APOLLO TRAINING

ENVIRONMENTAL CONTROL SYSTEM

BLOCK II

APRIL 1, 1969

FOR TRAINING PURPOSES ONLY

APOLLO LOGISTICS TRAINING

QUESTIONS RELATIVE TO THE CONTENTS OF THIS DOCUMENT

SHOULD BE DIRECTED TO:

W. D. BENEFIELD
P. E. OLSON
NR, SD
DOWNEY, CALIF.
Extension 4325, 6 or 7

CONTENTS

CONTENTS

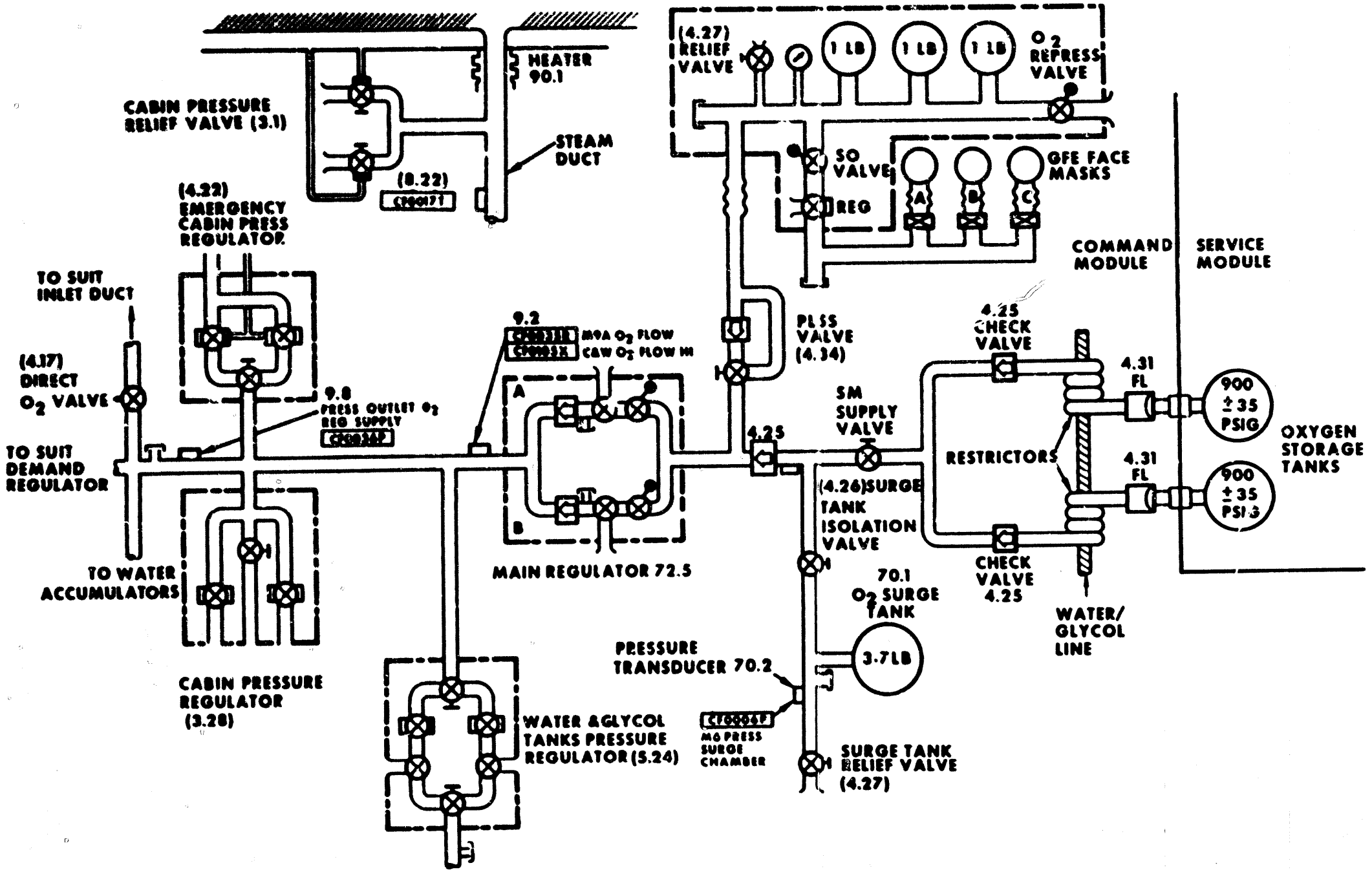
CONTENTS

CONTENTS

CONTENTS

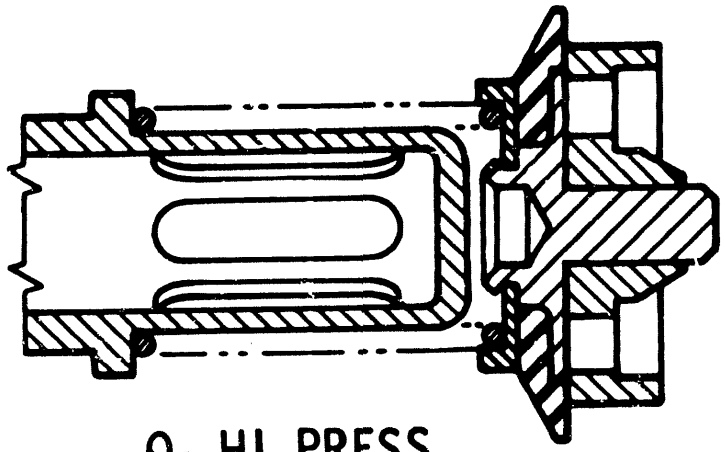
OXYGEN SUBSYSTEM

BLOCK II

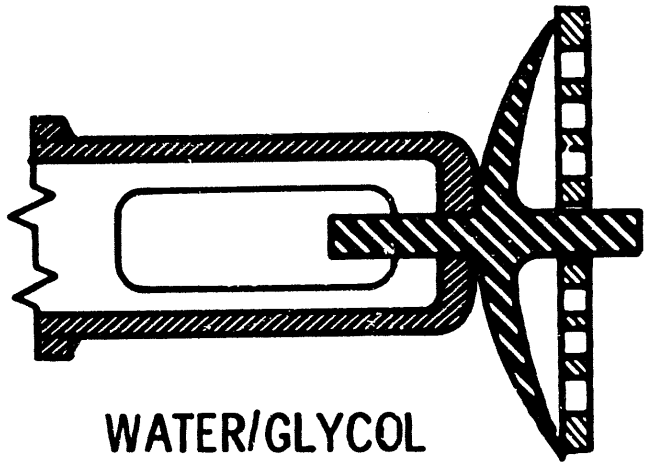


ECS-501H

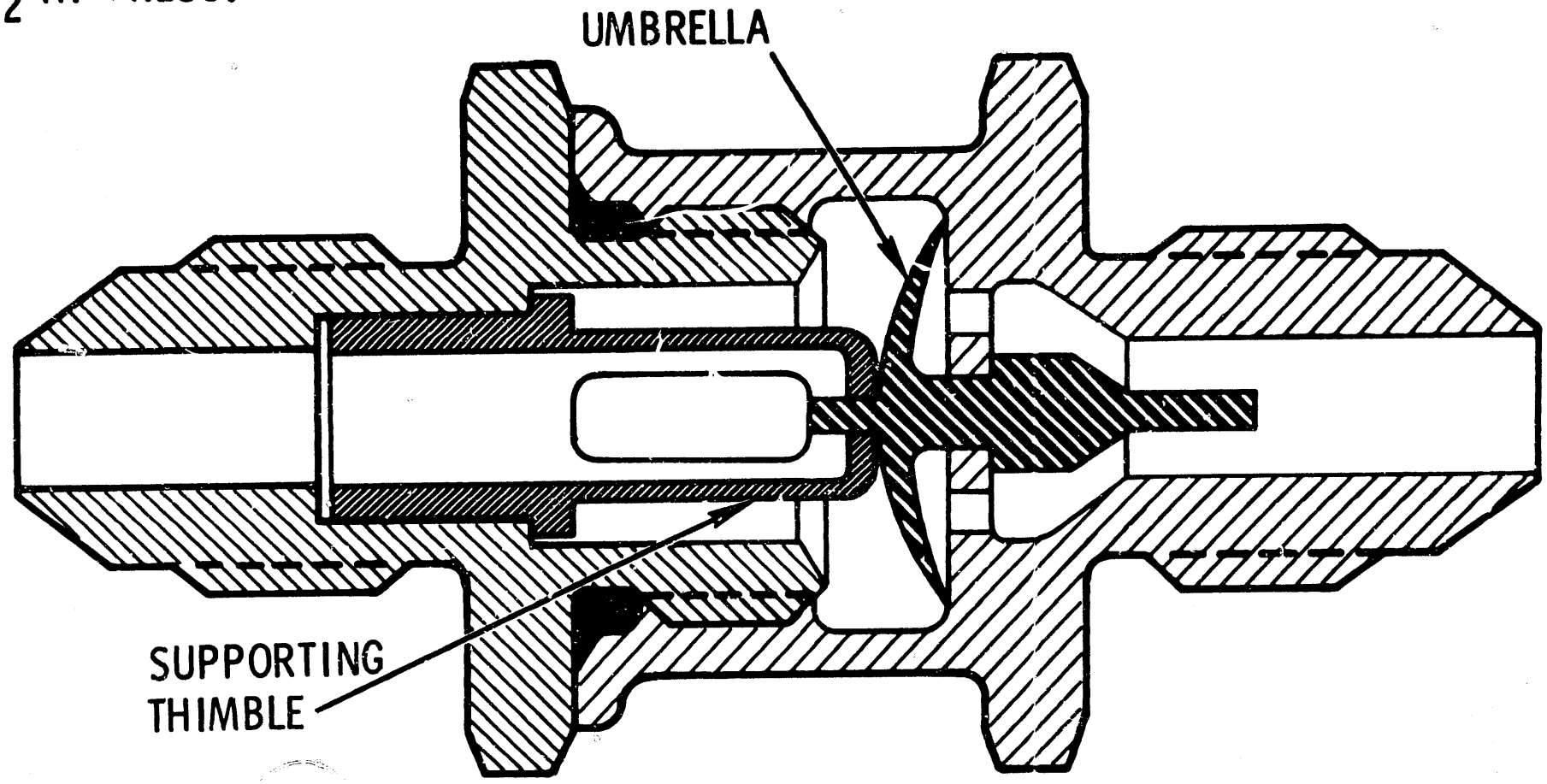
TYPICAL SYSTEM CHECK VALVES



O_2 HI PRESS.

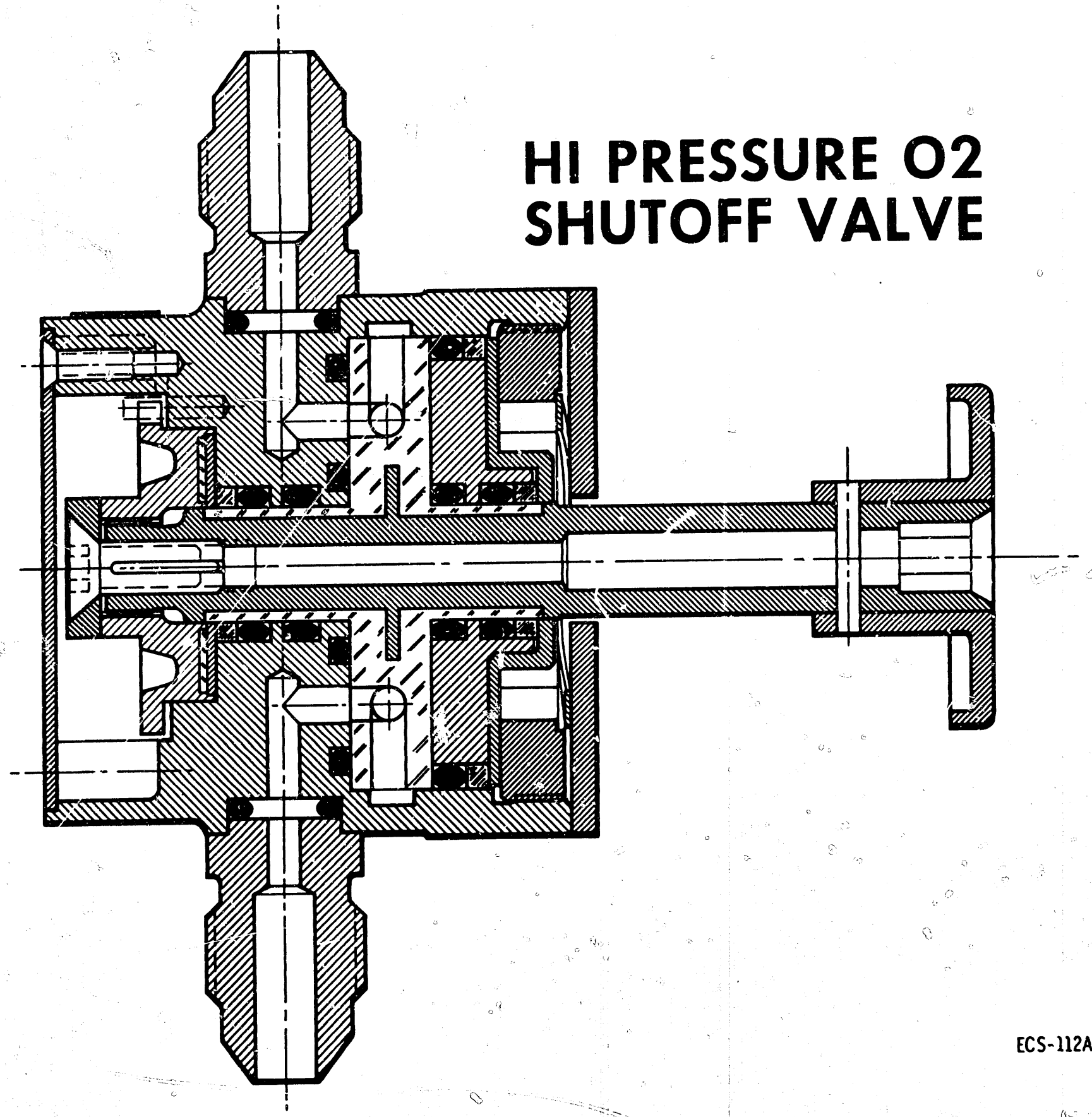


WATER/GLYCOL



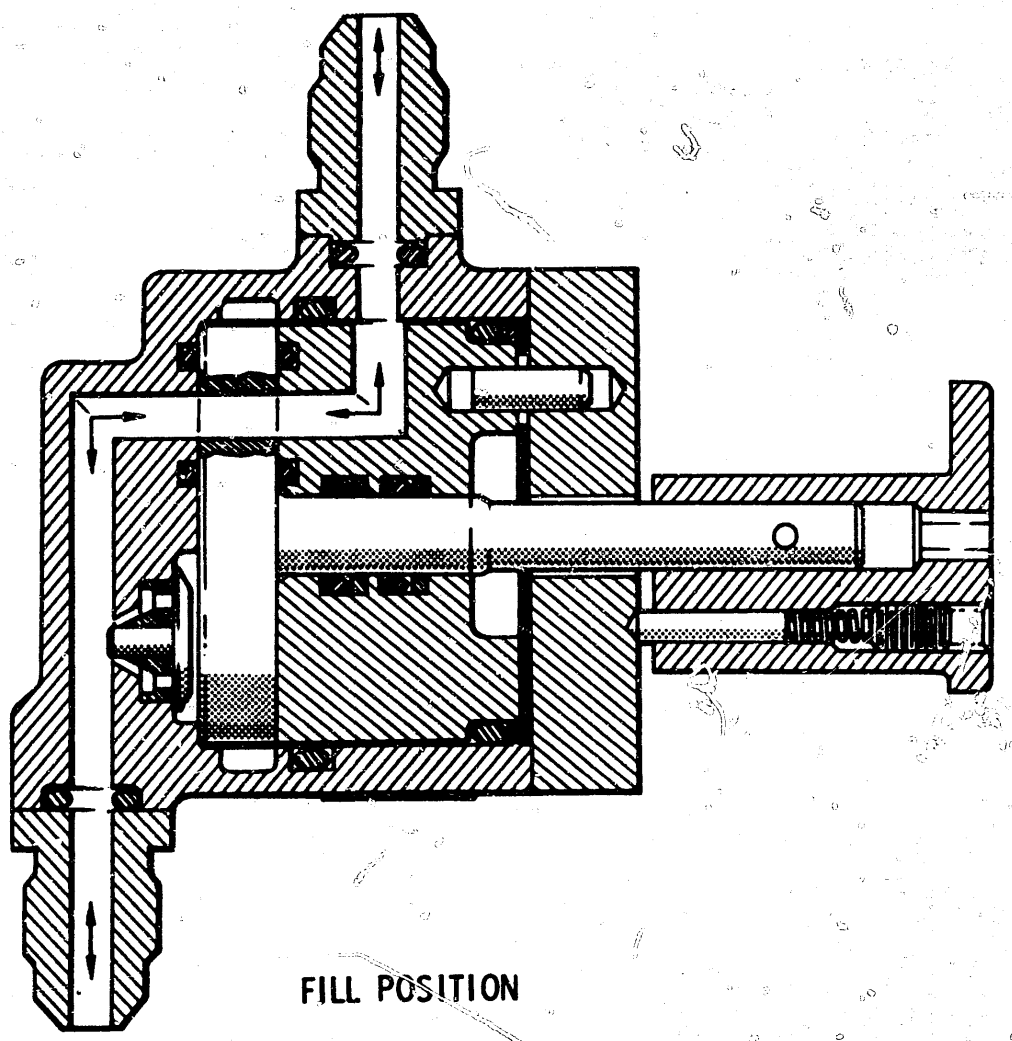
H_2O

HI PRESSURE O2 SHUTOFF VALVE

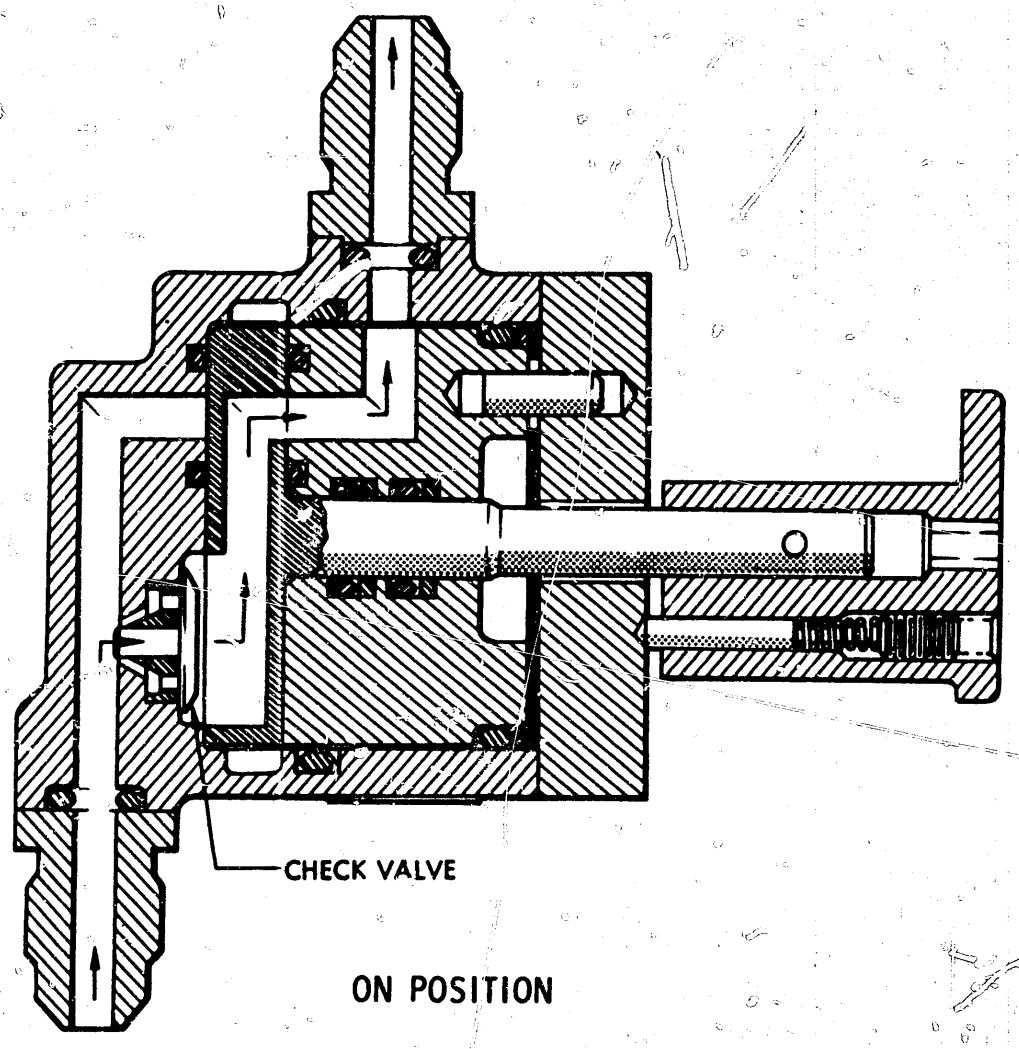


ECS-112A

PLSS VALVE

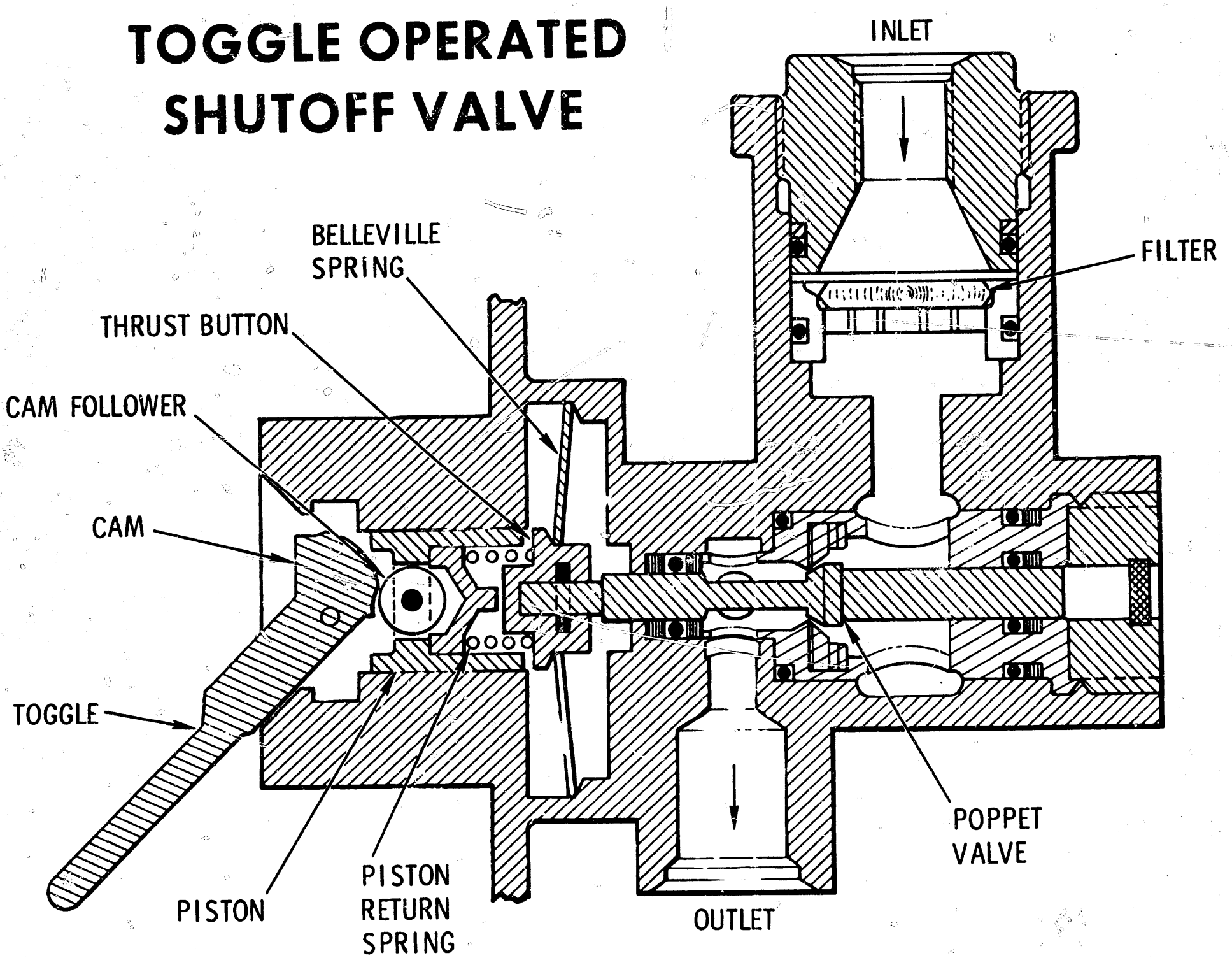


FILL POSITION

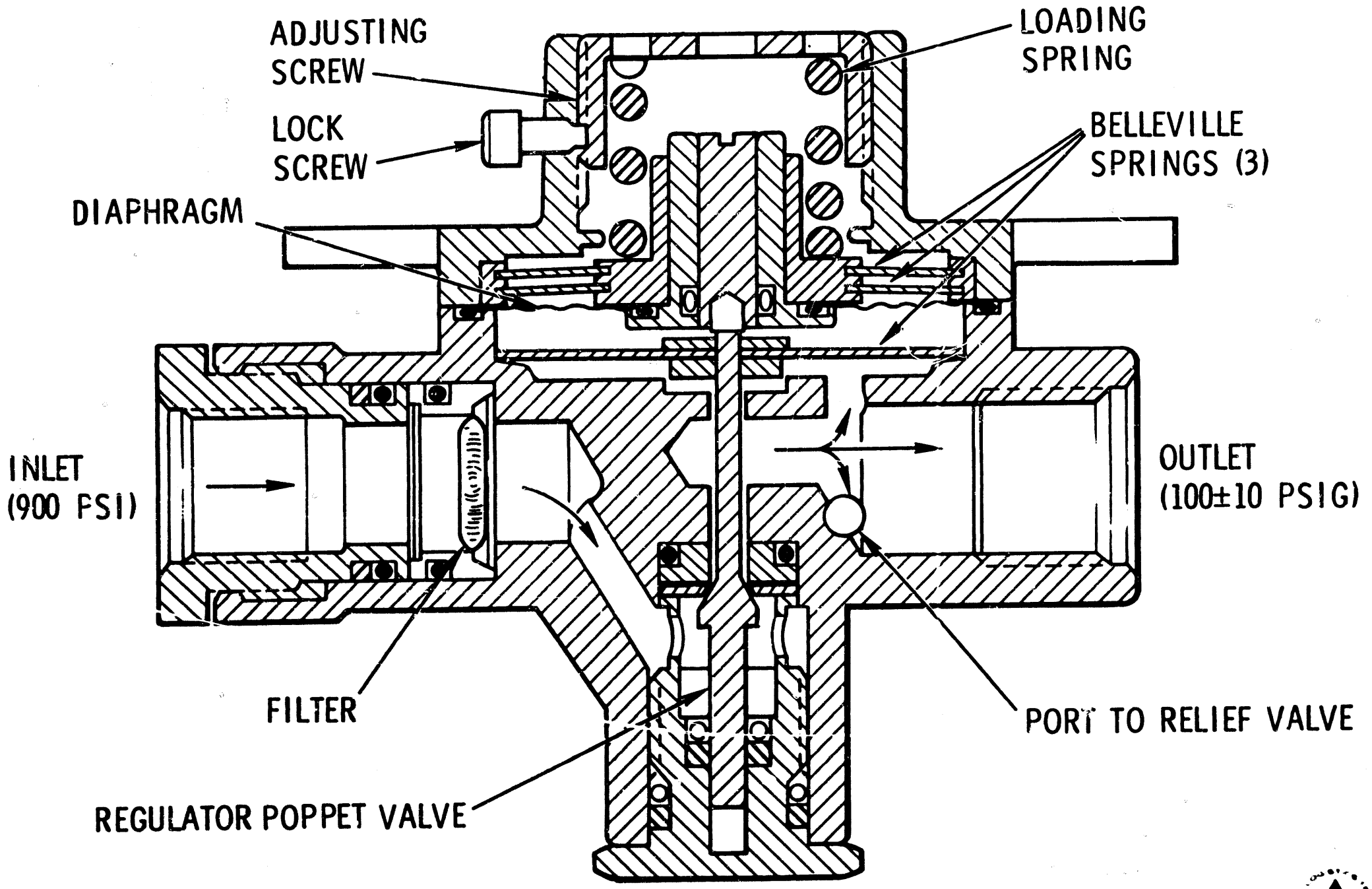


ON POSITION

TOGGLE OPERATED SHUTOFF VALVE

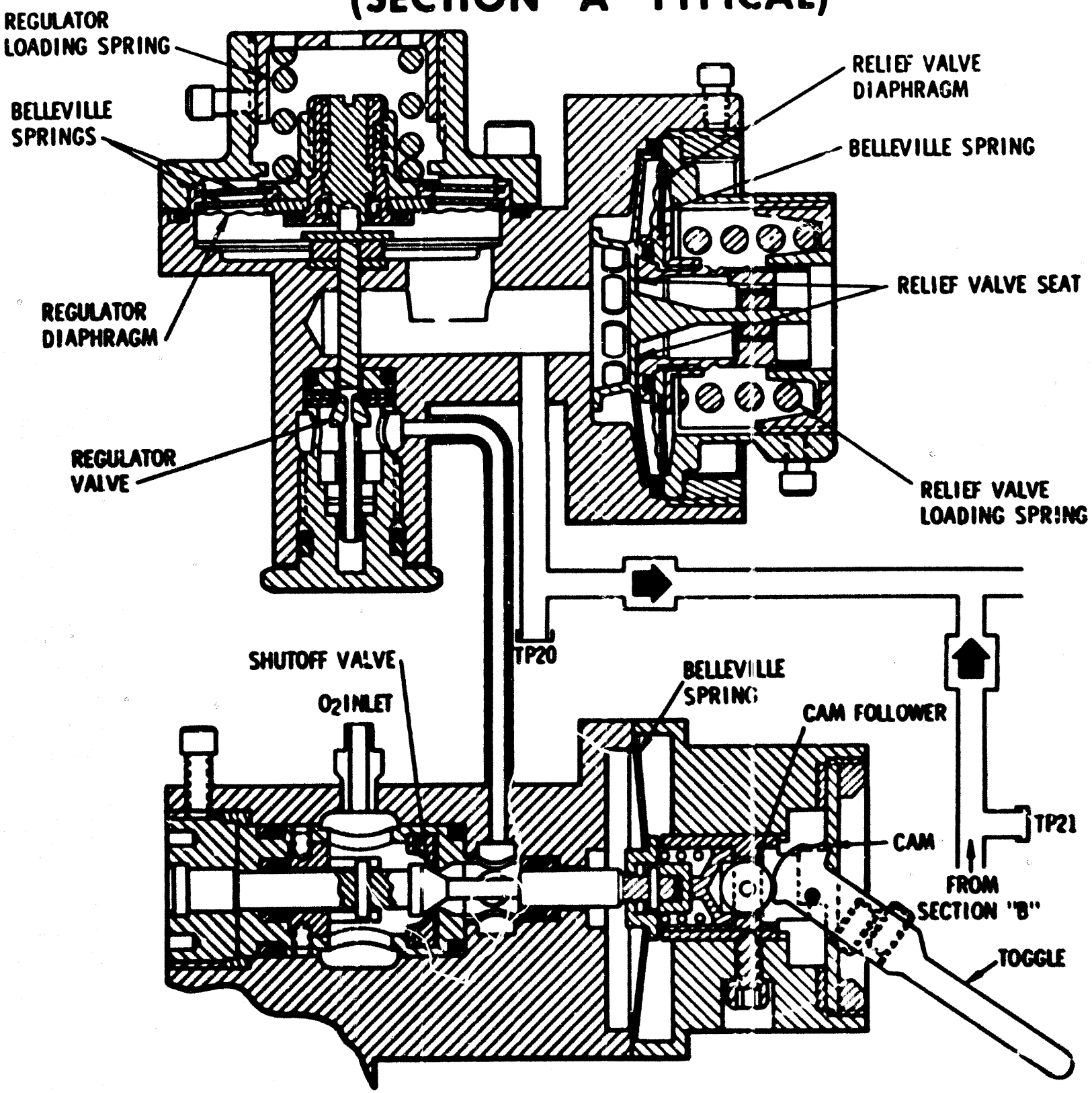


EMERGENCY BREATHING OXYGEN REGULATOR

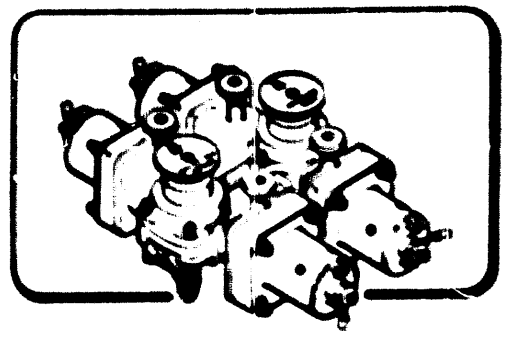


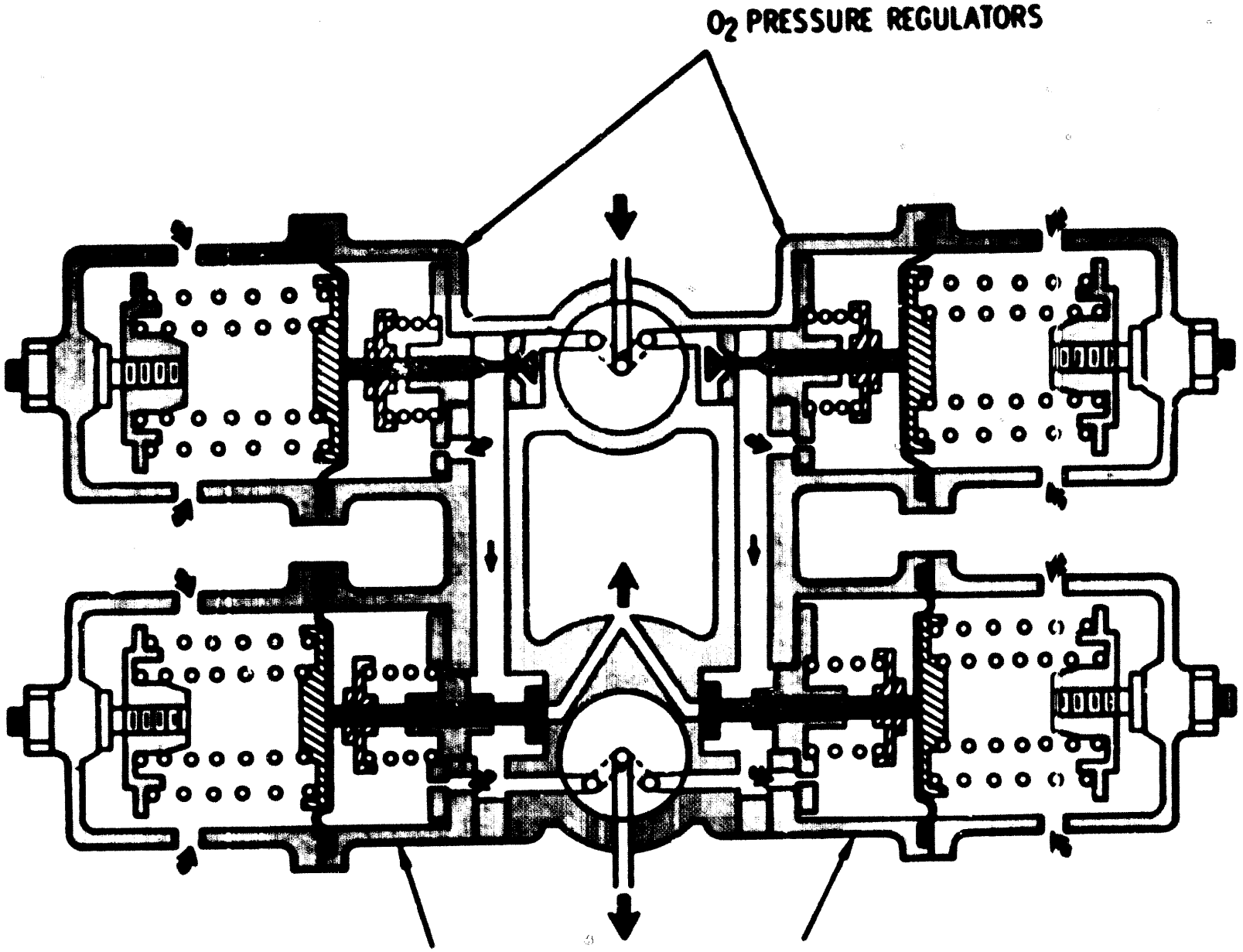
ECS-432

O_2 MAIN REGULATOR
(SECTION "A" TYPICAL)

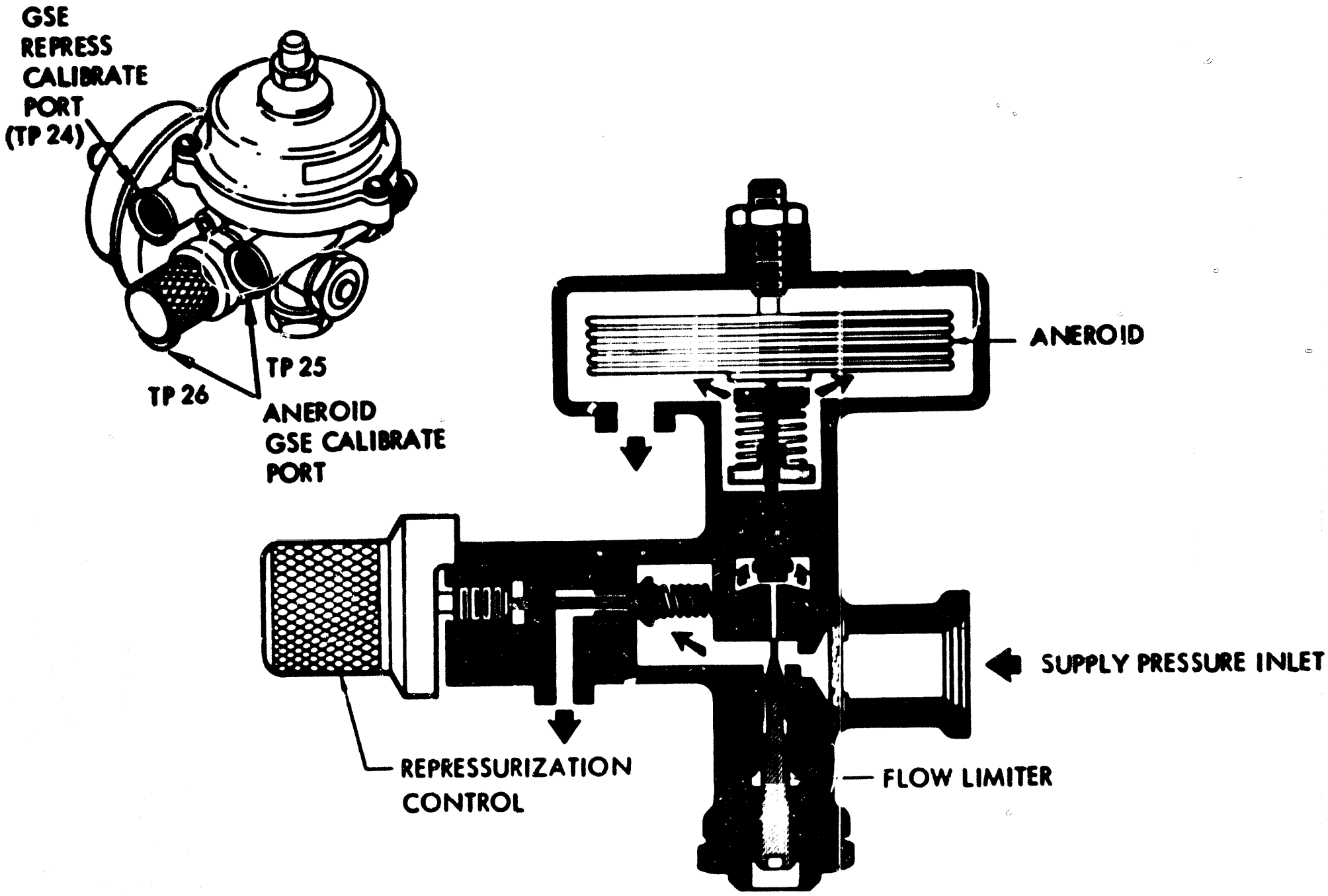


WATER & GLYCOL TANKS PRESSURE REGULATOR



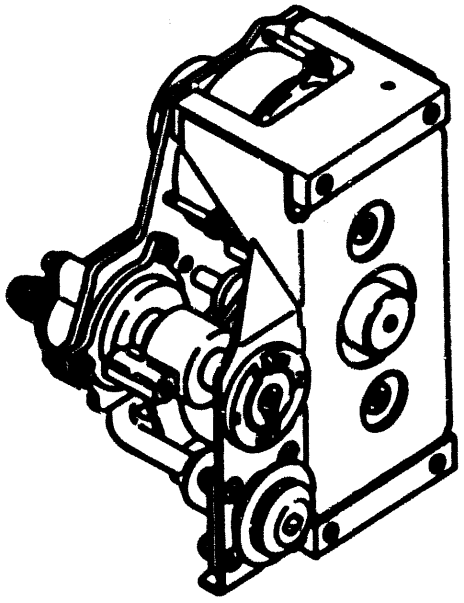


CABIN PRESSURE REGULATOR



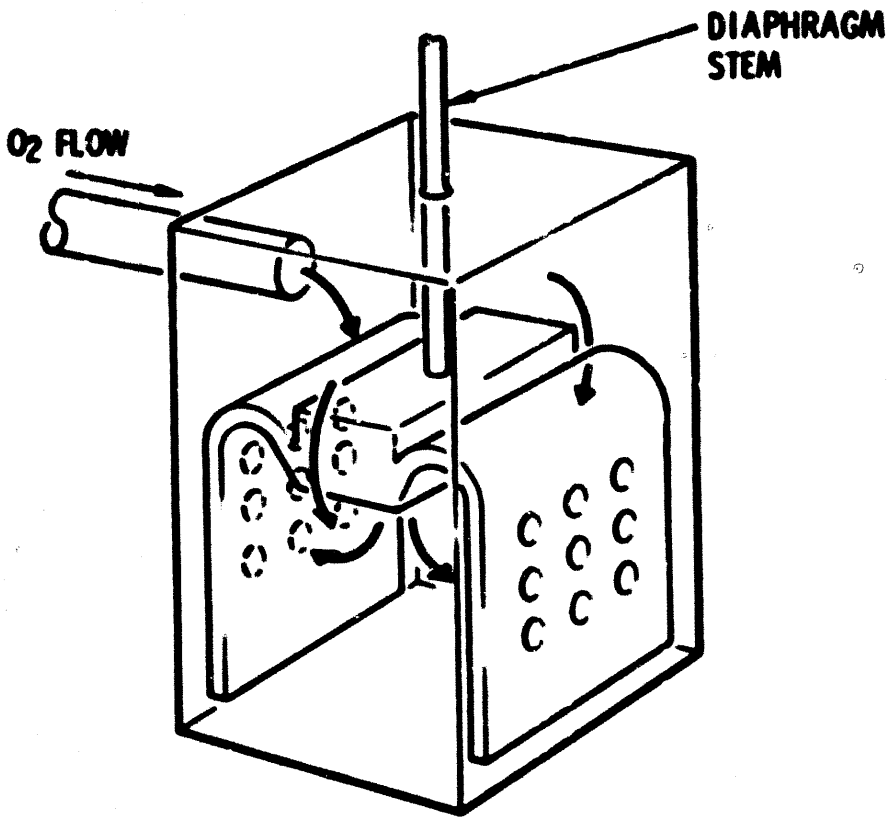
ECS-422B

EMERGENCY CABIN PRESSURE REGULATOR

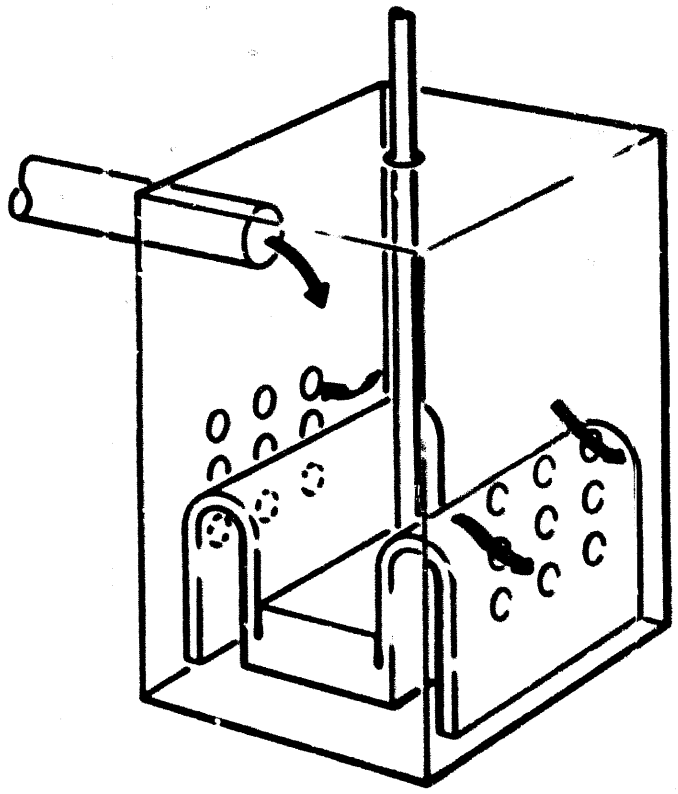


ECS-412C

"PEEL VALVE" SCHEMATIC



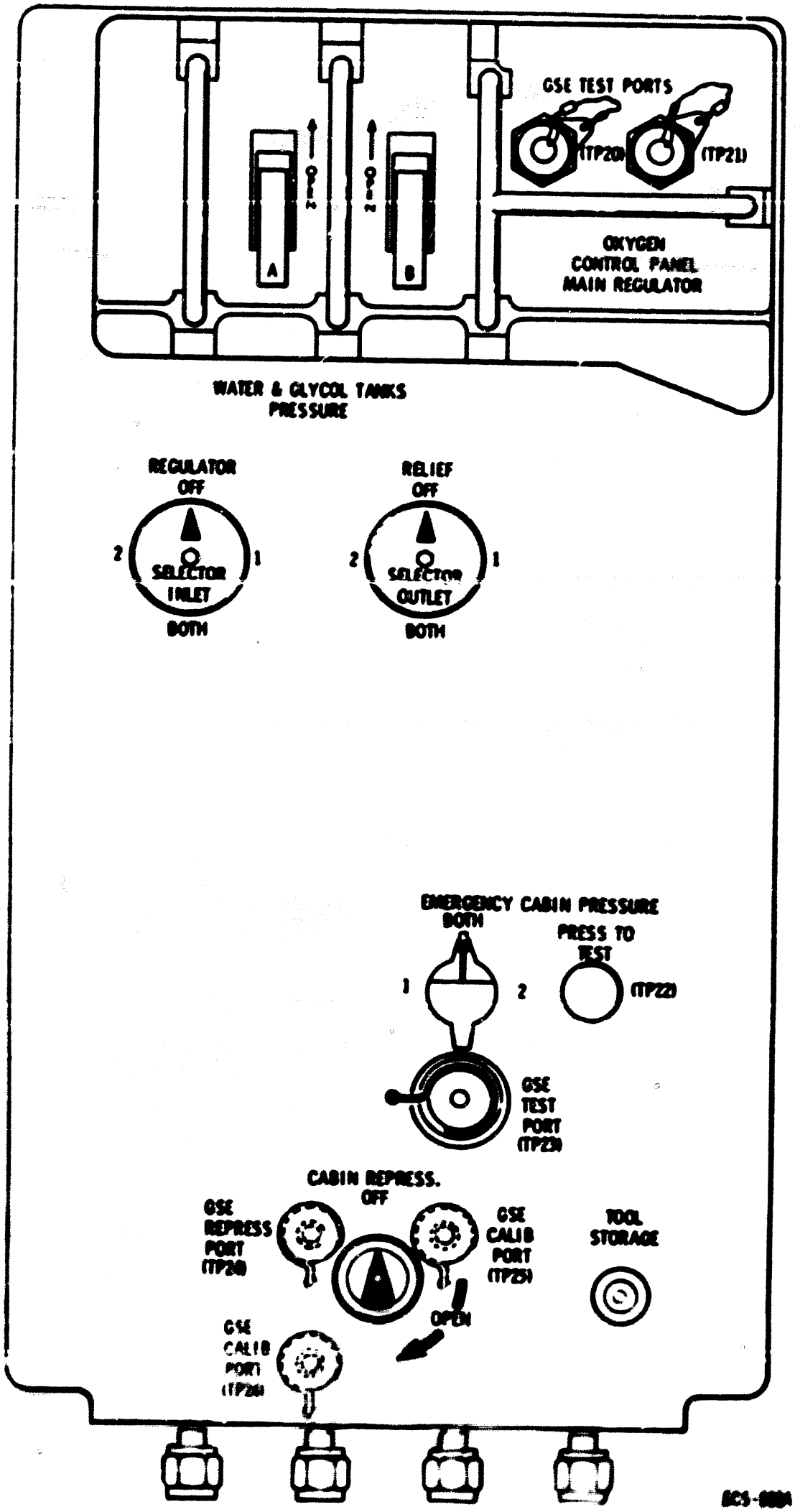
CLOSED



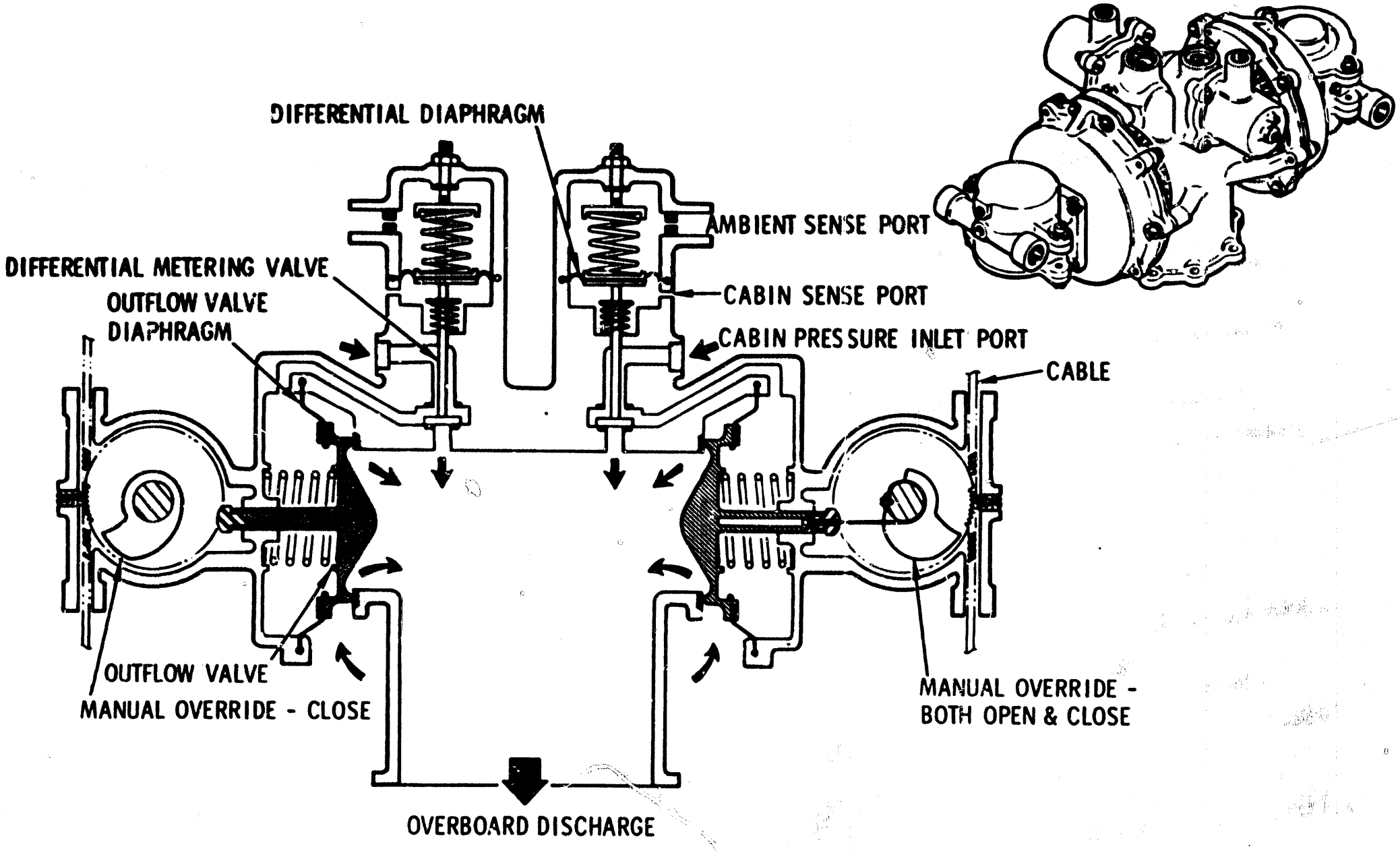
OPEN

OXYGEN CONTROL PANEL

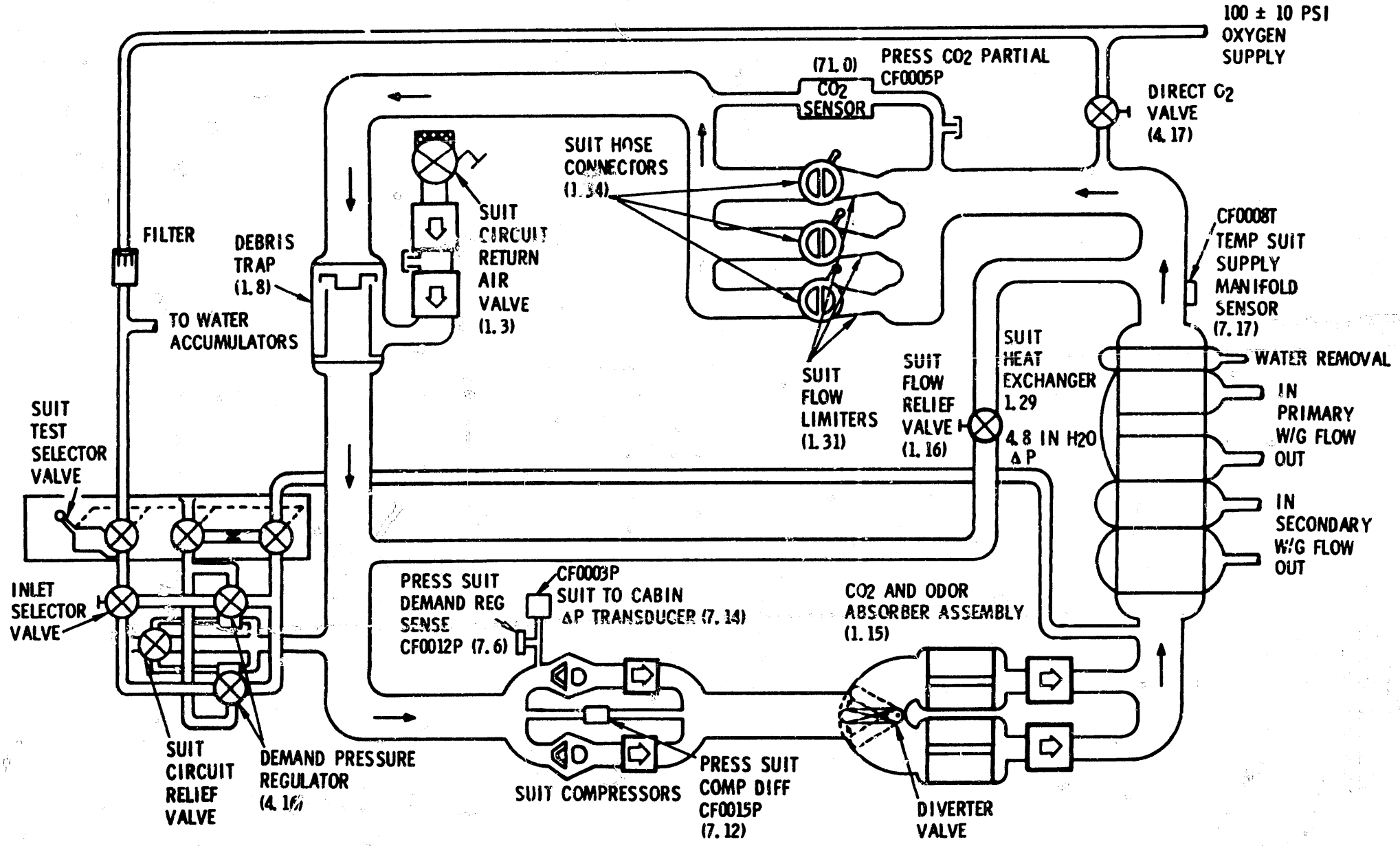
(S/C 102 & SUBS)



CABIN PRESSURE RELIEF VALVE

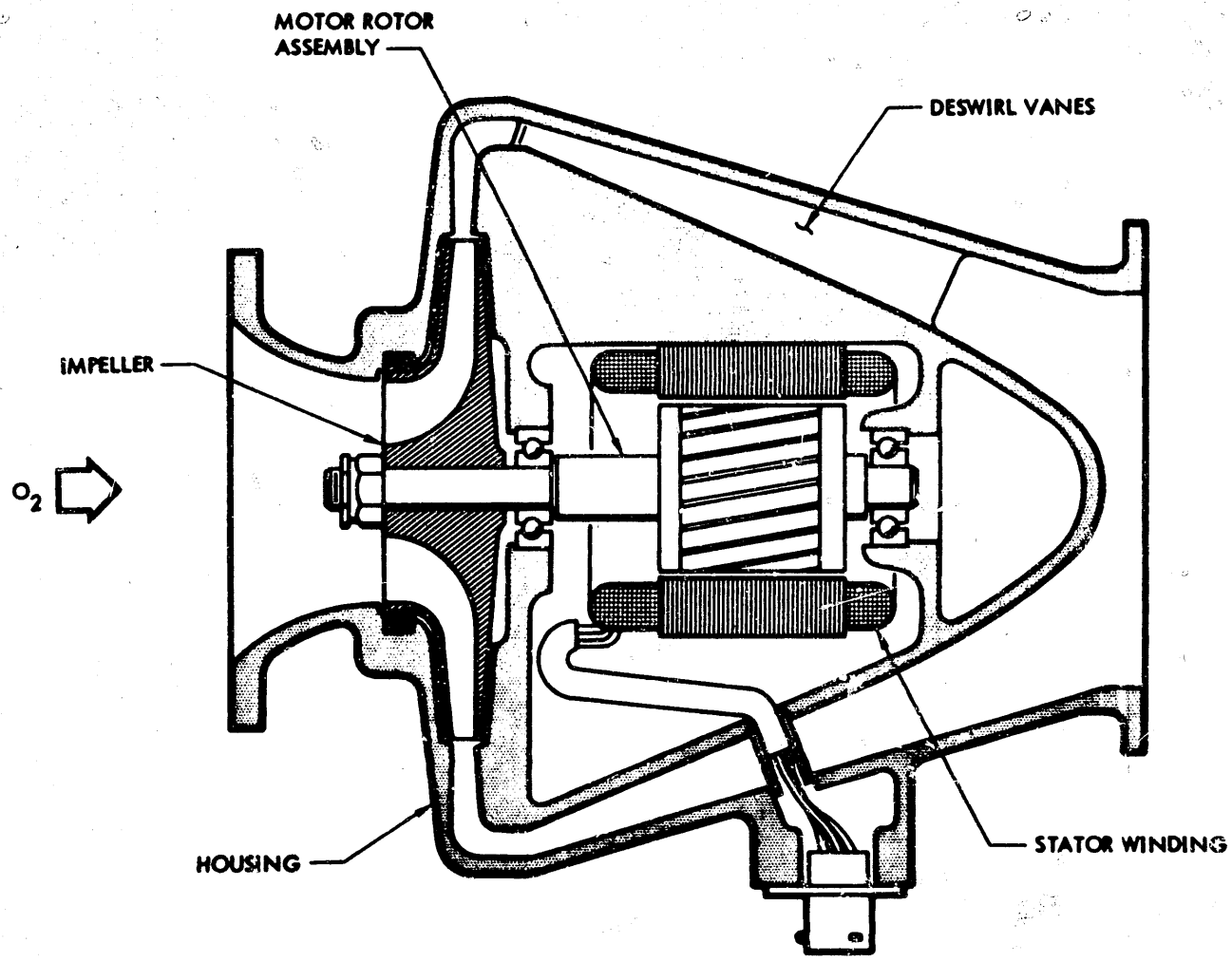


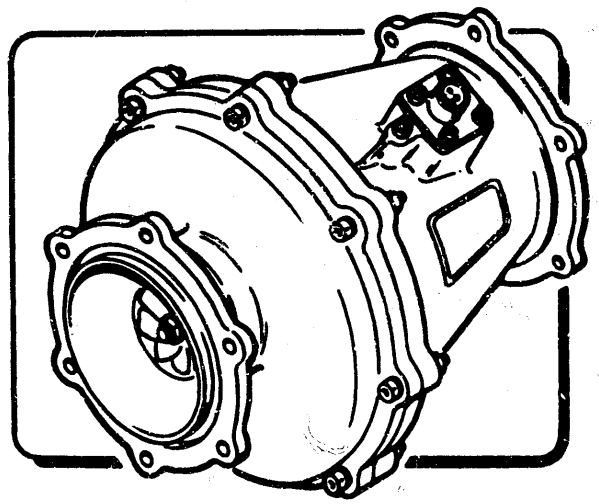
SUIT CIRCUIT
BLOCK II



ECS-502G

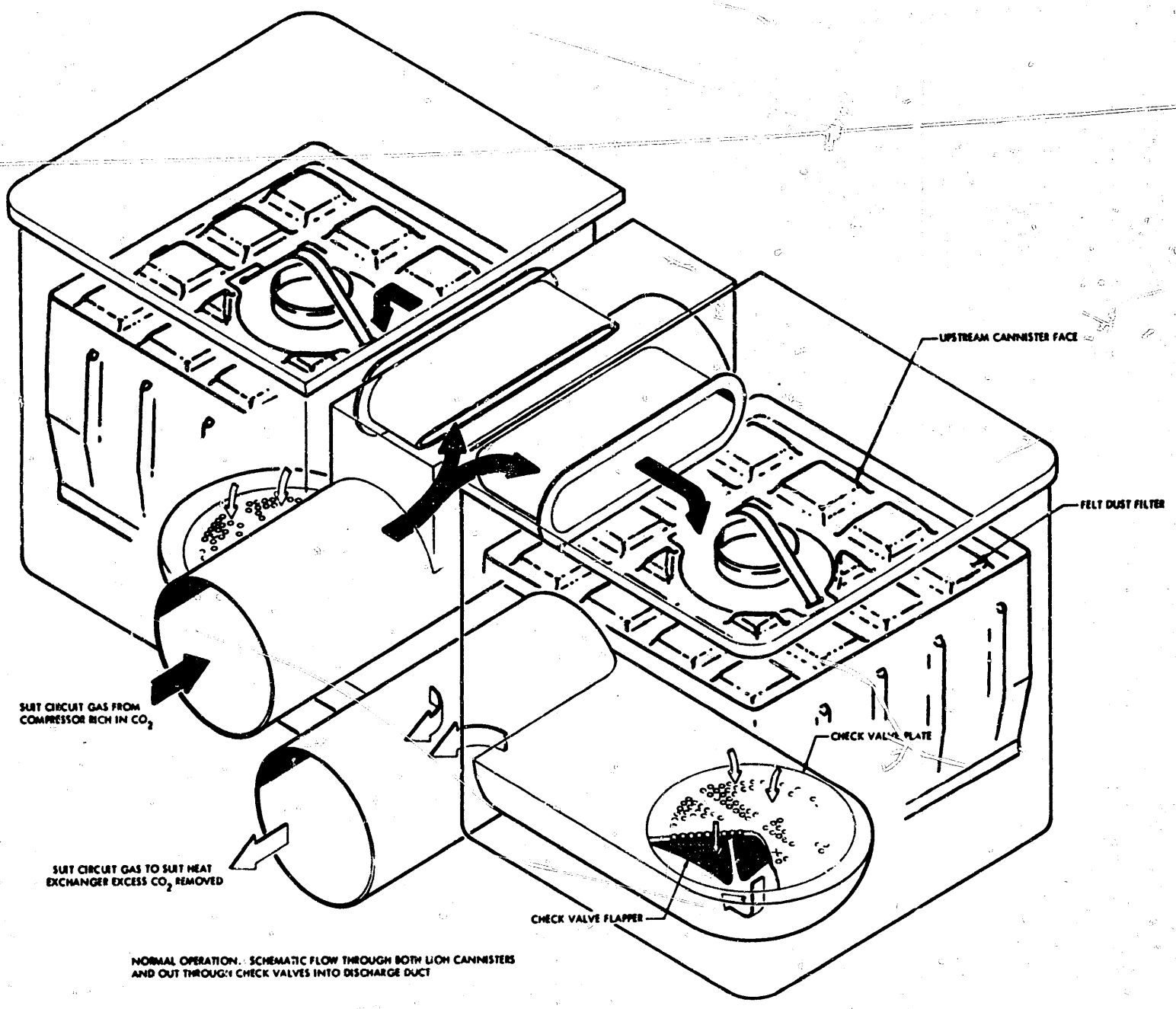
SUIT COMPRESSOR





CO_2 AND ODOR ABSORBER

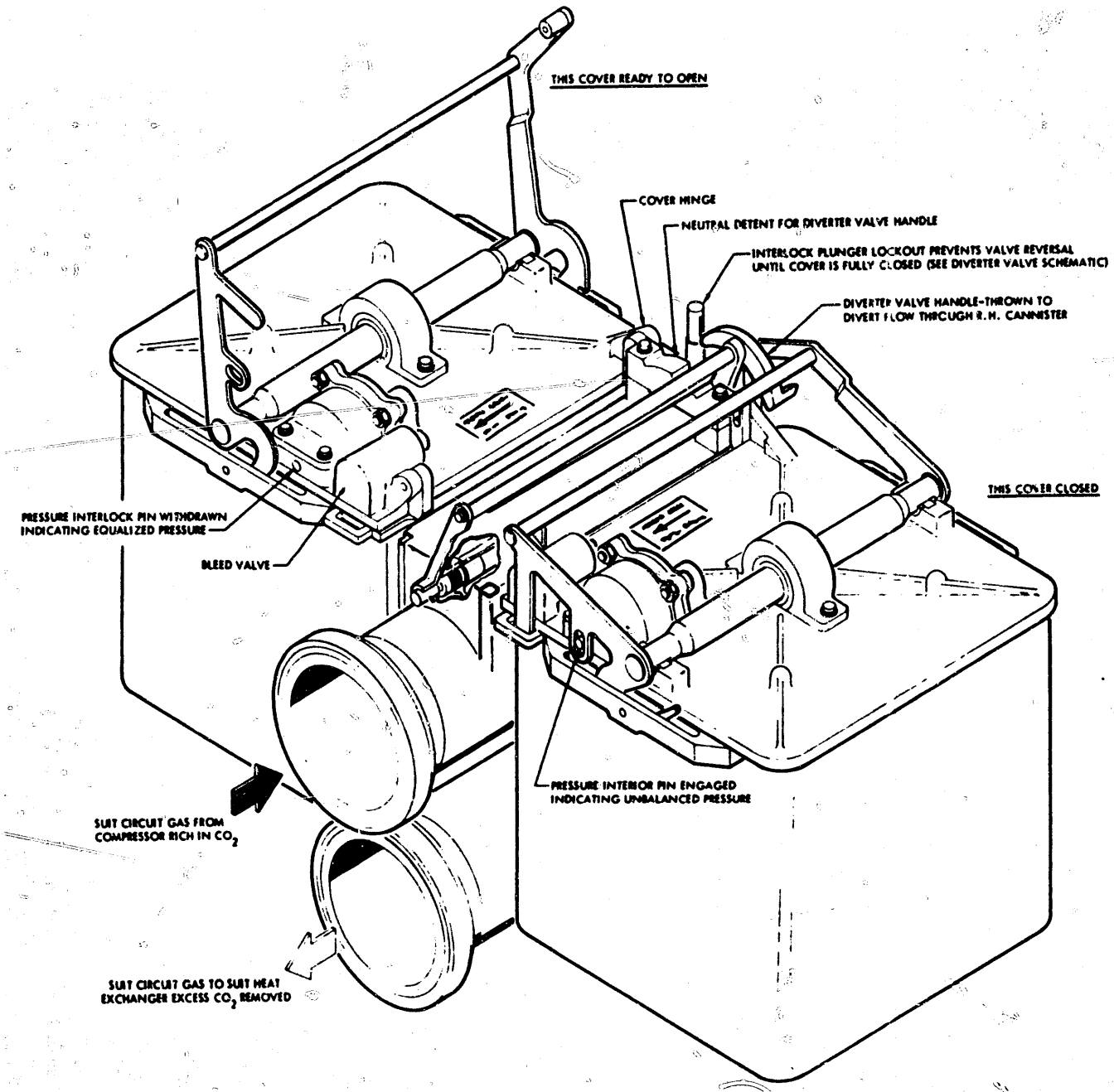
FLOW SCHEMATIC



NORMAL OPERATION. SCHEMATIC FLOW THROUGH BOTH LiOH CANNISTERS AND OUT THROUGH CHECK VALVES INTO DISCHARGE DUCT

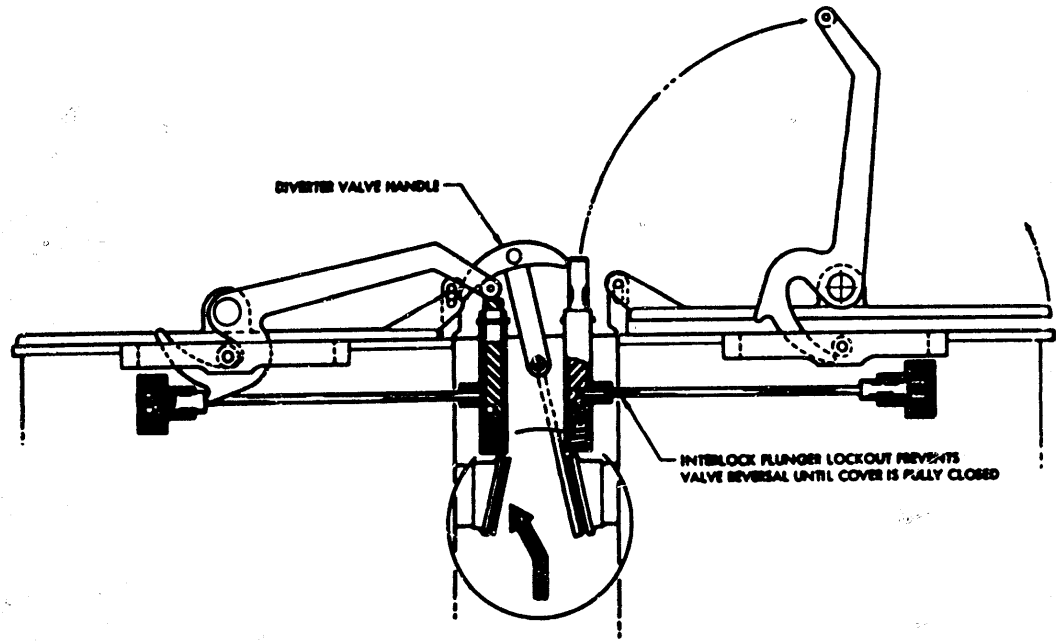
CO_2 AND ODOR ABSORBER

OPERATIONAL SCHEMATIC

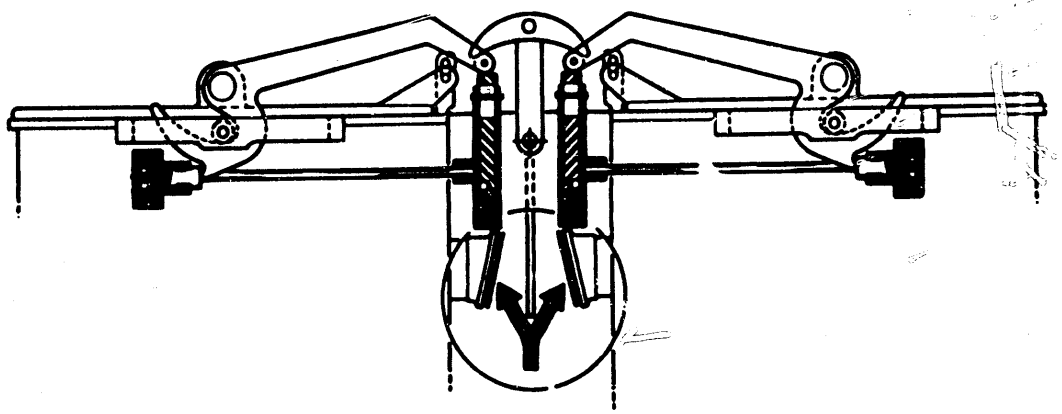


CO_2 AND ODOR ABSORBER

DIVERTER VALVE SCHEMATIC

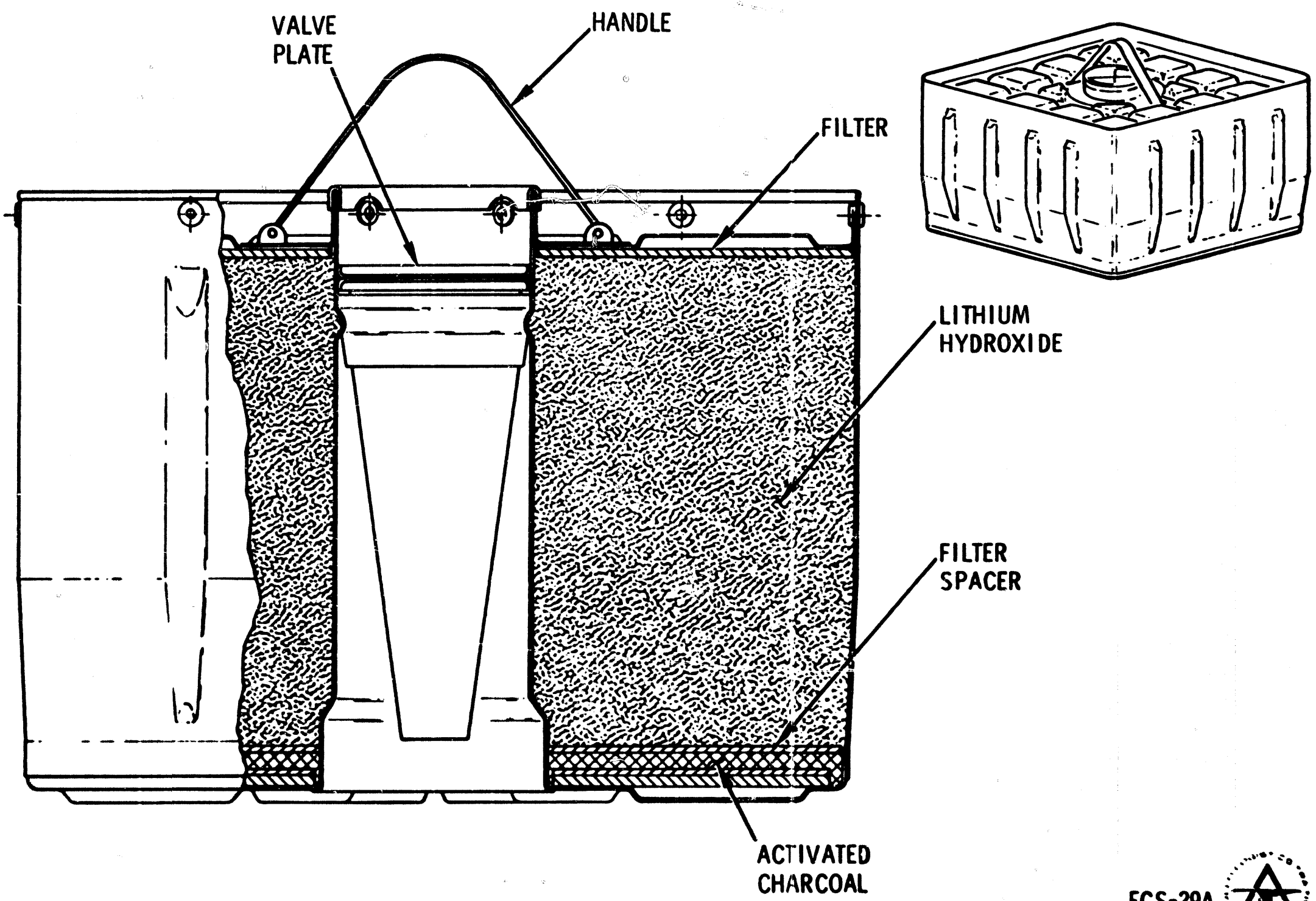


DIVERTER VALVE AND COVER INTERLOCKS IN POSITION TO DIVERT ALL FLOW THROUGH LEFT SIDE WHILE RIGHT SIDE DOOR IS OPENED TO REPLACE LiOH CONTAINER



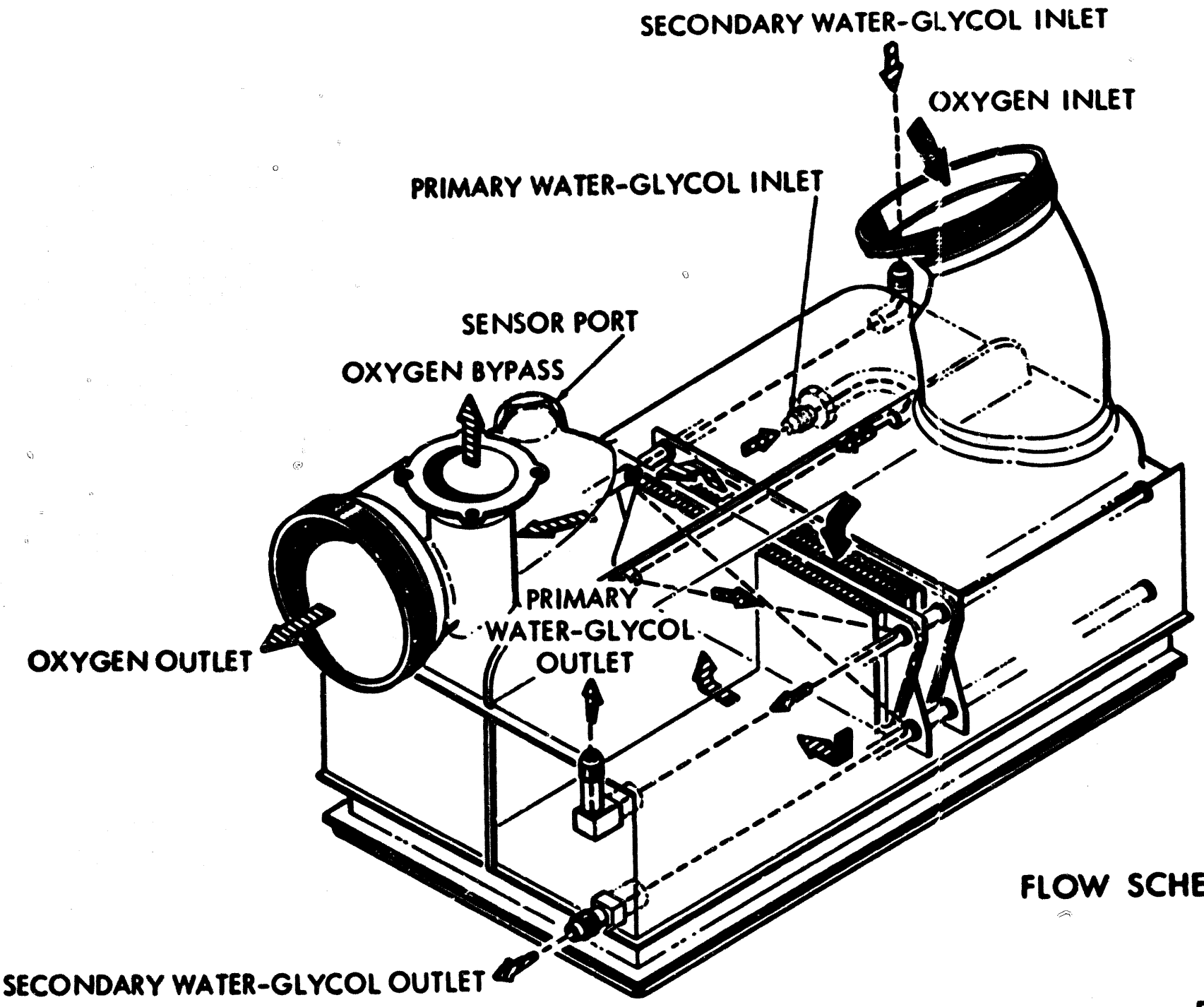
DIVERTER VALVE AND COVER INTERLOCKS IN NORMAL FLOW POSITION

CO_2 ABSORBER FILTER ASSEMBLY



ECS-29A

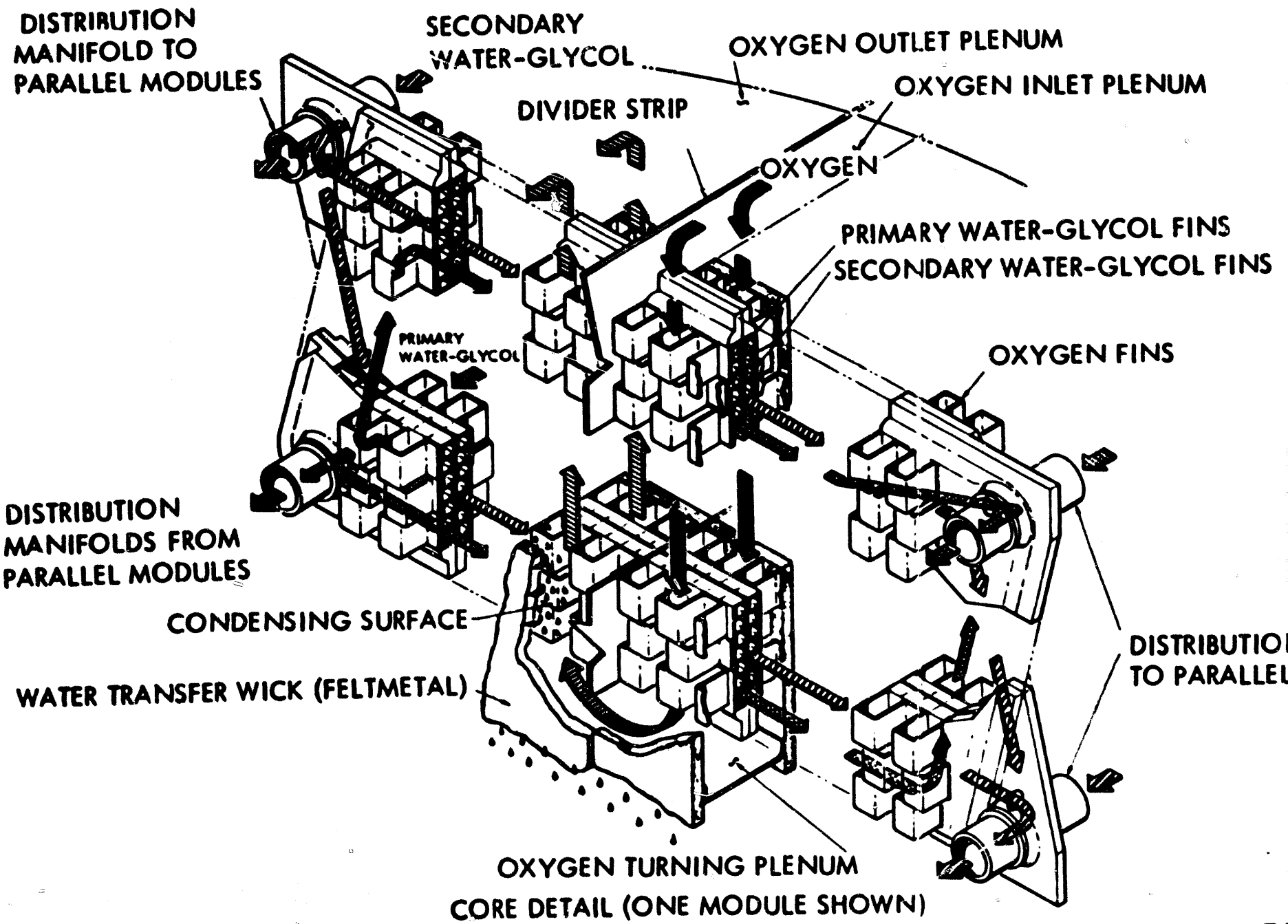
SUIT HEAT EXCHANGER



FLOW SCHEMATIC

ECS-403A

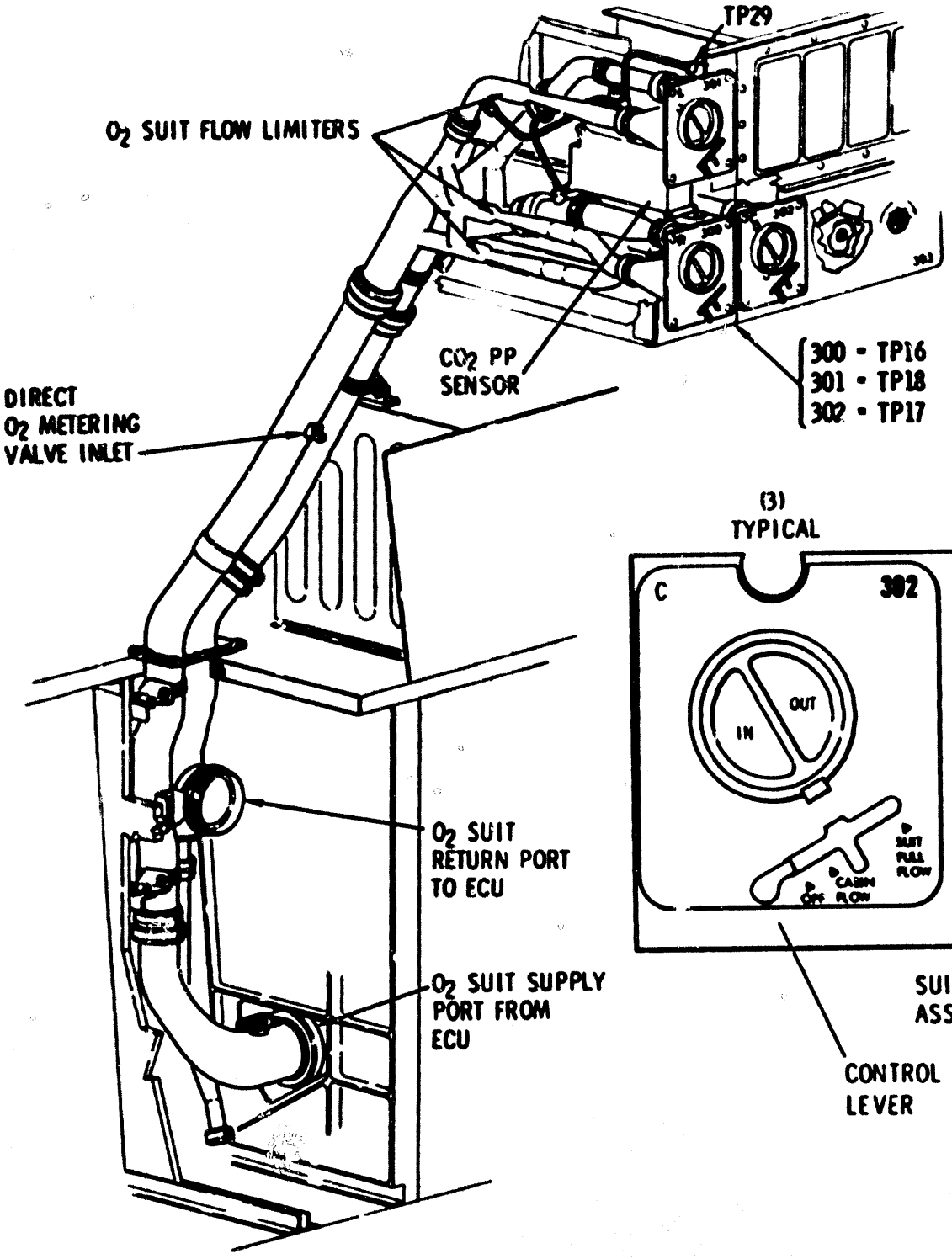
SUIT HEAT EXCHANGER
(CORE DETAIL)

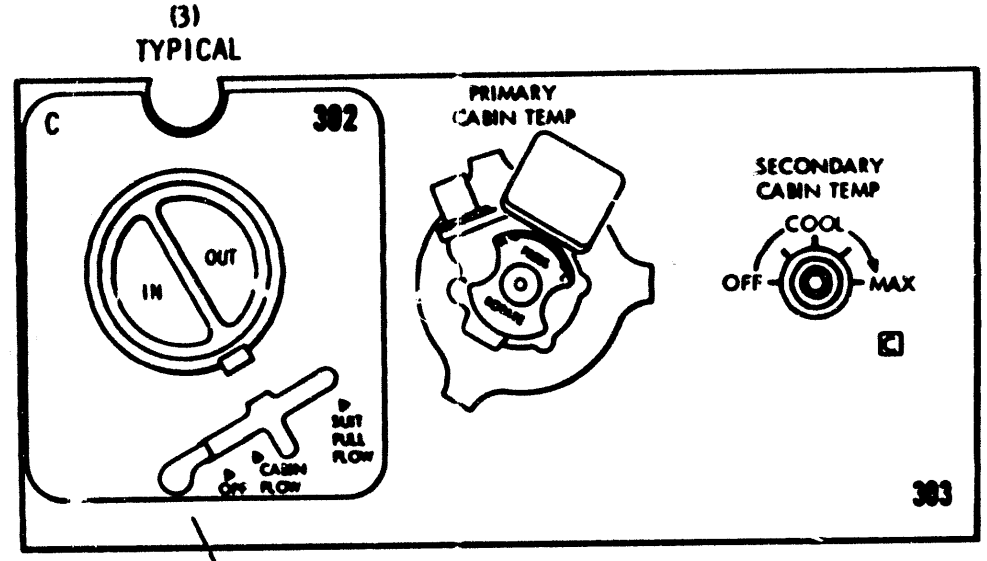


CORE DETAIL (ONE MODULE SHOWN)

ECS-408

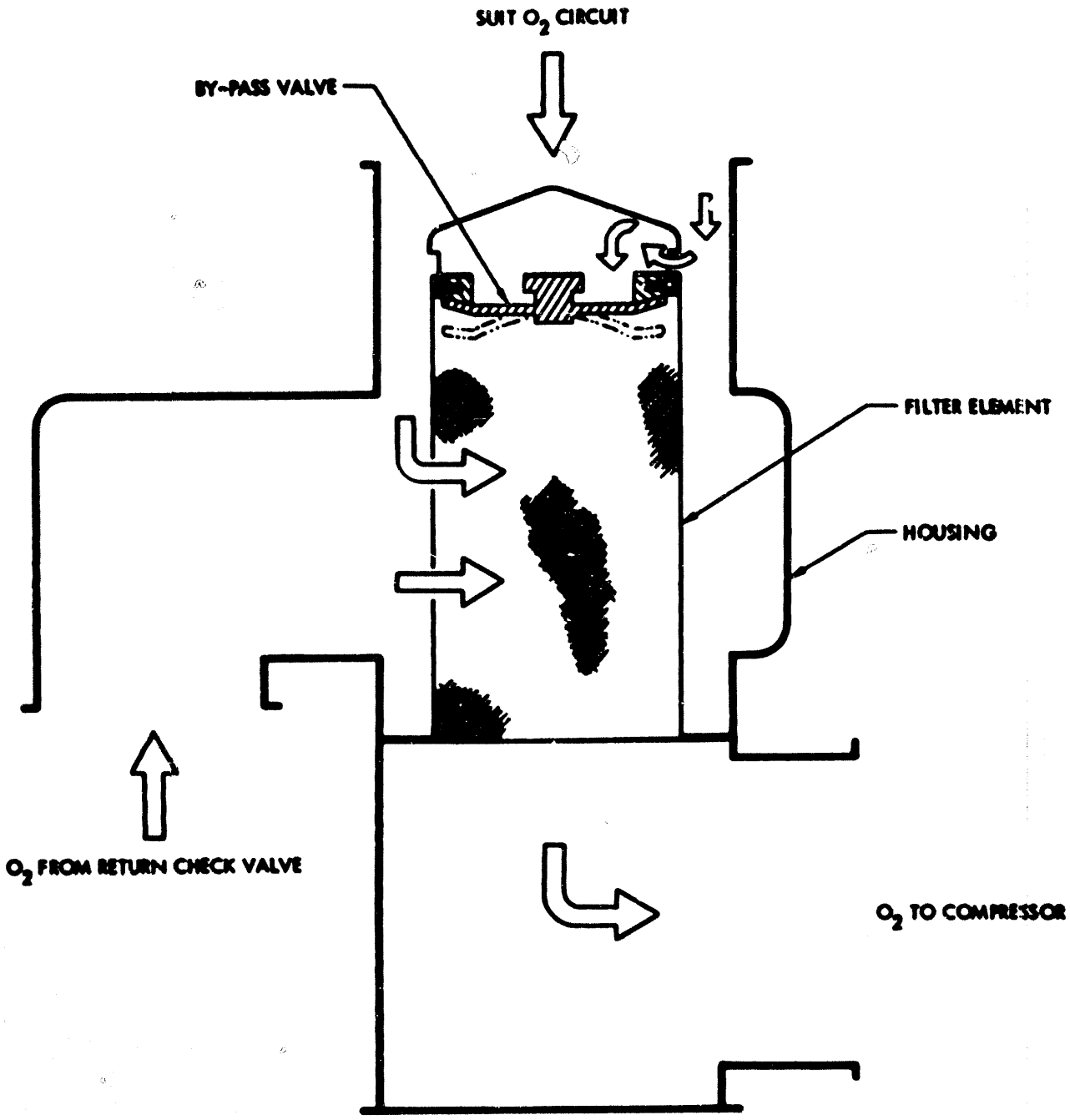
SUIT DISTRIBUTION DUCT & HOSE CONNECTORS

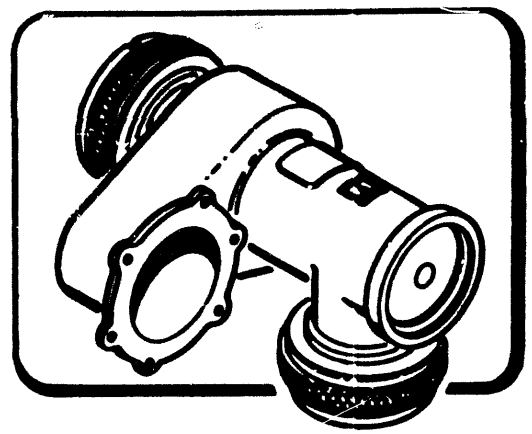




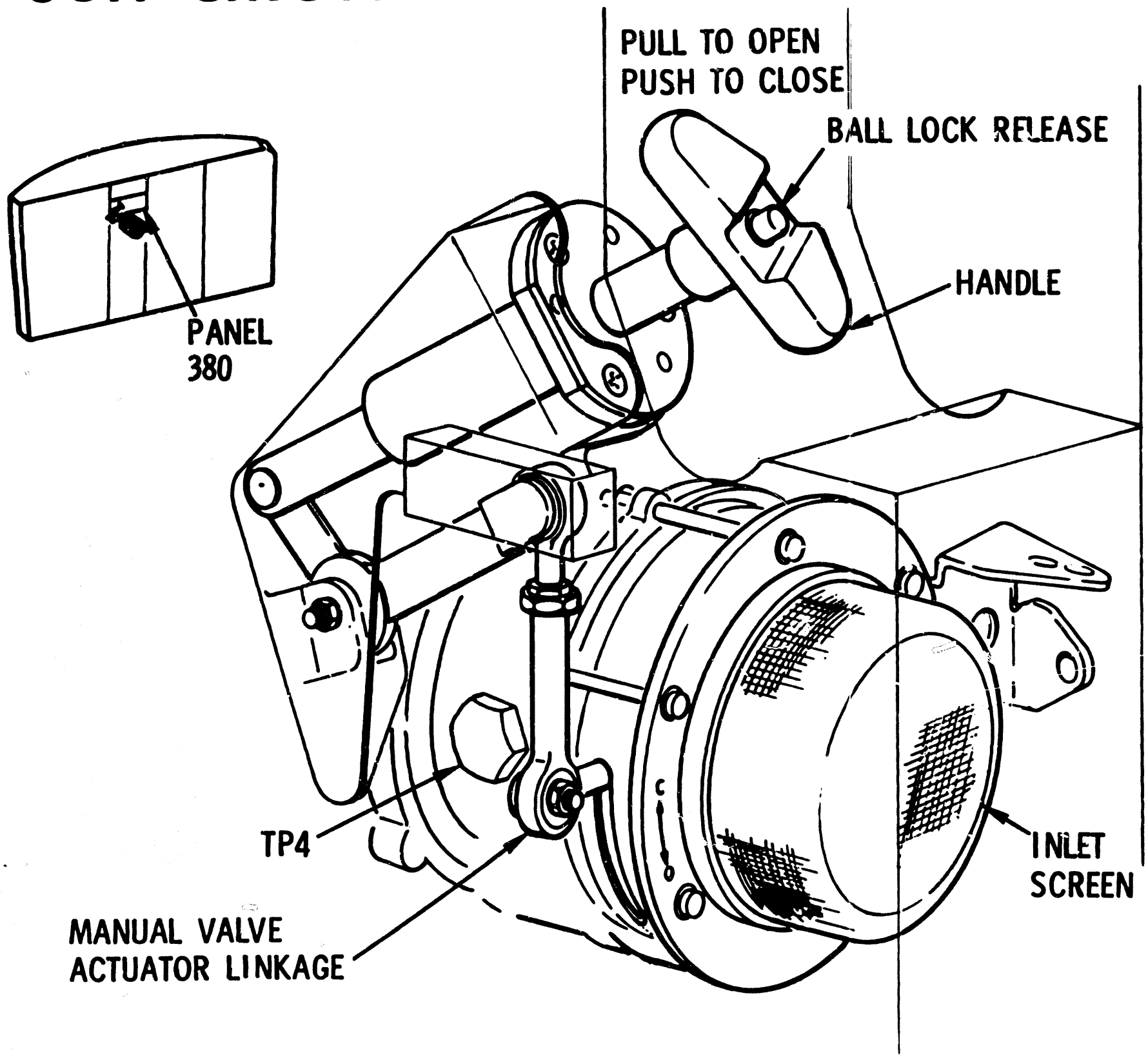
ECS-2168

DEBRIS TRAP


SUIT O_2 CIRCUIT
BY-PASS VALVE
FILTER ELEMENT
HOUSING
O_2 FROM RETURN CHECK VALVE
O_2 TO COMPRESSOR

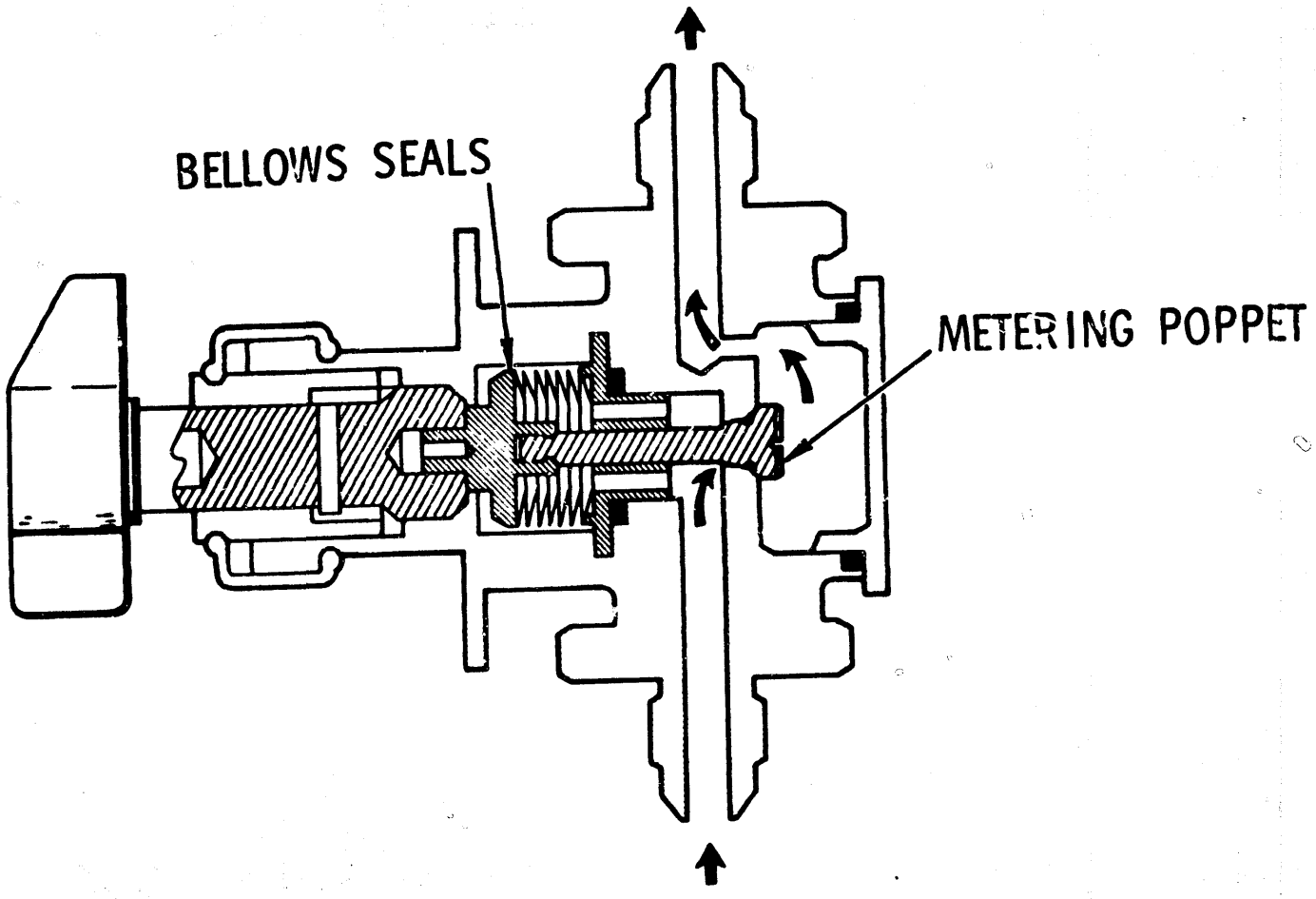


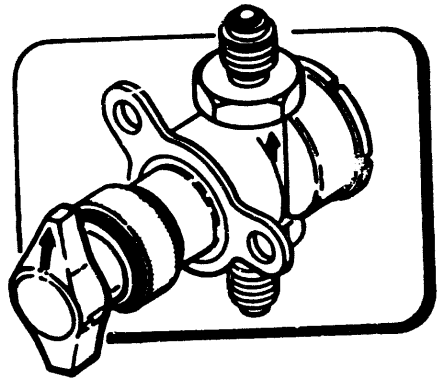
SUIT CIRCUIT RETURN SHUTOFF VALVE



ECS-513B

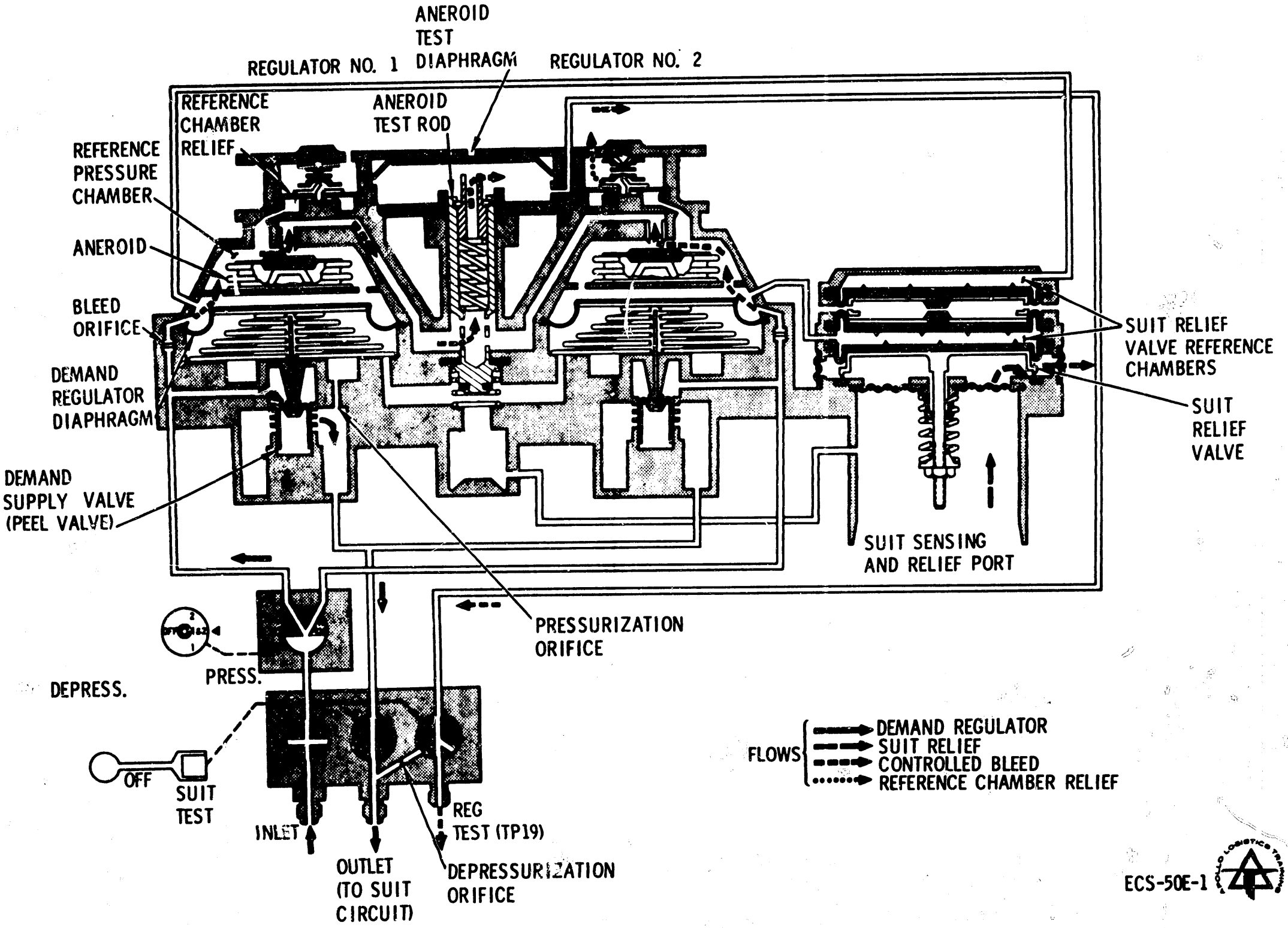
DIRECT O_2 VALVE





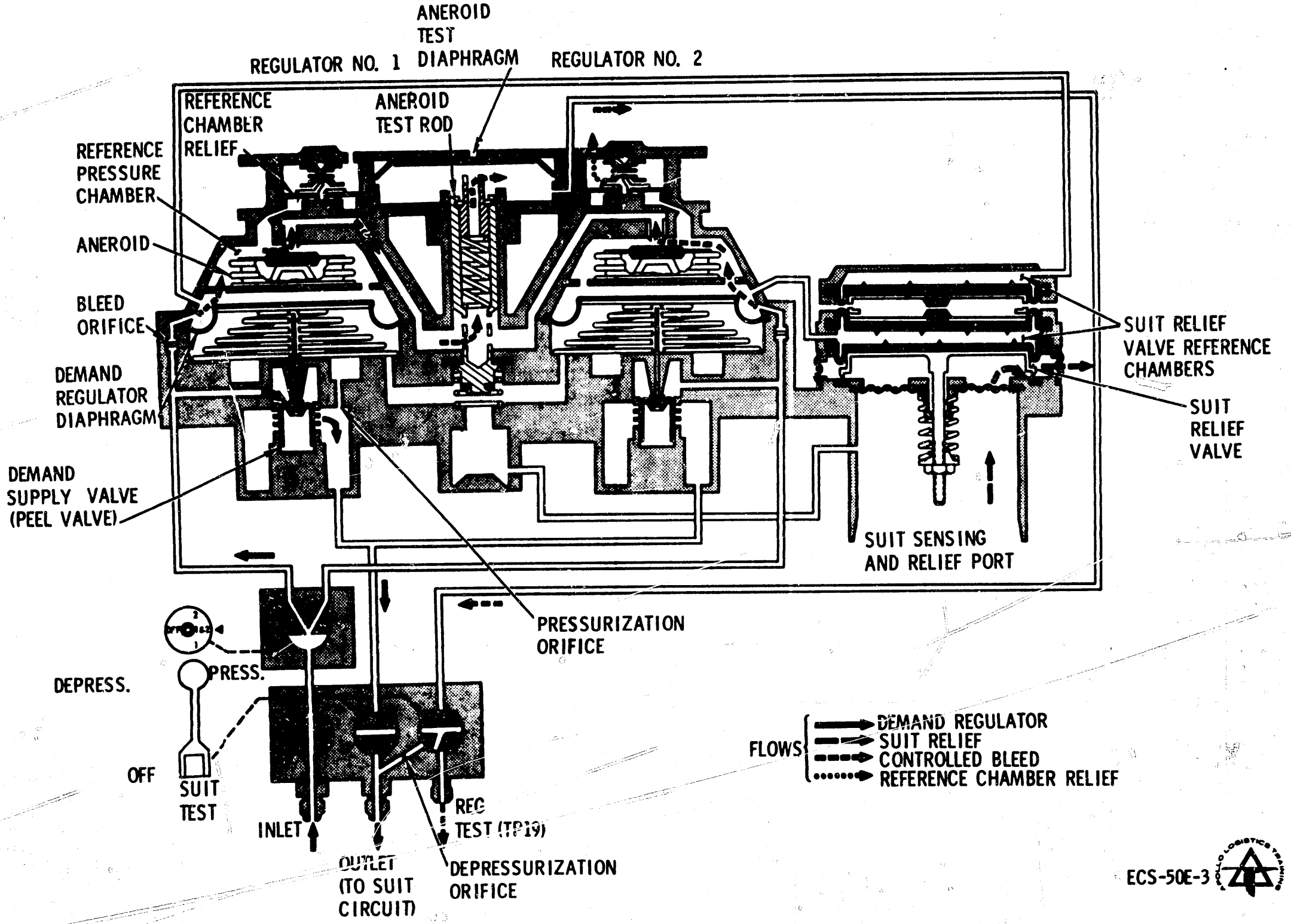
ECS-35A

SUIT DEMAND PRESSURE REGULATOR

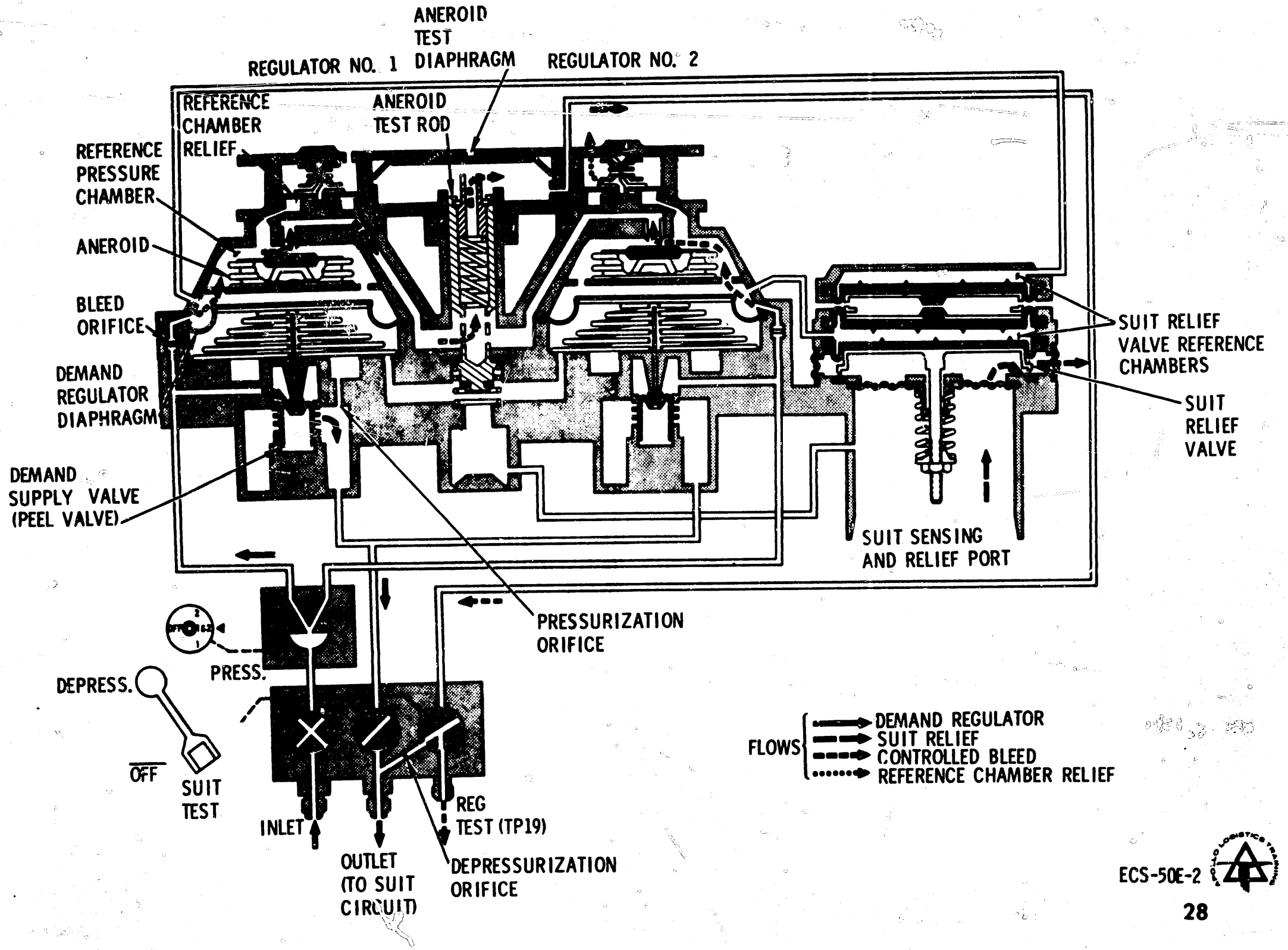


ECS-50E-1

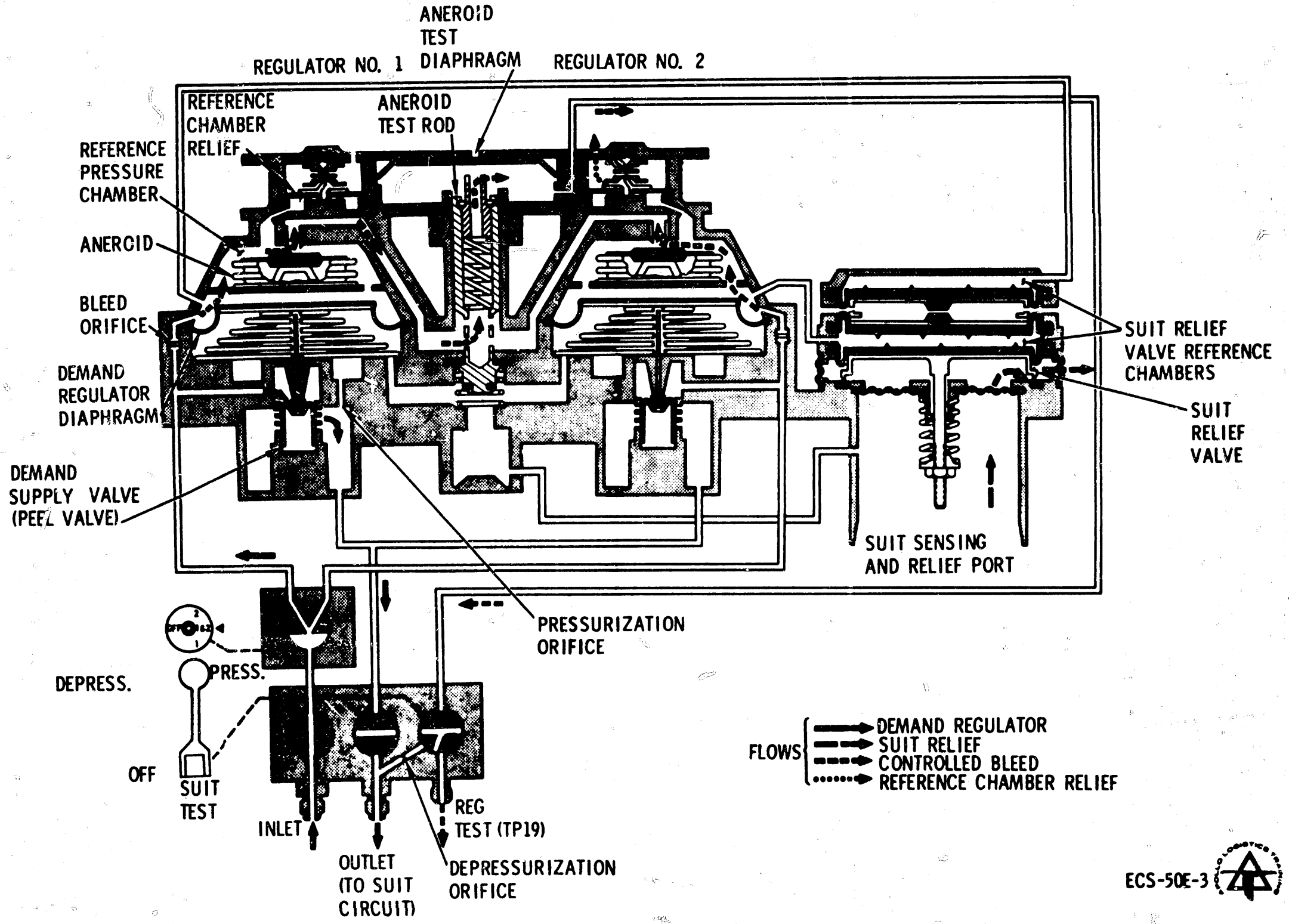
SUIT DEMAND PRESSURE REGULATOR



SUIT DEMAND PRESSURE REGULATOR



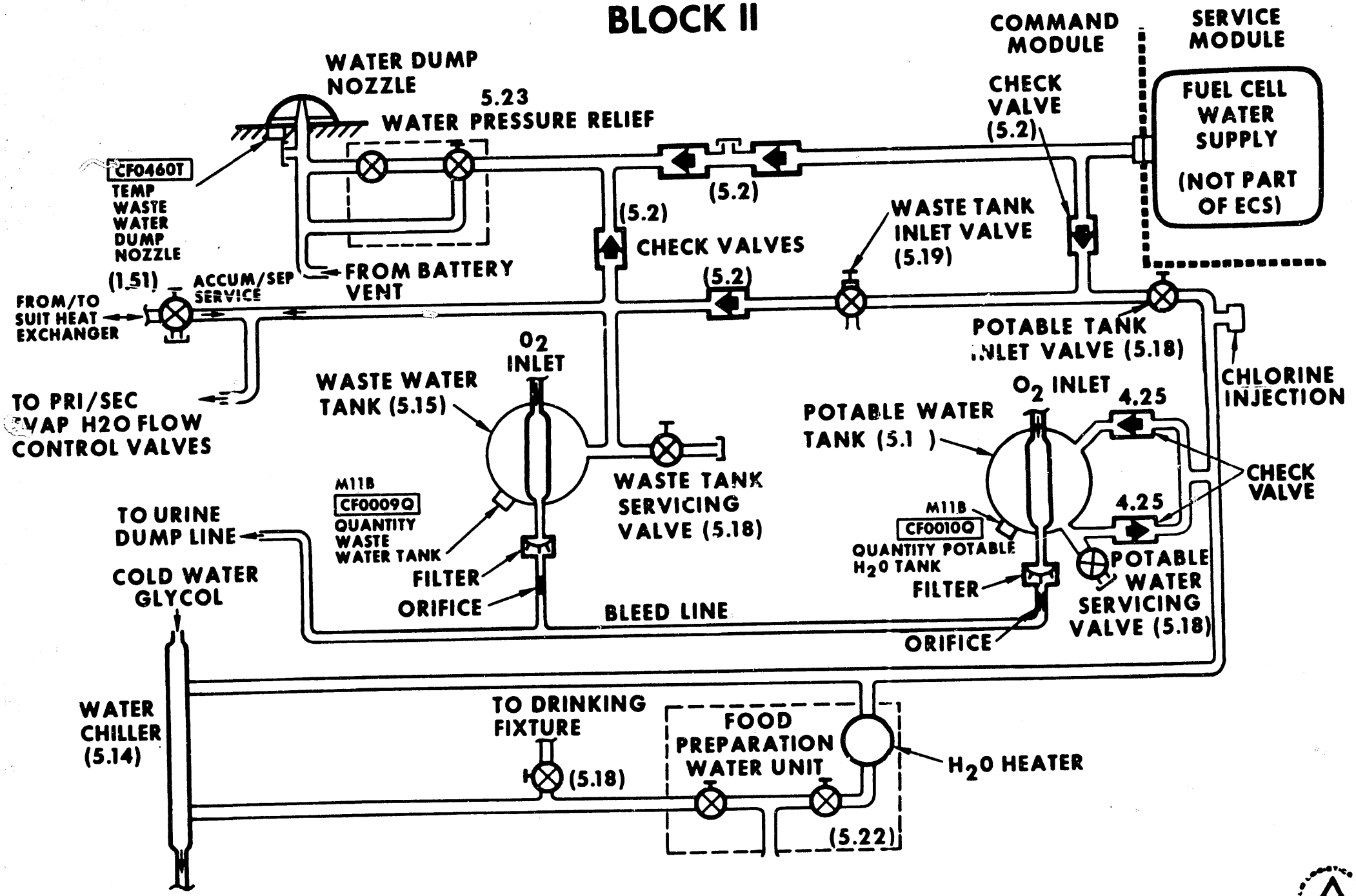
SUIT DEMAND PRESSURE REGULATOR



ECS-50E-3

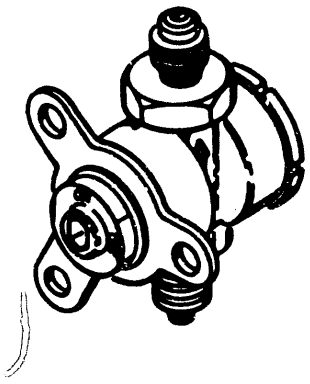
WATER MANAGEMENT SUBSYSTEM

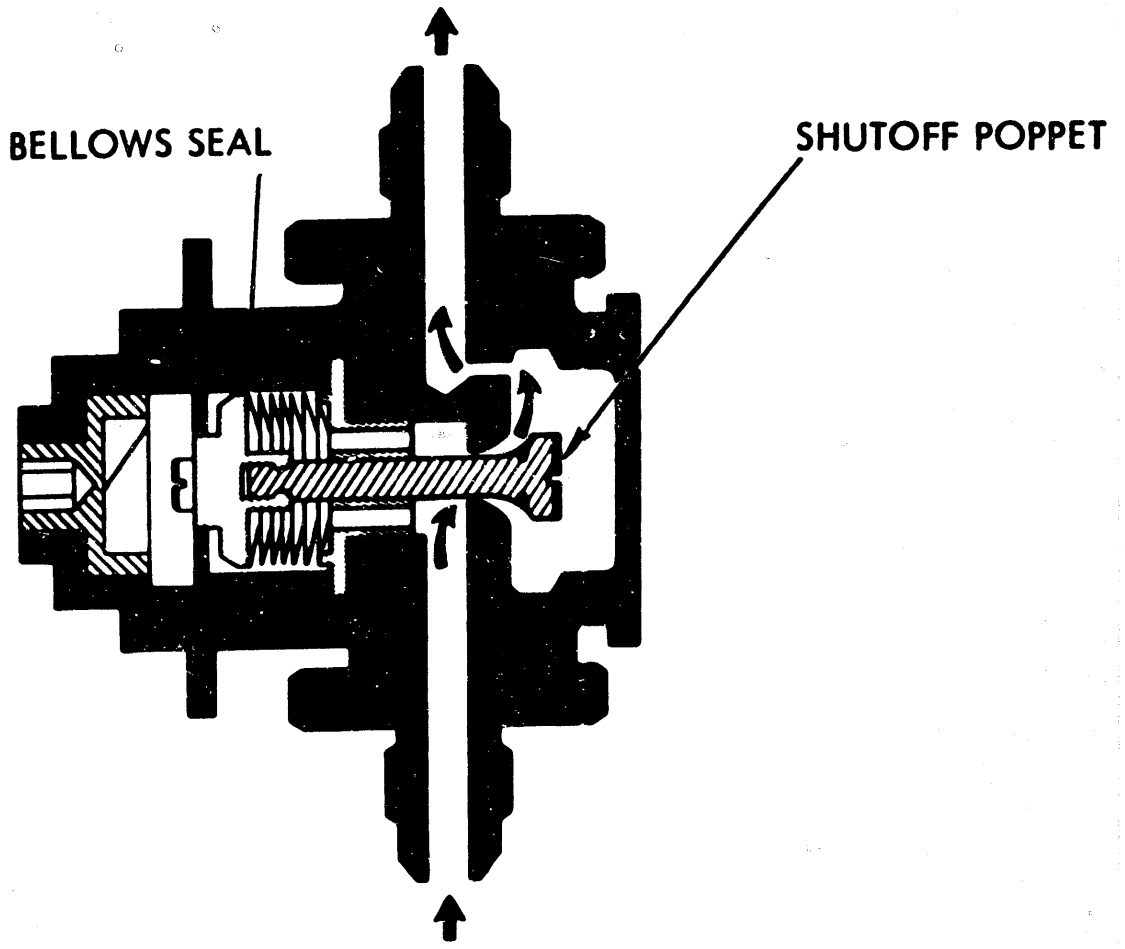
BLOCK II



ECS-508G

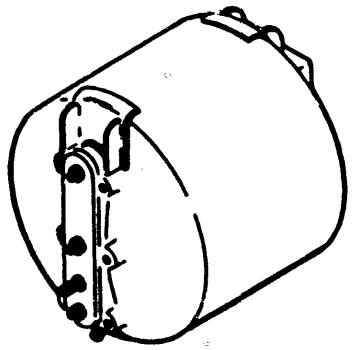
MANUAL VALVE
(TYPICAL)

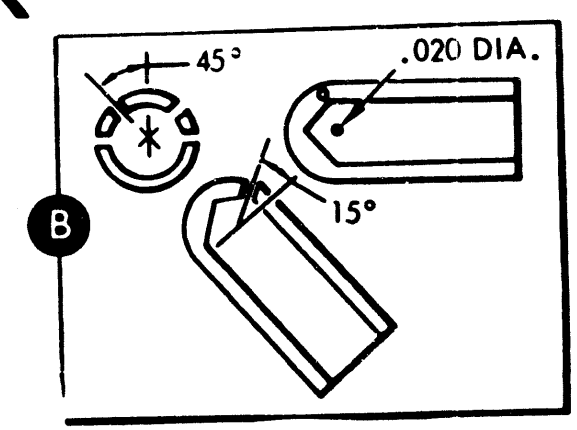


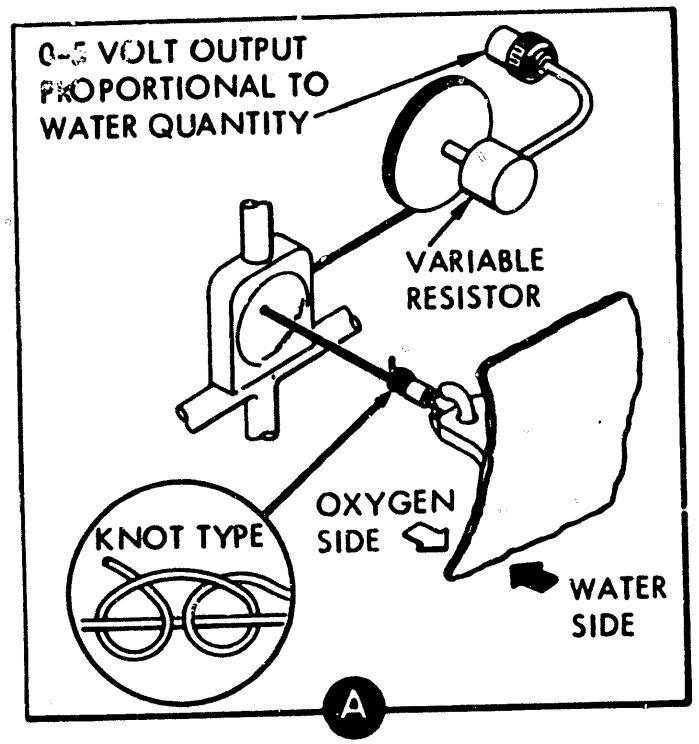


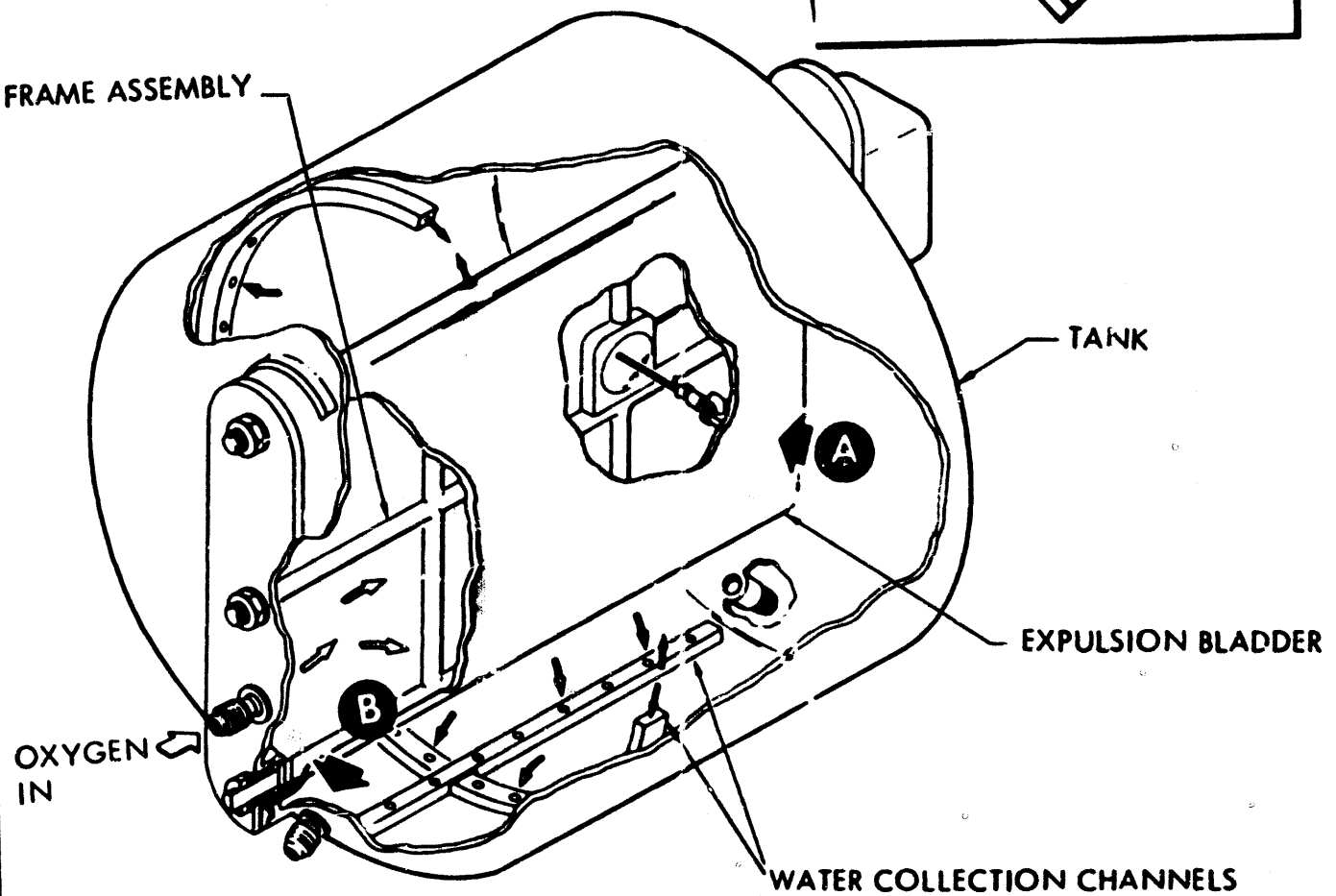
POTABLE WATER TANK

(TYPICAL)



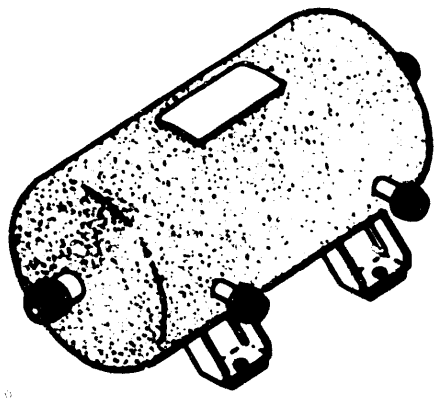


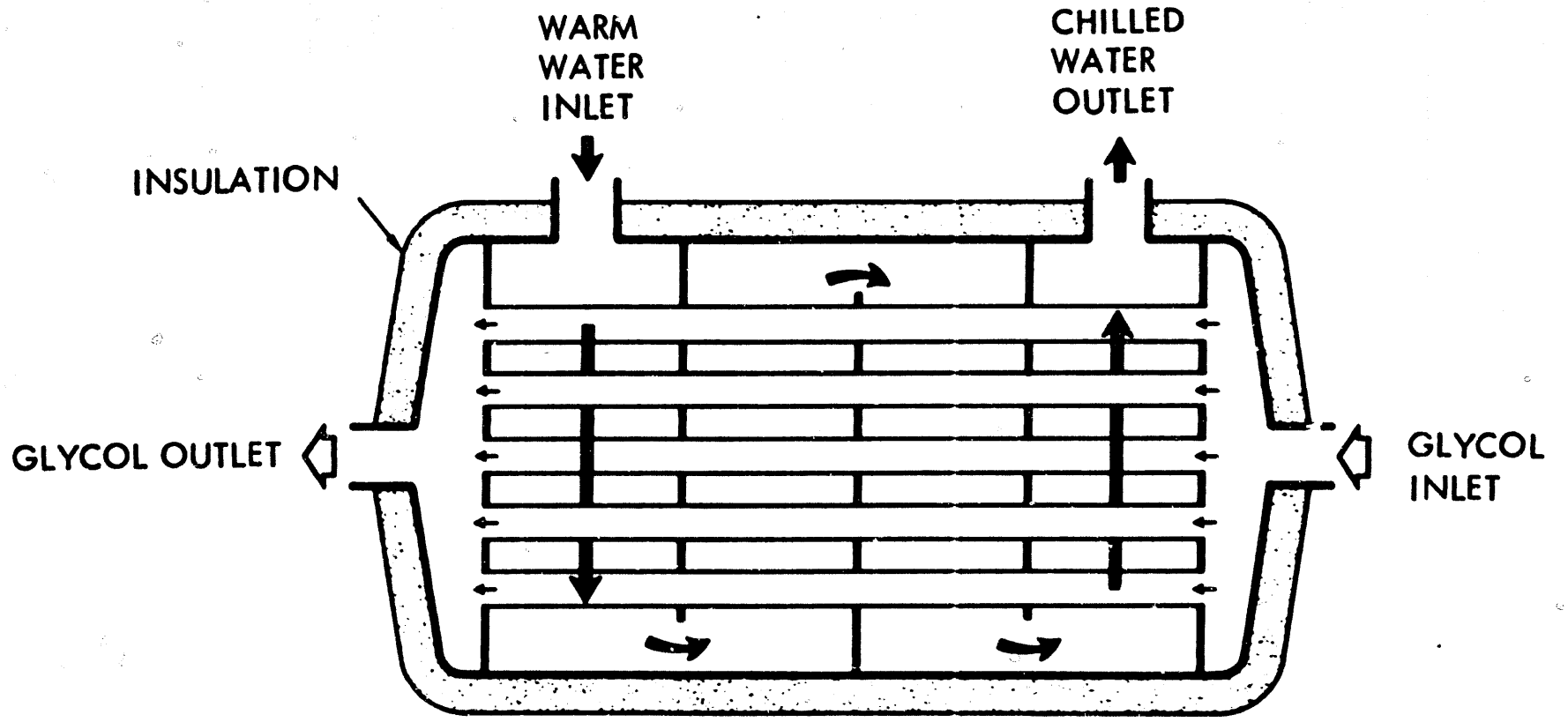




ECS-413A

WATER CHILLER

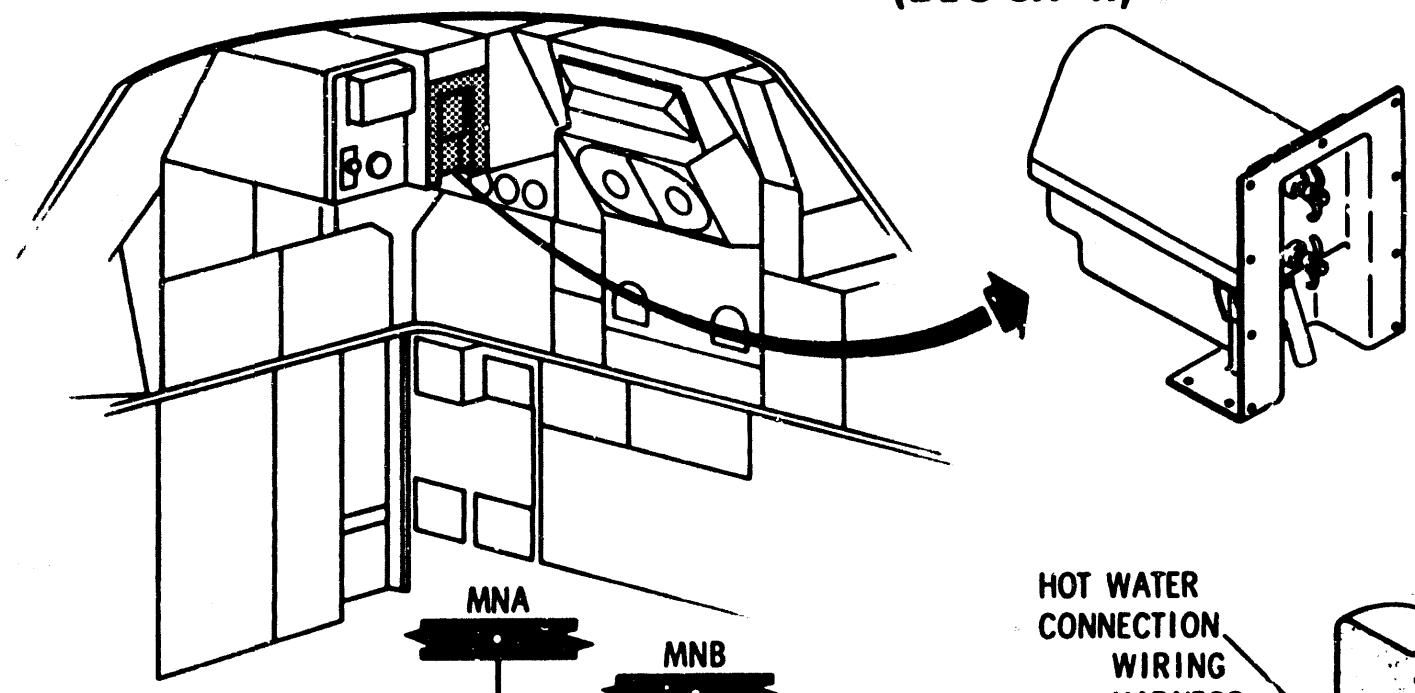


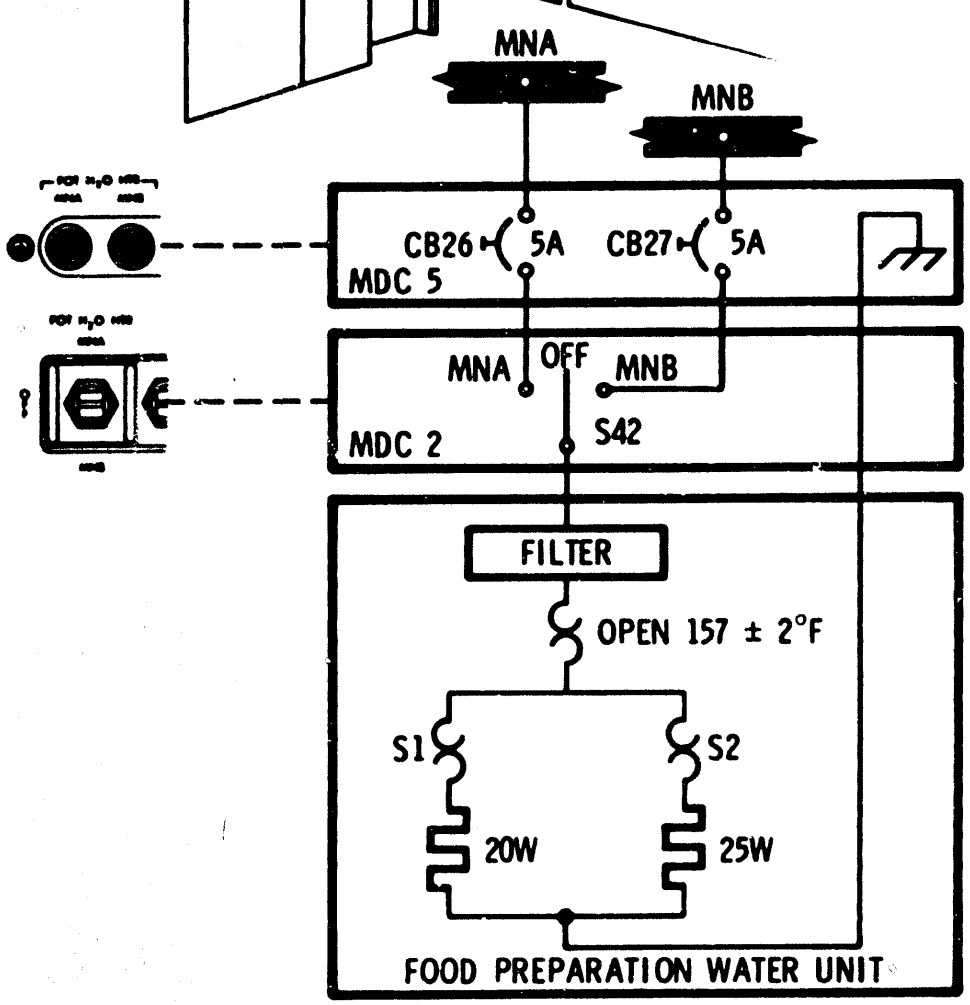


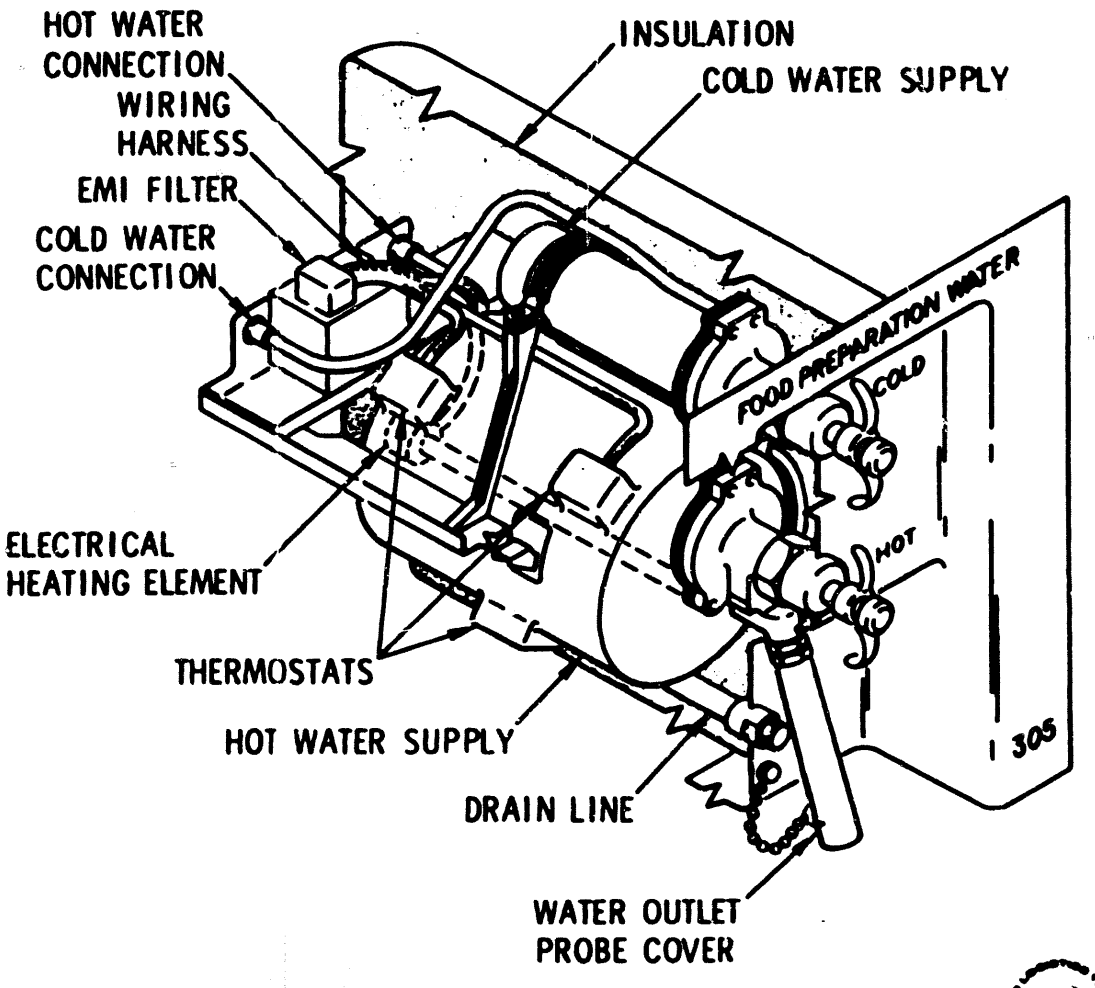
ECS-428

FOOD PREPARATION WATER UNIT

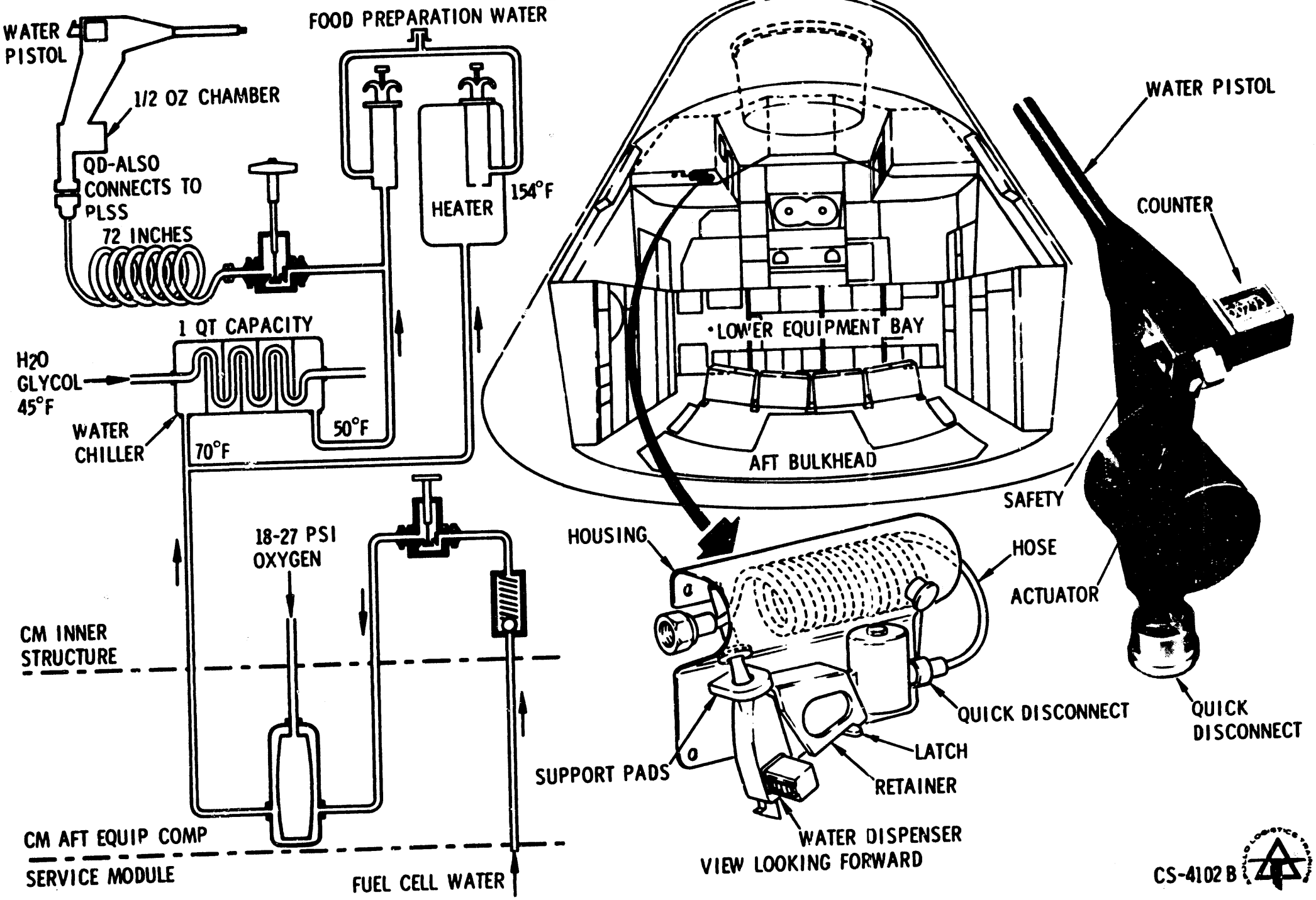
(BLOCK II)



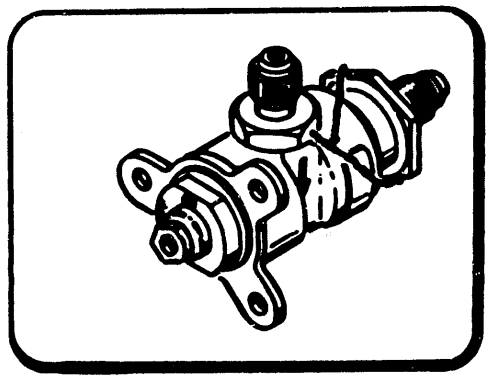


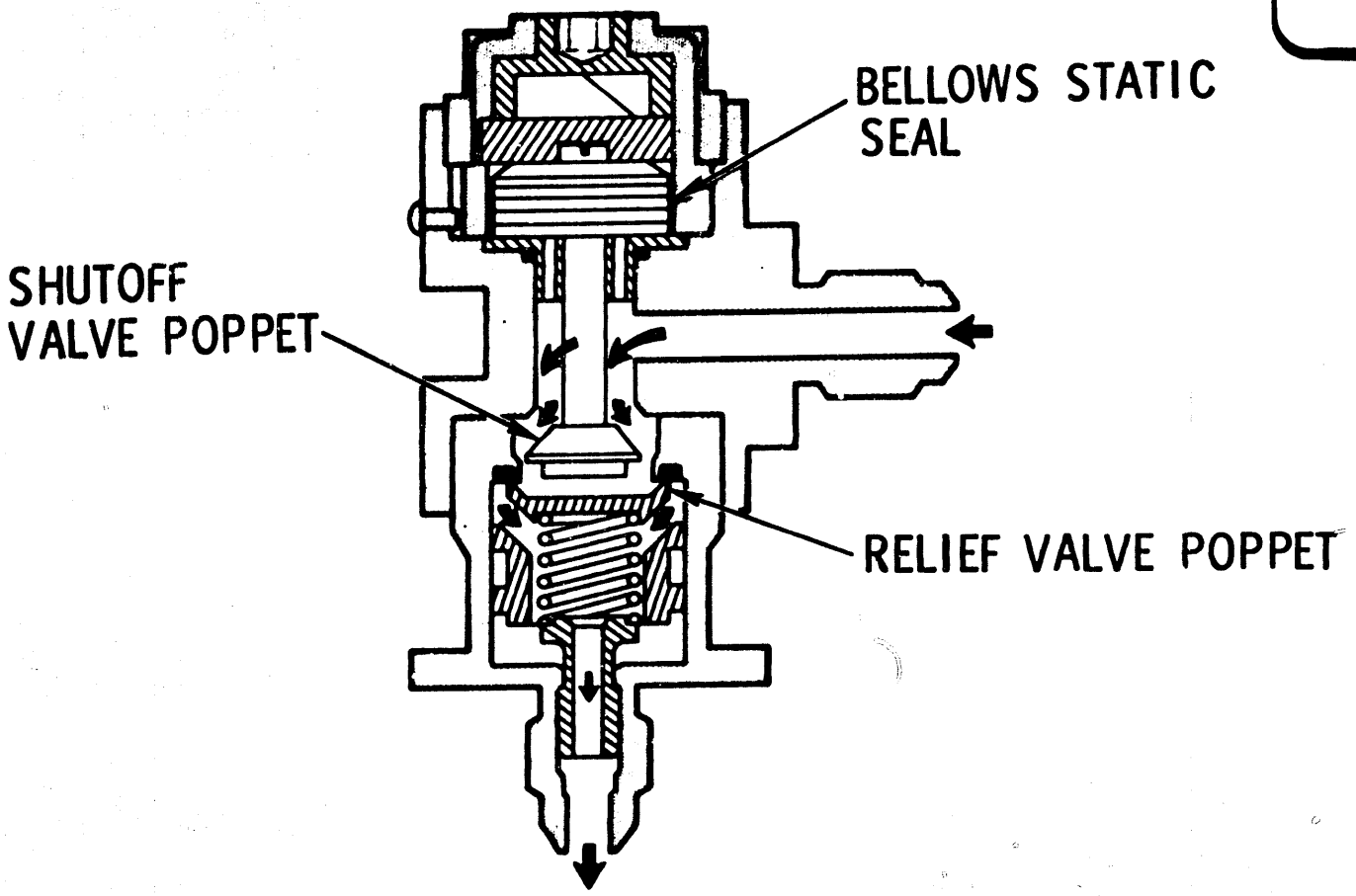


WATER METERING DISPENSER (PISTOL) ASSY
BLOCK II



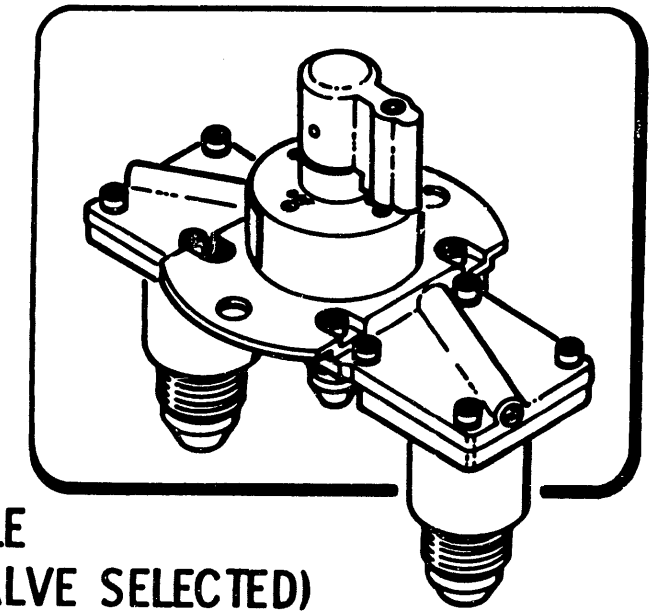
WASTE TANK INLET VALVE

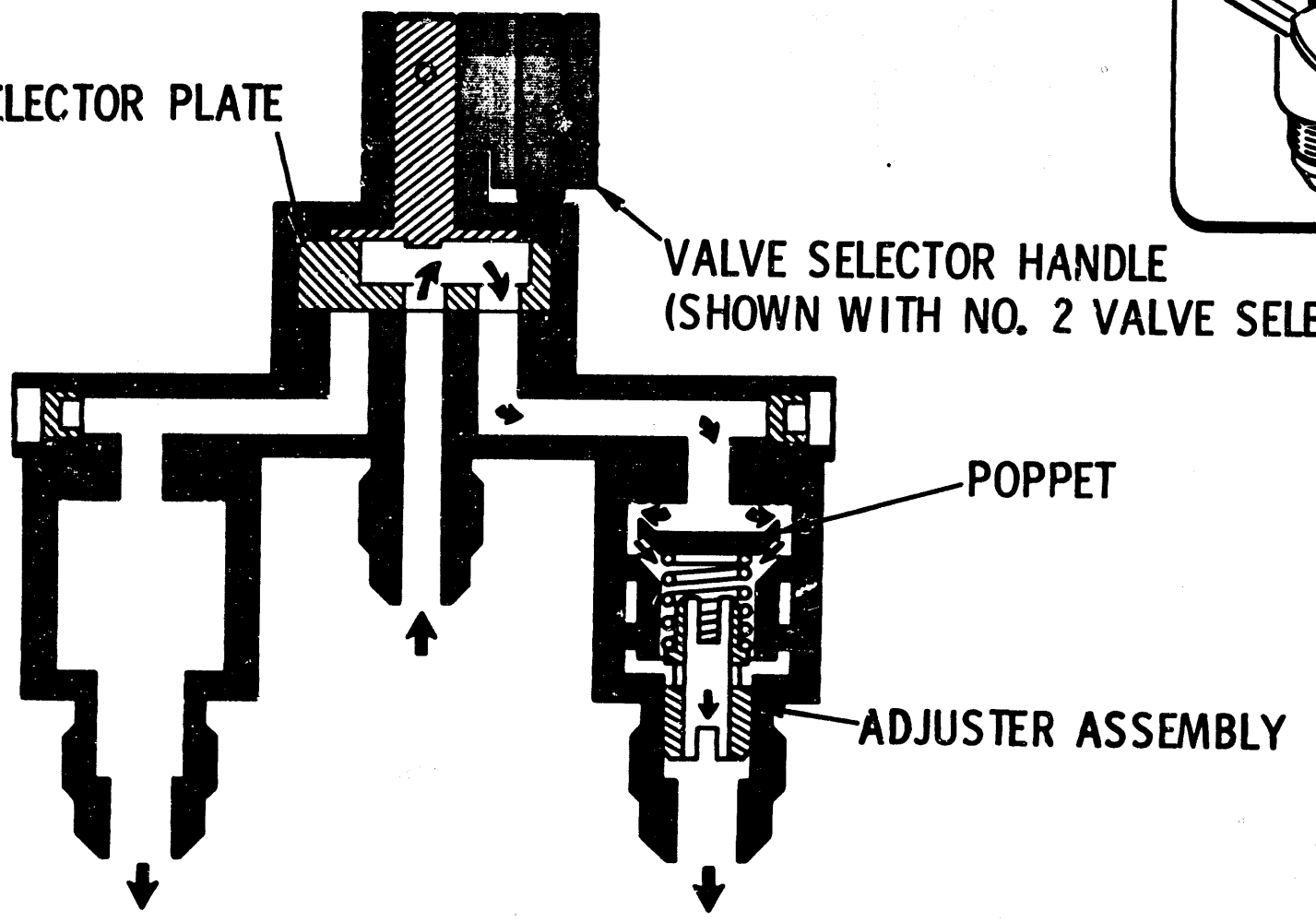




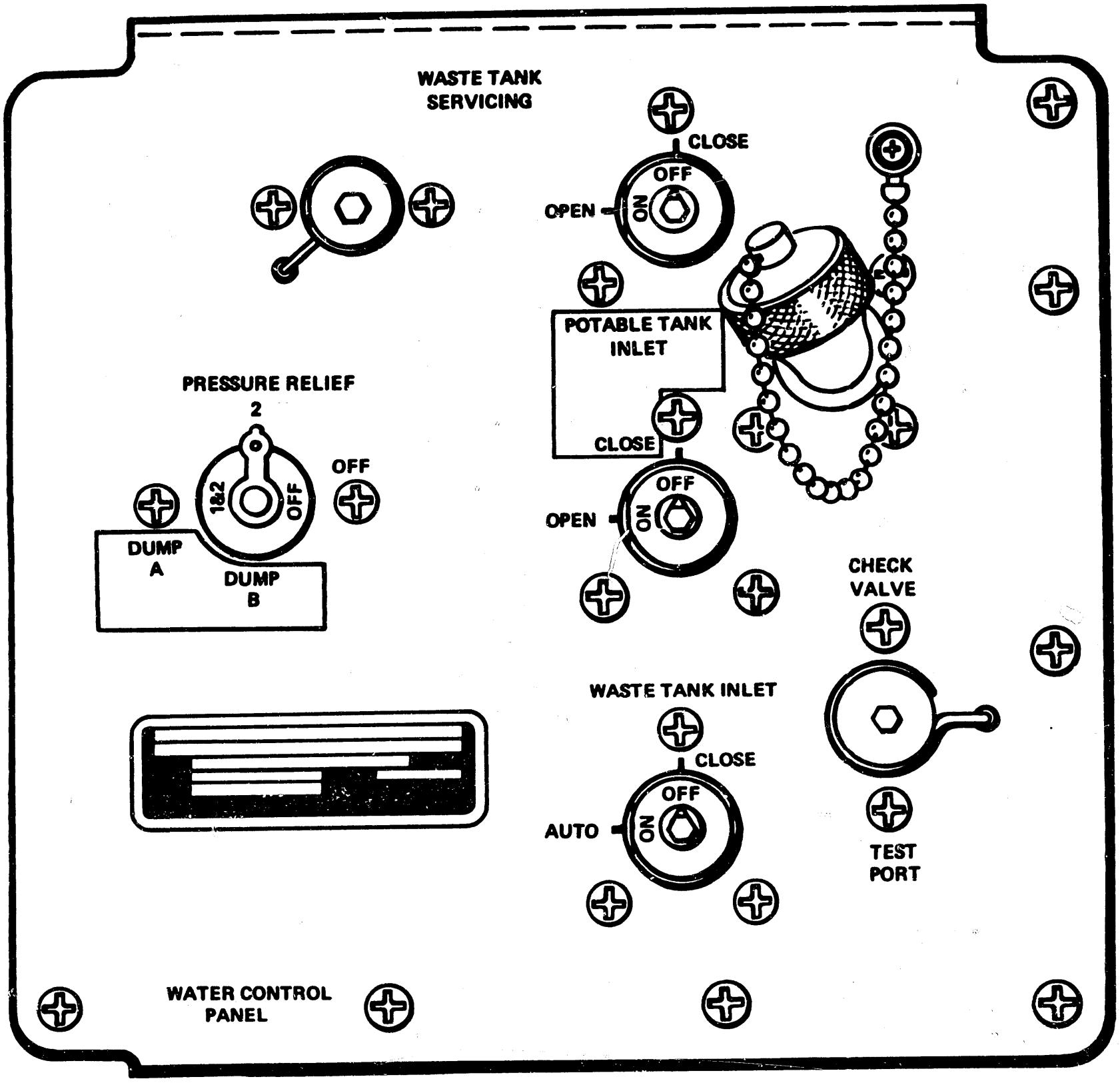
WATER PRESSURE RELIEF/DUMP VALVE

(106 & SUBS)

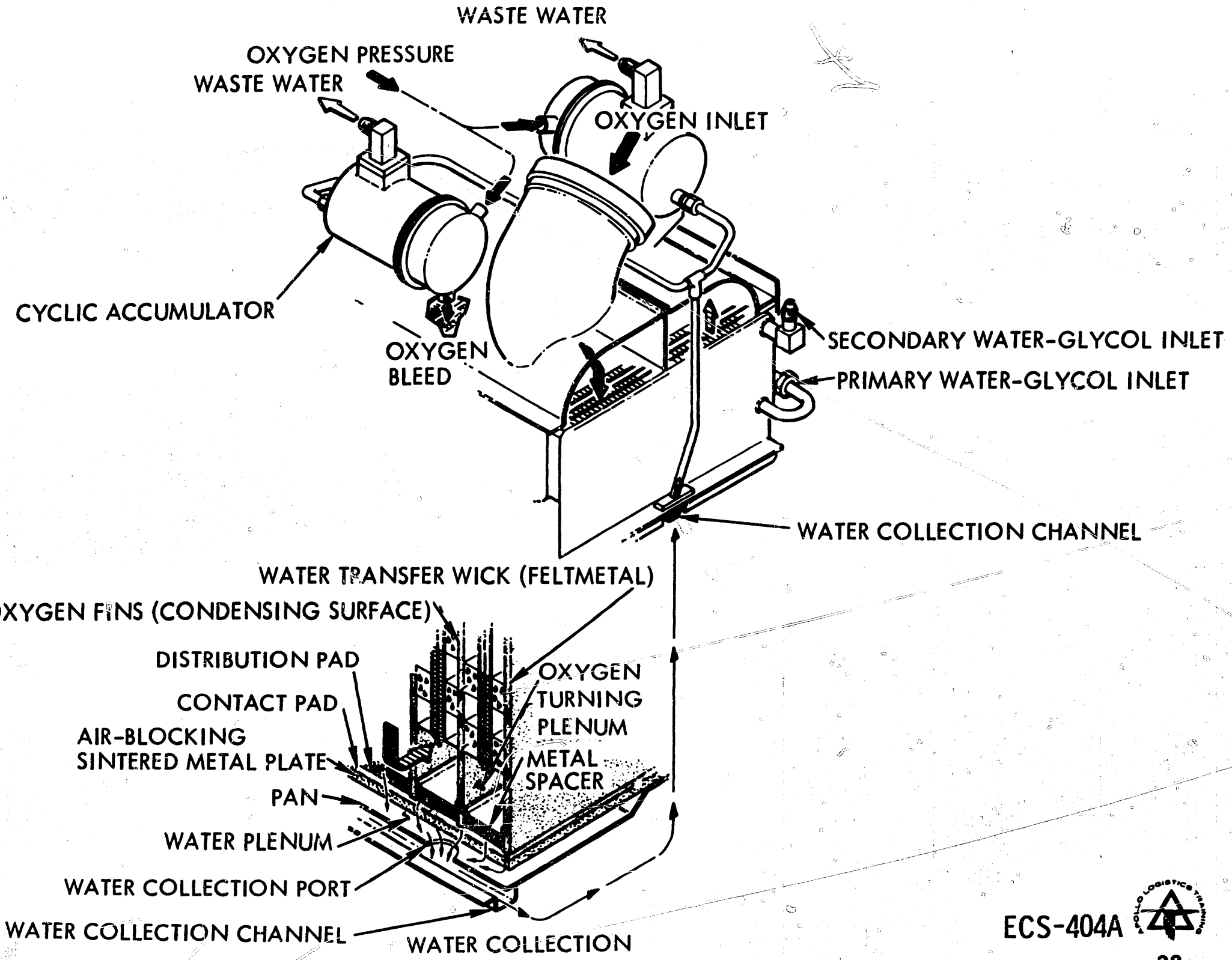




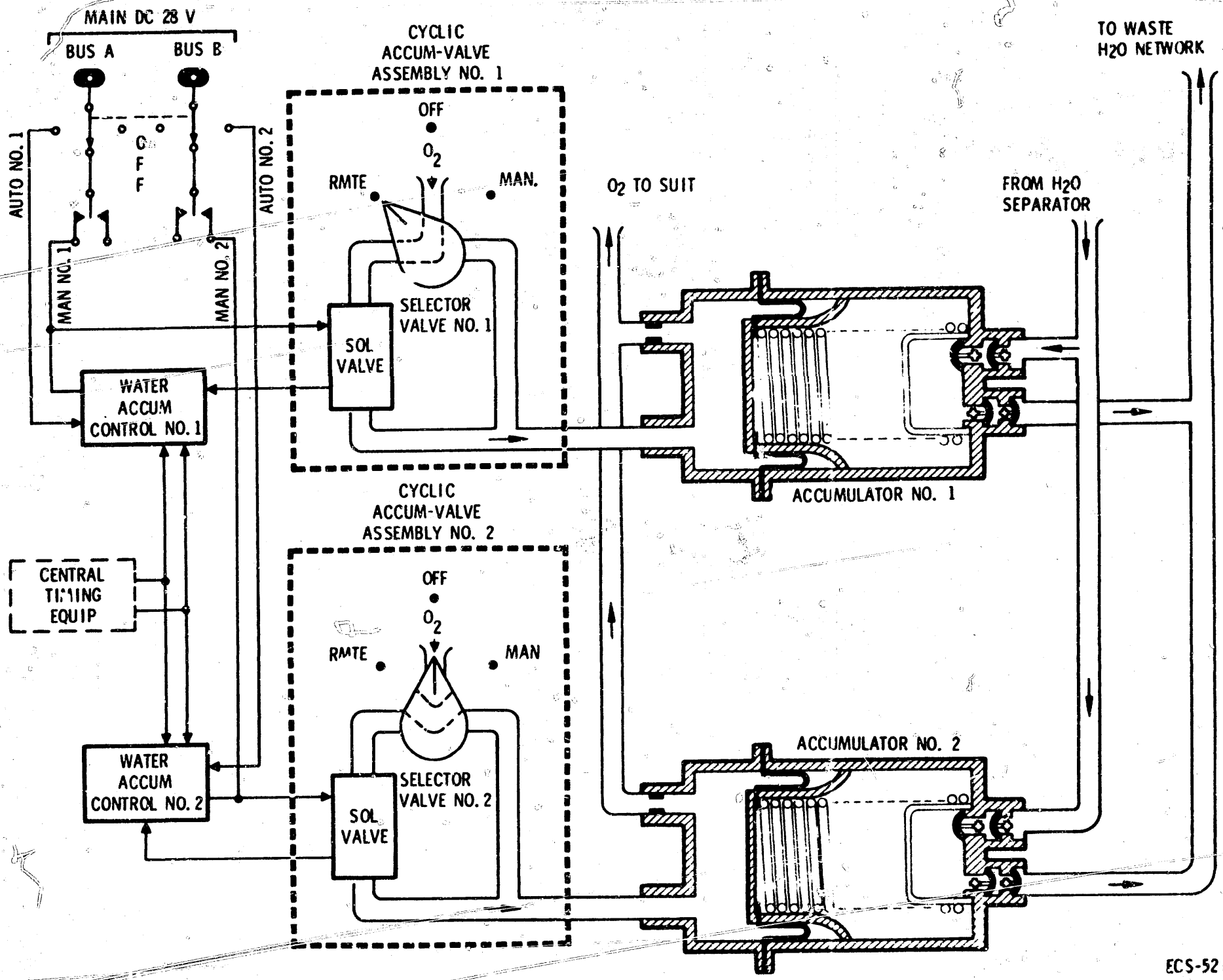
ECS-40C


WASTE TANK
SERVICING
CLOSE
OFF
ON
OPEN
POTABLE TANK
INLET
CLOSE
OFF
ON
OPEN
PRESSURE RELIEF
2
1&2
OFF
OFF
DUMP
A
DUMP
B
CHECK
VALVE
WASTE TANK INLET
CLOSE
OFF
ON
AUTO
TEST
PORT
WATER CONTROL
PANEL

WATER REMOVAL-SUIT HEAT EXCHANGER



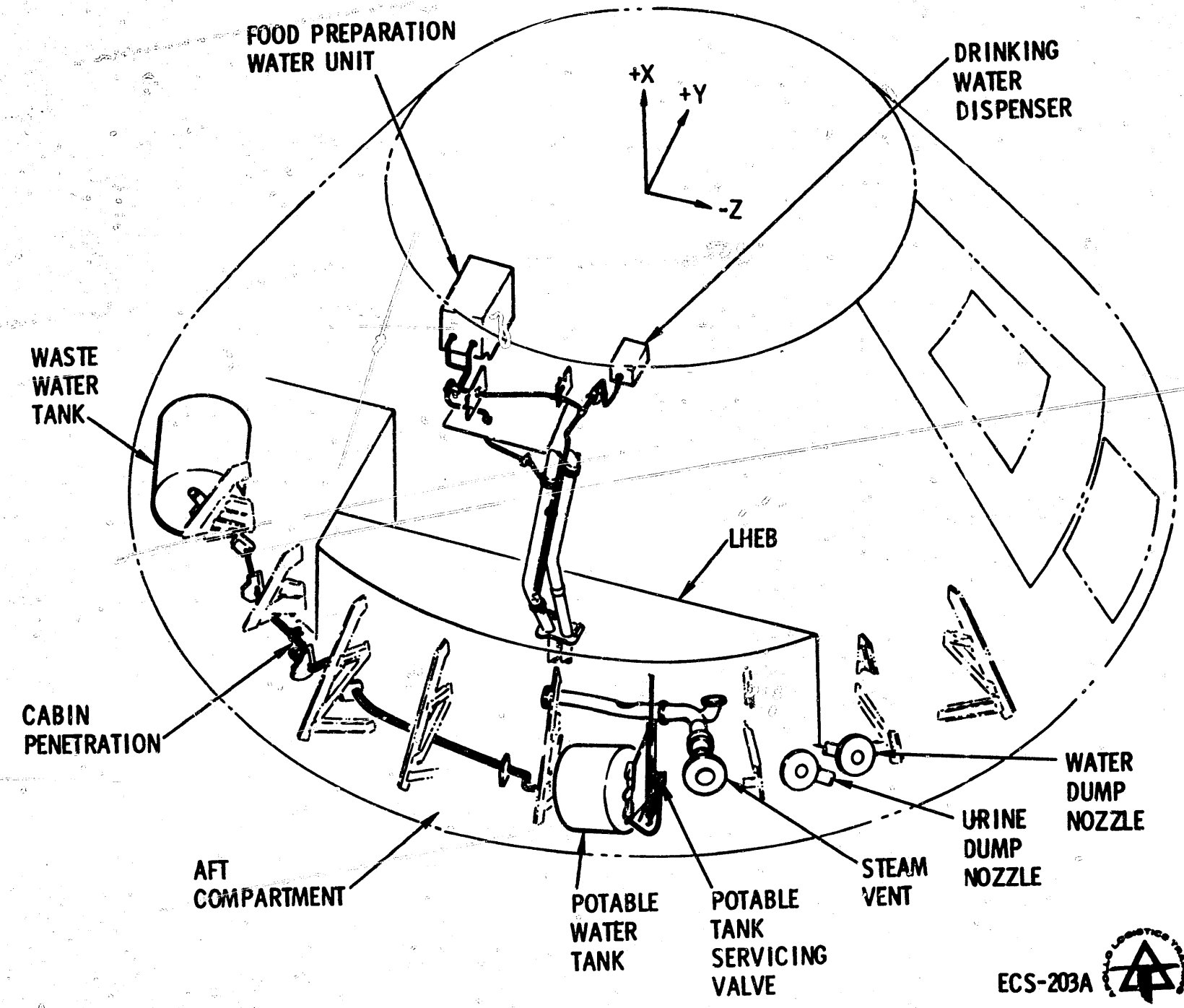
WATER ACCUMULATOR CONTROL



ECS-52H

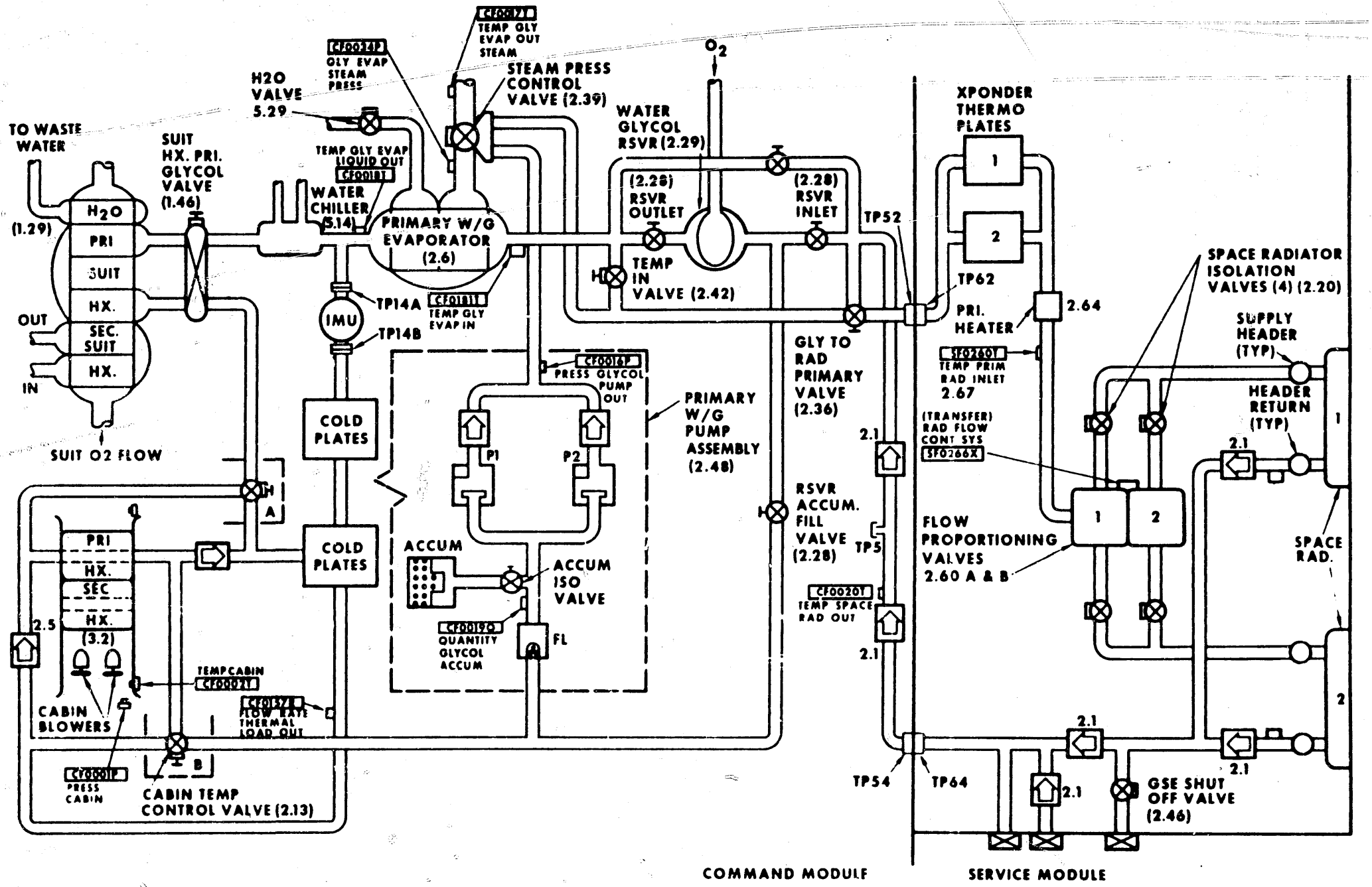
WATER SUBSYSTEM

INSTALLATION

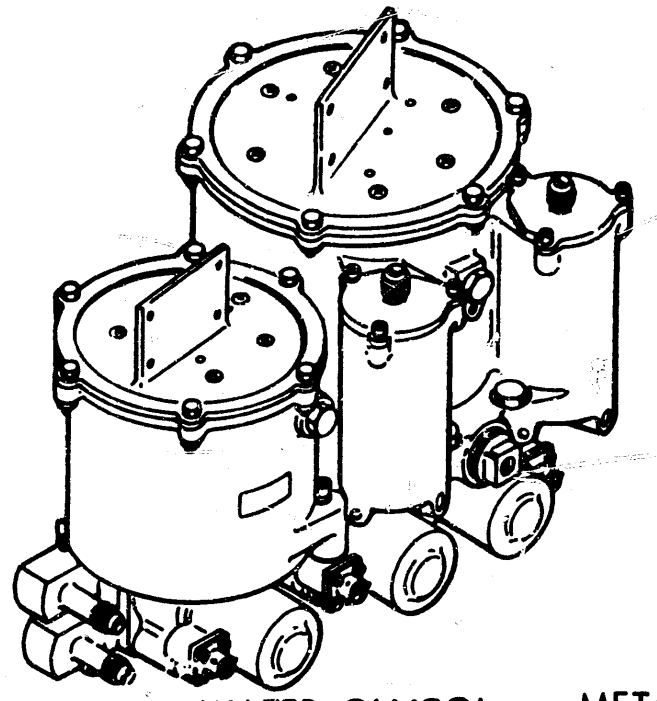


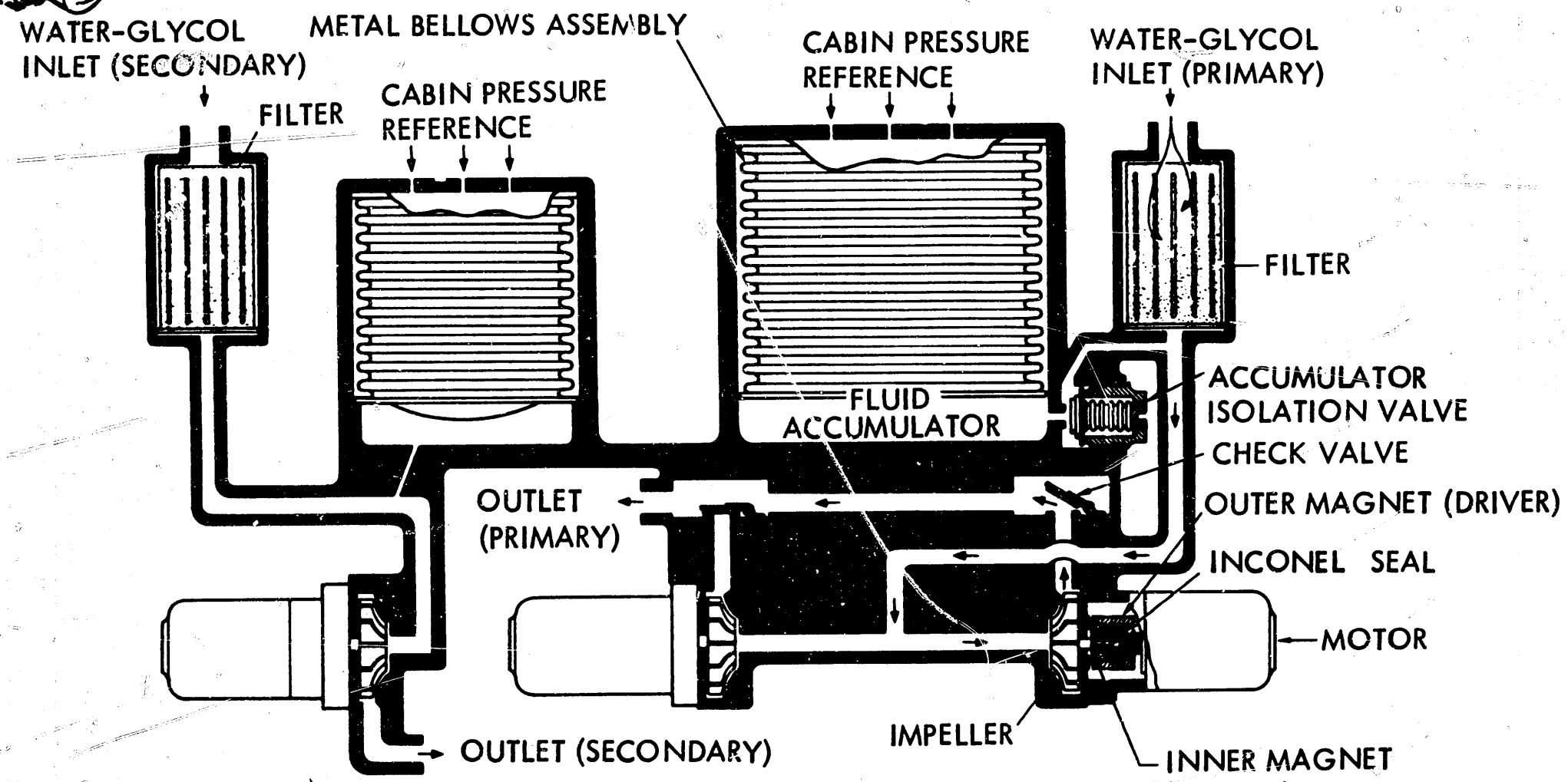
ECS-203A

PRIMARY WATER GLYCOL SUBSYSTEM



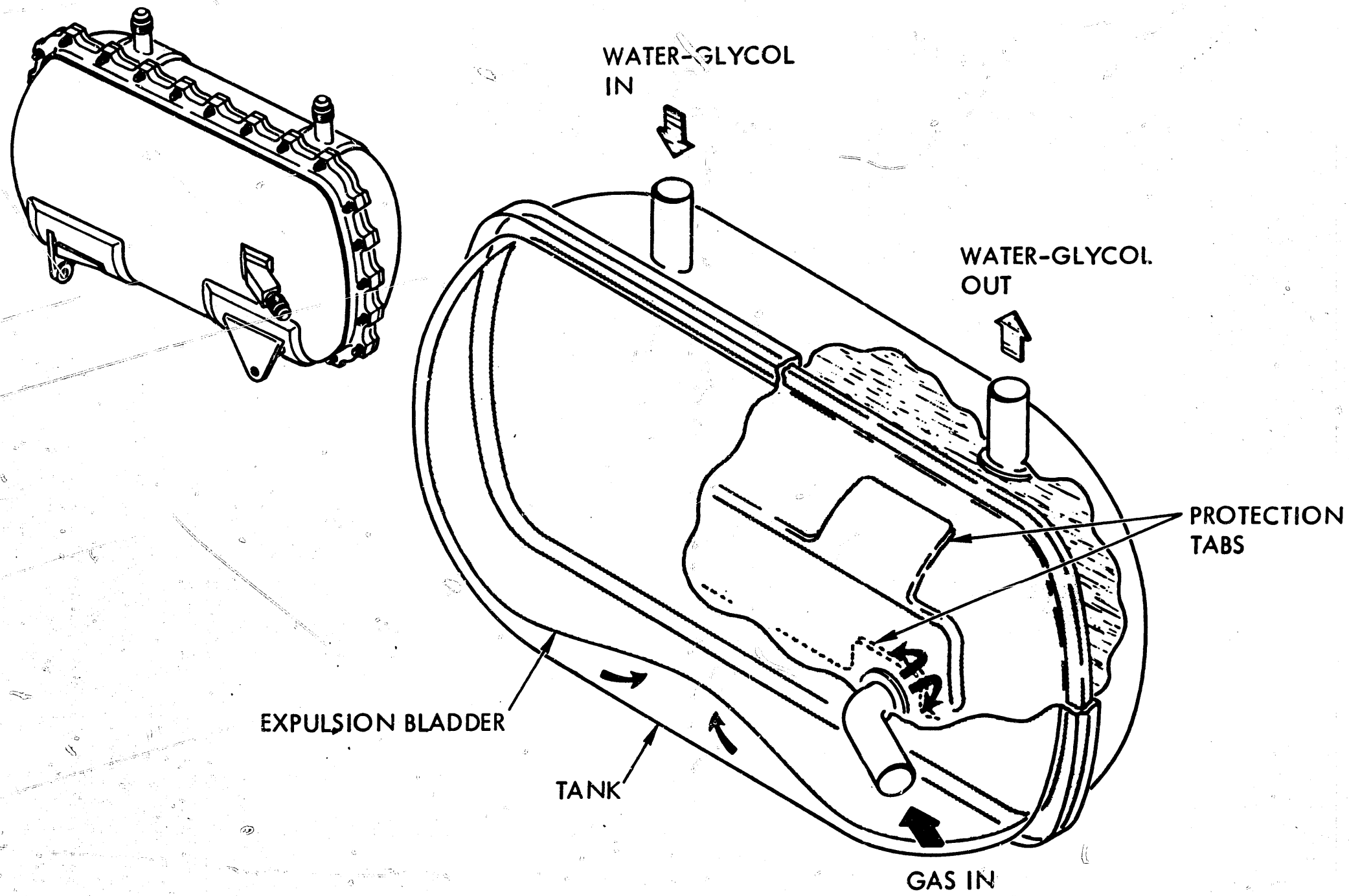
WATER-GLYCOL PUMP ASSEMBLY





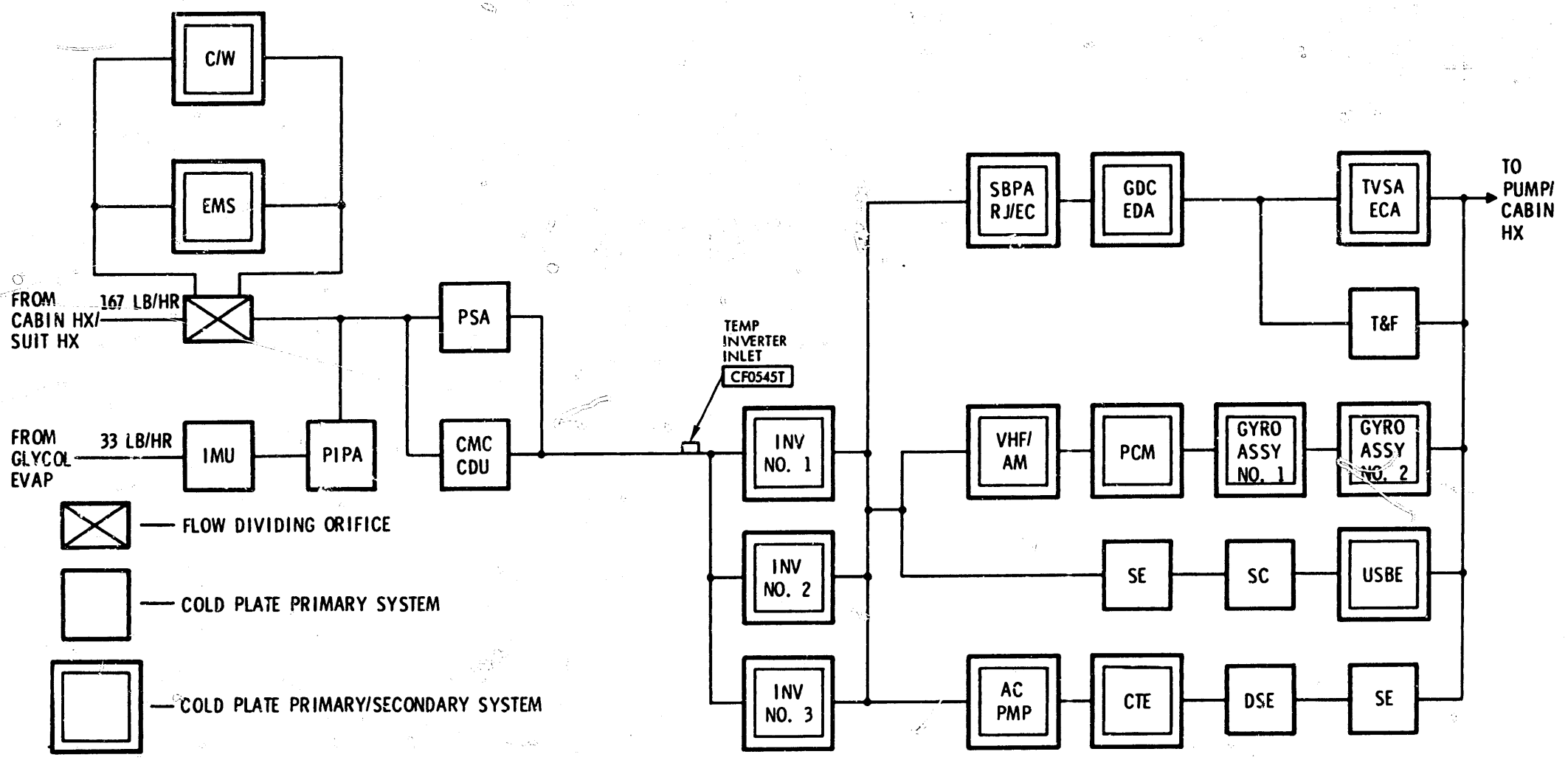
ECS 409A

WATER-GLYCOL RESERVOIR

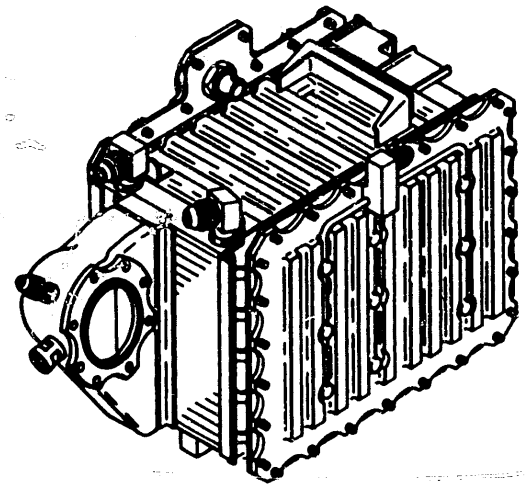


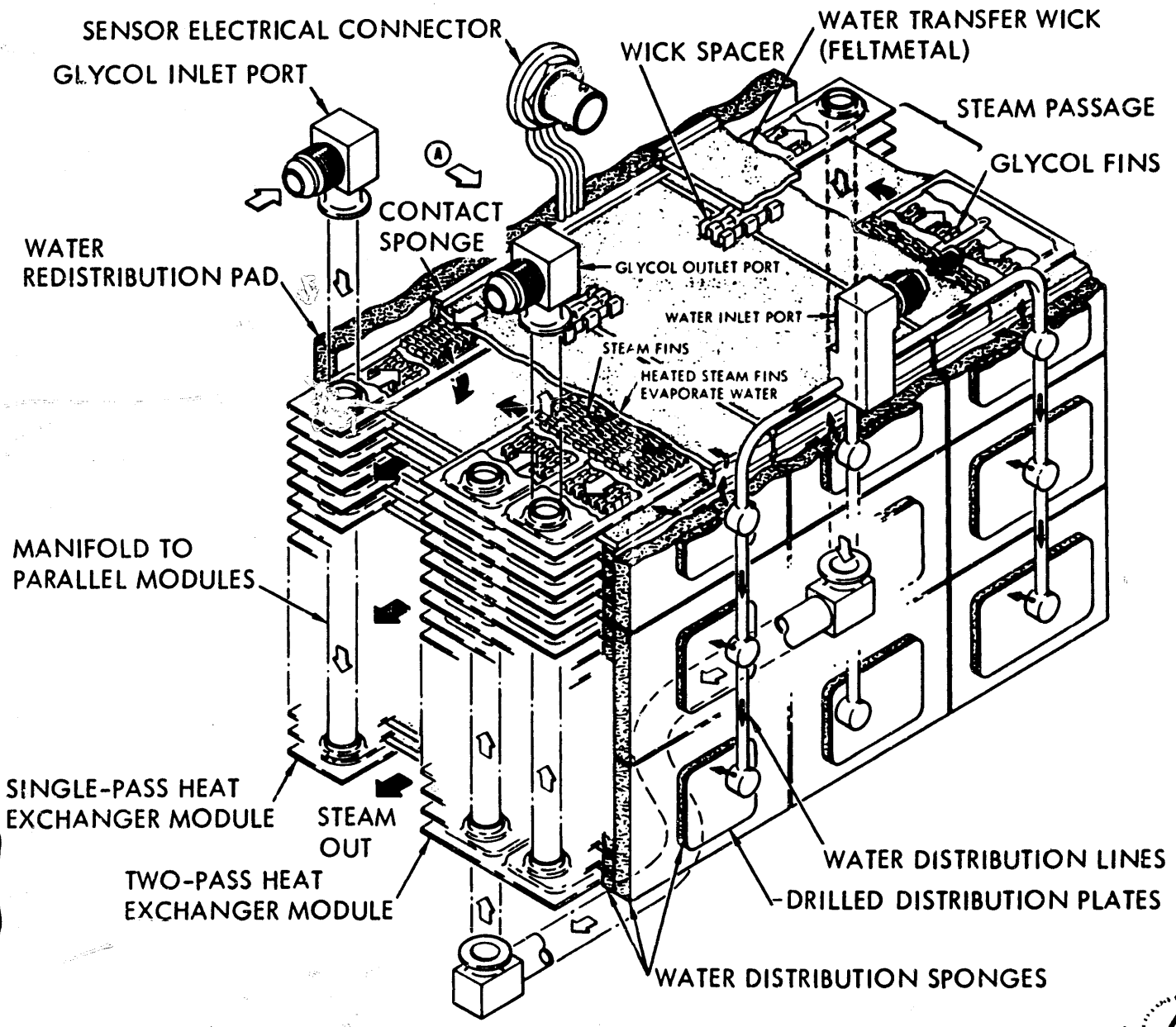
COLD PLATE NETWORK

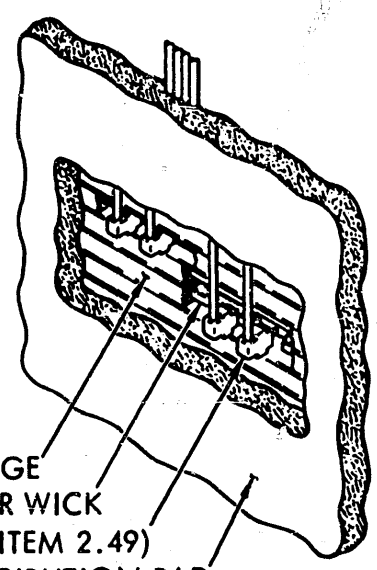
PRIMARY SYSTEM - BLOCK II



GLYCOL EVAPORATOR
BLOCK II
(TYPICAL)



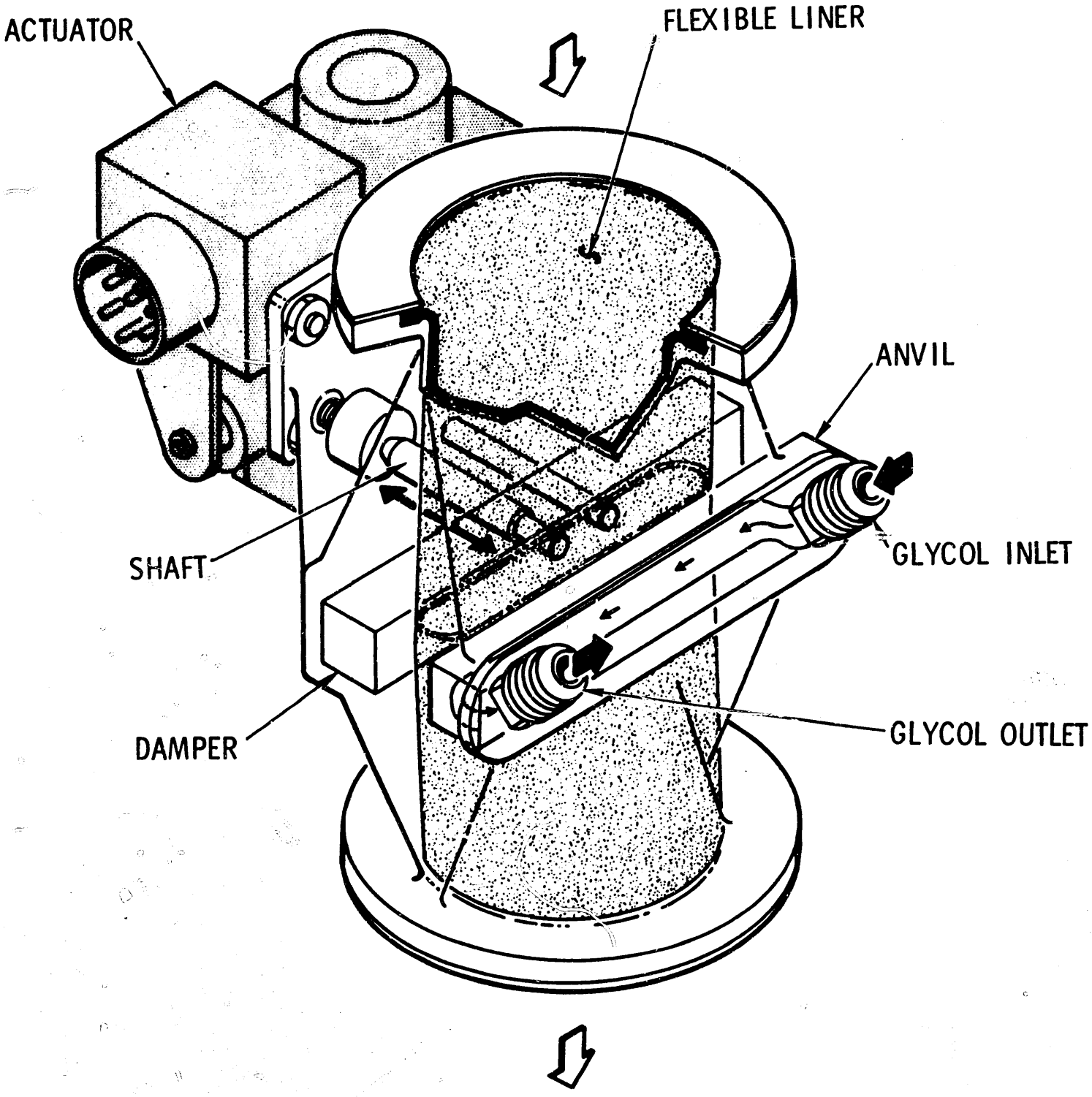


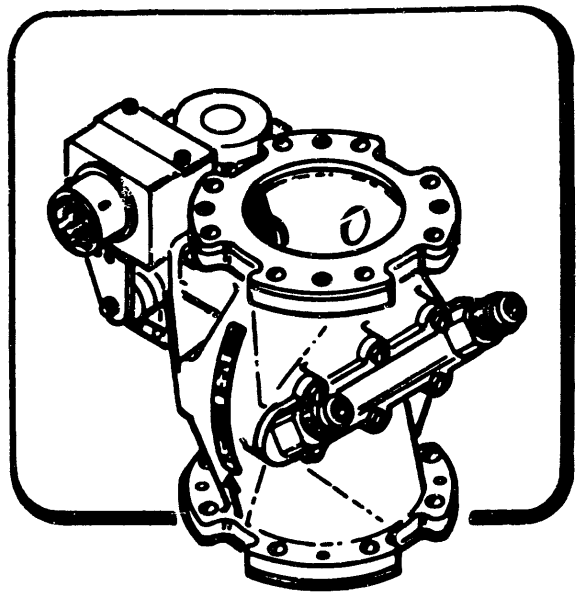


Ⓐ SENSOR DETAIL

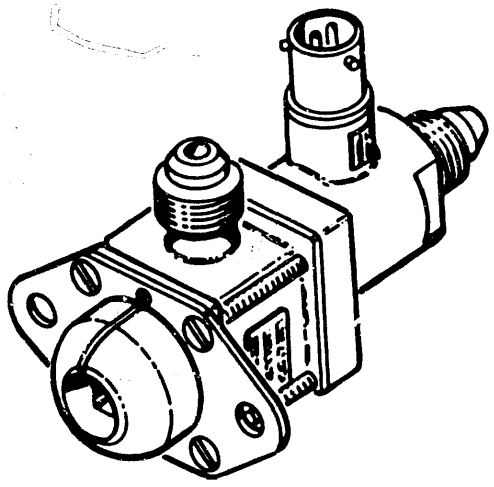
ECS-416 A

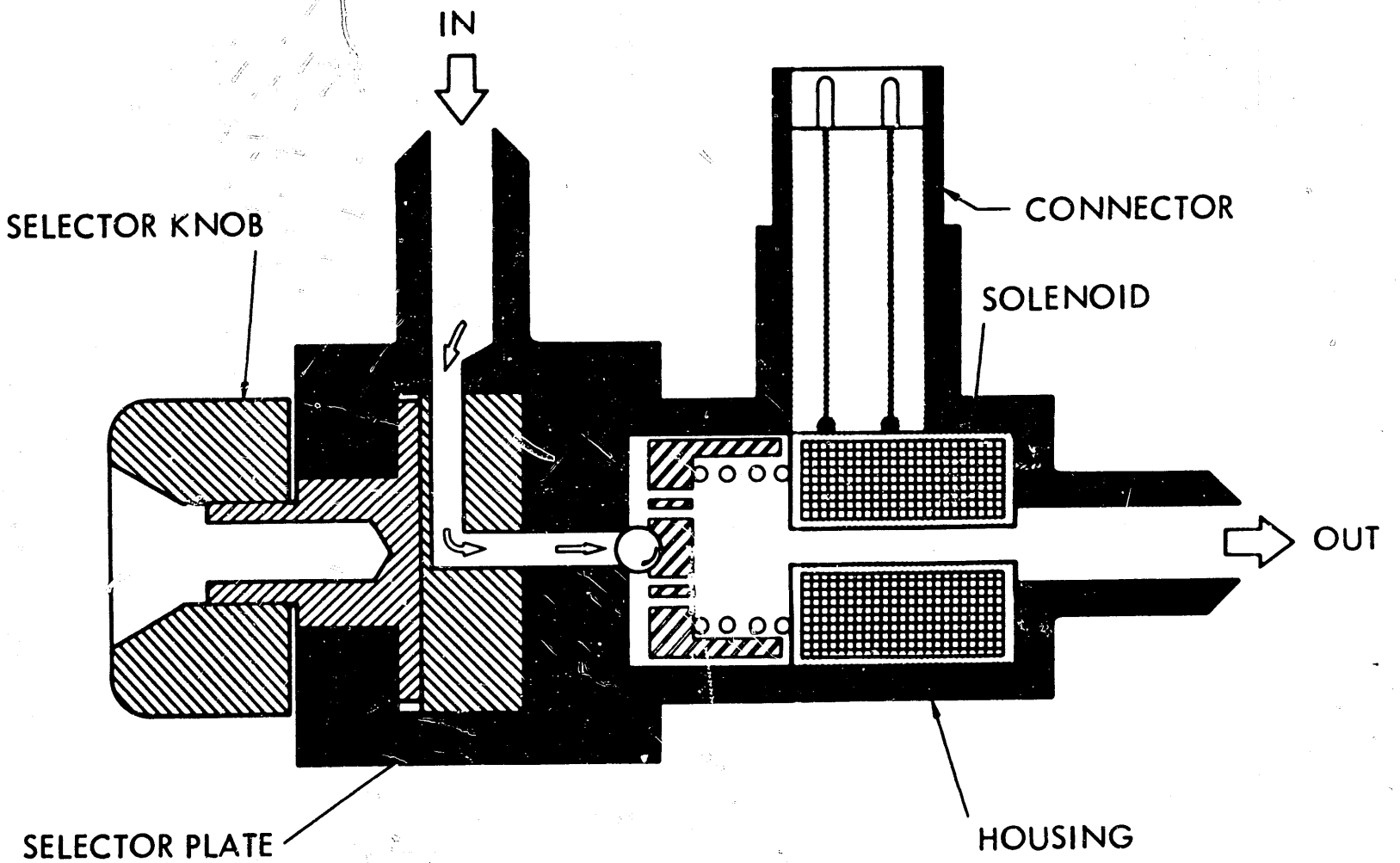
STEAM PRESSURE CONTROL VALVE





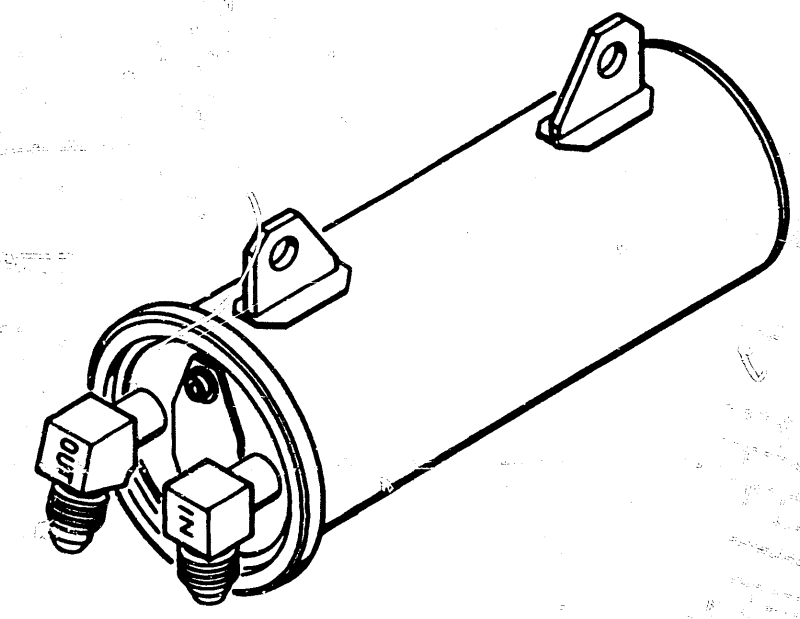
CONTROL VALVE EVAPORATOR WATER
(TYPICAL)





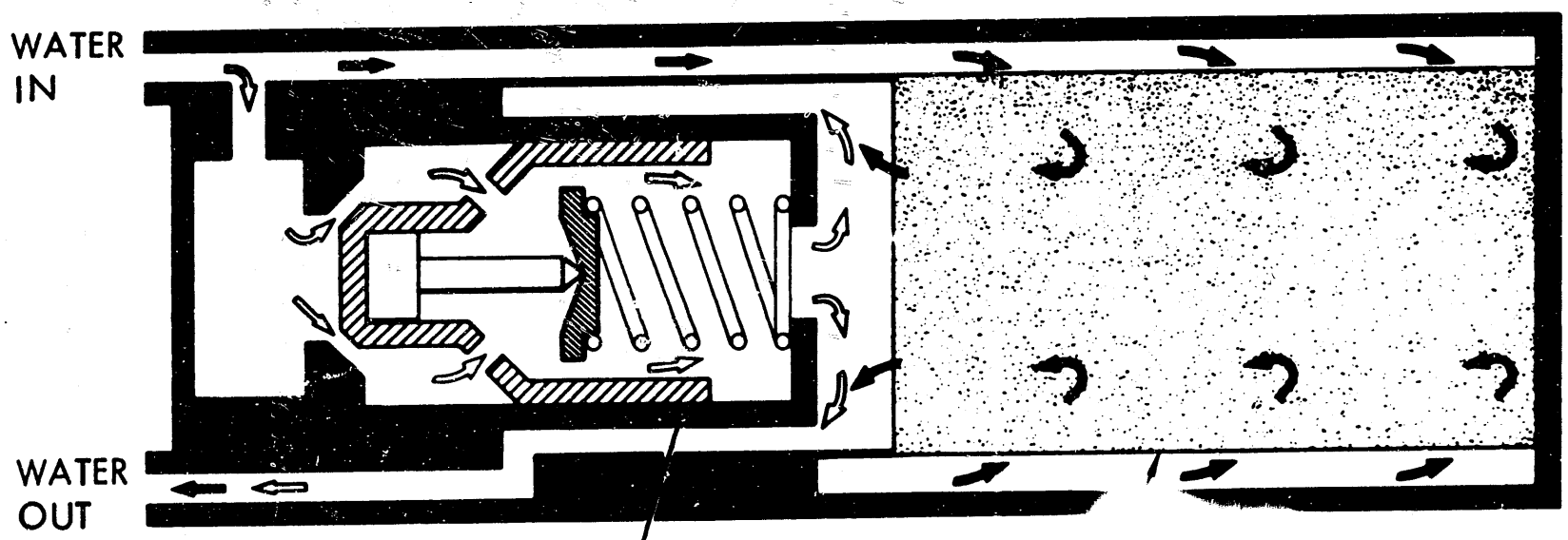
ECS-421

FILTER-EVAPORATOR WATER SUPPLY

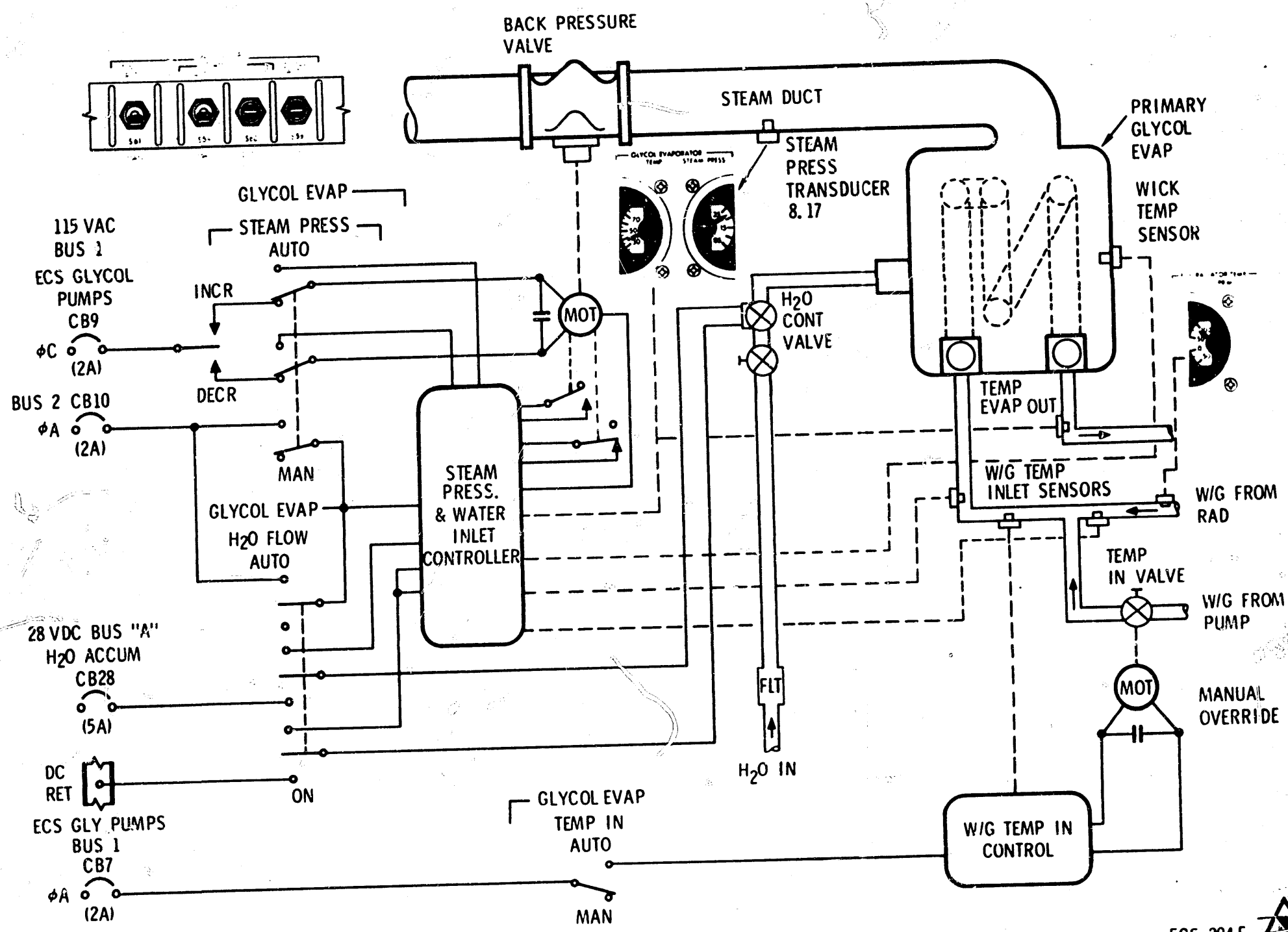


NORMAL FLOW (UNCLOGGED FILTER)

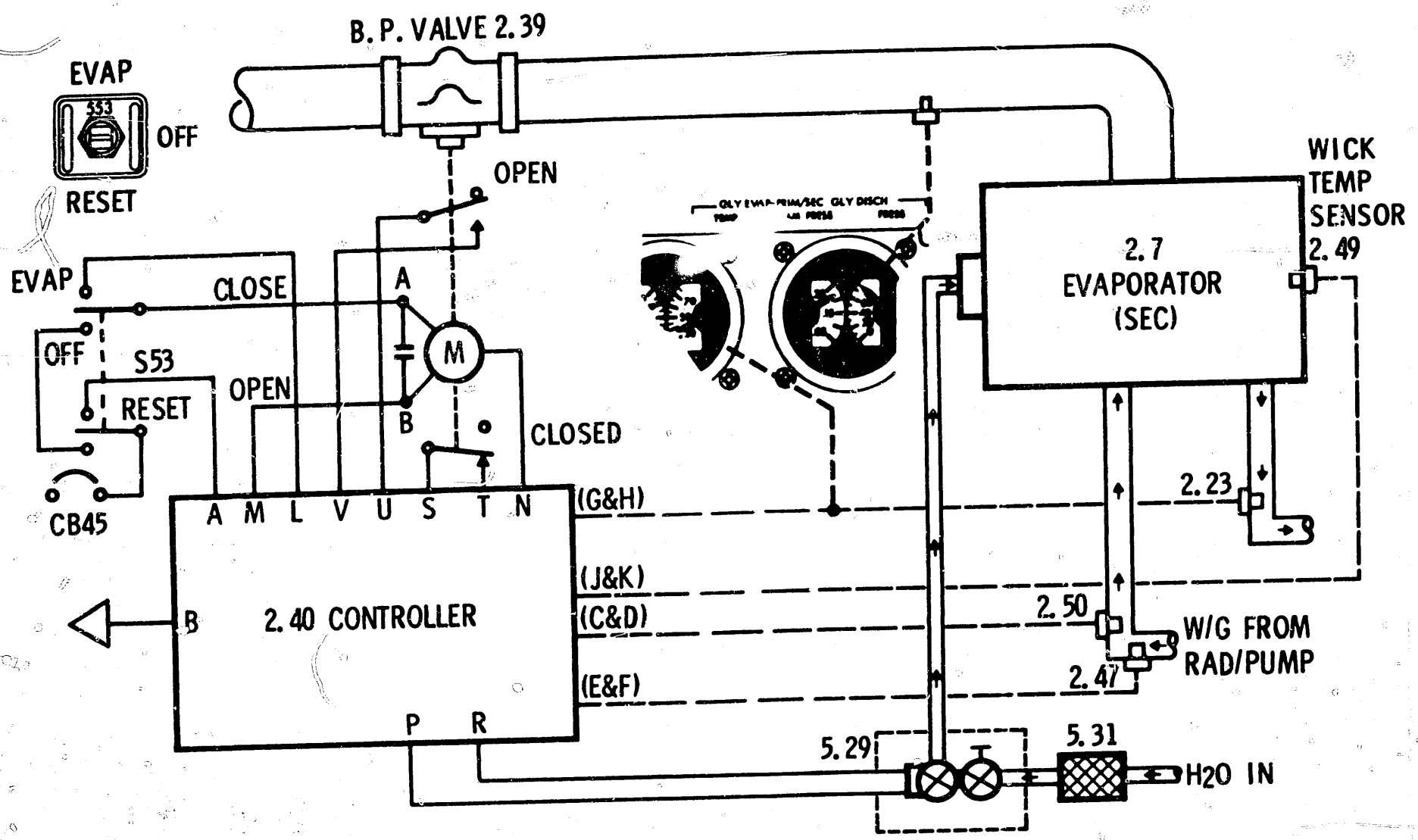
BYPASS FLOW (CLOGGED FILTER)



PRIMARY WATER GLYCOL EVAPORATOR CONTROL



SECONDARY W/G EVAPORATOR CONTROL



A	- POWER IN (AC)	M	- B.P. VALVE OPEN	C&D	- WICK TEMP BIAS
P&R	- WATER "ON"	L	- B.P. VALVE CLOSE	J&K	- WICK TEMP SIGNAL
S&T	- WATER "ON" INHIBIT	V&U	- OPEN POWER INHIBIT	G&H	- B.P. VALVE CONTROL (40°F-43°F)
N	- B.P. VALVE AC RETURN	E&F	- TEMP OVERRIDE (48°F-50.5°F)		

ECS-425B

Weight Statement F-X-A (cont'd.)

Comparison of Detail Weights of early and late ships, Standard Equipment

	Early F-X-A		Late F-X-A		Reason for Change
FURNISHINGS - CONTINUED					
Pilots cockpit enclosure assy.	68.5		68.0		
Baggage racks, cabin	19.5		19.5		
Toilet	10.5		10.5		
Wash basin with water tank	7.8		7.8		
Miscel. cabin equipment	25.0		25.0		
		76.7		100.7	
REMOVABLE EQUIPMENT					
Hand fire extng. & bracket(2)	11.2		11.2		
Flare brackets	9.0		9.0		
Flare release cable	2.5		2.5		
First aid kit	4.0		4.0		
Linoleum cabin floor	45.0		45.0		
Passenger safety belts (12)	-		24.0		No passenger belts on early ships
Pilots safety belts (2)	5		5		
		132.0		146.9	
ELECTRICAL EQUIPMENT					
Battery and Container (65 amp/hr)	75.		75.		
Main Connector panel	10.		10.		
Connector panels, nacelles	3		3		
Connector panels, wing	2		2		
Connector panels, tail	1		1		
Navigation lights	2		2		
Navigation light wiring & switch	12		12		
Conduit in wing for landing lights	-		8		
Wing bonding and terminals	-		9		
Cabin dome lights	3		3		
Entrance compt. light	.5		.5		
Cabin light wiring & switches	2.5		2.5		
Elect. equip't. on inst. panel	8.0		8.9		
Booster magneto	8.0		--		
Vibrator coils for starting	-		6.0		
Engine switch wiring	4.0		4.0		

Weight Statement F-X-A

Total Comparison of Detail Weights of Early and Late Ships, Standard Equipment

	Early F-X-A	Late F-X-A
Wing Group	1877	1905
Tail Group	164	171.8
Body Group	1091.2	1286.5
Landing Gear Group	663	681.9
Power Plant Group	2858	3080.3
Fixed Equipment	153	169.0
Furnishings	781.3	792.1
Removable Equipment	76.7	100.7
Electrical Equipment	132.0	146.9
Weight Empty	7796.2 lbs.	8334.2 lbs.

A. A. Gassner
Chief Engineer

Weight Statement F-X-A (cont'd.)

Comparison of Detail Weights of early and late ships, Standard Equipment

	Early F-X-A		Late F-X-A		Reason for Change
POWER PLANT GROUP		2858		3080.3	
Engine, Wasps (3) with magnetoes, hotspot, fuel pump.	1990		2124		Wasp "C" instead of "B"
Propeller	309		337.5		Heavier hubs
Exhaust collector rings with elbows, etc.	145.5		156.3		Larger exhaust for Wasp C.
Exhaust tailpipe and cabin heater	16.5		15.3		
Exhaust baffle plates	—		17.1		Added
Starter hand inertia, Eclipse Series 11	36.5		35.1		
Starter crank bracket and shaft extension	14.0		13.2		
Starter crank handle	2.5		2.5		
Fuel tanks with straps (2 tanks at 180 gals.)	170		181		Tanks of heavier gauge
Fuel gauge	5.5		5.5		
Fuel lines, cocks, strainers, hand pump	40		42.8		
Oil tanks with straps (3 at 15 gallons)	47		49.2		Tanks heavier gauge
Oil pipe lines	18		18.9		
Engine Controls	41.5		51.9		
FIXED EQUIPMENT		153.		163.	
Instruments	50		54.4		
Flying Controls	103		114.6		Dual elevator control instead of swing-over.
FURNISHINGS		781.8		792.1	
Main cabin floors	114		122.1		Reinforced plywood cover.
Front bagg. compartment floor	20		23.6		" " "
Rear " " "	16		23.0		" " "
Entrance" " "	20		26.0		" " "
Pilots cockpit floor	15		19.8		Reinforced dural
Front bulkhead and door	42		44.0		
Rear bagg. compt. bulkhead & door	24		42.0		Metal covered
Rear bagg. compt side walls	17		17		
Cabin side wall paneling	20		27.5		Heavier mahogany plywood
Miscellaneous Cabin Woodwork	15				
Cabin ceiling upholstery, mouldgs	18		11.5		
Cabin window glass & channels	98		89.7		5/16 glass instead 1/4
Cabin chairs (12)	110		120		
Cabin chair upholstery (12)	73		78		
Pilots seats	20		24.6		
Pilots seat cushions	13		13		

(Furnishings continued)

Weight Statement F-X-A

Comparison of Detail Weights of early and late ships, Standard Equipment.

	Early F-X-A		Late F-X-A		Reason for Change
WING GROUP		1877		1905	Friese ailerons
TAIL GROUP		164		171.8	
Stabilizer	62		60.2		
Elevator	50.5		54.0		
Fin	11.		11.		
Rudder	21.		20.3		
Brace Struts & Wires	19.5		26.3		Added top struts
BODY GROUP		1091.2		1284.5	
Fuselage Structure	570		628		Longer nose, misc. brackets cowl rings, tail for wheel
Window frames	55		60		New type windows
Covering battens	40		32.5		
Ceiling battens in cabin	10		10		
Fabric cover with seams	27		38.5		Heavier fabric
Dope and lacquer	23		33		Lacquer added
Nacelle Structure	126		155		Cowling rings added
Fuselage cowling	64		71.5		Tail end cowl omitted
Firewall	16		14		
Nacelle cowling	64		81		Heavier gauge
Nacelle cowling rings	14		14		
Pilots entrance door	10		11.7		Heavier metal cover
Main entrance door	20		23		" " "
Entrance door step and scuff plate	3.7		3.7		
Engine ring cowlings, three	--		65.7		Added on ships
Fairing wing to fuselage	--		3.1		" " "
Adjustable engine nose cowlings	38.5		38.4		
Pilots seat supports	10.0		13.4		
LANDING GEAR GROUP		663		821.9	
Axles and fairings	140		140		
Shock Absorber strut (rubber type)	112		112		
Brace strut & fairing	36		38		
Wheels 44x10 Sauzeide, with brakes	136		188		
Tires 44x10	130		118		
Brake Operating mech.	11		13.5		
Mudguard	16		16.4		
Tail Skid Assembly	32		—		
Tail Wheel Assembly	—		80.		Tail wheel on late ships

Weight AF-10-A - Pan American Airways

Extra Equipment installed at Factory

Radio shielding and bonding of wing, fuselage, light wires	35.00
Radio shielding of engines and booster magneto cables	19.50
Parachute flare brackets, supports and operating mechanism	32.00
Pressure fire extinguisher, pipes and brackets	24.00
Thermos carage and brackets	3.50
Roof ventilator and frame	6.00
Instrument board, cabin	4.50
Pioneer compass and bracket	5.50
Special cabin chair fasteners (Pan-Am. only)	12.00
Woodwork fuselage and wing emergency exits	25.00
Metal lining baggage compartments	25.00
Difference due to heavy tread tires	14.00
Assist loops in cabin (4)	2.00
Artificial leather upholstery cabin and entrance compartment	35.00
Woodwork air raft box in wing and metal cover	11.00
Total	253.00 lbs.

Weight AF-K-A Pan-American Airways

Extra Equipment Installed by Pan-American Airways

Radio equipment (telegraph system)	176#
2 Parachute flares at 19# each	38
P.A.A. cockpit ventilators	4
Add. tail skid bracing & cowling	4
Cabin carpet in aisle	3
Tail surface strut interbracing	5
TOTAL	230#

RIAS

Weight Empty late F-I-A (Standard equipped ship)		8334 lbs.
Not included in Pan-American ships:		
Townsend engine cowl rings	65.7	
Tail wheel (difference)	28.0	
		-93.7
Basic weight Pan-American ships		8240.3 lbs.
Extra Equipment installed at factory		268.0
Extra equipment installed by Pan-American		230.0
Weight Empty Pan-American ships		8723.3 lbs.

(Note actual sealed weight Pan-Am. #1016,)

Dept. Commerce license NC-395-E,

Sealed at Miami 1/5/31 8760.0 lbs.

(Unaccounted for 36.7 lbs.)

A.A. Gassner
Chief Engineer

FOKKER AIRCRAFT CORPORATION OF AMERICA

2/2/31
NO. OF PAGES

SERIAL NO. 226-H

S. A. T. F-X-A #1020 NC-469-E

Weight Empty (basic)	8334 lbs.
Additional Equipment installed at factory (see page 3)	619
Additional Equipment installed by S.A.T. (see page 4)	535
Total	9488 lbs.
Actually Scaled	9657 lbs.
Unaccounted for (add. paint on wing and fuselage, etc.)	169 lbs.

S. A. T. F-X-A #1030-1031 NC-401E-NC-402-E

Weight Empty (basic)	8334 lbs.
Additional Equipment installed at factory (see page 5)	413
Additional Equipment installed by S. A. T. (see page 4)	535
Total Weight Empty	9282 lbs.

S. A. T. P-X-A

Special equipment installed at factory - #1032, Dept. of Comm. NC-489-E (originally sold to Western Air)

Balsa wool soundproofing	115 lbs.
Radio shielding of engines	20
Radio shielding and bonding wing, etc.	36
Parachute flare brackets, etc.	32
Retractable landing lights	42
Pressure fire extinguisher and brackets	24
Dust shield lower longeron	16
Oil filtrators in oil tanks	30
Aerol strut landing gear	80
Electric inertia starters (difference)	48
Electric generator	20
Cables, switches, panels, for el. starter & lights	80
Metal lining baggage compartment	25
Earth inductor compass assembly	22
Ventilator in cabin roof	5
Galley	13
Instrument panel in cabin	6
Ash trays (12)	3
Map holder	2
Two extra dome lights	1
Total Special Equipment	619 lbs.

S. A. T. F-X-A #1029, 1030, 1031, 1055

Equipment installed by S.A.T.

Radio equipment consisting of:

Antenna mast and support, wire antenna, S-A transmitter and support, 9-A and S-A receiver and controls	119
Radio wiring	30
Radio dynamotor	42
Battery and dynamoto- sliding mount	35
30 amp. generator instead of 25 amp.	16
3 upper air intakes for carburetor	12
4 coat hangers in mail compartment	20
New type cabin heater (increase)	18
Townsend ring cowl changes	3
Paper cup holders in cabin	4
Tail surfaces strut interbracing	5
Heavier tail skid shoe	3
New ground starters, weight increase	3
Mail compartment added	100
2 flares	40
1 tool kit	15
1 cabinet for thermos bottles	20
Total Extra Equipment	555 lbs.

S. A. T. F-L-A #1030 and 1031
(originally sold to Universal Airlines)
(Dept. of Commerce # NC-801E and NC-802-E)

Special Equipment Installed at Factory:

Balsa wool soundproofing	116 lbs.
Retractable landing lights	42
Pressure fire extinguisher	24
Instrument board cabin	4.00
Radio shielding engines	19.50
Radio shielding and bonding wing, fuselage, light wires	35.0
Parachute flare brackets, supports, etc.	32.0
Pioneer compass #145	6.0
Metal lining bagg. compartment	25.0
Heavy tread tires	14.0
Galley in rear bagg. compt.	13.0
Aerol shock absorbers (difference)	80.0
12 ash trays in cabin	3.0
Total Special Equipment	413.0 lbs.

A.A. Gassner
Chief Engineer

FOKKER AIRCRAFT CORPORATION OF AMERICA

SERIAL NO.

	American F-X-A	Dutch F-XII
Length, overall	50'7"	57 ft. 5 in.
Wing Span	79'3"	75 ft. 5 in.
Height	12'9"	14 ft. 1 in.
Wheel track	20'	20 ft. 8 in.
Length of cabin	15'10"	16 ft. 0 in.
Width of Cabin	5'	6 ft. 7 in.
Height of Cabin	6'	6 ft. 3 in.
Total Wing Area	850 sq. ft.	893 sq. ft.
Engines	3 Wasp at 420 HP	3 Wasps at 420 HP
Rev's at cruising speed	1650	1650
Weight empty, equipped with radio	8,600 lbs.	10,230 lbs.
Crew	340 lbs.	340 lbs.
Fuel and Oil for 400 miles	1500 lbs.	1580 lbs.
Payload	3560 lbs.	3850 lbs.
Total Useful Load	5400 lbs.	5770 lbs.
Gross Weight	14,000 lbs.	16,000 lbs.
Wing Loading	16.5 lbs/sq.ft.	17.8 lbs/sq.ft.
Power Loading	11.1 lbs/HP.	12.7 lbs/HP.
Maximum Speed	153 MPH	137 MPH
Cruising Speed	127 MPH	118 MPH
Minimum Speed	64 MPH	68 MPH
Absolute Ceiling	20,000 ft.	16,700 ft.
Service Ceiling	18,000 ft.	14,750 ft.
Range, normal quantity of fuel		400 miles
Max. Range with full fuel tanks	360 gals. 720 miles	420 gals. 790 miles
Fuel Weight	360 " 2160 lbs.	420 " 3520 lbs.
Oil Weight	300 "	300 "
Payload with maximum range	2600 lbs.	2610 lbs.

Data for Dutch F-XII
taken from "Flight"
February 13, 1931

A. A. Tassner

ATLANTIC AIRCRAFT CORP.

NO. OF PAGES 8

PAGE 1

SERIAL NO. 226

OFFICIAL PERFORMANCE TEST
SUMMARY OF RESULTS

Date of issue Nov. 3, '28

I. (a) Airplane: Fokker Type: F-10 Transport Ident.No: N.C.-8010 (Sig. of Pilots _____

Total Wing Area: 714 sq. ft. Span: 71 ft. 2 in. Curve: Fokker

Wing loading: 17.52 lbs/sq.ft. lbs./ft. span: 175.7 Eff. power loading: 9.9 lbs/HP.

(b) Engines: Pratt & Whitney Type: Wasps (3) A.C.No.: - Factory No: not obtained

Rated H.P.: 410 each @ 1900 r.p.m. Effective HP.: L-426 L-1910 C-412 @ C-1870 r.p.m. R-426 R-1910

Standing r.p.m. L-1540 C-1560 R-1580 @ Water temp: Air cooled C-Strut temp: 15 C 29.242 ins hg.

(c) Propeller Mfg.: Standard Steel Prop Co. Dwg. No.: 1597 Diameter: 8'4"

Pitch: 18° at 42"R.

II. (a) Weights: As tested.

			Installation	Ballast
Weight empty with water	7586.00	lbs.		0.0 lbs.
Passengers (12) Inc. parachutes	0.00	"		2400.0 "
Equipment	302.55	"		0.0 "
Crew (Inc. parachutes)	400.00	"		0.0 "
Gasoline: 281 gals. @ 5.9 lbs/gal.	1659.00	"		0.0 "
Oil: 23-1/4 gals. @ 7.5 lbs/gal.	174.50	"		0.0 "
Total	10102.05	lbs.		2400.0 "
			Gross weight	12502.0 lbs.

Signature of loadmaster: Edward L. Pratt

(b) Armament and Items effecting parasite resistance in place during test? Yes.

If not, what was omitted? -

III (a) Conversion based on NACA International Standard.

Standard Altitude	LEVEL FLIGHT Speed M.P.H.	R.P.M.	CLIMB Speed M.P.H.	R.P.M.	Rate ft/min.	Time Min.
0	141.6	L-1910 C-1870 R-1910			830	0
5,000	Calibration of airspeed indicator not obtained therefore no speeds at altitude accompany this report.				604	7.0
10,000					380	17.4
15,000					157	37.1
20,000						
25,000						
Service Ceiling 16,270'					100	47.5
Absolute ceiling 18,500'					0	-

AAC-M

(b) Landing Spped - M.P.H. Speed of Min.Power - M.P.H. Max. Path Angle of Climb -
Distance to take off - Ft Distance Rolled on Landing - Ft.
Endurance, Full Throttle, Sea Level - 10,000 ft. ins. Climb - Service ceiling -
Cruising Speed (Approx. 80% of High Speed) 113.0 M.P.H. @ Not obtained R.P.M.
Endurance, Cruising Speed, Sea Level - Cruising Distance - Miles
Endurance entered only when actually accomplished. L-1900
Average Timed Speed 141.0 M.P.H. @ C-1860
R-1900 R.P.M.

(Inches Hg 29.242
(Temp. °C +13
(Equiv.Alt +640 ft.

Signature of Computer Paul H. Stanley

WEIGHT SCHEDULE F-X-A DE LUXE #1336
Dept. of Commerce License #NC-9790-Owner Lawrence Fisher, Detroit

Weight Empty, scaled (see attached sheet #1.)		9386 lbs.		9386 lbs.
Crew (2)	340		340	
Fuel	1680	(280 gals)	3000	(500 gals)
Oil 45 gals.	338		338	
Payload	1856		536	
Useful Load		4214 lbs.		4214 lbs.
Gross Weight		13,600 lbs.		13,600 lbs.

AAGardner
Chief Engineer

WEIGHING OF SHIP AP-XA #1036

Aug. 14th, 1930

Right Wheel	4187 lbs.
Left Wheel	4340
Tail Wheel	859
Total	9386 lbs.

This weight includes:

Electric Generator	20 lbs.
Electric Inertia Starter (increase of weight)	48
Radio shielding engines & Booster Magneto Cables.	20
Radio Shielding and Bonding of Wing, Fuselage and Electric Light Wires	35
Phister pressure fire extinguisher	24
Cables, switches, connector panels, etc. for electric inertia starter	66
Metal lining rear baggage compartment	25
Galley in rear baggage compartment	13
Ice box	18
Balsa wool soundproofing cabin	115
Landing lights with mechanism	42
2 Wiley flare assemblies	67
Aerol shock absorber struts (weight dif.)	80
Heavy Tread tires	14
Instrument board cabin	4
Third fuel tank	85
Pipelines for third fuel tank	15
Increase furniture weight over 12 standard chairs	80
Earth inductor compass	14
Townend rings	55
Drinking cup holders	5
Baggage box	25
Total	946 lbs.

O. L. Wallace

O. L. Wallace
Dept. of Com. Inspector

Paul E. Mayer

Paul E. Mayer
Executive Engineer

ATLANTIC AIRCRAFT CORP.

NO. OF PAGES

SERIAL NO.

PAGE

Actual Weight F-X #2 April 1928

Right Wheel	3735 (flying position)	
Left wheel	3700	
Tail skid	575	
	8010 lbs.	
Tare	103.5	
	7906.5	
Gas 65 gals. 390		
Oil 30 gals. 233		
	623	
	7283.5 lbs.	
12 chairs and cushions	165	
2 doors	24.5	
Fuselage cowling	38	
side cowlings	55	
Linoleum cabin	41.0	
	7607.0 lbs.	7607.0
Deductions	292	- 590
WEIGHT EMPTY	7315	7017.0

ACTUAL WEIGHTS F-X

March 1928

Fuselage structure	F X	4gk	F F - 510
Engine Nacelle		63	
Floors: Station 4-5		42 lbs.	
5-6		24.5	
6-7		23.5	
7-8		24.0	-114
8-9		20.5	
9-10		16.0	
front comp:		19.5	
All wooden floors		170.0	
Door and wall baggage compartment		22	
Walls rear baggage compartment		12	
Window frames, wood,		24-1/2	
Battens for fuselage cover		21	

F-X Actual Weights

Wing Assembly with Ailerons, Aileron cables, aileron pulleys, all fittings, el. wire conduit, insp. doors			1764 lbs.
Fuel tanks	center	(2)	81 lbs.
" "	outer	(1)	86
	FX		1931.
FX A' Wing			1887 (10-31-28)
2 tanks			128
tank support			20
			2035 *

4/12/28

Actual Weight F-X

Haywood W. Chair	8-1/4 lbs.
Chair with velour cushion	13-3/4
Linoleum cabin floor	35-3/4
Linoleum entrance floor	5-1/4
Battery with box	74
Thermos Bottle	4
Brake Shaft Assembly	20
Cabin windows, all glass,	73
cabin window channels, ass'y	10-1/2
mail box	49
Eclipse hand inertia starter M 1907 without hard crank	20-1/4
Balsa wool F-X #4 (Richfield)	113
Oil tank with strainer, Outboard	22-3/4
Oil tank with strainer, center	24-3/4
Weight of one strainer with flange	5
Cowling nacelle, ass'y (one)	47
Cowling fuselage nose	31
Nose spinner engine (F-X No. 1)	9
Pilots entrance door	8-1/2
Cockpit floor (Alum.)	13-1/2

ATLANTIC AIRCRAFT CORP.

NO. OF PAGES

SERIAL NO.

PAGE

Actual Weight Est 4-12-28

Landing Gear:

Axle Assembly with brake anch, flanges, etc.	48
Shock Absorber strut assembly with Streamline Cowling, wheelguard	62
Wheel, Semedde with Brake drum	71
Tire and tube 44x10	63
Diagonal Strut Ass'y.	14
	258 lbs.
Total Landing Gear	516 lbs.

ATLANTIC AIRCRAFT CORP.

NO. OF PAGES

SERIAL NO.

PAGE

8-4-28

Fuselage F-L-A #1005

Structure with old style brace wires, complete, painted 490.5 lbs.

F-10 718 sq. ft. wing

Aspect ratio $\frac{71.5^2}{718} = 7.1$

F-10 850 sq. ft. wing.

Aspect ratio $\frac{79^2}{850} = 7.35$

March 3, 1931

FOKKER AIRCRAFT CORPORATION OF AMERICA

NO. OF PAGES

SERIAL NO.

F-X - Single Engined (Hornet B)

Gross Weight		8,600 lbs.
Wing Area		748 total 690 useful
Engine		Hornet "B" 575 HP at 1950 rpm
Power Loading		15 #/HP
Wing Loading		12.5 #/sq.ft.
Maximum Speed		128 MPH
Cruising Speed		106 MPH
Landing Speed		57.3 mph
Rate of climb at sea level		500 ft/min.
Absolute Ceiling		12,500 ft.
Service Ceiling		10,000 ft.
Weight Empty		5250 lbs.
Fuel (5 hrs.) 150 gals.	900	
Oil 15 gals.	105	
Crew (one)	140	
Payload		2205 lbs.
Total Useful Load		3350 lbs.
Gross Weight		8600 lbs.
Sales Price $30,000.00		
Sales Price per rated H.P.		$52.20

$\frac{W_{UL}}{HP}$ x V cruis. = 572

Range 530 miles

Operation cost HP/hr. cent 8.49

Transport. Cost 100 #/mile cent 4.10
(full payload)

A. A. Isaacs
Chief Engineer

AF-10-A Weight Increase of Late over First Ships.

Window frames (fixed windows)	10
Covering battens (closer spaced)	15
Covering fabric and dope	5
Fuselage front cowling (longer nose)	11
Nacelle cowlings (heavier material)	8
Aerol shock absorber struts (increase)	52
Tail wheel instead of tail skid	30
Engines (Wasp C over B)	170
Exhaust (larger size)	30
Fuel system	16
Townend cowling rings	60
Cabin flooring reinforced	20
Cabin bulkheads, trim, etc.	15
Balsa wool sound proofing	115
Pilot's cockpit top reinforced	10
Metal lining rear baggage compartment	26
	592

Special Equipment - AF-10-A
Universal Air Lines

Generator	32
Pressure Fire extinguisher	24
Galley	15
Landing lights, retractable	42
2 Wiley flares Assembly	67
Heavy tread tires	14
Instrument board in cabin	4
Radio Shielding - engines	19
Radio bonding of ship	35
Pioneer compass #145	6
Ash trays in cabin	5
Western Electric Radio Equipment	190
	461

1043

ATLANTIC AIRCRAFT CORP.

NO. OF PAGES

SERIAL NO.

PAGE

7-7-28

Estimated weight wing F-L-A (850 sq.ft.)

F-10-A #1010
Sealed - Nov. 1928

	F-L-A		C-2A
Front Spar		Sealed	
top flange	142	152	122
bottom flange	75	80	77
webs	160	165	189.5
blocks at fittings	49	49	44
spar web stiffness	18	19	14
glue and nail	15	25	8.5
TOTAL FRONT SPAR	459	490	455
Rear Spar			
top flange	139	145	154.5
bottom flange	72	80	80
webs	121	130	115.1
blocks at fittings	30	30	8
spar web stiffness	15	19	10
glue and nail	15	22	7.4
TOTAL REAR SPAR	392	426	375
Wing Attach. fittings, control fittings, cables, bolts, insp. doors, bonding, wire conduit.	115	115	111
Ribs	211	180	208
Wing covering	400	430	415
Aux. spar for ailerons, stringers, wing tip bow, (Detach. tail edge spar (2)	62	62	69
Air speed ind. tubes	8	9	7.3
Nails and glue	75	75	50
Tape and paint	80	80	65
Total Wing Weight	1802	1887 lbs.	1755.3

AAC-26

ATLANTIC AIRCRAFT CORP.

NO. OF PAGES 2

PAGE 1

SERIAL NO.

OFFICIAL PERFORMANCE TEST
SUMMARY OF RESULTS

Date of issue Nov. 5, '28

(Sig. of Pilots) _____

I. (a) Airplane: Fokker Type: F-10 transport Ident. No: N.C.-8010

Total Wing Area: 714 sq. ft. Span: 71 ft. 2 in. Curve: Fokker

Wing loading: 17.52 lbs/sq.ft. lbs./ft. span: 175.7 Eff. power loading: 9.9 lbs/HP.

(b) Engines: Pratt & Whitney Type: Wasps (3) A.C.No.: - Factory No: not obtained

Rated H.P.: 410 each @ 1900 r.p.m. Effective HP.: L -426 L-1910 C -412 @ C-1870 r.p.m. R -426 R-1910

Standing r.p.m.: L-1540 C-1560 R-1560 @ Water temp: Air cooled C-Strut temp: -15 @ 29.242 ins hg.

(c) Propeller Mfg.: Standard Steel Prop Co. Dwg. No.: 1597 Diameter: 8'4"

Pitch: 18° at 42"R.

II. (a) Weights: As tested.

			Installation		Ballast	
Weight empty with water	7566.00	lbs.			0.0	lbs.
Passengers (12) Inc. parachutes	0.00	"			2400.0	"
Equipment	302.55	"			0.0	"
Crew (Inc. parachutes)	400.00	"			0.0	"
Gasoline: 281 gals. @ 5.9 lbs/gal.	1658.00	"			0.0	"
Oil: 23-1/4 gals. @ 7.5 lbs/gal.	174.50	"			0.0	"
Total	10102.05	lbs.			2400.0	"
				Gross weight	12502.0	lbs.

Signature of loadmaster: Edward L. Pratt

(b) Armament and Items effecting parasite resistance in place during test? Yes.

If not what was omitted? -

III (a) Conversion based on NACA International Standard.

Standard Altitude	LEVEL FLIGHT Speed M.P.H.	R.P.M.	CLIMB Speed M.P.H.	R.P.M.	Rate ft./min.	Time Min.
0	141.6	L-1910 C-1870 R-1910			830	0
5,000	Calibration of airspeed indicator not obtained therefore no speeds at altitude accompany this report.				604	7.0
10,000					320	17.4
15,000					157	37.2
20,000						
25,000						
Service Ceiling 18,200'					100	67.3
Absolute ceiling 18,800'					0	-

(b) Landing Speed - M.P.H. Speed of Min.Power - M.P.H. Max. Path Angle of Climb -
Distance to take off - Ft Distance Rolled on Landing - Ft.
Endurance, Full Throttle, Sea Level - 10,000 ft. ins. Climb - Service ceiling -
Cruising Speed (Apprax. 60% of High Speed) 113.0 M.P.H. @ Not obtained R.P.M.
Endurance, Cruising Speed, Sea Level - Cruising Distance - Miles
Endurance entered only when actually accomplished. L-1900
Average Timed Speed 141.0 M.P.H. @ C-1900
R-1900 R.P.M.

(Inches Hg 29.248
(Temp. °C -13
(Equiv.Alt -660 ft.

Signature of Computer Paul H. Stanley

AAC 18

ATLANTIC AIRCRAFT CORP.

7/12/28

NO. OF PAGES 1

SERIAL NO.

PAGE 1

Extra Weights New F-10A, W. A. E.

1.	Electric Inertia Starter, Switch, Cable	36.25			
	Hand Inertia Starter	20.25			
		16.00	x 3	=	48
2.	Oil Strainer 5 x 6				30
3.	Balsa Wool Soundproofing (Richfield)				113
4.	Automatic type windows with frames	180			
	Sliding windows with frames	103			
		77			77
5.	Landing lights 2 x 9.5	19			
	Landing light retracting mech.	12			
	Landing light cable	4			
		35			35
6.	Metal lining baggage com., add.				10
7.	Mahogany lining cabin walls.				48
8.	Extra fuel tank (first 3 ships)				83
9.	Dust shields on rear lower longerons.				16
10.	Pantry equipment.				20
	Total (not incl. in Pan American ships) (but required by W.A.E.)				480#

Included in first F-X's.

#2 Oil strainer	30	
#3 Balsa wood partially	50	
#7 Mahogany cabin lining	48	
#9 Dust shields	16	
		144#
		336#
Mailbox (not [illegible] on F-XA)		49
Total estimated increase F-XA		287#

AAC-M

Weights F-1

Eclipse Hand Inertia Starter without crank			20.25 lbs.
Eclipse Electric Inertia Starter without crank			31.00
Add weight for el. In. Cable, Switch			5.00
Balsa wool sound proofing #1003			113
Oil strainer W.A.E. ships 6x5			30
Chair cushions 12x5.5			66
Automobile type windows:			
Window glass	6-1/2x12	78 lbs.	
Window regulator	2-1/2x12	30	
Window channels	1 x 24	24	
Panels, bolts, etc.	4x12	48	
		180 lbs.	

Sliding windows:

window glass	73 lbs.	
channels	10-1/2	
frame	20	
	103-1/2 lbs.	

F-X Exhaust for Hornet and Wasp	
13 sq. in. collector ring with elbow (side engine)	32 lbs.
Trumpet	10 lbs.
Flanges at cylinders and flexible connections	9
Total exhaust (nacelles)	51 lbs.
F-X adjustable pilots seat with rubber cord	10 lbs.
F-X Exhaust small type Wasp	
10 sq. in. collector ring with elbow (side eng.)	26 lbs.
Trumpet	9.5
Flanges at cylinders and flex. conn.	9
Total exhaust (nacelle)	44.5 lbs.

Tail Wheel F-X-A		
Fork F-2035		21.5
Wheel with tire, 20x4		14.0
Center post assembly		
F-2037-8 tube		
F-2032 casting		
SKF Bearing #1008		
Rubber bumper and clamps		
Fork swivel pin F-2039-2		0.5
Axle F-2037-5		1.25
Latch assembly with band		5.25
Bronze casting F-2036		1.5
8 rubber rings		2.3
4 Steel springs with cable		3.0
Tail Wheel Assembly		60.8
Tail skid assembly	30	
Aux. Tail skid	2	32
Increase of weight		28.8

F-X-A Calculated Weight Empty

Wing			1905
Tail Group			172
Fuselage Group			1289.6
Fuselage Structure	628.0		
Firewall	14.7		
Pilots seat supports	13.4		
Window frames	60.0		
Fairing strips	32.5		
Fuselage cowling	73.4		
Covering	55.6		
Dope	33.0		
Fuselage entrance doors	34.7		
Door step	3.7		
Engine nacelles	105.2		
Nacelle cowl	81.0		
Nacelle cowling rings	14.2		
Townsend cowls with brackets	65.7		
Engine nose cowls & controls	33.4		
Fairing strips wing to fuselage	3.1		
Landing Gear Group			695.3
Axles and fairings	140.0		
Shock strut (Aerol)	155.6		
Brace strut	35.8		
Wheels (Bendix)	156.0		
Tires and tubes	118.0		
Brake operating mech.	13.5		
Mudguards	16.4		
Total Landing Gear		635.3	
Tail Wheel Assembly		60.0	
Power Plant Group			3071.0
Engines incl. radio shielding	2124.0		
Propellers (3)	357.5		
Exhaust collector rings	156.3		
Exhaust baffles	17.1		
Starter crank bracket & extension	12.6		
Starters, hand inertia	65.1		
Fuel tanks (2) with straps	180.0		
Fuel pipe lines, fittings, cocks, etc	56.4		
Oil tanks	49.2		
Oil pipe lines	18.9		
Engine controls	51.8		
Starter crank	2.0		

F-X-A Calculated Weight Empty (Cont'd.)

Fixed Equipment		1004.5
Instruments	54.4	
Sufaee Controls	114.6	
Pilots Seats	24.6	
Instrument panel support	2.0	
Pilots floor	19.3	
Cabin floors, total	214.1	
Bulkheads	130.0	
Cabin Ceiling	5.5	
Cabin side walls	33.5	
Cabin window glass	50.0	
Front bagg. compt. lining	4.0	
Rear bagg. compt. walls	23.0	
Toilet and wash basin	18.3	
Pilots cockpit enclosure	68.0	
Cabin heater assembly	17.0	
Passengers chairs (12)	120.0	
Passengers safety belts (12)	24.0	
Passengers chair cushions	36.0	
Pilots seat cushions	6.0	
Pilots safety belts	5.0	
Fire extinguishers (2) (hand)	11.2	
First aid kit	4.0	
Linoleum, cabin floor	20.0	
Electrical Equipment		165.0
Battery and Container	75.0	
Vibrator coils (6)	6.0	
Navig. lights	2.0	
Conduit in wing for light wires	21.8	
Wing bonding and terminals	9.0	
Wiring instrument panel to center engine	12.0	
Wiring to outboard engines	18.0	
Cabin dome lights	8.6	
Spark control	8.7	
El. equipment on instr. panel	8.9	

F-X-A Redesign

WING GROUP	1905.
TAIL GROUP	172.
FUSELAGE GROUP	1290.
LANDING GEAR	695.
POWER PLANT	3071.
FIXED EQUIPMENT	1005.
ELECTRICAL EQUIPMENT	165.
WEIGHT EMPTY (Stand. Equipment)	8303 lbs.

Fuel	360 gals.	2160
Oil	30 "	225
Crew (2)		340
Payload		2972
Total Useful Load		5697 lbs.
GROSS WEIGHT		14000 lbs.

F-X-A Redesign

Special Finishing and Special Equipment

1.	Balsa Wool soundproofing	110 lbs.
2.	Generator 15 V 15 Amp. & control box	23.0
3.	Nl. Inertia starters instead of hand starters	40.2
4.	Landing lights, Ryan retractable	9.0
5.	Landing light retracting mechanism	17.6
6.	Add. el. wiring for generators, starters, landing lights, switches	26.0
7.	Pressure fire extinguisher (ace)	24.0
8.	2 Wiley flares assemblies, incl. flares	60.0
9.	Cabin baggage racks	19.5
	Total Special Equipment	329.3 lbs.

Weight Empty Standard Ship	8303.0
Weight Empty, Special Equipment.	8632.0 lbs.

Fuel	360 gals.	2160
Oil	30 "	225
Crew	(2)	340
Payload		2643
Total Useful Load		5368.0
GROSS WEIGHT		14000.0 lbs.

A. A. Gassner

F-X-A Redesign

The following calculation of weight empty of F-X-A redesigned plane is based on actual scaled weights of F-X-A #1064 (Marine Corps) as per Detail Weight Statement of Glendale Plant dated January 15, 1931.

Weight of wing has been reduced by 154 lbs. as calculated in Glendale letter of 1/20/31. This takes into consideration bringing wing detail dimensions back to the ones of original F-X-A wings, and eliminates overweight as brought into subsequent articles.

The wing as calculated is equipped with Friese type ailerons.

Townend engine cowls are included.

Weight of special equipment, as electric inertia starters, generators, landing lights, flares and pressure fire extinguisher not included in this weight statement and is to be deducted from payload or from fuel load for ships so equipped.

The study takes into consideration the new Approved Type Certificate gross weight of 14,000 lbs. A comparison of the old F-X-A and the redesigned F-X-A, both standard equipped ships is as follows:

	Old F-X-A		Redesigned F-X-A	
Weight Empty		7780 lbs.		8302 lbs.
Fuel 360 gals.	2160 lbs.		2160	
Oil 30 "	225		225	
Crew (2)	340		340	
Payload	2595		2972	
Total Useful Load		5320		5697
GROSS WEIGHT		13100		14000

Increase of gross weight	6.87%
" " weight empty	6.73%
" " payload	14%

FOKKER AIRCRAFT CORPORATION OF AMERICA

NO. OF PAGES

SERIAL NO.

PAGE

COPY

To - Mr. Dunton

2-1-29

3rd Page

By checking over the table on page two, you will see that between 11:35 and 11:40 we climbed the ship 800 feet in a period of five minutes with only the two out-board engines turning around 1700 R.P.M.; at 11:40 to 11:45 we gradually reduced the R.P.M. to 1600, maintaining our altitude with an air speed of some 80 miles an hour; from 11:45 to 11:50 we flew the ship with the two out-board motors, turning some 1500 R.P.M. We still maintained our altitude of 2800 feet and had an air speed of 70 miles per hour. We then reduced the R.P.M. to 1480. This appears to be the minimum R.P.M. that we can keep the ships in level flight with two motors, with any degree of safety. We then flew the ship with one out-board motor and the center engine. It then handled very well and the altitude and climb appeared to be approximately the same as with the two- out-board engines only.

As the temperature of the engine was decreasing as we decreased our air speed and would not go up when we maintained normal R.P.M.'s, the length of flight was considered sufficient to prove that these ships can be safely operated under two motor conditions with full load.

By W. O. Snyder

Divisional Engineer

R&C-36

FOKKER AIRCRAFT CORPORATION OF AMERICA

SERIAL NO.

PAGE

NO. OF PAGES

TIME	LEFT ENGINE				CENTER ENGINE				ALTITUDE	AIR SPEED
	R.P.M.	Oil Pres.	Oil Temp.	Gas Pres.	R.P.M.	Oil Pres.	Oil Temp.	Gas Pres.		
11:30	1650		55	5	800		50	5	2000	82
11:35	1700	75	58	5	800	70	50	5	2000	82
11:40	1640	75	63	5	600	70	46	5	2000	82
11:45	1600	75	65	5	800	70	45	5	2000	82
11:50	1800	70	65	5	700	70	41	5	2000	82
11:55	1460	70	65	5	600	70	40	5	2000	82
11:58	1200	70	65	5	1700	80	60	5	3000	82
12:02	600	90	55	5	1600	80	60	5	2200	82

TIME	RIGHT ENGINE				ALTITUDE	AIR SPEED
	R.P.M.	Oil Pres.	Oil Temp.	Gas Pres.		
11:30	1700		50	7	2000	82
11:35	1750	80	55	7	2000	82
11:40	1680	80	58	7	2000	82
11:45	1600	80	65	7	2000	82
11:50	1870	75	65	7	2000	82
11:55	1460	80	65	7	2000	82
11:58	650	80	65	5	3000	82
12:02	600	80	55	5	2200	82

FOKKER AIRCRAFT CORPORATION OF AMERICA

NO. OF PAGES

SERIAL NO.

PAGE

COPY

PAN AMERICAN AIRWAYS, INC.
MEMORANDUM

February 1, 1929.

To - Mr. Denton
Operations
Miami

From - W. O. Snyder
Engineering
Miami

Subject: Load Test- 2 engines Plane NC-231 E.

The following is a summary of the test made this date on the above plane:

The results prove that these planes can be flown indefinitely on two out of the three motors. They will not operate very well under one motor only as the plane lost 800 feet altitude in five minutes of flying.

The results below are the details of the flying.

Barometer	30-altitude of field
Temperature	72 degrees fahrenheit on field
Weight Empty	7780
Gas 360 Gal.	2160
Oil 33 "	344
Pilot	170
Pilot 2nd	170
Radio Operator	145
Radio	125
Emergency Eqpt.	78
Add. Eqpt.	266
W.O. Snyder, Eng.	153
Sand Load	1650
Total Load -	13140 Gross

F-10-A (650 sq. ft. wing)

Weight Empty (including Standard Equipment-		7780 lbs.
Fuel (380 gals.)	2280	
Oil (45 gals.)	338	
Crew (2)	340	
Payload	2462	
Total Load		5320
GROSS WEIGHT		13100 lbs.

Dept. of Commerce, Pan-American (2),
W.A.E.(2), Mr. Fokker, Mr. Noorduyn,
Mr. Aument, Sales NYO, Stress Analysis Dept.
Eng. (2).

F. M. Jacobs.

F. M. Jacobs
Dept. of Commerce Inspector

A. A. Gassner
In charge of Engineering

AAC-28

Weight F-10-A #1012 - Plan Cover

Weight F-10-A #1012 following items of equipment are included: (See page 1)

1.	Radio shielding and bonding of wing, fuselage, & light wires	35.00
2.	Radio shielding of engines and booster magneto cables.	19.50
3.	Parachute flare brackets, support and operating mechanism	32.00
4.	Pressure fire extinguisher, pipes, brackets	24.00
5.	One Pyrene fire extinguisher and brackets. (1)	6.50
6.	Toilet equipment	24.00
7.	Thermos carafe and brackets	2.50
8.	Roof ventilator and frame	6.00
9.	Instrument board cabin	4.50
10.	Pioneer compass and bracket	5.50
11.	Special cabin chair fasteners	12.00
12.	Woodwork fuselage and wing emergency exits	25.00
13.	Metal lining baggage compartments	25.00
14.	Crank handle	4.00
15.	Difference due to heavy tread tires	14.00
16.	Assist loops in cabin (4)	2.00
17.	Artificial leather covering cabin and entrance compartment	35.00
18.	Woodwork air raft box in wing and metal cover	11.00
19.	Adjustable engine nose cowlings (3)	64.00
20.	Linoleum	41.00
21.	Galley	13.00
	Total	406.50

A. A. Casemer
In charge of Eng.

AAC-B

Weight F-10-A #1012 Pan-Cana.

WEIGHT STANDING ON GROUND

Right wheel	3734 lbs.	
Left wheel	3657	
Tail	579	
Total Weight	7970 lbs.	
12 cabin chairs (10 lbs.)	120 lbs.	
Gross weight empty	8090 lbs.	
Deductions (see 226-B (page 2)	405.50	
Net Weight Empty	7674.50	7674.50

Equipment not included in above weight:

Adjustable nose cowlings (3)	64.00
2 Pyrene fire extinguishers	13.00
Crank handle	4.00
Toilet equipment	24.00
First aid kit	3.00
	108.00

Weight Empty (Dept. of Commerce 7782.50

B. M. Jacobs.

B. M. Jacobs
Dept. of Commerce Inspector

A. A. Gassner
In charge of Engineering

AAC-26