

SECTION 39

GROUND SUPPORT EQUIPMENT

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 SECTION 39: GROUND SUPPORT EQUIPMENT

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LCC VIOLATION CALL: Orbiter Aft Compartment Purge Pressure Anomaly | EMERG COND: Yellow (11)

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GECP5A07A	Orb Aft I/F Press Ind	1 of	44	86	InH2O	CI
GECP8A03A	Orb Aft Duct Press Ind	2	66	98	InH2O	CI

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go for RSLs Start (T-31 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) Loss of purge will adversely affect (aft) hazardous gas detection system (hydrogen/oxygen) readings.
- (3) Orb compartments/components purged by aft circuit #3. (Purge consists of gaseous nitrogen (GN2) for inerting and thermal conditioning.)
 - A. Aft compartment.
 - B. SSME controllers.
 - C. SSME Chamber Coolant Valve Actuator.
- (4) Nominally, GECP5A07A is approximately 69 in. H2O at 110 +/- 5 lbs/min flowrate.
- (5) Nominally, GECP8A03A is approximately 88 in. H2O at 110 +/- 5 lbs/min flowrate.

REDLINE DERIVATION:

CRITICALITY: 1S

- (6) Ensures Orbiter aft compartment has an established GN2 inert atmosphere during cryogenic loading.
- (7) The minimum values based on worse case leakage scenario derived from a required flow rate of approximately 75 lbs/min.
- (8) Maximum Orb Aft I/F Press Ind value reflects PVD purge duct design certification levels of 79 in. H2O (2.85 psig) plus line loss between pressure transducer and flight purge quick disconnect.
- (9) Maximum Orb Aft Duct Press Ind value indicates the point at which a blockage or obstruction could prevent minimum inerting of the affected compartments.
- (10) Redlines developed to ensure that the Orb Aft Duct Press Ind would exceed the redline prior to the Orb Aft I/F Press for non-instrumentation failures.

CONSEQUENCES OF EXCEEDING REDLINE:

- (11) Depleted inert environment could result in potential accumulation of hazardous gases, loss of meaningful prelaunch hazardous gas data, and loss of thermal conditioning.

CAUSES OF EXCEEDING REDLINE:

- (12) Duct and Interface Low:
 - A. Loss of ECS flow control (fail close).
 - B. Duct failure/Leakage.
 - 1. Connect point separation.
 - 2. Fracture of Orbiter/GSE purge duct components.
- (13) Duct and Interface High:
 - A. Impediment of flow in GSE Ducting, at Orbiter interface or internal Orbiter purge duct system.
 - B. ECS GN2 system fail high.
- (14) Duct High and Interface Low:
 - A. Blockage between Duct and I/F Pressure Measurements.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> in.H2O									
GECP5A07A	0.552	0	138						
GECP8A03A	0.552	0	138						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
 INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: PVD

LCC VIOLATION CALL: Orbiter Purge Circuit #1 Pressure Anomaly | EMERG COND: Yellow (10)

Table with 7 columns: MEAS. NO., MEASUREMENT DESCRIPTION, CAT., MINIMUM, MAXIMUM, UNITS, CODE. Rows include GEC P5F07A and GEC P8F03A.

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go for RSLs Start (T-31 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) Orbiter compartments purged by the forward purge circuit #1. (Purge consists of gaseous nitrogen (GN2) for inerting and thermal conditioning.)
A. RCS cavity.
B. Fwd fuselage annulus.
C. Drag chute compartment.
D. R/H & L/H OMS pods.
E. Vertical stabilizer.
(3) Nominally, GEC P5F07A is approximately 63 in. H2O at 85 +/- 5 lbs/min flowrate.
(4) Nominally, GEC P8F03A is approximately 67 in. H2O at 85 +/- 5 lbs/min flowrate.

REDLINE DERIVATION:

CRITICALITY: 1S

- (5) Ensures Orbiter Forward Fuselage, FRCS, OMS pods, drag chute and vertical stabilizer compartments have an established GN2 inert atmosphere during cryogenic loading.
(6) The minimum values based on worse case leakage scenario derived from a required flow rate of approximately 55 lbs/min.
(7) Maximum Orb Fwd I/F Press Ind value reflects PVD purge duct design certification levels of 79 in. H2O (2.85 psig) plus line loss between pressure transducer and flight purge quick disconnect.
(8) Maximum Orb Fwd Duct Press Ind value indicates the point at which a blockage or obstruction could prevent minimum inerting of the affected compartments.
(9) Redlines developed to ensure that the Orb Fwd Duct Press Ind would exceed the redline prior to the Orb Fwd I/F Press for non-instrumentation failures.

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CONSEQUENCES OF EXCEEDING REDLINE:

- (10) Depleted inert environment could result in potential accumulation of hazardous gases and loss of thermal conditioning.

CAUSES OF EXCEEDING REDLINE:

- (11) Duct and Interface Low:
 - A. Loss of ECS flow control (fail close).
 - B. Duct failure/Leakage.
 - 1. Connect point separation.
 - 2. Fracture of Orbiter/GSE purge duct components.
- (12) Duct and Interface High:
 - A. Impediment of flow in GSE Ducting, at Orbiter interface or internal Orbiter purge duct system.
 - B. ECS GN2 system fail high.
- (13) Duct High and Interface Low:
 - A. Blockage between Duct and I/F Pressure Measurements.

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MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX

UNITS--> in.H2O									
GECP5F07A	0.552	0	138						
GECP8F03A	0.552	0	138						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE

INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: PVD

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LCC VIOLATION CALL: Orbiter Payload Bay Purge Pressure Anomaly | EMERG COND:
 | Yellow (13)

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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GECP5P07A	Orb PLB I/F Press Ind	1	28 (2)	86 (2)	InH2O	CI
		of	22 (3)	86 (3)	InH2O	CI
GECP8P03A	Orb PLB Duct Press Ind	2	30 (2)	90 (2)	InH2O	CI
			24 (3)	90 (3)	InH2O	CI

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go for RSLs Start (T-31 seconds)
-

REQUIREMENTS:

FIGURES/TABLES:

- (2) Minimum and maximum redlines for missions with all spigots closed.
 - (3) Minimum and maximum redlines for missions with the IUS or EDO spigot configuration.
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PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (4) Orbiter compartments purged by PLB purge circuit #2. (Purge consists of gaseous nitrogen (GN2) for inerting and thermal conditioning.)
 - A. PLB compartment.
 - B. Lower mid fuselage.
 - C. R/H & L/H wing glove compartment(s).
 - D. (If configured) Cargo components.
 - E. Aft compartment (through 1307 bulkhead).
 - F. R/H & L/H wings (through Xo940 wing vent).
 - (5) Nominally, GECP5P07A is approximately 40 in. H2O at 170 +/- 8 lbs/min flowrate with spigots closed.
 - (6) Nominally, GECP8P03A is approximately 42 in. H2O at 170 +/- 8 lbs/min nominal with spigots closed.
 - (7) IUS and EDO missions are the only open-spigot configurations thus far identified for future missions. LCC for other open-spigot configurations will be prepared on a mission specific basis as the configurations are identified.
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REDLINE DERIVATION:

CRITICALITY: 1S

- (8) Ensures Orbiter PLB compartment, wings and Aft compartment have an established GN2 inert atmosphere during cryogenic loading.
- (9) The minimum values based on worse case leakage scenario derived from a required flow rate of approximately 115 lbs/min.
- (10) Maximum PLB I/F Press Ind value corresponds to highest value obtainable without a flow distribution problem (i.e., impeded branch lines) or flow rate in excess of 240 lbs/min with spigots closed, based on previous data.

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REDLINE DERIVATION: (Continued)

- (11) Maximum Orb PLB Duct Press Ind value indicates the point at which a blockage or obstruction could prevent minimum inerting of the affected compartments.
- (12) Redlines developed to ensure that the Orb PLB Duct Press Ind would exceed the redline prior to the Orb PLB I/F Press for non-instrumentation failures.

CONSEQUENCES OF EXCEEDING REDLINE:

- (13) Depleted inert environment could result in potential accumulation of hazardous gases, loss of meaningful prelaunch hazardous gas data, and loss of thermal conditioning.

CAUSES OF EXCEEDING REDLINE:

- (14) Duct and Interface Low:
 - A. Loss of ECS flow control (fail close).
 - B. Duct failure/Leakage.
 - 1. Connect point separation.
 - 2. Fracture of Orbiter/GSE purge duct components.
- (15) Duct and Interface High:
 - A. Impediment of flow in GSE Ducting, at Orbiter interface or internal Orbiter purge duct system.
 - B. ECS GN2 system fail high.
- (16) Duct High and Interface Low:
 - A. Blockage between Duct and I/F Pressure Measurements.

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MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> in.H2O									
GECP5P07A	1.107	0	276.7						
GECP8P03A	1.108	0	277						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE

INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: PVD

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 LCC VIOLATION CALL: GSE PIC Rack Voltage Anomaly | EMERG COND:
 | None
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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV1313A	Sys A CPA DC Volts	1 of	26	NA	Volts	CI
GMSV3313A	Sys A CPA DC Red Volts	2	26	NA	Volts	CI
GMSV2313A	Sys B CPA DC Volts	1 of	26	NA	Volts	CI
GMSV4313A	Sys B CPA DC Red Volts	2	26	NA	Volts	CI

 TIME PERIOD:

- (1) From System Activation (T-4 hours) to Go for APU Start (T-5 minutes)

 REQUIREMENTS:

FIGURES/TABLES:

- (2) The PIC system must be up for launch with total functional redundancy. (3)

 PREPLANNED CONTINGENCY PROCEDURE:

- (3) A failure prior to APU start will result in a Hold in order to perform a PIC resistance test to determine System status. Both system A and B must be verified operational prior to resumption of the countdown.

 NOTES:

- (4) Visibility of System performance is monitored by PIC voltages (SSIDs GSE-05, -06, -07) after the Launch Release system is armed at T-18 seconds.

 REDLINE DERIVATION:

CRITICALITY:

- (5) 1978 LETF testing results indicated 26 volts minimum is necessary to yield 100% detonation. The nominal value is approximately 28 volts. Instrumentation error is accounted for in the test setup.
- (6) CPA (Control Panel Assembly) logic power is required to charge and fire the PICs.

 CONSEQUENCES OF EXCEEDING REDLINE:

- (7) Redline violation indicates PIC system will not provide redundancy for HDP (Hold-Down Post), TSM (Tail-Service Mast) and ETVAS (ET Vent Arm System) pyrotechnic release.

 CAUSES OF EXCEEDING REDLINE:

- (8) A dc power supply malfunction.
- (9) Although measurements are redundant, the electrical path from PIC rack to patch rack is a single point failure. Loss of PIC rack 6743 would result in loss of primary system A and redundant system B.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> Vdc									
GMSV1313A	.1176	0	29.4						
GMSV3313A	.1176	0	29.4						
GMSV2313A	.1176	0	29.4						
GMSV4313A	.1176	0	29.4						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

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SPACE SHUTTLE SYSTEMS HANDBOOK:	DWG NO	SHEET	ZONE
INTEGRATED SYSTEMS SCHEMATIC:	DWG NO	SHEET	ZONE

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ELEMENT: GSE SUBSYSTEM: EPD

LCC VIOLATION CALL: TSM PIC Cap Voltage Anomaly

EMERG COND:
Yellow

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV1309A	Sys A LH2 TSM PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3309A	Sys A LH2 TSM PIC Cap Red Volts	2	35.7	NA	Volts	CI
GMSV1310A	Sys A LO2 TSM PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3310A	Sys A LO2 TSM PIC Cap Red Volts	2	35.7	NA	Volts	CI
GMSV2309A	Sys B LH2 TSM PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4309A	Sys B LH2 TSM PIC Cap Red Volts	2	35.7	NA	Volts	CI
GMSV2310A	Sys B LO2 TSM PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4310A	Sys B LO2 TSM PIC Cap Red Volts	2	35.7	NA	Volts	CI

TIME PERIOD:

- (1) From T-16 seconds to SRB Ignition (T-0)

REQUIREMENTS:

FIGURES/TABLES:

- (2) The PIC system must be up for launch with total functional redundancy mandatory.

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (3) PIC arm performed by RSLs (T-18 sec) - LPS monitoring begins 2 sec after PIC arming to allow PICs to charge and to allow for instrumentation delays.

REDLINE DERIVATION:

CRITICALITY:

- (4) The Avionics Integration Panel has determined this minimum value to be all time all fire minimum voltage.
- (5) The nominal value is approximately 38.3 volts.

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) Violation of redline indicates a PIC System failure which eliminates redundancy for pyro release of LH2/LO2 TSM umbilical.

CAUSES OF EXCEEDING REDLINE:

- (7) PIC card failure.
- (8) Single point failure - although measurements are redundant, path from PIC rack to patch rack is a single point failure. Loss of PIC rack 6743 would result in loss of primary system A and redundant system B.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX

UNITS--> Vdc									
GMSV1309A	0.163	0	40.75						
GMSV3309A	0.163	0	40.75						
GMSV1310A	0.163	0	40.75						
GMSV3310A	0.163	0	40.75						
GMSV2309A	0.163	0	40.75						
GMSV4309A	0.163	0	40.75						
GMSV2310A	0.163	0	40.75						
GMSV4310A	0.163	0	40.75						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: EPD

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LCC VIOLATION CALL: ET Vent Arm PIC Cap Voltage Anomaly | EMERG COND:
 | Yellow

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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV1311A	Sys A ETVAS PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3311A	Sys A ETVAS PIC Cap Red Volts	2	35.7	NA	Volts	CI
GMSV2311A	Sys B ETVAS PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4311A	Sys B ETVAS PIC Cap Red Volts	2	35.7	NA	Volts	CI

TIME PERIOD:

- (1) From T-16 seconds to SRB ignition (T-0)
-

REQUIREMENTS:

FIGURES/TABLES:

- (2) The PIC System must be up for launch with total functional redundancy mandatory.
-

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (3) PIC arm performed by RSLs (T-18 sec) - LPS monitoring begins 2 sec after PIC arming to allow PICs to charge and to allow for instrumentation delays.
-

REDLINE DERIVATION:

CRITICALITY:

- (4) The Avionics Integration Panel has determined this minimum voltage to be all time all fire minimum voltage.
 - (5) The nominal value is approximately 38.3 volts.
-

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) Violation of redline indicates a PIC System failure which eliminates redundancy for pyro release of ET vent arm.
-

CAUSES OF EXCEEDING REDLINE:

- (7) PIC card failure.
 - (8) Single Point Failure - although measurements are redundant, path from PIC rack to patch rack is a single point failure. Loss of PIC rack 6743 would result in loss of primary system A and redundant system B.
-

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> Vdc									
GMSV1311A	0.163	0	40.75						
GMSV3311A	0.163	0	40.75						
GMSV2311A	0.163	0	40.75						
GMSV4311A	0.163	0	40.75						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK:	DWG NO	SHEET	ZONE
INTEGRATED SYSTEMS SCHEMATIC:	DWG NO	SHEET	ZONE

ELEMENT: GSE SUBSYSTEM: EPD

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LCC VIOLATION CALL: SRB Hold Down Post PIC Cap Voltage Anomaly | EMERG COND:
 | Yellow

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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV1301A	Sys A RH SRB HDP M1 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3301A	Sys A RH HDP M1 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1302A	Sys A RH SRB HDP M2 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3302A	Sys A RH HDP M2 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1303A	Sys A RH SRB HDP M3 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3303A	Sys A RH HDP M3 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1304A	Sys A RH SRB HDP M4 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3304A	Sys A RH HDP M4 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1305A	Sys A LH SRB HDP M5 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3305A	Sys A LH HDP M5 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1306A	Sys A LH SRB HDP M6 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3306A	Sys A LH HDP M6 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1307A	Sys A LH SRB HDP M7 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3307A	Sys A LH HDP M7 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV1308A	Sys A LH SRB HDP M8 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV3308A	Sys A LH HDP M8 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2301A	Sys B RH SRB HDP M1 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4301A	Sys B RH HDP M1 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2302A	Sys B RH SRB HDP M2 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4302A	Sys B RH HDP M2 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2303A	Sys B RH SRB HDP M3 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4303A	Sys B RH HDP M3 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2304A	Sys B RH SRB HDP M4 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4304A	Sys B RH HDP M4 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2305A	Sys B LH SRB HDP M5 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4305A	Sys B LH HDP M5 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2306A	Sys B LH SRB HDP M6 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4306A	Sys B LH HDP M6 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2307A	Sys B LH SRB HDP M7 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4307A	Sys B LH HDP M7 PIC Cap Volts Red	2	35.7	NA	Volts	CI
GMSV2308A	Sys B LH SRB HDP M8 PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV4308A	Sys B LH HDP M8 PIC Cap Volts Red	2	35.7	NA	Volts	CI

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TIME PERIOD:

- (1) From T-16 seconds to SRB Ignition (T-0)

REQUIREMENTS:

FIGURES/TABLES:

- (2) The PIC System must be up for launch with total functional redundancy mandatory.

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (3) PIC arm performed by RSLs (T-18 sec) - LPS monitoring begins 2 sec after PIC arming to allow PICs to charge and to allow for instrumentation delays.

REDLINE DERIVATION:

CRITICALITY:

- (4) The Avionics Integration Panel has determined this minimum value to be all time all fire minimum voltage.
(5) The nominal value is approximately 38.3 volts.

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) Violation of redline indicates a PIC System failure which eliminates redundancy for pyro release of SRB HDP (M1, M2, M3, M4, M5, M6, M7, M8).

CAUSES OF EXCEEDING REDLINE:

- (7) PIC card failure.
(8) Single point failure - although measurements are redundant, path from PIC rack to patch rack is a single point failure. Loss of PIC rack 6743 would result in loss of primary system A and redundant system B.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> Vdc									
GMSV1301A	0.163	0	40.75						
GMSV3301A	0.163	0	40.75						
GMSV1302A	0.163	0	40.75						
GMSV3302A	0.163	0	40.75						
GMSV1303A	0.163	0	40.75						
GMSV3303A	0.163	0	40.75						
GMSV1304A	0.163	0	40.75						
GMSV3304A	0.163	0	40.75						
GMSV1305A	0.163	0	40.75						
GMSV3305A	0.163	0	40.75						
GMSV1306A	0.163	0	40.75						
GMSV3306A	0.163	0	40.75						
GMSV1307A	0.163	0	40.75						
GMSV3307A	0.163	0	40.75						
GMSV1308A	0.163	0	40.75						
GMSV3308A	0.163	0	40.75						
GMSV2301A	0.163	0	40.75						
GMSV4301A	0.163	0	40.75						
GMSV2302A	0.163	0	40.75						
GMSV4302A	0.163	0	40.75						
GMSV2303A	0.163	0	40.75						
GMSV4303A	0.163	0	40.75						
GMSV2304A	0.163	0	40.75						
GMSV4304A	0.163	0	40.75						
GMSV2305A	0.163	0	40.75						
GMSV4305A	0.163	0	40.75						
GMSV2306A	0.163	0	40.75						
GMSV4306A	0.163	0	40.75						
GMSV2307A	0.163	0	40.75						
GMSV4307A	0.163	0	40.75						
GMSV2308A	0.163	0	40.75						
GMSV4308A	0.163	0	40.75						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
 INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: EPD

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 LCC VIOLATION CALL: H2 Burn System PIC Rack Voltage Anomaly | EMERG COND:
 | None
 =====

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV5313A	H2-Burn Sys A CPA DC Volts	1 of	26	NA	Volts	CI
GMSV7313A	Sys A H2-Burn CPA DC Red Volts	2	26	NA	Volts	CI
GMSV6313A	H2-Burn Sys B CPA DC Volts	1 of	26	NA	Volts	CI
GMSV8313A	Sys B H2-Burn CPA DC Red Volts	2	26	NA	Volts	CI

 TIME PERIOD:

- (1) From System Activation (T-4 hours) to Go For APU Start (T-5 minutes)

 REQUIREMENTS:

FIGURES/TABLES:

- (2) The PIC system must be up for launch with total functional redundancy. (3)

 PREPLANNED CONTINGENCY PROCEDURE:

- (3) A failure prior to APU start will result in a Hold in order to perform PIC resistance tests to determine System status. Both system A and B must be verified operational prior to resumption of the countdown.

 NOTES:

- (4) Visibility of System performance is monitored by PIC voltages (SSIDs GSE-09, -20) after the H2 BURN system is armed at T-55 seconds.

 REDLINE DERIVATION:

CRITICALITY:

- (5) 1978 LETF testing results indicated 26 volts minimum is necessary to yield 100% detonation. The nominal value is approximately 28 volts. Instrumentation error is accounted for in the test setup.
- (6) CPA (Control Panel Assembly) logic power is required to charge and fire the PICs.

 CONSEQUENCES OF EXCEEDING REDLINE:

- (7) Violation of redline indicates PIC system will not provide redundancy for free hydrogen burn resulting in Orbiter base heatshield overpressurization at SSME ignition.

 CAUSES OF EXCEEDING REDLINE:

- (8) A dc power supply malfunction.
- (9) Although measurements are redundant, the electrical path from PIC rack to patch rack is a single point failure. Loss of PIC rack 6744 would result in loss of primary system A and redundant system B.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> Vdc									
GMSV5313A	.1176	0	29.4						
GMSV7313A	.1176	0	29.4						
GMSV6313A	.1176	0	29.4						
GMSV8313A	.1176	0	29.4						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: EPD

LCC VIOLATION CALL: Hydrogen Burn System PIC Cap Voltage Anomaly | EMERG COND: None

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV5309A	H2-Burn Sys A Eng 2 Cap Volts	1 of	35.7	NA	Volts	CI
GMSV5319A	H2-Burn Sys A Eng 2 Cap Volts Red	2	35.7	NA	Volts	CI
GMSV5310A	H2-Burn Sys A Eng 3 Cap Volts	1 of	35.7	NA	Volts	CI
GMSV5320A	H2-Burn Sys A Eng 3 Cap Volts Red	2	35.7	NA	Volts	CI
GMSV5311A	H2-Burn Sys A Eng 1 Cap Volts	1 of	35.7	NA	Volts	CI
GMSV5321A	H2-Burn Sys A Eng 1 Cap Volts Red	2	35.7	NA	Volts	CI
GMSV6309A	H2-Burn Sys B Eng 2 Cap Volts	1 of	35.7	NA	Volts	CI
GMSV6319A	H2-Burn Sys B Eng 2 Cap Volts Red	2	35.7	NA	Volts	CI
GMSV6310A	H2-Burn Sys B Eng 3 Cap Volts	1 of	35.7	NA	Volts	CI
GMSV6320A	H2-Burn Sys B Eng 3 Cap Volts Red	2	35.7	NA	Volts	CI
GMSV6311A	H2-Burn Sys B Eng 1 Cap Volts	1 of	35.7	NA	Volts	CI
GMSV6321A	H2-Burn Sys B Eng 1 Cap Volts Red	2	35.7	NA	Volts	CI

TIME PERIOD:

- (1) After Systems ARM (T-50 seconds) to Go For SSME Start (T-10 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) H2-Burn Pyrotechnic Initiator Controllers (PICs) are armed at T-55 seconds. Launch Processing System (LPS) monitoring starts at T-50 seconds.

REDLINE DERIVATION:

CRITICALITY: 1R

- (3) a. SSID Intent Summary - The purpose of this redline is to ensure the PICs are properly armed (charged) prior to the ignition of the H2 Burn ordnance. If an H2 Burn igniter does not get properly armed and fired, then expelled/accumulated hydrogen in the area would not be burned off prior to Main Engine Start. There are six H2 Burn igniters, two for each main engine. Each igniter is started by a NASA Standard Initiator (NSI) and a PIC. The PIC capacitor voltage is the only means available to verify that the PIC has been armed.
- b. Voting Logic - The 1 of 2 voting logic for H2 Burn capacitor voltages accommodates a single instrumentation failure per PIC while ensuring the visibility required to verify that each PIC remains charged prior to

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REDLINE DERIVATION: (Continued)

firing it is maintained.

- c. Minimum and Maximum Redline Development - Based upon the PIC specification MC450-0018 and allowing for a +/- 2 count instrumentation error, 35.7 VDC has been determined to be the minimum voltage for a lower limit indication when a PIC has been armed. The Avionics Integration Panel has determined this minimum value to be all time all fire minimum voltage.
- d. Time Period - T-50 seconds start time chosen to begin monitoring H2 Burn capacitor volts just after the ARM commands are issued at T-55 seconds (providing a minimum 2 second charge time). T-10 second stop time chosen because the FIRE commands are sent at that time to start the igniters prior to Main Engine Start at T-6.6 seconds.
- e. Requirements - Full System A and System B PIC redundancy is required for all engine PICs. One of two measurement verification for each PIC CAP Voltage ensures redundancy is maintained.
- f. Preplanned Contingency Procedure - N/A

CONSEQUENCES OF EXCEEDING REDLINE:

- (4) Possible damage to orbiter heat shield because of overpressure.
- (5) Damage to SSME nozzle.

CAUSES OF EXCEEDING REDLINE:

- (6) Equipment malfunction (PIC Rack, Control Power Assembly (CPA)).
 - (7) Instrumentation error.
-

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> Vdc									
GMSV5309A	0.163	0	40.75						
GMSV5319A	0.163	0	40.75						
GMSV5310A	0.163	0	40.75						
GMSV5320A	0.163	0	40.75						
GMSV5311A	0.163	0	40.75						
GMSV5321A	0.163	0	40.75						
GMSV6309A	0.163	0	40.75						
GMSV6319A	0.163	0	40.75						
GMSV6310A	0.163	0	40.75						
GMSV6320A	0.163	0	40.75						
GMSV6311A	0.163	0	40.75						
GMSV6321A	0.163	0	40.75						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: EPD

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LCC VIOLATION CALL: Orbiter Access Arm Accumulator GN2 Pressure | EMERG COND:
 Anomaly | Yellow (13)

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GSAX7731E	OAA 3000 psi GN2 Press Sw-Normal	(1)	ON (3)	NA	Event	CI
		(2)	ON (3)	NA	Event	DI
GSAX7736E	OAA 3000 psi GN2 Press Sw-Normal	(1)	ON (3)	NA	Event	CI
		(2)	ON (3)	NA	Event	DI
GSAP7801A	OAA 2700 psi GN2 Press Transducer	(1)	2000(3)	2800(4)	psi	CI
		(2)	2000(3)	NA	psi	DI
GSAP7806A	OAA 2700 psi GN2 Press Transducer	(1)	2000(3)	2800(4)	psi	CI
		(2)	2000(3)	NA	psi	DI

TIME PERIOD:

- (1) From Accumulator Forced Recharge (approximately T-2 hours) to prior to OAA Retract (T-7 minutes, 30 seconds)
- (2) Verify after completion of accumulator recharge (approximately T-3 minutes).

REQUIREMENTS:

FIGURES/TABLES:

- (3) 1 of 4 Measurements required for verification of Minimum Redline. (5,6)
- (4) 1 of 2 Measurements required for verification of Maximum Redline. (7)

PREPLANNED CONTINGENCY PROCEDURE:

- (5) For indications of low GN2 pressure, check GN2 charging valve:
 (GSAX7101E/GSAX7106E OPEN & GSAX7102E/GSAX7107E CLOSED)
 - If valve indicates CLOSED, command GN2 charging valve OPEN. If either transducer or pressure switch measurement indicates acceptable GN2 pressure, LCC violation cleared, continue countdown.
- (6) For indications of low GN2 pressure prior to Orbiter Access Arm (OAA) retract (after verifying charging valve is OPEN), assemble Red Crew to adjust GN2 regulator to increase pressure. If at least one measurement indicates acceptable GN2 pressure, LCC violation cleared, continue countdown.
- (7) For indications of high GN2 pressure prior to OAA retract, assemble Red Crew to vent GN2 pressure from accumulator and, if required, adjust GN2 regulator to decrease pressure. If at least one transducer measurement indicates acceptable GN2 pressure, LCC violation cleared, continue countdown.

NOTES:

- (8) Indications of high GN2 pressure after retract/recharge, with no violation of GSE-11, does not constitute an LCC violation.
- (9) OAA Accumulator GN2 Pressure is monitored by pressure switch A101442 and pressure transducer A101441. Nominal operating pressure is 2650 psi.

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REDLINE DERIVATION:

CRITICALITY:

- (10) a. SSID Intent Summary - The purpose of this requirement is to ensure OAA Accumulators have the correct GN2 pressure to ensure OAA retraction and emergency extension. OAA Accumulator GN2 pressure is monitored by a pressure switch and a pressure transducer. The output for each device is split into two MSID indications using independent Hardware Interface Modules (HIMs) and Launch Processing System (LPS) paths.
- b. Voting Logic - N/A
- c. Minimum and Maximum Redline Development - The minimum redline of 2000 psi for the OAA 2700 psi GN2 Press Transducer(s) ensures there is enough pressure for a 30 second emergency extend of the OAA. The minimum redline of ON for the OAA 2700 psi GN2 Press Switch(s) is another way of verifying that adequate pressure exists for a 30 second emergency extend.

The maximum redline of 2800 psi for the OAA 2700 psi GN2 Press Transducer(s) was chosen because successful hydraulic recharge of accumulators after OAA retract can not be assured above these pressures.
- d. Time Period - The OAA accumulator is recharged at T-2 hours and the OAA is retracted at T-7 minutes, 30 seconds. A one time verification at approximately T-3 minutes is sufficient to ensure accumulator recharge for emergency OAA extend.
- e. Requirements - Only one measurement is needed to verify adequate pressure for OAA retract or emergency extend. Only one of the OAA 2700 psi GN2 Press Transducer(s) is required to verify the maximum redline requirement.
- f. Preplanned Contingency Procedures - The GN2 Charging Valve needs to be open and the GN2 Supply Regulator needs to be properly set to ensure the GN2 accumulator is at the right pressure. The pre-planned procedures return the system to the correct configuration so launch countdown can continue.

CONSEQUENCES OF EXCEEDING REDLINE:

- (11) Improper pressure indications (before retract) suggest that the hydraulic accumulators are not within normal operating pressure parameters and may not support a normal OAA retraction or extension within the required time frames.
 - (12) Retract/extend can be accomplished with hydraulic pressure supplied by the Hydraulic Charging Unit (HCU), without any accumulators, provided the hydraulic system does not have a gross external leak. However, extend time may be greater than 30 seconds without stored accumulator pressure (ref OMRS G51FEGPAO.012 for Pad A, or G61FEGPAO.012 for Pad B).
 - (13) Loss of safe Crew egress route from Orbiter to Fixed Service Structure (FSS) if OAA is not extended and locked.
-

CAUSES OF EXCEEDING REDLINE:

- (14) Fault in the GN2 regulation system.
- (15) Significant GN2 leakage.
- (16) Instrumentation failure.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> psi									
GSAP7801A	16	0	4000						
GSAP7806A	16	0	4000						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
 INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: ARMS

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LCC VIOLATION CALL: OAA Hydraulic Accumulator Level Anomaly | EMERG COND: Yellow (12)

Table with 7 columns: MEAS. NO., MEASUREMENT DESCRIPTION, CAT., MINIMUM, MAXIMUM, UNITS, CODE. Rows include primary and secondary measurements for OAA Accum Level Sw No 1-4.

TIME PERIOD:

- (1) From Accumulator Forced Recharge (approximately T-2 hours) to prior to OAA retract (T-7 minutes, 30 seconds). (3)
(2) After completion of accumulator recharge (approximately T-3 minutes) to Go for RSLs Start (T-31 seconds). (4)

REQUIREMENTS:

FIGURES/TABLES:

- (3) 2 of 4 primary measurements or 2 of 4 secondary measurements are required ON. (5)
(4) 1 of 4 primary measurements or 1 of 4 secondary measurements are required ON. (6)

PREPLANNED CONTINGENCY PROCEDURE:

- (5) Prior to Orbiter Access Arm (OAA) retract, if the hydraulic accumulator level switch(s) indicates OFF, the console operator may perform a manual recharge (Ref S0007 Volume 5 and V2153).
(6) After OAA retract and accumulator recharge, if the hydraulic accumulator level switch(s) indicates OFF, the console operator may perform a manual recharge.

NOTES:

- (7) OAA can support nominal extend (30 seconds max) or retract (105 - 140 seconds) if GN2 pressure is above 2000 psi (reference GSE-10) and one accumulator level is normal.

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NOTES: (Continued)

- (8) There are four hydraulic accumulators that are used to extend or retract the OAA. Each accumulator can hold 10 gallons of hydraulic fluid. The OAA Accumulator Level Switches only register when the accumulator is full of hydraulic fluid.

	Accumulator	Level Switch
#1	A101321	A101314
#2	A101322	A101316
#3	A101323	A101318
#4	A101324	A101320

REDLINE DERIVATION:

CRITICALITY:

- (9) a. SSID Intent Summary - The purpose of this requirement is to ensure adequate hydraulic fluid volume to retract and/or re-extend the OAA. The OAA Accumulator Level Switches are a means of measuring the volume of fluid in each of the four hydraulic accumulators. The output for each switch is split into a Primary and Secondary MSID indication using independent Hardware Interface Modules (HIMs) and Launch Processing System (LPS) paths.
- b. Voting Logic - N/A
- c. Minimum and Maximum Redline Development - OAA Accumulator Level Switches remotely measure the amount of hydraulic fluid in the hydraulic accumulators. The minimum redline of ON means that the respective accumulator is completely full of hydraulic fluid.
- d. Time Period - The accumulators are charged at approximately T-2 hours and are at stable values until OAA Retract at T-7 minutes, 30 seconds. After OAA retract the accumulators are recharged and are at stable values at approximately T-3 minutes and committed for launch at T-31 seconds.
- e. Requirements - Prior to retract, two accumulators indicating NORMAL are required to ensure a complete retract/extend cycle. Following retract, one accumulator indicating NORMAL is required to ensure an emergency extension. Either the Primary or Secondary MSID's may be used to verify the required accumulator volume measurements.
- f. Preplanned Contingency Procedures - Procedures exist to manually recharge the hydraulic accumulators and/or verify sufficient fluid volume exists for OAA re-extend by data extrapolation.

CONSEQUENCES OF EXCEEDING REDLINE:

- (10) Improper level indications on more than two accumulators (before retract) suggest that the hydraulic accumulators are not within normal operating volume parameters and may not support a normal OAA retraction or extension within the required time frames.

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CONSEQUENCES OF EXCEEDING REDLINE: (Continued)

- (11) Retract/extend can be accomplished with hydraulic pressure supply from the Hydraulic Charging Unit (HCU), without any accumulators, provided the hydraulic system does not have a gross external leak. However, extend time may be greater than 30 seconds without stored accumulator pressure (ref OMRS G51FEGPAO.012 for Pad A, or G61FEGPAO.012 for Pad B).
(12) Loss of safe Crew Egress Route from Orbiter to FSS if OAA is not Extended and Locked.

CAUSES OF EXCEEDING REDLINE:

- (13) Fault in hydraulic fill system, or leaking accumulators.
(14) Gross external leak in the hydraulic system.
(15) Instrumentation failure.

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE
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ELEMENT: GSE SUBSYSTEM: ARMS
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LCC VIOLATION CALL: OAA Retract Indication Anomaly | EMERG COND:
 | None

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GSAX7621E	OAA Pri Fully Rtr Sw-Retracted	2	ON	NA	Event	CI
GSAX7622E	OAA Sec Fully Rtr Sw-Retracted	of	ON	NA	Event	CI
GSAH7831A	OAA Position Indication	3	NA	2 (2)	Deg	CI
OR						
GSAX7626E	OAA Pri Fully Rtr Sw-Retracted	2	ON	NA	Event	CI
GSAX7627E	OAA Sec Fully Rtr Sw-Retracted	of	ON	NA	Event	CI
GSAH7836A	OAA Position Indication	3	NA	2 (2)	Deg	CI

TIME PERIOD:

- (1) From OAA Retract Indication (approx T-5 minutes) to Go For SSME Start (T-10 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

- (2) Using Operational Television (OTV), verify the Orbiter Access Arm (OAA) is overlapping the skid weldment by at least 5 feet. If OAA position is acceptable, LCC violation cleared, continue countdown.

NOTES:

- (3) OAA retracted switches A103 and A105 indicate if the OAA is fully retracted on the latchback assembly. OAA position indicator A130006 monitors the rotational position of the OAA.

REDLINE DERIVATION:

CRITICALITY:

- (4) a. SSID Intent Summary - The purpose of this requirement is to ensure the OAA is safely retracted to avoid potential interference with the shuttle vehicle during liftoff. There are two retract switches and one position indicator that monitor the position of the OAA. The output for each device is split into two MSID indications (Primary and Secondary) using independent Hardware Interface Modules (HIMs) and Launch Processing System (LPS) paths.
- b. Voting Logic - Two of three measurements required to verify OAA retraction.
- c. Minimum and Maximum Redline Development - The OAA Primary and Secondary Fully Retract Switch is activated when the OAA is fully retracted. The minimum redline requirement of ON means the OAA has been fully retracted. There is not a maximum redline requirement for the

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REDLINE DERIVATION: (Continued)

retract switch. The OAA Position Indicator maximum redline requirement of 2 degrees corresponds to a sufficiently retracted OAA which will not contact the vehicle during launch. There is not a minimum redline requirement for this measurement.

d. Time Period - The OAA is retracted at T-7 minutes, 30 seconds and should be fully retracted at approximately T-5 minutes. The end time of T-10 seconds protects against inadvertent OAA extension which could potentially contact the orbiter during lift-off.

e. Requirements - NA

f. Preplanned Contingency Procedures - Visual observation using OTV cameras can be used to determine if the OAA position is acceptable. The OAA is sufficiently retracted to avoid contact with the vehicle when it overlaps the skid weldment by at least 5 feet.

CONSEQUENCES OF EXCEEDING REDLINE:

(5) The OAA may be at rest, away from the latchback assembly, and could potentially result in vehicle interference during lift-off.

CAUSES OF EXCEEDING REDLINE:

- (6) OAA may not be fully retracted.
- (7) Failure of switches A103 and A105 or potentiometer A130006.
- (8) Instrumentation failure.

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MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
	UNITS-->	deg							
GSAH7831A	0.28	0	70						
GSAH7836A	0.28	0	70						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: ARMS
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LCC VIOLATION CALL: GOX Vent Arm Retract Anomaly | EMERG COND: None

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GSAX8221E	6308A103 Retract Switch No.1	2	ON	NA	Event	CI
GSAX8222E	6308A102 Retract Switch No.2	of	ON	NA	Event	CI
GSAH8191A	A133566 Arm Position Indication	3	NA	2 (2)	Deg	CI
OR						
GSAX8226E	6308A103 Retract Switch No.1	2	ON	NA	Event	CI
GSAX8227E	6308A102 Retract Switch No.2	of	ON	NA	Event	CI
GSAH8196A	A133566 Arm Position Indication	3	NA	2 (2)	Deg	CI

TIME PERIOD:

- (1) Approximately T-40 seconds to Go For RSLs Start (T-31 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

- (2) Using Operational Television (OTV), verify GOX Vent Arm (GVA) hood is entirely overlapping the Seal Access Platform. If GVA position is acceptable, LCC violation cleared, continue countdown.

NOTES:

- (3) GVA retracted switches A102 and A103 indicate if the GVA is fully retracted on the latchback assembly. GVA position indicator A133566 monitors the rotational position of the GVA.
- (4) If prior to retract (T-2min 50sec), the GVA Hydraulic GN2 pressure indications both fail (transducer and switch), while 2 of 3 hydraulic accumulators indicate OK (indicating sufficient hydraulic supply), the Hydraulic Charging Unit may be used to assist GVA retraction by opening the Hydraulic Supply Valve (A133472). ref: S0007.500.

REDLINE DERIVATION:

CRITICALITY: 3

- (5) a. SSID Intent Summary - The purpose of this requirement is to ensure the GVA is safely retracted to avoid potential interference with the shuttle vehicle during liftoff. Monitoring of the retract indications confirms successful GVA retraction. Fault tolerance is provided by two retract switches and one position indicator that monitor the position of the GVA. 2 of 3 indications are required to verify GVA position. Additional fault protection is provided by the output for each switch being split into two MSID indications (Primary and Secondary) using independent Hardware Interface Modules (HIMs) and Launch Processing System (LPS) paths.

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REDLINE DERIVATION: (Continued)

- b. Voting Logic - Two of three measurements from either HIM/LPS path are required to verify the GVA is fully retracted and clear of the vehicle. Redundancy is provided by using two separate switch assemblies that are side by side on the Arm latchback.
- c. Minimum and Maximum Redline Development - The GVA Primary and Secondary Fully Retract Switch is activated when the GVA is fully retracted. The minimum redline requirement of ON means the GVA has been fully retracted. There is not a maximum redline requirement for the retract switch. The GVA Position Indicator maximum redline requirement of 2 degrees corresponds to a sufficiently retracted GVA which will not contact the vehicle during launch. There is not a minimum redline requirement for this measurement.
- d. Time Period - LCC monitoring effectivity starts at approximately T-40 seconds to allow for all nominal, or contingency, automated operations to complete, if required (ie. switching from primary to secondary systems for Hood raise and Arm retract). The ending time effectivity of T-31 seconds is appropriate because after successful retraction, the GVA is mechanically fixed via a locking mechanism and hydraulically locked in retract mode to prevent any possibility of inadvertent re-extension.
- e. Requirements - N/A
- f. Preplanned Contingency Procedures - Visual observation using OTV cameras can be used to determine if the GVA position is acceptable for launch. The GVA is sufficiently retracted to avoid contact with the vehicle when the GVA hood completely overlaps the Seal Access Platform.

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) The GVA may be at rest, away from the latchback assembly, and could potentially result in vehicle interference during lift-off.
- (7) Reference Launch and Landing Hazard Report LL-0125 (Impact/Collision of the GOX Vent Arm Hood with the External Tank due to undetected structural damage could result in loss of life/vehicle)

CAUSES OF EXCEEDING REDLINE:

- (8) GVA may not be fully retracted.
- (9) Failure of switches A102, A103 or potentiometer A133566.
- (10) Instrumentation failure.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> deg									
GSAH8191A	0.292	0	73						
GSAH8196A	0.292	0	73						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK:	DWG NO	SHEET	ZONE
INTEGRATED SYSTEMS SCHEMATIC:	DWG NO	SHEET	ZONE

ELEMENT: GSE SUBSYSTEM: LACC

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LCC VIOLATION CALL:  Sound Suppression Water Valve Actuation      | EMERG COND:
                      Pressure Anomaly                            | None
=====

```

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=====
MEAS. NO. | MEASUREMENT DESCRIPTION | CAT. | MINIMUM | MAXIMUM | UNITS | CODE
-----|-----|-----|-----|-----|-----|-----
GWDPPPT01A | SS Pneu Press Trans PT1 Status | 1 of | 1200 | 1700 | psig | CI
GWDPPPT02A | SS Pneu Press Trans PT2 Status | 2 | 1200 | 1700 | psig | CI
=====

```

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) To Go For RSLs Start (T-31 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) Complex Control Center (CCC) monitors comparable measurements.
- (3) Control transferred from CCC to FR at T-9 hours, 15 minutes.

REDLINE DERIVATION:

CRITICALITY:

- (4) Below minimum redline, 48" Sound Suppression (SS) valves cannot be opened per pad testing.
- (5) Above maximum redline, 48" valves may be damaged (relief valve setting is 1705 psig).
- (6) Nominal operating pressure is 1500 psig.

CONSEQUENCES OF EXCEEDING REDLINE:

- (7) Component failure (above maximum redline).
- (8) If 48" valves fail to open, possible damage to vehicle and payload (below minimum redline).

CAUSES OF EXCEEDING REDLINE:

- (9) Failure of redundant GN2 supply system.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> psig									
GWDPPT01A	12	0	3000						
GWDPPT02A	12	0	3000						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
 INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: ARMS

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=====
LCC VIOLATION CALL:  Sound Suppression Water Tank Level Anomaly | EMERG COND:
                                                              | None
=====

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=====
MEAS. NO. | MEASUREMENT DESCRIPTION | CAT. | MINIMUM | MAXIMUM | UNITS | CODE
-----|-----|-----|-----|-----|-----|-----
GWDQPT83A | SS Tank Water Level Status | 1 of | 258.2 | NA (5) | Ft | CI
GWDQPT84A | SS Tank Water Level Status | 2(2) | 258.2 | NA (5) | Ft | CI
=====

```

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go For GLS Start (T-9 minutes)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

- (2) For failure of both measurements, use overflow capability to determine tank level.

NOTES:

- (3) Complex Control Center (CCC) monitors comparable measurements.
- (4) Control transferred from CCC to Firing Room (FR) at T-9 hours, 15 minutes.
- (5) Maximum redline not applicable because of the presence of overflow capability of the SS water tank.

REDLINE DERIVATION:

CRITICALITY:

- (6) Minimum level required to supply the sound suppression water system and to guarantee full water flow for the time period duration from SSME start thru SRB ignition and lift-off.
- (7) Nominal value is 260 ft.

CONSEQUENCES OF EXCEEDING REDLINE:

- (8) Minimum redline indicates loss of SS water (possible damage to vehicle and payload).

CAUSES OF EXCEEDING REDLINE:

- (9) Leaking 48" SS valve.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> ft									
GWDQPT83A	1.35	0	270						
GWDQPT84A	1.35	0	270						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: ARMS

```

=====
LCC VIOLATION CALL:  Firing Room/Launch Processing System Command | EMERG COND:
                      Bus Control Anomaly                          | None
=====

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=====
MEAS. NO. | MEASUREMENT DESCRIPTION | CAT. | MINIMUM | MAXIMUM | UNITS | CODE
-----|-----|-----|-----|-----|-----|-----
GWDXPT24E | PTCR FR SS Cmd Bus On Ind | 1 of | ON      | NA      | Event | DI
GWDXPT26E | PTCR FR SS Cmd Bus On Ind | 2    | ON      | NA      | Event | DI
=====

```

TIME PERIOD:

- (1) Verify after initiation of FR Cmd Bus "On" (T-50 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

- (2) If unable to verify Sound Suppression Firing Room Command Bus is ON, console operator may attempt to send the bus on commands and/or cycle the Prelift-off vent valves in order to verify the command bus is ON. Reference OMI S0007, Volume V, Sound Suppression FR Command Bus Failure. If the command bus is verified operational, LCC violation cleared, continue countdown.

NOTES:

- (3) Complex Control Center (CCC) monitors comparable measurements.
- (4) Busses commanded on by GLS at T-1 minute, 15 seconds.

REDLINE DERIVATION:

CRITICALITY:

- (5) Firing Room (FR) must have FR Cmd Bus ON to initiate sound suppression valve commands that occur at T-28 seconds (prelift-off vent valves) and T-16 seconds (prelift-off valves and postlift-off vent valves).

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) FR cannot open 48" prelift-off valves; possible damage to vehicle and payload.

CAUSES OF EXCEEDING REDLINE:

- (7) Hardware malfunction.

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=====
SPACE SHUTTLE SYSTEMS HANDBOOK:  DWG NO          SHEET          ZONE
INTEGRATED SYSTEMS SCHEMATIC:   DWG NO          SHEET          ZONE
=====

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ELEMENT: GSE                      SUBSYSTEM: ARMS
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LCC VIOLATION CALL: Sound Suppression Solenoid Power Bus Indication Anomaly	EMERG COND: None
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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GWDXPT29E	SS Sol Pwr Bus On Ind	1 of	ON	NA	Event	CI
GWDXPT53E	SS Sol Pwr Bus On Ind	2	ON	NA	Event	CI

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go For RSLs Start (T-31 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

- (2) If unable to verify Sound Suppression Solenoid Power Bus is ON, console operator may attempt to send the bus on commands and/or cycle the Pre-lift-off vent valves in order to verify the power bus is ON. Reference OMI S0007, Volume V, Sound Suppression Solenoid Power Bus Failure. If the solenoid power bus is verified operational, LCC violation cleared, continue countdown.

NOTES:

- (3) Control transferred from Complex Control Center (CCC) to Firing Room (FR) at T-9 hours, 15 minutes.
- (4) CCC monitors comparable measurements.

REDLINE DERIVATION:

CRITICALITY:

- (5) Solenoid valves require solenoid power bus ON for operation at T-28 sec (prelift-off vent valves), T-16 sec (prelift-off valves and postlift-off vent valves), and T-0 (postlift-off valves).

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) 48" prelift-off and postlift-off valves would not come open, possible damage to vehicle and payload.
- (7) Loss of T-0 water will result in an acoustic increase of 1 dB to 3 dB with resulting potential life impact on avionics boxes, elevons, body flap, vertical stabilizer and a potential violation of NSTS 07700 Volume XIV, Space Shuttle System Payload Accommodations.

CAUSES OF EXCEEDING REDLINE:

- (8) Hardwire malfunction.
- (9) Circuit breaker malfunction.

LCC VIOLATION CALL: Sound Suppression Postlift-off Vent Valve Open | EMERG COND: Indication Anomaly | None

Table with 7 columns: MEAS. NO., MEASUREMENT DESCRIPTION, CAT., MINIMUM, MAXIMUM, UNITS, CODE. Rows include GWDXP55E, GWDXP56E, and GWDXP57E.

TIME PERIOD:

- (1) Verify Prior To Go For SSME Start (T-10 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) Post L/O vent valves are commanded ON by GLS at T-16 seconds.
(3) Complex Control Center (CCC) monitors comparable measurements.

REDLINE DERIVATION:

CRITICALITY:

- (4) 48" postlift-off sound suppression valves cannot be opened without venting close pressure through at least two valves, per Pad A testing.
(5) Loss of T-0 water will result in an acoustic increase of 1 db to 3 db with resulting potential life impact on avionics boxes, elevons, body flap, vertical stabilizer and a potential violation of Volume XIV, Payload Bay Design Environment.

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) 48" postlift-off sound suppression valves fail to open with possible damage to vehicle/payload.

CAUSES OF EXCEEDING REDLINE:

- (7) Component failure.

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: ARMS

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=====
LCC VIOLATION CALL:  Sound Suppression Prelift-off Valves Open | EMERG COND:
                    Indication Anomaly                       | None
=====

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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GWDXP70E	SS Preliftoff Vlv-LS V27 Op Ind	2	ON	NA	Event	DI
GWDXP72E	SS Preliftoff Vlv-LS V26 Op Ind	of	ON	NA	Event	DI
GWDXP74E	SS Preliftoff Vlv-LS V25 Op Ind	3	ON	NA	Event	DI

TIME PERIOD:

- (1) Verify Prior To Go For SSME Start (T-10 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) Prelift-off valves commanded on at T-16 seconds.
- (3) Complex Control Center (CCC) monitors comparable measurements.

REDLINE DERIVATION:

CRITICALITY:

- (4) Two valves open allows the Sound Suppression system to meet flow requirements.

CONSEQUENCES OF EXCEEDING REDLINE:

- (5) Possible damage to vehicle and payload.

CAUSES OF EXCEEDING REDLINE:

- (6) GN2 pressure below minimum required for valve actuation.
- (7) Failure of hydraulic portion of valve actuator.

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=====
SPACE SHUTTLE SYSTEMS HANDBOOK:  DWG NO          SHEET          ZONE
INTEGRATED SYSTEMS SCHEMATIC:   DWG NO          SHEET          ZONE
=====

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ELEMENT: GSE

SUBSYSTEM: ARMS

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LCC VIOLATION CALL:  ETVAS Lanyard PIC Voltage Anomaly      | EMERG COND:
                                                              | Yellow
=====

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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GMSV5603A	Sys A ETVAS Lanyard PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV7603A	Sys A ETVAS Lanyard PIC Cap Volts	2	35.7	NA	Volts	CI
GMSV6603A	Sys B ETVAS Lanyard PIC Cap Volts	1 of	35.7	NA	Volts	CI
GMSV8603A	Sys B ETVAS Lanyard PIC Cap Volts	2	35.7	NA	Volts	CI

TIME PERIOD:

- (1) From H2 Burn PIC Charge (T-50 seconds) to SRB Ignition (T-0)

REQUIREMENTS:

FIGURES/TABLES:

- (2) The PIC System must be up for launch with total functional redundancy mandatory.

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (3) Command to charge H2 Burn PIC issued at T-55 seconds. SRB Ignition Command from RSLs fires the ETVAS Lanyard.

REDLINE DERIVATION:

CRITICALITY:

- (4) The Avionics Integration Panel has determined this minimum value to be all time all fire minimum voltage.
- (5) The nominal value is approximately 38.3 volts.

CONSEQUENCES OF EXCEEDING REDLINE:

CAUSES OF EXCEEDING REDLINE:

- (6) PIC card failure.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> Vdc									
GMSV5603A	0.163	0	40.75						
GMSV7603A	0.163	0	40.75						
GMSV6603A	0.163	0	40.75						
GMSV8603A	0.163	0	40.75						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

=====

SPACE SHUTTLE SYSTEMS HANDBOOK:	DWG NO	SHEET	ZONE
INTEGRATED SYSTEMS SCHEMATIC:	DWG NO	SHEET	ZONE

=====

ELEMENT: GSE SUBSYSTEM: EPP

Orbiter/ET LH2 Disconnect Purge
(THIS REQUIREMENT HAS BEEN DELETED)

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LCC VIOLATION CALL: SRB Aft Skirt GN2 Purge Anomaly

EMERG COND:
None

MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GHYP8014A	Aft skirt purge GN2 press Pri	1 of	(2)	NA	psig	CI
GHYP8015A	Aft skirt purge GN2 press Sec	2	(2)	NA	psig	CI

TIME PERIOD:

- (1) From activation of SRB Aft Skirt Purge (approximately T-15 minutes) to Go for RSLs Start (T-31 seconds)

REQUIREMENTS:

FIGURES/TABLES:

- (2) Verify the purge has been at either 90 psig or greater for at least 7 consecutive minutes or 30 psig or greater for at least 10 consecutive minutes. Monitoring is not required after this criteria is satisfied.

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (3) The trickle purge hand valve is manually opened at the pad during S0007 pre-operations and remains open until post operations securing.
- (4) A126583 is the primary GN2 pressure transducer.
- (5) A506905 is the secondary GN2 pressure transducer.
- (6) Reference LCC SRM-07 and BTVC-15 for SRB Aft Skirt Purge associated requirements for SRB Aft Skirt thermal conditioning.

REDLINE DERIVATION:

CRITICALITY: 1R

- (7) a. SSID Intent Summary - The intent of this SSID is to ensure the SRB Aft Skirt oxygen content is less than four percent by volume (industry standard for inert environments) prior to HPU start. This will reduce the possibility of a fire in the SRB Aft Skirt due to external leakage of any Thrust Vector Control fluids or hydrogen gas intrusion. This inert environment is obtained by activation of the SRB Aft Skirt GN2 purge at approximately T-15 minutes per OMRS S00FM0.430 (File 2, Vol. 1) and by verifying per this SSID that minimum pressure and associated continuous purge duration time is met. This purge may be either a high flow rate (90 psig minimum pressure, 7 minutes minimum duration) purge or a low flow rate (30 psig minimum pressure, 10 minutes minimum duration) purge. The high flow rate purge is preferred. Either flow rate is controlled by a primary or secondary remotely operated valve. A GN2 trickle purge supplements the high or low flow purge at all times and if the high and low flow purge is lost after verification of LCC requirements the necessary inert environment is maintainable by the trickle purge for a minimum of 1 hour based on test data. The system is zero fault tolerant for a failed CLOSED A126575 Normally OPEN solenoid valve if the failure were to occur prior to verification of Requirement

=====

REDLINE DERIVATION: (Continued)

- (2) since a failure would result in loss of both high and low flow purges. Following verification of Requirement (2) the system is single fault tolerant for this same failure due to the ability of the trickle purge to continue to maintain the inert environment after loss of high and low purges (requires multiple failures).
- b. Voting Logic - Purge pressure output is monitored by two independent pressure transducers downstream of the purge control valves. If one transducer fails the remaining transducer will still provide adequate purge monitoring capability. Failure of both transducers, with one outside of expected range and LCC limits and one failure indicating within nominal pressure ranges and LCC limits, is not considered credible.
- c. Minimum and Maximum Redline Development - The minimum pressure of 30 psig is the minimum ICD pressure required to assure a low flow GN2 purge of 35 - 45 lb/min, and the minimum pressure of 90 psig is the minimum ICD pressure required to assure a high flow purge of 75 - 85 lb/min (reference ICD-2-0A002).
- d. Time Effectivity - The GN2 purge is activated at approximately T-15 minutes and will inert the aft skirt to less than 0.5% oxygen within 10 minutes. Once the 0.5% oxygen content has been achieved, the trickle purge will maintain the inert environment for up to a one hour duration which satisfies the intent of the LCC. The LCC ends at T-31 seconds to allow the maximum time to meet the purge requirements to inert the SRB aft skirt. A subsequent failure would not have an impact since the trickle purge is able to maintain the inert environment until HPU start at T-28 seconds and through the remainder of the launch countdown.
- e. Requirements - The pressure associated with the minimum consecutive minutes in high flow purge (7 minutes) or low flow purge (10 minutes) were developed from SRB Aft Skirt Purge Testing (Reference SRB test report 90ENR-0193) and reflect the time required to obtain a 0.5% oxygen environment (4% Oxygen and below is considered an inert/noncombustible atmosphere by industry standards) with a 1.4 time factor of safety included. Verification that the purge has been in effect long enough to obtain the no greater than 0.5% Oxygen environment in the aft skirt ensures that the GN2 trickle purge will maintain that environment below the maximum allowable Oxygen concentration of 4% for at least one hour if the high and low flow purges were subsequently lost.
- f. Preplanned Contingency Procedures - N/A

CONSEQUENCES OF EXCEEDING REDLINE:

- (8) Inability to achieve an inert aft skirt environment prior to HPU activation.
- (9) Reference Integrated Hazard Report ISPR-05
-

CAUSES OF EXCEEDING REDLINE:

- (10) Clogged filter.
- (11) Failure/loss of control capability of 2 of 2 high flow supply valves (A126576 and A126577) and 2 of 2 low flow supply valves (A126598 and A126599).
- (12) Uncommanded closure of main supply valve (A126575).
- (13) Loss of SRB Aft Skirt Purge panel 150 and 750 psig GN2 supply.

MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> psig									
GHYP8014A	1.2	0	300						
GHYP8015A	1.2	0	300						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
 INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: GSE SUBSYSTEM: BHYD

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LCC VIOLATION CALL: SRB Ignition Overpressure Water Bag Anomaly | EMERG COND: None

Table with 7 columns: MEAS. NO., MEASUREMENT DESCRIPTION, CAT., MINIMUM, MAXIMUM, UNITS, CODE. Contains two rows of measurement data for SRB water bag levels.

TIME PERIOD:

- (1) Verify minimum requirements at T-3 hours

REQUIREMENTS:

FIGURES/TABLES: 39-01

- (2) All 22 primary water bags must be full (5). (Ref. Figure 39-01.)
(3) All segments in each of the 40 secondary water bags must be full (5). The allowed exceptions are specified in Figure 39-01.

PREPLANNED CONTINGENCY PROCEDURE:

- (4) Refill water bags per (2) & (3) if the source of leakage can be determined and repaired.

NOTES:

- (5) Full water bag level is overflowing down to approximately 2 inches below the lowest point of the top of the liner.

REDLINE DERIVATION:

CRITICALITY:

- (6) To suppress the effect of the pressure pulse generated during the SRB ignition transient.

CONSEQUENCES OF EXCEEDING REDLINE:

- (7) The SRB ignition pressure pulse, without the minimum required suppression, exert transient forces on the orbiter wings and elevons which approach structural limits.

CAUSES OF EXCEEDING REDLINE:

- (8) Water bag leakage.

SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: Facility SUBSYSTEM: GSE

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LCC VIOLATION CALL: Surface Wind Limits

EMERG COND:
None

MEAS. NO.	MEASUREMENT DESCRIPTION		CAT.	MINIMUM	MAXIMUM	UNITS	CODE
	WIND DIRECTION						
NA	000-062	DEGREES		NA	23	Knots	CI
NA	063-064	DEGREES		NA	24	Knots	CI
NA	065-067	DEGREES		NA	25	Knots	CI
NA	068-069	DEGREES		NA	26	Knots	CI
NA	070-071	DEGREES		NA	27	Knots	CI
NA	072-073	DEGREES		NA	28	Knots	CI
NA	074	DEGREES		NA	29	Knots	CI
NA	075-076	DEGREES		NA	30	Knots	CI
NA	077	DEGREES		NA	31	Knots	CI
NA	078	DEGREES		NA	32	Knots	CI
NA	079	DEGREES		NA	33	Knots	CI
NA	080-100	DEGREES		NA	34	Knots	CI
NA	101-110	DEGREES		NA	31	Knots	CI
NA	111-120	DEGREES		NA	30	Knots	CI
NA	121-134	DEGREES		NA	29	Knots	CI
NA	135-140	DEGREES		NA	28	Knots	CI
NA	141-152	DEGREES		NA	27	Knots	CI
NA	153-157	DEGREES		NA	26	Knots	CI
NA	158-163	DEGREES		NA	25	Knots	CI
NA	164-196	DEGREES		NA	24	Knots	CI
NA	197-202	DEGREES		NA	25	Knots	CI
NA	203-223	DEGREES		NA	26	Knots	CI
NA	224-229	DEGREES		NA	27	Knots	CI
NA	230-233	DEGREES		NA	28	Knots	CI
NA	234-236	DEGREES		NA	29	Knots	CI
NA	237-239	DEGREES		NA	30	Knots	CI
NA	240-241	DEGREES		NA	31	Knots	CI
NA	242-244	DEGREES		NA	32	Knots	CI
NA	245-340	DEGREES		NA	34	Knots	CI
NA	341	DEGREES		NA	33	Knots	CI
NA	342	DEGREES		NA	32	Knots	CI
NA	343	DEGREES		NA	31	Knots	CI
NA	344-345	DEGREES		NA	30	Knots	CI
NA	346	DEGREES		NA	29	Knots	CI
NA	347-348	DEGREES		NA	28	Knots	CI
NA	349-350	DEGREES		NA	27	Knots	CI
NA	351-352	DEGREES		NA	26	Knots	CI
NA	353-355	DEGREES		NA	25	Knots	CI
NA	356-357	DEGREES		NA	24	Knots	CI
NA	358-359	DEGREES		NA	23	Knots	CI

TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go for APU Start (T-5 minutes)

REQUIREMENTS:

FIGURES/TABLES: Tables GSE-24.01, .02, .03

- (2) During the hold at T-9 minutes, the Launch Weather Officer will provide the forecasted winds for the active launch pad through T-0. If the forecast violates any maximum redline in the Measurement/Requirement Table above, then LCC violation confirmed, No Go for launch.
- (3) If real time events cause the Launch Weather Officer to revise the forecasted winds after T-9 minutes but prior to T-5 minutes, and the revised forecast violates any maximum redline in the Measurement/Requirement Table above, then LCC violation confirmed, No Go for launch.

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (4) The wind limits in the Measurement/Requirement Table contain the wind speed/direction limits not to be exceeded at time of launch. The table was created by using the limiting wind speed/direction from RSRM Case Buckle Load, ET Vent Line VJ Pipe and Pivot Shaft Safety Factors and ET Vent Umbilical to Structure and to Vehicle Clearances. These limits are shown in Table GSE-24.01, GSE-24.02 and GSE-24.03.
- (5) Forecasts are formulated using all available meteorological sensors and assets available to the Launch Weather Officer. Wind tower sensors at pads A and B (camera sites 3 and 6) are selectively used such that the data represents the most consistent wind velocity effect on the Space Shuttle Vehicle (SSV).
- (6) Real time wind information for both pads A and B is available on Operational Television (OTV) Channel 189 (this channel monitors the Cape Weather display for pad winds).
- (7) Real time wind information for the active pad only is available via Launch Processing System (LPS). Measurement Stimulus Identification (MSIDs) KMTLn001A and KMTLn002A represent wind speeds at pad camera sites 6 and 3 respectively, MSIDs KMTHn001A and KMTHn002A represent wind directions at pad camera sites 6 and 3 respectively. The LPS Test Configuration Identifier Document (TCID) patch determines which MSIDs are available ("n" may be either "A" or "D").

REDLINE DERIVATION:

CRITICALITY:

- (8) a. SSID Intent Summary - This SSID provides wind speed vs. directional limits in order to protect both vehicle flight hardware, and Pad Fixed Service Structure hardware. Specifically, the Case Buckle Load Wind Limits (Ref. Table GSE-24.01) ensure that wind speeds coupled with SSV on pad motion induced by SSME ignition do not reduce the factor of safety for RSRM case buckling to below 1.4. Meeting this requirement envelopes all vehicle hardware. The ET Vent Line Vacuum Jacket (VJ) Pipe and Pivot Shaft Wind Limits (Ref. Table GSE-24.02) and the ET Vent Line Umbilical Structure and Vehicle Clearance Wind Limits (Ref. Table GSE-24.03) ensure, at umbilical separation, that wind speeds coupled with SSV on pad motion induced by SSME ignition at umbilical separation do not cause the ETVAS capture envelope to be exceeded during umbilical

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REDLINE DERIVATION: (Continued)

retraction, leading to possible generation of uncontained debris. Additionally, the ETVAS VJ pipe pivot shaft and pivot plate Factor of Safety for material yield are maintained at Program approved values. This SSID also ensures that ETVAS to left hand RSRM clearances satisfy program liftoff certification clearance requirements during static lanyard release mode.

- b. Voting Logic - N/A
- c. Minimum and Maximum Redline Development - This SSID provides limits that protect flight hardware and ground support hardware from hazardous failures due to wind loading effects at T-0. The maximum winds limits referenced in this SSID are for peak winds at elevation per NSTS 07700 Vol. X Book 2 - Design Peak Winds 4.1.2.1.1. The peak ground wind speed is referenced to the 18.3m level (60 feet above natural grade) and corrected for winds at the ETVAS 195 foot elevation. The Case Buckle Load Wind Limits are based on NSTS 07700, Vol. X Book 2, Appendix 10.10 and NSTS 07700, Vol. X, Book 1, paragraph 3.2.2.1.5.2.e, that provides exceptions to the NSTS 07700 Vol. X, Book 2 requirements in order to maintain an RSRM factor of safety of 1.4 for case buckling due to the block II SSME upgrade. The ETVAS Retract Load Wind Limits are based on actual test data and ADAMS software modeling. The limits ensure that potential wind loads applied to the ETVAS during retraction can not exceed the system's capability to retract the umbilical without structural contact, will not cause VJ pipe, pivot shaft and pivot plate factors of safety on yield to be exceeded, and will ensure clearances between flight hardware and ground support hardware are maintained. The wind limits for RSRM Case Buckle, ET Vent Arm Assembly Retract and Vehicle Clearance of ET Vent Arm Assembly can be found in Tables GSE-24.01, GSE-24.02 and GSE-24.03 respectively.
- d. Time Period - The starting time period selected ensures monitoring of wind speed and direction from the beginning of ET Cryo Tanking at T-6 hours by the Launch Weather Officer. The ending time period ensures that the wind speed and direction forecast through T-0, that is presented to the launch team during the T-9 minute hold, remains valid through T-5 minutes and counting. T-5 minutes is an acceptable ending effectivity because holding at T-5 minutes represents the last time that the Launch Director will ever have a forecasted wind discussion with the Launch Weather Officer. After T-5 minutes there is no longer the capability for the Launch Weather Officer to forecast the pad winds as the wind evaluation from that point until T-0 becomes real time.
- e. Requirements - The requirements in this SSID ensure that the Launch Weather Officer and the Launch Director communicate the forecasted winds for the active launch pad at the appropriate times during the last portion of the launch countdown to protect flight and ground hardware from damage. Requirement (2) ensures that the forecasted wind report at T-9 minutes provides the Launch Director with the information required to commit the launch team to count down past T-9 minutes. Requirement (3) provides the Launch Weather Officer the last possible

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REDLINE DERIVATION: (Continued)

opportunity to revise the forecasted winds for the active launch pad.

f. Preplanned Contingency Procedure - N/A

CONSEQUENCES OF EXCEEDING REDLINE:

- (9) SSV on pad motion induced by SSME ignition and wind forces will exert loads on the SSV that will exceed design certification and approach structural limits of RSRM.
- (10) SSV on pad motion induced by SSME ignition and wind loads on the ETVAS would cause capture mechanism envelope to be exceeded. This failure could result in hard impact during ETVAS retraction leading to generation of debris which could impact the vehicle during launch.
- (11) SSV on pad motion induced by SSME ignition and wind loads on the ETVAS would cause unacceptable loads to be transferred into the VJ pipe, pivot shaft and pivot plate reducing the factor of safety on yield below Program agreed to limits.
- (12) SSV ascent profile and wind loads on the ETVAS could cause contact between the ETVAS and the left SRB during static lanyard release mode. This failure could result in debris generation and a catastrophic failure of the left SRB.
- (13) Reference: Integrated Hazard Reports INEV-01 and IVLD-01

CAUSES OF EXCEEDING REDLINE:

- (14) Greater than allowable ground wind environment.

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MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
n = 1 AND 2 FOR CAMERA SITE 6 AND 3 RESPECTIVELY									
	UNITS-->								
KMTLA00nA	0.24	0.00	60.0						
	UNITS-->								
KMTHA00nA	2.16	0.00	540.0						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE

ELEMENT: Launch and Landing SUBSYSTEM: GSE

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Wind Direction		Minimum	Maximum	Units
000-100	Degrees	NA	34	Knots
101-110	Degrees	NA	31	Knots
111-120	Degrees	NA	30	Knots
121-134	Degrees	NA	29	Knots
135-140	Degrees	NA	28	Knots
141-152	Degrees	NA	27	Knots
153-157	Degrees	NA	26	Knots
158-163	Degrees	NA	25	Knots
164-196	Degrees	NA	24	Knots
197-202	Degrees	NA	25	Knots
203-207	Degrees	NA	26	Knots
208-211	Degrees	NA	27	Knots
212-214	Degrees	NA	28	Knots
215-216	Degrees	NA	29	Knots
217-219	Degrees	NA	30	Knots
220-221	Degrees	NA	31	Knots
222-223	Degrees	NA	32	Knots
224-225	Degrees	NA	33	Knots
226-000	Degrees	NA	34	Knots

Table GSE-24.01 – Wind Limits for RSRM Case Buckle

Wind Direction		Minimum	Maximum	Units
000-062	Degrees	NA	23	Knots
063-064	Degrees	NA	24	Knots
065-067	Degrees	NA	25	Knots
068-069	Degrees	NA	26	Knots
070-071	Degrees	NA	27	Knots
072-073	Degrees	NA	28	Knots
074	Degrees	NA	29	Knots
075-076	Degrees	NA	30	Knots
077	Degrees	NA	31	Knots
078	Degrees	NA	32	Knots
079	Degrees	NA	33	Knots
080-179	Degrees	NA	34	Knots
180-181	Degrees	NA	33	Knots
182-183	Degrees	NA	32	Knots
184-187	Degrees	NA	31	Knots
188-190	Degrees	NA	30	Knots
191-196	Degrees	NA	29	Knots
197-223	Degrees	NA	28	Knots
224-229	Degrees	NA	29	Knots
230-232	Degrees	NA	30	Knots
233-236	Degrees	NA	31	Knots
237-238	Degrees	NA	32	Knots
239-240	Degrees	NA	33	Knots
241-340	Degrees	NA	34	Knots
341	Degrees	NA	33	Knots
342	Degrees	NA	32	Knots
343	Degrees	NA	31	Knots
344-345	Degrees	NA	30	Knots
346	Degrees	NA	29	Knots
347-348	Degrees	NA	28	Knots
349-350	Degrees	NA	27	Knots
351-352	Degrees	NA	26	Knots
353-355	Degrees	NA	25	Knots
356-357	Degrees	NA	24	Knots
358-359	Degrees	NA	23	Knots

Table GSE-24.02 – Wind Limits for ET Vent Arm Assembly Retract

Wind Direction		Minimum	Maximum	Units
000-002	Degrees	NA	28	Knots
003-006	Degrees	NA	27	Knots
007-010	Degrees	NA	26	Knots
011-016	Degrees	NA	25	Knots
017-043	Degrees	NA	24	Knots
044-049	Degrees	NA	25	Knots
050-053	Degrees	NA	26	Knots
054-057	Degrees	NA	27	Knots
058-060	Degrees	NA	28	Knots
061-062	Degrees	NA	29	Knots
063-064	Degrees	NA	30	Knots
065-066	Degrees	NA	31	Knots
067-068	Degrees	NA	32	Knots
069-070	Degrees	NA	33	Knots
071-175	Degrees	NA	34	Knots
176-178	Degrees	NA	32	Knots
179-180	Degrees	NA	31	Knots
181-183	Degrees	NA	30	Knots
184-186	Degrees	NA	29	Knots
187-190	Degrees	NA	28	Knots
191-196	Degrees	NA	27	Knots
197-223	Degrees	NA	26	Knots
224-229	Degrees	NA	27	Knots
230-233	Degrees	NA	28	Knots
234-236	Degrees	NA	29	Knots
237-239	Degrees	NA	30	Knots
240-241	Degrees	NA	31	Knots
242-244	Degrees	NA	32	Knots
245-349	Degrees	NA	34	Knots
350-351	Degrees	NA	33	Knots
352-353	Degrees	NA	32	Knots
354-355	Degrees	NA	31	Knots
356-357	Degrees	NA	30	Knots
358-359	Degrees	NA	29	Knots

Table GSE-24.03 – Wind Limits for Vehicle Clearance of ET Vent Arm Assembly

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LCC VIOLATION CALL: Launch Release PIC Fire 1 Anomaly | EMERG COND: Yellow (6)

Table with 7 columns: MEAS. NO., MEASUREMENT DESCRIPTION, CAT., MINIMUM, MAXIMUM, UNITS, CODE. Rows include measurements like GMSX1003E, GMSX2003E, etc.

TIME PERIOD:

- (1) From System activation (T-4 Hours) to Go for SSME Start (T-10 seconds)

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (2) The ETVAS Lanyard circuits are armed at T-55 seconds...
(3) For any premature Fire 1 indication ON, a MEC Preflight and OPS Bite will be performed...

REDLINE DERIVATION:

CRITICALITY: 1R

- (4) An erroneous F1 output will reduce redundancy protection. This will apply a Fire 1 signal to the associated PICs...
(5) Prevention of a premature pyrotechnic ignition which may result in loss of flight vehicle and crew.

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CONSEQUENCES OF EXCEEDING REDLINE:

- (6) Yellow condition exists with a premature FIRE 1 indication ON prior to PIC arming which reduces safety margin. After PIC arming the possibility for a premature NASA Standard Initiator (NSI) Firing could result in:
A) An early/partial release of the Holddown Post system resulting in the loss of the Shuttle vehicle and crew.
B) An early/partial release of the Tail Service Mast system resulting in the loss of all command and monitor functions.
C) An early/partial release of the External Tank Vent Arm System resulting in the loss of the ET control and monitor functions.
D) An early/partial release of the ETVAS Lanyard system resulting in separation of the ET Ground Umbilical Carrier Plate (GUCP).

CAUSES OF EXCEEDING REDLINE:

- (7) PIC Rack component failure.
MEC failure.

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE
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ELEMENT: GSE SUBSYSTEM: EPD
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LCC VIOLATION CALL:  Photo Optical Control System Anomaly      | EMERG COND:
                                                                | None
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MEAS. NO. | MEASUREMENT DESCRIPTION | CAT. | MINIMUM | MAXIMUM | UNITS | CODE
-----|-----|-----|-----|-----|-----|-----
N/A      | Photo Optical Control System |      | (2)     | N/A     | N/A   | CI
=====

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TIME PERIOD:

- (1) From Start of ET Cryo Tanking (T-6 hours) to Go for GLS Start (T-9 minutes).

REQUIREMENTS:

FIGURES/TABLES:

- (2) Complete loss of Photo Optical Control System (POCS) capability to issue the camera START command to the fixed high speed cameras at the active pad is unacceptable (i.e., all of the fixed high speed cameras will fail to start due to the POCS failure).

PREPLANNED CONTINGENCY PROCEDURE:

NOTES:

- (3) POCS functional health with respect to its ability to issue the camera START command to the suite of fixed high speed ground cameras at the active pad is a complex task and requires expert interpretation of POCS performance and functional anomalies.

REDLINE DERIVATION:

CRITICALITY: 3

- (4) a. SSID Intent Summary - This SSID ensures that failures of the POCS or supporting systems that result in total inability of POCS to issue the fixed high speed camera START commands for the active pad will result in an LCC violation and constrain launch. This requirement is intended solely to protect for POCS failures that would prevent recording of launch/ascent imagery from the entire suite of fixed high speed cameras at the active pad.
- b. Voting Logic - N/A.
- c. Redline Development - This requirement ensures monitoring of the POCS for any failure that will result in total loss of the ability to issue the camera START command to the fixed high speed cameras.
- d. Time Period - The POCS system is configured and stable prior to T-6 hrs and per LCC guidelines is committed to launch at T-9 minutes. Violations after T-9 minutes and counting will be reported but will not constrain launch.
- e. Requirements - See Redline Development above.
- f. Preplanned Contingency Procedures - N/A.

=====
CONSEQUENCES OF EXCEEDING REDLINE:

- (5) Inability of the POCS to issue the START command for fixed high speed camera for the active pad, would result in a total loss of fixed high speed ground based launch and ascent imagery. Loss of this imagery would not impact current flight safety since the Orbiter de-orbit and entry decision is not based on ground based launch or ascent imagery. However, violation does increase the risk of undetected performance or configuration anomalies that may affect safety of flight for subsequent missions. A secondary effect of this violation is that, in an emergency, the ability of the NASA Test Director (NTD) to initiate the subset of these cameras that are designated as emergency cameras, used to document emergencies at the pad, will be lost.

CAUSES OF EXCEEDING REDLINE:

- (6) Processing Control Center (PCC) Facility Power failure combined with Uninterruptible Power Supply (UPS) failure.
(7) Multiple POCS equipment failures.

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SPACE SHUTTLE SYSTEMS HANDBOOK: DWG NO SHEET ZONE
INTEGRATED SYSTEMS SCHEMATIC: DWG NO SHEET ZONE
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ELEMENT: LL SUBSYSTEM: GSE
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LCC VIOLATION CALL: GOX Vent Hood Purge Termination Anomaly | EMERG COND: None

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MEAS. NO.	MEASUREMENT DESCRIPTION	CAT.	MINIMUM	MAXIMUM	UNITS	CODE
GSAP9101A	A140347 NE Seal Press	2	NA	0.296	psig	DI
GSAP9111A	A140348 SW Seal Press	of	NA	0.296	psig	DI
GSAP9091A	A135915 Plenum Press	3	NA	0.296	psig	DI
OR						
GSAP9106A	A140347 NE Seal Press	2	NA	0.296	psig	DI
GSAP9116A	A140348 SW Seal Press	of	NA	0.296	psig	DI
GSAP9096A	A135915 Plenum Press	3	NA	0.296	psig	DI

TIME PERIOD:

- (1) Verify prior to GOX Vent Hood lift (approx T-2 minutes 30 seconds).

REQUIREMENTS:

FIGURES/TABLES:

PREPLANNED CONTINGENCY PROCEDURE:

- (2) Using either LPS indications of zero pressure at both GN2 regulators (A135910 (GSAP9071A & GSAP9076A) and A135911 (GSAP9081A & GSAP9086A)) or Operational Television (OTV) verification of visible slack seals, is an acceptable indication of GN2 flow termination. Upon verification of purge termination, the GOX Vent Hood will be lifted and the GOX Vent Arm retracted by Launch Processing System (LPS) commands per OMI S0007.500 and OMI G2158. LCC violation cleared, continue countdown.
- (3) If purge has not terminated, further termination attempts may be performed with LPS commands per OMI S0007.500 and OMI G2158. Upon verification of purge termination, the GOX Vent Hood will be lifted and the GOX Vent Arm retracted by LPS commands per OMI S0007.500 and OMI G2158. LCC violation cleared, continue countdown.

NOTES:

- (4) The two seal pressure transducers A347 and A348 directly indicate GN2 purge pressure within the GOX Vent Seals. Pressure transducer A915 indicates GN2 purge pressure within the plenum which directly feeds the seals and is a direct representation of seal pressures.

REDLINE DERIVATION:

CRITICALITY: 1

- (5) a. SSID Intent Summary - The purpose of this requirement is to ensure that the GOX Vent GN2 purge pressures have dropped sufficiently to cause no damage to the ET TPS during GOX Vent Hood raising. The output of each transducer is split into two function designator indications using independent Hardware Interface Modules (HIMs) and LPS paths.
- b. Voting Logic - Two of three measurements required to verify GOX Vent

=====
REDLINE DERIVATION: (Continued)

Purge termination.

- c. Minimum and Maximum Redline Development - The maximum redline requirement of 0.296 psig is derived from seal pressure operational requirements of 0.3 to 0.5 psig (8.3 to 13.8 inches of water). Pressures below this operational requirement have been verified to not cause any ET Thermal Protection System (TPS) damage that is an ascent debris concern for any element. There is not a minimum redline requirement for this measurement.
- d. Time Period - This is a one-time verification prior to raising the GOX Vent Hood. Failure of this verification will result in not raising the GVA Hood and a hold at T-31 seconds.
- e. Requirements - NA
- f. Preplanned Contingency Procedures - LPS verification of alternate pressure measurements or visual observation using OTV cameras can be used to determine if the GOX Vent Seal purge pressures have been terminated. LPS commands can be initiated to close alternate control valves and terminate purge. Indications of zero pressure or visibly slack seals are acceptable indications of purge termination.

CONSEQUENCES OF EXCEEDING REDLINE:

- (6) Inability to terminate purge will result in not raising the GOX Vent Hood or retracting the GOX Vent Arm.

CAUSES OF EXCEEDING REDLINE:

- (7) Failure of GN2 control valves to cycle closed.
- (8) Instrumentation failure.

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MEASUREMENT INFORMATION TABLE:

MSID	BIT VALUE	PCM RANGE		HW C&W		BACKUP C&W		BFS SM	
		LOW	HIGH	MIN	MAX	MIN	MAX	MIN	MAX
UNITS--> psig									
GSAP9101A	0.004	0	1						
GSAP9106A	0.004	0	1						
GSAP9111A	0.004	0	1						
GSAP9116A	0.004	0	1						
GSAP9091A	0.008	0	2						
GSAP9096A	0.008	0	2						

METER/DISPLAY RANGE - MSID: NA LOW: HIGH:
=====

NSTS 16007

LAUNCH COMMIT CRITERIA AND BACKGROUND

SSID: GSE-27

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SPACE SHUTTLE SYSTEMS HANDBOOK:	DWG NO	SHEET	ZONE
INTEGRATED SYSTEMS SCHEMATIC:	DWG NO	SHEET	ZONE

ELEMENT: GSE

SUBSYSTEM: LACC

MISSION: 114-999
AUTH: S072380EE

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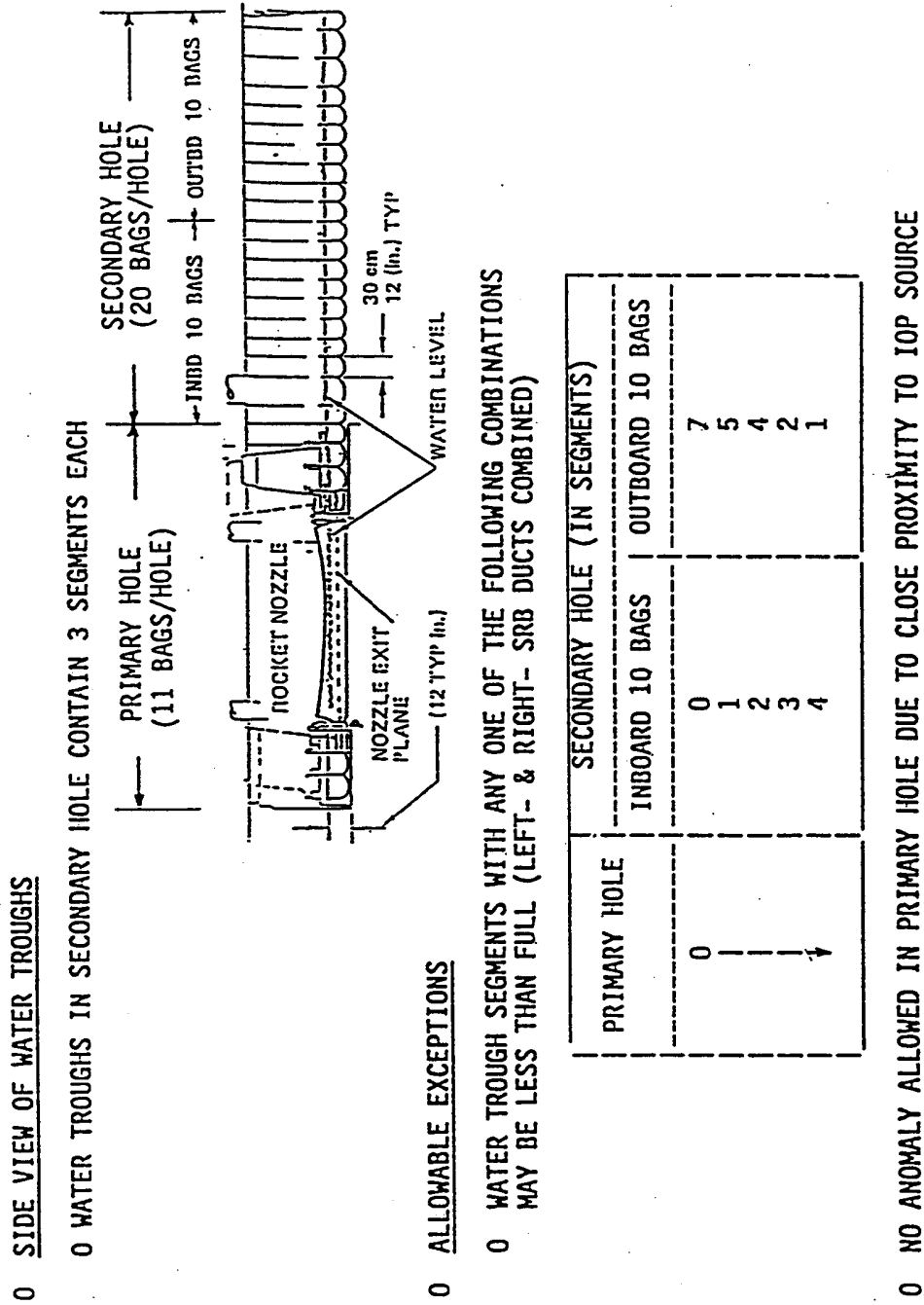


Figure 39-01 SRB Ignition Overpressure Water Bag System

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LH2 ORB/ET DISCONNECT CAVITY PURGE PRESSURE ANOMALY

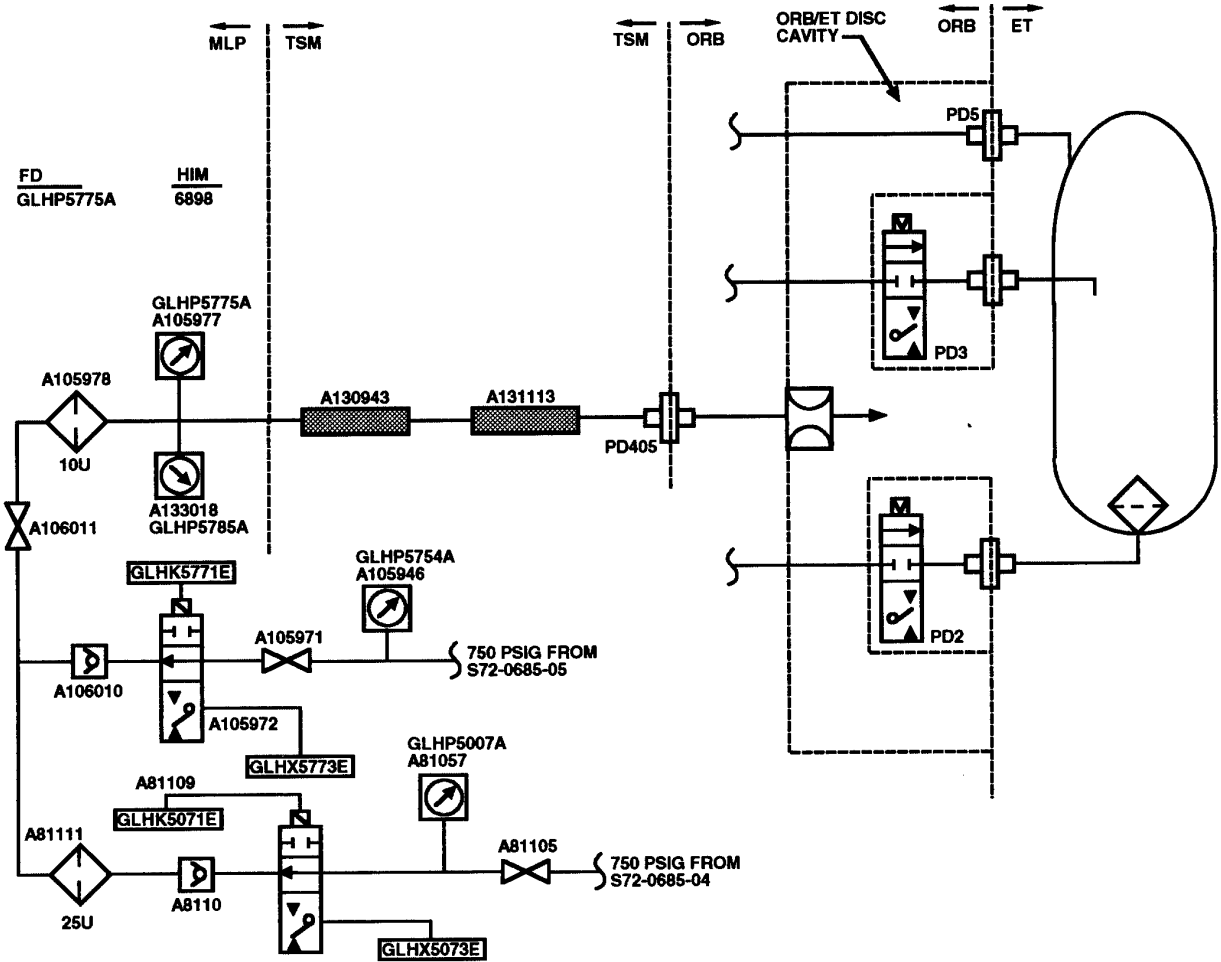


Figure 39-02 LH2 Orbiter/ET Disconnect Cavity Purge Pressure

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Maximum Allowable Surface Wind Vectors

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