

Spacehab Malfunction Procedures and Systems Data

**Mission Operations Directorate
Operations Division**

**Generic, Rev A
June 21, 2006**

NOTE

For STS-116 and subsequent flights

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



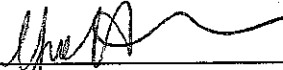
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**SPACEHAB MALFUNCTION PROCEDURES
AND SYSTEMS DATA**

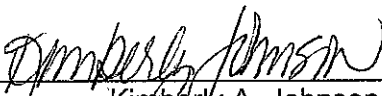
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June 21, 2006

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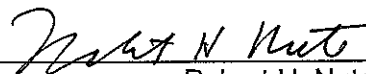
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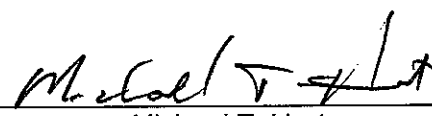
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SPACEHAB MALFUNCTION PROCEDURES
AND SYSTEMS DATA

LIST OF EFFECTIVE PAGES

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REV A 06/21/06

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– Prelift-off information required

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EPS

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EPS

1.1a '214 SH EMG BUS V' ↑↓

SM ALERT

214 SH EMG BUS V

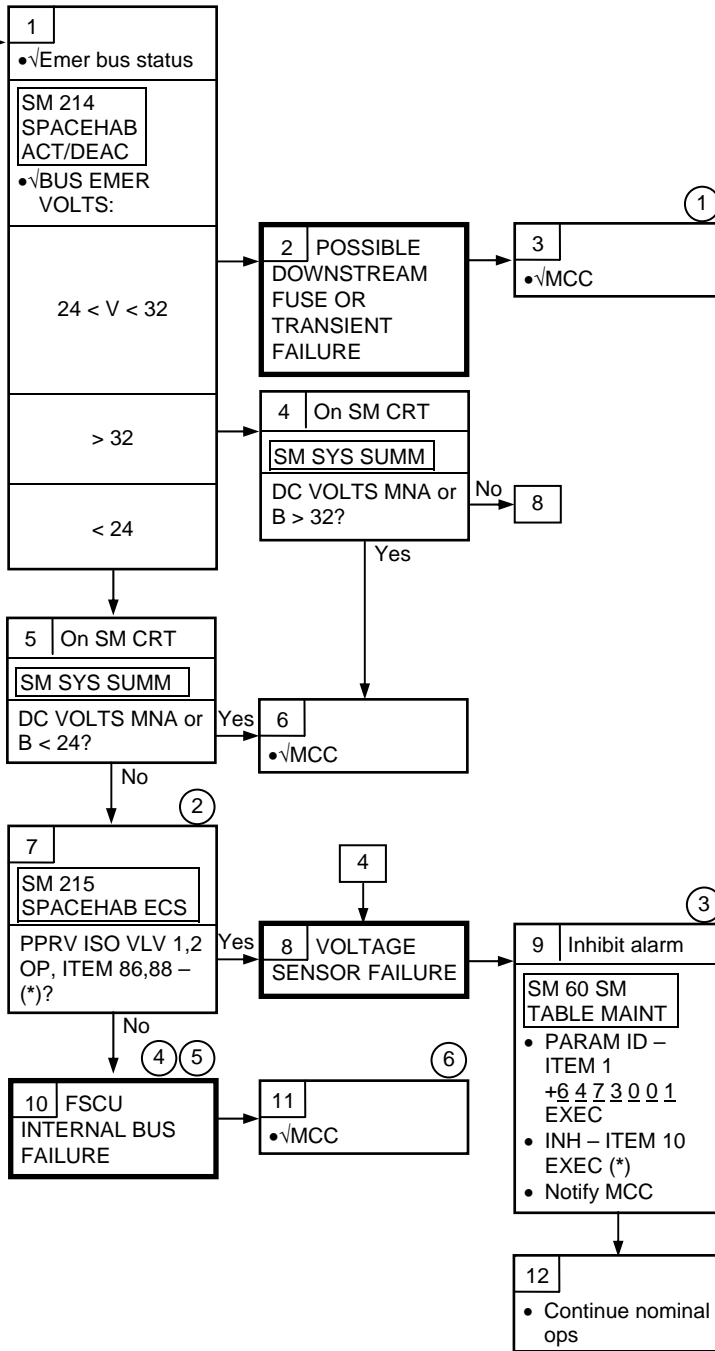
If BUS EMER volts < 24 or > 32

Nominal Config:
ORBITER:

SM 215
SPACEHAB ECS

PPRV ISO VLV 1,2
(two) OP, ITEM
86,88 - (*)
(R1)

PL AUX - ON
AFT MNB - ON



- ① Ground will use present and historical data to assess fuse health
- ② PPRV ISO VLV 1,2 OP is microswitch indication pwr'd by FSCU INT bus
- ③ FDA can be inhibited by MCC ground command
- ④ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ⑤ Possible cause is failure of FSCU fuses F5 & F6
- ⑥ IFM-3.1 can be performed to check fuse continuity

EPS

**1.1b '214 SH AUX BUS A' ↑ OR
'214 SH AFT BUS A' ↑**

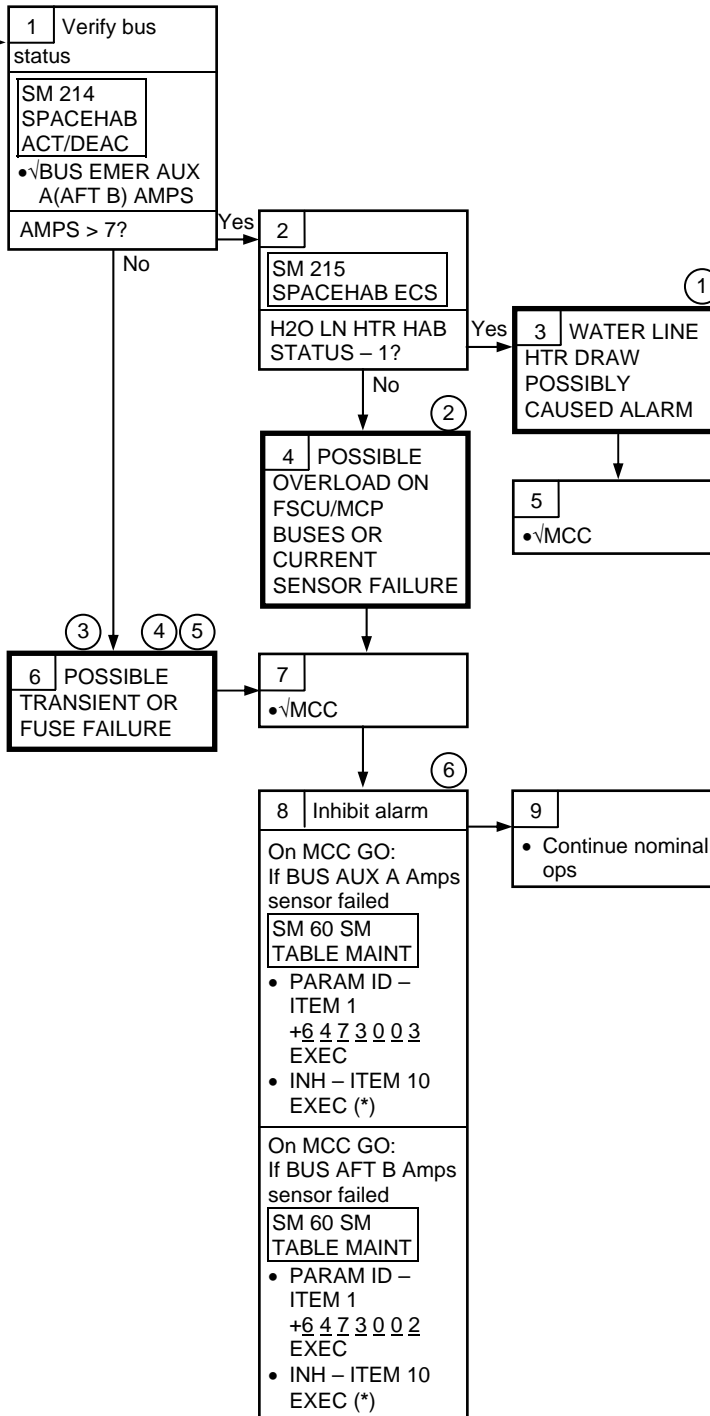
SM ALERT

214 SH AUX BUS A

214 SH AFT BUS A

If AUX A or AFT B amps > 7

Nominal Config:
ORBITER:
(R1)
PL AUX – ON
AFT MNB – ON



- ① H2O line htrs draw 90 W from Aft B Bus only. If Aux A and Aft B not splitting total load evenly, additional htr draw may cause alarm
- ② MCC will use ORB bus data and end item performance to gain insight
- ③ Possible equipment short may have blown fuse. MCC will verify bus status and end item function
- ④ IFM-3.1 can be performed to check fuse continuity
- ⑤ Refer to BUS/CRITICAL EQUIPMENT LOSS table for indications of FSCU INT, FSCU EMER1, MCP INT, or MCP EMER 2 bus failure
- ⑥ FDA can be inhibited by MCC ground command

EPS

**1.1c '214 SH MN BUS V' ↑↓ OR
'214 SH SEC BUS V' ↑↓**

SM ALERT

214 SH MN BUS V

214 SH SEC BUS V

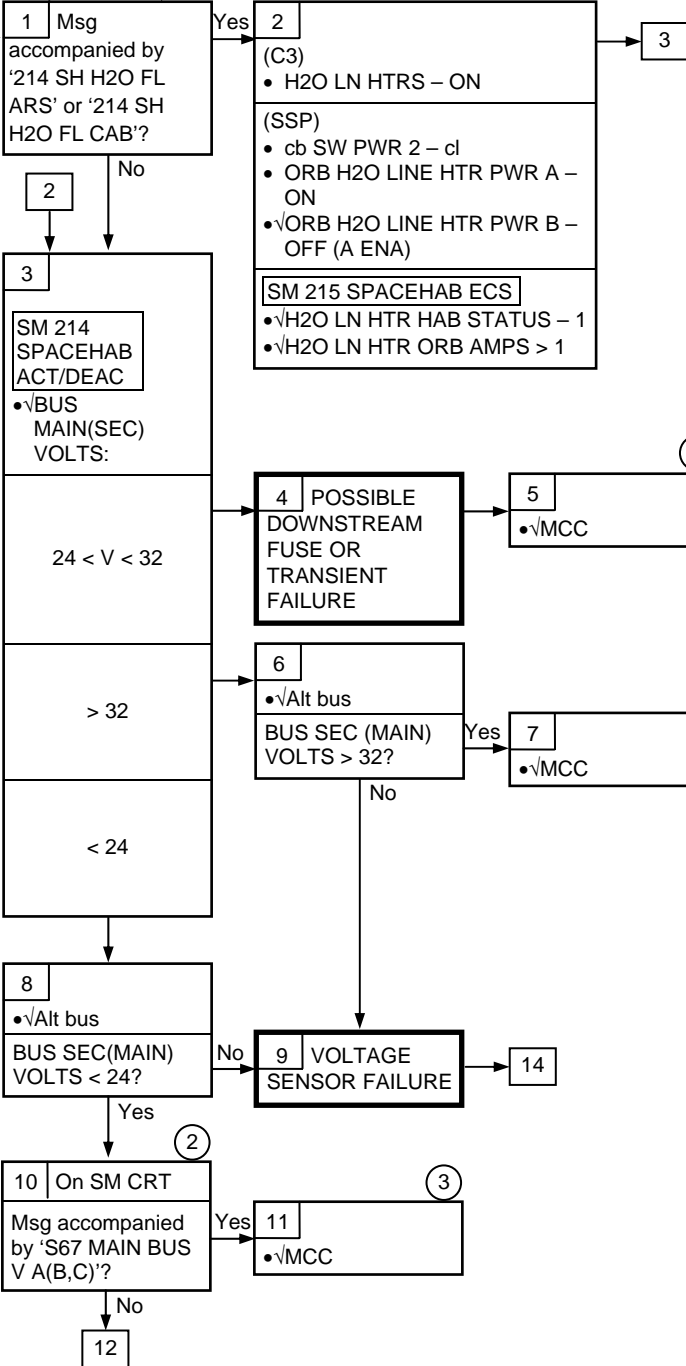
If MAIN(SEC) volts < 24 or > 32

Nominal Config:
ORBITER:

SM 214 SPACEHAB ACT/DEAC

BUS SEC - ON (SSP)
ORB SEC DC BUS tb - gray

1.1d	2	
1.1f	2	1.2d 4
1.1h	2	1.2h 9
1.1j	2	1.2k 2

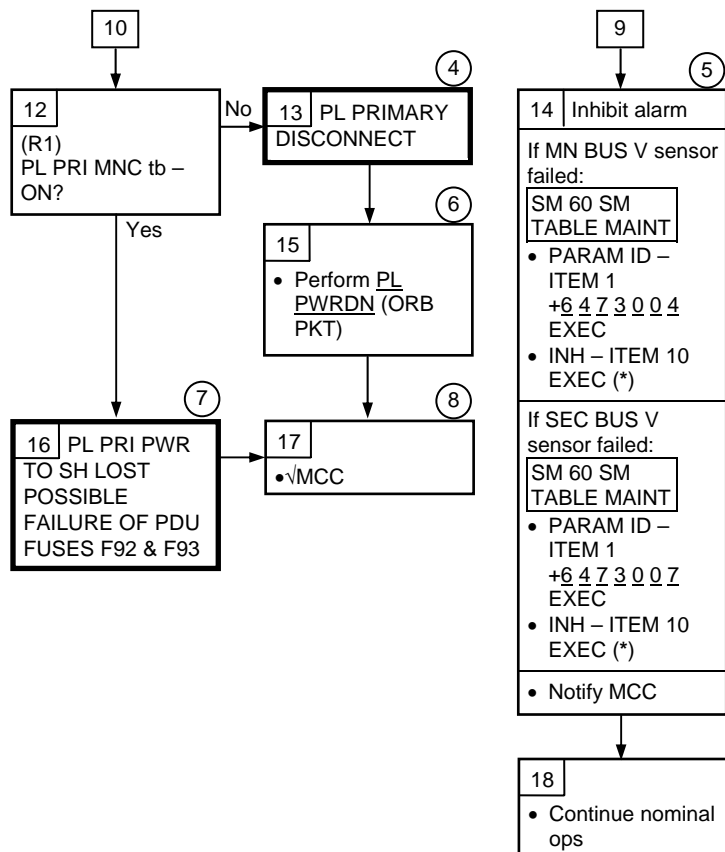


① Ground will use present and historical data to assess fuse health

② Following msgs also displayed:
'214 SH EXP BUS V'
'214 SH WFCEU V'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
If WFCEU in mode 1,
'215 SH WFCEU MODE'

③ Failure may be caused by an orbiter problem

EPS 1.1c (Cont)



- ④ PL PRI disconnect could be inadvertent or due to a PL powerdown
- ⑤ FDA can be inhibited by MCC ground command
- ⑥ Recovery via PL PRI Temporarily Lost procedure of ORB PKT C/L puts all PL PRI equip in proper configuration to be repowered when PL PRI is restored
- ⑦ Fuses F92 & F93 are inside PDU and inaccessible during flight. Fuses are 150 amp
- ⑧ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts

EPS

1.1d '214 SH WFCEU V' ↑↓

SM ALERT

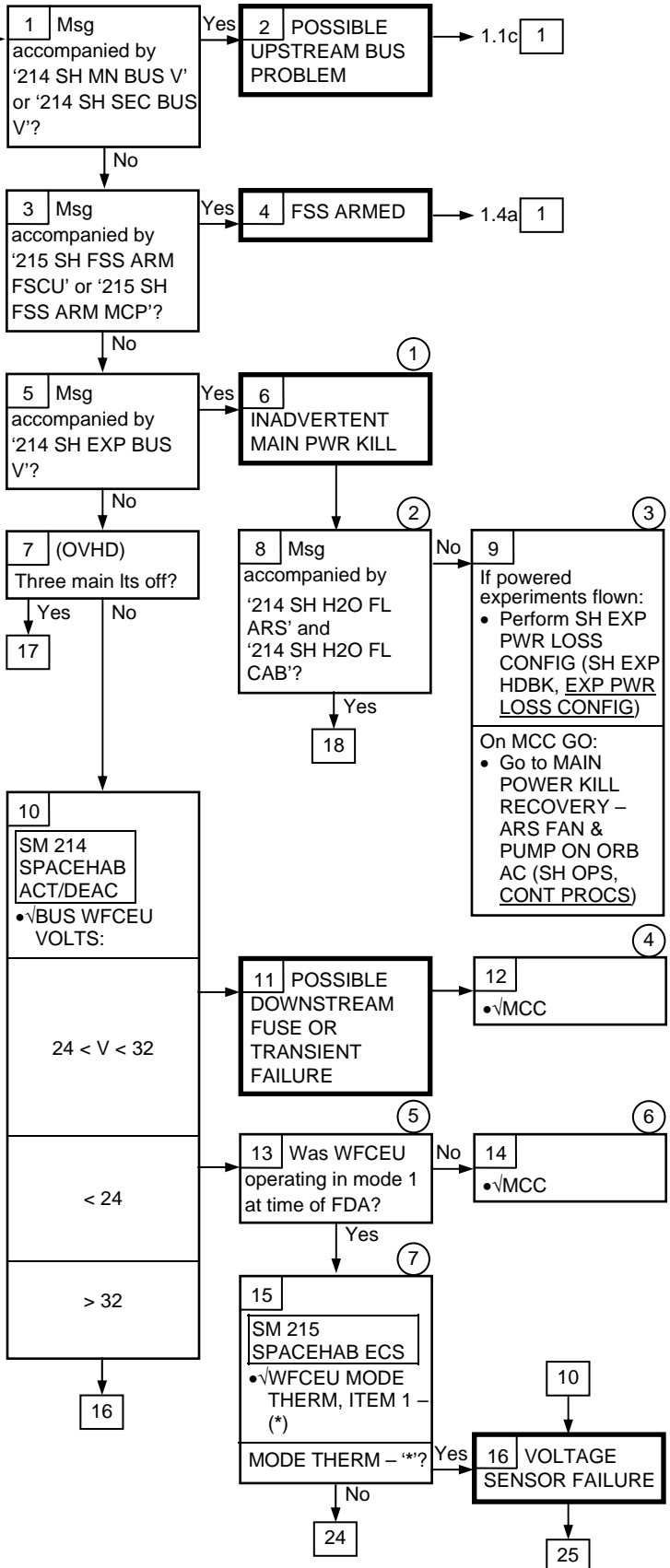
214 SH WFCEU V

If BUS WFCEU volts < 24 or > 32

Nominal Config:
ORBITER:

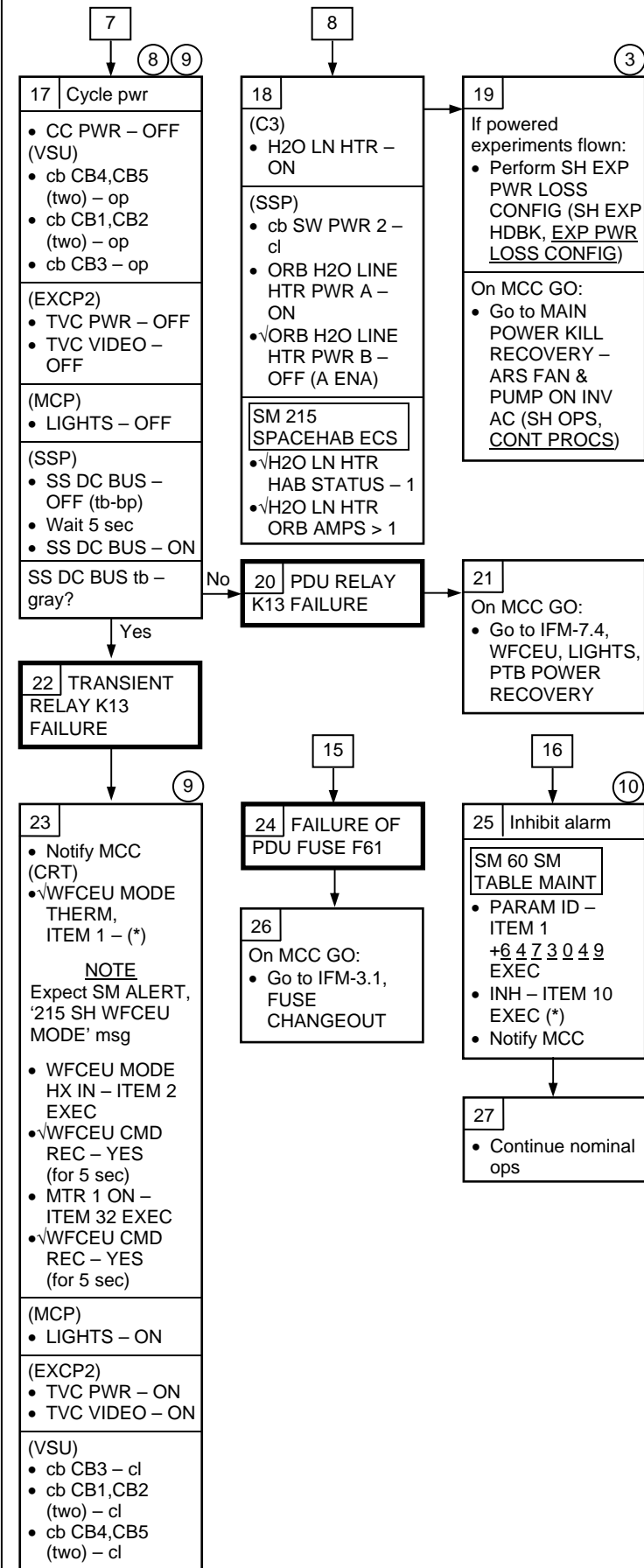
SM 214 SPACEHAB ACT/DEAC

DC PTB/CCTV ON, ITEM 27 - (*)
BUS WFCEU - ON (SSP)
SS DC BUS tb - gray (R1)
PL PRI MNC tb - ON



- ① Following msgs also displayed
If Hab fan ON:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
If WFCEU in mode 1:
'215 SH WFCEU MODE'
- ② MN PWR KILL will take down SH water pump if powered by SH INV; thus water line heaters will need to be activated. Water pump will not be affected if on ORB AC. Recovery procedures different if pump powered by ORB AC vs INV
- ③ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments
- ④ Ground will use present and historical data to assess fuse health
- ⑤ Nominal operating mode of WFCEU is mode 2
- ⑥ If WFCEU is operating in modes 2 or 3, POCC analysis (via good relay K2-K14 current measurements) is reqd to determine failure mode
- ⑦ If WFCEU is operating in MODE THERM, loss of pwr to WFCEU will cause loss of MODE THERM ind

EPS 1.1d (Cont)



(3) SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments

(8) K13 relay failure. MCC will assess health of K14 relay and determine whether to cycle pwr via ground command or crew action. K13 can only be powered off via the SS DC BUS switch on the SSP, which would also power off the K14 relay

(9) Video pwrdn and pwrup steps not required for missions without CC in SH Module

(10) FDA can be inhibited by MCC ground command

EPS

1.1e '214 SH SS BUS A' ↑

SM ALERT

214 SH BUS A SS

If SS amps > 98

Nominal Config:
ORBITER:

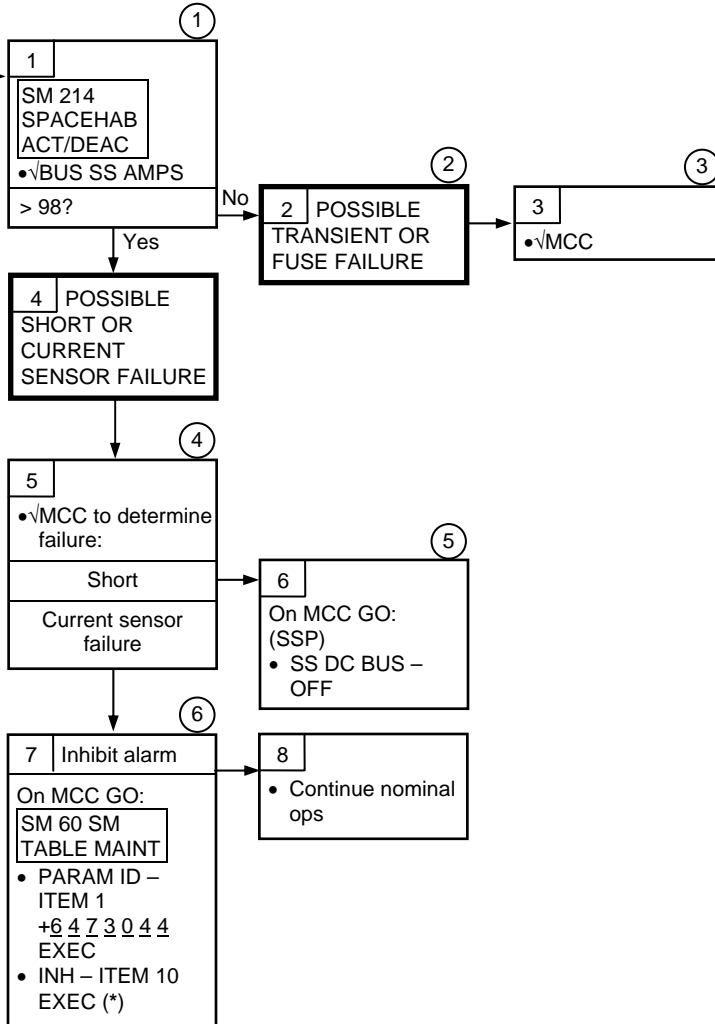
SM 214
SPACEHAB
ACT/DEAC

DC PTB/CCTV ON,
ITEM 27 – (*)

BUS WFCEU – ON
(SSP)

SS DC BUS tb –
gray
(R1)

PL PRI MNC tb –
ON



① POCC has information on relay K13,K14 contact currents not available on board. Sum of these current measurements should equal value of SS AMPS

② Fuse on relay K13(K14) input may have blown due to equipment short. SS current may be within limits after fuse failure. MCC will verify bus status and end item function

③ IFM-3.1, FUSE CHANGEOUT, can be performed to check fuse continuity

④ Ground will determine if bus short occurring. Erratic behavior of three of four fwd module lights could indicate a SS bus short

⑤ This scenario requires a sustained short in circuitry between SS bus current sensor and downstream fuses and is considered highly unlikely

⑥ FDA can be inhibited by MCC ground command

EPS

1.1f '214 SH EXP BUS V' ↑↓

SM ALERT

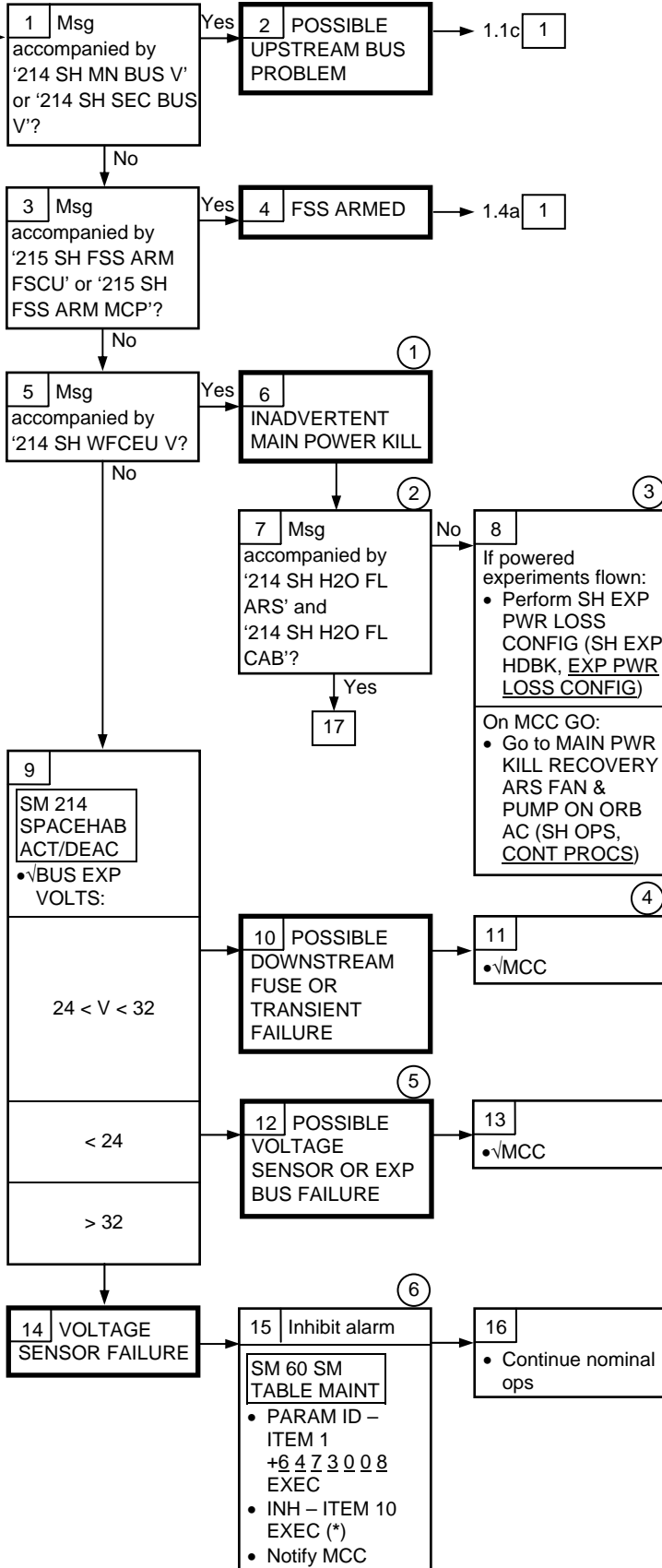
214 SH EXP BUS V

If EXP volts < 24 or > 32

Nominal Config:
ORBITER:

SM 214 SPACEHAB ACT/DEAC

DC EXP BUS ON, ITEM 3 – (*) (SSP)
EXP DC BUS tb – gray (R1)
PL PRI MNC tb – ON



① Following messages also displayed:
If Hab fan ON:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
If WFCEU in mode 1,
'215 SH WFCEU MODE'

② MN PWR KILL will take down SH water pump if powered by SH INV; thus water line heaters will need to be activated. Water pump will not be affected if on ORB AC. Recovery procedures different if pump powered by ORB AC vs INV

③ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments

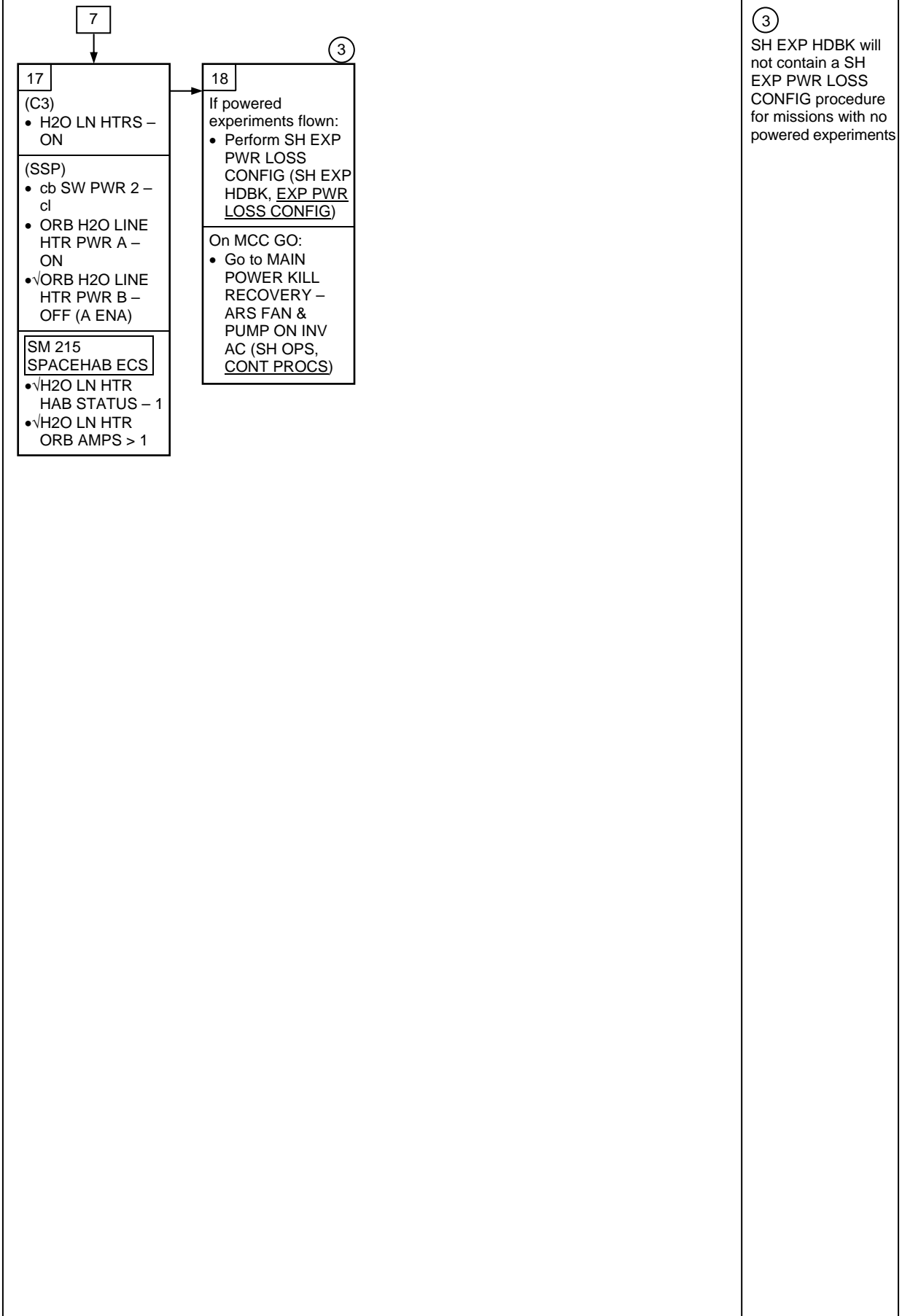
④ Ground will use present and historical data to assess

⑤ POCC has information on relay K2-K12 currents not available on board

⑥ FDA can be inhibited by MCC ground command

EPS

1.1f (Cont)



EPS

1.1g '214 SH EXP BUS A' ↑

SM ALERT

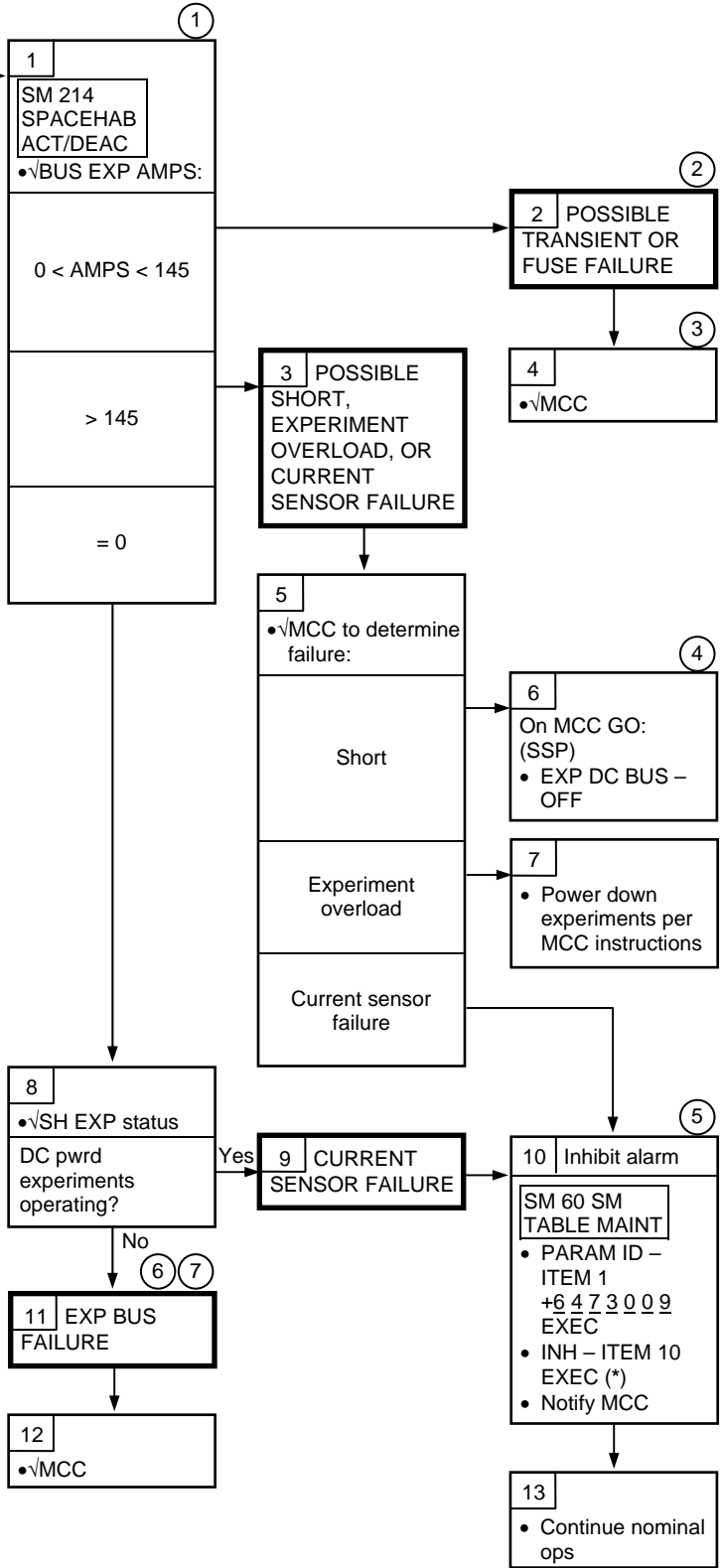
214 SH EXP BUS A

If BUS EXP amps > 145

Nominal Config:
ORBITER:

SM 214 SPACEHAB ACT/DEAC

DC EXP BUS ON, ITEM 3 – (*)
BUS EXP – ON (SSP)
EXP DC BUS tb – gray (R1)
PL PRI MNC tb – ON



① POCC has information on relay K2-K12 currents not available on board. Sum of these current measurements should equal value of EXP AMPS

② Fuse on relays K2-K12 may have blown due to equipment short. EXP current may be within limits after fuse failure. MCC will verify bus status and end item function

③ IFM-3.1, FUSE CHANGEOUT, can be performed to check fuse continuity

④ This scenario requires a sustained short in circuitry between the EXP bus current sensor and downstream fuses and is considered highly unlikely

⑤ FDA can be inhibited by MCC ground command

⑥ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts

⑦ Possible cause is failure of PDU relays PC2 and K16

EPS

1.1h '214 SH INV DC V' ↑↓

SM ALERT

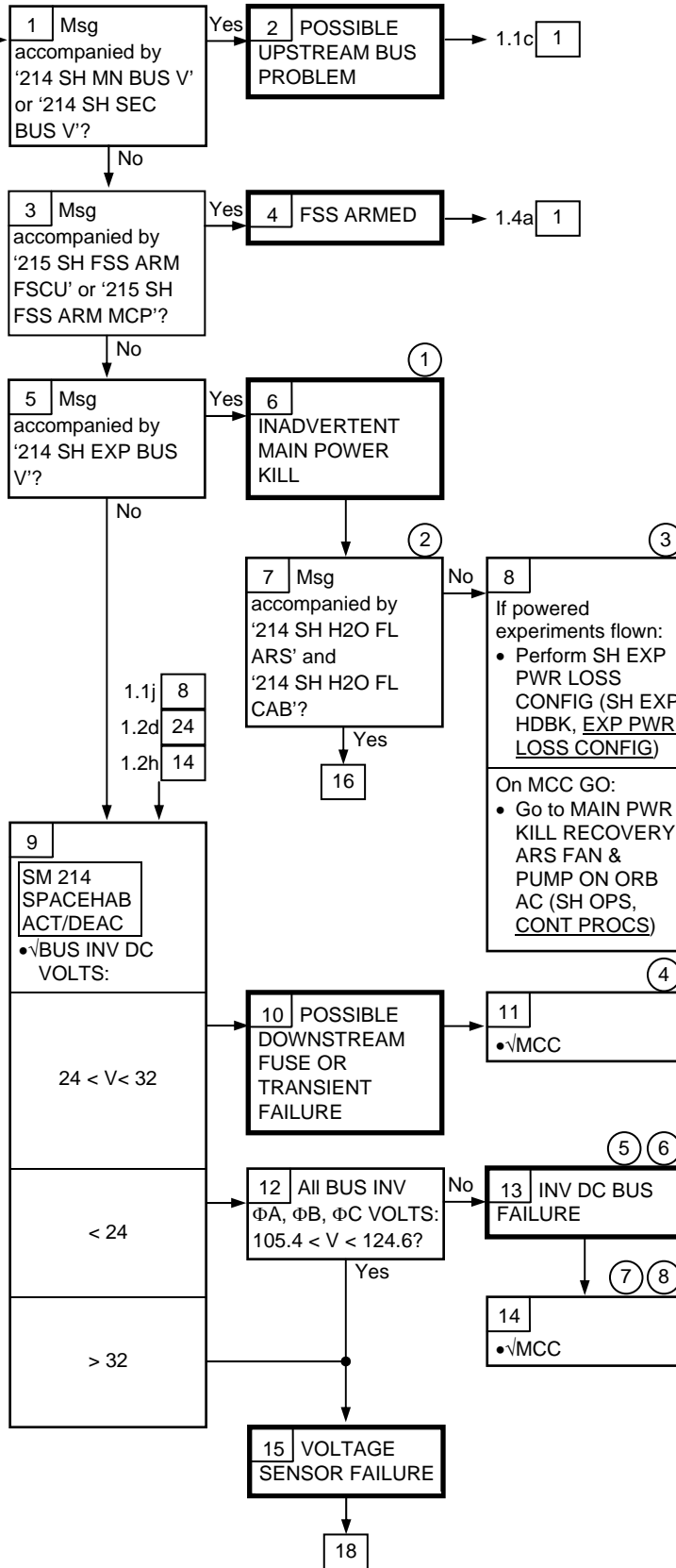
214 SH INV DC V

If: INV DC volts < 24 or > 32

Nominal Config:
ORBITER:

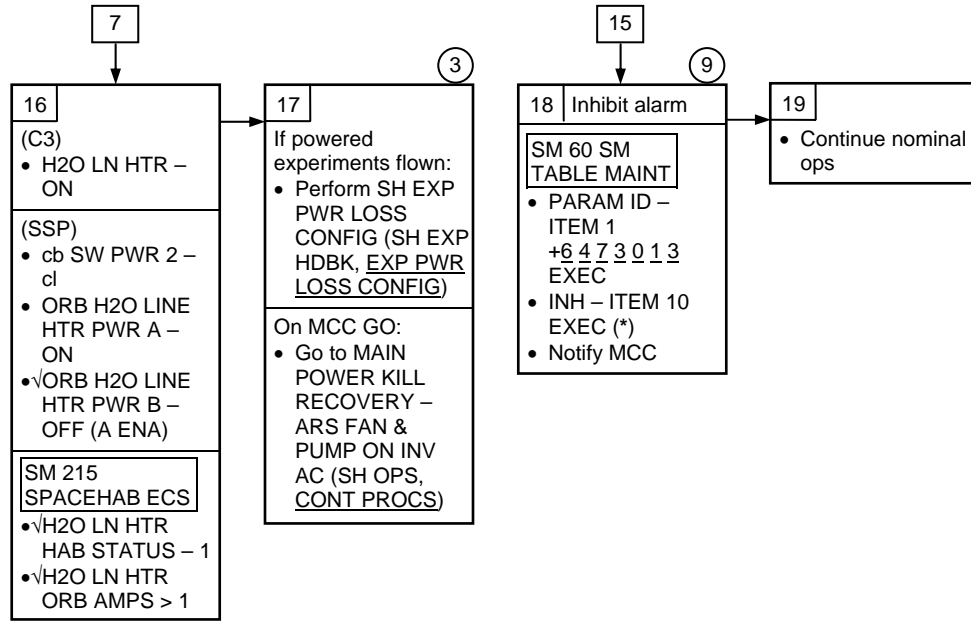
SM 214 SPACEHAB ACT/DEAC

DC INV ON – ITEM 1 – (*)
FANS ARS ORB, ITEM 65 – (*)
FANS CABIN ORB, ITEM 66 – (*)
H2O PUMP 2 ORB ITEM 73 – (*)
H2O PUMP 2 ON/1 OFF, ITEM 75 – (*)
(SSP)
INVERTER tb – gray (R1)
PL PRI MNC tb – ON
(MA73C:E)
cb AC3 PL 3Φ – cl



- ① Following messages also displayed:
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
'214 SH WFCEU V'
If WFCEU in mode 1, '215 SH WFCEU MODE'
If Hab fan ON:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'
- ② MN PWR KILL will take down SH water pump if powered by SH INV; thus water line heaters will need to be activated. Water pump will not be affected if on ORB AC. Recovery procedures different if pump powered by ORB AC vs INV
- ③ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG (SH EXP HDBK, EXP PWR LOSS CONFIG) procedure for missions with no powered experiments
- ④ Fuse protecting equipment may have blown due to equipment short. Voltage may be within limits after fuse blows. MCC will verify bus status and end item function
- ⑤ Possible cause is PDU relay K1 failure
- ⑥ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ⑦ IFM-7.1 can recover from failed PDU relay K1
- ⑧ MCC will determine whether to perform SSR-5 to swap subsystem equipment from INV AC to ORB. Waterline heaters will be needed if ORB AC not available

EPS 1.1h (Cont)



③ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments

⑨ FDA can be inhibited by MCC ground command

EPS

1.1i '214 SH INV DC A' ↑

SM ALERT

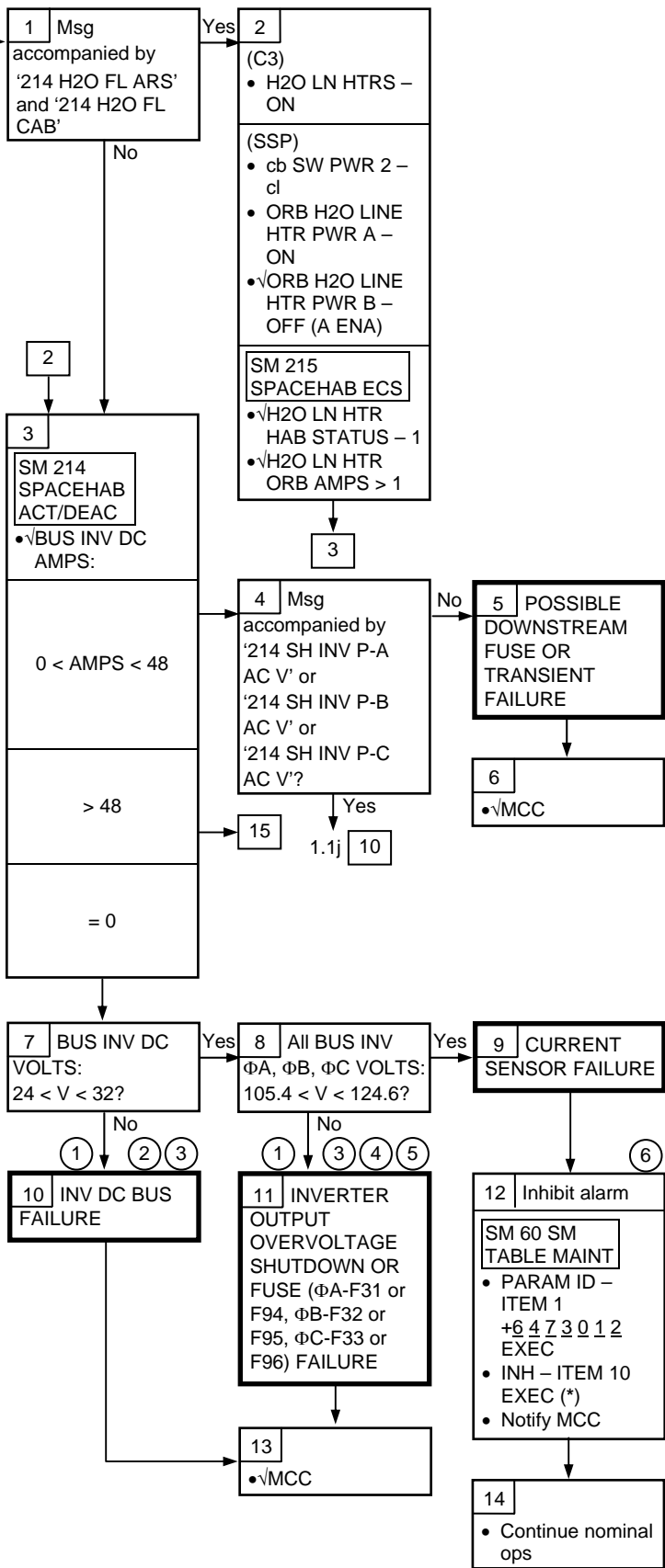
214 SH INV DC A

If INV DC amps > 48

Nominal Config:
ORBITER:

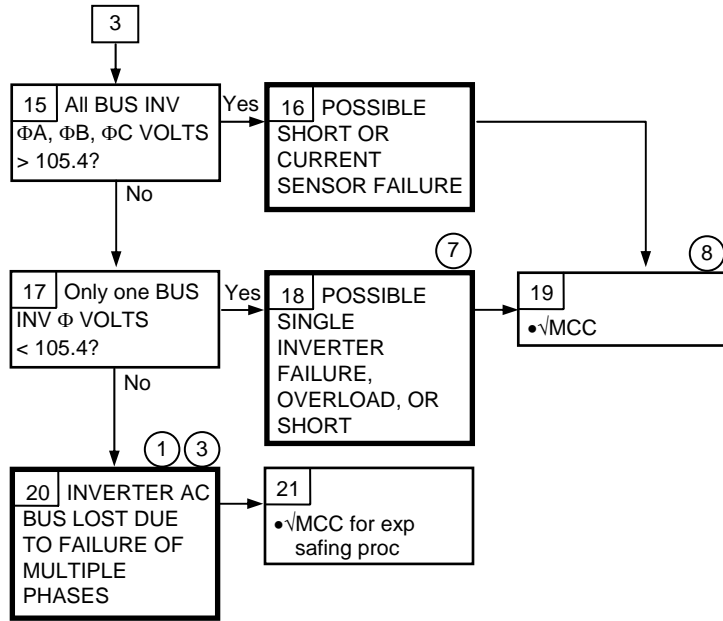
SM 214 SPACEHAB ACT/DEAC

DC INV ON, ITEM 1 – (*)
FANS ARS ORB, ITEM 65 – (*)
FANS CABIN ORB, ITEM 66 – (*)
H2O PUMP 2 ORB, ITEM 73 – (*)
H2O PUMP 2 ON/1 OFF, ITEM 75 – (*)
(SSP)
INVERTER tb – gray (R1)
PL PRI MNC tb – ON (MA73C:E)
cb AC3 PL 3Φ – cl



- ① Refer to BUS/CRITICAL EQUIPMENT LOSS for system impacts
- ② Possible cause is failure of PDU relay K1
- ③ MCC will determine whether to perform SSR-5 to swap subsystem equipment from INV AC to ORB AC. Waterline heaters will be needed if ORB AC not available
- ④ Inverter design incorporates automatic shutdown at 127 VAC to protect AC equipment from damage
- ⑤ IFM-3.1 can be performed to check fuses
- ⑥ FDA can be inhibited by MCC ground command

EPS 1.1i (Cont)



①
Refer to
BUS/CRITICAL
EQUIPMENT LOSS
for system impacts

③
MCC will determine
whether to perform
SSR-5 to swap
subsystem
equipment from INV
AC to ORB AC.
Waterline heaters
will be needed if
ORB AC not
available

⑦
Loss of one phase
will degrade
performance of INV
AC pwr'd equip and
exp

⑧
Ground analysis
includes calculation
of inverter input
using existing output
measurements and
inverter efficiency

EPS

1.1j '214 SH INV P-A(P-B,P-C) AC V' ↑↓

SM ALERT

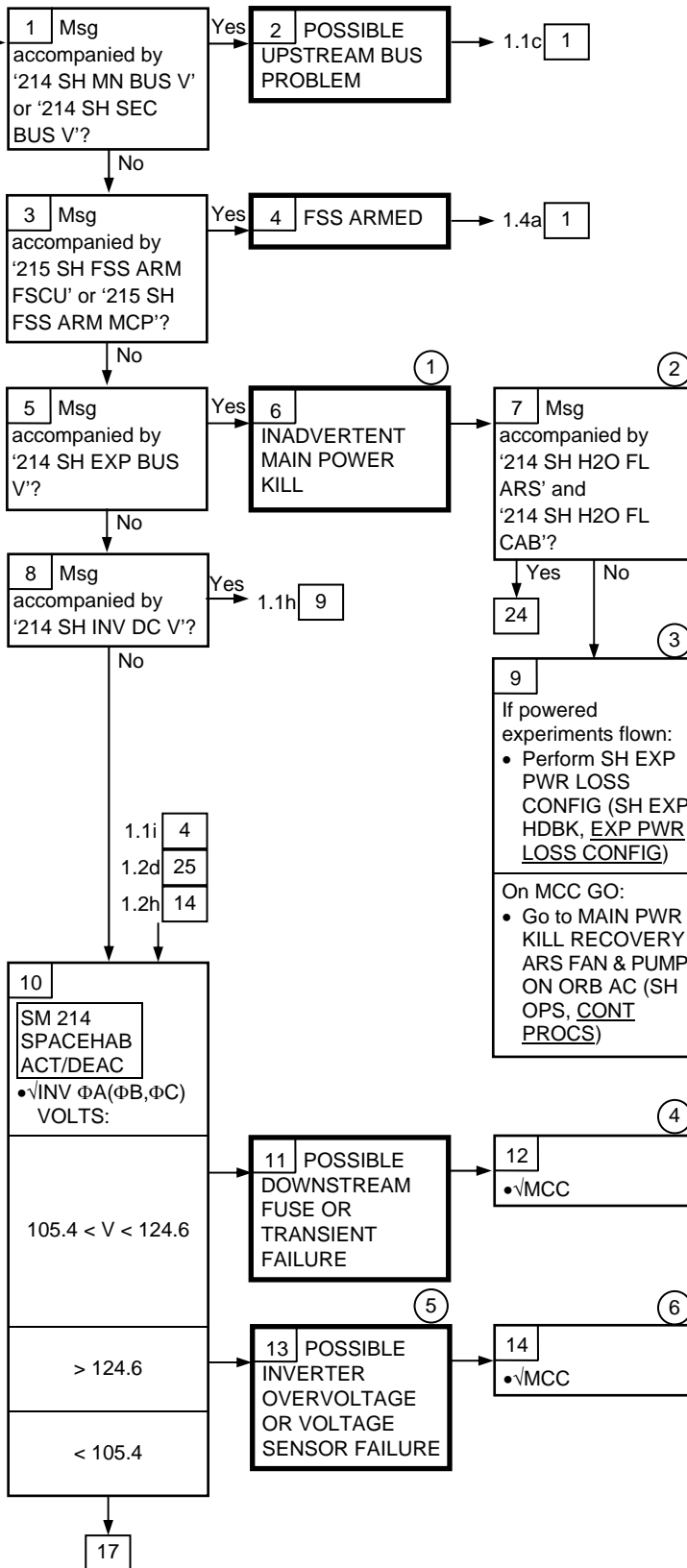
214 SH INV P-A (P-B, P-C) AC V

If INV $\phi A(\phi B, \phi C)$ volts < 105.4 or > 124.6

Nominal Config:
ORBITER:

SM 214 SPACEHAB ACT/DEAC

DC INV ON, ITEM 1 – (*)
FANS ARS ORB, ITEM 65 – (*)
FANS CABIN ORB, ITEM 66 – (*)
H2O PUMP 2 ORB, ITEM 73 – (*)
H2O PUMP 2 ON/1 OFF, ITEM 75 – (*) (SSP)
INVERTER tb – gray (R1)
PL PRI MNC tb – ON (MA73C:E)
cb AC3 PL 3 ϕ – cl



①
Following messages also displayed:
'214 SH INV DC V'
'214 SH WFCEU V'
If WFCEU in mode 1,
'215 SH WFCEU MODE'
If Hab fan ON:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'

②
MN PWR KILL will take down SH water pump if powered by SH INV; thus water line heaters will need to be activated. Water pump will not be affected if on ORB AC. Recovery procedures different if pump powered by ORB AC vs INV

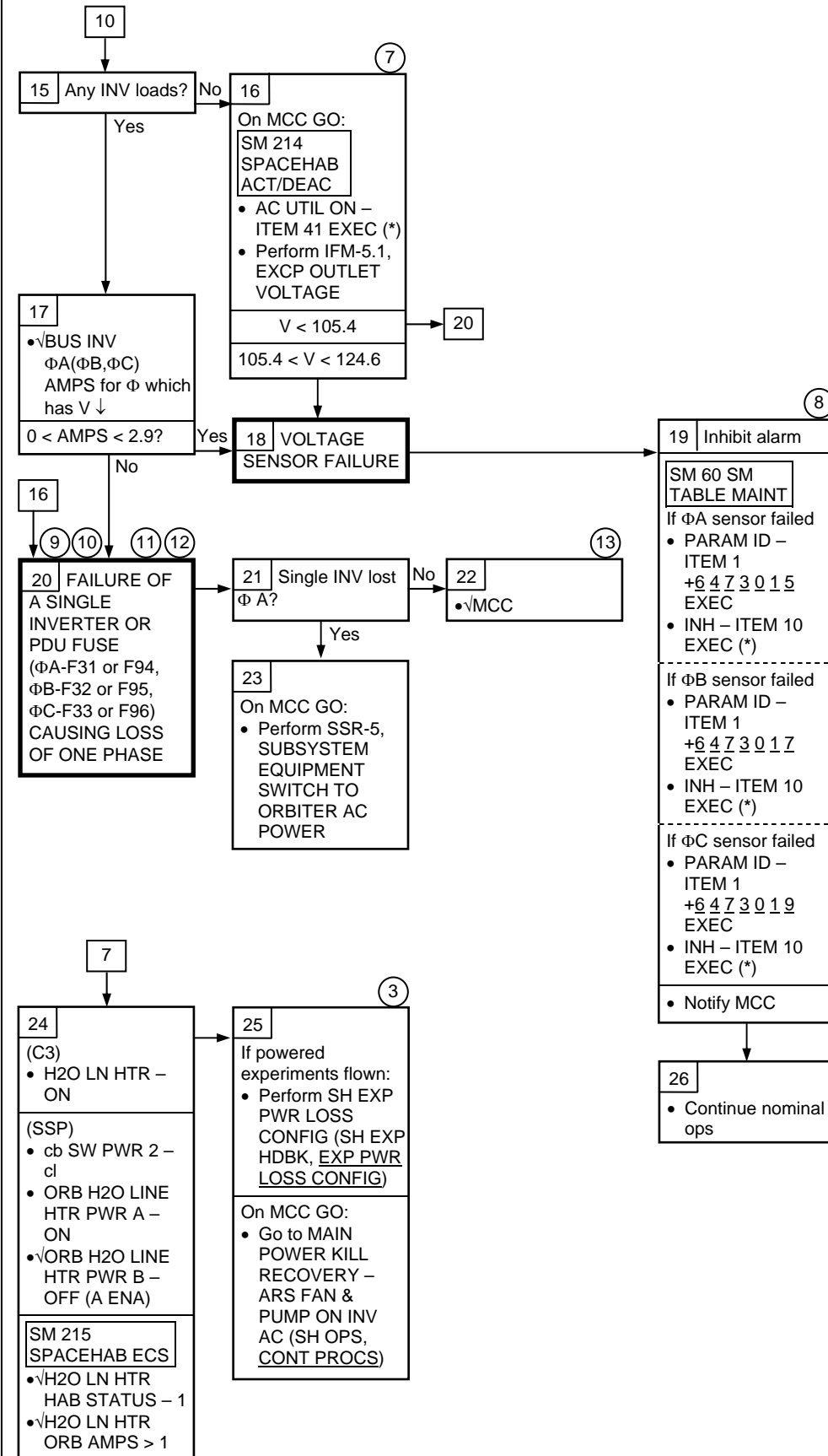
③
SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments

④
Fuse protecting equipment may have blown due to equipment short. MCC will verify bus status and end item function

⑤
Inverter design incorporates automatic shutdown at 127 VAC to protect AC equipment from damage

⑥
MCC will use INV bus data and end item performance to gain insight

EPS 1.1j (Cont)



- ③ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no
- ⑦ Unless otherwise notified, AC connector EXCP 3 outlet J318 for Φ which has V ↓ should be tested
- ⑧ FDA can be inhibited by MCC ground command
- ⑨ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ⑩ Loss of one phase may cause increase in other two-phase currents
- ⑪ IFM-3.1 checks fuses, IFM-4.1 may be performed to replace failed inverter
- ⑫ Master sync signal failure at INV A will cause loss of ability to keep inverter outputs in phase. Failure of fuse ΦA-F31 or F94 will cause loss of master sync signal
- ⑬ INV can be powered down if no single or three phase equipment being powered. 3Φ equipment will continue to operate as long as the phase that failed is not ΦA

EPS

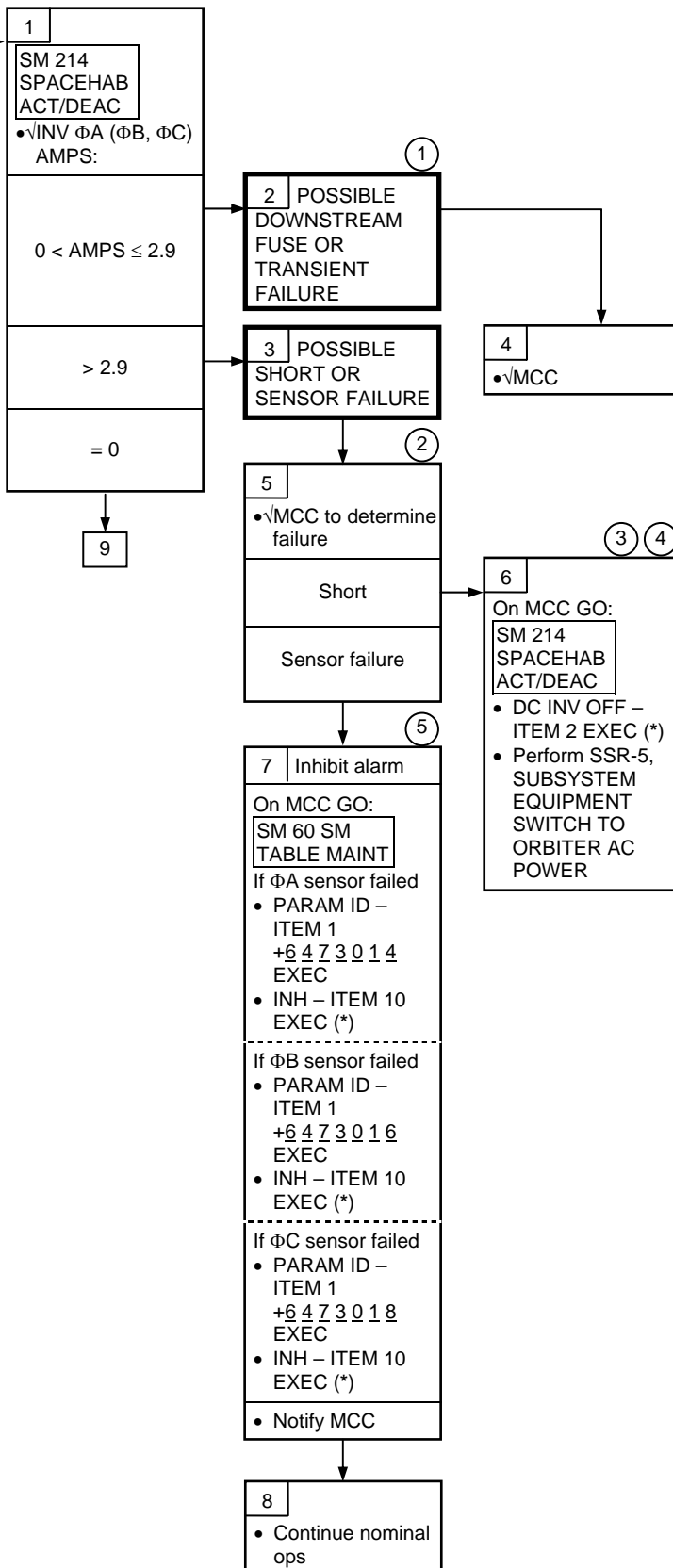
1.1k '214 SH INV P-A(P-B,P-C) AC A' ↑

SM ALERT

214 SH INV P-A (P-B, P-C) AC A
If INV $\Phi A(\Phi B, \Phi C)$ AMPS > 2.9

Nominal Config: ORBITER:

SM 214 SPACEHAB ACT/DEAC
DC INV ON, ITEM 1 – (*)
FANS ARS ORB, ITEM 65 – (*)
FANS CABIN ORB, ITEM 66 – (*)
H2O PUMP 2 ORB, ITEM 73 – (*)
H2O PUMP 2 ON/1 OFF, ITEM 75 – (*) (SSP)
INVERTER tb – gray (R1)
PL PRI MNC tb – ON (MA73C:E)
cb AC3 PL 3 Φ – cl



① Experiment or PDU fuse protecting inverter powered equipment may have blown due to equipment short. INV current may be within limits after fuse failure

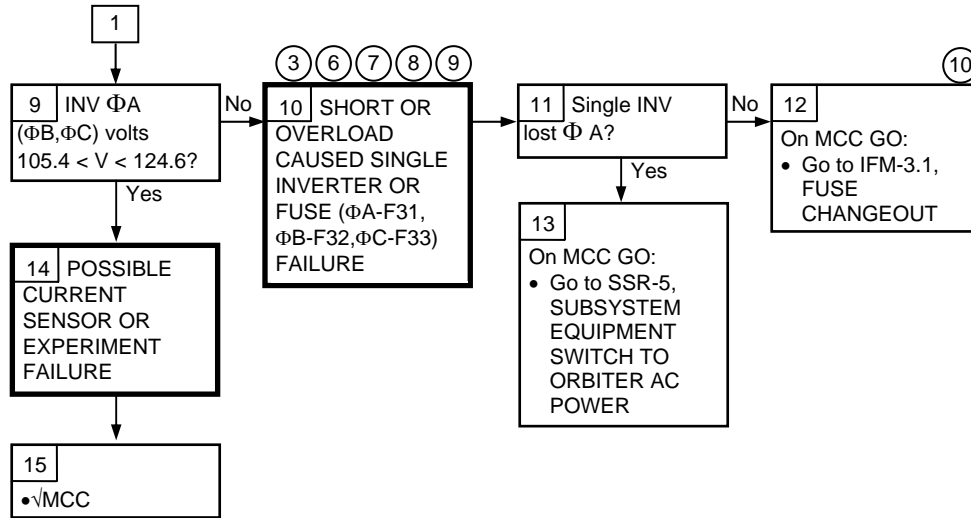
② Ground will use present and historical data to assess INV health. Failure could be due to an erratic sensor

③ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts

④ If Subsystem equipment on INV AC, switch to Orb AC. If Orb AC not available, turn on water line heaters

⑤ FDA can be inhibited by MCC ground command

EPS 1.1k (Cont)



③ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts

⑥ IFM-4.1 can be performed to replace a failed inverter

⑦ Master sync signal failure at INV-A will cause loss of ability to keep inverter outputs in phase. Failure of fuse ΦA-F31 will cause loss of master sync signal

⑧ Experiments using INV power need to be assessed for two phase capability

⑨ IFM 3.1 can be performed to check fuse continuity

⑩ INV must be powered down prior to checking fuse(s)

ECS

ECS

1.2

ECS

1.2

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ECS

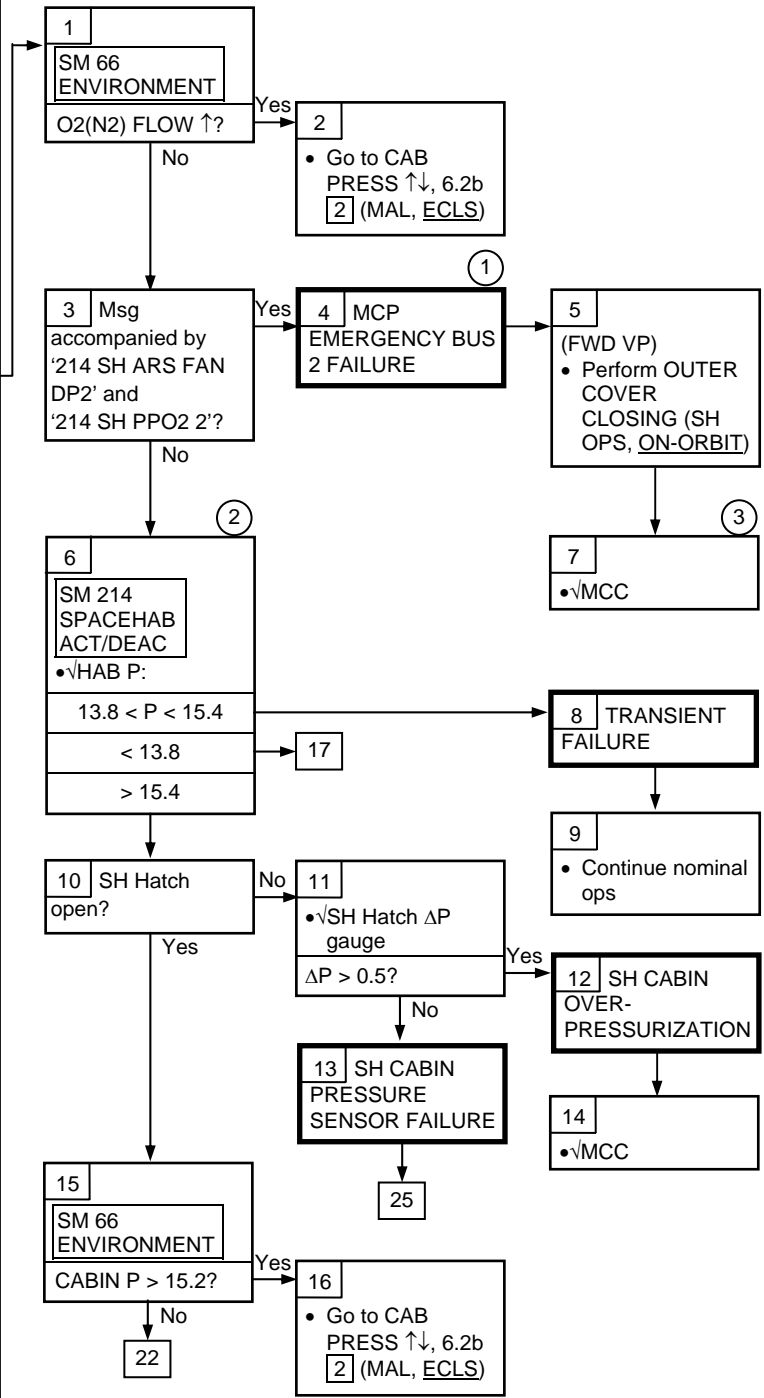
- PL WARNING (F7)
- BACKUP C/W ALARM (F7)
- MASTER ALARM (MCP/L6)
- 214 SH HAB P

If HAB P < 13.8 or > 15.4 psia

Nominal Config:

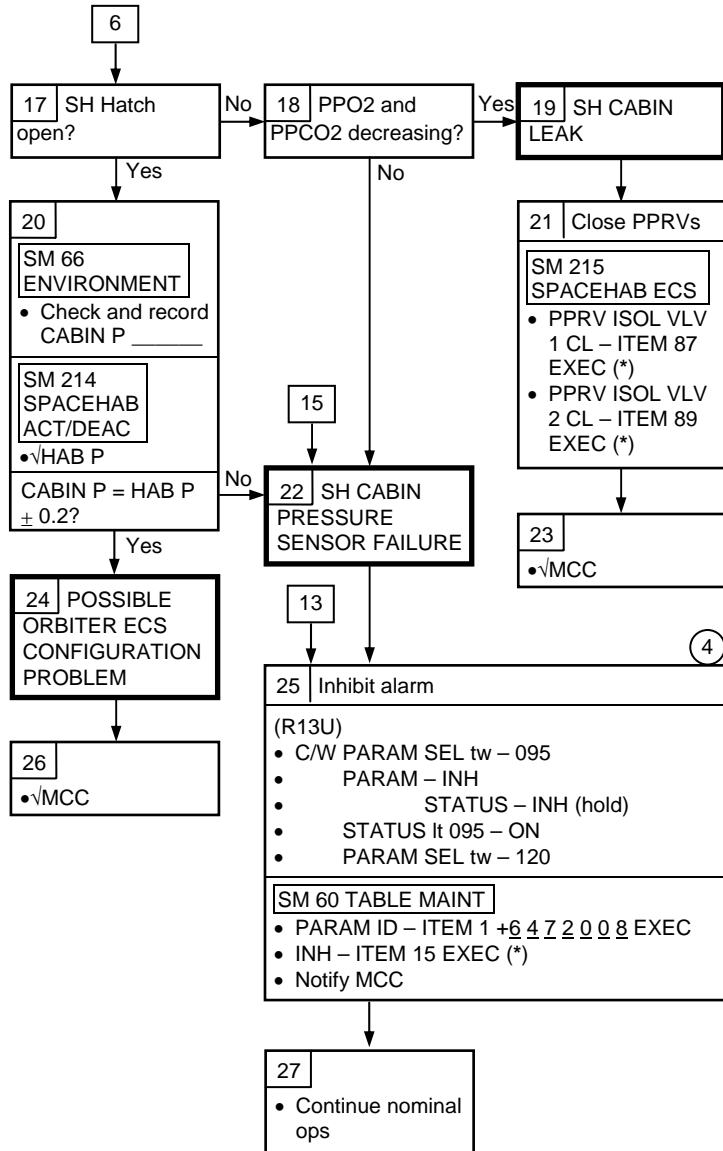
- ORBITER:
 - SM 215 SPACEHAB ECS
- PPRV ISOL VLV 1,2 (two) OP, ITEM 86,88 - (*) (SSP)
- CAB DEPRESS VLV ARM tb - bp NOT CLOSED tb - bp
- SPACEHAB: (FWD BKHD) CAB DEP VLV - cl (OVHD) EXP VENT VLV - cl

1.2a '214 SH HAB P' ↑↓



- ① Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ② SH subsystem data also available on PGSC
- ③ IFM-3.1 can be performed to check MCP fuse(s) F1/F2 continuity

ECS 1.2a (Cont)



4

SPEC 60 actions can be performed by MCC. Crew must perform R13U actions if required

ECS

1.2b '214 SH PPO2 1(2)' ↓↑

PL WARNING (F7)

PL CAUTION (F7)

BACKUP C/W ALARM (F7)

MASTER ALARM (MCP/L6)

214 SH PPO2 2

214 SH PPO2 1

If PPO2 1(2) < 2.7 or > 3.6 psia

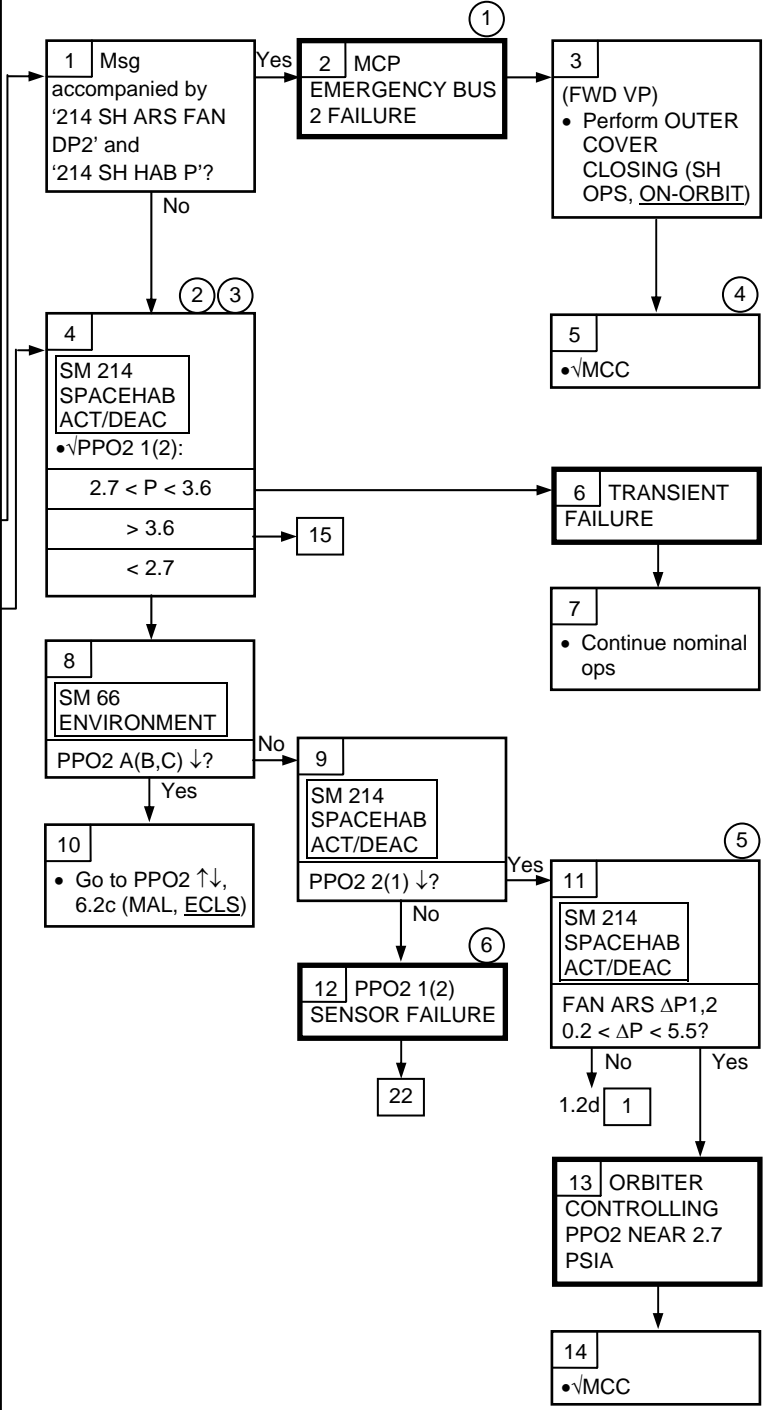
Nominal Config:
ORBITER:
SM 214 SPACEHAB ACT/DEAC

FANS ARS ON, ITEM 67 - (*)
FANS ARS ORB, ITEM 65 - (*)

SM 215 SPACEHAB ECS

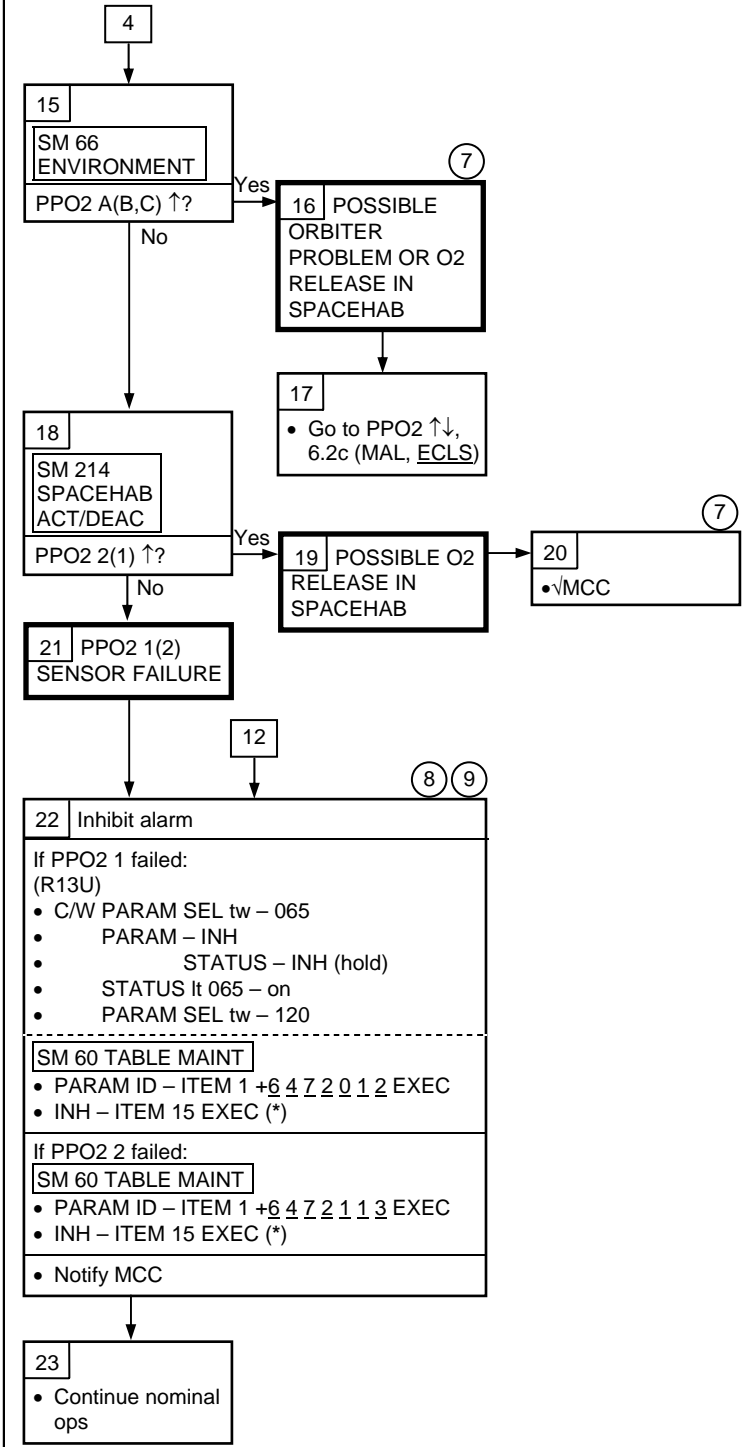
PPRV ISO VLV 1,2 (two) OP, ITEM 86,88 - (*) (SSP)
CAB DEPRESS VLV ARM tb - bp NOT CLOSED tb - bp (TNL ADPTR)
PL ISOL VLV - op
PL ISOL VLV CAP - removed (MA73C:E)
cb AC3 PL 3Φ - cl
SH Hatch - op

SPACEHAB:
(FWD BKHD)
CAB DEP VLV - cl
NPRV covers (2) - cl (OVHD)
EXP VENT vlv - cl



- ① Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ② SH data also available on PGSC
- ③ PPO2 sensor 1 pwr'd from same source as DMU
- ④ IFM-3.1 can be performed to check MCP fuse(s) F1/F2 continuity
- ⑤ ARS fan provides atmosphere exchange between Spacehab and orbiter. Loss of fan would cause PPO2 to drop over time
- ⑥ Class 2 caution and warning alarm remains operational via redundant parameter

ECS 1.2b (Cont)



- ⑦ Ground will assess manifest to determine if O2 source in Spacehab
- ⑧ FDA can be inhibited by ground command
- ⑨ Class 2 C/W remains operational via redundant parameter

ECS

1.2c '214 SH PPCO2 1(2)' ↑

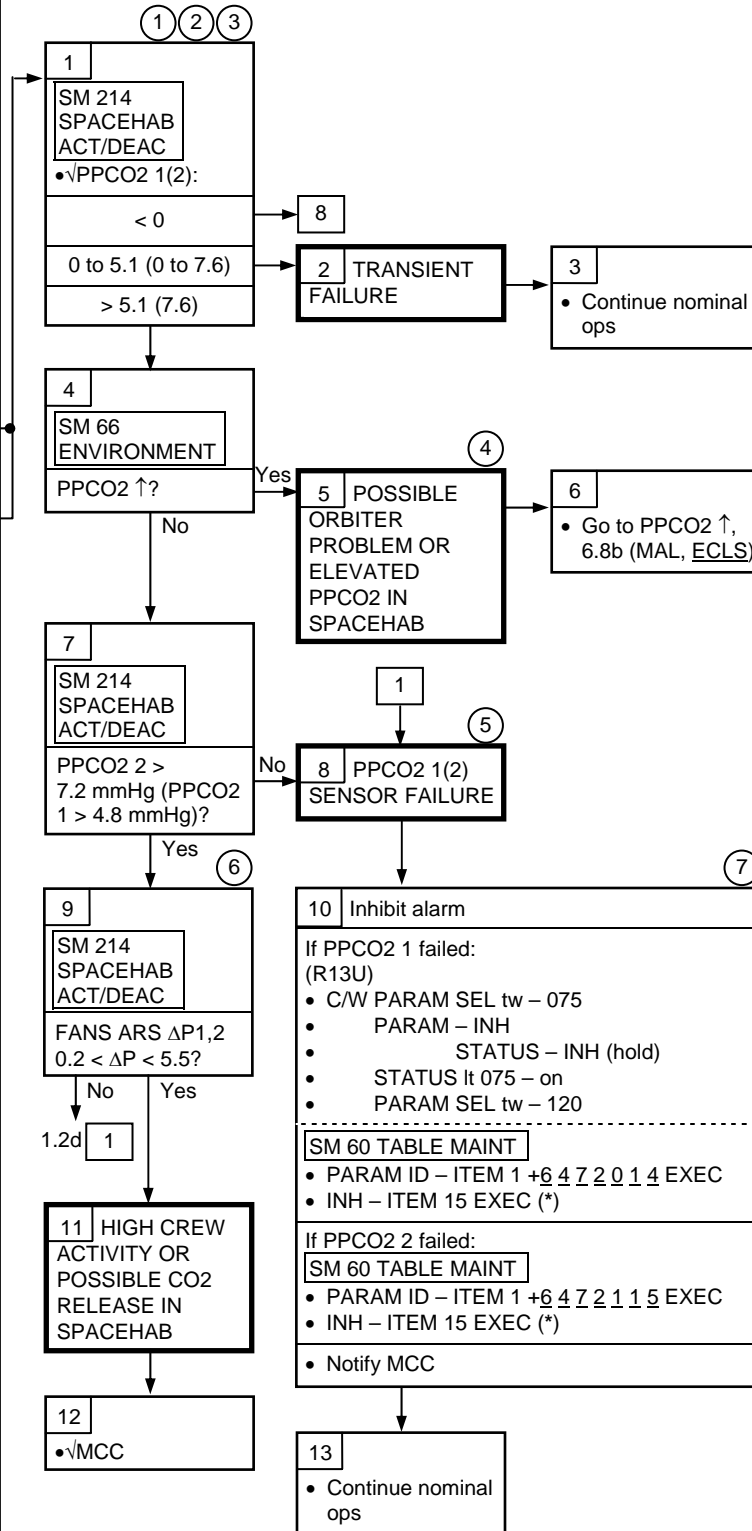
- PL WARNING (F7)
- PL CAUTION (F7)
- BACKUP C/W ALARM (F7)
- MASTER ALARM (MCP/L6)
- 214 SH PPCO2 2
- 214 SH PPCO2 1

If PPCO2 1(2) > 5.1 (7.6) mmHG

Nominal Config:

- ORBITER:
- SM 214 SPACEHAB ACT/DEAC

FANS ARS ON, ITEM 67 - (*)
 FANS ARS ORB, ITEM 65 - (*)
 (MA73C:E)
 cb AC3 PL 3Φ - cl
 SH Hatch - op



- ① SH subsystem data available on SS PGSC
- ② PPCO2 sensor #1 pwr'd from same source as DMU
- ③ PPCO2 1 output voltage is 8.0% low. 4.8 mmHg on PPCO2 1 corresponds to a reading of 7.2 mmHg actual PPCO2 reading. Another 0.4 mmHg is allowed for sensor A/D conversion error
- ④ Ground will assess manifest to determine if CO2 source in Spacehab
- ⑤ Class 2 C/W alarm remains operational via redundant parameter
- ⑥ ARS fan provides atmosphere exchange between Spacehab and orbiter. Loss of fan would cause PPCO2 to rise over time
- ⑦ SPEC 60 actions can be performed by MCC. Crew must perform R13U actions if required

ECS

PL CAUTION
(F7)

PL WARNING
(F7)

BACKUP C/W
ALARM
(F7)

MASTER
ALARM
(MCP/L6)

214 SH ARS
FAN DP 1

214 SH ARS
FAN DP 2

If ARS ΔP < 0.2 or > 5.5

214 SH CAB
FAN DP 1

214 SH CAB
FAN DP 2

If CAB ΔP < 0.2 or > 5.5

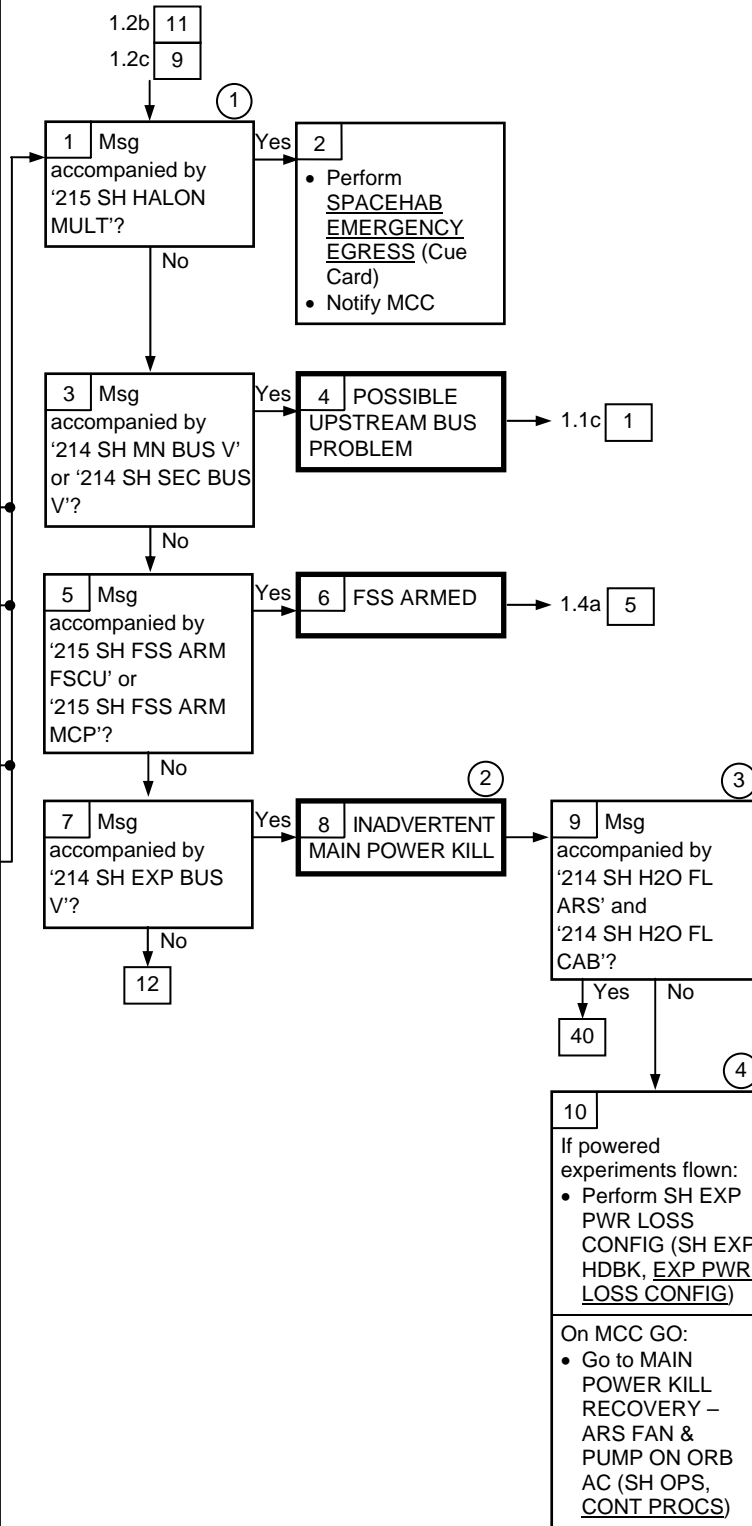
Nominal Config:
ORBITER:

SM 214
SPACEHAB
ACT/DEAC

FANS ARS ORB,
ITEM 65 – (*)
FANS ARS ON,
ITEM 67 – (*)
FANS CABIN ORB,
ITEM 66 – (*)
FANS CABIN ON,
ITEM 68 – (*)
(MA73C:E)
cb AC3 PL 3Φ – cl

SPACEHAB:
(EXCP 2)
ARS – KILL ENA

**1.2d '214 SH ARS FAN DP 1(2)' ↑↓ OR
'214 SH CAB FAN DP 1(2)' ↑↓**



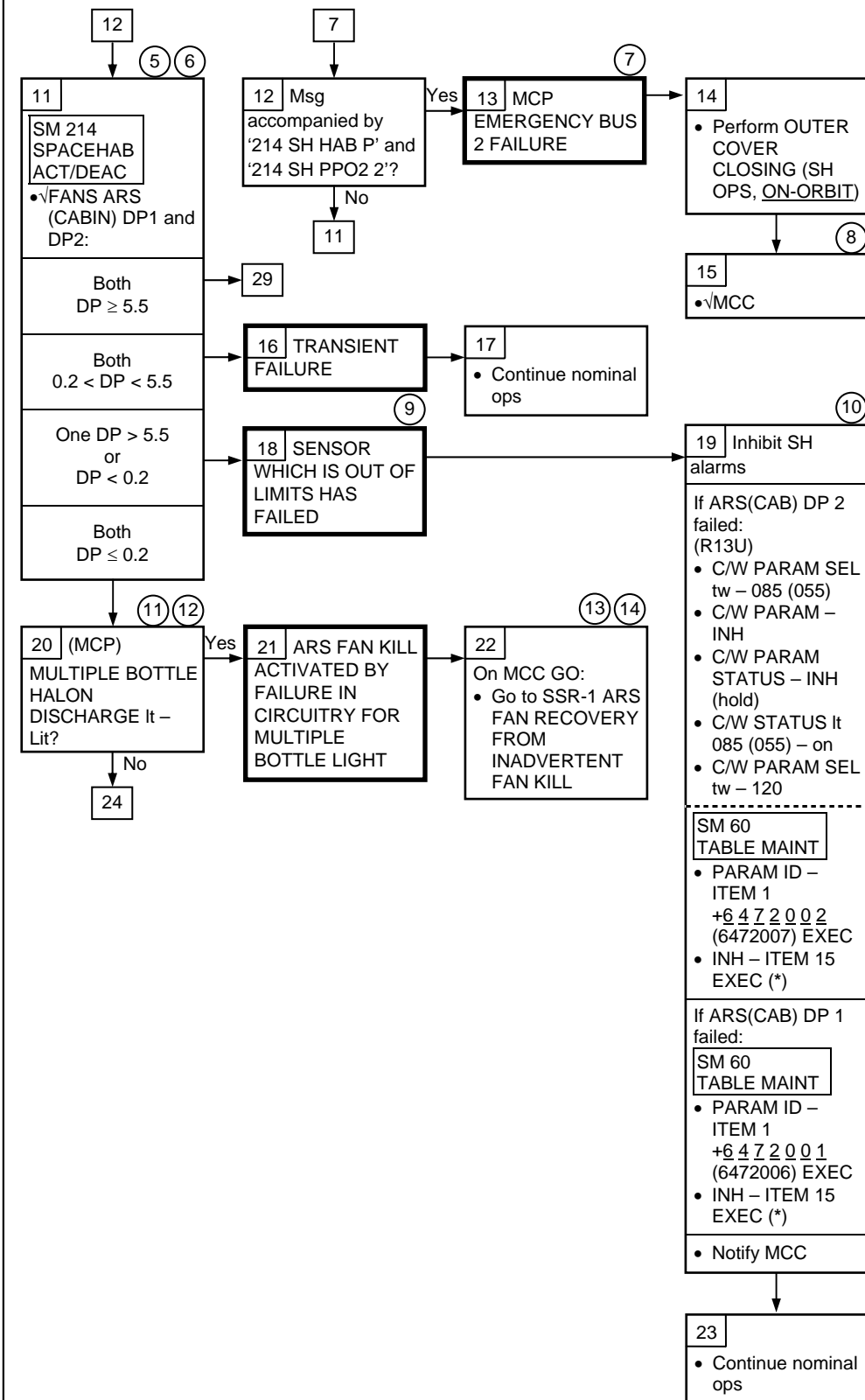
① Individual bottle status will be checked at the POCC

② Following msgs also displayed:
'214 SH WFCEU V'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
If WFCEU in mode 1,
'215 SH WFCEU, MODE'

③ MN PWR KILL will take down SH water pump if powered by SH INV; thus, water line heaters will need to be activated. Water pump will not be affected if on ORB AC. Recovery procedures different if pump powered by ORB AC vs INV

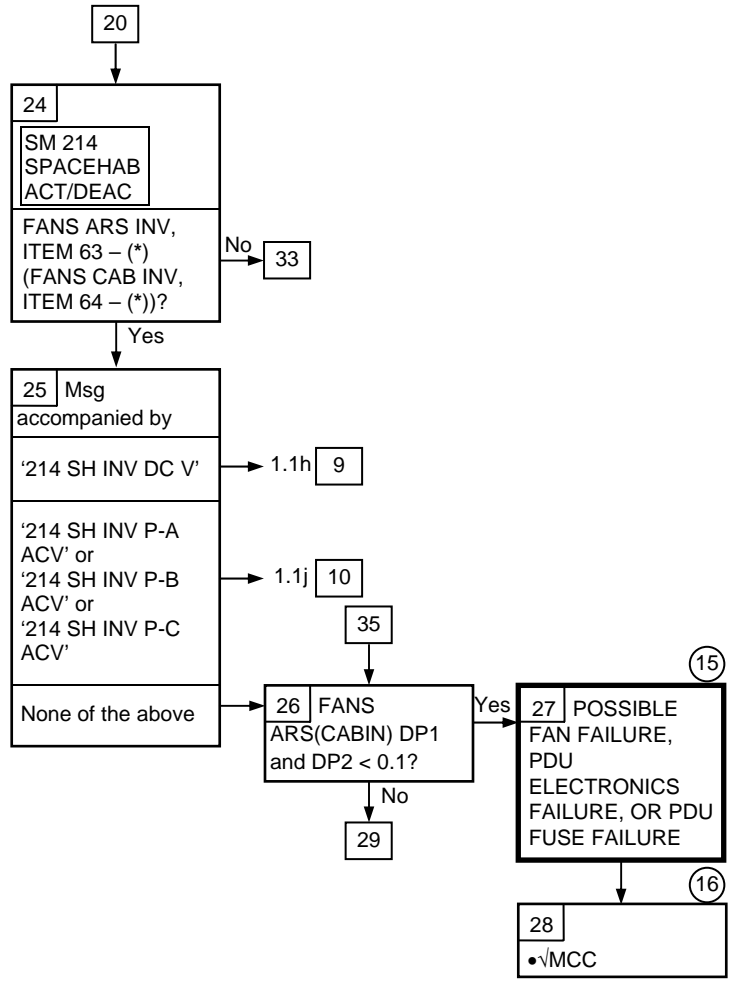
④ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments

ECS 1.2d (Cont)



- ⑤ SH subsystem data available on PGSC
- ⑥ ARS FAN DP1 and CAB FAN DP1 sensors are pwr'd from same source as DMU
- ⑦ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ⑧ IFM-3.1 can be performed to check fuse continuity
- ⑨ Class 2 caution and warning alarm remains operational via redundant parameter
- ⑩ SPEC 60 actions can be performed by MCC. Crew must perform R13U actions if required
- ⑪ Control logic failure can illuminate multiple bottle discharge light on the MCP but not discharge the bottles
- ⑫ If SH has been isolated for long period of time (i.e., EVA), then failure of lamp prior to check in [20] possible
- ⑬ MCC must determine failure cause before action can be taken
- ⑭ SSR-1 may be attempted to recover the ARS fan prior to proceeding with further troubleshooting actions

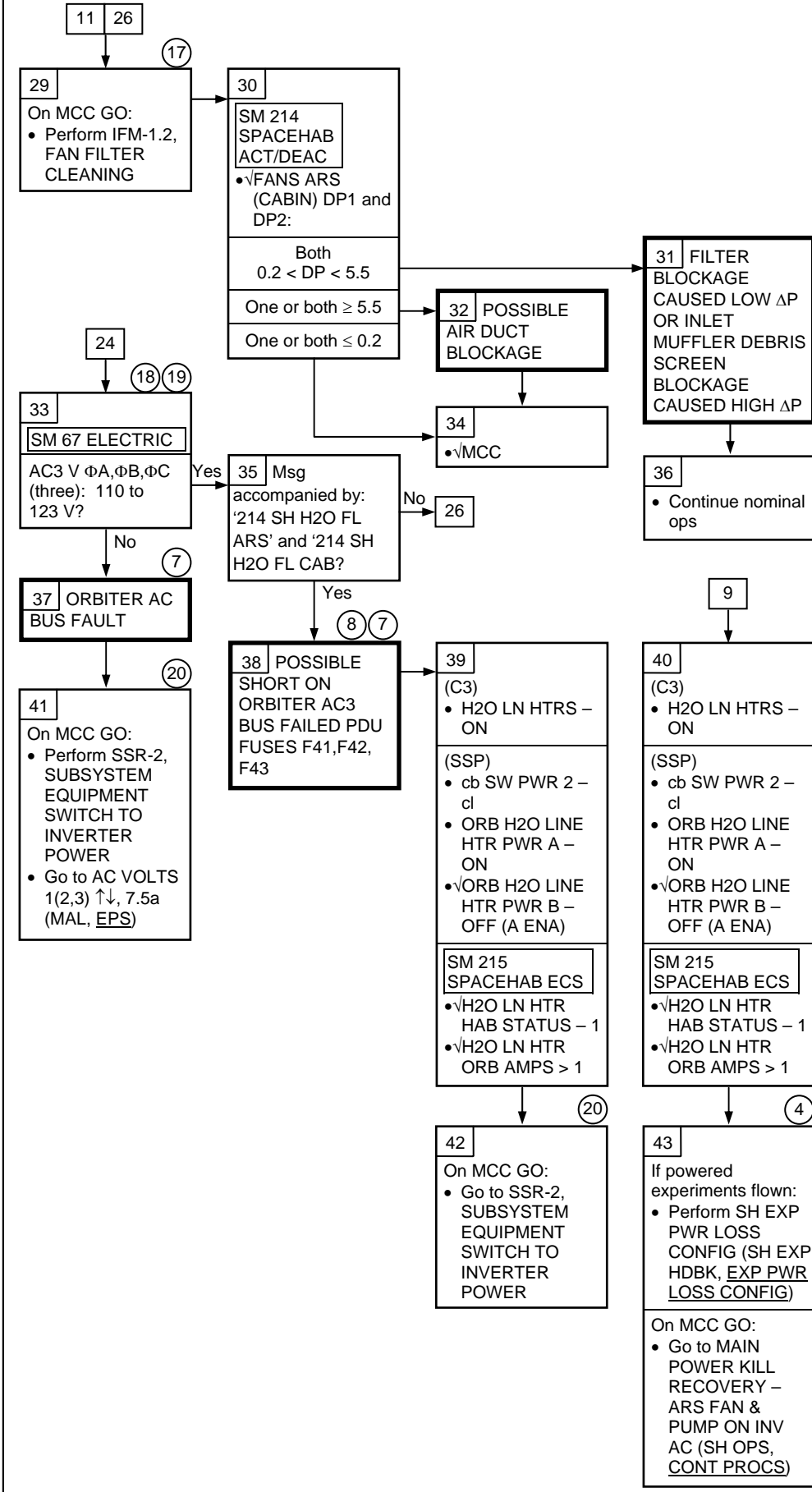
ECS 1.2d (Cont)



(15) Internal fan failure, PDU relay K22(K23) failure, PDU fuse failure (F4,F5,F6 for ARS Fan and F7,F8,F9 for Cabin Fan), or current limiting and power factor correction circuitry failure (within PDU) are all possible causes of low ΔP

(16) Fan changeout IFM-1.1 can be performed on MCC call if reqd and IFM-3.1 can be performed to √fuses

ECS 1.2d (Cont)



- ④ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments
- ⑧ IFM-3.1 can be performed to check fuse continuity
- ⑦ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ⑱ IFM checks fan filter, middeck inlet housing, inlet muffler, and debris screens for blockage
- ⑱ SH smoke detection capability lost while ARS and Cabin fans off or failed
- ⑲ Orbiter AC3 is source of power to ARS and Cabin fans, as well as H2O Pump 2 during nominal on-orbit ops
- ⑳ MCC must determine unique AC power down (if reqd) and system reconfiguration

ECS

1.2e '214 SH H2O P OUT' ↑↓

SM ALERT

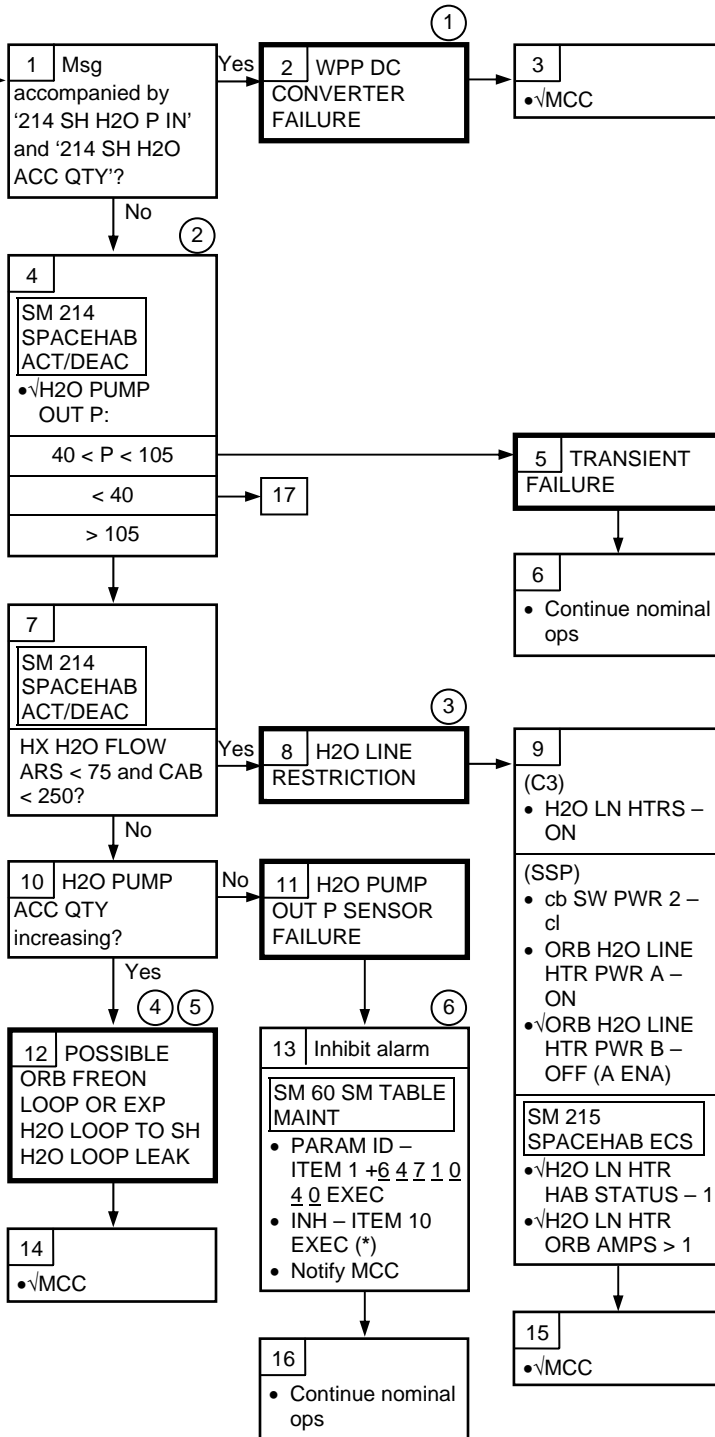
214 SH H2O P OUT

If H2O PUMP OUT P < 40 or > 105 psia

Nominal Config:
ORBITER:

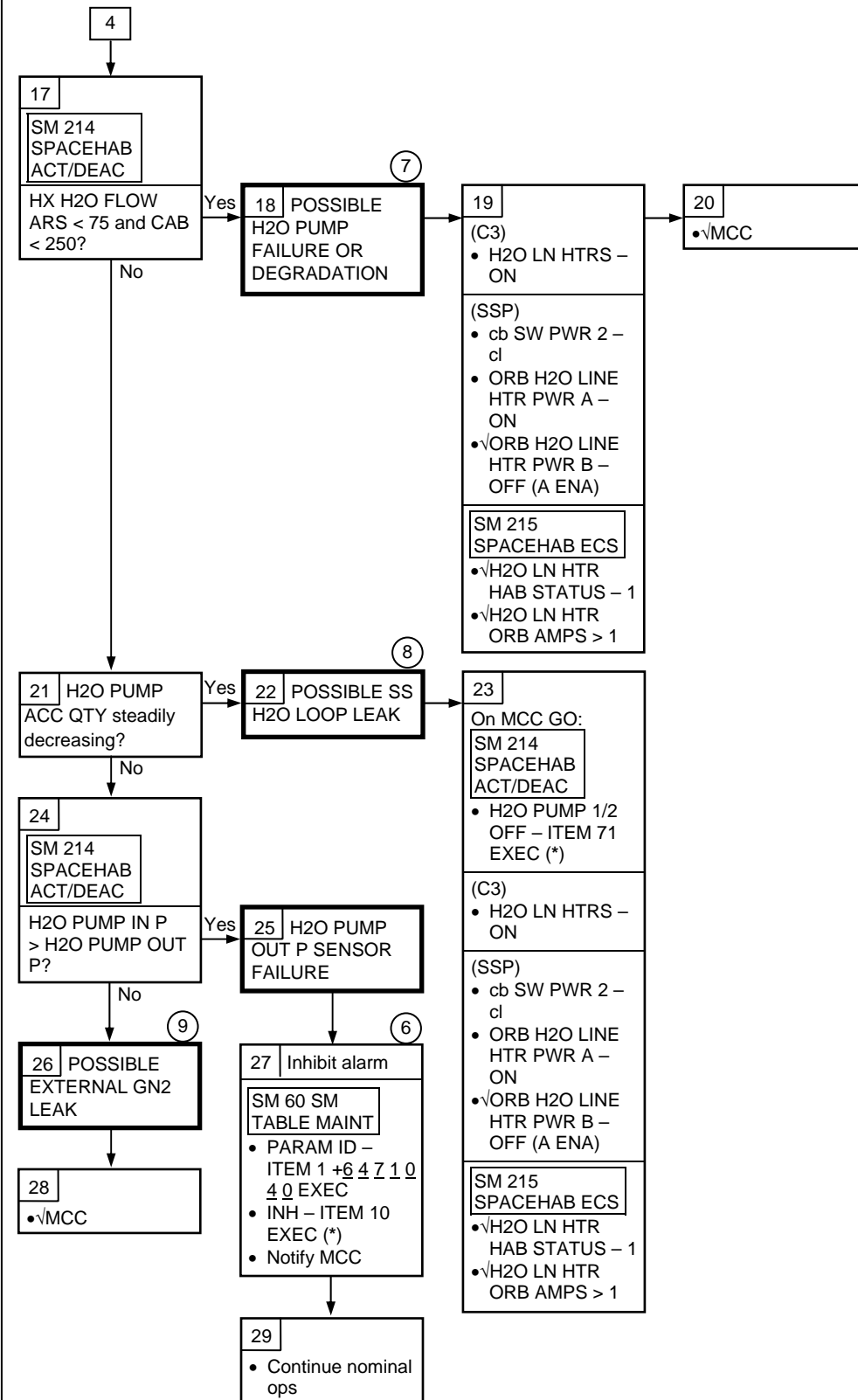
SM 214 SPACEHAB ACT/DEAC

H2O PUMP 2 ON/ 1 OFF, ITEM 75 – (*)
H2O PUMP 2 ORB, ITEM 73 – (*) (MA73C:E)
cb AC3 PL 3Φ – cl



- ① H2O pump inlet pressure, outlet pressure, accumulator quantity, and inlet temp monitoring lost
- ② SH subsystem data available on SS PGSC
- ③ H2O pump will be run until thermal or operational constraints require pump pwr off
- ④ MDF will be declared if ORB Freon loop leak to SH H2O loop. SH will be prepared for entry, egressed, and isolated
- ⑤ Orb Freon loop operates at higher pressure than SH H2O loop. A leak in HX would cause the mass in SH H2O loop to incr
- ⑥ FDA can be inhibited by MCC ground command

ECS 1.2e (Cont)



⑥
FDA can be inhibited
by MCC ground
command

⑦
A possible cause
could be loss of an
AC phase. POCC
must determine
failure cause before
pumps can be
switched. If a phase
is lost, pump
performance will
degrade. Three
phase pwr reqd to
start a pump

⑧
If not previously
performed, IFM-2.3
may be requested to
locate leak. If
pumps are powered
off, water line
heaters are reqd to
prevent freezing of
water in PL HX

⑨
May cause degraded
pump performance
or cavitation

ECS

1.2f '214 SH H2O P IN' ↓↑

SM ALERT

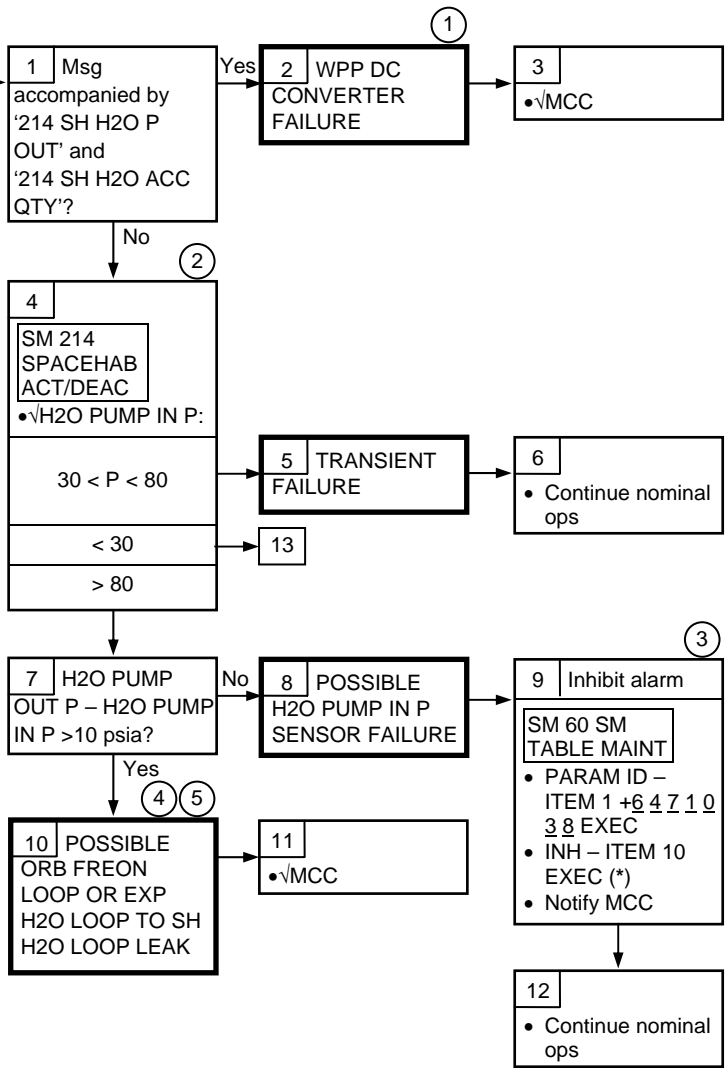
214 SH H2O P IN

If H2O PUMP IN P < 30 or > 80 psia

Nominal Config: ORBITER:

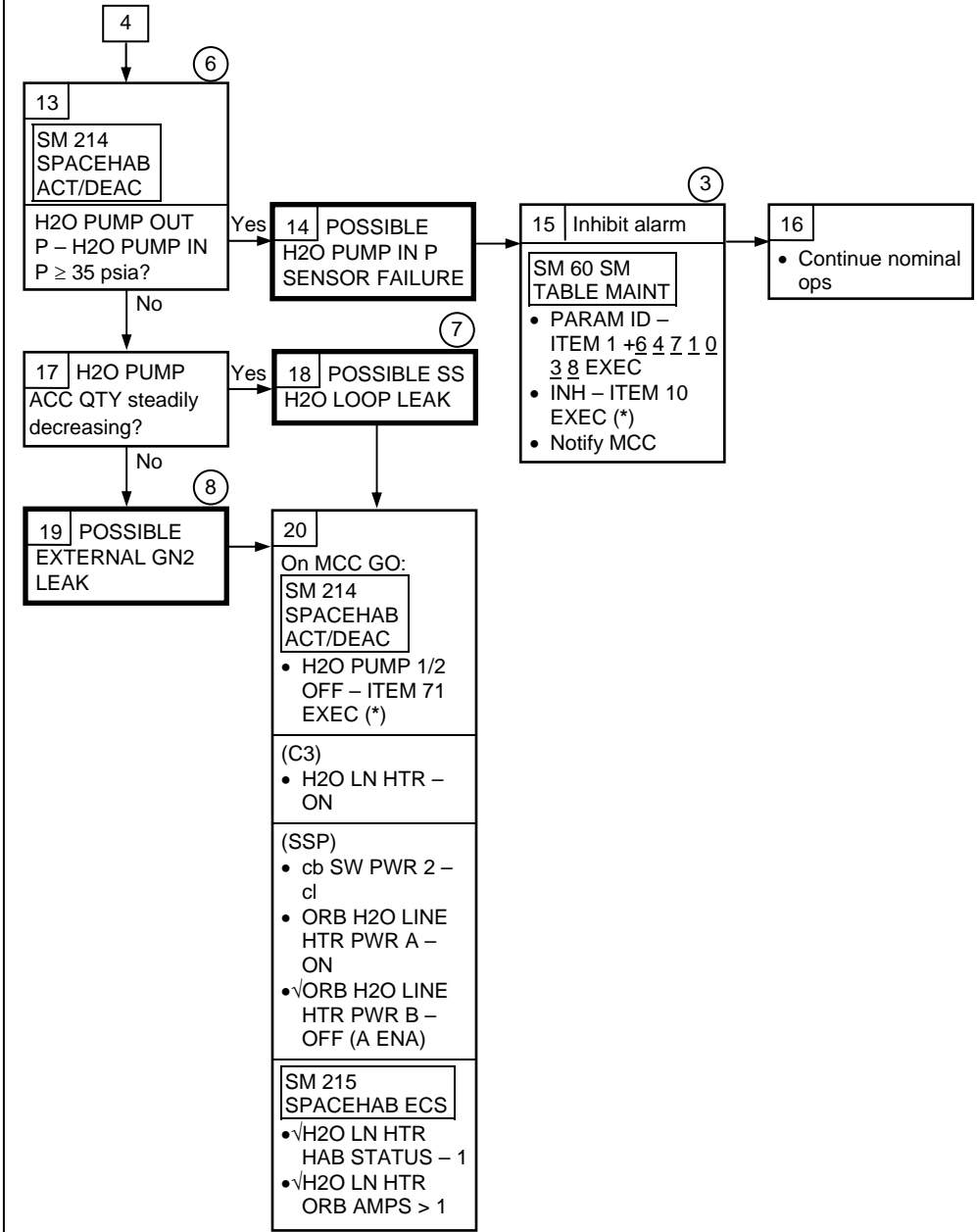
SM 214 SPACEHAB ACT/DEAC

H2O PUMP 2 ON/1 OFF, ITEM 75 - (*)
 H2O PUMP 2 ORB, ITEM 73 - (*)
 (MA73C:E)
 cb AC3 PL 3Φ - cl



- ① H2O pump inlet pressure, outlet pressure, accumulator quantity, and inlet temp monitoring lost
- ② SH subsystem data available on PGSC
- ③ FDA can be inhibited by MCC ground command
- ④ Orb Freon loop operates at higher press than SH water loop. Leak allows the mass in SH water loop to increase. SH water loop should be allowed to operate until advised otherwise
- ⑤ MDF will be declared if ORB Freon loop leak to SH H2O loop. SH will be prepared for entry, egressed, and isolated

ECS 1.2f (Cont)



- ③ FDA can be inhibited by MCC ground command
- ⑥ Nominal ΔP is approximately 25 psia
- ⑦ If not previously performed, IFM-2.3 may be requested to locate leak. If pumps powered off, water line heaters are reqd to prevent freezing of water in PL HX
- ⑧ May cause degraded pump performance or cavitation

ECS

1.2g '214 SH H2O ACC QTY' ↑↓

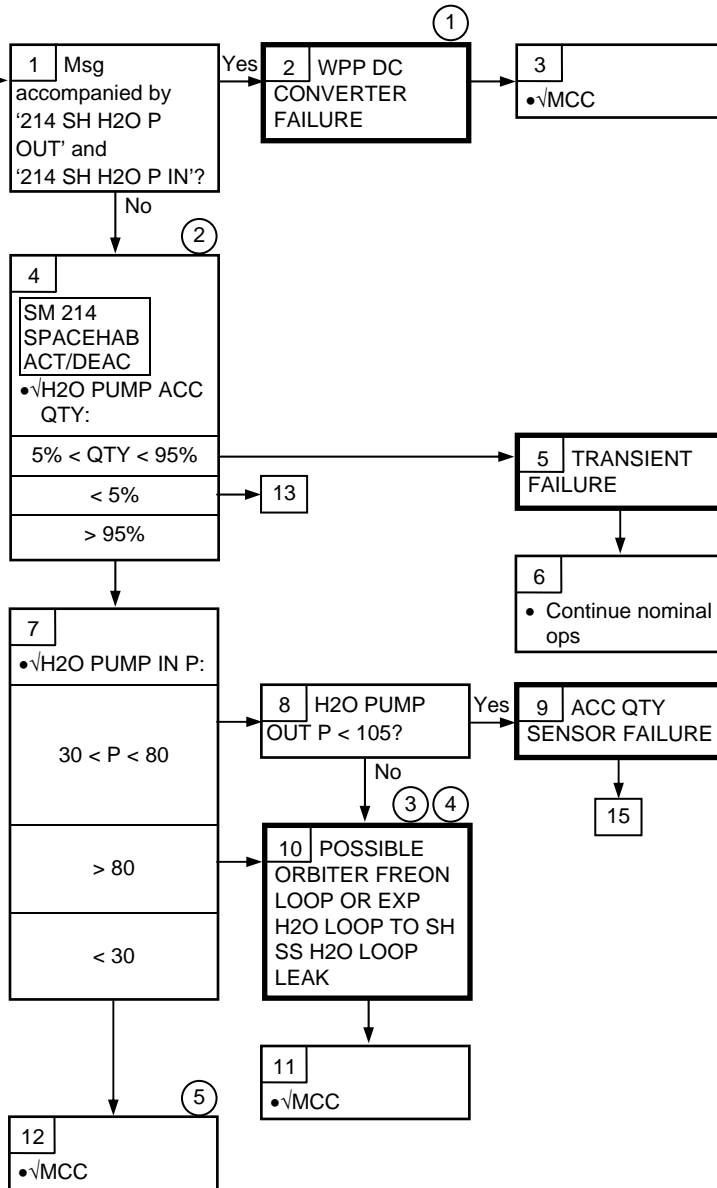
SM ALERT

214 SH H2O ACC QTY

If H2O ACCUM QTY < 5% or > 95%

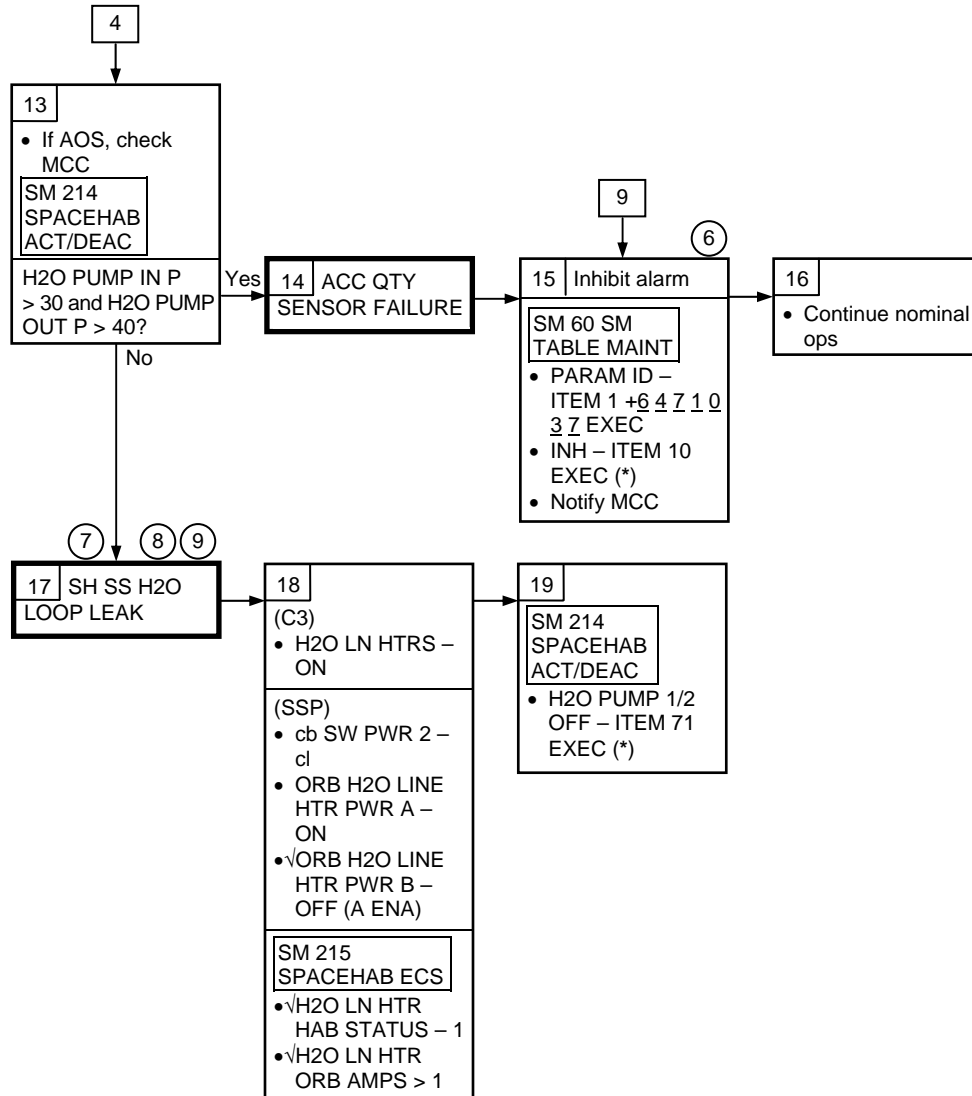
Nominal Config:
ORBITER:
SM 214 SPACEHAB ACT/DEACT

H2O PUMP 2 ON/1 OFF, ITEM 75 – (*)
H2O PUMP 2 ORB, ITEM 73 – (*)
(MA73C:E)
cb AC3 PL 3Φ – cl



- ① H2O pump inlet pressure, outlet pressure, accumulator quantity, and inlet temp monitoring lost
- ② SH subsystem data also available on PGSC
- ③ MDF will be declared if ORB Freon loop leak to SH H2O loop. SH will be prepared for entry, egressed, and isolated
- ④ Orb Freon loop operates at higher pressure than SH loop. A leak would cause the mass in SH H2O loop to increase. It is possible for a fwd module exp H2O loop pressure to be higher than the SS H2O loop pressure at the EXP heat exchanger
- ⑤ Multiple failures may have occurred requiring ground analysis

ECS 1.2g (Cont)



⑥ FDA can be inhibited by MCC ground command

⑦ Expect pump cavitation if not already occurring

⑧ If not previously performed, IFM-2.3 may be requested to locate leak

⑨ MCC has trending data to determine a water leak

ECS

**1.2h '214 SH H2O FL ARS' ↓ OR
'214 SH H2O FL CAB' ↓**

SM ALERT

214 SH H2O FL ARS

If H2O FL ARS < 75 lb/hr

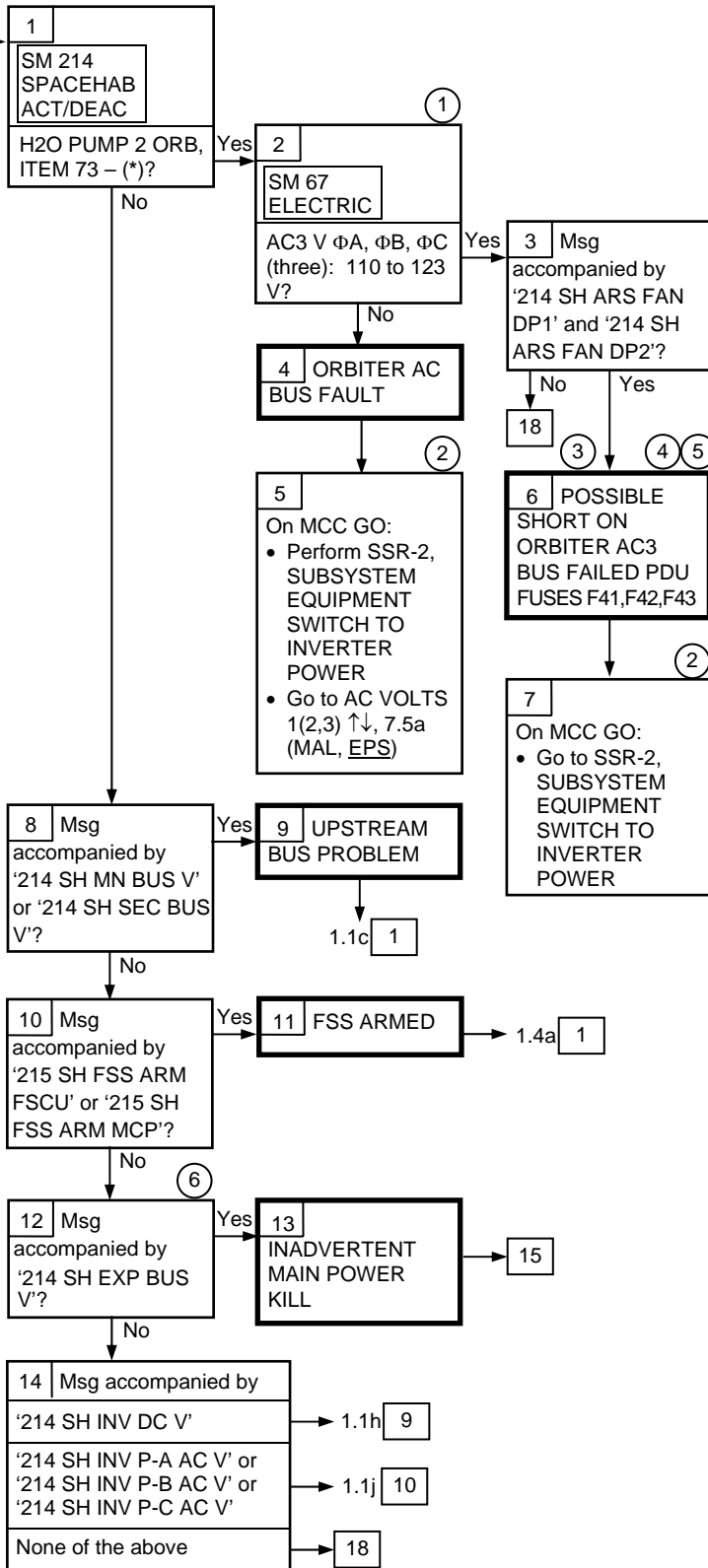
214 SH H2O FL CAB

If H2O FL CAB < 250 lb/hr

Nominal Config:
ORBITER:

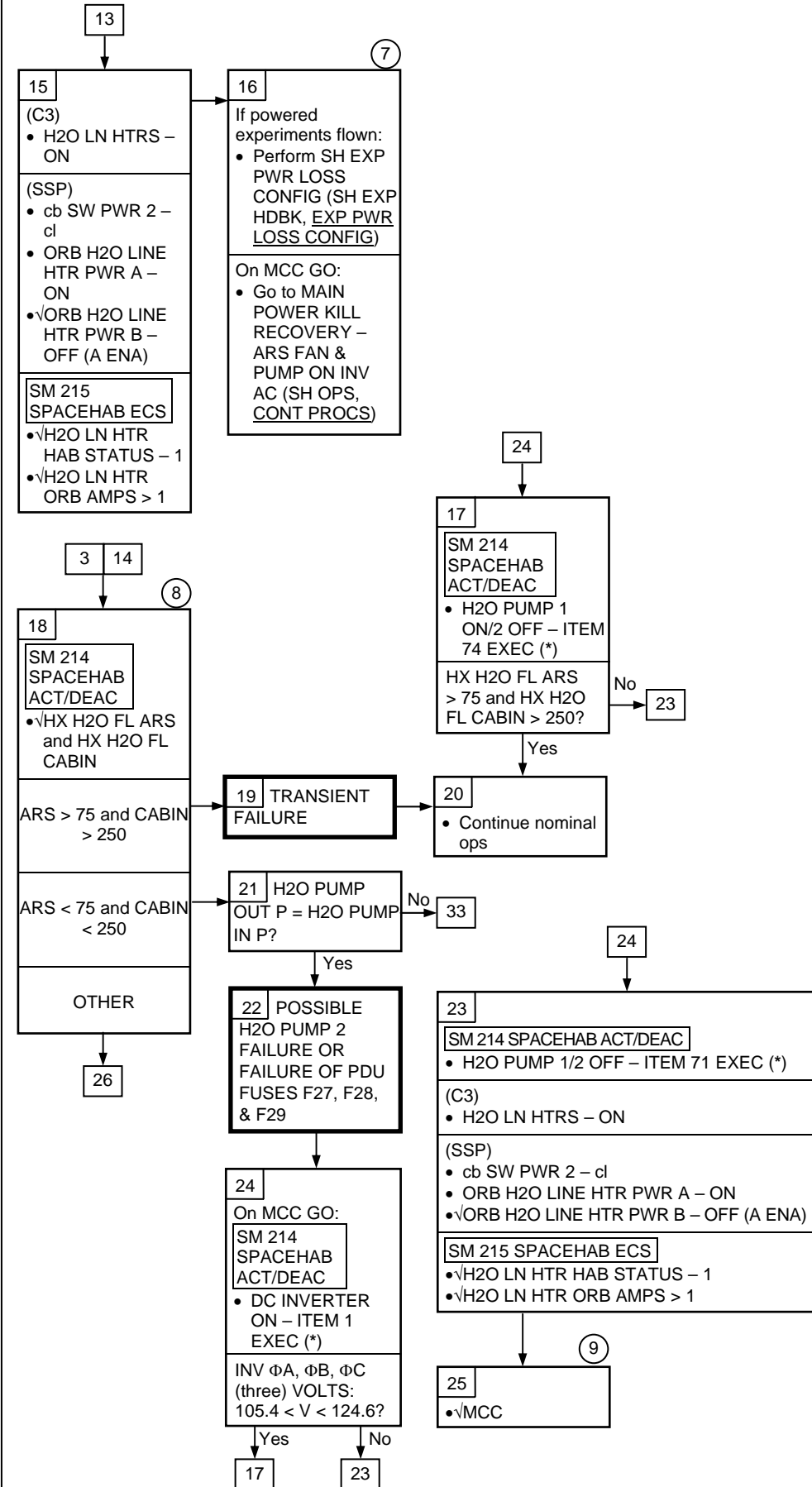
SM 214 SPACEHAB ACT/DEAC

H2O PUMP 2 ON/1 OFF, ITEM 75 – (*) (MA73C:E)
cb AC3 PL 3Φ – cl



- ① Orb AC3 is source of pwr to ARS and Cabin fans, as well as H2O PUMP 2 during nominal on-orbit ops
- ② MCC must determine unique AC powerdown (if reqd) and system reconfiguration
- ③ Refer to BUS/CRITICAL EQUIPMENT LOSS table for system impacts
- ④ IFM-3.1 can be performed to check fuse continuity
- ⑤ SH smoke detection capability lost while ARS and Cabin fans off or failed
- ⑥ Following msgs also displayed:
'214 SH WFCEU V'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
If WFCEU in mode 1,
'215 SH WFCEU, MODE'

ECS 1.2h (Cont)

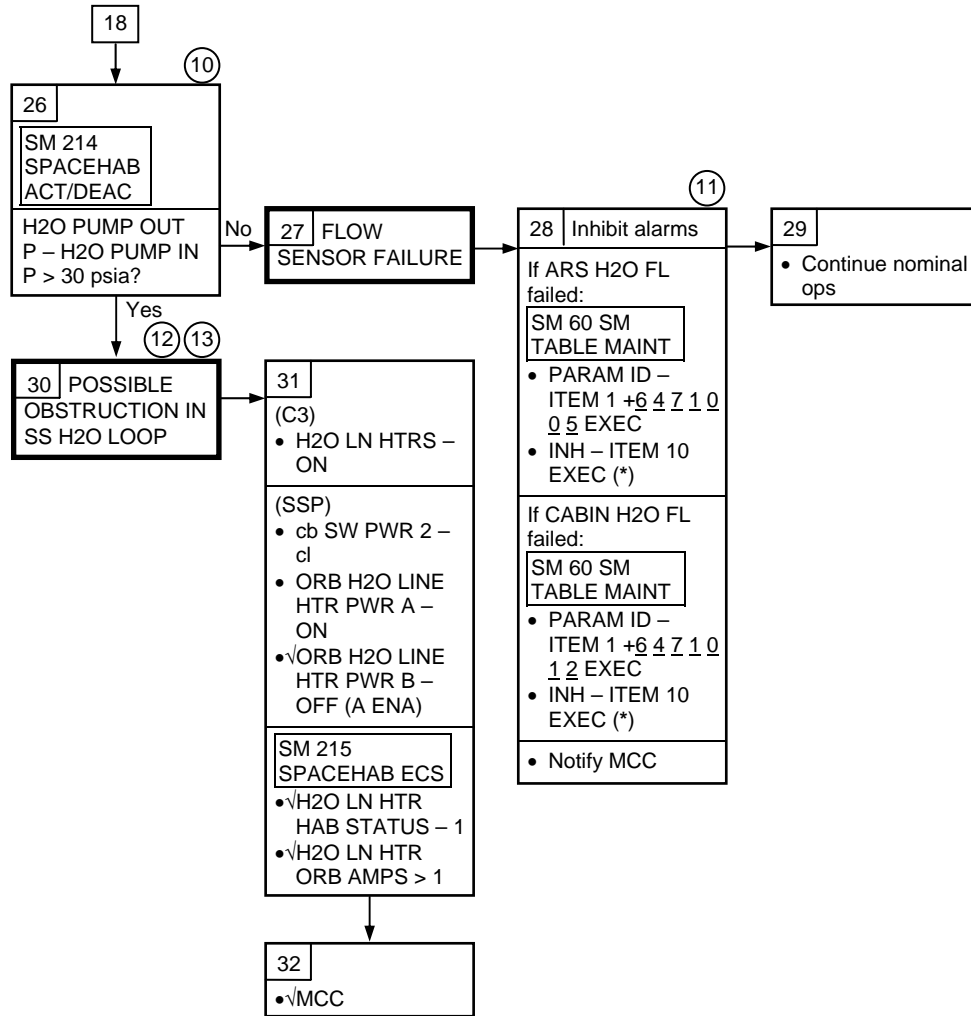


(7) SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments

(8) Both sensors pwr'd from same source as DMU

(9) MCC must determine failure cause before further action can be taken

ECS 1.2h (Cont)



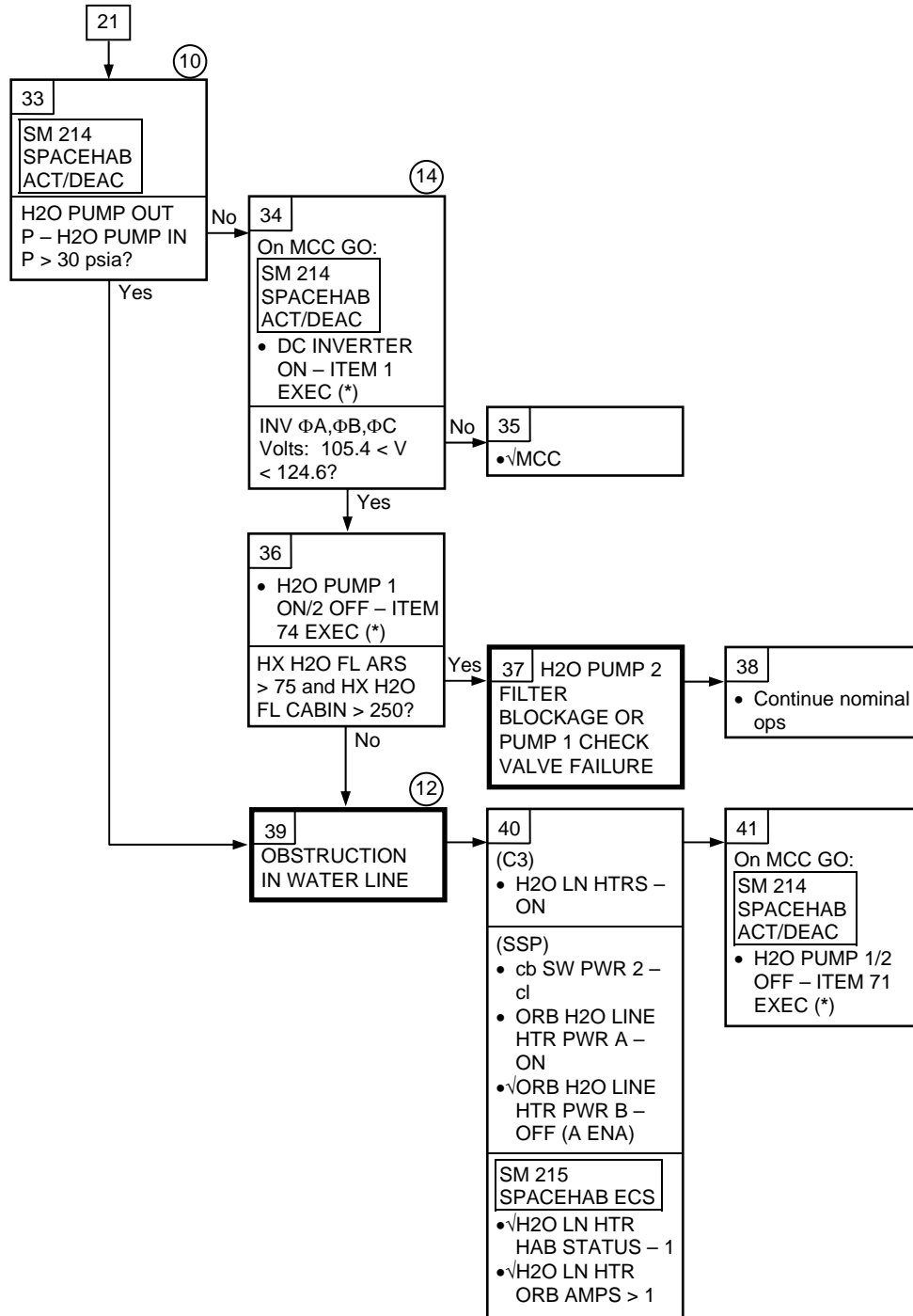
⑩
Nominal ΔP is
approximately
25 psia

⑪
FDA will be inhibited
by MCC ground
command

⑫
H2O pump will be
run until thermal or
operational
constraints require
pump power off

⑬
This failure results in
decrease in system
heat rejection
capability

ECS 1.2h (Cont)



⑩ Nominal P is approximately TBD psia

⑫ H2O pump will be run until thermal or operational constraints require pump power off

⑭ SH Inverter must be turned on before H2O Pump 1 can be activated. If power margins are not available to SH INV, water line heaters must be activated

ECS

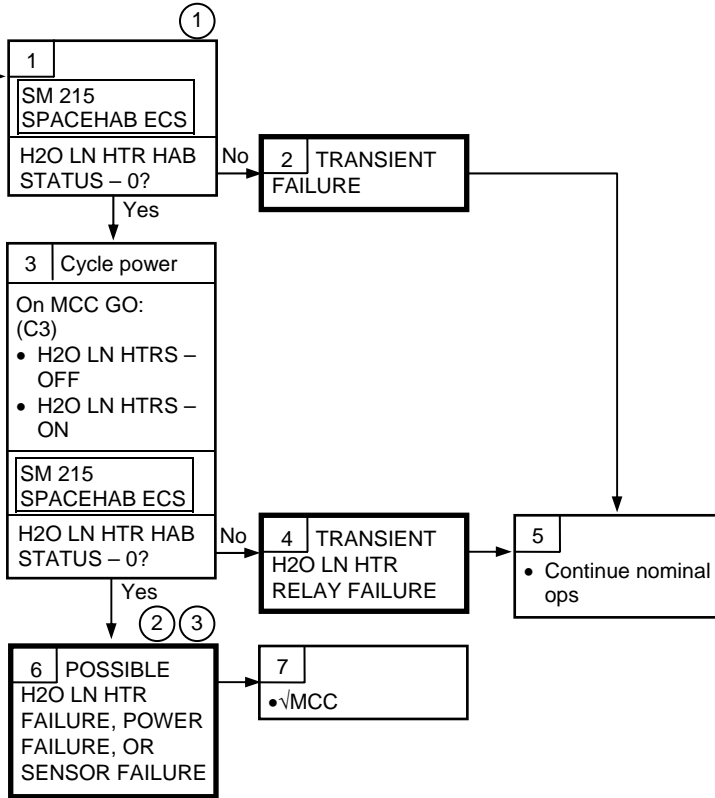
1.2i '215 SH H2O HTR HAB' ↓

SM ALERT

215 SH H2O HTR HAB

If H2O LN HTR HAB STATUS = 0 (OFF)

Nominal Config:
ORBITER:
(C3)
H2O LN HTRS – ON



- ① H2O LN HTR turned on for water loop failures to prevent external line freezing
- ② Orbiter attitude control reqd to prevent line freezing and damaging PHX if H2O line htrs failed off
- ③ Spacehab POCC can distinguish between failures by analyzing bus currents. Htr requires 3.2A while on

ECS

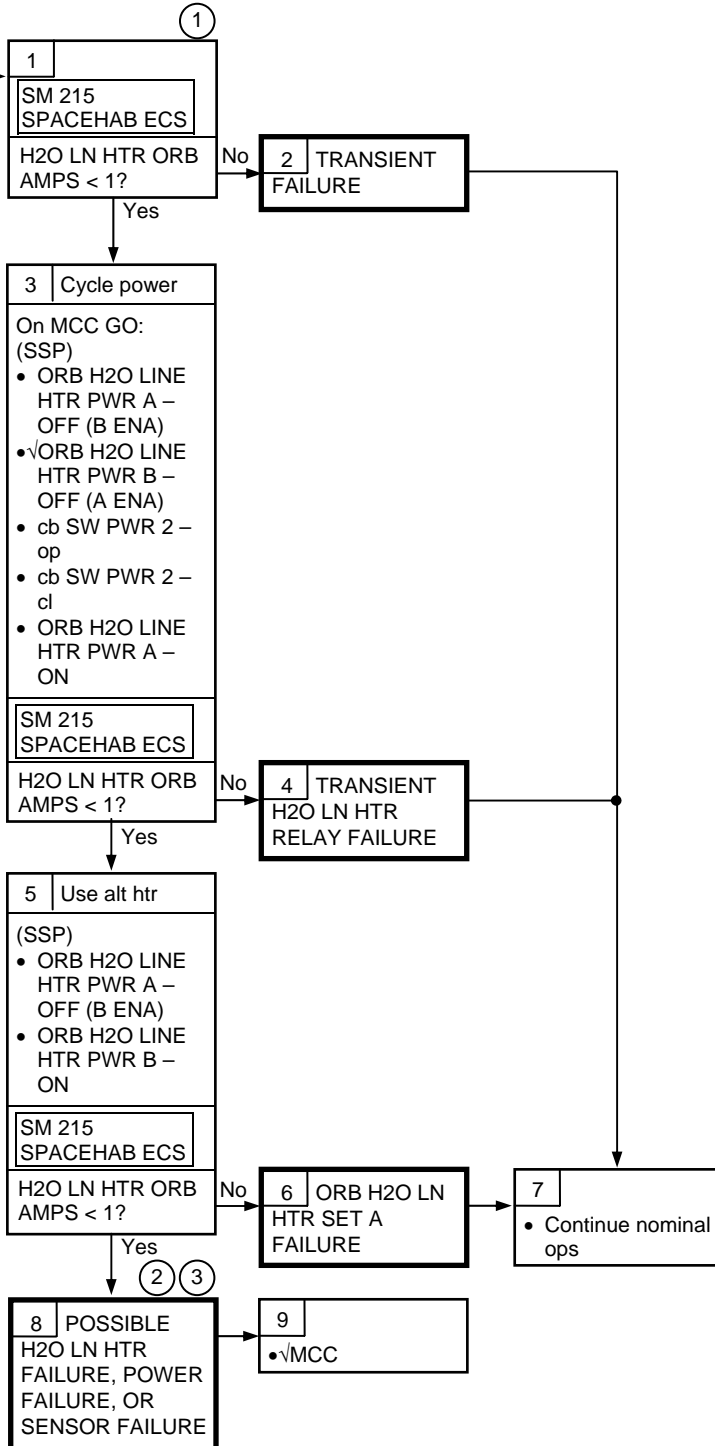
1.2j '215 SH H2O HTR ORB' ↓

SM ALERT

225 SH H2O HTR ORB

If H2O LN HTR ORB AMPS < 1 amp

Nominal Config:
 ORBITER:
 (SSP)
 cb SW PWR 2 – cl
 ORB H2O LINE HTR PWR A – ON
 ORB H2O LINE HTR PWR B – OFF (A ENA)



- ① H2O LN HTR turned on for water loop failures to prevent external line freezing
- ② Orbiter attitude control reqd to prevent line freezing and damaging PHX if H2O line htrs failed off
- ③ MCC can distinguish between failures by analyzing bus currents

ECS

1.2k '215 SH WFCEU MODE' ↓

SM ALERT

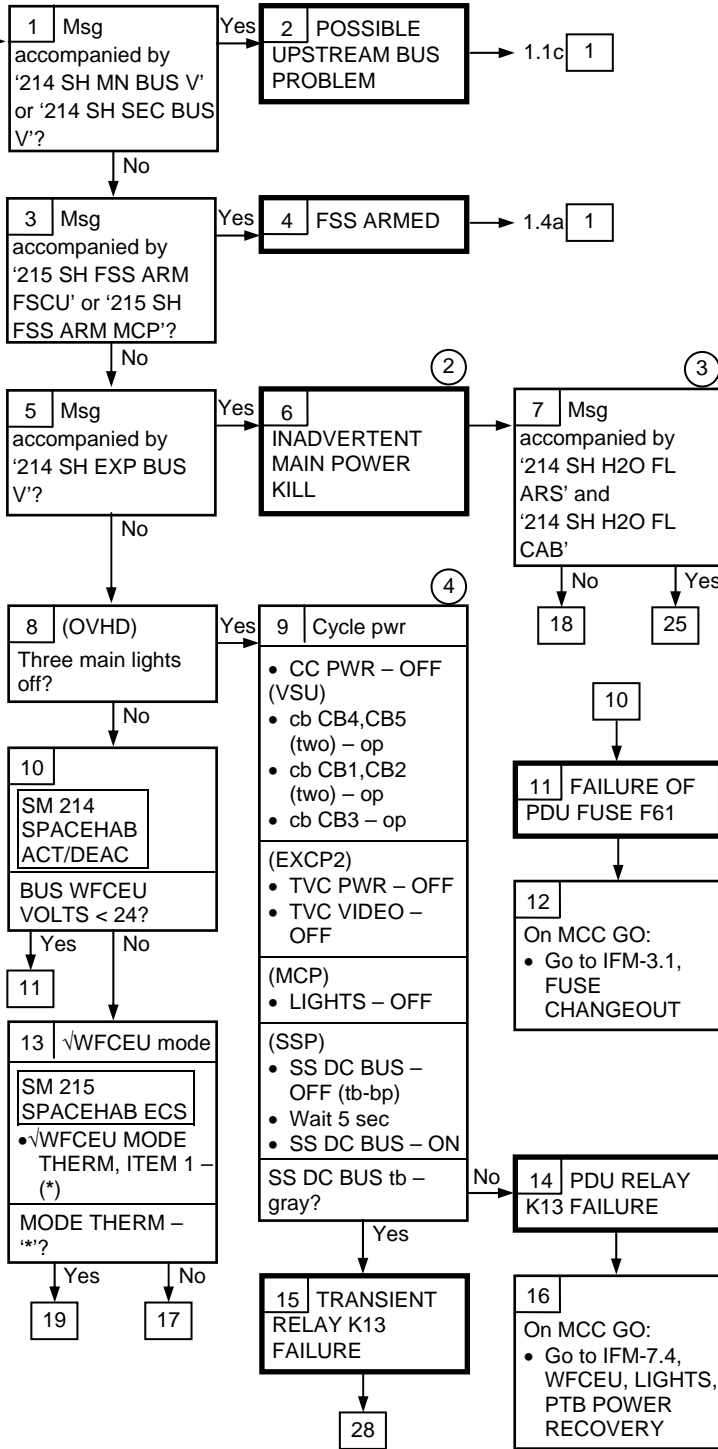
215 SH WFCEU MODE

If WFCEU MODE THERM, ITEM 1 – blank (no*), and ↓

Nominal Config:
ORBITER:

SM 214 SPACEHAB ACT/DEAC

BUS WFCEU – ON (SSP)
SS DC BUS tb – gray



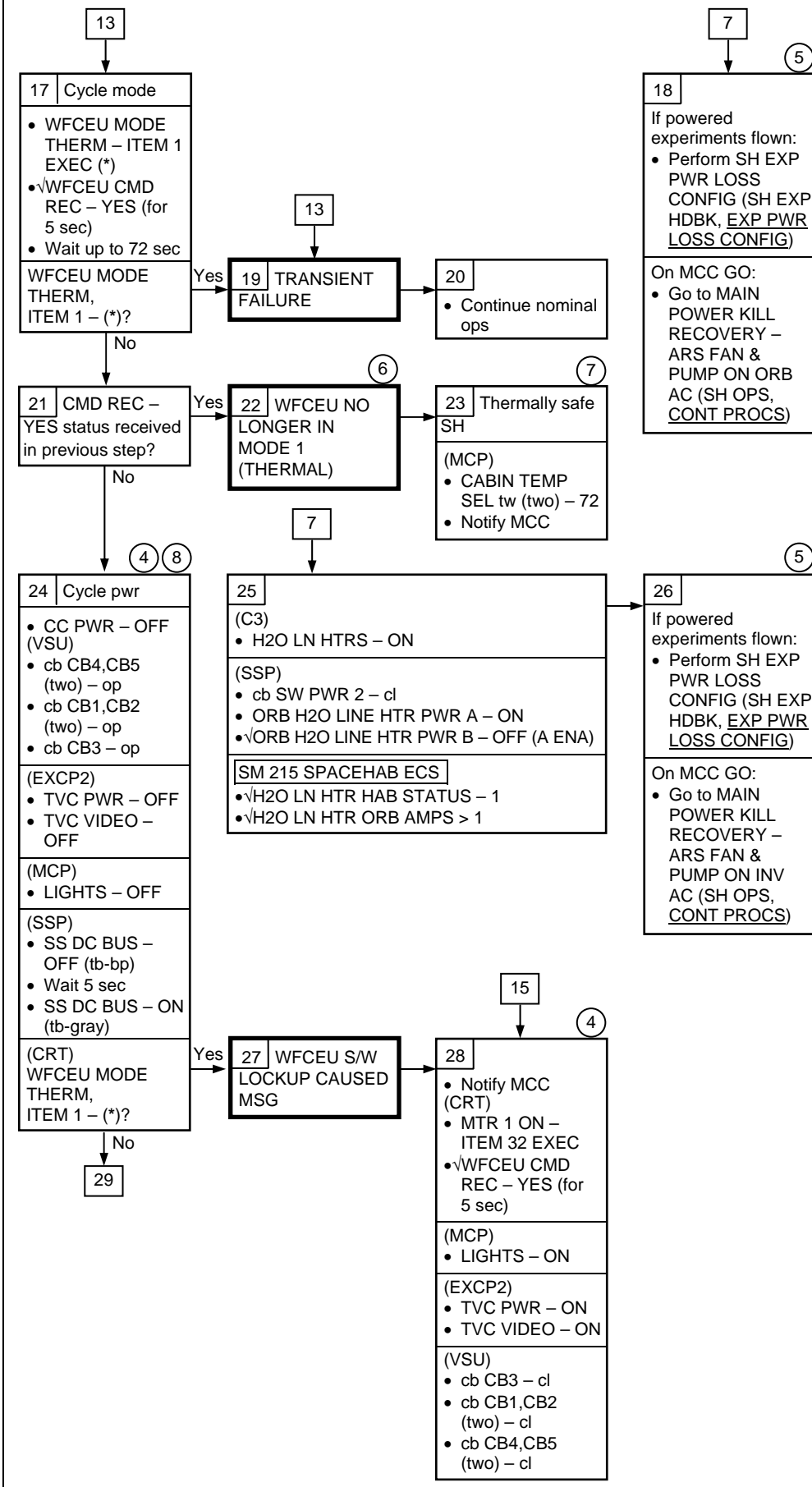
①
Msg is only obtained when WFCEU is operating in mode 1

②
Following msgs also displayed:
'214 SH WFCEU V'
If Hab fan ON:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'

③
MN PWR KILL will take down SH water pump if powered by SH INV; thus, water line heaters will need to be activated. Water pump will not be affected if on ORB AC. Recovery procedures different if pump powered by ORB AC vs INV

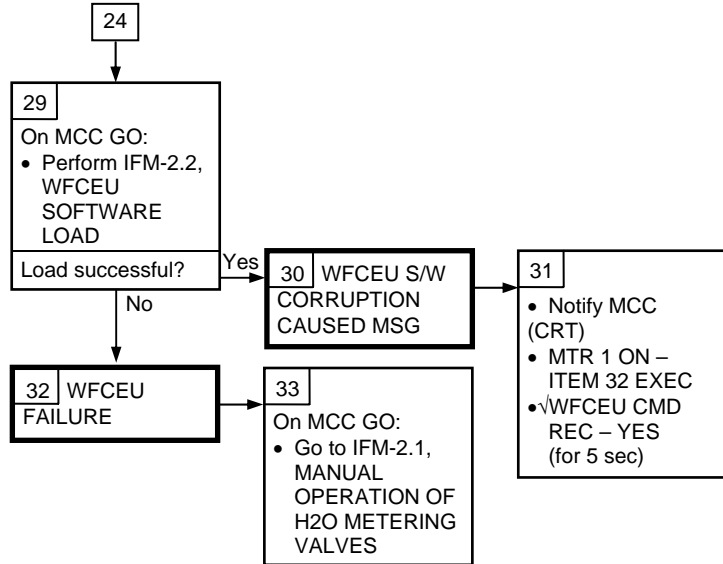
④
Video pwrdn and pwrup steps not required for missions without CC in SH Module

ECS 1.2k (Cont)



- ④ Video pwrn and pwrup steps not required for missions without CC in SH Module
- ⑤ SH EXP HDBK will not contain a SH EXP PWR LOSS CONFIG procedure for missions with no powered experiments
- ⑥ If Fan/Hx inlet temp sensor failed, WFCEU will be in mode 3 at this point
- ⑦ Selecting cabin temp = 72 degF places WFCEU in most benign state to allow time for POCC analysis
- ⑧ Video system (VSU) and its also pwr'd by SS DC BUS

ECS 1.2k (Cont)



RESERVED

RESERVED

1.3

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RESERVED

1.3

FIRE/SMOKE

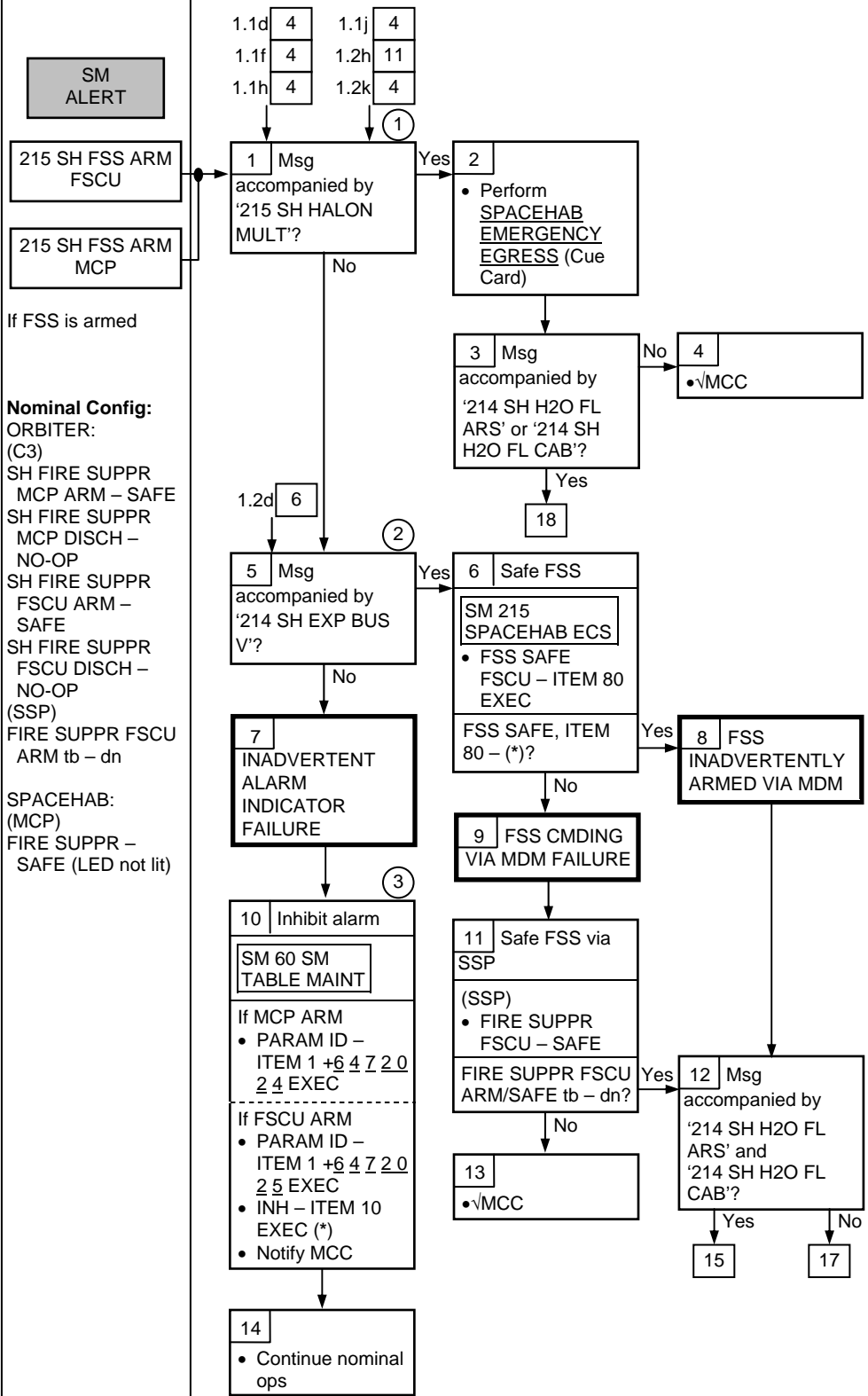
FIRE/SMOKE

1.4

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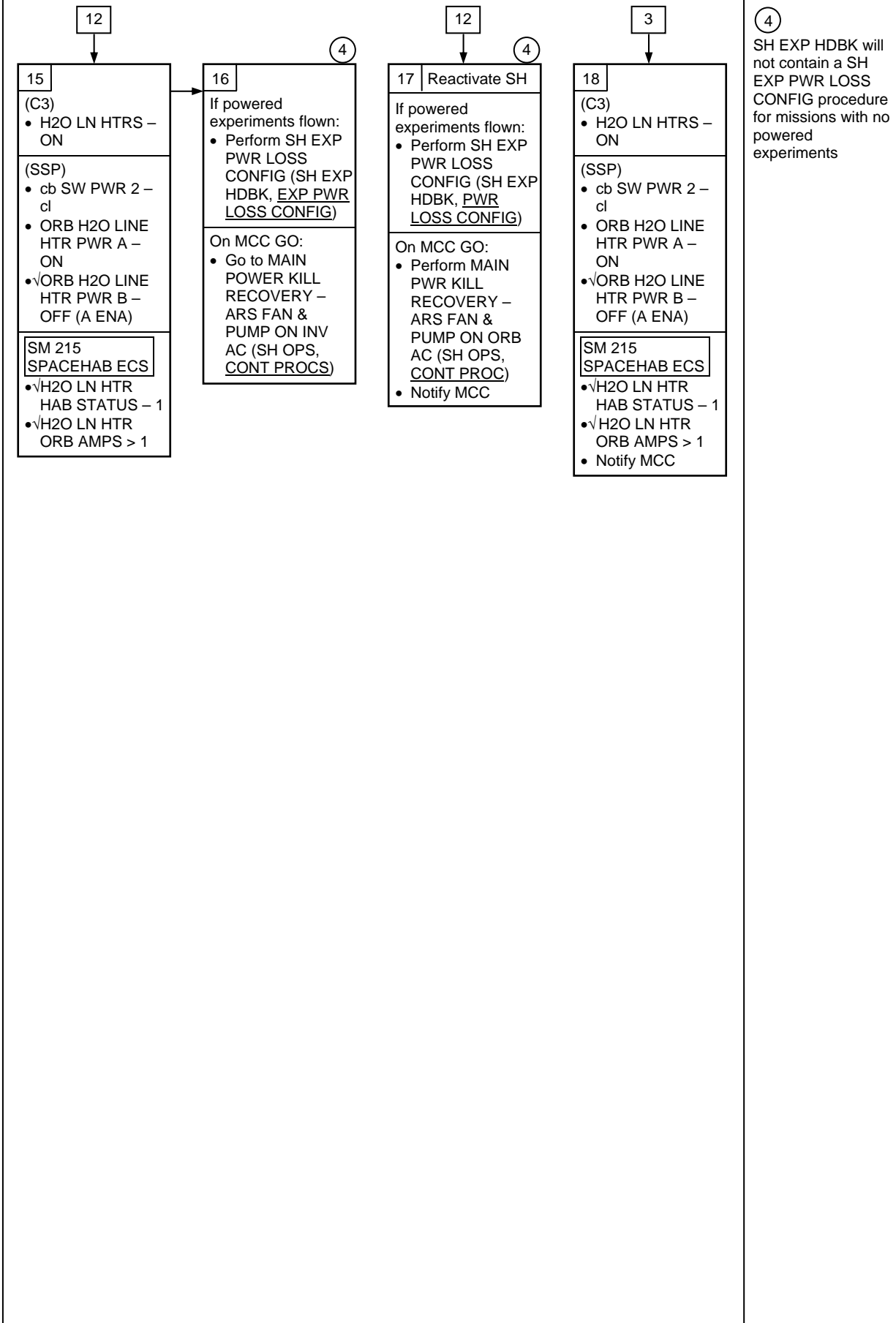
FIRE/SMOKE

**1.4a '215 SH FSS ARM FSCU' ↓ OR
'215 SH FSS ARM MCP' ↓**



- ① Individual bottle status will be checked at the POCC
- ② Following msgs will also be displayed:
'214 SH WFCEU V'
If Hab fan ON:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'
If Inverter ON:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'
If WFCEU in mode 1,
'215 SH WFCEU MODE'
- ③ FDA can be inhibited by MCC ground command

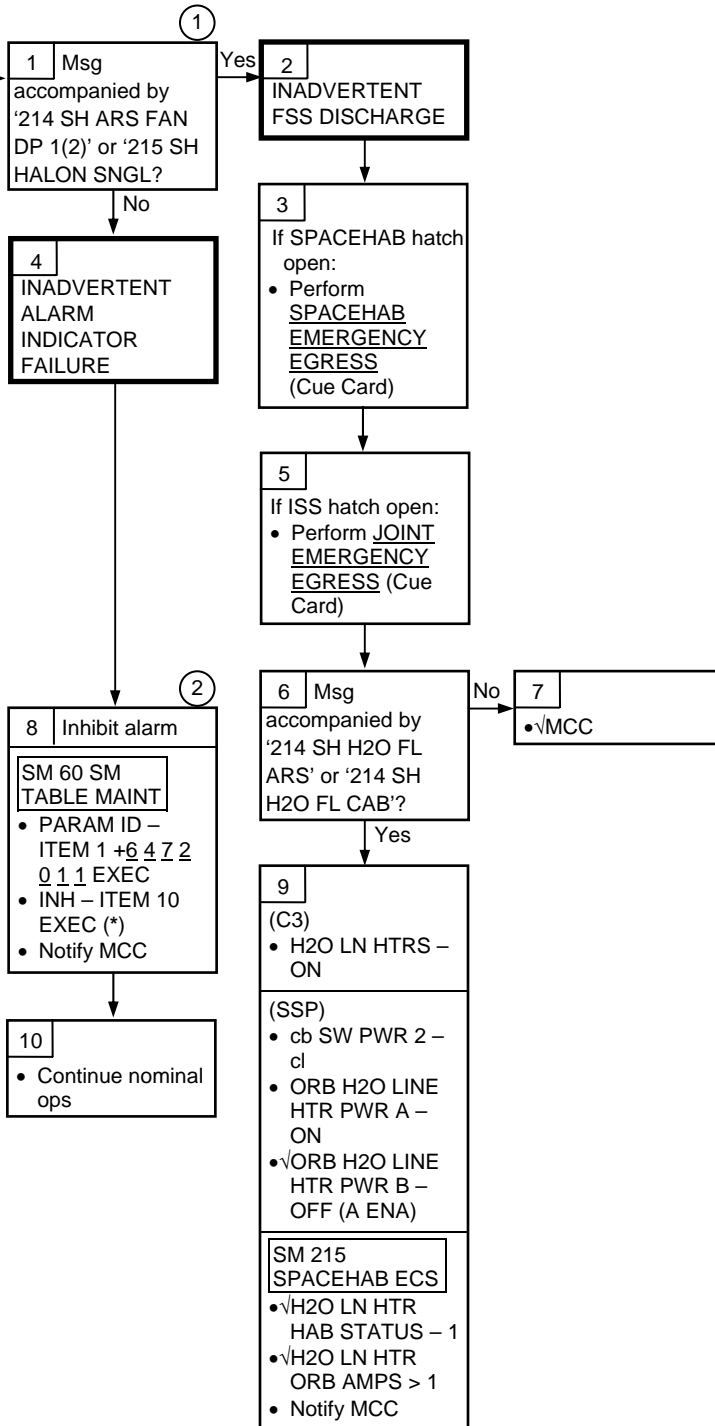
FIRE/SMOKE 1.4a (Cont)



FIRE/SMOKE 1.4b '215 SH HALON MULT'

- SM ALERT
- PL CAUTION (F7)
- BACKUP C/W ALARM (F7)
- 215 SH HALON MULT

Nominal Config:
 ORBITER: (C3)
 SH FIRE SUPPR MCP ARM – SAFE
 SH FIRE SUPPR MCP DISCH – NO-OP
 SH FIRE SUPPR FSCU ARM – SAFE
 SH FIRE SUPPR FSCU DISCH – NO-OP (SSP)
 FIRE SUPPR FSCU ARM tb – dn
 SPACEHAB: (MCP)
 FIRE SUPPR – SAFE (LED not lit)
 MULTI BOTTLE HALON DISCH – L3 (light not lit) (EXCP2)
 ARS – KILL ENA



① Individual bottle status will be checked at the POCC

② FDA can be inhibited by MCC ground command

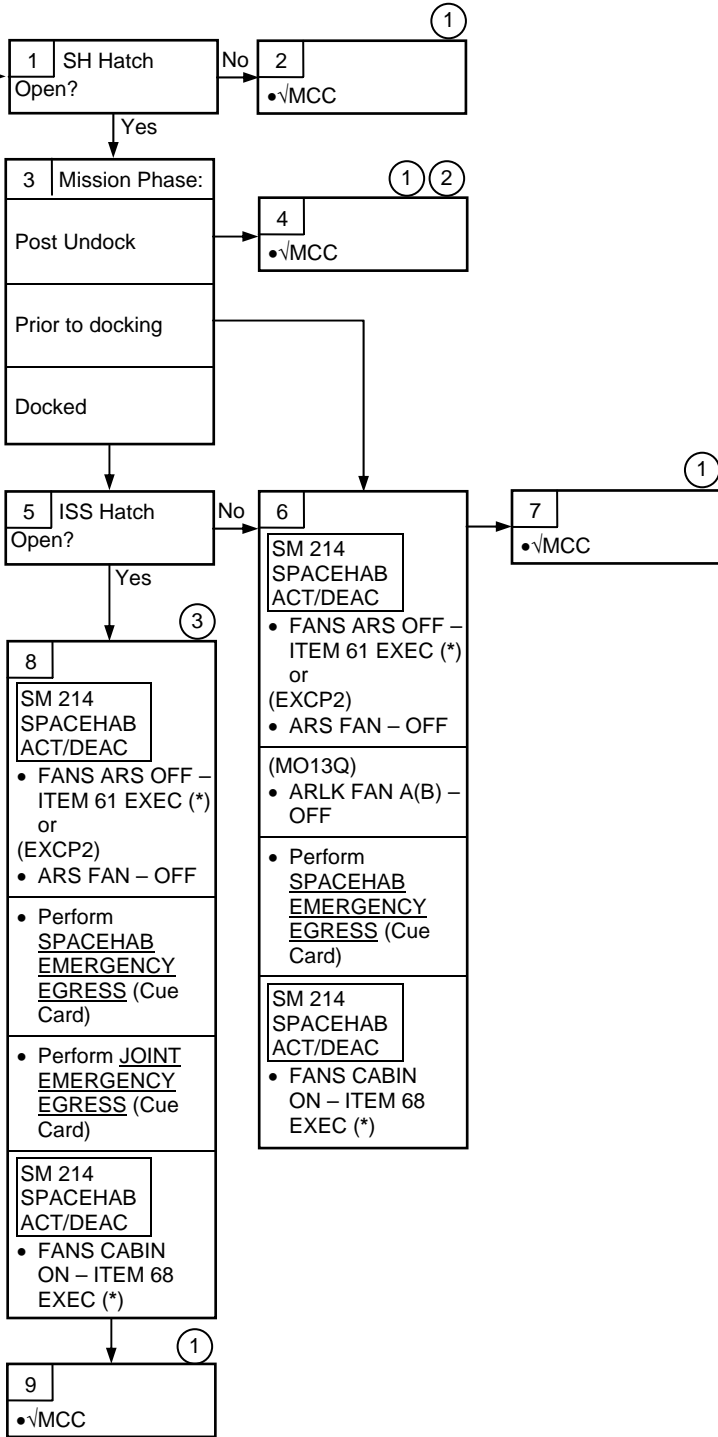
FIRE/SMOKE 1.4c '215 SH HALON SNGL'

SM ALERT

215 SH HALON SNGL

Nominal Config:
 ORBITER:
 (C3)
 SH FIRE SUPPR
 MCP ARM – SAFE
 SH FIRE SUPPR
 MCP DISCH –
 NO-OP
 SH FIRE SUPPR
 FSCU ARM –
 SAFE
 SH FIRE SUPPR
 FSCU DISCH –
 NO-OP
 (SSP)
 FIRE SUPPR FSCU
 ARM tb – dn

SPACEHAB:
 (MCP)
 FIRE SUPPR –
 SAFE (LED not lit)



- ① POCC has insight into individual status of each halon bottle
- ② For a single bottle discharge, crew is OK to continue SH operations in the module for 72-100 hours for a single module config and the entire mission for a double module config
- ③ Procedures can be performed simo

MECH

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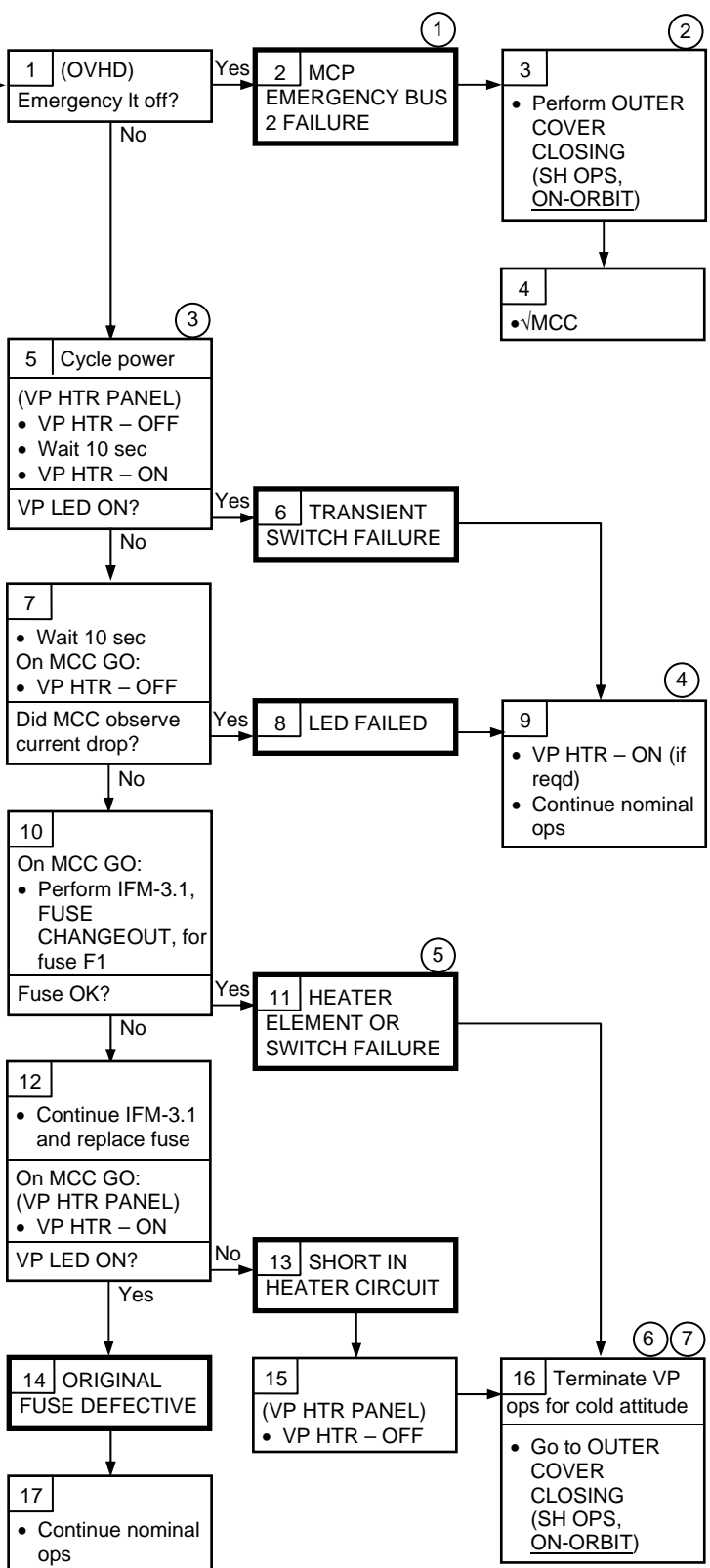
MECH

1.5a FWD VIEWPORT LED OFF WHEN SHOULD BE ON

Viewport LED off

If Heater fails OFF

Nominal Config:
SPACEHAB (Fwd Module):
VP outer cover open at cold attitude
VP HTR – ON



- ① Refer to BUS/CRITICAL EQUIPMENT LOSS for system impacts
- ② IFM-3.1 can be performed to check MCP fuse(s) F1/F2 continuity
- ③ LED provides only crew indication of htr status
- ④ VP violations are documented in the Execute Package or FLIGHT PLAN and will list times when the VP htr must be on or off
- ⑤ Spacehab POCC can also determine heater status by analyzing bus currents. Htr requires 1A while on
- ⑥ VP htr reqd for cold orbiter attitudes if outer cover is open
- ⑦ Ground will provide updated times for viewport constraints

MECH

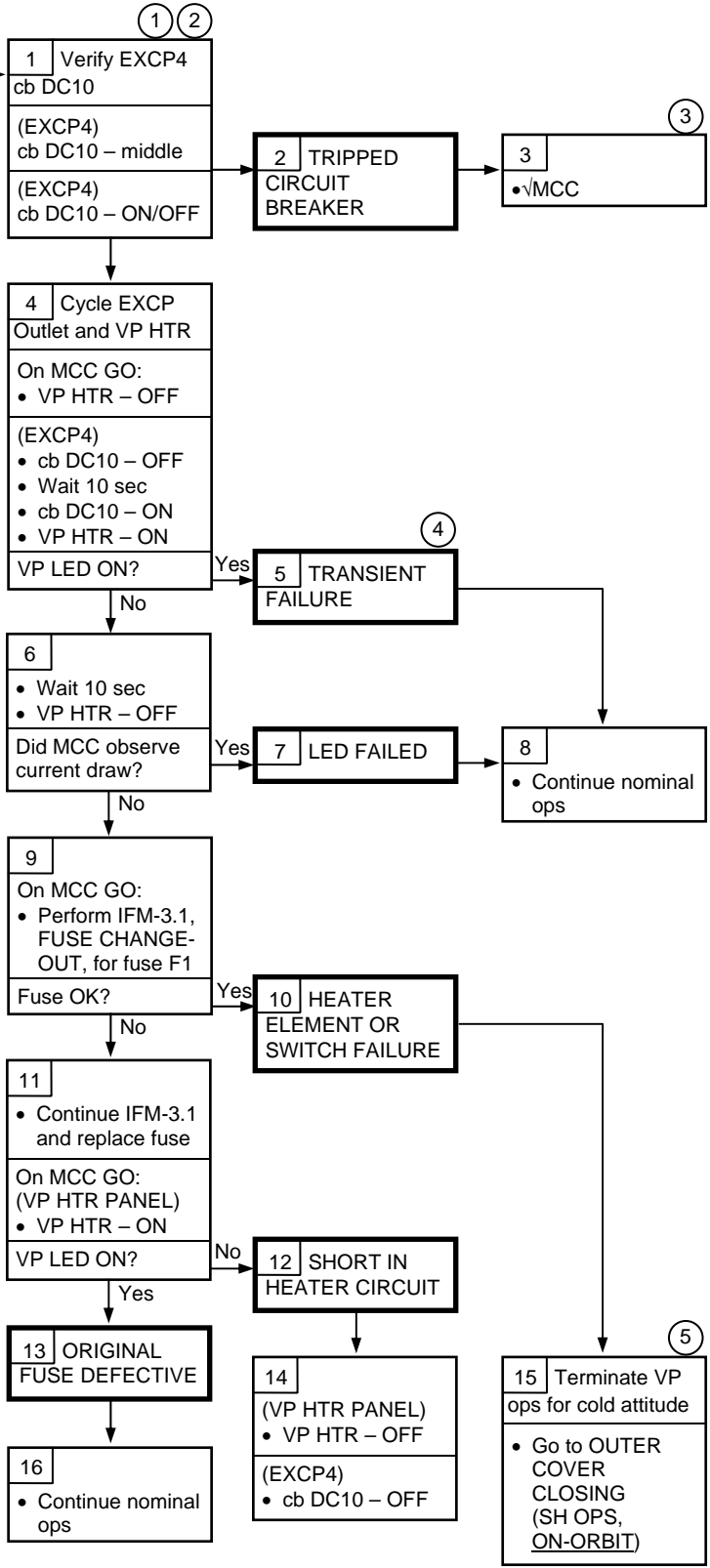
1.5b AFT VIEWPORT LED OFF WHEN SHOULD BE ON

Viewport LED off

Nominal Config:
ORBITER:
SM 214
SPACEHAB
ACT/DEAC

DC EXCP 4 ON,
ITEM 9 – (*)
SPACEHAB (Aft
Module):
VP outer cover open
at cold attitude
VP HTR – ON

(EXCP4)
cb DC10 – ON



- ① EXCP cb in middle position indicates tripped
- ② If any cb found in tripped position, ground must first look for evidence of shorts before repowering
- ③ MCC may direct crew to cycle EXCP outlet and VP HTR after ground review of data
- ④ If DC10 was found in off position, this was cause of problem, otherwise transient failure
- ⑤ VP HTR reqd for cold orbiter attitudes if outer cover is open

SS PGSC

SUBSYSTEM PGSC TROUBLESHOOTING TABLE

SYMPTOM	RECOVERY ACTIONS	CAUSES
A. PGSC not receiving power	1. Perform Mal 1.6a	1. Transient 2. Loose connection 3. Failed utility outlet 4. PGSC or cable failure
B. Spacehab Monitor Program will not run	1. √MCC	1. Transient 2. Hard disk or software failure 3. PGSC failure
C. RS-422 ERR or TIMEOUT/RETRY messages present ^{2,3,4} or time not incrementing after activation	1. Check data connections ¹ 2. √MCC	1. Loose connection 2. Hard disk or software failure 3. Failure of DMU or PGSC I/F 4. PGSC or RS-422 data cable failure
D. PGSC running on battery power (DC Pwr Adapter LED – off and/or remaining battery status percentage decreasing)	1. Check power connections ⁵ 2. √MCC 3. Shutdown PGSC S/W 4. Perform MAL 1.6a	1. Loose connection 2. Failed utility outlet, DC Pwr Adapter or cable

¹ EXCP1 J116 (PGSC DATA) – RS-422 Data Cable/Adapter/PCMCIA Card

² RS-422 ERR message means PGSC receiving data, but not in correct format

³ Timeout/Retry message means communication between DMU and PGSC lost

⁴ Intermittent messages do not indicate hardware or software problem

⁵ EXCP1 J103 (DC 3) – DC Pwr cable – A31p Pwr Supply – A31p Pwr cable

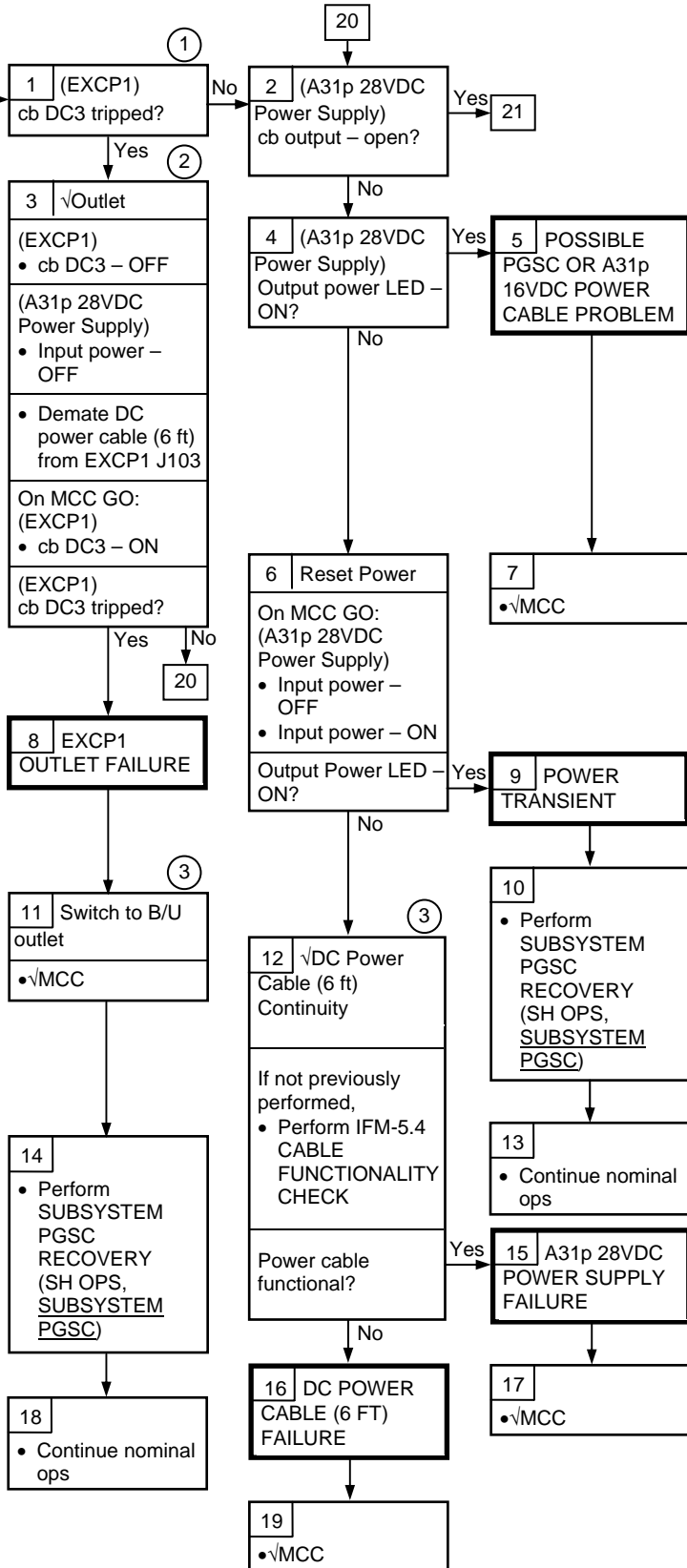
SS PGSC
1.6

SYSTEM

1.6a LOSS OF SUBSYSTEM PGSC POWER

PGSC Not Receiving Power

Nominal Config:
 (EXCP1)
 cb DC3 – ON
 (A31p 28VDC Power Supply)
 Input power – ON
 cb output – CLOSE
 Fan inlet/outlet clear of all blockage

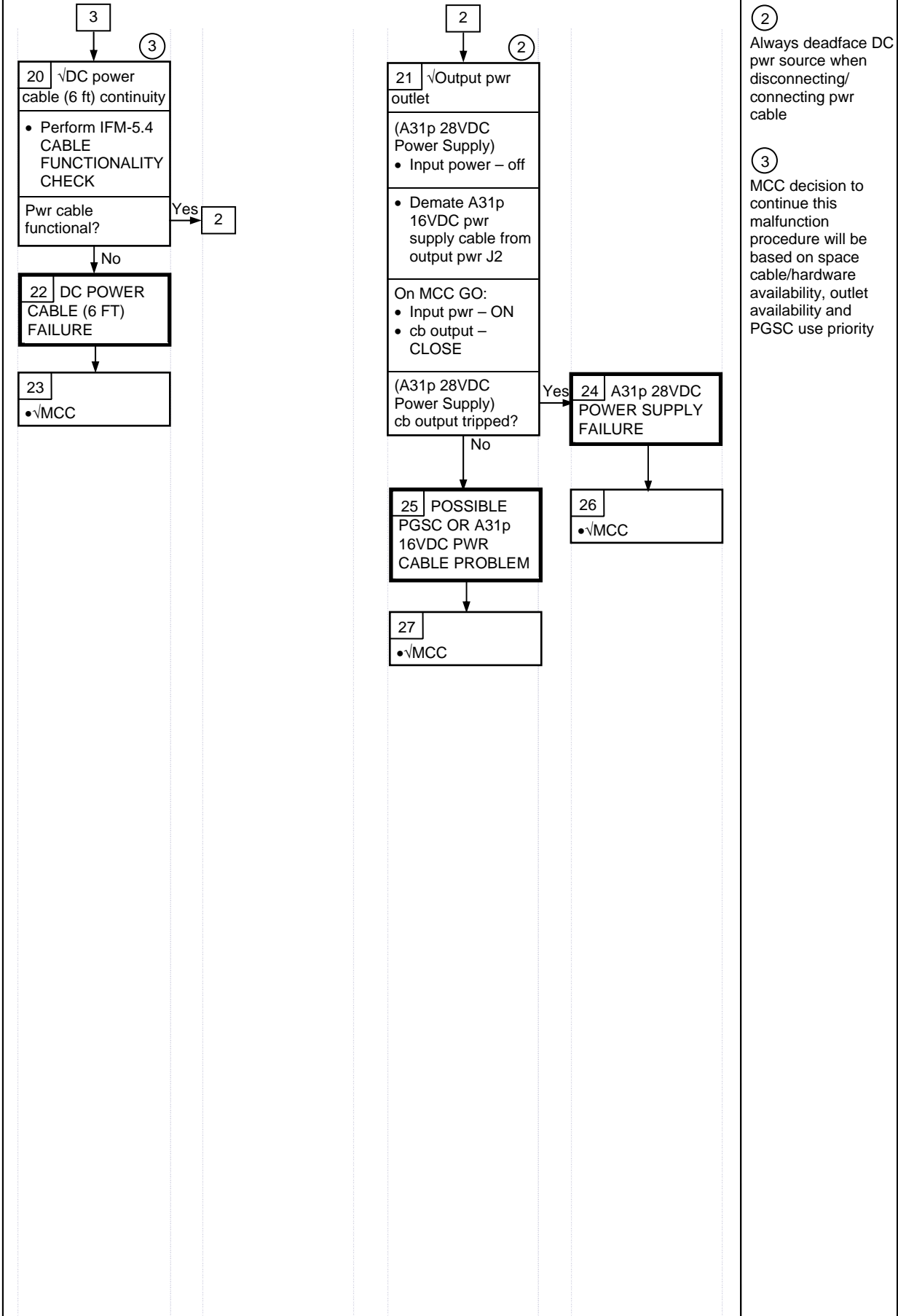


① EXCP cb in middle position indicates tripped

② Always deadface DC pwr source when disconnecting/connecting pwr cable

③ MCC decision to continue this malfunction procedure will be based on spare cable/hardware availability, outlet availability and PGSC use priority

SYSTEM 1.6a (Cont)



SSRs

SSR-1	ARS FAN RECOVERY FROM INADVERTENT FAN KILL.....	2-3
SSR-2	SUBSYSTEM EQUIPMENT SWITCH TO INVERTER POWER.....	2-4
SSR-3	DMU RAM FORMAT SOFTWARE LOAD.....	2-5
SSR-4	PPRV CONFIGURATION	2-6
SSR-5	SUBSYSTEM EQUIPMENT SWITCH TO ORBITER AC POWER	2-7
SSR-6	WFCEU RECOVERY	2-8
SSR-7	H2O LINE HTR CONFIGURATION	2-9
SSR-8	FAN RECOVERY	2-10

SSRs

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SSR-1

ARS FAN RECOVERY FROM INADVERTENT FAN KILL

EXCP2

1. ARS – KILL INHB

SM 214 SPACEHAB ACT/DEAC

CRT

2. $\sqrt{\text{FANS ARS ORB, ITEM 65 - (*)}$

3. ON – ITEM 67 EXEC (*)

4. $\sqrt{\Delta P 1,2 \text{ (two)} > 0.2 \text{ and } < 5.5}$

SSR-2
SUBSYSTEM EQUIPMENT SWITCH TO INVERTER POWER

NOTE

This procedure assumes all subsystem equipment is on Orbiter power

1. \sqrt{MCC} for AC equipment pwrdrn

If Inverter not ON:

CRT

SM 214 SPACEHAB ACT/DEAC

2. DC INVERTER ON – ITEM 1 EXEC (*)
3. $\sqrt{BUS INV \Phi A, \Phi B, \Phi C VOLTS}$ (three) > 105.4 and < 124.6

SWITCH ARS FAN PWR

NOTE

Expect MASTER ALARM, msgs:

'214 SH ARS FAN DP 1'
'214 SH ARS FAN DP 2'

4. FANS ARS OFF – ITEM 61 EXEC (*)
5. INV – ITEM 63 EXEC (*)
6. ON – ITEM 67 EXEC (*)
7. $\sqrt{\Delta P 1,2}$ (two) > 0.2 and < 5.5

If Cabin Fan in use:

SWITCH CABIN FAN PWR

NOTE

Expect MASTER ALARM, msgs:

'214 SH CAB FAN DP 1'
'214 SH CAB FAN DP 2'

8. FANS CABIN OFF – ITEM 62 EXEC (*)
9. INV – ITEM 64 EXEC (*)
10. ON – ITEM 68 EXEC (*)
11. $\sqrt{\Delta P 1,2}$ (two) > 0.2 and < 5.5

SWITCH WATER PUMP 2 PWR

NOTE

Expect SM ALERT, msgs:

'214 SH H2O FL ARS'
'214 SH H2O FL CAB'

12. H2O PUMP 1/2 OFF – ITEM 71 EXEC (*)
13. 2 INV – ITEM 72 EXEC (*)
14. 2 ON/1 OFF – ITEM 75 EXEC (*)
15. $\sqrt{HX H2O FLOW ARS}$ > 75
16. \sqrt{CABIN} > 250

17. \sqrt{MCC} for AC equipment pwrup

SSR-3 DMU RAM FORMAT SOFTWARE LOAD

PGSC

QUIT SUBSYSTEM PGSC SOFTWARE

1. Press [ALT]/[Q] to exit software
2. Press [SHIFT]/[F10] to confirm

LOAD FORMAT SOFTWARE

3. Double click on SHUTTLE APPS folder on desktop
4. Double click on SPACEHAB folder
5. Double click on FORMAT LOAD icon
6. ✓SPACEHAB SUMMARY SCREEN displayed

ACCESS FORMAT LOAD MENU

PGSC: SPACEHAB SUMMARY

7. Press [ALT]/[Q] to select exit menu
8. Press [SHIFT]/[F10] to confirm
9. ✓SPACEHAB SYSTEM SOFTWARE MENU displayed

LOAD RAM SOFTWARE

10. Press [3] to select load only option
11. Press [SHIFT]/[F10] to confirm
12. At prompt, press [SHIFT]/[F10] to load RAM Software
13. ✓'FORMAT OPS IN PROGRESS' message displayed
14. ✓SPACEHAB SYSTEM SOFTWARE MENU displayed after 1 min

EXECUTE RAM SOFTWARE

15. Press [5] to select execute option
16. Press [SHIFT]/[F10] to confirm
17. At RAM EXEC prompt, press [SHIFT]/[F10]
18. At RAM LOAD COMPLETE prompt, press [SHIFT]/[F10] to execute RAM Software
19. ✓SPACEHAB SYSTEM SOFTWARE MENU displayed

RETURN TO NOMINAL SS PGSC OPS

20. Press [7] to select exit option
21. Press [ALT]/[RTN] to confirm
22. Shut down Windows
23. ✓Automatic pwr off of PGSC
24. PGSC pwr – on
25. Select SPACEHAB SUBSYSTEM boot option
26. ✓Windows displayed
27. Double click on SHUTTLE APPS folder on desktop
28. Double click on SPACEHAB folder
29. Double click on 'SPACEHAB MONITOR' icon in SPACEHAB folder
30. Press [ALT]/[G]
31. Press [1] to set launch time
32. Input launch time
33. Press [SHIFT]/[F10] to confirm
34. Press [2] to set GMT
35. ✓GMT displayed is correct, change if necessary
36. Press [SHIFT]/[F10] to confirm
37. Press [SHIFT]/[F1] to return to display

SSR-4
PPRV CONFIGURATION

CLOSE PPRVs

- | | |
|-----|--|
| | <div style="border: 1px solid black; padding: 2px; display: inline-block;">SM 215 SPACEHAB ECS</div> |
| CRT | 1. PPRV ISO VLV 1 CL – ITEM 87 EXEC (*) |
| | 2. 2 CL – ITEM 89 EXEC (*) |

OPEN PPRVs

- | | |
|-----|--|
| | <div style="border: 1px solid black; padding: 2px; display: inline-block;">SM 215 SPACEHAB ECS</div> |
| CRT | 3. PPRV ISO VLV 1 OP – ITEM 86 EXEC (*) |
| | 4. 2 OP – ITEM 88 EXEC (*) |

**SSR-5
SUBSYSTEM EQUIPMENT SWITCH TO ORBITER AC POWER**

NOTE

This procedure assumes all subsystem equipment is on Inverter power

1. \sqrt MCC for AC equipment pwrdrn

MA73C:E

2. \sqrt cb AC3 PL 3 Φ – cl

SWITCH WATER PUMP 2 PWR

NOTE

Expect SM ALERT, msgs:
'214 SH H2O FL ARS'
'214 SH H2O FL CAB'

SM 214 SPACEHAB ACT/DEAC

CRT

3. H2O PUMP 1/2 OFF – ITEM 71 EXEC (*)
4. 2 ORB – ITEM 73 EXEC (*)
5. 2 ON/1 OFF – ITEM 75 EXEC (*)
6. \sqrt HX H2O FLOW ARS > 75
7. \sqrt CABIN > 250

SWITCH ARS FAN PWR

NOTE

Expect MASTER ALARM, msgs:
'214 SH ARS FAN DP 1'
'214 SH ARS FAN DP 2'

8. FANS ARS OFF – ITEM 61 EXEC (*)
9. ORB – ITEM 65 EXEC (*)
10. ON – ITEM 67 EXEC (*)
11. \sqrt Δ P 1,2 (two) > 0.2 and < 5.5

If Cabin Fan in use:

SWITCH CABIN FAN PWR

NOTE

Expect MASTER ALARM, msgs:
'214 SH CAB FAN DP 1'
'214 SH CAB FAN DP 2'

12. FANS CABIN OFF – ITEM 62 EXEC (*)
13. ORB – ITEM 66 EXEC (*)
14. ON – ITEM 68 EXEC (*)
15. \sqrt Δ P 1,2 (two) > 0.2 and < 5.5

16. \sqrt MCC for AC equipment pwrup

SSR-6
WFCEU RECOVERY

RESET WFCEU

- CRT
- | |
|---------------------|
| SM 215 SPACEHAB ECS |
|---------------------|
1. FLAG F9 – ITEM 19 EXEC (no feedback)
 2. √WFCEU CMD REC – YES (for 5 sec)
 3. If YES not received, notify MCC and go to step 15
 4. Wait 3 min

USE PRIMARY WFCV MOTOR

- On MCC GO:
5. MTR 1/2 OFF – ITEM 31 EXEC (no feedback)
 6. √WFCEU CMD REC – YES (for 5 sec)
 7. MTR 1 ON – ITEM 32 EXEC (no feedback)
 8. √WFCEU CMD REC – YES (for 5 sec)
 9. Wait 3 min

USE BACKUP WFCV MOTOR

- On MCC GO:
10. MTR 1/2 OFF – ITEM 31 EXEC (no feedback)
 11. √WFCEU CMD REC – YES (for 5 sec)
 12. MTR 2 ON – ITEM 33 EXEC (no feedback)
 13. √WFCEU CMD REC – YES (for 5 sec)
 14. Wait 3 min

POWER CYCLE WFCEU

NOTE

Expect SM ALERT, msg:
'214 SH WFCEU V'
Expect fwd module lights to cycle off/on

- SSP
- On MCC GO:
15. SS DC BUS – OFF (tb-bp)
 16. Wait 10 sec
 17. SS DC BUS – ON (tb-gray)

NOTE

Expect SM ALERT, msg:
'215 SH WFCEU MODE'

- CRT
18. WFCEU MODE HX IN – ITEM 2 EXEC (no feedback)
 19. √WFCEU CMD REC – YES (for 5 sec)
 20. MTR 1 ON – ITEM 32 EXEC (no feedback)
 21. √WFCEU CMD REC – YES (for 5 sec)

SSR-7
H2O LINE HTR CONFIGURATION

ACTIVATION

- C3
SSP
1. H2O LN HTRS – ON
 2. cb SW PWR 2 – cl
 3. ORB H2O LINE HTR PWR A – ON
 4. √PWR B – OFF (A ENA)

NOTE

Possible SM ALERT, msg:
'214 SH AFT BUS A'

SM 215 SPACEHAB ECS

- CRT
5. √H2O LN HTR HAB STATUS – 1
 6. √ORB AMPS > 1

DEACTIVATION

NOTE

Expect SM ALERT, msgs:
'215 SH H2O HTR ORB'
'215 SH H2O HTR HAB'

- SSP
C3
7. ORB H2O LINE HTR PWR A – OFF (B ENA)
 8. cb SW PWR 2 – op
 9. H2O LN HTRS – OFF

**SSR-8
FAN RECOVERY**

ARS FAN SWITCH TO CABIN FAN USING INVERTER POWER

NOTE

Expect MASTER ALARM, msgs:
'214 SH ARS FAN DP 1'
'214 SH ARS FAN DP 2'

CRT

SM 214 SPACEHAB ACT/DEAC

1. FANS ARS OFF – ITEM 61 EXEC (*)
2. $\sqrt{\Delta P}$ FANS CABIN INV – ITEM 64 (*)
3. FANS CABIN ON – ITEM 68 EXEC (*)
4. $\sqrt{\Delta P}$ 1,2 (two) > 0.2 and < 5.5

ARS FAN SWITCH TO CABIN FAN USING ORBITER AC POWER

NOTE

Expect MASTER ALARM, msgs:
'214 SH ARS FAN DP 1'
'214 SH ARS FAN DP 2'

SM 214 SPACEHAB ACT/DEAC

5. FANS ARS OFF – ITEM 61 EXEC (*)
6. $\sqrt{\Delta P}$ FANS CABIN ORB – ITEM 66 (*)
7. FANS CABIN ON – ITEM 68 EXEC (*)
8. $\sqrt{\Delta P}$ 1,2 (two) > 0.2 and < 5.5

CABIN FAN SWITCH TO ARS FAN USING INVERTER POWER

NOTE

Expect MASTER ALARM, msgs:
'214 SH CAB FAN DP 1'
'214 SH CAB FAN DP 2'

CRT

SM 214 SPACEHAB ACT/DEAC

9. FANS CABIN OFF – ITEM 62 EXEC (*)
10. $\sqrt{\Delta P}$ FANS ARS INV – ITEM 63 (*)
11. FANS ARS ON – ITEM 67 EXEC (*)
12. $\sqrt{\Delta P}$ 1,2 (two) > 0.2 and < 5.5

CABIN FAN SWITCH TO ARS FAN USING ORBITER AC POWER

NOTE

Expect MASTER ALARM, msgs:
'214 SH CAB FAN DP 1'
'214 SH CAB FAN DP 2'

CRT

SM 214 SPACEHAB ACT/DEAC

13. FANS CABIN OFF – ITEM 62 EXEC (*)
14. $\sqrt{\Delta P}$ FANS ARS ORB – ITEM 65 (*)
15. FANS ARS ON – ITEM 67 EXEC (*)
16. $\sqrt{\Delta P}$ 1,2 (two) > 0.2 and < 5.5

SPACEHAB IN-FLIGHT MAINTENANCE

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SPACEHAB
IFM

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OBJECTIVE: Replace failed fan (ARS or Cabin) with spare

TOOLS REQD: SPACEHAB

- SS Stow 4
- Flat Tip Screwdriver (Long), 3/16-in blade width
 - 4-in Ratchet Wrench, 1/4-in drive
 - 1/4-in Driver Handle
 - 5/16-in 6-point Standard Socket, 1/4-in drive
 - 7/16-in 6-point Deepwell Socket, 1/4-in drive
 - 4-in Extension, 1/4-in drive
 - Antistatic Wrist (ASW) Tethers
 - 1/4-in Torque Wrench
 - Gray Tape

SM 214 SPACEHAB ACT/DEAC

If replacing Cabin Fan:

NOTE

Expect MASTER ALARM, msgs:
 '214 SH CAB FAN DP 1'
 '214 SH CAB FAN DP 2'

1. FANS CABIN OFF – ITEM 62 EXEC (*)

If replacing ARS Fan:

NOTE

Expect MASTER ALARM, msgs:
 '214 SH ARS FAN DP 1'
 '214 SH ARS FAN DP 2'

2. FANS ARS OFF – ITEM 61 EXEC (*)

CAUTION

Pip pins in subfloor are noncaptive

D05

3. Remove pip pins, open floor panel, temp stow pip pins in floor panel
4. If replacing Cabin Fan, loosen ten 1/4-turn fasteners on muffler cover. Do not remove pip pin. Lift and rotate cover to access fan (Screwdriver) (fig 3-1)
5. Don ASW tethers, clip to ground

NOTE

Refer to figure 3-2 for steps 6 thru 23

6. Demate electrical power cable on top of fan assembly
7. Unclip ASW tethers
 If fan clamps in place:
 8. Loosen nuts on two fan clamps enough to allow clamps to expand. Do not remove nuts (4-in Ratchet, 7/16-in 6-point Deepwell Socket)
 9. Release T-handle on clamps, remove clamps
10. Loosen aft (two) boot clamps enough to allow clamps to expand. Do not remove screws (1/4-in Driver Handle, 5/16-in 6-point Standard Socket or Screwdriver)
11. Slide aft boot and clamps aft onto air duct
12. Loosen forward boot clamps enough to allow clamps to expand. Do not remove screws (4-in Ratchet, 5/16-in 6-point Standard Socket or Screwdriver)
13. Lift fan straight out of subfloor and slide front boot and clamps off failed fan
14. Mark failed fan with tape
15. Cover the failed fan connector with tape

16. Unstow spare fan
 17. Stow inoperative fan
 18. Slide boot and clamps on inlet of spare fan (note direction arrow)
- If replacing Cabin Fan:
19. Install spare fan with air flow direction arrow on side of fan pointing aft toward heat exchanger housing
- If replacing ARS Fan:
20. Install spare fan with air flow direction arrow on side of fan matching flow direction arrow on ARS duct
 21. Slide both boots and clamps into original positions
 22. Tighten four boot clamps (1/4-in Driver Handle, 5/16-in 6-point Standard Socket or Screwdriver)
- If fan clamps to be reinstalled:
23. Fasten two clamps which secure fan to mounting bracket. Torque to 30 in-lb (1/4-in Torque Wrench, 4-in Extension, 7/16-in 6-point Deepwell Socket)
 24. Clip ASW tethers to ground
 25. Mate electrical power cable on top of fan assembly
 26. Unclip ASW tethers
 27. If replacing Cabin Fan, lift and rotate muffler housing cover back in place and tighten ten 1/4-turn fasteners (fig 3-1)
 28. Close floor panel, replace pip pins
 29. Stow tools

SM 214 SPACEHAB ACT/DEAC

On MCC GO:

If Cabin Fan replaced:

30. FANS CABIN ON – ITEM 68 EXEC (*)
31. $\sqrt{\Delta P_{1,2}}$ (two) > 0.2 and < 5.5

If ARS Fan replaced:

32. FANS ARS ON – ITEM 67 EXEC (*)
33. $\sqrt{\Delta P_{1,2}}$ (two) > 0.2 and < 5.5

34. If no ON status received or ΔP measurements outside operating limits, contact MCC

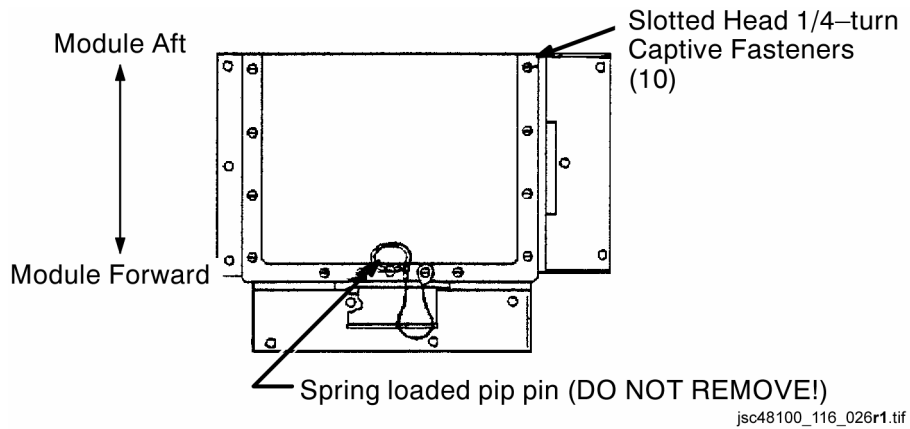


Figure 3-1.- Muffler cover (top view).

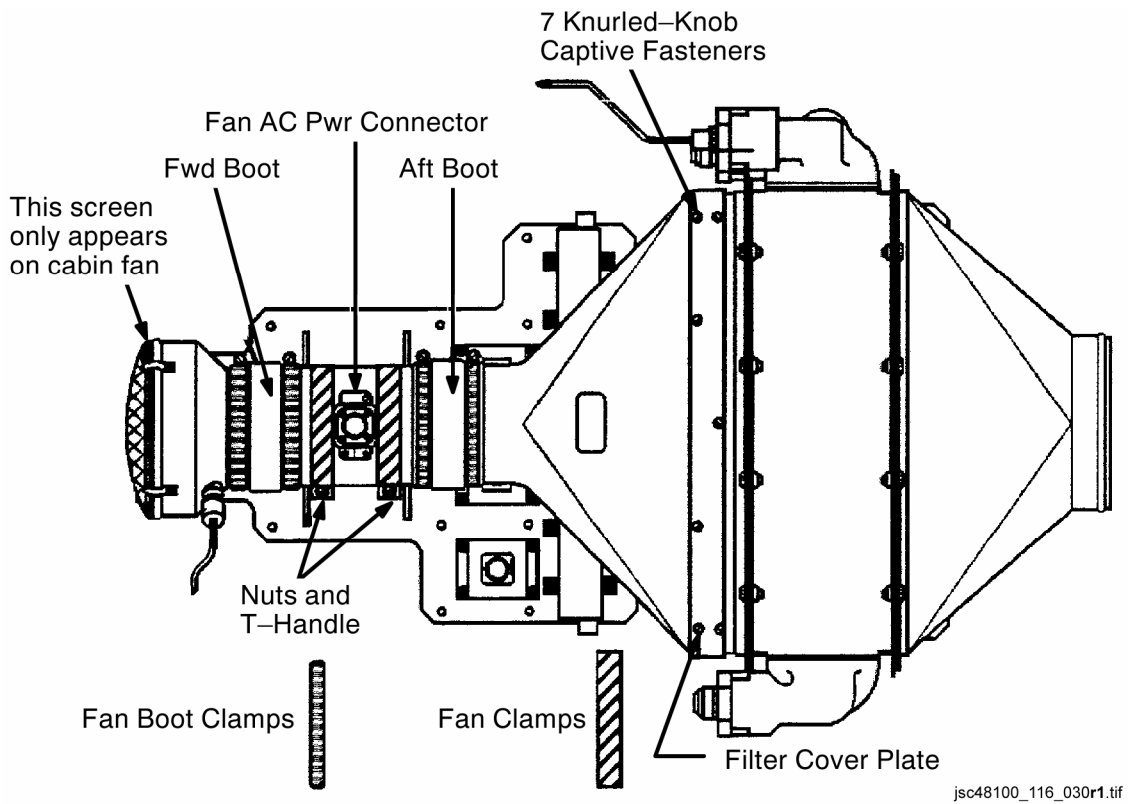


Figure 3-2.- Fan/HX assy (top view).

IFM-1.2 FAN FILTER CLEANING

(30 min Delta Pressure High) I
(30 min Delta Pressure Low)

OBJECTIVE: Check filter and screen locations for blockage/debris and clean as reqd

TOOLS REQD: ORBITER

Orbiter Vacuum Cleaner (Vacuum Cleaner ops only, as reqd)
Vacuum Cleaner Suction Hose (Vacuum Cleaner ops only, as reqd)
Crevice Tool (Vacuum Cleaner Ops only, as reqd)

SS Stow 4

SPACEHAB

Flat Tip Screwdriver (long), 1/4-in blade width
Flat Tip Screwdriver (long), 3/16-in blade width
Needlenose Pliers (large)
Needlenose Pliers (small)
Gray Tape

FAN DELTA PRESSURE HIGH

If CABIN FAN DP is high, go to step 13

If ARS FAN DP is high:

NOTE

Expect MASTER ALARM, msgs:

'214 SH ARS FAN DP 1'

'214 SH ARS FAN DP 2'

MO13Q
MIDDECK

SM 214 SPACEHAB ACT/DEAC

1. FANS ARS OFF – ITEM 61 EXEC (*)
2. ARLK FAN A,B (two) – OFF
3. √Outside of middeck air inlet screens (two) for blockage
If debris is present, clean screen with tape, notify MCC
4. Disconnect airlock flex duct from cabin floor fitting
5. If debris present, clean with tape or Vacuum Cleaner if necessary
(Refer to FILTER CLEANING (IFM, SCHEDULED MAINTENANCE)
for Vacuum Cleaner setup in middeck)
6. Reconnect air lock flex duct to cabin floor fitting
7. Disconnect flex duct from screen assembly on tunnel duct inlet and
PL ISOL vlv outlet
8. √Screen assembly for blockage
If debris present, clean screen with tape, notify MCC
9. Reconnect flex duct to tunnel duct inlet and PL ISOL vlv outlet
10. If debris is not present in any of the above checks, perform
BOOSTER FAN FILTER CLEANING (IFM, SCHEDULED
MAINTENANCE)

SH Tunnel

On MCC GO:

SM 214 SPACEHAB ACT/DEAC

MO13Q

11. FANS ARS ON – ITEM 67 EXEC (*)
12. ARLK FAN A(B) – ON

CAUTION

Pip pins in subfloor are noncaptive

D05

13. Remove pip pins (two), open floor panel, temp stow pip pins in floor panel

Access inlet muffler:

14. Loosen ten 1/4-turn captive fasteners (Screwdriver, 3/16-in blade)
Do not remove pip pin
Lift and rotate cover ccw to access fan inlet muffler
15. √ARS and cabin fan inlet muffler debris screens for blockage, notify MCC
(fig 3-3a)

D05

16. If debris is present, clean debris screens with tape, notify MCC
If vacuum cleaner necessary, perform DC(AC) VACUUM CLEANER
OPS (SH OPS, ON-ORBIT)
17. Replace Muffler cover:
Lift and rotate cover back in place
Push cover down and tighten ten 1/4-turn captive fasteners
(Screwdriver, 3/16-in blade) (fig 3-1)
18. Close floor panel, replace pip pins (two)
19. ✓Forward and aft module (if flown) debris screens for blockage (fig 3-3a)
20. Clean blocked debris screens with tape
21. Stow tools
22. Notify MCC >>

FAN DELTA PRESSURE LOW

SM 214 SPACEHAB ACT/DEAC

If Cabin Fan dP low:

NOTE

Expect MASTER ALARM, msgs:

'214 SH CAB FAN DP 1'

'214 SH CAB FAN DP 2'

23. FANS CABIN OFF – ITEM 62 EXEC (*)

If ARS Fan dP low:

NOTE

Expect MASTER ALARM, msgs:

'214 SH ARS FAN DP 1'

'214 SH ARS FAN DP 2'

24. FANS ARS OFF – ITEM 61 EXEC (*)

CAUTION

Pip pins in subfloor are noncaptive

D06

25. Remove pip pins (four), open floor panel, temp stow pip pins in floor panel
 26. Remove filter cover plate of affected fan by loosening seven captive fasteners (Screwdriver, 1/4-in blade) (fig 3-2)
Remove, temp stow plate
 27. Remove filter (Needlenose Pliers) (fig 3-3b)
 28. Carefully remove debris using tape or vacuum cleaner, if necessary
(refer to DC(AC) VACUUM CLEANER SETUP (SH OPS, ON-ORBIT))
 29. Reinstall fan filter in housing assembly by inserting into guide tracks and pushing down
 30. Reinstall filter cover plate and tighten seven fasteners (Screwdriver, 1/4-in blade)
 31. Reinstall floor panel, replace pip pins (four)
- On MCC GO:

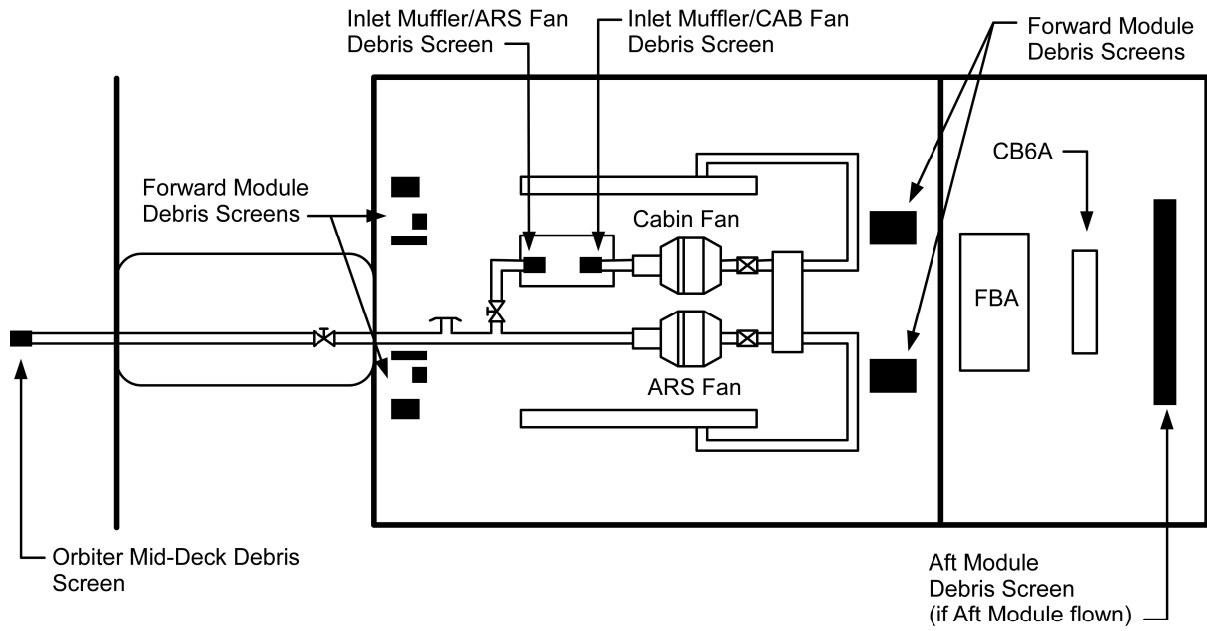
SM 214 SPACEHAB ACT/DEAC

If Cabin Fan cleaned:

32. FANS CABIN ON – ITEM 68 EXEC (*) >>

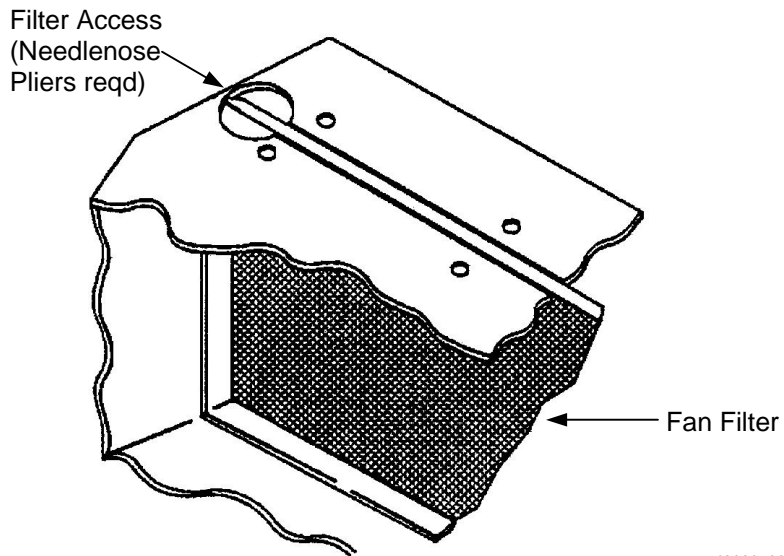
If ARS Fan cleaned:

33. FANS ARS ON – ITEM 67 EXEC (*) >>



jsc48100_116_032r3.cvx

Figure 3-3a.- Debris screen locations.



48089_002

Figure 3-3b.- Fan filter cleaning.

IFM-2.1 MANUAL OPERATION OF H2O METERING VALVES

(30 min)

OBJECTIVE: Allow crew to manually control position of cold and hot water bypass metering valves to regain water loop control in event of Water Flow Control Electronics Unit (WFCEU) failure or to adjust the flow split through the ARS and cabin HX to aid cabin temperature control

TOOLS REQD: SPACEHAB
SS Stow 4 5/32-in L-shaped Hex Wrench
Towel
6-mm L-shaped Hex Wrench

C3
SSP

1. H2O LN HTRS – ON
2. cb SW PWR 2 – cl
ORB H2O LINE HTR PWR A – ON
√B – OFF (A ENA)

SM 215 SPACEHAB ECS

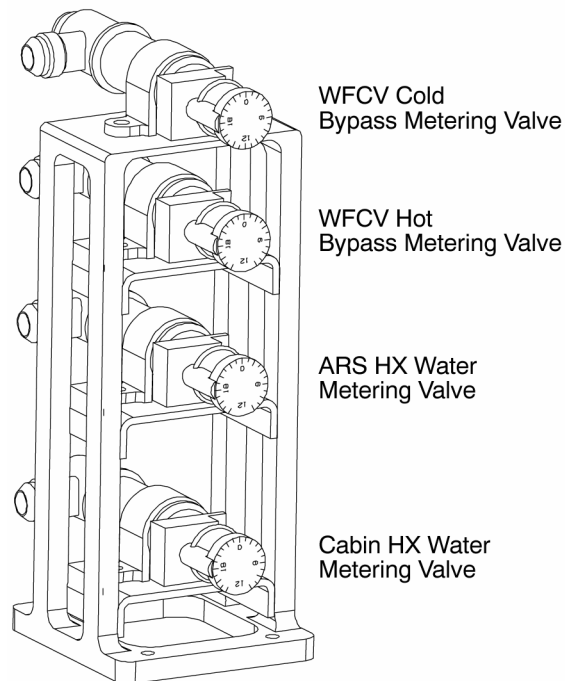
- √H2O LN HTR HAB STATUS – 1
√ORB AMPS > 1

CAUTION

Pip pins in subfloor are noncaptive

D04

3. Remove pip pins, open floor panel, temp stow pip pins in floor panel
4. √MCC for direction and number of valve turns or clicks (24 clicks per complete turns) (figs 3-4a and 3-4b)
Turn WFCV cold water bypass metering valve _____
Turn WFCV hot water bypass metering valve _____
Turn ARS HX Water metering valve _____
Turn Cabin HX Water metering valve _____
5. Close floor panel, replace pip pins

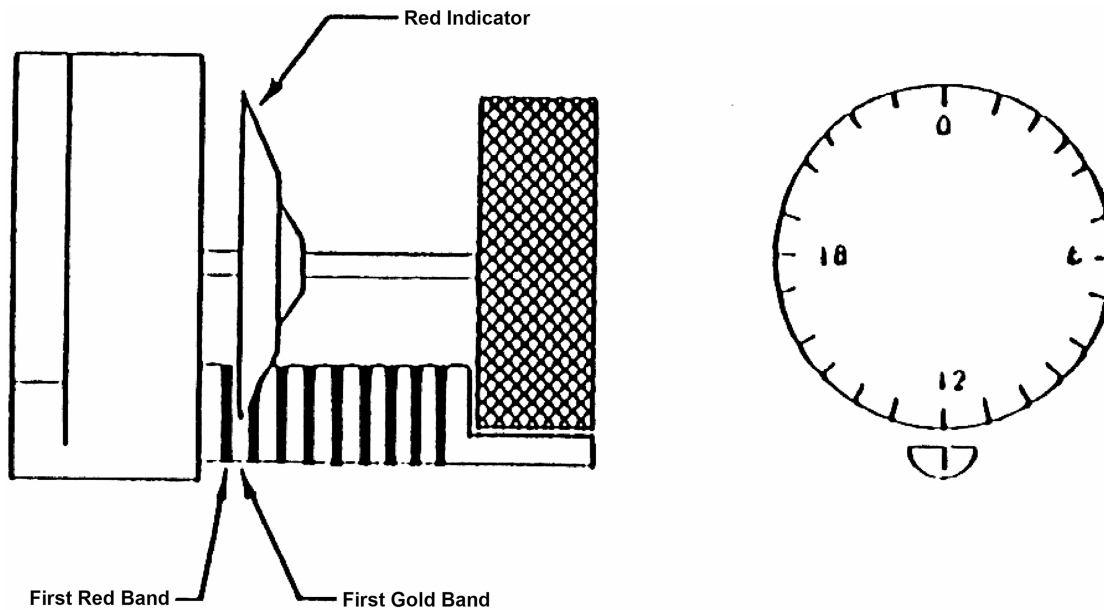


jsc48100_116_033r1.tif

Figure 3-4a.- Water Metering Valve detail.

D01

6. Loosen four 1/4-turn captive fasteners
Remove, temp stow floor panel (6-mm L-shaped Hex Wrench)
7. Close QD:
Loosen two recessed hex head screws on waterline bracket forward of QD (5/32-in L-shaped Hex Wrench) (fig 3-5). Do not remove screws
Place towel around QD
Push button on QD and turn in the direction of CLOSE arrow (ccw) until QD locks and button pops out
Tighten two recessed hex head screws (5/32-in L-shaped Hex Wrench)
Stow towel in wet trash (if reqd)
8. Reinstall floor panel. Tighten four 1/4-turn captive fasteners ccw (6-mm L-shaped Hex Wrench)
9. Stow tools
10. Notify MCC complete



The Metering Valve position in the figure above would be recorded as follows

Number of Complete Rotations: First Gold Band

Dial Position 12

Figure 3-4b.- Water Metering Valve reading convention.

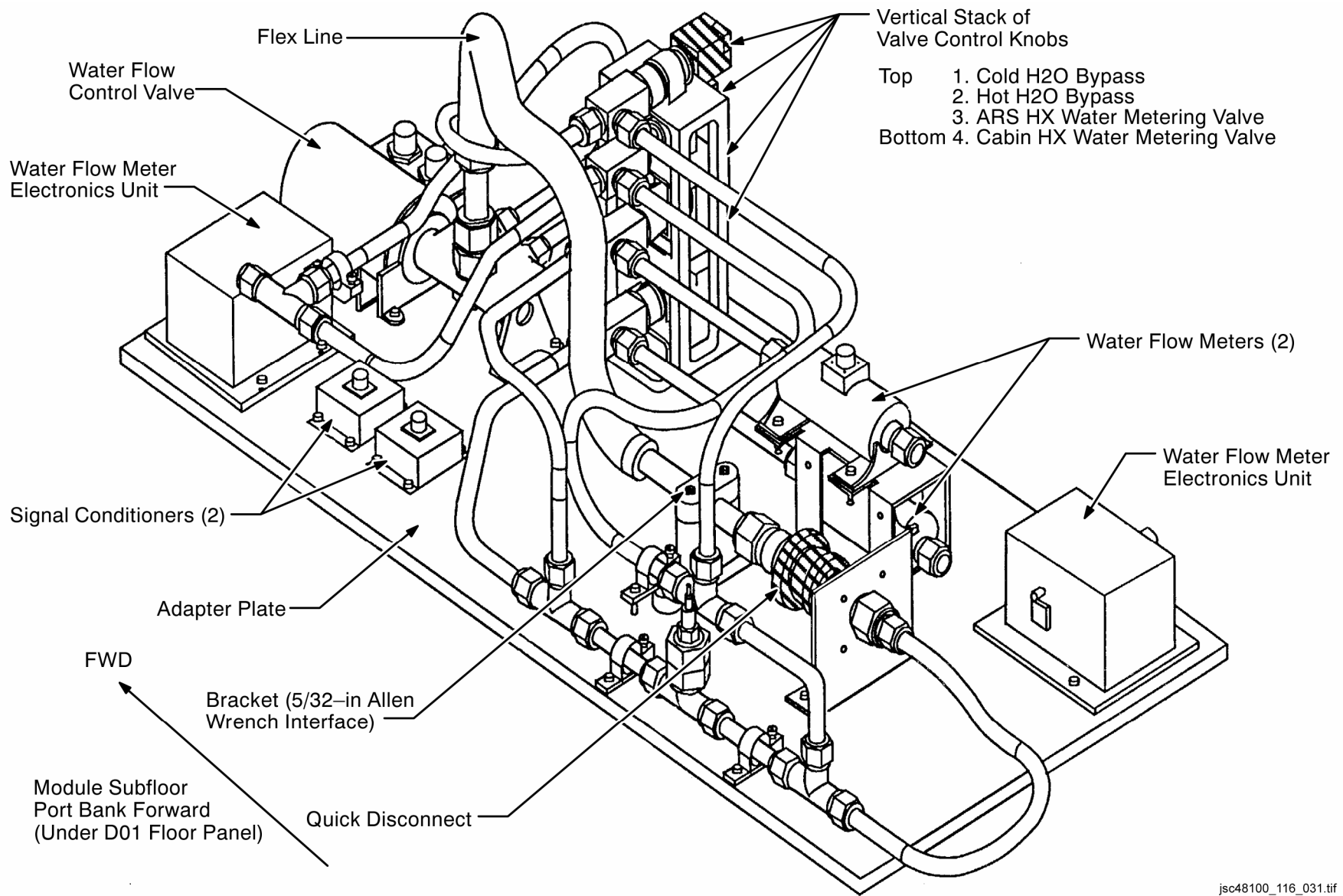


Figure 3-5.- Water Flow Control Valve Plate (electrical cables, some hardline H2O pipes not shown).

IFM-2.2 WFCEU SOFTWARE LOAD

(20 min) I

OBJECTIVE: Reload WFCEU operating software from PGSC Hard Drive following WFCEU or pwr anomaly

TOOLS REQD: SPACEHAB

- SS Stow 4 6mm L-shaped Hex Wrench
Flat Tip Screwdriver, 1/8-in blade width
Antistatic Wrist (ASW) Tethers
Inspection mirror
- SS Stow 1 WFCEU IFM Cable (9062936-1)
- D03 1. Loosen 1/4-turn fasteners (four), lift floor panel
Temp stow (6mm L-shaped Hex Wrench)
If SS PGSC is powered on:
- SS PGSC 2. Quit any running applications
3. Exit Windows
4. PGSC pwr – off
- D03 5. Disconnect RS-422 (SED39126965-301) interface cable from PGSC
connector on PCMCIA card
- D03 6. Don ASW tethers, clip to ground
7. Remove connector cap on WFCEU connector J5
8. Connect WFCEU IFM cable to WFCEU connector J5 and PGSC
connector SERIAL COM 1/RS-232 (Inspection mirror, Screwdriver)
- SS PGSC 9. Unclip ASW tethers
10. PGSC pwr – on
11. Double click SHUTTLE APPS folder on desktop
Double click on SPACEHAB folder
Double click on WFCEU_CONTROL_LOAD.EXE
12. Click “TRANSMIT CONTROL MODULE” button
13. Click the YES button on the CONFIRM TRANSMIT pop-up window
14. Verify the TRANSMIT CONTROL MODULE button changes to
TRANSMITTING...
15. Verify a green button and “GOOD CHECKSUM” indications in the
RESULTS box
16. Verify checksum displayed in checksum box and note it here:
17. Notify MCC of load completion and call down checksum
If the RESULTS box displays a red button due to a time out or a bad
checksum:
18. On MCC GO:
Repeat steps 12-17
19. Click “EXIT” button to end program and return to Windows
20. Click “YES” button on the CONFIRM EXIT pop-up window

On MCC call:

SM 215 SPACEHAB ECS

- 21. MTR 1 ON – ITEM 32 EXEC (no feedback)
 - 22. √WFCEU CMD REC – YES (for 5 sec)
 - SS PGSC 23. PGSC pwr – off
 - SS Stow 1 24. Disconnect WFCEU IFM cable from WFCEU connector J5 and
PGSC connector SERIAL COM 1/RS-232, stow (Screwdriver)
 - D03 25. Replace connector cap on WFCEU connector J5
 - 26. Close floor panel, tighten 1/4-turn fasteners (four) (6mm L-shaped
Hex Wrench)
 - 27. Stow tools
 - SS PGSC 28. Reconnect RS-422 interface cable to PGSC PCMCIA RS-422
connector
- If SS PGSC in use:
- 29. PGSC pwr – on
 - 30. √Windows displayed
 - 31. Double click on SHUTTLE APPS folder on desktop
 - 32. Double click on SPACEHAB folder
 - 33. Double click on SPACEHAB icon in SPACEHAB folder
 - 34. √MCC for WFCEU reconfig steps

IFM-2.3 WATER LEAK CHECK

(20 min)

OBJECTIVE: To inspect all Spacehab water lines for leakage

TOOLS REQD: SPACEHAB
SS Stow 4 6mm L-shaped Hex Wrench
Flashlight, if reqd
Towel

- D01
1. Loosen four 1/4-turn fasteners, remove floor panel, temp stow (6mm L-shaped Hex Wrench)
 2. Check all water lines and quick disconnects for leakage (refer to fig 7-1a Spacehab subfloor (single module), fig 3-5 Water Flow Control Valve Plate)

NOTE

All water lines are marked with label as shown

COOLANT	/
SYSTEM	/
WATER	/

Blue White

3. Replace floor panel, tighten four 1/4-turn fasteners (6mm L-shaped Hex Wrench)

CAUTION

Pip pins in subfloor are noncaptive

- D04
4. Remove pip pins (two), lift floor panel, stow pip pins in floor panel
 5. Check water lines and quick disconnect for leakage (port side of PDU) (refer to fig 7-1a, Spacehab subfloor (single module))
 6. Close floor panel, replace pip pins

CAUTION

Pip pins in subfloor are noncaptive

- D05
7. Remove pip pins (two), lift floor panel, stow pip pins in floor panel
 8. Check water lines, quick disconnects, EHx for leakage (refer to fig 7-1a, Spacehab subfloor (single module))
 9. Close floor panel, replace pip pins
 10. Stow tools
 11. Report results to MCC

IFM-3.1 FUSE CHANGEOUT

(20 min)

OBJECTIVE: Replace fuses in Spacehab electrical power system

TOOLS REQD: ORBITER
 Multimeter Kit
 IFM Pin Kit (Middle Flap of Insert) (for Viewport HTR Fuse only)

SPACEHAB
 SS Stow 4 SPACEHAB Fuse Kit
 Ziplock Bag
 Antistatic Wrist (ASW) Tethers

1. Replaceable and accessible fuses are located on:
 - Fire Suppression Control Unit (FSCU) – 8 fuses -- D04
 - Monitor and Control Panel (MCP) – 6 fuses -- FC08
 - Current Sensor Assembly (CSA) – 2 fuses -- D05
 - Power Distribution Unit (PDU) – 90 fuses -- D04
 - Viewport Heater Control Panel – 1 fuse -- Overhead (Replace with orbiter 2A fuse)
 - Water Flow Control Electronics Unit (WFCEU) – 1 fuse -- D03
2. Contact POCC for location and number of fuse to changeout and subsystem powerdown

If fuse located in subfloor:

<p>CAUTION Pip pins in subfloor are noncaptive</p>
--

3. Remove pip pins
4. Open appropriate floor panel to gain access, stow pip pins in floor panel
5. Don ASW tethers, clip to ground
6. Remove fuse cap from box by rotating ccw
7. Remove fuse from fuse cap
8. Set up Multimeter per instructions on flap for resistance Ω
9. Verify fuse is blown before installing new fuse (measure Ω using Multimeter/Test Probes)
10. Notify MCC of fuse status
11. On MCC GO, install new fuse in fuse cap (Spacehab Fuse Kit)
12. Install fuse cap in box, rotate cw
13. Unclip ASW tethers
14. Put blown fuses in Ziplock Bag, stow in SS Stow 1
15. Stow Multimeter (Orbiter), Fuse Kit (SS Stow 1)
16. Notify MCC complete

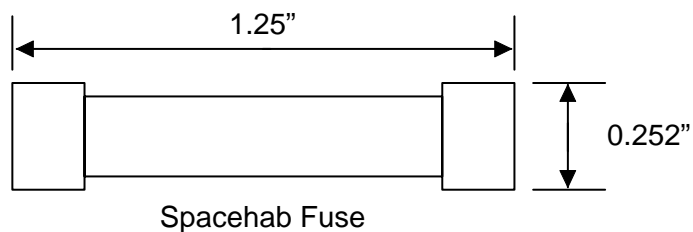


Table 3-1. ACCESSIBLE AND REPLACEABLE FUSES

#	AMP	FUNCTION	SUPPLY BUS
WFCEU			
F1	3A	WFCEU Power	SS DC BUS
FSCU			
F1	10A	Aft B to MCP	PL AFT B
F2	10A	Aux A to MCP	PL AUX A
F3	3A	EM Bus 1 (FSCU)	PL AFT B
F4	3A	EM Bus 1 (FSCU)	PL AUX A
F5	3A	FSCU Internal Bus	PL AFT B
F6	3A	FSCU Internal Bus	PL AUX A
F7	3A	Cabin Fan Package and Smoke Sensor A Power	EM BUS 1 (FSCU)
F8	5A	FSS Firing Pulses and H2O Line Heater Power	PL AFT B
MCP			
F1	3A	EM Bus 2	PL AUX A
F2	3A	EM Bus 2	PL AFT B
F3	3A	MCP Internal Bus	PL AUX A
F4	3A	MCP Internal Bus	PL AFT B
F5	7.5A	FSS Firing Pulses	PL AUX A
F6	3A	Cabin Fan Package and Smoke Sensor B Power	EM BUS 2 (MCP)

Table 3-I. ACCESSIBLE AND REPLACEABLE FUSES (Cont)

#	AMP	FUNCTION	SUPPLY BUS
Viewport Heater Control Panel			
F1	2A	Viewport Heater Power	EM BUS 2 (MCP)
CSA			
F1	3A	CSA Power	SS DC BUS
F2	3A	CSA Power	SS DC BUS
PDU			
F1	3A	AC UTIL EXCP 4 (J94) Φ A	AC UTIL BUS (INV) Φ A
F2	3A	AC UTIL EXCP 4 (J94) Φ B	AC UTIL BUS (INV) Φ B
F3	3A	AC UTIL EXCP 4 (J94) Φ C	AC UTIL BUS (INV) Φ C
F4	3A	ARS Fan Φ A	ORB/INV AC Φ A
F5	3A	ARS Fan Φ B	ORB/INV AC Φ B
F6	3A	ARS Fan Φ C	ORB/INV AC Φ C
F7	3A	Cabin Fan Φ A	ORB/INV AC Φ A
F8	3A	Cabin Fan Φ B	ORB/INV AC Φ B
F9	3A	Cabin Fan Φ C	ORB/INV AC Φ C
F10	3A	Spare AC 2 Φ A	INV AC Φ A
F11	3A	Spare AC Φ A (PDU J17)	AC UTIL BUS (INV) Φ A
F12	3A	Spare AC Φ B (PDU J17)	AC UTIL BUS (INV) Φ B
F13	3A	Spare AC Φ C (PDU J17)	AC UTIL BUS (INV) Φ C
F14	3A	AC UTIL EXCP 3 (J318) Φ A	AC UTIL BUS (INV) Φ A
F15	3A	AC UTIL EXCP 3 (J318) Φ B	AC UTIL BUS (INV) Φ B
F16	3A	AC UTIL EXCP 3 (J318) Φ C	AC UTIL BUS (INV) Φ C
F17	3A	Spare AC 1 Φ A (AC UTIL EXCP 1)	ORB AC 3 Φ A
F18	3A	Spare AC 1 Φ B (AC UTIL EXCP 1)	ORB AC 3 Φ B
F19	3A	Spare AC 1 Φ C (AC UTIL EXCP 1)	ORB AC 3 Φ C
F20	3A	Spare AC 2 Φ B	INV AC Φ B
F21	3A	AC UTIL EXCP 6 (J323) Φ A	AC UTIL BUS (INV) Φ A
F22	3A	AC UTIL EXCP 6 (J323) Φ B	AC UTIL BUS (INV) Φ B
F23	3A	AC UTIL EXCP 6 (J323) Φ C	AC UTIL BUS (INV) Φ C

Table 3-I. ACCESSIBLE AND REPLACEABLE FUSES (Cont)

#	AMP	FUNCTION	SUPPLY BUS
F24	3A	Spare AC Φ A (PDU J20)	AC UTIL BUS (INV) Φ A
F25	3A	Spare AC Φ B (PDU J20)	AC UTIL BUS (INV) Φ B
F26	3A	Spare AC Φ C (PDU J20)	AC UTIL BUS (INV) Φ C
F27	3A	Water Pmp 2 Φ A	INV/ORB AC Φ A
F28	3A	Water Pmp 2 Φ B	INV/ORB AC Φ B
F29	3A	Water Pmp 2 Φ C	INV/ORB AC Φ C
F30	3A	Spare AC 2 Φ C	INV AC Φ C
F31	5A	Inv AC Bus Φ A	INV (MAIN DC)
F32	5A	Inv AC Bus Φ B	INV (MAIN DC)
F33	5A	Inv AC Bus Φ C	INV (MAIN DC)
F34	3A	Spare AC Φ A (PDU J17)	AC UTIL BUS (INV) Φ A
F35	3A	Spare AC Φ B (PDU J17)	AC UTIL BUS (INV) Φ B
F36	3A	Spare AC Φ C (PDU J17)	AC UTIL BUS (INV) Φ C
F37	3A	Water Pmp 1 Φ A	INV/ORB AC Φ A
F38	3A	Water Pmp 1 Φ B	INV/ORB AC Φ B
F39	3A	Water Pmp 1 Φ C	INV/ORB AC Φ C
F40	3A	Spare AC 3 Φ A	INV AC Φ A
F41	3A	Orb AC Bus Φ A	ORB AC3 Φ A
F42	3A	Orb AC Bus Φ B	ORB AC3 Φ B
F43	3A	Orb AC Bus Φ C	ORB AC3 Φ C
F44	3A	115v AC (Expansion) Φ A	INV AC Φ A
F45	3A	115v AC (Expansion) Φ B	INV AC Φ B
F46	3A	115v AC (Expansion) Φ C	INV AC Φ C
F47	3A	Rack 1 AC BUS Φ A	INV AC Φ A
F48	3A	Rack 1 AC BUS Φ B	INV AC Φ B
F49	3A	Rack 1 AC BUS Φ C	INV AC Φ C
F50	3A	Spare AC 3 Φ B	INV AC Φ B
F51	3A	Rack 2 AC BUS Φ A	INV AC Φ A
F52	3A	Rack 2 AC BUS Φ B	INV AC Φ B

Table 3-I. ACCESSIBLE AND REPLACEABLE FUSES (Cont)

#	AMP	FUNCTION	SUPPLY BUS
F53	3A	Rack 2 AC BUS Φ C	INV AC Φ C
F54	3A	Spare AC 3 Φ C	INV AC Φ C
F55	25A	EXCP 1 DC BUS	EXP DC BUS
F56	25A	EXCP 1 DC BUS	EXP DC BUS
F57	25A	EXCP 2 DC BUS	EXP DC BUS
F58	25A	EXCP 6 DC BUS	EXP DC BUS
F59	25A	EXCP 6 DC BUS	EXP DC BUS
F60	25A	EXCP 6 DC BUS	EXP DC BUS
F61	7.5A	WFCEU/DPEU/CSA PWR	SS DC BUS
F62	10A	MAIN LIGHTS (MCP) PWR	SS DC BUS
F63	10A	Spare DC (K13)	SS DC BUS
F64	25A	Spare K12	EXP DC BUS
F65	25A	EXCP 3 DC BUS	EXP DC BUS
F66	25A	EXCP 3 DC BUS	EXP DC BUS
F67	25A	Spare DC (K3)	EXP DC BUS
F68	25A	SH Top A DC BUS	EXP DC BUS
F69	25A	DM FAN/LIGHT PWR	EXP DC BUS
F70	25A	Spare DC (K7)	EXP DC BUS
F71	7.5A	CCTV Pwr	SS DC BUS
F72	10A	PTB Pwr	SS DC BUS
F73	10A	Spare DC (K14)	SS DC BUS
F74	25A	Spare DC (K12)	EXP DC BUS
F75	25A	EXCP 4 DC BUS	EXP DC BUS
F76	25A	EXCP 4 DC BUS	EXP DC BUS
F77	25A	EXCP 4 DC BUS	EXP DC BUS
F78	25A	DC UTIL (J95)	EXP DC BUS
F79	25A	DC UTIL (J99)	EXP DC BUS
F80	25A	EXCP 6 UTIL (J320)	EXP DC BUS
F81	25A	EXCP 5 DC BUS	EXP DC BUS

Table 3-I. ACCESSIBLE AND REPLACEABLE FUSES (Cont)

#	AMP	FUNCTION	SUPPLY BUS
F82	25A	EXCP 5 DC BUS	EXP DC BUS
F83	25A	EXCP 5 DC BUS	EXP DC BUS
F84	25A	DC UTIL EXCP 1 (J95)	EXP DC BUS
F85	25A	DC UTIL EXCP 1 (J99)	EXP DC BUS
F86	25A	DC UTIL EXCP 3 (J315)	EXP DC BUS
F87	25A	Spare DC (K12)	EXP DC BUS
F88	3A	PDU Power Supply 1,2	EM BUS 1 (FSCU)
F94	25A	INVERTER DC BUS	MAIN/SEC DC BUS
F95	25A	INVERTER DC BUS	MAIN/SEC DC BUS
F96	25A	INVERTER DC BUS	MAIN/SEC DC BUS

Fuses 89-93 are mounted internally and therefore not accessible during flight

2A Viewport Htr fuse must be replaced with 2A fuse from orbiter IFM Pin Kit Fuse and Jumper Assembly

Following spare fuses available in SS Stow 4:

Fuse Rating	Part Number	Quantity
3A	9003473-509	6
5A	9003473-511	3
7.5A	9003473-517	3
10A	9003473-513	3
15A	9003473-519	3
20A	9003473-515	3
25A	9003473-521	6

IFM-4.1 INVERTER CHANGEOUT

(1:00 hr) I

OBJECTIVE: Replace failed inverter with spare

TOOLS REQD: SPACEHAB

- SS Stow 4
- Wire Cutters
- 4-in Ratchet Wrench, 1/4-in drive
- 6-in Extension, 1/4-in drive
- 5/32-in Allen Head Driver, 1/4-in drive
- Connector Pliers
- Needlenose Pliers (small)
- Antistatic Wrist (ASW) Tethers
- 1/4-in Torque Wrench
- 6mm L-shaped Hex Wrench
- Strap Wrench (in jumper bag)
- Gray Tape

1. √MCC for experiment equipment pwrn:

Subsystem equipment pwrn:

- SM 214 SPACEHAB ACT/DEAC
- 2. AC UTIL OFF – ITEM 42 EXEC (*)
- 3. √SPARE 2 OFF, ITEM 50 – (*)
- 4. √FANS ARS ORB, ITEM 65 – (*)
- 5. √CABIN ORB, ITEM 66 – (*)
- 6. √H2O PUMP 2 ORB, ITEM 73 – (*)

NOTE

Expect SM ALERT, msgs:

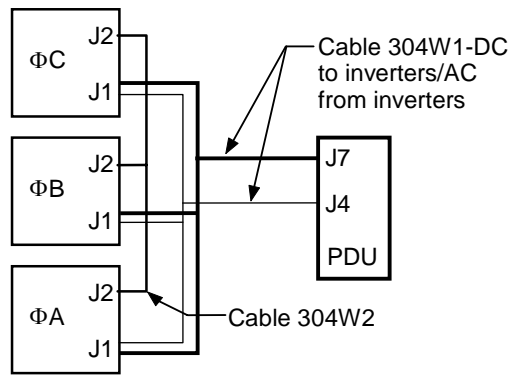
- '214 SH INV DC V'
- '214 SH INV P-A AC V'
- '214 SH INV P-B AC V'
- '214 SH INV P-C AC V'

7. DC INVERTER OFF – ITEM 2 EXEC (*)

D10

8. Loosen four 1/4-turn captive fasteners cw
Remove, temp stow floor panel (6mm L-shaped Hex Wrench)

9. Don ASW tethers, clip to ground



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10. Demate cable 304W2 (9060518-501) from connector J2 on inverter to be removed (Connector Pliers or Strap Wrench if necessary)

CAUTION
FOD potential once lockwire cut

11. Cut lockwire from four hex head fasteners on inverter to be removed (Wire Cutters)

CAUTION
Fasteners and washers are not tethered

12. Remove four hex head fasteners and washers from inverter, temp stow (4-in Ratchet Wrench, 6-in Extension, 5/32-in Allen Head Driver)
 13. Remove lockwire from fasteners, stow in trash (Needlenose Pliers)
 14. Demate cable 304W1 (9060518-1) from connector J1 (Connector Pliers or Strap Wrench if necessary)
 15. Lift failed inverter out of subfloor, temp stow
 16. Unclip ASW tethers
 17. Mark failed inverter with tape
 18. Cover connector on failed inverter with tape
 19. Unstow spare inverter
 20. Stow inoperative inverter
 21. Clip ASW tethers to ground
 22. Mate cable 304W1 to spare inverter connector J1
 23. Mount spare inverter to subfloor with 4 hex head fasteners and washers. Install longer fasteners on port side of inverter. Torque to 20 in-lb (1/4-in Torque Wrench, 6-in Extension, Adapter (1/4-in to 3/8-in), 5/32-in Allen Head Driver)
 24. Mate cable 304W2 to spare inverter connector J2
 25. Unclip ASW tethers
 26. Reinstall floor panel. Tighten four 1/4-turn captive fasteners ccw (6mm L-shaped Hex Wrench)
 27. Stow tools
- SM 214 SPACEHAB ACT/DEAC
28. DC INVERTER ON – ITEM 1 EXEC (*)
 29. √BUS INV ΦA, ΦB, ΦC VOLTS (three) > 105.4 and < 124.6
 30. If any out of limits, √MCC
- On MCC GO:
31. AC UTIL ON – ITEM 41 EXEC (*)
 32. √MCC for experiment equipment powerup

SS Stow 3

D10

CRT

IFM-5.1 EXCP OUTLET VOLTAGE

(20 min)

OBJECTIVE: To provide additional troubleshooting data, not available on the ground, in the event of an EXCP power anomaly

TOOLS REQD: ORBITER
Multimeter Kit
IFM Pin Kit

1. Contact POCC for connectors to test

Location	Outlet	Voltage
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

2. Look up connector in figure 3-6b to determine sockets to test and power type (AC or DC)

CONFIGURE MULTIMETER

3. Set up Multimeter per instructions on flap for DC or AC V (auto range) (see fig 3-6a for Multimeter setup)

NOTE

Red and black Multimeter leads have removable test probes installed on one end. Once removed, this end of leads can also be installed into Multimeter so banana jacks on other end can be used with Pin Kit accessories

4. Remove test probes from red and black Multimeter leads and insert this end into Multimeter
5. Install red and black test adapters from Pin Kit (flap 7) onto banana jacks of Multimeter (16-ga adapter for DC outlets, 20-ga adapters for AC and Video outlets)
6. Install one 5-in Pin/Socket Test jumper lead from Pin Kit (flap 5) onto red test adapter and one 5-in Pin/Pin Test jumper lead (back flap of insert) onto black test adapter (16-ga test jumper leads for DC outlets and 20-ga test jumper leads for AC and Video outlets)

TEST EXCP OUTLET

7. If outlet to be tested has a cable connected:

If experiment outlet affected:

√Affected experiment power off _____

Configure cb – OFF

If video outlet affected:

cb CB1,CB2,CB3,CB4,CB5 (five) – op

TVC PWR sw – OFF

Disconnect cable from outlet

Install test jumper leads into sockets to be tested (fig 3-6b)

Configure cb – ON or TVC PWR sw – ON

Record Multimeter reading

Configure cb – OFF or TVC PWR sw – OFF

Disconnect test jumper leads from outlet

VSU
EXCP2

↑

If outlet to be tested does not have a cable connected:

- Remove connector cap from outlet
 - Install test jumper leads into sockets to be tested (fig 3-6b)
 - Configure cb – ON
 - Record Multimeter reading
 - Configure cb – OFF
 - Disconnect test jumper leads from outlet
 - Replace connector cap
8. Repeat steps 2 and 7 for other outlets, as reqd by MCC
 9. Notify MCC of Multimeter readings and ✓for further actions
 10. Stow Multimeter and Pin Kit accessories

IFM-5.2 EXCP DC POWER OUTLET RECOVERY

(30 min) I

OBJECTIVE: To install pin/socket jumpers at EXCP to recover DC power to subsystem/experiment equipment

TOOLS REQD: ORBITER

Multimeter Kit

IFM Pin Kit

SPACEHAB

SS Stow 4

12-ft IFM Pin/Socket Jumpers 800W9 (9062862-515)

2-ft IFM Pin/Socket Jumpers 800W7 (9062862-511)

6-in IFM Pin/Socket Jumpers 800W8 (9062862-513)

Gray Tape

1. √MCC:

Affected experiment _____

Failed outlet _____

Outlet to be jumpered to _____

Outlet jumper length _____

EXCP__

2. √cb _____ – OFF (failed outlet)

EXCP__

3. √cb _____ – OFF (outlet to be jumpered to)

EXCP__

4. Verify experiment turned off _____

5. √Connector demated from _____ (failed outlet)

6. Cover failed outlet (tape) and secure cable

7. Disconnect power cable from experiment

JUMPER CONNECTIONS

EXCP__

8. Insert sockets of jumper into subsystem/experiment cable connector (EXCP end) per fig 3-6b, based on failed outlet location. Secure cable

9. Remove connector cap from outlet to be jumpered to

10. Insert pins of jumper into EXCP outlet to be jumpered to per fig 3-6b, based on EXCP connector type

11. Tape end of jumper in place

TEST CONNECTION

EXCP__

12. If Multimeter not already configured to check EXCP outlet voltage (IFM-5.1):

Install one 16-ga, 5-in _____ test jumper lead from pin kit (_____) onto red test adapter and one 16-ga, 5-in _____ test jumper lead from pin kit (_____) onto black test adapter

13. Install test jumper leads to _____ of the cable disconnected (Reference experiment malfunction procedure _____ for pin/sockets to be tested and connector layout)

14. cb _____ – ON

15. Record Multimeter reading _____ volts and notify MCC

16. cb _____ – OFF

17. If Multimeter reading is not ≥ 24 VDC:

Recheck jumper wires for reverse connection

√MCC for further actions

RETURN TO NOMINAL OPS

EXCP__

18. Disconnect test jumper leads from cable

19. Reconnect power cable to experiment

20. cb _____ – ON (outlet to be jumped to)

21. Notify MCC pwr outlet recovery complete

22. Stow tools

IFM-5.3 VIDEO RECOVERY

(30 min/side)

OBJECTIVE: To recover power to video system in event of power loss or blown fuse

TOOLS REQD: SPACEHAB

SS Stow 4 1 set of Video Jumpers (800W10 (9062862-517) and 800W11 (9062862-519)) for each video outlet
Gray Tape

- VSU
EXCP2
EXCP__
1. √MCC for outlet to be jumpered to _____
 2. √cb CB1,CB2,CB3,CB4,CB5 (five) – op
 3. √TVC VIDEO,SYNC,PWR (three) – OFF
 4. √cb _____ – OFF
 5. Remove connector cap from outlet to be jumpered to, secure with tape
 6. Insert pins of jumper 800W10 into outlet to be jumpered to as follows:
(fig 3-6b)
 - + pin of 800W10 to socket _____
 - pin of 800W10 to socket _____
 - GND pin of 800W10 to socket _____
- EXCP2
7. Demate cable _____ connector _____ from connector VID/SYNC CAMR PWR J213
 8. Insert sockets of jumper 800W10 into cable _____ connector _____ as follows: (fig-3-6b)
 - + socket of 800W10 to pin H of cable
 - socket of 800W10 to pin J of cable
 - GND socket of 800W10 to pin L of cable
 9. Tape jumper 800W10 in place
 10. Insert pins of jumper 800W11 into connector VID/SYNC CAMR PWR J213 as follows: (fig 3-6b)
 - VID pin of 800W11 to socket C
 - RTN pin of 800W11 to socket D
 11. Insert sockets of jumper 800W11 into cable _____ connector _____ as follows: (fig 3-6b)
 - VID socket of 800W11 to pin C of cable
 - RTN socket of 800W11 to pin D of cable
 12. Tape jumper 800W11 in place
- EXCP__
EXCP2
VSU
13. cb _____ – ON
 14. TVC VIDEO – ON
 15. VSU Activation:
 - cb CB3 – cl
 - √+5V,-5V,+15V,-15V lts (four) – on
 - cb CB1 – cl
 - √V1 lt – on
 - cb CB2 – cl
 - √V2 lt – on
 - cb CB4,5 (two) – cl
 16. If VSU cbs or EXCP _____ cb trips, √MCC
 17. √MCC for Camcorder powerup
 18. Stow tools

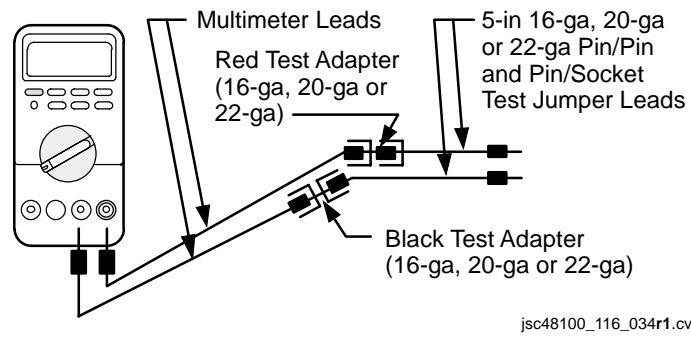


Figure 3-6a.- Multimeter setup.

TABLE 3-II. EXCP CONNECTOR LAYOUTS

OUTLET	Type I, N	Type I, W	Type I, X	Type II, N	Type II, W	Type II, X	Type II, Y	Type II, Z
EXCP 1 DC1 (J96)	•							
DC2 (J100)	•							
DC3 (J103)	•							
DC4 (J104)			•					
DC5 (J105)		•						
DC6 (J106)	•							
DC7 (J107)		•						
DC8 (J108)					•			
EXCP 2 DC2 (J203)			•					
DC3 (J204)	•							
EXCP 3 DC1 (J303)	•							
DC2 (J304)		•						
DC3 (J305)			•					
DC4 (J306)	•							
DC5 (J307)		•						
DC6 (J308)					•			
DC7 (J316)	•							
EXCP 4 DC1 (J104)		•						
DC2 (J105)	•							
DC3 (J106)			•					
DC4 (J107)		•						
DC5 (J108)					•			
DC6 (J109)						•		
DC7 (J110)							•	
DC8 (J96)	•							
DC9 (J100)	•							
DC10 (J111)								•
DC 11(J112)				•				
DC12 (J113)		•						
EXCP 5 DC1 (J204)		•						
DC2 (J205)	•							
DC3 (J206)			•					
DC4 (J207)		•						
DC5 (J208)					•			
DC6 (J209)						•		
DC7 (J210)							•	
DC8 (J211)								•
DC9 (J212)				•				
DC10 (J213)		•						
EXCP 6 DC1 (J304)		•						
DC2 (J305)	•							
DC3 (J306)			•					
DC4 (J321)	•							
DC5 (J307)		•						
DC6 (J308)					•			

TABLE 3-II. EXCP CONNECTOR LAYOUTS (Cont)

OUTLET	Type I, N	Type I, W	Type I, X	Type II, N	Type II, W	Type II, X	Type II, Y	Type II, Z
EXCP 6 DC7 (J309)						•		
DC8 (J310)							•	
DC9 (J311)								•
DC10 (J312)				•				
DC 11(J313)		•						

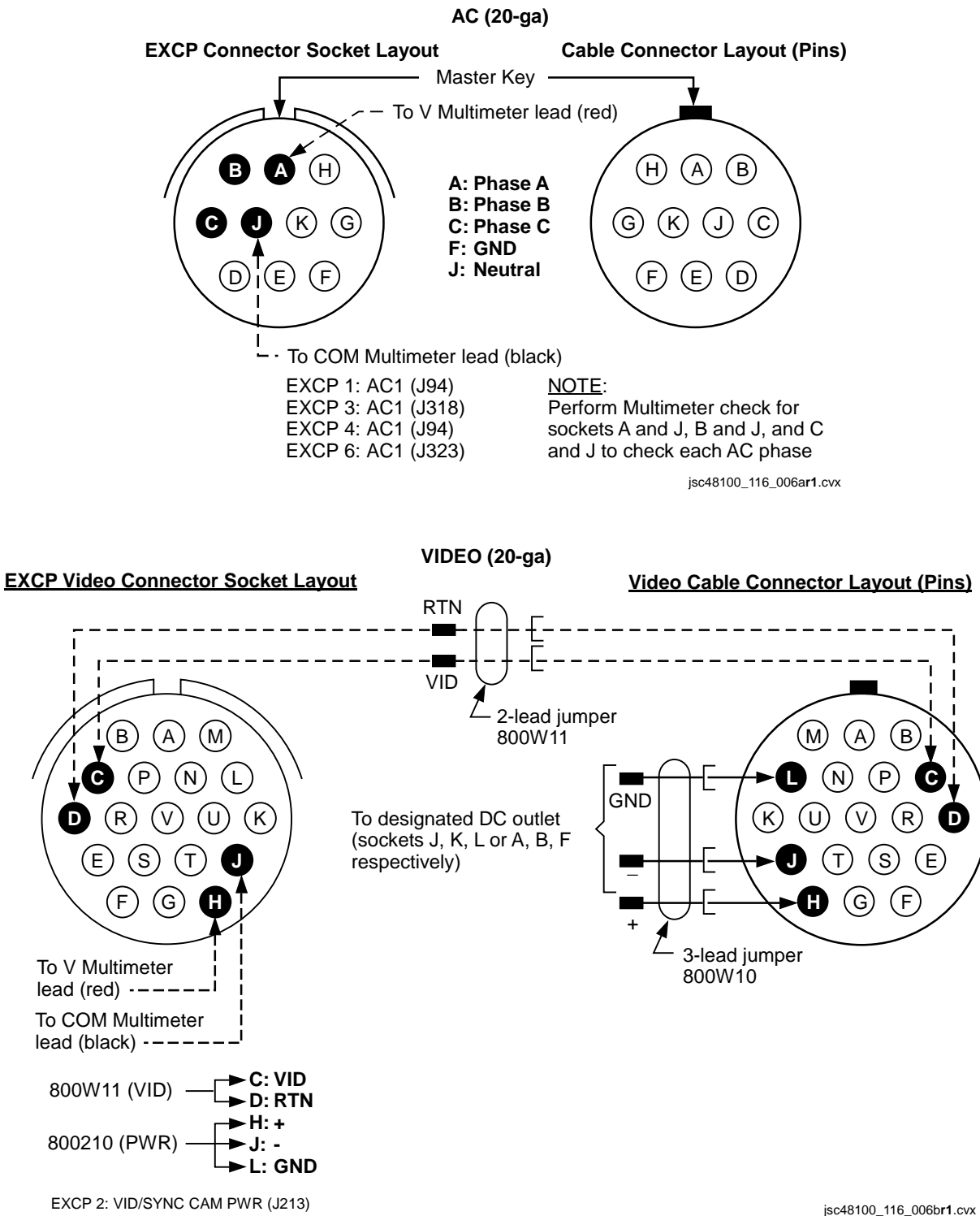
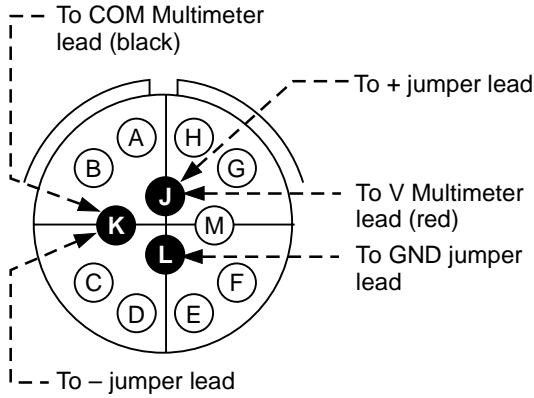


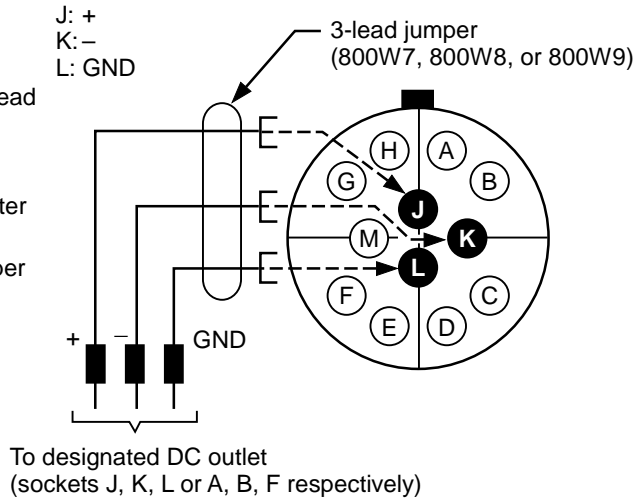
Figure 3-6b.- EXCP connector layouts.

DC-Type I, N Clcking (16-ga)

EXCP Connector Socket Layout



Cable Connector Layout (Pins)

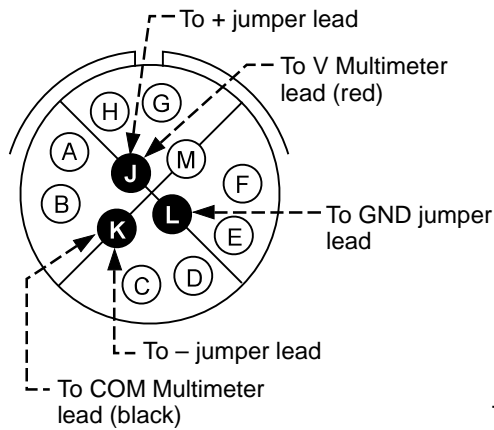


- EXCP 1: DC1 (J96), DC2 (J100), DC3 (J103), DC6(J106)
- EXCP 2: DC3 (J204)
- EXCP 3: DC1 (J303), DC4 (J306), DC7 (J316)
- EXCP 4: DC2 (J105), DC8 (J96), DC9 (J100)
- EXCP 5: DC2 (J205)
- EXCP 6: DC2 (J305), DC4 (J321)

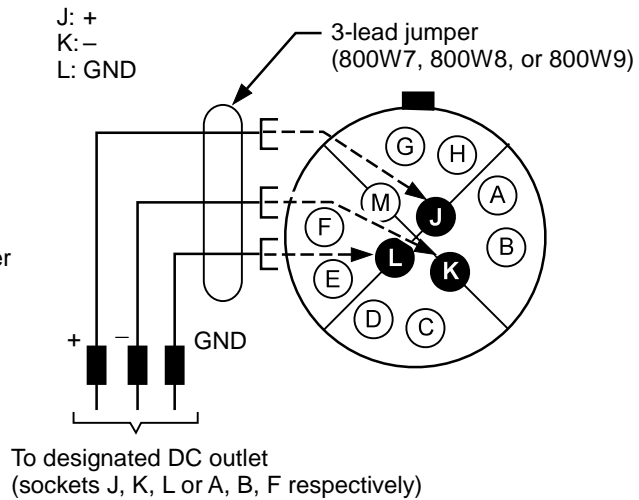
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DC-Type I, W Clcking (16-ga)

EXCP Connector Socket Layout



Cable Connector Layout (Pins)



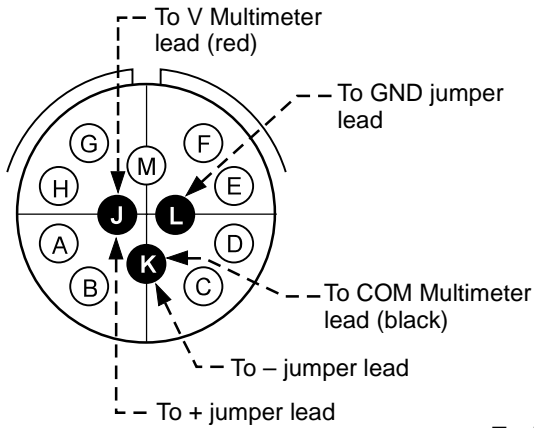
- EXCP 1: DC5 (J105), DC7 (J107)
- EXCP 3: DC2 (J304), DC5 (J307)
- EXCP 4: DC1 (J104), DC4 (J107), DC12 (J113)
- EXCP 5: DC1 (J204), DC4 (J207), DC10 (J213)
- EXCP 6: DC1 (J304), DC5 (J307), DC11 (J313)

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Figure 3-6b.- EXCP connector layouts (Cont).

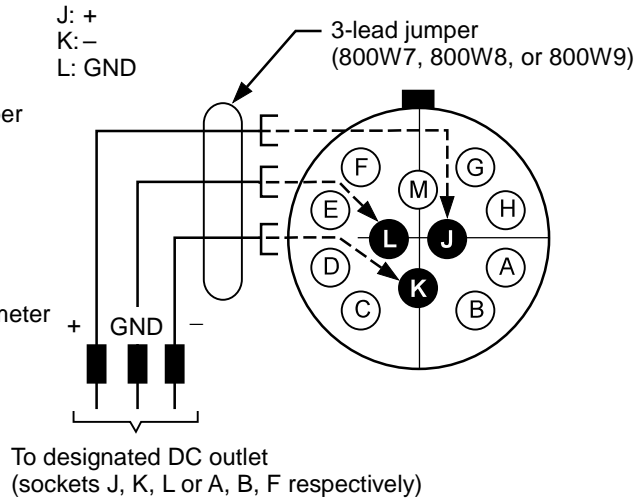
DC-Type I, X Clocking (16-ga)

EXCP Connector Socket Layout



- EXCP 1: DC4 (J104)
- EXCP 2: DC2 (J203)
- EXCP 3: DC3 (J305)
- EXCP 4: DC3 (J106)
- EXCP 5: DC3 (J206)
- EXCP 6: DC3 (J306)

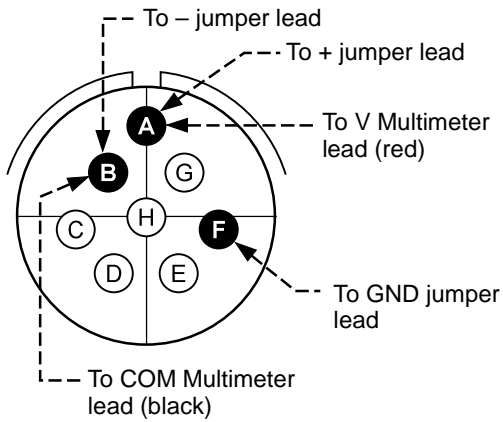
Cable Connector Layout (Pins)



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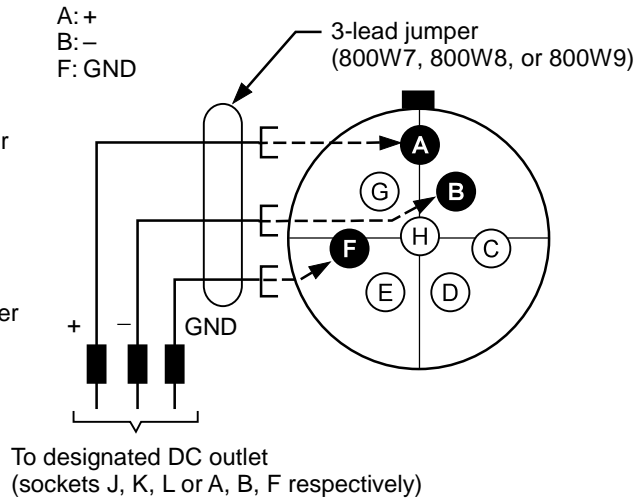
DC-Type II, N Clocking (16-ga)

EXCP Connector Socket Layout



- EXCP 4: DC11 (J112)
- EXCP 5: DC9 (J212)
- EXCP 6: DC10 (J312)

Cable Connector Layout (Pins)

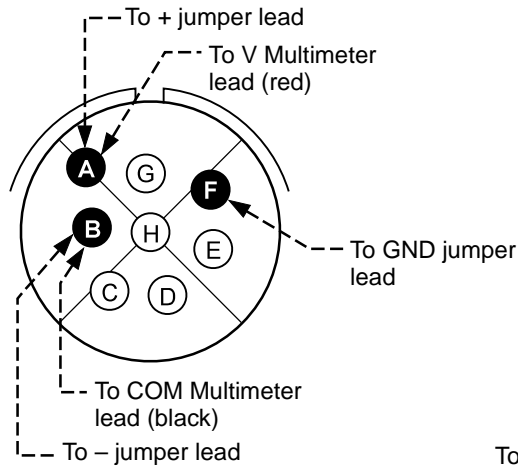


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Figure 3-6b.- EXCP connector layouts (Cont).

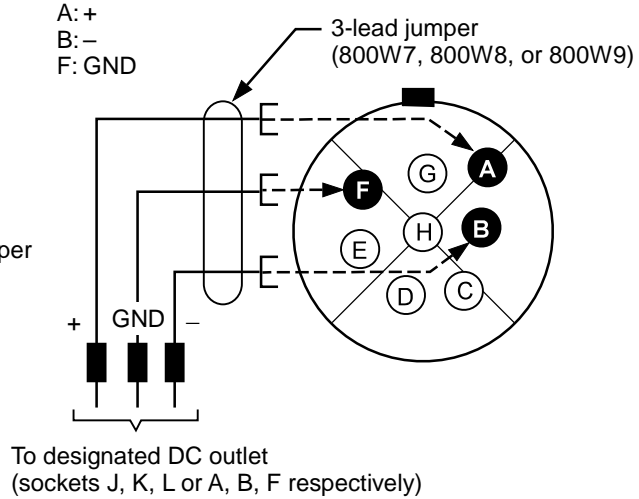
DC-Type II, W Clocking (16-ga)

EXCP Connector Socket Layout



- EXCP 1: DC8 (J108)
- EXCP 3: DC6 (J308)
- EXCP 4: DC5 (J108)
- EXCP 5: DC5 (J208)
- EXCP 6: DC6 (J308)

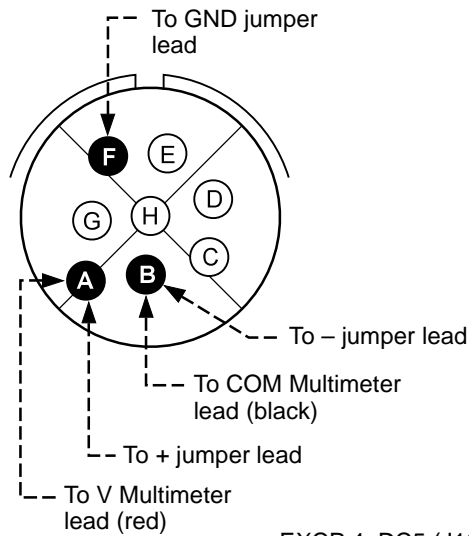
Cable Connector Layout (Pins)



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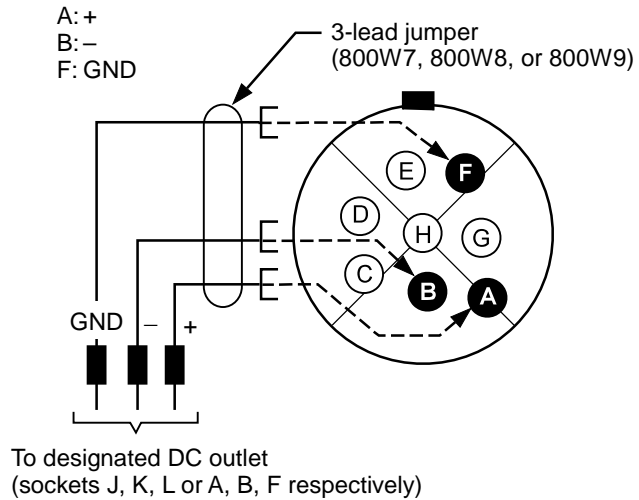
DC-Type II, X Clocking (16-ga)

EXCP Connector Socket Layout



- EXCP 4: DC5 (J109)
- EXCP 5: DC6 (J209)
- EXCP 6: DC7 (J309)

Cable Connector Layout (Pins)

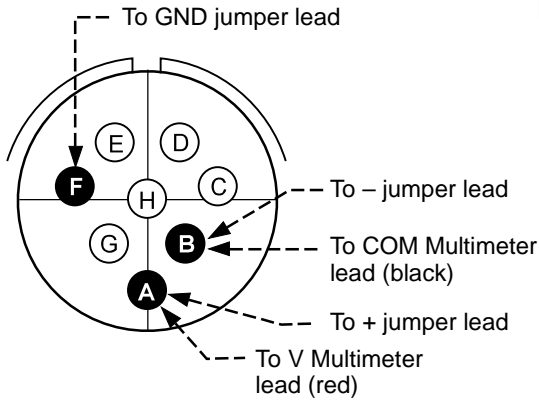


jsc48100_116_023br1.cvx

Figure 3-6b.- EXCP connector layouts (Cont).

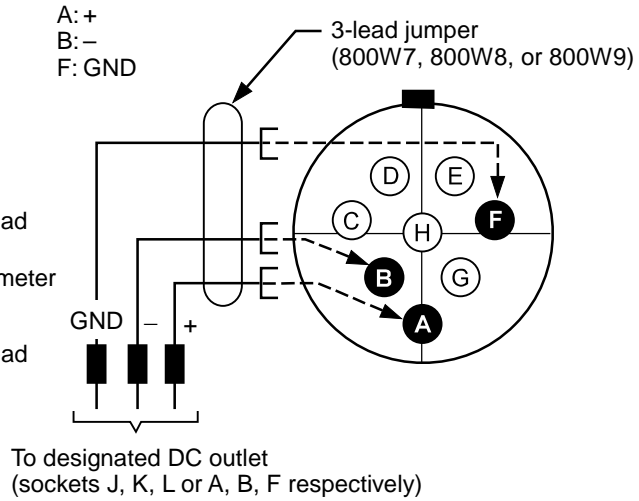
DC-Type II, Y Clocking (16-ga)

EXCP Connector Socket Layout



EXCP 4: DC7 (J110)
 EXCP 5: DC7 (J210)
 EXCP 6: DC8 (J310)

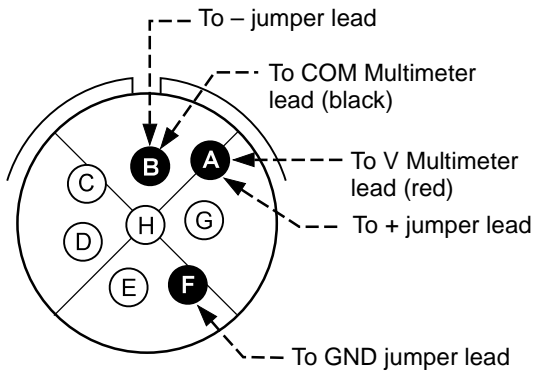
Cable Connector Layout (Pins)



jsc48100_116_024ar1.cvx

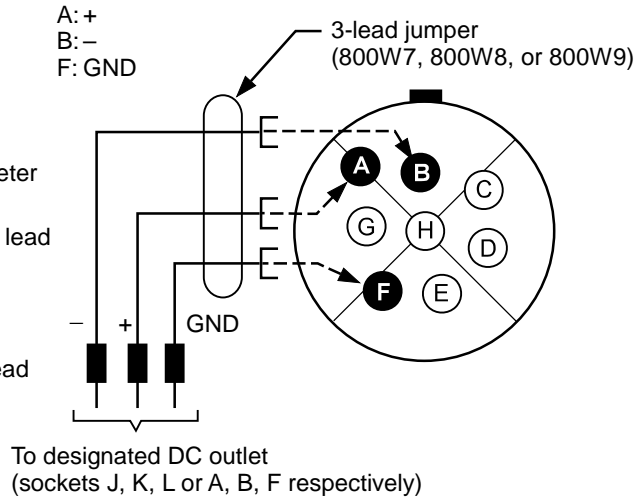
DC-Type II, Z Clocking (16-ga)

EXCP Connector Socket Layout



EXCP 4: DC10 (J111)
 EXCP 5: DC8 (J211)
 EXCP 6: DC9 (J311)

Cable Connector Layout (Pins)



jsc48100_116_024br1.cvx

Figure 3-6b.- EXCP connector layouts (Cont).

IFM-5.4 CABLE FUNCTIONALITY CHECK

(20 min)

OBJECTIVE: To provide failure data in the event of a power anomaly

TOOLS REQD: ORBITER
Multimeter Kit
IFM Pin Kit

CONFIGURE MULTIMETER TO TEST EXPERIMENT CABLE

1. If Multimeter not already configured to check EXCP or video outlet voltage (IFM-5.1):
2. Set up Multimeter per instructions on flap for DC V (auto range) (see fig 3-6a for Multimeter setup)

NOTE

Red and black Multimeter leads have removable test probes installed on one end. Once removed, this end of leads can also be installed into Multimeter so banana jacks on other end can be used with Pin Kit accessories

3. Remove test probes from red and black Multimeter leads and insert this end into Multimeter
4. If video cable to be tested, go to step 24

EXP DC

5. Contact POCC for cable to test

Exp/location	Plug in location	Voltage
_____	_____	_____
_____	_____	_____
_____	_____	_____

- _____
- EXCP__
6. √Affected experiment turned off _____
 7. √cb _____ – OFF
 8. Connect power cable to be tested to outlet _____
 9. Install 16-ga red and black test adapters from Pin Kit (flap 7) onto banana jacks of Multimeter
 10. Install one 16-ga, 5-in _____ test jumper lead from Pin Kit (_____) onto red test adapter and one 16-ga, 5-in _____ test jumper lead from Pin Kit (_____) onto black test adapter

TEST FOR POWER AT THE EXPERIMENT CABLE

- _____
11. Disconnect power cable from experiment
 12. Install test jumper leads to _____ of cable to be tested (reference experiment malfunction procedure _____ for pin/sockets to be tested and connector layout)

NOTE

If testing a Y-Cable, each leg is tested individually

- EXCP__
13. If testing a Y-Cable, √power cable disconnected from outlet _____
 14. cb _____ – ON
 15. If cb trips, √MCC
 16. Record Multimeter reading
 17. cb _____ – OFF

18. If testing a Y-Cable and only one leg has been tested:
 Disconnect power cable leg that has been tested from outlet

 Connect power cable leg that has not been tested to outlet

 Repeat steps 14 thru 17 for other cable leg

19. Notify MCC of Multimeter readings
20. Disconnect test jumper leads from cable
21. If Multimeter reading ≥ 24 VDC

- _____
 EXCP__
- Reconnect power cable to experiment
 If Y-Cable tested, connect power cable leg to _____ |
 cb _____ – ON
 22. \sqrt MCC for further actions
 23. Stow Multimeter and Pin Kit accessories >>

CONFIGURE MULTIMETER TO TEST VIDEO CABLE |

24. If Multimeter already configured to check Video outlet voltage (IFM-5-1):
 Disconnect the following and return to Pin Kit:
 20-ga 5-in pin/socket test jumper lead (flap 5)
 pin/pin test jumper lead (back flap of insert)
 red and black test adapters (flap 7)
25. Install 22-ga red and black test adapters from Pin Kit (flap 7)
26. Install one 22-ga 5-in pin/socket test jumper lead from Pin Kit (flap 5)
 onto red test adapter, and one 22-ga 5-in pin/pin test jumper lead from
 Pin Kit (back flap of insert) onto black test adapter
27. \sqrt cb CB1,CB2,CB3,CB4,CB5 (five) – op
28. \sqrt TVC VIDEO, SYNC, POWER (three) – OFF
29. Connect cable _____ connector _____ to connector
 VID/SYNC CAMR POWER J213

VSU
 EXCP2

TEST FOR POWER AT THE VIDEO CABLE |

- VSU
30. Disconnect cable from VSU connector J1
 31. Install test jumper leads to sockets of cable to be tested (Ref MP-01
 Loss of SH Video Downlink (SH EXP HDBK) for connector layout)
- EXCP2
32. TVC POWER – ON
 33. Record Multimeter reading _____ (volts)
 34. TVC POWER – OFF
 35. Notify MCC of Multimeter reading and check for further actions
 36. Disconnect test jumper leads from cable
 37. Stow Multimeter, Pin Kit accessories

IFM-6.1 DC HARNESS (POWER) CABLE INSTALLATION

(10 min) I

OBJECTIVE: To install spare DC Harness (Power) Cable (10108-10082) from orbiter Contingency Hose/Cable Kit for use on Forward or Aft DC Utility outlets

TOOLS REQD: None

1. Unstow DC Harness cable (24 ft) from orbiter Contingency Hose/Cable Kit. This cable will interface at any of the following locations:

- EXCP 1 – DC1
- EXCP 1 – DC2
- EXCP 1 – DC3
- EXCP 1 – DC6
- EXCP 2 – DC3
- EXCP 3 – DC1
- EXCP 3 – DC4
- EXCP 3 – DC7
- EXCP 4 – DC2
- EXCP 4 – DC8
- EXCP 4 – DC9
- EXCP 5 – DC2
- EXCP 6 – DC2
- EXCP 6 – DC4

EXCP__

2. √MCC for EXCP outlet to be used
3. √cb _____ – off
4. Remove connector cap from outlet
5. Mate DC Harness cable connector P1 to _____
6. Mate DC Harness cable connector J1 to _____
7. cb _____ – on

IFM-7.1 INVERTER POWER RECOVERY

(1:00 hr)

OBJECTIVE: To install IFM Y-Cable 800W1 (9062862-1) to regain DC power to inverter. This procedure is invoked in the event of PDU relay K1 failure. The inverter power source will be changed from PDU Connector J7 pins ABCDEF, to PDU J19 pins HJKLMN

NOTE

To access the spare pins, equipment that share – PDU connector J19/relay K14 will have to be powered down. After IFM cable installation, the inverter will be controlled via PDU relay K12 (DC SPARE). To access and disconnect PDU connector J7, cables 300W9 and 300W10 must be disconnected from PDU connectors J13 and J15, respectively, resulting in a temporary loss of DMU/MDM discrete data and commands to the PDU

TOOLS REQD: SPACEHAB
SS Stow 4 Connector Pliers
Antistatic Wrist (ASW) Tethers
Gray Tape

FC06 Temporarily shut down Subsystem PGSC:
1. Press [ALT] [Q] to exit software
2. Press [SHIFT]/[F10] to confirm
3. Exit Windows
4. PGSC pwr – off
5. DC PWR SPLY SW 1 – off (It off)
6. √MCC for experiment equipment pwrdn:

Subsystem equipment pwrdn:
SM 214 SPACEHAB ACT/DEAC
7. AC UTIL OFF – ITEM 42 EXEC (*)
8. √SPARE 2 OFF, ITEM 50 – (*)
9. √FANS ARS ORB, ITEM 65 – (*)
10. √CABIN ORB, ITEM 66 – (*)
11. √H2O PUMP 2 ORB, ITEM 73 – (*)

NOTE

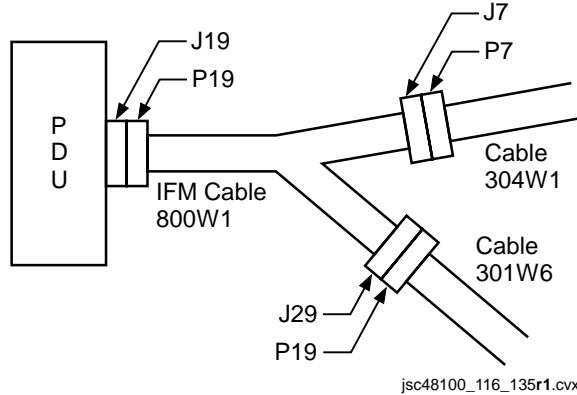
Expect SM ALERT, msgs:
'214 SH INV DC V'
'214 SH INV P-A AC V'
'214 SH INV P-B AC V'
'214 SH INV P-C AC V'

12. DC INVERTER OFF – ITEM 2 EXEC (*)
13. UTIL FWD OFF – ITEM 24 EXEC (*)
14. √SPARE OFF, ITEM 26 – (*)
15. PTB/CCTV OFF – ITEM 28 EXEC (*)
SS Stow 2 16. Unstow IFM cable 800W1

CAUTION
Pip pins in subfloor are noncaptive

D04 17. Remove pip pins, open floor panel, temp stow pip pins in floor panel
18. Don ASW tethers, clip to ground

19. Demate following to access PDU connector J7 (Connector Pliers):
 - Cable 300W9 (9060067-515) from PDU connector J13 (temp loss of DMU/MDM discrete data from PDU)
 - Cable 300W10 (9060067-517) from PDU connector J15 (temp loss of DMU/MDM discrete cmds to PDU)
20. Demate cable 304W1 (9060518-1) from PDU connector J7 (Connector Pliers)
21. Demate cable 301W6 (9060517-509) from PDU connector J19 (Connector Pliers)
22. Install IFM cable as follows:
 - Mate cable 800W1 connector P19 to PDU connector J19
 - Mate cable 800W1 connector J7 to cable 304W1 connector P7
 - Mate cable 800W1 connector J29 to cable 301W6 connector P19



23. Cover PDU connector J7 with tape
24. Remate cables:
 - Cable 300W9 connector P13 to PDU connector J13
 - Cable 300W10 connector P15 to PDU connector J15
25. Unclip ASW tethers
26. Close floor panel, replace pip pins
27. Stow tools

D04

Inverter powerup:

SM 214 SPACEHAB ACT/DEAC

28. DC SPARE ON – ITEM 25 EXEC (*)
29. $\sqrt{\text{BUS INV } \Phi A, \Phi B, \Phi C \text{ VOLTS (three)}} > 105.4 \text{ and } < 124.6$
30. If any out of limits, $\sqrt{\text{MCC}}$

On MCC GO:

CRT

31. DC UTIL FWD ON – ITEM 23 EXEC (*)
32. PTB/CCTV ON – ITEM 27 EXEC (*)
33. AC UTIL ON – ITEM 41 EXEC (*)

FC06

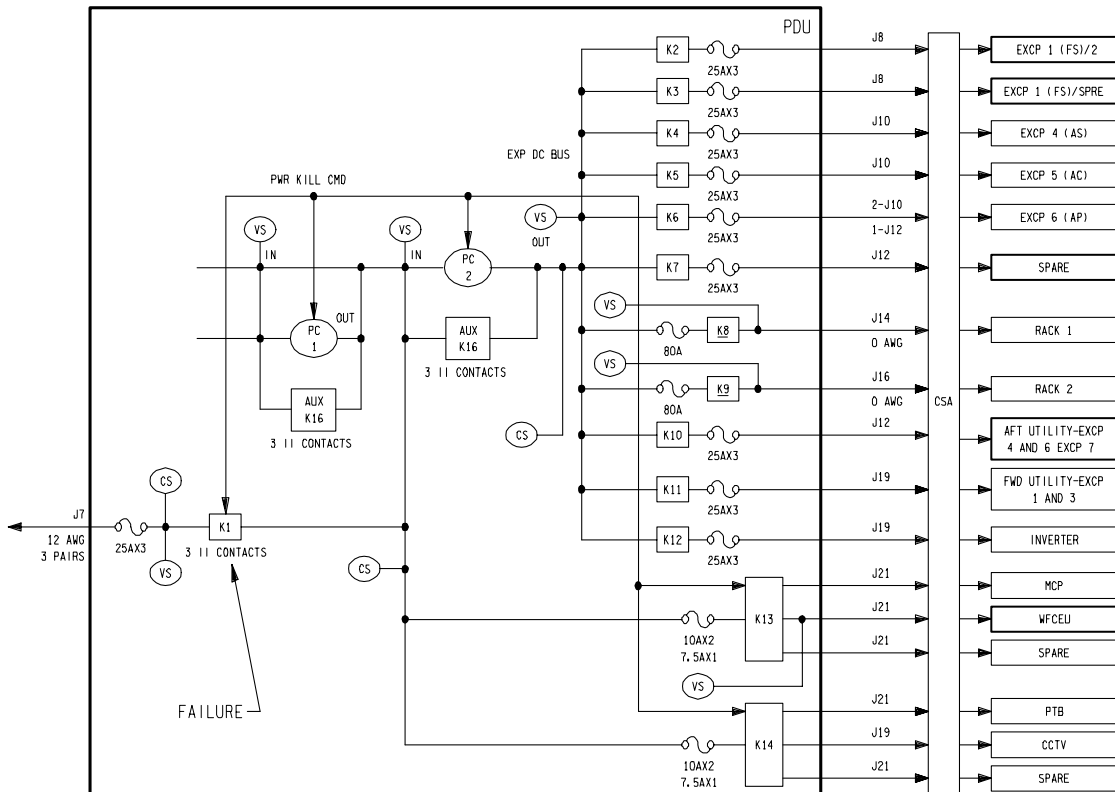
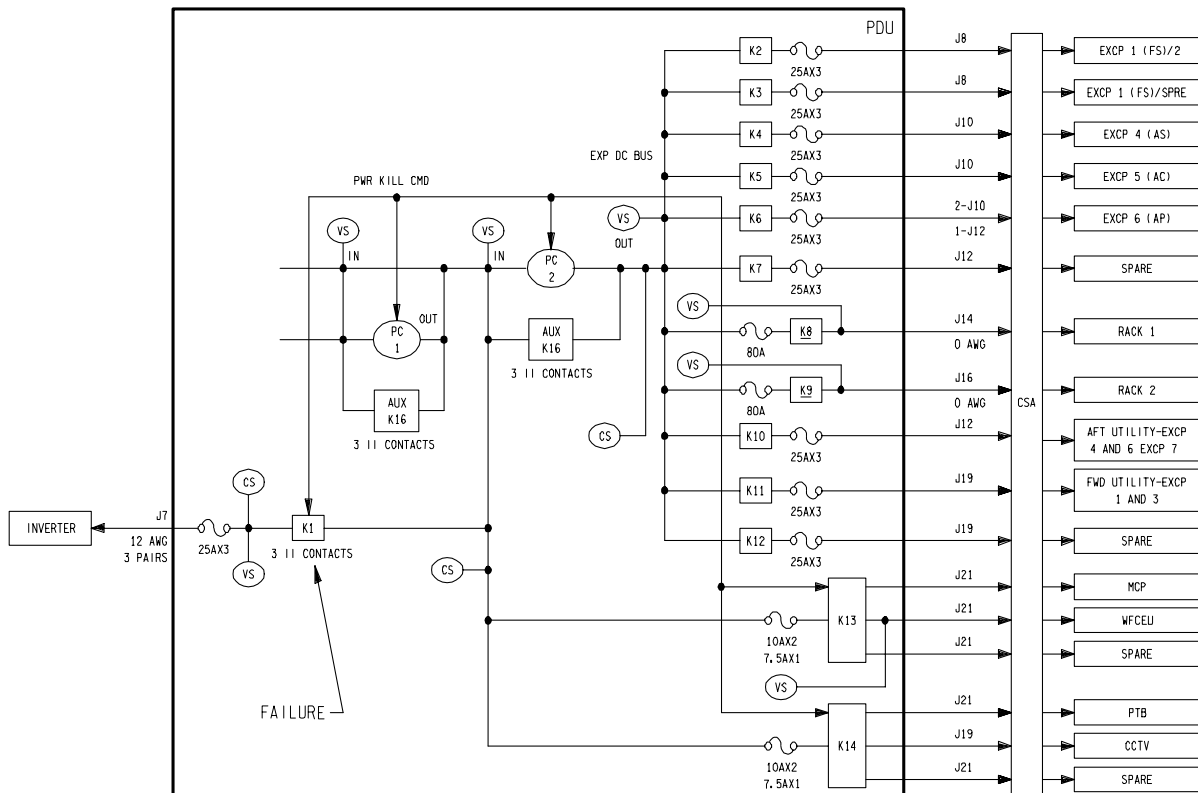
Repower Subsystem PGSC:

34. DC PWR SPLY SW 1 – on (It on)
35. PGSC pwr – on
36. Select SPACEHAB SUBSYSTEM boot option
37. $\sqrt{\text{Windows displayed}}$
38. Double click on SHUTTLE APPS folder on desktop
39. Double click on SPACEHAB folder
40. Double click on SPACEHAB MONITOR icon in SPACEHAB folder

PGSC: SPACEHAB SUMMARY

41. $\sqrt{\text{MCC}}$ for experiment equipment powerup:

PDU DC POWER DISTRIBUTION



TOP: ORIGINAL CONFIGURATION
 BOTTOM: MODIFIED CONFIGURATION

48100100_116_SCH; 1

Figure 3-7.- Inverter power recovery final configuration.

IFM-7.2 RACK 1 DC POWER RECOVERY

(1:00 hr)

OBJECTIVE: To install IFM cable 800W5 (9062862-507) to regain DC power to RACK 1

NOTE

After IFM cable installation, Rack 1 will be controlled via PDU Relay K9 and Rack 2 will be unpowered

TOOLS REQD: SPACEHAB

- SS Stow 4 Connector Pliers
- Antistatic Wrist (ASW) Tethers
- Gray Tape
- Strap Wrench (jumper bag)

1. √MCC for subsystem and experiment pwrdrn:

SM 214 SPACEHAB ACT/DEACT

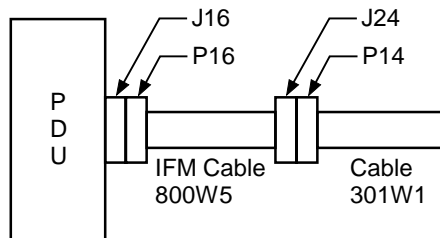
SS Stow 2

- 2. √DC RACK 1 OFF, ITEM 18 – (*)
- 3. Unstow IFM cable 800W5

CAUTION
Pip pins in subfloor are noncaptive

D04

- 4. Remove pip pins, open floor panel, stow pip pins in floor panel
- 5. Don ASW tethers, clip to ground
- 6. Demate the following (Connector Pliers or Strap Wrench if necessary):
 - Cable 301W2 (9060517-501) from PDU connector J16
 - Demate the following connector to access PDU connector J14:
 - Cable 300W10 (9060067-517) from PDU connector J15 (temp loss of DMU commanding to PDU)
 - Cable 301W1 (9060517-1) from PDU connector J14
- 7. If cable 301W1 connector J14 is routed underneath cable to PDU connector J2, slide connector J14 out from under connector J2 by pulling on cable 301W1 aft of PDU towards CSA
- 8. Install IFM cable as follows:
 - Mate cable 800W5 connector P16 to PDU connector J16
 - Mate cable 800W5 connector J24 to cable 301W1 connector P14



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- 9. Secure cable 301W2 to subfloor and cover PDU connector J14 (tape)
- 10. Mate cable 300W10 connector P15 to PDU connector J15
- 11. Unclip ASW tethers
- 12. Close floor panel, replace pip pins
- 13. Stow tools
- 14. √MCC for experiment powerup:

IFM-7.3 RACK 2 DC POWER RECOVERY

(1:00 hr)

OBJECTIVE: To install IFM cable 800W6 (9062862-509) to regain DC power to RACK 2

NOTE

After IFM cable installation, Rack 2 will be controlled via PDU Relay K8 and Rack 1 will be unpowered

TOOLS REQD: SPACEHAB

- SS Stow 4 Connector Pliers
- Antistatic Wrist (ASW) Tethers
- Gray Tape
- Strap Wrench (jumper bag)

1. √MCC for subsystem and experiment pwrdsn:

SM 214 SPACEHAB ACT/DEACT

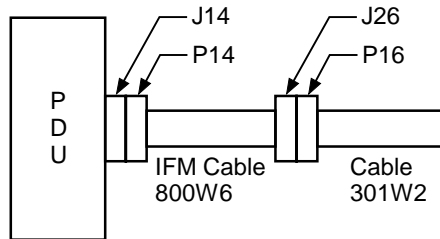
SS Stow 2

- 2. √DC RACK 2 OFF, ITEM 20 – (*)
- 3. Unstow IFM cable 800W6

CAUTION
Pip pins in subfloor are noncaptive

D04

- 4. Remove pip pins, open floor panel, stow pip pins in floor panel
- 5. Don ASW tethers, clip to ground
- 6. Demate the following (Connector Pliers or Strap Wrench if necessary):
 - Cable 301W2 (9060517-501) from PDU connector J16
 - Demate the following connector to access PDU connector J14:
 - Cable 300W10 (9060067-517) from PDU connector J15 (temp loss of DMU commanding to PDU)
 - Cable 301W1 (9060517-1) from PDU connector J14
- 7. Install IFM cable as follows:
 - Mate cable 800W6 connector P14 to PDU connector J14
 - Mate cable 800W6 connector J26 to cable 301W2 connector P16



jsc48100_116_137r1.cvx

- 8. Secure cable 301W1 to subfloor and cover PDU connector J16 (tape)
- 9. Mate cable 300W10 connector P15 to PDU connector J15
- 10. Unclip ASW tethers
- 11. Close floor panel, replace pip pins
- 12. Stow tools
- 13. √MCC for experiment powerup:

IFM-7.4 WFCEU, LIGHTS, PTB POWER RECOVERY

(1:00 hr)

OBJECTIVE: To install IFM cable 800W2 (9062862-501) at PDU to regain DC pwr to WFCEU, fwd lights, or PTB. This procedure is invoked due to failure of PDU Relay K13 or K14. A Y-Cable will change WFCEU, fwd lights, and PTB power source from PDU connector J21 to PDU Connector J19 Spare

NOTE

After IFM cable installation, WFCEU, Fwd lights, and PTB will be controlled via PDU Relay K12 (DC SPARE). Since the Fwd Utility and CCTV share PDU Connector J19, they will have power interrupted during the IFM cable installation. If K13 has failed, CCTV will regain power. If K14 has failed, CCTV may be recovered via IFM-5.3

TOOLS REQD: SPACEHAB
SS Stow 4
Connector Pliers
Antistatic Wrist (ASW) Tethers
Flashlight
Gray Tape

FC06 Temp shut down Subsystem PGSC:
1. Press [ALT] [Q] to exit software
2. Press [SHIFT]/[F10] to confirm
3. Exit Windows
4. PGSC pwr – off
5. DC PWR SPLY SW 1 – off (It off)
6. √MCC for experiment equipment pwrn:

VSU Subsystem pwrn:
7. Camcorder PWR – OFF
8. cb CB1,2,3,4,5 (five) – op
SM 214 SPACEHAB ACT/DEAC
9. DC UTIL FWD OFF – ITEM 24 EXEC (*)
10. LIGHTS OFF – ITEM 30 (no feedback)

NOTE

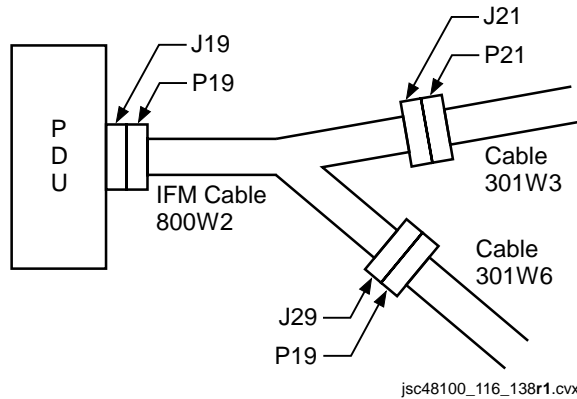
Expect SM ALERT, msgs:
'214 SH WFCEU V'
If WFCEU in MODE 1,
'215 SH WFCEU MODE'

SSP 11. SS DC BUS – OFF (tb-bp)
SS Stow 2 12. Unstow IFM cable 800W2

CAUTION
Pip pins in subfloor are noncaptive

D04 13. Remove pip pins, open floor panel, stow pip pins in floor panel
14. Don ASW tethers, clip to ground
15. Demate following (Connector Pliers):
Cable 301W6 (9060517-509) connector P19 from PDU connector J19
Cable 301W3 (9060517-503) connector P21 from PDU connector J21

16. Install IFM cable as follows:
 - Mate cable 800W2 connector P19 to PDU connector J19
 - Mate cable 800W2 connector J21 to cable 301W3 connector P21
 - Mate cable 800W2 connector J29 to cable 301W6 connector P19



D04

17. Cover PDU J21 connector with tape
 18. Unclip ASW tethers
 19. Close floor panel, replace pip pins
 20. Stow tools
- Repower WFCEU, lights, PTB, CCTV:
- SM 214 SPACEHAB ACT/DEAC
21. DC SPARE ON – ITEM 25 EXEC (*)
 22. UTIL FWD ON – ITEM 23 EXEC (*)
 23. PTB/CCTV ON – ITEM 27 EXEC (*)
 24. LIGHTS ON – ITEM 29 EXEC (no feedback)
- SM 215 SPACEHAB ECS
25. √WFCEU MODE THERM, ITEM 1 – (*)

NOTE

Expect SM ALERT, '215 SH WFCEU MODE' msg.
Expect ↓ next to ITEM 1 on SPEC 215

26. WFCEU MODE HX IN – ITEM 2 EXEC (no feedback)
27. √CMD REC – YES (for 5 sec)
28. MTR 1 ON – ITEM 32 EXEC (no feedback)
29. √WFCEU CMD REC – YES (for 5 sec)

FC06

- Repower Subsystem PGSC:
30. DC PWR SPLY SW 1 – on (It on)
 31. PGSC pwr – on
 32. Select SPACEHAB SUBSYSTEM boot option
 33. √Windows displayed
 34. Double click on SHUTTLE APPS folder on desktop
 35. Double click on SPACEHAB folder
 36. Double click on SPACEHAB MONITOR icon in SPACEHAB folder
- PGSC: SPACEHAB SUMMARY
37. √MCC for experiment powerup (FWD CCTV, PTB, DC UTIL):

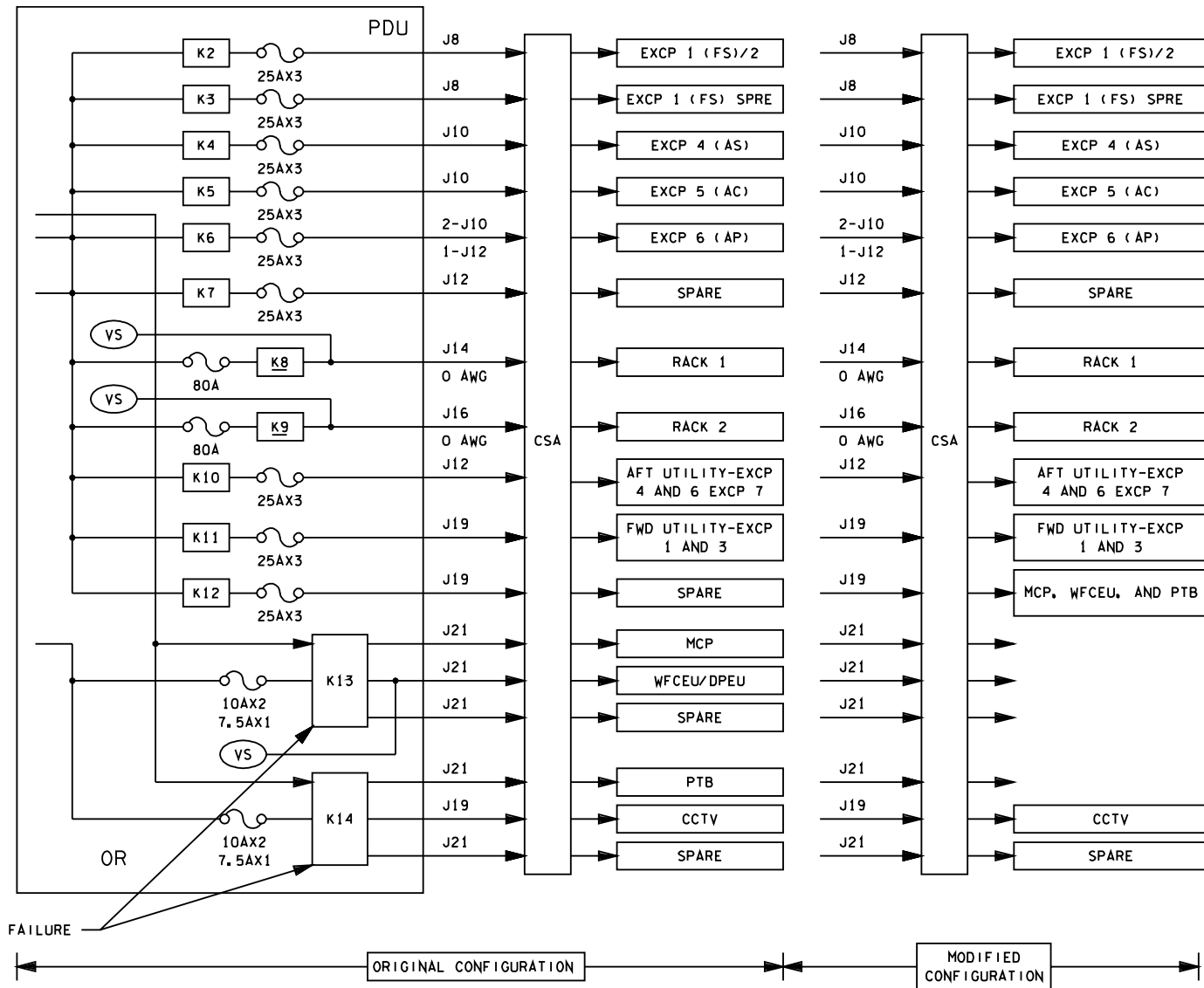


Figure 3-8.- WFCEU, fwd lights, PTB power recovery final configuration.

IFM-7.5 ARS FAN POWER RECOVERY

(45 min)

OBJECTIVE: To Install IFM Y-Cable 800W3 (9062862-503) to regain AC power to ARS Fan. This procedure is invoked due to failure of PDU Relay K22. A Y-Cable will be installed to change the Fan power source from PDU Connector J23 to PDU Connector J17. The power source for SS WPP WP1 will be changed from PDU Connector J23 to PDU Connector J17 as well

NOTE

After IFM cable installation, the ARS Fan will be controlled via PDU Relay K21 (AC SPARE 1) receiving orbiter power only, and will no longer be configurable to Inverter power. H2O PUMP 1 will be controlled via PDU Relay K20 (AC UTIL) receiving Inverter power (if powered)

TOOLS REQD: SPACEHAB
SS Stow 4 Connector Pliers
Antistatic Wrist (ASW) Tethers
Gray Tape

1. √MCC for experiment pwrdrn:

Subsystem equipment pwrdrn:

NOTE

Expect SM ALERT, msgs:
'214 SH H2O FL ARS'
'214 SH H2O FL CAB'

SM 214 SPACEHAB ACT/DEAC

- 2. H2O PUMP 1/2 OFF – ITEM 71 EXEC (*)
- 3. 2 INV – ITEM 72 EXEC (*)
- 4. ON/1 OFF – ITEM 75 EXEC (*)
- 5. √FANS ARS OFF, ITEM 61 – (*)

NOTE

Expect MASTER ALARM, msgs:
'214 SH CAB FAN DP1'
'214 SH CAB FAN DP2'

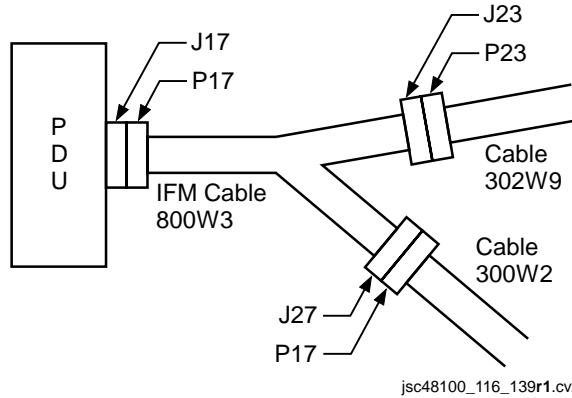
- 6. FANS CABIN OFF – ITEM 62 EXEC (*)
- 7. INV – ITEM 64 EXEC (*)
- 8. ON – ITEM 68 EXEC (*)
- 9. AC UTIL OFF – ITEM 42 EXEC (*)
- 10. √SPARE 1 OFF, ITEM 48 – (*)
- 11. √2 OFF, ITEM 50 – (*)

MA73C:E 12. cb AC3 PL 3Φ – op
SS Stow 2 13. Unstow IFM cable 800W3

CAUTION
Pip pins in subfloor are noncaptive

- D04
- 14. Remove pip pins, open floor panel, stow pip pins in floor panel
 - 15. Don ASW tethers, clip to ground

16. Demate the following (Connector Pliers):
 - Cable 302W9 (9060520-515) connector P23 from PDU connector J23
 - Demate the following connector to access PDU connector J17:
 - Cable 302W2 (9060520-501) connector P3 from PDU connector J3
 - Cable 300W2 (9060067-501) connector P17 from PDU connector J17
17. Install IFM cable as follows:
 - Mate cable 800W3 connector P17 to PDU connector J17
 - Mate cable 800W3 connector J23 to cable 302W9 connector P23
 - Mate cable 800W3 connector J27 to cable 300W2 connector P17



18. Cover PDU connector J23 with tape
 19. Mate cable 302W2 connector P3 to PDU connector J3
 20. Unclip ASW tethers
 21. Close floor panel, replace pip pins
 22. Stow tools
 23. cb AC3 PL 3Φ – cl
- ARS fan powerup:

SM 214 SPACEHAB ACT/DEAC

24. AC SPARE 1 ON – ITEM 47 EXEC (*)
 25. $\sqrt{\text{FANS ARS } \Delta P_{1,2} \text{ (two)}} > 0.2 \text{ and } < 5.5$
- On MCC GO:

NOTE

Expect MASTER ALARM, msgs:
 '214 SH CAB FAN DP1'
 '214 SH CAB FAN DP2'

26. FANS CABIN OFF – ITEM 62 EXEC (*)
27. ORB – ITEM 66 EXEC (*)
28. ON – ITEM 68 EXEC (*)

NOTE

Expect SM ALERT, msgs:
 '214 SH H2O FL ARS'
 '214 SH H2O FL CAB'

29. H2O PUMP 1/2 OFF – ITEM 71 EXEC (*)
30. 2 ORB – ITEM 73 EXEC (*)
31. AC UTIL ON – ITEM 41 EXEC (*)
32. $\sqrt{\text{MCC}}$ for experiment powerup (AC UTIL OUTLETS)

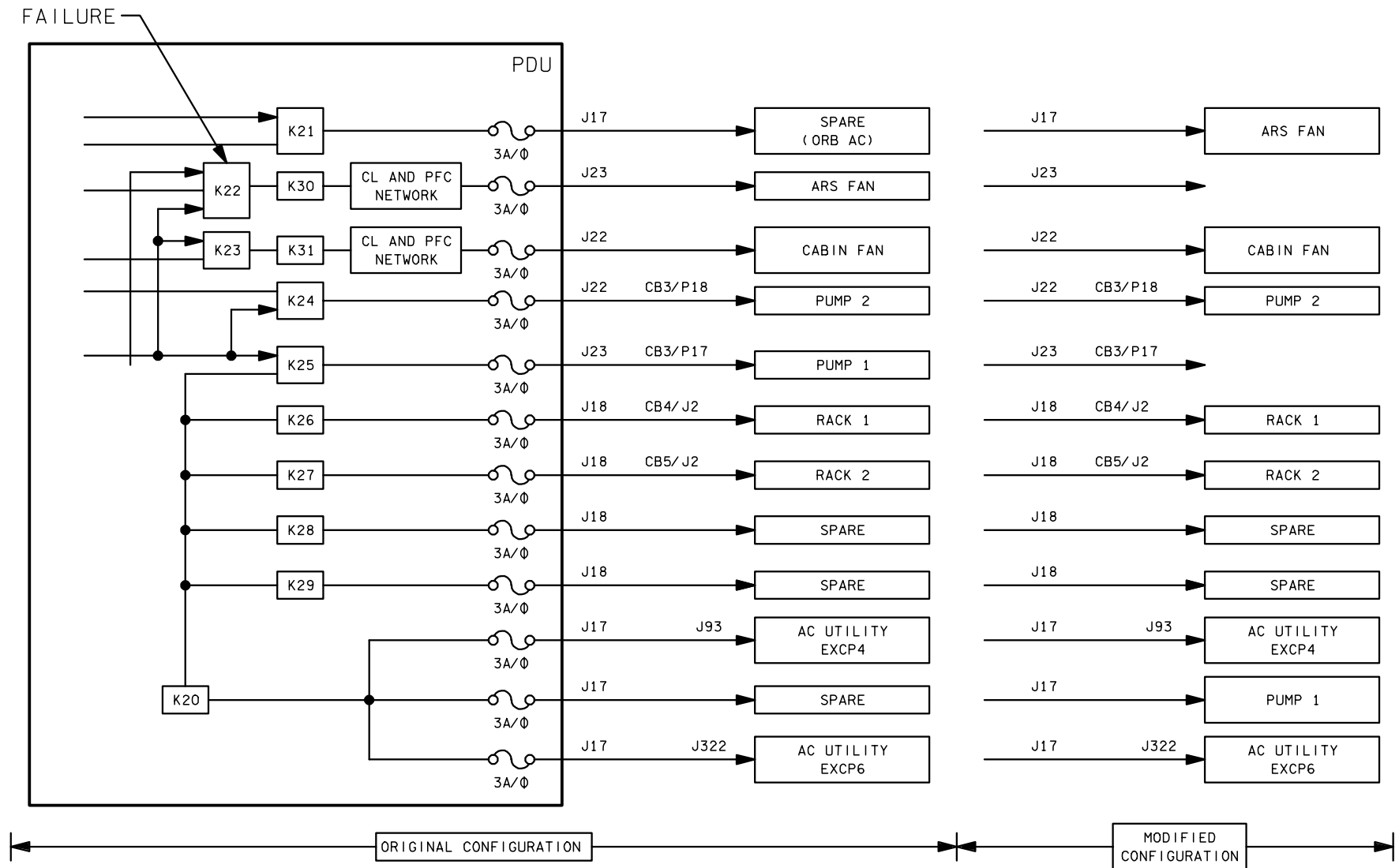


Figure 3-9.- ARS fan power recovery final configuration.

IFM-7.6 CABIN FAN POWER RECOVERY

(45 min)

OBJECTIVE: To install IFM Y-Cable 800W12 (9062862-521) to regain AC power to Cabin Fan. This procedure is invoked due to failure of PDU Relay K23. A Y-Cable will be installed to change the Fan power source from PDU connector J22 to PDU Connector J17. The power source for SS WPP WP2 will be changed from PDU connector J22 to PDU Connector J12 as well

NOTE

After IFM cable installation, Cabin Fan will be controlled via PDU Relay K21 (AC SPARE 1) receiving orbiter power only, and will no longer be configurable to Inverter power. SS H2O pump 2 will be controlled via PDU Relay K20 (AC UTIL) receiving Inverter power (if powered)

TOOLS REQD: SPACEHAB
SS Stow 4 Wire Cutters
Connector Pliers
Antistatic Wrist (ASW) Tethers
Gray Tape

1. √MCC for experiment pwrdrn:

Subsystem equipment pwrdrn:

NOTE

Expect SM ALERT, msgs:
'214 SH H2O FL ARS'
'214 SH H2O FL CAB'

SM 214 SPACEHAB ACT/DEAC

2. H2O PUMP 1 ON/2 OFF – ITEM 74 EXEC (*)
3. √FANS CABIN OFF, ITEM 62 – (*)

NOTE

Expect MASTER ALARM, msgs:
'214 SH ARS FAN DP1'
'214 SH ARS FAN DP2'

4. FANS ARS OFF – ITEM 61 EXEC (*)
5. INV – ITEM 63 EXEC (*)
6. ON – ITEM 67 EXEC (*)
7. AC UTIL OFF – ITEM 42 EXEC (*)
8. √SPARE 1 OFF, ITEM 48 – (*)
9. √2 OFF, ITEM 50 – (*)
10. cb AC3 PL 3Φ – op
11. Unstow IFM cable 800W12

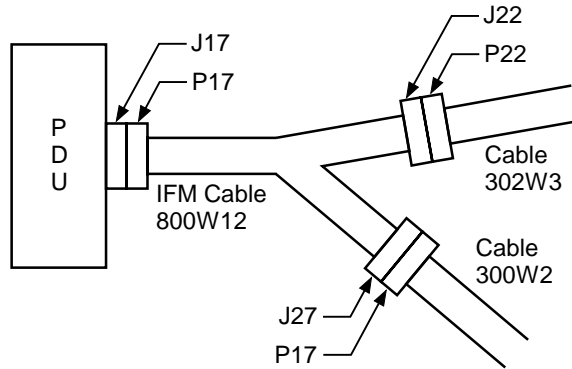
MA73C:E
SS Stow 2

CAUTION

Pip pins in subfloor are noncaptive

- D04
12. Remove pip pins, open floor panel, stow pip pins in floor panel
 13. Don ASW tethers, clip to ground

14. Demate the following (Connector Pliers):
 - Demate the following connector to access PDU connector J17:
 - Cable 302W2 (9060520-501) connector P3 from PDU connector J3
 - Cable 300W2 (9060067-501) connector P17 from PDU connector J17
 - Demate the following connector to access PDU connector J22:
 - Cable 300W9 (9060067-515) connector P9 from PDU connector J9
 - Cable 302W3 (9060520-503) connector P22 from PDU connector J22
15. Install IFM cable as follows:
 - Mate cable 800W12 connector P17 to PDU connector J17
 - Mate cable 800W12 connector J22 to cable 302W3 connector P22
 - Mate cable 800W12 connector J27 to cable 300W2 connector P17



16. Cover PDU connector J22 with tape
 17. Mate cable 302W2 connector P3 to PDU connector J3
 18. Mate cable 300W9 connector P9 to PDU connector J9
 19. Unclip ASW tethers
 20. Close floor panel, replace pip pins
 21. Stow tools
 22. cb AC3 PL 3Φ – cl
- Cabin fan powerup:
23. AC SPARE 1 ON – ITEM 47 EXEC (*)
 24. $\sqrt{\text{FANS CABIN } \Delta P_{1,2} \text{ (two)}} > 0.2 \text{ and } < 5.5$
- On MCC GO:

D04

MA73C:E

CRT

NOTE

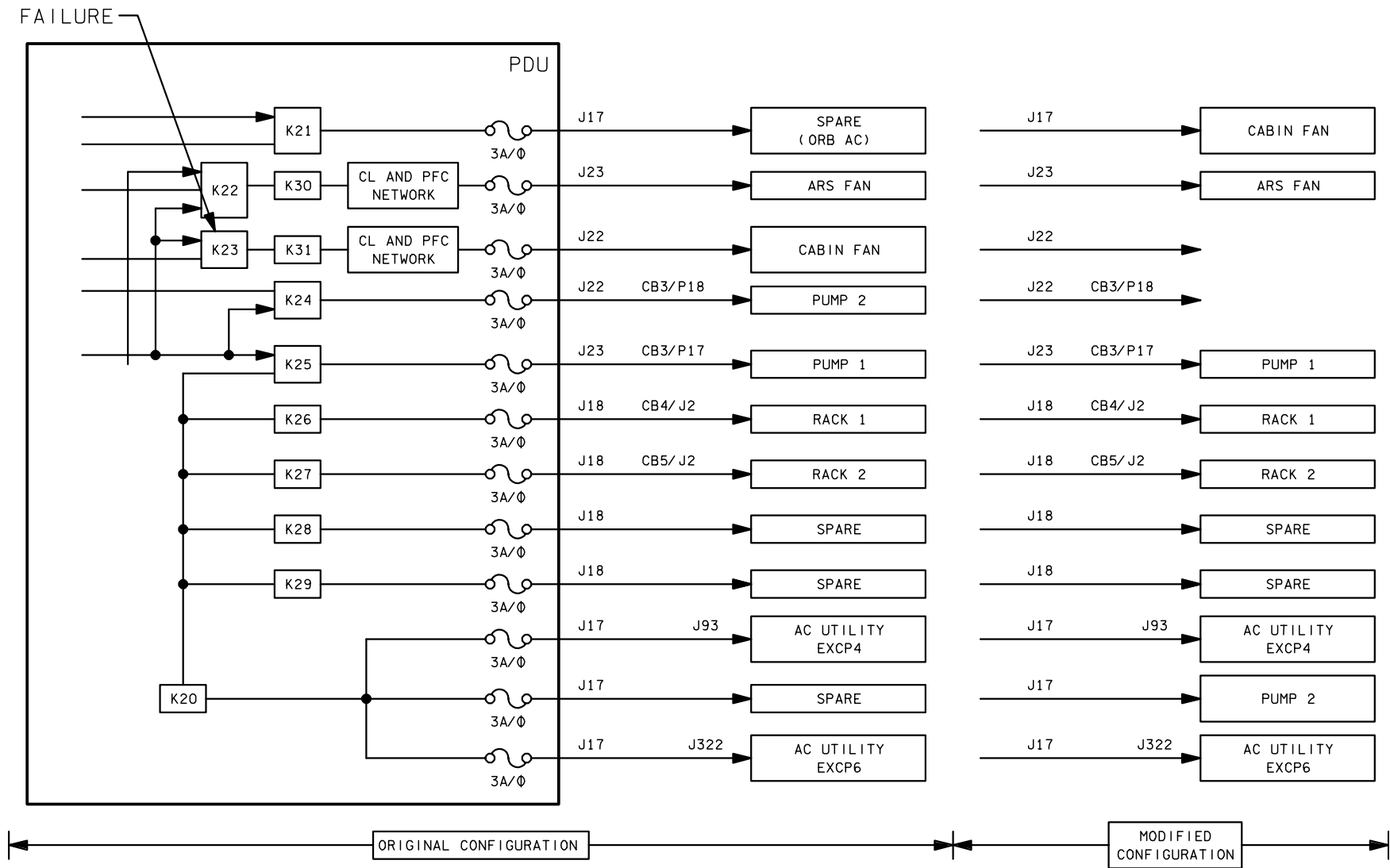
Expect MASTER ALARM, msgs:
 '214 SH ARS FAN DP1'
 '214 SH ARS FAN DP2'

25. FANS ARS OFF – ITEM 61 EXEC (*)
26. ORB – ITEM 65 EXEC (*)
27. ON – ITEM 67 EXEC (*)

NOTE

Expect SM ALERT, msgs:
 '214 SH H2O FL ARS'
 '214 SH H2O FL CAB'

28. H2O PUMP 1/2 OFF – ITEM 71 EXEC (*)
29. AC UTIL ON – ITEM 41 EXEC (*)
30. $\sqrt{\text{MCC}}$ for experiment powerup (AC UTIL OUTLETS)



48100103_116. SCH 1

Figure 3-10.- Cabin fan power recovery final configuration.

IFM-7.7 RACK 1 AC POWER RECOVERY

(45 min)

OBJECTIVE: To install IFM cable 800W4 to regain AC power to Rack 1

LOCATION:

TOOLS REQD: SPACEHAB

- SS Stow 4 Connector Pliers
- Antistatic Wrist (ASW) Tethers

1. √MCC for experiment pwrn:

Subsystem equipment pwrn:

SM 214 SPACEHAB ACT/DEAC

2. AC UTIL OFF – ITEM 42 EXEC (*)
3. RACK 1 OFF – ITEM 44 EXEC (*)
4. √RACK 2 OFF, ITEM 46 – (*)
5. √SPARE 2 OFF, ITEM 50 – (*)
6. √FANS ARS ORB, ITEM 65 – (*)
7. √CABIN ORB, ITEM 66 – (*)
8. √H2O PUMP 2 ORB, ITEM 73 – (*)

NOTE

Expect SM ALERT, msgs:

- '214 SH INV DC V'
- '214 SH INV P-A AC V'
- '214 SH INV P-B AC V'
- '214 SH INV P-C AC V'

9. DC INVERTER OFF – ITEM 2 EXEC (*)

SS Stow 2

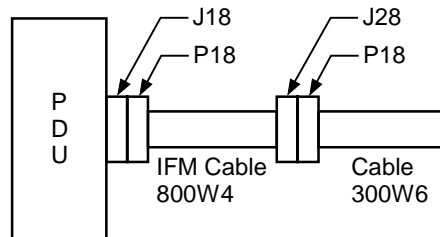
10. Unstow IFM cable 800W4

CAUTION

Pip pins in subfloor are noncaptive

D04

11. Remove pip pins, open floor panel, stow pip pins in floor panel
12. Don ASW tethers, clip to ground
13. Demate the following (Connector Pliers):
 - Demate the following connector to access PDU connector J18:
 - Cable 304W1 (9060518-1) connector P4 from PDU connector J4
 - Cable 300W6 (9060067-509) connector P18 from PDU connector J18
14. Install IFM cable as follows:
 - Mate cable 800W4 connector P18 to PDU connector J18
 - Mate cable 800W4 connector J28 to cable 300W6 connector P18



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Mate cable 304W1 connector P4 to PDU connector J4

D04

15. Unclip ASW tethers
16. Close floor panel, replace pip pins
17. Stow tools

Inverter powerup:

SM 214 SPACEHAB ACT/DEAC

18. DC INVERTER ON – ITEM 1 EXEC (*)

19. $\sqrt{\text{BUS INV } \Phi A, \Phi B, \Phi C \text{ VOLTS (three) } > 105.4 \text{ and } < 124.6}$
 20. If any out of limit, $\sqrt{\text{MCC}}$
- On MCC GO:
21. AC UTIL ON – ITEM 41 EXEC (*)
 22. SPARE 2 ON – ITEM 49 EXEC (*)
23. $\sqrt{\text{MCC}}$ for experiment powerup:

IFM-7.8 MAIN POWER KILL SIGNAL DISCONNECT AND RECOVERY

(1:00 hr)

OBJECTIVE: To disconnect a hard failed main power kill signal. There are three main power kill signal inputs (MCP, FSCU, and SSP). This procedure attempts to insulate the erroneous signal and disconnect it while leaving the other signals connected, thus maintaining main power kill capability

NOTE

This procedure requires two crewmembers

TOOLS REQD: SPACEHAB
SS Stow 4 Antistatic Wrist (ASW) Tethers
Flashlight
Gray Tape
Insertion/Extraction Tool (Fuse Pack)

SYSTEM SAFING

If powered experiments flown:

- FC06
1. √SPACEHAB EXPERIMENT POWER LOSS CONFIG (SH EXP HDBK, EXPERIMENT POWER LOSS CONFIG) complete
 2. PGSC pwr – off
SM 214 SPACEHAB ACT/DEAC
 3. DC LIGHTS OFF – ITEM 30 EXEC (no feedback)

PREACTIONATION CHECKOUT

- R1
4. √PL PRI MNC – ctr (tb-ON)
 5. √AUX – ON
 6. √AFT MNB – ON
 7. √CAB – MNA(MNB)

EPS RECOVERY

- SSP
8. √MN PWR – NO-OP
 9. √INVERTER – NO-OP
 10. ORB SEC DC BUS – OFF (tb-bp)

CAUTION

Pip pins in subfloor are noncaptive

- D04
11. Remove pip pins, open floor panel, stow pip pins in floor panel
 12. Don ASW Tethers, clip to ground
 13. Locate main power kill jiffy junctions at PDU connector J9
 14. √MCC for identification of power kill signal source to disconnect (MCP, FSCU, or SSP); if no comm, proceed in sequence

MCP, FSCU, SSP SIGNAL DISCONNECT

- PDU
15. Disconnect input wire (labeled “DISCONNECT THIS END”) from JJ1 (MCP signal) using the Insertion/Extraction Tool
- SSP
16. ORB SEC DC BUS – ON (tb-gray)
- If power recovery successful:
- D04
17. Notify MCC which input wire disconnected
 18. Tape down disconnected wire
 19. Unclip ASW Tethers
 20. Close floor panel, replace pip pins
 21. Perform MN PWR KILL RECOVERY – ARS FAN AND PUMP ON ORB AC, steps ____ (SH OPS, CONTINGENCY PROCS)

- SSP
- If no joy:
22. ORB SEC DC BUS – OFF (tb-bp)
 23. Reconnect input wire to JJ1(JJ2,JJ3), using Insertion/Extraction Tool

24. Disconnect input wire (labeled "DISCONNECT THIS END") from JJ2, FSCU signal (JJ3, SSP signal)
25. Repeat steps 16 thru 24 for JJ2(JJ3) signal
26. If still no joy on power recovery after all wires tested, √MCC

IFM-7.9 WATER PUMP 1 POWER RECOVERY

(45 min)

OBJECTIVE: To install IFM Cable 800W13 (9062862-523) to route orbiter AC power to Water Pump 1

TOOLS REQD: SPACEHAB
SS Stow 4 Connector Pliers
Antistatic Wrist (ASW) Tethers
Gray Tape

1. √MCC for subsystem pwrdsn:

- MA73C:E
SS Stow 2
2. cb AC3 PL 3Φ – op
 3. Unstow IFM Cable 800W13

CAUTION
Pip pins in subfloor are noncaptive

- D04
4. Remove pip pins, open floor panel, stow pip pins in floor panel
 5. Don ASW Tethers, clip to ground
 6. Disconnect:
Cable 302W2 (9060520-501) Connector P3 from PDU Connector J3 (Connector Pliers)
Cable 302W9 (9060520-515) Connector P23 from PDU Connector J23 (Connector Pliers)
 7. Install IFM cable as follows:
Refer to figure 3-11
Mate Cable 800W13 Connector J3 to Cable 302W2 Connector P3
Mate Cable 800W13 Connector J23 to Cable 302W9 Connector P23

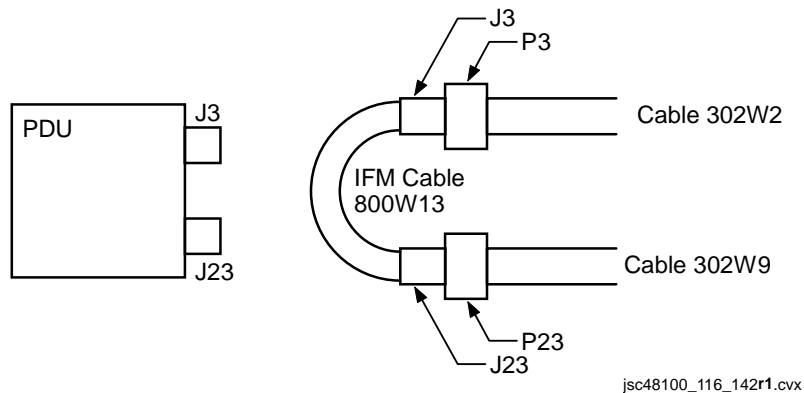


Figure 3-11.- IFM cable installation for water pump 1.

- D04
8. Secure Cable 800W13 to subfloor and cover PDU Connectors J3 and J23 (tape)
 9. Unclip ASW Tethers
 10. Close floor panel, replace pip pins
 11. Stow tools
- On MCC GO:
- MA73C:E
12. cb AC3 PL 3Φ – cl
 13. √MCC for subsystem pwrup:

IFM-7.10 WATER PUMP 2 POWER RECOVERY

(45 min)

OBJECTIVE: To install IFM Cable 800W13 (9062862-523) to route orbiter AC power to Water Pump 2

TOOLS REQD: SPACEHAB
 SS Stow 4 Wire Cutters
 Connector Pliers
 Antistatic Wrist (ASW) Tethers
 Gray Tape

1. √MCC for subsystem pwrdsn:

MA73C:E
 SS Stow 2

2. cb AC3 PL 3Φ – op
3. Unstow IFM Cable 800W13

CAUTION
 Pip pins in subfloor are noncaptive

D04

4. Remove pip pins, open floor panel, stow pip pins in floor panel
5. Don ASW Tethers, clip to ground

PDU

6. Disconnect:
 Cable 302W2 (9060520-501) Connector P3 from PDU Connector J3 (Connector Pliers)
 Cable 302W3 (9060520-503) Connector P22 from PDU Connector J22 (Connector Pliers)
7. Install IFM cable as follows:
 Refer to figure 3-12
 Mate Cable 800W13 Connector J3 to Cable 302W2 Connector P3
 Mate Cable 800W13 Connector J23 to Cable 302W3 Connector P22

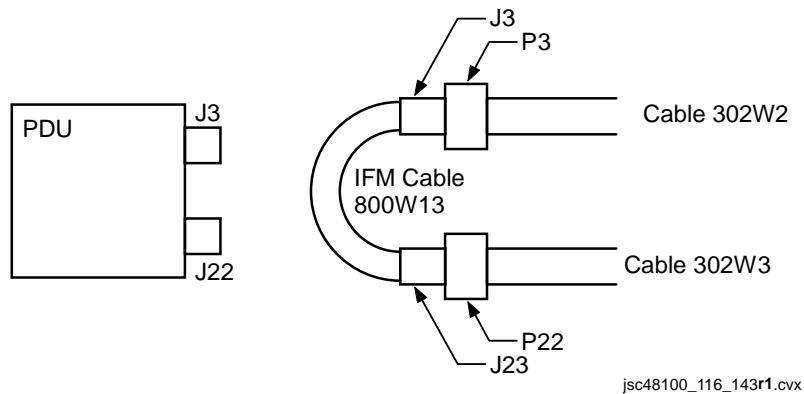


Figure 3-12.- IFM cable installation for water pump 2.

D04

8. Secure Cable 800W13 to subfloor and cover PDU Connectors J3 and J22 (tape)
9. Unclip ASW Tethers
10. Close floor panel, replace pip pins
11. Stow tools

MA73C:E

- On MCC GO:
12. cb AC3 PL 3Φ – cl
 13. √MCC for subsystem pwrup:

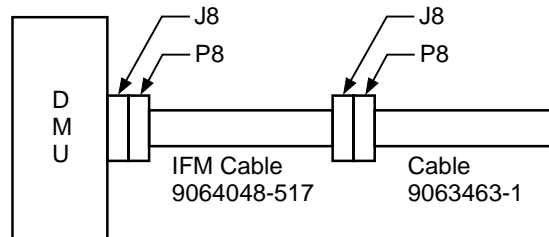
IFM-7.11 DMU PDI OUTPUT RECOVERY

(30 min)

OBJECTIVE: To install IFM cable jumper (9064048-517) to recover the payload data interleaver (PDI) output from the DMU (J8) using an output reserved for the payload recorder (PLR) output

TOOLS REQD: SPACEHAB
SS Stow 4 L-Shaped 6mm Hex Wrench
Antistatic Wrist (ASW) Tethers

- SS Stow 2
D03
1. Unstow IFM Jumper Cable 9064048-517
 2. Loosen 1/4-turn captive fasteners (four) (L-Shaped 6mm Hex Wrench); remove, temp stow floor panel
 3. Don ASW Tethers; clip to ground
 4. Demate the following:
Cable 9063463-1 from DMU Connector J8
 5. Install IFM cable as follows:
Refer to figure 3-13
Mate Cable 9064048-517 Connector J8 to Cable 9063463-1 Connector P8
Mate Cable 9064048-517 Connector P8 to DMU Connector J8



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Figure 3-13. IFM cable installation.

6. Unclip ASW Tethers
7. Replace floor panel, tighten 1/4-turn captive fasteners (four) (L-Shaped 6-mm Hex Wrench)
8. Stow tools
9. √MCC

IFM-7.12 ARS FAN AND WATER PUMP COMMAND CAPABILITY RECOVERY

(1:00 hr)

OBJECTIVE: To Install IFM Y-Cable 800W3 (9062862-503) to regain command capability for Water Pump 1 and ARS Fan. This procedure is invoked due to failure of the PF1 MDM card prior to Spacehab activation. PF1 MDM card has ARS Fan ON, ARS Fan OFF, H2O PUMP 1 ON/2 OFF, and H2O PUMP 2 ON/1 OFF commands. A Y-Cable will be installed which will change the Fan power source from PDU Connector J23 (relay K22) to PDU Connector J17 (relay K21). The power source for the H2O PUMP 1 will be changed from PDU Connector J23 (relay K25) to PDU Connector J17 (relay K20)

NOTE

After IFM cable installation, the ARS Fan will be controlled via PDU Relay K21 (AC SPARE 1) receiving orbiter power only, and will no longer be configurable to Inverter power. SS WPP WP1 will be controlled via PDU Relay K20 (AC UTIL) receiving Inverter power (if powered)

TOOLS REQD: SPACEHAB
SS Stow 4
Wire Cutters
Connector Pliers
Antistatic Wrist (ASW) Tethers
Gray Tape
Ziplock Bag

1. √MCC for experiment pwrdrn:

C3
SSP

H2O HTR ACTIVATION

- 2. H2O LN HTRS – ON
- 3. cb SW PWR 2 – cl
- 4. ORB H2O LINE HTR PWR A – ON
- 5. √B – OFF (A ENA)

SM 215 SPACEHAB ECS

- 6. √H2O LN HTR HAB STATUS – 1
- 7. √ORB AMPS > 1

SUBSYSTEM EQUIPMENT PWRDN

SM 214 SPACEHAB ACT/DEAC

- 8. AC UTIL OFF – ITEM 42 EXEC (*)
- 9. √SPARE 1 OFF, ITEM 48 – (*)

NOTE

Expect SM ALERT, msgs:
‘214 SH H2O FL ARS’
‘214 SH H2O FL CAB’
‘223 SH INV DC V’
‘223 SH INV P-A AC V’
‘223 SH INV P-B AC V’
‘223 SH INV P-C AC V’

MA73C:E 10. DC INVERTER OFF – ITEM 2 EXEC (*)
If cb AC3 PL 3Φ – cl

NOTE
Expect MASTER ALARM, msgs:
'214 SH ARS FAN DP1'
'214 SH ARS FAN DP2'

11. cb AC3 PL 3Φ – op

CABLE AND FUSE CONFIG

SS Stow 2 12. Remove IFM Y-Cable 800W3 from stowed position in Subsystem Stowage

CAUTION
Pip pins in subfloor are noncaptive

- D04
13. Remove pip pins, open and brace floor panel, stow pip pins in floor panel
 14. Don ASW Tethers, clip to ground
 15. Demate the following cables, using Connector Pliers if necessary:
 - Cable 302W9 (9060520-515) Connector P23 from PDU Connector J23
 - Cable 302W2 (9060520-501) Connector P3 from PDU connector J3 (precaution to completely remove orbiter AC power from PDU)
 - Cable 300W2 (9060067-501) Connector P17 from PDU Connector J17
 16. Install IFM Cable 800W3 as follows:
 - Refer to figure 3-14
 - Mate IFM Cable 800W3 Connector P17 to PDU Connector J17
 - Mate IFM Cable 800W3 Connector J23 to Cable 302W9 Connector P23
 - Mate IFM Cable 800W3 Connector J27 to Cable 300W2 Connector P17
 - Cover PDU Connector J23 with Gray Tape

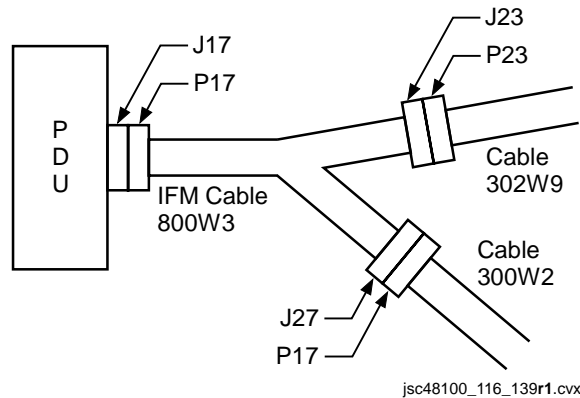


Figure 3-14.- IFM cable installation for AC power.

17. Remove AC fuses (9) F4, F5, F6, F27, F28, F29, F37, F38, and F39 from PDU (Port side) using the following steps:
 18. Remove fuse cap from PDU by rotating counterclockwise
 19. Remove fuse from fuse cap
 20. Stow fuse in Ziplock Bag
 21. Install fuse cap, rotate clockwise
22. Mate Cable 302W2 Connector P3 to PDU Connector J3
23. Unclip ASW Tethers
24. cb AC3 PL 3Φ – cl

MA73C:E

SUBSYSTEM EQUIPMENT PWRUP

SM 214 SPACEHAB ACT/DEAC

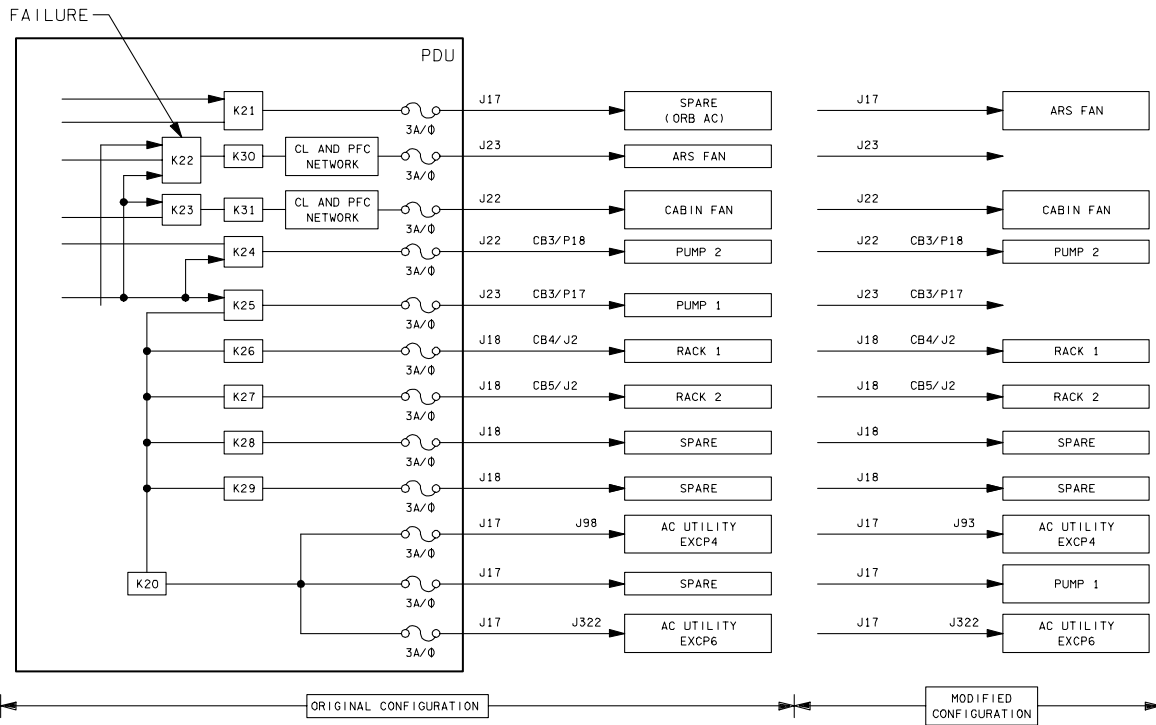
- 25. DC INVERTER ON – ITEM 1 EXEC (*)
- 26. $\sqrt{\text{BUS INV } \Phi A, \Phi B, \Phi C \text{ VOLTS (three)}} > 105.4 \text{ and } < 124.6$
- 27. AC SPARE 1 ON – ITEM 47 EXEC (*)
- 28. UTIL ON – ITEM 41 EXEC (*)
- 29. $\sqrt{\text{FANS ARS } \Delta P 1,2 \text{ (two)}} > 0.2 \text{ and } < 5.5$
- 30. $\sqrt{\text{HX H2O FLOW ARS}} > 75$
- 31. $\sqrt{\text{HX H2O FLOW CAB}} > 250$
- 32. Close floor panel and replace pip pins
- 33. Stow tools

H2O HTR DEACTIVATION

NOTE

Expect SM ALERT, msgs:
 '215 SH H2O HTR ORB'
 '215 SH H2O HTR HAB'

- SSP 34. cb SW PWR 2 – cl
- 35. ORB H2O LINE HTR PWR A – OFF (B ENA)
- 36. \sqrt{B} – OFF (A ENA)
- C3 37. H2O LN HTRS – OFF
- 38. $\sqrt{\text{MCC}}$ for experiment pwrup:



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Figure 3-15.- ARS fan and water pump command recovery final configuration.

IFM-8.1 SUBFLOOR AIR VALVE ADJUSTMENT

(30 min)

OBJECTIVE: Adjust setting of subfloor air valve to obtain proper air flow from orbiter

TOOLS REQD: SPACEHAB
SS Stow 4 5/32-in L-shaped Hex Wrench
4-in Adjustable Wrench

CAUTION
Pip pins in subfloor are noncaptive

- | | |
|---------------------|---|
| D05
FC06
PGSC | <ol style="list-style-type: none">1. Remove pip pins, open floor panel, stow pip pins in floor panel2. Relocate subsystem PGSC near floor panel D05, temp stow3. Record ARS fan delta pressures
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 20px;">PGSC: SPACEHAB SUMMARY</div>
FANS ARS $\Delta P1$ _____
$\Delta P2$ _____ |
| SAV | <ol style="list-style-type: none">4. Loosen locking bolt and nut on subfloor air valve enough to allow valve stem rotation. Do not remove nut and bolt (5/32-in L-shaped Hex Wrench, 4-in Adjustable Wrench)5. Adjust subfloor air valve stem clockwise until ARS fan delta pressure is _____
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 20px;">PGSC: SPACEHAB SUMMARY</div>
$\sqrt{\text{FANS ARS } \Delta P1, \Delta P2}$ |
| D05
FC06 | <ol style="list-style-type: none">6. Tighten locking bolt and nut (5/32-in L-shaped Hex Wrench, 4-in Adjustable Wrench)7. Close floor panel, replace pip pins8. Attach subsystem PGSC to PGSC table9. Stow tools |

IFM-8.2 CONTINGENCY AIR DUCT CONFIG

(30 min) I

OBJECTIVE: To configure the middeck and tunnel air ducts to allow maximum airflow to Spacehab

TOOLS REQD: SPACEHAB
SS Stow 4 Torque Driver #10, 3/8-in drive
3/8-in Driver Handle
1/4-in Driver Handle
4-in Extension, 1/4-in drive
5/16-in 6-point Standard Socket, 1/4-in drive
Torq Set Bit, 1/4-in drive
1/4-in Torque Wrench
Ziplock Bag
Gray Tape

DISABLE FORWARD MIDDECK AIR INLET HOUSING

1. Fold 26-in piece of Gray Tape on itself for 2-in X 13-in screen cover
2. Tape around air inlet housing grill

SETUP MIDDECK

DISABLE AFT MIDDECK AIR INLET HOUSING

3. Disconnect airlock flex duct from cabin floor fitting
4. Remove five screws on air inlet housing, temp stow (Torque Driver #10, 3/8-in Driver Handle)
5. Remove air inlet housing
6. Remove orifice and gasket from housing, stow
7. Fold 26-in piece of Gray Tape on itself for 2-in X 13-in screen cover
8. √Tape around air inlet housing grill
9. Replace air inlet housing
10. Replace five screws on air inlet housing (Torque Driver #10, 3/8-in Driver Handle)
11. Reconnect airlock flex duct to cabin floor fitting

EXT A/L

CONFIGURE EXTERNAL A/L

12. Tape halo vents closed

REMOVE ORIFICE

CAUTION
Clamps are not tethered

TNL

13. Locate flex duct just forward of module entrance
14. Loosen flex duct clamps (two) enough to allow clamps to slide off flex duct and onto hard duct (1/4-in Driver Handle, 5/16-in 6-point Standard Socket)
15. Slide ends of flex duct off of hard duct
16. Lift flex duct and cylinder assembly away from hard ducts

CAUTION
Screws are noncaptive

17. Remove four screws holding orifice plate to cylinder assembly (Torq Set Bit, 1/4-in driver)
18. Put orifice plate and screws (four) in Ziplock Bag and stow in VW Bag

CAUTION
Clamps are not tethered

19. Replace flex duct and cylinder assembly in line with hard ducts
20. Slide ends of flex duct onto hard duct and place clamps (two) over flex duct ends

21. Torque clamps to 20 in-lb (1/4-in Torque Wrench, 4-in Extension, 5/16-in 6-point Standard Socket)
22. Stow tools

D04

CONFIGURE ASCENT/DESCENT INLET STUB

<p><u>CAUTION</u> Pip pins in subfloor are noncaptive</p>

23. Remove pip pins, open floor panel, stow pip pins in floor panel
24. Unscrew cap, temp stow to Velcro on duct
25. Close floor panel, replace pip pins >>

TEARDOWN

CONFIGURE ASCENT/DESCENT INLET STUB

<p><u>CAUTION</u> Pip pins in subfloor are noncaptive</p>

D04

26. Remove pip pins, open floor panel, stow pip pins in floor panel
27. Insert Ascent/Descent Inlet stub cap into stub opening, turn until tight

<p><u>CAUTION</u> Clamps are not tethered</p>

28. Close floor panel, replace pip pins

TNL

REPLACE ORIFICE

29. Locate flex duct just forward of module entrance
30. Loosen flex duct clamps (two) enough to allow clamps to slide off flex duct and onto hard duct (1/4-in Driver Handle, 5/16-in 6-point Standard Socket)
31. Slide ends of flex duct off of hard duct
32. Lift flex duct and cylinder assembly away from hard ducts
33. Unstow orifice and screws (four) in Ziplock Bag

VW Bag

<p><u>CAUTION</u> Screws are noncaptive</p>

34. Attach orifice plate to cylinder assembly with screws (four) (Torq Set Bit, 1/4-in driver)
35. Replace flex duct and cylinder assembly in line with hard ducts
36. Slide ends of flex duct onto hard duct and place clamps (two) over flex duct ends
37. Torque clamps to 20 in-lb (1/4-in Torque Wrench, 4-in Extension, 5/16-in 6-point Standard Socket)

TNL

CONFIGURE EXTERNAL A/L

EXT A/L

38. Remove tape from halo vents

MIDDECK

ENABLE MIDDECK AIR INLET HOUSING (TWO)

39. Disconnect airlock flex duct from cabin floor fitting
40. Remove five screws on AFT air inlet housing, temp stow (Torque Driver #10, 3/8-in Driver Handle)
41. Remove air inlet housing
42. Replace orifice and gasket in housing
43. Remove tape from air inlet housing grill, stow in trash
44. Replace five screws on AFT air inlet housing (Torque Driver #10, 3/8-in Driver Handle)
45. Reconnect airlock flex duct to cabin floor fitting
46. Remove tape from FORWARD air inlet housing grill, stow in trash
47. Stow tools

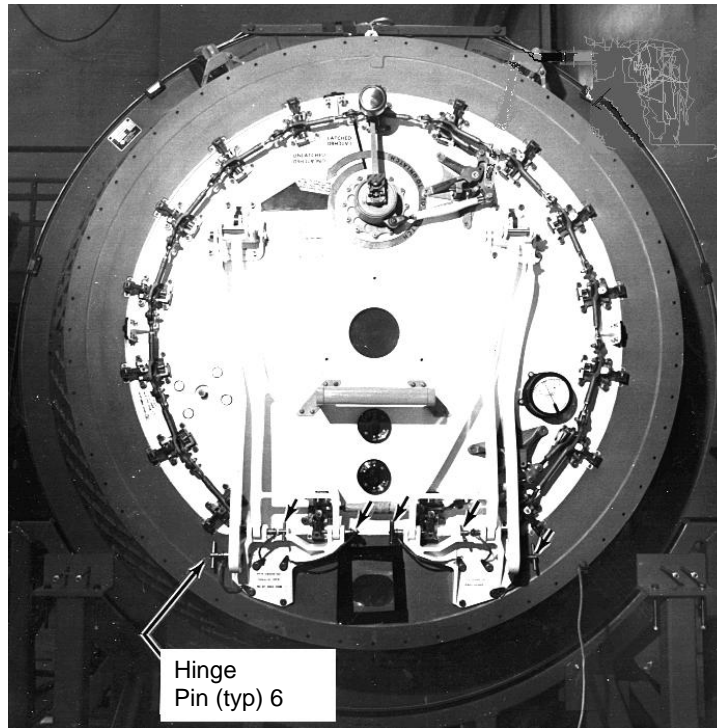
IFM-9.1 HATCH HINGE DISCONNECT

(15 min)

OBJECTIVE: Provides ability to open Spacehab hatch on tunnel adapter or ODS from SH side of hatch, in event of jammed hinge

LOCATION: See photo for locations

1. Remove hatch hinge pins (six)
2. Ingress airlock by pushing on hatch
3. ✓Hinge arms and pip pins clear of opening
4. Position hatch for closing
5. Close, lock hatch



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h_01

IFM-10.1 AFT MODULE FAN CHANGEOUT

(45 min)

OBJECTIVE: Replace failed aft Module Fan with spare

TOOLS REQD: SPACEHAB
SS Stow 4 Wire Cutters
Connector Pliers
Flat Tip Screwdriver (long)
4-in Ratchet Wrench, 1/4-in drive
4-in Extension, 1/4-in drive
5/32 Allen Head Driver, 1/4-in drive
Antistatic Wrist (ASW) Tethers
Gray Tape

NOTE

Portable Fluorescent Light can be used for supplemental lighting if reqd

- FBA
1. cb AFT MODULE FAN – OFF
 2. LIGHTS – OFF
 3. SM 214 SPACEHAB ACT/DEAC
 4. DC DM FN/LT OFF – ITEM 16 EXEC (*)
 4. Loosen nine 1/4-turn fasteners on FBA cover, temp stow (Flat Tip Screwdriver)
 5. Don ASW tethers, clip to ground
 6. Detach fan cable connector P1 from FBA electronics bracket connector J4
 7. Cut tie wraps to release fan cable as reqd (Wire Cutters)
 8. Loosen four captive fasteners on outlet flange of fan (4-in Ratchet Wrench, 4-in Extension, #25 Torx Driver)
 9. Pull fan away from fan mounting bracket
 10. Unclip ASW tethers
 11. Remove outlet flange, temp stow
 12. Mark failed fan with Tape
- SS Stow 4
13. Unstow spare fan (DC)
 14. Stow failed fan
- FBA
15. Clip ASW tethers to ground

NOTE

When inserting spare fan, orient fan such that debris screen faces aft

16. Retrieve outlet flange
17. Place outlet flange over forward (fan blades visible) side of fan
18. Pull fan cable forward through front of flange
19. Insert fasteners of outlet flange through mounting holes of fan
20. Align flange fasteners with fan bracket mounting holes
21. Push fasteners (four) through mounting holes and tighten (4-in Ratchet Wrench, 4-in Extension, #25 Torx Driver)
22. Mate fan cable connector P1 to FBA electronics bracket connector J4
23. Take up fan cable slack and tape to side of electronics bracket
24. Replace FBA cover
25. Tighten nine 1/4-turn fasteners (Flat Tip Screwdriver)

CRT

26. DC DM FN/LT ON – ITEM 15 EXEC (*)

On MCC GO:

FBA

27. cb AFT MODULE FAN – ON

On MCC GO:

28. cb AFT MODULE LIGHTS – ON

IFM-10.2 FAN BOX ASSY (FBA) POWER RECOVERY

(30 min)

OBJECTIVE: To install IFM cable 800W16 (9062862-529) to regain DC power to Fan Box Assy

TOOLS REQD: SPACEHAB
SS Stow 4 Connector Pliers
Antistatic Wrist (ASW) Tethers
Gray Tape

NOTE

Portable Fluorescent Light can be used for supplemental lighting if reqd

- | | | |
|--------------------------|--|--------------------------|
| FBA | 1. cb AFT MODULE FAN – OFF | |
| | 2. LIGHTS – OFF | |
| | <table border="1"><tr><td>SM 214 SPACEHAB ACT/DEAC</td></tr></table> | SM 214 SPACEHAB ACT/DEAC |
| SM 214 SPACEHAB ACT/DEAC | | |
| SS Stow 2 | 3. DC DM FN/LT OFF – ITEM 16 EXEC (*) | |
| EXCP 6 | 4. Unstow IFM cable 800W16 | |
| | 5. √cb DC6,7 (two) – OFF | |
| | 6. Remove connector caps from connectors J308 and J309, secure with Tape | |
| | 7. Mate cable 800W16 connector P308 to EXCP 6 connector J308 | |
| | 8. Mate cable 800W16 connector P309 to EXCP 6 connector J309 | |
| | 9. Don ASW tethers, clip to ground near FBA | |
| FBA | 10. Demate cable MOD2W6 connector P1 from FBA connector J1, secure to floor with Tape (Connector Pliers if reqd) | |
| | 11. Mate cable 800W16 connector P1 to FBA connector J1 | |
| | 12. Unclip ASW tethers | |
| EXCP 6 | 13. Tape cable in place | |
| | 14. cb DC6,7 (two) – ON | |
| | On MCC GO: | |
| FBA | 15. cb AFT MODULE FAN – ON | |
| | On MCC GO: | |
| | 16. cb AFT MODULE LIGHTS – ON | |

CRT/SS PGSC DISPLAYS

CRT/SS
PGSC DISPLAYS

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1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
1 XXXX/XXX/206 SH LAUNCH/ENTRY XX X DDD/HH:MM:SS
2 DDD/HH:MM:SS
3 FIRE/SMOKE HAB
4
5 A B PPO2 1 2
6 ALARM XXXS XXXS X.XXS X.XXS
7 CONC XX.XS XX.XS (Mg/M3) HAB P XX.XS
8
9 FSS FSCU MCP FANS ARS CABIN
10 ARM XS XS ΔP1 X.XXS X.XXS
11 DISCHARGE XS ΔP2 X.XXS X.XXS
12
13 HALON
14 MULTI XXXS
15
16 POWER
17 VOLTS AMPS
18 EMER XX.XS
19 AUX A XX.XS
20 AFT B XX.XS
21 SS XXX.XS
22 INV ΦA X.XS
23 INV ΦB X.XS
24 INV ΦC X.XS
25
26 (XX)

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PARAMETER CHARACTERISTICS: BFS 206 SH LAUNCH/ENTRY

MSID	CRT NAME	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
	FIRE/SMOKE							
P47X2017YV P47X2019YV	ALARM A XXXS B XXXS	event event	yes or no yes or no	M M				↓ ↓
P47Q2018AV P47Q2020AV	CONC XX.XS XX.XS	mg/m3 mg/m3	13.2 to -4.1 13.2 to -4.1	M M			↑ ↑	
P47X2025YV P47X2024YV P47X2009YV	FSS FSCU MCP ARM XS XS DISCHARGE XS	event event event	* or blank * or blank * or blank	M M M				↓ ↓ ↓
P47X2011YV	HALON MULTI XXXS	event	yes or no	M				↓
P47P2012AV P47P2113VV	HAB PPO2 1 X.XXS 2 X.XXS	psia psia	0 to 5.1 0 to 5	M M			↑ ↑	↓ ↓
P47P2008AV	HAB P XX.XS	psia	0 to 20.4	M			↑	↓

PARAMETER CHARACTERISTICS: BFS 206 SH LAUNCH/ENTRY (Cont)

MSID	CRT NAME			UNITS	DISPLAY RANGE	STATUS INDICATORS				
						M	H	L	↑	↓
P47P2001AV	FANS	ARS	CABIN	in H2O	0 to 7.14	M			↑	↓
P47P2006AV	ΔP1	X.XXS	X.XXS	in H2O	0 to 7.14	M			↑	↓
P47P2002AV	ΔP2	X.XXS	X.XXS	in H2O	0 to 7.14	M			↑	↓
P47P2007AV				in H2O	0 to 7.14	M			↑	↓
	POWER									
		VOLTS	AMPS							
P47V3001AV	EMER	XX.XS		volts	18 to 32.3	M			↑	↓
P47C3003AV	AUX A		XX.XS	amps	0 to 15.3	M			↑	
P47C3002AV	AFT B		XX.XS	amps	0 to 15.3	M			↑	
P47C3044AV	SS		XXX.XS	amps	0 to 102	M			↑	
P47C3014AV	INV A		X.XS	amps	0 to 5.1	M			↑	
P47C3016AV	INV B		X.XS	amps	0 to 5.1	M			↑	
P47C3018AV	INV C		X.XS	amps	0 to 5.1	M			↑	

	1										2										3										4										5									
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
1	XXXX / 214 / XXX										SPACEHAB										ACT/ DEAC										XX X										DDD / HH : MM : SS									
2																																									DDD / HH : MM : SS									
3	DC					ON OFF					BUS					VOLTS					AMPS					HAB																								
4	INVERTER					1X 2X					EMER					XX.XS					T XXX.XS																													
5	EXP BUS					3X 4X					AUX A					XX.XS					P XX.XS																													
6	EXCP 1/2					5X 6X					AFT B					XX.XS					PP02																													
7	3					7X 8X					MAIN					XX.XS					1 X.XXS																													
8	4					9X 10X					SEC					XXX XX.XS					2 X.XXS																													
9	5					11X 12X					EXP					XXX XX.XS					PPCO2																													
10	6					13X 14X					SS					XXX.XS					1 XX.XS																													
1	DM FN/LT					15X 16X					WFCEU					XXX XX.XS					2 XXX.XS																													
2	RACK 1					17X 18X					INV DC					XX.XS					XXX.XS																													
3	2					19X 20X					ΦA					XXX.XS					X.XS																													
4	UTIL AFT					21X 22X					ΦB					XXX.XS					X.XS																													
5	FWD					23X 24X					ΦC					XXX.XS					X.XS																													
6	SPARE					25X 26X					FANS ARS					CABIN					H2O PUMP																													
7	PTB/CCTV					27X 28X					OFF					61X 62X					1/2 OFF 71X																													
8	LIGHTS					29 30					INV					63X 64X					2 INV 72X																													
9	AC										ORB					65X 66X					ORB 73X																													
20	UTIL					41X 42X					ON					67X 68X					1 ON/2 OFF 74XS																													
1	RACK 1					43X 44X					ΔP1					X.XXS X.XXS					2 ON/1 OFF 75XS																													
2	2					45X 46X					ΔP2					X.XXS X.XXS					IN P XXXS																													
3	SPARE 1					47X 48X					HX H2O										OUT P XXXS																													
4	2					49X 50X					FLOW					XXXS XXXS					ACC QTY XXXS																													
5																																									(XX)									
6																																																		

PARAMETER CHARACTERISTICS: SM 214 SPACEHAB ACT/DEAC

MSID	CRT NAME			UNITS	DISPLAY RANGE	STATUS INDICATORS				
						M	H	L	↑	↓
	DC	ON	OFF							
P47X3011E	INVERTER	1X	2X	event	* or blank					
P47X3010E	EXP BUS	3X	4X	event	* or blank					
P47X3021E	EXCP 1/2	5X	6X	event	* or blank					
P47X3023E	3	7X	8X	event	* or blank					
P47X3025E	4	9X	10X	event	* or blank					
P47X3027E	5	11X	12X	event	* or blank					
P47X3029E	6	13X	14X	event	* or blank					
P47X3031E	DM FN/LT	15X	16X	event	* or blank					
P47X3033E	RACK 1	17X	18X	event	* or blank					
P47X3036E	2	19X	20X	event	* or blank					
P47X3039E	UTIL AFT	21X	22X	event	* or blank					
P47X3041E	FWD	23X	24X	event	* or blank					
P47X3043E	SPARE	25X	26X	event	* or blank					
P47X3052E	PTB/CCTV	27X	28X	event	* or blank					
P47K7024J	LIGHTS	29		cmd	no feedback					
P47K7023J			30	cmd	no feedback					
	AC									
P47X3056E	UTIL	41X	42X	event	* or blank					
P47X3058E	RACK 1	43X	44X	event	* or blank					
P47X3059E	2	45X	46X	event	* or blank					
P47X3057E	SPARE 1	47X	48X	event	* or blank					
P47X3060E	2	49X	50X	event	* or blank					

PARAMETER CHARACTERISTICS: SM 214 SPACEHAB ACT/DEAC (Cont)

MSID	CRT NAME	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
	BUS							
P47V3001A	EMER XX.XS	volts	18 to 32.3	M	H	L	↑	↓
P47C3003A	AUX A XX.XS	amps	0 to 15.3	M	H	L	↑	
P47C3002A	AFT B XX.XS	amps	0 to 15.3	M	H	L	↑	
P47V3004A	MAIN XX.XS	volts	18 to 32.3	M	H	L	↑	↓
P47X3006E	SEC XXX	event	on or off					
P47V3007A	XX.XS	volts	18 to 32.3	M	H	L	↑	↓
P47X3010E	EXP XXX	event	on or off					
P47V3008A	XX.XS	volts	18 to 32.3	M	H	L	↑	↓
P47C3009A	XXX.XS	amps	0 to 204	M	H	L	↑	
P47C3044A	SS XXX.XS	amps	0 to 102	M	H	L	↑	
P47X3046E	WFCEU XXX	event	on or off					
P47V3049A	XX.XS	volts	18 to 32.3	M	H	L	↑	↓
P47V3013A	INV DC XX.XS	volts	18 to 32.3	M	H	L	↑	↓
P47C3012A	XXX.XS	amps	0 to 102	M	H	L	↑	
P47V3015A	ΦA XXX.XS	volts	105 to 125.4	M	H	L	↑	↓
P47C3014A	X.XS	amps	0 to 5.1	M	H	L	↑	
P47V3017A	ΦB XXX.XS	volts	105 to 125.4	M	H	L	↑	↓
P47C3016A	X.XS	amps	0 to 5.1	M	H	L	↑	
P47V3019A	ΦC XXX.XS	volts	105 to 125.4	M	H	L	↑	↓
P47C3018A	X.XS	amps	0 to 5.1	M	H	L	↑	
	HAB							
P47T1014A	T XXX.XS	degF	31.9 to 140	M	H	L	↑	
P47P2008A	P XX.XS	psia	0 to 20.4	M	H	L	↑	↓
	PPO2							
P47P2012A	1 X.XXS	psia	0 to 5.1	M	H	L	↑	↓
P47P2113V	2 X.XXS	psia	0 to 5	M	H	L	↑	↓
	PPCO2							
P47P2014A	1 XX.XS	mmHg	-3.9 to 31.5	M	H	L	↑	
P47P2115V	2XXX.XS	mmHg	-3.9 to 28.8	M	H	L	↑	
	FANS ARS CABIN							
P47X1002E	OFF 61X 62X	event	* or blank					
P47X1009E		event	* or blank					
P47X1004E	INV 63X 64X	event	* or blank					
P47X1011E		event	* or blank					
P47X1004E	ORB 65X 66X	event	* or blank					
P47X1011E		event	* or blank					
P47X1002E	ON 67X 68X	event	* or blank					
P47X1009E		event	* or blank					
P47P2001A	ΔP1 X.XXS X.XXS	in H2O	0 to 7.14	M	H	L	↑	↓
P47P2006A		in H2O	0 to 7.14	M	H	L	↑	↓
P47P2002A	ΔP2 X.XXS X.XXS	in H2O	0 to 7.14	M	H	L	↑	↓
P47P2007A		in H2O	0 to 7.14	M	H	L	↑	↓
	HX H2O							
P47R1005A	FLOW XXXS XXXS	lbm/h	50 to 607	M	H	L		↓
P47R1012A		lbm/h	50 to 607	M	H	L		↓
	H2O PUMP							
P47X1034Y	1/2 OFF 71X	event	* (off) or blank					
P47X1036Y			if either pump on					
P47X1035E	2 INV 72X	event	* or blank					
P47X1035E	ORB 73X	event	* or blank					
P47X1034Y	1 ON/2 OFF 74XS	event	* or blank	M				
P47X1036Y	2 ON/1 OFF 75XS	event	* or blank	M				
P47P1038A	IN P XXXS	psia	-2 to 215	M	H	L	↑	↓
P47P1040A	OUT P XXXS	psia	-2 to 215	M	H	L	↑	↓
P47Q1037A	ACC QTY XXXS	pct	-2 to 100	M	H	L	↑	↓

ITEM ENTRY CHARACTERISTICS: SM 214 SPACEHAB ACT/DEAC

- ITEM 1: Closes PDU relay K1 which provides DC power to the inverters
- ITEM 2: Opens PDU relay K1 which removes DC power to the inverters
- ITEM 3: Closes PDU Power Contactor 2 and relay K16 which provides DC power to the Experiment Bus
- ITEM 4: Opens PDU Power Contactor 2 and relay K16 which removes DC power from the Experiment Bus
- ITEM 5: Closes PDU relay K2 which provides power to Fwd Locker Experiment Connector Panel (EXCP) 1/2
- ITEM 6: Opens PDU relay K2 which provides power to Fwd Locker Experiment Connector Panel (EXCP) 1/2
- ITEM 7: Closes PDU relay K3 which provides power to Fwd Locker EXCP 3
- ITEM 8: Opens PDU relay K3 which removes power from Fwd Locker EXCP 3
- ITEM 9: Closes PDU relay K4 which provides power to Aft Locker EXCP 4
- ITEM 10: Opens PDU relay K4 which removes power from Aft Locker EXCP 4
- ITEM 11: Closes PDU relay K5 which provides power to Aft Locker EXCP 5
- ITEM 12: Opens PDU relay K5 which removes power from Aft Locker EXCP 5
- ITEM 13: Closes PDU relay K6 which provides power to Aft Locker EXCP 6
- ITEM 14: Opens PDU relay K6 which removes power from Aft Locker EXCP 6
- ITEM 15: Closes PDU relay K7 which provides power to DM FAN/LIGHTS (Double Module) or SPARE (Single Module)
- ITEM 16: Opens PDU relay K7 which removes power from DM FAN/LIGHTS (Double Module) or SPARE (Single Module)
- ITEM 17: Closes PDU relay K8 which provides DC power to Rack 1
- ITEM 18: Opens PDU relay K8 which removes DC power from Rack 1
- ITEM 19: Closes PDU relay K9 which provides DC power to Rack 2
- ITEM 20: Opens PDU relay K9 which removes DC power from Rack 2
- ITEM 21: Closes PDU relay K10 which provides DC power to Aft Utility Outlets
- ITEM 22: Opens PDU relay K10 which removes DC power from Aft Utility Outlets
- ITEM 23: Closes PDU relay K11 which provides DC power to Fwd Utility Outlets
- ITEM 24: Opens PDU relay K11 which removes DC power from Fwd Utility Outlets
- ITEM 25: Closes PDU relay K12 which provides DC power to Spare
- ITEM 26: Opens PDU relay K12 which removes DC power from Spare
- ITEM 27: Closes PDU relay K14 which provides DC power to PTB/CCTV/Spare

ITEM ENTRY CHARACTERISTICS: SM 214 SPACEHAB ACT/DEAC (Cont)

- ITEM 28: Opens PDU relay K14 which removes power from PTB/CCTV/Spare
- ITEM 29: Closes MCP relay K1 which provides power to 3 of the 4 fwd module lights
- ITEM 30: Open MCP relay K1 which removes power to 3 of the 4 fwd module lights
- ITEM 41: Closes PDU relay K20 which provides AC power to the AC Utility Outlets
- ITEM 42: Opens PDU relay K20 which removes AC power from the AC Utility Outlets
- ITEM 43: Closes PDU relay K26 which provides AC power to Rack 1
- ITEM 44: Opens PDU relay K26 which removes AC power from Rack 1
- ITEM 45: Closes PDU relay K27 which provides AC power to Rack 2
- ITEM 46: Opens PDU relay K27 which removes AC power from Rack 2
- ITEM 47: Closes PDU relay K21 which provides AC power to Spare 1
- ITEM 48: Opens PDU relay K21 which removes AC power from Spare 1
- ITEM 49: Closes PDU relay K28 which provides AC power to Spare 2
- ITEM 50: Opens PDU relay K28 which removes AC power from Spare 2
- ITEM 61: Opens PDU relay K22 which removes power from ARS Fan
- ITEM 62: Opens PDU relay K23 which removes power from Cabin Fan
- ITEM 63: Toggles PDU relay K17 which switches ARS Fan from orbiter AC pwr to SH Inverter pwr
- ITEM 64: Toggles PDU relay K18 which switches Cabin Fan from orbiter AC pwr to SH Inverter pwr
- ITEM 65: Toggles PDU relay K17 which switches ARS Fan from SH Inverter pwr to orbiter AC pwr
- ITEM 66: Toggles PDU relay K18 which switches Cabin Fan from SH inverter pwr to orbiter AC pwr
- ITEM 67: Closes PDU relay K22 which provides AC power to ARS Fan
- ITEM 68: Closes PDU relay K23 which provides AC power to Cabin Fan
- ITEM 71: Opens PDU relays K24 and K25 which remove power from both Water Pumps 1 & 2
- ITEM 72: Toggles PDU relay K19 which switches Water Pump 2 from orbiter AC pwr to SH Inverter pwr
- ITEM 73: Toggles PDU relay K19 which switches Water Pump 2 from SH Inverter pwr to orbiter AC pwr
- ITEM 74: Opens PDU relay K25 and closes relay K24 which provides AC pwr to Water Pump 1 and removes AC pwr from Water Pump 2
- ITEM 75: Opens PDU relay K24 and closes relay K25 which removes AC pwr from Water Pump 1 and provides AC pwr to Water Pump 2

	1										2										3										4										5																			
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0										
1	XXXX/215/XXX										SPACEHAB ECS										XX X										DDD/HH:MM:SS																													
2																															DDD/HH:MM:SS																													
3	WFCEU										FIRE/SMOKE										A										B										HAB																			
4	CMD REC XXX										ALARM										XXXX										XXXX										T XXX.XS																			
5	MODE THERM 1XS										CONC										XXX.XS										XXX.XS										P XX.XS																			
6	HX IN 2																																								PP02																			
7	MAN 3										FSS										FSCU										MCP										1 X.XXS																			
8	FLAG										SAFE										80X										X										2 X.XXS																			
9	F1 11										F6 16										ARM										82XS										XS										PPC02									
10	F2 12										F7 17										DISCHARGE										84XS										XS										1 XX.XS									
1	F3 13										F8 18																																								2 XXX.XS									
2	F4 14										F9 19										HALON																																							
3	F5 15										F10 20										MULTI										XXXX																													
4																					SINGLE										XXXX																													
5	MTR 1/2 OFF 31																				PPRV ISO VLV																																							
6	1 ON 32																				OP CL																																							
7	2 ON 33																				1 86X 87X																																							
8	DIR CHANGE 34																				2 88X 89X																																							
9	PULSE STEP 35																																																											
20																																																												
1	HX IN T XXX.X																				H2O LN HTR																																							
2	DEWPT 1 XX.XS																				HAB STATUS										XS																													
3	2 XX.XS																				ORB AMPS										XXX.XS																													
4	WFCV POS XXX.X																																																											
5																																																												
6																																																												

PARAMETER CHARACTERISTICS: SM 215 SPACEHAB ECS

MSID	CRT NAME	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
P47X1042E	WFCEU							
P47X1045E	CMD REC XXX	event	yes or no					
P47K5019J	MODE THERM 1XS	event	* or blank	M				↓
P47K5020J	HX IN 2	cmd	no feedback					
P47K5020J	MAN 3	cmd	no feedback					
P47K5021J	FLAG							
P47K5026J	F1 11 F6 16	cmd	no feedback					
P47K5022J	F2 12 F7 17	cmd	no feedback					
P47K5027J	F3 13 F8 18	cmd	no feedback					
P47K5023J	F4 14 F9 19	cmd	no feedback					
P47K5028J	F5 15 F10 20	cmd	no feedback					
P47K5024J		cmd	no feedback					
P47K5029J		cmd	no feedback					
P47K5025J		cmd	no feedback					
P47K5030J		cmd	no feedback					
P47K5015J	MTR 1/2 OFF 31	cmd	no feedback					
P47K5016J	1 ON 32	cmd	no feedback					
P47K5017J	2 ON 33	cmd	no feedback					
P47K5031J	DIR CHANGE 34	cmd	no feedback					
P47K5013J	PULSE STEP 35	cmd	no feedback					
P47T1019A	HX IN T XXX.X	degF	31.9 to 140					
P47T1015A	DEWPT 1 XX.XS	degF	32.1 to 81.9	M	H	L	↑	↓
P47T1016A	2 XX.XS	degF	32.1 to 81.9	M	H	L	↑	↓
P47H1044A	WFCV POS XXX.X	pct	1.3 to 102.1					

PARAMETER CHARACTERISTICS: SM 215 SPACEHAB ECS (Cont)

MSID	CRT NAME	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
P47X1032E	PPRV ISO VLV OP CL 1 86X 87X	event	* or blank					
P47X1033E	2 88X 89X	event	* or blank					
P47J2027V	H2O LN HTR HAB STATUS XS	status	1 = on, 0 = off	M	H	L		↓
P47C2028V	ORB AMPS XXX.XS	amps	-10.2 to 10.2	M				↓
P47T1014A	HAB T XXX.XS	degF	31.9 to 140	M	H	L	↑	
P47P2008A	P XX.XS	psia	0 to 20.4	M	H	L	↑	↓
P47P2012A	PPO2 1 X.XXS	psia	0 to 5.1	M	H	L	↑	↓
P47P2113V	2 X.XXS	psia	0 to 5	M	H	L	↑	↓
P47P2014A	PPCO2 1 XX.XS	mmHg	-3.9 to 31.5	M	H	L	↑	
P47P2115V	2 XXX.XS	mmHg	-3.9 to 28.8	M	H	L	↑	
P47X2017Y	FIRE/SMOKE A B ALARM XXXS XXXS	event	yes or no	M				↓
P47X2019Y		event	yes or no	M				↓
P47Q2018A	CONC XXX.XS XXX.XS	mg/m3	483.8 to -10.4	M	H	L	↑	
P47Q2020A		mg/m3	483.8 to -10.4	M	H	L	↑	
P47X2025Y	FSS FSCU MCP SAFE 80X X	event	* or blank	M				
P47X2024Y		event	* or blank	M				
P47X2025Y	ARM 82XS XS	event	* or blank	M				↓
P47X2024Y		event	* or blank	M				↓
P47X2009Y	DISCHARGE 84XS XS	event	* or blank	M				
P47X2011Y	HALON MULTI XXXS	event	yes or no	M				↓
P47X2016E	SINGLE XXXS	event	yes or no	M				↓

ITEM ENTRY CHARACTERISTICS: SM 215 SPACEHAB ECS

- ITEM 1: MODE THERM – commands operational mode of WFCEU using cabin temperature as controlling element
- ITEM 2: MODE HX IN – commands operational mode of WFCEU using fan/hx inlet temp as controlling element
- ITEM 3: MODE MAN – commands operational mode of WFCEU using cabin setpoint to control position of WFCV
- ITEM 11 thru 20:
 FLAG F1 thru F10 – commands used for all three operational modes of WFCEU. The function of each flag is dependent on mode of WFCEU
- Table indicates flag function versus mode

ITEM ENTRY CHARACTERISTICS: SM 215 SPACEHAB ECS (Cont)

Flag Commands	MODE THERM	MODE HX IN	MODE MAN
Flag 1	Inhibit cabin air set point (default = 76)	Set fan hx inlet temp to 65	Drives WFCV valve min distance to decrease hot water side flow
Flag 2	Inhibit WFCV position (compute position from fan/hx inlet temp, WFCV cold water inlet temp, and water pump inlet temp)	Set fan hx inlet temp = 80	Drives WFCV valve 0 distance
Flag 3	Inhibit fan hx inlet temp (compute value from WFCV cold water inlet temp, water pump inlet temp, and WFCV position)	Set gain = 0.02	Drives WFCV valve min distance to increase hot water side flow
Flag 4	Inhibit water pump inlet temp (compute value from fan hx inlet temp and WFCV cold water inlet temp)	Set gain = 0.05 (default)	Drives WFCV valve max distance to increase hot water side flow
Flag 5	Inhibit WFCV cold water inlet temp (default = 36.0)	Set gain = 0.125	Set gain = 0.02
Flag 6	Inhibit dewpoint 1 (read dewpoint 2)	Set fan hx inlet temp = current value	Set gain = 0.05
Flag 7	Inhibit both dewpoint sensors (default = 63)	Unused	Set gain = 0.125
Flag 8	Toggle cabin air temp gain (0.02, default = 0.05, 0.125)	Inhibit WFCV position sensor	Inhibit WFCV position sensor
Flag 9	Reset all flags and gains	Reset all flags and gains	Reset all flags and gains
Flag 10	Inhibit cabin air temp (default = 72.0)	Set fan hx inlet temp = 50	Drives WFCV valve max distance to decrease hot water side flow

ITEM ENTRY CHARACTERISTICS: SM 215 SPACEHAB ECS (Cont)

- ITEM 31: MTR 1/2 OFF – commands both WFCV position drive motors off
- ITEM 32: MTR 1 ON – commands WFCV mtr 1 on
- ITEM 33: MTR 2 ON – commands WFCV mtr 2 on
- ITEM 34: MTR DIR CHANGE – changes direction in which WFCV will move when item 35 is issued
- ITEM 35: MTR PULSE STEP – moves WFCV 25 steps in selected direction
- ITEM 80: FSS FSCU SAFE – safes fire suppression circuitry located within FSCU
- ITEM 82: FSS FSCU ARM – arms fire suppression circuitry located within FSCU
- ITEM 84: FSS FSCU DISCHARGE – discharges halon bottles via FSCU circuitry
- ITEM 86: PPRV ISO VLV 1 OP – opens electrical PPRV 1 isolation valve
- ITEM 87: PPRV ISO VLV 1 CL – closes electrical PPRV 1 isolation valve
- ITEM 88: PPRV ISO VLV 2 OP – opens electrical PPRV 2 isolation valve
- ITEM 89: PPRV ISO VLV 2 CL – closes electrical PPRV 2 isolation valve

SPACEHAB ECS

STATUS

MET ___/___:___:___

GMT ___/___:___:___

DC INVERTER	ON	OFF	BUS EMER	VOLTS	AMPS	FIRE/SMOKE CONC	A	B	HAB T
EXP BUS	-	-	AUX A	_____	_____				P
EXCP 1/2	-	-	AUX B			HALON SINGLE			PPO2
3	-	-	MAIN	_____	_____				1
4	-	-	SEC ON	_____	_____				2
5	-	-	EXP ON	_____	_____	PPRV ISO VLV			PACO2
6	-	-	SS	_____	_____	OP CL			1
DM FN/LT RACK 1	-	-	WFCEU ON	_____	_____	1 - -			2
2	-	-	INV DC	_____	_____	2 - -			
UTIL AFT	-	-	ΦA	_____	_____	FAN	ARS	CABIN	H2O PUMP
FWD	-	-	ΦB	_____	_____	OFF	-	-	2 INV
SPARE	-	-	ΦC	_____	_____	INV	-	-	ORB
PTB/CCTV	-	-	WFCEU			ORB	-	-	IN P
AC	-	-	HX IN T	_____	_____	ON	-	-	OUT P
UTIL RACK 1	-	-	DEWPT 1	_____	_____	ΔP1	_____	_____	ACC QTY
2	-	-	DEWPT 2	_____	_____	ΔP2	_____	_____	
SPARE 1	-	-	WFCV POS	_____	_____	HX H2O			
2	-	-	CMD REC	_____	_____	FLOW			
	-	-	MODE THERM	_____	_____				

[ALT]/[?] = HELP [G] = TIME [A] = ACK [F2] = ACT/DEAC [F3] = ECS [V] = VSU [D] = DMU [Q] = QUIT

Figure 4-1.- SS PGSC Spacehab summary display.

SPACEHAB SUMMARY DISPLAY

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
DC					
INVERTER	P47X3011E	OFF/ON	EVENT	* under column	K1 relay
EXP BUS	P47X3010E	OFF/ON	EVENT	* under column	PC 2
EXCP 1/2	P47X3021E	OFF/ON	EVENT	* under column	K2 relay
3	P47X3023E	OFF/ON	EVENT	* under column	K3 relay
4	P47X3025E	OFF/ON	EVENT	* under column	K4 relay
5	P47X3027E	OFF/ON	EVENT	* under column	K5 relay
6	P47X3029E	OFF/ON	EVENT	* under column	K6 relay
DM FN/LT	P47X3031E	OFF/ON	EVENT	* under column	K7 relay
RACK 1	P47X3033E	OFF/ON	EVENT	* under column	K8 relay
RACK 2	P47X3036E	OFF/ON	EVENT	* under column	K9 relay
UTIL AFT	P47X3039E	OFF/ON	EVENT	* under column	K10 relay
UTIL FWD	P47X3041E	OFF/ON	EVENT	* under column	K11 relay
SPARE	P47X3043E	OFF/ON	EVENT	* under column	K12 relay
PTB/CCTV	P47X3052E	OFF/ON	EVENT	* under column	K14 relay
AC					
UTIL	P47X3056E	OFF/ON	EVENT	* under column	K20 relay
RACK 1	P47X3058E	OFF/ON	EVENT	* under column	K26 relay
2	P47X3059E	OFF/ON	EVENT	* under column	K27 relay
SPARE 1	P47X3057E	OFF/ON	EVENT	* under column	K21 relay
2	P47X3060E	OFF/ON	EVENT	* under column	K28 relay
BUS					
EMER **	P47V3001A	18-32.3 (29)	VOLTS	EMER BUS VOLTAGE NN.N V	
AUX A **	P47C3003A	0-15.3 (2.5)	AMPS	AUX A CURRENT NN.N A	
AFT B **	P47C3002A	0-15.3 (2.5)	AMPS	AFT B CURRENT NN.N A	
MAIN **	P47V3004A	18-32.3 (29)	VOLTS	MAIN DC BUS VOLTAGE NN.N V	
SEC	P47X3006E	OFF/ON	EVENT	SEC DC BUS NNN	PC 1
**	P47V3007A	18-32.3 (29)	VOLTS	SEC DC BUS VOLTAGE NN.N V	
EXP	P47X3010E	OFF/ON	EVENT	EXP DC BUS NN.N	PC 2
**	P47V3008A	18-32.3 (29)	VOLTS	EXP DC BUS VOLTAGE NNN.N V	
**	P47C3009A	0-204	AMPS	EXP DC BUS CURRENT NNN.NN A	
SS **	P47C3044A	0-102	AMPS	SS DC CURRENT NNN.N A	
WFCEU	P47X3046E	OFF/ON	EVENT	WFCEU/MCP/CSA DC NNN	K13 relay
**	P47V3049A	18-32.3 (29)	VOLTS	WFCEU/CSA DC VOLTAGE NN.N V	

** Indicates that parameter FDA'd
() Indicates nominal value

SPACEHAB SUMMARY DISPLAY (Cont)

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
INV DC **	P47V3013A	18-32.3 (29)	VOLTS	INV DC VOLTAGE NN.N V	
**	P47C3012A	0-102	AMPS	INV DC CURRENT NN.N A	
ΦA **	P47V3015A	105-125.4 (115)	VOLTS	INV ΦA VOLTAGE NNN.N V	
**	P47C3014A	0-5.1	AMPS	INV ΦA CURRENT NN.N A	
ΦB **	P47V3017A	105-125.4 (115)	VOLTS	INV ΦB VOLTAGE NNN.N V	
**	P47C3016A	0-5.1	AMPS	INV ΦB CURRENT NN.N A	
ΦC **	P47V3019A	105-125.4 (115)	VOLTS	INV ΦC VOLTAGE NNN.N V	
**	P47C3018A	0-5.1	AMPS	INV ΦC CURRENT NN.N A	
WFCEU HX IN T	P47T1019A	31.9-140	DEGF	HX IN TEMP NNN.N DEG F	
DEWPT 1 **	P47T1015A	32.1-81.9 (50)	DEGF	DEWPT 1 TEMP NN.N DEG F	
2 **	P47T1016A	32.1-81.9 (50)	DEGF	DEWPT 2 TEMP NN.N DEG F	
WFCV POS	P47H1044A	1.3-102.1	PER	PHX BYP PERCENT NNN.N %	
CMD REC	P47X1042E	YES/NO	EVENT	CMD RECEIVED NNN	
MODE THERM **	P47X1045E	YES/NO	EVENT	WFCEU OPER – MODE * If operational	
FIRE/SMOKE CONC A **	P47Q2018A	483.8 to - 10.4 (0.5)	mg/cu M	SMOKE SEN A CONC NNN.N	
B **	P47Q2020A	483.8 to - 10.4 (0.5)	mg/cu M	SMOKE SEN B CONC NNN.N	
HALON SINGLE	P47X2016E	YES/NO	EVENT	SINGLE HALON DISCH NNN	
PPRV ISOL VLV 1	P47X1032E	OPEN/ CLOSE	EVENT	* under column	
2	P47X1033E	OPEN/ CLOSE	EVENT	* under column	

** Indicates that parameter FDA'd
() Indicates nominal value

SPACEHAB SUMMARY DISPLAY (Cont)

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
FAN ARS OFF INV ORB ON ΔP1 ** ΔP2 **	P47X1002E P47X1004E P47X1004E P47X1002E P47P2001A P47P2002A	OFF/ON ORB/INV ORB/INV OFF/ON 0-7.14 0-7.14	EVENT EVENT EVENT EVENT in H2O in H2O	* under column * under column * under column * under column ARS DELTA PRESS 1 N.NN in H2O ARS DELTA PRESS 2 N.NN in H2O	K22 relay K17 relay K17 relay K22 relay
FAN CABIN OFF INV ORB ON ΔP1 ** ΔP2 **	P47X1009E P47X1011E P47X1011E P47X1009E P47P2006A P47P2007A	OFF/ON ORB/INV ORB/INV OFF/ON 0-7.14 0-7.14	EVENT EVENT EVENT EVENT in H2O in H2O	* under column * under column * under column * under column CAB DELTA PRESS 1 N.NN in H2O CAB DELTA PRESS 2 N.NN in H2O	K23 relay K18 relay K18 relay K23 relay
HX H2O FLOW ARS ** CAB **	P47R1005A P47R1012A	50-607 50 -607	LBM/HR LBM/HR	ARS HX H2O FLOW NNN LBM/HR CAB HX H2O FLOW NNN LBM/HR	
CAB T ** P ** PPO2 1 ** 2 PPCO2 1 ** 2	P47T1014A P47P2008A P47P2012A P47P2013A P47P2014A P47P2015A	31.9-140 0-20.4 0-5.1 0-5.1 -3.9 to 31.5 -3.9 to 31.5	DEGF PSIA PSIA PSIA PSIA PSIA	CAB TEMP NNN.N DEG F CAB PRESSURE NN.N PSIA CAB PPCO2 1 N.NN PSIA CAB PPCO2 2 N.NN PSIA CAB PPCO2 1 NN.N PSIA CAB PPCO2 2 NN.N PSIA	
H2O PUMP 2 INV ORB IN P ** OUT P ** ACC QTY **	P47X1035E P47X1035E P47P1038A P47P1040A P47Q1037A	ORB/INV ORB/INV -2 to 215 -2 to 215 -2 to 100	EVENT EVENT PSIA PSIA PERCENT	* next to inv if on SH Inverter pwr * next to orb if on orbiter power H2O PUMP IN P NNN PSIA H2O PUMP OUT P NNN PSIA H2O ACCUM QTY NNN %	

** Indicates that parameter FDA'd
() Indicates nominal value

SPACEHAB ECS

STATUS

MET ___/___:___:___

GMT ___/___:___:___

WFCEU CMD REC _____ MODE THERM 1- HX IN 2 MAN 3 FLAG F1 11 F6 16 F2 12 F7 17 F3 13 F8 18 F4 14 F9 19 F5 15 F10 20 MTR 1/2 OFF 31 1 ON 32 2 ON 33 DIR CHANGE 34 PULSE STEP 35 HX IN T _____ DEWPT 1 _____ 2 _____ WFCV POS _____				FIRE/SMOKE ALARM (MDM) _____ CONC (MDM) _____ FSS SAFE FSCU 80 (MDM) (MDM) ARM 82 (MDM) (MDM) DISCHARGE 84 (MDM) (MDM) HALON MULTI (MDM) _____ SINGLE _____		HAB T _____ P _____ PPO2 1 _____ 2 _____ PPCO2 1 _____ 2 _____	
PPRV ISO VLV OP CL 1 86- 87- 2 88- 89- H2O LN HTR HAB STATUS (MDM) ORB AMPS (MDM)							

[ALT]/[?] = HELP [G] = TIME [A] = ACK [F1] = SUMMARY [F2] = ACT [V] = VSU [D] = DMU [Q] = QUIT

Figure 4-2.- SS PGSC Spacehab ECS display.

SPACEHAB ECS DISPLAY

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
WFCEU CMD REC	P47X1042E	YES/NO	EVENT	CMD RECEIVED NNN WFCEU OPER – MODE * If operational	
MODE THERM 1	P47X1045E	YES/NO	EVENT		
HX IN 2	N/A				
MAN 3	N/A				
FLAG	N/A				
F1	N/A				
F2	N/A				
F3	N/A				
F4	N/A				
F6	N/A				
F7	N/A				
F8	N/A				
F9	N/A				
F10	N/A				
MTR 1/2 OFF	N/A				
1 ON	N/A				
2 ON	N/A				
DIR CHANGE	N/A				
PULSE STEP	N/A				
HX IN T	P47T1019A	31.9-140	DEGF	HX IN TEMP NNN.N DEG F	
DEWPT 1	P47T1015A	32.1-81.9 (50)	DEGF	DEWPT 1 TEMP NN.N DEG F	
2	P47T1016A	32.1-81.9 (50)	DEGF	DEWPT 2 TEMP NN.N DEG F	
WFCV POS	P47P1044A	1.3-102.1	PER	PHX BYP PERCENT NNN.N %	
FIRE/SMOKE ALARM A	N/A			SMOKE SEN A CONC NNNN.N SMOKE SEN B CONC NNNN.NN	
B	N/A				
CONC A	P47Q2018A	483.8 to -10.4 (0.5)	mg/cu M		
B	P47Q2020A	483.8 to -10.4 (0.5)	mg/cu M		
FSS					
FSCU SAFE	N/A				
MCP SAFE	N/A				
FSCU ARM	N/A				
MCP ARM	N/A				
FSCU DISCH	N/A				
MCP DISCH	N/A				

() Indicates nominal value

N/A – Not applicable, no telemetry for crewmembers

SPACEHAB ECS DISPLAY (Cont)

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
HALON MULTI SINGLE **	N/A P47X2016E	YES/NO	EVENT	SINGLE HALON DISCH NNN	
PPRV ISOL VLV 1	P47X1032E	OPEN/CLOSE	EVENT	* under column	
2	P47X1033E	OPEN/CLOSE	EVENT	* under column	
H2O HTR	N/A				
CAB T **	P47T1014A	31.9 -140	DEGF	CAB TEMP NNN.N DEG F	
P **	P47P2008A	0-20.4 (14.7)	PSIA	CAB PRESSURE NN.N PSIA	
PPO2 1 **	P47P2012A	0-5.1 (3.1)	PSIA	CAB PPO2 1 N.NN PSIA	
2	P47P2013A	0-5.1 (3.1)	PSIA	CAB PPO2 2 N.NN PSIA	
PPCO2 1 **	P47P2014A	-3.9 to 31.5	MMHG	CAB PPCO2 1 NN.N PSIA	
2	P47P2015A	-3.9 to 31.5	MMHG	CAB PPCO2 2 NN.N PSIA	

** Indicates that parameter FDA'd
 () Indicates nominal value
 N/A – Not applicable, no telemetry for crewmembers

SPACEHAB ACT/DEAC			STATUS			MET ___/___:___:___		GMT ___/___:___:___	
						VOLTS	AMPS		
DC	ON	OFF	BUS	EMER		_____			
	1-	2-		AUX A		_____			
	3-	4-		AFT B		_____			
	5-	6-		MAIN		_____			
	7-	8-		SEC	ON	_____			
	9-	10-		EXP	ON	_____			
	11-	12-		SS		_____			
	13-	14-		WFCEU	ON	_____			
	15-	16-		INV DC		_____			
	17-	18-		INV AC Φ A		_____			
	19-	20-		Φ B		_____			
	21-	22-		Φ C		_____			
	23-	24-				_____			
	25-	26-				_____			
	27-	28-				_____			
AC	29	30	FANS	OFF	61-	62-	1/2 OFF		H2O PUMP
	41-	42-	UTIL	INV	63-	64-	2 INV		71 (MDM)
	43-	44-	RACK 1	ORB	65-	66-	ORB		72-
	45-	46-	2	ON	67-	68-	1 ON/2 OFF		73-
	47-	48-	SPARE 1	Δ P1	_____	_____	2 ON/1 OFF		74 (MDM)
	49-	50-	2	Δ P2	_____	_____	IN P		75 (MDM)
				HX H2O FLOW	_____	_____	OUT P		
					_____	_____	ACC QTY		

[ALT]/[?] = HELP [G] = TIME [A] = ACK [F1] = SUMMARY [F3] = ECS [V] = VSU [D] = DMU [Q] = QUIT

Figure 4-3.- SS PGSC Spacehab ACT/DEAC display.

SPACEHAB ACT/DEAC DISPLAY

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
DC					
INVERTER	P47X3011E	OFF/ON	EVENT	* next to item run	K1 relay
EXP BUS	P47X3010E	OFF/ON	EVENT	* next to item run	PC 2
EXCP 1/2	P47X3021E	OFF/ON	EVENT	* next to item run	K2 relay
3	P47X3023E	OFF/ON	EVENT	* next to item run	K3 relay
4	P47X3025E	OFF/ON	EVENT	* next to item run	K4 relay
5	P47X3027E	OFF/ON	EVENT	* next to item run	K5 relay
6	P47X3029E	OFF/ON	EVENT	* next to item run	K6 relay
DM FN/LT	P47X3031E	OFF/ON	EVENT	* next to item run	K7 relay
RACK 1	P47X3033E	OFF/ON	EVENT	* next to item run	K8 relay
2	P47X3036E	OFF/ON	EVENT	* next to item run	K9 relay
UTIL AFT	P47X3039E	OFF/ON	EVENT	* next to item run	K10 relay
FWD	P47X3041E	OFF/ON	EVENT	* next to item run	K11 relay
SPARE	P47X3043E	OFF/ON	EVENT	* next to item run	K12 relay
PTB/CCTV	P47X3052E	OFF/ON	EVENT	* next to item run	K14 relay
LIGHTS	N/A			No telemetry status	Visual verification
AC					
UTIL	P47X3056E	OFF/ON	EVENT	* next to item run	K20 relay
RACK 1	P47X3058E	OFF/ON	EVENT	* next to item run	K26 relay
2	P47X3059E	OFF/ON	EVENT	* next to item run	K27 relay
SPARE 1	P47X3057E	OFF/ON	EVENT	* next to item run	K21 relay
2	P47X3060E	OFF/ON	EVENT	* next to item run	K28 relay
BUS					
EMER **	P47V3001A	18-32.3 (29)	VOLTS	EMER BUS VOLTAGE NN.N V	
AUX A **	P47C3003A	0-15.3 (2.5)	AMPS	AUX A CURRENT NN.N A	
AFT B **	P47C3002A	0-15.3 (2.5)	AMPS	AFT B CURRENT NN.N A	
MAIN **	P47V3004A	18-32.3 (29)	VOLTS	MAIN DC BUS VOLTAGE NN.N V	
SEC	P47X3006E	OFF/ON	EVENT	SEC DC BUS NNN	PC 1
**	P47V3007A	18-32.3 (29)	VOLTS	SEC DC BUS VOLTAGE NN.N V	
EXP	P47X3010E	OFF/ON	EVENT	EXP DC BUS NNN	PC 2
**	P47V3008A	18-32.3 (29)	VOLTS	EXP DC BUS VOLTAGE NN.N V	
**	P47C3009A	0-204	AMPS	EXP DC BUS CURRENT NNN.N A	
SS **	P47C3044A	0-102	AMPS	SS DC CURRENT NNN.N A	
WFCEU	P47X3046E	OFF/ON	EVENT	WFCEU/MCP/CSA DC NNN	K13 relay
**	P47V3049A	18-32.3 (29)	VOLTS	WFCEU/CSA DC VOLTAGE NN.N V	

** Indicates that parameter FDA'd
() Indicates nominal value

SPACEHAB ACT/DEAC DISPLAY (Cont)

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
INV DC **	P47V3013A	18-32.3 (29)	VOLTS	INV DC VOLTAGE NN.N V	
**	P47C3012A	0-102	AMPS	INV DC CURRENT NN.N A	
INV AC Φ A **	P47V3015A	105-125.4 (115)	VOLTS	INV Φ A VOLTAGE NNN.N V	
**	P47C3014A	0-5.1	AMPS	INV Φ A CURRENT NN.N A	
Φ B **	P47V3017A	105-125.4 (115)	VOLTS	INV Φ B VOLTAGE NNN.N V	
**	P47C3016A	0-5.1	AMPS	INV Φ B CURRENT NN.N A	
Φ C **	P47V3019A	105-125.4 (115)	VOLTS	INV Φ C VOLTAGE NNN.N V	
**	P47C3018A	0-5.1	AMPS	INV Φ C CURRENT NN.N A	
FAN ARS					
OFF	P47X1002E	OFF/ON	EVENT	* under column	K22 relay
INV	P47X1004E	ORB/INV	EVENT	* under column	K17 relay
ORB	P47X1004E	ORB/INV	EVENT	* under column	K17 relay
ON	P47X1002E	OFF/ON	EVENT	* under column	K22 relay
Δ P1 **	P47P2001A	0-7.14 (1.9)	in H2O	ARS DELTA PRESS 1 N.NN in H2O	
Δ P2 **	P47P2002A	0-7.14 (1.9)	in H2O	ARS DELTA PRESS 2 N.NN in H2O	
FAN CABIN					
OFF	P47X1009E	OFF/ON	EVENT	* under column	K23 relay
INV	P47X1011E	ORB/INV	EVENT	* under column	K18 relay
ORB	P47X1011E	ORB/INV	EVENT	* under column	K18 relay
ON	P47X1009E	OFF/ON	EVENT	* under column	K23 relay
Δ P1 **	P47P2006A	0-7.14 (1.1)	in H2O	CAB DELTA PRESS 1 N.NN in H2O	
Δ P2 **	P47P2007A	0-7.14 (1.1)	in H2O	CAB DELTA PRESS 2 N.NN in H2O	
HX H2O FLOW					
ARS **	P47R1005A	50-607	LBM/HR	ARS HX H2O FLOW NNN LBM/HR	
CAB **	P47R1012A	50-607	LBM/HR	CAB HX H2O FLOW NNN LBM/HR	
CAB					
T **	P47T1014A	31.9-140	DEGF	CAB TEMP NNN.N DEGF	
P **	P47P2008A	0-20.4 (14.7)	PSIA	CAB PRESSURE NN.N PSIA	
PPO2					
1 **	P47P2012A	0-5.1 (3.1)	PSIA	CAB PPO2 1 N.NN PSIA	
2	P47P2013A	0-5.1 (3.1)	PSIA	CAB PPO2 2 N.NN PSIA	
PPCO2					
1 **	P47P2014A	-3.9 to 31.5 (0.2)	MMHG	CAB PPCO2 1 NN.N PSIA	
2	P47P2015A	-3.9 to 31.5 (0.2)	MMHG	CAB PPCO2 2 NN.N PSIA	

** Indicates that parameter FDA'd
() Indicates nominal value

SPACEHAB ACT/DEAC DISPLAY (Cont)

NOMENCLATURE	MSID	RANGE	UNITS	DISPLAY FORMAT	NOTES
H2O PUMP 1/2 OFF 2 INV	N/A P47X1035E	ORB/INV	EVENT	* next to inv if on SH Inverter pwr	
ORB	P47X1035E	ORB/INV	EVENT	* next to orb if on orbiter pwr	
1 ON/2 OFF 2 ON/1 OFF IN P **	N/A N/A P47P1038A	-2 to 215	PSIA	H2O PUMP IN P NNN PSIA	
OUT P **	P47P1040A	-2 to 215	PSIA	H2O PUMP OUT P NNN PSIA	
ACC QTY **	P47Q1037A	-2 to 100	PERCENT	H2O ACCUM QTY NNN %	

** Indicates that parameter FDA'd

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SM 214 SPACEHAB ACT/DEAC

MSG TEXT	A L	N F	P R	LIMIT SENSED PARAMETER		LIMITS		LS TD	L S	(1)	REMARKS
				MSID	CRT NOMENCLATURE	LOW	HIGH				
214 SH AFT BUS A	3	4	1	P47C3002A	BUS EMER AFT B		7		1	*	
214 SH ARS FAN DP 1	2	2	1	P47P2001A	FANS ARS ΔP1	0.2	5.5		1		
214 SH ARS FAN DP 2	2	2	1	P47P2002A	FANS ARS ΔP2	0.2	5.5		1		
214 SH AUX BUS A	3	4	1	P47C3003A	BUS EMER AUX A		7		1	*	
214 SH WFCEU V	3	4	1	P47V3049A	BUS WFCEU	24	32		1	*	
214 SH EMG BUS V	3	4	1	P47V3001A	BUS EMER	24	32		1		
214 SH EXP BUS A	3	4	1	P47C3009A	BUS EXP		145		1	*	
214 SH EXP BUS V	3	4	1	P47V3008A	BUS EXP	24	32		1	*	
214 SH CAB FAN DP 1	2	2	1	P47P2006A	FANS CABIN ΔP1	0.2	5.5		1		
214 SH CAB FAN DP 2	2	2	1	P47P2007A	FANS CABIN ΔP2	0.2	5.5		1		
214 SH HAB P	2	2	1	P47P2008A	HAB P	13.8	15.4		1		
214 SH HAB T	3	3	1	P47T1014A	HAB T		90		1	*	
214 SH H2O FL ARS	3	3	1	P47R1005A	HX H2O FLOW ARS	75			1		
214 SH H2O FL CAB	3	3	1	P47R1012A	HX H2O FLOW CABIN	250			1		
214 SH H2O ACC QTY	3	3	1	P47Q1037A	H2O PUMP ACC QTY	5	95		1		
214 SH H2O P IN	3	3	1	P47P1038A	H2O PUMP IN P	30	80		1		
214 SH H2O P OUT	3	3	1	P47P1040A	H2O PUMP OUT P	40	105		1		
214 SH INV DC A	3	4	1	P47C3012A	BUS INV DC		48		1	*	
214 SH INV DC V	3	4	1	P47V3013A	BUS INV DC	24	32		1	*	
214 SH INV P-A AC A	3	4	1	P47C3014A	BUS INV φA		2.9		1	*	
214 SH INV P-A AC V	3	4	1	P47V3015A	BUS INV φA	105.4	124.6		1	*	
214 SH INV P-B AC A	3	4	1	P47C3016A	BUS INV φB		2.9		1	*	
214 SH INV P-B AC V	3	4	1	P47V3017A	BUS INV φB	105.4	124.6		1	*	
214 SH INV P-C AC A	3	4	1	P47C3018A	BUS INV φC		2.9		1	*	
214 SH INV P-C AC V	3	4	1	P47V3019A	BUS INV φC	105.4	124.6		1	*	
214 SH MN BUS V	3	4	1	P47V3004A	BUS MAIN	24	32		1	*	

(1) An * in this column indicates which FDAs are disabled during crew sleep periods.

SM 214 SPACEHAB ACT/DEAC (Cont)

MSG TEXT	A L	N F	P R	LIMIT SENSED PARAMETER		LIMITS		LS TD	L S	(1)	REMARKS
				MSID	CRT NOMENCLATURE	LOW	HIGH				
214 SH PPCO2 1	2	2	1	P47P2014A	HAB PPCO2 1		5.1		1		
214 SH PPCO2 2	2	2	1	P47P2115V	HAB PPCO2 2		7.6		1		
214 SH PPO2 1	2	2	1	P47P2012A	HAB PPO2 1	2.7	3.6		1		
214 SH PPO2 2	2	2	1	P47P2113V	HAB PPO2 2	2.7	3.6		1		
214 SH SEC BUS V	3	4	1	P47V3007A	BUS SEC	24	32		1	*	
214 SH SS BUS A	3	4	1	P47C3044A	BUS SS		98		1	*	

(1) An * in this column indicates which FDAs are disabled during crew sleep periods.

SM 215 SPACEHAB ECS

MSG TEXT	A L	N F	P R	LIMIT SENSED PARAMETER		LIMITS		LS TD	L S	(1)	REMARKS
				MSID	CRT NOMENCLATURE	LOW	HIGH				
215 SH FSS ARM FSCU	3	2	1	P47X2025Y	FSS FSCU ARM	1			1	*	
215 SH FSS ARM MCP	3	2	1	P47X2024Y	FSS MCP ARM	1			1	*	
215 SH HALON MULT	2	2	1	P47X2011Y	HALON MULTI	1			1		
215 SH HALON SNGL	3	2	1	P47X2016E	HALON SINGLE	1			1		
215 SH H2O HTR HAB	3	4	1	P47J2027V	H2O LN HTR HAB STATUS	0.25			1	*	
215 SH H2O HTR ORB	3	4	1	P47C2028V	H2O LN HTR ORB AMPS	1			1	*	
215 SH SMOKE A	2	2	1	P47X2017Y	FIRE/SMOKE ALARM A	1			1		
215 SH SMOKE B	2	2	1	P47X2019Y	FIRE/SMOKE ALARM B	1			1		
	0	2	1	P47Q2018A	FIRE/SMOKE CONC A		2.0		1		
	0	2	1	P47Q2020A	FIRE/SMOKE CONC B		2.0		1		
215 SH WFCEU MODE	3	3	1	P47X1045E	WFCEU MODE THERM	0			1	*	
	0	2	1	P47T1015A	DEWPT 1	35.9	68		1		
	0	2	1	P47T1016A	DEWPT 2	35.9	68		1		

(1) An * in this column indicates which FDAs are disabled during crew sleep periods

BFS 206 SH LAUNCH/ENTRY

MSG TEXT	A L	N F	P R	LIMIT SENSED PARAMETER		LIMITS		LS TD	L S	REMARKS
				MSID	CRT NOMENCLATURE	LOW	HIGH			
206 PL CL 2	2	2	1	P47X2017YV	FIRE/SMOKE ALARM A	1			1	
206 PL CL 2	2	2	1	P47X2019YV	FIRE/SMOKE ALARM B	1			1	
	0	2	1	P47Q2018AV	FIRE/SMOKE CONC A		1.85		1	
	0	2	1	P47Q2020AV	FIRE/SMOKE CONC B		1.85		1	
	0	2	1	P47P2006AV	FANS CABIN ΔP1	0.2	5.5		1	
206 PL CL 2	2	2	1	P47P2002AV	FANS ARS ΔP2	0.2	5.5		1	
	0	2	1	P47P2007AV	FANS CABIN ΔP2	0.2	5.5		1	
206 PL CL 3	3	2	1	P47X2025YV	FSS ARM FSCU	1			1	
206 PL CL 3	3	2	1	P47X2024YV	FSS ARM MCP	1			1	
	0	2	1	P47X2011YV	HALON MULTI	1			1	
	0	2	1	P47P2012AV	PPO2 #1	2.7	3.6		1	
	0	2	1	P47P2113VV	PPO2 #2	2.7	3.6		1	
	0	2	1	P47P2008AV	HAB P	13.8	15.4		1	
206 PL CL 2	2	2	1	P47P2001AV	FANS ARS ΔP1	0.2	5.5		1	
206 PL CL 3	3	2	1	P47V3001AV	EMER VOLTS	24	32		1	
206 PL CL 3	3	2	1	P47C3003AV	EMER AUX A AMPS		7		1	
206 PL CL 3	3	2	1	P47C3002AV	EMER AFT B AMPS		7		1	
	0	2		P47C3044AV	SS AMPS		98		1	
	0	2	1	P47C3014AV	INV ΦA		2.9		1	
	0	2	1	P47C3016AV	INV ΦB		2.9		1	
	0	2	1	P47C3018AV	INV ΦC		2.9		1	

SPACEHAB H/W CAUTION AND WARNING SET POINT CONVERSION TABLE

Volts	Hab PPCO2 (mmHg)	Hab PPO2 (psia)	Cabin/ARS Fan DP (in. H2O)	Hab Pressure (psia)
5.0 → 0	28.8 → -3.9	0 → 5	0 → 7	0 → 20
5	28.8391	0	0	0
4.95	27.5682	0.05	0.07	0.2
4.9	26.3370	0.1	0.14	0.4
4.85	25.1447	0.15	0.21	0.6
4.8	23.9907	0.2	0.28	0.8
4.75	22.8744	0.25	0.35	1
4.7	21.7952	0.3	0.42	1.2
4.65	20.7525	0.35	0.49	1.4
4.6	19.7456	0.4	0.56	1.6
4.55	18.7739	0.45	0.63	1.8
4.5	17.8367	0.5	0.7	2
4.45	16.9335	0.55	0.77	2.2
4.4	16.0635	0.6	0.84	2.4
4.35	15.2263	0.65	0.91	2.6
4.3	14.4211	0.7	0.98	2.8
4.25	13.6473	0.75	1.05	3
4.2	12.9043	0.8	1.12	3.2
4.15	12.1915	0.85	1.19	3.4
4.1	11.5082	0.9	1.26	3.6
4.05	10.8538	0.95	1.33	3.8
4	10.2277	1	1.4	4
3.95	9.6292	1.05	1.47	4.2
3.9	9.0578	1.1	1.54	4.4
3.85	8.5128	1.15	1.61	4.6
3.8	7.9935	1.2	1.68	4.8
3.75	7.4994	1.25	1.75	5
3.7	7.0297	1.3	1.82	5.2
3.65	6.5840	1.35	1.89	5.4
3.6	6.1615	1.4	1.96	5.6
3.55	5.7616	1.45	2.03	5.8
3.5	5.3837	1.5	2.1	6
3.45	5.0272	1.55	2.17	6.2
3.4	4.6914	1.6	2.24	6.4
3.35	4.3757	1.65	2.31	6.6

Volts	Hab PPCO2 (mmHg)	Hab PPO2 (psia)	Cabin/ARS Fan DP (in. H2O)	Hab Pressure (psia)
5.0 → 0	28.8 → -3.9	0 → 5	0 → 7	0 → 20
3.3	4.0796	1.7	2.38	6.8
3.25	3.8022	1.75	2.45	7
3.2	3.5431	1.8	2.52	7.2
3.15	3.3016	1.85	2.59	7.4
3.1	3.0770	1.9	2.66	7.6
3.05	2.8688	1.95	2.73	7.8
3	2.6763	2	2.8	8
2.95	2.4989	2.05	2.87	8.2
2.9	2.3359	2.1	2.94	8.4
2.85	2.1868	2.15	3.01	8.6
2.8	2.0509	2.2	3.08	8.8
2.75	1.9275	2.25	3.15	9
2.7	1.8160	2.3	3.22	9.2
2.65	1.7159	2.35	3.29	9.4
2.6	1.6265	2.4	3.36	9.6
2.55	1.5471	2.45	3.43	9.8
2.5	1.4771	2.5	3.5	10
2.45	1.4160	2.55	3.57	10.2
2.4	1.3630	2.6	3.64	10.4
2.35	1.3175	2.65	3.71	10.6
2.3	1.2790	2.7	3.78	10.8
2.25	1.2467	2.75	3.85	11
2.2	1.2201	2.8	3.92	11.2
2.15	1.1985	2.85	3.99	11.4
2.1	1.1814	2.9	4.06	11.6
2.05	1.1680	2.95	4.13	11.8
2	1.1577	3	4.2	12
1.95	1.1500	3.05	4.27	12.2
1.9	1.1441	3.1	4.34	12.4
1.85	1.1395	3.15	4.41	12.6
1.8	1.1355	3.2	4.48	12.8
1.75	1.1315	3.25	4.55	13
1.7	1.1269	3.3	4.62	13.2
1.65	1.1211	3.35	4.69	13.4
1.6	1.1133	3.4	4.76	13.6

SPACEHAB H/W CAUTION AND WARNING SET POINT CONVERSION TABLE (Cont)

Volts	Hab PPCO2 (mmHg)	Hab PPO2 (psia)	Cabin/ARS Fan DP (in. H2O)	Hab Pressure (psia)
5.0 → 0	28.8 → -3.9	0 → 5	0 → 7	0 → 20
1.55	1.1031	3.45	4.83	13.8
1.5	1.0897	3.5	4.9	14
1.45	1.0725	3.55	4.97	14.2
1.4	1.0509	3.6	5.04	14.4
1.35	1.0243	3.65	5.11	14.6
1.3	0.9921	3.7	5.18	14.8
1.25	0.9535	3.75	5.25	15
1.2	0.9081	3.8	5.32	15.2
1.15	0.8551	3.85	5.39	15.4
1.1	0.7939	3.9	5.46	15.6
1.05	0.7240	3.95	5.53	15.8
1	0.6446	4	5.6	16
0.95	0.5551	4.05	5.67	16.2
0.9	0.4550	4.1	5.74	16.4
0.85	0.3436	4.15	5.81	16.6
0.8	0.2202	4.2	5.88	16.8
0.75	0.0843	4.25	5.95	17
0.7	-0.0649	4.3	6.02	17.2
0.65	-0.2278	4.35	6.09	17.4
0.6	-0.4052	4.4	6.16	17.6
0.55	-0.5977	4.45	6.23	17.8
0.5	-0.8059	4.5	6.3	18
0.45	-1.0305	4.55	6.37	18.2
0.4	-1.2720	4.6	6.44	18.4
0.35	-1.5311	4.65	6.51	18.6
0.3	-1.8084	4.7	6.58	18.8
0.25	-2.1046	4.75	6.65	19
0.2	-2.4203	4.8	6.72	19.2
0.15	-2.7560	4.85	6.79	19.4
0.1	-3.1126	4.9	6.86	19.6
0.05	-3.4904	4.95	6.93	19.8
0	-3.8903	5	7	20

CRITICAL EQUIPMENT LOSS

PF MDM CHANNELIZATION.....	6-3
BUS/CRITICAL EQUIPMENT LOSS.....	6-4
MDM BUS LOSS IMPACTS.....	6-6

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**CRITICAL EQUIP
LOSS**

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PF MDM CHANNELIZATION

	MSID	NOMENCLATURE
PF1	DIL – CARD 13 CHANNEL 02	
	P47X1034Y	WATER PUMP 1 OFF/ON
	P47X1036Y	WATER PUMP 2 OFF/ON
	P47X2009Y(V)	FSS DISCHARGED
	P47X2011Y(V)	MULTI BOTTLE HALON DISCHARGE
	P47X2017Y(V)	SMOKE SEN A ALARM
	P47X2019Y(V)	SMOKE SEN B ALARM
	P47X2024Y(V)	FSS ARM/SAFE (MCP)
	P47X2025Y(V)	FSS ARM/SAFE (FSCU)
	AID – CARD 11 CHANNEL 01	
P47C2028V	ORBITER WATER LINE HEATER CURRENT	
PF1	AID – CARD 11 CHANNEL 02	
	P47P2113V(V)	PARTIAL PRESSURE O2 2 – MDM
	AID – CARD 11 CHANNEL 03	
	P47P2115V	PARTIAL PRESSURE CO2 2 – MDM
PF2	AID – CARD 11 CHANNEL 04	
	P47J2027V	WATER LINE HEATER STATUS
PF1	DOL – CARD 00 CHANNEL 02	
	P47K5001J	ARS FAN OFF
	P47K5002J	ARS FAN ON
	P47K5003J	CABIN FAN OFF
	P47K5004J	CABIN FAN ON
	P47K5009J	WATER PUMP 1 ON/2 OFF
	P47K5010J	WATER PUMP 2 ON/1 OFF
	P47K8000U	SH RST PF01 CARD 00 CH 2 BITS 0-05
	DOH – CARD 02 CHANNEL 02	
	P47K6007J	FSS ARM (FSCU)
	P47K6010J	FSS SAFE (FSCU)
	P47K7048J	WATER PUMP 2 TO INVERTER
	P47K7049J	WATER PUMP 2 TO ORBITER
	P47K8002U	SH RST PF01 CARD 02 CH 2 BITS 6-7
PF2	DOH – CARD 02 CHANNEL 02	
	P47K6008J	FSS DISCHARGE (FSCU)
	P47K8003U	SH RST PF02 CARD 2 CHAN 2 BIT 7

(V) IN 10TH CHARACTER INDICATES PARAMETER ALSO AVAILABLE IN BFS

BUS/CRITICAL EQUIPMENT LOSS

I

PL PRI (2 FEEDS)

EXPERIMENT BUS:

- EXCP 1-6 DC outlets
- Rack DC power
- Fwd utility outlets (PGSC)
- Aft utility outlets
 - EXCP 7 (if flown)
- Fan Box Assembly (double module only)
 - Aft Module Fan
 - Aft Module Lights

SUBSYSTEM BUS:

- MCP
 - Luminaries (3 of 4)
- WFCEU
 - DPEU
 - Dewpoint Temp #1
 - Dewpoint Temp #2
- Payload Timing Buffer
- CCTV pwr

INV DC BUS:

- Inverter:
 - Water Pump 1
 - AC utility outlets (except EXCP 1 AC1)
 - Rack AC pwr
 - Power redundancy to Orbiter AC:
 - ARS Fan
 - Cabin Fan
 - Water Pump 2

PL AC3

- ARS Fan *
- Cabin Fan *
- Water Pump 2*
- AC utility outlet
- EXCP 1 AC1 utility outlet

* May be switched to SH Inverter

BUS/CRITICAL EQUIPMENT LOSS (Cont)

PL AFT B and PL AUX A

FSCU

MCP

FSS pulses (PL AFT B only)

Water Line Heaters (PL AFT B only)

INTERNAL BUS:

PPRV 1 Motor and indicator pwr

PPRV 2 Motor and indicator pwr

PPRV 1 & 2 control logic

FSS firing circuitry

Main Power Kill Circuitry

EMERGENCY BUS 1:

Smoke Sensor A

ARS Fan Delta Pressure #1

ARS H/X H2O Flow

ARS H/X Outlet H2O Temperature

ARS Fan Air Inlet & Outlet Temperatures

Water Pump Package Sensors:

Inlet Pressure

Outlet Pressure

Accumulator Quantity

Inlet Temperature

DMU:

PDI monitoring capability

PSP commanding capability

Interface with SS PGSC

Cabin Fan Delta Pressure #1

PPCO2 #1

Cabin H/X Outlet H2O Temperature

Cabin H/X H2O Flow

PPO2 #1

PDU

C3 (3 switches – FSCU Arm/Safe, FSCU Disch, H2O Ln Htrs)

SSP (6 switches – FSCU Arm/Safe, FSCU Disch, SS DC Bus, EXP DC Bus,

MN Pwr Kill, Inverter)

Water Temperature Sensors (four)

MCP

FSS pulses (AUX A only)

INTERNAL BUS:

Cabin Depress Valve Motor and indicator pwr

CDV Control Logic

Main pwr kill switch (on MCP)

FSS firing circuitry

C3 (2 switches – MCP Arm/Safe, MCP Disch)

Halon Bottle status circuitry

EMERGENCY BUS 2:

ARS Kill Enable sw – FAN OFF cmd only (EXCP 2)

ARS Fan Delta Pressure #2

Cabin Fan Delta Pressure #2

PPCO2 #2

Cabin Fan Air Inlet & Outlet Temperatures

PPO2 #2

Total Pressure

Cabin Temperature

Viewport Heater (forward)

Smoke Sensor B

Emergency Light

SSP (2 switches – CDV Arm/Safe, Smoke Sensor B Enable)

MDM BUS LOSS IMPACTS

OF1

No Spacehab impact

OF2

No Spacehab impact

OF4

PSP GCIL TELEMETRY – Possible loss of PSP Commanding

OA1

No Spacehab impact

OA3

No Spacehab impact

PF1 MDM

Primary command path via PSP1

Ku Band antenna control

SPACEHAB DISCRETE CMDS:

ARS Fan On

ARS Fan Off

Cabin Fan On

Cabin Fan Off

Water Pump 1 On/Water Pump 2 Off

Water Pump 2 On/Water Pump 1 Off

FSS Arm (FSCU)

FSS Safe (FSCU)

Water Pump 2 To Inverter

Water Pump 2 To orbiter

C/W annunciation:

B/U C/W Alarm

SPACEHAB DISCRETE MONITORS:

Water Pump 1 Off/On

Water Pump 2 Off/On

FSS Discharged

Multi-bottle Halon Discharge

Smoke Sensor A Alarm

Smoke Sensor B Alarm

FSS Arm/Safe (MCP)

FSS Arm/Safe (FSCU)

SPACEHAB ANALOG MONITORS:

PPCO2 #2

PPO2 #2

Orbiter waterline heater current

PF2 MDM

Redundant command path via PSP2

SPACEHAB ANALOG MONITOR:

H2O Line Htr status

C/W Annunciation:

Payload Caution, B/U C/W Alarm

SPACEHAB DISCRETE COMMAND:

FSS Discharge (FSCU)

FF1

Uplink thru NSP1

FF3

Uplink thru NSP2

REFERENCE DATA

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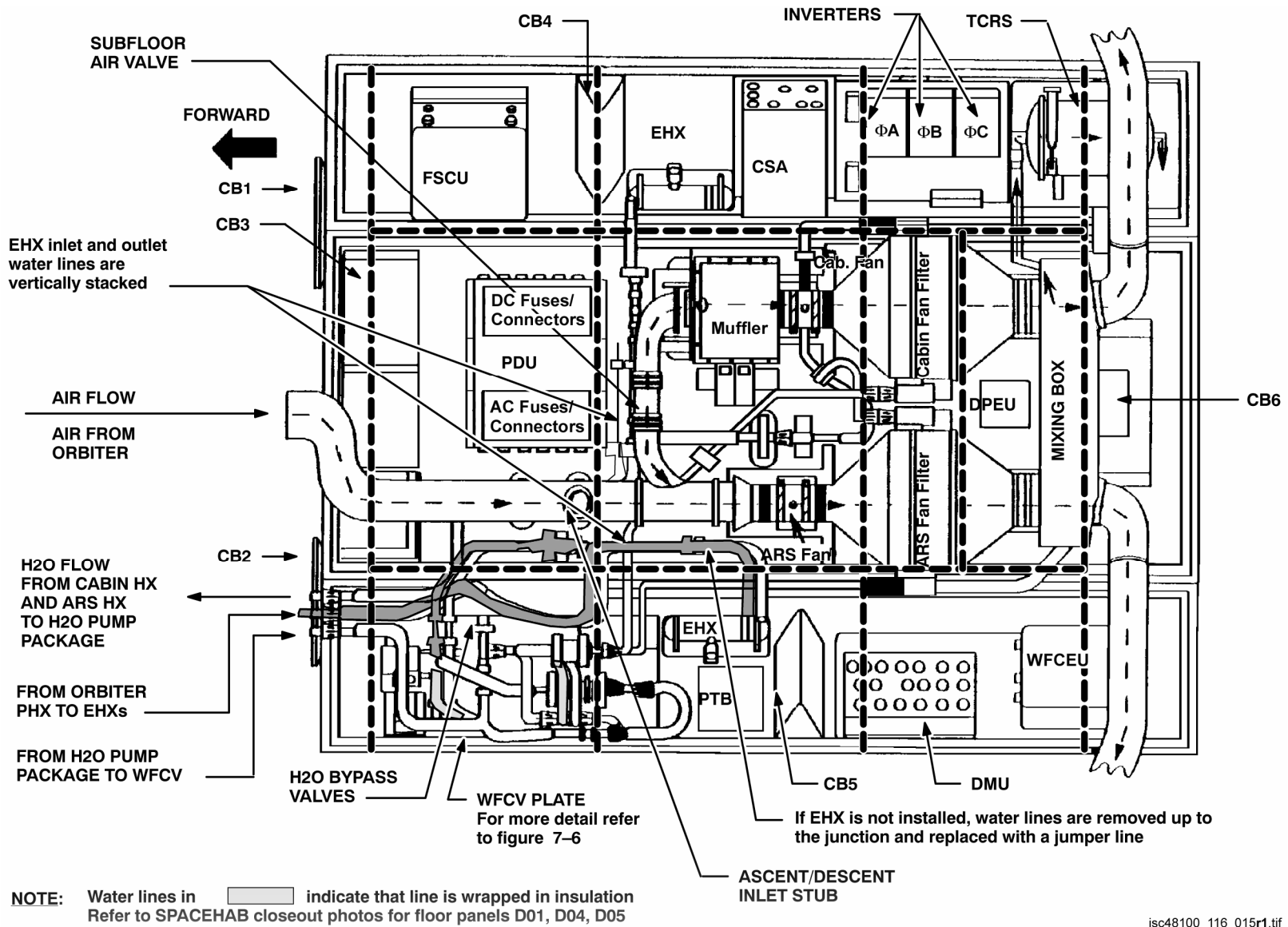
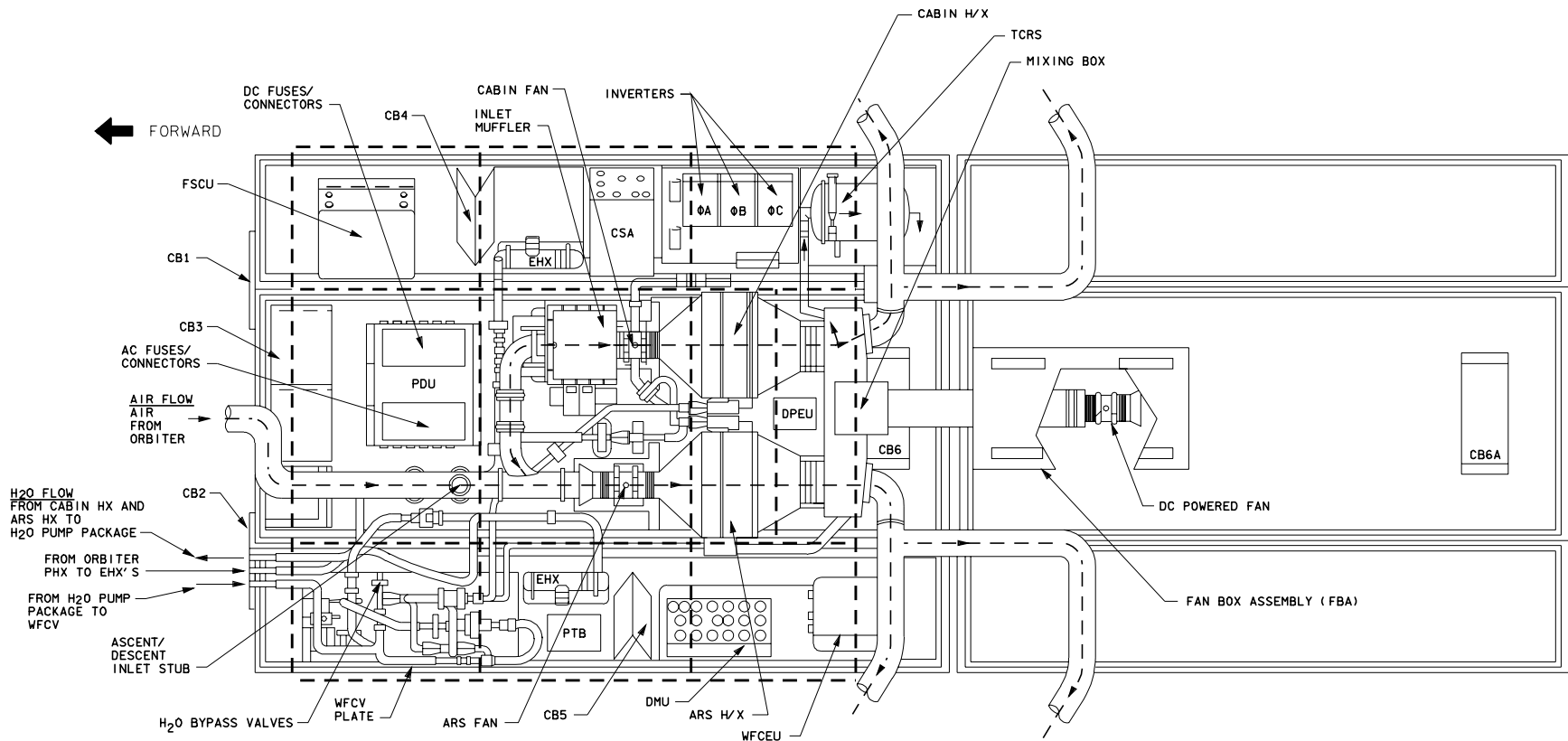


Figure 7-1a.- SPACEHAB subfloor (single module).

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48100704_116. ART 1

Figure 7-1b.- SPACEHAB subfloor (double module).

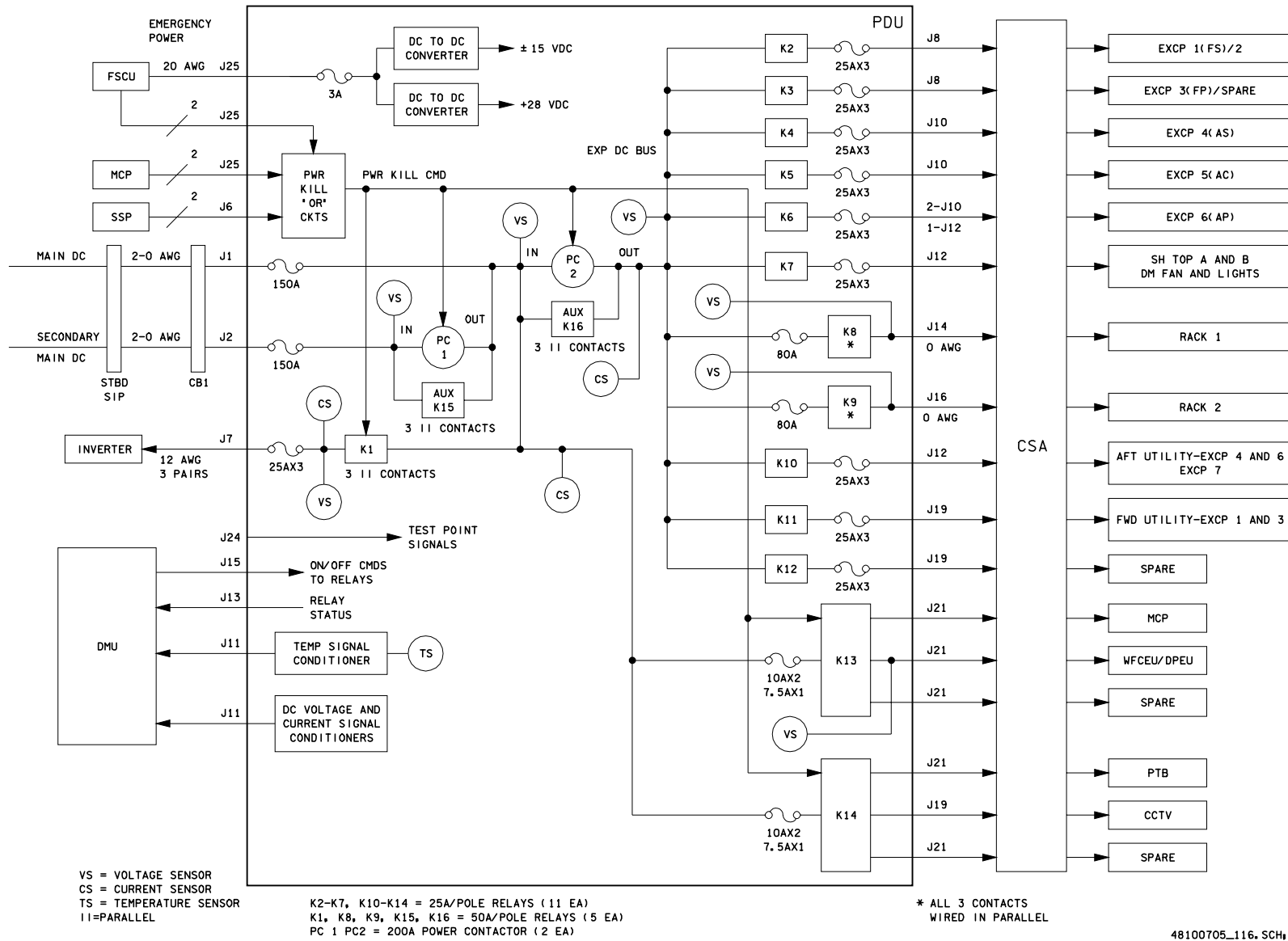
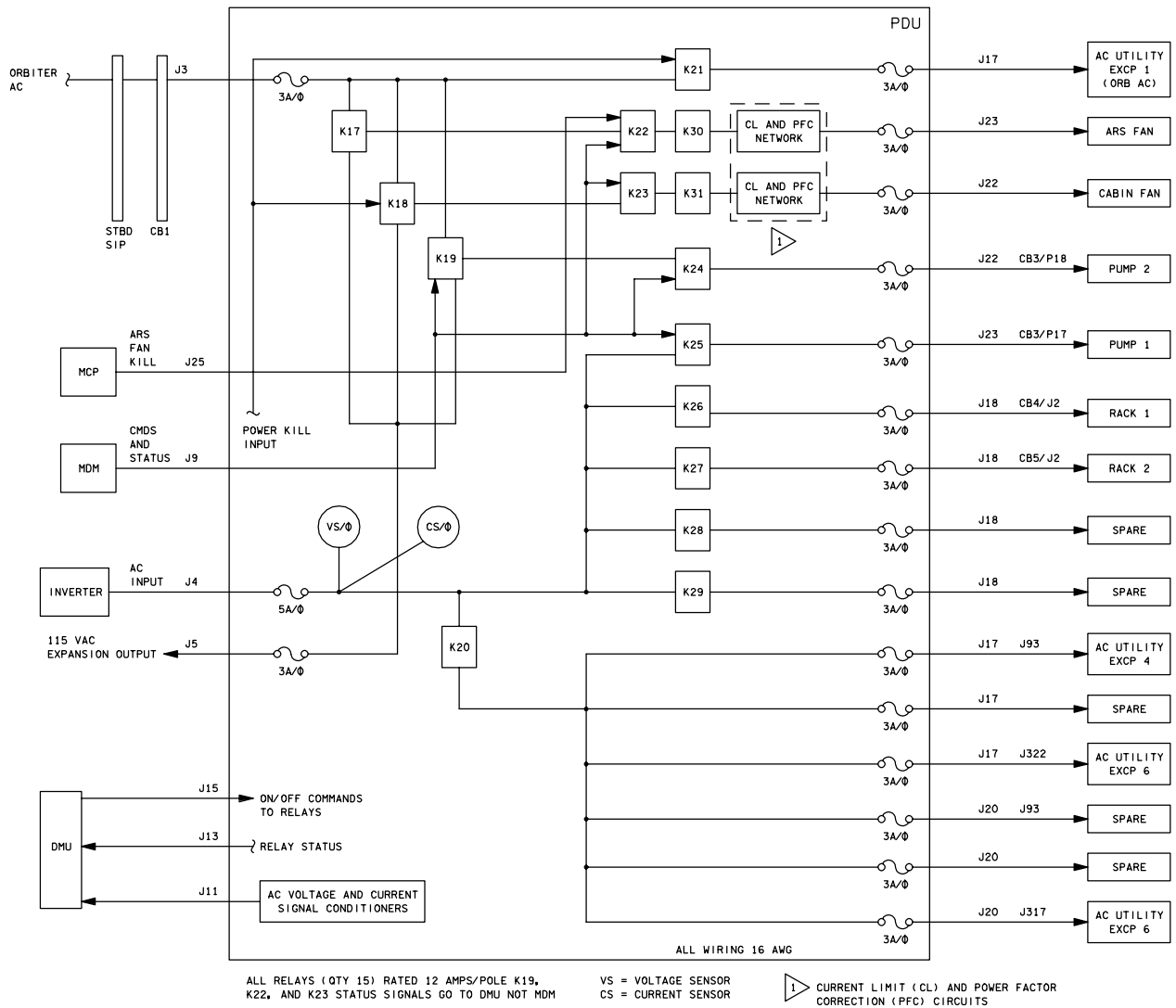
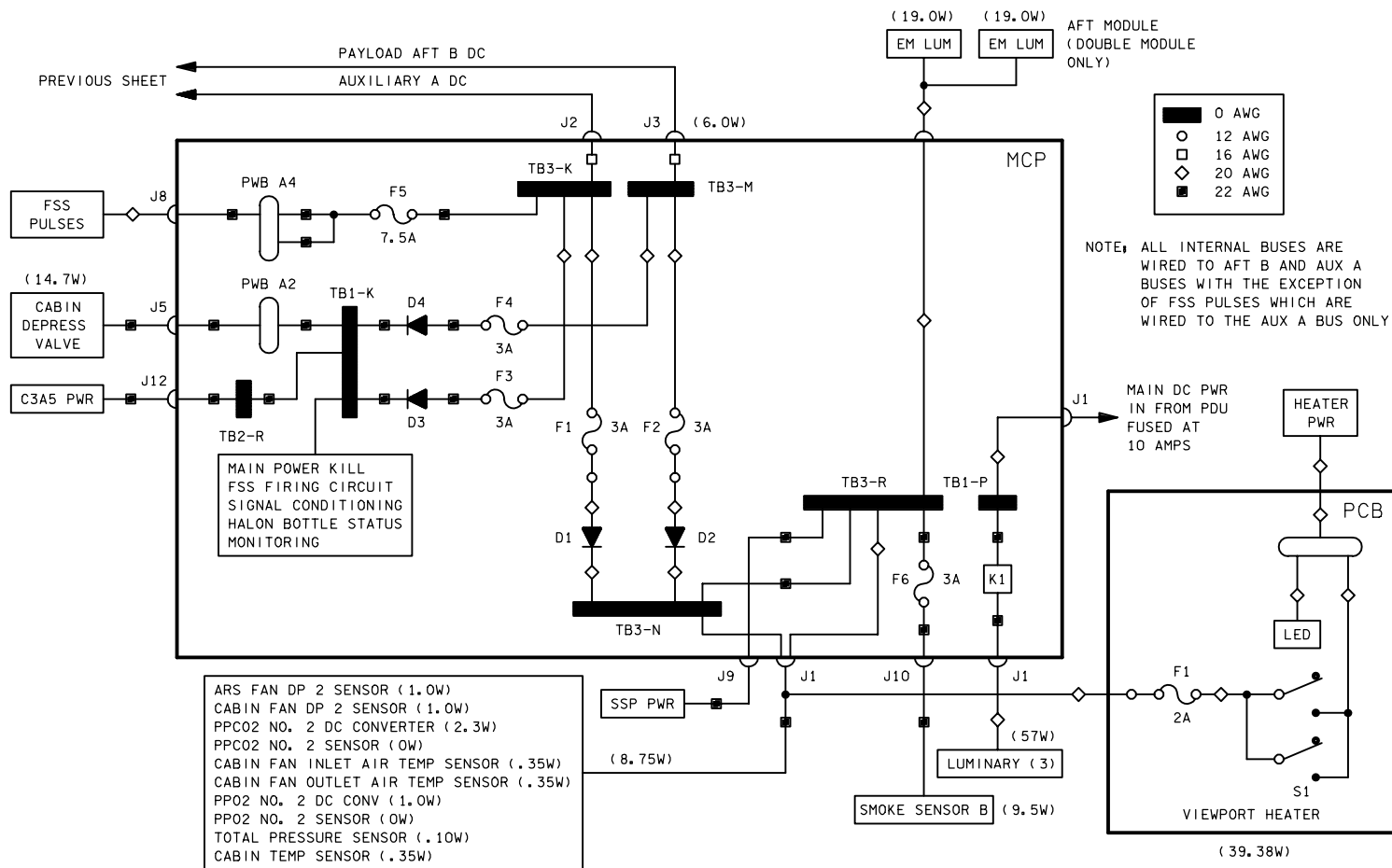


Figure 7-2.- PDU DC distribution.



48100706_116. SCH# 2

Figure 7-3.- PDU AC distribution.



48100708_116. SCH 2

Figure 7-4.- FSCU emergency bus distribution.

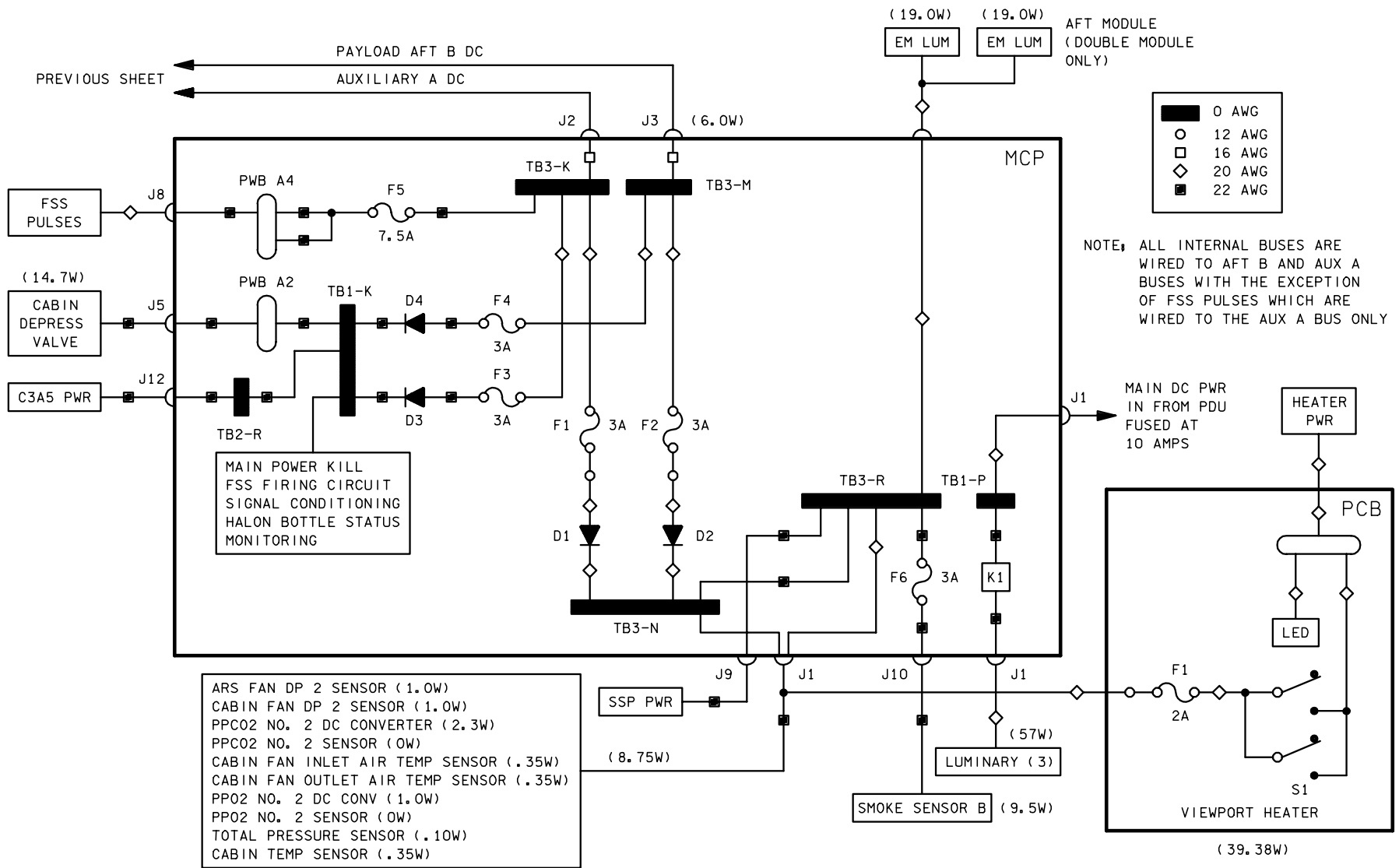


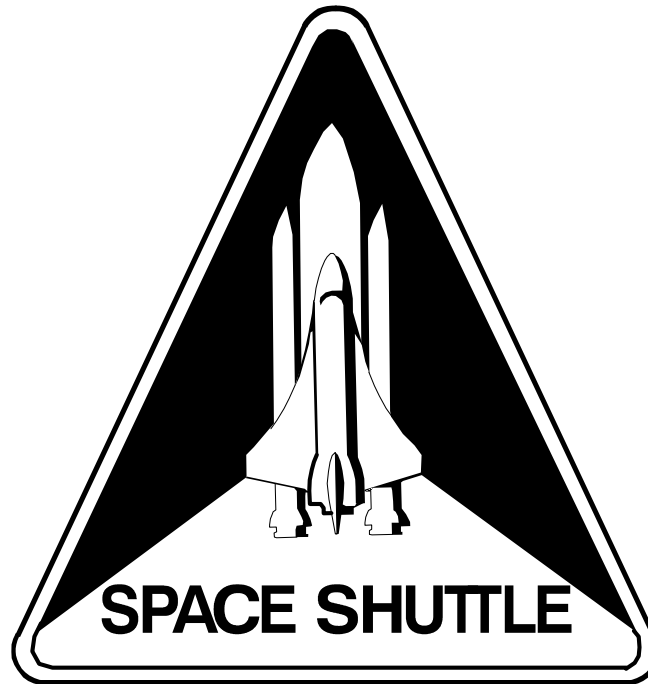
Figure 7-5.- MCP emergency bus distribution.

48100708_116. SCH, 2

SPACEHAB SCHEMATICS

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