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**AEROSPACE  
INFORMATION  
REPORT**

**AIR 1899**

Issued August 1985

Revised

**AIRCRAFT HYDRAULIC SYSTEM CHARACTERISTICS**

1. **PURPOSE:** The purpose of this document is to provide system design information on various aircraft fluid power systems.
2. **SCOPE:** Supply data comparing various aircraft fluid power system design requirements in order to provide a more complete frame of reference for future aircraft fluid power system design.

3. **DEFINITION:**

The following design information will be provided:

Design Specification	Governing military specifications.
System pressure	Fluid power system operating pressure.
Hydraulic fluid	Type of fluid aircraft system designed for.
Accumulator data	Usage, volume, and precharge requirements.
Reservoir data	System reservoir requirements - volume and pressure.
System quiescent flow	Flow requirements for each individual system.
Hydraulic pump data	System pump requirements.
Auxiliary pump data	System auxiliary pump or back-up data.
Tubing data	Material, size and usage.
Fitting data	Material, size, type and connection.
Temperature	Specific system temperature.
Seal material type	System seal material and usage.
Filtration	System filtration data.
Hydraulic motor data	System hydraulic motor requirements.
Hand pump data	Pressure, displacement requirements.
Relief valve setting	Max. flow pressure and min. reseal pressure.

4. **GENERAL:** The information exchange may be used to find similar type systems, components, and materials which will in turn help solve problems and lower costs. If more detailed information is required, direct contact with the aircraft manufacturer will help resolve the particular problem or question.

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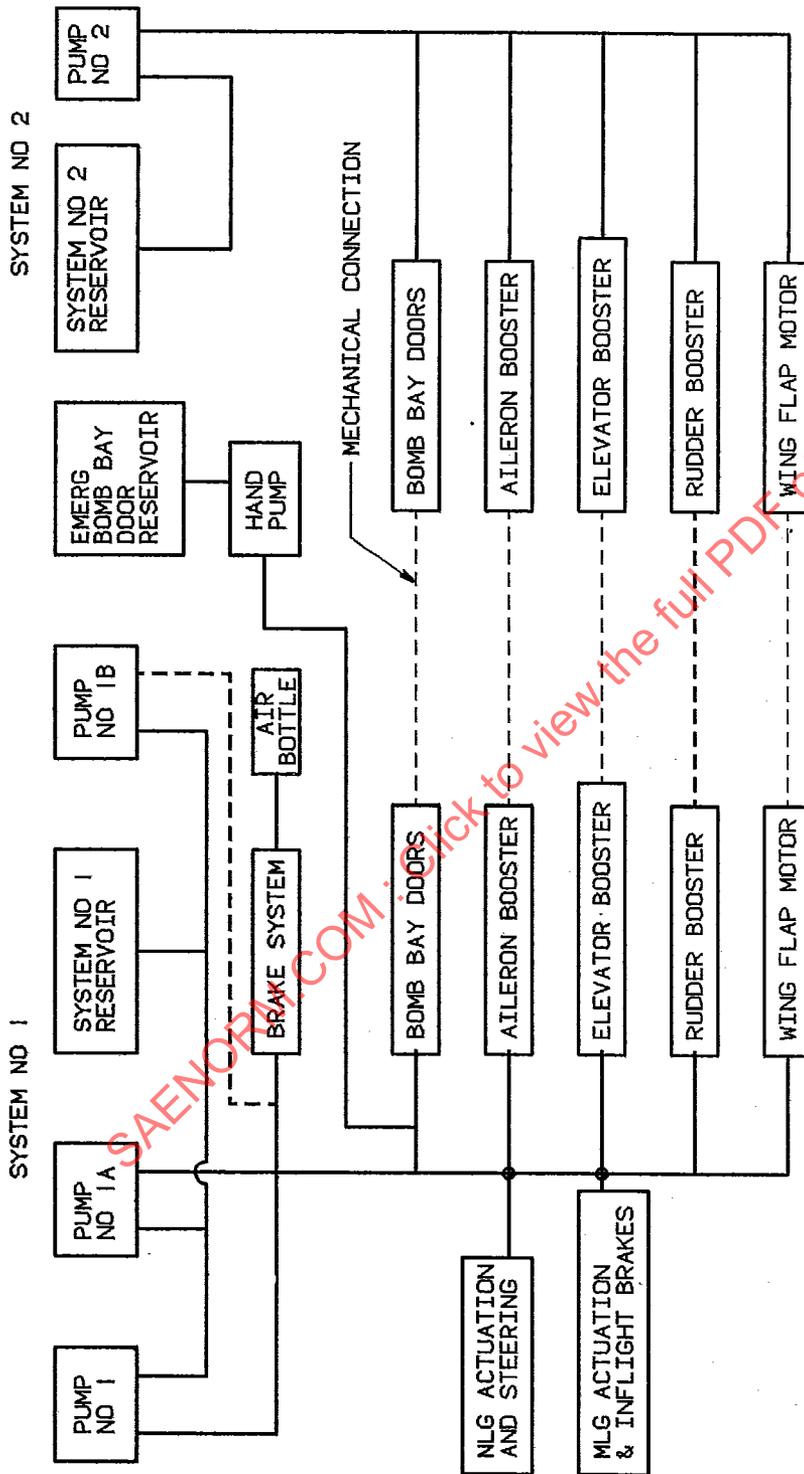
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PREPARED BY THE  
MILITARY AIRCRAFT AND HELICOPTER PANEL OF  
SUBCOMMITTEE A-6A, FLUID POWER  
SYSTEMS OF  
SAE COMMITTEE A-6,  
AEROSPACE FLUID POWER AND CONTROL TECHNOLOGIES

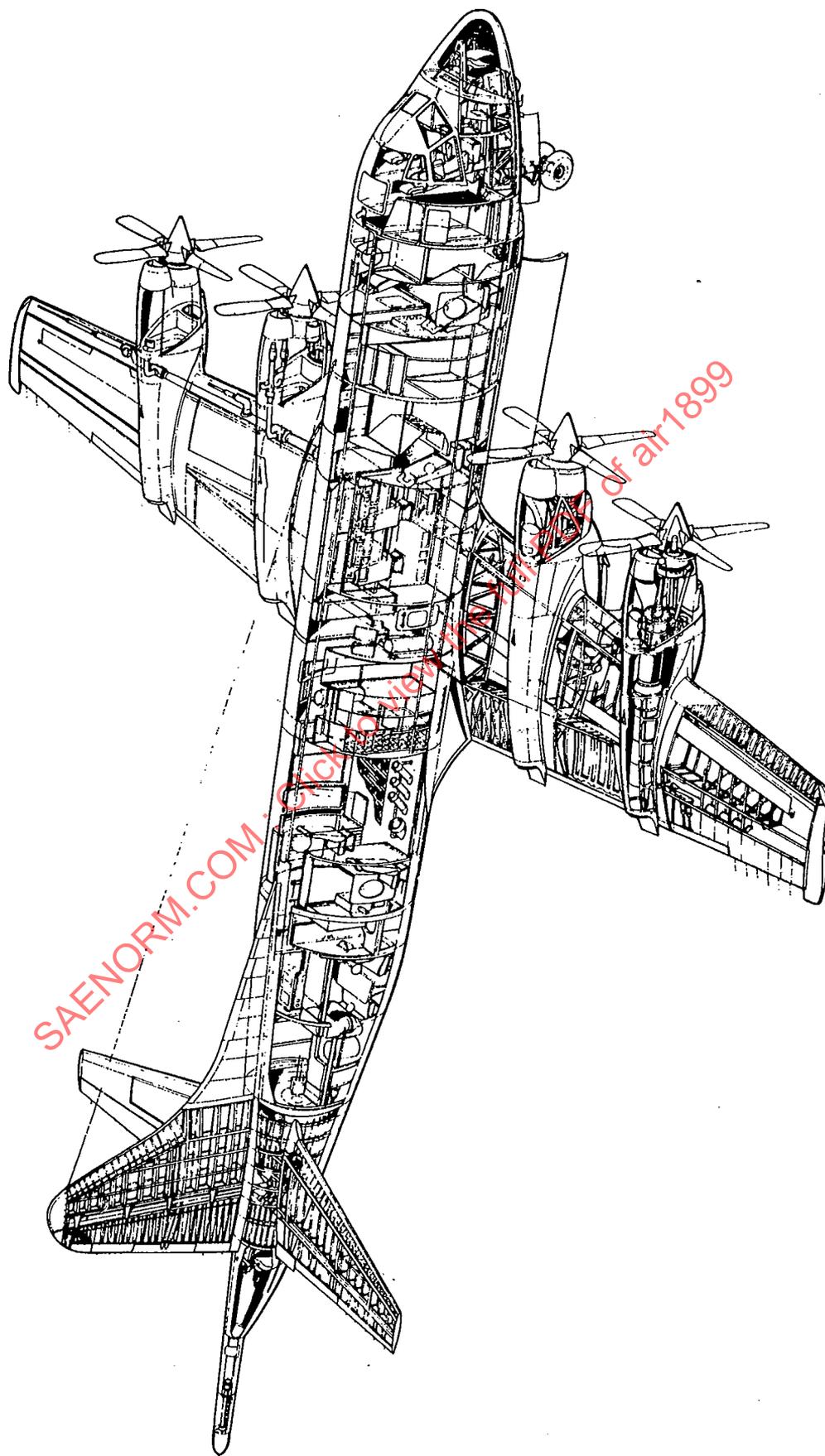
## AIRCRAFT - P-3

1. DESIGN SPECIFICATION		MIL-H-5440 D			
2. SYSTEM PRESSURE		3000 PSIG			
3. HYDRAULIC FLUID		MIL-H-5606			
4. ACCUMULATOR DATA		USAGE		VOLUME	PRE-CHARGE
		BRAKE ACCUMULATOR STEERING CONT VALVE ACCUM		200 CU IN 4.0 CU IN	800 PSI SPRING
5. RESERVOIR DATA TYPE AND PRESS FULL SYSTEM VOLUME RESERVOIR VOLUME		SYSTEM NO. 1		SYSTEM NO. 2	
		AIR/OIL 12 PSI 1155 CU IN 3742 CU IN 1294 CU IN		AIR/OIL 12 PSI 231 CU IN 924 CU IN 231 CU IN	
6. SYSTEM QUIESCENT FLOW		SYS NO 1, 0.3 GPM		SYS NO 2, 0.3 GPM	
7. HYDRAULIC PUMP DATA TYPE RATED FLOW @ NOTED PRESSURE  CASE FLOW DISPLACEMENT RATED SPEED TORQUE ROTATION FROM SHAFT END MOTOR/PUMP SPEED RATIO		SYS NO 1, 2 UNITS		SYS NO 2, 1 UNIT	
		ELECT MOTOR DRIVEN-3/ 200/115 V.AC 8.0 GPM AT 0 TO 2200 PSI 6.0 GPM AT 2950 +50/-0 PSI 0.0 GPM AT 3000 +150/-0 PSI 1.8 GPM MIN @ 8.0 GPM RATED FLOW 0.598 CU IN/REV 3200 RPM, PUMP & 11400 RPM, MOTOR  CCW 3.3625			
8. AUXILIARY PUMP INPUT POWER TYPE PRESSURE-FLOW  SPEED DISPLACEMENT VOLTS AMPS HP/KW		AUXILIARY BRAKE SYSTEM			
		ELECT MOTOR DRIVEN-28 V.DC 0.20 GPM AT 3000PSI (PRESS SWITCH CONTROLLED)  FIXED DISPLACEMENT (GEAR TYPE) 18 TO 30 V.DC 32 AMPS AT 26V MAX .42 HP/KW			
9. TUBING DATA	DIA(IN)	W.T.(STL)	W.T.(AL)	SPECIFICATION	USAGE
	0.250	0.030		PRESSURE LINES CRES 304 1/8 H PER AMS 5566	PRESS PRESS RETURN RETURN
	0.250	0.016	0.035		
	0.250			RETURN LINES AL ALLOY 6061-T6 PER WW-T-606/T6	PRESS RETURN PRESS RETURN RETURN PRESS RETURN
	0.375	0.028	0.035		
	0.375				
	0.500	0.035	0.035		
	0.500				
	0.625	0.042	0.035		
	0.625		0.049		
0.625		0.035			
0.750	0.049	0.035			
0.750					
10. FITTING DATA		MS FLARELESS			
11. TEMPERATURE RANGE		-45°F TO +160°F			
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)					
13. FILTRATION MAIN RETURN CASE DRAIN FLIGHT CONTROL & SUBSYSTEM		5 MICRON ABS			
		5 MICRON ABS 25 MICRON ABS 15 MICRON ABS			
14. HYDRAULIC MOTOR DATA		(WING FLAP DRIVE) 2.8 GPM 0.095 CIR			
15. HAND PUMP DATA		AN6248-2 0.7. CU IN/CYCLE			
16. RELIEF VALVE SETTINGS		*SYS NO 1, SYS NO 2 & AUX SYS: 3450 PSI MAX AT 8 GPM & 3200 PSI MIN, RESEAT  *RESERVOIR VENT, 12 PSI MAX AT 16 GPM OR MINUS 1 PSI AT 2 CFM OF FILTERED AIR			



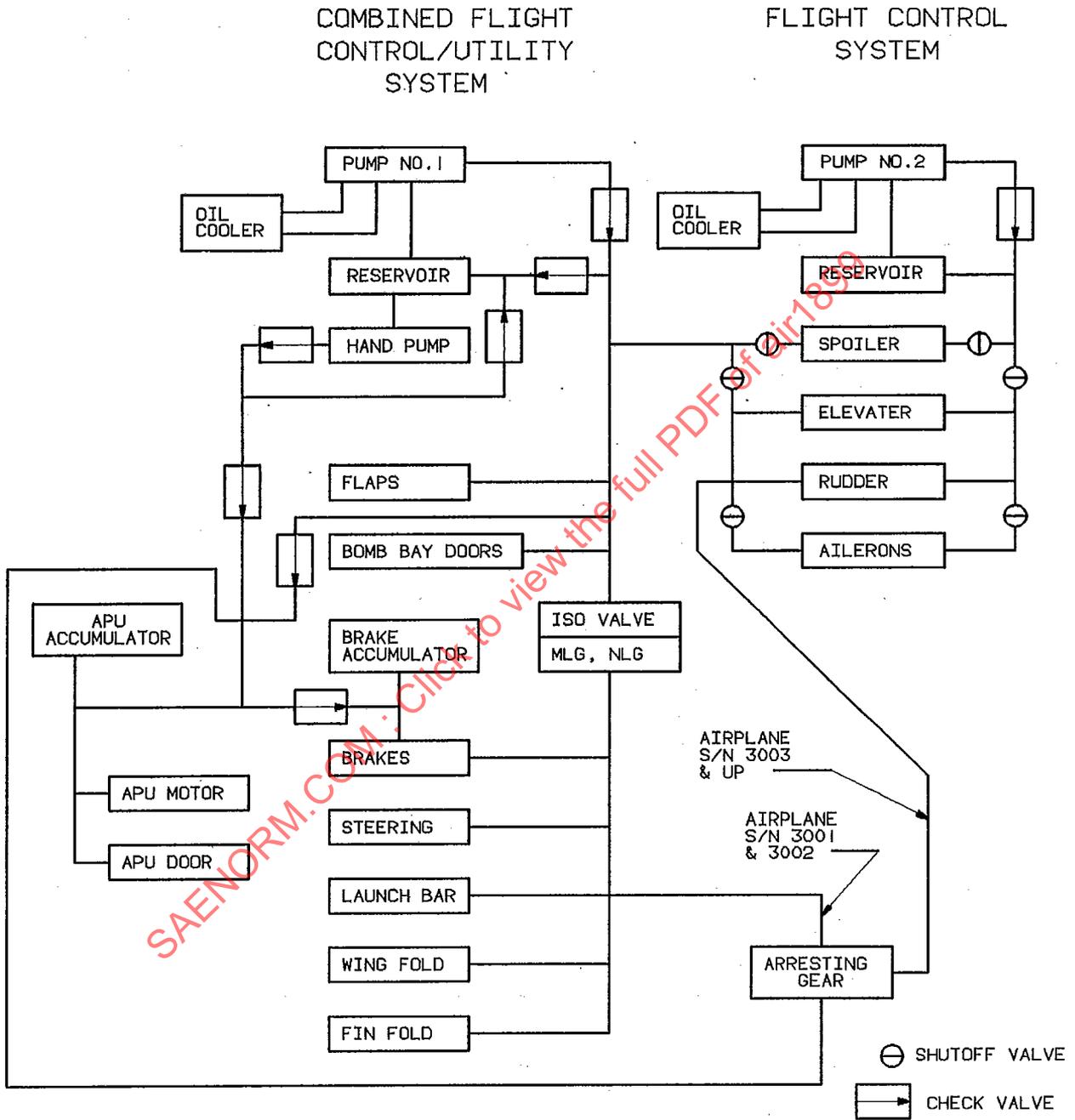
P-3 HYDRAULIC SYSTEM BLOCK DIAGRAM

**LOCKHEED P-3C ORION**



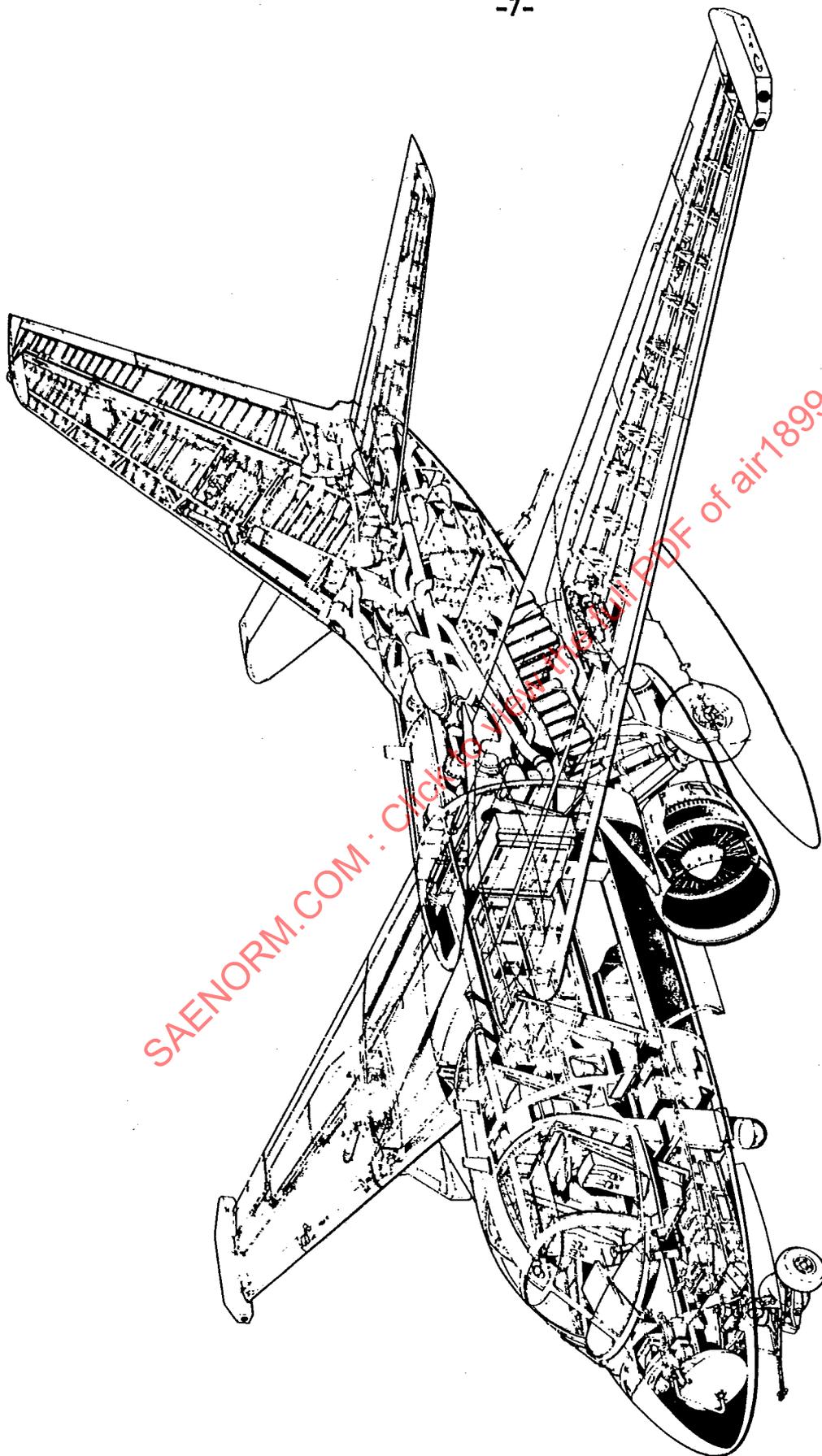
## AIRCRAFT - S-3A

1. DESIGN SPECIFICATION		MIL-H-5440 D			
2. SYSTEM PRESSURE		3000 PSIG			
3. HYDRAULIC FLUID		MIL-H-5606			
4. ACCUMULATOR DATA		USAGE		VOLUME	PRE-CHARGE
		APU ACCUMULATOR EMER BRAKE ACCUMULATOR		250 CU IN 129 CU IN	1900 PSI 1000 PSI
5. RESERVOIR DATA TYPE AND PRESS FULL SYSTEM VOLUME RESERVOIR VOLUME		COMBINED SYSTEM		FLIGHT CONT SYSTEM	
		BOOTSTRAP, 93 PSI 693 CU IN 3241 CU IN 1340 CU IN		BOOTSTRAP, 93 PSI 208 CU IN 968 CU IN 323 CU IN	
6. SYSTEM QUIESCENT FLOW		COMBINED SYS. 0.3-0.5 GPM		FLT CONT SYS 0.3-0.5 GPM	
7. HYDRAULIC PUMP DATA TYPE PRESSURE RATED FLOW CASE FLOW DISPLACEMENT RATED SPEED TORQUE ROTATION FROM SHAFT END ENG/PUMP SPEED RATIO  PUMP DATA GROUND IDLE APPROACH LONG RANGE CRUISE CLIMB MILITARY		FLIGHT SYSTEM		COMBINED SYSTEM	
		SAME PUMP DATA AS COMBINED SYSTEM		ENGINE DRIVEN 2875 PSI MIN@FULL FLOW 28.8 GPM 3.0-4.2 GPM@RATED FLOW 1.24 CU IN/REV 5890 RPM 630 IN-LB MAX CCW 0.329  3718 RPM 5149 RPM 5149 RPM 5758 RPM ----	
8. AUXILIARY PUMP DATA					
9. TUBING DATA	DIA(IN)	W.T. (STL)	W.T. (TI)	SPECIFICATION	USAGE
	0.188 0.250 0.375 0.500 0.500 0.625 0.625 0.750 0.750 1.000  0.250 0.375 0.500	0.016 0.016 0.020 0.026 0.020 0.033 0.020 0.039 0.020 0.026			21-6-9 CRES PER AMS 5561  COMM. PURE TITA. LCC SPEC C-08-1335
10. FITTING DATA		BRAZED CONNECTIONS, MS FLARELESS REMOVABLE CONN.			
11. TEMPERATURE RANGE		-65°F TO +275°F			
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)					
13. FILTRATION MAIN RETURN CASE DRAIN		5 MICRON ABS 5 MICRON ABS 5 MICRON ABS			
14. HYDRAULIC MOTOR DATA		BOMB BAY DOORS-2.97 GPM, 0.05 CIR WING FOLD 0.25 CIR			
15. HAND PUMP DATA		AN6248			
16. RELIEF VALVE SETTINGS		*COMBINED & FLIGHT CONT SYS, 3700 PSI MAX AT 29 GPM & 3175 PSI MIN RESEAT  *COMBINED SYS RESERVE, 3400 PSI MAX AT .5GPM & 3200 PSI MIN RESEAT  *COMBINED & FLIGHT CONT RESERVE OVERB'D 140 PSI MAX AT 25 GPM & 115 PSI MIN RESEAT  *ACCUM THERMAL, 3850 PSI MAX AT 30GPM & 3390 PSI MIN RESEAT			



S-3A HYDRAULIC SYSTEM BLOCK DIAGRAM

**LOCKHEED 8-3A VIKING**

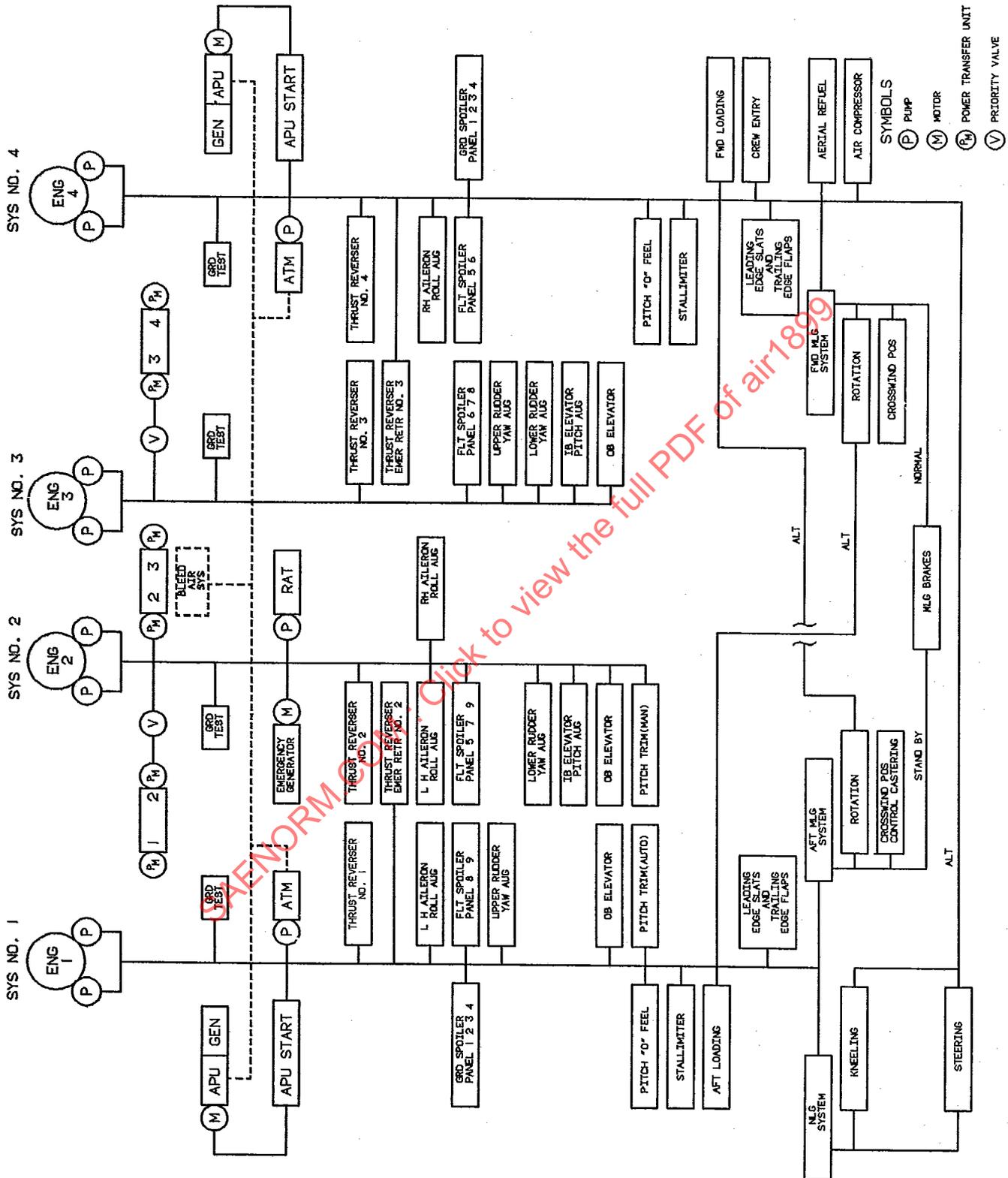


PILOT PRESS COPYRIGHT DRAWING

## AIRCRAFT - C-5A

1. DESIGN SPECIFICATION	MIL-H-5440 D					
2. SYSTEM PRESSURE	3000 PSIG					
3. HYDRAULIC FLUID	MIL-H-5606					
4. ACCUMULATOR DATA	USAGE			VOLUME	PRECHARGE	
	APU START (SELF DISPLACEMENT) RAM AIRTURBINE-EXTEND			500 IN <sup>3</sup> 500 IN <sup>3</sup>	1500 PSI 1500 PSI	
5. RESERVOIR DATA	COMBINED SYSTEM		FLIGHT SYSTEM		HYD. DRIVEN	
	TWD (2) SYSTEMS UNPRESSURIZED BOOST PUMP 10 GALS		TWD (2) SYSTEMS UNPRESSURIZED BOOST PUMP 5.7 GALS			
6. SYSTEM QUIESCENT FLOW	10 GPM		10 GPM			
7. HYDRAULIC PUMP DATA	ENGINE DRIVEN, VARIABLE VOLUME (8) 2/ENGINE					
TYPE	3000 PSI					
PRESSURE	60 GPM (AT CRUISE)					
RATED FLOW	3.0 IN <sup>3</sup> /REV					
DISPLACEMENT	5000 RPM (FULL FLOW)					
RATED SPEED	1500 IN.POUNDS					
TORQUE						
ROTATION FROM SHAFT END						
ENGINE TO PAD RATIO						
7A. PUMP DATA	GROUND IDLE FLIGHT CRUISE					
	3250 RPM (40 GPM) 5000 RPM (60 GPM)					
8. AUXILIARY PUMP DATA	AIR TURBINE		RAM AIR		POWER TRANSFER UNITS	
	3000 PSI 40 GPM 5200 RPM 1.8 CU.IN./REV 1 & 4		3000 PSI 32-40 GPM 5250-6800 RPM 1.5 CU.IN./REV 2		3000 PSI 35 GPM 5600 RPM 1.52 CU.IN./REV 1/2, 2/3, 3/4	
9. TUBING DATA	DIA	W.T. (STL)	W.T. (AL)	SPECIFICATION	USAGE	
	0.250	0.016	0.020	AM 350 CRT (FOR STL)	PRESSURE	
	0.375	0.018	0.020			
	0.500	0.020	0.028	6061-T6 (FOR AL)	RETURN	
	0.625	0.022	0.035			
	0.750	0.026	0.049			
	1.000	0.035	0.049			
	1.250	0.043	0.035		SUCTION	
	1.250		0.065		RETURN	
	1.500	0.052	0.035		SUCTION	
1.500		0.072	RETURN			
1.750		0.035	SUCTION			
10. FITTING DATA	SIZE RANGE	TYPE		MATERIAL	CONNECTION	
	1/4-1/2	PERMANENT & DETACHABLE		17-4PH	MS WELDED	
REPAIR:						
11. TEMPERATURE RANGE	-65F TO +275F					
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)	PISTON MS 28775 BUNA-N O-RINGS MS 28778 BUNA-N O-RINGS					
13. FILTRATION	MAIN-PRESSURE RETURN CASE DRAIN FLIGHT ACTUATORS					
	15 MICRON ABS 5 MICRON ABS 5 MICRON ABS 15 MICRON ABS					
14. HYDRAULIC MOTOR DATA	SYSTEM	DISPLACEMENT (CU. IN./REV)	SPEED (RPM)	PRESSURE (PSI)	FLOW (GPM)	TORQUE (IN-LB)
	FLAPS(2)	1.5	3946	3000	26	700
	STAB. TRIM	0.37/0.95	4000/6500	3000	6/27	180/450
	M.L. GEAR(4)	0.6	7500	3000	20	300
	N.L. GEAR	0.6	4500	3000	12	300
	NLG DOOR(2)	0.6	5400	3000	14	300
	NOSE VISOR	0.6	4500	3000	12	300
	CARGO DOOR	0.6	6500	3000	17	300
	APU START(2) EMER. GEN.	0.37 0.22	10,000 12,000	3000 3000	16 10.2	180 100
15. HAND PUMP DATA	STANDARD 1 CU. IN./STROKE PUMP TO CHARGE APU START ACCUMULATORS					

SECTION 4.3

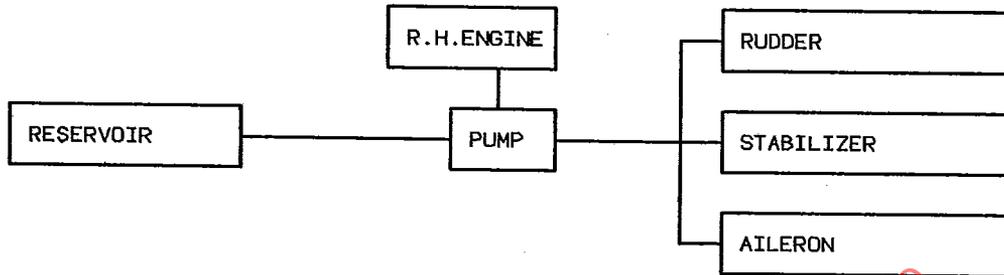


C-5A HYDRAULIC SYSTEM POWER DISTRIBUTION

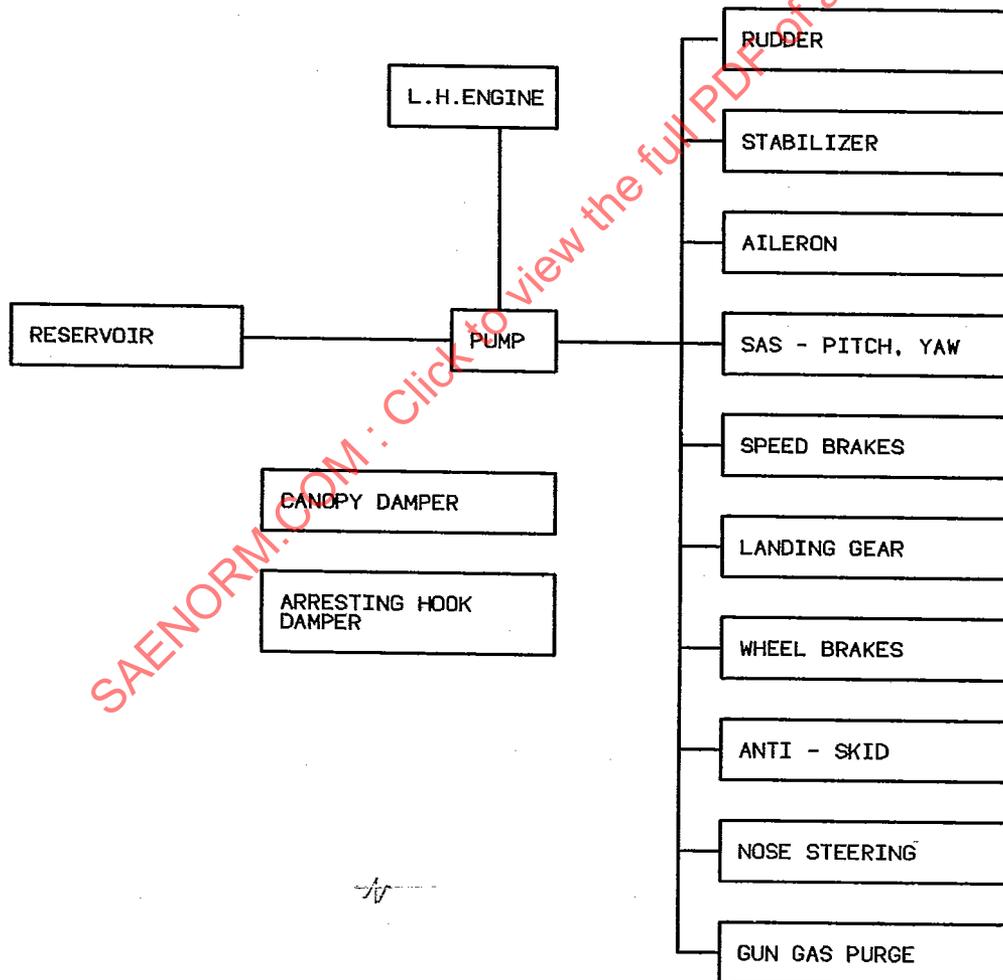
## AIRCRAFT - F-5E

1. DESIGN SPECIFICATION	MIL-H-5440 B (ALSO D & F)				
2. SYSTEM PRESSURE	3000 PSI				
3. HYDRAULIC FLUID	DESIGNED FOR MIL-H-5606				
4. ACCUMULATOR DATA	NONE				
5. RESERVOIR DATA	UTILITY & FLT. CONTROL SYSTEM				
TYPE AND PRESS FILL LEVEL SYSTEM VOLUME RESERVOIR VOLUME REFILL VOLUME	AIR / OIL 16 PSIG 428 CU.IN. 1100 CU.IN. UTILITY - 525 CU.IN. F. C. 477 CU.IN. 368 CU.IN.				
6. SYSTEM QUIESCENT FLOW	UTILITY & FLT. CONTROL : 1.0 GPM				
7. HYDRAULIC PUMP DATA	UTILITY OR FLT. CONTROL				
TYPE PRESSURE RATED FLOW CASE FLOW DISPLACEMENT RATED SPEED TORQUE ENG/PUMP SPEED RATIO	ENGINE DRIVEN - CHECK VALVE TYPE 2600 PSI FULL FLOW 9.9 GPM NOT APPLICABLE 0.6 CU.IN./REV 3900 RPM 360 IN-LB GEAR BOX RATIOS : LOW 0.219 HIGH 0.330				
7A. PUMP SPEED DATA GROUND IDLE CLIMB	2731 RPM 3752 RPM				
8. AUXILIARY PUMP DATA					
9. TUBING DATA	DIA (IN)	W.T. (STL)	W.T. (AL)	SPECIFICATION	USAGE
	0.250	0.028	0.035	CRES 304 1/8 H	PRESS & RETURN PRESS & RETURN
	0.375	0.028	0.049		
	0.500	0.035	0.049	AL 5052-0 COND A	PRESS & RETURN RETURN SUPPLY SUPPLY
	0.625	0.042	0.049		
	0.750	0.049	0.049		
	1.000				
10. FITTINGS DATA	MS FLARELESS, AND SOME PERMASWAGE				
11. TEMPERATURE RANGE	-65°F TO +275°F				
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)	FILLED TEFLON : U-CUPS FOR 1ST STAGE ROD SEALS. MS28775 O-RINGS AND TEFLON MS BACKUPS.				
13. FILTRATION	10 MICRON NOMINAL				
14. UTILITY PUMP/MOTOR	NOT APPLICABLE				
15. HAND PUMP DATA	NOT APPLICABLE				
16. RELIEF VALVE SETTING	3500 CRACK, 3750 FULL FLOW				

F-5E HYDRAULICS SYSTEMS BLOCK DIAGRAM



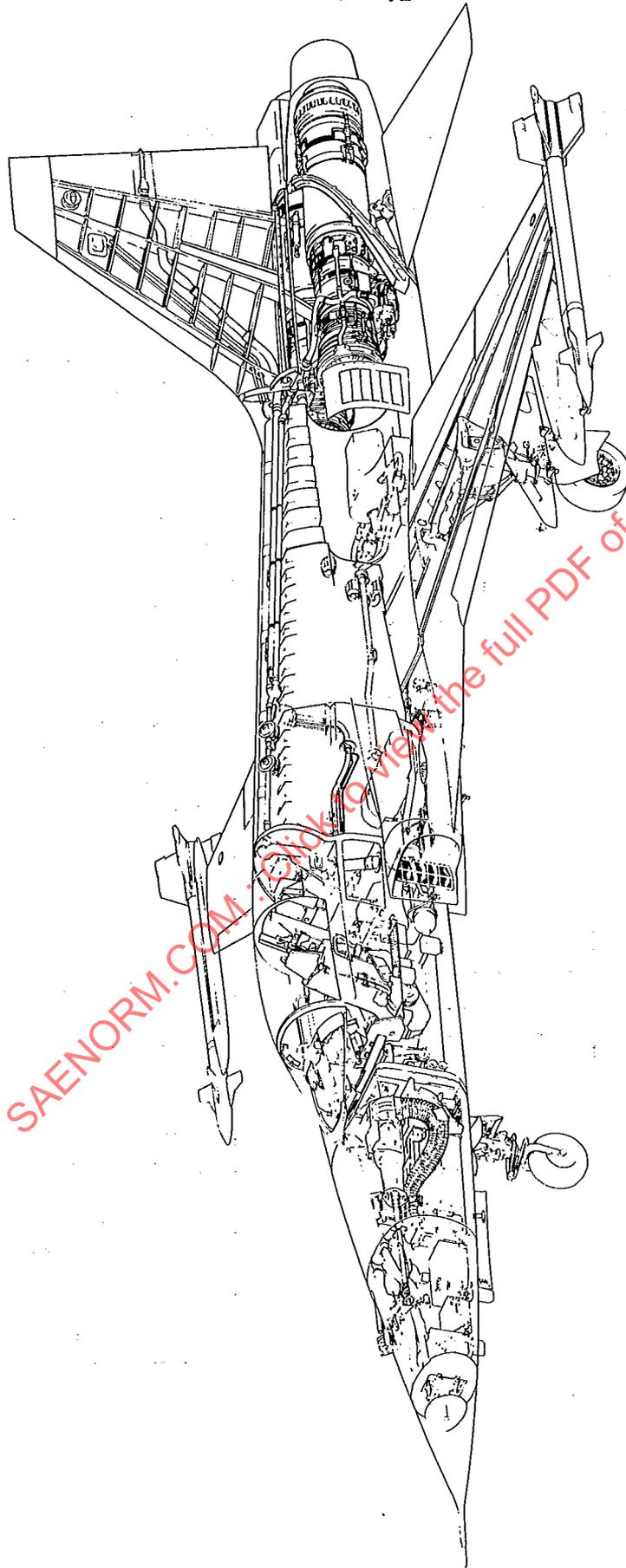
FLIGHT CONTROL SYSTEM



UTILITY SYSTEM

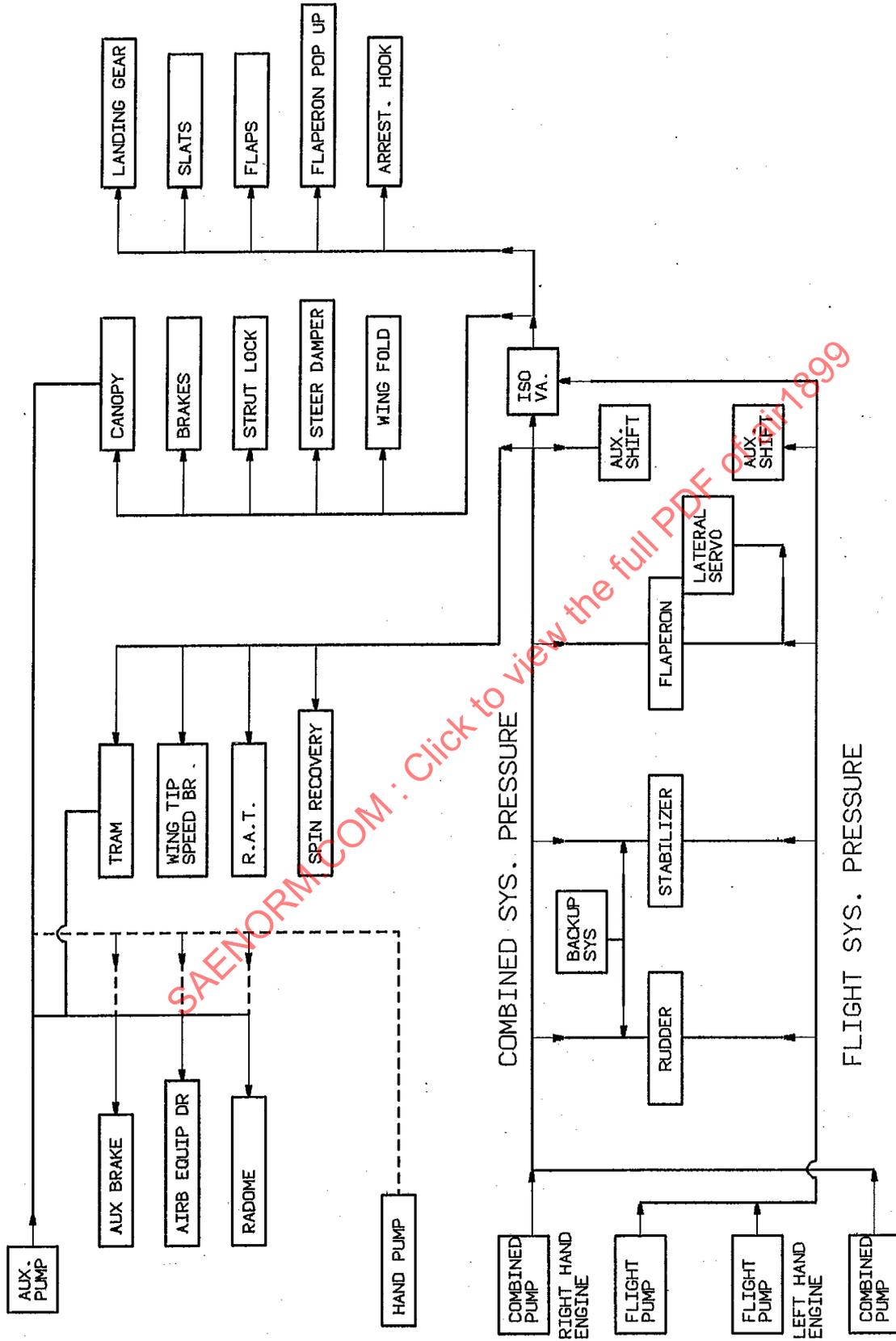
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**NORTHROP F5E**



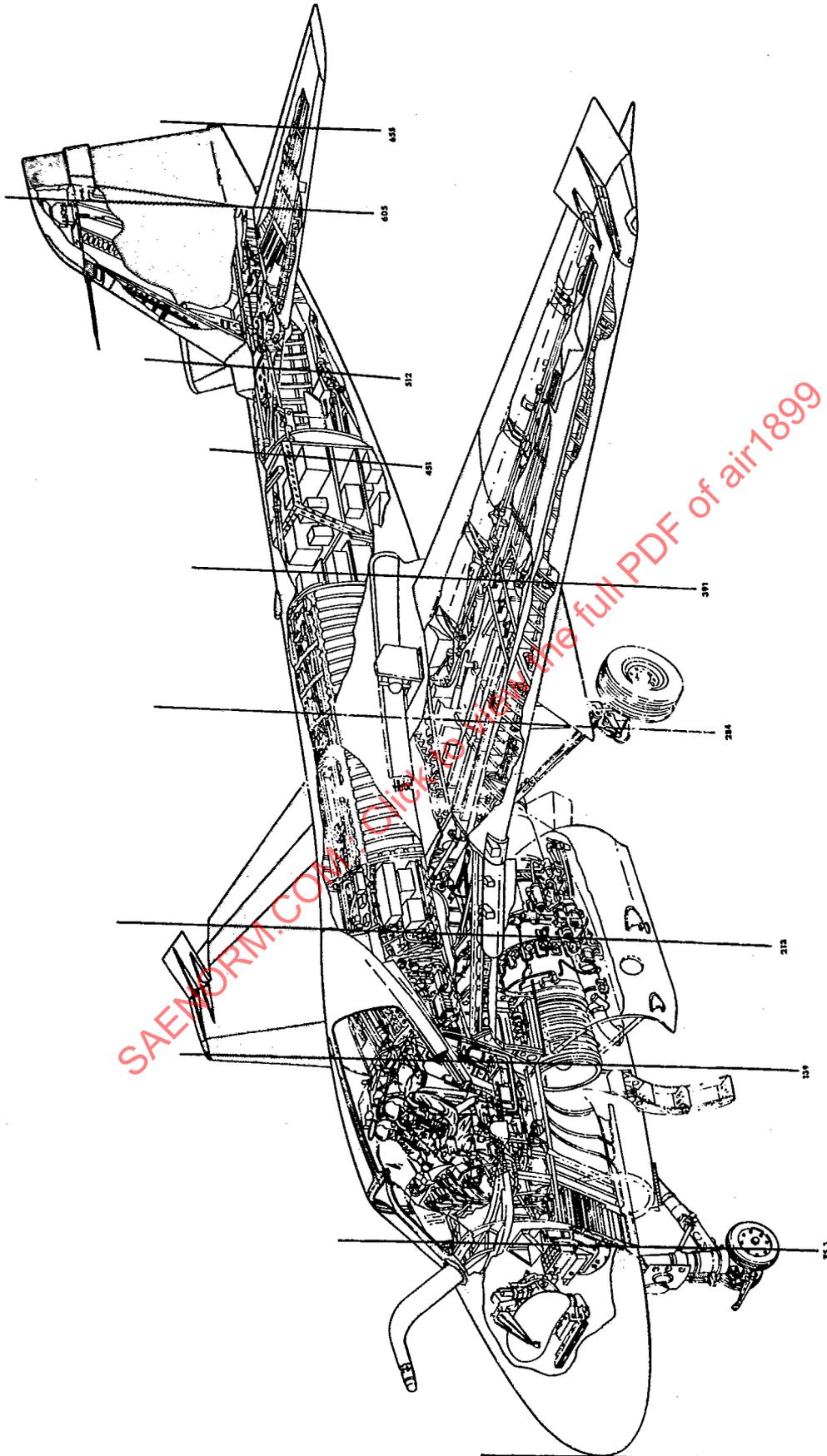
## AIRCRAFT - A6A

1. DESIGN SPECIFICATION	MIL-H-5440 B					
2. SYSTEM PRESSURE	3000. PSIG					
3. HYDRAULIC FLUID	MIL-H-5606					
4. ACCUMULATOR DATA	USAGE		VOLUME	PRECHARGE		
	FLIGHT SYSTEM MAIN ACCUM. COMBINED SYSTEM MAIN ACCUM. BRAKE SYSTEM EMERGENCY RAM AIR TURBINE EMERG EXTEN		25 CU IN 25 CU IN 50 CU IN 50 CU IN	2000 PSI 2000 PSI 800 PSI 500 PSI		
5. RESERVOIR DATA	FLIGHT SYSTEM	COMBINED SYSTEM	BACK-UP SYSTEM			
	AIR/OIL 40 PSI FULL SYSTEM VOLUME RESERVOIR VOLUME	AIR/OIL 40 PSI 688 CU IN 3000 CU IN 1040 CU IN	SPRING/OIL 40 PSI 24 CU IN 48 CU IN			
6. SYSTEM QUIESCENT FLOW	COMB - 1.02GPM, FLT NORM 1.02GPM, STAB AUX 2.54GPM					
7. HYDRAULIC PUMP DATA	FLIGHT SYSTEM		COMBINED SYSTEM			
	ENGINE DRIVEN 2900 PSI FULL FLOW 14.2 GPM 0.7 GPM 0.92 CU IN/REV 3750 RPM 490 IN LBS CCW 0.34 PUMP RPM 2380 RPM 3168 RPM 3960 RPM		(SAME AS FLIGHT SYS)			
8. AUXILIARY PUMP INPUT POWER	ELEC MOTOR DR-BACKUP 3000 P.S.I. 3GPM @ 1000, 0GPM @ 3100 PSI 5650 RPM 0.128 CU IN/REV 115/200 AC 400 CPS 8.66 A 2.41 HP		ELEC MOTOR DR-AUXILIARY 3000 P.S.I. 0.6GPM @ 2700 P.S.I. ----- 0.023 CU IN/REV 24 VDC CONTINUOUS 60 A MAX -----			
	9. TUBING DATA	DIAMETER	W.T. (STL)	W.T. (AL)	MATERIAL	USAGE
	0.250	0.016 (P)	0.035 (P)	18-8 & 6061-T6	(P) PRESS	
	0.250	0.020 (P)	0.035 (R)	18-8 & 6061-T6	(P) PRESS & (R) RETURN	
	0.375		0.049	6061-T6	PRESS & RETURN	
	0.500		0.065	6061-T6	PRESS & RETURN	
	0.625	0.042 (P)	0.042 (R)	18-8 & 5052-0	(P) PRESS & (R) RETURN	
	0.750	0.049 (P)	0.049 (R)	18-8 & 5052-0	(P) PRESS & (R) RETURN	
	1.000	0.058 (P)	0.065 (R)	18-8 & 5052-0	(P) PRESS & (R) RETURN	
10. FITTING DATA	SIZE RANGE		TYPE	MATERIAL	CONNECTION	
	.25-1.0		DETACHABLE	304 S. S.	37 DEGREES FLARED	
11. TEMPERATURE RANGE (DES)	-65 DEGREES F TO +275 DEGREES F					
12. SEAL MATERIAL TYPE FLT ACTUATORS	PISTON - SPRING LOADED TEFLON MS28775 BUNA-N O-RINGS MS28778 BUNA-N O-RINGS					
13. FILTRATION	FLIGHT SYSTEM		COMBINED SYSTEM	BACK-UP SYSTEM		
	5 MICRON ABS 5 MICRON ABS 5 MICRON ABS 15 MICRON ABS CHEM DRIER		5 MICRON ABS 5 MICRON ABS 5 MICRON ABS 15 MICRON ABS CHEM DRIER	5 MICRON ABS		
14. HYDRAULIC MOTOR DATA	SYSTEM	DISPLACEMENT CU IN/REV	SPEED RPM	PRESSURE PSI	FLOW GPM	TORQUE IN-LB
	FLAP SLAT	0.115 0.115	10000 10000	3000 3000	5.03 5.03	45.5 45.5
15. HAND PUMP DATA	PRESSURE - 3000 PSI DISPLACEMENT - 1.8 IN3/CYCLE 750 PSI 0.45 IN3/CYCLE 3000 PSI					
16. RELIEF VALVE SETTING	3560 PSI MAX FLOW 3100 PSI MIN RESEAT					



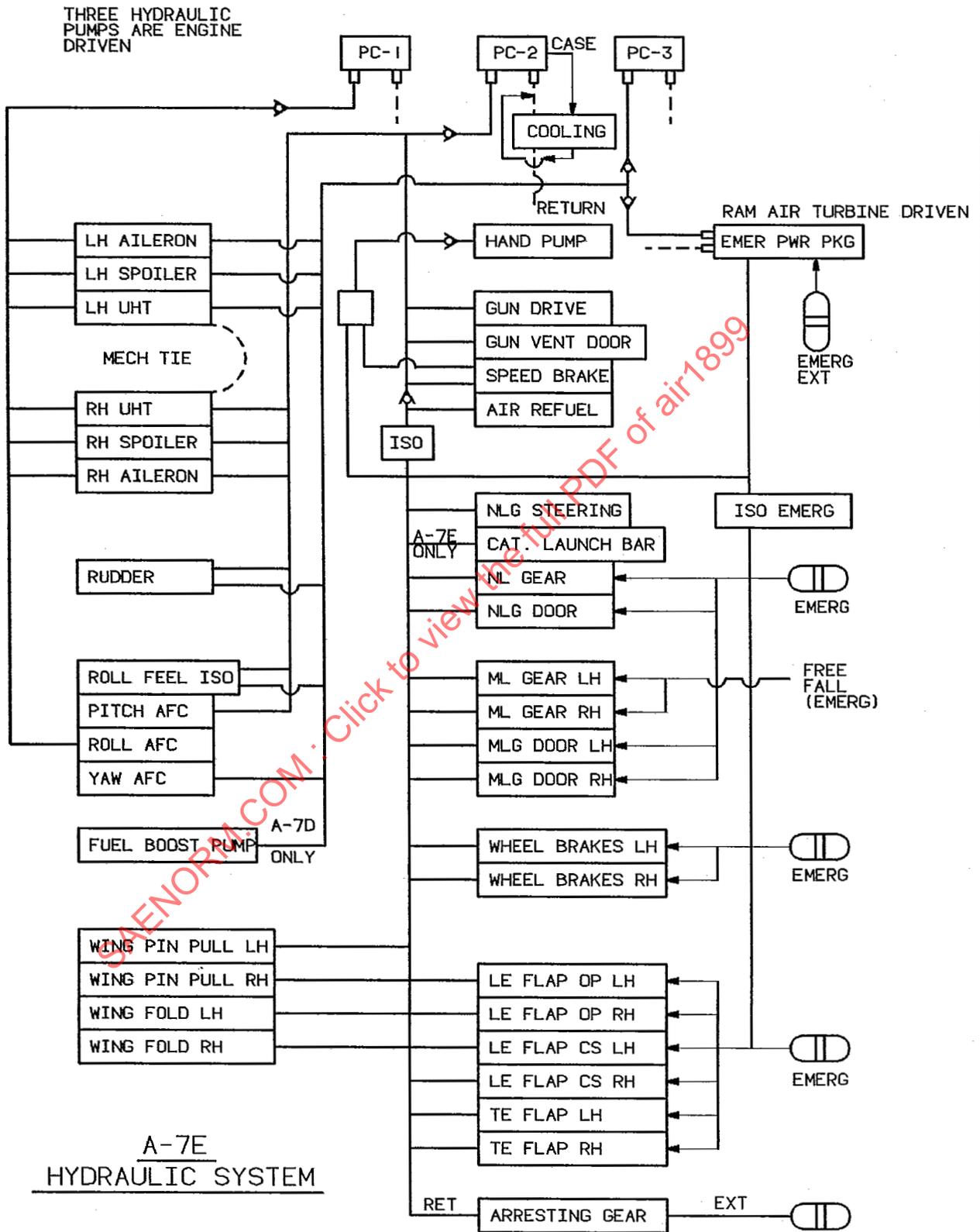
A6A HYDRAULIC SCHEMATIC

GRUMMAN A-6A



## AIRCRAFT - A-7

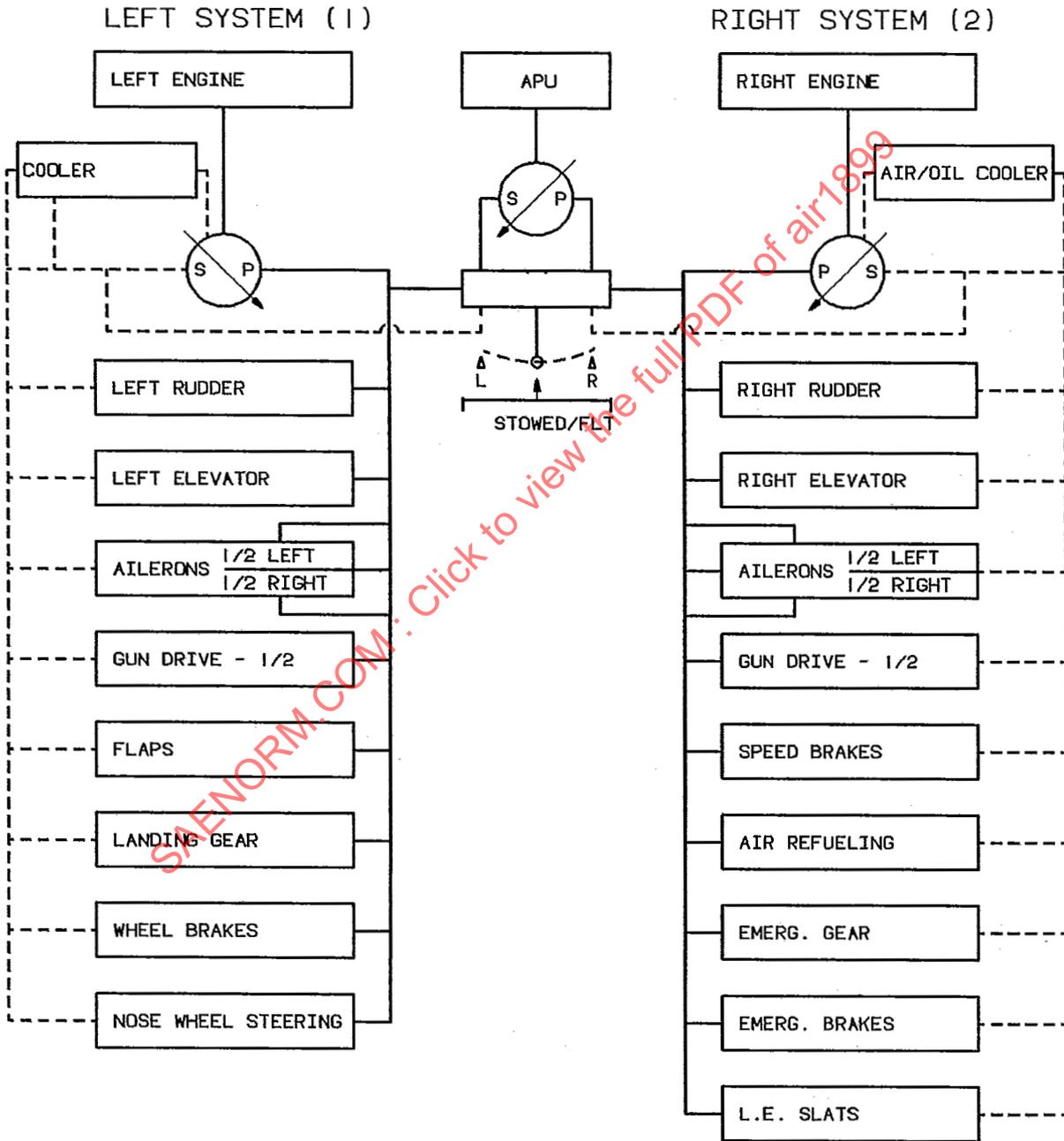
1. DESIGN SPECIFICATION		MIL-H-5440 D					
2. SYSTEM PRESSURE		3000 PSIG					
3. HYDRAULIC FLUID		MIL-H-5606					
		USAGE		VOLUME		PRECHARGE	
4. ACCUMULATOR DATA		UTILITY BRAKE ACCUM.		25 CU IN		700 PSI	
		SURGE DAMPER		25 CU IN		1000 PSI	
		RESERVOIR PRESS. ACCUM.		25 CU IN		1500 PSI	
		EMERG LANDING GEAR ACCUM.		142.5 CU IN		1450 PSI	
		EMERG FLAP ACCUM.		155.5 CU IN		1250 PSI	
		EMERG BRAKE ACCUM.		73.3 CU IN		1400 PSI	
		EMERG POWER PKG ACCUM(RAT)		73.3 CU IN		1300 PSI	
		ARRESTING GEAR ACCUM.		81.9 CU IN		1100 PSI	
5. RESERVOIR DATA		PC-1		PC-2		PC-3	
TYPE AND PRESS		BOOTSTRAP 90 PSI		BOOTSTRAP 97.5PSI		BOOTSTRAP 90 PSI	
SYSTEM VOLUME		540 CU IN		1592 CU IN		515 CU IN	
TOTAL RESERVOIR VOLUME		265 CU IN		1280 CU IN		265 CU IN	
6. SYSTEM QUIESCENT FLOW		PC-1 1.2GPM, PC-2 2.06PM, PC-3 1.16PM					
7. HYDRAULIC PUMP DATA		PC-1		PC-2		PC-3	
TYPE		IN LINE		IN LINE		IN LINE	
PRESSURE		3000 PSI		3000 PSI		3000 PSI	
RATED FLOW		24.1 GPM		42.3 GPM		15.6 GPM	
CASE FLOW		-----		1.90 GPM		1.5 GPM	
DISPLACEMENT		1.15 CU IN/REV		1.80 CU IN/REV		0.90 CU IN/REV	
RATED SPEED		5890 RPM		5890 RPM		4400 RPM	
TORQUE							
ROTATION FROM SHAFT END		CCW		CCW		CW	
ENG/PUMP SPEED RATIO		0.454		0.454		0.339	
8. AUXILIARY PUMP INPUT POWER						RAM AIR	
TYPE						TURBINE DRIVE	
PRESSURE						IN LINE PUMP	
						3000 PSI	
9. TUBING DATA		DIA (IN)	W.T.(STL)	W.T.(AL)	SPECIFICATION	USAGE	
		0.188	0.020			PNEUMATIC PRESS	
		0.250	0.020	0.028	CRES 321 1/8 H	PRESS & RETURN	
		0.250	0.035	0.035		PRESS & RETURN	
		0.375	0.022	0.028	CRES 304	PRESS & RETURN	
		0.375	0.035	0.035	AL 6061-T6	PRESS & RETURN	
		0.500	0.028	0.035		PRESS & RETURN	
		0.500	0.042			PRESS & RETURN	
		0.625	0.035	0.049		PRESS & RETURN	
		0.625	0.049			PRESS & RETURN	
		0.750	0.028	0.065		PRESS & RETURN	
		0.750	0.042			PRESS & RETURN	
		0.750	0.065			PRESS & RETURN	
		1.000	0.035	0.065		PRESS & RETURN	
		1.000	0.058			PRESS & RETURN	
		1.000	0.083			PRESS & RETURN	
10. FITTING DATA		SIZE RANGE	TYPE	MATERIAL	CONNECTION		
		3/16 TO 1"	PERMANENT & DETACHABLE	AL & CRES	MS FLARELESS		
					BRAZED		
					PERMASWAGE FLARELESS		
11. TEMPERATURE RANGE (DES)		-65 DEGREES F TO +275 DEGREES F					
12. SEAL MATERIAL TYPE FLT ACTUATORS		PISTONS-SPRING LOADED TEFLON; O-RING WITH TEFLON CAP; BUNA-N O-RING; T-RING - MS28775 WITH TEFLON CAP, M83248 VITON, FLUOROSILICONE (LOW PRESSURE), N756-75 O-RINGS - CVC4233 O-RINGS (STATIC)					
13. FILTRATION		PCI, 2 & 3					
MAIN		5 MICRON ABS DISPOSABLE					
RETURN		NONE					
CASE DRAIN		5 MICRON ABS DISPOSABLE					
FLIGHT ACTUATORS		NONE					
OTHER		COMPONENTS 45 MICRON ABS RESERVOIR RELIEF VALVE 65 MICRON ABS					
14. HYDRAULIC MOTOR DATA (A-7D ONLY)		SYSTEM	DISPLACEMENT CU IN/REV	SPEED RPM	PRESSURE PSI	FLOW GPM	TORQUE IN-LB
		FUEL BST PUMP	.057	6100	2500 DIFF.	1.75	18 MAX
		GUN DRIVE	.950	6600	3000	26.0	125 MIN 325 MAX
15. HAND PUMP DATA		0.7 CU.IN./CYCLE TO 3000 PSI					
16. RELIEF VALVE SETTING		3850 PSI FULL FLOW & 3390 PSI RESEAT					



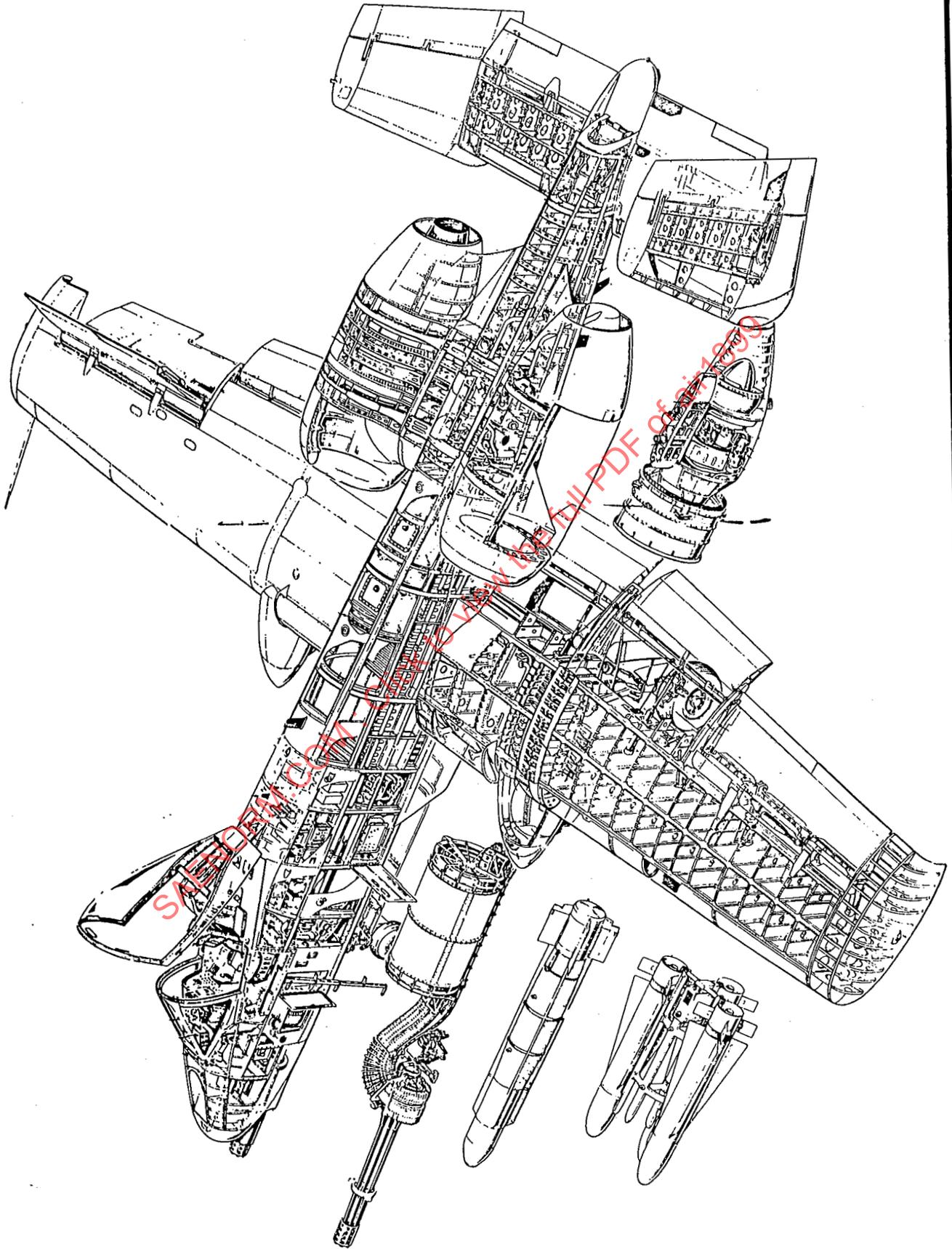
## AIRCRAFT - A-10A

1. DESIGN SPECIFICATION		MIL-H-5540 F				
2. SYSTEM PRESSURE		3000 PSIG				
3. HYDRAULIC FLUID		DESIGNED FOR MIL-H-83282				
4. ACCUMULATOR DATA		USAGE		VOLUME	PRECHARGE	
		EMERGENCY L/G ACCUM.		50 CU IN	1200 PSI	
		EMERGENCY BRAKE ACCUM.		50 CU IN	1200 PSI	
		RESV. B'STRAP (LEFT)		10 CU IN	1600 PSI	
		RESV. B'STRAP (RIGHT)		10 CU IN	1600 PSI	
5. RESERVOIR DATA  TYPE AND PRESS. SYSTEM VOLUME TOTAL RESV. VOLUME		LEFT(#1) FLT. CONT.& UTIL.		RT.(#2) FLT. CONT.& UTIL..		
		BOOTSTRAP - 70 PSIG 4068 CU IN 550 + 25 CU IN - 0 CU IN		BOOTSTRAP - 70 PSIG 4068 CU IN 550 + 25 CU IN - 0 CU IN		
6. SYSTEM QUIESCENT FLOW		LEFT : 0.74 GPM		RIGHT : 2.75 GPM		
7. HYDRAULIC PUMP DATA  TYPE PRESSURE RATED FLOW DISPLACEMENT ROTATION (FROM SHAFT END) RATED SPEED: A. GROUND IDLE B. CRUISE C. TAKE-OFF		ENGINE DRIVEN VARIABLE DELIVERY PUMP 3100 ± 75 PSIG 43 GPM 1.9 CU IN/REV.  CCW  3717 RPM 5113 RPM 6709 RPM				
8. AUXILIARY PUMP  TYPE PRESSURE FLOW SPEED DISPLACEMENT (MAX.)		APU DRIVEN VARIABLE 3025 ± 75 PSIG 10 GPM 8000 ± 300 RPM 0.3 CU IN/REV.				
9. TUBING DATA		DIA(IN)	W.T.(STL)	W.T.(AL)	SPECIFICATION	USAGE
		0.2500	0.020	0.028	21-6-9 DRES. AMS 5561	PRESS & RETURN
		0.3125	0.020	0.025		PRESS & RETURN
		0.3750	0.020	0.028		PRESS & RETURN
		0.5000	0.026	0.028		PRESS & RETURN
		0.6250	0.033	0.035	6061-T6 AL MIL-T-7081	PRESS & RETURN
		0.7500	0.039	0.035		PRESS & RETURN
1.0000	N/A	0.049	RETURN			
10. FITTING DATA		SIZE RANGE	TYPE	MATERIAL	CONNECTION	
		0.25 - 1.0	PERMASWAGED PERMANENT & ATTACHABLE	CRES.& AL.	CONNECTS TO MS FLARELESS	
11. TEMPERATURE RANGE		-40F TO +275F (FLUID); -65F TO 160F (AMBIENT)				
12. SEAL MATERIAL/TYPE		FLT. ACTUATORS		COMPONENTS		
		SHAMBAN S11065, S11589, S13077; MS28775, MS28774		PUMP - MS28775 (TEFLON) "T" SEAL, M83248/1/2 (VITON)		
13. FILTRATION		FLIGHT SYSTEMS				
PRESSURE RETURN APU CASE DRAIN		5 M ABS 5 M ABS 5 M ABS				
14. HYDRAULIC MOTOR DATA  (GUN DRIVE MOTOR)(2)		DISPLACEMENT (CU IN/REV.)	SPEED (RPM)	PRESSURE (PSI)	FLOW (GPM)	TORQUE (IN-LB)
		0.97	6200	2578	26	300
15. HAND PUMP DATA		NONE				
16. RELIEF VALVE SETTINGS		3850 PSI MAX. @ 45 GPM				

A-10A HYDRAULICS SYSTEMS BLOCK DIAGRAM



FAIRCHILD A-10A



AIRCRAFT - F-14A

1. DESIGN SPECIFICATION		MIL-H-5440 D					
2. SYSTEM PRESSURE		3000 PSIG					
3. HYDRAULIC FLUID		MIL-H-5606 D					
4. ACCUMULATOR DATA		USAGE		VOLUME		PRECHARGE	
		COMBINED SYS RESERVOIR		50 CU IN		1800 PSI	
		WHEEL BRAKE		50 CU IN		1900 PSI	
		FLIGHT SYSTEM RESERVOIR		200 CU IN		1900 PSI	
				75 CU IN		1800 PSI	
5. RESERVOIR DATA		COMBINED SYSTEM		FLIGHT SYSTEM			
TYPE		BOOTSTRAP		BOOTSTRAP			
PRESSURE		105 PSI		105 PSI			
FULL RESERVOIR VOLUME		1340 CU.IN.		724 CU.IN.			
		1684 CU.IN.		787 CU.IN.			
6. SYSTEM QUIESCENT FLOW		FLIGHT: 2-3GPM, COMBINED: 3-6GPM					
7. HYDRAULIC PUMP DATA		ENGINE DRIVEN, VARIABLE VOLUME					
TYPE		3000 PSI					
PRESSURE		84 GPM					
RATED FLOW		3.70 CU.IN./REV					
DISPLACEMENT		5540 RPM (FULL FLOW)					
RATED SPEED		2000 IN-LB					
TORQUE		CCW					
ROTATION FROM SHAFT END		.388					
ENGINE TO PAD RATIO		PUMP RPM					
7A. PUMP DATA		3867 RPM					
GROUND IDLE		3892 RPM					
FLIGHT M=.2		4868 RPM					
CRUISE M=.7							
8. AUXILIARY PUMP DATA		FLIGHT CONTROL BACKUP			SPOILER MOD. & HI LIFT BACKUP		
TYPE		AC MOTOR DRIVEN BACKUP			AC MOTOR DRIVEN		
PRESSURE		3000 PSI			3000 PSI		
FLOW		14.5 GPM-500 PSI (HI)			6.5 GPM-2050 PSI		
		2.4 GPM-3000 PSI (HI)			0.5 GPM-3000 PSI		
		7.2 GPM-500 PSI (LOW)					
		1.2 GPM-3000 PSI (LOW)					
SPEED		12000 RPM (HI)			11300 RPM		
		6000 RPM (LOW)					
DISPLACEMENT		0.32 CU.IN./REV			0.133 CU.IN./REV		
8A. TRANSFER PUMP DATA		HYD PUMP/MOTOR, FIXED DISPLACEMENT					
TYPE		0-30 GPM @ 2050 PSI-2400 PSI					
PUMP OUTPUT		30 GPM @ 2050 PSI					
RATED		0-33 GPM @ 2400 PSI-3000 PSI					
MOTOR INPUT		32.8 GPM @ 2850 PSI					
RATED		5750 RPM					
RATED FLOW		1.27 CU.IN./REV					
DISPLACEMENT							
9. TUBING DATA		DIAMETER	W.T. (STL)	W.T. (TI)	MATERIAL	USAGE	
		0.187	0.028		CRES 304 1/8 H	COIL	
		0.187	0.028		CRES 321	PNEUMATIC	
		0.250	0.020		CRES 321	PRESS & RETURN	
		0.250	0.028		CRES 304 1/8 H	COIL	
		0.250	0.028		CRES 321	PRESS & RETURN	
		0.375	0.042		CRES 321	PRESS & RETURN	
		0.375	0.042		CRES 304 1/8 H	COIL	
		0.375		0.028	TI, 3AL-2.5V	PRESS & RETURN	
		0.500		0.036	TI, 3AL-2.5V	PRESS & RETURN	
		0.625		0.044	TI, 3AL-2.5V	PRESS & RETURN	
		0.750		0.054	TI, 3AL-2.5V	PRESS & RETURN	
		1.000		0.073	TI, 3AL-2.5V	PRESS & RETURN	
		1.500		0.042	TI, 3AL-2.5V	SUCTION	
10. FITTING DATA		SIZE RANGE	TYPE	MATERIAL	CONNECTION		
		.187-1.50	PERMANENT & DETACHABLE	17-4 PH 6AL-4VTI	LIP SEAL BRZ&CRYOFIT		
11. TEMPERATURE RANGE		LIP SEAL & CRYOFIT -65F TO +275F					
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)		PISTON - SPRING LOADED TEFLON MS 28775 BUNA-N O-RINGS MS 28778 BUNA-N O-RINGS					
13. FILTRATION		TRANSFER PUMP MAIN RETURN CASE DRAIN FLIGHT ACTUATORS 5 MICRON ABS 5 MICRON ABS 5 MICRON ABS 5 MICRON ABS 25 MICRON ABS INLET					
14. HYDRAULIC MOTOR DATA		SYSTEM	DISPLACEMENT (CU. IN./REV)	SPEED (RPM)	PRESSURE (PSI)	FLOW (GPM)	TORQUE (IN-LB)
		EM GEN	0.173 MAX	12000	3000	9.00	
		WNG SWP	1.15	7510	3000	40.00	
		HI-LIFT	0.22	9400	3000	8.95	
		GUN	0.93	5700MIN	3000	22.95	
		DRIVE		6450MAX		25.96	
15. HAND PUMP DATA		RESERVOIR CAPACITY - 0.063 GAL. DISPLACEMENT - 0.7 CU.IN./CYCLE					
16. RELIEF VALVE SETTINGS		3750 PSI FULL FLOW 3250 PSI MIN RESEAT					

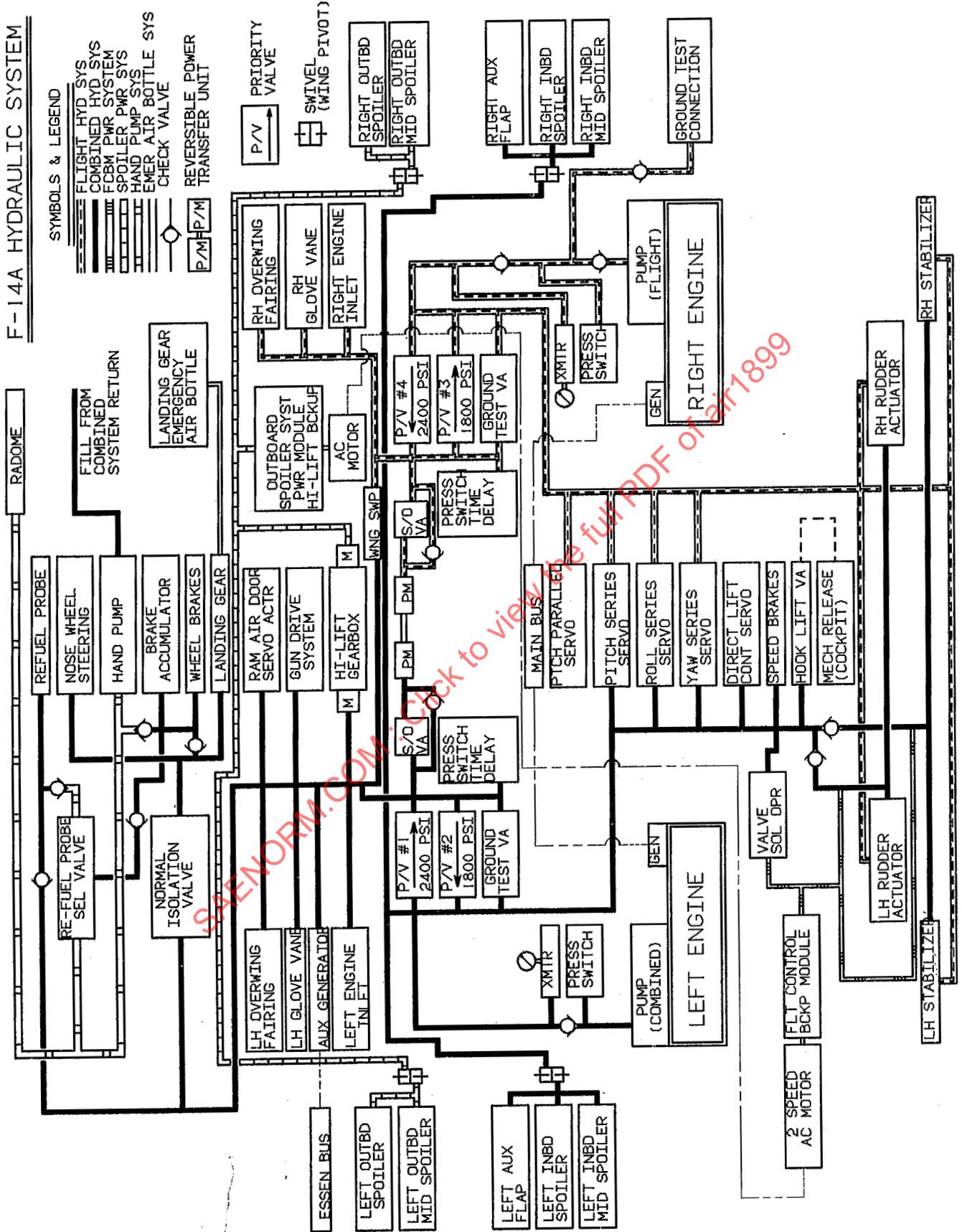
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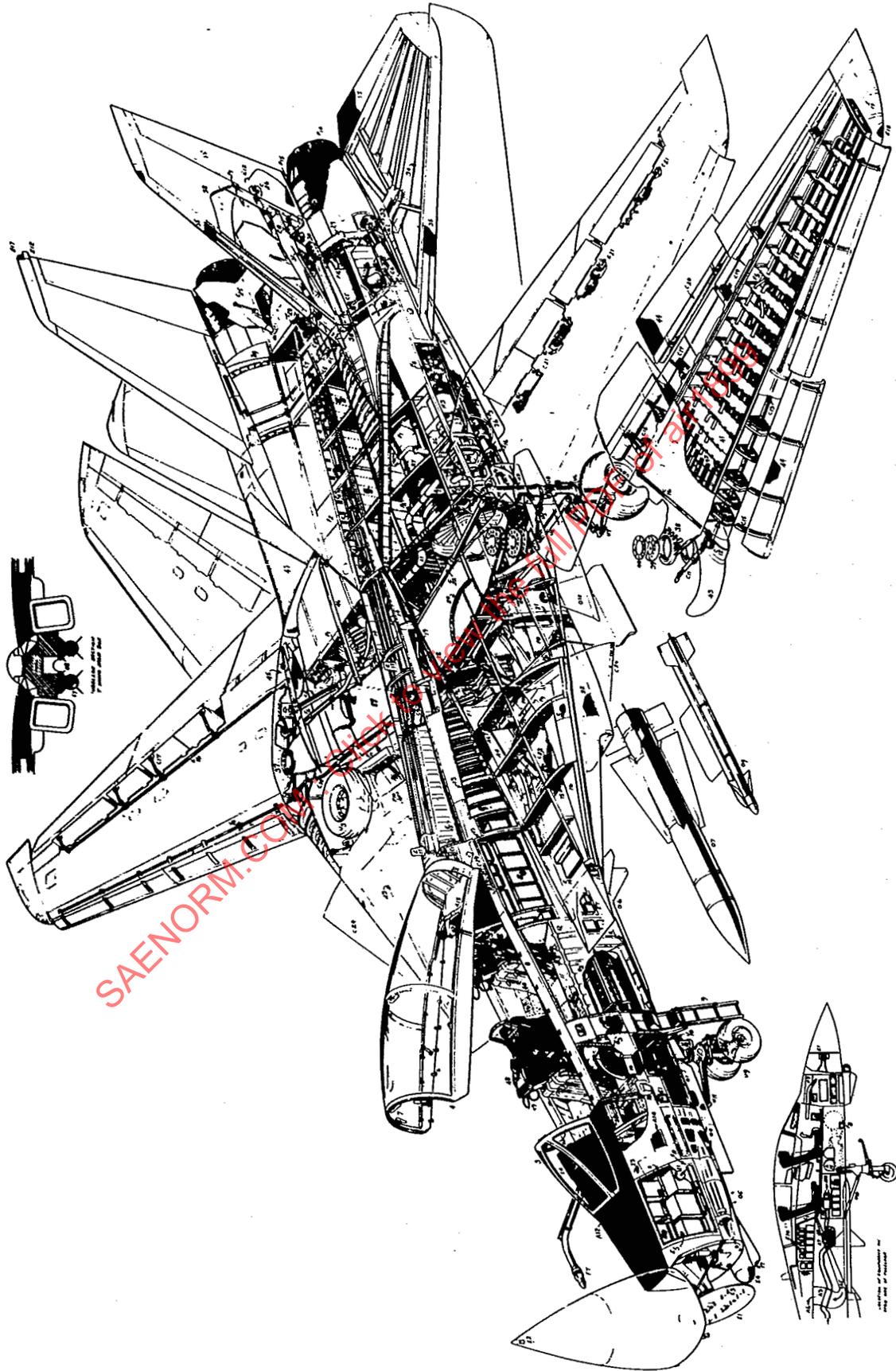
F-14A HYDRAULIC SYSTEM

SYMBOLS & LEGEND

- FLIGHT HYD SYS
- COMBINED HYD SYS
- FCBM PWR SYSTEM
- SPOILER, PWR SYS
- HAND PUMP SYS
- EMER AIR BOTTLE SYS
- CHECK VALVE
- REVERSIBLE POWER TRANSFER UNIT



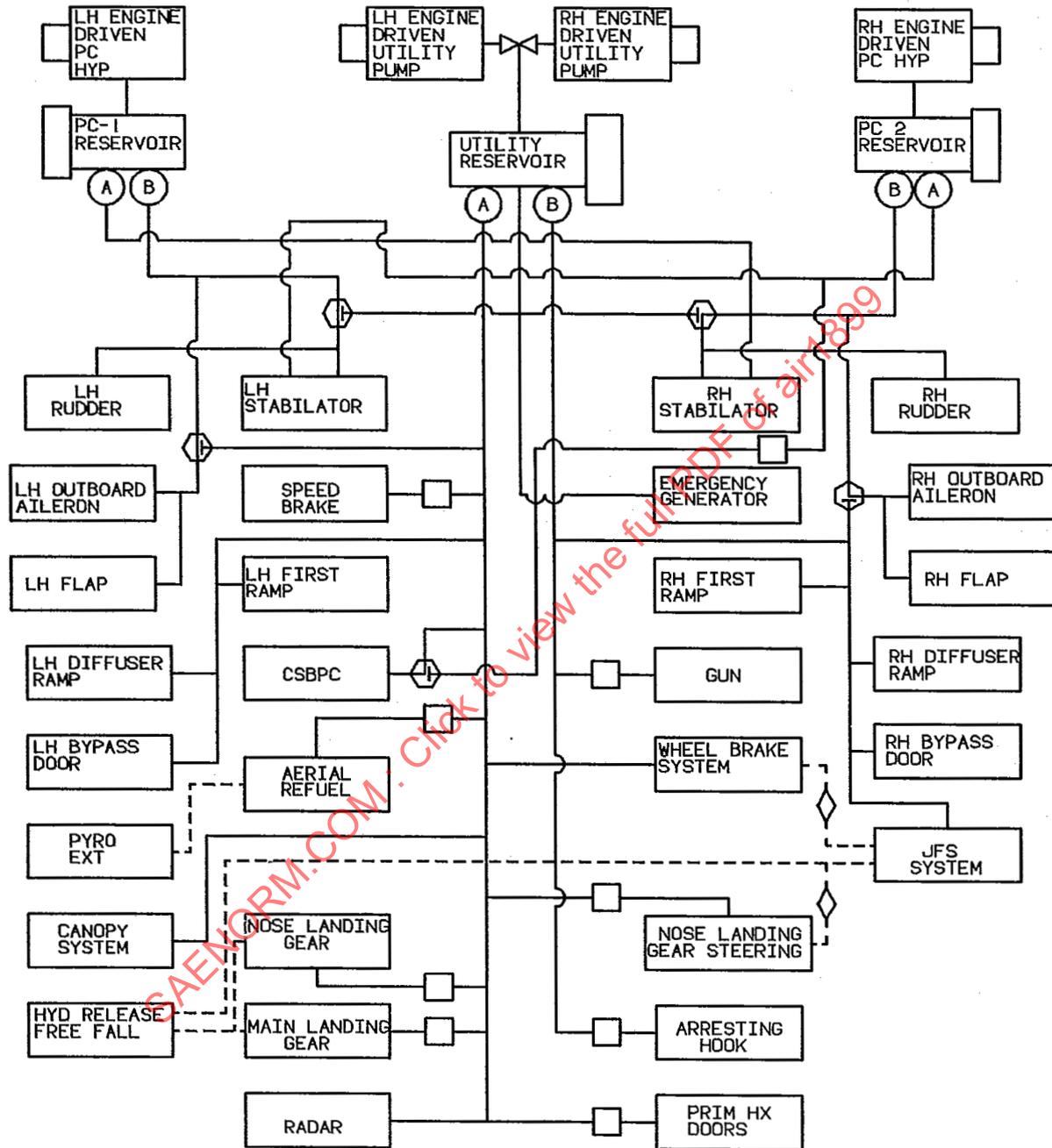
# GRUMMAN F-14A



## AIRCRAFT - F-15A

1. DESIGN SPECIFICATION		MIL-H-5440 E					
2. SYSTEM PRESSURE		3000 PSIG					
3. HYDRAULIC FLUID		MIL-H-5606					
4. ACCUMULATOR DATA		USAGE		VOLUME		PRECHARGE	
		CENTRAL SYSTEM		NONE		NONE	
		JET FUEL STARTER (JFS)-SELF DISPLACING 2 PER A/C		220 GAS 142 OIL		1720 PSIG	
		CANOPY SUPPLY		50 GAS 45 OIL		784 PSIG	
5. RESERVOIR DATA		PC SYSTEM		UTILITY SYSTEM			
TYPE		BOOTSTRAP WITH RESERVOIR LEVEL SENSING					
PRESSURE		48 PSIG		56 PSIG			
SYSTEM VOLUME		1065 CU. IN.		3350 CU. IN.			
RESERVOIR VOLUME		355 CU. IN.		950 CU. IN.			
6. SYSTEM QUIESCENT FLOW		PC SYSTEMS - 1.3 GPM, UTILITY SYSTEM - 2.7 GPM					
7. HYDRAULIC PUMP DATA		PC SYSTEMS				UTILITY SYSTEM	
TYPE		VARIABLE DELIVERY, AXIAL PISTON					
PRESSURE		3000 PSIG				3000 PSIG	
RATED FLOW		56 GPM				56 GPM	
RATED SPEED		4600 RPM				4600 RPM	
DISPLACEMENT		3.0 CIR				3.0 CIR	
ROTATION FROM SHAFT END		CCW				CCW	
PUMP/ENGINE PAD RATIO		.262				.292	
GROUND IDLE		2570 RPM				2890 RPM	
CRUISE		3360 RPM				3710 RPM	
TAKE-OFF (MAX)		3780 RPM				4340 RPM	
APPROACH		2970 RPM				3110 RPM	
8. AUXILIARY PUMP DATA							
9. TUBING DATA		DIA (IN)	W.T. (TI)	W.T. (AL)	MATERIAL	USAGE	
		0.250	0.016		TI 3AL-2.5 V	PRESS & RETURN	
		0.250	0.028		TI 3AL-2.5 V	COILED TUBE	
		0.375		0.028	AL 6061-T6	RETURN ONLY	
		0.375	0.019		TI 3AL-2.5 V	PRESS & RETURN	
		0.375	0.042		TI 3AL-2.5 V	COILED TUBE	
		0.500		0.028	AL 6061-T6	RETURN ONLY	
		0.500	0.026		TI 3AL-2.5 V	PRESS & RETURN	
		0.500	0.056		TI 3AL-2.5 V	COILED TUBE	
		0.625		0.035	AL 6061-T6	RETURN ONLY	
		0.625	0.032		TI 3AL-2.5 V	PRESS & RETURN	
		0.625	0.039		TI 3AL-2.5 V	COILED TUBE	
		0.750		0.035	AL 6061-T6	RETURN ONLY	
		0.750	0.039		TI 3AL-2.5 V	PRESS & RETURN	
		1.000		0.042	AL 6061-T6	RETURN ONLY	
		1.000	0.051		TI 3AL-2.5 V	PRESS & RETURN	
		1.250		0.049	AL 6061-T6	RETURN ONLY	
		1.250	0.065		TI 3AL-2.5 V	PRESS & RETURN	
		1.500	0.032		TI 3AL-2.5 V	SUCTION ONLY	
10. FITTING DATA		SIZE RANGE		TYPE	MATERIAL	CONNECTIONS	
		.25-1.50		PERMANENT	UNALLOYED TI & 6061 AL AL	PERMASWAGE	
				DETACHABLE	6AL-4V TI	LIP SEAL	
11. TEMPERATURE RANGE		-65F TO +275F					
12. SEAL MATERIAL (FLIGHT ACTUATORS)		MS 28775 BUNA-N O-RINGS ROD SEAL : MS28775 O-RING ON TEFLON PISTON SEAL : TURCON SLEEVE SEAL : T SECTION & 2 BACKUP O-RINGS					
13. FILTRATION		CENTRAL MANIFOLD-COMMON ELEMENT					
TYPE		15 MICRON ABS					
MAIN		15 MICRON ABS					
RETURN		15 MICRON ABS					
CASE DRAIN		15 MICRON ABS					
14. HYDRAULIC MOTOR DATA		SYSTEM	DISPLACEMENT (CU. IN./REV)	SPEED (RPM)	PRESSURE (PSI)	FLOW (GPM)	TORQUE (IN-LB)
		6UN DRV	.95	6600		29	275
		EMER GN	.52	12000			
		JFS	.30	---			
15. HAND PUMP DATA		1 CU. IN./CYCLE TO 2000 PSI .45 CU. IN./CYCLE TO 2000-3800 PSI					
16. RELIEF VALVE SETTING		PC SYSTEMS			UTILITY SYSTEM		
CRACKING PRESSURE :		3450 PSIG			3450 PSIG		
FULL FLOW PRESSURE :		3500 PSIG @ 45 GPM			3750 PSIG @ 104 GPM		
RESEAT PRESSURE :		3250 PSIG			3250 PSIG		

F-15A HYDRAULIC SYSTEM BLOCK DIAGRAM



○ RLS VALVE

□ CONTROL VALVE

◇ MANUAL VALVE

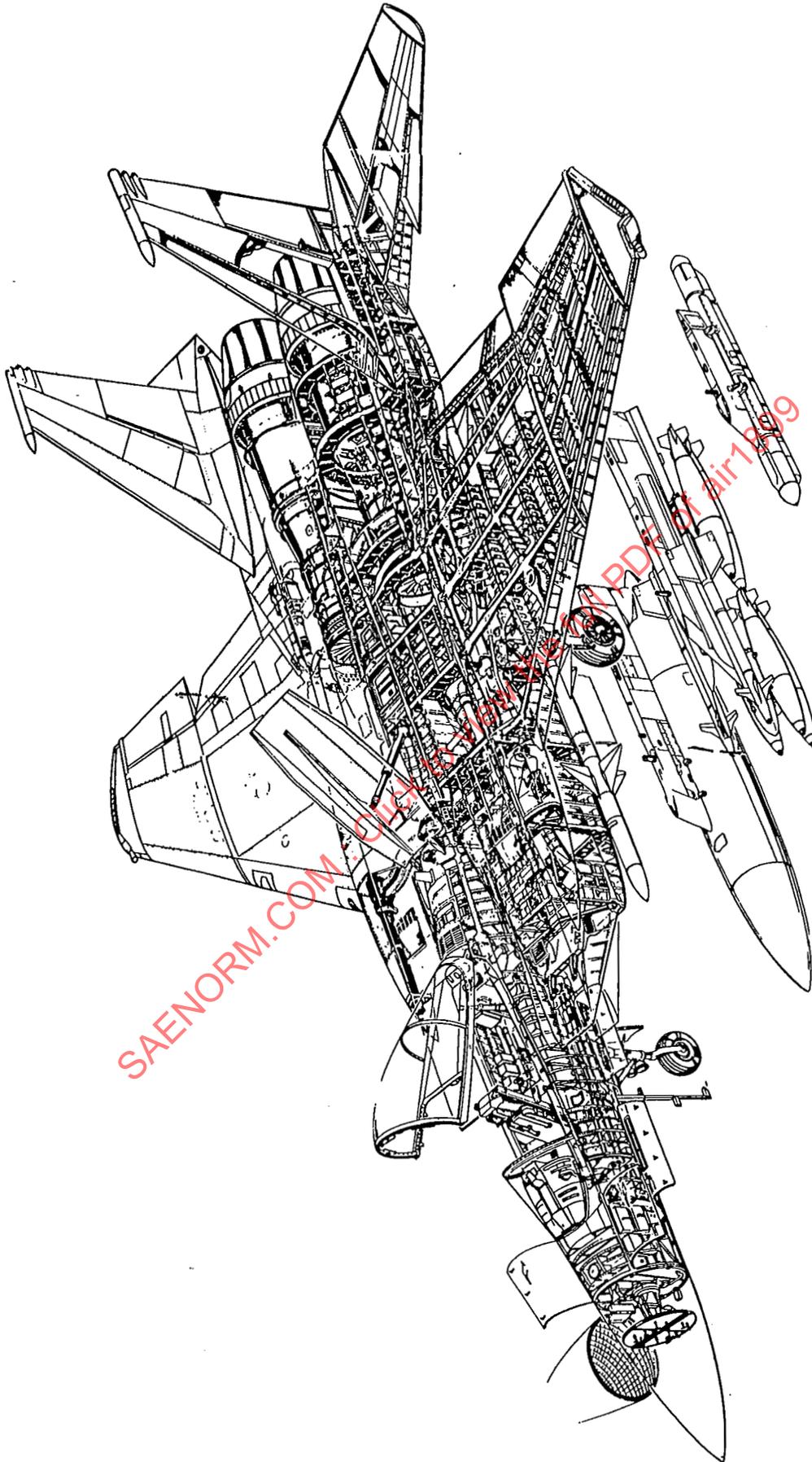
▷ CHECK VALVE

◻ SWITCHING VALVE WITH RPS

--- EMERGENCY

CSBPC CONTROL STICK BOOST PITCH COMPENSATOR

**MCDONNELL-DOUGLAS F-15A**



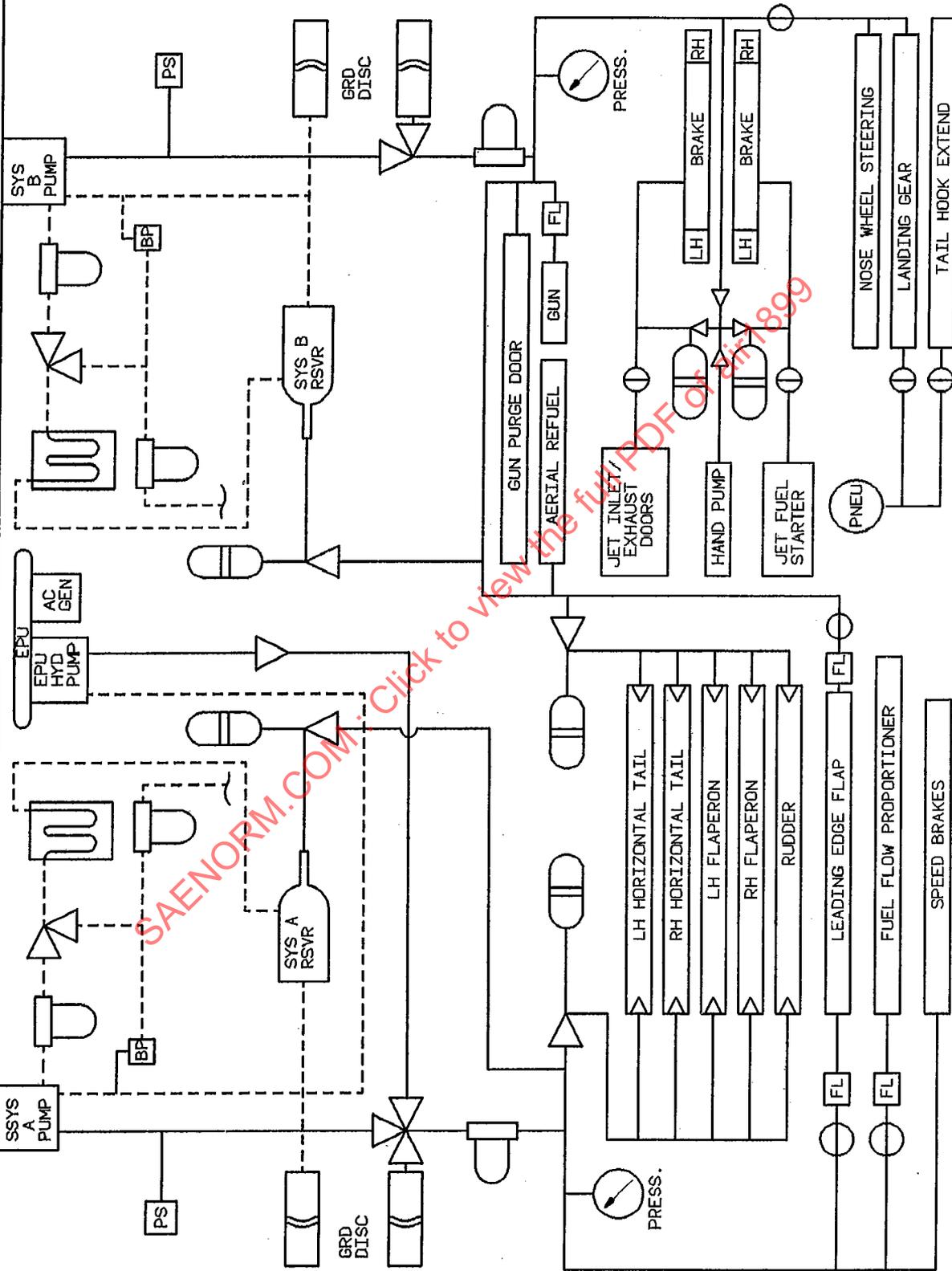
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SECTION 4.10

## AIRCRAFT - F-16

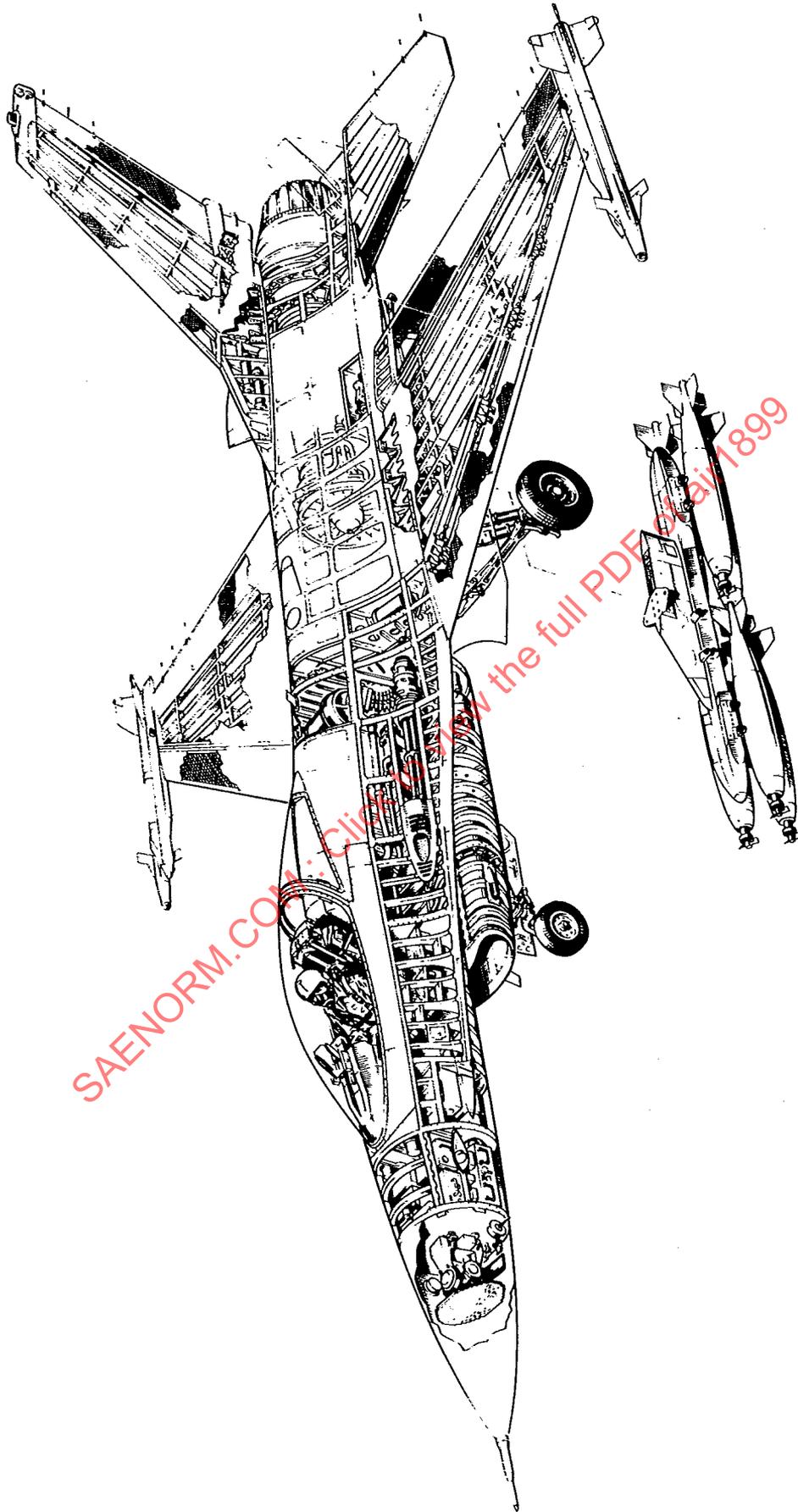
1. DESIGN SPECIFICATION	MIL-H-5440				
2. SYSTEM PRESSURE	3100. PSIG				
3. HYDRAULIC FLUID	MIL-H-5606				
4. ACCUMULATOR DATA	USAGE		VOLUME		
	RESERVOIR PRESSURIZATION FLIGHT CONTROL SUPPLY WHEEL BRAKES / JFS START		25 CU IN 100 CU IN 200 CU IN		
5. RESERVOIR DATA	SYSTEM A		SYSTEM B		
	TYPE PRESSURE TOTAL CAPACITY		BOOTSTRAP 85 PSIG 370 CU IN		BOOTSTRAP 85 PSIG 800 CU IN
6. SYSTEM QUIESCENT FLOW	SYSTEM A		SYSTEM B		
	1.20 GPM		2.00 GPM		
7. HYDRAULIC PUMP DATA	ENGINE DRIVEN 3100 PSI 42.5 GPM 1.80 CU IN/REV 5800 RPM CCW				
8. AUXILIARY PUMP DATA	EMERGENCY POWER UNIT (EPU) : RUNS ON HYDRAZINE AND/OR BLEED AIR				
	VARIABLE DELIVERY POSITIVE DISPL. - AXIAL PISTON 3000 - 3050 PSIG 22.7 GPM 0.75 CU IN/REV 7500 RPM NOM.				
9. TUBING DATA	DIA	W.T. (STL)	W.T. (AL)	SPECIFICATION	
	0.250	0.020		STEEL CRES 21-6-9	
	0.375	0.020			
	0.500	0.026			
	0.625	0.033	0.035	ALUMINUM 6061-T6	
	0.750	0.039	0.049		
	1.000	0.052	0.058		
1.250	0.032	0.072			
10. FITTING DATA	PERMANENT - PERMASWAGE DETACHABLE - DYNATUBE				
11. TEMPERATURE RANGE	-40F TO +275F				
12. SEAL MATERIAL (FLIGHT ACTUATORS)	ROD SEAL : SHAMBAN HAT SEAL WITH MIL-R-83461 ELASTOMER HEAD SEAL : CAST IRON				
13. FILTRATION	MAIN - 15 MICRON ABSOLUTE RETURN - 15 MICRON ABSOLUTE CASE DRAIN - 15 MICRON ABSOLUTE				
GUN DRIVE JFS FUEL FLOW PROPORTIONER LEADING EDGE FLAP	MOTOR DISPLACEMENT (CIR)	SPEED (RPM)	PRESSURE (PSI)	FLOW (GPM)	TORQUE (IN-LB)
	0.93	6000	3000	26.0	450
	0.42	13400	3000	24.0	200
	0.38	1720	3000	2.8	179
	0.77	4800	3000	16.0	367
15. HAND PUMP DATA	0.7 CU.IN./CYCLE TO 3000 PSI (MANUAL MODE) 0.26 GPM AT 375 RPM AND 3000 PSI (POWER MODE)				
16. RELIEF VALVE SETTINGS	CRACKING PRESSURE : 3600 PSIG FULL FLOW PRESSURE : 3850 PSIG RESEAT PRESSURE : 3400 PSIG				

AIRFRAME MOUNTED ACCESSORY GEARBOX



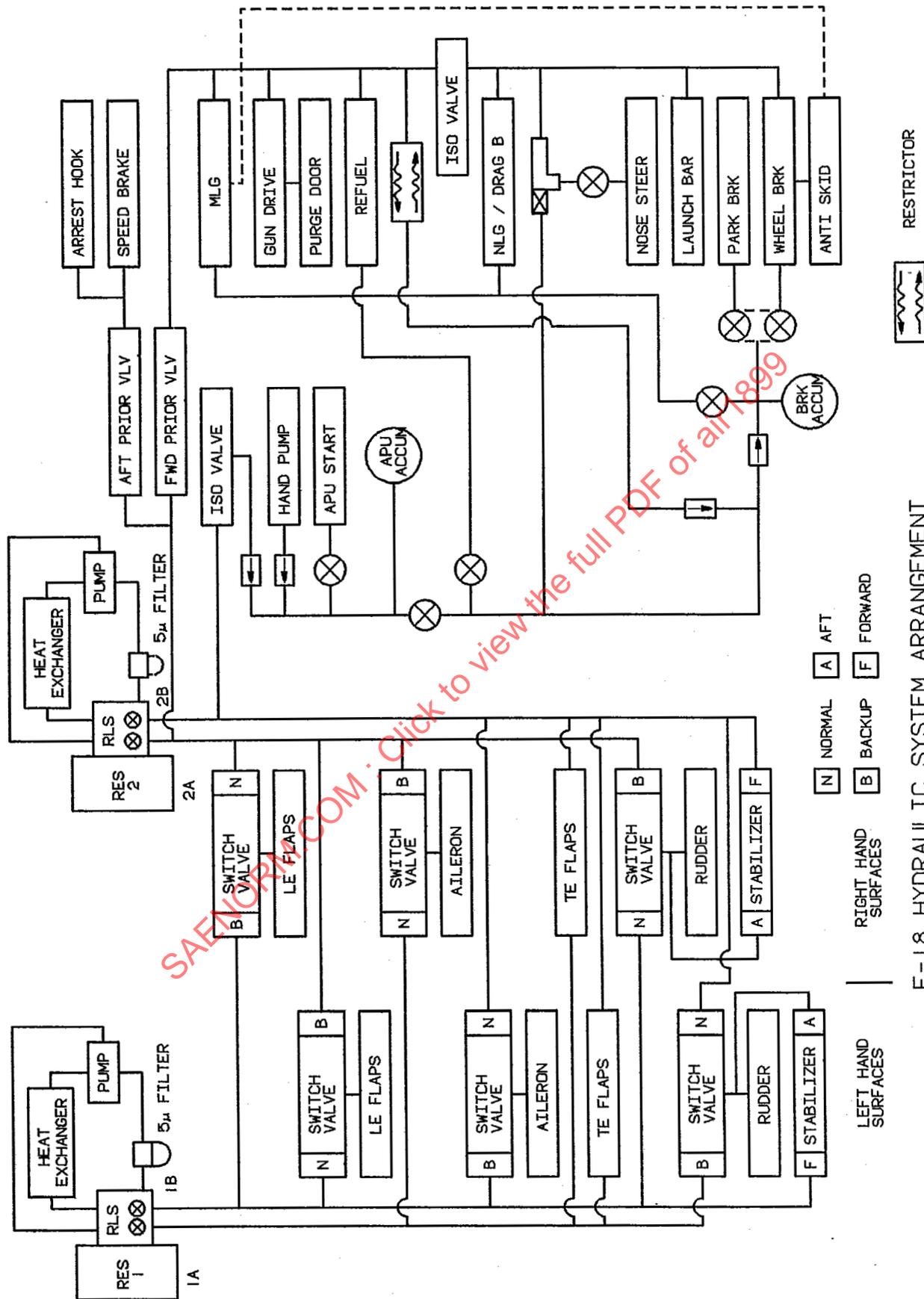
AIRCRAFT F-16 HYDRAULIC SYSTEM ARRANGEMENT

**GENERAL DYNAMICS F-16**



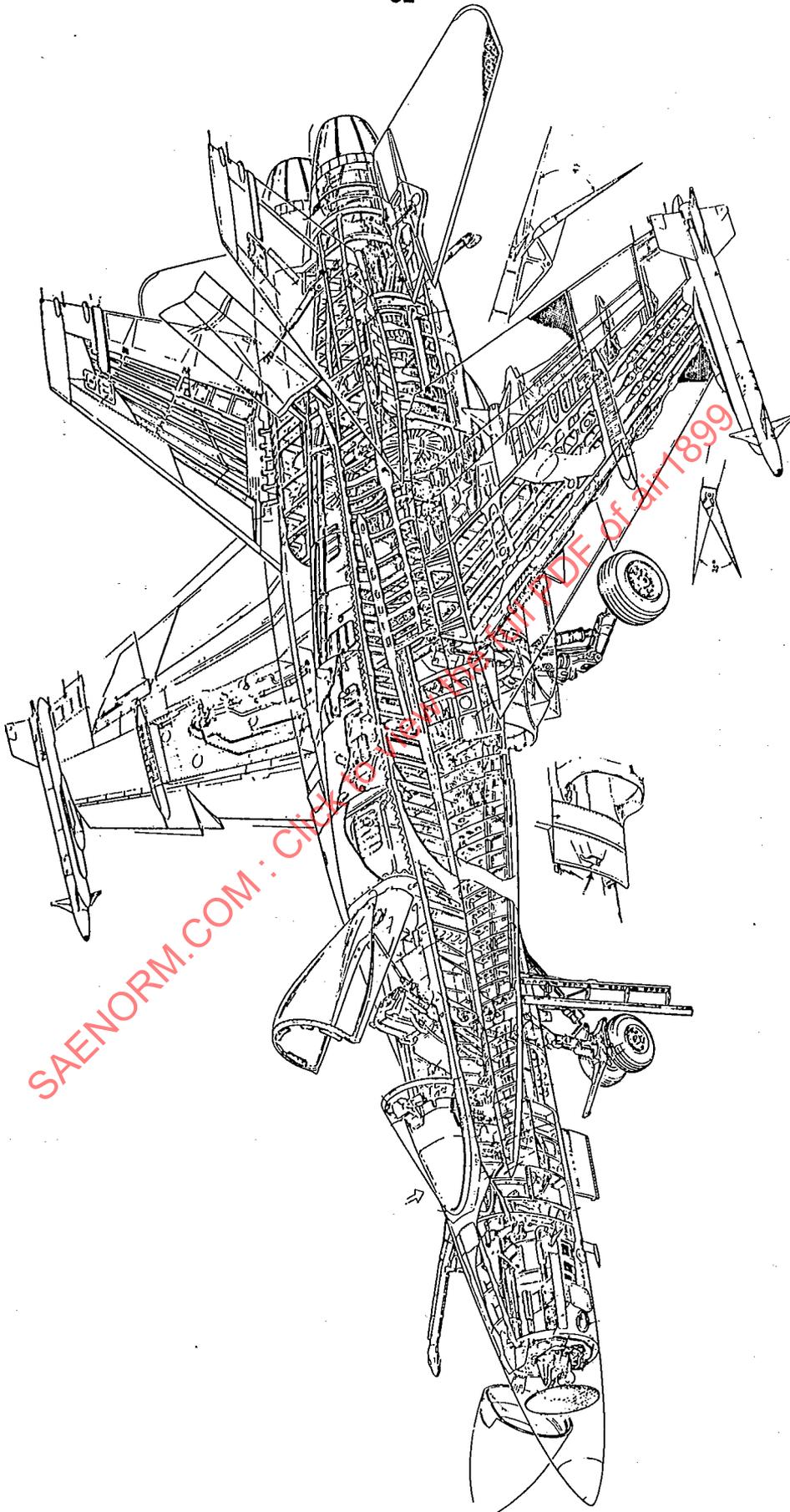
## AIRCRAFT - F-18

1. DESIGN SPECIFICATION	MIL-H-5440 F					
2. SYSTEM PRESSURE	3000 PSIG					
3. HYDRAULIC FLUID	MIL-H-83282 A					
4. ACCUMULATOR DATA	VOLUME		PRECHARGE			
	AUXILIARY POWER UNIT (SELF DISPLACING)	290 CU.IN. GND 143 CU.IN. OIL (MAX)	1950 PSIG			
	EMERGENCY BRAKE	100 CU.IN. GND 50 CU.IN. OIL	1500 PSIG			
6. RESERVOIR DATA	SYSTEM 1		SYSTEM 2			
	TOTAL CAPACITY NORMAL SERVICE TYPE PRESSURE	450 CU.IN. 364 CU.IN. BOOTSTRAP * 85 PSI	766 CU.IN. 547 CU.IN. BOOTSTRAP * 85 PSI * WITH RESERVOIR LEVEL SENSING			
6. SYSTEM QUIESCENT FLOW	SYSTEM 1		SYSTEM 2			
	3.1 GPM		3.5 GPM			
7. HYDRAULIC PUMP DATA	SYSTEM 1		SYSTEM 2			
	TYPE PRESSURE RATED FLOW RATED SPEED DISPLACEMENT ROTATION FROM SHAFT END PUMP/ENGINE PAD RATIO WINDMILL GROUND IDLE FLIGHT IDLE 85% CRUISE 100%	VARIABLE DELIVERY, AXIAL PISTON 3000 PSIG 56 GPM 4600 RPM 3.0 CIR CCW 0.2736 690 RPM 2875 RPM 3220 RPM 3910 RPM 4048 RPM 4600 RPM		3000 PSIG 56 GPM 4600 RPM 3.0 CIR CCW 0.2736 690 RPM 2875 RPM 3220 RPM 3910 RPM 4048 RPM 4600 RPM		
8. AUXILIARY PUMP DATA						
9. TUBING DATA	DIA (IN.)	W.T. (TI)	W.T. (STL)	MATERIAL	USAGE	
	0.250	0.016		3AL-2.5V TI  (PERMASWAGE)	PRESS & RETURN	
	0.250	0.028			COILED TUBE	
	0.375	0.019			PRESS & RETURN	
	0.375	0.042			COILED TUBE	
	0.500	0.026			PRESS & RETURN	
	0.500	0.056			COILED TUBE	
	0.625	0.032			PRESS & RETURN	
	0.750	0.039			PRESS & RETURN	
	1.000	0.028			RETURN ONLY	
1.000	0.051		PRESS & RETURN			
10. FITTING DATA	SIZE RANGE	TYPE		MATERIAL	CONNECTIONS	
	0.25-1.25	PERMANENT (PERMASWAGED) & DETACHABLE (PERMASWAGE LIP SEAL AND DYNATUBE)		6AL-4V TI 21-6-9 CRES	METAL TO METAL (LIP SEAL)	
11. TEMPERATURE RANGE	-40F TO +275F					
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)	MS83461/1 : O-RINGS ROD SEAL : TWO STAGE MS83461/1 O-RING ON TEFLON AND O-RING WITH 2 BACKUP RINGS PISTON SEAL : MS83461/1 O-RING ON TEFLON VALVE SLEEVE SEAL : T SECTION & 2 BACKUP RINGS					
13. FILTRATION	TYPE : CENTRAL MANIFOLD FOR PRESSURE AND RETURN WITH COMMON ELEMENT PRESSURE - 5 MICRON ABS. (NON-BYPASSING) RETURN - 5 MICRON ABS. (WITH BYPASS RELIEF) CASE DRAIN - 5 MICRON ABS. (WITH BYPASS RELIEF)					
14. HYDRAULIC MOTOR DATA	MOTOR DISPLACEMENT (CIR)	SPEED (RPM)	PRESSURE (PSI)	FLOW (GPM)	TORQUE	
	GUN DRIVE	0.95	6600	2200	29.0	355
	APU START LEADING EDGE FLAP	0.365	14000	3000	22.0	174
		0.620	6975	3000	19.0	302
15. HAND PUMP DATA	0.5 CU.IN./ CYCLE TO 3000 PSI					
16. RELIEF VALVE SETTING	SYSTEM 1 & SYSTEM 2 : HIGH PRESSURE CRACKING PRESSURE : 3600 PSIG, MAX. FULL FLOW PRESSURE : 3600 PSIG, MAX. AT 56 GPM RESEAT PRESSURE : 3250 PSIG, MIN.					



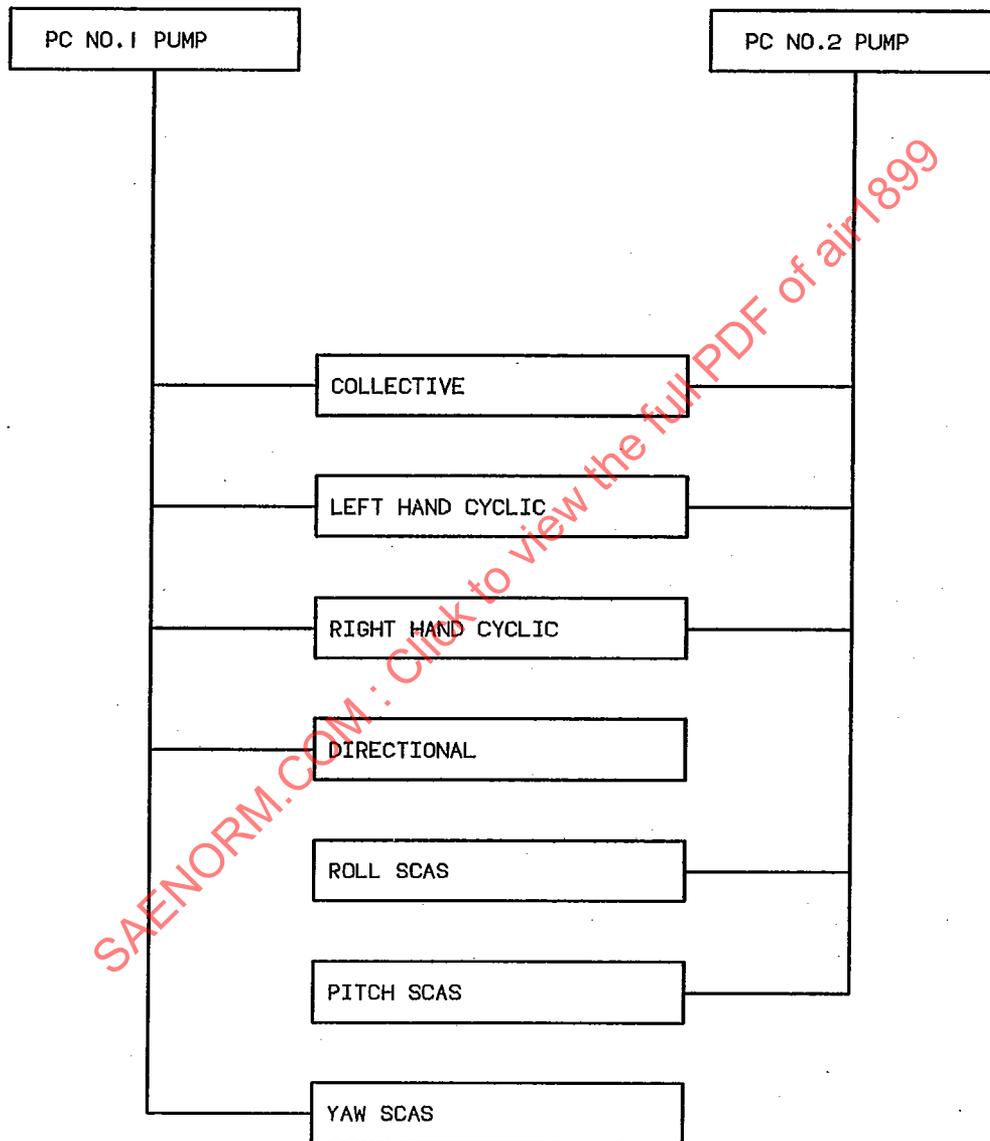
F-18 HYDRAULIC SYSTEM ARRANGEMENT

**MCDONNELL-DOUGLAS F-18**



### HELLICOPTER - 214A

1. DESIGN SPECIFICATION		MIL-H-5440			
2. SYSTEM PRESSURE		3000. PSIG			
3. HYDRAULIC FLUID		MIL-H-5606			
4. ACCUMULATOR DATA					
5. RESERVOIR DATA		PC SYSTEM NO.1		PC SYSTEM NO.2	
TYPE AND PRESS. FULL SYSTEM VOLUME RESERVOIR VOLUME - FULL		BOOTSTRAP 75 PSIG. 276.06 CU.IN. 57.50 CU.IN.		BOOTSTRAP 75 PSIG. 278.55 CU.IN. 57.50 CU.IN.	
6. SYSTEM QUIESCENT FLOW		PC NO.1 0.196 GPM		PC NO.2 0.313 GPM	
7. HYDRAULIC PUMP DATA		PC NO.1		PC NO.2	
TYPE PRESSURE RATED FLOW DISPLACEMENT RATED SPEED ROTATION FROM SHAFT END MAIN ROTOR TO PAD RATIO		VARIABLE DELIVERY PRESSURE COMPENSATED 3000 PSIG. 6.5 GPM. 0.31 CU.IN./REV. 5250 RPM CCW 1:17.58		VARIABLE DELIVERY PRESSURE COMPENSATED 3000 PSIG. 6.8 GPM. 0.31 CU.IN./REV. 5550 RPM CCW 1:18.52	
8. AUXILIARY PUMP DATA					
9. TUBING DATA	DIA(IN)	W.T.(STL)	W.T.(AL)	MATERIAL	USAGE
MS FLARELESS	0.250	0.020		6061-T6 AL	DRAIN
	0.250	0.020		CRES 304 1/8 HARD	PRESS. & RET.
	0.375	0.028	0.035	6061-T6 AL	RETURN
	0.375	0.028	0.035	CRES 304 1/8 HARD	PRESSURE
	0.500	0.035	0.035	6061-T6 AL	RETURN
	0.500	0.035	0.035	CRES 304 1/8 HARD	PRESSURE
	0.625	0.035	0.035	6061-T6 AL	PUMP SUCTION
10. FITTING DATA		MS FLARELESS			
11. TEMPERATURE RANGE		-65F TO +275F			
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)		MS28775 BUNA-N O-RING ROD SEAL : MS28775 O-RING ON TEFLON PISTON HEAD SEAL : MS28775 O-RING UNDER TEFLON			
13. FILTRATION		PRESSURE ELEMENT - 15 MICRON ABS (CLEANABLE) RETURN ELEMENT - 15 MICRON ABS (CLEANABLE)			
14. HYDRAULIC MOTOR DATA					
15. HAND PUMP DATA					
16. RELIEF VALVE SETTINGS		PC NO.1 & PC NO.2 : 3850 PSID MAX. AT 7.0 GPM 3250 PSID MIN. RESEAT			

214A HYDRAULIC SYSTEM BLOCK DIAGRAM

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SECTION 4.13

## AIRCRAFT - MRCA

1. DESIGN SPECIFICATION		MIL-H-5440 D											
2. SYSTEM PRESSURE		3940 PSIG											
3. HYDRAULIC FLUID		MIL-H-5606											
4. ACCUMULATOR DATA (AT 68F)		USAGE		VOLUME		PRE-CHARGE							
		SYSTEM MAIN ACCUMULATOR CANOPY ACCUMULATOR BRAKE ACCUMULATOR PITCH FEEL ACCUMULATOR		50 CU IN 100 CU IN 60 CU IN 7.3 CU IN		2000 PSI 1500 PSI 2000 PSI 800 PSI							
5. RESERVOIR DATA  TYPE AND PRESSURE FULL SYSTEM VOLUME RESERVOIR VOLUME TOTAL		BOOTSTRAP 4000PSI		BOOTSTRAP 120PSI									
		990 CU.IN.		990 CU.IN.									
6. SYSTEM QUIESCENT FLOW		3.17 GPM											
7. HYDRAULIC PUMP DATA  TYPE PRESSURE RATED FLOW DISPLACEMENT RATED SPEED TORQUE ROTATION FROM SHAFT END ENGINE/PUMP SPEED RATIO		ENGINE DRIVEN 3800 PSI FULL FLOW 46 GPM 1.95 CU IN/REV 6000 RPM 1240 IN-LB CCW 0.33											
		ELECTRIC MOTOR DRIVEN 4000 PSI 1.58GPM, 2000PSI 3.17GPM, 3800PSI 8700 RPM .088 CU IN/REV 26 VDC 200 AMPS											
8. AUXILIARY PUMP  TYPE PRESSURE FLOW SPEED DISPLACEMENT VOLTS AMPS		ELECTRIC MOTOR DRIVEN 4000 PSI 1.58GPM, 2000PSI 3.17GPM, 3800PSI 8700 RPM .088 CU IN/REV 26 VDC 200 AMPS											
		ELECTRIC MOTOR DRIVEN 4000 PSI 1.58GPM, 2000PSI 3.17GPM, 3800PSI 8700 RPM .088 CU IN/REV 26 VDC 200 AMPS											
9. TUBING DATA		DIAMETER (IN)		W.T. (STL)		W.T. (AL)		MATERIAL		USAGE			
		0.196 : 0.314 0.236 : 0.472 0.393 : 0.590 0.551 : 0.708 0.629 : 0.866 0.787 : 1.102						PRESSURE NIMONIC 75		PRESS : RETURN PRESS : RETURN PRESS : RETURN PRESS : RETURN PRESS : RETURN PRESS : RETURN			
10. FITTING DATA  REPAIR:		SIZE RANGE		TYPE		MATERIAL		CONNECTION					
		.196-1.102 IN		DETACHABLE		B.S. S96, L85		60 CONE, SWAGED PANAVTA STND					
11. TEMPERATURE RANGE (DES)		-65F TO 275F											
12. SEAL MATERIAL TYPE (FLIGHT ACTUATORS)		MS 28775 BUNA-N O-RINGS MS 28778 BUNA-N O-RINGS DYNA-SEALS, VARIOUS SPECIAL SEALS											
13. FILTRATION  MAIN RETURN		15 MICRON ABS 5 MICRON ABS											
		15 MICRON ABS 5 MICRON ABS											
14. HYDRAULIC MOTOR DATA		SYSTEM		DISPLACEMENT		SPEED (RPM)		PRESSURE		FLOW (GPM)		TORQUE (IN-LB)	
		WING FLAP SLAT		1.049CUIN/REV .200 CUIN/REV .087 CUIN/REV		4950 10200 14500		4000 PSI 4000 PSI 4000 PSI		25.5 8.8 5.5		470 97 36	
15. HAND PUMP DATA		PRESSURE 4000 PSI DISPLACEMENT .415 CU.IN. PER DOUBLE STROKE											
16. RELIEF VALVE SETTINGS													

HYDRAULIC SYSTEM  
TORNADO MRCA

