

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

September 22, 2021

Attachment 4 –No. 2 Engine (P36235C) Fuel Control Test Report

POWERPLANTS

CEN20LA215

Customer: AlliedSignal Engines, ASE PSC No. 897780

W.G.Co. SALES ORDER _____

Date 07-27-2021

BY [REDACTED]

Prod. Order _____

W.G.Co. S/N 1709638

CASE# _____

Test Stand No. 184

Test Condition except where noted:

Ambient pressure - 14.7 psia

Ambient temperature - 59 deg. F

NOTE: INPUT SETTINGS AND GAGE ACCURACIES.

Unless otherwise specified, use these tolerances when setting the following parameters:

Pt2 = ± 0.2 PSIA

Approach all inlet pressure settings from a lower pressure setting.

Tt2 = ± 2 Deg.
or .001 Mic. setting

Approach all inlet temperature settings from a higher temperature setting. (USE WT-118820)

Ps3 = ± 0.2 PSIA

Approach all compressor pressure setting from a lower pressure setting except when checking decel schedules.

PL = ± 0.5 Deg.

Approach all power lever angular settings from a lower setting.

Speed Setting Tolerance = ± 10 RPM

Underspeed Governor Lever (USG) Tolerance = ± 0.5 Deg.

PN = Fuel Discharge Pressure

GAGE ACCURACIES

Definition	Instrument Accuracy	Set Point Accuracy
Control Speed	± 5 RPM	± 5 RPM
Metered Flow(PPH)	$\pm 1\%$ of point	$\pm 1\%$ of point
Inlet Pressure(PSIG)	$\pm 5\%$ or 7.5 PSIG Whichever is greater	$\pm 5\%$ or 7.5 PSIG Whichever is greater
Differential Pressure(PSID)	± 0.5 PSID	± 0.5 PSID
Air Pressure(Pt2 and PS3)	± 0.25 PSIA	± 0.25 PSIA
Temperature	± 2 Deg. F.	± 2 Deg. F.
Pressure Gages	± 0.25 PSIA	± 0.25 PSIA

1.0 STANDARD ACCELERATION SCHEDULE

Sea level start flow checking procedure: (Test pt. 1.2 only). Start flows to be accomplished in the following sequence:

CAUTION: At no time in this calibration procedure is P12 to be set above Ps3.

- Preset speed, T12. Underspeed governor lever, power lever as specified on data sheet.
- Set Ps3 at 20 psia minimum.
- Set P12 from a low pressure to the required set point without overshoot.
- Reset Ps3 to 15 psia without undershoot.
- Read start fuel flow.

HOLD CONSTANT: T12 = 59 deg. F. P12 = 14.7 psia											
TEST POINT	INLET FLOW PPH REF.	REQ'D LEVER POSITIONS DEGREES		INPUT SPEED RPM	Ps3 PSIA	Pn PSIG REF.	PPH		PPH	Hysteresis	
		USG	PL				SPEC'D	RECORD INC/PS3 RECORD	RECORD DEC/PS3 RECORD		
1.1	450	Min	0	1000	15	150	80±2	52	—	—	—
1.2	450	Max	0	1000	15	150	80±2	52	—	—	—
1.3	1000	Max	0	1800	30	210	96±6	98	—	—	—
1.4	1400	Max	0	3000	50	245	232±9	237	—	—	—
1.5	1750	Max	0	3600	70	270	305±12	316	—	—	—
1.6	1950	Max	0	4000	90	300	352±14	360	362	5	
1.7	1950	Max	0	4000	120	370	443±16	437.6	443.6	10	
1.8	1950	Max	0	4000	135	490	528±21	519.6	—	—	—

Remarks: ** Hysteresis shall be from a low PS3 to a high, then decrease PS3. Record at decrease then subtract to achieve hysteresis point.

2.0 15,000 FOOT ACCEL SCHEDULE

HOLD CONSTANT: T12 = 59 deg. F. P12 = 8.8 psia								
TEST POINT	INLET FLOW PPH REF.	REQ'D LEVER POSITIONS DEGREES		INPUT SPEED RPM	Ps3 PSIA	Pn PSIG REF.	PPH	
		USG	PL				SPEC'D	RECORD
2.1	450	Min	0	1000	8.8	150	57 ±5	
2.2	1400	Max	0	3100	30	210	139 ±6	
2.3	1950	Max	0	4000	60	250	227 ±9	
2.4	1950	Max	0	4000	75	275	284 ±12	
2.5	1950	Max	Max	4000	90	310	383 ±15	

3.0 35,000 FOOT ACCEL SCHEDULE

HOLD CONSTANT: T12 = 59 deg. F. P12 = 3.5 psia								
TEST POINT	INLET FLOW PPH REF.	REQ'D LEVER POSITIONS DEGREES		INPUT SPEED RPM	Ps3 PSIA	Pn PSIG REF.	PPH	
		USG	PL				SPEC'D	RECORD
3.1	1950	Max	0	4000	25	200	92 ±4	
3.2	1950	Max	0	4000	35	220	147 ±6	

4.0 HOT DAY ACCEL SCHEDULE

HOLD CONSTANT: T12 = 103 deg. F. P12 = 14.7 psia								
TEST POINT	INLET FLOW PPH REF.	REQ'D LEVER POSITIONS DEGREES		INPUT SPEED RPM	Ps3 PSIA	Pn PSIG REF.	PPH	
		USG	PL				SPEC'D	RECORD
4.1	450	Min	0	1000	15	155	62 ±6	63
4.2	1600	Max	0	3400	50	250	242 ±10	237
4.3	1950	Max	0	4000	90	305	367 ±14	374
4.4	1950	Max	0	4000	130	495	521 ±21	512

5.0 COLD DAY ACCEL SCHEDULE

HOLD CONSTANT: T12 = -60 deg. F. P12 = 14.7 psia								
TEST POINT	INLET FLOW PPH REF.	REQ'D LEVER POSITIONS DEGREES		INPUT SPEED RPM	Ps3 PSIA	Pn PSIG REF.	PPH	
		USG	PL				SPEC'D	RECORD
5.1	450	Min	0	1000	15	135	58 ±6	54
5.2	1400	Max	0	3000	50	240	204 ±8	216
5.3	1850	Max	0	3800	90	290	309 ±12	324
5.4	1950	Max	0	4000	135	400	464 ±19	486
5.5	1950	Max	0	4000	145	500	529 ±21	545

6.0 UNDERSPEED GOVERNOR 73.0% SPEED

HOLD CONSTANT: PL = 0 deg. T12 = 59 deg.F P12 = 14.7 PSIA							
TEST POINT	USG LEVER POSITIONS DEGREES	INPUT SPEED ±5 RPM	INLET FLOW REF.	Ps3 PSIA	Pn PSIG REF.	PPH	
						SPECIFIED	RECORD
6.1	11.50 ± 2.50 18	3210 Min	1300	50	225	215 Min	240
6.2	11.50 ± 2.50 18	3311	1300	50	225	118 ±5	238
6.3	11.50 ± 2.50 18	3333	1300	50	225	(1) 6.2-6.3	238
6.4	11.50 ± 2.50 18	3311	1300	50	225	118 (2)	238

NOTE: (1) A minimum of 5 PPH less than the fuel flow at DATA POINT 6.2.
(2) Subtract 6.2-6.4 must be within 10 pph.

3592

7.0 UNDERSPEED GOVERNOR 95.5% SPEED

HOLD CONSTANT: PL = 0 deg. T12 = 59 deg.F P12 = 14.7 PSIA							
TEST POINT	USG LEVER POSITIONS DEGREES	INPUT SPEED ± 5 RPM	INLET FLOW REF.	Ps3 PSIA	Pn PSIG REF.	PPH	
						SPECIFIED	RECORD
7.1	42 39.00 $\pm .75$	4232	2050	132	350	376 Min	519
7.2	42 39.00 $\pm .75$	4332	2150	120	320	194 ± 5	428
7.3	42 39.00 $\pm .75$	4420	2150	120	320	(3) 7.2-7.3	237
7.4	42 39.00 $\pm .75$	4332	2150	120	320	194 (4)	423
7.5	14 ± 1	3400(5)	1500	63	240	120 ± 3	282

- Note: (3) A minimum of 5 pph less than the fuel flow at 7.2.
(4) Subtract 7.2-7.4 must be within 10 pph.
(5) Set speed and fuel flow. Record speed lever angle. Req. 14 ± 1 deg.

8.0 OVERSPEED GOVERNOR

HOLD CONSTANT: T12=59 deg.F PL=max. P12=14.7 psia							
TEST POINT	USG LEVER POSITIONS DEGREES	INPUT SPEED ± 5 RPM	INLET FLOW REF.	Ps3 PSIA	Pn PSIG REF.	PPH	
						SPECIFIED	RECORD
8.1	Max.	4536	2300	155	580	—	581.5
8.2	Max.	4581	2350	155	560	* 8.1-8.2	474.574
8.3	Max.	4740	2400	155	360	248 ± 10	300
8.4	Max.	4824	2500	155	310	105 ± 5	177
8.5	Max.	4740	2400	155	360	** 248 ± 10	293

- Notes: * Record 8.1-8.2, shall be no more than 12 PPH max.
** Subtract 8.3-8.5 must be within 10 pph

9.0 DECEL SCHEDULE

HOLD CONSTANT: T12 = 59 deg.F. Inlet flow = 2300 REF. Speed = 4536. PL = 0. USG = Min.					
TEST POINT	P12 PSIA	Ps3 PSIA	Pn PSIG REF.	PPH	
				SPECIFIED	RECORD
9.1	14.7	135	325	166 ± 7	183
9.2	14.7	76	250	85 ± 7	106
9.3	14.7	44	215	68 ± 7	99

10.0 POWER LEVER SCHEDULE - T12 Correction

HOLD CONSTANT: P12 = 14.7 Psia. Inlet flow = 2300 PPH REF. Speed = 4536 rpm. USG = Max. NOTE: Approach all PL settings from a lower setting.										
TEST POINT	PL Deg.	T12 REF. Deg.F	WT- 118820 ±.001	Ps3 PSIA	Pn REF. PSIG	PPH				
						SPEC'D	(1) RECORD	(2) RECORD	Hysteresis	
									SPEC'D	REC'D (1-2)
10.1 **	101	103	.823	170	430	455 ±10	563	—	—	—
10.2	101	59	.800	170	530	535 ±10	579	—	18	—
10.3 **	101	38	.788	180	595	573 ±10	579	—	—	—
10.4	40	103	.823	90	265	193 ±5	174	—	—	—
10.5	40	59	.800	90	265	214 ±5	189	—	5	—
10.6	40	-60	.735	90	280	271 ±10	223	—	—	—

NOTE: Hysteresis shall be from a high T12 (column 1) to a low, then increase T12 (column 2). Subtract column 1 from column 2 to achieve hysteresis point.

** Fuel FLOW between T.P. 10.1 & 10.3 to be 118 PPH ± 8 PPH

Record _____

11.0 POWER LEVER SCHEDULE - T12 CORRECTION - 15,000 ft.

HOLD CONSTANT: P12=8.8 PSIA Inlet Flow=2300 PPH REF. Speed 4536 RPM USG=Max. NOTE: Approach all PL settings from a lower lever setting.									
TEST POINT	PL POSITION Deg.	T12 REF. Deg.F	WT- 118820 ±.001	Ps3 PSIA	Pn REF. PSIG	Fuel Flow = PPH			
						SPEC'D	RECORD	Delta SPEC'D	Delta REC'D
11.1	101	59	.800	120	330	320 ±10	—	—	—
11.2	101	103	.823	120	325	—	—	48 ±15	—
11.3	101	-65	.733	120	390	—	—	135 ±15	—

12.0 POWER LEVER SCHEDULE - P12 CORRECTION

HOLD CONSTANT: T12 = 59 deg.F. Speed = 4536 RPM. USG = MAX Inlet flow = 2300 PPH REF. NOTE: Approach all PL settings from a lower lever setting.									
TEST POINT	PL POSITION Deg.	P12 Deg.F	Ps3 PSIA	Pn PSIG	PPH				
					SPEC'D	ACT.	ACT.	Hysteresis	
								SPEC'D	REC'D
12.1	101	3.5	55	235	127 ±10	—	—	—	—
12.2	101	16.0	180	595	582 ±10	—	—	10	—
12.3	40	8.8	50	250	128 ±5	—	—	—	—
12.4	40	17.6	90	270	256 ±10	—	—	4	—

NOTE: Hysteresis shall be from a low P12 (column 1) to a high, then decrease P12 (column 2). Subtract column 1 from column 2 to achieve hysteresis point.

13.0 LEVER SHAFT TORQUE

TEST POINT		SPEC'D TORQUE IN-LB	RECORD TORQUE RANGE
13.1	PL	7 Max.	8
13.2	USG	10 Max.	8

14.0 POWER LEVER ANGULAR TRAVELS

TEST POINT	FLAT		ANGLE DEGREES	
			SPECIFIED	RECORD
14.1	GI		0	
14.2	FI	Min.	35-37	
		Max.	43-45	
14.3	M/P	Min.	93-97	
14.4	M/P	Max.	101 ± .5 deg	

15.0 MAX FUEL FLOW LIMIT

HOLD CONSTANT: P12=14.7 PSIA USG=Max								
TEST POINT	INLET FLOW REF.	PL POSITION DEGREES	SPEED RPM	T12	Ps3	Pn PSIG	PPH	
							SPEC'D	RECORD
15.1*	2300	0	4000	59	160	450	550 ±5	587
15.2	1950	0	4000	103	115	360	437 ±18	457
15.3	1950	0	4000	59	115	350	420 ±17	438

*Adjust accel limit Max. stop CW to achieve specified fuel flow.

16.0 MAX POWER ADJ. CHECK

Test Point

- 16.1 Record fuel flow at test point 11.1 RECORD _____
- 16.2 Adjust max power adjustment upward. Must be 30 PPH minimum more than 16.1 RECORD _____
- 16.3 Adjust max power adjustment downward. Must be 12 PPH minimum less than 16.1. RECORD _____