APOLLO TRAINING

BLOCK II CSM
PROPULSION SUBSYSTEM
CSM 106 AND SUBS

10 MARCH 1969

FOR TRAINING PURPOSES ONLY

APOLLO LOGISTICS TRAINING

The following corrections are to be made to the CSM Propulsion Subsystem handout package dated 10 March 1969.

Page 4	SM-2A-1353N	Change note as follows: from ** CSM 111 and subs: to ** CSM 108 and subs. Add note as follows to SP0061T and SP0062T, **** Caution and warning light on MDC-2 will illuminate on CSM 106 and 107 but is ignored. Light on MDC-2 is disconnected and covered with a decal on CSM 108 and subs.
Page 5	SM-2A-2028	Delete MDC-2 and from SP0061T and SP0062T.
Page 7	SM-2A-1243G	Disconnect lead to SPS PUSNSR caution and warning light on MDC-2 thus rendering the light inoperative from the PUG system on CSM 106 and subs.
Page 10	P-5096-1A	Delete page in its entirety due to SPS PUSNSR caution and warning light being disconnected (page 7).
Page 68		Change SPS TEMP FUEL ENGINE FEEDLINE (SP0048T) and TEMP OX ENGINE FEEDLINE (SP0049T) operating range as follows: +45 to +75°F. Redline mark at +27 and +100°F for SP0048T. Delete all presently stated operating range voltages and temperatures for SP0049T and add as follows: 1. 1250 vdc = 45°F 1. 95 vdc = 75°F

Page 81	P-7027M	Delete, parenthesis and CM RCS 1 and parenthesis and CM RCS 2 Add 1 after CR00015P HEL TANK PRESS 1 after CR00037T HEL TANK TEMP 2 after CR00027T HEL TANK PRESS 2 after CR00047T HEL TANK TEMP
	P-0043	CSM Propulsion Power Distribution CSM 106 and subs: Delete Panal 2 SPS PUSNSR caution and warning light. Add statement to SP0061T and SP0062T, light on Panel 2 will illuminate on CSM 106 and 107 but is ignored, on CSM 108 and subs light is disconnected and covered with a decal.
	P-0044	Control and display panel MDC-2. The SPS PUSNSR light is covered with a decal on CSM 106 and subs.

Questions Relative To The Contents of This Document

Should Be Directed To:

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F. M. Matthews

NR SD

Downey, California
Extension 4325, or 6

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The following pages contained within this handout package have been revised or added since the 12 December 1968 Block II CSM Propulsion Subsystem Handout Package.

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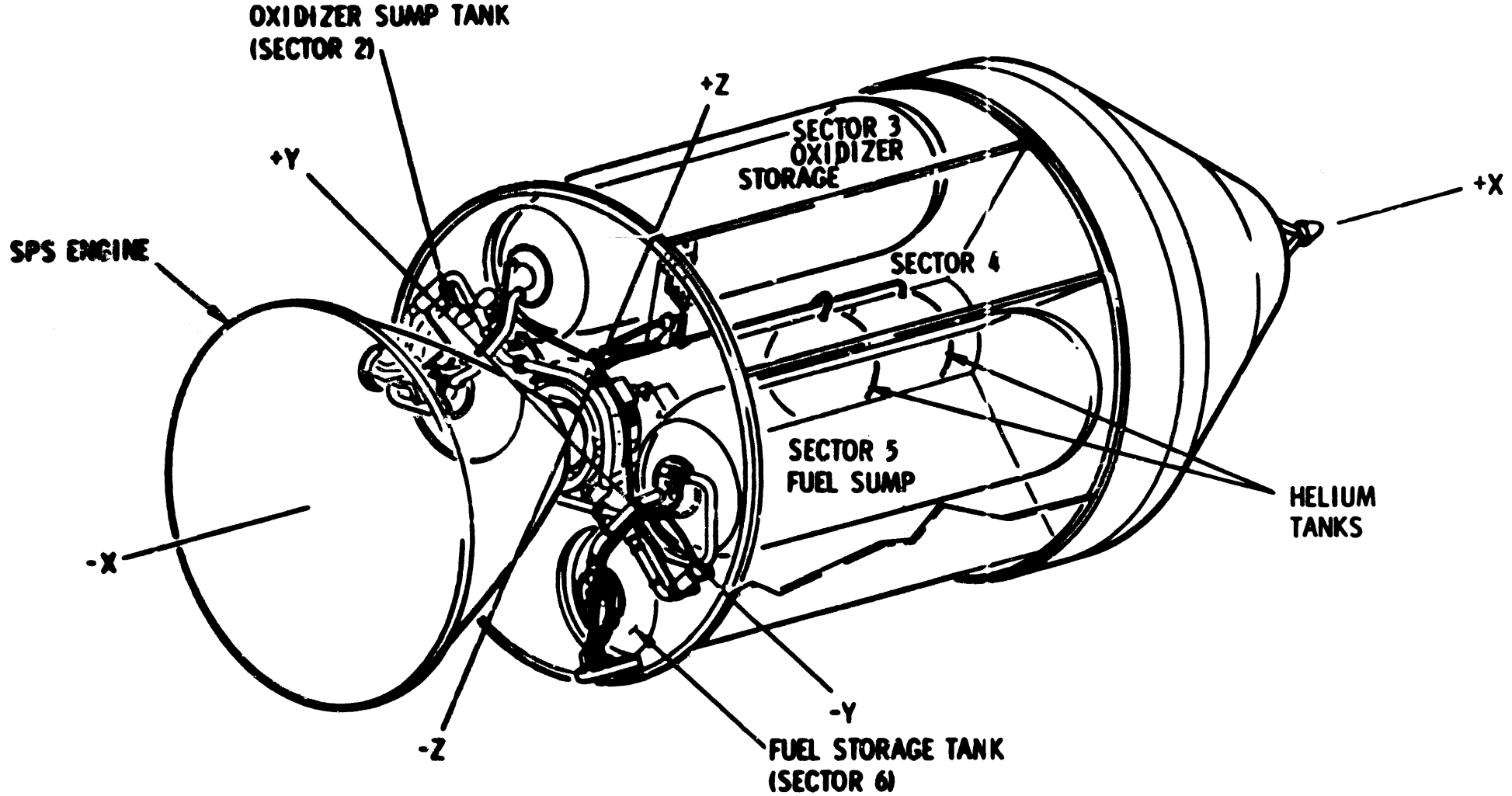
SERVICE PROPULSION SYSTEM



TYPE OF SYSTEM: NON-THROTTLEABLE, PRESSURE FEED SYSTEM, HYPERGOLIC PROPELLANTS AND ABLATIVE THRUST CHAMBER WITH A RADIANT COOLED NOZZLE EXTENSION.

SYSTEM DESCRIPTION: ONE SYSTEM CONSISTING OF A PROPELLANT FEED SYSTEM AND ONE ENGINE

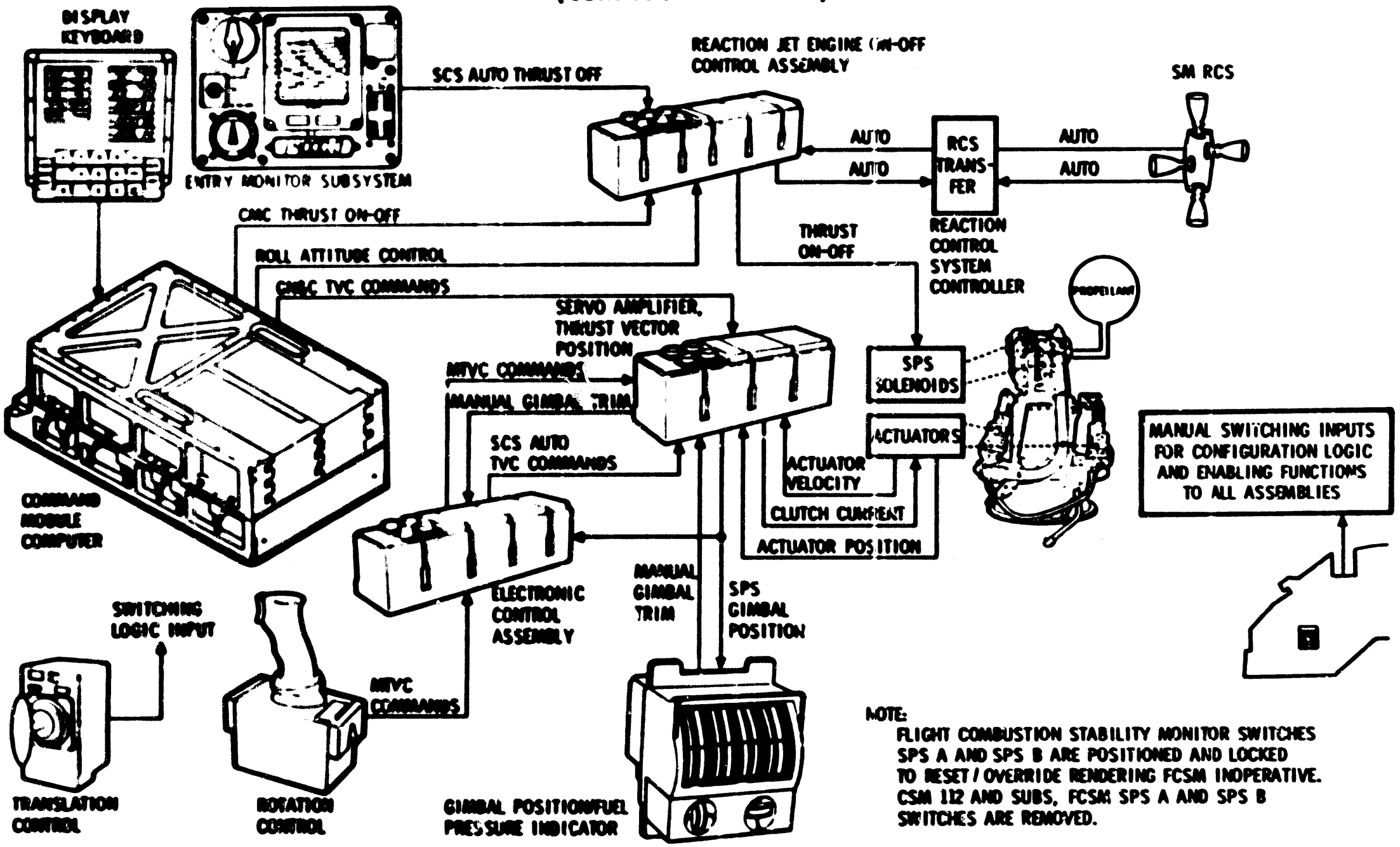
PROPELLANTS - INHIBITED NITROGEN TETROXIDE AND BLENDED HYDRAZINE (APPROX 50% UDMH & 50% HYDRAZINE)

SYSTEM CONTROLLED BY CMC OR SCS WITH A DIRECT CONTROL BACK-UP CAPABILITY

PURPOSE: PROVIDE THRUST FOR X-AXIS VELOCITY CHANGES AFTER SEPARATION FROM THE S-IVB BOOSTER UP UNTIL CM/SM SEPARATION. IN ADDITION SUPPORTS THE SPS ABORT CAPABILITY DURING THE BOOST PHASE AFTER THE LAUNCH ESCAPE TOWER HAS BEEN JETTISONED.

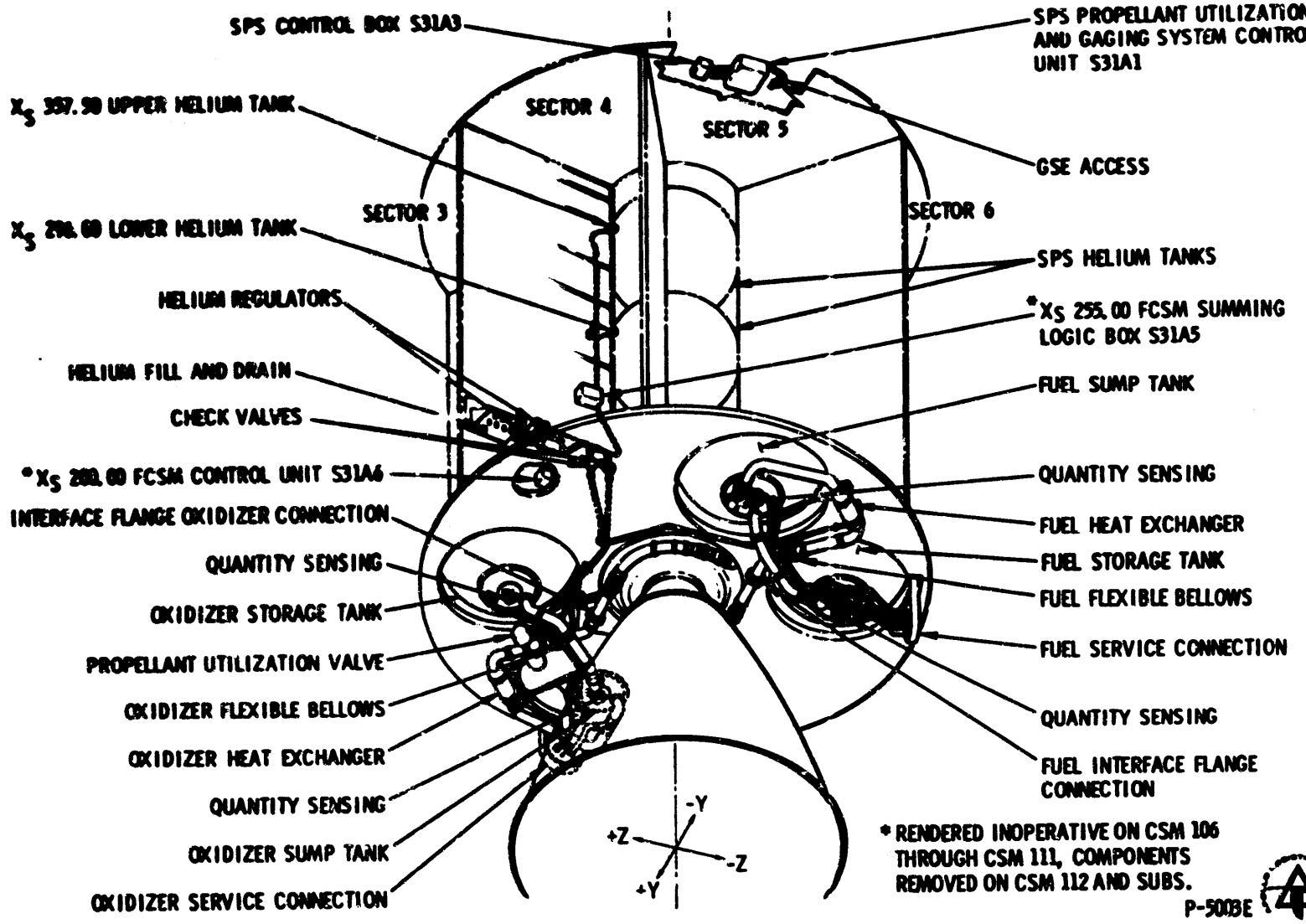
SERVICE PROPULSION SYSTEM

INTERFACE CONTROL
(CSM 106 AND SUBS)



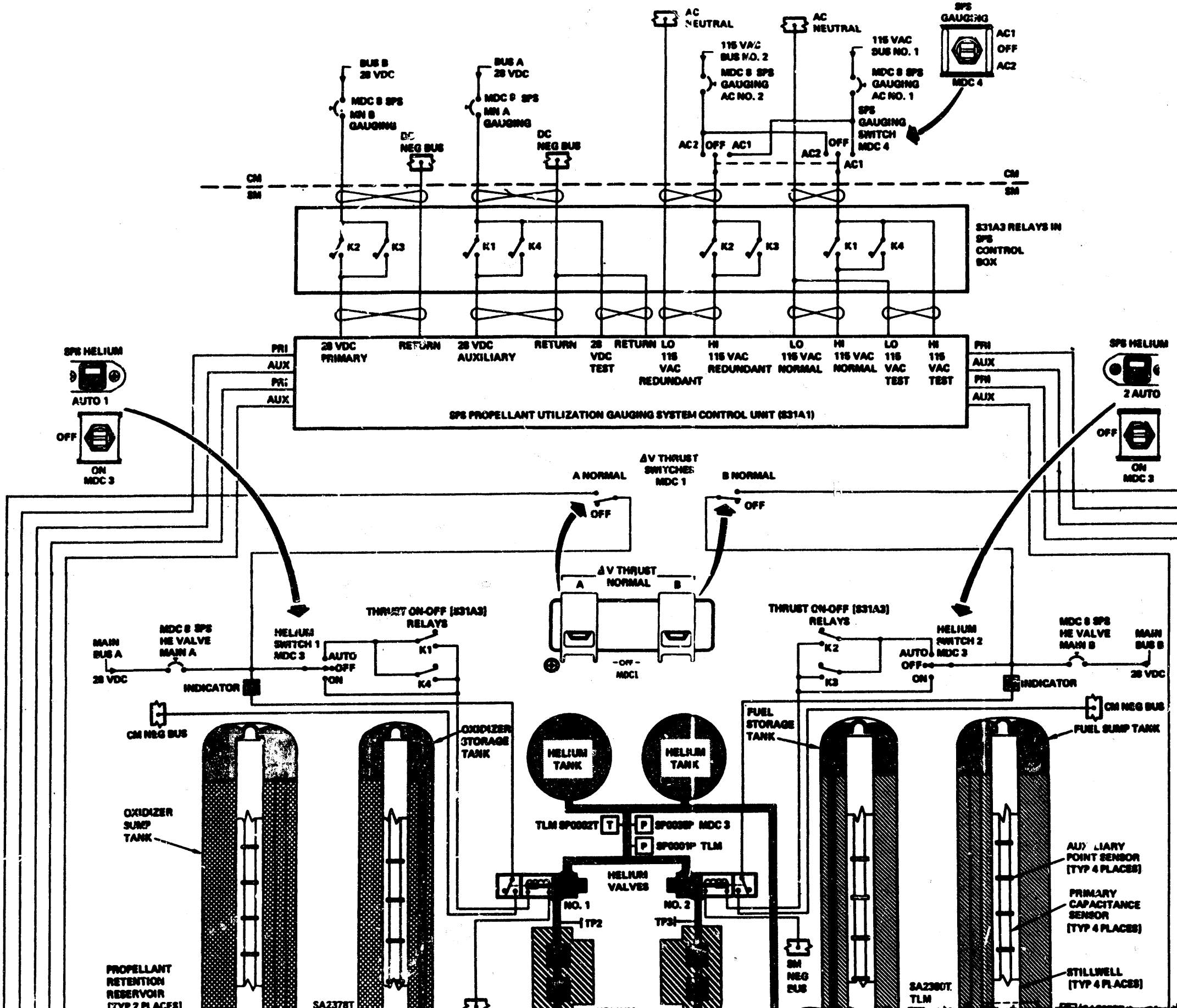
NOTE:
FLIGHT COMBUSTION STABILITY MONITOR SWITCHES SPS A AND SPS B ARE POSITIONED AND LOCKED TO RESET / OVERRIDE RENDERING FCSM INOPERATIVE. CSM 112 AND SUBS, FCSM SPS A AND SPS B SWITCHES ARE REMOVED.

SPS COMPONENT LOCATIONS AFT VIEW



* RENDERED INOPERATIVE ON CSM 106 THROUGH CSM 111, COMPONENTS REMOVED ON CSM 112 AND SUBS.

P-5003E


AC NEUTRAL
AC NEUTRAL
SPS GAUGING
AC1
OFF
AC2
MDC 4
115 VAC BUS NO. 2
MDC 8 SPS GAUGING AC NO. 2
115 VAC BUS NO. 1
MDC 8 SPS GAUGING AC NO. 1
SPS GAUGING SWITCH MDC 4
BUS B 28 VDC
MDC 8 SPS MN B GAUGING
BUS A 28 VDC
MDC 8 SPS MN A GAUGING
DC NEG BUS
DC NEG BUS
AC2 OFF AC1
AC2 OFF AC1
CM/SM
CM/SM
S31A3 RELAYS IN SPS CONTROL BOX
K2 K3
K1 K4
K2 K3
K1 K4
PRI
AUX
PRI
AUX
28 VDC PRIMARY
RETURN
28 VDC AUXILIARY
RETURN
28 VDC TEST
RETURN
LO 115 VAC REDUNDANT
HI 115 VAC REDUNDANT
LO 115 VAC NORMAL
HI 115 VAC NORMAL
LO 115 VAC TEST
HI 115 VAC TEST
PRI
AUX
PRI
AUX
SPS PROPELLANT UTILIZATION GAUGING SYSTEM CONTROL UNIT (S31A1)
SPS HELIUM
AUTO 1
OFF
ON
MDC 3
SPS HELIUM
2 AUTO
OFF
ON
MDC 3
ΔV THRUST SWITCHES MDC 1
A NORMAL
OFF
B NORMAL
OFF
ΔV THRUST NORMAL
A
B
-OFF-
MDC1
THRUST ON-OFF (S31A3) RELAYS
K1
K4
THRUST ON-OFF (S31A3) RELAYS
K2
K3
MAIN BUS A
28 VDC
MDC 8 SPS HE VALVE MAIN A
HELIUM SWITCH 1 MDC 3
AUTO
OFF
ON
INDICATOR
HELIUM SWITCH 2 MDC 3
AUTO
OFF
ON
INDICATOR
MDC 8 SPS HE VALVE MAIN B
MAIN BUS B
28 VDC
CM NEG BUS
CM NEG BUS
OXIDIZER STORAGE TANK
HELIUM TANK
HELIUM TANK
FUEL STORAGE TANK
FUEL SUMP TANK
OXIDIZER SUMP TANK
TLM SP0002T
T
P
SP0003P MDC 3
P
SP0001P TLM
HELIUM VALVES
NO. 1
NO. 2
TP2
TP3
SM NEG BUS
AUXILIARY POINT SENSOR [TYP 4 PLACES]
PRIMARY CAPACITANCE SENSOR [TYP 4 PLACES]
STILLWELL [TYP 4 PLACES]
PROPELLANT RETENTION RESERVOIR [TYP 2 PLACES]
SA2378T
SA2380T TLM

ON
MDC 3

A NORMAL

SWITCHES
MDC 1

B NORMAL

ON
MDC 3

OFF

OFF

ΔV THRUST
NORMAL

A

B

-OFF-
MDC1

MAIN
BUS A

28 VDC

MDC 8 SPS
HE VALVE
MAIN A

INDICATOR

HELIUM
SWITCH 1
MDC 3

AUTO
OFF
ON

THRUST ON-OFF (S31A3)
RELAYS

K1

K4

THRUST ON-OFF (S31A3)
RELAYS

K2

K3

HELIUM
SWITCH 2
MDC 3

AUTO
OFF
ON

MDC 8 SPS
HE VALVE
MAIN B

MAIN
BUS B

28 VDC

INDICATOR

CM NEG BUS

CM NEG BUS

FUEL
STORAGE
TANK

FUEL SUMP TANK

OXIDIZER
STORAGE
TANK

HELIUM
TANK

HELIUM
TANK

OXIDIZER
SUMP
TANK

TLM SP0002T

SP0002P MDC 3

SP0001P TLM

HELIUM
VALVES

NO. 1

NO. 2

TP2

TP3

AUXILIARY
POINT SENSOR
[TYP 4 PLACES]

PRIMARY
CAPACITANCE
SENSOR
[TYP 4 PLACES]

PROPELLANT
RETENTION
RESERVOIR
[TYP 2 PLACES]

SA2377T
TLM

SM
NEG
BUS

SM
NEG
BUS

SA2378T
TLM

HELIUM
REGULATORS

SA2380T
TLM

STILLWELL
[TYP 4 PLACES]

SA2379T
TLM

OXIDIZER FILL
& DRAIN TP13

TP17

SP0003P
MDC 2,3
& TLM

SA2469T
TLM ***

TP8

FILTER

SP0003P
MDC 2,3
& TLM

SA2461T ***

HELIUM SUPPLY TP1

TP9

TP10

TP7

TP6

HELIUM
CHECK
VALVES

FUEL VENT TP16

OXIDIZER
VENT TP14

FUEL FILL & DRAIN TP15

TLM
SP0057T

HELIUM
RELIEF VALVE
[TYP 2 PLACES]

TP
12

SP0054T TLM

PROTECTIVE
COVER
[TYP 2 PLACES]

PROPELLANT
UTILIZATION
VALVE

SP0031P TLM

HEAT EXCHANGER
[TYP 2 PLACES]

FLEXIBLE BELLOWS
[TYP 2 PLACES]

SP0030P TLM

TP11

PRIMARY

GN_2 FILL
& DRAIN
[2 PLACES]

GN_2

INTERFACE FLANGE CONNECTION

ORIFICES

FILTERS

OXID

FUEL

SECONDARY

GN_2

SP0001P

MDC 3
& TLM

** FILTER [2 PLACES]

INJECTOR PRE-VALVE
[2 PLACES]

SP0003P
MDC 3 &
TLM

FLEXIBLE BELLOWS
[4 PLACES]

BALL VALVE
[8 PLACES]

SP0004T
MDC 3 & TLM

FUEL SEAL DRAIN

SP0004T
MDC 101 & TLM

ORIFICE [2 PLACES]

SP28

REGULATOR PACKAGE
[2 PLACES]

NO. 1

SOLENOID
CONTROL
VALVE

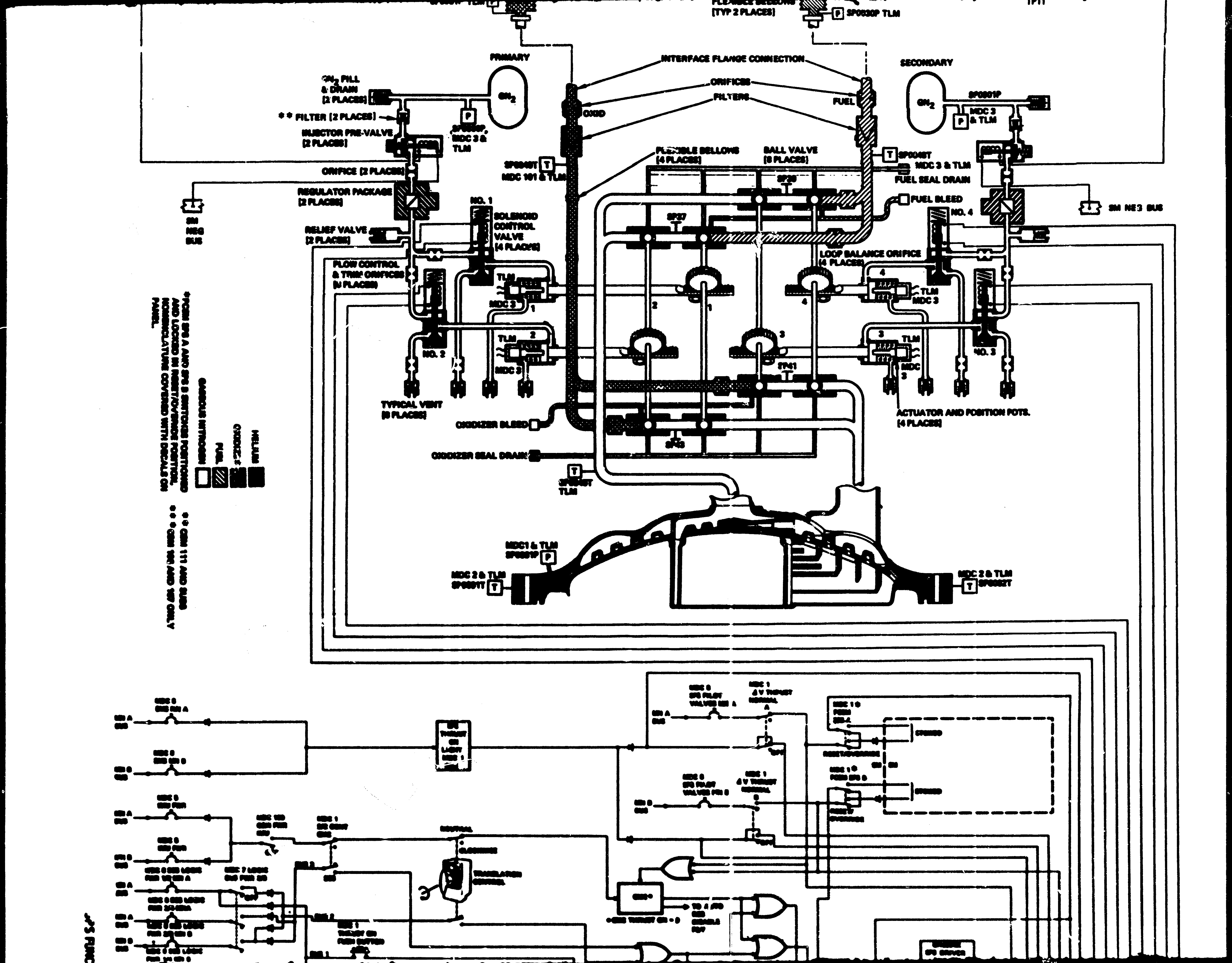
FUEL BLEED

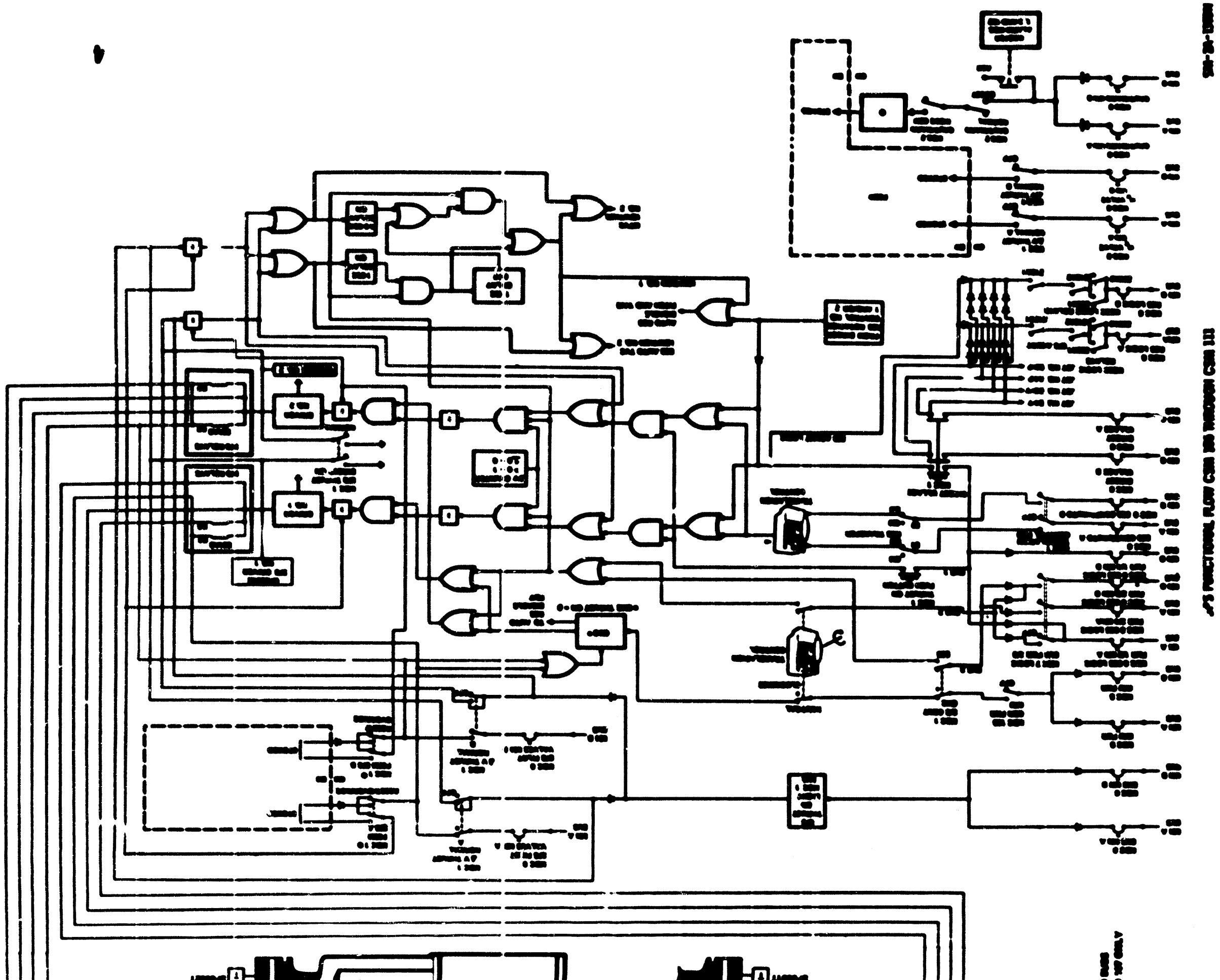
NO. 4

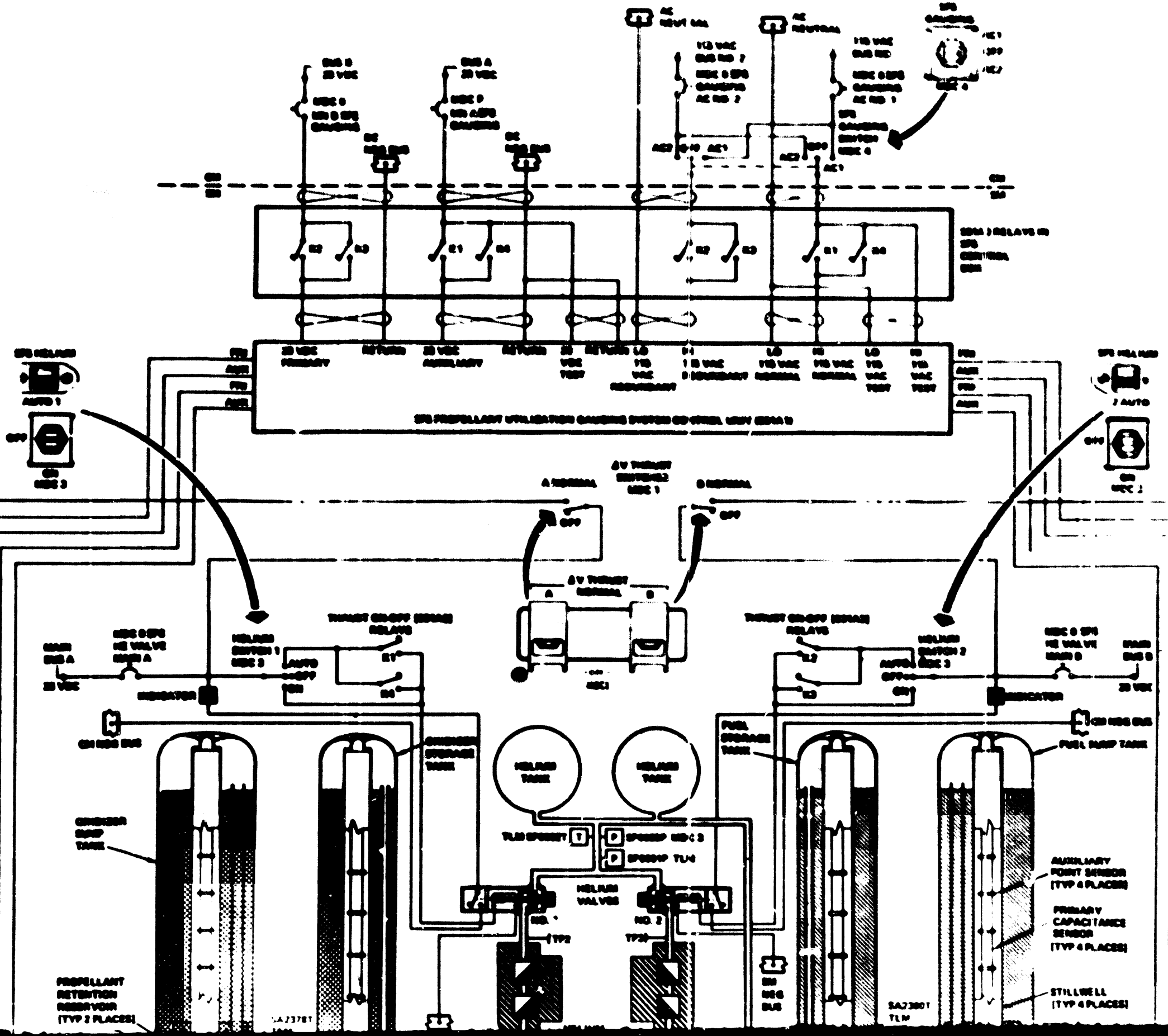
SM NEG BUS

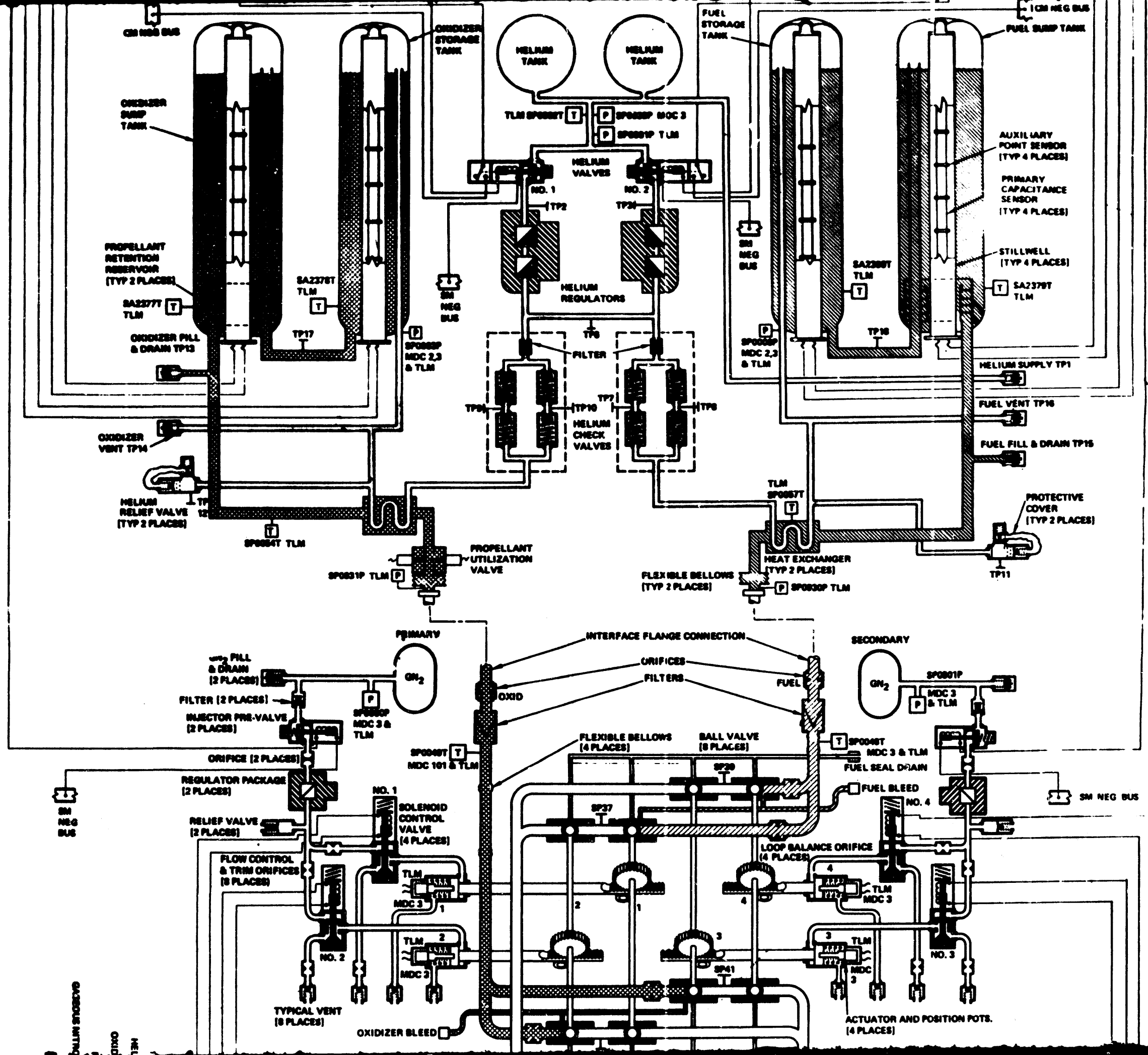
SP27

RELIEF VALVE


PRIMARY
SECONDARY
INTERFACE FLANGE CONNECTION
ORIFICES
FILTERS
OXID
FUEL
GN2 FILL & DRAIN [2 PLACES]
* * FILTER [2 PLACES]
INJECTOR PRE-VALVE [2 PLACES]
ORIFICE [2 PLACES]
REGULATOR PACKAGE [2 PLACES]
RELIEF VALVE [2 PLACES]
FLOW CONTROL & TRIM ORIFICES [4 PLACES]
SOLENOID CONTROL VALVE [4 PLACES]
BALL VALVE [8 PLACES]
LOOP BALANCE ORIFICE [4 PLACES]
FUEL BLEED
FUEL SEAL DRAIN
MDC 3 & TLM
MDC 101 & TLM
SM NEG BUS
SM NEG BUS
NO. 1
NO. 2
NO. 3
NO. 4
TYPICAL VENT [8 PLACES]
OXIDIZER BLEED
OXIDIZER SEAL DRAIN
ACTUATOR AND POSITION POTS. [4 PLACES]
MDC1 & TLM
MDC 2 & TLM
HELIUM
OXIDIZER
FUEL
GASEOUS NITROGEN
*PCSM SPS A AND SPS B SWITCHES POSITIONED AND LOCKED IN RESET/OVERIDE POSITION. NOMENCLATURE COVERED WITH DECALS ON PANEL.
* * CSM 111 AND SUBS
* * * CSM 106 AND 107 ONLY
TRANSLATION CONTROL
..PS FUNC




PROPELLANT RETENTION RESERVOIR (TYP 2 PLACES)
FUEL STORAGE TANK
FUEL PUMP TANK
HELIUM TANK
HELIUM TANK
AUXILIARY POINT SENSOR (TYP 4 PLACES)
PRIMARY CAPACITANCE SENSOR (TYP 4 PLACES)
STILLWELL (TYP 4 PLACES)
SA23801 TLM


OXIDIZER STORAGE TANK
HELIUM TANK
HELIUM TANK
FUEL STORAGE TANK
FUEL SURGE TANK
OXIDIZER SURGE TANK
AUXILIARY POINT SENSOR (TYP 4 PLACES)
PRIMARY CAPACITANCE SENSOR (TYP 4 PLACES)
STILLWELL (TYP 4 PLACES)
HELIUM VALVES
NO. 1
NO. 2
HELIUM REGULATORS
FILTER
HELIUM CHECK VALVES
PROPELLANT RETENTION RESERVOIR (TYP 2 PLACES)
OXIDIZER FILL & DRAIN TP13
OXIDIZER VENT TP14
HELIUM RELIEF VALVE (TYP 2 PLACES)
HELIUM SUPPLY TP1
FUEL VENT TP16
FUEL FILL & DRAIN TP15
PROTECTIVE COVER (TYP 2 PLACES)
PROPELLANT UTILIZATION VALVE
HEAT EXCHANGER (TYP 2 PLACES)
FLEXIBLE BELLOWS (TYP 2 PLACES)
PRIMARY
SECONDARY
INTERFACE FLANGE CONNECTION
ORIFICES
FILTERS
OXID
FUEL
FLEXIBLE BELLOWS (4 PLACES)
BALL VALVE (8 PLACES)
INJECTOR PRE-VALVE (2 PLACES)
ORIFICE (2 PLACES)
REGULATOR PACKAGE (2 PLACES)
RELIEF VALVE (2 PLACES)
SOLENOID CONTROL VALVE (4 PLACES)
FLOW CONTROL & TRIM ORIFICES (8 PLACES)
FUEL BLEED
FUEL SEAL DRAIN
LOOP BALANCE ORIFICE (4 PLACES)
TYPICAL VENT (8 PLACES)
OXIDIZER BLEED
ACTUATOR AND POSITION POTS. (4 PLACES)
SM NEG BUS

UTILIZATION VALVE

SP0831P TLM P

HEAT EXCHANGER (TYP 2 PLACES)

FLEXIBLE BELLOWS (TYP 2 PLACES)

SP0830P TLM P

TP11

PRIMARY

SECONDARY

INTERFACE FLANGE CONNECTION

ORIFICES

FILTERS

OXID

FUEL

GN_2 FILL & DRAIN (2 PLACES)

FILTER (2 PLACES)

INJECTOR PRE-VALVE (2 PLACES)

SP0830P MDC 3 & TLM

SP0801P MDC 3 & TLM

SP0831T MDC 101 & TLM T

FLEXIBLE BELLOWS (4 PLACES)

BALL VALVE (8 PLACES)

SP0840T MDC 3 & TLM

FUEL SEAL DRAIN

ORIFICE (2 PLACES)

REGULATOR PACKAGE (2 PLACES)

SM NEG BUS

RELIEF VALVE (2 PLACES)

NO. 1 SOLENOID CONTROL VALVE (4 PLACES)

FUEL BLEED

NO. 4

SP29

SP27

LOOP BALANCE ORIFICE (4 PLACES)

FLOW CONTROL & TRIM ORIFICES (8 PLACES)

TLM MDC 3

NO. 2

NO. 3

SP41

SP43

TYPICAL VENT (8 PLACES)

OXIDIZER BLEED

OXIDIZER SEAL DRAIN

ACTUATOR AND POSITION POTS. (4 PLACES)

SP0840T TLM T

MDC1 & TLM SP0801P P

MDC 2 & TLM SP0831T T

MDC 2 & TLM SP0802T T

GASEOUS NITROGEN

FUEL

OXIDIZER

HELIUM

MDC 0 SM A

MDC 0 SM B

MDC 0 PWR

MDC 100 PWR

MDC 1 SPS IGNT

NEUTRAL

CLOCKWISE

TRANSLATION CONTROL

MDC 0 SM LOGIC PWR 100 A

MDC 7 LOGIC SM PWR 200

MDC 0 SM LOGIC PWR 200 B

MDC 1 SM LOGIC PWR 200 A

MDC 1 SM LOGIC PWR 100 B

TO AUTO RCS ENABLE P8V (2 SECOND DELAY)

CMC

CMC THRUST ON = 0

MDC 1 THRUST ON PUSH BUTTON

MDC 0 SPS PILOT VALVES SM A

MDC 1 ΔV THRUST REMOVAL A

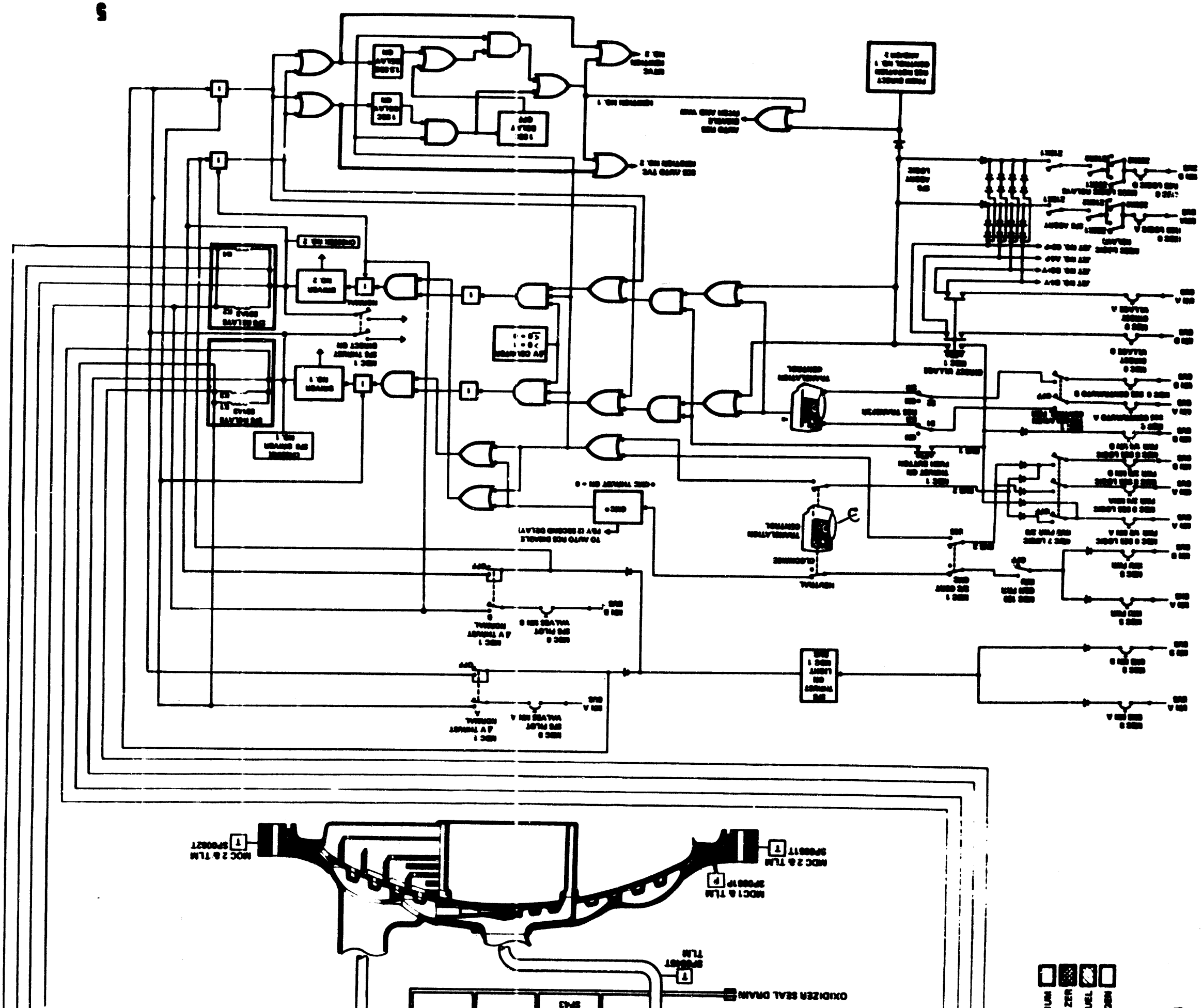
MDC 0 SPS PILOT VALVES SM B

MDC 1 ΔV THRUST REMOVAL B

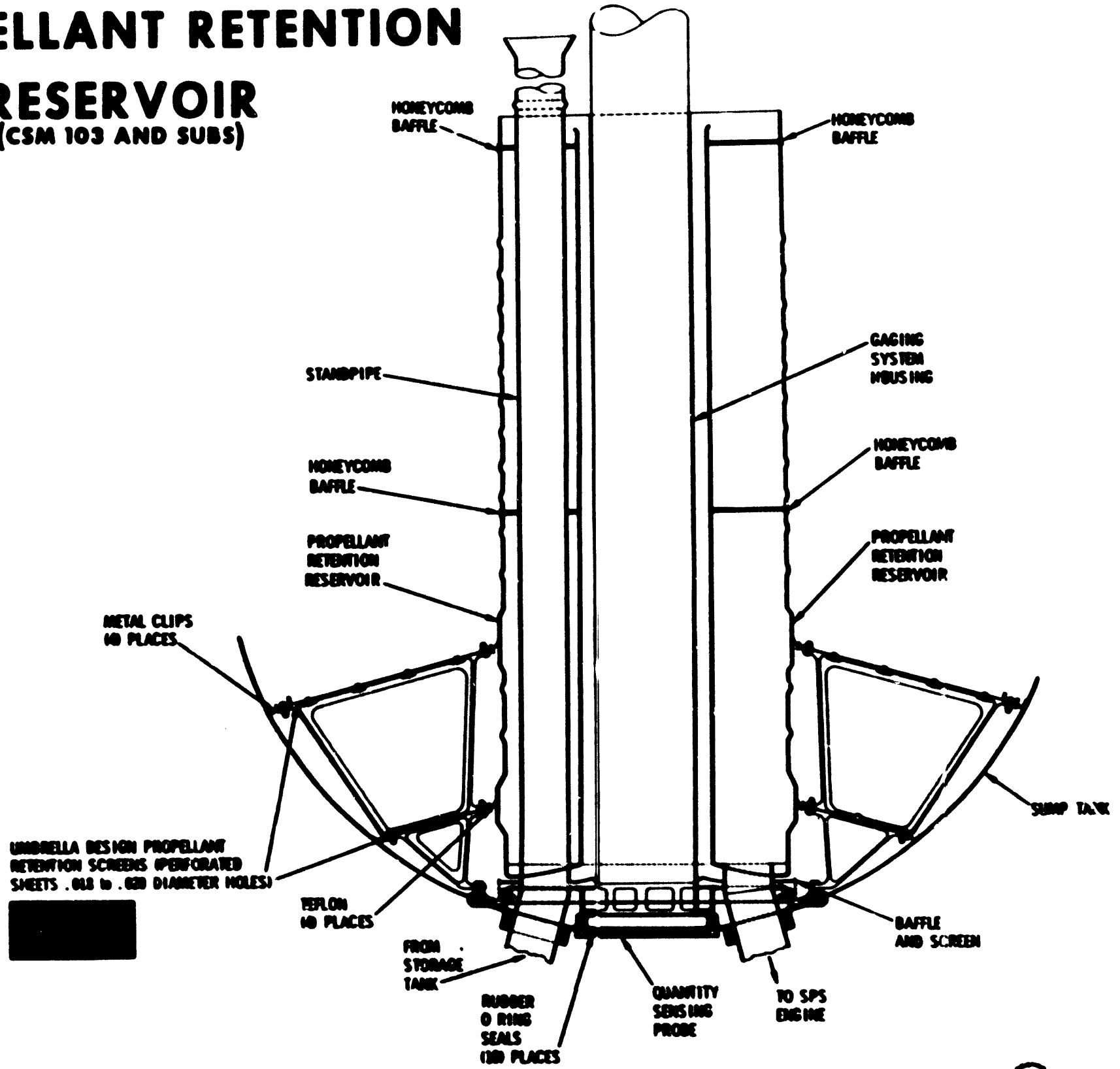
SPS THRUST ON LIGHT MDC 1

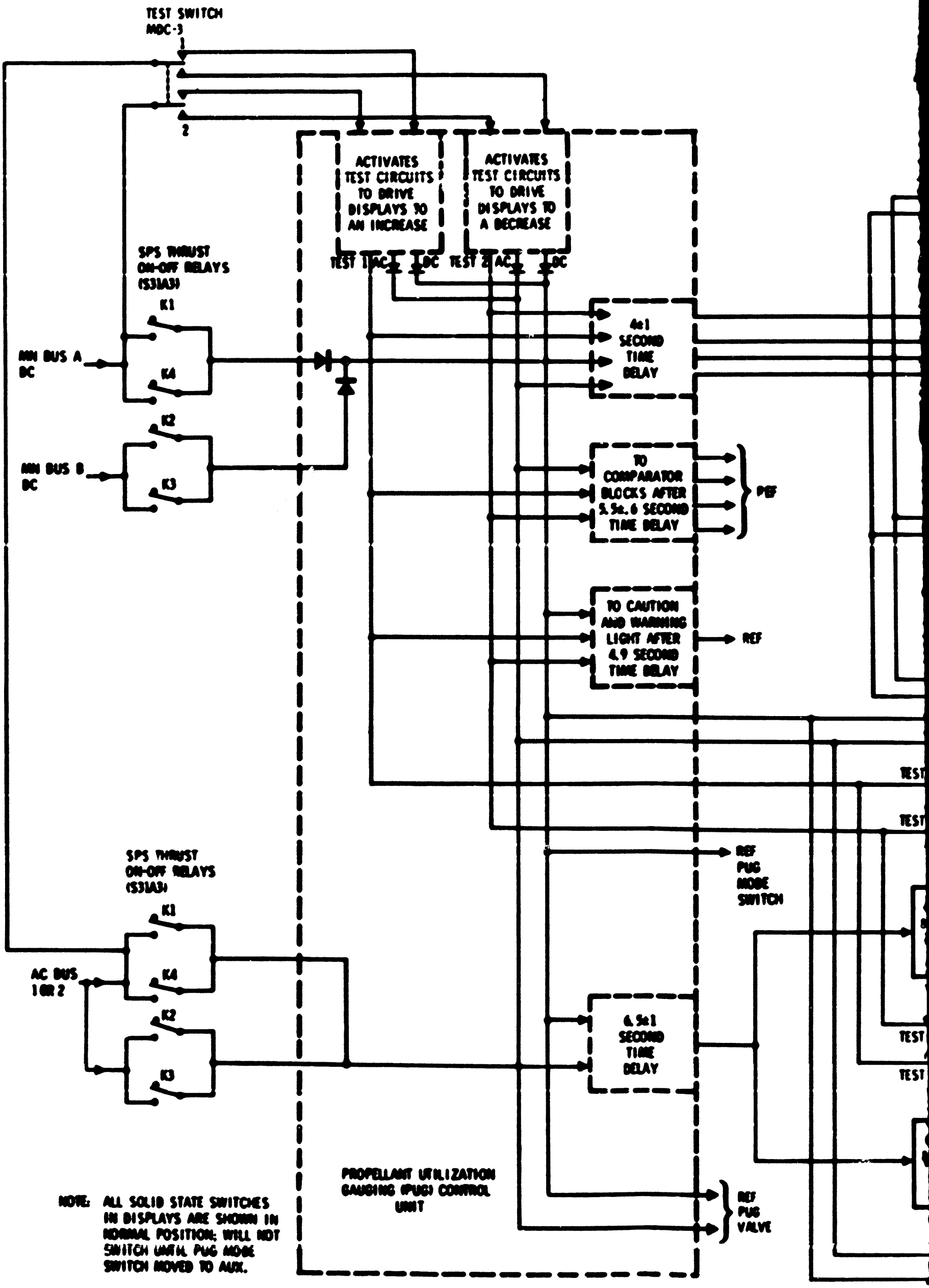
CHAMBER

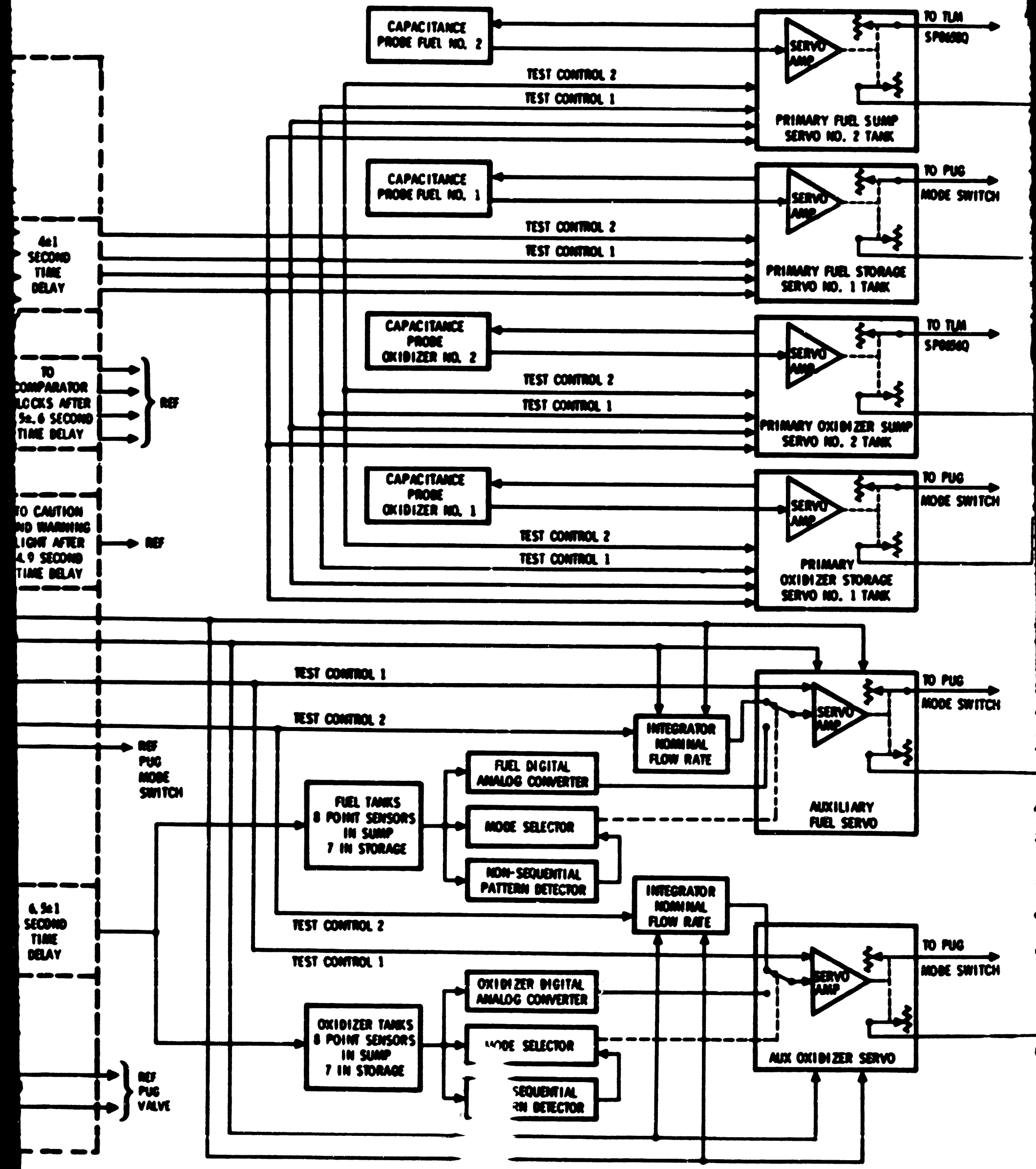
SPS FUNCTIONAL FLOW CSM 112 AND SUBS

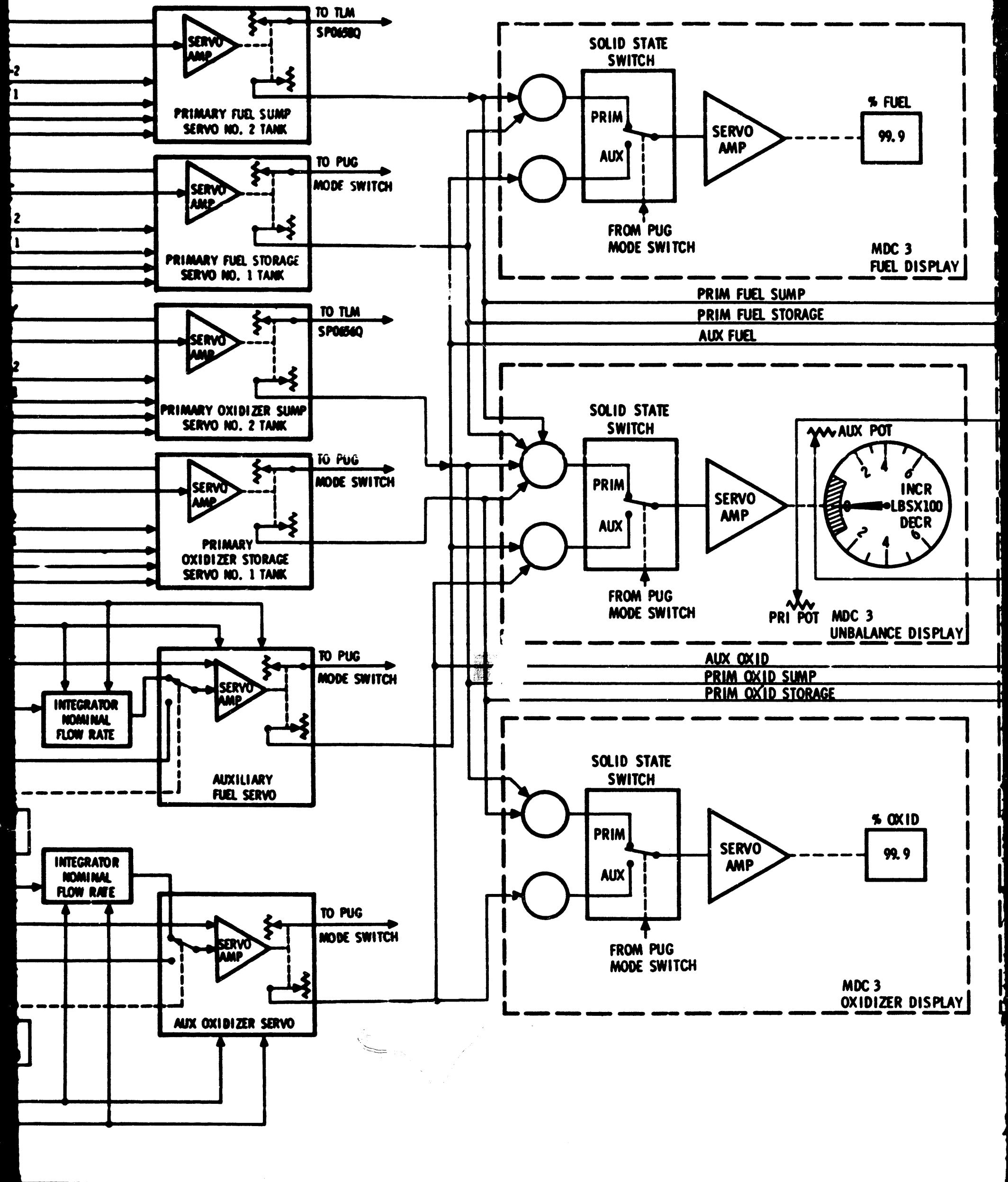


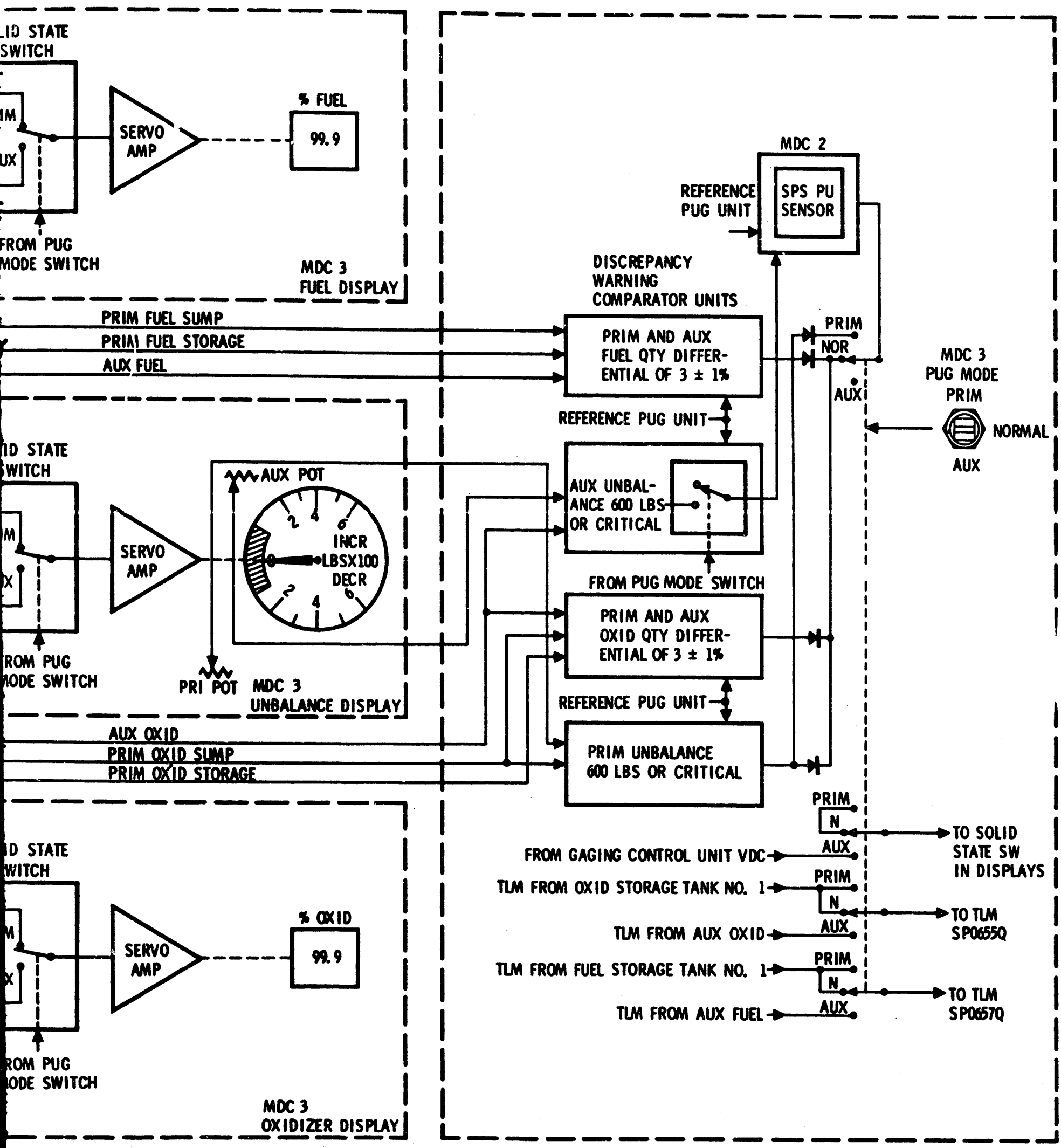
SPS PROPELLANT RETENTION RESERVOIR
(CSM 103 AND SUBS)




TEST SWITCH
MDC-3
1
2
ACTIVATES TEST CIRCUITS TO DRIVE DISPLAYS TO AN INCREASE
ACTIVATES TEST CIRCUITS TO DRIVE DISPLAYS TO A DECREASE
TEST 1 AC
DC
TEST 2 AC
DC
SPS THRUST ON-OFF RELAYS (S31A3)
K1
K4
K2
K3
MN BUS A DC
MN BUS B DC
4±1 SECOND TIME DELAY
TO COMPARATOR BLOCKS AFTER 5.5±.6 SECOND TIME DELAY
PBF
TO CAUTION AND WARNING LIGHT AFTER 4.9 SECOND TIME DELAY
RBF
RBF PUG MODE SWITCH
TEST
TEST
TEST
TEST
SPS THRUST ON-OFF RELAYS (S31A3)
K1
K4
K2
K3
AC BUS 1 OR 2
6.5±1 SECOND TIME DELAY
PROPELLANT UTILIZATION GAUGING (PUG) CONTROL UNIT
RBF PUG VALVE
NOTE: ALL SOLID STATE SWITCHES IN DISPLAYS ARE SHOWN IN NORMAL POSITION; WILL NOT SWITCH UNTIL PUG MODE SWITCH MOVED TO AUX.


CAPACITANCE PROBE FUEL NO. 2
TEST CONTROL 2
TEST CONTROL 1
SERVO AMP
TO TLM SP86880
PRIMARY FUEL SUMP SERVO NO. 2 TANK
CAPACITANCE PROBE FUEL NO. 1
TEST CONTROL 2
TEST CONTROL 1
SERVO AMP
TO PUG MODE SWITCH
PRIMARY FUEL STORAGE SERVO NO. 1 TANK
4±1 SECOND TIME DELAY
CAPACITANCE PROBE OXIDIZER NO. 2
TEST CONTROL 2
TEST CONTROL 1
SERVO AMP
TO TLM SP86860
PRIMARY OXIDIZER SUMP SERVO NO. 2 TANK
TO COMPARATOR LOCKS AFTER 5±.6 SECOND TIME DELAY
REF
CAPACITANCE PROBE OXIDIZER NO. 1
TEST CONTROL 2
TEST CONTROL 1
SERVO AMP
TO PUG MODE SWITCH
PRIMARY OXIDIZER STORAGE SERVO NO. 1 TANK
TO CAUTION AND WARNING LIGHT AFTER 4.9 SECOND TIME DELAY
REF
TEST CONTROL 1
TEST CONTROL 2
INTEGRATOR NOMINAL FLOW RATE
SERVO AMP
TO PUG MODE SWITCH
AUXILIARY FUEL SERVO
REF PUG MODE SWITCH
FUEL DIGITAL ANALOG CONVERTER
FUEL TANKS 8 POINT SENSORS IN SUMP 7 IN STORAGE
MODE SELECTOR
NON-SEQUENTIAL PATTERN DETECTOR
4, 5±1 SECOND TIME DELAY
INTEGRATOR NOMINAL FLOW RATE
TEST CONTROL 2
TEST CONTROL 1
SERVO AMP
TO PUG MODE SWITCH
OXIDIZER DIGITAL ANALOG CONVERTER
OXIDIZER TANKS 8 POINT SENSORS IN SUMP 7 IN STORAGE
MODE SELECTOR
SEQUENTIAL PATTERN DETECTOR
AUX OXIDIZER SERVO
REF PUG VALVE


TO TLM
SP0658Q
SERVO AMP
PRIMARY FUEL SUMP SERVO NO. 2 TANK
TO PUG
MODE SWITCH
PRIMARY FUEL STORAGE SERVO NO. 1 TANK
TO TLM
SP0656Q
PRIMARY OXIDIZER SUMP SERVO NO. 2 TANK
TO PUG
MODE SWITCH
PRIMARY OXIDIZER STORAGE SERVO NO. 1 TANK
INTEGRATOR NOMINAL FLOW RATE
TO PUG
MODE SWITCH
AUXILIARY FUEL SERVO
INTEGRATOR NOMINAL FLOW RATE
TO PUG
MODE SWITCH
AUX OXIDIZER SERVO
SOLID STATE SWITCH
PRIM
AUX
SERVO AMP
% FUEL
99.9
FROM PUG MODE SWITCH
MDC 3 FUEL DISPLAY
PRIM FUEL SUMP
PRIM FUEL STORAGE
AUX FUEL
SOLID STATE SWITCH
AUX POT
INCR
LBSX100
DECR
FROM PUG MODE SWITCH
PRI POT
MDC 3 UNBALANCE DISPLAY
AUX OXID
PRIM OXID SUMP
PRIM OXID STORAGE
SOLID STATE SWITCH
% OXID
99.9
FROM PUG MODE SWITCH
MDC 3 OXIDIZER DISPLAY

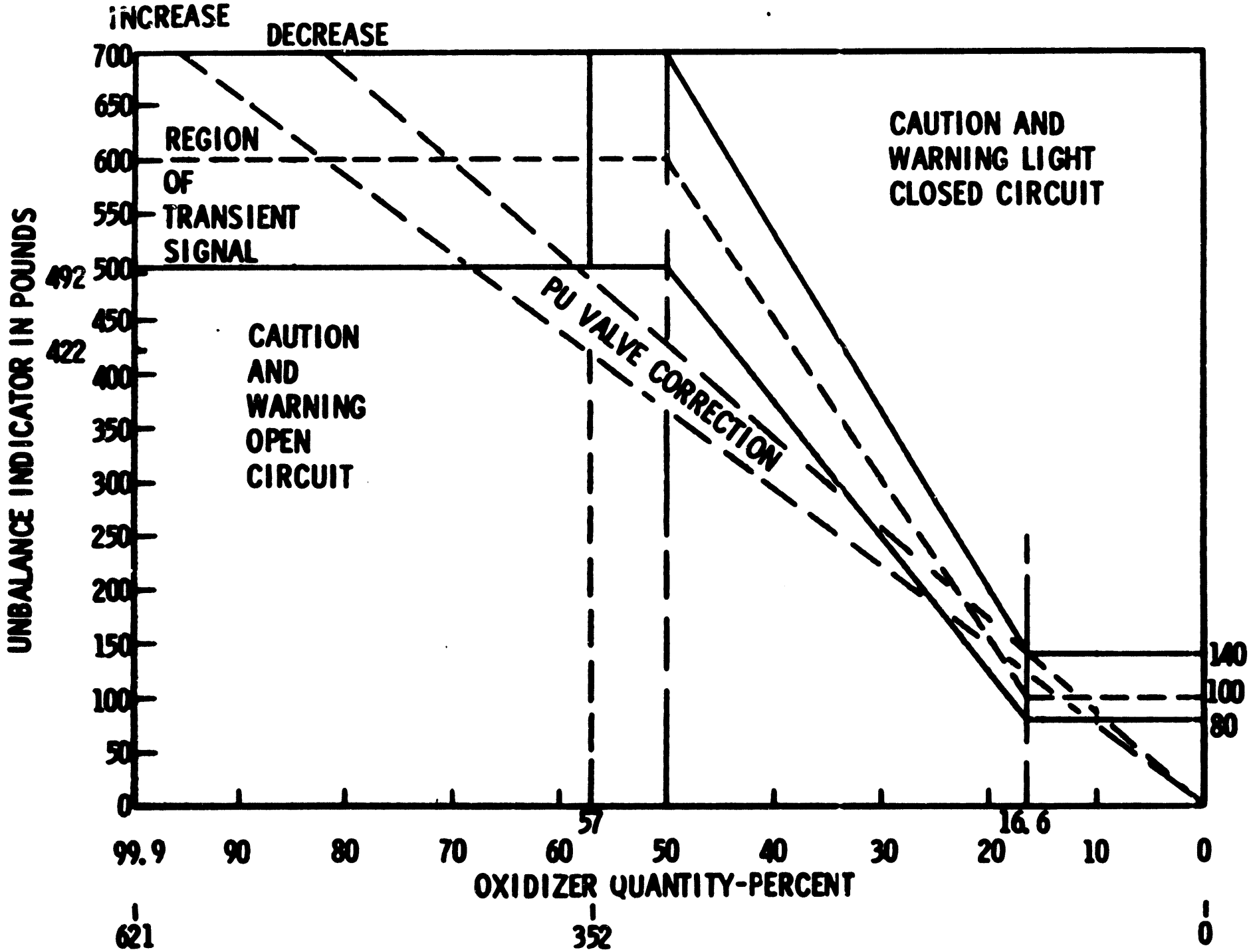

LID STATE SWITCH
IM
UX
SERVO AMP
% FUEL
99.9
FROM PUG MODE SWITCH
MDC 3 FUEL DISPLAY
MDC 2
REFERENCE PUG UNIT
SPS PU SENSOR
DISCREPANCY WARNING COMPARATOR UNITS
PRIM FUEL SUMP
PRIM FUEL STORAGE
AUX FUEL
PRIM AND AUX FUEL QTY DIFFER-ENTIAL OF 3 ± 1%
PRIM
NOR
AUX
MDC 3 PUG MODE PRIM
NORMAL
AUX
REFERENCE PUG UNIT
ID STATE SWITCH
AUX POT
INCR
LBSX100
DECR
AUX UNBAL-ANCE 600 LBS OR CRITICAL
SERVO AMP
FROM PUG MODE SWITCH
PRIM AND AUX OXID QTY DIFFER-ENTIAL OF 3 ± 1%
PRI POT
MDC 3 UNBALANCE DISPLAY
REFERENCE PUG UNIT
AUX OXID
PRIM OXID SUMP
PRIM OXID STORAGE
PRIM UNBALANCE 600 LBS OR CRITICAL
PRIM
N
AUX
FROM GAGING CONTROL UNIT VDC
TO SOLID STATE SW IN DISPLAYS
TLM FROM OXID STORAGE TANK NO. 1
TO TLM SP0655Q
TLM FROM AUX OXID
TLM FROM FUEL STORAGE TANK NO. 1
TO TLM SP0657Q
TLM FROM AUX FUEL
ID STATE SWITCH
SERVO AMP
% OXID
99.9
FROM PUG MODE SWITCH
MDC 3 OXIDIZER DISPLAY

SM-2A-1243G

OXIDIZER POINT SENSOR LOCATIONS				
NUMBER	WEIGHT POUNDS	PERCENT MAXIMUM		INCHES
	TEMP 70°F	70°F		
	PRESS. 176.60 PSIA	176.60 PSIA		
15	1,586.01	6.5	OXIDIZER SUMP TANK NO. 2	25.36
14	3,172.02	13.0		41.34
13	4,758.03	19.5		57.25
12	6,344.04	26.0		72.07
11	7,930.05	32.5		86.89
10	9,516.06	39.0		101.72
9	11,102.07	45.5		116.54
8	12,688.08	52.0		131.60
7	14,274.09	57.8	OXIDIZER STORAGE TANK NO. 1	10.50
6	15,860.10	64.3		30.57
5	17,446.11	70.8		49.55
4	19,032.13	77.3		68.54
3	20,618.14	83.8		87.52
2	22,204.15	90.3		106.51
1	23,790.16	96.8		125.49

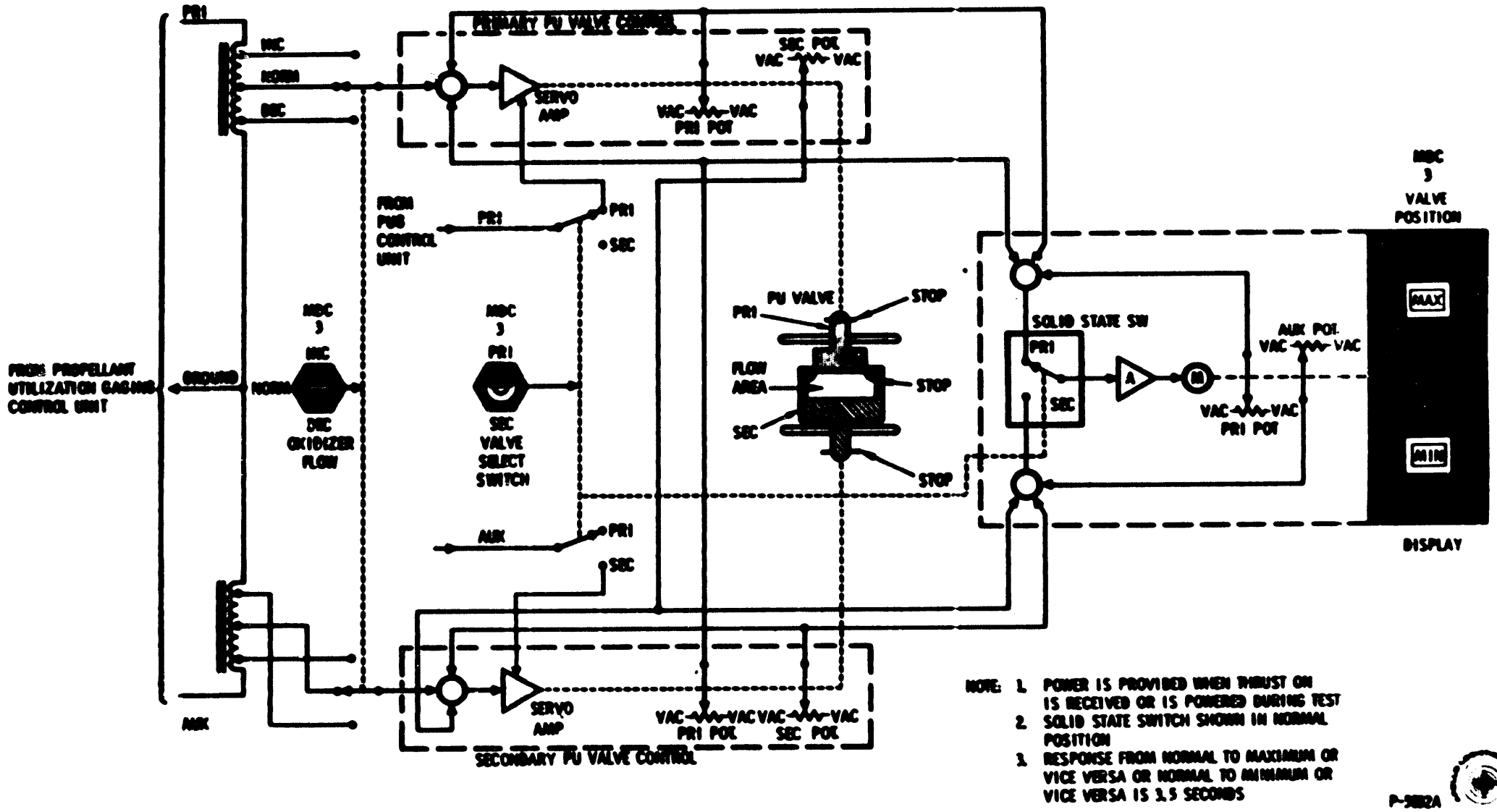
FUEL POINT SENSOR LOCATIONS				
NUMBER	WEIGHT POUNDS	PERCENT MAXIMUM		INCHES
	TEMP 70°F	70°F		
	PRESS. 176.60 PSIA	176.60 PSIA		
15	992.08	6.5	FUEL SUMP TANK NO. 2	25.36
14	1984.16	13.0		41.34
13	2976.24	19.5		57.25
12	3968.32	26.0		72.07
11	4960.40	32.5		86.89
10	5952.48	39.0		101.72
9	6944.56	45.5		116.54
8	7936.64	52.0		131.60
7	8928.72	57.8	FUEL STORAGE TANK NO. 1	10.48
6	9920.80	64.3		30.55
5	10912.88	70.8		49.54
4	11904.96	77.3		68.52
3	12897.04	83.8		87.51
2	13889.12	90.3		106.49
1	14881.20	96.8		125.48

CAUTION AND WARNING
CRITICAL PROPELLANT UNBALANCE COMPARATOR



P-5096-1A (A) 10

PROPELLANT UTILIZATION VALVE CONTROL AND FLAG DISPLAY

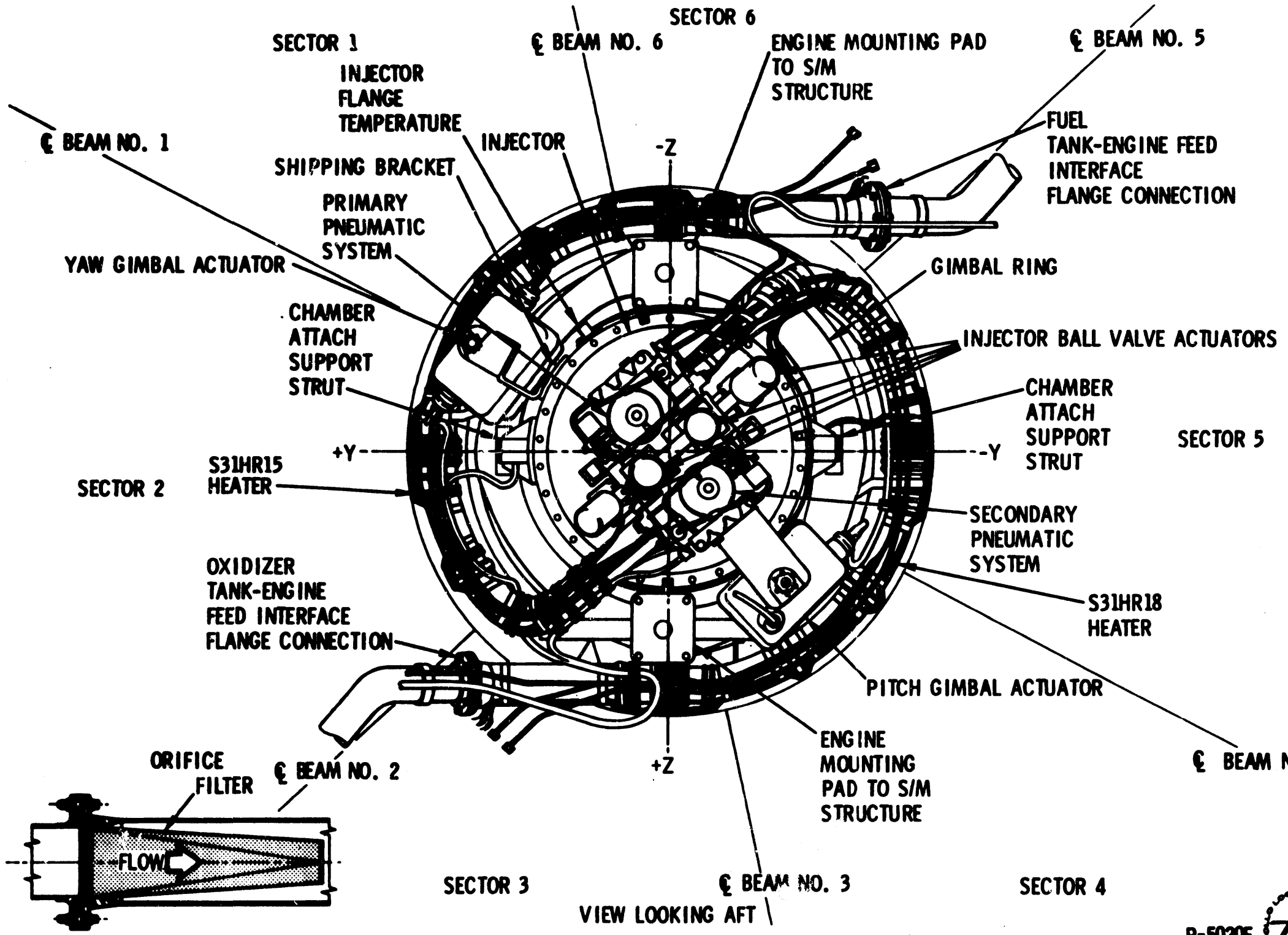


NOTE: 1. POWER IS PROVIDED WHEN THRUST ON IS RECEIVED OR IS POWERED DURING TEST
2. SOLID STATE SWITCH SHOWN IN NORMAL POSITION
3. RESPONSE FROM NORMAL TO MAXIMUM OR VICE VERSA OR NORMAL TO MINIMUM OR VICE VERSA IS 3.5 SECONDS

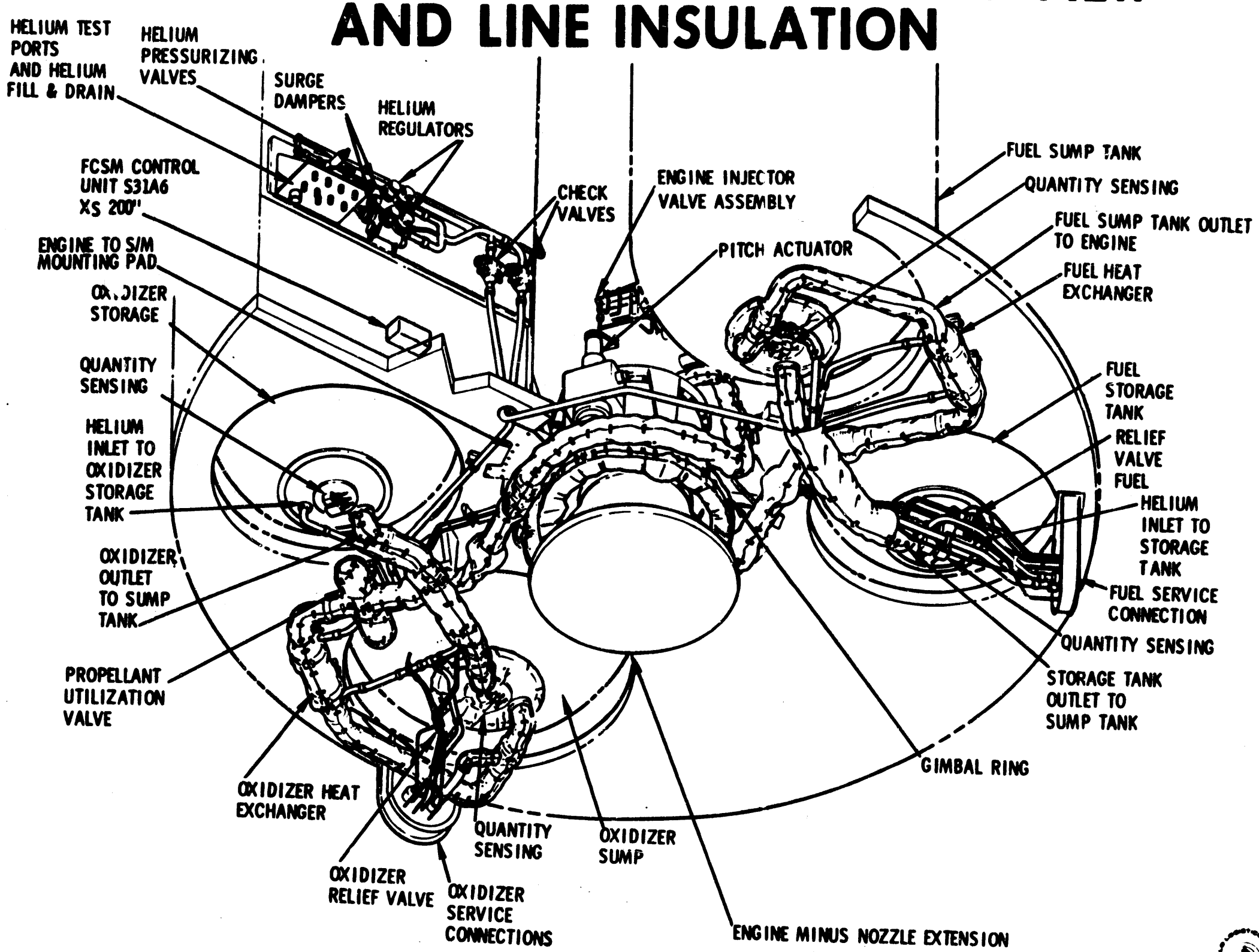
P-5882A

TOP VIEW OF SPS ENGINE

(CSM 106 AND SUBS)

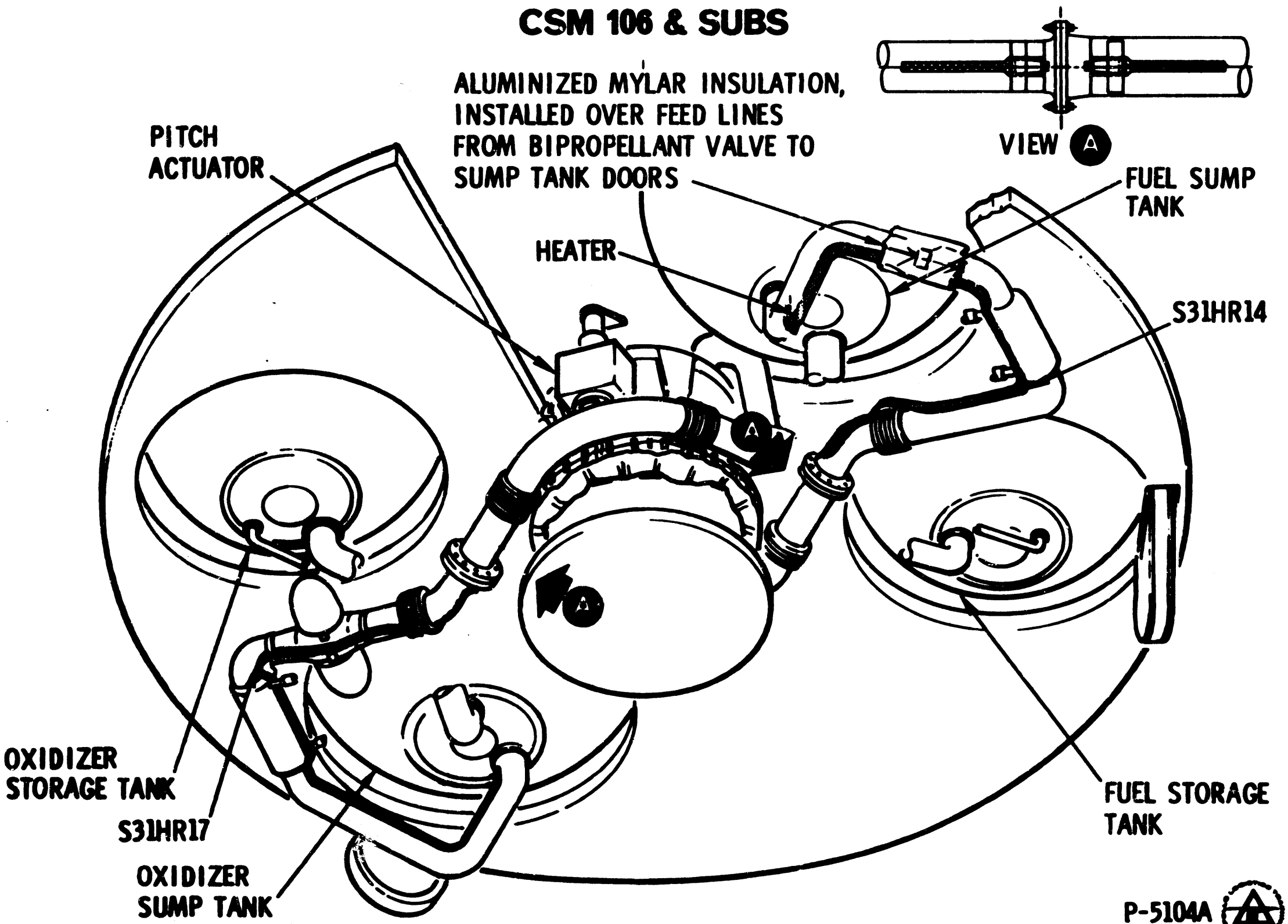


SPS COMPONENT LOCATIONS AFT VIEW AND LINE INSULATION

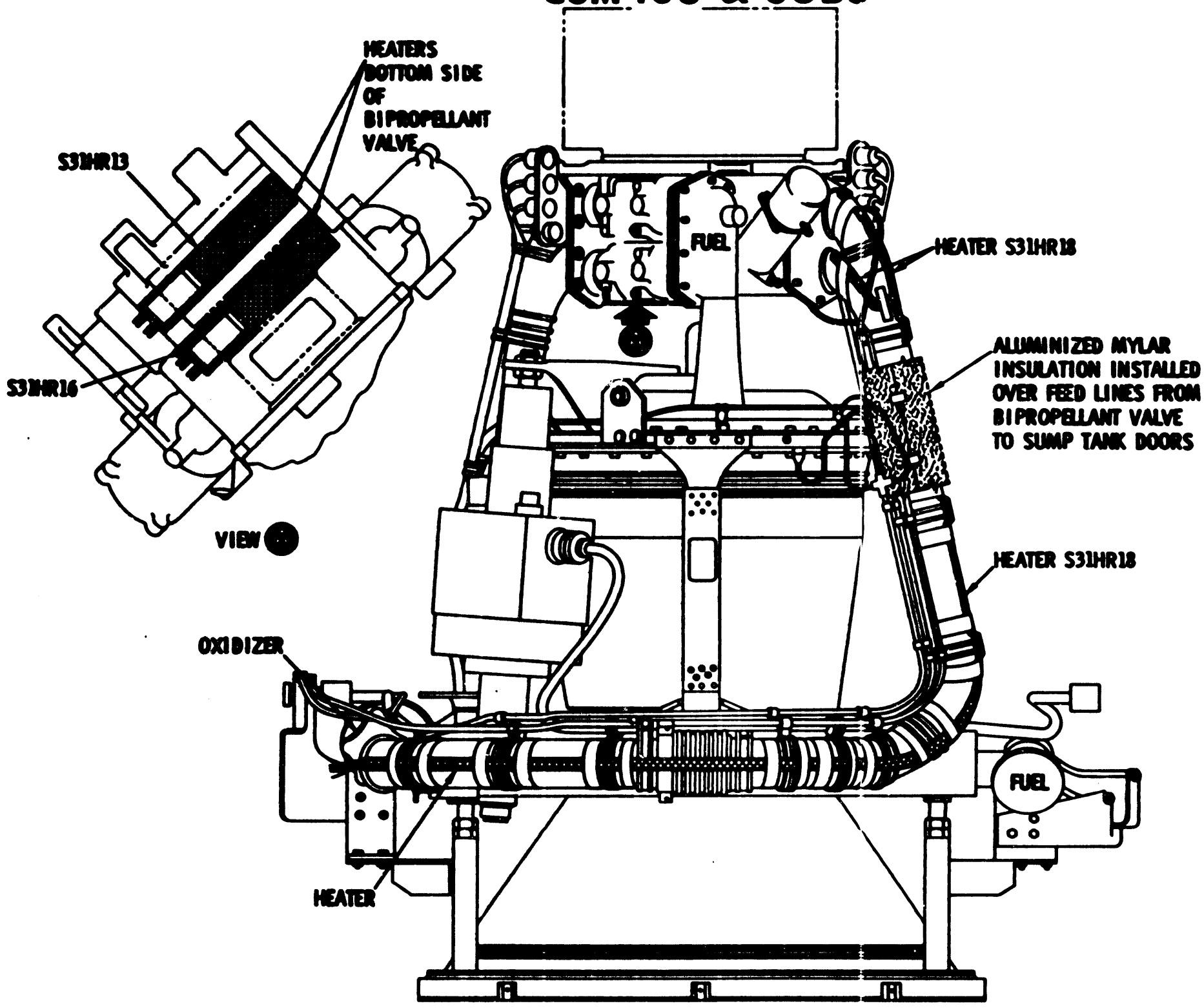


SPS HEATER INSTALLATION, TANK FEED LINES

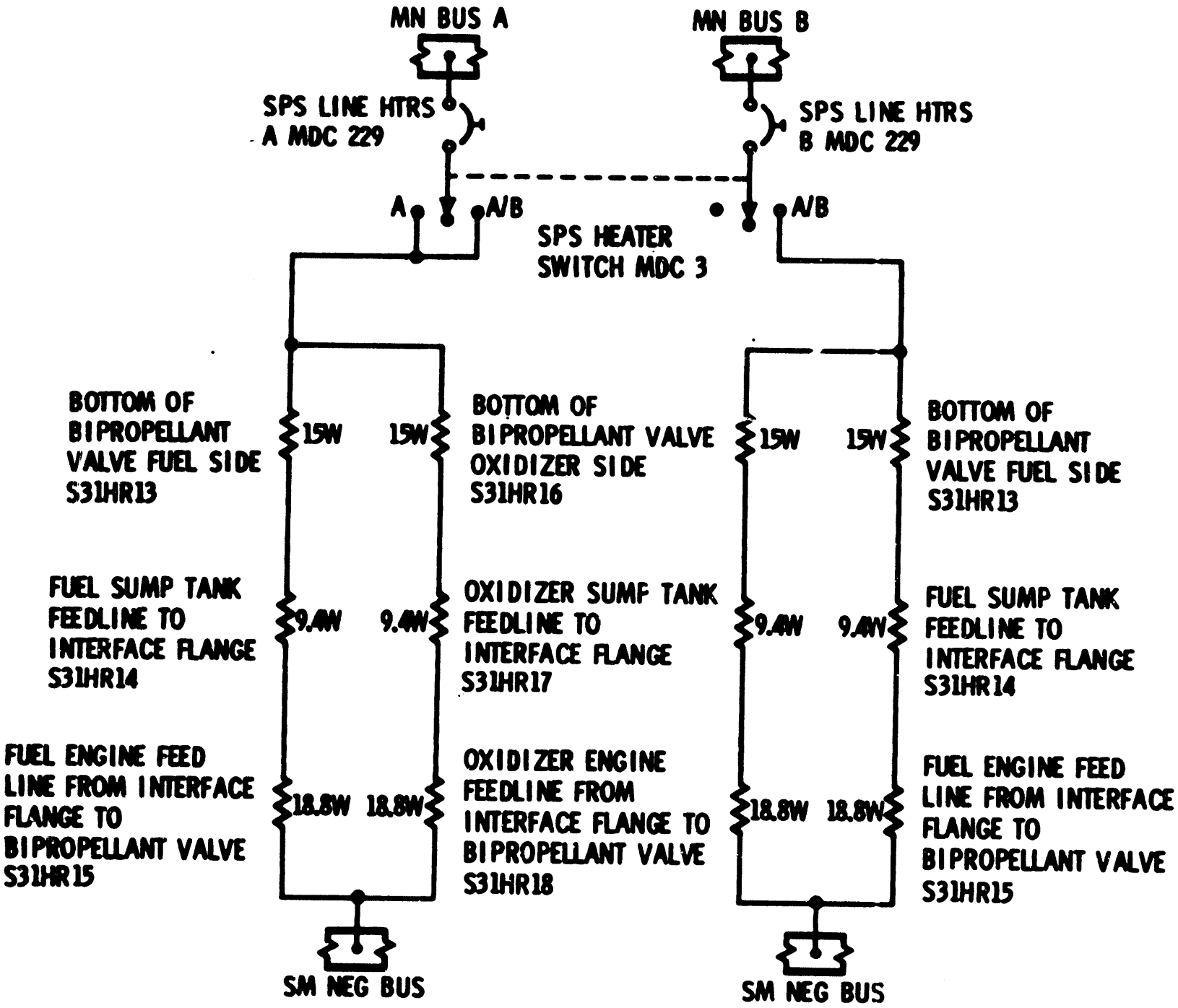
CSM 106 & SUBS



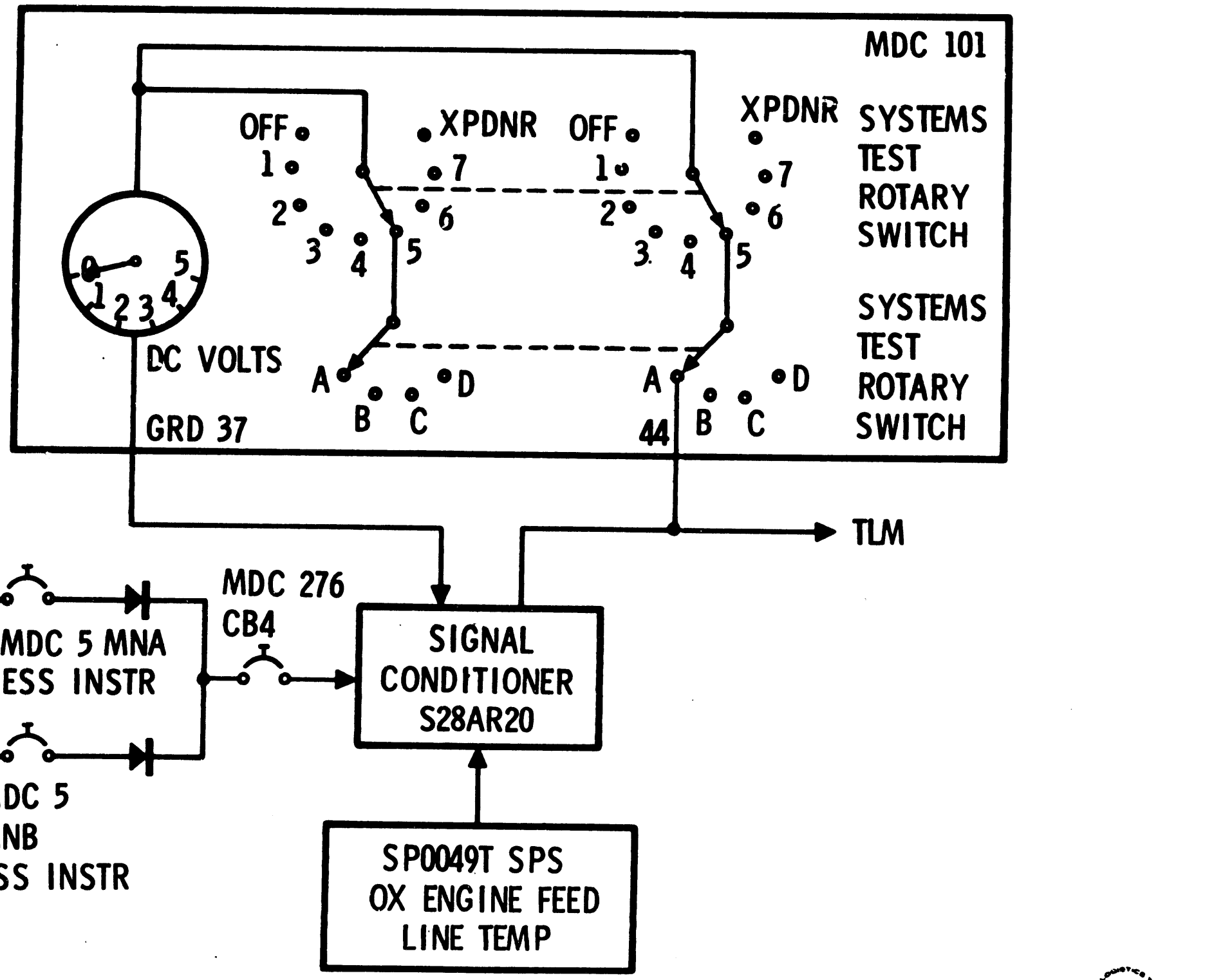
SPS HEATER INSTALLATION ENGINE FEED LINES
CSM 106 & SUBS



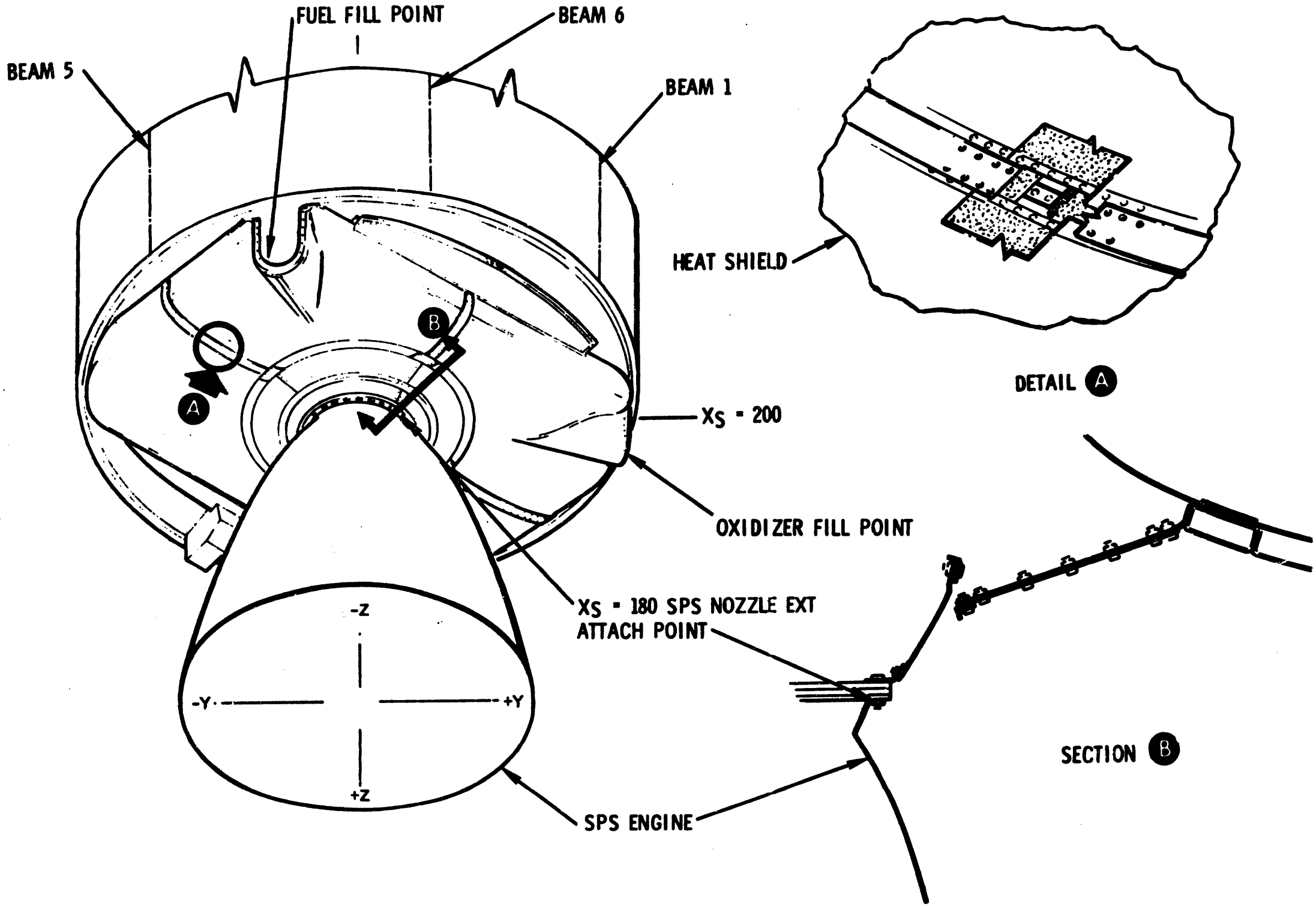
SPS ENGINE HEATER SCHEMATIC
CSM 106 & SUBS



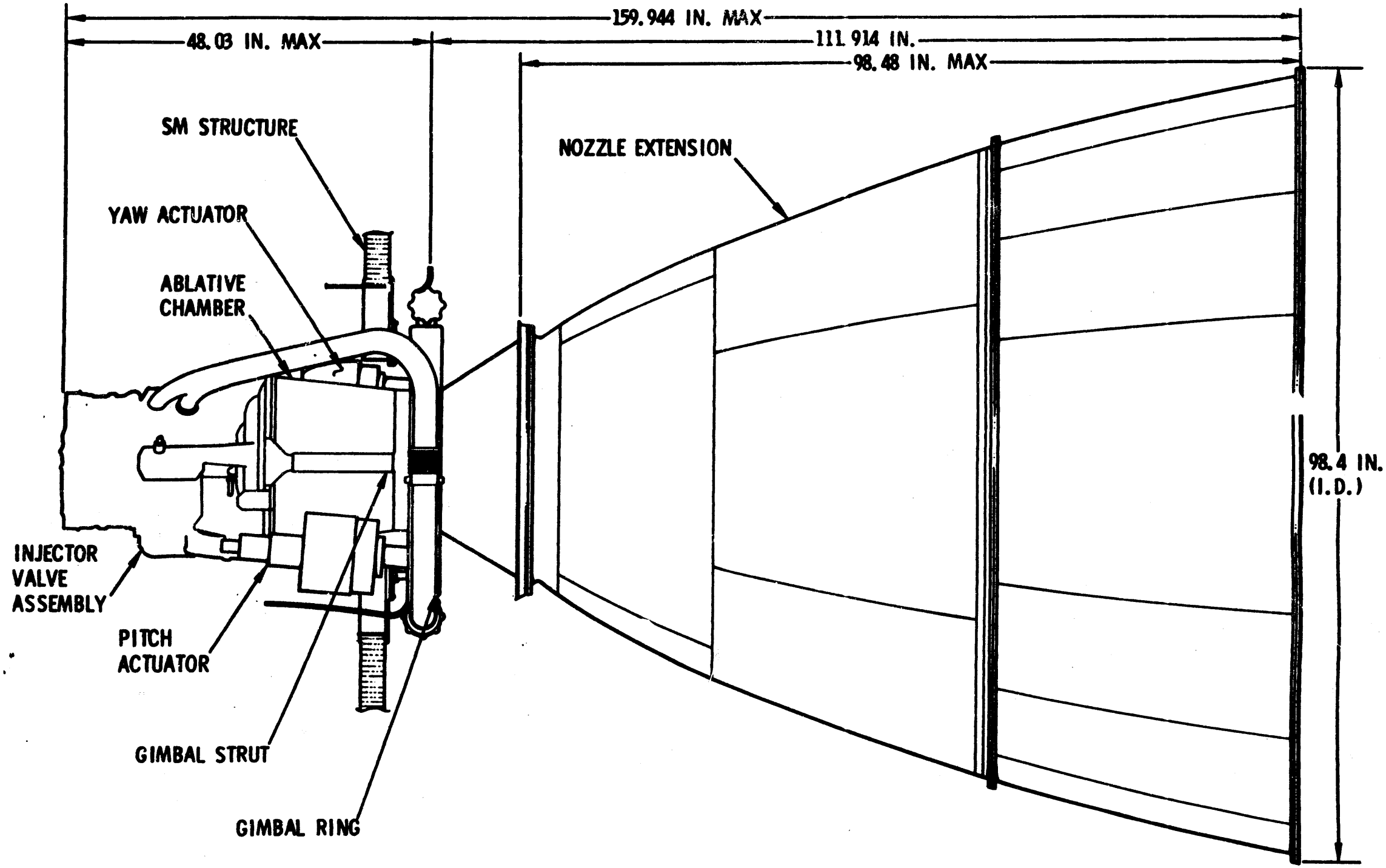
SPS OXIDIZER ENGINE FEED LINE
TEMPERATURE MONITORING



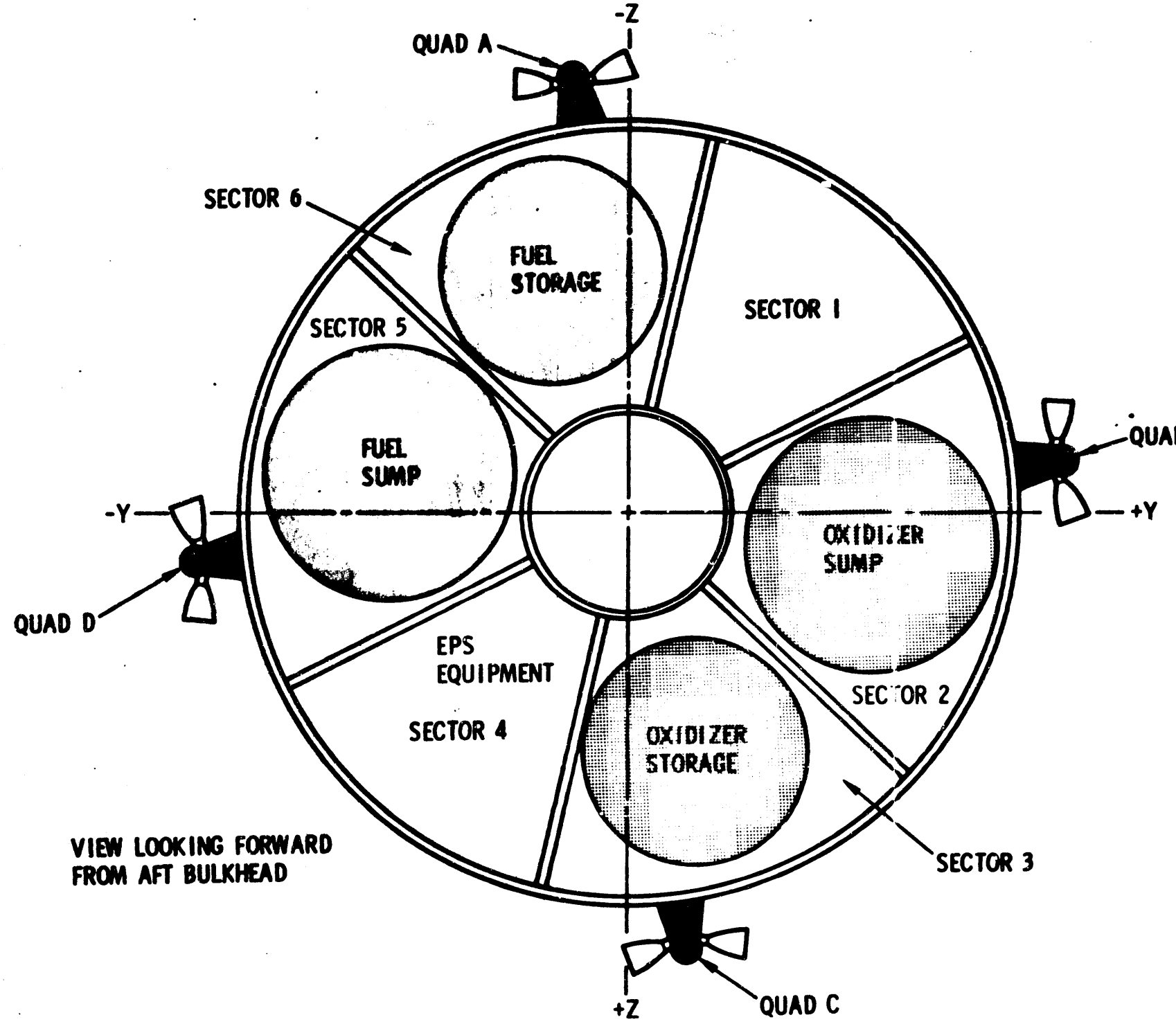
SM SPS NOZZLE AND HEAT SHIELD



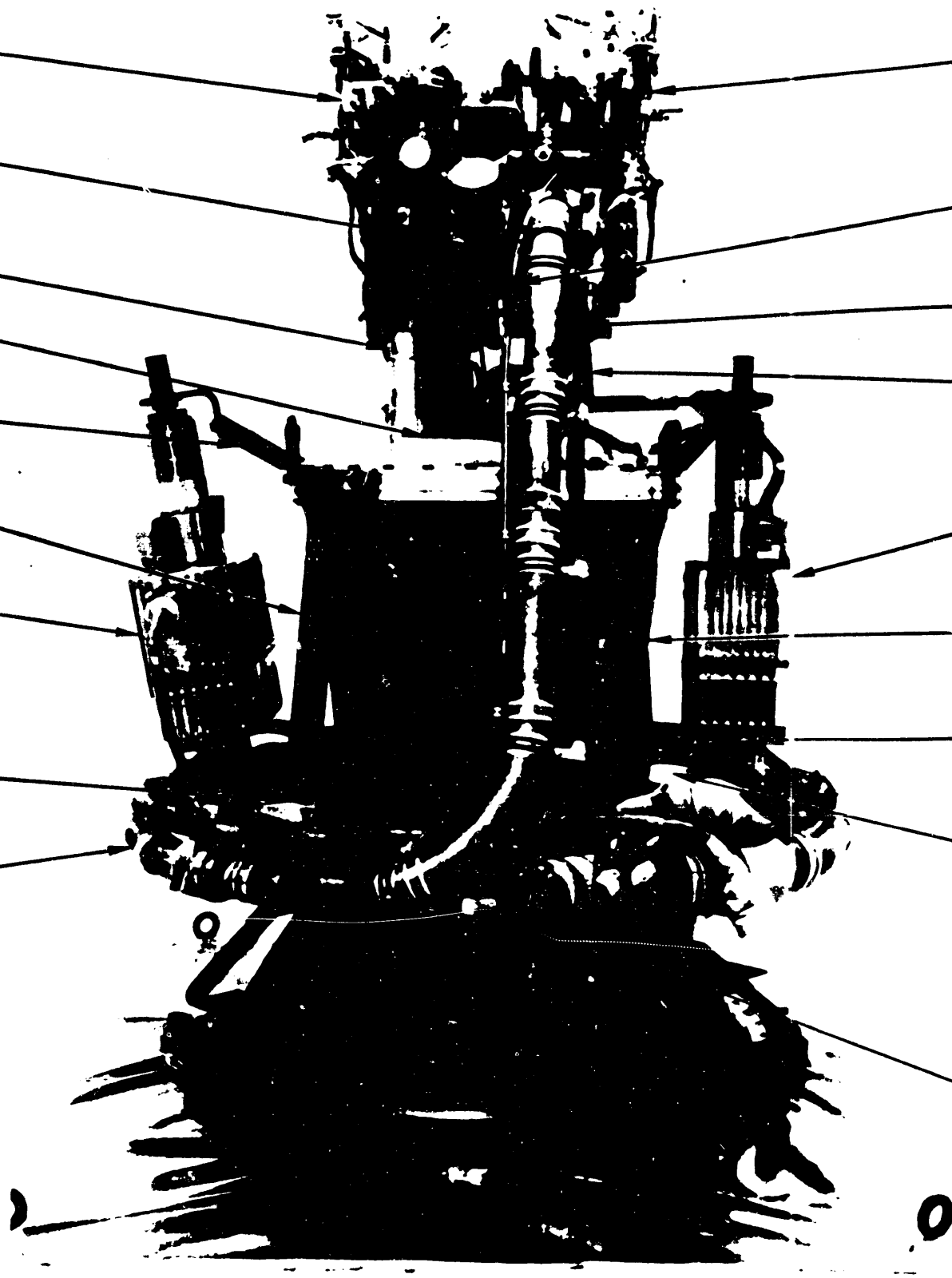
SPS ENGINE AJ10-137



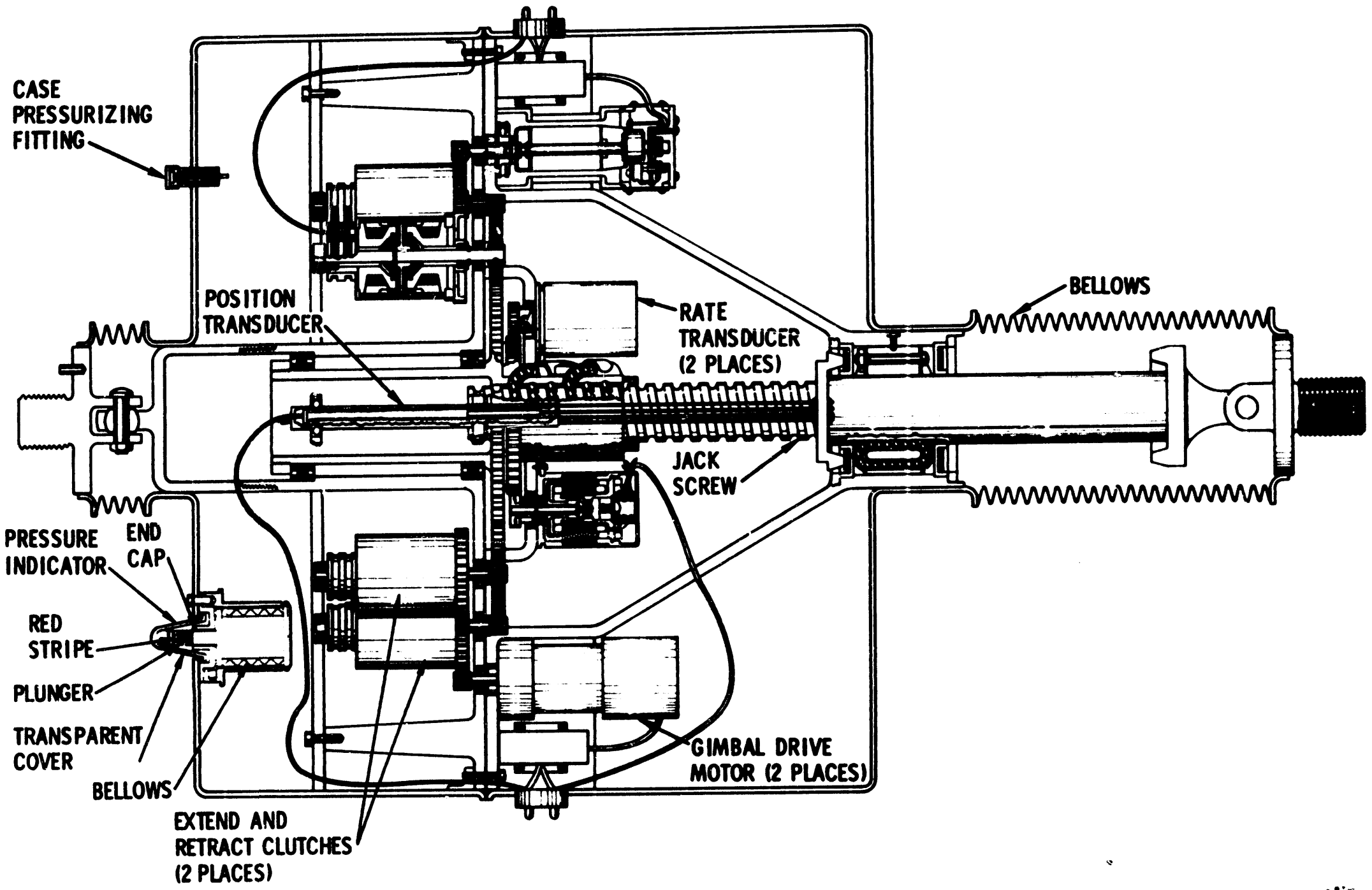
SERVICE MODULE SECTORS



SPS ENGINE
VIEWED BETWEEN +Y AND +Z



SPS ELECTRO-MECHANICAL GIMBAL ACTUATOR



FUNCTIONAL FLOW

SC CONT MDC 1 TRANSLATION CONTROL

POWER INPUTS

CMC

NEUTRAL

SCS

CW

RATE

ACCEL

SCS TVC MDC 1 AUTO

IGNITION NO. 2

CMC

SCS AUTO

MTVC WITH RATE

MTVC WITHOUT RATE

INHIBIT TO

DEMOD

RATE GENERATO

CH3667C TLM YAW DIFFERENTIAL

PRIMARY

EXTEND CLUTCH

PRIMARY SERVO AMP

ARC SUPPRESSION COIL DISCHARGE

M1

RETRACT CLUTCH

+15V

TVC SERVO POWER SWITCH MDC 7

-15V

TRIM NO. 1 (PRIMARY)

TV GIMBAL POSITION TRIM THUMBWHEEL MDC 1

(SECONDARY) TRIM NO. 2 +15V

TVC SERVO POWER SWITCH MDC 7

-15V

A4K4

A4K5

A4K6

A4K6

A4K6

A4K6

A4K4

A4K5

TO SCS INTEG RATOR

TLM CH3518H YAW GMBL POSITION

DC

DEMOD

GIMBAL POSITION

S-IVB FUEL PRESS

S-II FUEL PRESS

S-IVB OXID PRESS

PITCH

A11K6

A11K5

A11K3

A11K4

LV TANK PRESS MDC-1

LV/SPS IND MDC 1 S-II/S-IVB

A11K3

A11K6

GP1

EDS 1 BAT MDC 8

EDS 3 BAT MDC-8

A11K4

A11K5

GIMBAL POSITION

DC

DEMOD

EXTEND CLUTCH

SECONDARY SERVO AMP

ARC SUPPRESSION COIL DISCHARGE

M2

RETRACT CLUTCH

INDENTICAL REDUNDANT INPUTS, SAME AS PRIMARY SERVO AMP

CH3667C TLM YAW DIFFERENTIAL

SECONDARY

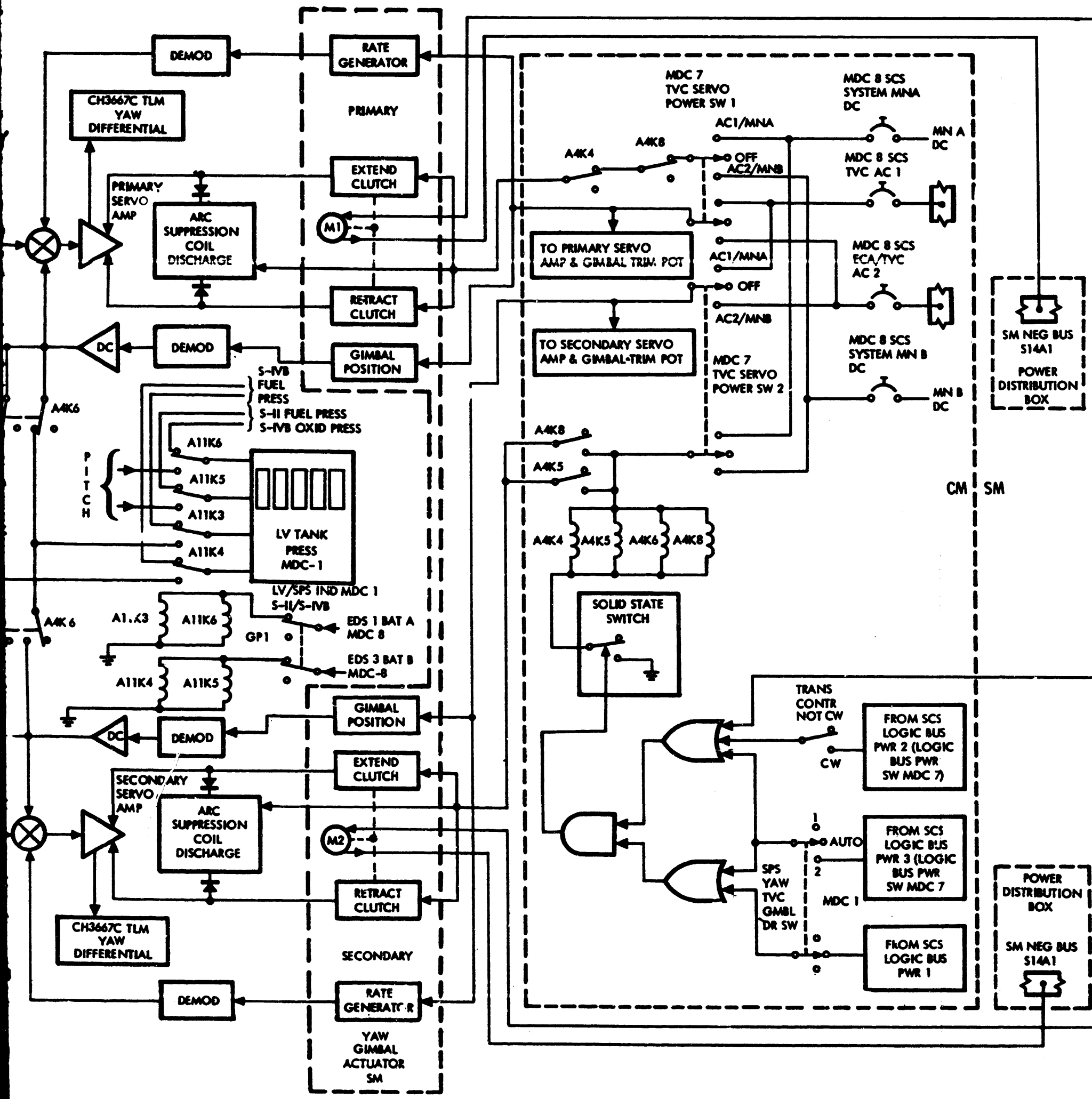
DEMOD

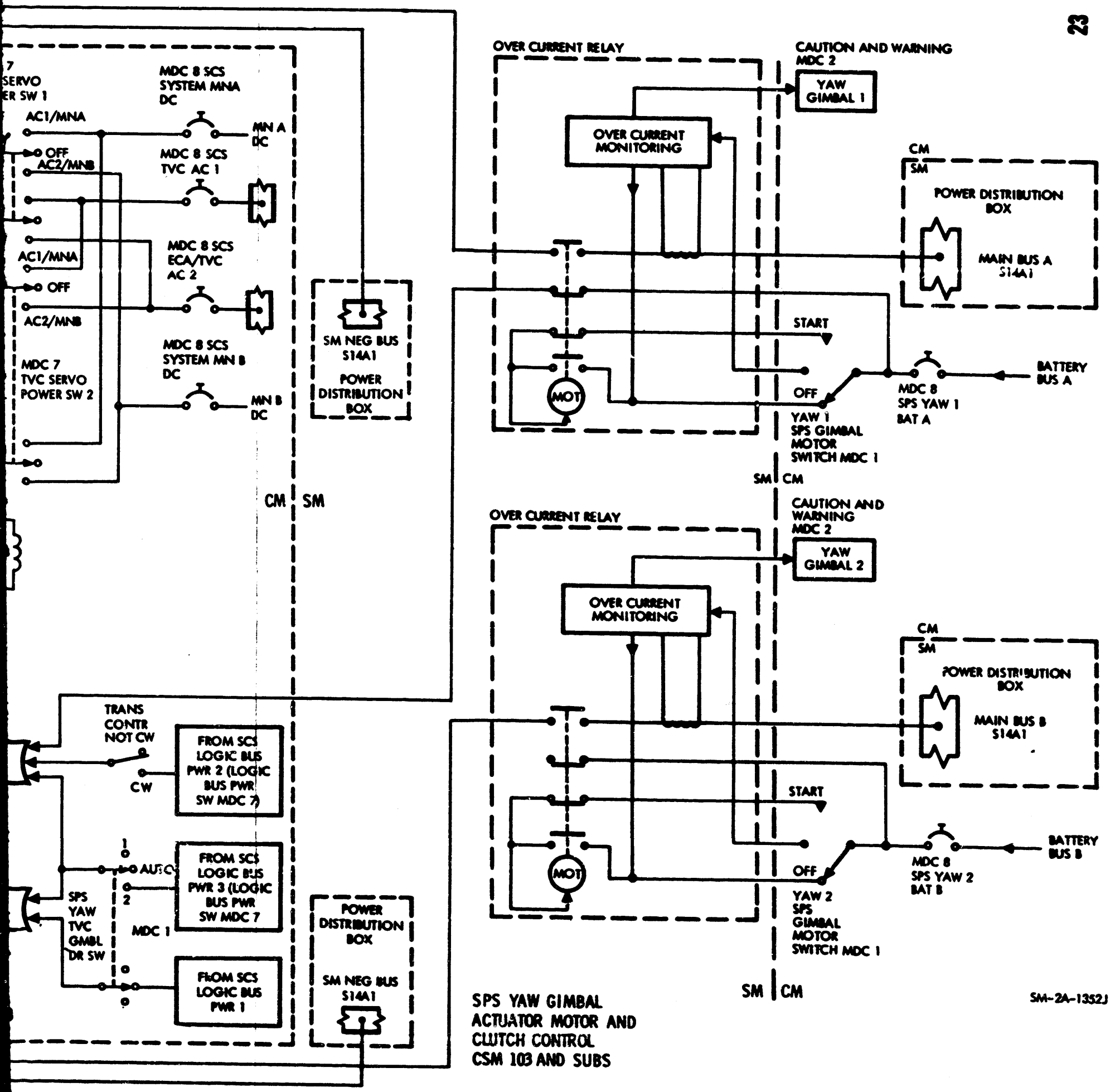
RATE GENERATO

YAW GIMBAL ACTUATOR SM

CH3517H TLM PITCH GIMBAL POSITION

CH3666C TLM PITCH DIFFERENTIAL


DEMOD
RATE GENERATOR
CH3667C TLM YAW DIFFERENTIAL
PRIMARY
EXTEND CLUTCH
PRIMARY SERVO AMP
ARC SUPPRESSION COIL DISCHARGE
M1
RETRACT CLUTCH
DC
DEMOD
GIMBAL POSITION
S-IVB FUEL PRESS
S-II FUEL PRESS
S-IVB OXID PRESS
A4K6
A11K6
A11K5
A11K3
A11K4
PITCH
LV TANK PRESS MDC-1
LV/SPS IND MDC 1 S-II/S-IVB
EDS 1 BAT A MDC 8
EDS 3 BAT B MDC-8
GP1
A11K3
A11K6
A11K4
A11K5
A4K6
DC
DEMOD
GIMBAL POSITION
EXTEND CLUTCH
SECONDARY SERVO AMP
ARC SUPPRESSION COIL DISCHARGE
M2
RETRACT CLUTCH
CH3667C TLM YAW DIFFERENTIAL
SECONDARY
DEMOD
RATE GENERATOR
YAW GIMBAL ACTUATOR SM
MDC 7 TVC SERVO POWER SW 1
AC1/MNA
A4K4
A4K8
OFF
AC2/MNB
TO PRIMARY SERVO AMP & GIMBAL TRIM POT
AC1/MNA
OFF
AC2/MNB
TO SECONDARY SERVO AMP & GIMBAL-TRIM POT
MDC 7 TVC SERVO POWER SW 2
A4K8
A4K5
A4K4
A4K5
A4K6
A4K8
SOLID STATE SWITCH
MDC 8 SCS SYSTEM MNA DC
MN A DC
MDC 8 SCS TVC AC 1
MDC 8 SCS ECA/TVC AC 2
MDC 8 SCS SYSTEM MN B DC
MN B DC
SM NEG BUS S14A1
POWER DISTRIBUTION BOX
CM
SM
TRANS CONTR NOT CW
CW
FROM SCS LOGIC BUS PWR 2 (LOGIC BUS PWR SW MDC 7)
1
AUTO
2
MDC 1
SPS YAW TVC GMBL DR SW
FROM SCS LOGIC BUS PWR 3 (LOGIC BUS PWR SW MDC 7
FROM SCS LOGIC BUS PWR 1
POWER DISTRIBUTION BOX
SM NEG BUS S14A1

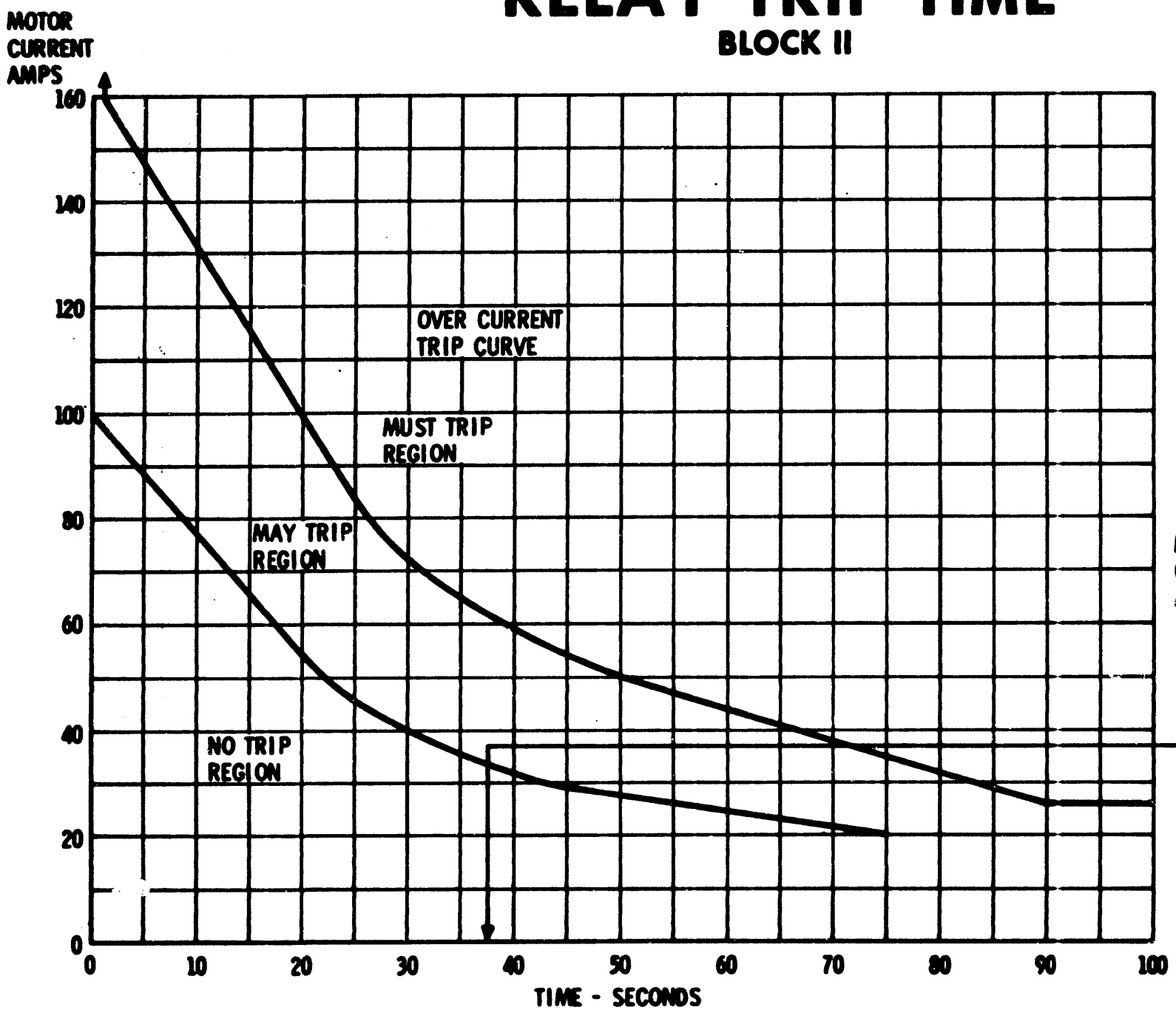


SPS YAW GIMBAL ACTUATOR MOTOR AND CLUTCH CONTROL CSM 103 AND SUBS

SM-2A-1352J

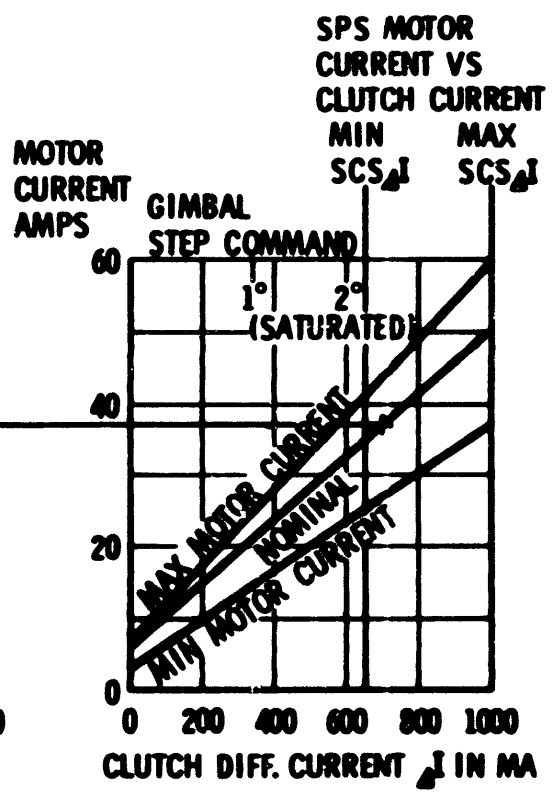
SPS GIMBAL ACTUATOR OVER CURRENT RELAY TRIP TIME

BLOCK II

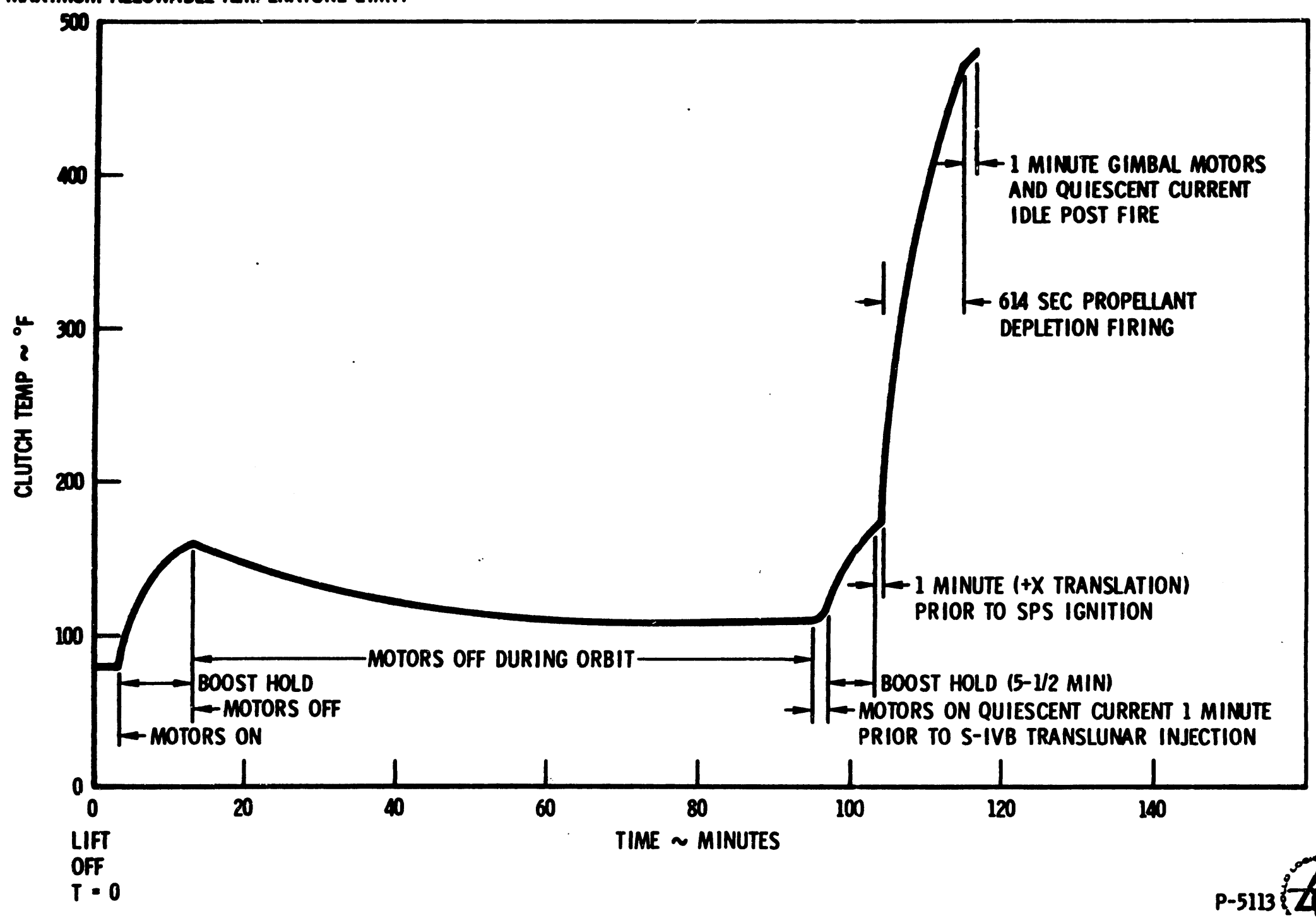


EXAMPLE

1. SATURATED SCS AMPLIFIER OUTPUT CURRENT OF 700 MA CAUSES SPS GIMBAL MOTOR TO DRAW 37 AMPS, OVER CURRENT RELAY TRIPS IN 37.5 SECONDS NOMINAL

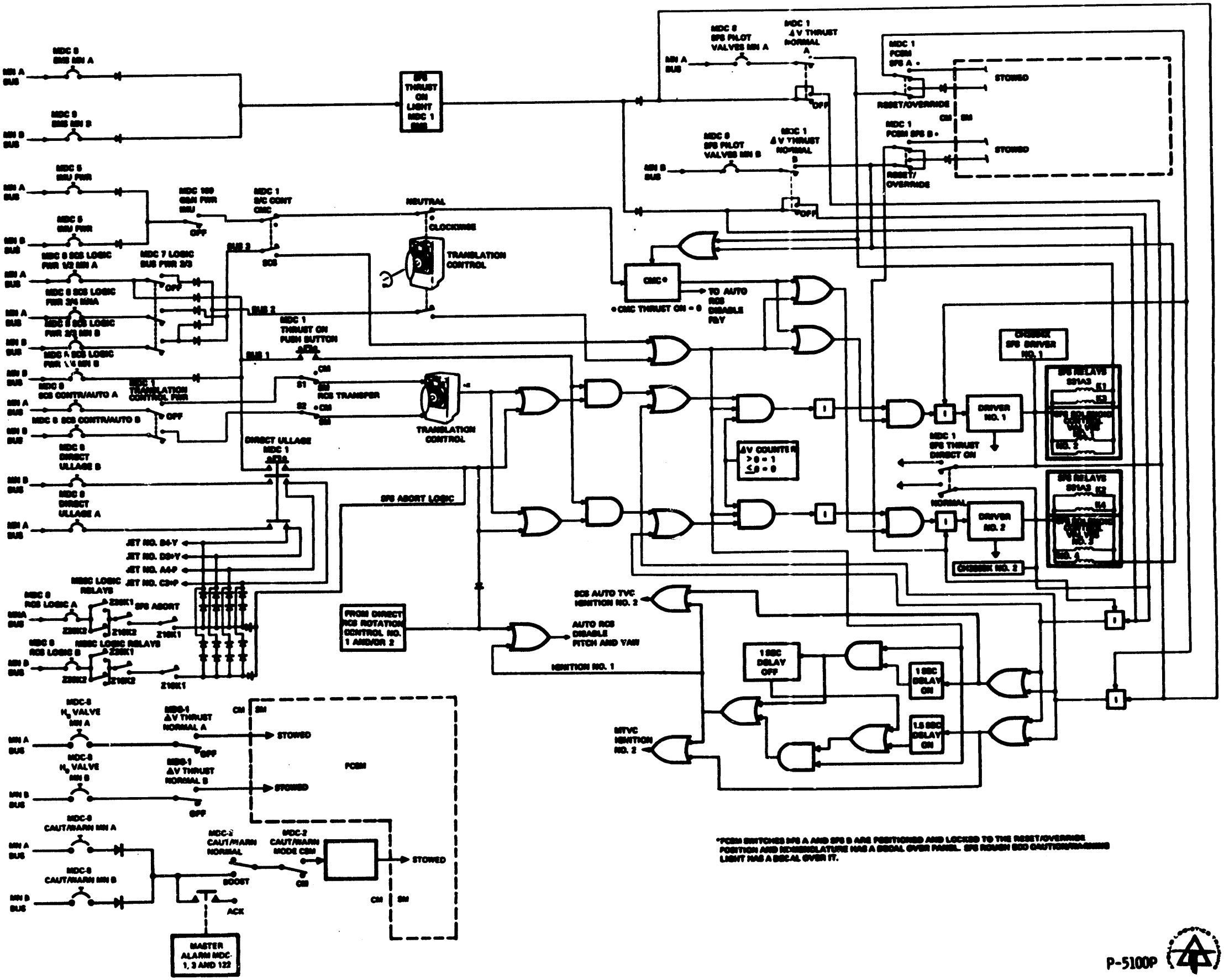


SPS ENGINE GIMBAL ACTUATOR CLUTCH TEMPERATURE



SPS THRUST ON–OFF LOGIC

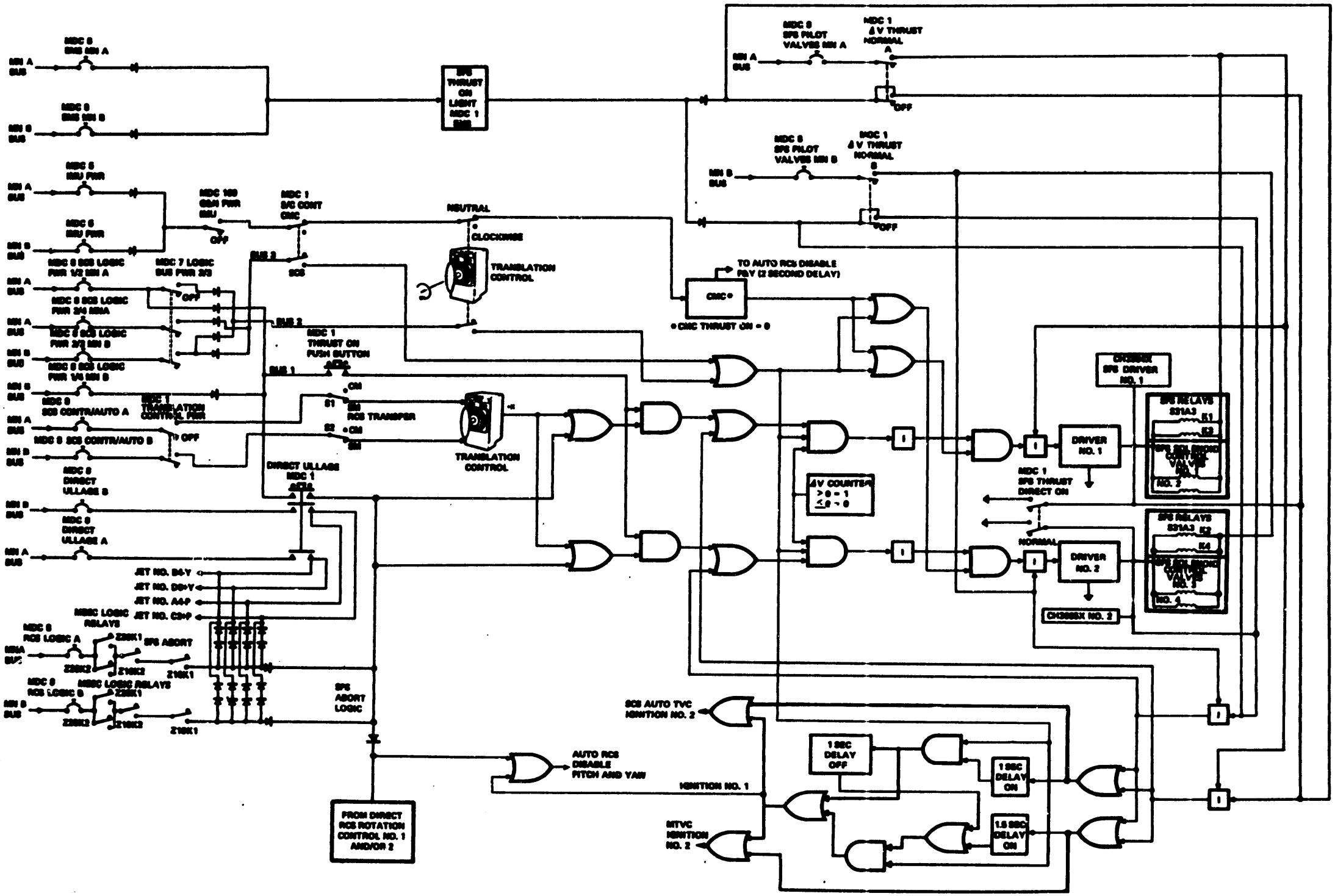
CSM 106 THROUGH CSM 111



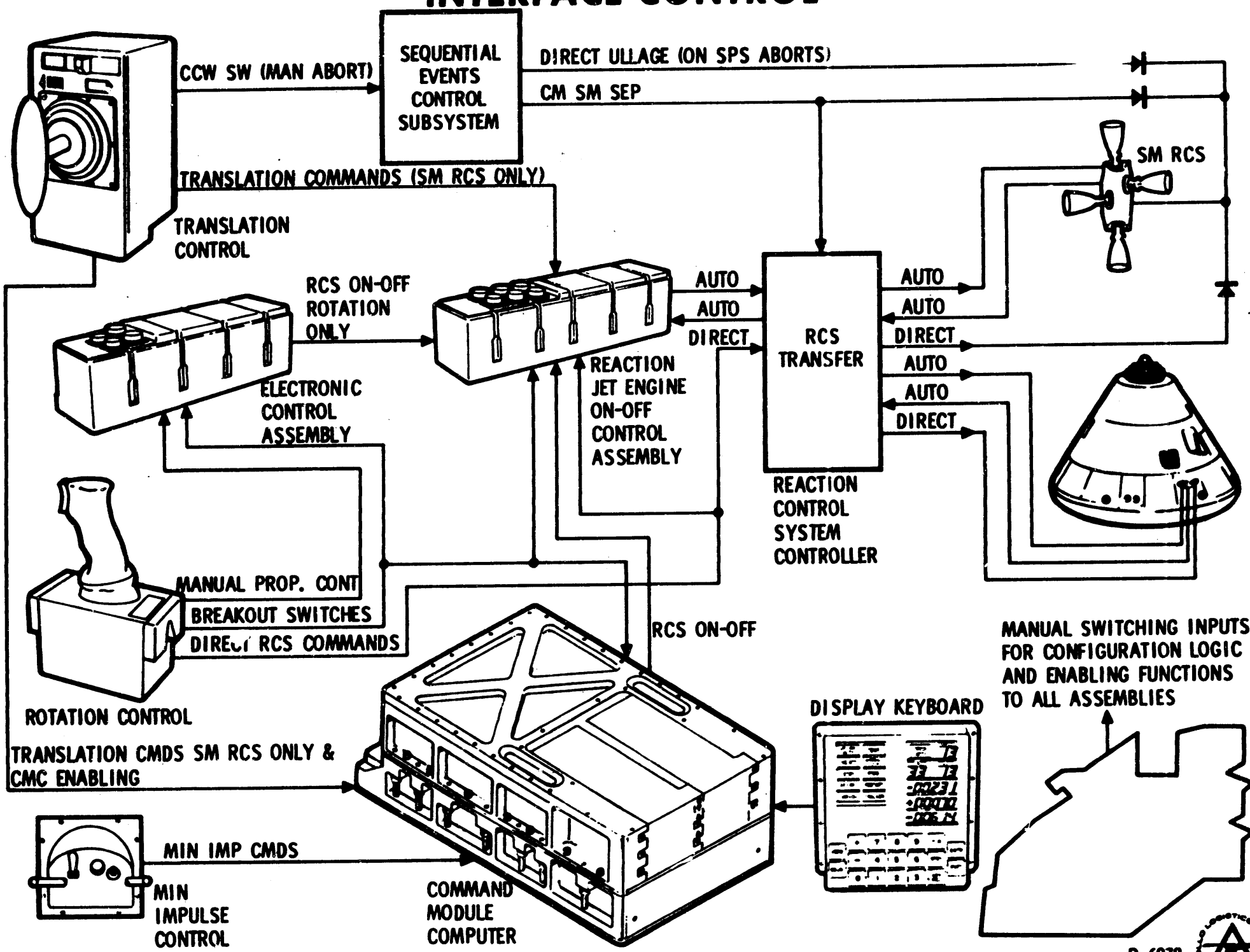
*PCSM SWITCHES SPS A AND SPS B ARE POSITIONED AND LOCKED TO THE RESET/OVERRIDE POSITION AND NOMENCLATURE HAS A DECAL OVER PANEL. SPS ROUGH SCO CAUTION/WARNING LIGHT HAS A DECAL OVER IT.

SPS THRUST ON–OFF LOGIC

(CSM 112 AND SUBS)



CSM REACTION CONTROL SYSTEM
INTERFACE CONTROL



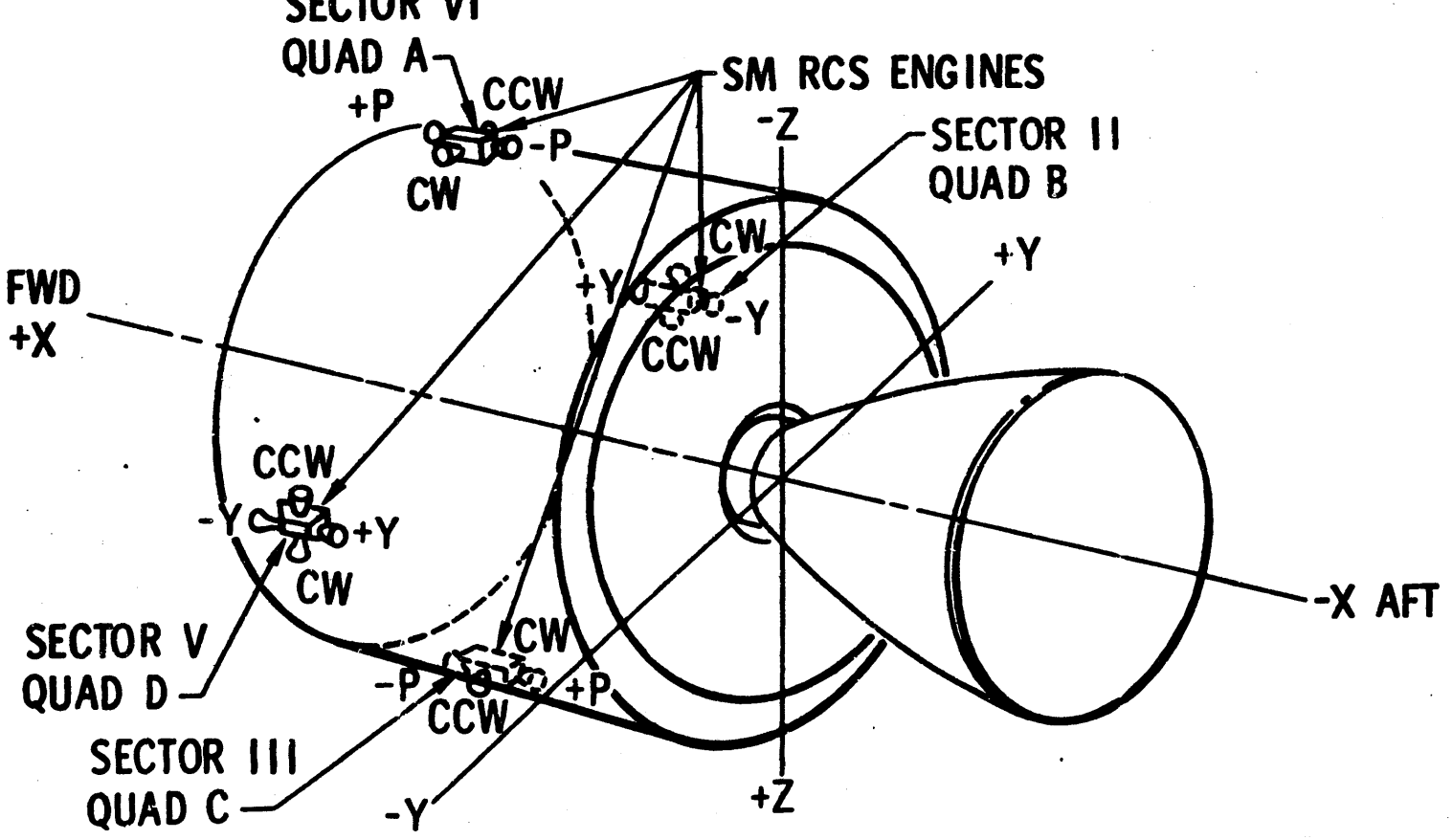
P-6078

SM REACTION CONTROL SYSTEM

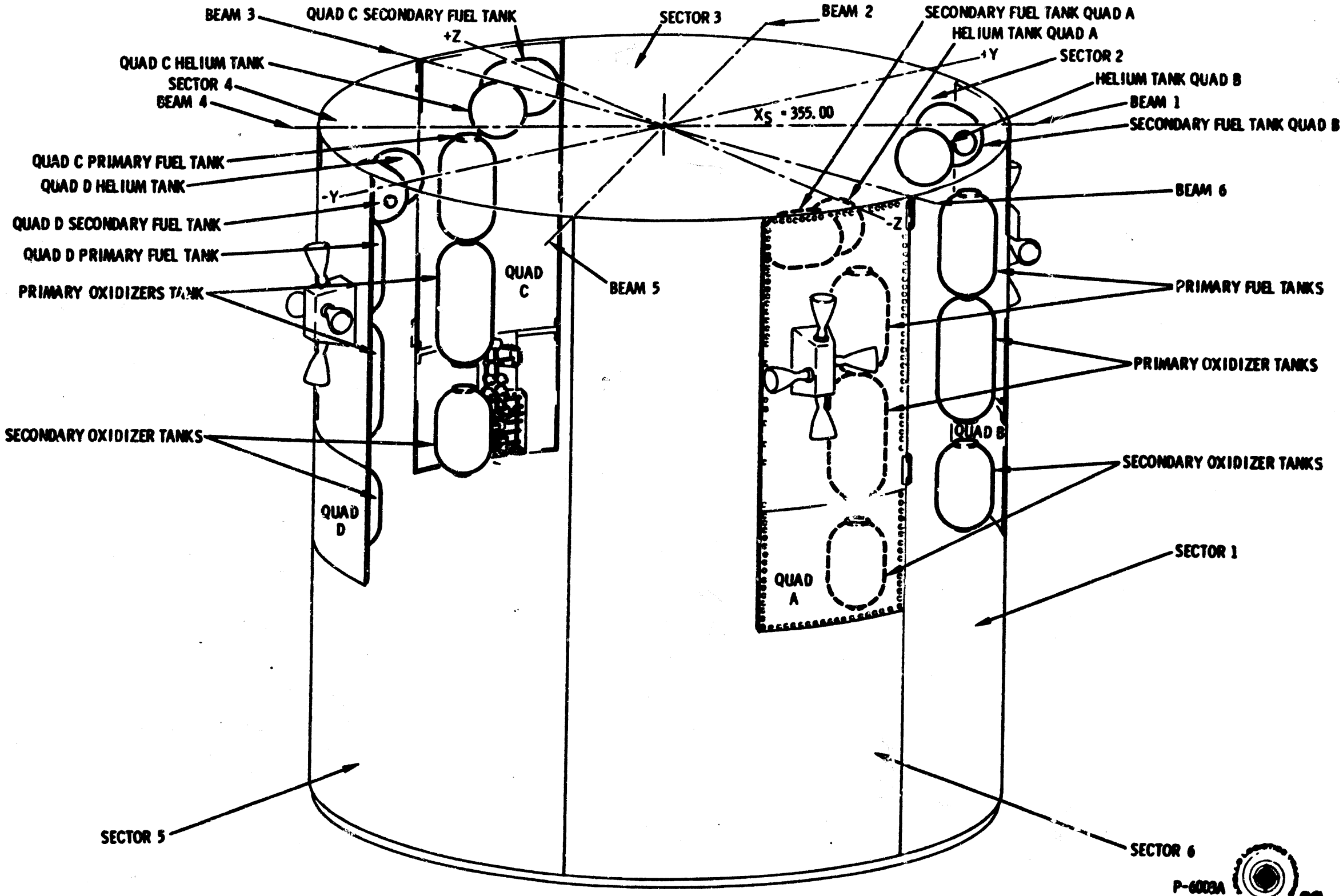
PURPOSE: PROVIDE THRUST FOR ATTITUDE AND/OR TRANSLATION CONTROL AFTER SEPARATION FROM THE S-IVB BOOSTER UP UNTIL CM/SM SEPARATION

TYPE OF SYSTEM: NON THROTTLEABLE, PRESSURE FEED SYSTEM, HYPERGOLIC PROPELLANTS AND RADIANT COOLED THRUST CHAMBERS

SYSTEM DESCRIPTION: FOUR INDIVIDUAL QUADS
EACH QUAD CONSISTS OF A SEPARATE PROPELLANT FEED SYSTEM AND FOUR THRUST CHAMBERS
PROPELLANTS - INHIBITED NITROGEN TETROXIDE AND MONOMETHYL HYDRAZINE
SYSTEM CONTROLLED BY CMC OR SCS WITH A DIRECT CONTROL BACK-UP CAPABILITY



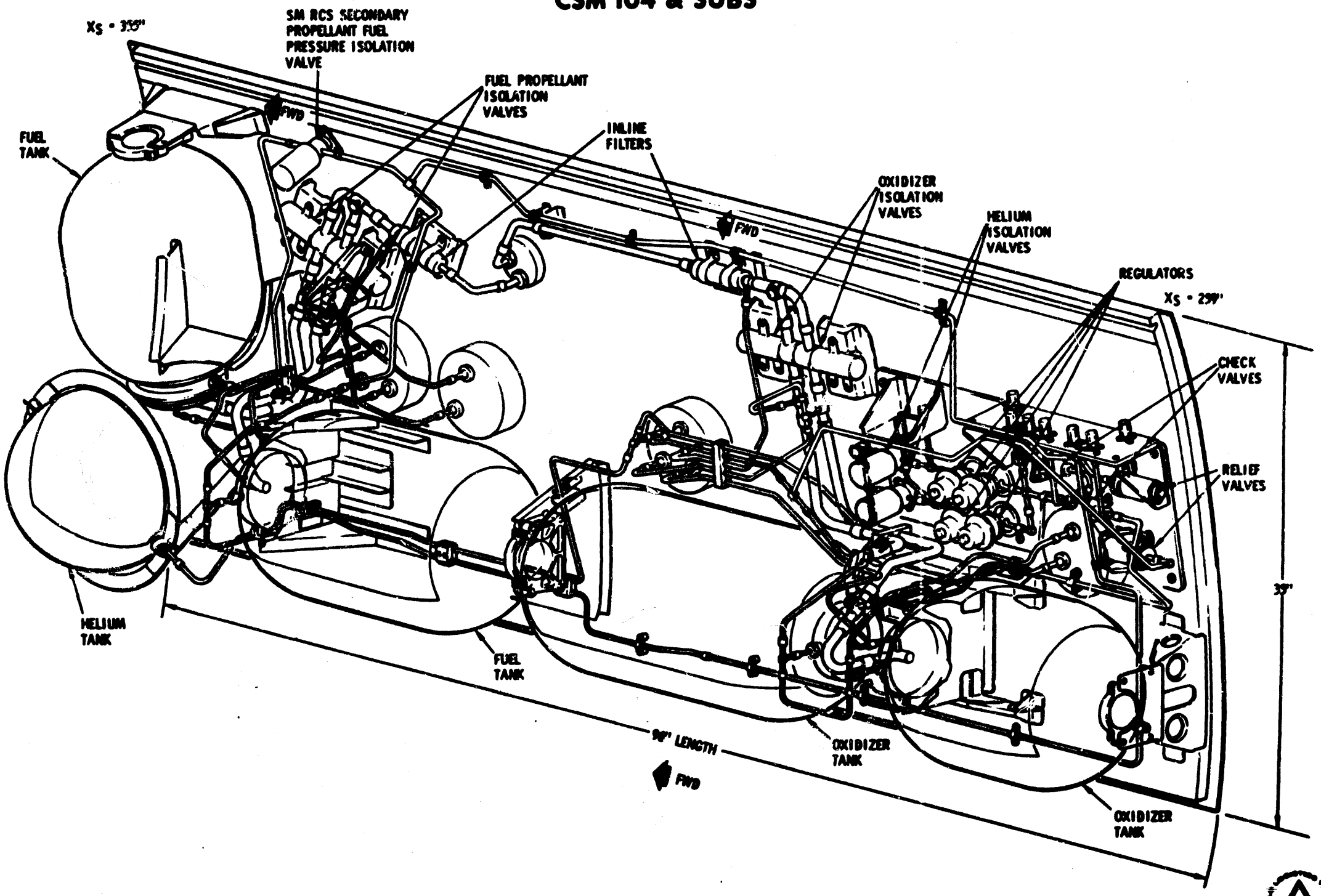
SM RCS QUADS



P-6009A

SM RCS PANEL ASSEMBLY QUAD A &C

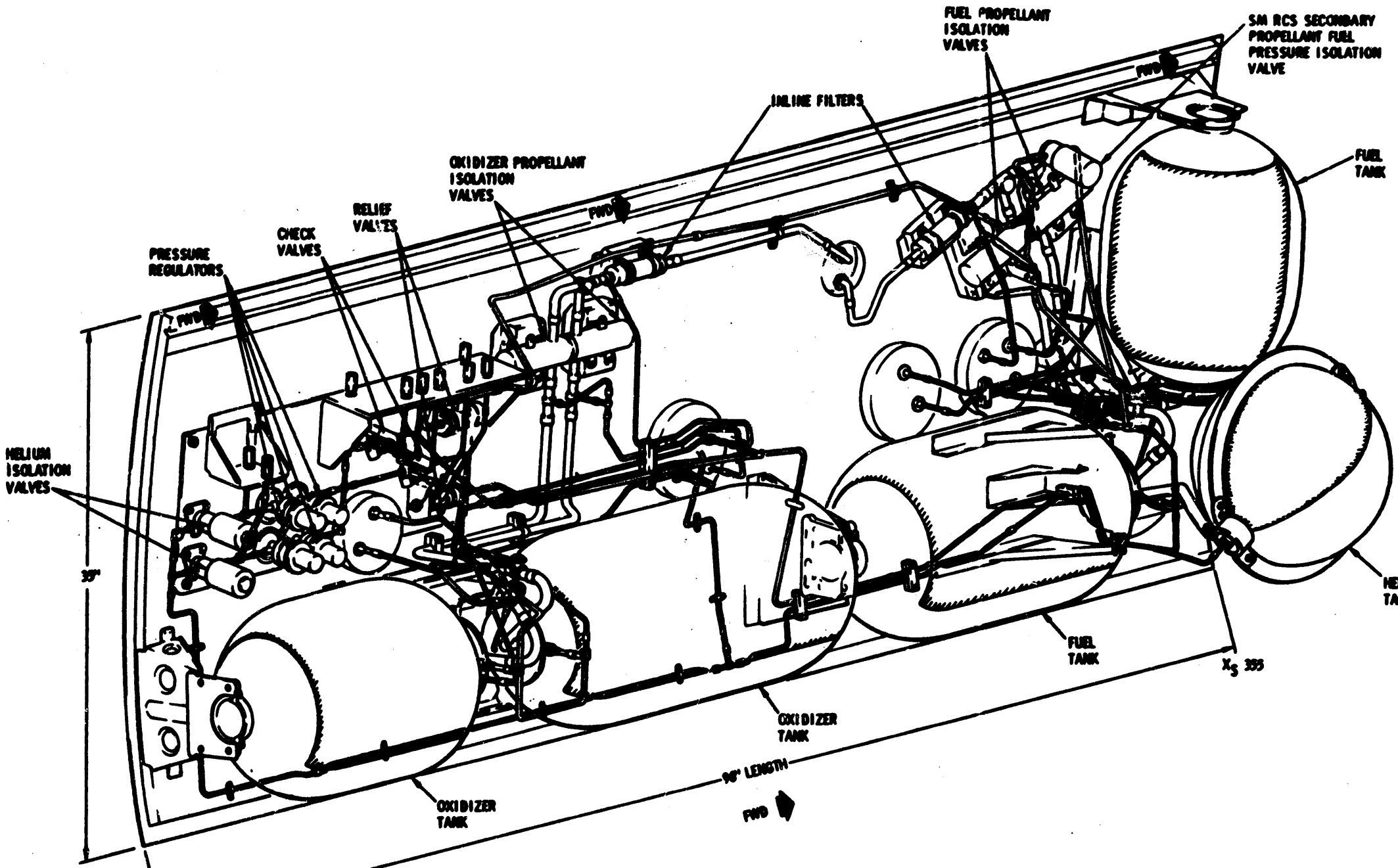
CSM 104 & SUBS



P-6809A

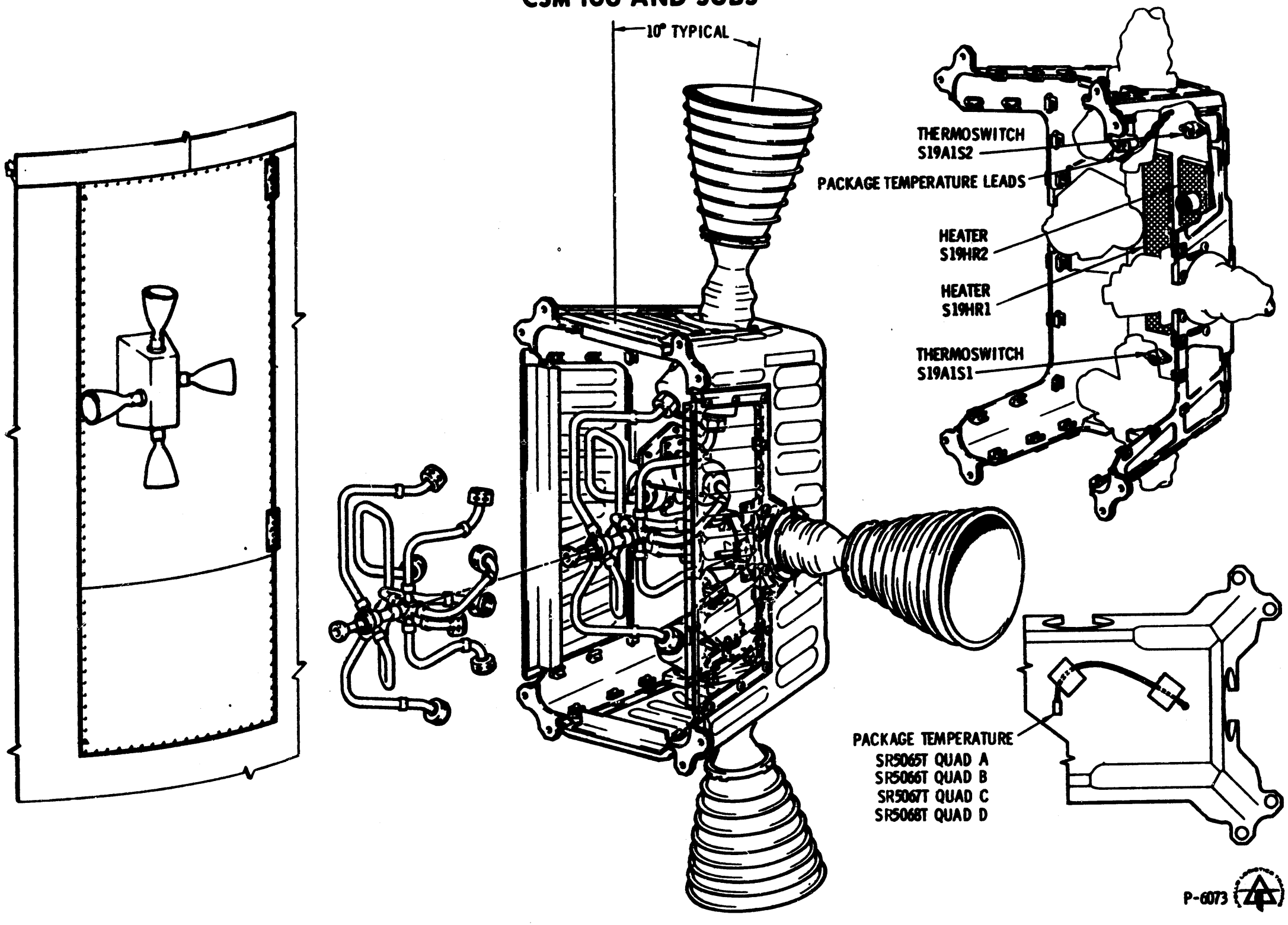
SM RCS PANEL ASSEMBLY QUAD B & D

CSM 104 & SUBS



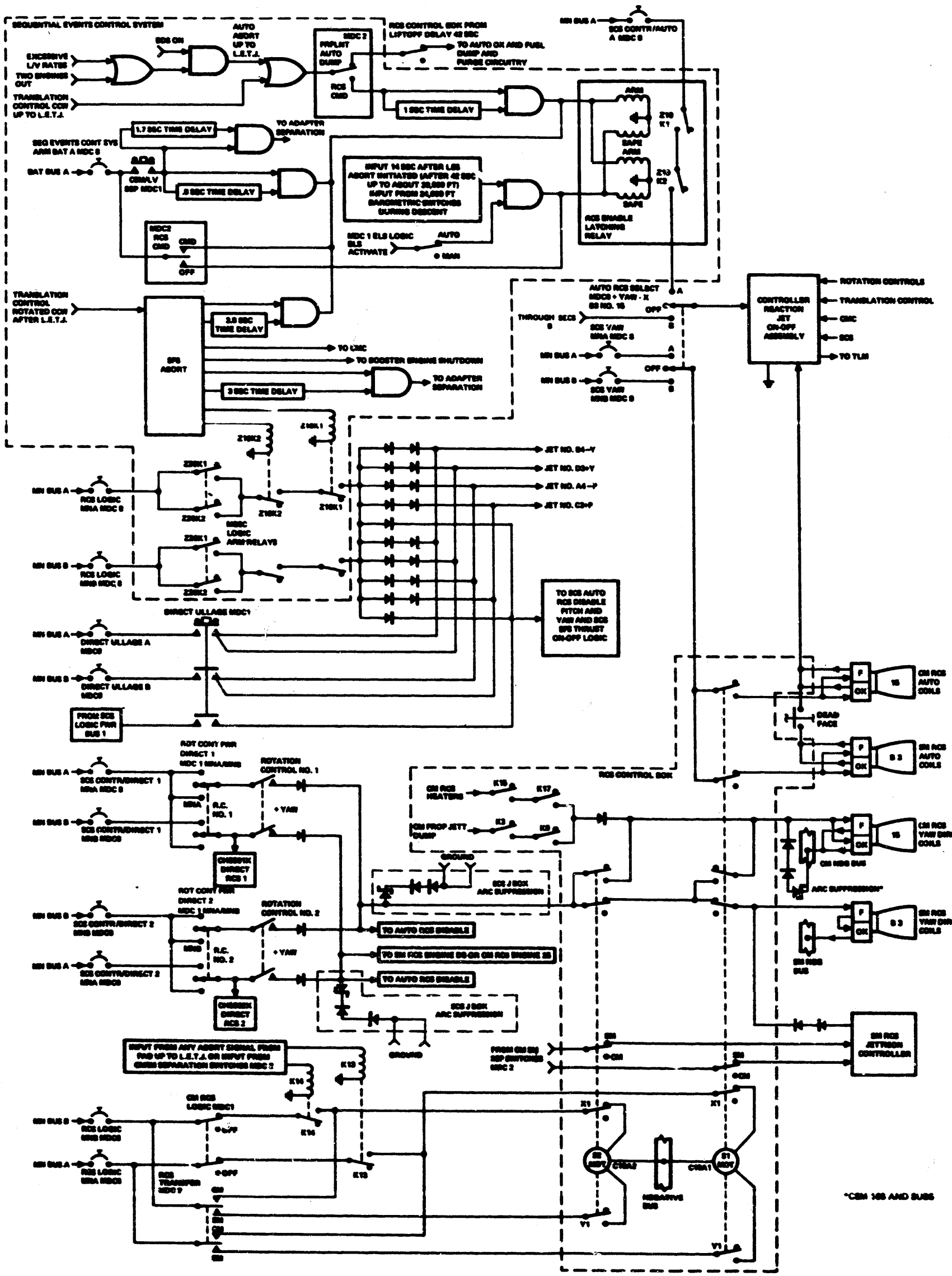
SM RCS ENGINE HOUSING

CSM 106 AND SUBS



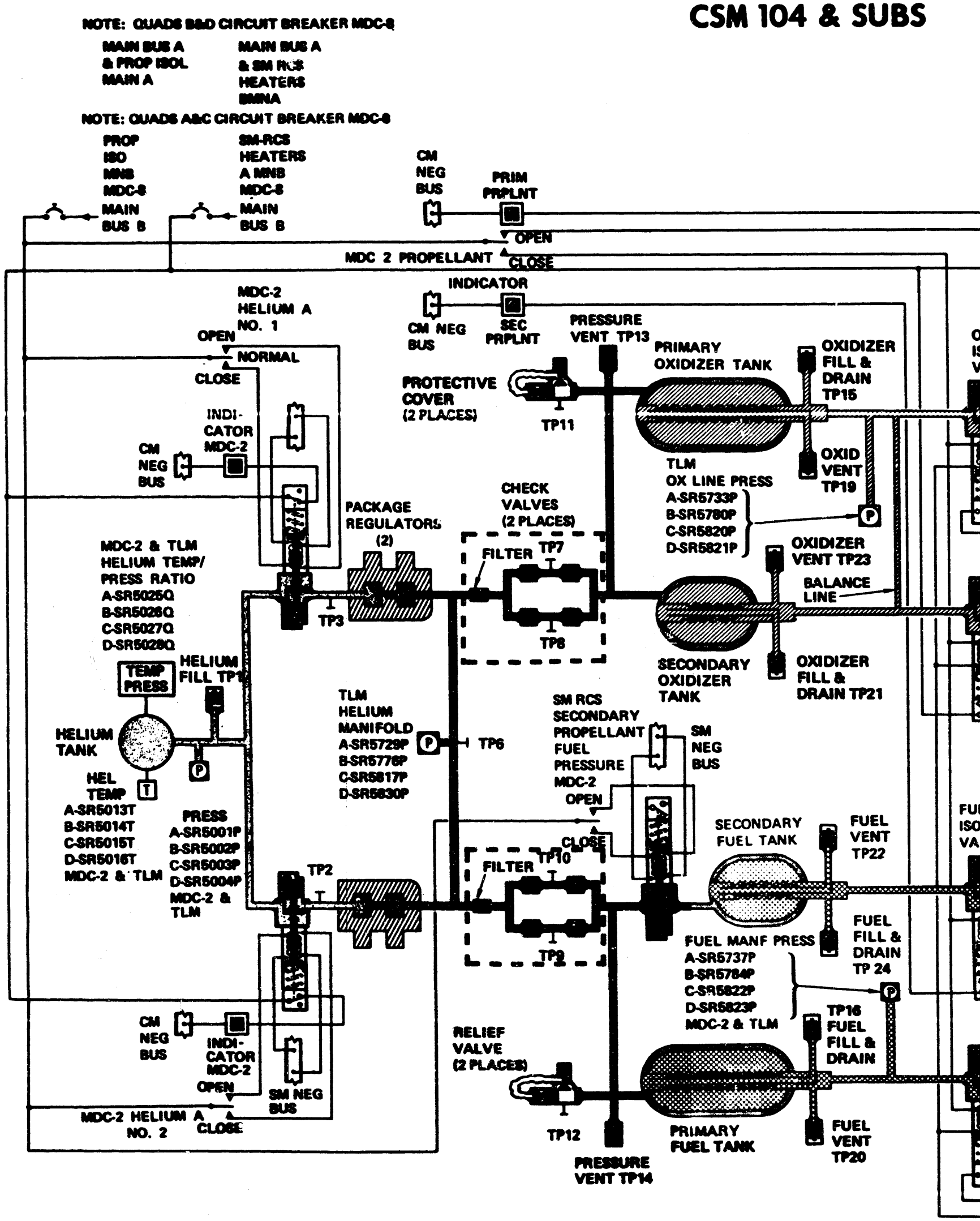
RCS ELECTRICAL CONTROL

CSM 103 & SUBS



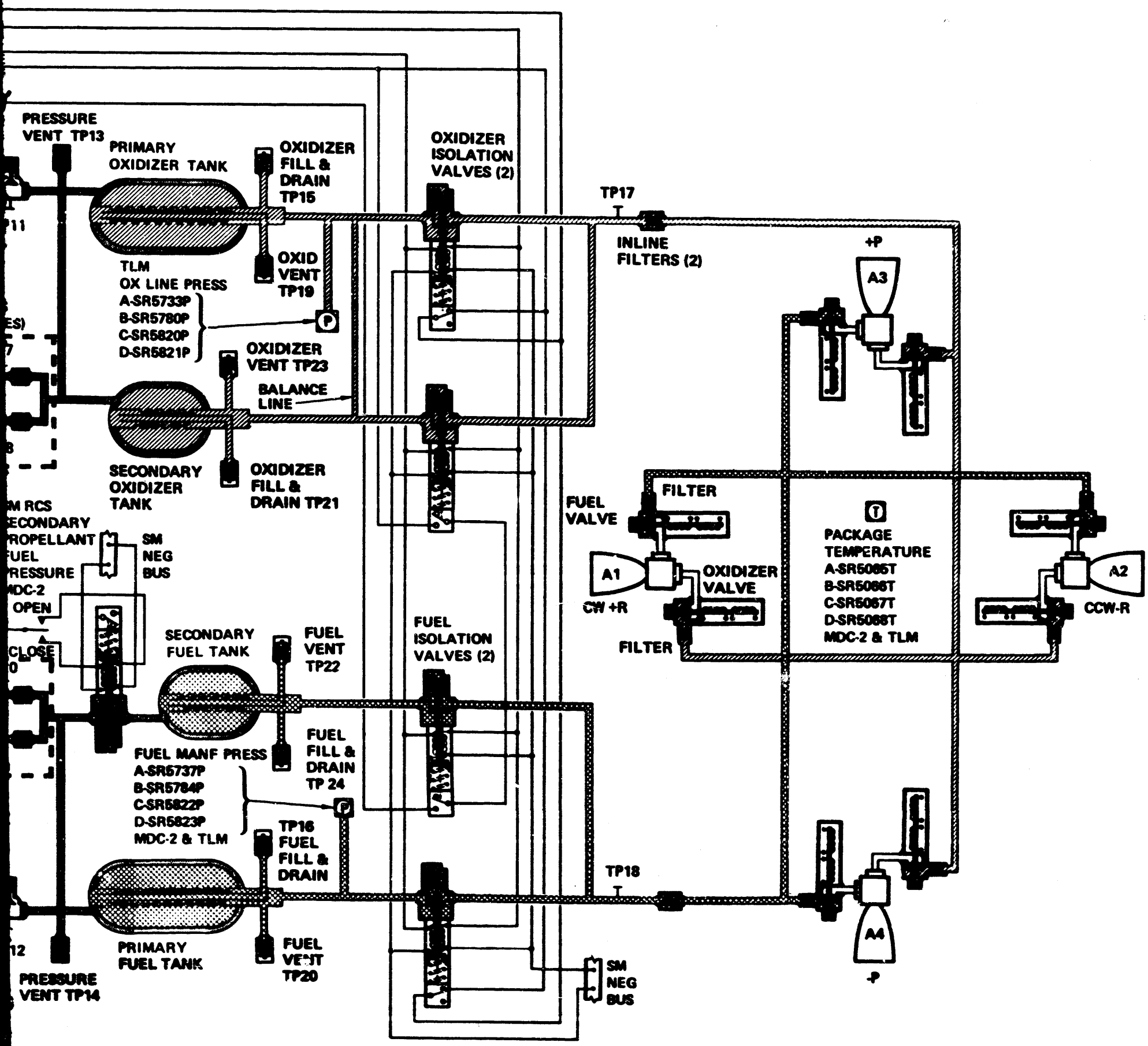
SM RCS SUBSYSTEM Q

CSM 104 & SUBS



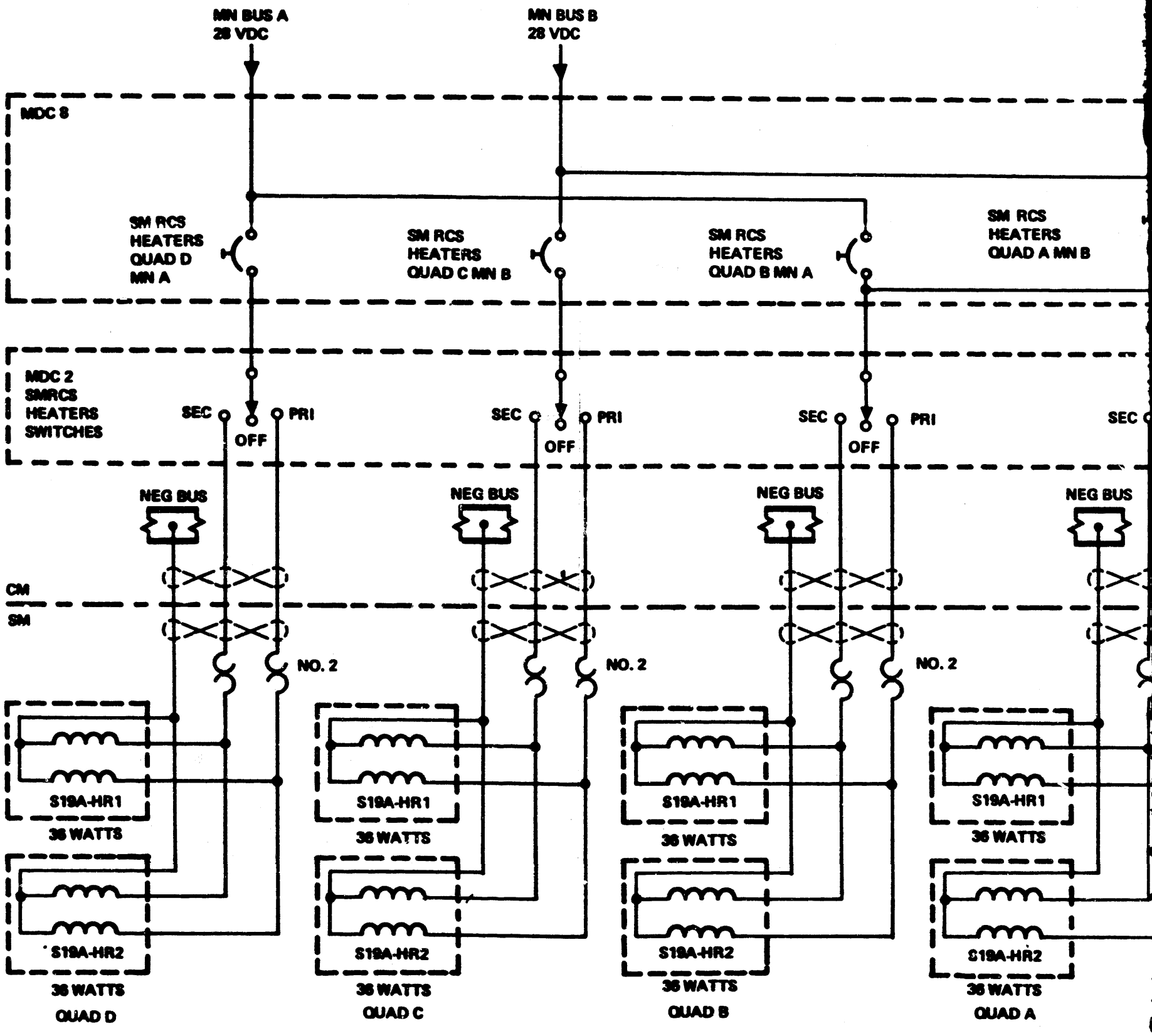
SM RCS SUBSYSTEM QUAD

CSM 104 & SUBS



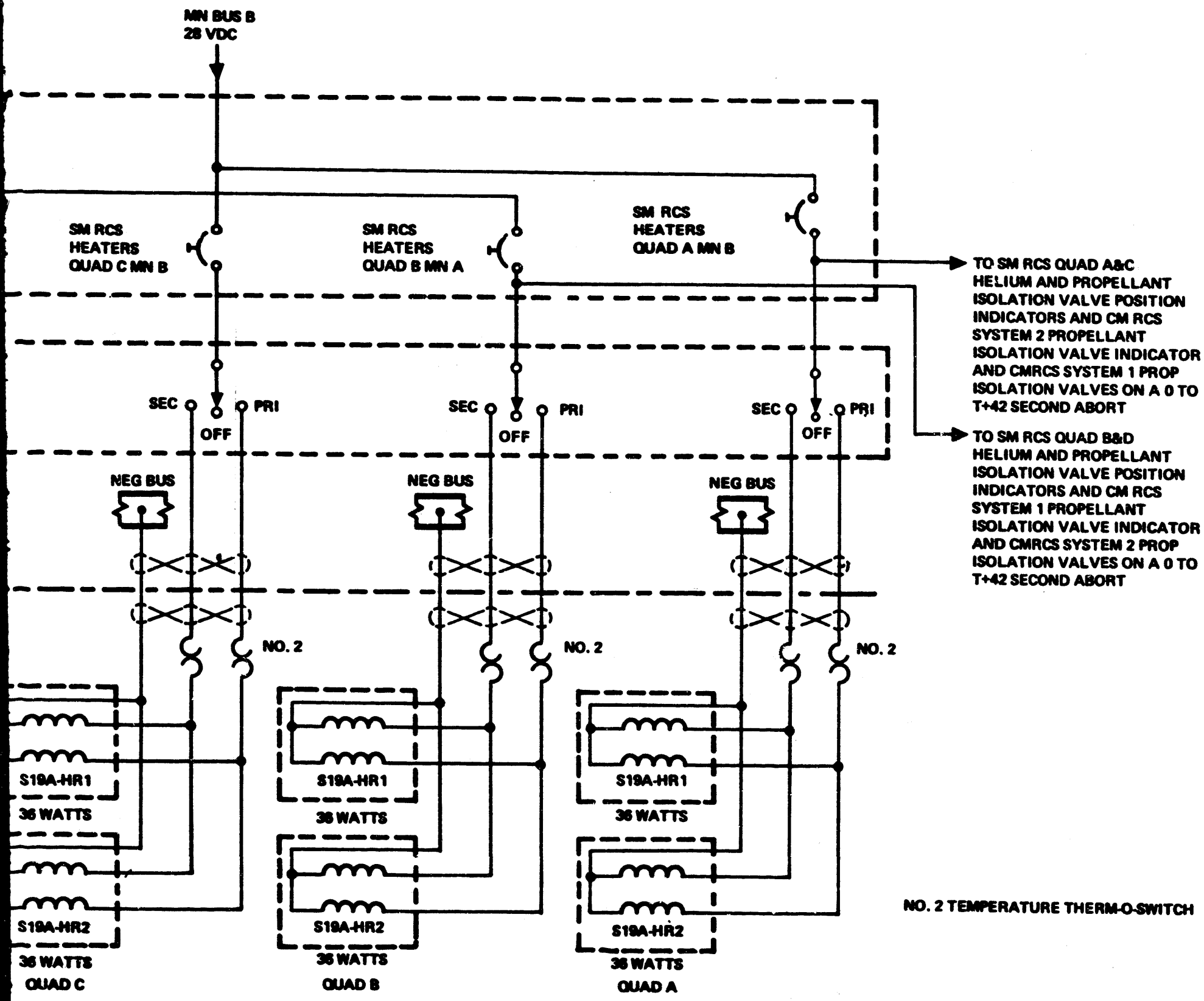
SM RCS ELECTRICAL HEATERS

CSM 106 & SUBS



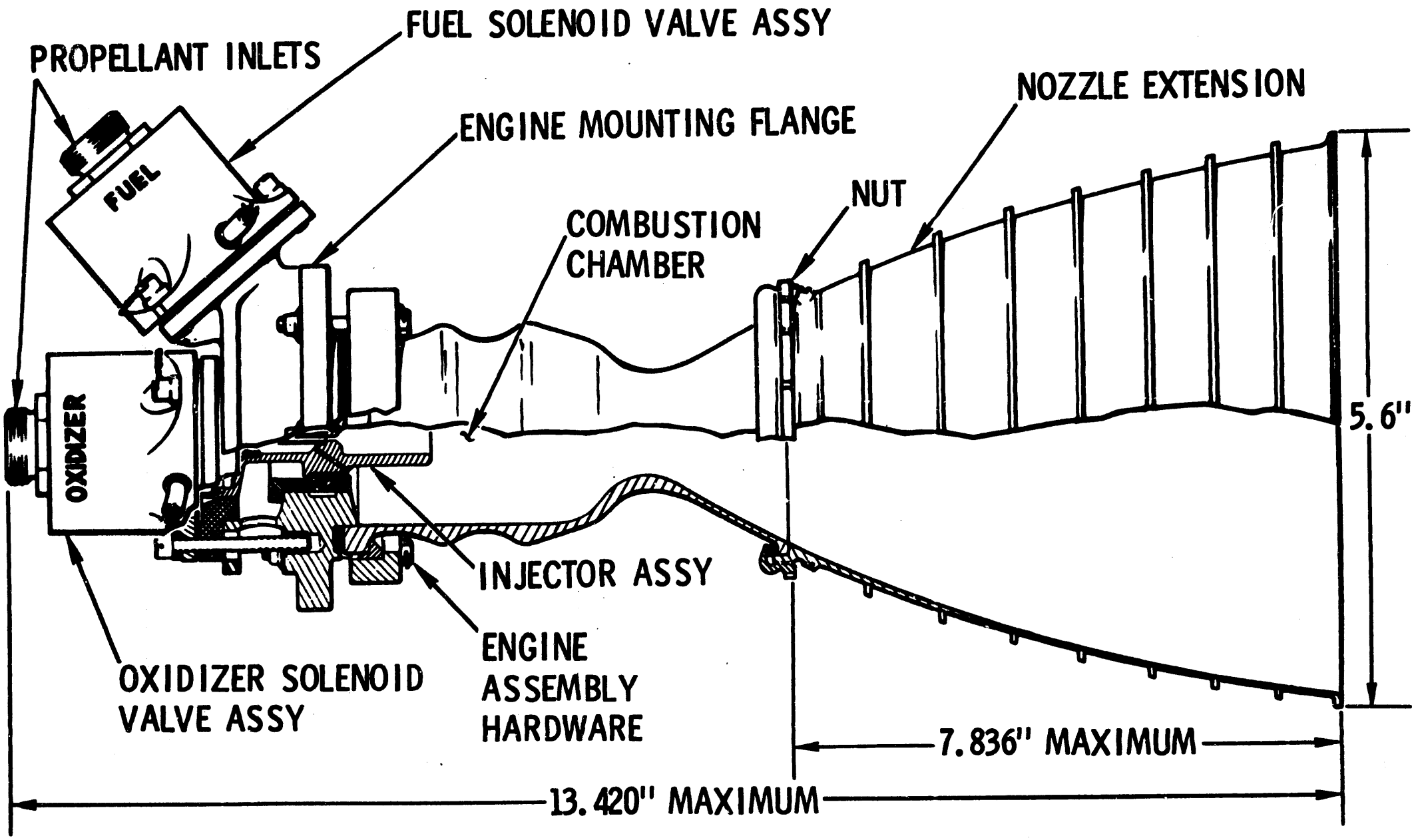
SM RCS ELECTRICAL HEATERS

CSM 106 & SUBS



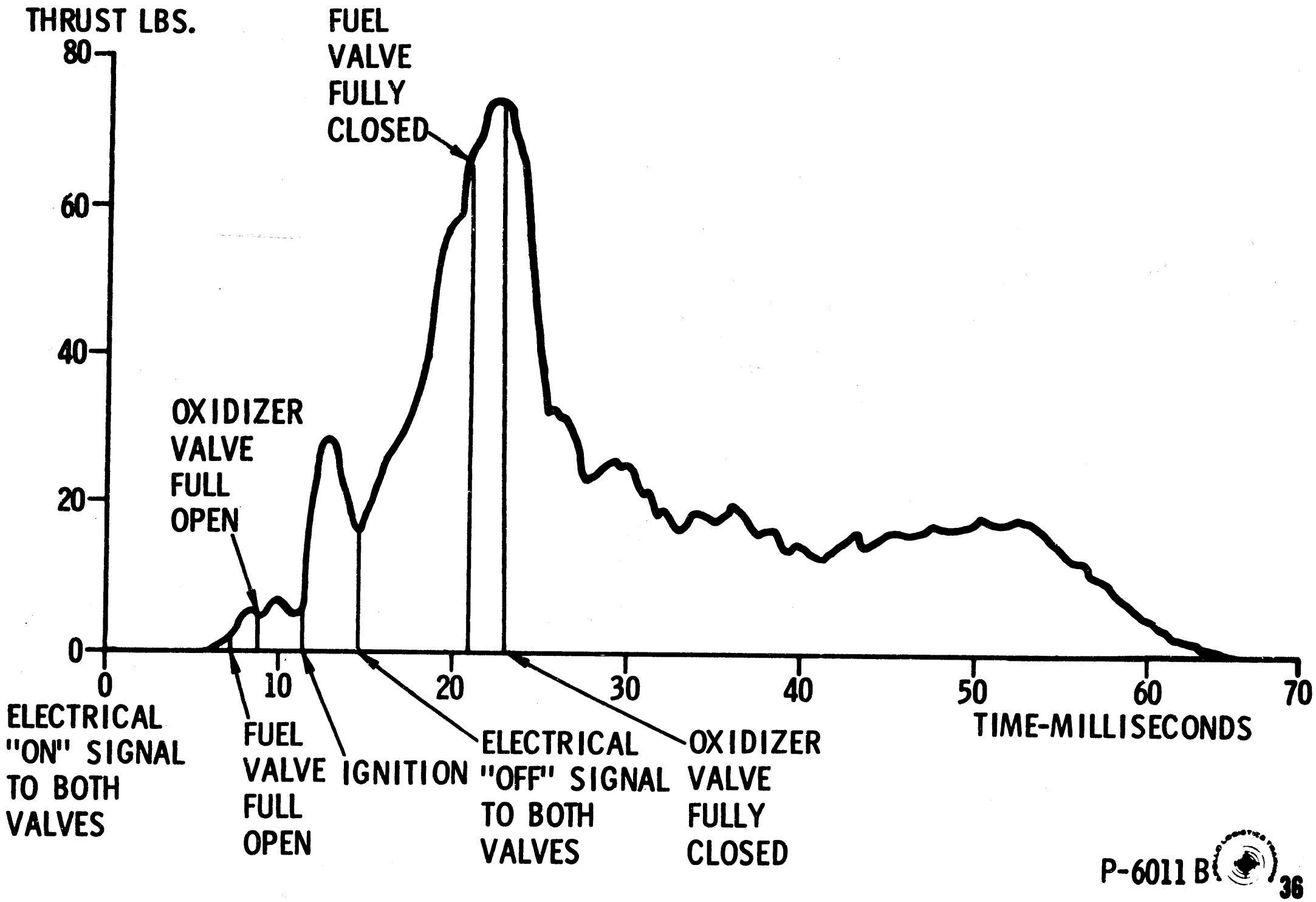
SM-2A-1351J

SM RCS ENGINE CUTAWAY



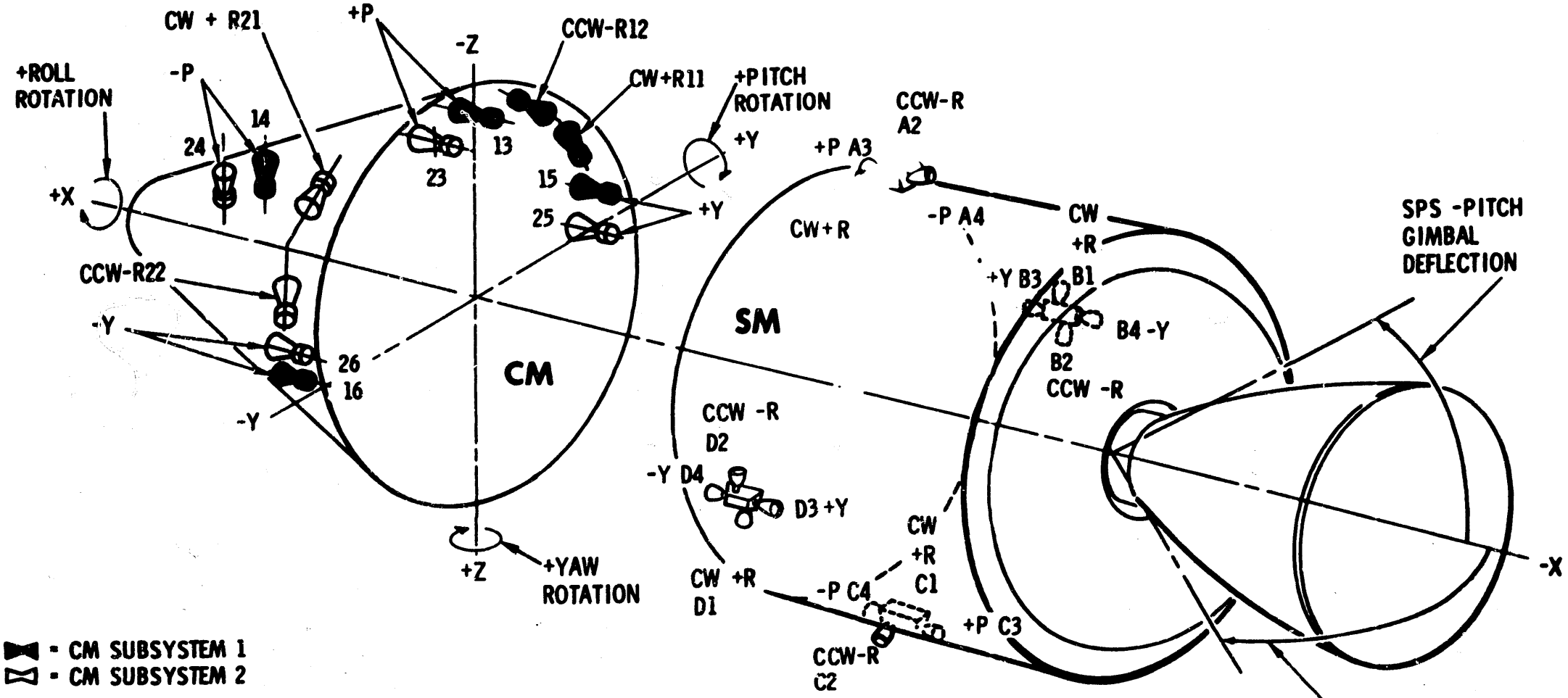
S/M RCS ENGINE-MINIMUM TOTAL IMPULSE

(CONTROLLER REACTION JET ON-OFF ASSEMBLY 15±3 MILLISECONDS)



CM SM ENGINE LOCATIONS

CSM 101 & SUBS



▬ = CM SUBSYSTEM 1
▭ = CM SUBSYSTEM 2

ODD NUMBER
ENGINES = +ROTATION MANEUVER 1, 3, 5

EVEN NUMBER
ENGINES = -ROTATION MANEUVER 2, 4, 6

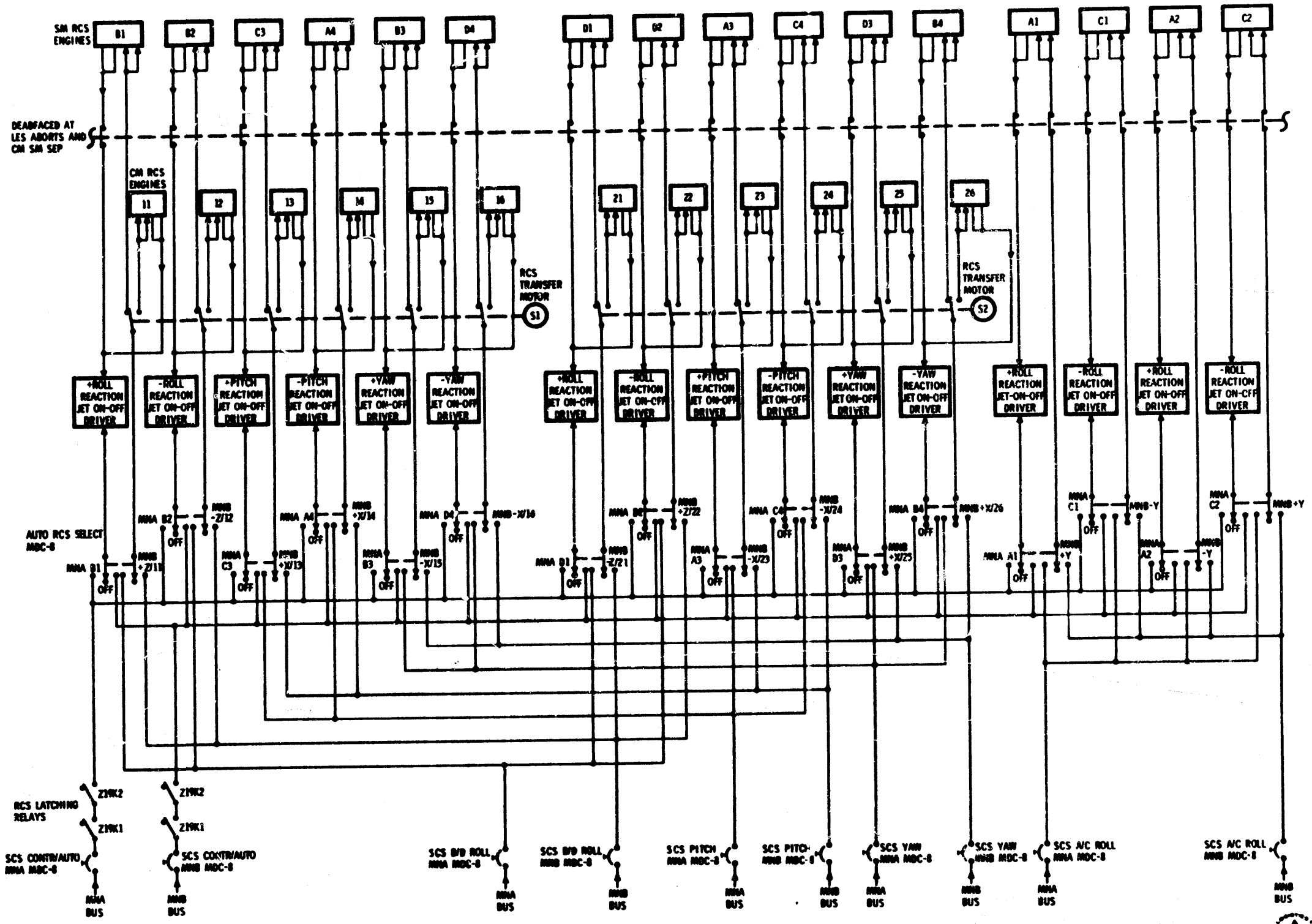
A= SM RCS QUAD A
B= SM RCS QUAD B
C= SM RCS QUAD C
D= SM RCS QUAD D

ODD NUMBER
ENGINES = +ROTATION MANEUVER 1, 3

EVEN NUMBER
ENGINES = -ROTATION MANEUVER 2, 4

CSM RCS AUTO CONTROL

CSM 103 AND SUBS



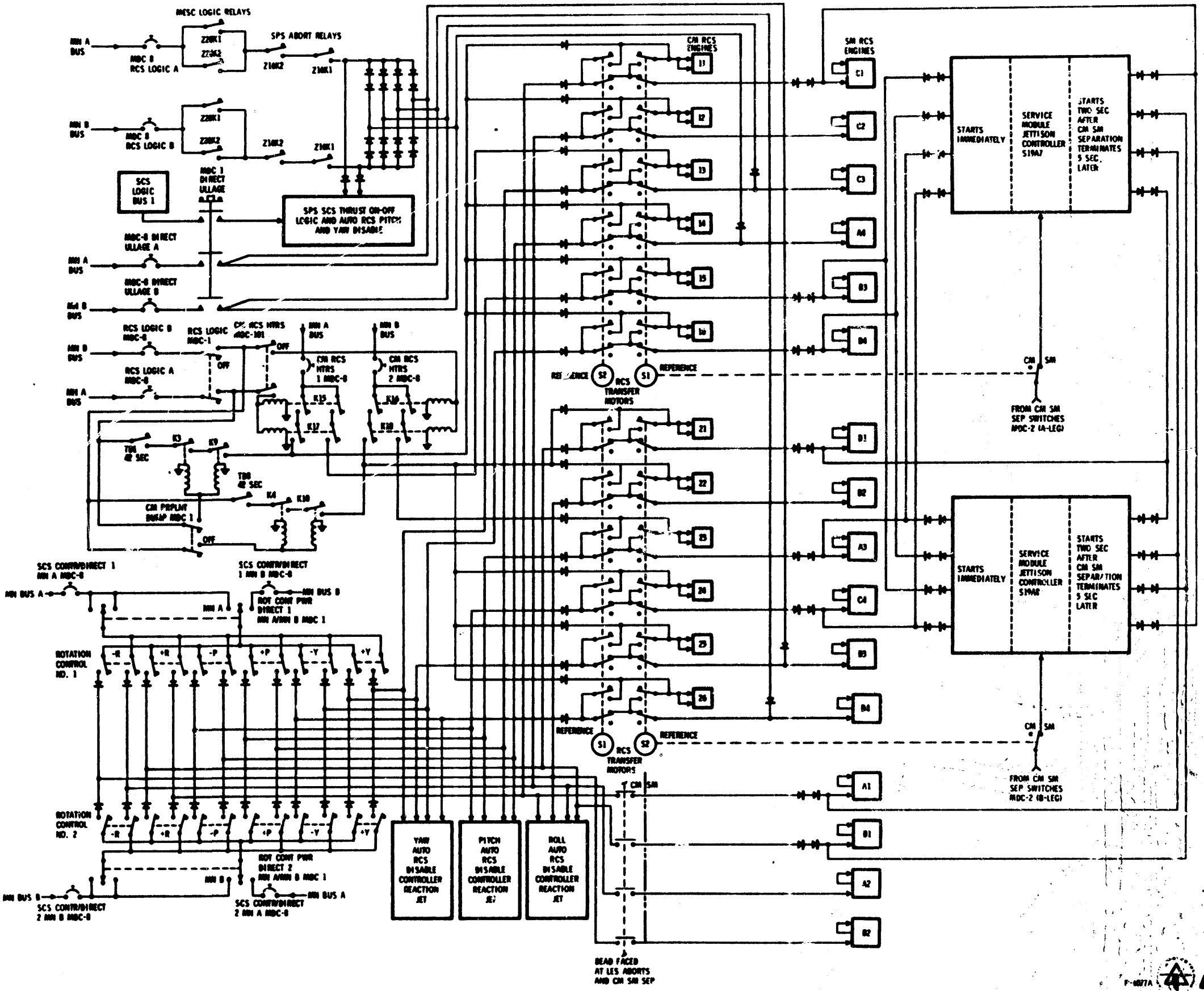
SM CM RCS ENGINE POWER SUPPLIES AUTOMATIC

CSM 103 & SUBS

BUS POWER	CIRCUIT BREAKER MDC 8	AUTORCS SELECT SWITCHES MDC 8	SM ENGINE				CM ENGINE				SM ENGINE UTILIZATION FOR TRANSLATION MANEUVERS						TRANSFER MOTOR
			QUAD	MANEUVER	SCS NO.	PROP. NO.	SYSTEM	MANEUVER	SCS NO.	PROP. NO.	-X	+X	-Y	+Y	-Z	+Z	
MNA	SCS MNA PITCH	PITCH C3 +X13	C	+P	C3	S19A3B3	1	+P	13	C1987		C3					S1
		PITCH A4 +X14	A	-P	A4	S19A1B3	1	-P	14	C19811		A4					S1
		PITCH A3 -X23	A	+P	A3	S19A1B1	2	+P	23	C1988	A3						S2
		PITCH C4 -X24	C	-P	C4	S19A3B1	2	-P	24	C19812	C4						S2
MNB	SCS MNB PITCH	PITCH C3 +X13	C	+P	C3	S19A3B3	1	+P	13	C1987		C3					S1
		PITCH A4 +X14	A	-P	A4	S19A1B3	1	-P	14	C19811		A4					S1
		PITCH A3 -X23	A	+P	A3	S19A1B1	2	+P	23	C1988	A3						S2
		PITCH C4 -X24	C	-P	C4	S19A3B1	2	-P	24	C19812	C4						S2
MNA	SCS MNA YAW	YAW D3 +X25	D	+Y	D3	S19A4B1	2	+Y	25	C19810		D3					S2
		YAW B4 +X26	B	-Y	B4	S19A2B1	2	-Y	26	C1982		B4					S2
		YAW B3 -X15	B	+Y	B3	S19A2B3	1	+Y	15	C1989	B3						S1
		YAW D4 -X16	D	-Y	D4	S19A4B3	1	-Y	16	C1981	D4						S1
MNB	SCS MNB YAW	YAW D3 +X 25	D	+Y	D3	S19A4B1	2	+Y	25	C19810		D3					S2
		YAW B4 +X26	B	-Y	B4	S19A2B1	2	-Y	26	C1982		B4					S2
		YAW B3 -X15	B	+Y	B3	S19A2B3	1	+Y	15	C1989	B3						S1
		YAW D4 -X16	D	-Y	D4	S19A4B3	1	-Y	16	C1981	D4						S1
MNA	SCS MNA B/D ROLL	B/D ROLL B1 +X11	B	CW+R	B1	S19A2B2	1	CW+R	11	C1985						B1	S1
		B/D ROLL B2 +Z22	D	CCW-R	B2	S19A4B4	2	CCW-R	22	C1984						B2	S2
		B/D ROLL B1 -Z21	D	CW+R	B1	S19A4B2	2	CW+R	21	C1986					D1		S2
		B/D ROLL B2 -Z12	B	CCW-R	B2	S19A2B4	1	CCW-R	12	C1983					B2		S1
MNB	SCS MNB B/D ROLL	B/D ROLL B1 +X11	B	CW+R	B1	S19A2B2	1	CW+R	11	C1985						B1	S1
		B/D ROLL B2 +Z22	D	CCW-R	B2	S19A4B4	2	CCW-R	22	C1984						B2	S2
		B/D ROLL B1 -Z21	D	CW+R	B1	S19A4B2	2	CW+R	21	C1986					D1		S2
		B/D ROLL B2 -Z12	B	CCW-R	B2	S19A2B4	1	CCW-R	12	C1983					B2		S1
MNA	SCS MNA A/C ROLL	A/C ROLL A1 +Y	A	CW+R	A1	S19A1B4	DEAD FACED AT CM SM SEPARATION AND LES ABORTS							A1			
		A/C ROLL C2 +Y	C	CCW-R	C2	S19A3B2								C2			
		A/C ROLL C1 -Y	C	CW+R	C1	S19A3B4							C1				
		A/C ROLL A2 -Y	A	CCW-R	A2	S19A1B2							A2				
MNB	SCS MNB A/C ROLL	A/C ROLL A1 +Y	A	CW+R	A1	S19A1B4								A1			
		A/C ROLL C2 +Y	C	CCW-R	C2	S19A3B2								C2			
		A/C ROLL C1 -Y	C	CW+R	C1	S19A3B4							C1				
		A/C ROLL A2 -Y	A	CCW-R	A2	S19A1B2							A2				

CSM RCS DIRECT CONTROL

CSM 103 AND SUBS



SM CM RCS ENGINE POWER SUPPLIES DIRECT ROTATION CONTROL NO. 1

CSM 103 AND SUBS

BUS POWER	CIRCUIT BREAKER MDC-8	DIRECT I SWITCH MDC 1	ROTATION CONTROL	SM ENGINE				CM ENGINE				TRANSFER MOTOR
				QUAD	MANEUVER	SCS NO.	PROP NO.	SYSTEM	MANEUVER	SCS NO.	PROP NO.	
MN A MN B	CONTR/DIRECTRCS 1A CONTR/DIRECTRCS 1B	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I+P I+P	C A	+P +P	C3 A3	S19A3B3 S19A1B1	1 2	+P +P	13 23	C1987 C1988	S2 & S1 S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA R.C. 1 MNA R.C. 1	I+P I+P	C A	+P +P	C3 A3	S19A3B3 S19A1B1	1 2	+P +P	13 23	C1987 C1988	S2 & S1 S1 & S2
MN A MN B	CONTR/DIRECTRCS 1A CONTR/DIRECTRCS 1B	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I-P I-P	A C	-P -P	A4 C4	S19A1B3 S19A3B1	1 2	-P -P	14 24	C19811 C19812	S2 & S1 S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA R.C. 1 MNA R.C. 1	I-P I-P	A C	-P -P	A4 C4	S19A1B3 S19A3B1	1 2	-P -P	14 24	C19811 C19812	S2 & S1 S1 & S2
MN A MN B	CONTR/DIRECTRCS 1A CONTR/DIRECTRCS 1B	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I+Y I+Y	B D	+Y +Y	B3 D3	S19A2B3 S19A4B1	1 2	+Y +Y	15 25	C1989 C19810	S2 & S1 S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA R.C. 1 MNA R.C. 1	I+Y I+Y	B D	+Y +Y	B3 D3	S19A2B3 S19A4B1	1 2	+Y +Y	15 25	C1989 C19810	S2 & S1 S1 & S2
MN A MN B	CONTR/DIRECTRCS 1A CONTR/DIRECTRCS 1B	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I-Y I-Y	D B	-Y -Y	D4 B4	S19A4B3 S19A2B1	1 2	-Y -Y	16 26	C1981 C1982	S2 & S1 S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA R.C. 1 MNA R.C. 1	I-Y I-Y	D B	-Y -Y	D4 B4	S19A4B3 S19A2B1	1 2	-Y -Y	16 26	C1981 C1982	S2 & S1 S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I+R I+R	C A	CW+R CW+R	C1 A1	S19A3B4 S19A1B4	1 CW+R 11 C1985 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S2 & S1
MN B	CONTR/DIRECTRCS 1B	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I+R I+R	D B	CW+R CW+R	D1 B1	S19A4B2 S19A2B2	2 CW+R 21 C1986 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA R.C. 1 MNA R.C. 1	I+R I+R	C A	CW+R CW+R	C1 A1	S19A3B4 S19A1B4	1 CW+R 11 C1985 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S2 & S1
		MNA R.C. 1 MNA R.C. 1	I+R I+R	D B	CW+R CW+R	D1 B1	S19A4B2 S19A2B2	2 CW+R 21 C1986 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I-R I-R	C A	CCW-R CCW-R	C2 A2	S19A3B2 S19A1B2	1 CCW-R 12 C1983 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S2 & S1
MN B	CONTR/DIRECTRCS 1B	MNA/MNB R.C. 1 MNA/MNB R.C. 1	I-R I-R	D B	CCW-R CCW-R	D2 B2	S19A4B4 S19A2B4	2 CCW-R 22 C1984 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S1 & S2
MN A	CONTR/DIRECTRCS 1A	MNA R.C. 1 MNA R.C. 1	I-R I-R	C A	CCW-R CCW-R	C2 A2	S19A3B2 S19A1B2	1 CCW-R 12 C1983 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S2 & S1
		MNA R.C. 1 MNA R.C. 1	I-R I-R	D B	CCW-R CCW-R	D2 B2	S19A4B4 S19A2B4	2 CCW-R 22 C1984 DEADFACED AT CM SM SEPARATION AND LES ABORTS				S1 & S2

SM CM RCS ENGINE POWER SUPPLIES DIRECT ROTATION CONTROL NO. 2

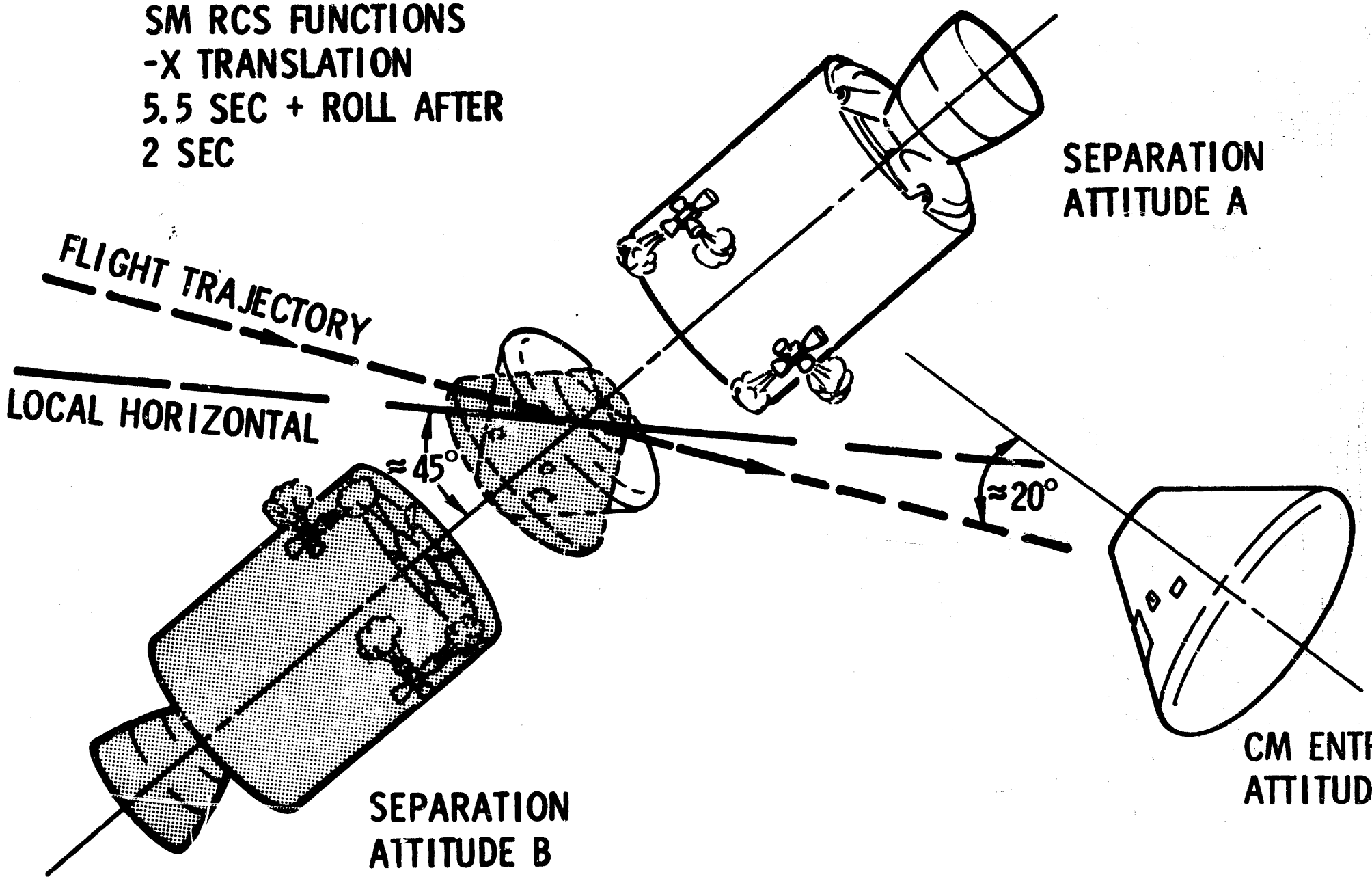
CSM 103 AND SUBS

BUS POWER	CIRCUIT BREAKER MDC-8	DIRECT 2 SWITCH MDC 1	ROTATION CONTROL	SM ENGINE				CM ENGINE				TRANSFER MOTOR
				QUAD	MANEUVER	SCS NO.	PROP NO.	SYSTEM	MANEUVER	SCS NO.	PROP NO.	
MN B MN A	CONTR/DIRECTRCS 2B CONTR/DIRECTRCS 2A	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2+P 2+P	C A	+P +P	C3 A3	S19A3B3 S19A1B1	1 2	+P +P	13 23	C19B7 C19B8	S2 & S1 S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNB R.C. 2 MNB R.C. 2	2+P 2+P	C A	+P +P	C3 A3	S19A3B3 S19A1B1	1 2	+P +P	13 23	C19B7 C19B8	S2 & S1 S1 & S2
MN B MN A	CONTR/DIRECTRCS 2B CONTR/DIRECTRCS 2A	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2-P 2-P	A C	-P -P	A4 C4	S19A1B3 S19A3B1	1 2	-P -P	14 24	C19B11 C19B12	S2 & S1 S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNB R.C. 2 MNB R.C. 2	2-P 2-P	A C	-P -P	A4 C4	S19A1B3 S19A3B1	1 2	-P -P	14 24	C19B11 C19B12	S2 & S1 S1 & S2
MN B MN A	CONTR/DIRECTRCS 2B CONTR/DIRECTRCS 2A	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2+Y 2+Y	B D	+Y +Y	B3 D3	S19A2B3 S19A4B1	1 2	+Y +Y	15 25	C19B9 C19B10	S2 & S1 S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNB R.C. 2 MNB R.C. 2	2+Y 2+Y	B D	+Y +Y	B3 D3	S19A2B3 S19A4B1	1 2	+Y +Y	15 25	C19B9 C19B10	S2 & S1 S1 & S2
MN B MN A	CONTR/DIRECTRCS 2B CONTR/DIRECTRCS 2A	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2-Y 2-Y	D B	-Y -Y	D4 B4	S19A4B3 S19A2B1	1 2	-Y -Y	16 26	C19B1 C19B2	S2 & S1 S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNB R.C. 2 MNB R.C. 2	2-Y 2-Y	D B	-Y -Y	D4 B4	S19A4B3 S19A2B1	1 2	-Y -Y	16 26	C19B1 C19B2	S2 & S1 S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2+R 2+R	C A	CW+R CW+R	C1 A1	S19A3B4 S19A1B4	1 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CW+R	11	C19B5	S2 & S1
MN A	CONTR/DIRECTRCS 2A	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2+R 2+R	D B	CW+R CW+R	D1 B1	S19A4B2 S19A2B2	2 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CW+R	21	C19B6	S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNB R.C. 2 MNB R.C. 2	2+R 2+R	C A	CW+R CW+R	C1 A1	S19A3B4 S19A1B4	1 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CW+R	11	C19B5	S2 & S1
		MNB R.C. 2 MNB R.C. 2	2+R 2+R	D B	CW+R CW+R	D1 B1	S19A4B2 S19A2B2	2 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CW+R	21	C19B6	S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2-R 2-R	C A	CCW-R CCW-R	C2 A2	S19A3B2 S19A1B2	1 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CCW-R	12	C19B3	S2 & S1
MN A	CONTR/DIRECTRCS 2A	MNA/MNB R.C. 2 MNA/MNB R.C. 2	2-R 2-R	D B	CCW-R CCW-R	D2 B2	S19A4B4 S19A2B4	2 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CCW-R	22	C19B4	S1 & S2
MN B	CONTR/DIRECTRCS 2B	MNB R.C. 2 MNB R.C. 2	2-R 2-R	C A	CCW-R CCW-R	C2 A2	S19A3B2 S19A1B2	1 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CCW-R	12	C19B3	S2 & S1
		MNB R.C. 2 MNB R.C. 2	2-R 2-R	D B	CCW-R CCW-R	D2 B2	S19A4B4 S19A2B4	2 DEADFACED AT CM SM SEPARATION AND LES ABORTS	CCW-R	22	C19B4	S1 & S2

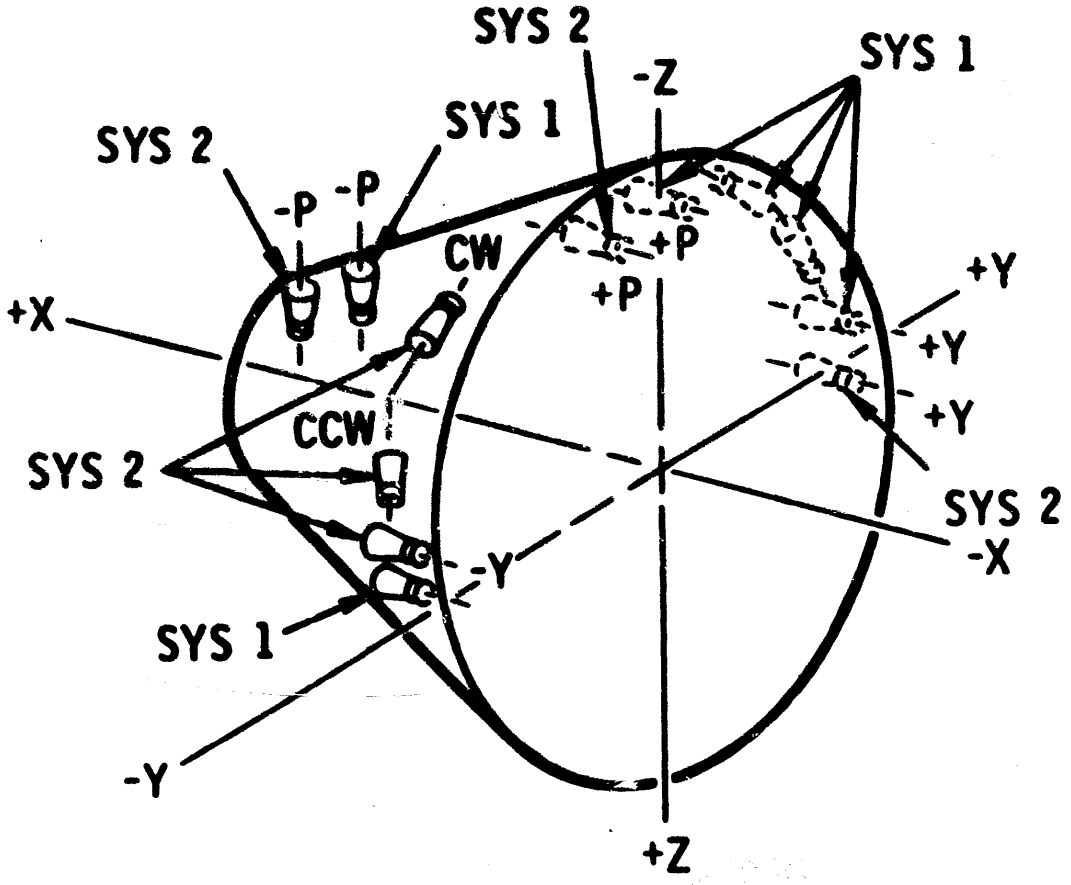
NORMAL CM-SM SEPARATION AND SM JETTISON

BLOCK II

SM RCS FUNCTIONS
-X TRANSLATION
5.5 SEC + ROLL AFTER
2 SEC



CM REACTION CONTROL SYSTEM



PURPOSE: PROVIDE THRUST FOR ATTITUDE CONTROL AFTER CM/SM SEPARATION FOR ENTRY

TYPE OF SYSTEM: NON THROTTLEABLE PRESSURE-FEED SYSTEM, HYPERGOLIC PROPELLANTS AND ABLATIVE THRUST CHAMBERS

SYSTEM DESCRIPTION:

TWO INDIVIDUAL SYSTEMS

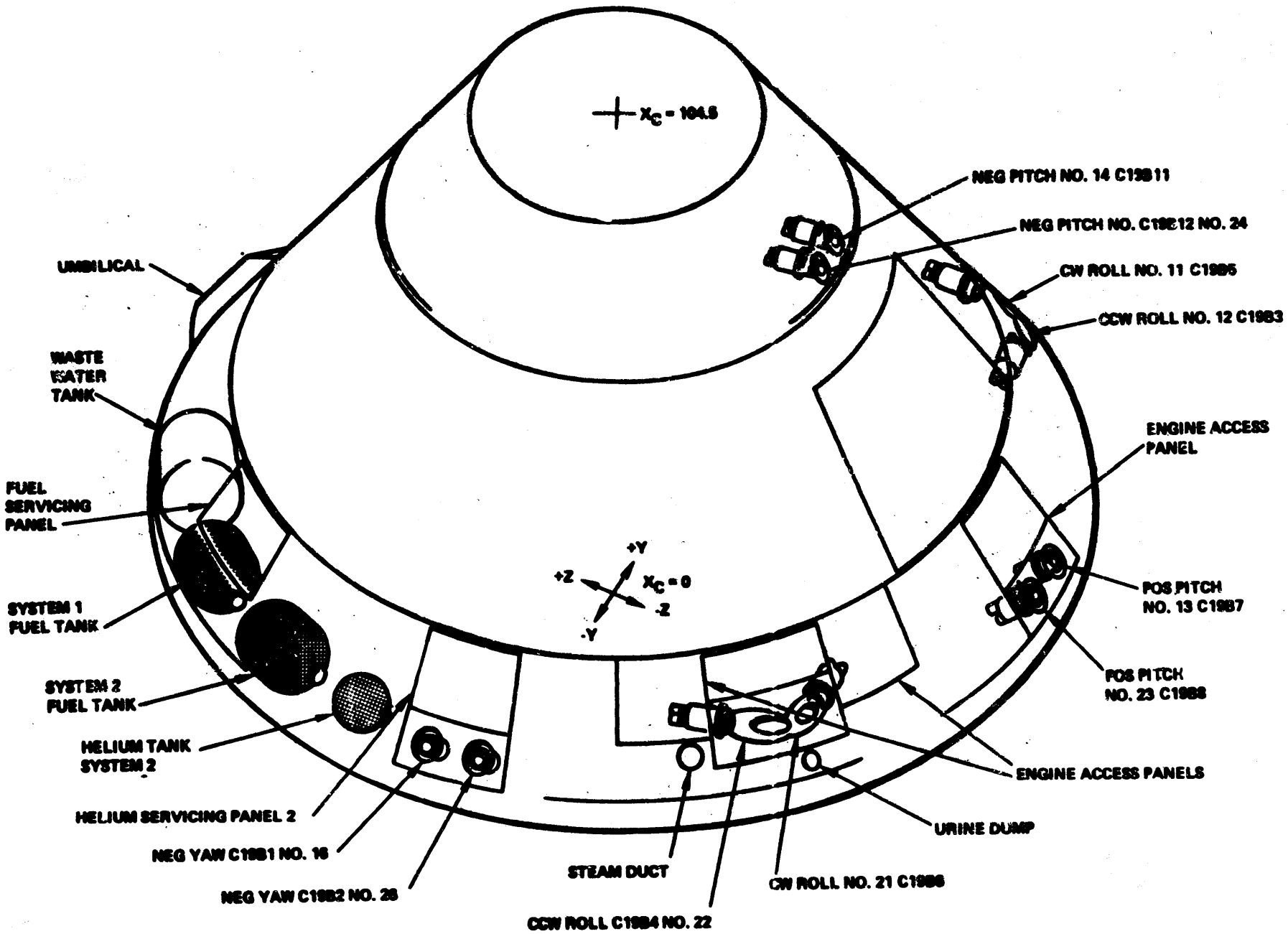
EACH SYSTEM CONSISTS OF A SEPARATE PROPELLANT FEED SYSTEM AND SIX THRUST CHAMBERS

PROPELLANTS-INHIBITED NITROGEN TETROXIDE AND MONOMETHYL HYDRAZINE

SYSTEM CONTROLLED BY CMC OR SCS WITH A DIRECT CONTROL BACKUP CAPABILITY

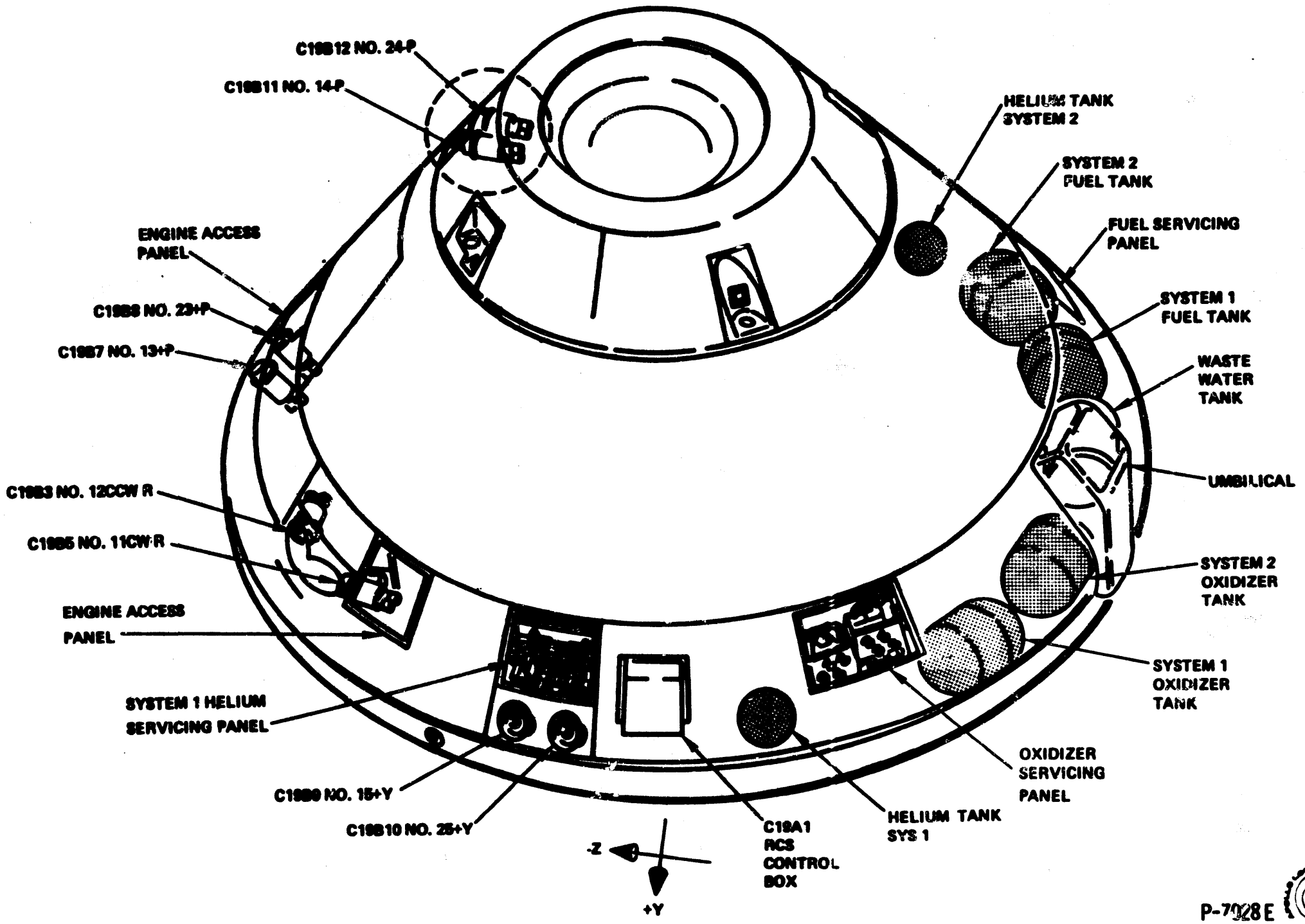
CMRCS COMPONENT LOCATION

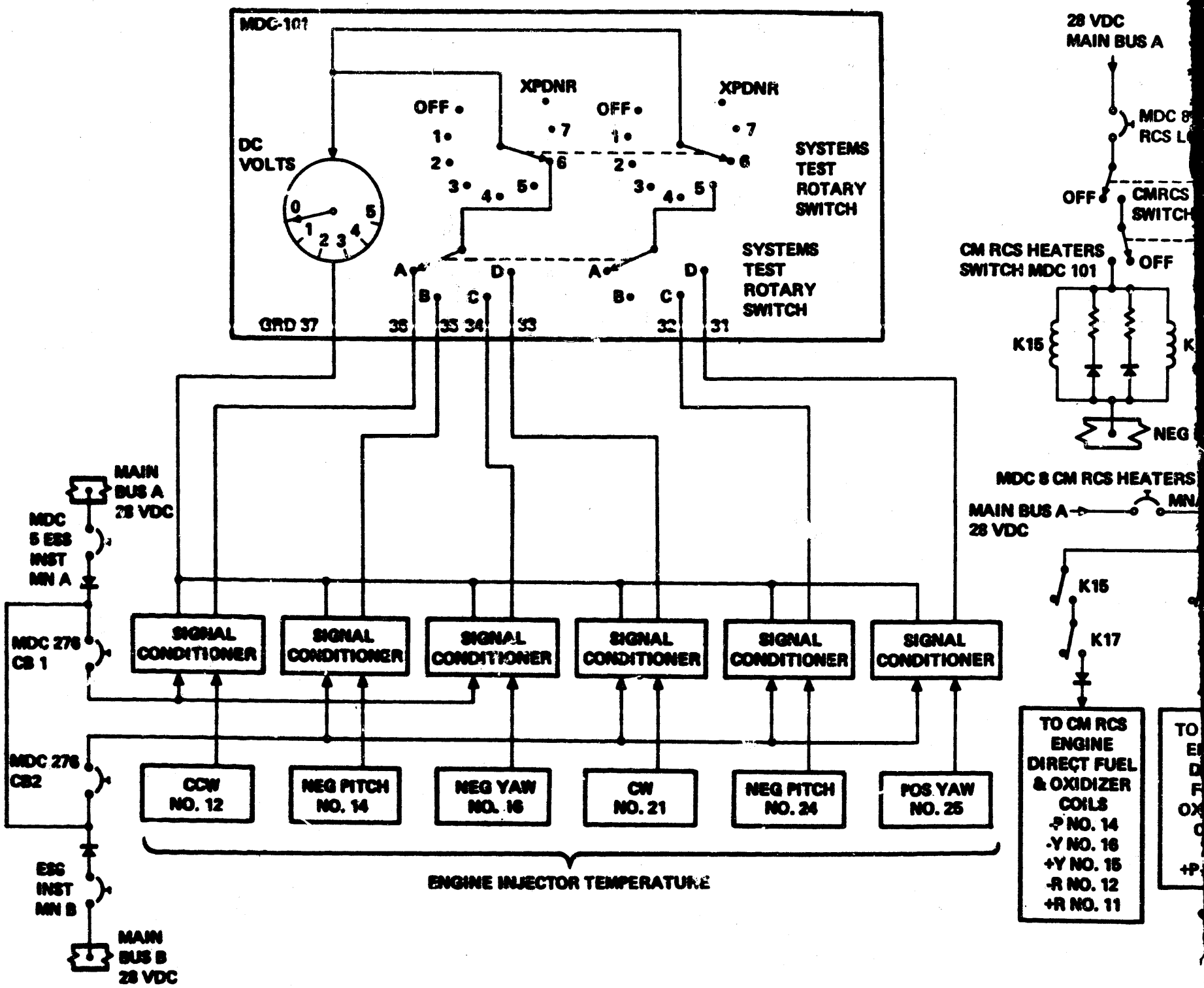
VIEW A

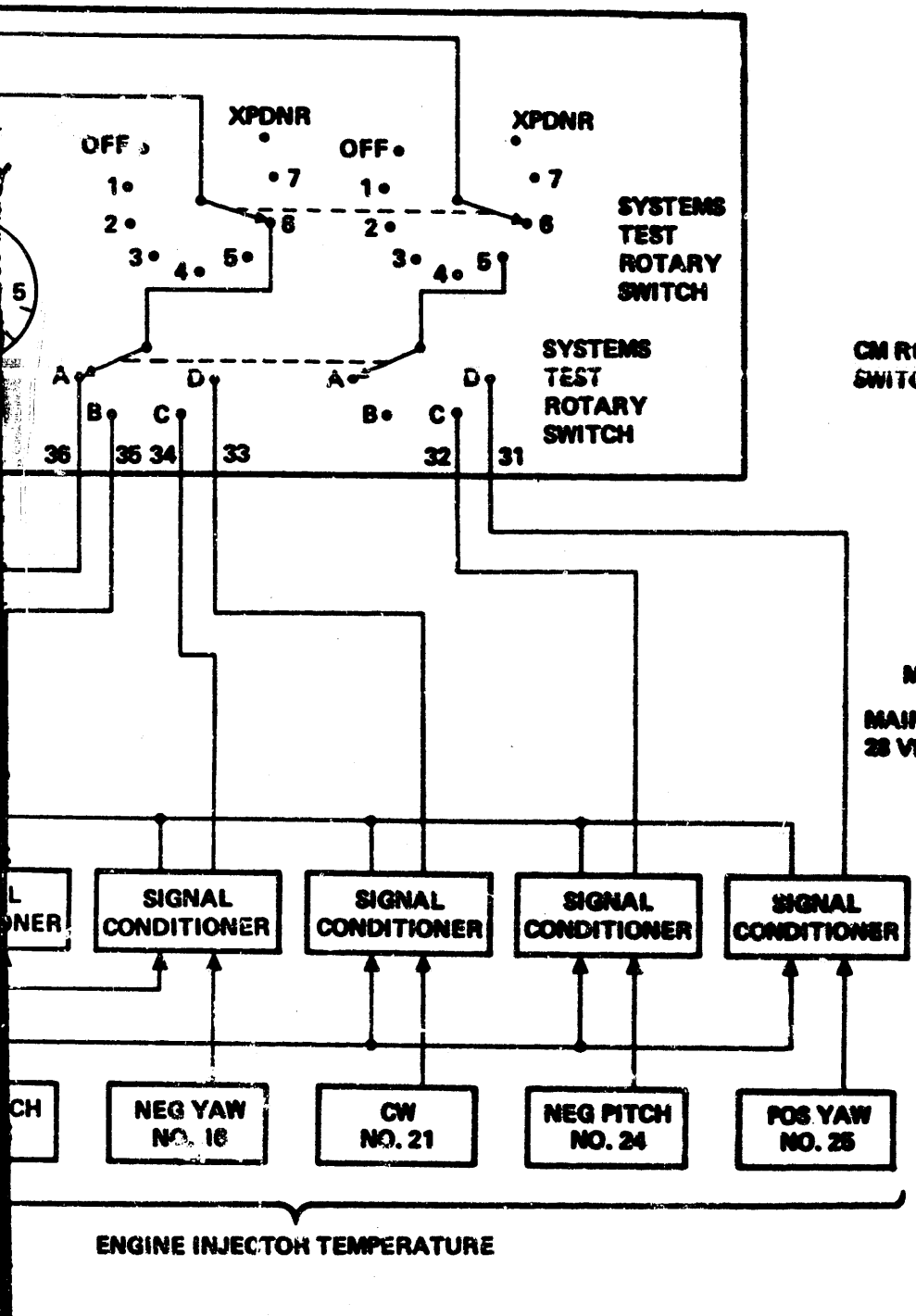


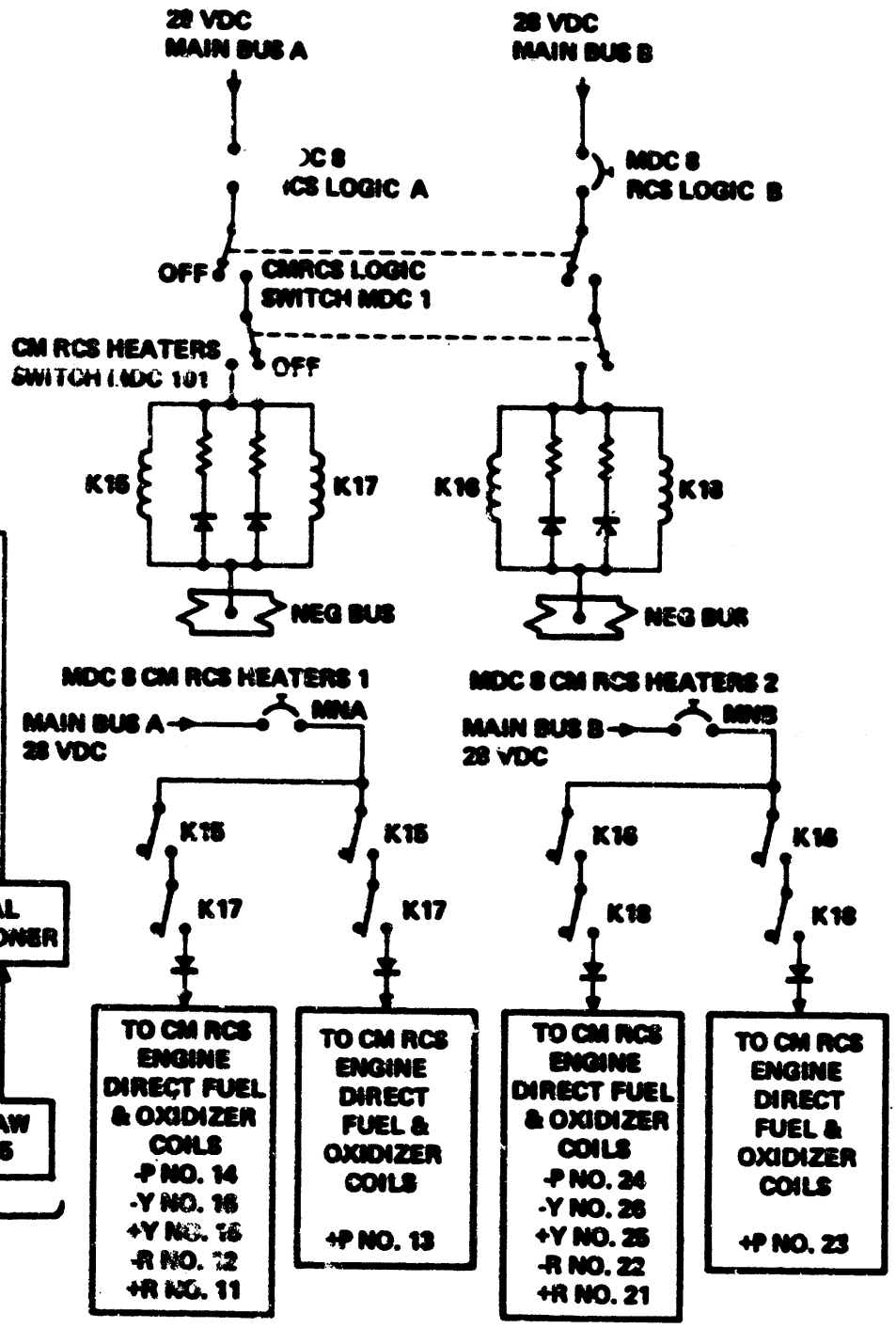
CMRCS COMPONENT LOCATION

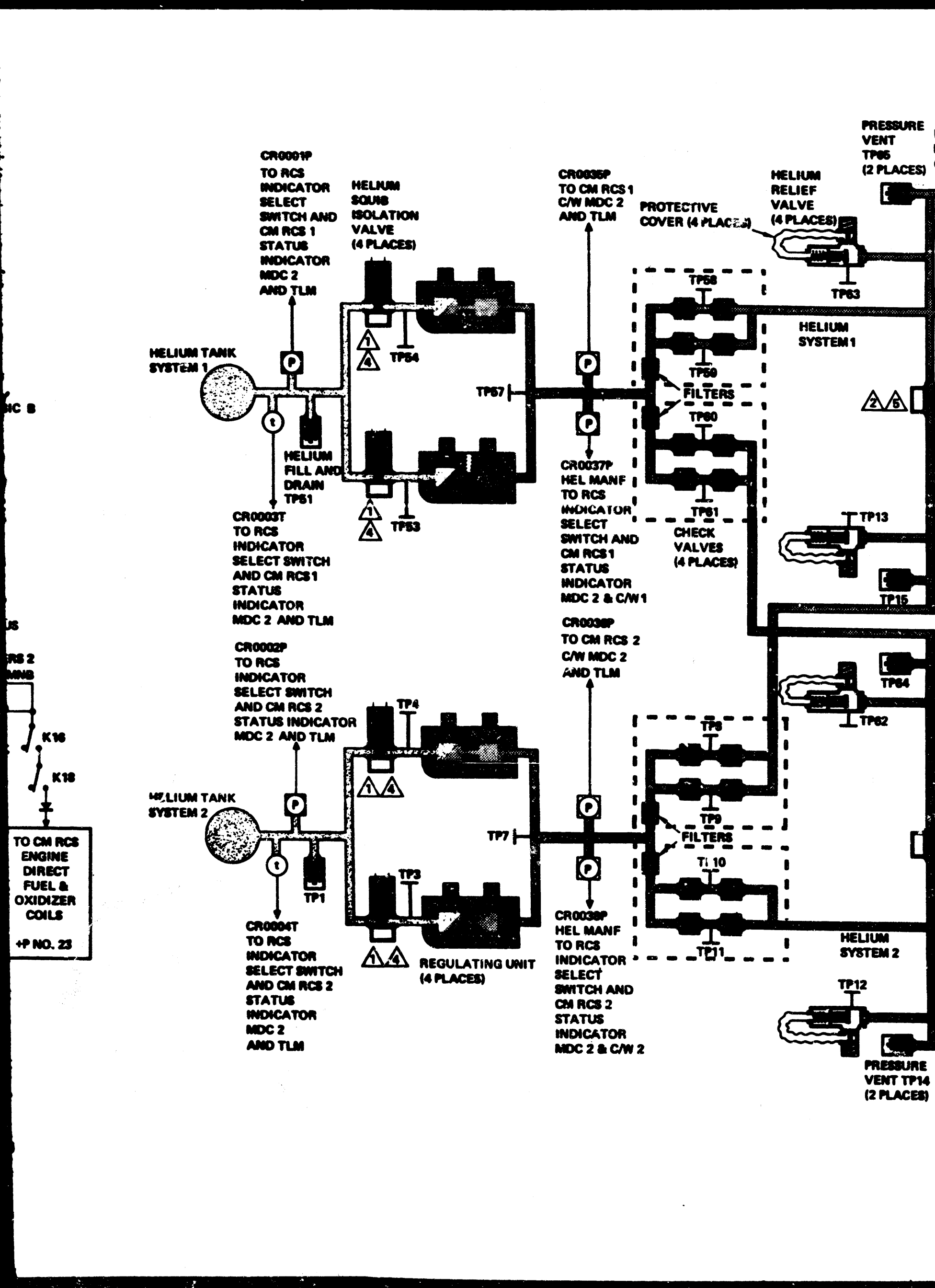
VIEW B




MDC-101
DC VOLTS
0
1
2
3
4
5
OFF
XPDNR
1
2
3
4
5
6
7
SYSTEMS TEST ROTARY SWITCH
A
B
C
D
GRD 37
36
35
34
33
32
31
MAIN BUS A 28 VDC
MDC 5 ESS INST MN A
MDC 276 CB 1
MDC 276 CB2
ESS INST MN B
MAIN BUS B 28 VDC
SIGNAL CONDITIONER
CCW NO. 12
NEG PITCH NO. 14
NEG YAW NO. 16
CW NO. 21
NEG PITCH NO. 24
POS YAW NO. 25
ENGINE INJECTOR TEMPERATURE
28 VDC MAIN BUS A
OFF
CMRCS SWITCH
CM RCS HEATERS SWITCH MDC 101
K15
K17
NEG
MDC 8 CM RCS HEATERS
MAIN BUS A 28 VDC
TO CM RCS ENGINE DIRECT FUEL & OXIDIZER COILS
-P NO. 14
-Y NO. 16
+Y NO. 15
-R NO. 12
+R NO. 11


XPDNR
OFF
1
2
3
4
5
6
7
SYSTEMS TEST ROTARY SWITCH
A
B
C
D
36
35
34
33
32
31
SIGNAL CONDITIONER
NEG YAW NO. 16
CW NO. 21
NEG PITCH NO. 24
POS YAW NO. 25
ENGINE INJECTOR TEMPERATURE


28 VDC MAIN BUS A
28 VDC MAIN BUS B
MDC 8 RCS LOGIC A
MDC 8 RCS LOGIC B
OFF
CMRCS LOGIC SWITCH MDC 1
CM RCS HEATERS SWITCH MDC 101
OFF
K15
K17
K16
K18
NEG BUS
NEG BUS
MDC 8 CM RCS HEATERS 1
MDC 8 CM RCS HEATERS 2
MAIN BUS A 28 VDC
MAIN BUS B 28 VDC
MNA
MNB
TO CM RCS ENGINE DIRECT FUEL & OXIDIZER COILS -P NO. 14 -Y NO. 16 +Y NO. 15 -R NO. 12 +R NO. 11
TO CM RCS ENGINE DIRECT FUEL & OXIDIZER COILS +P NO. 13
TO CM RCS ENGINE DIRECT FUEL & OXIDIZER COILS -P NO. 24 -Y NO. 26 +Y NO. 25 -R NO. 22 +R NO. 21
TO CM RCS ENGINE DIRECT FUEL & OXIDIZER COILS +P NO. 23


CR0001P
TO RCS
INDICATOR
SELECT
SWITCH AND
CM RCS 1
STATUS
INDICATOR
MDC 2
AND TLM
HELIUM
SQUIB
ISOLATION
VALVE
(4 PLACES)
CR0035P
TO CM RCS 1
C/W MDC 2
AND TLM
PROTECTIVE
COVER (4 PLACES)
HELIUM
RELIEF
VALVE
(4 PLACES)
PRESSURE
VENT
TP65
(2 PLACES)
TP63
HELIUM TANK
SYSTEM 1
TP64
TP58
HELIUM
SYSTEM 1
TP59
TP57
FILTERS
TP60
HELIUM
FILL AND
DRAIN
TP51
TP53
CR0037P
HEL MANF
TO RCS
INDICATOR
SELECT
SWITCH AND
CM RCS1
STATUS
INDICATOR
MDC 2 & C/W1
TP61
CHECK
VALVES
(4 PLACES)
TP13
TP15
CR0003T
TO RCS
INDICATOR
SELECT SWITCH
AND CM RCS1
STATUS
INDICATOR
MDC 2 AND TLM
CR0038P
TO CM RCS 2
C/W MDC 2
AND TLM
TP64
TP62
CR0002P
TO RCS
INDICATOR
SELECT SWITCH
AND CM RCS 2
STATUS INDICATOR
MDC 2 AND TLM
TP4
TP8
HELIUM TANK
SYSTEM 2
TP9
TP7
FILTERS
TP10
TP3
TP1
CR0004T
TO RCS
INDICATOR
SELECT SWITCH
AND CM RCS 2
STATUS
INDICATOR
MDC 2
AND TLM
REGULATING UNIT
(4 PLACES)
CR0036P
HEL MANF
TO RCS
INDICATOR
SELECT
SWITCH AND
CM RCS 2
STATUS
INDICATOR
MDC 2 & C/W 2
TP11
HELIUM
SYSTEM 2
TP12
PRESSURE
VENT TP14
(2 PLACES)
K16
K18
TO CM RCS
ENGINE
DIRECT
FUEL &
OXIDIZER
COILS
+P NO. 23

NOTE:

MAIN BUS B & PROP ISOL MAIN B FOR CM RCS SYS 2 PROP ISOL VALVES

MAIN BUS B & SM RCS HEATERS AMN B FOR CM RCS SYS 2 INDICATOR & ABORT PAD TO T + 42 SEC CLOSURE

CR2103 TO MDC ROTARY SWITCH

PRESSURE VENT TP65 (2 PLACES)

FUEL SQUIB BYPASS VALVE (2 PLACES)

HELIUM RELIEF VALVE (4 PLACES)

TP63

HELIUM SYSTEM 1

FUEL VENT TP73

SYSTEM 1 FUEL

FUEL SQUIB DUMP VALVES

DIAPHRAGM BURST ISOLATION VALVE (4 PLACES)

TP69

MAIN BUS A

PROP ISO MNA MDC 8

PROP I SWITCH MDC 2

ON OFF

MAIN BUS A

SM RCS HEATERS B MN A

CM NEG BUS

INDICATOR

PROPELLANT ISOLATION VALVE FUEL (2 PLACES)

PAD TO T+42 SEC

K1 K7

RCS CONTROL BOX ABORT

CM NEG BUS

FUEL FILL AND DRAIN TP67

OVER BOARD

HELIUM INTERCONNECT SQUIB VALVE (2 PLACES)

FUEL SQUIB INTERCONNECT VALVE

TP17

SYSTEM 2 FUEL

TP13

TP19

TP21

TP23

TP15

TP64

TP72

OXIDIZER SQUIB DUMP VALVES

TP62

TP68

TP70

SYSTEM 1 OXIDIZER

TP66

OVER BOARD

OXIDIZER FILL AND DRAIN TP16

SYSTEM 2 OXIDIZER

OXIDIZER SQUIB INTERCONNECT VALVE

TP20

HELIUM SYSTEM 2

TP12

TP18

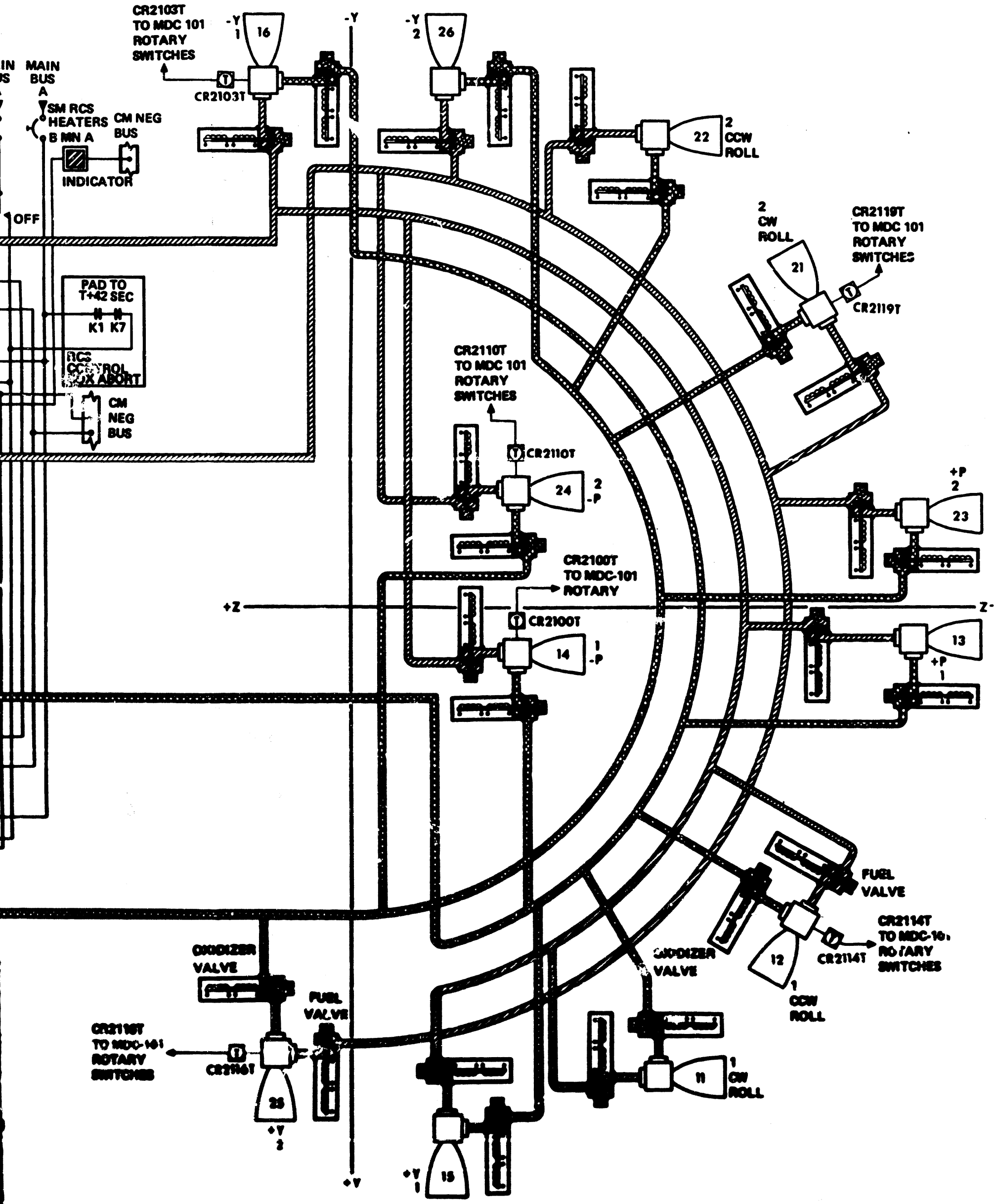
OXIDIZER VENT TP22

PROPELLANT ISOLATION VALVE OXIDIZER (2 PLACES)

PRESSURE VENT TP14 (2 PLACES)

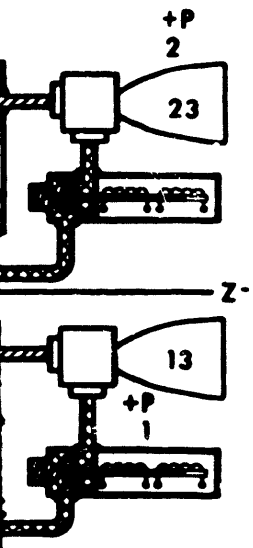
OXIDIZER SQUIB BYPASS VALVE (2 PLACES)

CR2107 TO MDC-101 ROTARY SWITCHES


CR2103T
TO MDC 101
ROTARY
SWITCHES
CR2103T
-Y
1
16
-Y
-Y
2
26
22
2
CCW
ROLL
2
CW
ROLL
21
CR2119T
TO MDC 101
ROTARY
SWITCHES
CR2119T
MAIN
BUS
A
SM RCS
HEATERS
B MN A
CM NEG
BUS
INDICATOR
OFF
PAD TO
T+42 SEC
K1 K7
RCS
CONTROL
BOX ABORT
CM
NEG
BUS
CR2110T
TO MDC 101
ROTARY
SWITCHES
CR2110T
24
2
-P
+P
2
23
CR2100T
TO MDC-101
ROTARY
+Z
Z-
CR2100T
14
1
-P
13
+P
1
FUEL
VALVE
CR2114T
TO MDC-101
ROTARY
SWITCHES
CR2114T
12
1
CCW
ROLL
OXIDIZER
VALVE
OXIDIZER
VALVE
FUEL
VALVE
CR2116T
TO MDC-101
ROTARY
SWITCHES
CR2116T
25
+Y
2
+V
+Y
1
15
11
1
CW
ROLL

2119T
MDC 101
TARY
ITCHES

2119T



EL
LVE

CR2114T
TO MDC-101
ROTARY
SWITCHES

PHASE	SEQUENCE	SQUIB VALVE INDICATION (TOTAL:				
		HELIUM ISOLATION (4)	FUEL SIDE HELIUM INTERCONNECT (1)	OXIDIZER SIDE HELIUM INTERCONNECT (1)	FUEL INTERCONNECT (1)	OXIDIZER INTERCONNECT (1)
NORMAL ENTRY	1. PRIOR TO CM SM SEPARATION	1 (NORMAL OR BACKUP) / (BACKUP OR NORMAL) 4				
	2. MAIN PARACHUTE LINE STRETCH		2	2	2	2
	3. AFTER PROPELLANT DEPLETION					
ABORT PAD TO T + 42 SECONDS	1. SIMULTANEOUS WITH EDS OR MANUAL ABORT INITIATION	4 (NORMAL) / (BACKUP) 1	5	5	5	5
	2. ABORT INITIATION PLUS 5 SECONDS.					
	3. 13 SECONDS AFTER FUEL DUMP INITIATION					
ABORT AFTER T + 42 SECONDS	1. SIMULTANEOUS WITH EDS OR MANUAL ABORT INITIATION.	4 (NORMAL) / (BACKUP) 1				
	2. MAIN PARACHUTE LINE STRETCH		2	2	2	2
	3. AFTER PROPELLANT DEPLETION					
ALL SPS ABORTS	SAME AS NORMAL ENTRY					

HELIUM
OXIDIZER
FUEL
P PRESSURE TRANSDUCER
T TEMPERATURE TRANSDUCER
C/W CAUTION AND WARNING

CM RCS FUNCTIONAL FLOW
CSM 104 AND SUBS

SQUIB VALVE INDICATION (TOTAL: 16 VALVES)								
LIUM ATION 4)	FUEL SIDE HELIUM INTERCONNECT (1)	OXIDIZER SIDE HELIUM INTERCONNECT (1)	FUEL INTERCONNECT (1)	OXIDIZER INTERCONNECT (1)	FUEL TANK BYPASS (2)	OXIDIZER TANK BYPASS (2)	OXIDIZER DUMP (2)	FUEL DUMP (2)
AL CKUP) CKUP OR ORMAL) 4								
	2	2	2	2				
					3 (NORMAL) (BACKUP) 6	3 (NORMAL) (BACKUP) 6		
RMAL) ACKUP) 1	5	5	5	5			5	
								5
					5	5		
MAL) CKUP) 1								
	2	2	2	2				
					3 (NORMAL) (BACKUP) 6	3 (NORMAL) (BACKUP) 6		

LEGEND FOR SQUIB VALVE ACTUATION

1. CM RCS PRESSURIZE, SWITCH MDC 2
2. CM PROPELLANT DUMP SWITCH MDC 1
3. CM PROPELLANT PURGE SWITCH MDC 1
4. AUTOMATIC (CM SM SEPARATION)
5. AUTOMATIC (RCS CONTROL BOX)
6. CM RCS HELIUM DUMP PUSHBUTTON, MDC 1

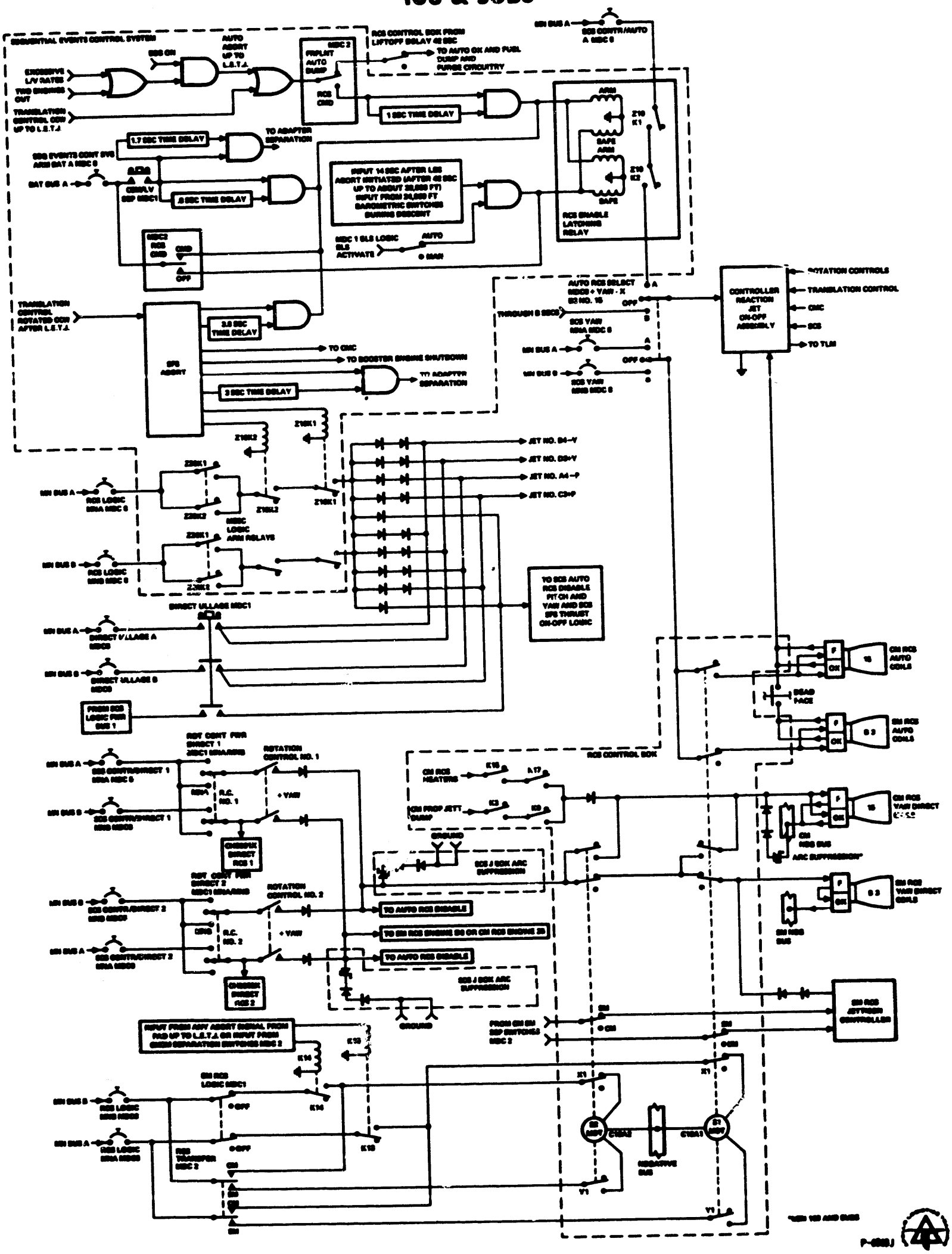
CM RCS FUNCTIONAL FLOW

CSM 104 AND SUBS

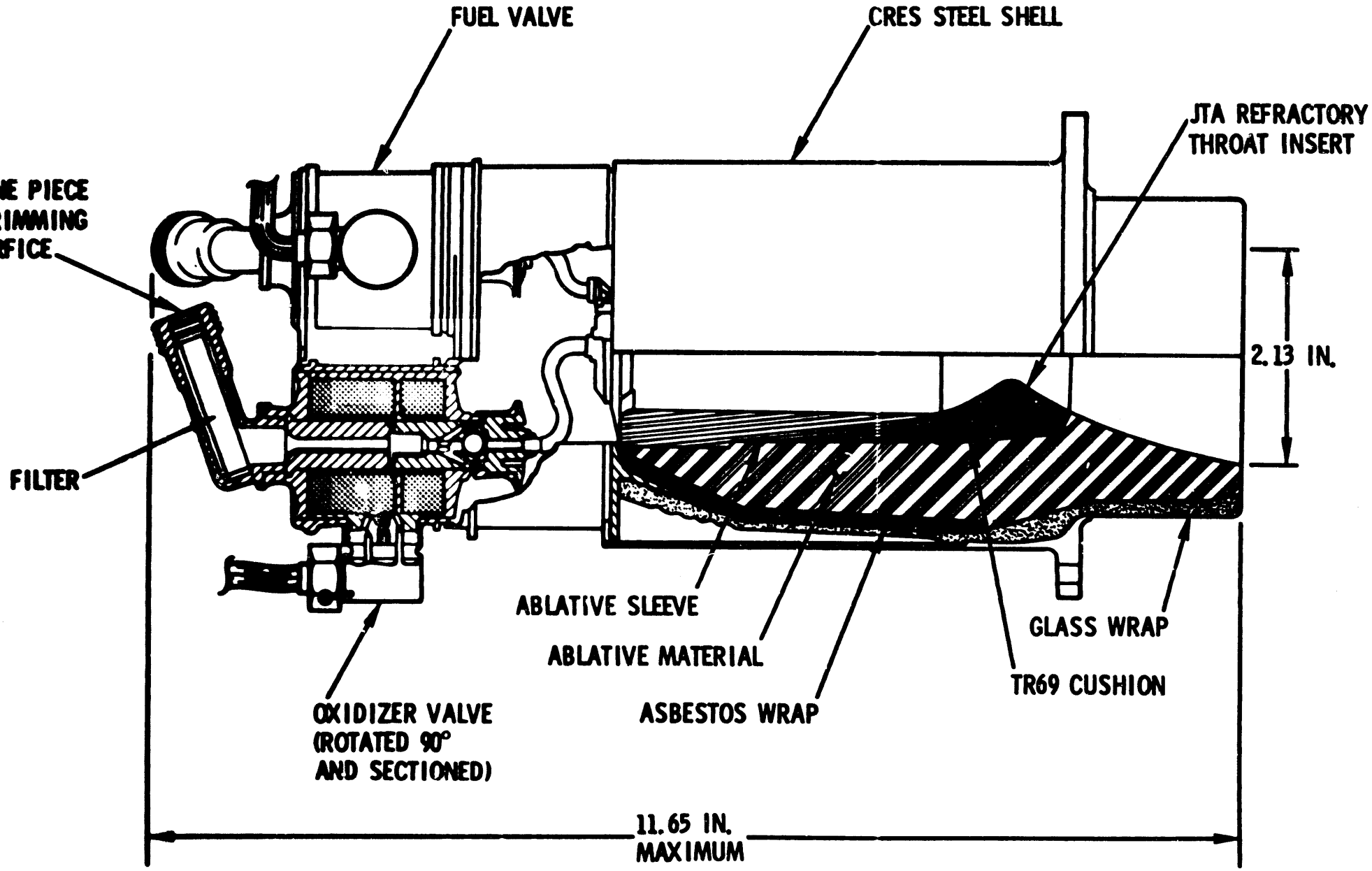
SM-2A-1261R

RCS ELECTRICAL CSM CONTROL

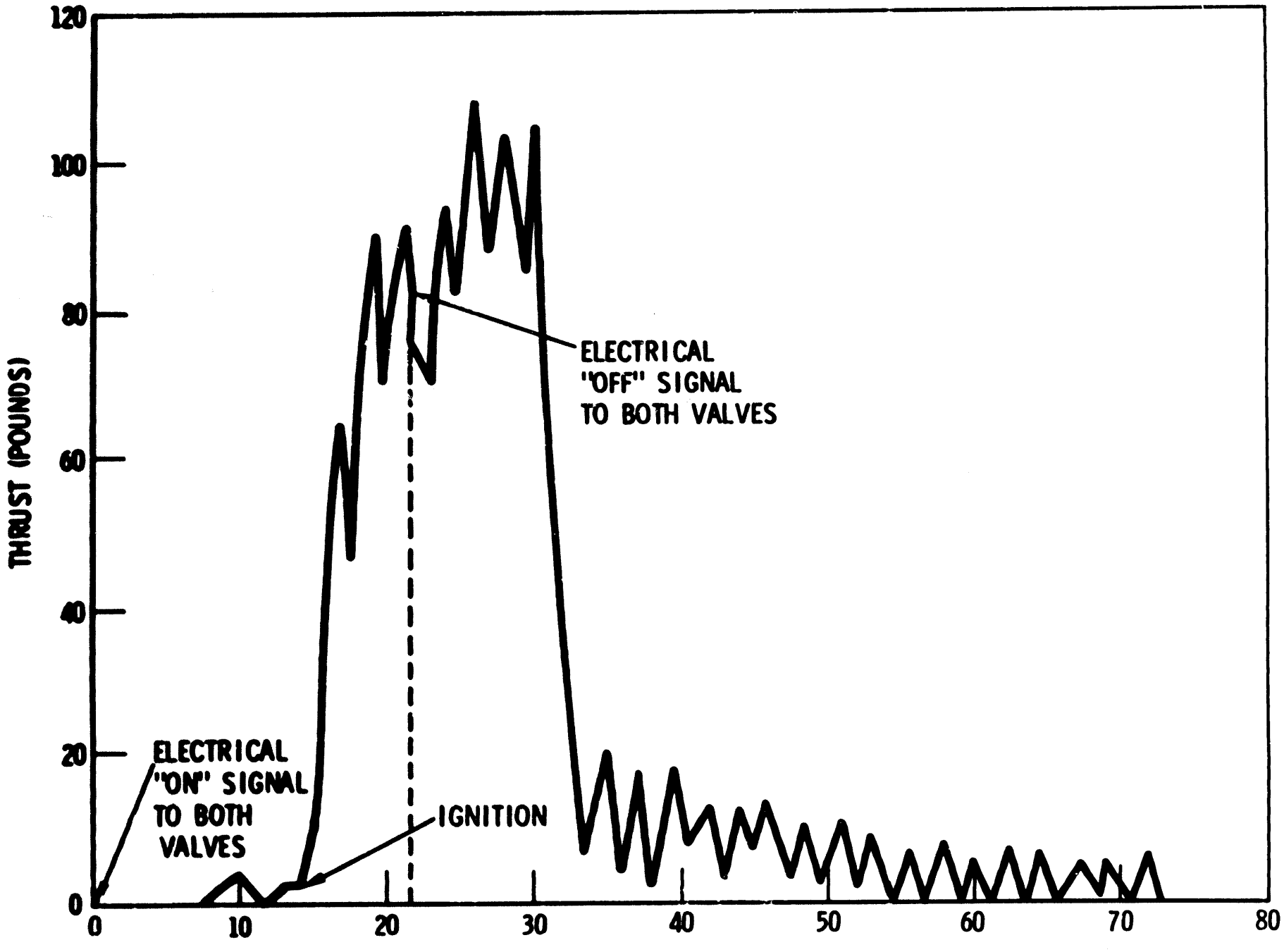
103 & SUBS



CM RCS ENGINE

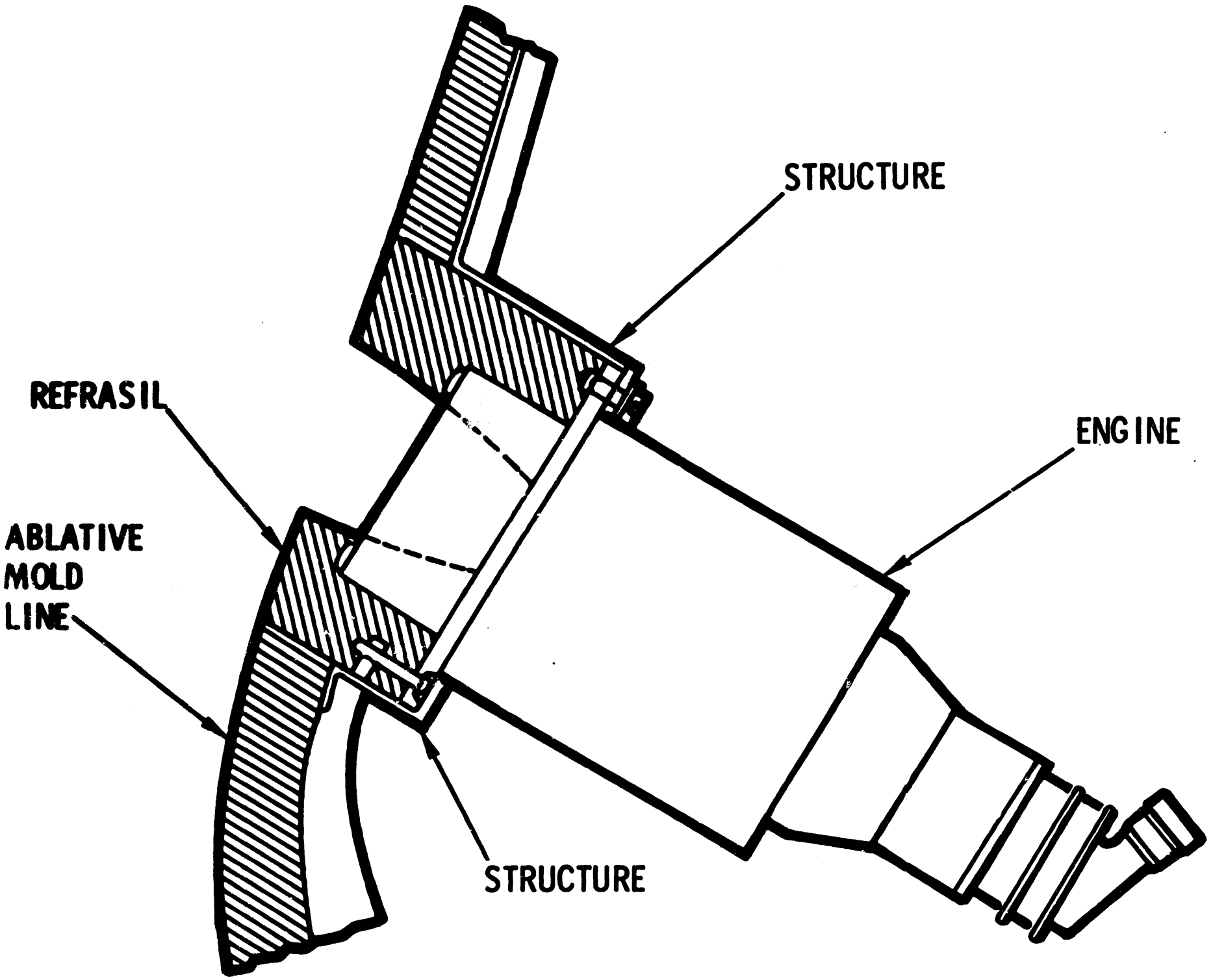


TYPICAL COMMAND MODULE RCS ENGINE THRUST

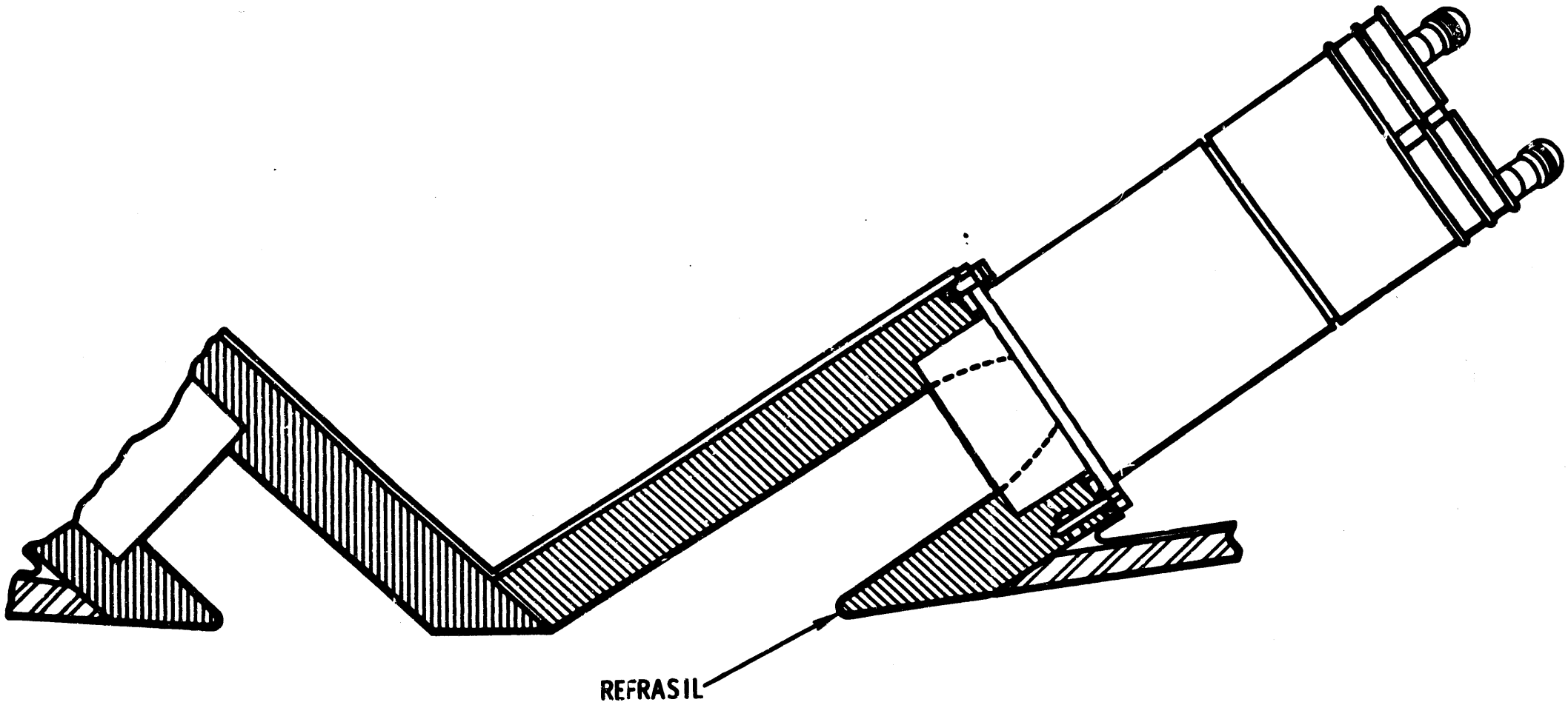


P-7031

C/M RCS TYPICAL NOZZLE EXTENSION PITCH AND YAW

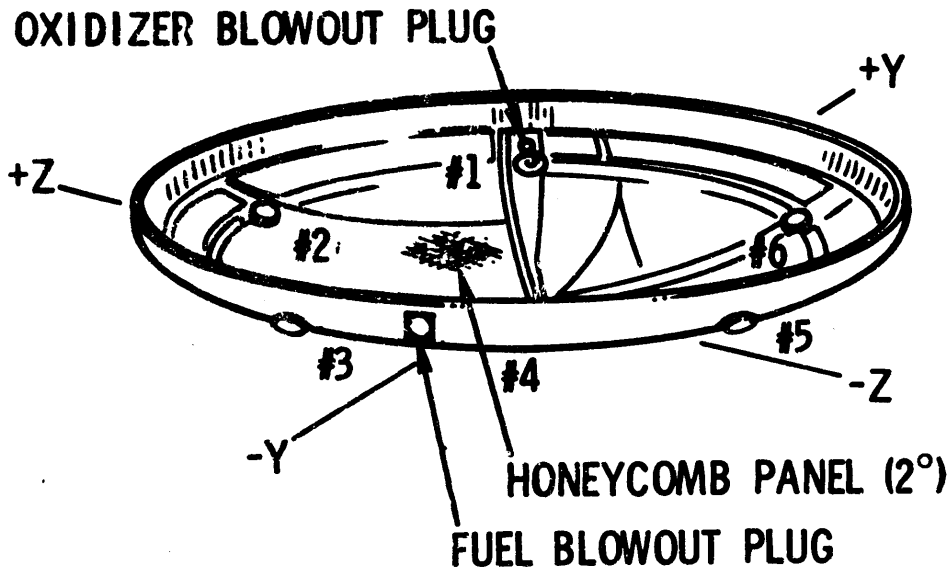


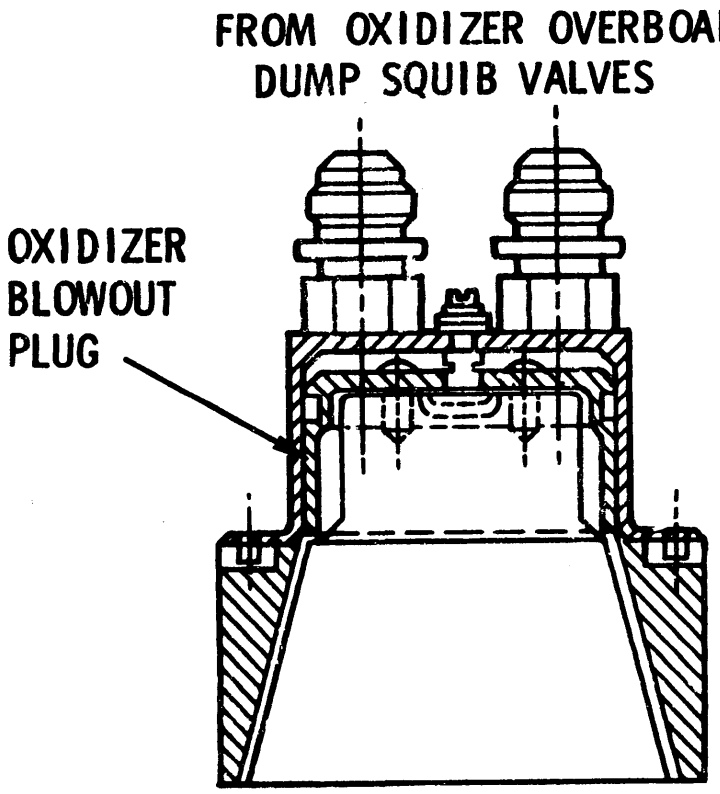
C/M RCS TYPICAL NOZZLE EXTENSION ROLL

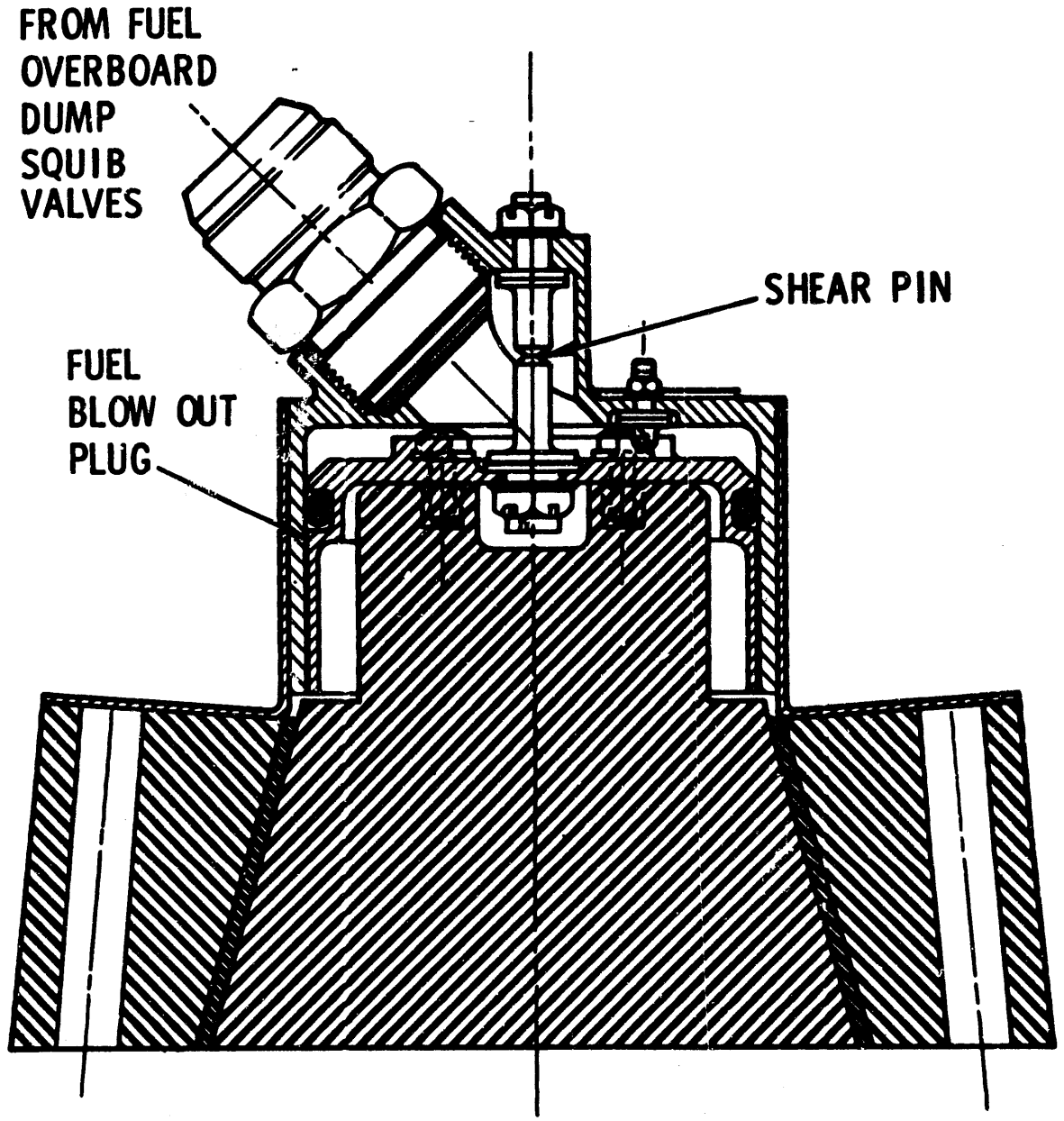


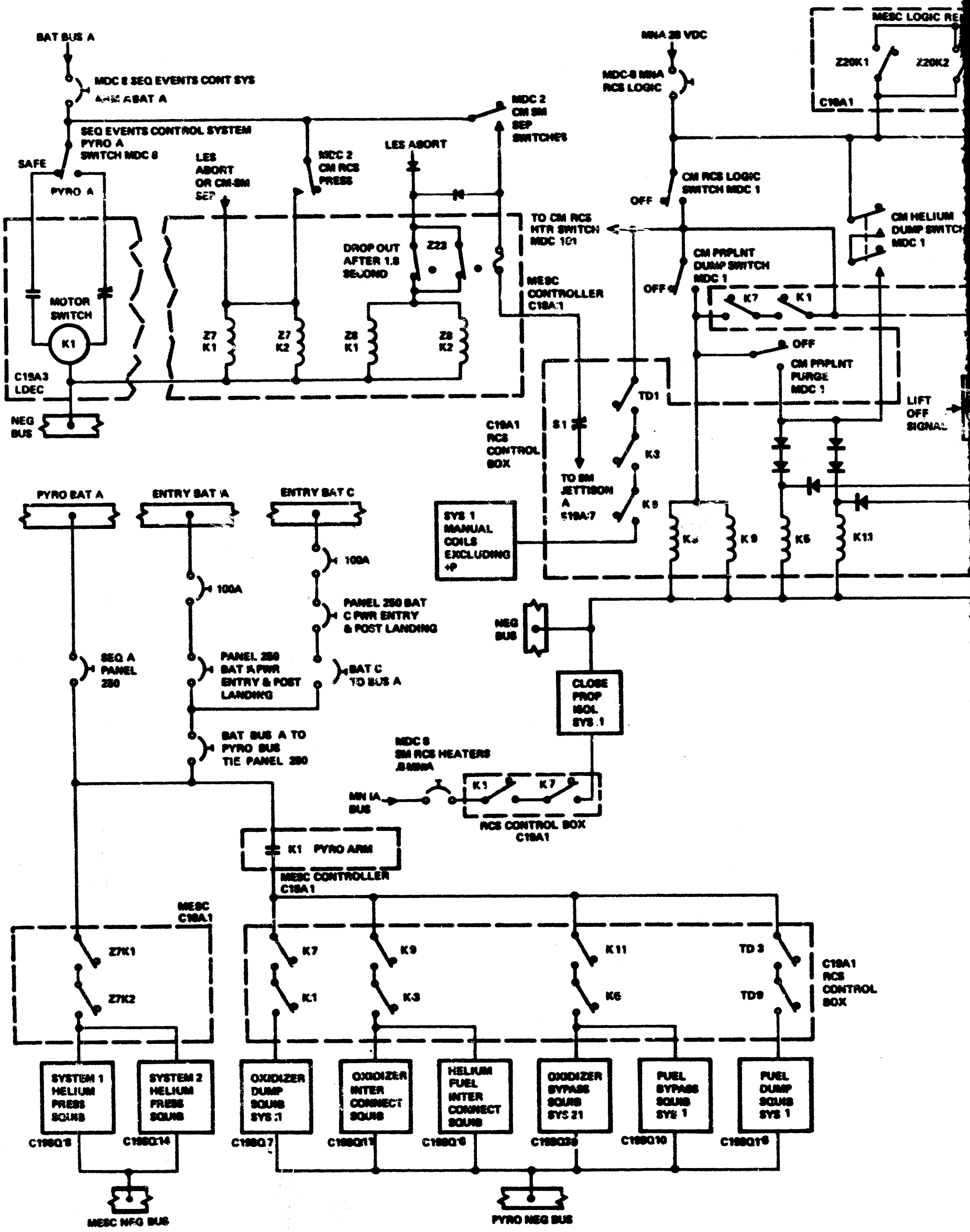
CMRCS RAPID FUEL AND OXIDIZER OVERBOARD DUMP PLUGS

BLOCK II








BAT BUS A
MDC 8 SEQ EVENTS CONT SYS
SEQ EVENTS CONTROL SYSTEM
PYRO A
SWITCH MDC 8
SAFE
PYRO A
LES
ABORT
OR CM-SM
SEP
MDC 2
CM RCS
PRESS
LES ABORT
MDC 2
CM SM
SEP
SWITCHES
DROP OUT
AFTER 1.8
SECOND
Z23
TO CM RCS
HTR SWITCH
MDC 101
MESC
CONTROLLER
C19A1
MOTOR
SWITCH
K1
Z7
K1
Z7
K2
Z8
K1
Z8
K2
C19A3
LDEC
NEG
BUS
MNA 28 VDC
MDC 8 MNA
RCS LOGIC
MESC LOGIC RE
Z20K1
Z20K2
C19A1
CM RCS LOGIC
SWITCH MDC 1
OFF
CM HELIUM
DUMP SWITCH
MDC 1
CM PRPLNT
DUMP SWITCH
MDC 1
OFF
K7
K1
OFF
CM PRPLNT
PURGE
MDC 1
LIFT
OFF
SIGNAL
TD1
C19A1
RCS
CONTROL
BOX
S1
K3
TO SM
JETTISON
A
S19A7
K9
SYS 1
MANUAL
COILS
EXCLUDING
+P
K3
K9
K5
K11
PYRO BAT A
ENTRY BAT A
ENTRY BAT C
100A
100A
100A
PANEL 250 BAT
C PWR ENTRY
& POST LANDING
SEQ A
PANEL
250
PANEL 250
BAT A PWR
ENTRY & POST
LANDING
BAT C
TO BUS A
BAT BUS A TO
PYRO BUS
TIE PANEL 250
NEG
BUS
CLOSE
PROP
ISOL
SYS 1
MDC 8
SM RCS HEATERS
MNA
MIN IA
BUS
K1
K7
RCS CONTROL BOX
C19A1
K1 PYRO ARM
MESC CONTROLLER
C19A1
MESC
C19A1
Z7K1
Z7K2
K7
K1
K9
K3
K11
K6
TD 3
TD9
C19A1
RCS
CONTROL
BOX
SYSTEM 1
HELIUM
PRESS
SQUIB
SYSTEM 2
HELIUM
PRESS
SQUIB
OXIDIZER
DUMP
SQUIB
SYS 1
OXIDIZER
INTER
CONNECT
SQUIB
HELIUM
FUEL
INTER
CONNECT
SQUIB
OXIDIZER
BYPASS
SQUIB
SYS 21
FUEL
BYPASS
SQUIB
SYS 1
FUEL
DUMP
SQUIB
SYS 1
C19Q18
C19Q14
C19Q7
C19Q11
C19Q6
C19Q38
C19Q10
C19Q16
MESC NEG BUS
PYRO NEG BUS

MNA 28 VDC

-8 MNA LOGIC

MESC LOGIC RELAYS

Z20K1

Z20K2

Z16K2

Z16K1

C18A1

SPS ABORT RELAYS

TO SPS ABORT DIRECT ULLAGE

TO EPS MOTOR SWITCH PLACING BATTERIES OFF MAIN BUS

OFF

BAT BUS A

BAT A CHARGE MDC 5

MAIN BUS TIE BAT A/C MDC 5

TO EPS MOTOR SWITCH PLACING BATTERIES ON MAIN BUS

AUTO

RCS TRANSFER MDC 2

SM

NORMAL

CM

CM RCS LOGIC SWITCH MDC 1

OFF

CM HELIUM DUMP SWITCH MDC 1

CM PRPLNT DUMP SWITCH MDC 1

OFF

K7

K1

OFF

CM PRPLNT PURGE MDC 1

Y1

K13

X1

S1

MOTOR SWITCH

TD13

TD7

K14

K13

S1

TD9

TD3

K5

K11

TD7

TD7

TD1

LIFT OFF SIGNAL

TD1 42 SEC TIMER

TD9 5 SEC TIMER

TD3 5 SEC TIMER

TD11 13 SEC TIMER

TD5 13 SEC TIMER

TD13 13 SEC TIMER

TD7 13 SEC TIMER

TD7

TD 13

TD 13

TO SYS B

TD 13

K3

K9

K3

K9

K5

K11

FROM SYS B

LEAD DISCONNECT

TO PITCH CONTROL MOTOR LAUNCH ESCAPE SYSTEM

C18A1 RCS CONTROL BOX

K7

K1

K13

TD1

PRPLNT AUTO DUMP

TO "A" RCS LATCHING RELAY Z19K1 AND K2

MDC 2 RCS CMD

MDC-8 SEQ EVENTS CONT SYS ARM A BAT A

MDC-8 SEQ EVENTS CONTROL SYSTEM LOGIC 1

BAT BUS A

OFF

LOGIC 2

OFF

Z20 K1

Z20 K2

NSG BUS

Z20 K2

Z20 K1

Z20 K2

Z20 K1

MDC-8 SEQ EVENTS CONT SYS LOGIC A BAT A

BAT BUS A

C18A1

TD 3

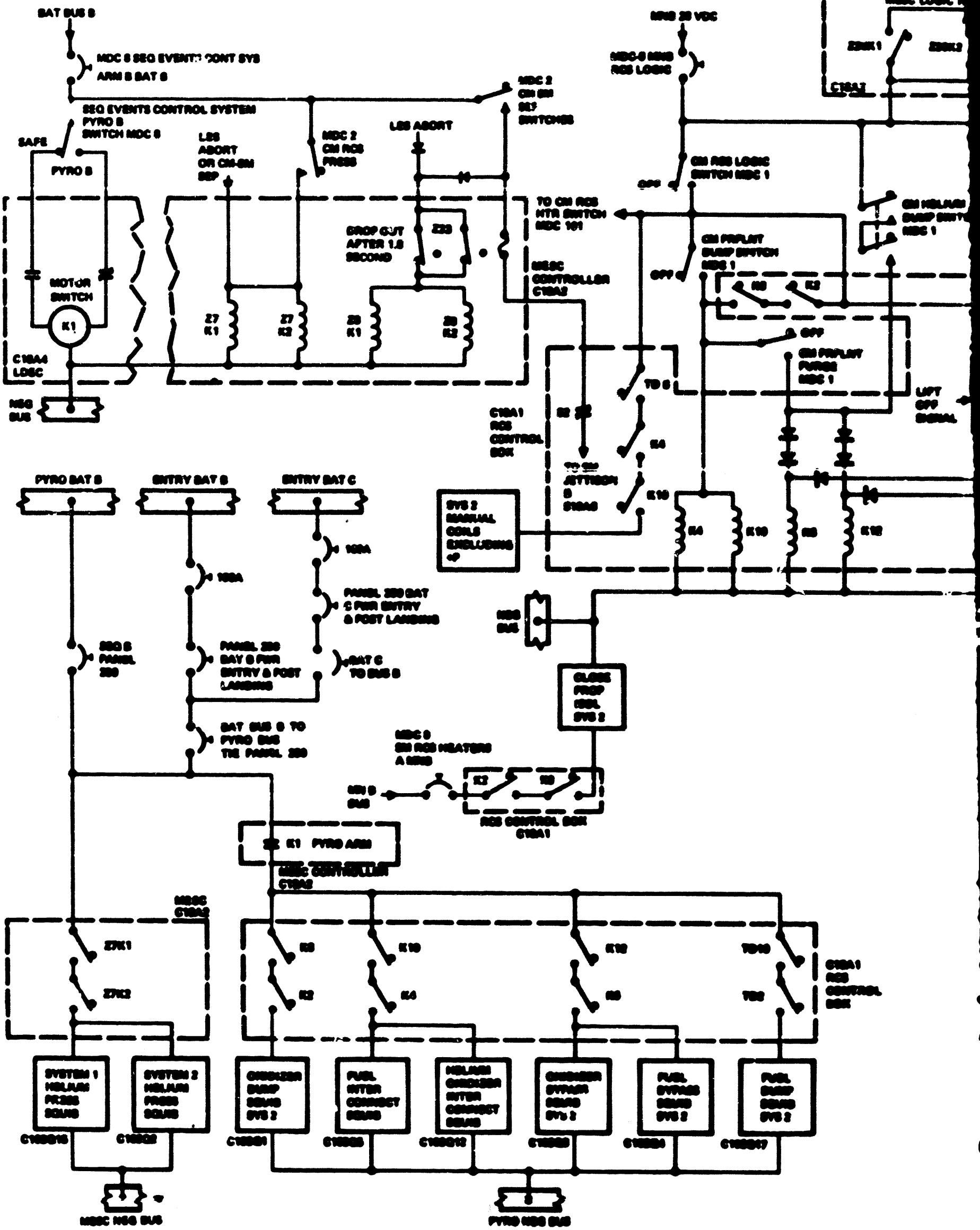
TD9

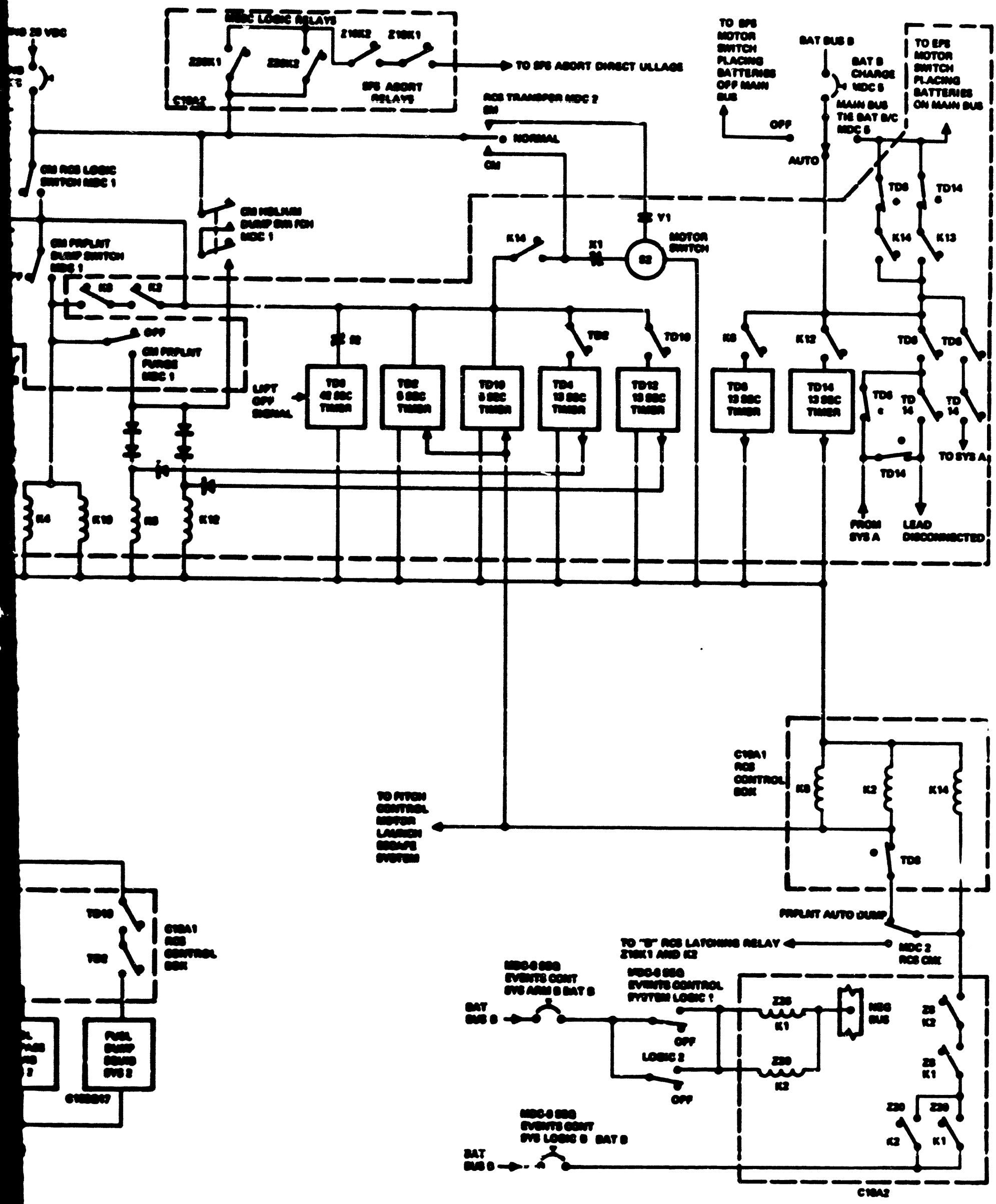
C18A1 RCS CONTROL BOX

FUEL BYPASS SQUIB SYS 1

FUEL DUMP SQUIB SYS 1

C18SC21S


BAT BUS B
MDC 8 SEQ EVENTS CONT SYS
ARM B BAT B
SEQ EVENTS CONTROL SYSTEM
PYRO B
SWITCH MDC 8
SAFE
PYRO B
LES
ABORT
OR CM-SM
SEP
MDC 2
CM RCS
PRESS
LES ABORT
MDC 2
CM SM
SEP
SWITCHES
MOTOR
SWITCH
K1
C19A4
LDEC
MDC
BUS
DROP OUT
AFTER 1.5
SECOND
Z20
Z7
K1
Z7
K2
Z8
K1
Z8
K2
MDEC
CONTROLLER
C19A2
TO CM RCS
HTR SWITCH
MDC 101
MINB 28 VDC
MDC-8 MINB
RCS LOGIC
CM RCS LOGIC
SWITCH MDC 1
CM PYPLNT
DUMP SWITCH
MDC 1
CM PYPLNT
PVRSS
MDC 1
LIFT
OFF
SIGNAL
TD 8
C19A1
RCS
CONTROL
BOX
K4
K10
K5
K12
PYRO BAT B
ENTRY BAT B
ENTRY BAT C
100A
100A
PANEL 250 BAT
C PWR ENTRY
& POST LANDING
SEQ 8
PANEL
250
PANEL 250
BAT B PWR
ENTRY & POST
LANDING
BAT C
TO BUS B
BAT BUS B TO
PYRO BUS
TIE PANEL 250
MDC 8
CM RCS HEATERS
A SRS
K2
K9
RCS CONTROL BOX
C19A1
K1 PYRO ARM
MDEC CONTROLLER
C19A2
MDEC
C19A2
Z7K1
Z7K2
K9
K2
K10
K4
K12
K5
TD10
TD9
C19A1
RCS
CONTROL
BOX
SYSTEM 1
HELIUM
PRESS
SOLNS
SYSTEM 2
HELIUM
PRESS
SOLNS
CHAMBER
PURGE
SOLNS
SYS 2
FUEL
INTER
CONNECT
SOLNS
HELIUM
CHAMBER
INTER
CONNECT
SOLNS
CHAMBER
PURGE
SOLNS
SYS 2
FUEL
PURGE
SOLNS
SYS 2
FUEL
DUMP
SOLNS
SYS 2
C19D10
C19D2
C19D1
C19D5
C19D12
C19D8
C19D4
C19D7
MDEC HEG BUS
PYRO HEG BUS



CM RCS SQUIB VALVE CONTROL

SM-2A-1260 T

HELIUM TANKS (2)	3600±50 PSIA nominal fill pressure, 4400 maximum operating pressure, capacity 19.4 cubic ft. each. Inside diameter 40" and a wall thickness of .46". Weight 393 lbs. each.
REGULATOR UNITS (2)	Working regulator, (Class I) primary 186±4 PSIG, secondary 191±4 PSIG. Primary lockup 195 PSIG. Secondary lockup 200 PSIG. Inlet filter 10 micron nominal, 25 micron absolute. (Class II) Normally locked-up (closed) regulator, primary 181±4 PSIG, secondary 191±4 PSIG. Primary lockup 195 PSIG. Secondary lockup 205 PSIG. Inlet filter 10 micron nominal, 25 micron absolute.
CHECK VALVES - FILTERS	40 micron nominal and 74 micron absolute inlet port, test ports 50 micron nominal and 74 micron absolute, one at inlet to check valve assembly, one at each test port.
PRESSURE TRANSDUCERS (2)	Fuel and oxidizer under pressure setting (SPS PRESS LIGHT MDC-2) 157 PSIA. Fuel and oxidizer over pressure setting (SPS PRESS LIGHT MDC-2) 200 PSIA.
PROPELLANT UTILIZATION	Increase position - Approximately 3% more than nominal flow Normal position - Nominal flow Decrease position - Approximately 3 - 1/2 % less than nominal flow Response time, normal to increase or vice versa or normal to decrease or vice versa is 3.5 seconds.
QUANTITY SENSING SYSTEM	Indicators - Difference between actual quantity and total quantity indicated for each propellant not to exceed ± .35% of full tank plus +.35% of propellant remaining separately to total fuel and oxidizer separately. TLM - Difference between actual quantity on each tank and that represented to TLM be within ±.35% of full tank plus +.35% of propellant remaining.

HELIUM RELIEF VALVE (2)

Diaphragm rupture 219±6 PSIG
Filter, 10 micron, 25 micron absolute
Relief valve relieves at 212 psig minimum to 225 psig maximum
Relief valve reseats at 208 PSIG minimum
Flow capacity 3 lbs/minute maximum at 60°F and 225 PSIG
Bleed device closes when increasing pressure reaches no greater than 150 PSIG in cavity and reopens when decreasing pressure has reached no less than 20 PSIG.

OXIDIZER STORAGE TANK #1

Total tank capacity 11,284.69 lbs.
Fill pressure 110 PSIA
Height 154.47"
Inside diameter 45"
Wall thickness .054"
128.52 cubic feet

OXIDIZER SUMP TANK #2

Total tank capacity 13,923.72 lbs. = 57%
Fill pressure 110 PSIA
Height 153.8"
Inside diameter 51"
Wall thickness .054"
161.48 cubic feet

FUEL STORAGE TANK #1

Total tank capacity 7058.36 lbs.
Fill pressure 110 PSIA
Height 154.47"
Inside diameter 45"
Wall thickness .054"
128.52 cubic feet

FUEL SUMP TANK #2

Total tank capacity 8708.10 lbs. = 57%
Fill pressure 110 PSIA
Height 153.8"
Inside diameter 51"
Wall thickness .054"
161.48 cubic feet

TOTAL PROPELLANT (IN TANKS)	OXIDIZER 25,208.41 lbs = 103.4% FUEL 15,766.46 lbs = 103.4% 99.9% oxidizer gaugeable = 24,389.10 lbs. 99.9% fuel gaugeable = 15,252.70 lbs.
ALL PROPELLANT TANKS	Pressurized to 10 ± 5 PSIG of helium when empty to prevent collapsing of tanks (negative pressure of .5 PSIG will collapse tanks).
INTERFACE FLANGE FILTER (2)	500 micron absolute
GN_2 BIPROPELLANT VALVE CONTROL SYSTEMS (2)	GN_2 vessel pressure 2500±50 PSI at 68°F, 2900 PSI at 130°F, I.D. 4.65", Length 9.6", 5.8 cubic inch capacity each. Support 43 valve actuations Regulator - Single stage, dynamic 187 PSIG minimum, lockup 195 to 225 PSIG Relief Valve - Relieves at 350±15 PSI Reseats at not less than 250 PSI
	*GN_2 filters, one between each GN_2 supply tank and injector pre-valve, 5 micron nominal and 18 micron absolute. One at each GN_2 regulator outlet test port, 5 micron nominal and 18 micron absolute.
HEATERS CSM 106 AND SUBS	6 heaters, 2 elements in each heater, 3 elements in series on the fuel side rated at 15 watts, 9.4 watts and 18.8 watts, 3 elements in series on the oxidizer side rated at 15 watts, 9.4 watts and 18.8 watts. SPS heater switch position A/B on MDC-3 supplies 28 VDC to 12 elements. SPS heater switch position A on MDC-3 supplies 28 VDC to 6 elements.

*CSM 108 and subs

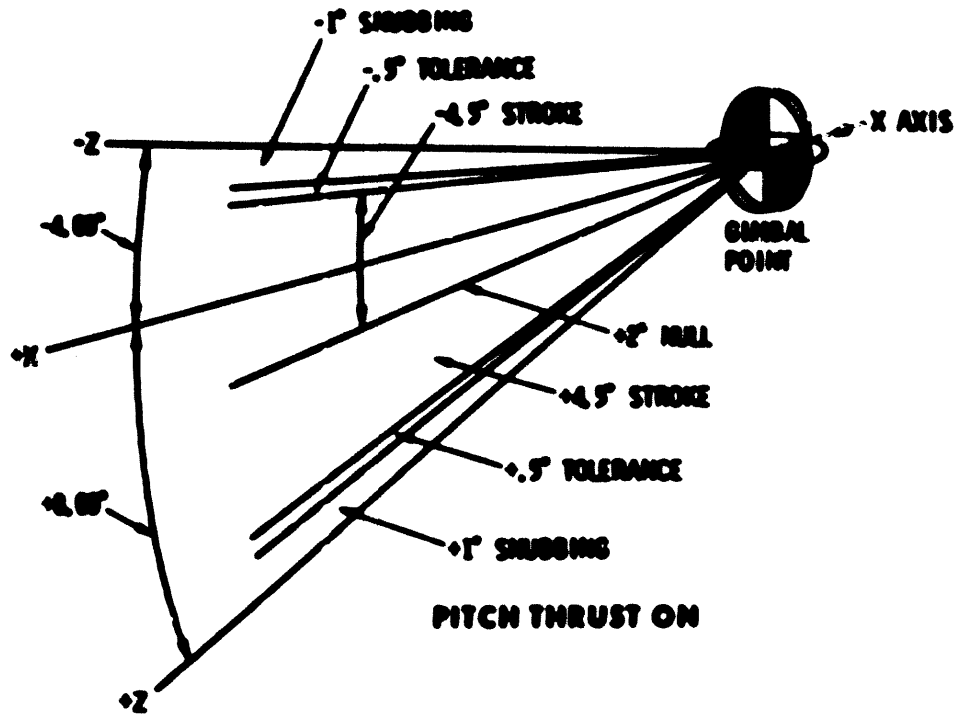
ENGINE (1)

750 second service life
Support 36 Restarts Minimum
Expansion ratio = 6 to 1 at ablative chamber exit area
= 62.5 to 1 at nozzle extension exit area
Chamber cooling = Ablation and film cooled
Nozzle extension = Radiation cooled
Injector type = Baffled, unlike impingement
Oxidizer lead 8°
Length 159.944" maximum
Nozzle extension exit diameter 98.4" Inside Diameter
Weight - Approximately 650 lbs.
Injector Flange Temperature - Illuminate SPS FLANGE TEMP HI (Caution and Warning on MDC-2) at 480°F
SPS P_c transducer, displayed on MDC-1 through SPS P_c ∝ switch to SPS P_c ∝ on MDC-1. Green range on indicator 65 to 125% (corresponds to PSIA). Normal 95 to 105 PSIA.

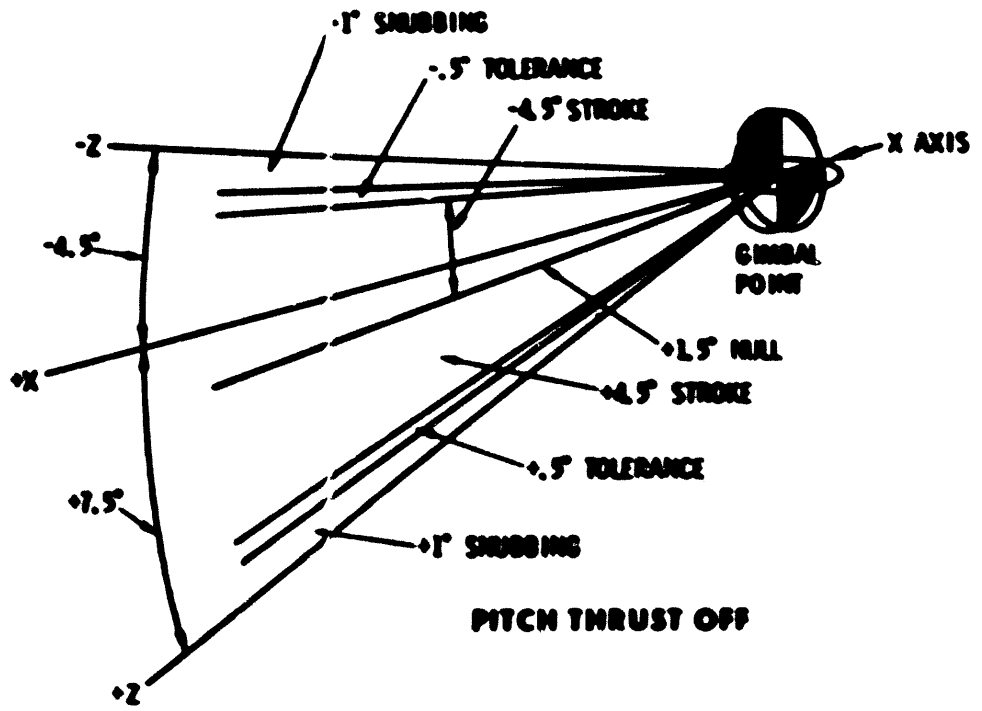
GIMBAL ACTUATORS

Structural mounting pad offset 4° to +Y
About Z-Z axis ±4 1/2+1/2-0° with additional 1° for snubbing,(yaw) null 1° to +Y thrust vector during engine thrusting.
About Y-Y axis ±4 1/2+1/2-0° with additional 1° for snubbing, (pitch) null 2° to +Z thrust vector during engine thrusting.
Overcurrent relays (4)
Overcurrent dependent upon temperature during start transient, steady state and gimbal angle change.
Quiescent current of 60+10-5 milliamps
Pressurized to 3.0 to 5.0 PSI of dry air
Deflection rate .12 radians per second (low side) 6.87° per second to .132 radians per second (high side) 7.56° per second.

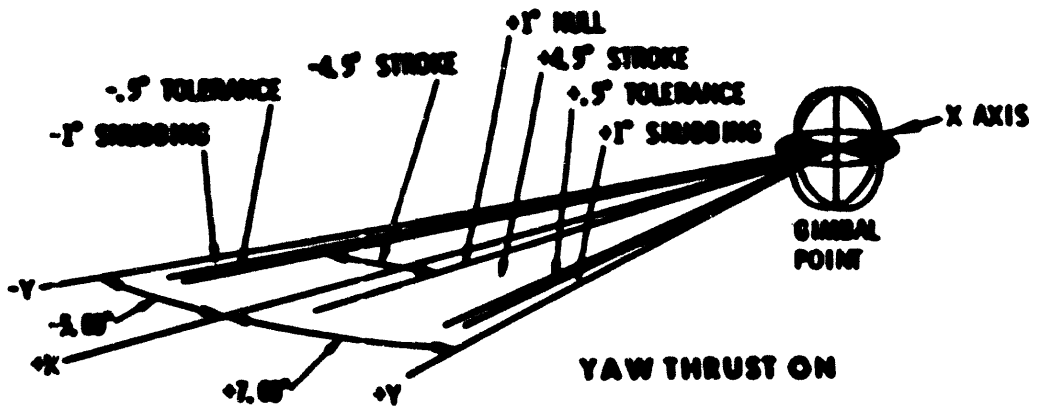
SPS GIMBAL ANGLES PITCH AND YAW



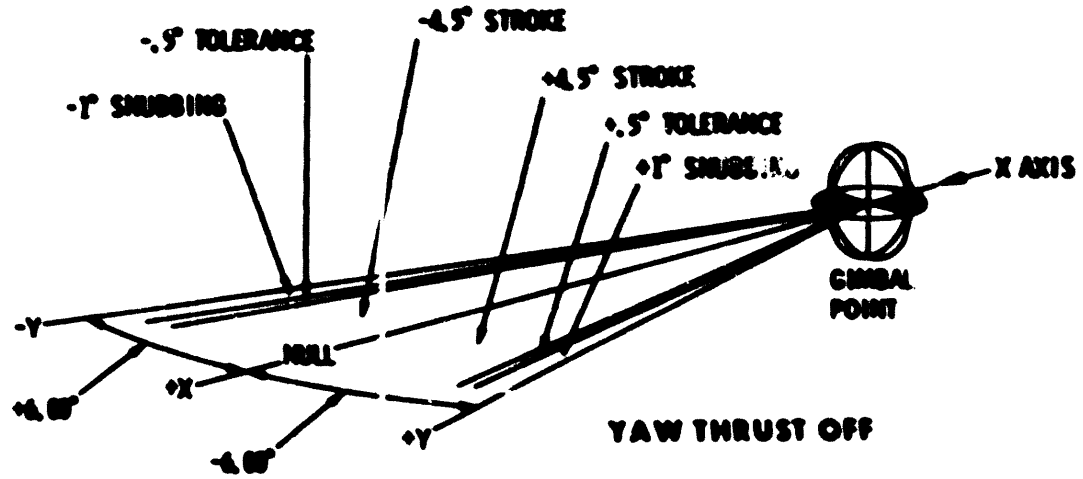
PITCH THRUST ON



PITCH THRUST OFF



YAW THRUST ON



YAW THRUST OFF

THE ENGINE MOUNTING PADS IN THE SERVICE MODULE ARE CANTED 4° (THRUST VECTOR) TO THE +Y AXIS OF THE SPACECRAFT. HOWEVER THE ACTUATOR NULL ADJUSTMENTS ARE AS FOLLOWS:

PITCH

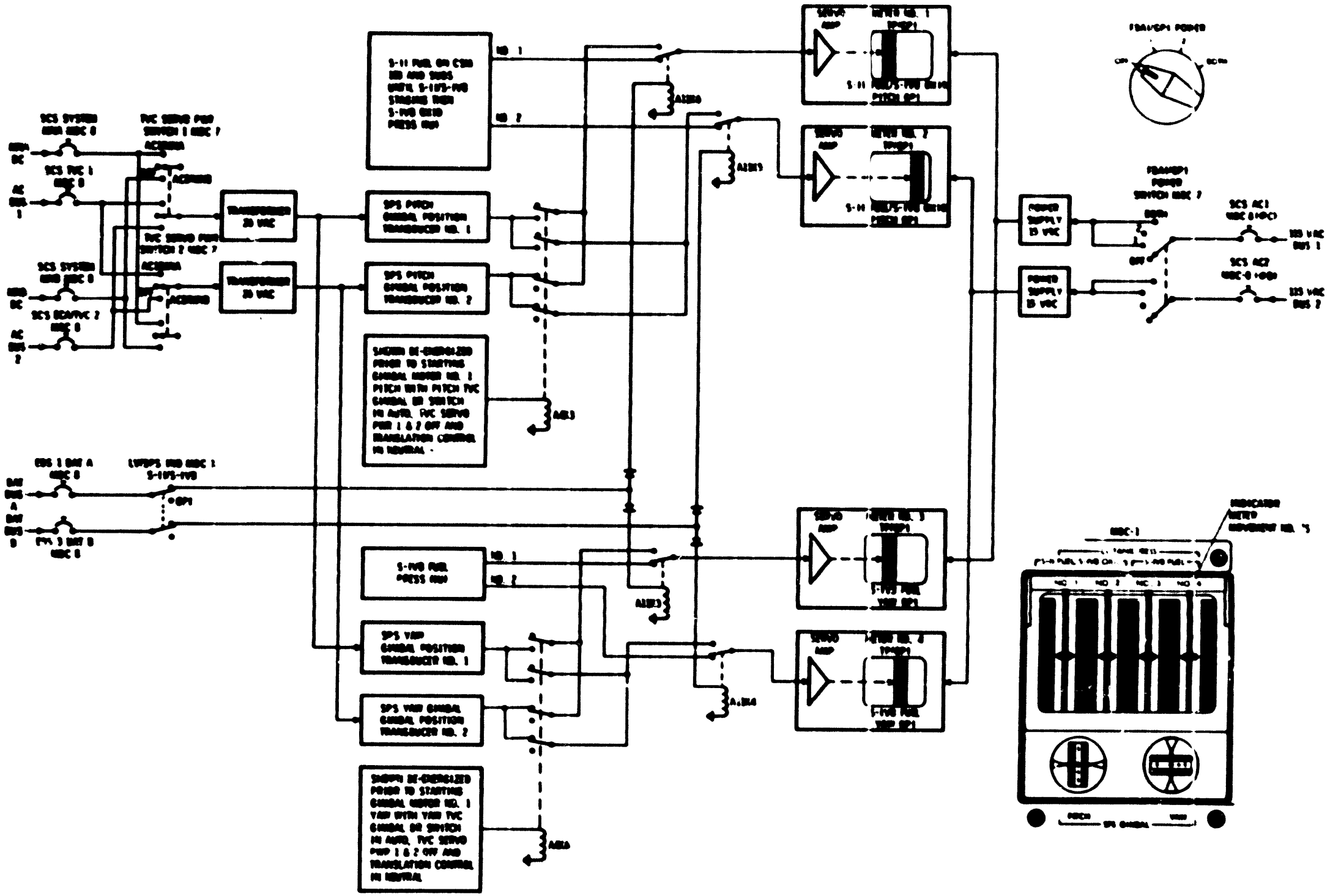
THE PITCH ACTUATOR NULL POSITION IS +2° THRUST VECTOR TO THE +Z, ENGINE NOZZLE -2° TO THE -Z DURING AN SPS ENGINE FIRING. THE NULL POSITION IS +1.5° THRUST VECTOR TO THE +Z, ENGINE NOZZLE -1.5° TO THE -Z DURING SPS NON-THRUSTING PERIODS. THE THUMB WHEEL ON MDC 1 & GIMBAL POSITION INDICATOR/FUEL PRESSURE INDICATOR ON MDC 1 WILL BE 0.0°.

YAW

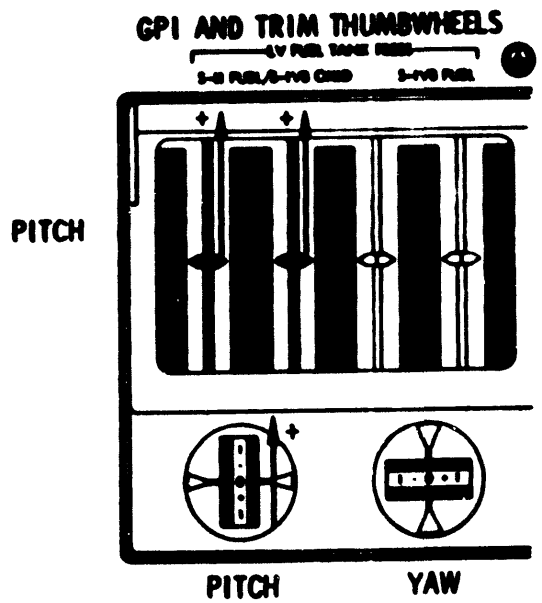
THE YAW ACTUATOR NULL POSITION IS +1° THRUST VECTOR TO THE +Y, ENGINE NOZZLE IS -1° TO THE -Y DURING AN SPS ENGINE FIRING. THE NULL POSITION IS 0° THRUST VECTOR TO THE Y, ENGINE NOZZLE IS 0° TO THE Y AXIS DURING SPS NON-THRUSTING PERIODS. THE THUMB WHEEL ON MDC 1 & GIMBAL POSITION INDICATOR/FUEL PRESSURE INDICATOR ON MDC 1 WILL BE 0.0°.

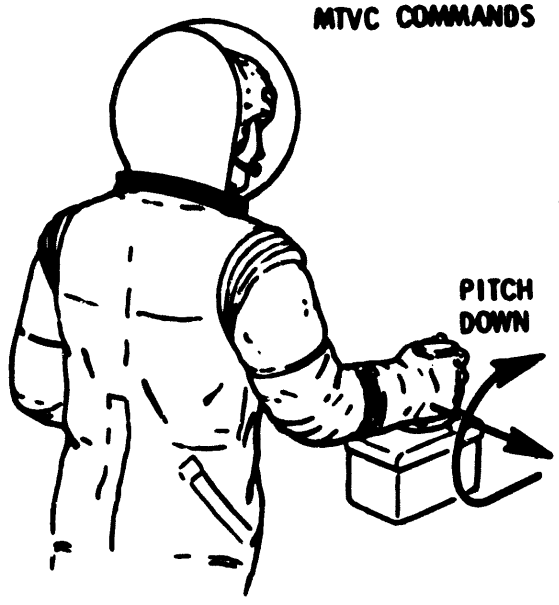
THE REASON FOR THE DIFFERENCE BETWEEN A NON SPS ENGINE FIRING VERSUS AN SPS ENGINE FIRING IS DUE TO DEFLECTIONS OF ENGINE AND VEHICLE STRUCTURE.

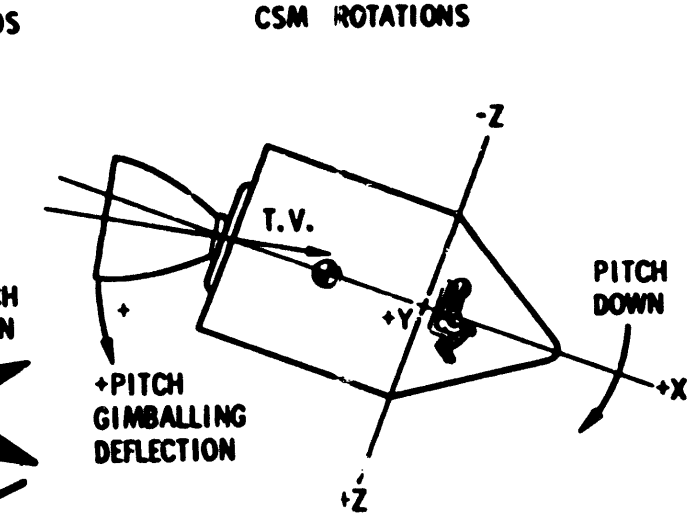
LV TANK PRESSURE/GPI INDICATOR POWER

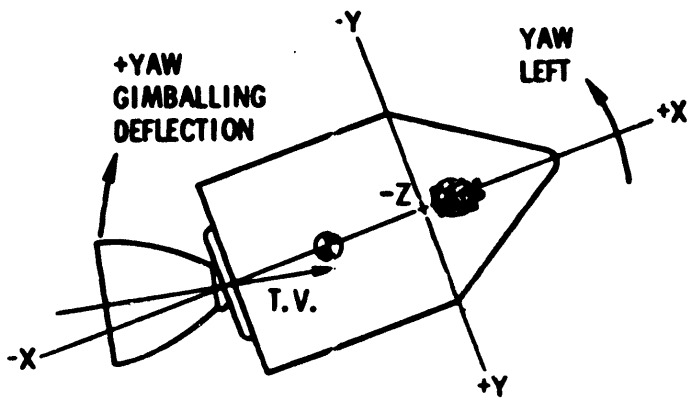


SPS GIMBALLING



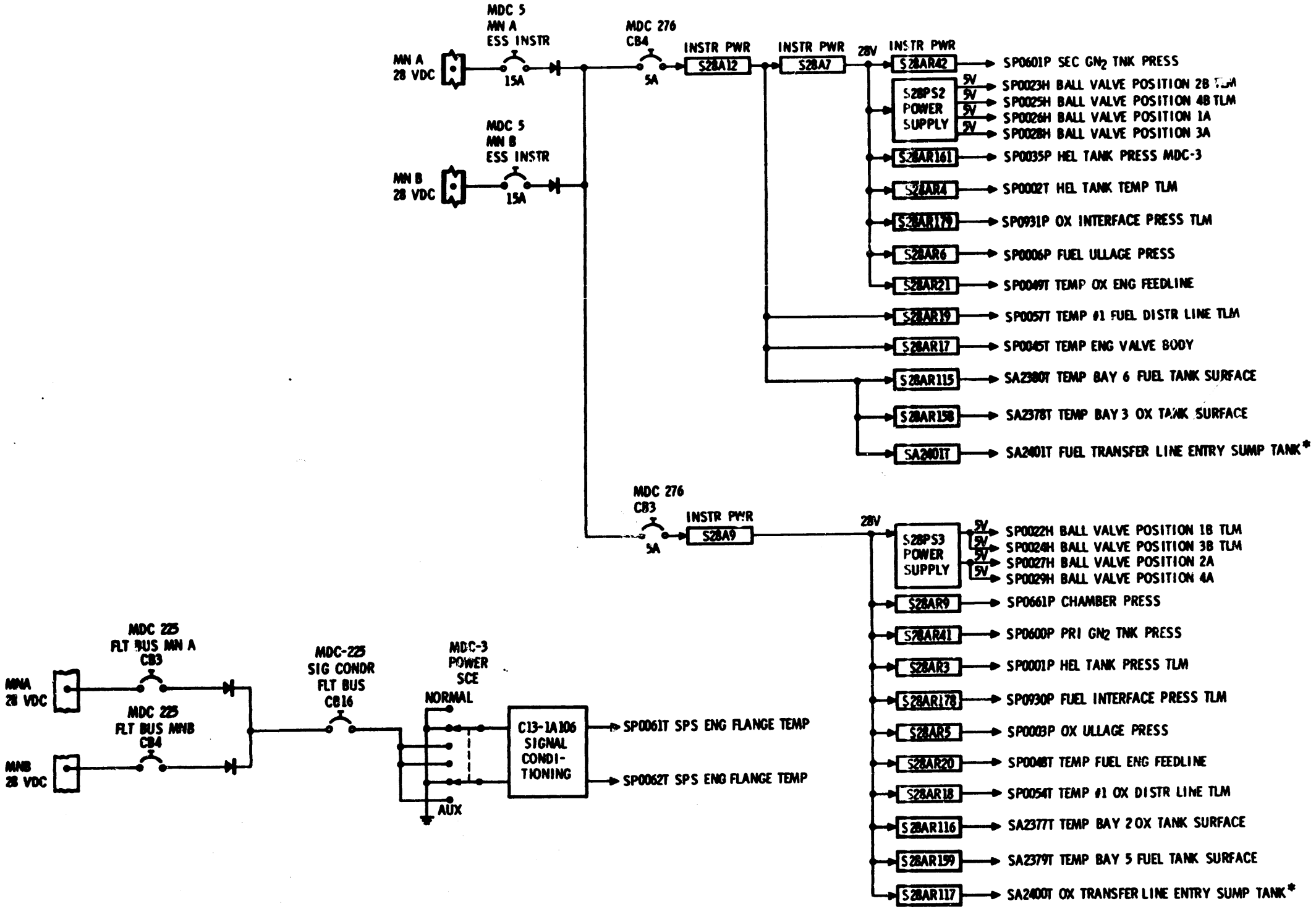






SPACE CRAFT AXIS	SPACE CRAFT NOSE MOTION	THUMB WHEEL TRAVEL	TRIM VOLTAGE	GPI INDICATION	MTVC COMMAND ROTATION CONTROL	ENGINE ANGLE COMM AND	ACTUATOR RAM TRAVEL	ENGINE INJECTOR TRAVEL THRUST VECTOR	ENGINE SKIRT TRAVEL
PITCH	↑ (DOWN)	↑ +NUMERAL	+	+	-PITCH (FORWARD)	+	EXTEND	-Z	+Z
	↓ (UP)	↓ -NUMERAL	-	-	+PITCH (AFT)	-	RETRACT	+Z	-Z
YAW	→ (LEFT)	↑ +NUMERAL	+	+	-Y (CCW)	+	EXTEND	+Y	-Y
	← (RIGHT)	↓ -NUMERAL	-	-	+Y (CW)	-	RETRACT	-Y	+Y

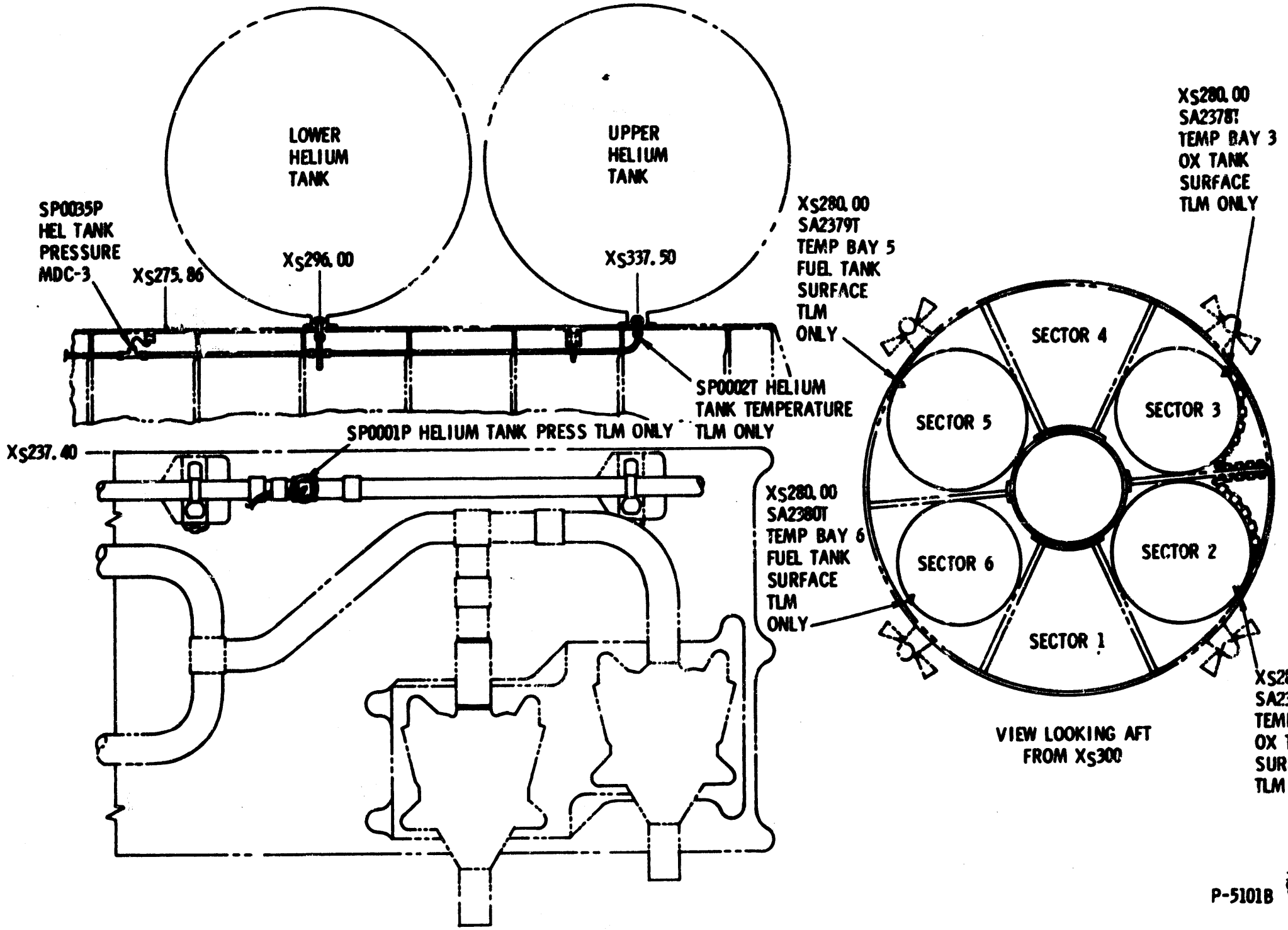
SPS INSTRUMENTATION POWER



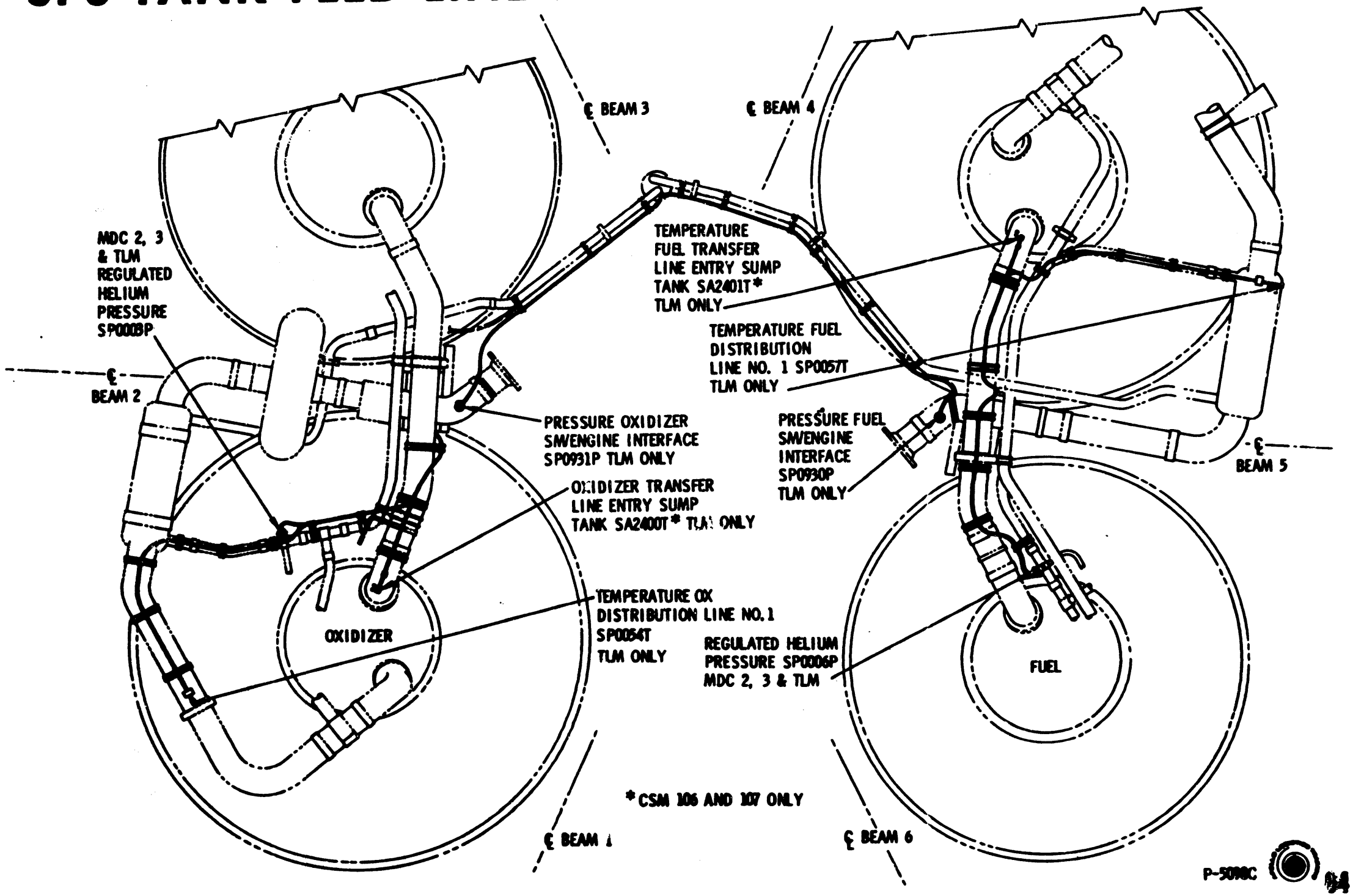
*CSM 106 AND 107 ONLY

SPS INSTRUMENTATION LOCATION

TANK TEMPERATURE, HELIUM TEMPERATURE AND PRESSURE

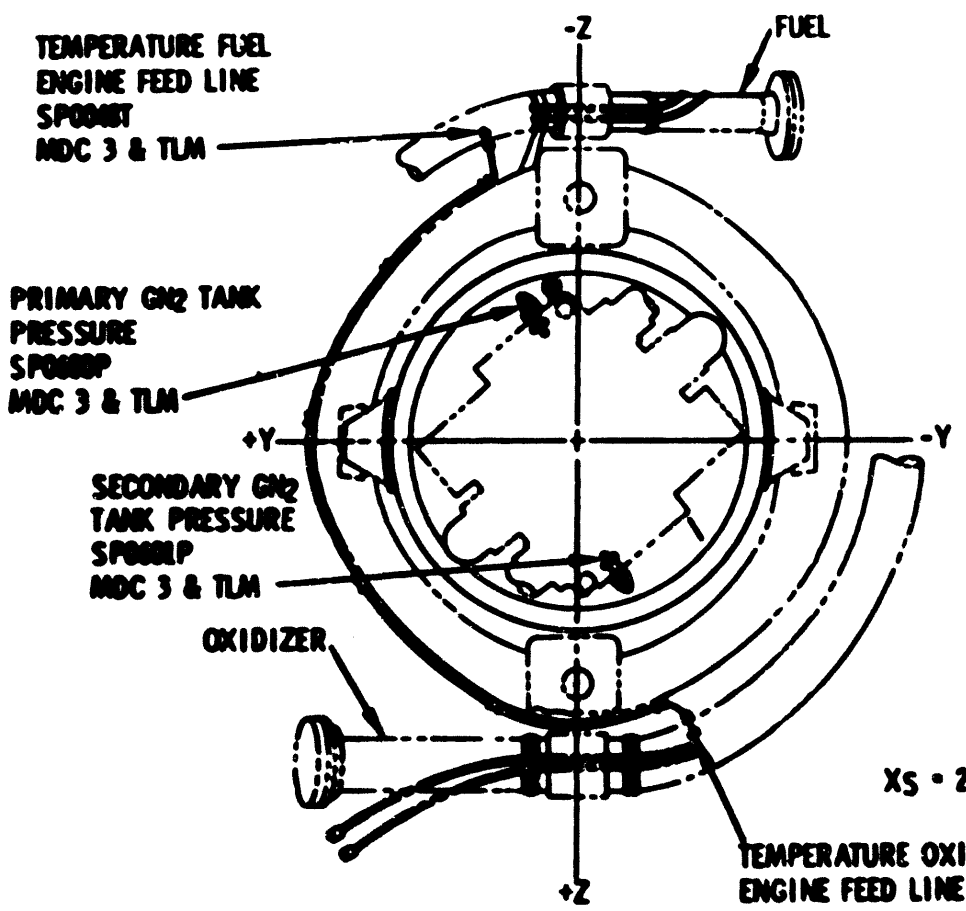


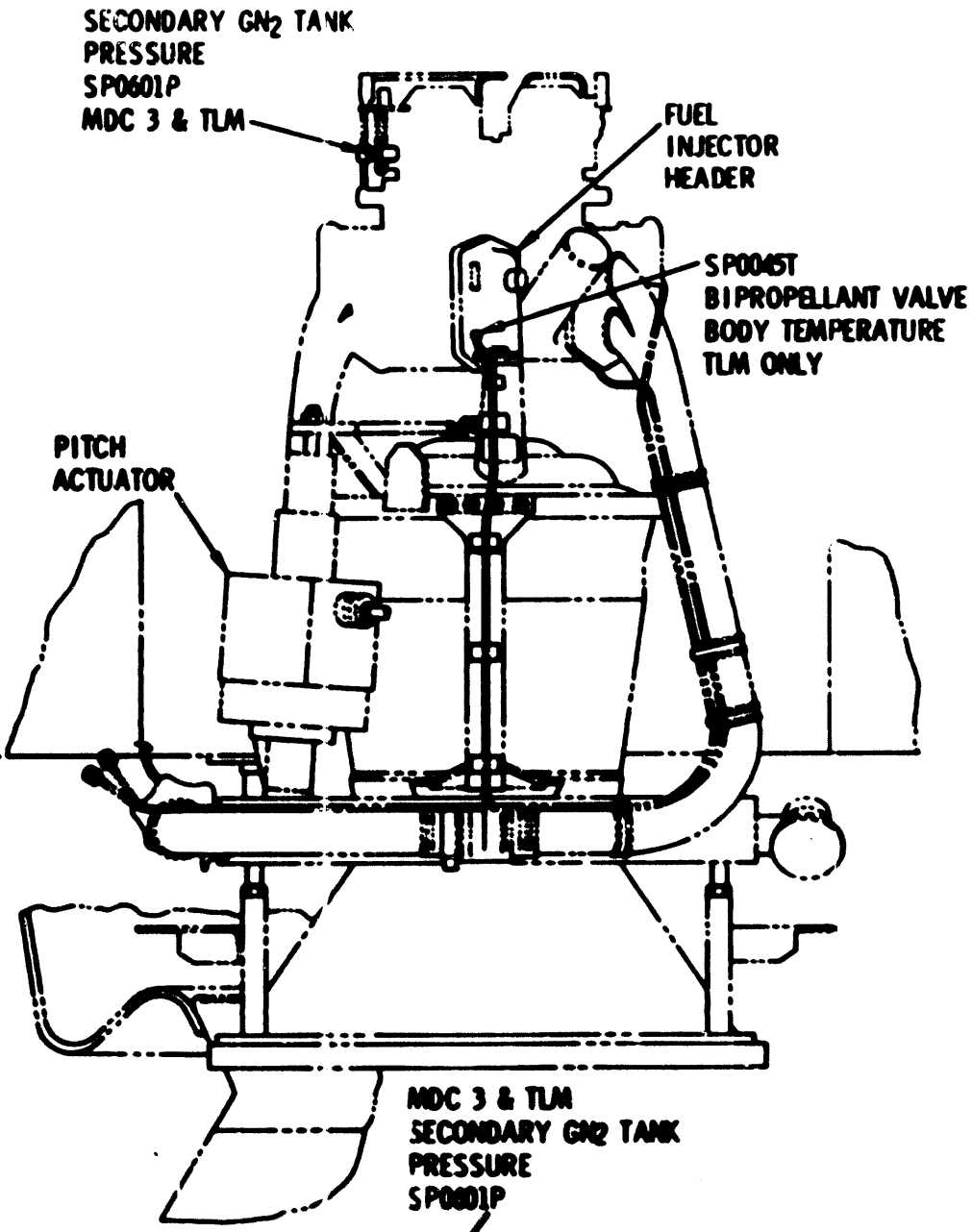
SPS TANK FEED LINE INSTRUMENTATION LOCATIONS

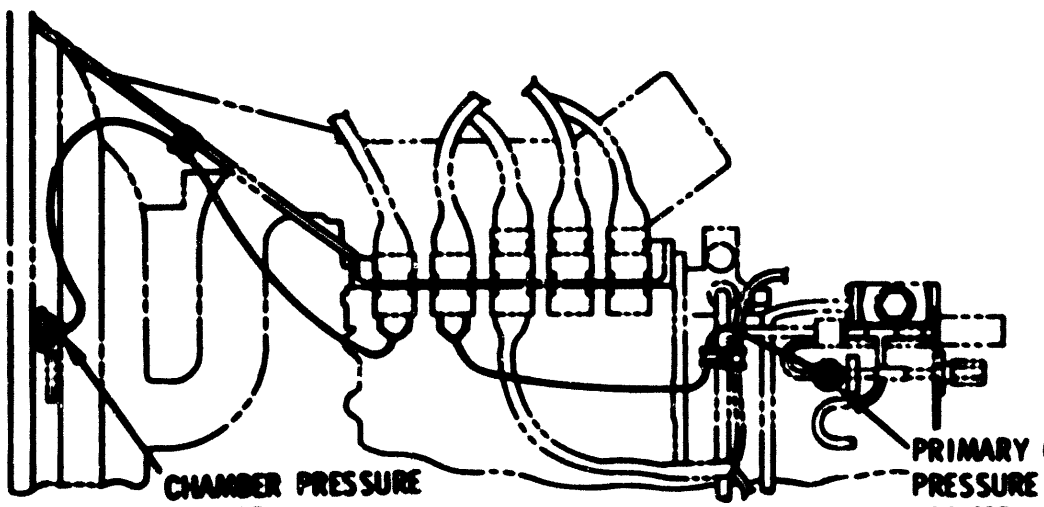


P-5098C

SPS ENGINE INSTRUMENTATION LOCATIONS







P-5007E

SPS MEASUREMENTS

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
MDC 3	HELIUM TANK PRESSURE	SP0035P	0+5K PSIA	S28AR161				3600±50 PSIA & DECREASE
	HELIUM TANK PRESSURE	SP0001P	0+5K PSIA	S28AR3	11A10	H2	PCM	3600±50 PSIA & DECREASE
	HELIUM TANK TEMPERATURE	SP0002T	-100+200°F	S28AR4	10A16	H1	PCM	VARIABLE
MDC 2 & 3	FUEL ULLAGE PRESSURE	SP0006P	0+250 PSIA	S28AR6	11A12	H2	PCM	170 to 195 PSIA
MDC 2 & 3	OXIDIZER ULLAGE PRESSURE	SP0003P	0+250 PSIA	S28AR5	11A11	H2	PCM	170 to 195 PSIA
MDC 2 & 3	QUANTITY SENSING SYSTEM SENSOR SELECT IN NORMAL							
	PRIMARY FUEL SUMP #2	SP0658Q	0+60%	C13-1A101	10A31	H1	PCM	VARIABLE
	PRIMARY FUEL STORAGE #1	SP0657Q	0+50%	C13-1A101	10A29	H1	PCM	VARIABLE
	PRIMARY OXIDIZER SUMP #2	SP0656Q	0+60%	C13-1A101	10A28	H1	PCM	VARIABLE
	PRIMARY OXIDIZER STOR. #1	SP0655Q	0+50%	C13-1A101	10A26	H1	PCM	VARIABLE

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate	Operating Range
	SENSOR SELECT IN PRIMARY						
	PRIMARY FUEL SUMP #2	SP0658Q	0+60%	C13-1A101	10A31	H1 PCM	VARIABLE
	PRIMARY FUEL STOR. #1	SP0657Q	0+50%	C13-1A101	10A29	H1 PCM	
	PRIMARY OX. SUMP #2	SP0656Q	0+60%	C13-1A101	10A28	H1 PCM	
	PRIMARY OX. STOR. #1	SP0655Q	0+50%	C13-1A101	10A26	H1 PCM	
	SENSOR SELECT IN AUXILIARY						
	PRIMARY FUEL SUMP #2	SP0658Q	0+60%	C13-1A101	10A31	H1 PCM	VARIABLE
	PRIMARY OX. SUMP #2	SP0656Q	0+60%	C13-1A101	10A28	H1 PCM	
	AUX FUEL	SP0657Q	0+100%	C13-1A101	10A29	H1 PCM	
	AUX OXIDIZER	SP0655Q	0+100%	C13-1A101	10A26	H1 PCM	
	TEMP #1 OX. DISTR. LINE	SP0054T	0+200 F	S28AR18	10A44	H1 PCM	+27°F MIN +100°F MAX
	TEMP #1 FUEL DIST. LINE	SP0057T	0+200°F	S28AR19	10A59	H1 PCM	
	FUEL INTERFACE PRESSURE TO ENGINE	SP0930P	0+300 PSIA	S28AR178	11A152	H1 PCM	VARIABLE
	OXIDIZER INTERFACE PRESSURE TO ENGINE	SP0931P	0+300 PSIA	S28AR179	11A161	H1 PCM	

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
MDC 3	TEMP FUEL ENGINE FEEDLINE	SP0048T	0+200° F	S28AR20	I0A117	H2	PCM	+55 to +75° F during translunar coast +70 to +90° F during lunar orbit and transearth coast. Redline markings at +27 and +100° F.
MDC 101	TEMP OX ENGINE FEEDLINE	SP0049T	0+200° F	S28AR21	I0A120	H2	PCM	1.4 VDC = 55° F 1.812 VDC = 70° F 1.95 VDC = 75° F 2.362 VDC = 90° F
	TEMP ENGINE VALVE BODY	SP0045T	0+200° F	S28AR17	I0A37	HI	PCM	+27° F min. +100° F max.
MDC 3	PRIMARY GN_2 TANK PRESS	SP0600P	0+5K PSIA	S28AR41	I0A10	HI	PCM	2500+ 50 PSIA AND DECREASE
MDC 3	SECONDARY GN_2 TANK PRESS	SP0601P	0+5K PSIA	S28AR42	I0A11	HI	PCM	
	BALL VALVE POSITION 1B	SP0022H	0+90 DEG	C13-1A101	I1A31	HI	PCM	OPEN OR CLOSED (0° or 90°)
MDC 3	BALL VALVE POSITION 1A	SP0026H	0+90 DEG					
	BALL VALVE POSITION 2B	SP0023H	0+90 DEG	C13-1A101	I1A32	HI	PCM	
MDC 3	BALL VALVE POSITION 2A	SP0027H	0+90 DEG					
	BALL VALVE POSITION 3B	SP0024H	0+90 DEG	C13-1A101	I1A33	HI	PCM	

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
MDC 3	BALL VALVE POSITION 3A	SP0028H	0+90 DEG					
	BALL VALVE POSITION 4B	SP0025H	0+90 DEG	C13-1A101	11A34	HI	PCM	OPEN OR CLOSED (0° or 90°)
MDC 3	BALL VALVE POSITION 4A	SP0029H	0+90 DEG					
MDC 1	CHAMBER PRESSURE	SP0661P	0+150 PSIA	S28AR9	12A14	HI	PCM	95 to 105 PSIA during burn.
MDC 2	ENGINE INJECTOR FLANGE TEMP. NO. 1	SP0061T	0+600° F	C13-1A106	10A47	HI	PCM	ILLUMI-NATES SPS FLANGE TEMP HI ON MDC 2 AT 480° F = 4 VDC
	ENGINE INJECTOR FLANGE TEMP. NO. 2	SP0062T	0+600° F	C13-1A106	10A49	HI	PCM	
	GIMBAL POSITION PITCH 1 OR 2	CH3517H	-5.0 to +5.0 DEG	SCS	12A8	HI	PCM	VARIABLE
	GIMBAL POSITION YAW 1 OR 2	CH3518H	-5.0 to +5.0 DEG	SCS	12A10	HI	PCM	
	YAW DIFFERENTIAL CURRENT	CH3667C	-0.835 to +0.835 AMP	SCS	12A16	HI	PCM	
	PITCH DIFFERENTIAL CURRENT	CH3666C	-0.835 to +0.835 AMP	SCS	22A4	HI	PCM	
	SPS SOLENOID DRIVER #1	CH3640X	EVENT	SCS	11E4-4	E2	PCME	OFF ON EVENT
	SPS SOLENOID DRIVER #2	CH3605X	EVENT	SCS	11E9-4	E2	PCME	

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
	TEMP BAY 2 OX TANK SURFACE	SA2377T	-100+200°F	S28AR116	10A142	HI	PCM	VARIABLE
	TEMP BAY 3 OX TANK SURFACE	SA2378T	-100+200°F	S28AR158	10A137	HI	PCM	
	TEMP BAY 5 FUEL TANK SURFACE	SA2379T	-100+200°F	S28AR159	10A139	HI	PCM	
	TANK BAY 6 FUEL TANK SURFACE	SA2380T	-100+200°F	S28AR115	10A140	HI	PCM	
	*OX TRANSFER LINE ENTRY SUMP TANK	SA2400T	-100+200°F	S28AR117	10A143	HI	PCM	
	*FUEL TRANSFER ENTRY SUMP TANK	SA2401T	-100+200°F	S28AR118	10A145	HI	PCM	

*CSM 106 and 107 only

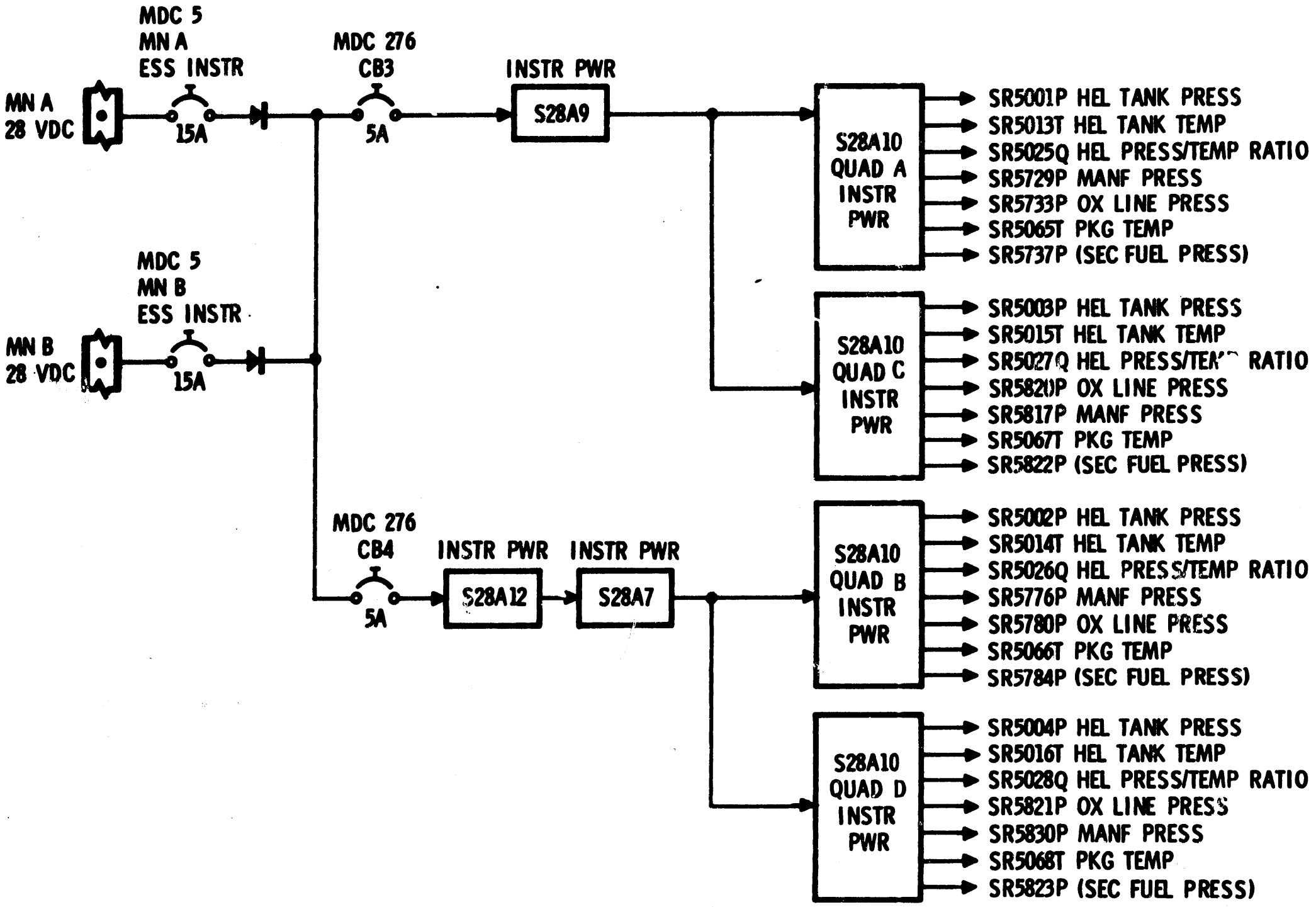
SMRCS DATA

HELIUM TANKS (4)	4150±50 PSIG at 70±5° during servicing, after servicing setting on launch pad 70±10°F. Capacity 1.35 lbs. Internal volume of 910±5 cubic inches Weight 11.5 lbs. wall thickness, 0.135 inch. Diameter 12.37"
REGULATOR UNITS (8)	Filter 25 micron nominal, 40 micron absolute Primary 181±3 PSIG with a normal lock-up of 183±5 PSIG. Secondary lock-up of 187±5 PSIG. From lock-up pressure do not drop below 182 PSIG or rise above 188 PSIG.
SECONDARY FUEL PRESSURE TRANDUCERS (4)	Illuminate Caution and Warning light on MDC-2 (SMRCS A, B, C, D). Under pressure 145 PSIA nominal Over pressure 215 PSIA nominal
CHECK VALVES - FILTERS	40 micron nominal, 74 micron absolute, one at inlet to check valve assembly, one at each test port.
HELIUM RELIEF VALVES (8)	Diaphragm rupture at 228±8 PSIG Filter, 10 micron nominal, 25 micron absolute Relief valve relieves at 236.5±11.5 PSIG. Relief valve reseats at not less than 220 PSIG. Flow capacity .3 lbs/minute at 248 PSIG at 60°F. Bleed device closes when increasing pressure reaches no more than 179 PSIG in the cavity and a helium flow of less than 20 standard cubic centimeters per hour across the bleed device and relief valve assembly combined. The bleed device shall reopen when decreasing pressure has reached no less than 20 PSIG.
PRIMARY FUEL TANK (4)	Combined propellant and ullage volume of 69.1 lbs, initially at 65°F at 150 PSIG, resulting in a tank pressure of no more than 215 PSIA when heated to 85°F. Outside diameter 12.62" maximum Length 23.717" + .060" - .000" Wall thickness .017" to .022" Helium inlet port 1/4", fill and drain port 1/2"

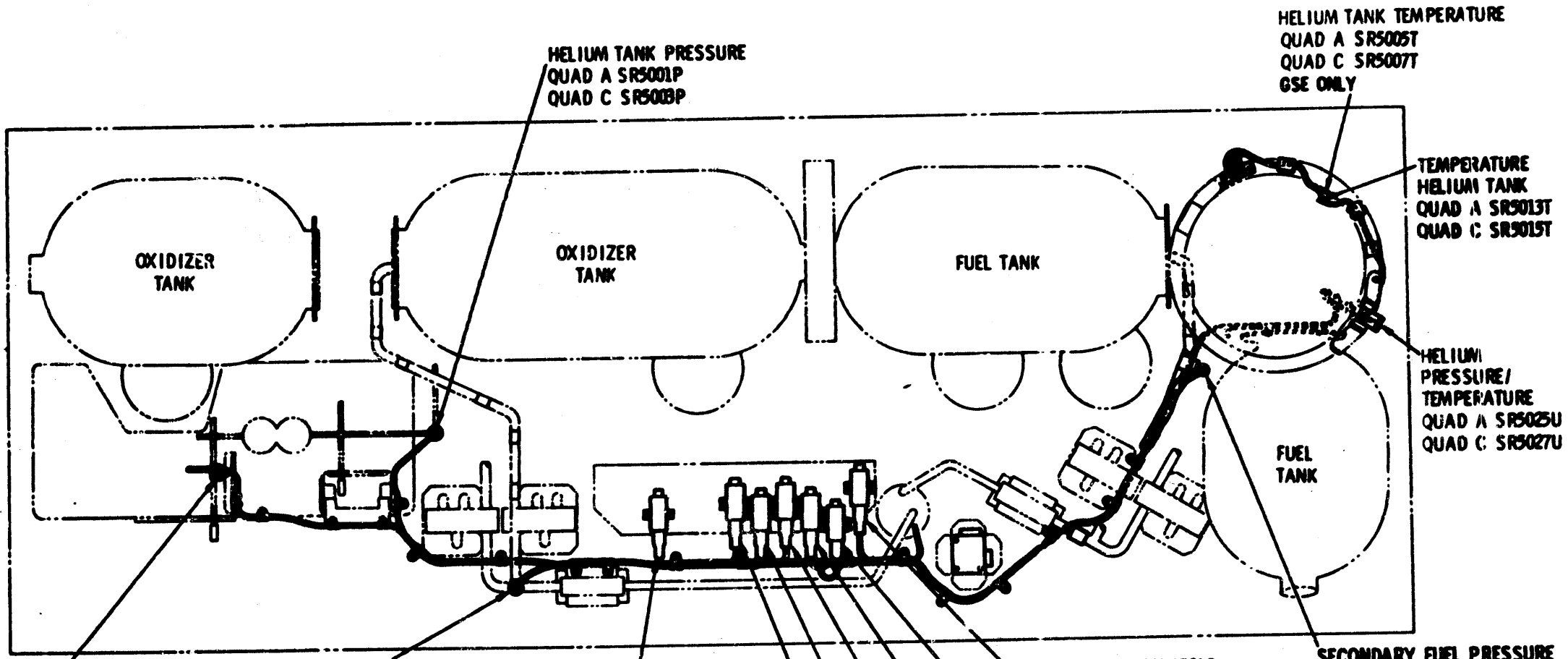
PRIMARY OXIDIZER TANK (4)	Combined propellant and ullage volume of 137.0 lbs., initially at 65°F at 150 PSIG, resulting in a tank pressure of no more than 215 PSIA when heated to 85°F. Outside diameter 12.62" maximum Length 28.558" + .060" - .000" Wall thickness .017" to .022"
SECONDARY FUEL TANK (4)	Combined propellant and ullage volume of 45.2 lbs., initially at 65°F at 150 PSIG, resulting in a tank pressure of no more than 205 PSIA when heated to 105°F. Outside diameter 12.62" maximum Length 17.329" + .040" - .000" Wall thickness .022" to .027"
SECONDARY OXIDIZER TANK (4)	Combined propellant and ullage volume of 89.2 lbs., initially at 65°F at 150 PSIG, resulting in a tank pressure of no more than 205 PSIA when heated to 105°F. Outside diameter 12.65" maximum Length 19.907" + .040" - .000" Wall thickness .022" to .027"
IN LINE FILTERS (8)	5 micron nominal, 15 micron absolute
ENGINE (16)	1000 second service life, 750 seconds continuous CSM 103 and subs, capable of 10,000 operational cycles. Expansion ratio 40 to 1 at nozzle exit Cooling - Film and radiation Injector - Pre-mix ignitor one on one unlike impingement, 8 fuel annulus for film cooling of pre-mix ignitor, main chamber 8 on 8 unlike impingement, 8 fuel for film cooling of combustion chamber wall Nozzle extension - L 605 cobalt base Nozzle exit diameter - 5.6" Fuel lead Automatic coils - Connected in parallel Direct coils - Connected in series Weight - 4.99 lbs. Length - 13.400" maximum Filters - Each injector valve inlet, 100 micron nominal, 250 micron absolute

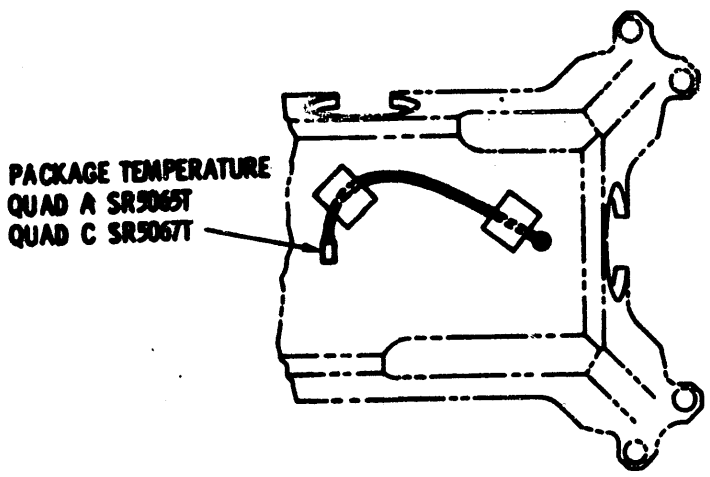
PACKAGE TEMPERATURE TRANSDUCER (4)	Illuminate Caution and Warning light on MDC-2 (SMRCS A, B, C, D) 75°F nominal 205° nominal
HEATER THERMO SWITCH CSM 106 and Subs	Open at 134°F Close at 115°F Minimum Spread 9°F 36±3.6 watts per element nominal Two per quad

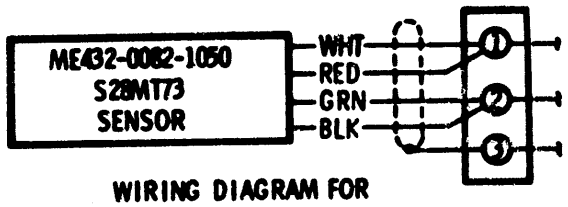
SM RCS INSTRUMENTATION POWER



SM RCS QUAD A&C INSTRUMENTATION



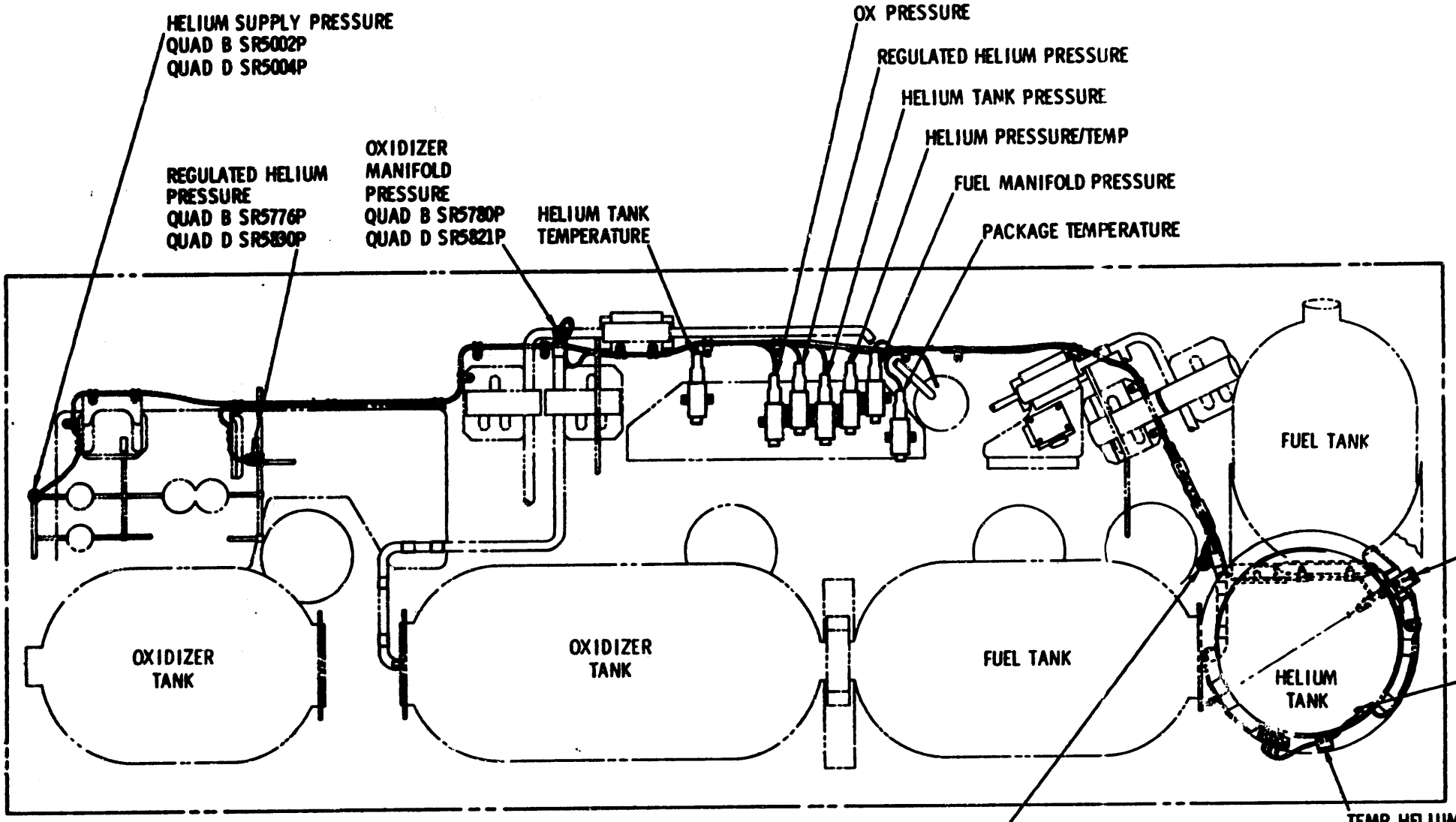


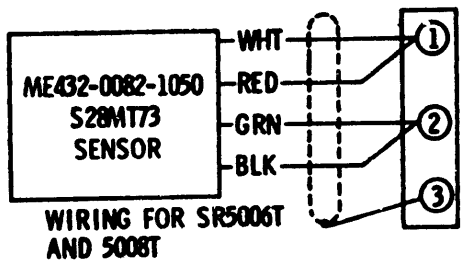


WIRING DIAGRAM FOR
SR5005T
SR5007T

P-6060G

SM RCS QUAD B&D INSTRUMENTATION





WIRING FOR SR5006T AND 5008T

P-6059F

SMRCS MEASUREMENTS

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
MDC-2	Helium Tank Pressure A	SR5001P	0+5K PSIA	S28AR36(S19A1)	10A24	H2	PCM	4150$^{+}_{-}$50 PSIA and Decrease
MDC-2	Helium Tank Pressure B	SR5002P	0+5K PSIA	S28AR36(S19A2)	10A27	H2	PCM	
MDC-2	Helium Tank Pressure C	SR5003P	0+5K PSIA	S28AR36(S19A3)	10A30	H2	PCM	
MDC-2	Helium Tank Pressure D	SR5004P	0+5K PSIA	S28AR36(S19A4)	10A33	H2	PCM	
MDC-2	Helium Tank Temperature A	SR5013T	0+100°F	S28AR164(S19A1)	11A163	H2	PCM	VARIABLE
MDC-2	Helium Tank Temperature B	SR5014T	0+100°F	S28AR164(S19A2)	11A164	H2	PCM	
MDC-2	Helium Tank Temperature C	SR5015T	0+100°F	S28AR164(S19A3)	11A165	H2	PCM	
MDC-2	Helium Tank Temperature D	SR5016T	0+100°F	S28AR164(S19A4)	11A166	H2	PCM	
MDC-2	Helium Press/Temp Ratio System A	SR5025Q	0+100%	S28AR174(S19A1)	10A93	H2	PCM	VARIABLE
MDC-2	Helium Press/Temp Ratio System B	SR5026Q	0+100%	S28AR174(S19A2)	10A99	H2	PCM	
MDC-2	Helium Press/Temp Ratio System C	SR5027Q	0+100%	S28AR174(S19A3)	10A102	H2	PCM	
MDC-2	Helium Press/Temp Ratio System D	SR5028Q	0+100%	S28AR174(S19A4)	10A105	H2	PCM	
	Manifold Pressure A	SR5729P	0+400 PSIA	S28AR44(S19A1)	11A39	H2	PCM	178 to 192 PSIA
	Manifold Pressure B	SR5776P	0+400 PSIA	S28AR44(S19A2)	11A40	H2	PCM	
	Manifold Pressure C	SR5817P	0+400 PSIA	S28AR44(S19A3)	11A46	H2	PCM	
	Manifold Pressure D	SR5830P	0+400 PSIA	S28AR44(S19A4)	11A130	H2	PCM	

SMRCS MEASUREMENTS

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
	Oxidizer Line Pressure A	SR5733P	0+300 PSIA	S28AR170(S19A1)	IIA23	HI	PCM	
MDC-2	Secondary Fuel Pressure A	SR5737P	0+400 PSIA	S28AR171(S19A1)	IIA92	H2	PCM	
	Oxidizer Line Pressure B	SR5780P	0+300 PSIA	S28AR170(S19A2)	IIA24	HI	PCM	178
MDC-2	Secondary Fuel Pressure B	SR5784P	0+400 PSIA	S28AR171(S19A2)	IIA94	H2	PCM	to
	Oxidizer Line Pressure C	SR5820P	0+300 PSIA	S28AR170(S19A3)	IIA27	HI	PCM	192
MDC-2	Secondary Fuel Pressure C	SR5822P	0+400 PSIA	S28AR171(S19A3)	IIAIII	H2	PCM	PSIA
	Oxidizer Line Pressure D	SR5821P	0+300 PSIA	S28AR170(S19A4)	IIA28	HI	PCM	
MDC-2	Secondary Fuel Pressure D	SR5823P	0+400 PSIA	S28AR171(S19A4)	IIAII2	H2	PCM	
MDC-2	A Package Temperature	SR5065T	0+300° F	S28AR40(S19A1)	I0AI36	HI	PCM	75° F NOMINAL
MDC-2	B Package Temperature	SR5066T	0+300° F	S28AR40(S19A2)	I0AI7	HI	PCM	to
MDC-2	C Package Temperature	SR5067T	0+300° F	S28AR40(S19A3)	I0AI9	HI	PCM	205° F NOMINAL
MDC-2	D Package Temperature	SR5068T	0+300° F	S28AR40(S19A4)	I0A20	HI	PCM	
	Direct RCS Switch No. 1 Enable	CH3601X	EVENT	SCS	IIE24-3	E2	PCM	OFF ON EVENT
	Direct RCS Switch No. 2 Enable	CH3602X	EVENT	SCS	IIE24-4	E2	PCM	

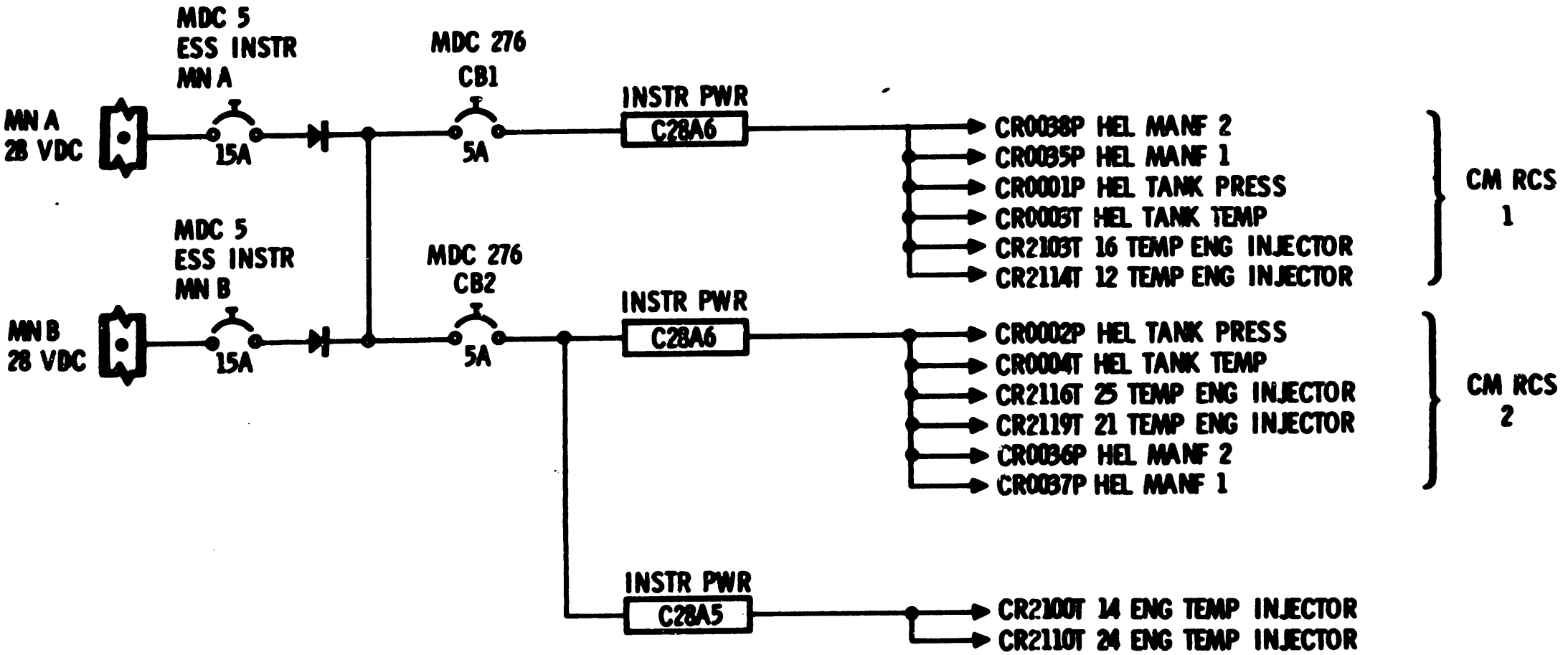
CMRCS DATA

HELIUM TANKS (2)	4150±50 PSIG at 70±5° during servicing, setting on launch pad 70±10°F Capacity .57 lbs. Inside diameter 8.84" Wall thickness .105". Internal volume of 365±5 cubic inches. Weight 5.25 lbs.
HELIUM ISOLATION SQUIB VALVE FILTER	Remove 98% of all particles whose two smallest dimensions are greater than 40 microns. Remove 100% of all particles whose two smallest dimensions are greater than 74 microns.
REGULATOR UNITS (4)	Filter 25 micron nominal, 40 micron absolute Primary 291±4 PSIG, lockup pressure minimum of 287 PSIG and not to exceed 302 PSIG. Secondary lockup 287 to 302 PSIG
CHECK VALVE FILTERS	40 micron nominal, 74 micron absolute, one at inlet to check valve assembly, one each at test port
HELIUM RELIEF VALVES (4)	Diaphragm rupture at 340±8 PSIG Filter, 10 micron nominal, 25 micron absolute Relief valve relieves at 346±14 PSIG Relief valve reseats at no less than 327 PSIG Flow capacity .3 lb/minute at 60°F and 346±14 PSIG Bleed device closes when increasing pressure has reached no more than 179 PSIG in the cavity and a helium flow of less than 20 standard cubic centimeters per hour across the bleed device and relief valve assembly combined. Bleed device shall reopen when decreasing pressure has reached no less than 20 PSIG.
HELIUM MANIFOLD PRESSURE TRANSDUCERS (4)	Illuminates Caution and Warning light on MDC-2 (CMRCS 1 or 2) after helium isolation squib valve actuation. Under pressure 260 PSIA nominal Over pressure 330 PSIA nominal
FUEL TANKS (2)	See SMRCS secondary fuel tank
OXIDIZER TANKS (2)	See SMRCS secondary oxidizer tank

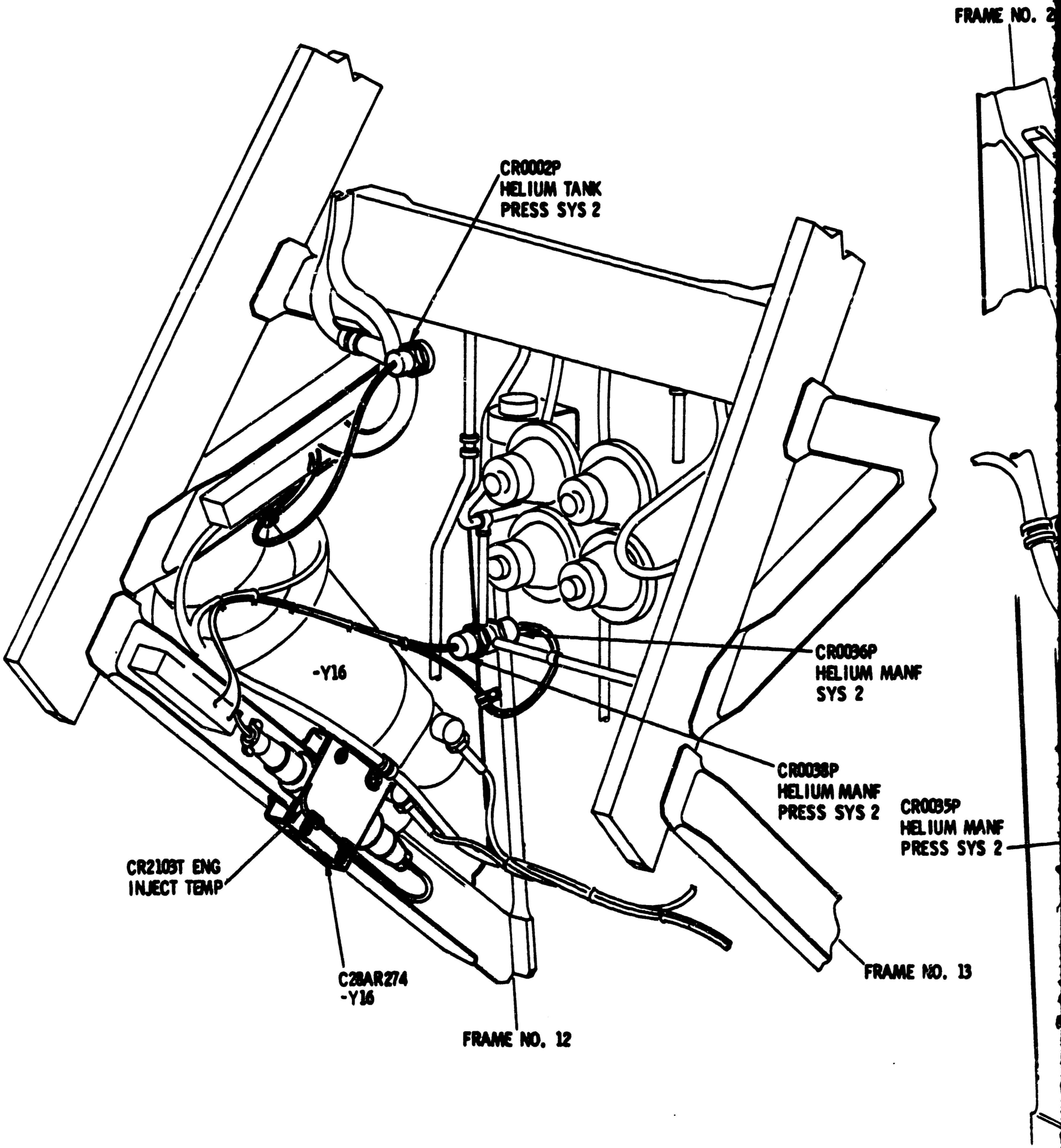
CMRCS DATA

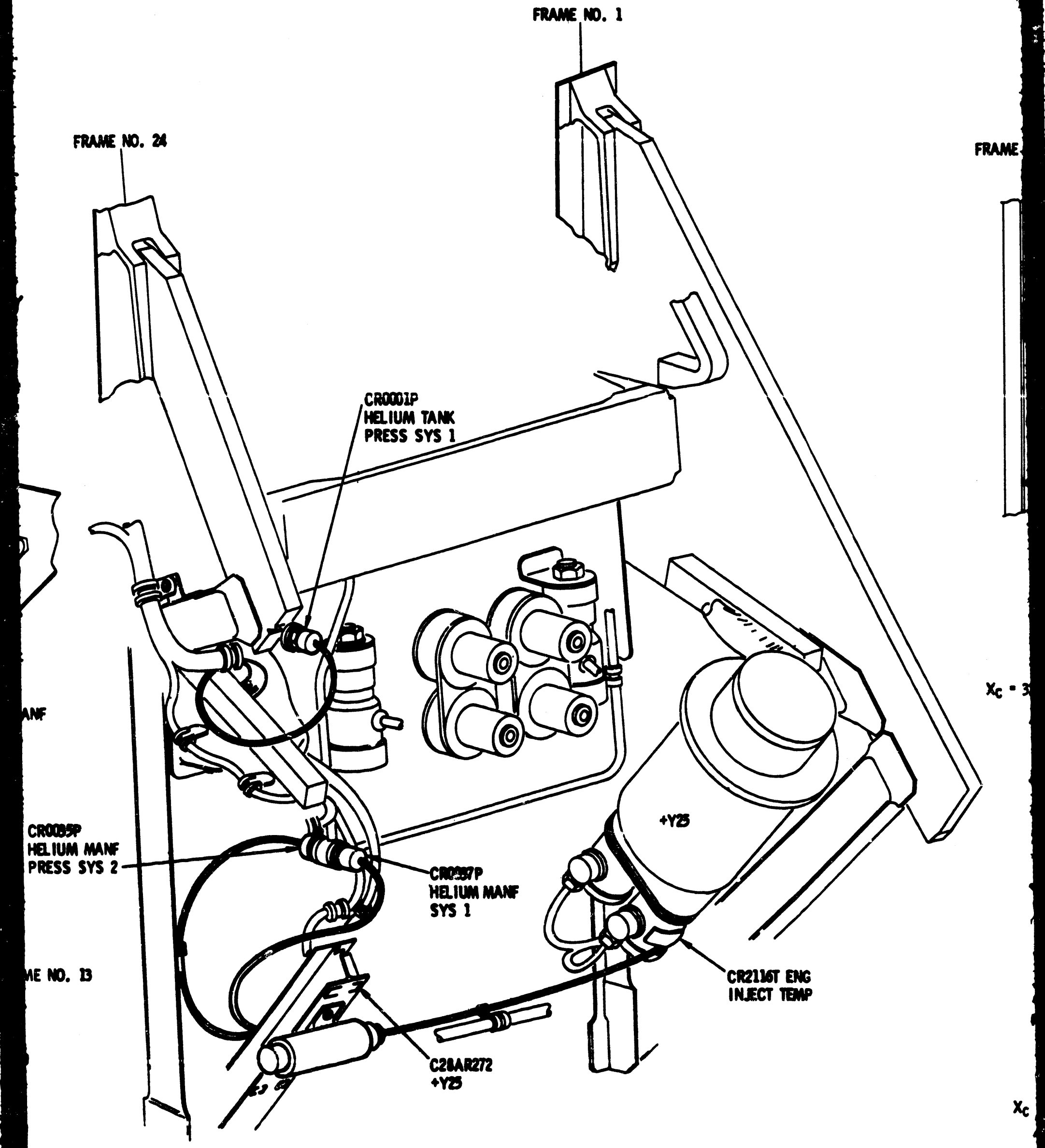
VALVE ISOLATION (4) **BURST DIAPHRAGM**	**Rupture at 241±14 PSIG within 2 seconds after rupture pressure is reached at any temperature between 40 to 105°F** **Filter, 75 micron nominal, 100 micron absolute**
ENGINE (12)	**200 second service life, 3000 operational cycles** **Expansion ratio 9 to 1** **Cooling - Ablation** **Injector -16 on 16 splash plate** **Combustion chamber - Refrasil ablative sleeve and graphite base throat insert.** **Automatic and direct coils - Connected in parallel** **Weight 8.3 lbs.** **Length 11.65" maximum** **Nozzle exit diameter 2.13"** **Nozzle extension - Ablative refrasil**
OXIDIZER AND FUEL BLOWOUT PLUG	**Pin shear at approximately 200 PSI.**

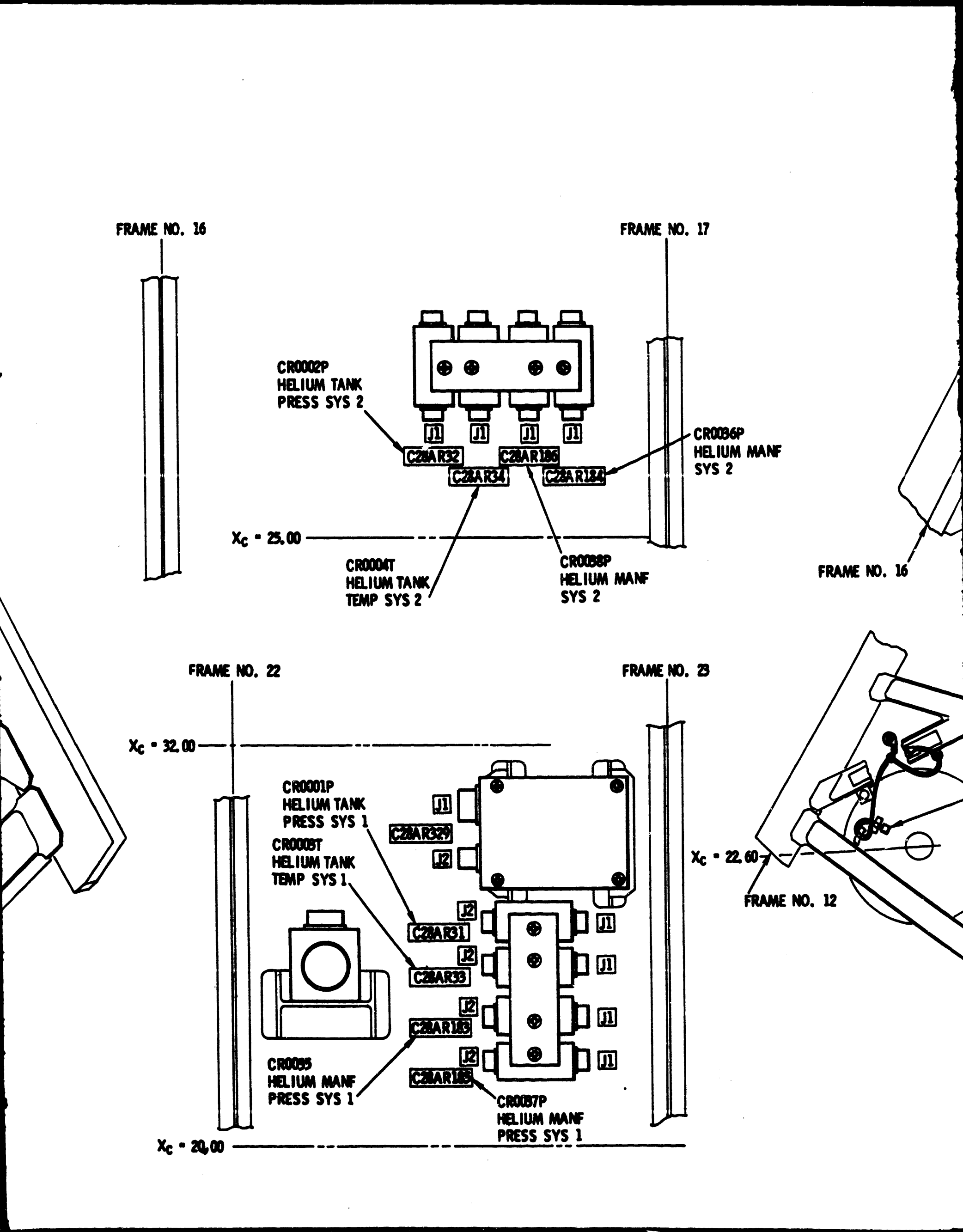
CM RCS INSTRUMENTATION POWER



P-7027G 81

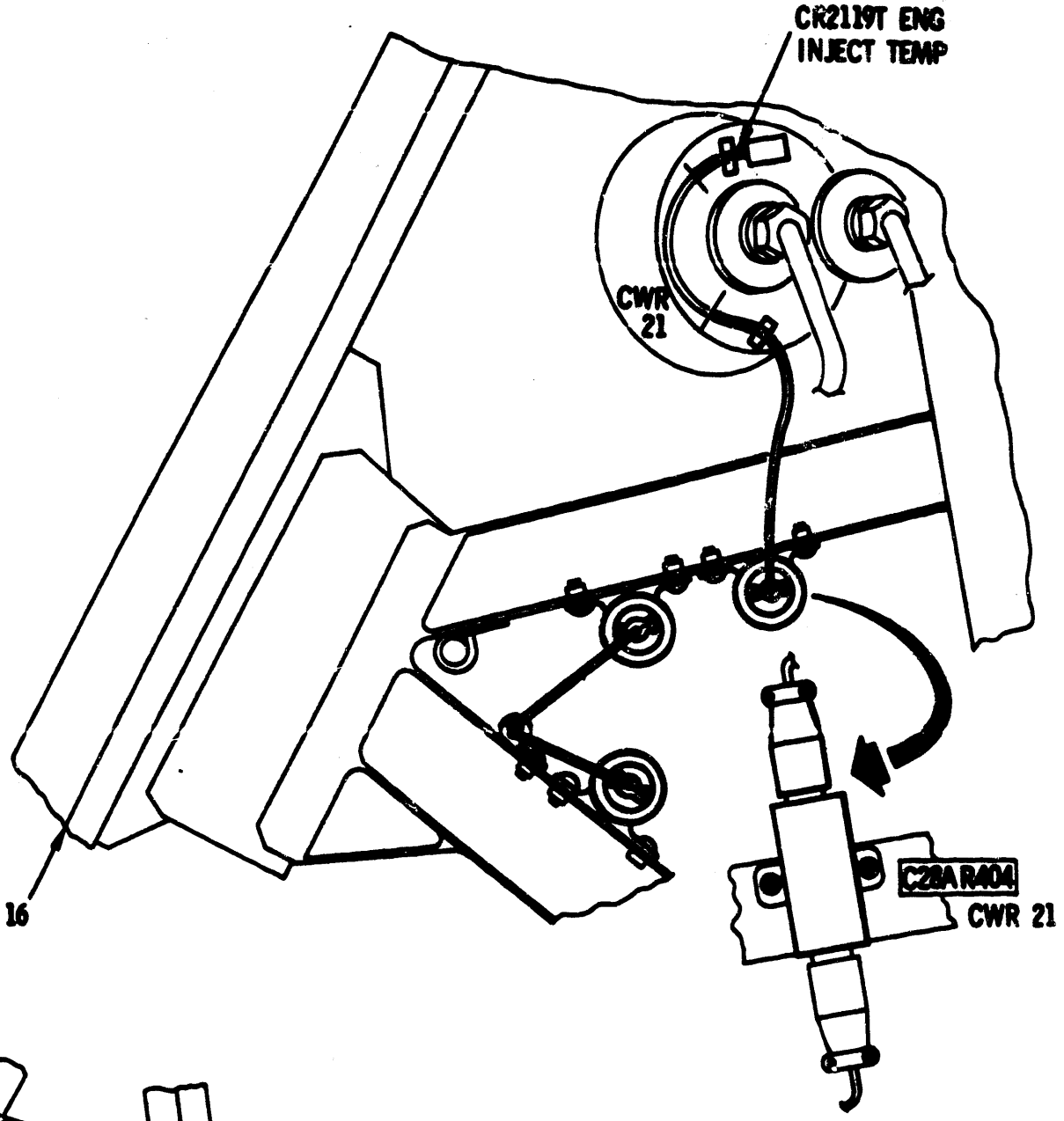

FRAME NO. 2
CR0002P
HELIUM TANK
PRESS SYS 2
-Y16
CR0036P
HELIUM MANF
SYS 2
CR0038P
HELIUM MANF
PRESS SYS 2
CR0035P
HELIUM MANF
PRESS SYS 2
CR2103T ENG
INJECT TEMP
C28AR274
-Y16
FRAME NO. 13
FRAME NO. 12


FRAME NO. 1
FRAME NO. 24
FRAME
CR0001P
HELIUM TANK
PRESS SYS 1
ANF
CR0035P
HELIUM MANF
PRESS SYS 2
CR0357P
HELIUM MANF
SYS 1
+Y25
CR2116T ENG
INJECT TEMP
C28AR272
+Y25
ME NO. 13
X_C = 3
X_C

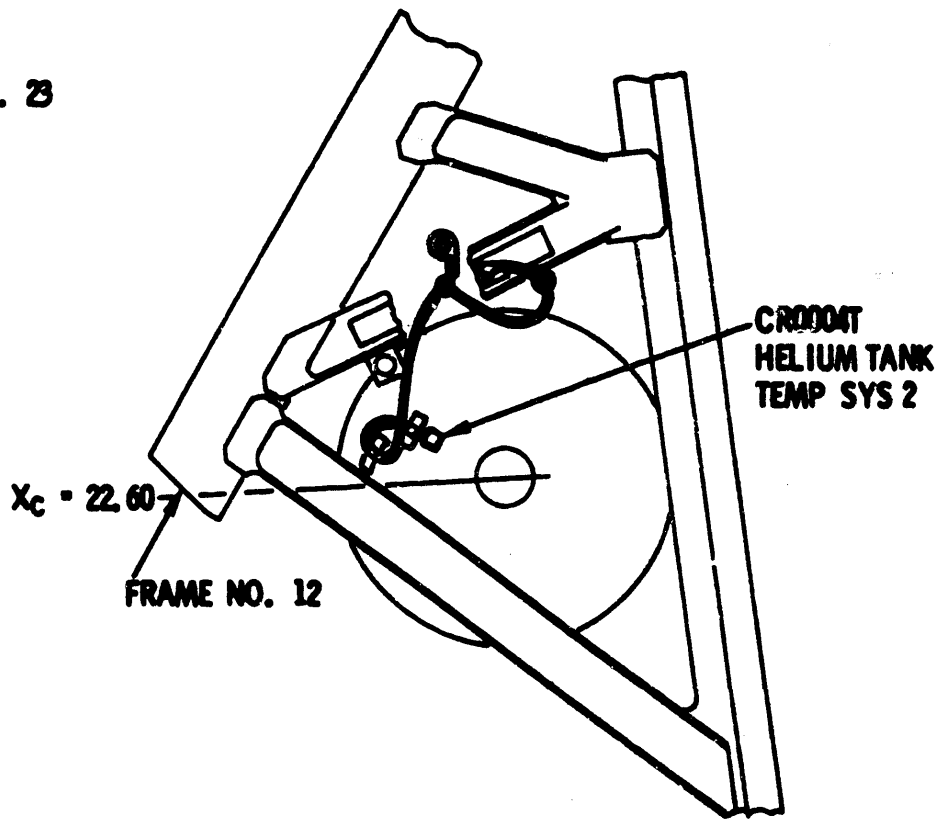

FRAME NO. 16
FRAME NO. 17
CR0002P
HELIUM TANK
PRESS SYS 2
J1
J1
J1
J1
C28AR32
C28AR186
C28AR34
C28AR184
CR0036P
HELIUM MANF
SYS 2
X_C = 25.00
CR0004T
HELIUM TANK
TEMP SYS 2
CR0038P
HELIUM MANF
SYS 2
FRAME NO. 16
FRAME NO. 22
FRAME NO. 23
X_C = 32.00
CR0001P
HELIUM TANK
PRESS SYS 1
CR0008T
HELIUM TANK
TEMP SYS 1
J1
C28AR329
J2
J2
C28AR31
J2
C28AR33
J2
C28AR183
J2
C28AR185
J1
J1
J1
J1
CR0035
HELIUM MANF
PRESS SYS 1
CR0037P
HELIUM MANF
PRESS SYS 1
X_C = 22.60
FRAME NO. 12
X_C = 20.00

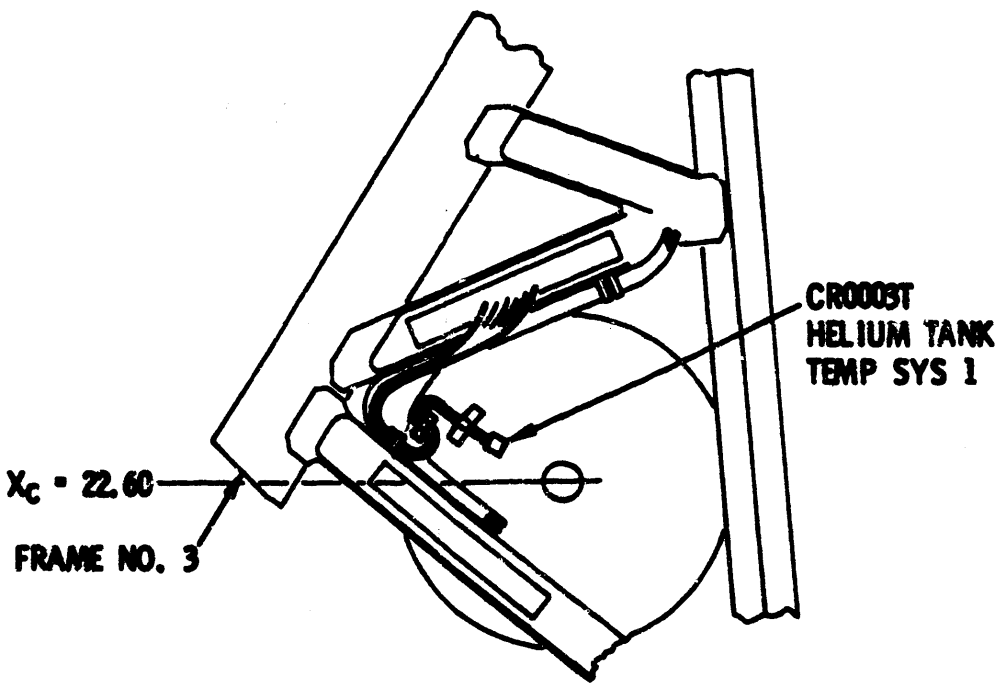
NO. 17

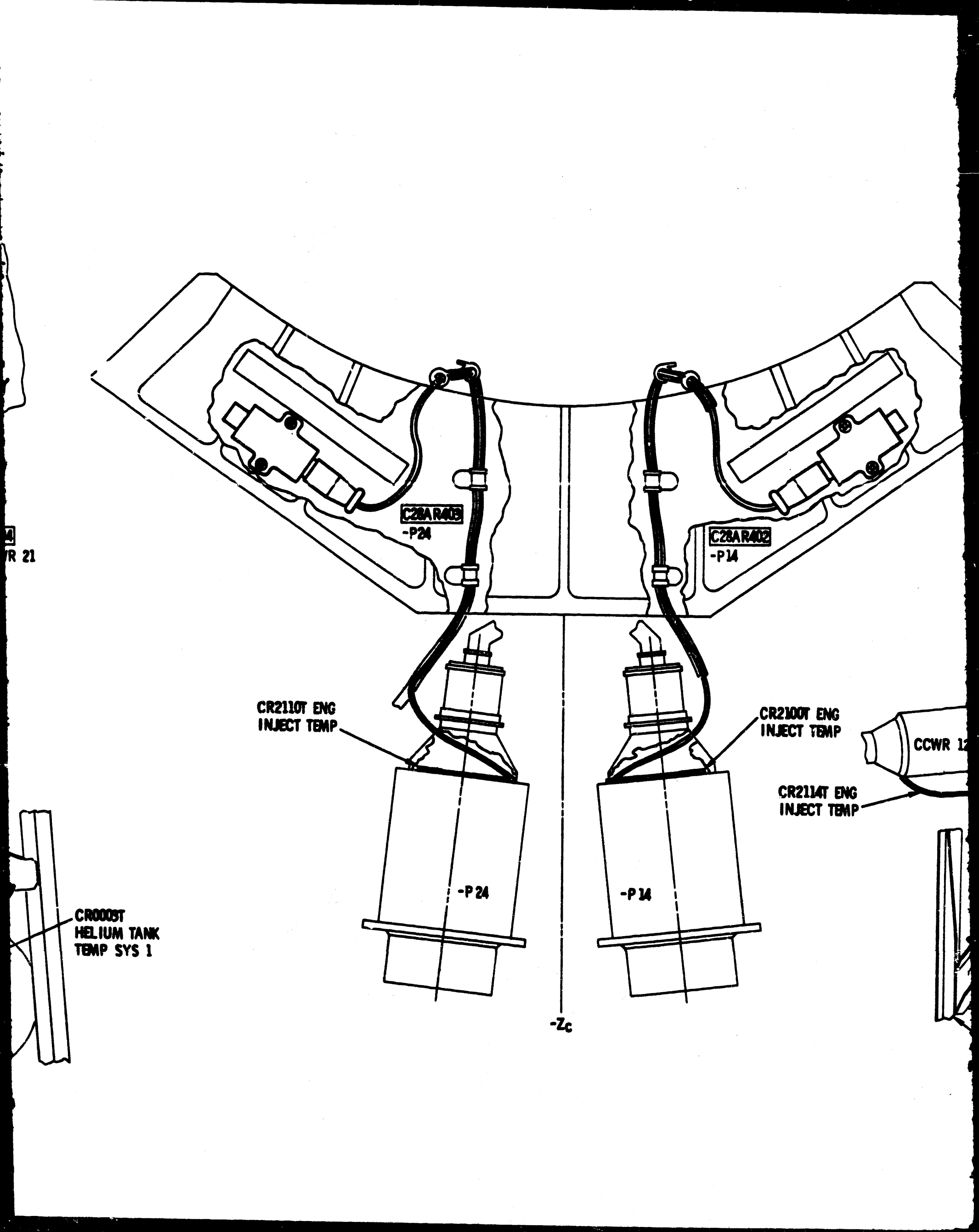
CR0036P
HELIUM MANF
SYS 2



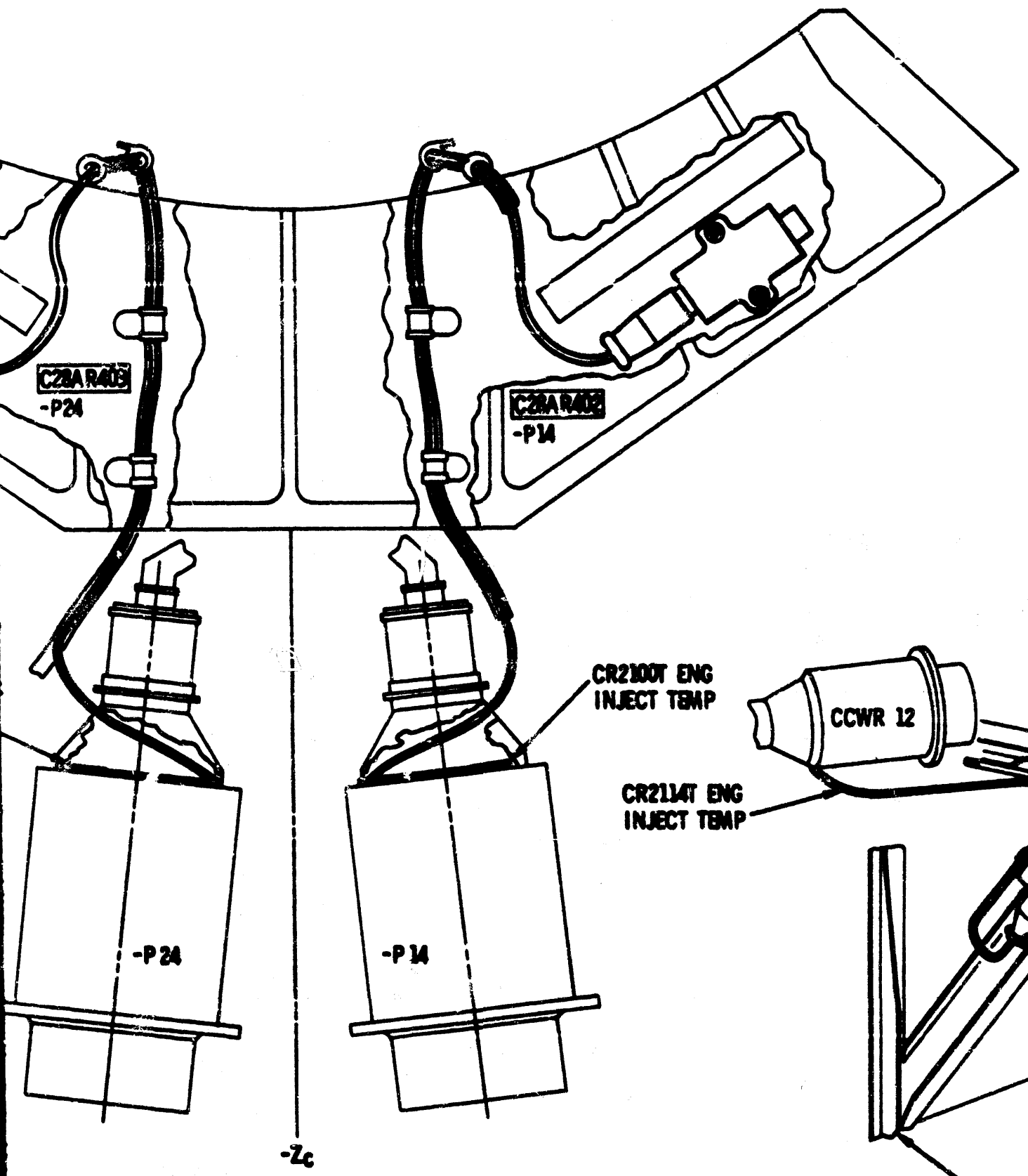
O. 23



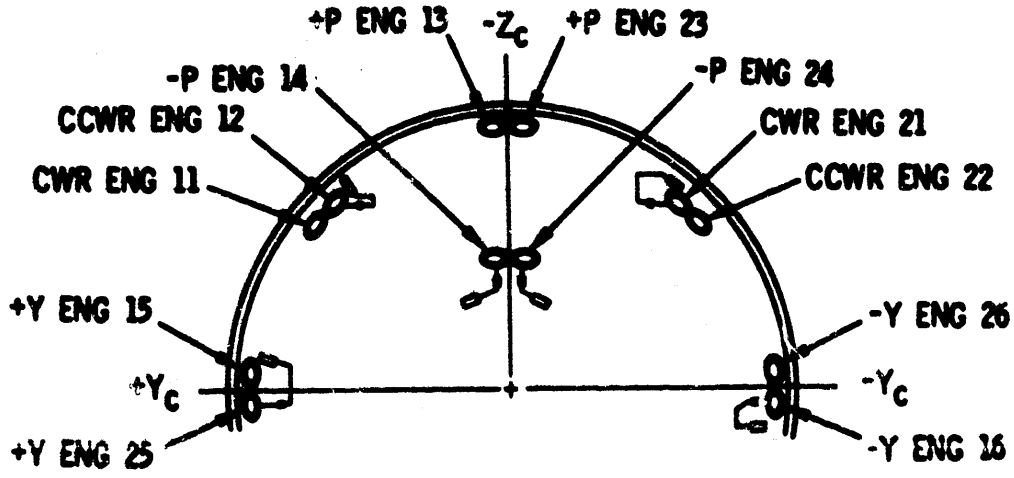


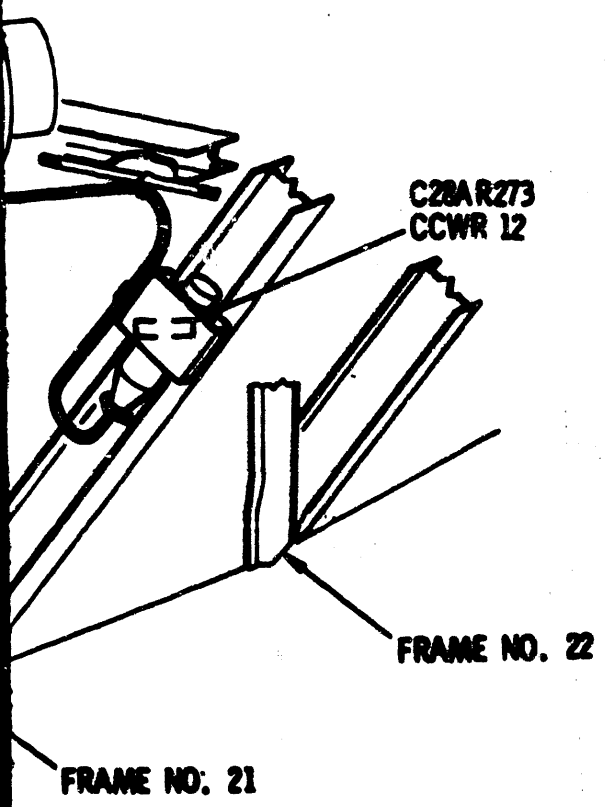

C28AR403
-P24
C28AR402
-P14
CR2110T ENG
INJECT TEMP
CR2100T ENG
INJECT TEMP
CCWR 12
CR2114T ENG
INJECT TEMP
-P24
-P14
CR0003T
HELIUM TANK
TEMP SYS 1
-Zc

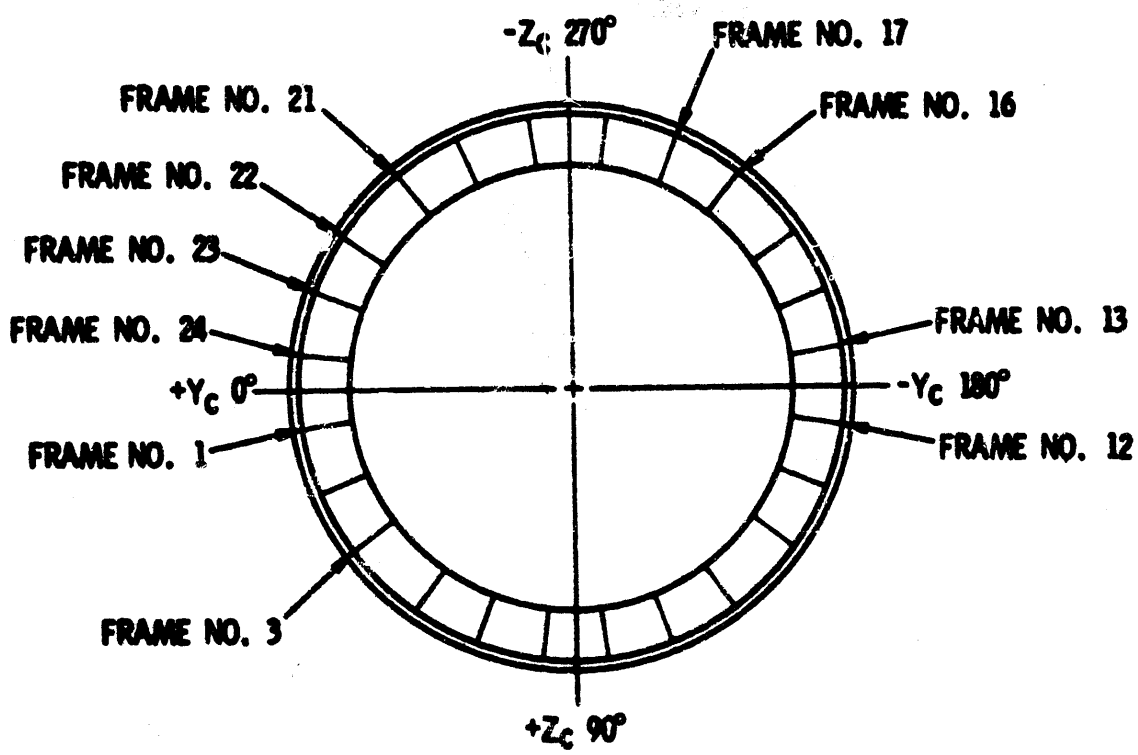
CM RCS INSTRU



CM RCS INSTRUMENTATION LOCATIONS







CMRCS MEASUREMENTS

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
MDC-2	1 Helium Tank Pressure	CR0001P	0+5K PSIA	C28AR31	10A18	H2	PCM	4150±50 PSIA and DECREASE
MDC-2	2 Helium Tank Pressure	CR0002P	0+5K PSIA	C28AR32	10A21	H2	PCM	
MDC-2	1 Helium Tank Temperature	CR0003T	0+300°F	C28AR33	11A155	H2	PCM	VARIABLE
MDC-2	2 Helium Tank Temperature	CR0004T	0+300°F	C28AR34	11A156	H2	PCM	
MDC-2	1 Helium Manifold Press	CR0037P	0+400 PSIA	C28AR185				
	1 Helium Manifold Press	CR0035P	0+400 PSIA	C28AR183	11A21	H2	PCM	285 to
MDC-2	2 Helium Manifold Press	CR0038P	0+400 PSIA	C28AR186				302
	2 Helium Manifold Press	CR0036P	0+400 PSIA	C28AR184	11A22	H2	PCM	PSIA
MDC-101	1-P Temperature Engine #14 Injector	CR2100T	-50+50°F	C28AR402				Preheat required if below +28°F 3.9 vdc. If heating required heat for 20 minutes.
MDC-101	1-Y Temperature Engine #16 Injector	CR2103T	-50+50°F	C28AR274				
MDC-101	1 CCWR Temperature Engine #12 Injector	CR2114T	-50+50°F	C28AR273				
MDC-101	2-P Temperature Engine #24 Injector	CR2110T	-50+50°F	C28AR403				
MDC-101	2+Y Temperature Engine #25 Injector	CR2116T	-50+50°F	C28AR272				
MDC-101	2CWR Temperature Engine #21 Injector	CR2119T	-50+50°F	C28AR404				

CMRCS MEASUREMENTS

Crew Display	Measurement	Measurement Number	Range	Signal Conditioner	Channel Code	Bit Rate		Operating Range
	RCS Activate Signal A Z19	CD0170X	EVENT	Seq.	11E22-3	E2	PCM	
	RCS Activate Signal B Z19	CD0171X	EVENT	Seq.	11E23-3	E2	PCM	
	CMRCS Pressurize Signal A Z7	CD0173X	EVENT	Seq.	11E22-7	E2	PCM	OFF - ON EVENT
	CMRCS Pressurize Signal B Z7	CD0174X	EVENT	Seq.	11E23-5	E2	PCM	
	DIRECT RCS SWITCH NO. 1 ENABLE	CH3601X	EVENT	SCS	11E24-3	E2	PCM	
	DIRECT RCS SW SWITCH NO. 2 ENABLE	CH3602X	EVENT	SCS	11E24-4	E2	PCM	

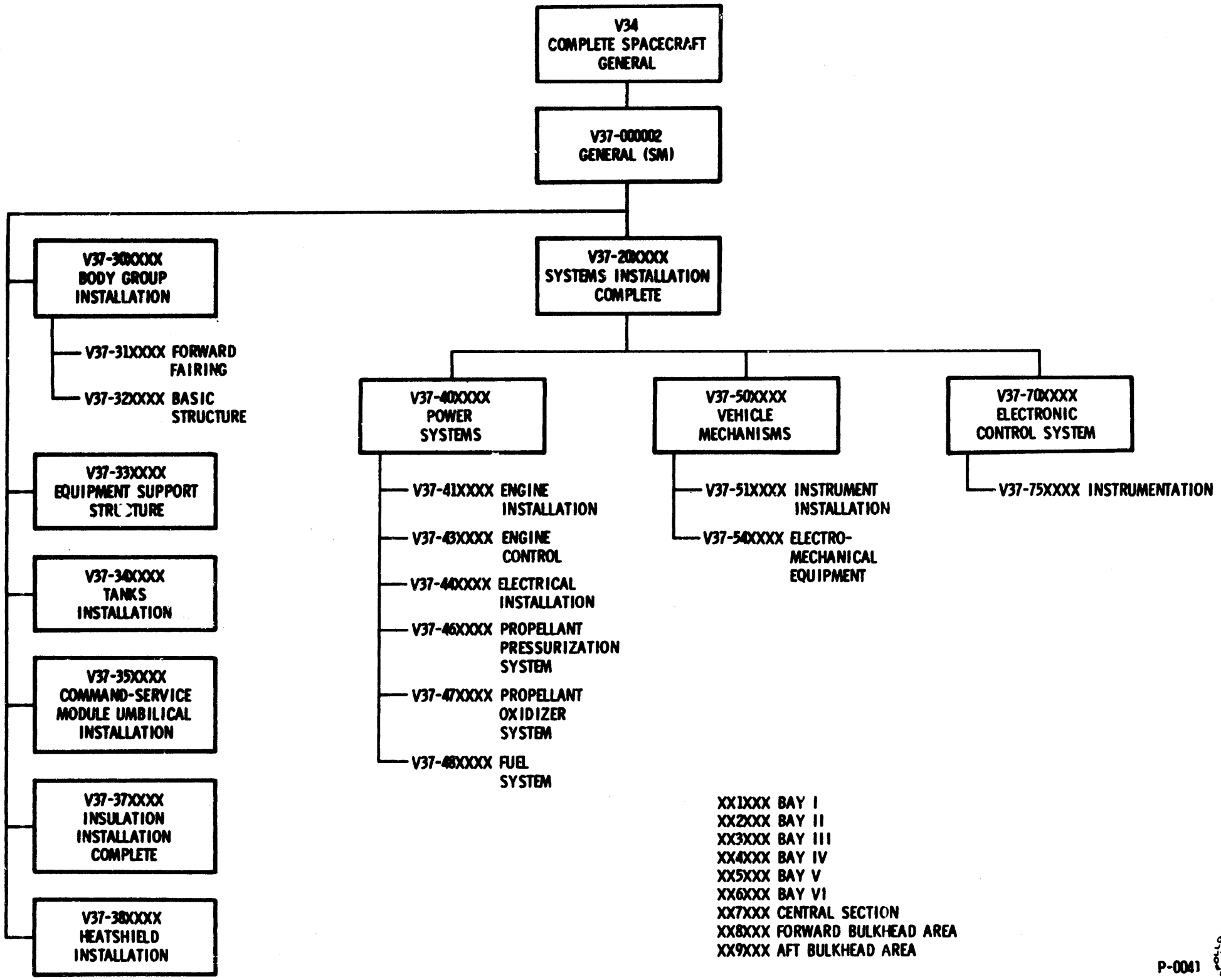
ABBREVIATIONS

AC	ALTERNATING CURRENT
ACCEL	ACCELERATION
ACK	ACKNOWLEDGE
AMP	AMPLIFIER
AUTO	AUTOMATIC
AUX	AUXILIARY
BAT	BATTERY
CAUT/WARN	CAUTION/WARNING
CCW	COUNTERCLOCKWISE
℄	CENTERLINE
CM OR C/M	COMMAND MODULE
CMC	COMMAND MODULE COMPUTER
CMD	COMMAND
CONT	CONTROL
CW	CLOCKWISE
DC	DIRECT CURRENT
DEC	DECREASE
DEMOD	DEMODULATOR
ECO	ENGINE CUTOFF
EDS	EMERGENCY DETECTION SYSTEM
EMS	ENTRY MONITOR SYSTEM
EPS	ELECTRICAL POWER SUBSYSTEM
FCSM	FLIGHT COMBUSTION STABILITY MONITOR
FT	FEET
GN_2	GASEOUS NITROGEN
GPI	GIMBAL POSITION INDICATOR
GRD	GROUND
GSE	GROUND SUPPORT EQUIPMENT
He	HELIUM
HI	HIGH
HR	HEATER
IMU	INERTIAL MEASUREMENT UNIT
INC	INCREASE
IND	INDICATOR
ISO	ISOLATION
ISOL	ISOLATION
JETT	JETTISON
LBS	POUNDS
LDEC	LUNAR DOCKING EVENT CONTROLLER
LES	LAUNCH ESCAPE SYSTEM
LO	LOW
LV	LAUNCH VEHICLE
MAX	MAXIMUM
MESC	MASTER EVENT SEQUENCE CONTROLLER
MDC	MAIN DISPLAY CONSOLE
MIN	MINIMUM
MN	MAIN
MOT	MOTOR
M1	MOTOR 1
M2	MOTOR 2
N	NORMAL
NEG	NEGATIVE
NO.	NUMBER
NORM	NORMAL
OX	OXIDIZER
OXID	OXIDIZER
POT	POTENTIOMETER
PRI	PRIMARY
PRIM	PRIMARY
PROP	PROPELLANT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PU	PROPELLANT UTILIZATION
PUG	PROPELLANT UTILIZATION GAUGING
PWR	POWER
RCS	REACTION CONTROL SUBSYSTEM
ROT	ROTATION
S	SWITCH

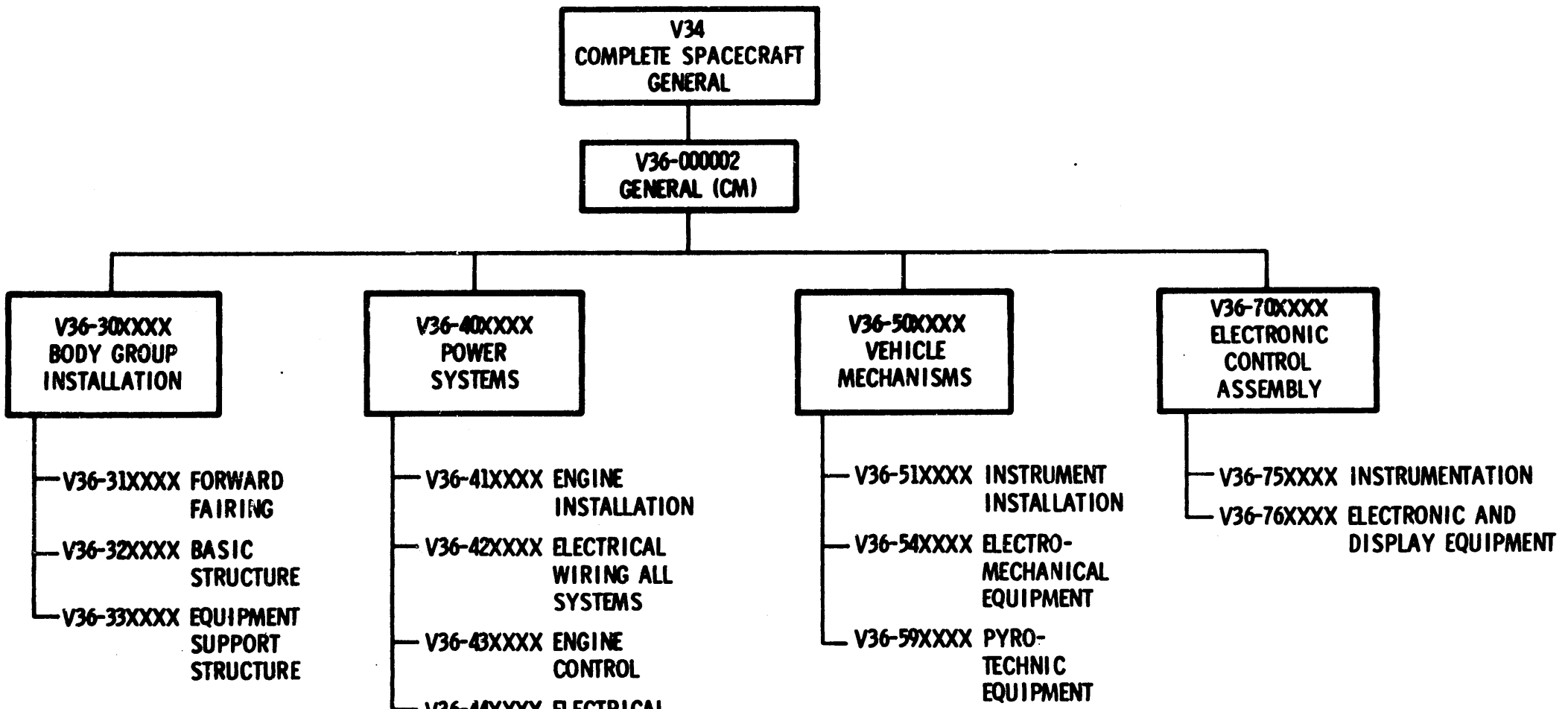
ABBREVIATIONS (Cont'd)

S/C	SPACECRAFT
SCS	STABILIZATION CONTROL SYSTEM
SEC	SECOND
SEC	SECONDARY
SEP	SEPARATION
SEQ	SEQUENCER
SM OR S/M	SERVICE MODULE
SPS	SERVICE PROPULSION SUBSYSTEM
SW	SWITCH
TEMP	TEMPERATURE
T.J.	TOWER JETTISON
TLM	TELEMETRY
TP	TEST PORT
TV	THRUST VECTOR
TVC	THRUST VECTOR CONTROL
UDMH	UNSYMMETRICAL DIAMETHYL HYDRAZINE
V	VOLTS
X_C	COMMAND MODULE STATION
XPDNR	TRANSPONDER
X_S	SERVICE MODULE STATION

APOLLO SERVICE MODULE DRAWING SYSTEM (V37-)
SERVICE MODULE PROPULSION SYSTEMS



APOLLO COMMAND MODULE DRAWING SYSTEM(V36-)
COMMAND MODULE PROPULSION SYSTEMS

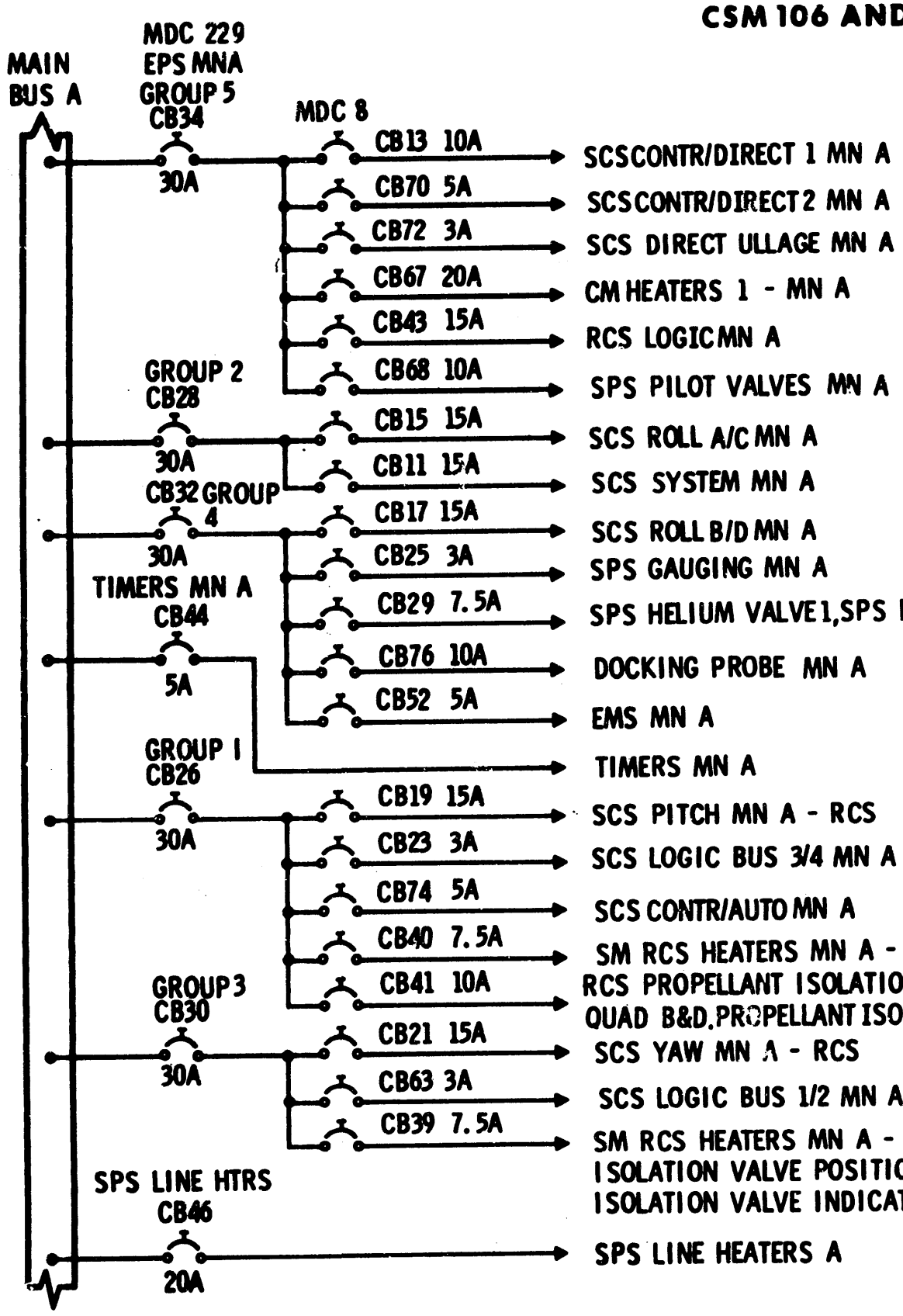


XX-XX1XX CREW BAY
XX-XX2XX RIGHT HAND EQUIPMENT BAY
XX-XX3XX LEFT HAND EQUIPMENT BAY
XX-XX4XX LOWER EQUIPMENT BAY
XX-XX5XX UPPER EQUIPMENT BAY
XX-XX6XX FORWARD COMPARTMENT
XX-XX7XX AFT COMPARTMENT

P-0042

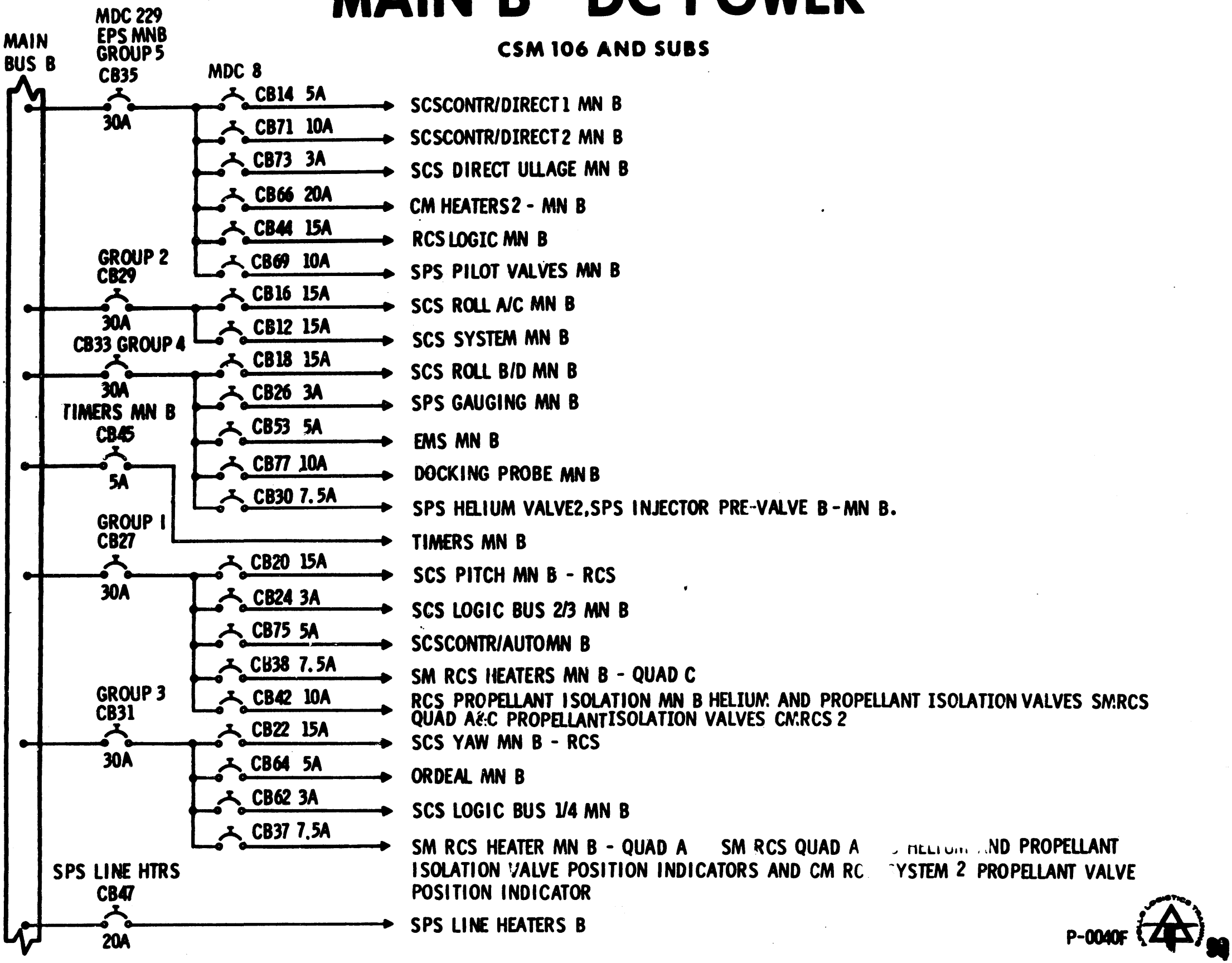
MAIN A DC POWER

CSM 106 AND SUBS



MAIN B DC POWER

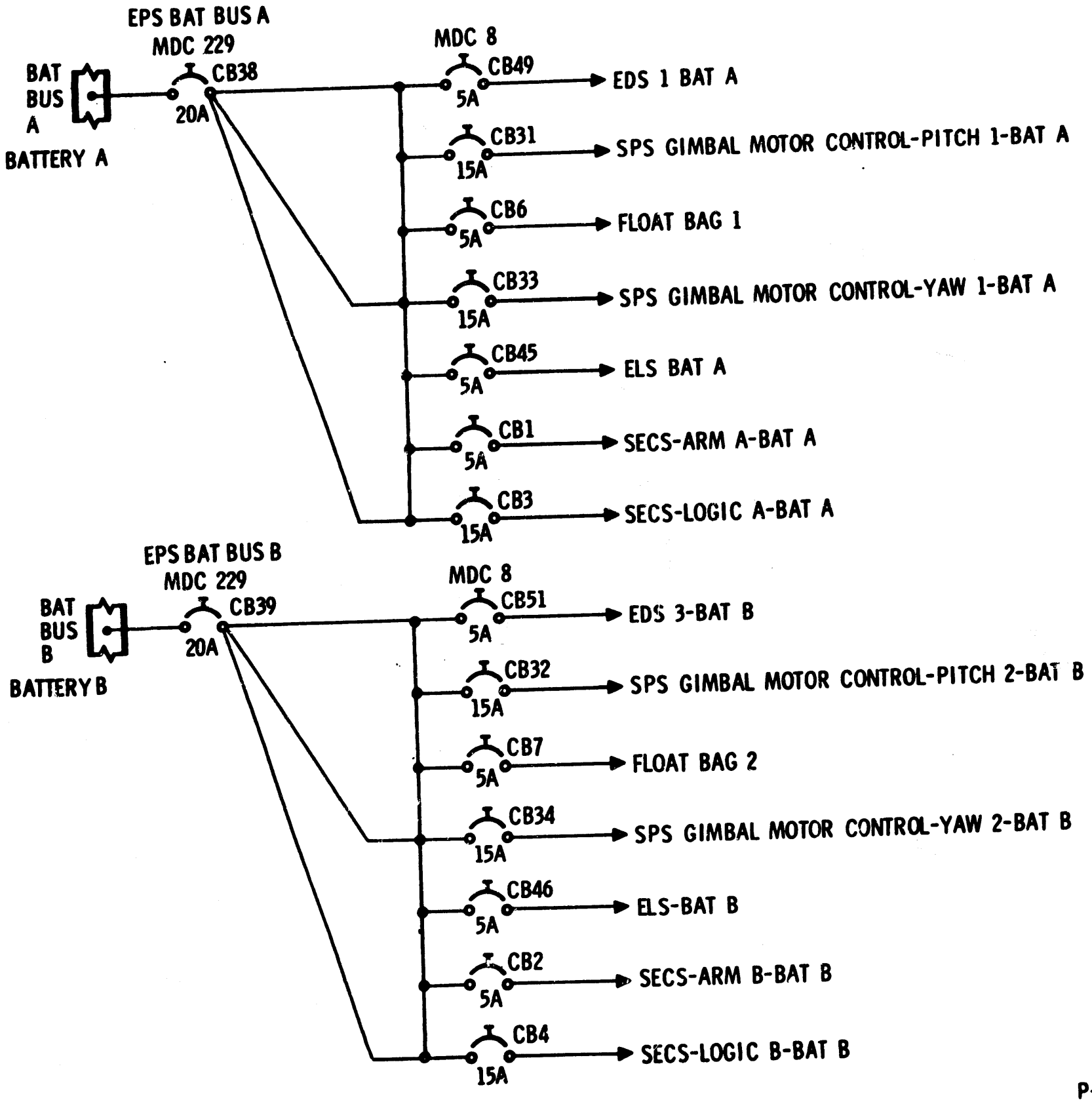
CSM 106 AND SUBS

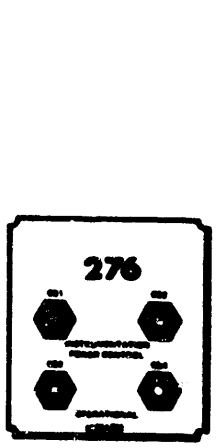


P-0040F

BATTERY A&B POWER

CSM 101 & SUBS

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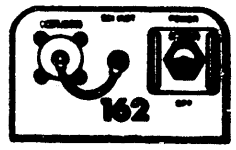
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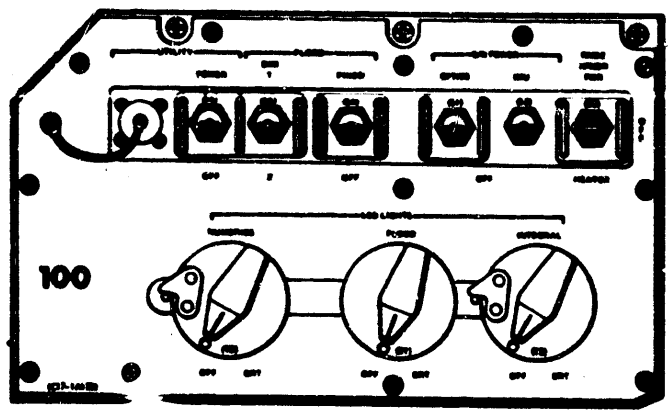
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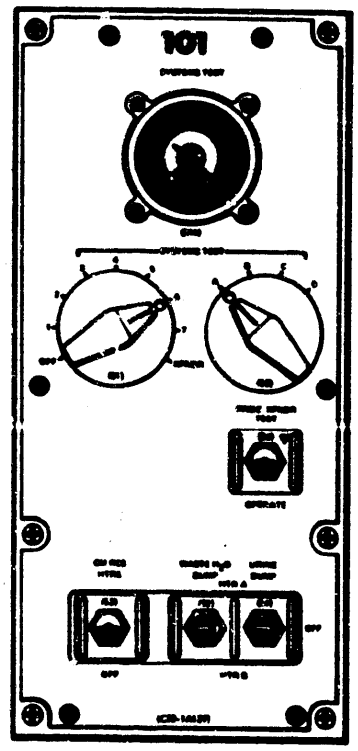
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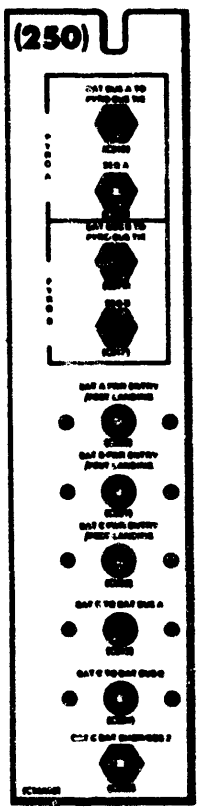
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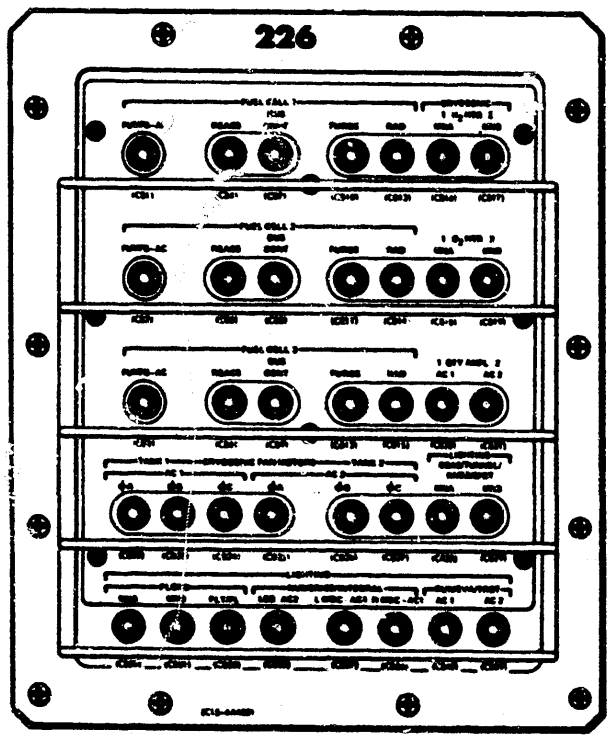
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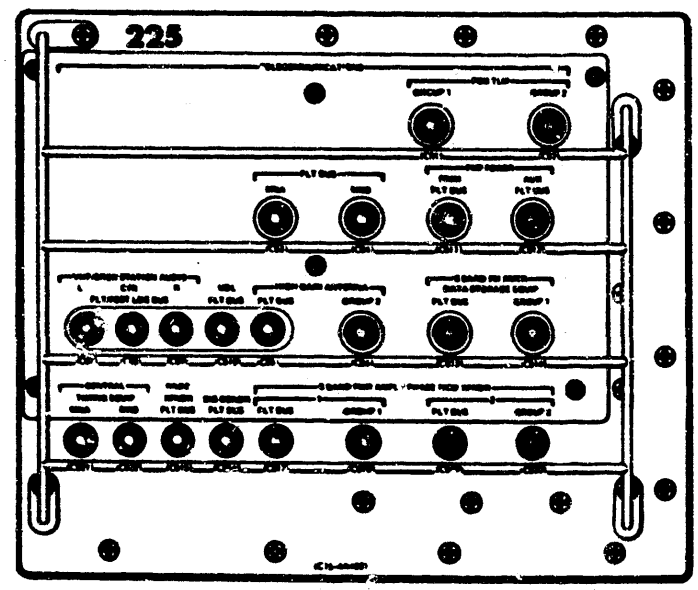
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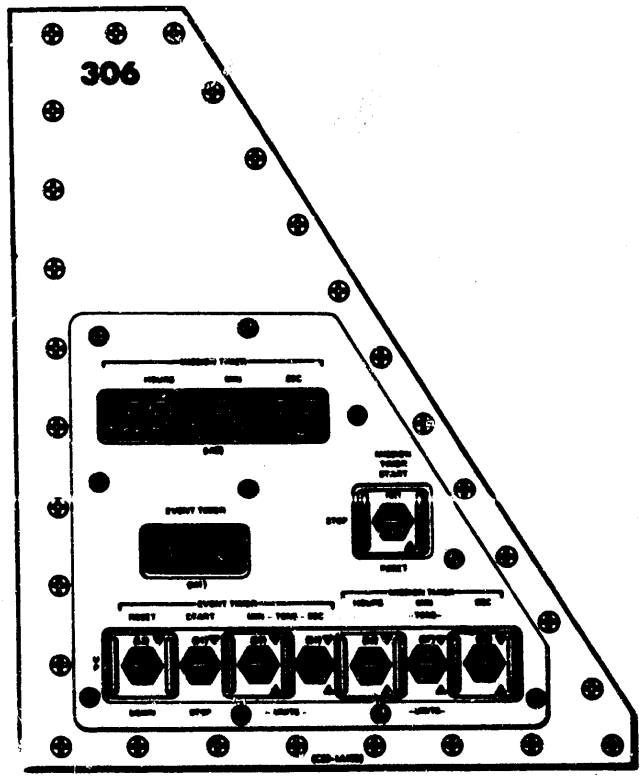
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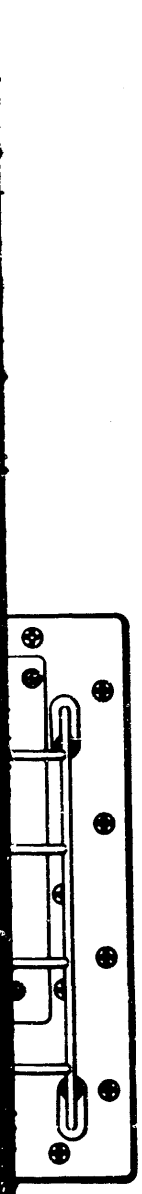

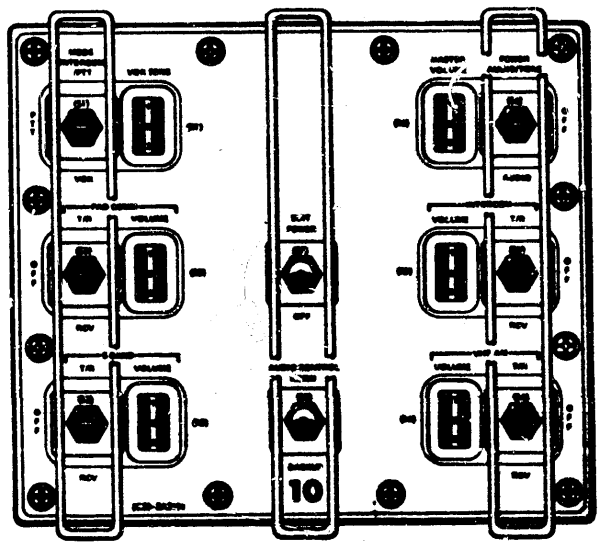
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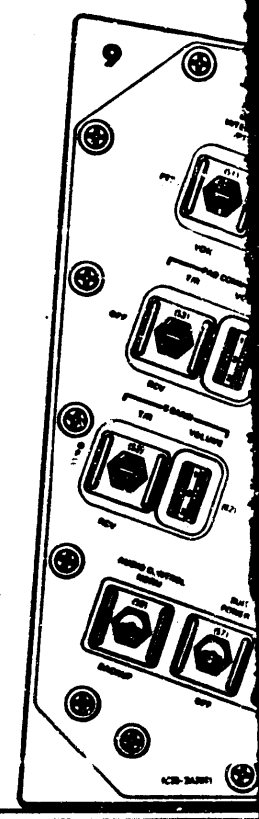
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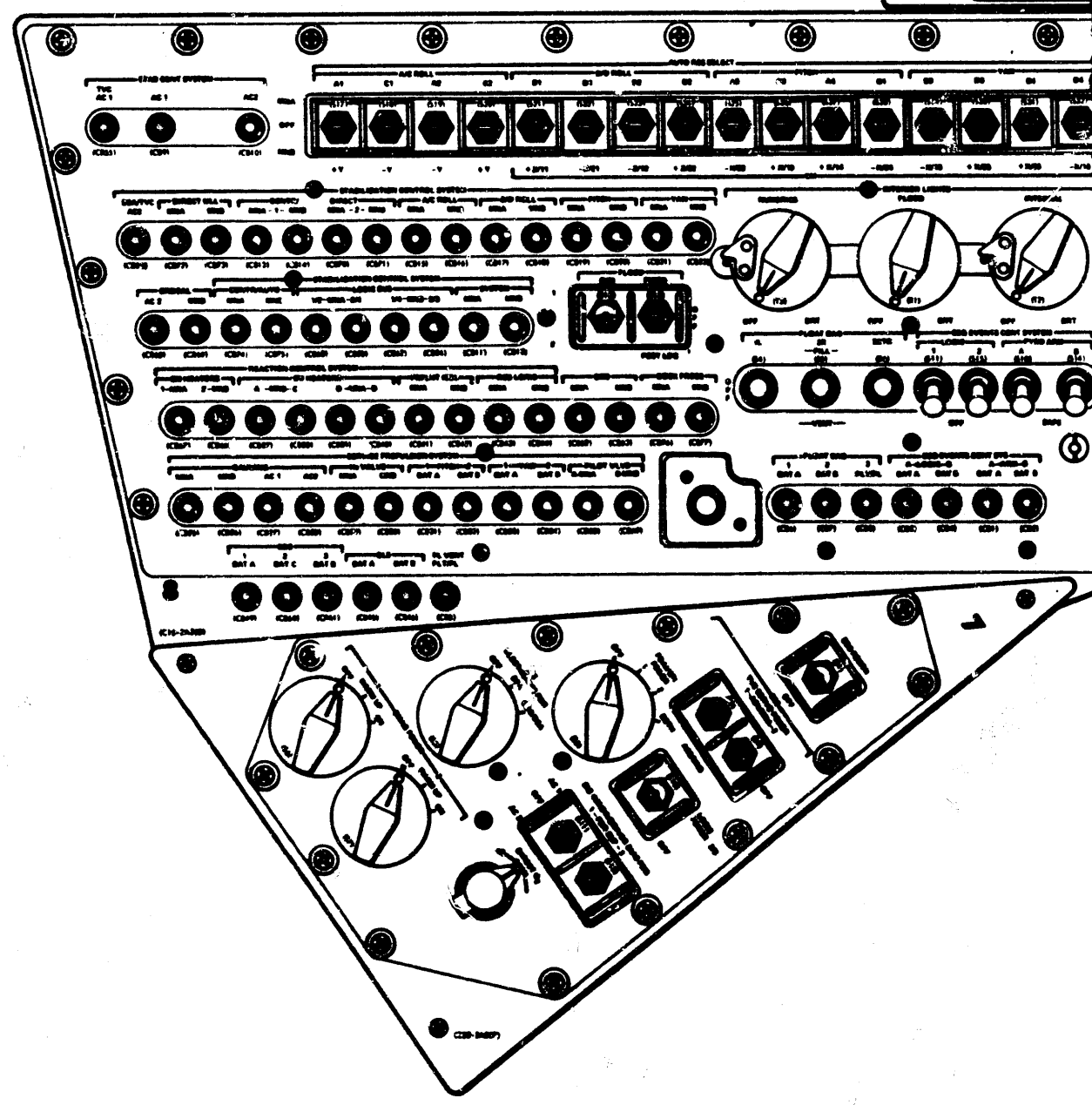
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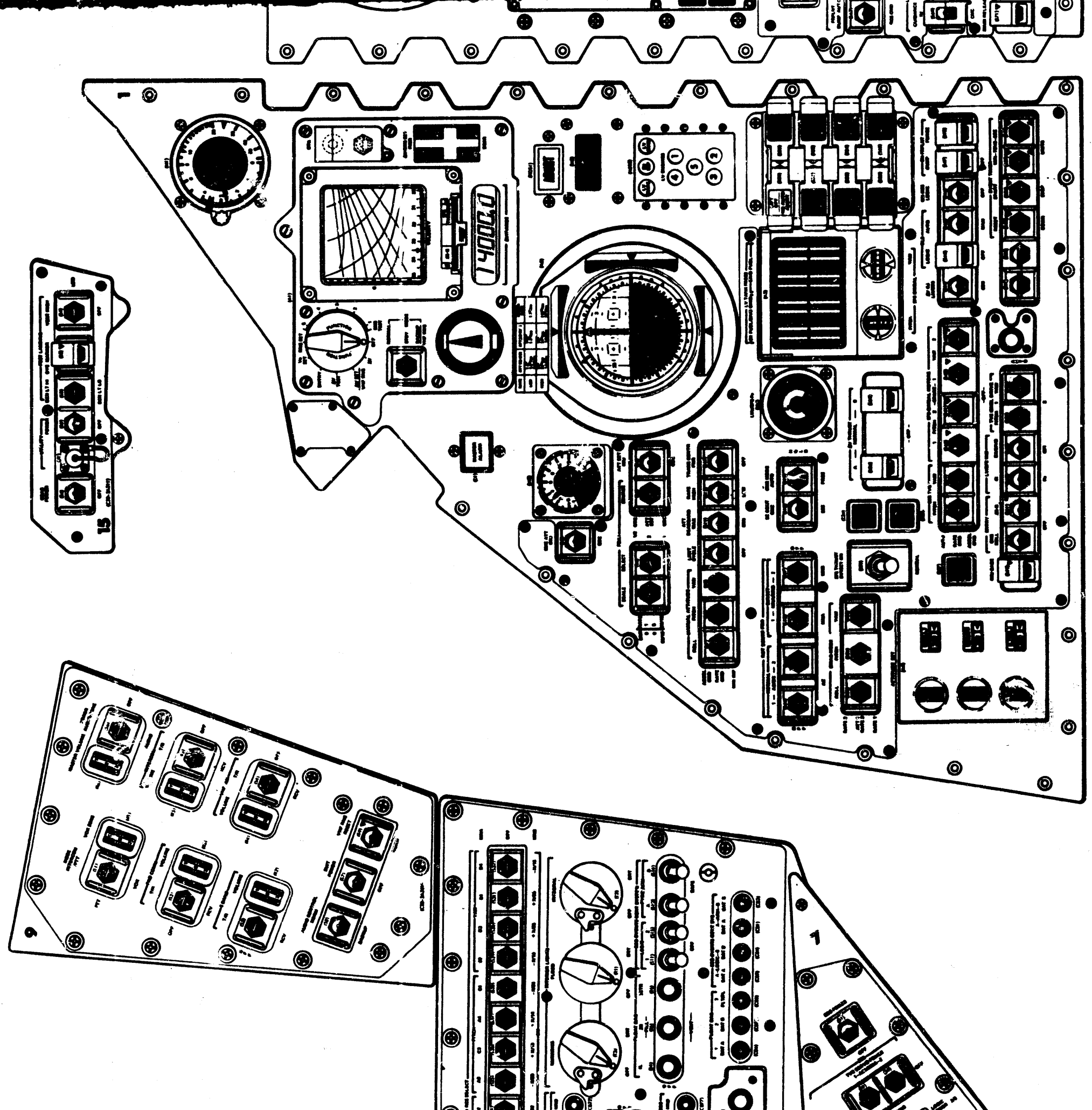
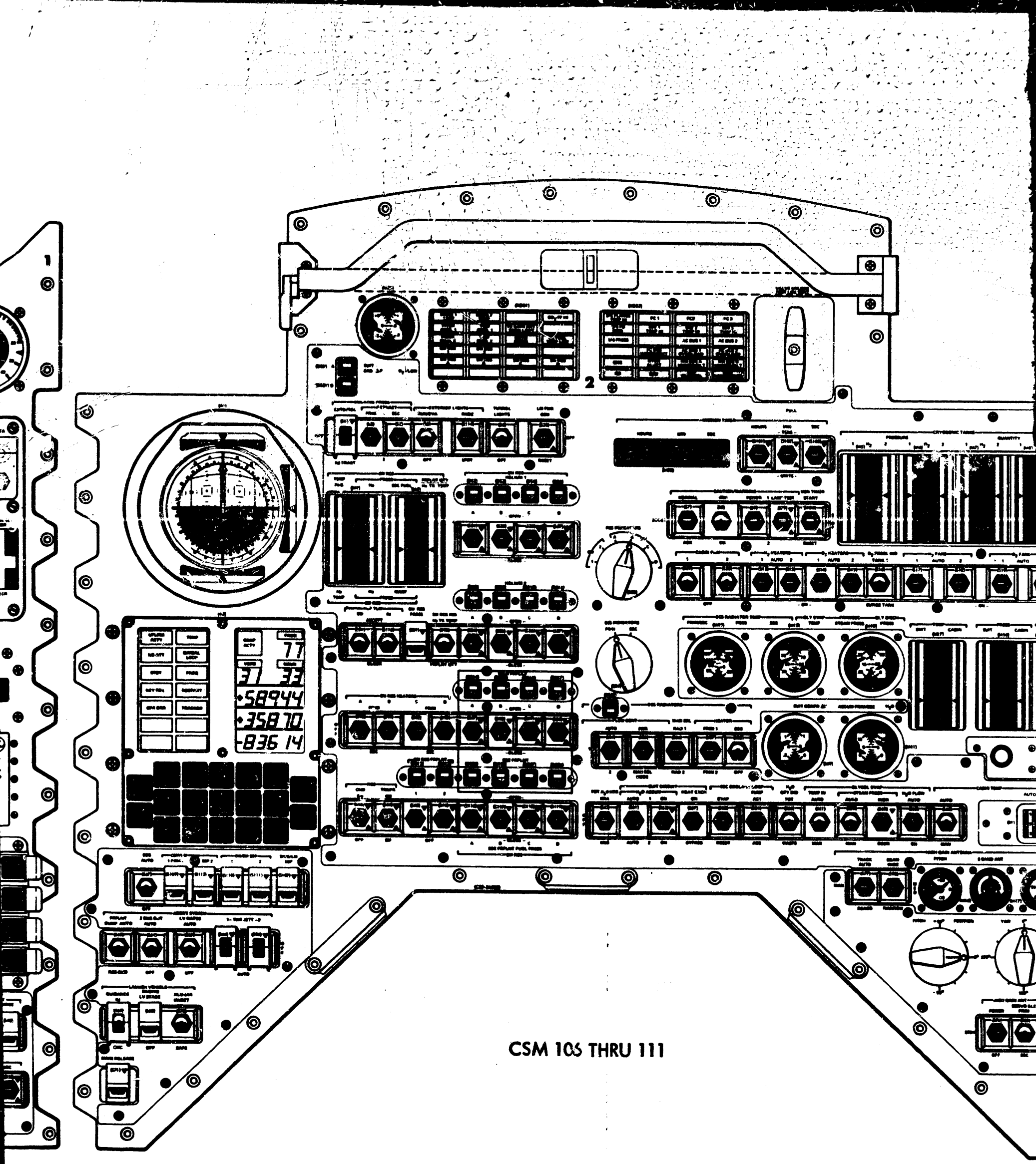
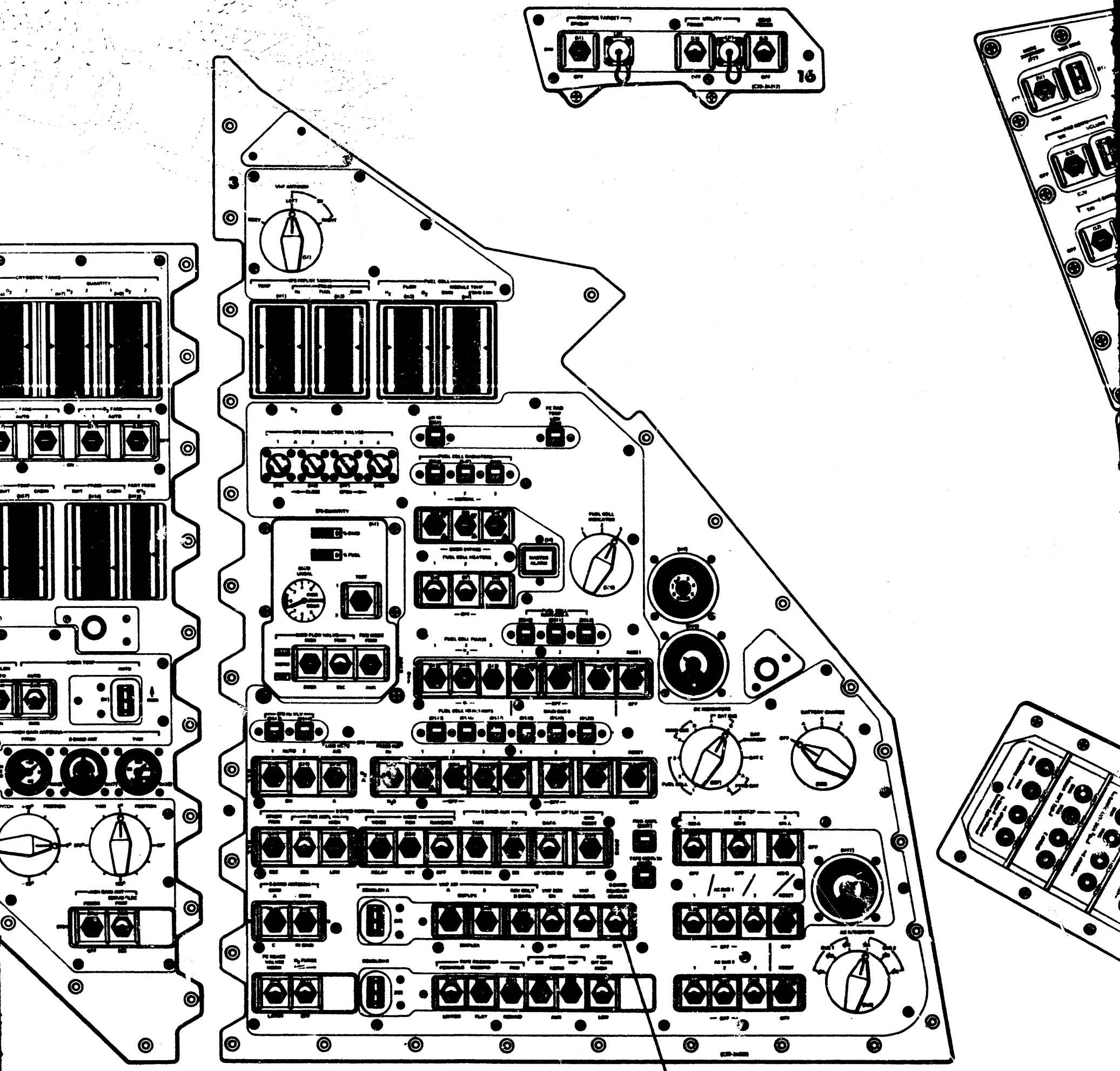
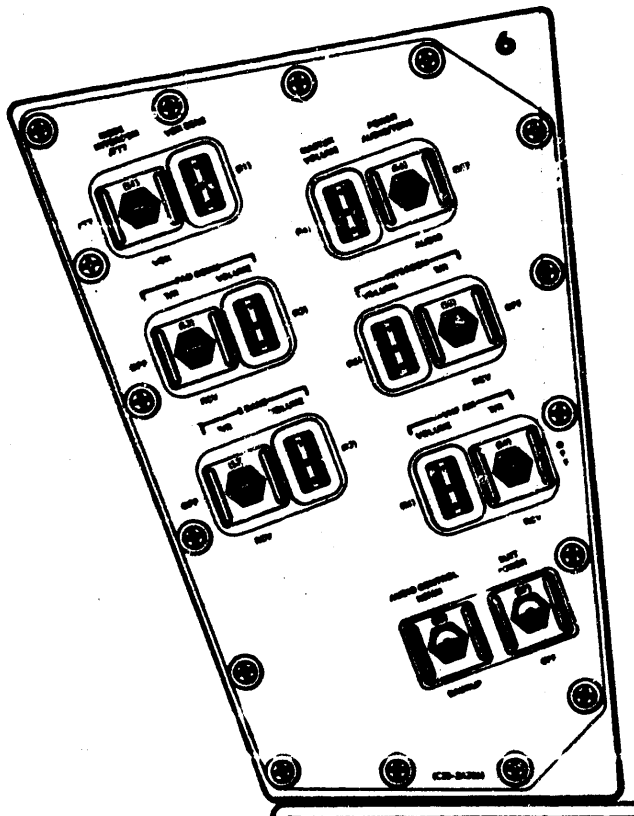


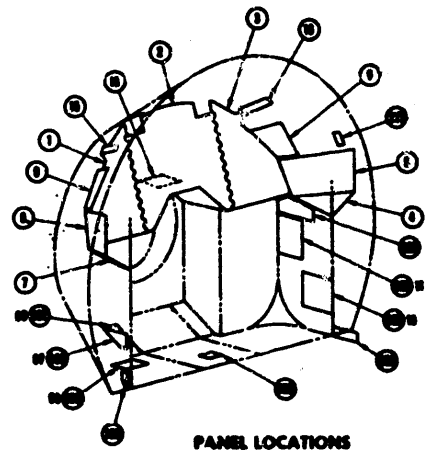


CSM 106 THRU 111

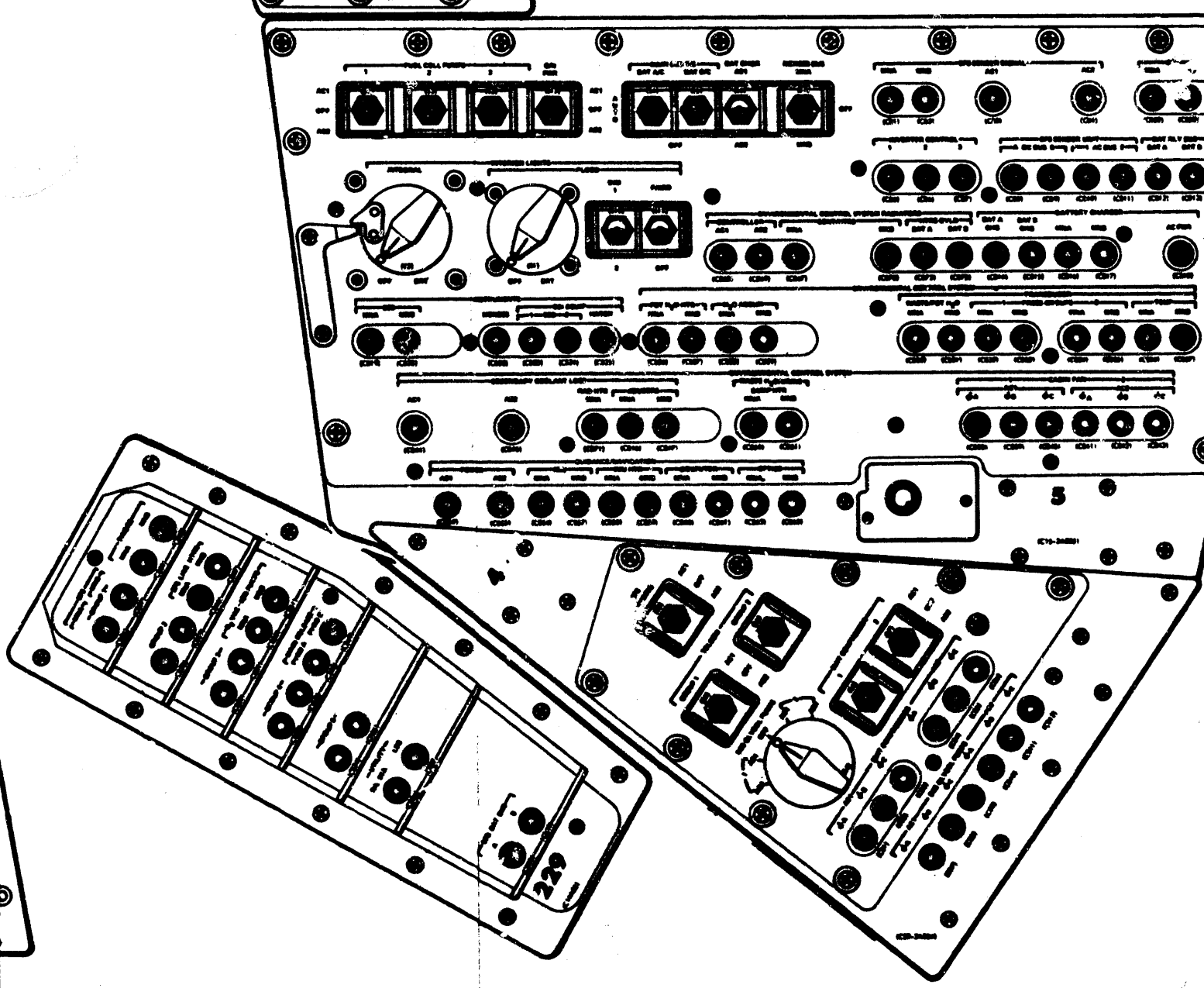


CSM 108 AND SUBS





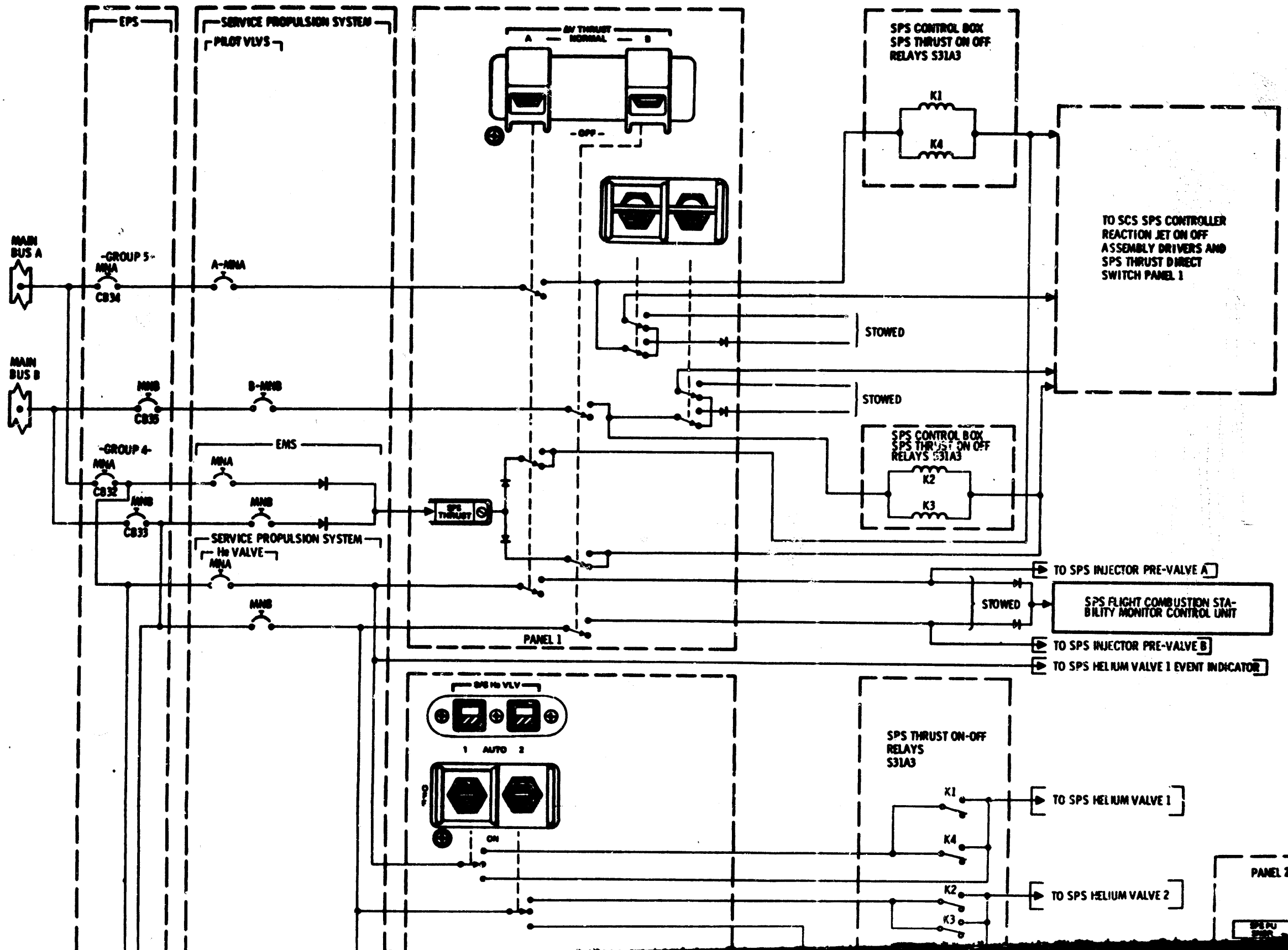
PANEL LOCATIONS

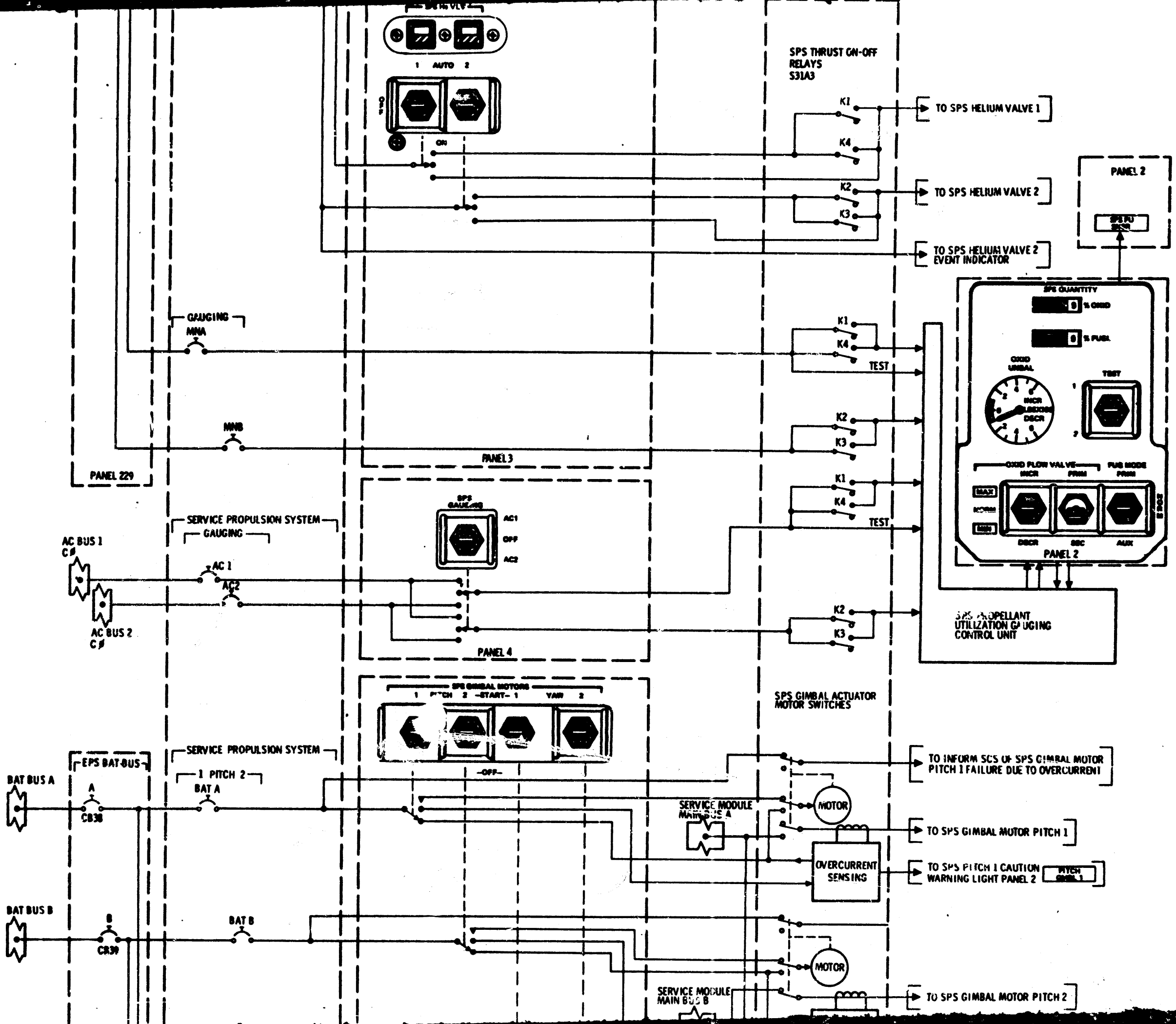


1. ALL NUMBERS AND LETTERS ENCASED WITH PARENTHESIS DO NOT APPEAR ON PANELS.
4. 'P' SYMBOL DENOTES MOMENTARY SWITCH POSITION AND DOES NOT APPEAR ON PANELS.
3. SWITCH POSITIONS ARE SHOWN FOR CONVENIENCE ONLY AND DO NOT NECESSARILY REFLECT OPERATING MODES DURING MISSION PHASES. TWO POSITION SWITCHES ARE SHOWN IN THE DOWN POSITION. THREE POSITION SWITCHES ARE SHOWN IN CENTER POSITION.
2. THIS IS AN ARRANGEMENT AND NOMENCLATURE CONTROL DWG FOR DESIGN REQUIREMENTS AND FOR USE BY OTHER DEPTS AS A GUIDE. ONLY RELEASED DESIGN DRAWINGS AND DOCUMENTS SHALL BE USED FOR MFG, MOCK-UP, SIMULATOR, EVALUATOR, TRAINER OR CENTRIFUGE PANELS WHICH ARE INTENDED TO REFLECT CURRENT DESIGN.
1. THIS DWG REFLECTS A CONFIGURATION AS DEFINED BY APPLICABLE SCR'S, ASSEMBLY DWGS AND MARKING DWGS AS OF THE DATE OF RELEASE WITH RESPECT TO THE AFFECTED VEHICLES.

NOTES:

P-0044


EPS
SERVICE PROPULSION SYSTEM
PILOT VLVS
ΔV THRUST
NORMAL
A
B
OFF
SPS CONTROL BOX
SPS THRUST ON OFF
RELAYS S31A3
K1
K4
TO SCS SPS CONTROLLER
REACTION JET ON OFF
ASSEMBLY DRIVERS AND
SPS THRUST DIRECT
SWITCH PANEL 1
MAIN
BUS A
-GROUP 5-
MNA
CB34
A-MNA
STOWED
MAIN
BUS B
MNB
CB35
B-MNB
STOWED
SPS CONTROL BOX
SPS THRUST ON OFF
RELAYS S31A3
K2
K3
-GROUP 4-
MNA
CB32
MNB
CB33
EMS
MNA
MNB
SPS THRUST
SERVICE PROPULSION SYSTEM
He VALVE
MNA
MNB
TO SPS INJECTOR PRE-VALVE A
STOWED
SPS FLIGHT COMBUSTION STA-
BILITY MONITOR CONTROL UNIT
TO SPS INJECTOR PRE-VALVE B
TO SPS HELIUM VALVE 1 EVENT INDICATOR
PANEL 1
SPS He VLV
1 AUTO 2
OPEN
ON
SPS THRUST ON-OFF
RELAYS
S31A3
K1
TO SPS HELIUM VALVE 1
K4
K2
TO SPS HELIUM VALVE 2
K3
PANEL 2


SPS THRUST ON-OFF RELAYS S31A3
K1
K4
K2
K3
TO SPS HELIUM VALVE 1
TO SPS HELIUM VALVE 2
TO SPS HELIUM VALVE 2 EVENT INDICATOR
1 AUTO 2
ON
PANEL 2
SPS QUANTITY
% OXID
% FUEL
OXID UNBAL
INCR
DECR
TEST
OXID FLOW VALVE
INCR
PRIM
FUS MODE
PRIM
MAX
NORM
MIN
DSCR
SSC
AUX
SPS PROPELLANT UTILIZATION GAUGING CONTROL UNIT
GAUGING
MNA
MNB
PANEL 229
PANEL 3
PANEL 4
SERVICE PROPULSION SYSTEM
GAUGING
AC BUS 1
AC BUS 2
AC 1
AC2
AC1
OFF
AC2
SPS GIMBAL MOTORS
1 PITCH 2 -START- 1 YAW 2
-OFF-
SPS GIMBAL ACTUATOR MOTOR SWITCHES
EPS BAT BUS
BAT BUS A
BAT BUS B
A
B
CB38
CB39
BAT A
BAT B
1 PITCH 2
TO INFORM SCS OF SPS GIMBAL MOTOR PITCH 1 FAILURE DUE TO OVERCURRENT
SERVICE MODULE MAIN BUS A
MOTOR
TO SPS GIMBAL MOTOR PITCH 1
OVERCURRENT SENSING
TO SPS PITCH 1 CAUTION WARNING LIGHT PANEL 2
SERVICE MODULE MAIN BUS B
MOTOR
TO SPS GIMBAL MOTOR PITCH 2

BAT BUS B

B

CB39

BAT B

MOTOR

SERVICE MODULE MAIN BUS B

TO SPS GIMBAL MOTOR PITCH 2

OVERCURRENT SENSING

TO SPS PITCH 2 CAUTION WARNING LIGHT PANEL 2

PITCH GIMBL 2

1 YAW 2

BAT A

TO INFORM SCS OF SPS GIMBAL MOTOR YAW 1 FAILURE DUE TO OVERCURRENT

MOTOR

TO SPS GIMBAL MOTOR YAW 1

OVERCURRENT SENSING

TO SPS YAW 1 CAUTION WARNING LIGHT PANEL 2

YAW GIMBL 1

BAT B

MOTOR

PANEL 1

TO SPS GIMBAL MOTOR YAW 2

OVERCURRENT SENSING

TO SPS YAW 2 CAUTION WARNING LIGHT PANEL 2

YAW GIMBL 2

SPS CONTROL BOX

SCS TVC SERVO POWER 1-AC1/MNA-2

OFF

AC2/MNB

EPS -GROUP 2-

STABILIZATION CONTROL SYSTEM

SYSTEM

MAIN BUS A

MNA

CB28

MNA

MAIN BUS B

MNB

CB29

MNB

PANEL 229

STABILIZATION CONTROL SYSTEM TVC AC 1

AC BUS 1 A #

STABILIZATION CONTROL SYSTEM ECA/TVC AC2

AC BUS 2 C #

PANEL 7

A4K7

A4K1

TO SPS GIMBAL ACTUATOR CLUTCHES PRIMARY PITCH

TO SCS SPS GIMBAL ACTU SERVOAMP ASSYS, GIMBAL TRIM POTS, RATE AND POSITION XDUCERS PITCH 1

A4K7

A4K2

TO SPS GIMBAL ACTU CLUTCHES SECONDARY PITCH

TO SCS SPS GIMBAL ACTU SERVOAMP ASSYS, GIMBAL TRIM POTS, RATE AND POSITION XDUCERS PITCH 2

A4K4

A4K8

TO SPS GIMBAL ACTUATOR CLUTCHES PRIMARY YAW

TO SCS SPS GIMBAL ACTU SERVOAMP ASSYS, GIMBAL TRIM POTS, RATE AND POSITION TRANSDUCERS YAW 1

A4K8

A4K5

TO SPS GIMBAL ACTU CLUTCHES SECONDARY YAW

TO SCS SPS GIMBAL ACTU SERVOAMP ASSYS, GIMBAL TRIM POTS, RATE AND POSITION TRANSDUCERS YAW 2

TVC GIMBL DRIVE PITCH 1 YAW

CB10

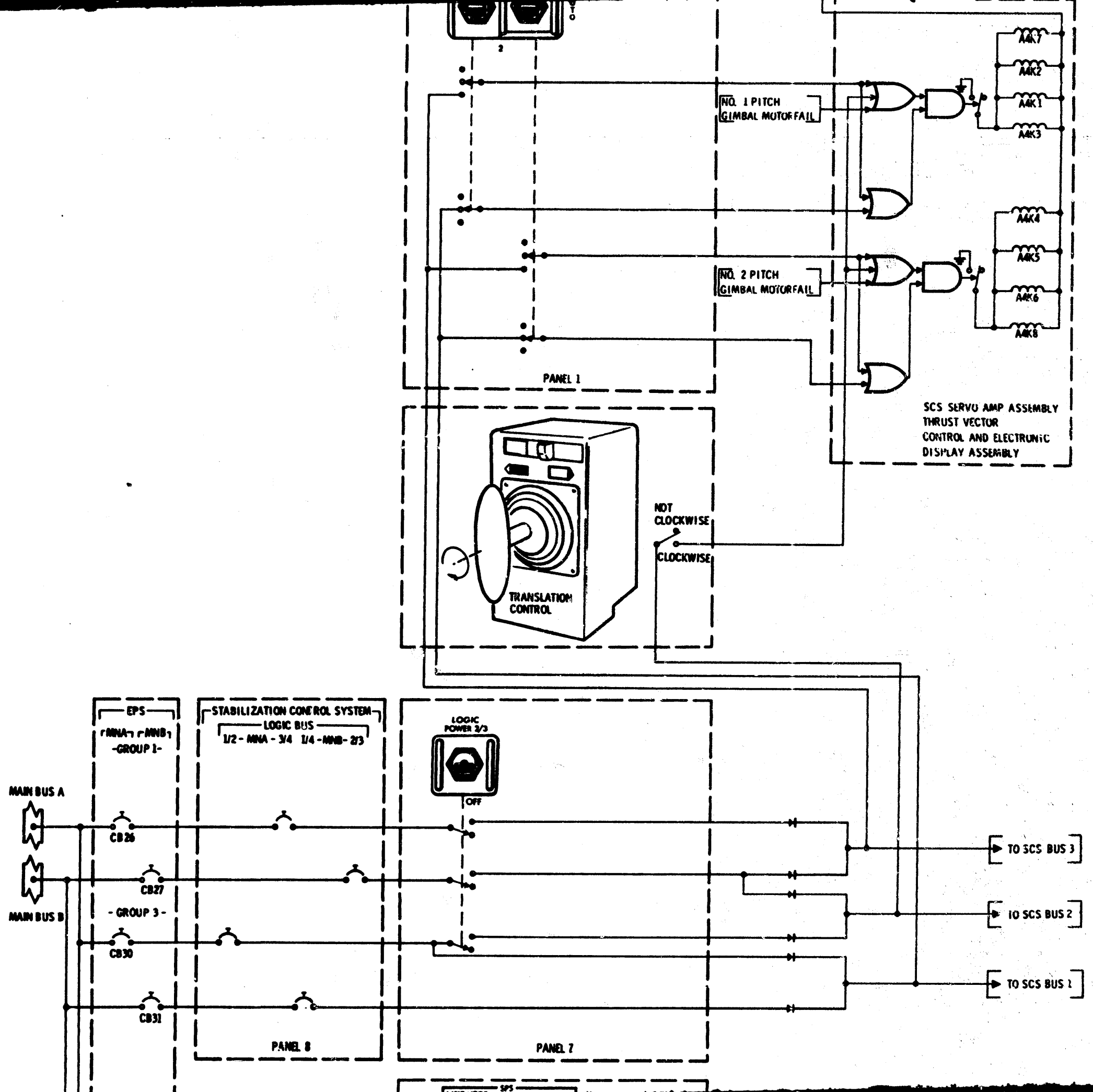
2

A4K7

A4K2

A4K1

NO. 1 PITCH GIMBAL MOTOR FAIL


A4K7
A4K2
A4K1
A4K3
NO. 1 PITCH GIMBAL MOTOR FAIL
A4K4
A4K5
NO. 2 PITCH GIMBAL MOTOR FAIL
A4K6
A4K8
PANEL 1
SCS SERVO AMP ASSEMBLY THRUST VECTOR CONTROL AND ELECTRONIC DISPLAY ASSEMBLY
NOT CLOCKWISE
CLOCKWISE
TRANSLATION CONTROL
EPS
-GROUP 1-
STABILIZATION CONTROL SYSTEM
LOGIC BUS
1/2 - MNA - 3/4 1/4 - MNB - 2/3
LOGIC POWER 2/3
OFF
MAIN BUS A
MAIN BUS B
CB26
CB27
- GROUP 3 -
CB30
CB31
PANEL 8
PANEL 7
TO SCS BUS 3
TO SCS BUS 2
TO SCS BUS 1

CB31

PANEL 8

PANEL 7

TO SCS BUS 1

SPS LINE HTRS

MNA MNB

LINE HTRS SPS A/B

CB46

TO SIX SPS HEATER ELEMENTS

CB47

TO SIX SPS HEATER ELEMENTS (REDUNDANT)

PANEL 3

EPS

MNA MNB

-GROUP 1-

REACTION CONTROL SYSTEM

PR PLNT ISOL

MNA MNB

SM RCS HELIUM

A B -OPEN- C D

-CLOSE-

CB26

TO HELIUM ISOLATION VALVE 1 QUAD B

TO HELIUM ISOLATION VALVE 1 QUAD D

CB27

TO HELIUM ISOLATION VALVE 1 QUAD A

TO HELIUM ISOLATION VALVE 1 QUAD C

HELIUM 2

A B -OPEN- C D

-CLOSE-

TO HELIUM ISOLATION VALVE 2 QUAD B

TO HELIUM ISOLATION VALVE 2 QUAD D

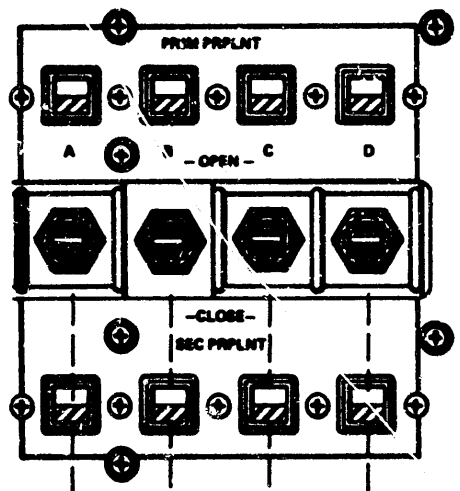
TO HELIUM ISOLATION VALVE 2 QUAD A

TO HELIUM ISOLATION VALVE 2 QUAD C

TO HELIUM ISOLATION VALVE 2 QUAD D

TO HELIUM ISOLATION VALVE 2 QUAD A

TO HELIUM ISOLATION VALVE 2 QUAD C

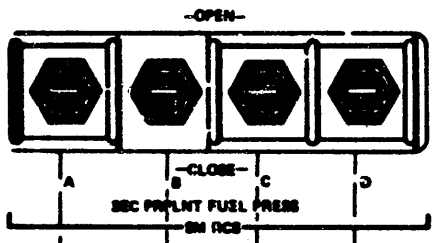


TO PROPELLANT ISOLATION VALVES (2 FUEL AND 2 OXIDIZER) QUAD B

TO PROPELLANT ISOLATION VALVES (2 FUEL AND 2 OXIDIZER) QUAD D

TO PROPELLANT ISOLATION VALVES (2 FUEL AND 2 OXIDIZER) QUAD A

TO PROPELLANT ISOLATION VALVES (2 FUEL AND 2 OXIDIZER) QUAD C

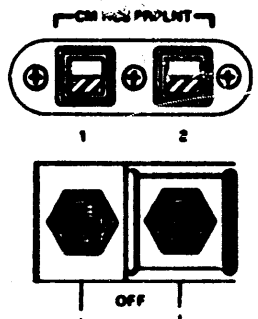


TO SECONDARY PROPELLANT FUEL PRESSURE VALVE QUAD B

TO SECONDARY PROPELLANT FUEL PRESSURE VALVE QUAD D

TO SECONDARY PROPELLANT FUEL PRESSURE VALVE QUAD A

TO SECONDARY PROPELLANT FUEL PRESSURE VALVE QUAD C



1 2

OFF

TO CMRCS PROPELLANT ISOLATION VALVES SYSTEM 1 (1 FUEL AND 1 OXIDIZER)

TO CMRCS PROPELLANT ISOLATION VALVES SYSTEM 2 (1 FUEL AND 1 OXIDIZER)

SM RCS HEATERS

A B C D

PRIM PRIM

OFF

SEC SEC

EPS

MNA MNB

GROUP 3

CB30

GROUP 1

CB29

GROUP 3

CB31

GROUP 1

CB27

REACTION CONTROL SYSTEM

SM HEATERS

A - MNB - C B - MNA - D

TO SMRCS QUAD B THERM-O-SWITCH AND HEATERS

TO SMRCS QUAD D THERM-O-SWITCH AND HEATERS

TO SMRCS QUAD A THERM-O-SWITCH AND HEATERS

TO SMRCS QUAD C THERM-O-SWITCH AND HEATERS

PANEL 2

TO SMRCS QUAD B AND D HELIUM AND PROPELLANT EVENT INDICATORS AND CMRCS SYSTEM 1 PROPELLANT EVENT INDICATORS. CLOSURE OF CMRCS SYSTEM 1 PROPELLANT ISOLATION VALVES ON ABORTS FROM THE PAD TO T + 42 SECONDS

TO SMRCS QUAD A AND C HELIUM AND PROPELLANT EVENT INDICATORS AND CMRCS SYSTEM 2 PROPELLANT EVENT INDICATORS. CLOSURE OF CMRCS SYSTEM 2 PROPELLANT ISOLATION VALVES ON ABORTS FROM THE PAD TO T + 42 SECONDS

RCS TRNSFR

CM

SM

REACTION CONTROL SYSTEM

RCS LOGIC

GROUP 5

CB 34

MNA

MNB

CB35

PANEL 2

CM RCS LOGIC

S1 TRANSFER MOTOR

SM RCS QUADS AND CM RCS

S2 TRANSFER MOTOR

SM RCS QUADS AND CM RCS

PANEL 2

S2 TRANSFER MOTOR

SM RCS QUADS AND CM RCS

CM RCS LOGIC

OFF

PANEL 1

K13

K14

INPUT FROM ANY LES ABORT OR CMSM SEP SWITCHES

CM RCS HTRS

OFF

K15

K17

K16

K18

REACTION CONTROL SYSTEM CM HEATERS

PANEL 101

TO CMRCS HEATERS SYSTEM 1, ENGINES 11 THROUGH 16

TO CMRCS HEATERS SYSTEM 2, ENGINES 21 THROUGH 26

PROPELLANT PURGE

TO CMRCS PROPELLANT JETTISON CIRCUITS "A"

TO CMRCS PROPELLANT JETTISON CIRCUITS "B"

TO CMRCS PROPELLANT JETTISON PURGE CIRCUITS "A"

TO CMRCS PROPELLANT JETTISON PURGE CIRCUITS "B"

SON PURGE CIRCUITS "B"

PANEL 1

PANEL 2

PANEL 3

IN PUT FROM LES ABORTS AND CRASH SEP SWITCHES

HELIUM ISOLATION PRESSURIZATION SQUIB VALVES CMRCS SYSTEM 1 AND 2

LUNAR DOCKING EVENTS CONTROLLER AND MASTER EVENT SEQUENCE CONTROLLER

TO CMRCS AUTOMATIC OXIDIZER FUEL DUMP AND PURGE CIRCUITS "A"

TO CMRCS AUTOMATIC OXIDIZER, FUEL DUMP AND PURGE CIRCUITS "B"

RCS CONTROL BOX

SMRCS DIRECT ULLAGE ENGINE B4

SMRCS DIRECT ULLAGE ENGINE D3

SMRCS DIRECT ULLAGE ENGINE A4

SMRCS DIRECT ULLAGE ENGINE C3

SPS ABORT DIRECT ULLAGE

PANEL 1

PANEL 2

POWER FROM SCS LOGIC BUS 1

CONTROLLER REACTION JET ON-OFF ASSEMBLY

SMRCS AUTO DISABLE PITCH AND YAW

AUTO RCS ENABLE

AUTO RCS DISABLE

SEQUENCER AUTO RCS ENABLE DISABLE

TO SMRCS ENGINE A1 AUTO COILS

TO SMRCS ENGINE C1 AUTO COILS

TO SMRCS ENGINE A2 AUTO COILS

TO SMRCS ENGINE C2 AUTO COILS

CONTROLLER REACTION JET ON-OFF ASSEMBLY

RCS CONTROL BOX

TO SMRCS ENGINE B1 AUTO COILS

TO CMRCS ENGINE 11 AUTO COILS

TO SMRCS ENGINE D1 AUTO COILS

TO CMRCS ENGINE 21 AUTO COILS

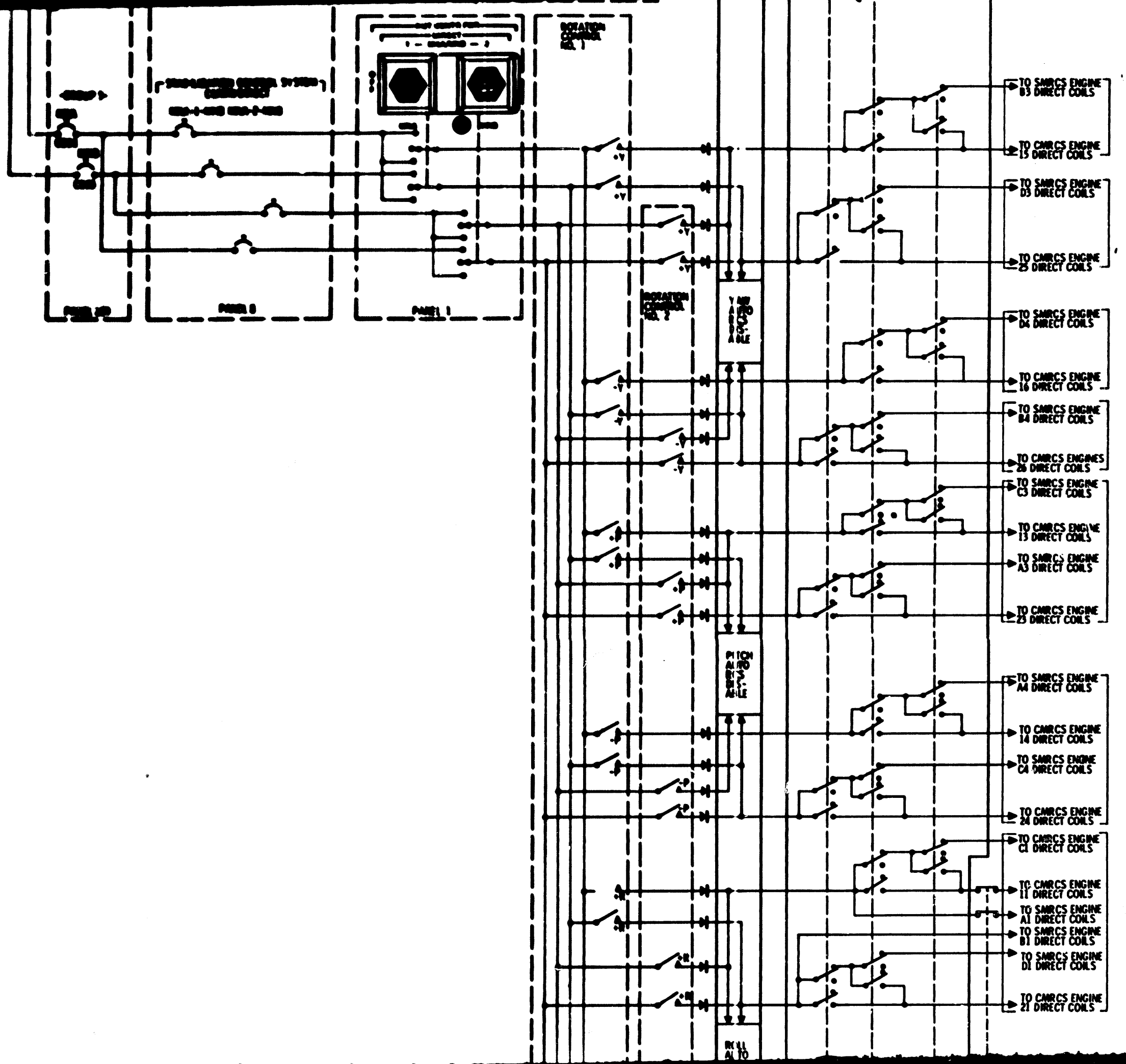
TO SMRCS ENGINE B2 AUTO COILS

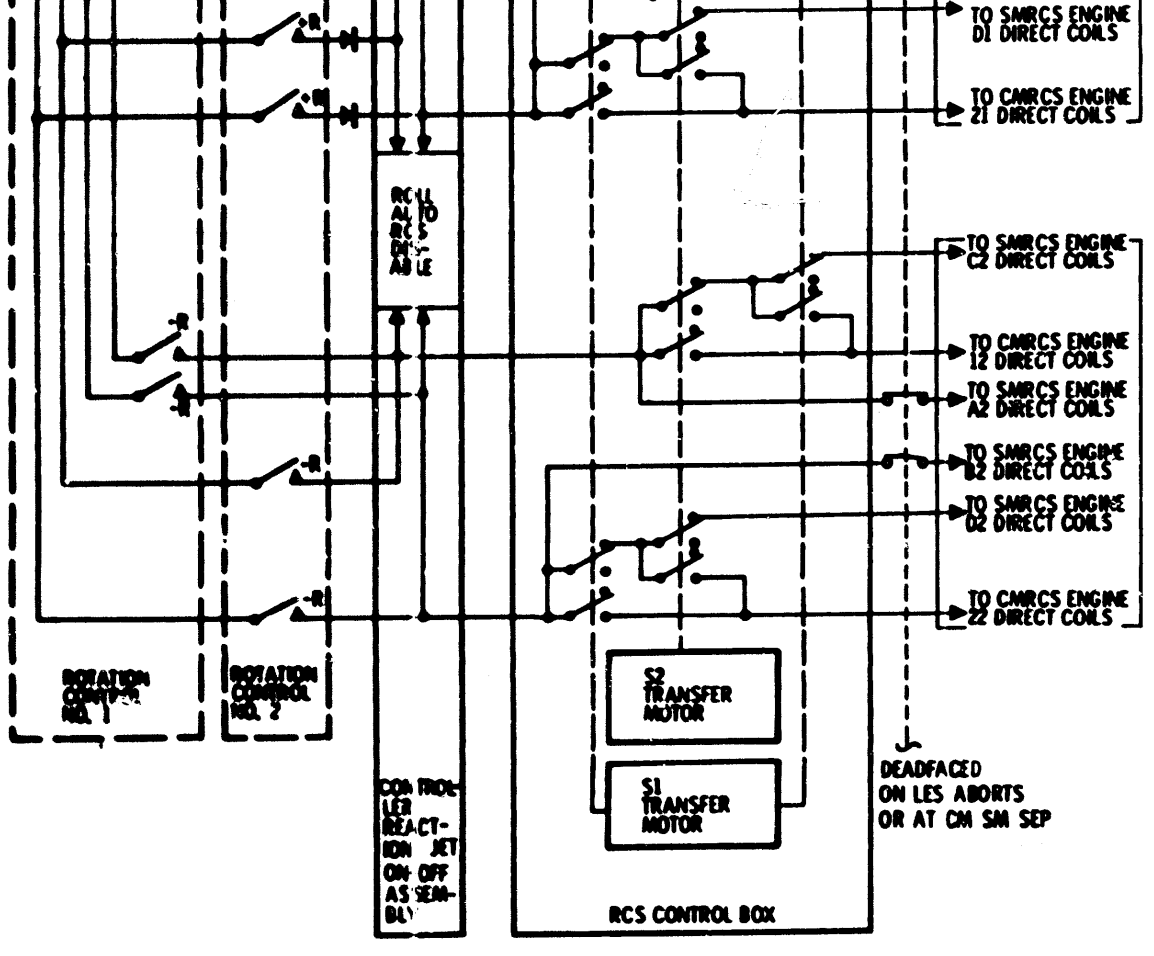
TO CMRCS ENGINE 12 AUTO COILS

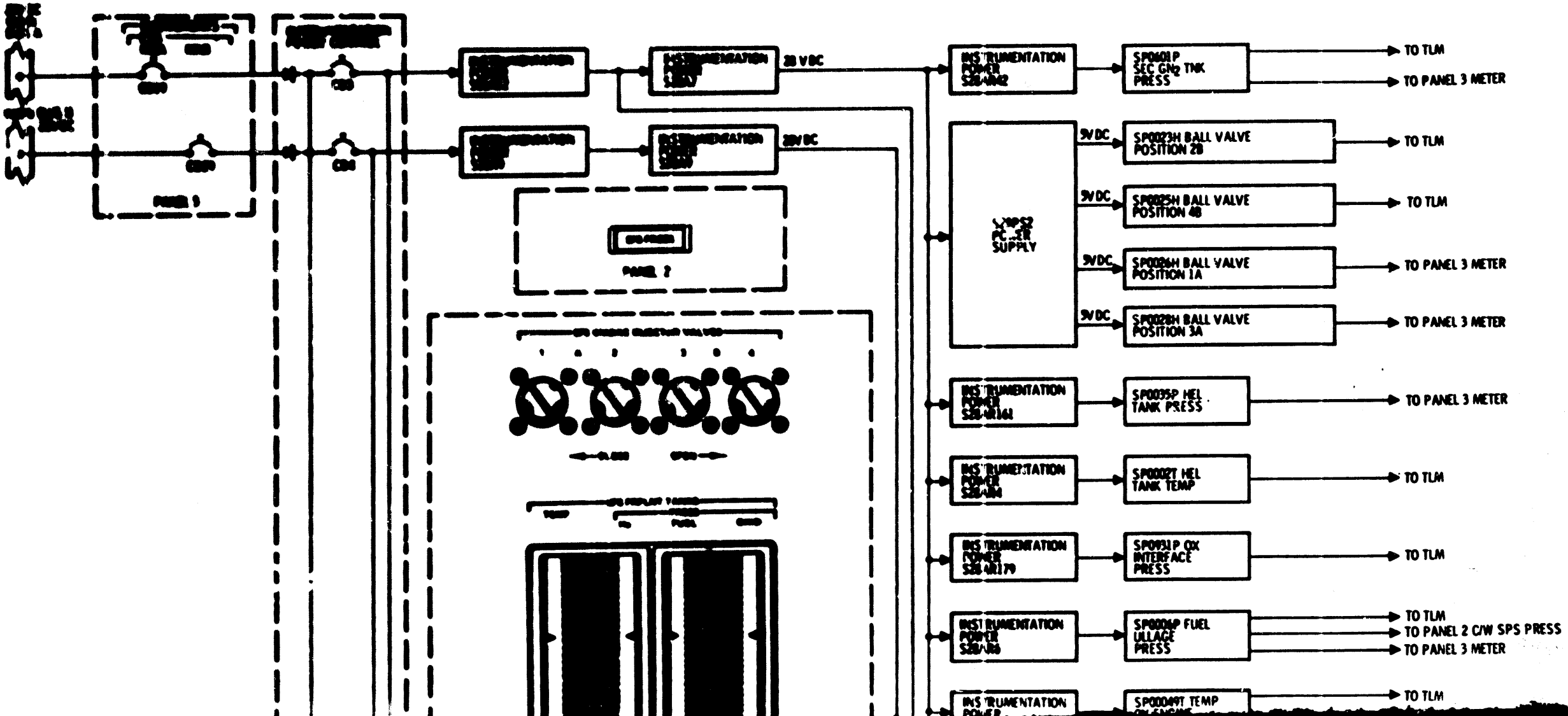
TO SMRCS ENGINE D2 AUTO COILS

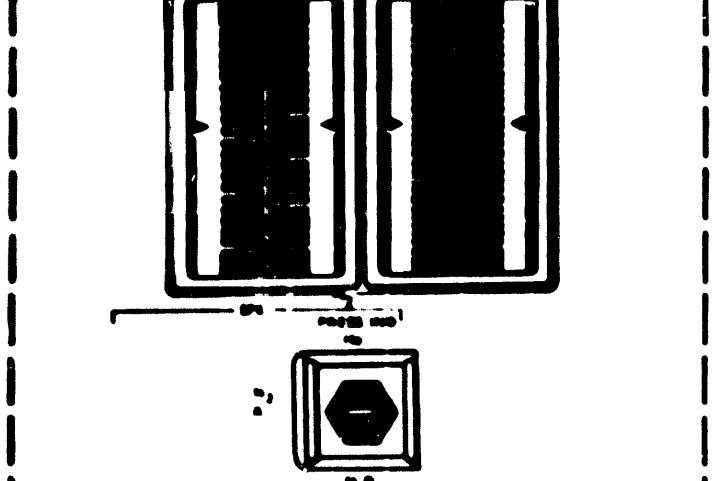
TO CMRCS ENGINE 22 AUTO COILS

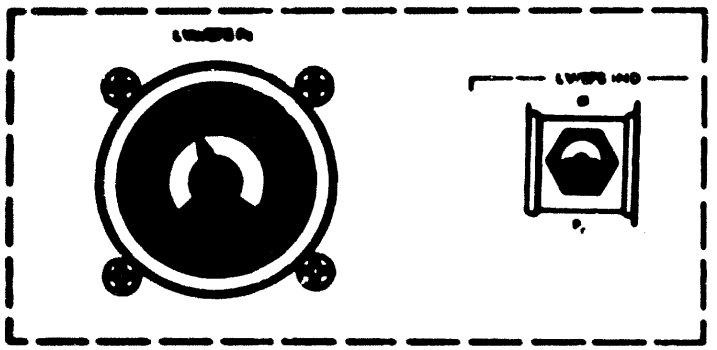
TO SMRCS ENGINE A3 AUTO COILS
TO CMRCS ENGINE 23 AUTO COILS
TO SMRCS ENGINE C3 AUTO COILS
TO CMRCS ENGINE 13 AUTO COILS
TO SMRCS ENGINE A4 AUTO COILS
TO CMRCS ENGINE 14 AUTO COILS
TO SMRCS ENGINE C4 AUTO COILS
TO CMRCS ENGINE 24 AUTO COILS
TO SMRCS ENGINE B3 AUTO COILS
TO CMRCS ENGINE 15 COILS
TO SMRCS ENGINE D3 AUTO COILS
TO CMRCS ENGINE 25 AUTO COILS
TO SMRCS ENGINE B4 AUTO COILS
TO CMRCS ENGINE 26 AUTO COILS
TO SMRCS ENGINE D4 AUTO COILS
TO CMRCS ENGINE 16 AUTO COILS
TO SMRCS ENGINE B3 DIRECT COILS

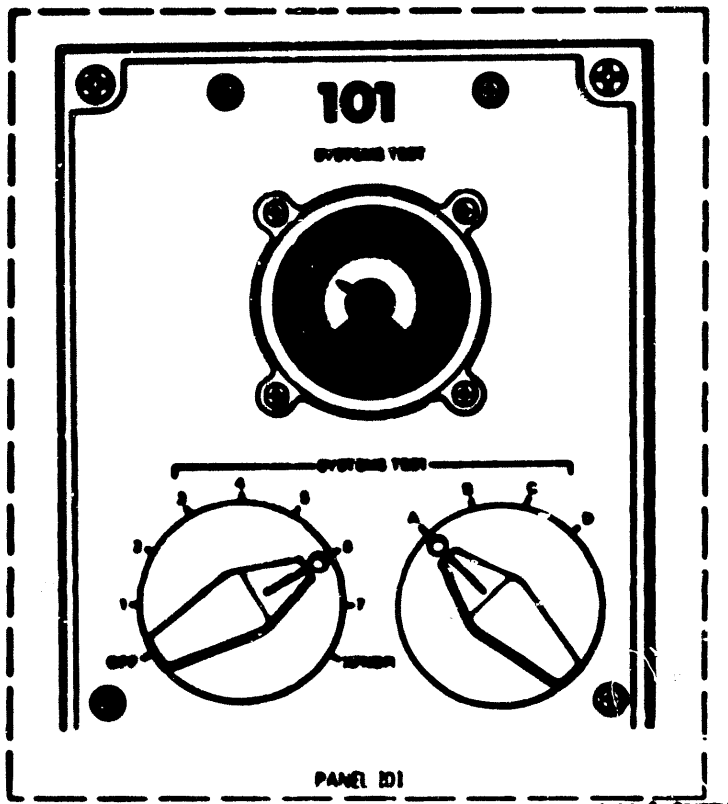

TO SMRCS ENGINE B3 DIRECT COILS
TO CMRCS ENGINE I3 DIRECT COILS
TO SMRCS ENGINE D3 DIRECT COILS
TO CMRCS ENGINE 23 DIRECT COILS
TO SMRCS ENGINE D4 DIRECT COILS
TO CMRCS ENGINE 16 DIRECT COILS
TO SMRCS ENGINE B4 DIRECT COILS
TO CMRCS ENGINES 26 DIRECT COILS
TO SMRCS ENGINE C3 DIRECT COILS
TO CMRCS ENGINE I3 DIRECT COILS
TO SMRCS ENGINE A3 DIRECT COILS
TO CMRCS ENGINE 23 DIRECT COILS
TO SMRCS ENGINE A4 DIRECT COILS
TO CMRCS ENGINE 14 DIRECT COILS
TO SMRCS ENGINE C4 DIRECT COILS
TO CMRCS ENGINE 24 DIRECT COILS
TO SMRCS ENGINE C1 DIRECT COILS
TO CMRCS ENGINE I1 DIRECT COILS
TO SMRCS ENGINE A1 DIRECT COILS
TO SMRCS ENGINE B1 DIRECT COILS
TO SMRCS ENGINE D1 DIRECT COILS
TO CMRCS ENGINE 21 DIRECT COILS
PANEL 3
PANEL 2
PANEL 1


TO SMRCS ENGINE D1 DIRECT COILS
TO CMRCS ENGINE 21 DIRECT COILS
TO SMRCS ENGINE C2 DIRECT COILS
TO CMRCS ENGINE 12 DIRECT COILS
TO SMRCS ENGINE A2 DIRECT COILS
TO SMRCS ENGINE B2 DIRECT COILS
TO SMRCS ENGINE D2 DIRECT COILS
TO CMRCS ENGINE 22 DIRECT COILS
ROTATION CONTROL NO. 1
ROTATION CONTROL NO. 2
S2 TRANSFER MOTOR
S1 TRANSFER MOTOR
DEADFACED ON LES ABORTS OR AT CM SM SEP
RCS CONTROL BOX


28 VDC
28VDC
INSTRUMENTATION POWER S28A042
SP0601P SEC GN2 TNK PRESS
TO TLM
TO PANEL 3 METER
5VDC
SP0023H BALL VALVE POSITION 2B
SP0025H BALL VALVE POSITION 4B
SP0026H BALL VALVE POSITION 1A
SP0028H BALL VALVE POSITION 3A
INSTRUMENTATION POWER S28A144
SP0035P HEL TANK PRESS
INSTRUMENTATION POWER S28A184
SP0002T HEL TANK TEMP
INSTRUMENTATION POWER S28A179
SP0931P CDX INTERFACE PRESS
INSTRUMENTATION POWER S28A186
SP0004P FUEL ULLAGE PRESS
TO PANEL 2 C/W SPS PRESS
INSTRUMENTATION
SP0004T TEMP







- S28PS1 POWER SUPPLY
  - INSTRUMENTATION POWER S28AR179 → SP0662P FUEL INTERFACE PRESS → TO TLM
  - INSTRUMENTATION POWER S28AR86 → SP0006P FUEL ULLAGE PRESS → TO TLM; TO PANEL 2 C/W SPS PRESS; TO PANEL 3 METER
  - INSTRUMENTATION POWER S28AR21 → SP0004T TEMP OX ENGINE FEEDLINE → TO TLM; TO PANEL 101 (5A)
  - INSTRUMENTATION POWER S28AR138 → SA2401T FUEL TRANS FER LINE ENTRY SUMP TANK CSM 106 & 107 ONLY → TO TLM
  - INSTRUMENTATION POWER S28AR128 → SA2378T TEMP BAY 3 OX TANK SURFACE → TO TLM
  - INSTRUMENTATION POWER S28AR115 → SA2380T TEMP BAY 6 FUEL TANK SURFACE → TO TLM
  - INSTRUMENTATION POWER S28AR19 → SP0005T TEMP FUEL LINE DISTRIBUTION LINE → TO TLM
  - INSTRUMENTATION POWER S28AR17 → SP0045T TEMP ENGINE VAVLE BODY → TO TLM
- S28PS3 POWER SUPPLY
  - 5VDC → SP0022H BALL VALVE POSITION 1B → TO TLM
  - 5VDC → SP0024H BALL VALVE POSITION 3B → TO TLM
  - 5VDC → SP0027H BALL VALVE POSITION 2A → TO PANEL 3 METER
  - 5VDC → SP0029H BALL VALVE POSITION 4A → TO PANEL 3 METER
- INSTRUMENTATION POWER S28AR9 → SP0661P CHAMBER PRESS → TO TLM; TO PANEL 1 METER
- INSTRUMENTATION POWER S28AR41 → SP0600P PRI GN2 TNK PRESS → TO TLM; TO PANEL 3 METER
- INSTRUMENTATION POWER S28AR3 → SP0001P HEL TANK PRESS → TO TLM; TO PANEL 3 METER
- INSTRUMENTATION POWER S28AR178 → SP0930P FUEL INTERFACE PRESS → TO TLM
- INSTRUMENTATION POWER S28AR5 → SP0003P OX ULLAGE PRESS → TO TLM; TO PANEL 2 C/W SPS PRESS; TO PANEL 3 METER
- INSTRUMENTATION POWER S28AR20 → SP0048T TEMP FUEL ENGINE FEEDLINE → TO TLM; TO PANEL 3 METER
- INSTRUMENTATION POWER S28AR18 → SP0054T OX DISTRIBUTION LINE → TO TLM

PANEL 101

INSTRUMENTATION POWER S28AR20 → SP0048T TEMP FUEL ENGINE FEEDLINE → TO TLM; TO PANEL 3 METER

INSTRUMENTATION POWER S28AR18 → SP0054T #1 OX DISTRIBUTION LINE → TC TLM

INSTRUMENTATION POWER S28AR116 → SA2377T TEMP BAY 2 OX TANK SURFACE → TO TLM

INSTRUMENTATION POWER S28AR119 → SA2379T TEMP BAY 5 FUEL TANK SURFACE → TO TLM

INSTRUMENTATION POWER S28AR117 → SA2400T OX TRANS FER LINE ENTRY SUMP TANK CSM 106 & 107 ONLY → TO TLM

PANEL 3

POWER
SCE
NORM
AUX

MNA BUS A 28 VDC

MNB BUS B 28 VDC

FLT BUS MNA → CB3

FLT BUS MNB → CB4

316 CONDR FLT BUS → CB16

PANEL 2

PANEL 3

C131A106 SIGNAL CONDITIONING → SP0061T SPS ENG FLANGE TEMP → TO TLM; TO PANEL 2 C/W SPS ENG FLANGE TEMP HI

C131A106 SIGNAL CONDITIONING → SP0062T SPS ENG FLANGE TEMP → TO TLM

INSTRUMENTATION POWER S28A9

INSTRUMENTATION POWER SM RCS QUAD A S28A10 → SR5001P HEL TANK PRESS → TO TLM; TO PANEL 2 METER

→ SR5013T HEL TANK TEMP → TO TLM; TO PANEL 2 METER

→ SR5025Q HEL PRESS/TEMP RATIO → TO TLM; TO PANEL 2 METER

→ SR5729P MANF PRESS → TO TLM

→ SR5733P OX LINE PRESS → TO TLM

→ SR5065T PKG TEMP → TO TLM; TO PANEL 2 C/W SM RCS A; TO PANEL 2 METER

→ SR5737 SEC FUEL PRESS → TO TLM; TO PANEL 2 C/W SM RCS A; TO PANEL 2 METER

INSTRUMENTATION POWER SM RCS QUAD C S28A10 → SR5003P HEL TANK PRESS → TO TLM; TO PANEL 2 METER

→ SR5015T HEL TANK TEMP → TO TLM; TO PANEL 2 METER

→ SR5027Q HEL PRESS/TEMP RATIO → TO TLM; TO PANEL 2 METER

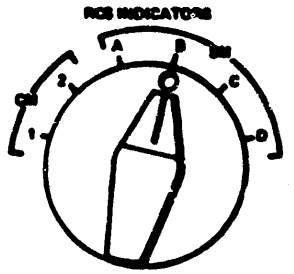
→ SR5820P OX LINE PRESS → TO TLM

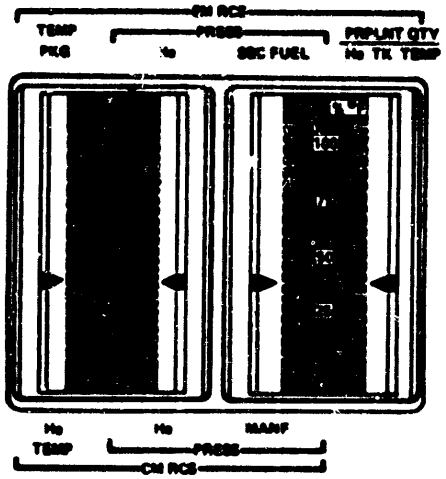
→ SR5822P SEC FUEL PRESS → TO TLM; TO PANEL 2 C/W SM RCS C

SM RCS HID He TK TEMP

FRPLNT QTY

RCS INDICATORS





PANEL 2

INSTRUMENTATION POWER SMRCS QUAD C S28A10

- SR5015T HEL TANK TEMP → TO PANEL 2 METER
- SR5027Q HEL PRESS/TEMP RATIO → TO TLM; TO PANEL 2 METER
- SR5820P OX LINE PRESS → TO TLM
- SR5822P SEC FUEL PRESS → TO TLM; TO PANEL 2 C/W SM RCS C; TO PANEL 2 METER
- SR5817P MANF PRESS → TO TLM
- SR5047T PKG TEMP → TO TLM; TO PANEL 2 C/W SM RCS C; TO PANEL 2 METER

INSTRUMENTATION POWER SMRCS QUAD B S28A10

- SR5002P HEL TANK PRESS → TO TLM; TO PANEL 2 METER
- SR5014T HEL TANK TEMP → TO TLM; TO PANEL 2 METER
- SR5026Q HEL PRESS/TEMP RATIO → TO TLM; TO PANEL 2 METER
- SR5776P MANF PRESS → TO TLM
- SR5780P OX LINE PRESS → TO TLM
- SR5784P SEC FUEL PRESS → TO TLM; TO PANEL 2 C/W SM RCS B; TO PANEL 2 METER
- SR5066T PKG TEMP → TO TLM; TO PANEL 2 C/W SM RCS B; TO PANEL 2 METER

INSTRUMENTATION POWER SMRCS QUAD D S28A10

- SR5004P HEL TANK PRESS → TO TLM; TO PANEL 2 METER
- SR5016T HEL TANK TEMP → TO TLM; TO PANEL 2 METER
- SR5028Q HEL PRESS/TEMPER RATIO → TO TLM; TO PANEL 2 METER
- SR5821P OXLINE PRESS → TO TLM
- SR5823P SEC FUEL PRESS → TO TLM; TO PANEL 2 METER; TO PANEL 2 C/W SM RCS D
- SR5830P MANF PRESS → TO TLM
- SR5068T PKG TEMP → TO TLM; TO PANEL 2 METER; TO PANEL 2 C/W SM RCS D

INSTRUMENTATION POWER S28A12 → INSTRUMENTATION POWER S28A7

CB1

INSTRUMENTATION POWER C28A6

- CR0038P HEL MANF SYSTEM 2 → TO PANEL 2 C/W CM RCS 2; TO PANEL 2 METER
- CR0035P HEL MANF SYSTEM 1 → TO TLM; TO PANEL 2 C/W CM RCS 1
- CR0001P HEL TANK PRESS → TO TLM; TO PANEL 2 METER
- CR0003P HEL TANK TEMP → TO TLM; TO PANEL 2 METER
- CR2103T 16 ENG INJECT TEMP → TO PANEL 101 METER (6C)
- CR2114T 12 ENG INJECT TEMP → TO PANEL 101 METER (6A)

CB2

INSTRUMENTATION POWER C28A6

- CR0002P HEL TANK PRESS → TO TLM; TO PANEL 2 METER

CR0001P HEL TANK PRESS → TO TLM; TO PANEL 2 METER

CR0003P HEL TANK TEMP → TO TLM; TO PANEL 2 METER

CR2103T 16 ENG INJECT TEMP → TO PANEL 101 METER (6C)

CR2114T 12 ENG INJECT TEMP → TO PANEL 101 METER (6A)

CB2

INSTRUMENTATION POWER C28A4

PANEL 276

CR0002P HEL TANK PRESS → TO TLM; TO PANEL 2 METER

CR0004T HEL TANK TEMP → TO TLM; TO PANEL 2 METER

CR0036P HEL MANF SYSTEM 2 → TO TLM; TO PANEL 2 C/W CM RCS 2

CR0037P HEL MANF SYSTEM 1 → TO PANEL 2 C/W CM RCS 1; TO PANEL 2 METER

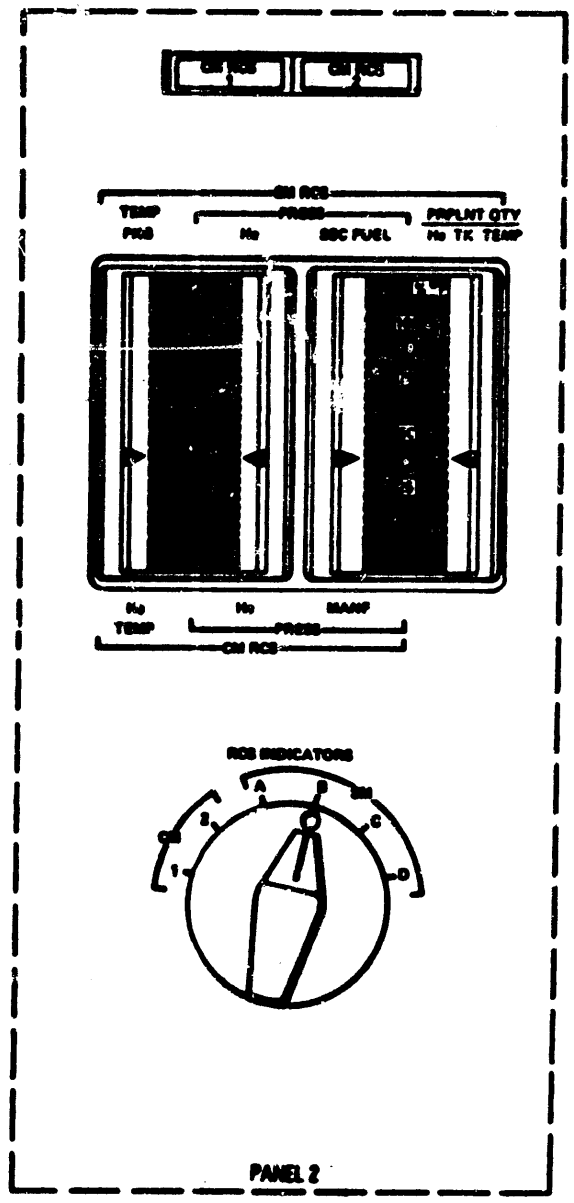
CR2116T 25 ENG INJECT TEMP → TO PANEL 101 METER (5D)

CR2119T 21 ENG INJECT TEMP → TO PANEL 101 METER (6D)

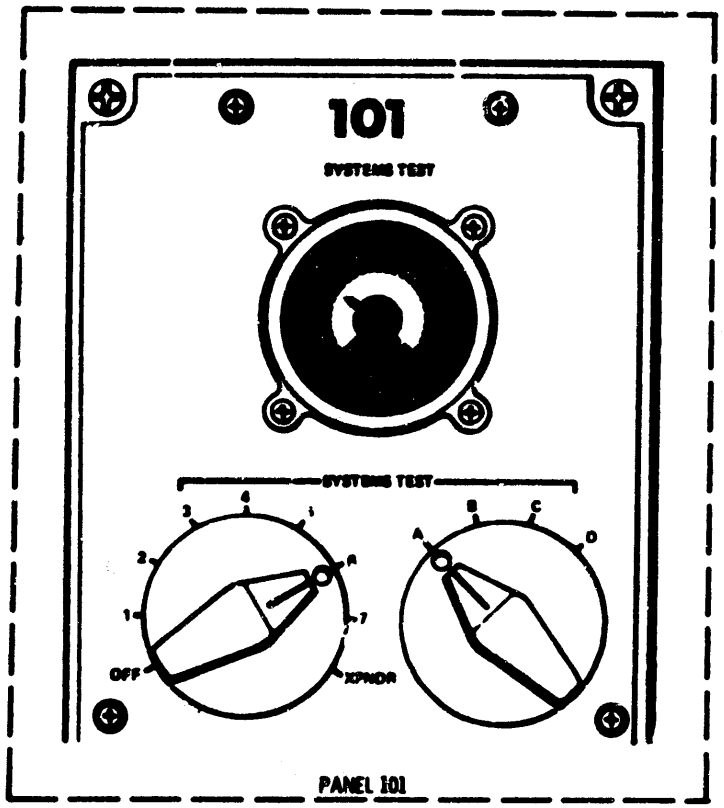
CR2100T 14 ENG INJECT TEMP → TO PANEL 101 METER (6B)

CR2110T 24 ENG INJECT TEMP → TO PANEL 101 METER (5C)

INSTRUMENTATION POWER C28A5



PANEL 2



PANEL 101

CSM PROPULSION POWER DISTRIBUTION

(CSM106 THROUGH CSM111)

P-0003