NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594
July 17, 1996

ADDENDUM TO
SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

A. ACCIDENT DCA-94-MA-076

Location: Aliquippa, Pennsylvania
Date: September 8, 1994,1996
Time: 1904 Eastern Daylight Time
Aircraft: Boeing 737-300, N513AU

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SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

A. ACCIDENT DCA-94-MA-076

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B. SYSTEMS GROUP

Chairman: Greg Phillips
National Transportation Safety Board
Aviation Engineering Division
Washington, DC

Member: John Calvin
Boeing Commercial Airplane Group
Seattle, WA

Member: Paul Cline
Boeing Commercial Airplane Group
Seattle, WA

Member: Captain John Cox
Air Line Pilots Association/USAir
Coraopolis, PA

Member: Ken Frey
Federal Aviation Administration
Aircraft Certification Office
Seattle, WA

Member: Dale A. Hoth
Federal Aviation Administration
Flight Standards District Office
Coraopolis, PA

Member:	Thomas C. Nicastro USAir-Engineering Pittsburgh, PA
Member:	Steve Weik Parker Hannifin Irvine, CA
Member:	Jack A. Wurzel USAir-IAMAW Pittsburgh, PA

C. SUMMARY

On September 8, 1994, at 1904 Eastern Daylight time, USAir flight 427, a Boeing 737-3B7 (737-300), N513AU, crashed while maneuvering to land at Pittsburgh International Airport, Pittsburgh, Pennsylvania. The airplane was being operated on an instrument flight rules (IFR) flight plan under the provisions of Title 14, Code of Federal Regulation (CFR), Part 121, on a regularly scheduled flight from Chicago, Illinois, to Pittsburgh. The airplane was destroyed by impact forces and fire near Aliquippa, Pennsylvania. All 132 persons on board were fatally injured.

D. DETAILS OF THE INVESTIGATION

On March 7 through 9, 1995, the systems group members noted above met at the Parker Hannifin facilities in Ogden, Utah, to perform a detailed dimensional examination of the accident airplane's main rudder power control unit (PCU). The detailed dimensional analysis was conducted on parts and areas of parts determined by the group to be critical to the operation of the PCU.

A dielectric/insulation resistance check of the PCU was also conducted. The PCU passed the dielectric tests. Test results are included as Attachment 2.

The PCU bypass valves were tested and were found to operate normally. Test results are included as Attachment 3.

The group determined that there were no significant anomalies detected that would adversely affect the operation of the PCU.

The group also examined and operated a PCU mounted in a test fixture to examine the effects of binding and/or jamming on different points of the external input mechanisms. Several non-standard tests were conducted to demonstrate operation of the PCU to the group members. This examination was recorded on video tape.

1.0 Details of dimensional inspections

Prior to dimensional examination of the components, the systems group defined the critical areas for examination and identified them by marking the engineering drawings. The dimensional examination did not include every dimension on the engineering drawing, only those defined by the systems group. The data sheets used to record the dimensions are attached to this factual report as attachment 1. All noted drawing tolerances are for new parts and do not account for in-service wear.

Mr. Harby Gogna of Parker Hannifin-Ogden performed the measurements of the PCU components at the direction of the systems group. All measurements were within drawing tolerances for new parts for the following parts.

Part #/Dwg Chg/# of measurements	Part Name
69-35606/A/8	Guide-Spring, Double internal summing
69-35614/B/2	Cap-Detent, Internal Summing
69-35566/E/7	Crank Assy, Valve Input
69-35567/H/8	Lever Assy, Summing
69-35601/B,G/8	Crank, Redundant Valve Input
69-22760/A/1	Pin-Detent, Internal Summing
66-22825/B/6	Guide-Spring, Single Internal Summing
69-35602/C/14	Lever Assy, Primary
69-35563/D/1	Link Assy, Valve
60164/A/5	Roller Secondary, Slide operating
69-35611/C/4	Sleeve, Yaw Actuator
59174/K/1	Cap-End, Mod. Piston
59188/D/1	Diaphragm, LVDT Transducer

The following components had measurements that were outside of drawing tolerances for new parts:

69-35612/B Piston, YD Actuator

Four of five measurements taken were within drawing tolerances.

1. The dimension for perpendicularity with datum A of the hole defined in drawing section A-A was out of tolerance.

69-35604 Lever, Secondary

Nine of ten measurements taken were within drawing tolerances.

1. .050 x 45° chamfer (3 places) was measured as .038 x 45°.

69-35607/B Segment, Cam

Ten of twelve measurements taken were within drawing tolerances.

1. .2502-.2504 dia. hole was .2508.
2. .3122-.3123 dia. dimension was .3120.

69-35605/B Segment, Walking Beam

Eleven of fourteen measurements taken were within drawing tolerances.

1. .8749-.8750 dia. dimension was .8747.
2. .3122-.3123 dia. dimension was .3119.
3. .2502-.2504 dimension was .2505.

69-35613/B Fork, Centering Summing Lever

Two of four measurements taken were within drawing tolerances.

1. .4505-.4510 dim was .4514
2. .2502-.2504 dia. hole was .2506-.2517.

65-44863/T Manifold, Aft

Fourteen of eighteen measurements taken were within drawing tolerances.

1. Sheet 1, zone C2, 3.999-4.0010 dim was 3.9989.
2. Sheet 1, zone C4, 2.999-.3001 dim was 3.0005-3.0017.
3. Sheet 1, zone B6, 3.158-3.162 dim was 3.1562.
4. Sheet 1, zone C3, 2.745-2.755 dim was 2.740.

2.0 Details of simulated binding/jamming tests

2.1 Test Setup

The binding/jamming tests were conducted using a production Main Rudder PCU, P/N 65-44861-11, mounted in a production acceptance test fixture. The acceptance test fixture was modified so that a production input control rod could be installed on the PCU. The modification included the kinematic geometry of the input torque tube and the "J" section structure near the input control rod (see Figure 1). Also, the external summing lever assembly, and the H-link assembly were modified so that the degree-of-freedom could be removed from each of the positions 1 through 4 shown in Figure 1.

A yaw damper coupler was used to drive the yaw damper actuator in a closed loop configuration. The coupler could be moved to simulate the airplane yawing motion while monitoring the Main Rudder PCU output. No provisions were made to simulate the airplane rigid body loop of the yaw damper control system.

2.2 Test results

A loss of degree-of-freedom on the external summing lever did not produce any anomalous or amplified main rudder PCU output due to yaw damper commands. In two cases at positions 1 and 2, the feedback gain was increased and the output of the main rudder PCU, due to yaw damper commands, was less than 3°. Jamming position 3 to structure ("J" section) or removing the degree of freedom at position 3, had no affect on the main rudder PCU output due to yaw damper commands. Jamming the input control rod to structure, such as the "J" section, also had no affect on the main rudder PCU output due to yaw damper commands.

For all of the above jam conditions, the degree-of-freedom was completely removed, and the main rudder PCU motion through the input control rod was not possible.

Jamming the input crank to the manifold, or removing the degree-of-freedom at position 4, caused the main rudder PCU to go full deflection. In this case the input control rod was back-driven as the main rudder PCU deflected.

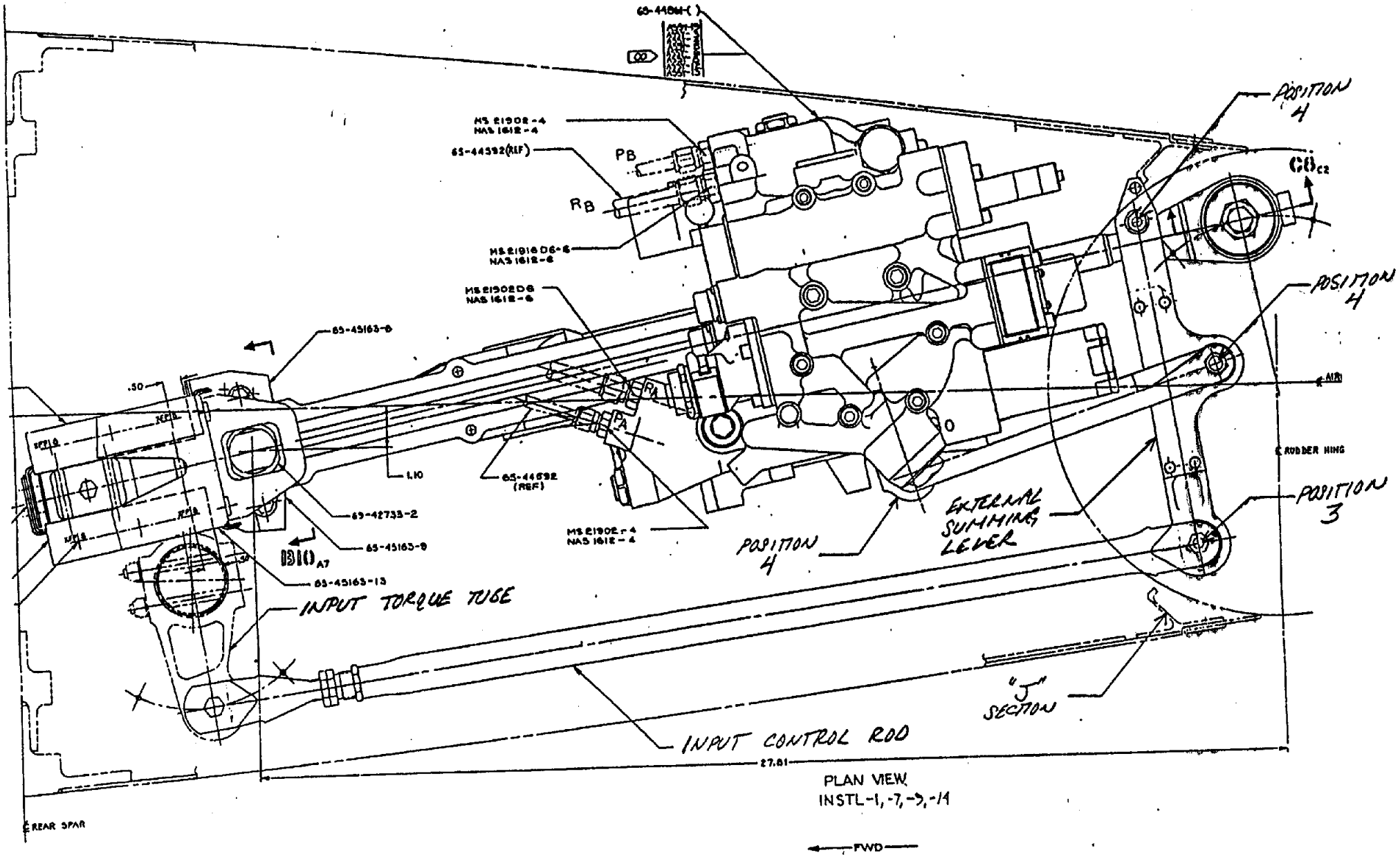
3.0 Video Documentation

Video documentation of the preceding tests was made and is attached to this report as attachment 4. The following is documented on video:

Approximate Time	Events
0-2:09	New PCU in test fixture, setup, yaw damper coupler
2:09-4:50	PCU operation with yaw damper input
4:50-7:30	Yaw damper input and PCU operation by moving yaw damper coupler
7:30-13:53	Simulated binding of center bearing on external summing link
13:53-19:30	Simulated binding of bearing nearest PCU on external summing
19:30-22:50	Simulated binding of input crank bolt
22:50-26:20	Simulated jams between input crank and PCU external manifold body stops
26:20-27:40	Examination of scrape mark on input rod at J-channel (new test unit)
27:40-30:22	Jam input rod against structure with yaw damper inputs
30:22-32:28	View of input rod clearance with structure
32:28-56:15	Secondary stroke flow test demonstration per Boeing overhaul manual

[redacted]

Gregory Phillips
Systems Group Chairman
National Transportation Safety Board



PLAN VIEW
INSTL-1, -7, -9, -14

FIGURE 1

Attachment 1

PARKER BERTEA AEROSPACE GROUP
CONTROL SYSTEMS DIVISION

FIRST ARTICLE INSPECTION REPORT

Parker

DATE: 3-8-95 PAGE: 1 OF: 1

PROGRAM	PART NAME	PART NO.	DWG CHG
737	GUIDE SPRING, DBL. INT. SUMMING	69-35606	A

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNA			1
PURCHASE ORDER NO.:	FAI/R COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY: 65-44861	REJ. 0
	UPDATE TO REV.:			

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.620 .630 Ø	.6242		Ø 215	
2		.535 .545 Ø	.5398		Ø 215	
3		.474 .476	.475		Ø 215	
4		.070 .080	.0752		Ø 215	
5		.120 .130	.1251		Ø 215	
6		.605 .607	.605		Ø 215	
7		.025 .035	.0293		Ø 215	
8		.020 .030	.0240		Ø 215	

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PROGRAM	PART NAME	PART NO.	DWG CHG
T3T	CAP-DETENT, INTER. SUMMING	69-35614	B

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNIA			1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY:	REJ.
	UPDATE TO REV.		65-44861	Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.075 ± .010	.0753		215	
2		.542 .546	.5445		215	

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	CRANK ASSY VALVE INPUT		69-35566	E
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNA			1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO:	NEXT ASSEMBLY	REJ.
	UPDATE TO REV.		65-44861	Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		6°23'	6°36'		215	
2		THESE CTR TO BE IN LINE WITH .001	ACCP		215	
3		2.995 3.005	3.000		215	
4		.862 .866	.8657		215	
5		.877 .881	.8789		215	
6		11° 11°30'	11.195°		215	
7		.330 .336	.3329		215	

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Parker

J916 NUMERICAL CONTROL INSPECTION

Part Number	Operation	B/P Rev.	Route
69-35555	N/A	E	N/A

S/N	Inspector	Time	Date
1915	HARRY GOGNA	10:52 AM	9 Mar 1995

	ACTUAL	NOMINAL	+ TOL	- TOL	DEV	OUT-TOL
X	3.0000	3.0000	.0050	.0050	0.0000	
Y	0.0000	0.0000	.0050	.0050	0.0000	
Y	-.8799	-.8790	.0010	.0010	.0001	+
Y	.8817	.8810	.0010	.0010	.0007	++++
[illegible]	11.195	11.250	.250	.250	-.055	-
[illegible]	[illegible]	11 15' 0"	0 15' 0"	0 15' 0"	-0 3'19"	-
[illegible]	-.3729	-.3730	.0030	.0030	.0001	+
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	++++ ++++

PARKER BERTEA AEROSPACE GROUP
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PROGRAM	PART NAME		PART NO.	DWG CHG
737	LEVER ASSY - SUMMING		69-35567	H
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME	HARRY J. GOGNA			1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REV.
	UPDATE TO REV.		65-44861	Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		1.377 1.387	1.3779		Ø 215	
2		4.120 4.130	4.1248		Ø 215	
3		8.740 8.750	8.7487		Ø 215	
4		.900 ± .010	.8987		Ø 215	
5		.125 ± .010	.1254		Ø 215	
6		.3125 ± .0003 Ø MKSP5	.3123 .3125		Ø 215	
7		.3125 ± .0003 Ø	.3123 .3125		Ø 215	
8		.3751 ± .0003 Ø	.3748 .3750		Ø 215	

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Parker

J94S NUMERICAL CONTROL INSPECTION

Part Number	Operation	B/P Rev.	Route
69-35567	N/A	D	N/A

S/N	Inspector	Time	Date
1358	HARRY GOGNA	04:08 PM	8 Mar 1995

	ACTUAL	NOMINAL	+ TOL	- TOL	DEV	OUT-TOL
X	5.7487	5.7450	.0050	.0050	.0037	+++
Y	0.0000	0.0000	.0050	.0050	0.0000	

	ACTUAL	NOMINAL	+ TOL	- TOL	DEV	OUT-TOL
X	-4.1318	-4.1350	.0050	.0050	.0032	+
Y	1.3729	1.3920	.0050	.0050	-.0041	----

	ACTUAL	NOMINAL	+ TOL	- TOL	DEV	OUT-TOL
Y	.9887	.9900	.0100	.0100	-.0013	-
X	.1354	.1350	.0100	.0100	.0004	+

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	LEVER ASSY-PRIMARY		69-35602	C
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNA			1
PURCHASE ORDER NO.	FAI: R/ COMPLETE ☐ UPDATE ☐	SERIAL NO:	NEXT ASSEMBLY	REJ.
	UPDATE TO REV.		65-44861	Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.8750 .8751 Ø	.8751		Ø 215	
2		.645 .649 R TYP	.649		Ø 215	
3		1.3000 1.3001 Ø	1.3000		Ø 215	
4		2.298 2.302	2.2980		Ø 215	
5		2.763 2.767	2.7664		Ø 215	
6		.463±.010 R TYP	.463		Ø 215	
7		.462 .464	.4628		Ø 215	
8		.125±.010 R	.125		Ø 215	
9		14° 16° TYP	15°		Ø 215	
10		45°±½° X .050±.010	45° X .048		Ø 215	
11		.470 .480	.473		Ø 215	
12		.143 .155 R	.152		Ø 215	
13		8 ✓	8 ✓		Ø 215	
14		.3124 .3125 Ø	.3124		Ø 215	

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PROGRAM	PART NAME	PART NO.	DWG CHG
737	GUIDE-SPRING. SNGL. INTER. SUMMING	66-22825	B

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME	HARRY S. GOGNA			1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REJ. 0
	UPDATE TO REV.			

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.348 .358 Ø	.3540		Ø 215	
2		.020 .030	.025		Ø 215	
3		.095 .105	.0994		Ø 215	
4		.148 .152	.1488		Ø 215	
5		.315 .325 Ø	.3155		Ø 215	
6		.458 .462	.4604		Ø 215	

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	PIN-DETENT-INTER. SUMMING		66-22760	A
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNA			1
PURCHASE ORDER NO.:	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO:	NEXT ASSEMBLY:	REJ.
	UPDATE TO REV.:			Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.0782 .0784 Ø	.0783		Ø 215	

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	CRANK - REDUNDANT		69-35601	B
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME	HARRY S. GOSNA			1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REJ.
	UPDATE TO REV.			Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		1.562 1.564	1.5634		Ø 215	
2		.2497 .2500 Ø THRU	.2498		3 215	
3		.6768 .6770 Ø	.6770		Ø 215	
4		.809 .811	.8105		Ø 215	
5		2.970 2.980	2.9725		Ø 215	
6		2.655 2.665	2.658		Ø 215	
7		6°15' 6°45'	6°25'		Ø 215	
8		℄ OF TOOTH	ACCP		Ø 215	

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	CRANK - REDUNDANT		69-35601	G
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME				1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO(S)	NEXT ASSEMBLY	REV.
	UPDATE TO REV.		69-35566	Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		1.562 1.564	1.5621		Ø 215	
2		.6240 .6245 Ø	.6244 .6245		Ø 215	
3		.635 .645	.637		Ø 215	
4		.676 .678 Ø	.6768 .6770		Ø 215	
5		.8740 .8745 Ø	.8740		Ø 215	
6		.284 .286	.2845		Ø 215	
7		.382 .392	.387		Ø 215	
8		6°15' 6°45'	6.671°		Ø 215	

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	LINK-ASSY VALVE		69-35563	D
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC. 1
VENDOR NAME	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REJ. Ø
PURCHASE ORDER NO.	UPDATE TO REV:		65-44861	

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		8.828 8.838	8.8327	ONE END MLE IS DAMAGED. BUT DIM IS ACCP. 8.835	Ø 215	

THIS PART IS WITH 69-35604 (ASSY)

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J94S NUMERICAL CONTROL INSPECTION

Part Number	Operation	D/P Rev.	Route
59-35553	N/A	D	N/A

S/N	Inspector	Time	Date
0001	HARRY GOGNA	10:22 AM	8 Mar 1995

	ACTUAL	NOMINAL	+ TOL	- TOL	DEV	OUT-TOL
X	8.8327	8.8330	.0050	.0050	-.0003	-
Y	0.0000	0.0000	.0050	.0050	0.0000	

DAMAGED HOLE DIM.

X	8.8358	8.8330	.0050	.0050	.0029	+++
Y	-.0012	0.0000	.0050	.0050	-.0012	-

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PROGRAM	PART NAME	PART NO.	DWG CHG
737	ROLLER SECONDARY SLIDE OPER.	60164	A

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME	HARRY S. GOGNA			1
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REJ.
	UPDATE TO REV.		60050	Ø

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.4900 ± .0002 Ø	.4899		Ø 215	
2		.035 ± .005	.0353		Ø 215	
3		.240 ± .005 R	.240		Ø 215	
4		.160 ± .001	.1606		Ø 215	
5		.075 ± .005	.0752		Ø 215	

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Parker

INSPECTION WORKSHEET

SLEEVE - MAIN ACTUATOR (G)

PART NUMBER: 69-35611 JOB NO: _____ REV: C

TOP ASSY P/N: PROGRAM: 737

SERIAL NO:	LOT NO:	B/P DIM:	ACTUAL DIM:	ACC:	REJ:
1 PC		7.873/7.877	7.876	X	
1PC		5.999/6.001	6.000	X	
1PC		.245/.249	.248	X	
1PC		.328/.332	.330	X	

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INSPECTION WORKSHEET

CAP - END, MOD. PISTON

PART NUMBER: 59174 JOB NO: ______ REV: K

TOP ASSY P/N. PROGRAM: 727,737

SERIAL NO:	LOT NO:	B/P DIM:	ACTUAL DIM:	ACC:	REJ:
1 PC		.025 +/-.005	.024	X	

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INSPECTION WORKSHEET

DIAPHRAGM - LVDT TRANSDUCER (CP)

PART NUMBER: 59188 JOB NO: _____ REV: D

TOP ASSY P/N: PROGRAM: _____

SERIAL NO:	LOT NO	B/P DIM:	ACTUAL DIM:	ACC:	REJ:
1 PC		1.003 +/-.005	1.004	X	

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INSPECTION WORKSHEET

PISTON-YOKE ASSEMBLY ACTUATOR (2)

PART NUMBER: 69-35612 JOB NO: _____ REV: B

TOP ASSY P/N: PROGRAM: 737

S/N:2377	LOT NO:	B/P DIM:	ACTUAL DIM:	ACC:	REJ:
1 PC		1.623/1.627	1.625	X	
1PC		1.495/1.505	1.502	X	
1PC		5.020/5.024	5.021	X	
1PC		2.999/3.001	2.999	X	
		.3124/.3125	.3125 TO .3127		X

PARKER BERTEA AEROSPACE GROUP
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PROGRAM	PART NAME	PART NO.	DWG CHG
737	LEVER SECONDARY	69-35604	C

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME	HARRY S. GOGNA			Ø
PURCHASE ORDER NO.	P.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO:	NEXT ASSEMBLY	REV.
	UPDATE TO REV.	N/A	69-35603	F

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		1.685 1.695 Ø	1.6898		Ø 215	
2		1.3001 1.3002 Ø	1.3001		Ø 215	
3		1.315 1.325	1.322		Ø 215	
4		.263 .267	ASSY		Ø 215	
5		1.563±.010	1.567		Ø 215	
6		.005 MAX MISMATCH	ASSY REG'S BEAR REMOVAL		Ø 215	
7		2.322±.010	2.319		Ø 215	
8		2.763 2.767	2.7668		Ø 215	
9		45°±½° X .050±.010 3PL	45° X.038 .020			Ø 215
10		.462 .464	.464		Ø 215	

PARKER BERTEA AEROSPACE GROUP
CONTROL SYSTEMS DIVISION

FIRST ARTICLE INSPECTION REPORT

Parker

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PROGRAM	PART NAME		PART NO.	DWG CHG
737	SEGMENT-CAM		69-35607	B
PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNA			Ø
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REJ.
	UPDATE TO REV:		69-35649	1

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.4495 .4500	.4497		Ø 215	
2		.2005 .2010	.2008		Ø 215	
3		.2502 .2504 Ø	.2508			Ø 215
4		2 HOLES IN LINE	IN LINE ACCP		Ø 215	
5		.125±.010 R TYP	.125		Ø 215	
6		.125±.010 R TYP	.125		Ø 215	
7		.223 .227 TYP	.2245 .2248		Ø 215	
8		14° 16° TYP	14°30'		Ø 215	
9		.298 .302	.2988		Ø 215	
10		1.923 1.927	1.926		Ø 215	
11		.152 .156 R	.155		Ø 215	
12		.3122 .3123 Ø	.3120			Ø 215

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PARKER BERTEA AEROSPACE GROUP
CONTROL SYSTEMS DIVISION

FIRST ARTICLE INSPECTION REPORT

Parker

DATE: 3-8-95 PAGE: 1 OF 1

PROGRAM	PART NAME	PART NO.	DWG CHG
737	SEGMENT-WALKING BEAM	69-35605	B

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME	HARRY S. GOGNA			Ø
PURCHASE ORDER NO.	F.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY	REJ.
	UPDATE TO REV.		69-35640	1

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		.431 .437 R	.436		Ø 215	
2		.8749 .8750 Ø	.8747			Ø 215
3		1.448 1.452	1.450		Ø 215	
4		.150 ±.010	.150		Ø 215	
5		.075±.010	.0735		Ø 215	
6		.3122 .3123 Ø	.3119			Ø 215
7		= C .003	.0003		Ø 215	
8		.150 .156 R	.156		Ø 215	
9		.2502 .2504 Ø	.2505			Ø 215
10		⊥ B .0005	.0001		Ø 215	
11		⊙ C .002 TIR	.0002		Ø 215	
12		.1995 .2000	.1997		Ø 215	
13		= A .003	.0002		Ø 215	
14		1.923 1.927	1.9255		Ø 215	

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PARKER BERTEA AEROSPACE GROUP
CONTROL SYSTEMS DIVISION

FIRST ARTICLE INSPECTION REPORT

Parker

DATE: 3-8-95 PAGE: 1 OF: 1

PROGRAM	PART NAME	PART NO.	DWG CHG
737	FORK-CENTERING SUMMING LEVER	69-35613	B

PARKER MADE ☐ VENDOR MADE ☐	INSPECTED BY:	STAMP	WORK ORDER:	ACC.
VENDOR NAME:	HARRY S. GOGNA			ϕ
PURCHASE ORDER NO:	P.A.I.R. COMPLETE ☐ UPDATE ☐	SERIAL NO.	NEXT ASSEMBLY:	REL.
	UPDATE TO REV.		65-44664	1

ITEM	B/P LOC	B/P REQ.	ACTUAL	COMMENTS	ACC.	REJ.
1		2.647 2.653	2.650		B 215	
2		.4505 .4510	.4514			B 215
3		.2502 .2504	.2506 .2517			B 215
4		2.534 2.540	2.536		B 215	

10718-15(1) R3/94

MANIFOLD, AFT (GP)

PARKER
FIRST ARTICLE TAPE INSPECTION

TAPE PROOF

Part #: 65-44863	Tape #:	Operation:	Drawing Change: REV T (GP)
Job #:	Date:	S/N:	Planning Change:
Inspected By:		ACC:	REJ:

LOC	DET	FT	DIM	HOLD@	TOLERANCE	ACTUAL	ACC	REJ
1 C/2		LC	.750		.755 .745	.7523	✓	
1 B/6		LO	2.238		2.240 2.236	2.2381	✓	
1 A/2		LO	2.750		2.755 2.745	2.7497	✓	
1 B/3		LO	2.827		2.829 2.825	2.8260	✓	
1 B/3		LO	1.625		1.627 1.623	1.6255	✓	
~~1 C/2~~		FC	4.000		~~4.0010~~ ~~4.000~~ (GP)			
1 C/2		FC	4.000		4.0010 3.999	3.9989		✓
1 C/4		FC	3.000		3.001 2.999	3.0005 – 3.0017		✓
1 B/5		LO	2238		2.236 2240	2.236	✓	
1 C/3		LO	2.750		2.755 2.745	2.740		✓
1 B/6		LO	3.160		3.162 3.158	3.1562 (THD LOCATE IN INSERT?)		✓
1 B/6		LO	2.800		2.802 2.798	2.7994	✓	
1 C/9		FC	1.450		1.4498 1.4452	1.4495	✓	
1 C/9		FC	.800		.798 .802	7995	✓	
1 A/13		F/C	.913		.912 .914	.9125 – 9132	✓	

Form ####-##

PAGE

PARKER

MANIFOLD, AFT (GP) FIRST ARTICLE TAPE INSPECTION

TAPE PROOF

Part #: 65-44863 (GP)	Tape #:	Operation:	Drawing Change: Rev T (GP)
Job #:	Date:	S/N:	Planning Change:
Inspected By:			ACC: REJ:

LOC	DET	FT	DIM	HOLD@	TOLERANCE	ACTUAL	ACC	REJ
2 C/2	C2	DD	1.575		1.576 1.574	NOT WORN 1.5760 | WORN 1.5751	✓ (3)	
2 C/2	C2	DD	2.275		2.277 2.273	2.2765	✓ (3)	
1 A/13	3B4	DI	1.179		1.178 1.180	1.1790-1.1794	✓ (3)	
1 A/13	3B4	DI	1.4995		1.4995 1.5000	1.4998 ~~1.4~~ 1.5000	✓ (3)	

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Attachment 2

BERIEA, IRVINE • CALIFORNIA **TEST PROCEDURE** CHECK BY DATE

PART NO: 65-44861-	SERIAL NO:	VALVE NO:	DATE:
IBM NO:	PART NAME RUDDER ACTUATOR P.C.U.		INSP:

TEST	REQUIREMENTS	RESULTS	ACC.	REJ.
20 LOW PRESSURE LEAKAGE	NO EXTERNAL LEAKAGE IN 2 HOURS.			
21 FLUSHING	FLUSH AND FILL WITH BMS 3-11 FLUID. CAP PORTS AND ELEC. RECEPTACLE.			
22 TEST ACCEPTANCE	INK STAMP BODY WITH DATA AND TEST ACCEPTANCE STAMP.			
ELECTRICAL TESTS - PERFORM IN SEQUENCE SHOWN				
23 DIELECTRIC STRENGTH 4.3.2	SLOWLY APPLY NOTED VOLTAGE. NO ARCING OR INSLUATION FAILURE IN ONE MINUTE. REDUCE VOLTAGE TO ZERO BEFORE DISCONNECTING.	-5, THRU -9, -11 SYS. ONLY		
		SYS "A" / SYS "B"		
	BODY TO PIN 1 AT 1500 VAC	/ OK		
	PIN 1,5,7, & BODY TO PIN 11	/ OK		
	PIN 1,5,7, & BODY TO PIN 9	/ OK		
	PIN 1 & BODY TO PIN 5	/ OK		
	PIN 1 & BODY TO PIN 7	/ OK		
	AT 1000 VAC			
	PIN 5 TO PIN 7 AT 800 VAC	/ OK		
	PIN 9 TO PIN 11			
24 INSULATION RESISTANCE 4.3.3	APPLY 500 VDC BETWEEN NOTED PINS. 100 MEGOHMS MIN RESISTANCE (REQUIREMENT)	-5, THRU -9, -11 SYS. ONLY		
		SYS "A" / SYS "B"		
	PINS 1,5,7,9,11 TO BODY	/ OK		
	PINS 5,7,9,11 TO 1	/ OK		
	PINS 7,9,11 TO 5	/ OK		
	PINS 9,11 TO 7	/ OK		
	PINS 11 TO 9	/ OK		
25 PIN TO PIN RESISTANCE	CHECK PIN TO PIN RESISTANCE AT 70°F AND RECORD. MUST COMPLY WITH NOTED VALUE	SYS "A" / SYS "B"		
	PINS RESISTANCE			
	1-2 71-87 OHMS	77 / 77		
	5-6 900-1100 OHMS	1003 / 1003		
	7-8 900-1100 OHMS	1003 / 1003		
	9-10 80-165 OHMS	104 / 104		
	11-12 60-135 OHMS	83 / 83		
	1-4 SHORTED	Short / Short		
	3 OPEN	open / open		

65-44861-1 PG. 28 OF 32 1-10-81-C9 AH

Attachment 3

(c) Apply 28 volts dc to pins A and C of receptacle (21). Valve must open without audible delay (indicated by fluid flow from cylinder port).

(6) Pressure Drop Test

(a) Open cylinder and return ports.

(b) Apply 28 volts dc to pins A and C of receptacle (21).

(c) Gradually apply 140-psi fluid pressure to pressure port. Measure flow at cylinder port. Flow must be at least 0.4 gpm.

6. Bypass Valve Assembly Pretest (Fig. 1101).

A. Test Equipment

(1) Test Fixture: TF68061-1001 (Fig. 710)

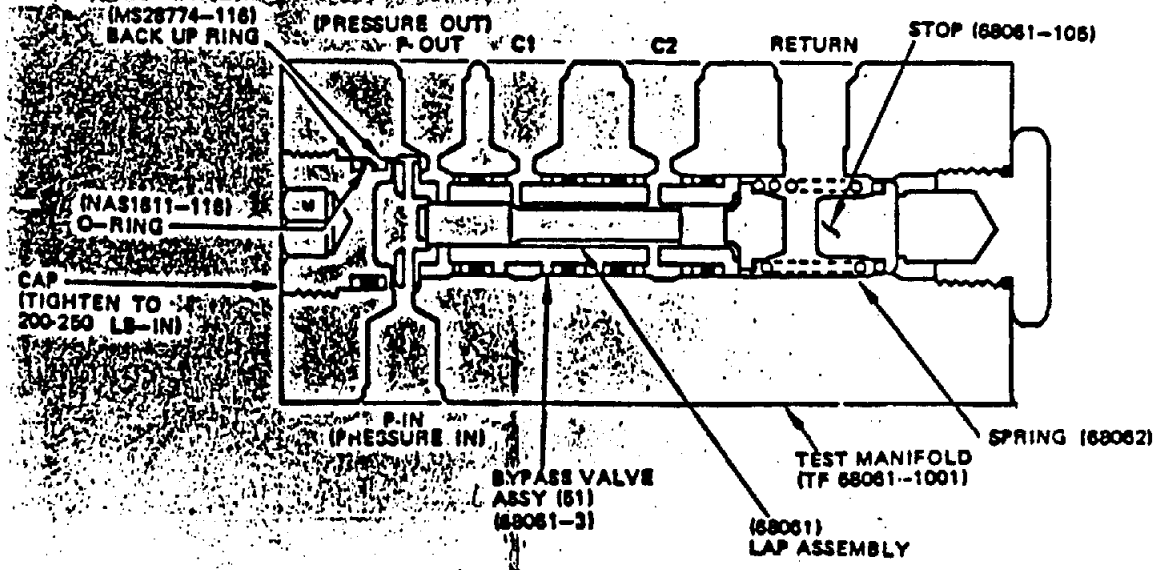
(2) Suitable supply of fluid pressure

(3) Suitable pressure gages, valves and flowmeters

B. Friction and Flow Tests (Fig. 1101).

(1) Install bypass valve (51) in test fixture TF68061-1001 (Fig. 710).

(2) Install a suitable plug in pressure outlet port.



Bypass Valve Test Setup
Figure 710

(3) Connect port C2 to flowmeter.

(4) With R (return port) open, apply pressure simultaneously to P-IN (pressure inlet) and port C1.

(5) Raise pressure to 250 psi and measure flow from C2. Flow from C2 shall be 1.08 gpm minimum.

(6) Slowly increase pressure until flow from C2 reduces to approximately 166 cc per minute.

(7) Measure maximum flow obtained prior to flow reduction to 166 cc per minute. Maximum flow shall be 1.75 gpm.

(8) Measure pressure at which flow reduction to 166 cc per minute from C2 occurs. Pressure shall be 460 psi maximum.

(9) Reduce pressure to 200 psi and measure flow from C2. Flow from C2 shall be 0.97 gpm minimum.

(10) Connect port C1 to flowmeter and repeat previous tests (1) through (9) applying pressure to P-IN and port C2 simultaneously.

C. Leakage Test

(1) Install suitable plug in P-OUT (pressure outlet) port.

(2) Open R port and connect port C1 to flowmeter.

(3) With 3000-psi pressure applied to P-IN port and port C2, measured flow from R port shall not exceed (19) 15 cc per minute.

(4) With pressure to C2 port reduced to 1500 psi, measure flow from port C1. Flow from port C1 shall be 209 to 409 cc per minute.

(5) Open port C2 and measure flow from ports C1 and C2 combined. Flow from ports C1 and C2 shall not exceed 6 cc per minute.

D. Bypass Flow Test

(1) With all other ports open and 50-psi fluid pressure applied to P-IN port, measured flow from P-OUT port must be 0.05 to 0.20 gallon per minute.

7. Check Valve Pretest (See figure 1101.)

A. Proof Pressure Test

Parker **PRODUCTION TEST PROCEDURE**

DRAWN BY D. CHRISTENSEN DATE 12-26-
CHECK BY S. WEIK DATE 11-5-8

PART NO: -1 68061-3	SERIAL NO: 6420	VALVE NO: 68061-3	DATE: 3-8-95
IBM NO:	PART NAME: BYPASS VALVE (A-SYSTEM)		INSP:

	TEST	REQUIREMENTS	RESULTS		ACC.	REJ.
	FRICTION & FLOW		PRESS	P IN, C2	P IN, C1	
			FLOW	C1	C2	
1 2	C1 - C2 C2 - C1	A) 1.08 GPM MIN. AT 250 PSI		1.20 GPM 250 PSI	1.15 GPM 250 PSI	
		B) 1.75 GPM MAX BEFORE SHUT-OFF.		1.35 GPM	1.3 GPM	
		C) 460 PSI MAX AT SHUT-OFF		360 PSI	360 PSI	
		D) REDUCE PRES: 0.97 GPM MIN. AT 200 PSI.		1.05 GPM 200 PSI	1.00 GPM 200 PSI	
3	LEAKAGE (1) (5)	C1: 15 CC/MIN MAX (-1) (MIL-H-5606 10 CC/MIN)		C1	R	
	FLOW (1)	300 ± 100 CC/MIN (-3) (MIL-H-5606 260 ± 50 CC/MIN)				
	LEAKAGE (1) (5)	R: 15 CC/MIN MAX (MIL-H-5606 10 CC/MIN) (-1, -3)		200 CC/MIN	No leakage CC/MIN	
4	LEAKAGE (1) (5)	C1 & C2 COMBINED: 5 CC/MIN MAX. (MIL-H-5606 3.5 CC/MIN)		1 CC/MIN		
5	BYPASS FLOW	P OUT: .20/.05 GPM (P OUT: .22/.05 GPM MIL-H-5606)		0.18 GPM		
6	TEST ACCEPTANCE	AFTER SATISFACTORY TEST, INK STAMP WITH TEST ACCEPTANCE.				

68061-T
UG. 4 UP 4
Boeing Spec 10-60926
4-19089
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Form 1041-19

PRODUCTION TEST PROCEDURE

DRAWN BY D. CHRISTENSEN DATE 12-26-
CHECK BY S. WEIK DATE 11-5-8

PART NO: -1 68061-3	SERIAL NO: 6430	VALVE NO: 68061-3	DATE: 3-8-95
IBM NO:	PART NAME: Bypass Valve (B-SYSTEM)		INSP:

	TEST	REQUIREMENTS	RESULTS		ACC.	REJ.
	FRICTION & FLOW		PRESS	P IN, C2	P IN, C1	
			FLOW	C1	C2	
1 2	C1 - C2 C2 - C1	A) 1.08 GPM MIN. AT 250 PSI		1.15 GPM 250 PSI	1.14 GPM 250 PSI	
		B) 1.75 GPM MAX BEFORE SHUT-OFF.		1.4 GPM	1.3 GPM	
		C) 460 PSI MAX AT SHUT-OFF		370 PSI	365 PSI	
		D) REDUCE PRES: 0.97 GPM MIN. AT 200 PSI.		0.97 GPM 200 PSI	1.00 GPM 200 PSI	
3	LEAKAGE (1) (5)	C1: 15 CC/MIN MAX (-1) (MIL-H-5606 10 CC/MIN)		C1	R	
	FLOW (1)	300 ± 100 CC/MIN (-3) (MIL-H-5606 260 ± 50 CC/MIN)				
	LEAKAGE (1) (5)	R: 15 CC/MIN MAX (MIL-H-5606 10 CC/MIN) (-1, -3)		250 CC/MIN	No leakage CC/MIN	
4	LEAKAGE (1) (5)	C1 & C2 COMBINED: 5 CC/MIN MAX. (MIL-H-5606 3.5 CC/MIN)		1.5 CC/MIN		
5	BYPASS FLOW	P OUT: .20/.05 GPM (P OUT: .22/.05 GPM MIL-H-5606)		0.18 GPM		
6	TEST ACCEPTANCE	AFTER SATISFACTORY TEST, INK STAMP WITH TEST ACCEPTANCE.				

68061-T

PG. 4 OF 4

Boeing Spec 10-60926

1-19089

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Form 1041-19