National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594

CEN22FA317

AIRWORTHINESS

Group Chair's Factual Report – Attachment #4

Woodward Test Results for the FCU and PT Governor

December 8, 2023

OZARK AEROWORKS
AN EAGLE PARTNER

P/N: 1-170-780-01 Model #: TA-7 S/N: 672AS1023 W.O. #: AI1003

Tested for standard day flows only JE

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
Date: NOV 17 2022 Part List: 100770A5 Operator: [redacted] Test Performed I.A.W.: 73-20-03 Stand: LTCT 319	NOV 17 2022 [redacted]	

A. GENERAL (PDF PAGE 461)

1. Service limits in this section can be used for a second source testing and service evaluation of field returned units. Service limits are not to be used for overhaul or reconditioning. All overhaul requirements apply during service testing except for the service limits included in this section. Service limits are used stated above to eliminate minor test equipment correlation problems. Units meeting service testing requirements are considered functionally serviceable with accrued service time. They may not be zero timed.

2. On units meeting service testing and local inspection and quality requirements, it is recommended that information pertinent to the following areas be reviewed and evaluated prior to release of unit for reinstallation on engine:
   - Consideration of remaining serviceable time
   - Physical condition and seal integrity
   - Evidence of internal contamination
   - Fuel control log entries
   - Service data
   - Data on suspected problem areas

B. STANDARD SETTINGS AND CONDITIONS (PDF PAGE 461)

1. The following conditions must be set and maintained during final test procedures, unless otherwise specified:

N_1	Limits per test requirements ± 4 RPM
P_B	4 ± 2 PSIG
P_1	29.92 ± 0.05 inches of mercury (Hg) absolute
P_N	200 ± 20 psig (1379 ± 137.9 kPa) at 300 ± 10 psig at 900 pph
Quad	100 ± 0.5 degrees, using test quadrant STD62480
T_1	59 ± 3°F
W_f	Limits per test requirement
IGV Lever	For units with IGV indicator plates, at 60 degree or greater mark. For units without the IGV indicator plate, between CCW position and horizontal position
Solenoid	In automatic system operation position
Igniter Line	Line closed
Fuel Inlet Temperature	65° to 85°F
Test Fluid	Calibrating fluid, Type 2 (ref. MIL-PRF-7024, TypeII)

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
C. SERVICE LIMITS TESTING (PDF PAGE 462)		
1. Conduct service limits test procedures under the same conditions, and in the same manner as final test procedures found in the Final Test Data Form, OAW-F-200-058. The following tests differ from those in the final test procedures as indicated, except for air-bleed limits. They are the same as in the Final Test Data Form, OAW-F-200-058.	NOV 17 2022 [redacted]	
2. **Preliminary Leak Test (with governor mounted on regulator) (PDF page 462)** a. Reduce outlet pressure (P_N) to zero by shutting down N_1 drive and N_2 drive. Set inlet temperature at 55°F to 85°F.	NOV 17 2022 [redacted]	NOV 17 2022 OAW INSP 114
b. Increase inlet pressure (P_B) 45 to 50 PSIG. Measure leakage at N_1 and N_2 seal drains during several one-minute periods.	NOV 17 2022 [redacted]	NOV 17 2022 OAW INSP 114
c. Set N_1 speed at 4300 RPM and N_2 speed at 4600 RPM, with inlet pressure (P_B) at 45 to 50 psig. Close the throttling valve to obtain 600 to 620 PSIG. Measure discharge pressure leakage at N_1 and N_2 seal drains during several one-minute periods.	NOV 17 2022 [redacted]	NOV 17 2022 OAW INSP 114
d. At no time must the combined leakage from N_1 and N_2 seal drains exceed one cc per minute. No other external leakage is permitted.	NOV 17 2022 [redacted]	
2. **Emergency (Manual) Flow Schedule (PDF page 442)** a. Apply 14 volts DC and switch solenoid to emergency position. Switchover (fuel flow) should occur in one second maximum. Shut off current to ensure solenoid is mechanically held in emergency position.	NOV 17 2022 [redacted]	
b. Run emergency flow schedule (Table 2) using standard conditions, except as specified. **NOTE: Use emergency maximum flow valve wrench (STD64917) when adjusting maximum flow valve (201, Figure 107).**	NOV 17 2022 [redacted]	
c. Run lines one through three, setting quadrant and N_1 speed in the increasing direction. Then record corresponding W_f values.	NOV 17 2022 [redacted]	
d. Make a hysteresis check at line two, setting quadrant in the decreasing direction.	NOV 17 2022 [redacted]	
e. Switch solenoid back to automatic system, at test completion. Shut off current to ensure solenoid is mechanically held in automatic position.	NOV 17 2022 [redacted]	

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
TABLE 2: EMERGENCY (MANUAL) FLOW SCHEDULE (DC=14V)	NOV 17 2022 [redacted]	

Line	$N_1 \pm 10$	Quad + 0.5	Fuel Flow		
			Minimum	Actual	Maximum
1	1800	21	105	126	123
2	2600	55	186	217	226
3	4100	100	675	690	725

3. **High Pressure Relief Valve Test (PDF page 463)** a. Set standard conditions and N_1 speed at 3500 ± 20 RPM for a fuel flow (Wf) of 620 ± 26 PPH.	NOV 17 2022 [redacted]	OAW INSP 114
b. Fully close throttling valve (13, Figure 704). The high-pressure relief valve must maintain at a differential pressure of 850 ± 50 PSIG (P_{N1} minus P_B) at no flow. 900	[redacted]	OAW INSP 114
4. **Stopcock Valve Test (PDF page 463)** a. Set standard conditions, and then set N_1 speed at 0 RPM. Set quadrant at zero degree and inlet pressure (P_B) at 10 ±5 PSIG.	[redacted]	OAW INSP 114
b. Disconnect throttling valve (13, Figure 704) from P_N port of fuel regulator. Measure leakage at discharge port for several one-minute periods.	[redacted]	OAW INSP 114
c. At no time shall leakage at P_N port exceed two drops per minute. If leakage exceeds this limit, shims (122 and 124, Figure 107) must be reduced in thickness, each by the same amount (refer to Figure 519 in the Assembly section of 73-20-30 Manual. 0	[redacted]	
5. **Acceleration and face cam schedule—T_1 at 59°F (PDF page 463):** Table 3 in the Final Test Data Form, OAW-F-200-058, is replaced by Table 1 in this form. All other steps in the performance of the test must be followed in the same sequence as the Final Test Data Form, OAW-F-200-058.	NOV 17 2022 [redacted]	

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE

TABLE 1: ACCELERATION AND FACE CAM SCHEDULE: T_1 AT 59°F

Line	P_1 (in. Hg abs)	N_1 (RPM)			Fuel Flow		
		Min	Act	Max	Min	Act	Max
1	29.92	546	550	554	59	59	75
2	29.92	1696	1700	1704	167	175	185
3*	29.92	2096	2100	2104	204	216	226
4	29.92	3696	3700	3704	706	720	770
5	29.92	4196	4200	4204	915	920	945

*HYSTERESIS LIMITS: ±2 PERCENT OF ACTUAL VALUE OBTAINED ON UP-RUN

NOTE: Set N_1 speed at 850 RPM. Reduce quadrant until dumping occurs, and record quadrant setting. Quadrant setting must be 18 degrees or less, and fuel flow must be within ±15 PPH of fuel flow obtained at a quadrant setting of 100 degrees.

Quadrant setting: 10°

NOV 17 2022 — [redacted] — NOV 17 2022 — OAW INSP 114

6. **Altitude (P_1) Schedule at 3700 RPM (PDF page 463)**
Table 4 in the *Final Test Data* form, OAW-F-200-058, is replaced by Table 2 in this form. All other steps in the performance of the test must be followed in the same sequence as in the *Final Test Data* form, OAW-F-200-058.

NOV 17 2022 — [redacted]

TABLE 2: ALTITUDE (P_1) SCHEDULE

Line	P_1 (in. Hg abs)	N_1 (± 4 RPM)	Fuel Flow		
			Min	Act	Max
1*	11	3700	262	271	288
2	15	3700	353	264	387
3	29.92	3700	706	720	770

*HYSTERESIS CHECK MADE BY DECREASING P_1 PRESSURE

NOV 17 2022 — [redacted] — NOV 17 2022 — OAW INSP 114

7. **Throttle Shaft Lever Schedule (PDF page 466)**
Table 5 in the *Final Test Data* form, OAW-F-200-058, is replaced by Table 3 in this form. All other steps in the performance of the test must be followed in the same sequence as in the *Final Test Data* form, OAW-F-200-058.

NOV 17 2022 — [redacted]

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE

TABLE 3: THROTTLE SHAFT LEVER SCHEDULE

Line	Quad (± 0.5°)	Fuel Flow			N_1		
		Min	Act	Max	Min	Act	Max
1	23	150	154	156	2155	2200	2235
2	26	150	154	156	2155	2235	2235
3	38	255	260	265	2980	3030	3060
4	42	255	260	265	2980	3035	3060
5*	100	833	900	900	4566	4570	4624

*SET MAXIMUM THROTTLE ADJUSTING SCREW WITH CONDITIONS OF LINE FIVE STABILIZED. APPROACH QUADRANT SETTINGS FROM LOW-SIDE.

NOV 17 2022 NOV 17 2022 [redacted] OAW INSP 114

8. **Deceleration Setting (PDF page 467)**
Table 6 in the *Final Test Data* form, OAW-F-200-058, is replaced by Table 4 in this form. All other steps in the performance of the test must be followed in the same sequence as in the *Final Test Data* form, OAW-F-200-058.

NOV 17 2022 [redacted]

TABLE 4: DECELERATION SETTING

Line	P_1 (in. Hg abs)	N_1 (± 10 RPM)	Fuel Flow		
			Min	Act	Max
1	29.92	4200	257	258	283
2	29.92	2800	127	134	141

NOV 17 2022 NOV 17 2022 [redacted] OAW INSP 114

9. **N_1 Governor Droop Schedule (PDF page 467)**
Table 7 in the *Final Test Data* form, OAW-F-200-058, is replaced by Table 5 in this form. All other steps in the performance of the test must be followed in the same sequence as in the *Final Test Data* form, OAW-F-200-058.

NOV 17 2022 [redacted]

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TABLE 5: N_1 GOVERNOR DROOP SCHEDULE

Line	N_1			Fuel Flow		
	Min	Act	Max	Min	Act	Max
1*	4531	4570	4589	882	900	918
2	---	4600	---	---	853	---

*HYSTERESIS LIMIT: WITHIN 12 RPM N_1 SPEED FOR SAME FUEL FLOW (W_F) AS ON UP-RUN

NOV 17 2022 [redacted] NOV 17 2022 OAW INSP 114

10. **Acceleration and Face Cam Schedule (T_1 at -30°F) (PDF page 468)**
    a. Subject T_1 sensor bulb to a temperature of -30° ±3°F. Set P_1 at 11.0 inches H_g absolute, N_1 at 3900 ±4 RPM, and record actual fuel flow (W_f).

    Actual fuel flow: _____

    NOTE: Fuel flow must be within the limits of 391 to 441 PPH.

    b. Set P_1 at 22.5 inches H_g absolute, and adjust N_1 peed to obtain a fuel flow of 842 to 874 PPH. Record actual fuel flow and adjusted N_1 speed. Adjusted N_1 speed must be within the limits of 4366 to 4452 RPM.

    [redacted]

    Actual fuel flow: _____

    Adjusted N_1 speed: _____

N/A NOV 17 2022

11. **Acceleration and Face Cam Schedule (T_1 at 100°F) (PDF page 468)** Table 9 in the *Final Test Data* form, OAW-F-200-058, is replaced by Table 6 in this form. All other steps in the performance of the test must be followed in the same sequence as in the *Final Test Data* form, OAW-F-200-058.

TABLE 6: ACCELERATION AND FACE CAM SCHEDULE (T_1 AT 100°F)

Line	P_1 (in. H_g Abs)	N_1 (±4 RPM)			W_f PPH		
		Min	Act	Max	Min	Act	Max
1	29.92	1196		1204	97		113
2	29.92	2896		2904	323		345
3	29.92	2696		3704	645		703
4*	22.50	4425		4489	652		678

*Face cam schedule

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
12. **Air-bleed trigger line schedule (PDF page 470)** Table 11 in the *Final Test Data* form, OAW-F-200-058, is replaced by Table 7 in this form. All other steps in the performance of the test must be followed in the same sequence as in the *Final Test Data* form, OAW-F-200-058.		

TABLE 7: AIR-BLEED TRIGGER LINE SCHEDULE: T_1-59° ±3

	PSIG (± 0.25)	T_1 (±3°F)	Fuel Flow (PPH)			N_1 (RPM)		
			Min	Act	Max	Min	Act	Max
OPEN	30.6	59	784	[redacted]	816	3902		3978
CLOSED	32.6	59	784		816	3965		4055
OPEN	30.6	59	392		408	3315		3385
CLOSED	32.6	59	392	N/A	408	3367		3457
OPEN	30.6	59	324		336	3185		3255
CLOSED	32.6	59	324		336	3235		3311
OPEN	30.6	59	220		230	3127		3197
CLOSED	32.6	59	220		230	3170		3260

13. **IGV Schedule (T_1 at 59°F) (P/N: 100770A3, 106500A1, and subsequent)** **NOTE: Check main fuel regulator cover assembly to determine that feedback cam arm (2, Figure 102) is indexed two teeth counterclockwise from the scribe line on the cam shaft.**	NOV 17 2022 [redacted]	
a. Adjust T_1 temperature to 59° ±2°F. Then connect two lines with two 0 to 200 PSI gauges to the wo IGV pressure ports (CYL 1 and CYL 2) as shown in Figure 705.		
b. Startup test stand and adjust N_1 speed so as to obtain a fuel flow (W_f) of 600 ±10PPH, and set control discharge pressure (P_N) to 50 ±5 PSIG.	NOV 17 2022 [redacted]	
c. Set N_1 speed at 3992 ±4 RPM, and move feedback cam arm until the two pressure gauge readings are equal or stable within no more than 20 PSIG of each other. Shut down test stand, and disconnect the two 0 to 200 PSIG gauges from the regulator.	NOV 17 2022 [redacted]	

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d. With these conditions set, the edge of the feedback cam arm must align with the edge of the IGV boss on the cover, farthest from he air-bleed cover, within ±15 degrees. If this position cannot be obtained, re-index the feedback cam arm on its shaft as required, and recheck the null position. **NOTE: Indexing one tooth on the spline will change the feedback cam arm approximately 10 degrees. A range of ±2 teeth in position from the nominal position is permitted. The scribe line on the shaft is in line with the open end in the feedback cam arm when the arm is in the nominal position.**	NOV 17 2022 [redacted]	
e. When the pressure gauge readings have been stabilized and the null position of the feedback cam arm has been obtained, shut down the test equipment and disconnect both IGV gauges.	NOV 17 2022 [redacted]	
f. Set N_1 speed at 550 ±4 RPM, and set P_1 at 29.92 inches H_g absolute. Move the feedback cam arm from full counterclockwise position to a horizontal position, checking fuel flow during the cam arm travel. Fuel flow must remain between 60 and 74 PPH. Record actual fuel flow. Actual Fuel Flow: 59 **CAUTION: DO NOT ROTATE FEEDBACK CAM ARM BEYOND THE HORIZONTAL POSITION.**	NOV 17 2022 [redacted]	NOV 17 2022 OAW INSP 114
g. Rotate feedback cam arm counterclockwise from the horizontal position and leave in that position for the remainder of final test.	NOV 17 2022 [redacted]	

P/N: 1-160-850-23 Model #: PTG-3 S/N: 652AM2506 W.O. #: AI1003

Tested for Standard day flows only TE

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
NOV 17 2022 Date: _____ Part List: 652AM2506 Operator: _____ Test Performed I.A.W.: 75-2002 Stand: LTCT 319	NOV 17 2022 [redacted]	
1. GENERAL (PDF PAGE 109)		
The following steps contain servo valve break-in, component adjustment, and final test of the assembled power turbine governor (PTG-3 and PTG-1 Series). The procedures outlined include all necessary shimming and adjustments required to meet test requirements. The servo valve break-in and adjustment for PTG-3 Series Governor with TA-7 Regulator may be completed using the Governor Flow Test Fixture or a calibrated TA-7 Regulator. Section 2 describes the procedure using the flow test fixture. Section 3 describes the procedure using a calibrated TA-7 Regulator. **NOTE: Final adjustment and test is not required for governors shipped as spares.**		
2. OPTIONAL METHOD FOR BREAK-IN AND ADJUSTMENT OF PTG-3 SERIES GOVERNOR WITH A TA-7 REGULATOR A. Test set-up: 1. Testing of governor setting may be performed with the governor assembled to a Model TA-7 regulator P/N: 107700 or 106500, which is known to be operable and within limits. The fuel control unit is mounted on fuel control test stand, LTCT319, to simulate engine mounting (with quadrant STD63973 installed). Necessary indicating and measuring devices are connected into the test system (refer to applicable Main Fuel Regulator Overhaul instructions manual). Calibrating fluid Type 2 (reference MIL-PRF-7024, Type II), at a temperature of 70°F to 80°F, must be used during testing. Fuel should be filtered with a 10-micron filter before entering the control inlet (Figure 703 (test set-up), PDF page 119). Equipment required: • Calibrated TA-7 P/N: 100770A3 or later configuration or P/N: 106500A1 or later configuration • Fuel control test stand LTCT 319 • Test quadrant STD63973 • Torque adapter STD65561 • Calibrating fluid MIL-PRF-7024, Type II	NOV 17 2022 [redacted]	
2. General TA-7 regulator settings and conditions: For all calibration and cycling tests, the following fixed variables will be maintained, unless instructed otherwise: • Manual operation switchover valve in automatic position • Fuel inlet temperature 75 ±5°F • Fuel pressure at control unit inlet: 2 to 10 PSIG • Fuel control outlet pressure set to provide 300 ±10 PSI at 900 PPH flow rate • Igniter line closed • P_1 air pressure: 29.92 ±0.10 in. hg. abs. • T_1 temperature at sensor bulb: 59 ±2°F • Throttle lever at 100° ±2° position • N_1 speed: 4000 ±20 RPM	NOV 17 2022 [redacted]	

P/N: 1-160-850-23 Model #: PTG-3 S/N: 652AM2506 W.O. #: AI1003

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
B. Preparation for break in: Vent the entrapped air in the governor through the power turbine upper cover as follows: 1. Install the plastic or equivalent bleed line after removing vent plug (20, 20A).	NOV 17 2022 [redacted]	
2. Set the regulator at the standard conditions listed above, and run the unit until a steady stream of fuel is flowing from the bleed line.	NOV 17 2022 [redacted]	
3. Start the N_2 governor drive.	NOV 17 2022 [redacted]	
C. Servo break-in procedure: This procedure is required for all new servo assemblies not previously run in an N_2 governor. 1. Set standard conditions listed in Section 3, Step A.2.		
2. Back out both minimum and maximum stop adjustment bolts (70, 75, Figure 1001, PDF pages 135-137).	NOV 17 2022	
3. Run the N_2 governor at a speed of 1000 RPM, and move stop lever through its full travel range. Fuel flow should increase and decrease at least 300 PPH as the stop lever is moved from stop to stop.	[redacted]	
4. Set and lock manual shaft stop lever (85) in position; so, fuel flow is approximately in the middle of the fuel flow range. **NOTE: If manual shaft stop lever (85, Figure 1001, PDF pages 135-137) can be moved through its full travel range while fuel flow remains constant, test cover STD64779 must be installed if it was removed. Use upper cover hardware to secure test cover. Run governor at 1000 RPM, and adjust test cover adjusting screw to obtain a fuel flow change of at least 300 PPH when the manual shaft stop lever is moved.**	N/A no Break in needed	
5. Break in governor as follows, ensuring it is approximately in the middle of the fuel flow range at each break-in speed: • Run the governor at a speed of 1000 RPM for a period of 30 minutes • Run the governor at a speed of 2500 RPM for a period of 30 minutes • Run the governor at a speed of 4000 RPM for a period of 30 minutes		
D. Governor component adjustment: **NOTE: Item numbers refer to Figure 1001 (PDF pages 135-137), unless otherwise specified.** 1. Equipment required is the same equipment listed in Section 3, Step A.1., this section.	NOV 17 2022 [redacted]	

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
2. Procedure: a. Remove unit upper cover assembly or test cover by removing screws (40,45) and washers (50). Remove pin (165, 165). Then remove lever and roller assembly (200, 200A). Carefully remove spring guide (205, 205A, 205B, 205C).	NOV 17 2022 [redacted]	
b. Retain the same thickness of shims as installed during assembly. Re-assemble lever assembly and upper cover assembly.	NOV 17 2022 [redacted]	
c. Install test fixture quadrant (STD63973) over governor manual control shaft (100, 100A) as shown in Figure 702, PDF page 112).	NOV 17 2022 [redacted]	
d. After governor and test equipment are set up, set the fuel regulator to standard conditions, but do not start N_2 test drive. Vent entrapment air through top cover port through the plastic bleed line.	NOV 17 2022 [redacted]	
e. Start test stand N_2 drive. Drive must run clockwise when looking at test stand drive.	NOV 17 2022 [redacted]	
f. Set quadrant pointer to zero degree. Increase speed slowly to 4023 ±4 RPM. Move quadrant pointer quadrant until fuel flow is 300 ±10 PPH. At this fuel flow reading, the pointer must be on the high-speed side and within 7 ±2 degrees of centerline (zero-degree mark) toward the high-speed stop (Figure 702, PDF page 112).	NOV 17 2022 [redacted]	
g. If pointer registers too far on the low side, remove a quantity of shims (210) to bring within limits. If pointer registers too far on the high side, add shims to qualify limits.	NOV 17 2022 [redacted]	
3. Adjustment settings maximum and minimum stops: a. Set low sped adjustment as follows: i. Set speed to 3270 ±4 RPM. Move pointer on low side until fuel flow is 400 ±5 PPH.	NOV 17 2022 [redacted]	
ii. Screw in low speed stop adjustment bolt (75) flush with stop lever (85).	NOV 17 2022 [redacted]	
iii. Secure adjustment bolt with check nut (80), while holding fuel flow at 400 ±5 PPH. Torque check nut 20 to 30 inch-pounds, using torque adapter STD65561. Torque Wrench #: D1178011773 EXP 6-23	NOV 17 2022 [redacted]	

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
b. Set high speed stop adjustment as follows: i. Bring speed up to 4450 ±4 RPM, and set fuel flow to 400 ±5 PPH by moving pointer on high side as shown in Figure 702 (PDF page 112).	NOV 17 2022 [redacted]	
ii. Screw in high speed stop adjustment bolt (70) to touch manual shaft stop lever (85). Secure bolt iwht check nut (80), making sure not to disturb setting. Torque check nut 20 to 30 inch-pounds, using torque adapter STD65561.	NOV 17 2022 [redacted]	
iii. Run Line 1 and 2 of Table 1 to ensure they fall within limits. If not, remove unit upper cover assembly.	NOV 17 2022 [redacted]	
TABLE 1: DROOP SCHEDULE (LEVER AT MAXIMUM SPEED STOP) *Hysteresis limit: ±8 PPH when settling same N_2 speed; ±12 RPM when setting same fuel flow (Wf). **Run with lever against low speed stop.		
iv. Back off machine screw (175) lever and roller assembly, and use lever adjusting screw (170) to adjust fuel flow. **NOTE: Screw in lever adjusting screw to decrease fuel flow. Back out adjusting screw to increase fuel flow.**	NOV 17 2022 [redacted]	
v. Reassemble unit upper cover assembly, test, and repeat procedure in Section 3, Step D.3.b.iii. until fuel flow is within limits. Reassemble as outlined in *Assembly*. **NOTE: The requirements set forth in Section 3, Steps D.2.f; D.3.a; and D.3.b. must be simultaneously within limits before proceeding.**	NOV 17 2022 [redacted]	
vi. Make both increasing and decreasing speed runs at Line 2 in Table 1. At increasing speeds, all readings must fall within limits listed.	NOV 17 2022 [redacted]	

LINE	N_1 SPEED	N_2 SPEED	WF—PPH	
			MIN	MAX
1	4000	4235-4291	735	765
2*	4000	4440-4460	392	408
3**	2000	3745-3755	125	155

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
vii. Readings on the decreasing speed run must be within readings on the increasing speed run at the set point only. If hysteresis is not within limits specified, do not proceed further until cause of hysteresis is eliminated.	NOV 17 2022 [redacted]	
c. Ensure pointer total travel from low speed stop adjustment to high speed stop adjustment is 60 ±4 degrees.	NOV 17 2022 [redacted]	
d. With N_2 speed set at 4270 ±30 RPM and the manual shaft stop lever against the high-speed stop adjustment bolt, vary Ps pressure from 100 to 700 PSIG. Fuel flow must not move more than 42 PPH.	NOV 17 2022 [redacted]	
e. Set manual shaft stop lever at high-speed, and set N_2 speed to 4270 ±20 RPM. Apply P_B pressure of 50 PSIG—leakage from drain port must not exceed 0.4 cc per minute. Reduce speed to 0 RPM, and maintain P_B pressure of 50 PSIG—leakage from drain port must not exceed 0.4 cc per minute. **NOTE: The drain lines at the N_2 drives should be so arranged that the drain leakage can be observed at any time throughout the test. Observe to ensure no governor leakage exists except at the governor (N_2) seal drain. At no condition should the drain leakage exceed 0.4 cc per minute.**	NOV 17 2022 [redacted]	NOV 17 2022 OAW INSP 114
f. Complete final test on calibrate TA-7 fuel regulator per Section 4.	NOV 17 2022 [redacted]	
3. FINAL GOVERNOR TEST (MOUNTED ON FUEL CONTROL)		
NOTE: Final testing of the PTG-3 and PTG-1 Series governors will be divided into two segments for clarity. The following step, A, applied to both series. **NOTE: Throughout tests, observe to ensure no governor leakage exists except at the governor (N_2) seal drain. At no condition should the drain leakage exceed 0.4 cc per minute. Drain lines at the N_2 drives should be arranged; so, the drain leakage can be observed at any time during test.**		

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
A. Set-up and equipment: **CAUTION: ENSURE CALIBRATING FLUID, MIL-PRF-7024: TYPE II, USED FOR TESTING HAS NOT DETERIORATED. CALIBRATING FLUID, PARTICULARLY IN SMALL VALUME, SELF-CONTAINED TEST STANDS, TENDS TO BECOME EXTREMELY OXIDIZED IN A RELATIVELY SHORT TIME (FOUR TO SIX MONTHS). OVEREXPOSURE OF NITRIL PACKING, TYPES MS9021 AND MS29513, TO OLD CALIBRATING FLUID WITH A HIGH OXIDATION POTENTIAL CAN RESULT IN HARDENING AND CRACKING OF THOSE PACKINGS SUBSEQUENT TO OVERHAUL. A SIMPLE TEST TO DETERMINE THE ACCEPTABILITY OF THE CALIBRATING FLUID MAY BE PERFORMED PERIODICALLY. SOAK A SAMPLE NITRILE PACKING IN CALIBRATING FLUID FOR 24 HOURS AT 158°F FOR 24 HOURS AT 158°F. DRY THE PACKING AT 158°F FOR 24 HOURS. MODERATE HARDENING OF THE PACKING IS ACCEPTABLE, BUT CRACKING, EXTREME HARDENING, OR OTHER DAMAGE IS REASON TO CHANGE THE CALIBRATING FLUID. UPON COMPLETION OF THE FINAL TEST, THOROUGHLY FLUSH THE GOVERNOR WITH GRADE 1010 LUBRICATING OIL TO REMOVE ANY RESIDUAL CALIBRATING FLUID.** 1. Final testing of governor setting is performed with the governor assembled to a Model TA-2B, TA-2G, TA-2S, or TA-7 regulator, which is known to be operable and within limits. The fuel control unit is mounted on fuel control test stand, LTCT319, to simulate engine mounting (with quadrant STD63973 installed). Necessary indicating and measuring devices are connected into test system. (Refer to applicable Main Fuel Regulator Overhaul Instructions Manual.) Calibrating fluid Type II (reference MIL-PRF-7024: Type II), at a temperature of 70°F to 80°F, must be used during testing. Fuel should be filtered before entering the control inlet with a 10-micron filter. If, during testing, it's not possible to obtain test data at the set points, stops may be reset, provided the manual shaft stop lever travel between low and high-speed stops remains 60 ±3 degrees. Only slight adjustment should be required. If large adjustment is required to meet set points, the governor must be recalibrated as outlined in Section 2, Step D or Section 3, Step D. (See Figure 703 (PDF page 119) for actual test set-up installation.) After governor and equipment are fully set up, start boost pump, and set P_B pressure to 10 PSIG. Vent the entrapped air in the governor through the upper cover as follows: **NOTE: Test values given in the following tests are the test values obtained when using a TA-7 fuel regulator.** a. Install plastic bleed line in governor after removing plug (20, 20A, Figure 1001, PDF pages 135-137).	NOV 17 2022 [redacted]	
b. With the governor mounted on the main fuel regulator running at 3900 RPM, 100-degrees quadrant setting, start the governor drive.	NOV 17 2022 [redacted]	
c. Set governor at high-stop, and gradually bring N_2 governor speed to 4450 RPM. Run unit for 10 minutes prior to making any governor adjustments.	NOV 17 2022 [redacted]	

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
d. During the last five minutes of the running period, cycle the governor manual shaft stop lever from low cam position to high cam position a minimum of 10 times to ensure proper venting of air from servo valve area.	NOV 17 2022 [redacted]	
2. General control settings and conditions—The following control settings and conditions must be maintained during testing, unless otherwise specified: • Manual operation switchover valve in automatic position • Fuel inlet temperature 70°F to 80°F • Fuel pressure at control unit inlet (P_B) 3 ±3 PSIG • Fuel control outlet pressure (P_N) is set to the following setting: o 300 ±10 PSIG at 900 ±10 PPH for TA-7 models Discharge pressures are set by setting an N_1 speed to obtain the specified fuel flow, and then setting the outlet pressure (P_N) using the valve at the discharge port. Leave the valve at the discharge port at this setting for the balance of testing, unless otherwise specified. • Air pressure (P_1) 29.92 ±0.05 inches of mercury absolute • Temperature at sensor bulb (T_1) 57°F to 61°F • Igniter line closed	NOV 17 2022 [redacted]	
B. Test speeder spring shimming: Set speed at 4023 ±4 RPM, adjust governor manual stop lever to obtain a fuel flow (Wf) of 300 ±10 PPH. The adjusted manual stop lever position as indicated by quadrant STD63973 pointer position must be 7 ±2 degrees on the high speed side. Record pointer position.	NOV 17 2022 [redacted]	
C. Stop setting and droop slope tests: With equipment set up as discussed in Section 4, Step A.1., and maintaining control settings as outlined in Section 4, Step A.2., proceed as follows: 1. Low speed stop setting: a. Set N_1 speed at 4000 RPM (TA-7 regulator), and set N_2 speed at 3270 ±10 RPM. Set minimum stop adjustment bolt (75, Figure 1001, PDF pages 135-137) to obtain a fuel flow (Wf) of 400 ±5 PPH. Lock minimum stop, and record quadrant setting.	NOV 17 2022 [redacted]	

TABLE 2: TEST SPEEDER SPRING SHIMMING

N_2	Wf	STOP LEVER	POINTER POSITION	
			PERMITTED	RECORDED
4023	300 ±10	Adjust to obtain fuel flow	7° ±2°	7°

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TABLE 3: LOW SPEED STOP CALIBRATION

N_1	N_2			FUEL FLOW		
	MIN	ACTUAL	MAX	MIN	ACTUAL	MAX
4000	3260	3260	3280	395	400	405

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[redacted]

2. High speed stop setting: With the equipment set up as discussed in Section 4, Step A.1., and maintaining the conditions as outlined in Section 4, Step A.2., proceed as follows:
   a. Set N_1 speed at 4000 RPM (TA-7 regulators). Adjust maximum stop adjustment bolt (70, Figure 1001, PDF pages 135-137) for a fuel flow (Wf) of 400 ±5 PPH with N_2 speed set at 4450 ±4 RPM. Lock maximum stop, and record quadrant setting.

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TABLE 4: HIGH SPEED STOP CALIBRATION

N_1	N_2			FUEL FLOW		
	MIN	ACTUAL	MAX	MIN	ACTUAL	MAX
4000	4446	4450	4454	395	400	405

[redacted]

   b. Ensure quadrant travel from high speed stop to low speed stop is 60 ±4 degrees.

      Recorded quadrant travel: 58°

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[redacted]

3. N/A: Droop schedule at high speed stop for TA-2B or TA-2G fuel regulators.

4. Droop schedule at high speed stop for PTG-3 Series governor with a TA-2S or TA-7 Series regulator:

   a. Run lines 1 through 3 of Table 5, setting N_1 and N_2 speeds and recording the corresponding Wf. Make both increasing and decreasing N_2 speed runs at Line 2 in Table 5). Hysteresis line at Line 2 is ±12 RPM when setting same fuel flow (Wf). If hysteresis is not within specified limits, do not proceed until cause of hysteresis is eliminated.

NOV 17 20[illegible]

[redacted]

TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE

TABLE 5: DROOP SCHEDULE: PTG-3 SERIES GOVERNORS WITH TA-2S OR TA-7 REGULATOR (LEVER AT MAXIMUM SPEED STOP)

LINE	N_1 SPEED	N_2 SPEED	W_F		
			MIN	ACTUAL	MAX
1	4000	4235-4291	735	750	765
2*	4000	4440-4460	392	400	408
3**	2000	3745-3755	125	146	155

*Hysteresis limit: ±8 PPH when setting same N_2 speed; ±12 RPM when setting same fuel flow (Wf)
**Run with lever against low speed stop

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[redacted]

D. Leak Tests:

1. With N_1 and N_2 speeds at zero, P_N at zero, and manual shaft stop lever against the high-speed stop, increase the P_B at 50 PSIG, and record leakage. On TA-2S and TA-7 regulators, increase N_1 speed to 4300 ±20 RPM, increase N_2 speed to 4600 ±20 RPM, and record N_2 seal leakage.

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TABLE 6: LEAK TEST

N_1	N_2	P_B	P_N	DRAIN LEAKAGE (CC/MINUTE)	
				PERMITTED	RECORDED
0	0	50	0	0.4	0
4300	4600	50	610	0.4	0.2

[redacted]

2. Governor seal drain leakage must not exceed 0.4 cc per minute. No governor external leakage is permissible except through drain port.

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[redacted]

E. Close-Up

1. Shut down test equipment, and remove governor from fuel regulator and test stand.

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[redacted]

2. Check that locking cups (270, Figure 1001, PDF pages 135-137) are staked in screws (265, 265A).

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[redacted]

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3. Lockwire the minimum and maximum stop adjustment bolts (75, 76, Figure 1001, PDF pages 135-137) to their respective check nuts (80).

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[redacted]

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TASK	TECHNICIAN INITIALS & DATE	INSPECTOR STAMP & DATE
4. Torque cover screws (40, 45) 20 to 30 inch-pounds. Lockwire cover screws. Torque Wrench #: [redacted] N/A NOV 17 2022		
5. Install identification plate ~~(5)~~ and decal (15).		