating: 5 µm for System 1 and System 2, 15 µm for System 3

5.7.12.2 Case Drain Filtration: 2 per aircraft; 1 for System 1 and 1 for System 2
Location: 1 in each EDP line
Filtration Rating: 15 µm

5.7.12.3 Return Filtration: 2 per aircraft; 1 for System 1 and 1 for System 2
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 5 µm

5.7.13 Tubing Data

5.7.13.1 High Pressure Lines

Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (17.15/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.051 in (25.4/1.295 mm)

5.7.13.2 Low Pressure Lines

5.7.13.2.1 Material Specification: Ti 3Al, 2.5V Titanium alloy per AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.50/0.026 in (12.7/0.660 mm), 0.625/0.032 in (17.15/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.051 in (25.4/1.295 mm)

5.7.13.2.2 Material Specification: 304 ¹/₈ hard Steel per MIL-T-6845

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm), 0.5/0.025 in (12.7/0.660 mm), 0.625/0.032 in (15.875/0.813 mm), 0.75/0.039 in (19.05/0.991 mm), 1.0/0.05 in (25.4/1.295 mm)

5.7.14 Fitting Data

5.7.14.1 Separable Type: 24 degree flareless

Material: Not known

End Connections: Internal swage, external pressure swage

5.7.14.2 Permanent Type: Externally pressure swaged

Material: Not known

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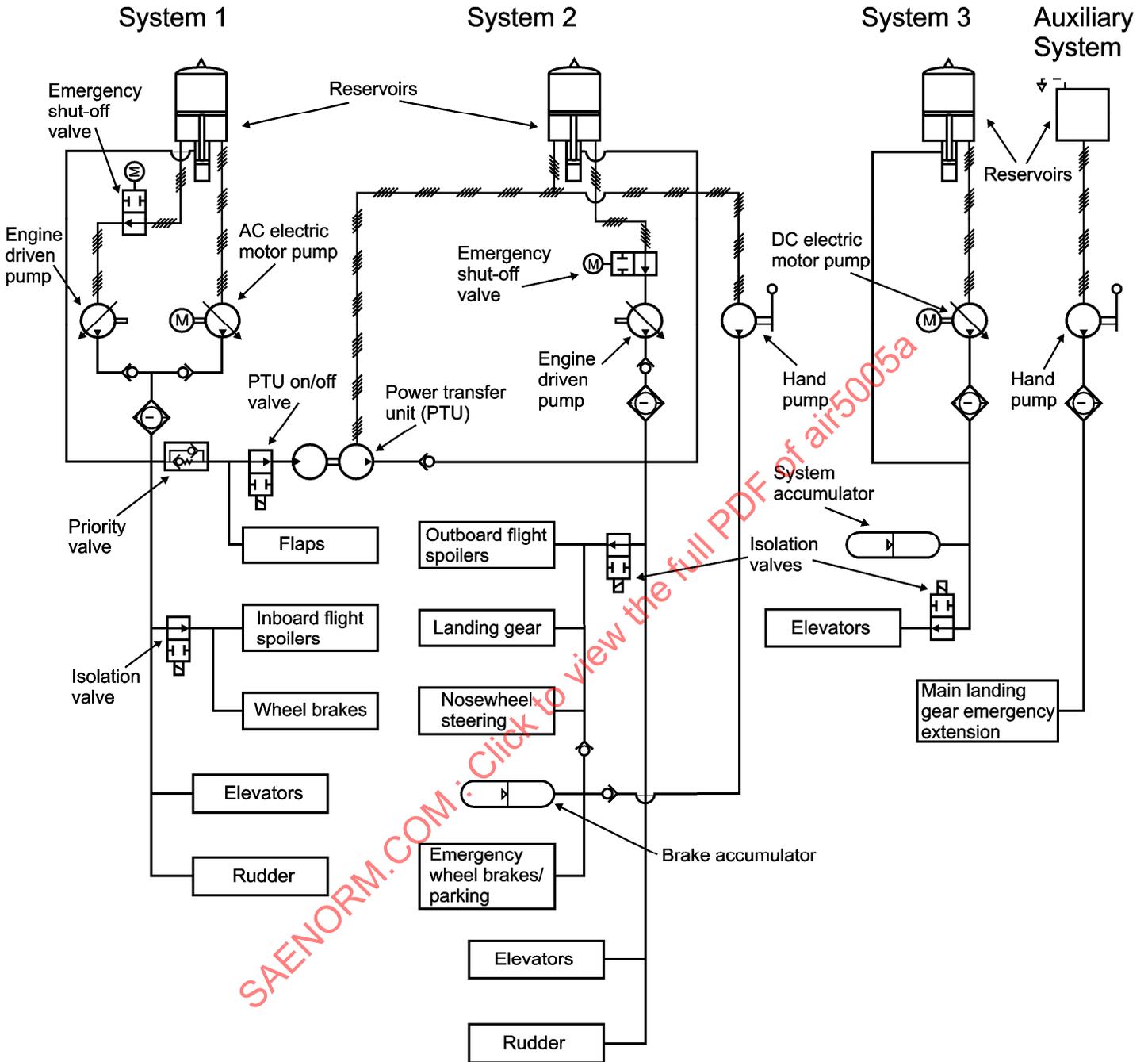


FIGURE 5.7 - BOMBARDIER DHC-8 DASH 8 Q400 HYDRAULIC SYSTEM SCHEMATIC

5.8 De Havilland DHC-7 Dash 7

5.8.1 Design Requirements: 14CFR Part 25 requirements

5.8.2 System Pressure: 3000 psi (20 690 kPa)

5.8.3 Hydraulic Fluid: AS1241

5.8.4 Number of Hydraulic Systems: 3 - No. 1 Power System, No. 2 Power System, Auxiliary System

5.8.5 System Temperature: -65 to +200 °F (-54 to +93 °C)

5.8.6 Main Hydraulic Pump Data

- 5.8.6.1 Engine Driven Pump: 4 per aircraft; 2 in No. 1 Power System, 2 in No. 2 Power System
Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 8.5 gpm (32.2 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.275 in³/rev (4.51 mL/rev)
Rated Speed: 7600 rpm
Rotation from Shaft End: Clockwise

5.8.7 Back-up Pump Data

- 5.8.7.1 Hand Pump: 2 per aircraft; 1 in Auxiliary system to deploy nose landing gear (emergency extension),
1 in No.2 Power System to operate parking brake
Pressure - Displacement: 3000 psi (20 690 kPa); 0.75 in³ (12.3 mL)/cycle

5.8.8 Hydraulic Motor Data

- 5.8.8.1 Fore Flap Motor: 1 per aircraft
Type: Fixed displacement inline axial piston
Displacement: 0.095 in³/rev (1.56 mL/rev)
Running Speed: 6060/9100 rpm (Maximum continuous duty/maximum intermittent duty)
Flow at Rated Pressure Differential: 2.5 gpm (14 L/min) at 3000 psi (20 690 kPa)

5.8.9 Accumulator Data

- 5.8.9.1 Braking System: 1 in No. 2 Power System
Type: Piston, gas charged
Volume: 25 in³ (0.41 L)
Precharge Pressure: 1000 psi (6896 kPa)

5.8.10 Reservoir Data

- 5.8.10.1 No. 1 and No. 2 Power Systems
Type: Hydraulically pressurized
Total Volume: 1.5 gal (5.62 L)
Pressure: 28.2 psi (194 kPa)
- 5.8.10.2 Auxiliary System
Type: Unpressurized
Total Volume: 0.3 gal (1.18L)
Pressure: Atmospheric

5.8.11 Relief Valve Data

- 5.8.11.1 Main System Relief Valve: 2 per aircraft; 1 per system
Relief Pressure: 3600 psi (24 828 kPa)
Rated Flow: 8.5 gpm (32.2 L/min)
Reseat Pressure: 3250 psi (22 414 kPa)

5.8.12 Filtration

- 5.8.12.1 Pressure Filtration: 2 per aircraft
Location: 1 in the combined EDPs' delivery line for each main system
Filtration Rating: 15 µm
- 5.8.12.2 Case Drain Filtration: 4 per aircraft
Location: 1 in each EDP line
Filtration Rating: 15 µm
- 5.8.12.3 Return Filtration: 2 per aircraft
Location: 1 in each system return line upstream of the reservoir
Filtration Rating: 5 µm

5.8.13 Tubing Data

5.8.13.1 High Pressure Lines

- 5.8.13.1.1 Material Specification: 6061 - T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.313/0.042 in (7.95/1.067 mm), 0.375/0.049 in (9.525/1.245 mm), 0.50/0.065 in (12.7/1.651 mm), 0.625/0.083 in (15.875/2.108 mm)
- 5.8.13.1.2 Material Specification: 304 - 1/8 hard CRES per MIL-T-8504
Diameters/Wall Thicknesses: 0.25/0.022 in (6.35/0.559 mm), 0.313/0.028 in (7.95/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.0358 in (12.7/0.899 mm), 0.625/0.049 in (15.875/1.245 mm)

5.8.13.2 Suction and Return Lines

- 5.8.13.2.1 Material Specification: 6061 - T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.313/0.028 in (7.95/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.028 in (12.7/0.711 mm), 0.625/0.035 in (15.875/0.899 mm), 0.75/0.035 in (19.05/0.889 mm)
- 5.8.13.2.2 Material Specification: 304 - 1/8 hard CRES per MIL-T-8504
Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.313/0.028 in (7.95/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.50/0.035 in (12.7/0.899 mm), 0.625/0.028 in (15.875/0.711 mm), 0.75/0.028 in (19.05/0.711 mm)

5.8.14 Fitting Data

- 5.8.14.1 Separable Type: 37 degree flared
Material: Al, CRES
End Connections: Pipe flare

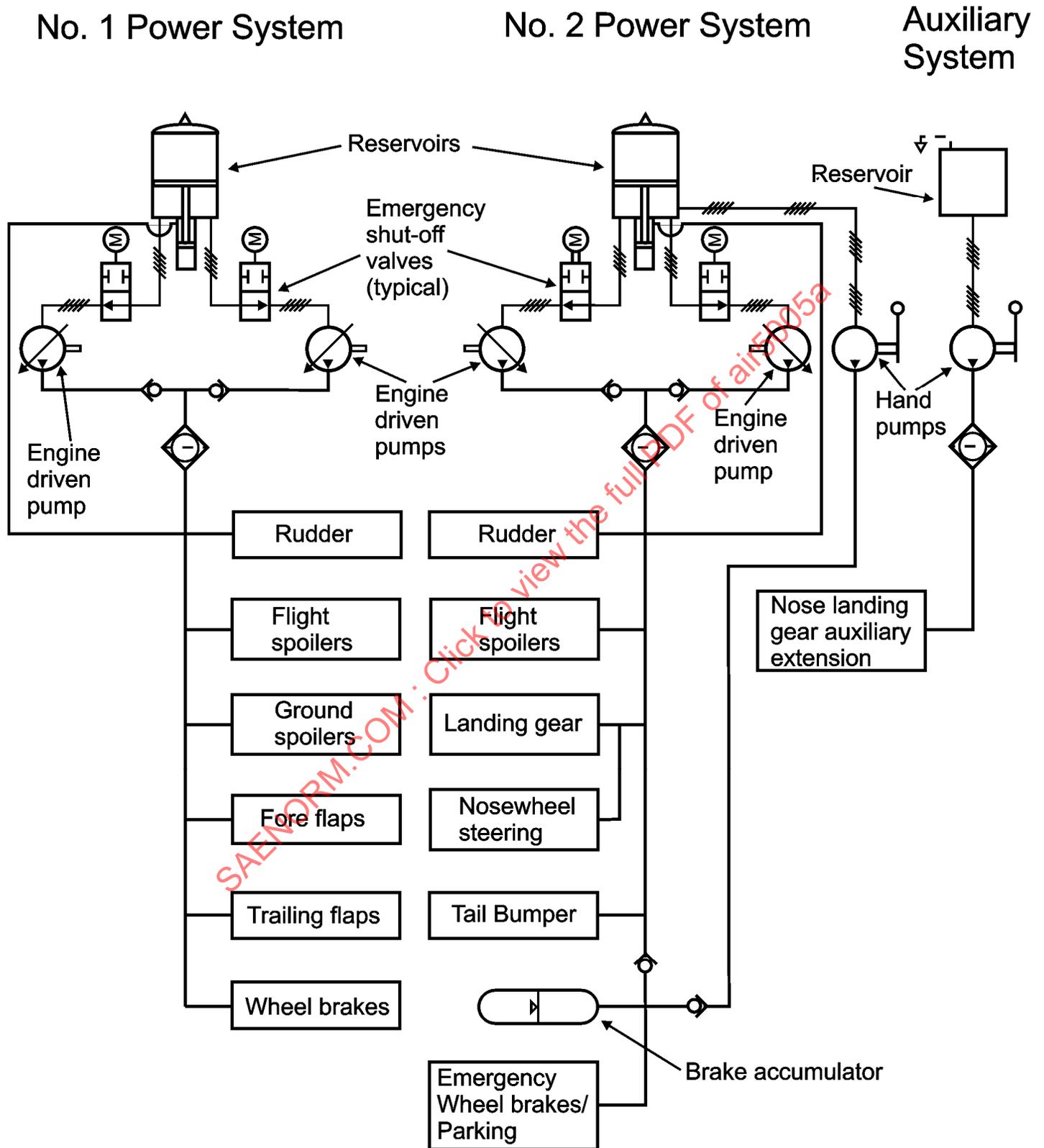


FIGURE 5.8 - DE HAVILLAND DHC-7 DASH 7 HYDRAULIC SYSTEM SCHEMATIC

5.9 Dornier 328

5.9.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

5.9.2 System Pressure: 3000 psi (20 690 kPa)

5.9.3 Hydraulic Fluid: MIL-PRF-5606

5.9.4 Number of Hydraulic Systems: 2 - Main System; Auxiliary System

5.9.5 System Temperature: -65 to +275 °F (-54 to +135 °C)

5.9.6 Main Hydraulic Pump Data

5.9.6.1 AC Electric Pump 1 in Main System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 2.1 gpm (8.0 L/min) at 2750 psi (18 966 kPa)
Displacement: 0.06 in³/rev (0.96 mL/rev)
Rated Speed: 9500 rpm

5.9.7 Back-up Pump Data

5.9.7.1 DC Motor Pump 1 in Main System

Type: Fixed displacement, inline piston
Rated Flow: 0.3 gpm (1.0 L/min)
Displacement: 0.01 in³/rev (0.22 mL/rev)
Rated Speed: 6000 rpm

5.9.7.2 Hand Pump: 1 in Auxiliary system

Type: Two stage
Pressure: - Flow characteristics
Up to 580 psi (4000 kPa) – 1.15 in³ (19 mL)/double stroke
Up to 3800 psi (26 200 kPa) – 0.37 in³ (6 mL)/double stroke

5.9.8 Hydraulic Motor Data

None are fitted to this aircraft

5.9.9 Accumulator Data

5.9.9.1 Power Generation System: – Without Ground Spoilers 1 in Main System

Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 1813 psi (12 500 kPa)

5.9.9.2 Power Generation System: – With Ground Spoilers 1 in Main System

Type: Piston, gas charged
Volume: 91.5 in³ (1.5 L)
Precharge Pressure: 1740 psi (12 000 kPa)

5.9.9.3 Braking System: Main System 1 per aircraft

Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 1015 psi (7000 kPa)

5.9.9.4 Auxiliary System 1 per aircraft
Type: Piston, gas charged
Volume: 50 in³ (0.82 L)
Precharge Pressure: 797 psi (5500 kPa)

5.9.10 Reservoir Data

5.9.10.1 Main System – Without Ground Spoilers
Type: Unpressurized
Full Volume: 1.6 gal (5.9 L)
Total Volume: 1.8 gal (6.8 L)

5.9.10.2 Main System – With Ground Spoilers
Type: Unpressurized
Full Volume: 1.6 gal (6.2 L)
Total Volume: 1.8 gal (6.8 L)

5.9.10.3 Auxiliary System
Type: Unpressurized
Full Volume: 0.5 gal (1.7 L)
Total Volume: 0.6 gal (2.2 L)

5.9.11 Relief Valve Data

5.9.11.1 Main System Relief Valve: 1 per aircraft
Relief Pressure: 3840 psi (24 000 kPa)
Rated Flow: 2.1 gpm (8.0 L/min)
Reseat Pressure: 3350 psi (23 100 kPa)

5.9.11.2 Auxiliary System Relief Valve 1 per aircraft
Relief Pressure: 3800 psi (26 200 kPa)

5.9.12 Filtration

5.9.12.1 Pressure Filtration: 2 per aircraft
Location: 1 in the combined DCP and ACP delivery line, 1 in the other Hand Pump: delivery line
Filtration Rating: 75 µm

5.9.12.2 Return Filtration: 1 per aircraft
Location: In return line upstream of the reservoir
Filtration Rating: 75 µm

5.9.13 Tubing Data

5.9.13.1 High Pressure Lines
Material Specification: 21-6-9 CRES per AMS5561
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.49 mm); 0.375/0.020 in (9.525/0.51 mm)

5.9.13.2 Low Pressure Lines
Material Specification: 6061-T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.022 in (6.35/0.56 mm); 0.375/0.035 in (9.525/0.889 mm)

5.9.14 Fitting Data

- 5.9.14.1 Separable Type: 24 degree flareless
Material: Al, CRES
End Connections: Internal swage
- 5.9.14.2 Permanent Type External swage
Material: Not known

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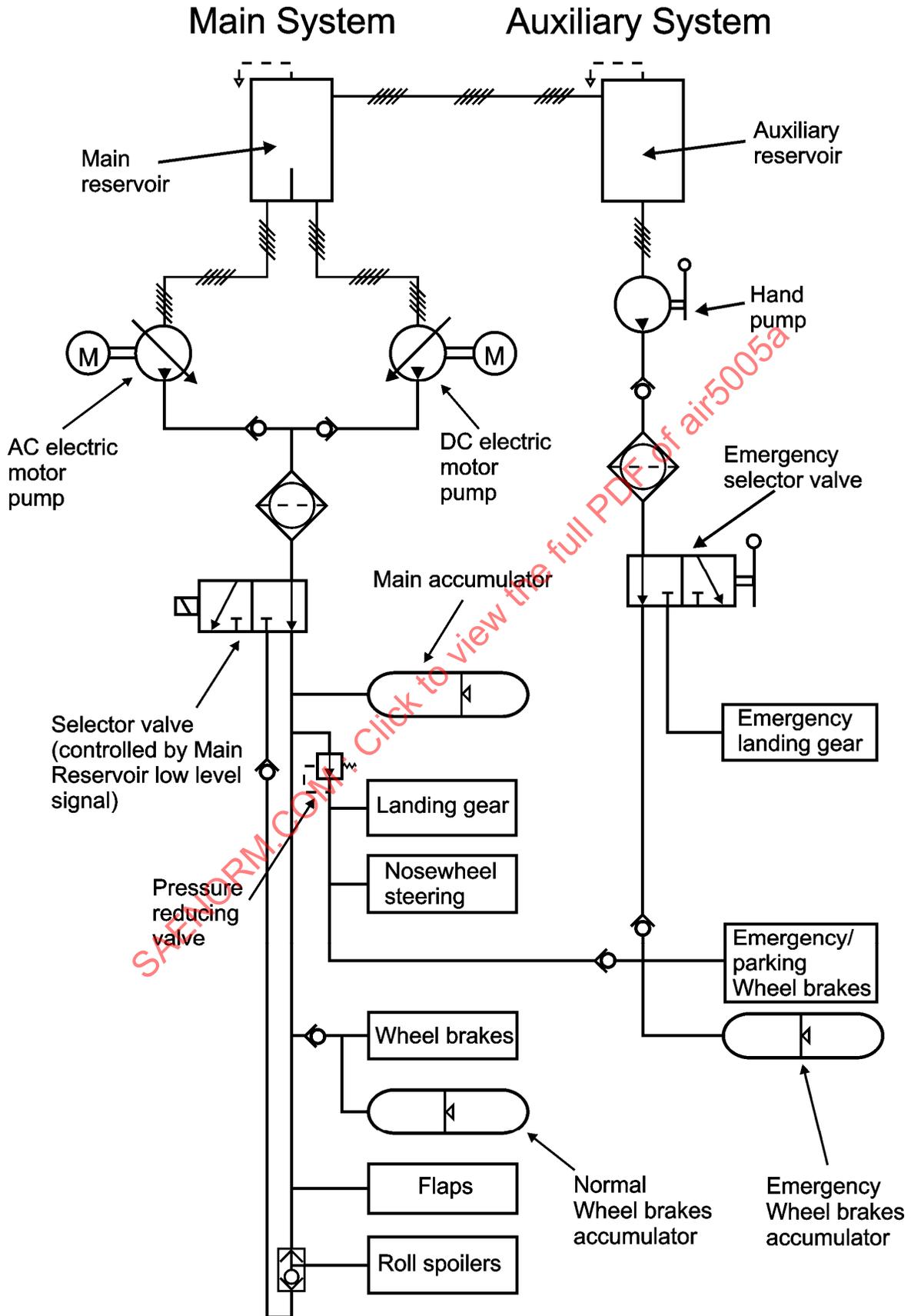


FIGURE 5.9.1 - DORNIER 328 - WITHOUT GROUND SPOILERS - HYDRAULIC SYSTEM SCHEMATIC

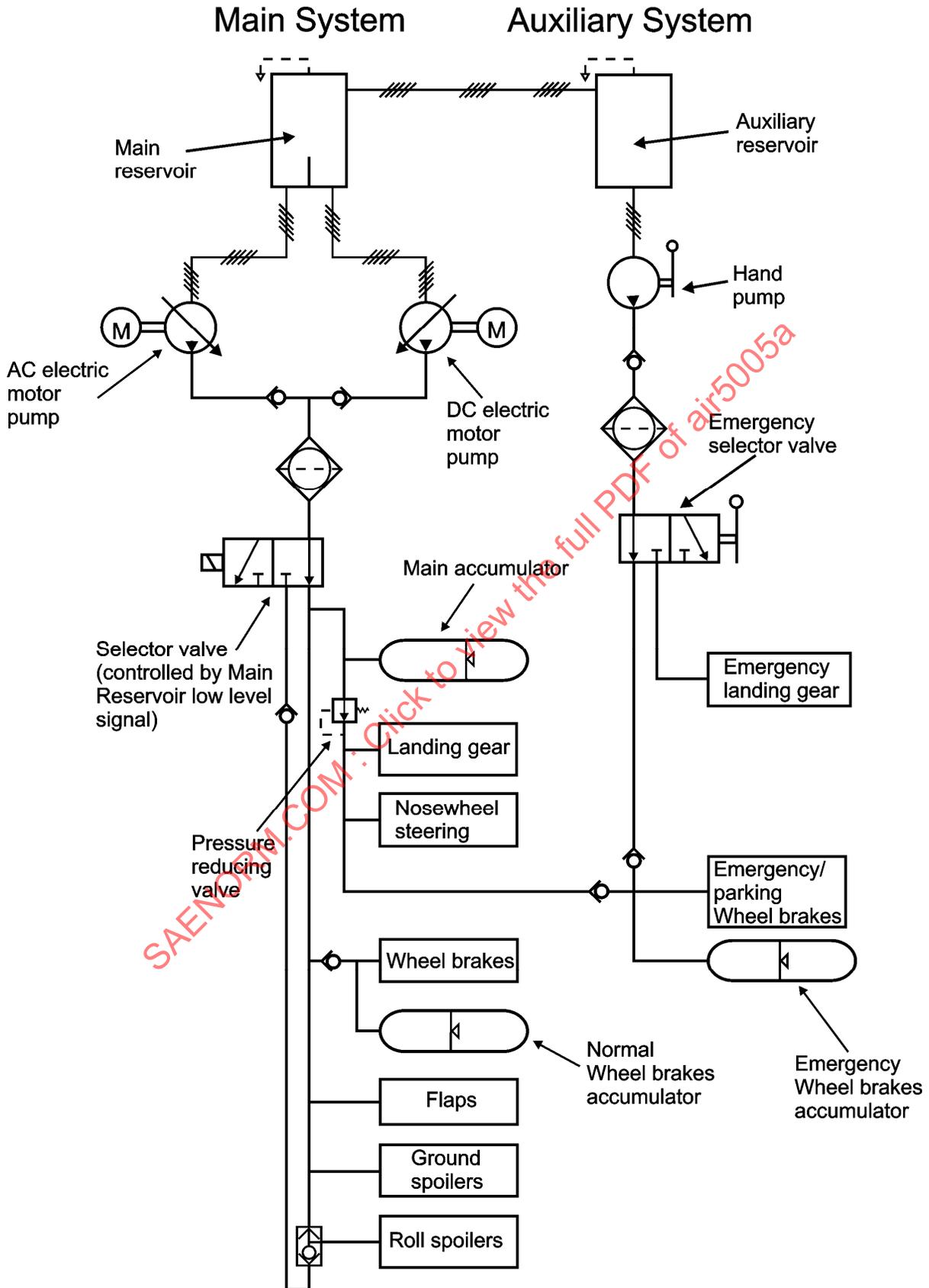


FIGURE 5.9.2 - DORNIER 328 - WITH GROUND SPOILERS - HYDRAULIC SYSTEM SCHEMATIC

5.10 EADS CASA CN-235

5.10.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

5.10.2 System Pressure: 3000 psi (20 690 kPa)

5.10.3 Hydraulic Fluid: MIL-PRF-5606 or MIL-PRF-83282

5.10.4 Number of Hydraulic Systems: 1

5.10.5 System Temperature: -65 to +160 °F (-54 to +71 °C)

5.10.6 Main Hydraulic Pump Data

5.10.6.1 DC Electric Motor Driven Pump 2 per aircraft

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 1.85 gpm (7.0 L/min)

Displacement: 0.058 in³/rev (0.95 mL/rev)

Rated Speed: 7200 rpm

5.10.7 Back-up Pump Data

None are fitted to this aircraft

5.10.8 Hydraulic Motor Data

None are fitted to this aircraft

5.10.8.1 Flap Motor: 1 per aircraft

Type: Fixed displacement, two element gear

Displacement: 0.549 in³/rev (8.99 mL/rev)

Running Speed: 500/600 rpm

Flow at Rated Pressure Differential: 1.8 gpm (7.0 L/min)

5.10.9 Accumulator Data

5.10.9.1 Braking System: 2 per aircraft, 1 in Emergency Brake system, 1 in Normal Brake system

Type: Piston, gas charged

Volume: 61 in³ (1.0 L)

Precharge Pressure: 1474 psi (10 171 kPa)

5.10.10 Reservoir Data

Type: Hydraulically pressurized

Full Volume: 2.2 gal (8.2 L)

Total Volume: 2.6 gal (10.0 L)

Pressure: 50 - 60 psi (345 - 414 kPa)

5.10.11 Relief Valve Data

5.10.11.1 Main System Relief Valve: 1 per aircraft

Relief Pressure: 3750 psi (25 870 kPa)

Rated Flow: 3.7 gpm (14.0 L/min)

Reseat Pressure: 3290 psi (22 701 kPa)

5.10.12 Filtration

5.10.12.1 Pressure Filtration: 1 per aircraft

Location: Combined DC pumps' delivery line

Filtration Rating: 15 μ m

5.10.12.2 Case Drain Filtration: 1 per aircraft

Location: Combined DC pumps' case drain line

Filtration Rating: 15 μ m

5.10.12.3 Return Filtration: 1 per aircraft

Location: Return line upstream of the reservoir

Filtration Rating: 5 μ m

5.10.13 Tubing Data

5.10.13.1 High Pressure Lines

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.4 mm), 0.375/0.020 in (9.525/0.508 mm)

5.10.13.2 Low Pressure Lines

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.375/0.035 in (9.525/0.889 mm), 0.5/0.035 in (12.7/0.889 mm)

5.10.14 Fitting Data

5.10.14.1 Separable Type: 24 degree flareless

Material: Al, CRES

End Connections: Internal swage

5.10.14.2 Permanent Type External swage

Material: Not known

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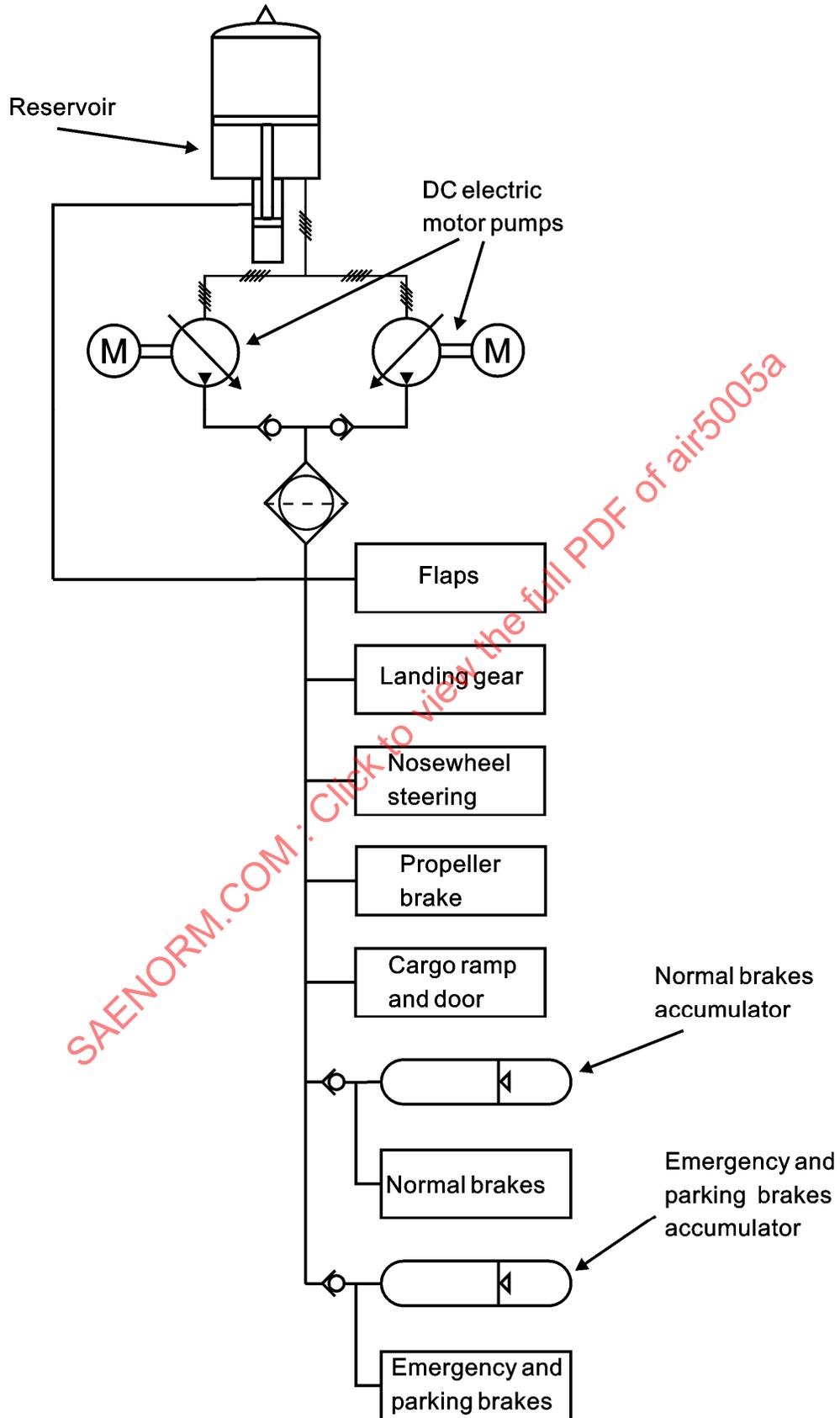


FIGURE 5.10 – EADS CASA CN-235 HYDRAULIC SYSTEM SCHEMATIC

5.11 Embraer EMB-110 Bandeirante

5.11.1 Design Requirements: 14CFR Part 25 requirements

5.11.2 System Pressure: 3000 psi (20 690 kPa)

5.11.3 Hydraulic Fluid: MIL-PRF-5606

5.11.4 Number of Hydraulic Systems: 2 - Main System, Emergency System

5.11.5 System Temperature: -65 to +194 °F (-54 to +90 °C)

5.11.6 Main Hydraulic Pump Data

5.11.6.1 Engine Driven Pump: 2 in Main System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 1.45 gpm (6.7 L/min) at 2900 psi (20 000 kPa)

Displacement: 0.047 in³/rev (0.770 mL/rev)

Rated Speed: 7654 rpm

Rotation from Shaft End: Clockwise

5.11.7 Back-up Pump Data

5.11.7.1 Hand Pump: 1 in Auxiliary System

Pressure - Displacement: 1500 psi (10 342 kPa) – 0.92 in³ (15 mL/cycle)

5.11.8 Hydraulic Motor Data

None are fitted to this aircraft

5.11.9 Accumulator Data

5.11.9.1 Power Generation System: 1 per aircraft

Type: Piston, gas charged

Volume: 31 in³ (0.5 L)

Precharge Pressure: 1000 psi (6895 kPa)

5.11.9.2 Normal Braking System: 1 per aircraft

Type: Piston, gas charged

Volume: 61 in³ (1.0 L)

Precharge Pressure: 1000 psi (6895 kPa)

5.11.9.3 Emergency Braking System: 1 per aircraft

Type: Piston, gas charged

Volume: 31 in³ (0.5 L)

Precharge Pressure: 1000 psi (6895 kPa)

5.11.10 Reservoir Data

5.11.10.1 Main reservoir

Type: Unpressurized, with submerged electric booster pump

Full Volume: 2.64 gal (4.0 L)

5.11.10.2 Emergency fluid portion of reservoir

Type: Unpressurized

Full Volume: 60 in³ (1.0 L)

5.11.11 Relief Valve Data

- 5.11.11.1 Main System Relief Valve: 1 per aircraft
 - Relief Pressure: 3290 psi (22 684 kPa)
 - Rated Flow: Not known
 - Reseat Pressure: Not known

5.11.12 Filtration

- 5.11.12.1 Pressure Filtration: 2 per aircraft;
 - Location: 1 in each EDP delivery line
 - Filtration Rating: 15 µm
- 5.11.12.2 Case Drain Filtration: 2 per aircraft
 - Location: 1 in each EDP line
 - Filtration Rating: 15 µm
- 5.11.12.3 Return Filtration: 3 per aircraft
 - Location: 1 in nosewheel steering return, 1 in brakes return, 1 in normal landing gear system return
 - Filtration Rating: 15 µm

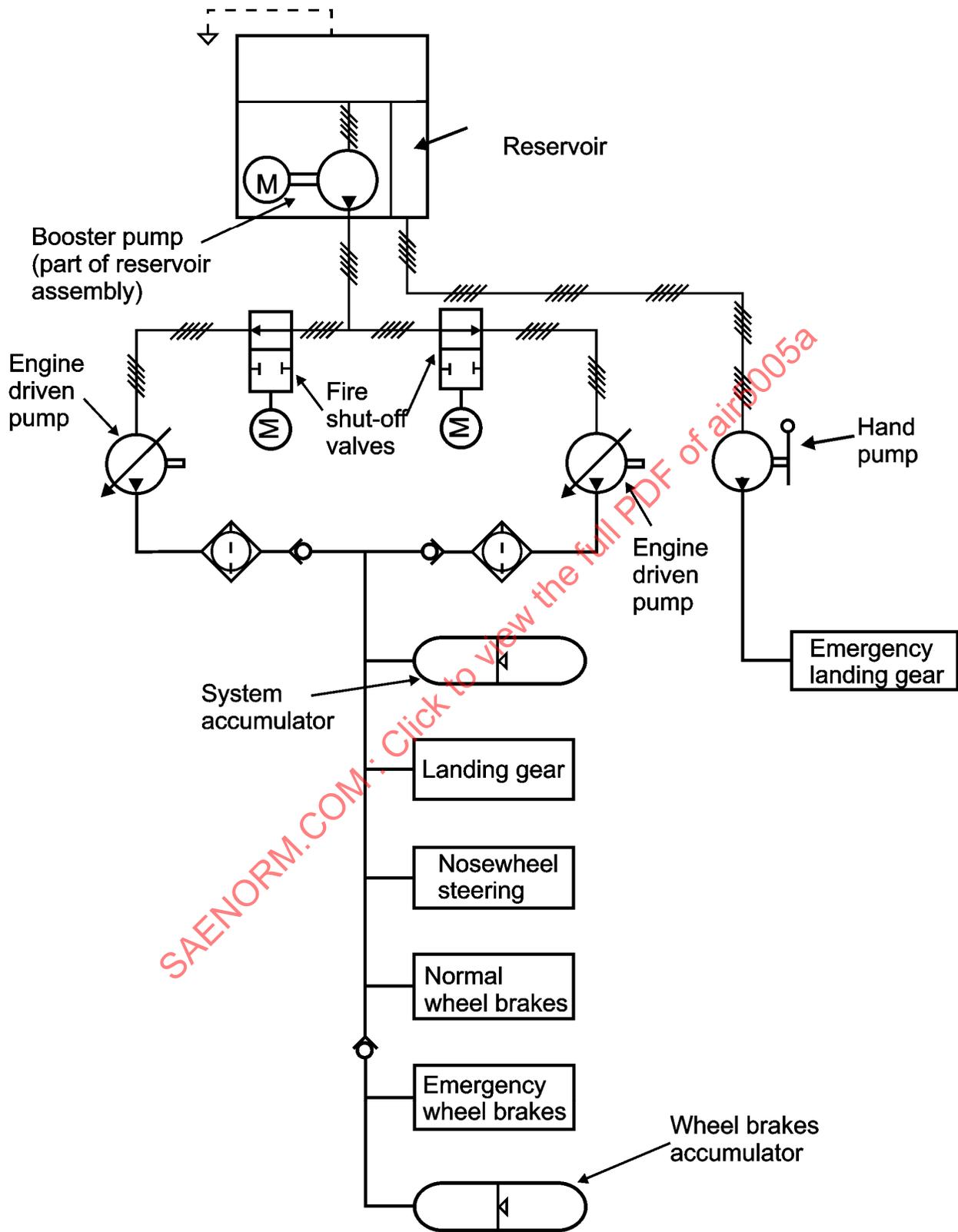
5.11.13 Tubing Data

- 5.11.13.1 High Pressure Lines
 - Material Specification: 304 - $\frac{1}{8}$ Stainless Steel per MIL-T-8504
 - Diameters/Wall Thicknesses: Not known
- 5.11.13.2 Low Pressure Lines
 - Material Specification: 5052-0 Aluminum alloy per WW-T-787
 - Diameters/Wall Thicknesses: Not known

5.11.14 Fitting Data

- 5.11.14.1 Separable Type: 24 degree flareless
 - Material: Al, CRES
 - End Connections: Not known

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NOTE: Aircraft pre-mod S.B. 110-029-0012 had two suction filters, located upstream of each inlet shut-off valve

FIGURE 5.11 - EMBRAER EMB-110 BANDEIRANTE HYDRAULIC SYSTEM SCHEMATIC

5.12 Embraer EMB-120 Brasilia

5.12.1 Design Requirements: 14CFR Part 25 requirements

5.12.2 System Pressure: 3000 psi (20 690 kPa)

5.12.3 Hydraulic Fluid: MIL-PRF-5606 or MIL-PRF-83282

5.12.4 Number of Hydraulic Systems: 2 - Green System, Blue System

5.12.5 System Temperature: -65 to +194 °F (-54 to +90 °C)

5.12.6 Main Hydraulic Pump Data

5.12.6.1 Engine Driven Pump: 2 per aircraft; 1 in Green System, 1 in Blue System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 5.0 gpm (18.9 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.16 in³/rev (2.67 mL/rev)
Rated Speed: 7630 rpm

5.12.7 Back-up Pump Data

5.12.7.1 DC Electric Motor Pump: 2 per aircraft; 1 in Green System 1 in Blue System

Type: Variable displacement, pressure compensated, inline piston
Rated Flow-Pressure: 1.5 gpm (18.9 L/min) at 2850 psi (19 655 kPa)
Displacement: 0.05 in³/rev (0.82 mL/rev)
Rated Speed: 9300 rpm

5.12.8 Hydraulic Motor Data

None are fitted to this aircraft

5.12.9 Accumulator Data

5.12.9.1 Power Generation System: 2 per aircraft; 1 per system

Type: Piston, gas charged
Volume: 82 in³ (1.3 L)
Precharge Pressure: 1650 psi (11 373 kPa)

5.12.9.2 Power Generation System: 2 per aircraft; 1 per system

Type: Piston, gas charged
Volume: 5.0 in³ (0.82L)
Precharge Pressure: 1640 psi (11 307 kPa)

NOTE Used to damp pressure oscillations and are built into the reservoir assemblies (not shown on the schematic diagram)

5.12.9.3 Emergency Landing Gear Deploy/Forward Door Actuation System: 1 in Green System

Type: Piston, gas charged
Volume: 100 in³ (1.6 L)
Precharge Pressure: 1500 psi (10 342 kPa)

5.12.9.4 Braking System: 1 in Blue System

Type: Piston, gas charged
Volume: 50 in³ (0.8 L)
Precharge Pressure: 1100 psi (7584 kPa)

5.12.10 Reservoir Data

5.12.10.1 Green System

Type: Air pressurized

5.12.10.2 Blue System

Type: Air pressurized

5.12.11 Relief Valve Data

5.12.11.1 Main System Relief Valve: 2 per aircraft, 1 per system

Relief Pressure: 3650 psi (25 166 kPa)

Rated Flow: Not known

Reseat Pressure: Not known

5.12.11.2 Thermal Relief Valve: 1 per system

Relief Pressure: 3650 psi (25 166 kPa)

Rated Flow: Not known

Reseat Pressure: Not known

5.12.12 Filtration

5.12.12.1 Pressure Filtration: 4 per aircraft

Location: 1 in each EDP and ACP delivery line

Filtration Rating: 5 µm

5.12.12.2 Return Filtration: 2 per aircraft

Location: 1 in each system return line upstream of the reservoirs

Filtration Rating: 5 µm

5.12.13 Tubing Data

5.12.13.1 High Pressure Lines

5.12.13.2 Material Specification: Ti 3Al 2.5V Titanium alloy per AMS4944 or AMS4945

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.375/0.019 in (9.53/0.483 mm)

5.12.13.3 Low Pressure Lines

5.12.13.3.1 General

Material Specification: 6061-T6 Aluminum alloy per AMS4083

Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.375/0.028 in (9.53/0.711 mm), 0.50/0.028 in (12.70/0.711 mm)

5.12.13.3.2 Specific Lines – All tubing exposed on the landing gear or in the landing gear bay

Material Specification: 21-6-9 CRES per AMS5561

Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.3125/0.016 in (7.938/0.406 mm), 0.375/0.020 in (9.53/0.508 mm)

5.12.14 Fitting Data

5.12.14.1 Separable Type: 24 degree flareless

Material: Steel, Aluminum

End Connections: Internal swage

5.12.14.2 Permanent Type

Material: Steel and Aluminum

End Connections: External swage

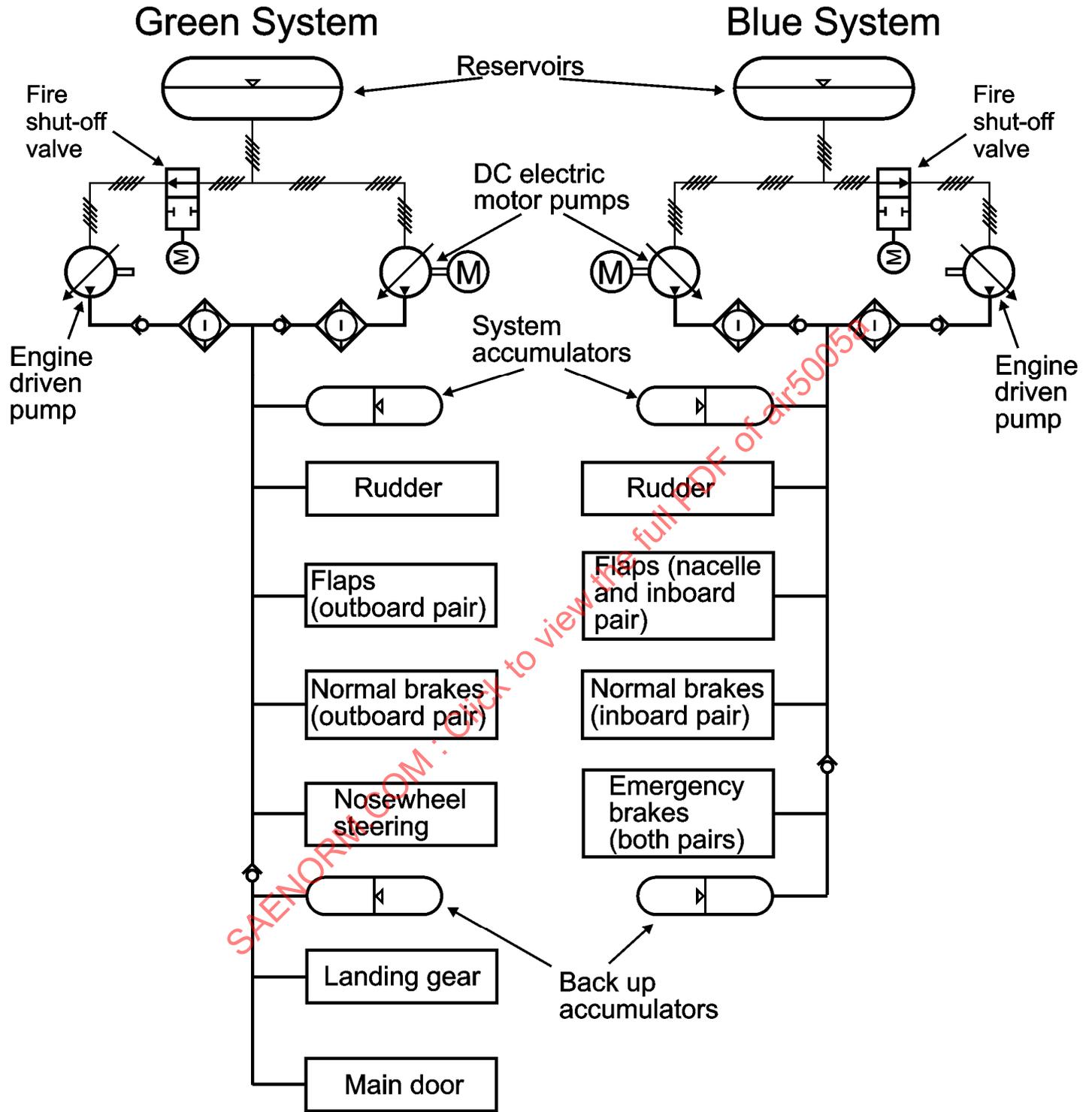


FIGURE 5.12 - EMBRAER EMB-120 BRASILIA HYDRAULIC SYSTEM SCHEMATIC

5.13 Fairchild Metro

5.13.1 Design Requirements: 14CFR 23 requirements

5.13.2 System Pressure: 2000 psi (13 793 kPa)

5.13.3 Hydraulic Fluid: MIL-PRF-83282

5.13.4 Number of Hydraulic Systems: 2 - Main System; Auxiliary System

5.13.5 System Temperature: -65 to +160 °F (-54 to +71 °C)

5.13.6 Main Hydraulic Pump Data

5.13.6.1 Engine Driven Pump: 2 per aircraft

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 3.10 gpm (22.0 L/min) at 1850 psi (12 759 kPa)

Displacement: 0.38 in³/rev (5.1 mL/rev)

Rated Speed: 3950 rpm

5.13.7 Back-up Pump Data

5.13.7.1 Hand Pump: 1 in Auxiliary System

Type: AN 6201 per MIL-P-5515 two stage

Flow characteristics 1.25/1.50 in³ (20.48/24.58 mL) per cycle (2 strokes)

5.13.8 Hydraulic Motor Data

None are fitted to this aircraft

5.13.9 Accumulator Data

5.13.9.1 Braking System: 2 per aircraft

Type: Piston, gas charged

Volume: 15 in³ (0.25 L)

Precharge Pressure: 750 psi (5172 kPa)

5.13.10 Reservoir Data

5.13.10.1 Main Reservoir

Type: Air pressurized

Total Volume: 1.0 gal (3.10 L)

Pressure: 33 psi (227 kPa)

5.13.10.2 Auxiliary Reservoir

Type: Unpressurized

Full Volume: 60 in³ (1.0 L)

5.13.11 Relief Valve Data

5.13.11.1 Main System Relief Valve: 1 per aircraft

Relief Pressure: 2300 psi (15 862 kPa)

Rated Flow: 3.10 gpm (14.0 L/min)

5.13.12 Filtration

- 5.13.12.1 Pressure Filtration: 1 per aircraft
 - Location: 1 in the combined EDP's line
 - Filtration Rating: 25 μ m

5.13.13 Tubing Data

5.13.13.1 High Pressure Lines

- Material Specification: CRES
- Diameters: 0.25 in (6.35 mm); 0.375 in (9.53 mm); 0.50 in (12.70 mm)
- Wall thickness 0.028 in (0.711 mm)

5.13.13.2 Low Pressure Lines

- Material Specification: 5052-0 Aluminum alloy per WW-T-787
- Diameters: 0.25 in (6.35 mm); 0.375 in (9.53 mm); 0.50 in (12.70 mm); 0.625 in (15.1075 mm)
- Wall thickness: 0.035 in (0.889 mm)

5.13.14 Fitting Data

- 5.13.14.1 Separable Type: 37 degree flared
 - Material: Al, CRES
 - End Connections: Pipe flare

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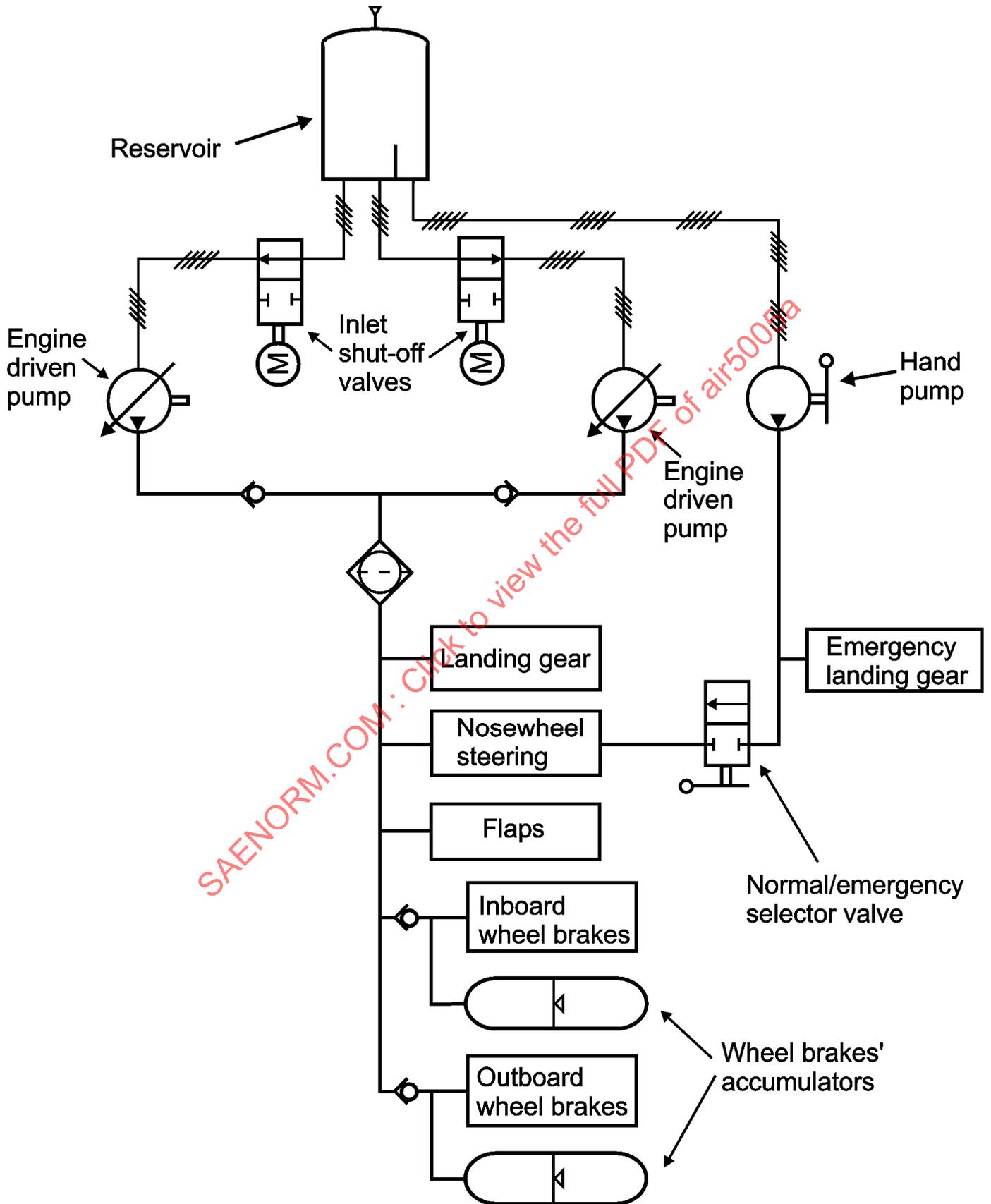


FIGURE 5.13 - FAIRCHILD METRO HYDRAULIC SYSTEM SCHEMATIC

5.14 Fokker 50

5.14.1 Design Requirements: 14CFR Part 25/JAR 25 requirements

5.14.2 System Pressure: 3000 psi (20 690 kPa)

5.14.3 Hydraulic Fluid: MIL-PRF-5606

5.14.4 Number of Hydraulic Systems: 1

5.14.5 System Temperature: -65 to 160 °F (-54 to 71 °C)

5.14.6 Main Hydraulic Pump Data

5.14.6.1 Engine Driven Pump: 2 per aircraft

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 9.0 gpm (34.0 L/min) at 2900 psi (20 000 kPa)

Displacement: 0.5 in³/rev (8.2 mL/rev)

Rated Speed: 4200 rpm

Rotation from Shaft End: Counter clockwise

5.14.7 Back-up Pump Data

5.14.7.1 AC Electric Motor Pump: 1 per aircraft

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 1.6 gpm (6.1 L/min) at 2850 psi (19 655 kPa)

Displacement: 0.055 in³/rev (0.9 mL/rev)

Rated Speed: 7600 rpm

5.14.8 Hydraulic Motor Data

5.14.8.1 Flap Motor: 1 per aircraft

Type: Fixed displacement inline axial piston

Running Speed: 4752 rpm

5.14.9 Accumulator Data

5.14.9.1 Braking System:

5.14.9.1.1 Normal Brake System: 1 per aircraft

Type: Piston, gas charged

Volume: 50 in³ (0.82 L)

Precharge Pressure: 800 psi (5517 kPa)

5.14.9.1.2 Alternate Brake System: 1 per aircraft

Type: Piston, gas charged

Volume: 100 in³ (1.64 L)

Precharge Pressure: 800 psi (5517 kPa)

5.14.10 Reservoir Data

5.14.10.1 System Reservoir

Type: Air pressurized

Full Volume: 1.64 gal (6.2 L)

Total Volume: 3.105 gal (11.9 L)

Pressure: 40 psi (276 kPa)

5.14.11 Relief Valve Data

- 5.14.11.1 Main System Relief Valve: 2 per aircraft, 1 in EDP delivery line, 1 in combined EDP and ACP delivery line
Relief Pressure: 3500 psi (24 138 kPa)
Rated Flow: 9.0 gpm (34.1 L/min) at 3750 psi (25 862 kPa)
Reseat Pressure: 3300 psi (22 759 kPa)

5.14.12 Filtration

- 5.14.12.1 Pressure Filtration: 2 per aircraft
Location: 1 in EDP delivery line, 1 in combined EDP and ACP delivery line
Filtration Rating: 15 µm
- 5.14.12.2 Return Filtration: 1 per aircraft
Location: In return line upstream of the reservoir
Filtration Rating: 5 µm

5.14.13 Tubing Data

5.14.13.1 High Pressure Lines

Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.313/0.020 in (7.938/0.508 mm), 0.375/0.028 in (9.525/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.875/1.067 mm)

5.14.13.2 Low Pressure Lines

- 5.14.13.2.1 Material Specification: 304 - $\frac{1}{8}$ hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.25/0.020 in (6.35/0.508 mm), 0.313/0.020 in (7.938/0.508 mm), 0.375/0.028 in (9.525/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.875/1.067mm), 1.0/0.028 in (25.4/0.711 mm)
- 5.14.13.2.2 Material Specification: 6061 - T6 Aluminum alloy per AMS4083
Diameters/Wall Thicknesses: 0.25/0.028 in (6.35/0.711 mm), 0.313/0.028 in (7.938/0.711 mm), 0.375/0.028 in (9.525/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.875/1.067mm), 1.0/0.035 in (25.4/0.889 mm)

5.14.14 Fitting Data

- 5.14.14.1 Separable Type: 24 degree flareless
Material: Al, CRES
End Connections: Internal swage
- 5.14.14.2 Permanent Type External swage
Material: Not known

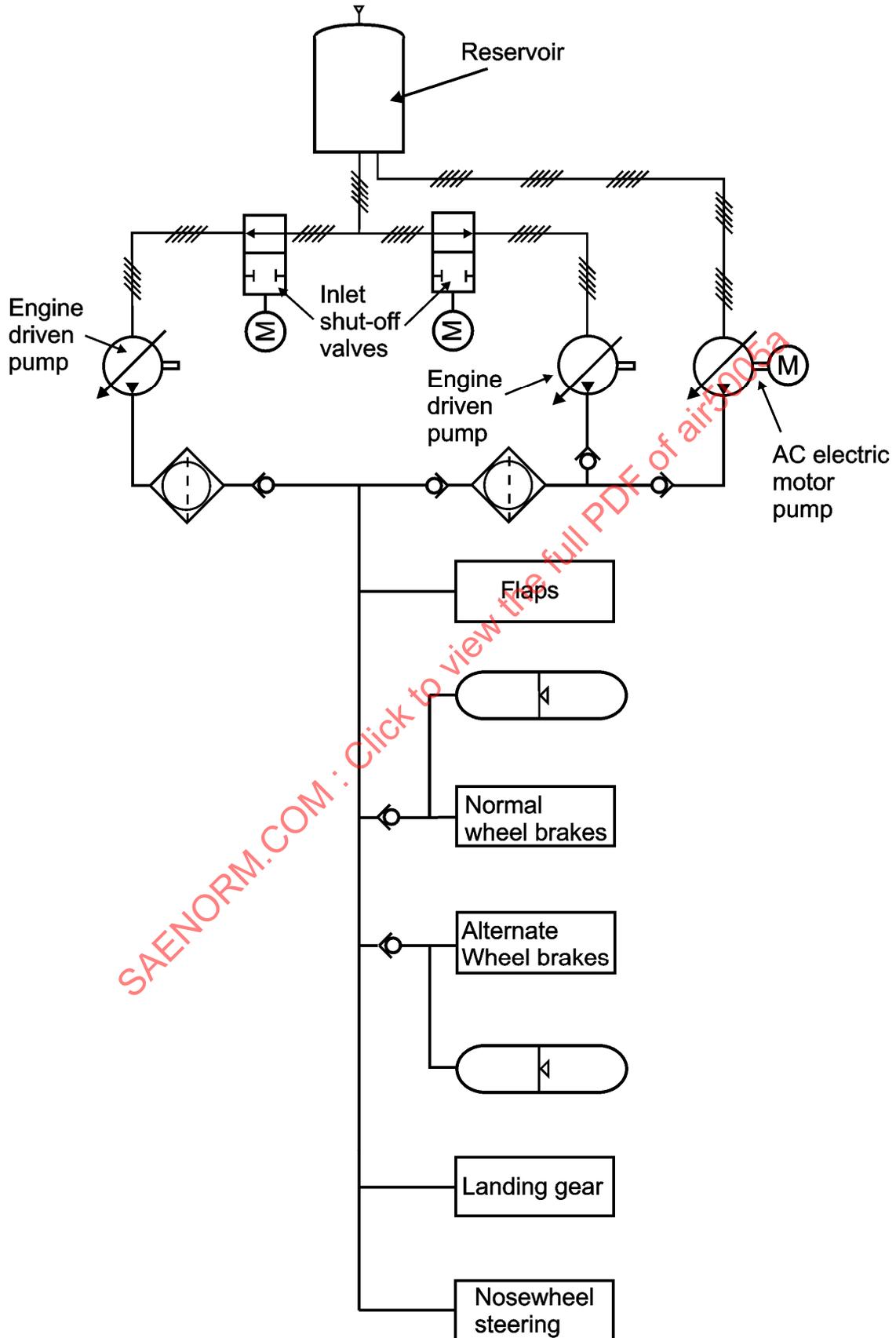


FIGURE 5.14 - FOKKER 50 HYDRAULIC SYSTEM SCHEMATIC

5.15 Lockheed L.188 Electra

5.15.1 Design Requirements: 14CFR Part 25 requirements

5.15.2 System Pressure: 3000 psi (20 690 kPa)

5.15.3 Hydraulic Fluid: MIL-PRF-5606

5.15.4 Number of Hydraulic Systems: 2 – No. 1 System, No. 2 System

5.15.5 System Temperature: -45 to 160 °F (-43 to 71 °C)

5.15.6 Main Hydraulic Pump Data

5.15.6.1 AC Electric Motor Pump: 3 per aircraft; 2 in No. 1 System, 1 in No. 2 System

Type: Variable displacement, pressure compensated, inline piston

Rated Flow-Pressure: 6.0 gpm (22.7 L/min) at 2950 psi (20 345 kPa)

8.0 gpm (30.3 L/min) at 2200 psi (15 172 kPa)

Displacement: 0.598 in³/rev (9.80 mL/rev)

Rated Speed: 3200 rpm

5.15.7 Back-up Pump Data

5.15.7.1 DC Electric Motor Pump 1 in No. 1 System

Type: Fixed displacement, gear, switch operated

Rated Flow-Pressure: 0.2 gpm (22.7 L/min) at 2950 psi (20 345 kPa)

Displacement: 0.598 in³/rev (9.80 mL/rev)

Rated Speed: 3200 rpm

5.15.8 Hydraulic Motor Data

5.15.8.1 Flap Motor: 2 per aircraft

Type: Fixed displacement

Displacement: 0.095 in³/rev (1.56 mL/rev)

Flow at Rated Pressure Differential: 2.8 gpm (10.6 L/min)

5.15.9 Accumulator Data

5.15.9.1 Braking System: 1 in No. 2 System

Type: gas charged

Volume: 200 in³ (3.3 L)

Precharge Pressure: 800 psi (5517 kPa)

5.15.9.2 Nosewheel Steering System 1 in No. 2 System

Type: Spring loaded

Volume: Not known

5.15.10 Reservoir Data

5.15.10.1 No. 1 System

Type: Air pressurized

Full Volume: 5.0 gal (18.9 L)

Total Volume: 5.6 gal (21.2 L)

Pressure: 12 psi (82.8 kPa)

5.15.10.2 No. 2 System

Type: Air pressurized
Full Volume: 1.0 gal (3.8 L)
Total Volume: 1.0 gal (3.8 L)
Pressure: 12 psi (82.8 kPa)

5.15.11 Relief Valve Data

5.15.11.1 Main System Relief Valve: 2 per aircraft, 1 per system

Relief Pressure: 3450 psi (23 793 kPa)
Rated Flow: 8.0 gpm (43.6 L/min)
Reseat Pressure: 3200 psi (22 069 kPa)

5.15.12 Filtration

5.15.12.1 Pressure Filtration: 4 per aircraft

Location: 1 in each pump delivery line
Filtration Rating: 5 µm

5.15.12.2 Suction Filtration: 2 per aircraft

Location: 1 in each reservoir
Filtration Rating: 5 µm

5.15.13 Tubing Data

5.15.13.1 High Pressure Lines

Material Specification: 304 - 1/8 hard CRES per AMS5566
Diameters/Wall Thicknesses: 0.25/0.016 in (6.35/0.406 mm), 0.25/0.030 in (6.35/0.762 mm), 0.375/0.028 in (9.525/0.711 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.042 in (15.875/1.067 mm), 0.75/0.049 in (19.05/1.245 mm)

5.15.13.2 Low Pressure Lines

Material Specification: 304 - 1/8 hard CRES per MIL-T-6845
Diameters/Wall Thicknesses: 0.25/0.035 in (6.35/0.889 mm), 0.375/0.035 in (9.525/0.889 mm), 0.5/0.035 in (12.7/0.889 mm), 0.625/0.035 in (15.875/0.889 mm), 0.75/0.035 in (19.05/0.889 mm)

5.15.14 Fitting Data

5.15.14.1 Separable Type: 24 degree flareless

Material: Steel, Aluminum
End Connections: External bite