APPENDIX D

RUDDER SERVO CONTROL FUNCTIONAL TEST PLAN

Servo Control
Functional Test Procedure
PN 31042-130

The investigation will be done according to the CMM 27-21-17 rev 6.

I- Control of pollution

Additional filter is installed on the test bench supply line (3 µm) to avoid any external contamination
Additional filter is installed on the test bench return line (25 µm) to collect any contamination coming from the servocontrol

These additional filters will be kept in place during all the tests, and removed after, for each servocontrol, to collect eventual contamination.

For the upper servocontrol, we check the pollution of the bench filter (return line) after cycling the servocontrol several times by increasing the pressure until the piston moves and by moving the input lever up to the test finger stop.

II- Functional tests

- cycle and check for external leakage.
- check the full retraction and extension of the test finger (jammed or not) : CMM §1
- measurement of the gap between neutral position and the fixed stops

For the following tests, the input lever needs to be set to the hydraulic neutral position.

- check dead travel at 50 bars and 206 bars: CMM §7

II-2-1 Control of the input lever and micro switch

- check the input lever travel between fixed stops : CMM §4-2
- check the input lever travel between test stops : CMM §4-1
- check travel past test stops to light and extinguish the micro switch, in retraction and extension : CMM §5-1 and §5-2
- check travel past fixed stops to light the micro switch, in retraction and extension : CMM §5-3
- check force required to operate the input lever : CMM §6-2.
- check the overall travel of the servocontrol : CMM §8.

- check jet pipe consumption : CMM §11-1. This test provides information mainly about the filter (clogged or not).
- check permanent consumption of the servocontrol in extension, retraction and middle position : CMM §11-2 and 11-3.
  This test provides information about the internal leakage between the 2 chambers, and, between one of the two chambers and the return. However, this test does not define the chamber.
- check the opening pressure of the by-pass valves by increasing the pressure from zero (extension and retraction). This test determines the pressure applied on the by-pass piston when the servocontrol is in "force fighting mode"
- check the flow rate of the calibrated damping ports with a ΔP of 20 bars (extension and retraction) : CMM §2-1 and §2-2.
- check the opening pressure of the by-pass valve with 216 bars supply pressure: CMM §2-3 and §2-4.
- check non-return valve leakage : CMM §3

II-2-3 Stall load

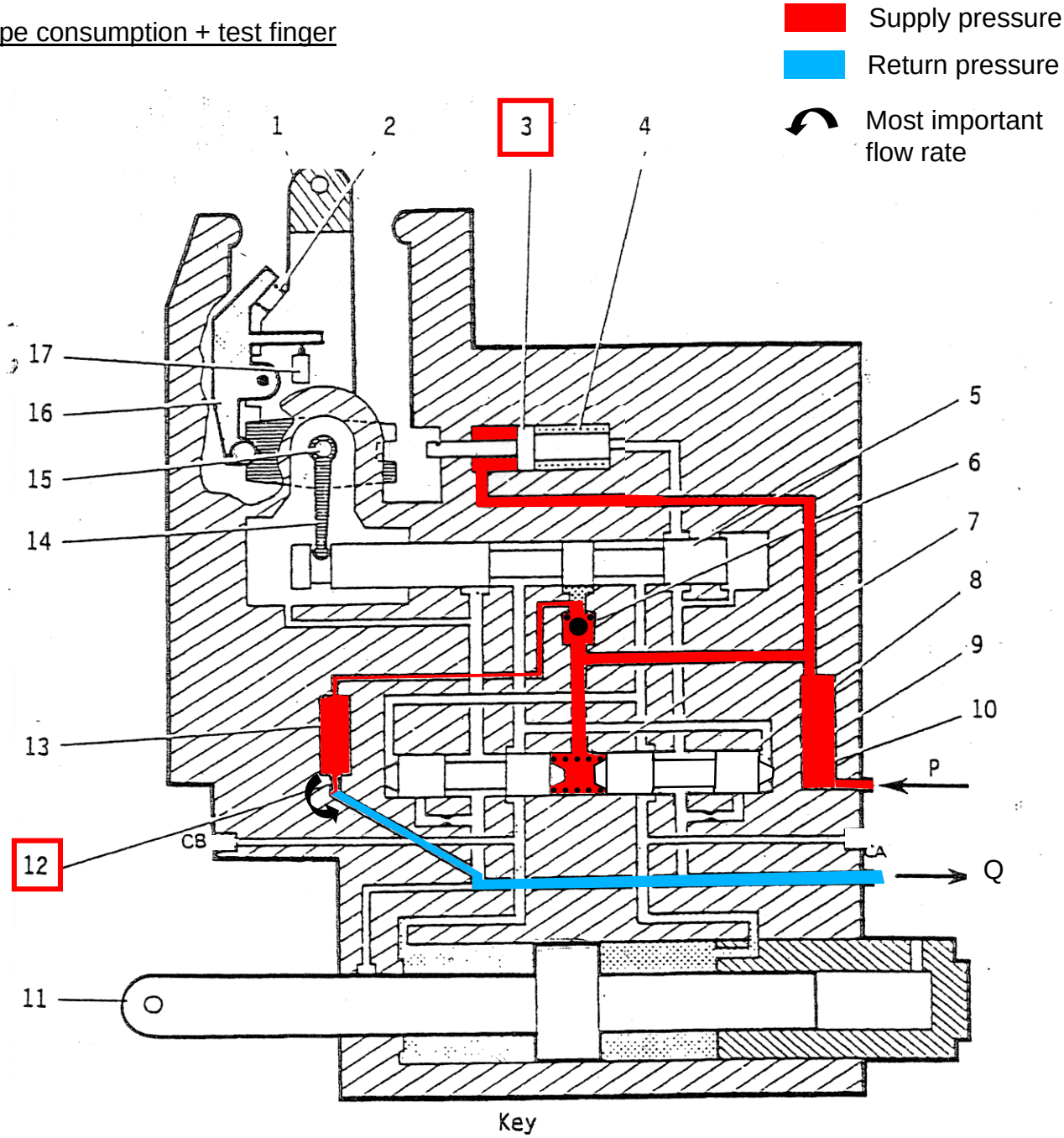
- check the pressure in C_A and C_B by applying 206 bars in the supply line. This test provides information on the pressure drop between the chambers and the supply line.
- check the pressure, applied in C_A and C_B, allowing the piston to move (see the friction test note).

II-2-4 Control of servocontrol speeds

- check firstly the intermediate speeds and then, the maximum no-load speeds : CMM §12. These speeds will be measured under 103 bars (see the speed note) before the stops (we must avoid any additional shock when cycling the servocontrol from stop to stop).

Functional diagram

Jet pipe consumption + test finger



Key

1 - Input lever
2 - Spring
3 - Test finger
4 - Spring
5 - Spool valve
6 - Non-return valve
7 - Spring
8 - By-pass piston
9 - Damping orifice
10 - Filter
11 - Piston
12 - Jet pipe
13 - Filter
14 - Drive pin
15 - Drive shaft
16 - Intermediate lever
17 - Microswitch

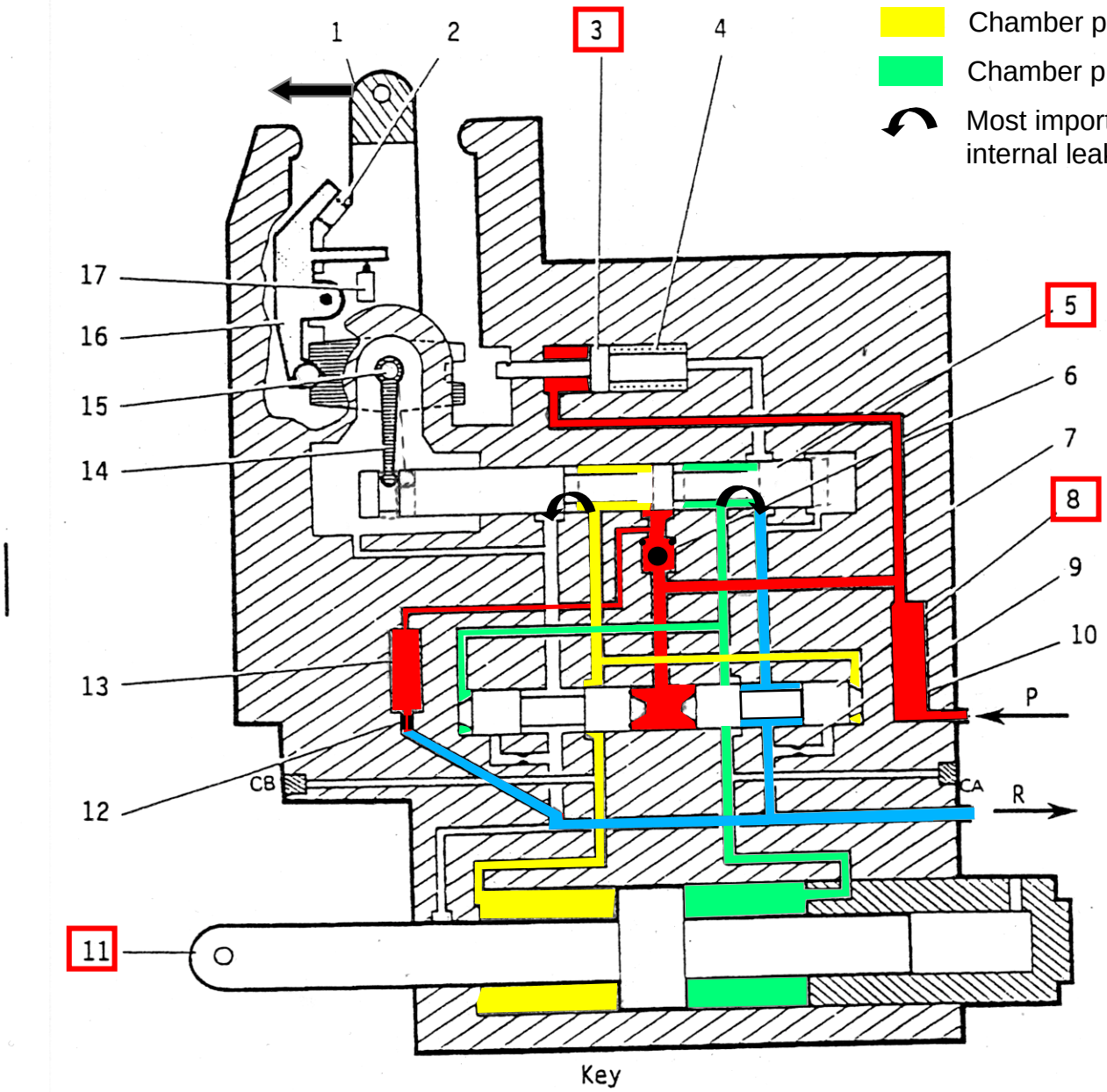
Functional diagram

Retraction

Internal leakage measurement :

test finger , spool valve, by pass valve, chambers

Supply pressure
Return pressure
Chamber pressure
Chamber pressure
Most important internal leakage



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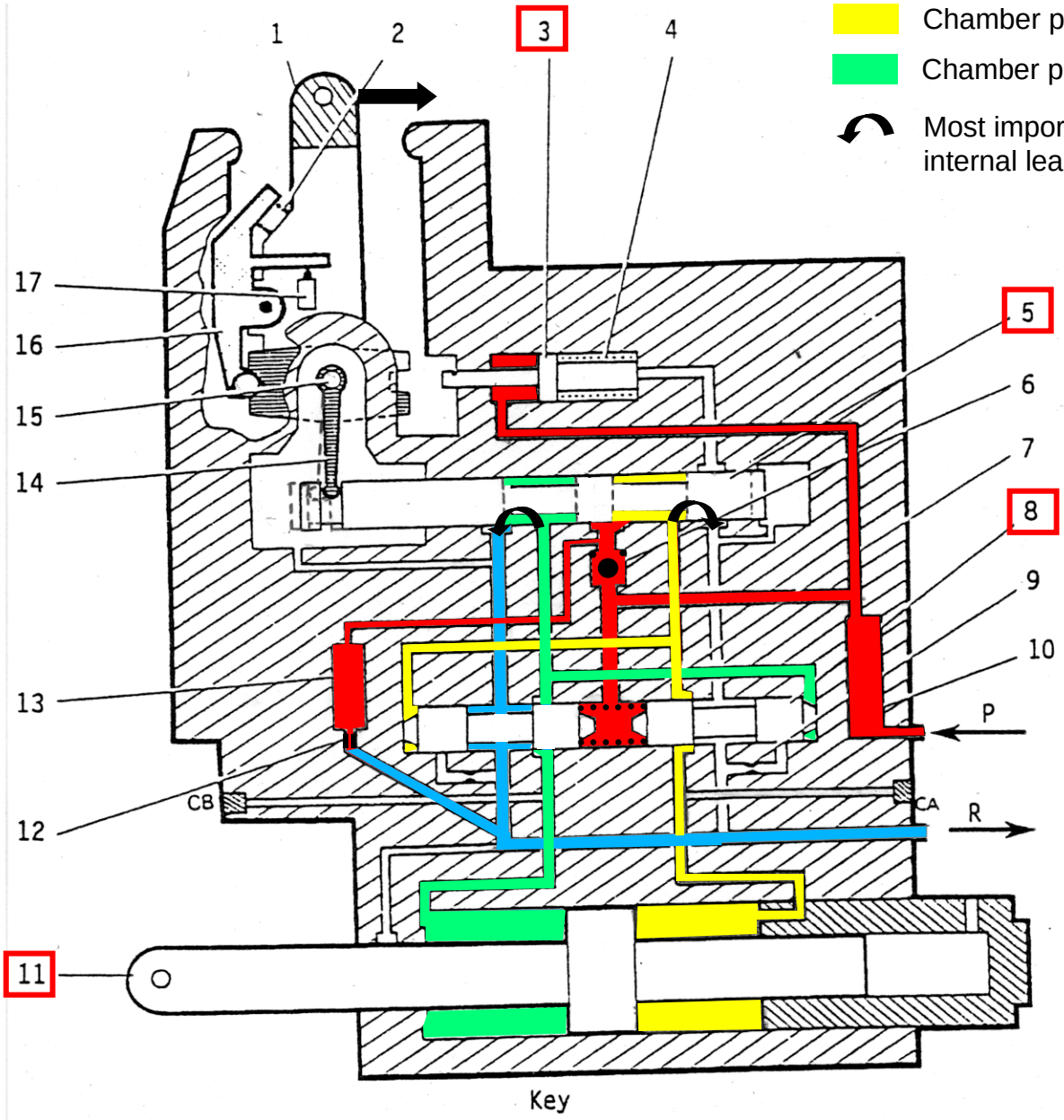
15 - Drive shaft
16 - Intermediate lever
17 - Microswitch

Functional diagram

Extension

Internal leakage measurement :

test finger , spool valve, by pass valve, chambers



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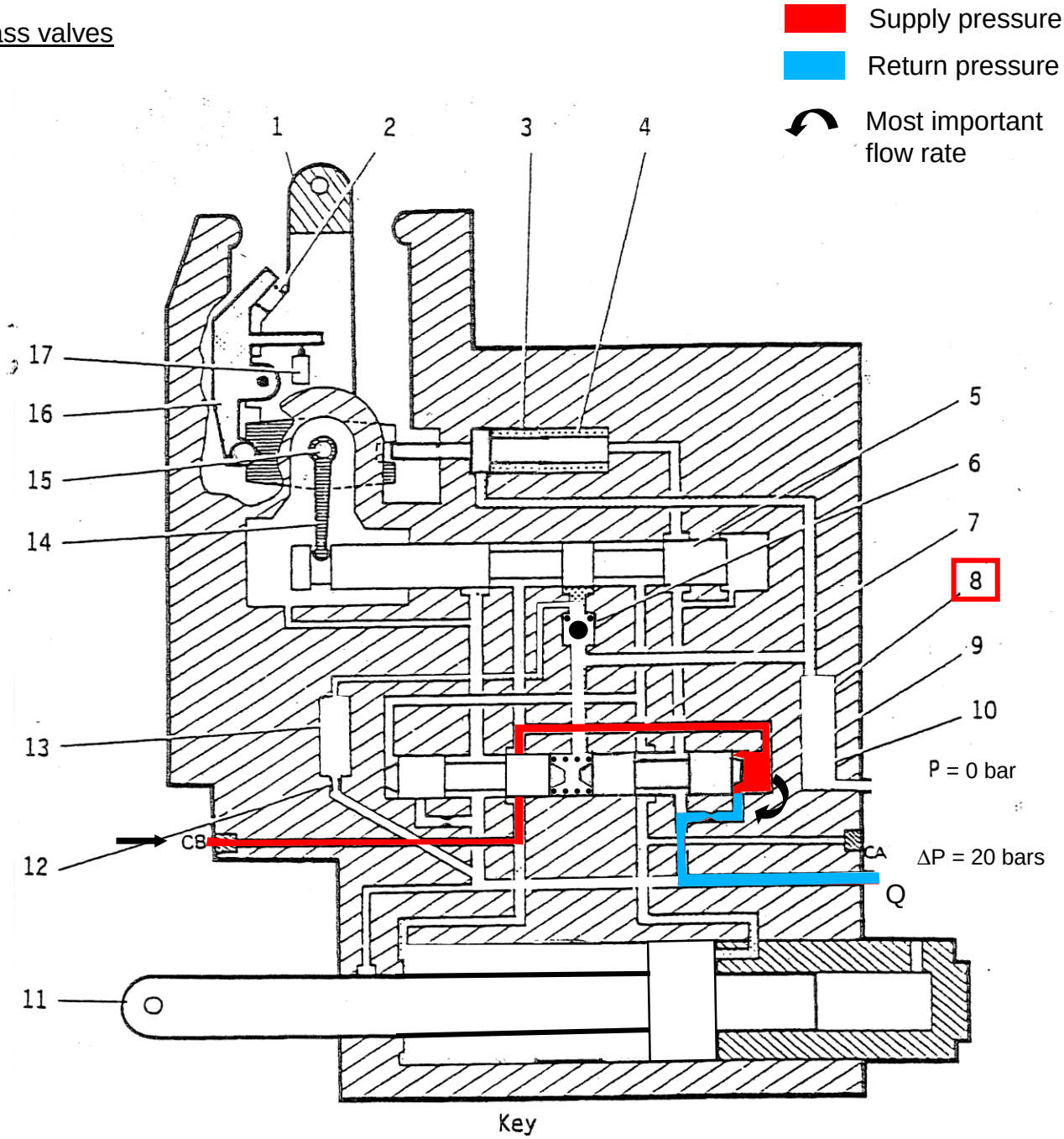
14 - Drive pin
15 - Drive shaft
16 - Intermediate lever
17 - Microswitch

Functional diagram

By pass valves



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7 - Spring
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10 - Filter
11 - Piston
12 - Jet pipe
13 - Filter
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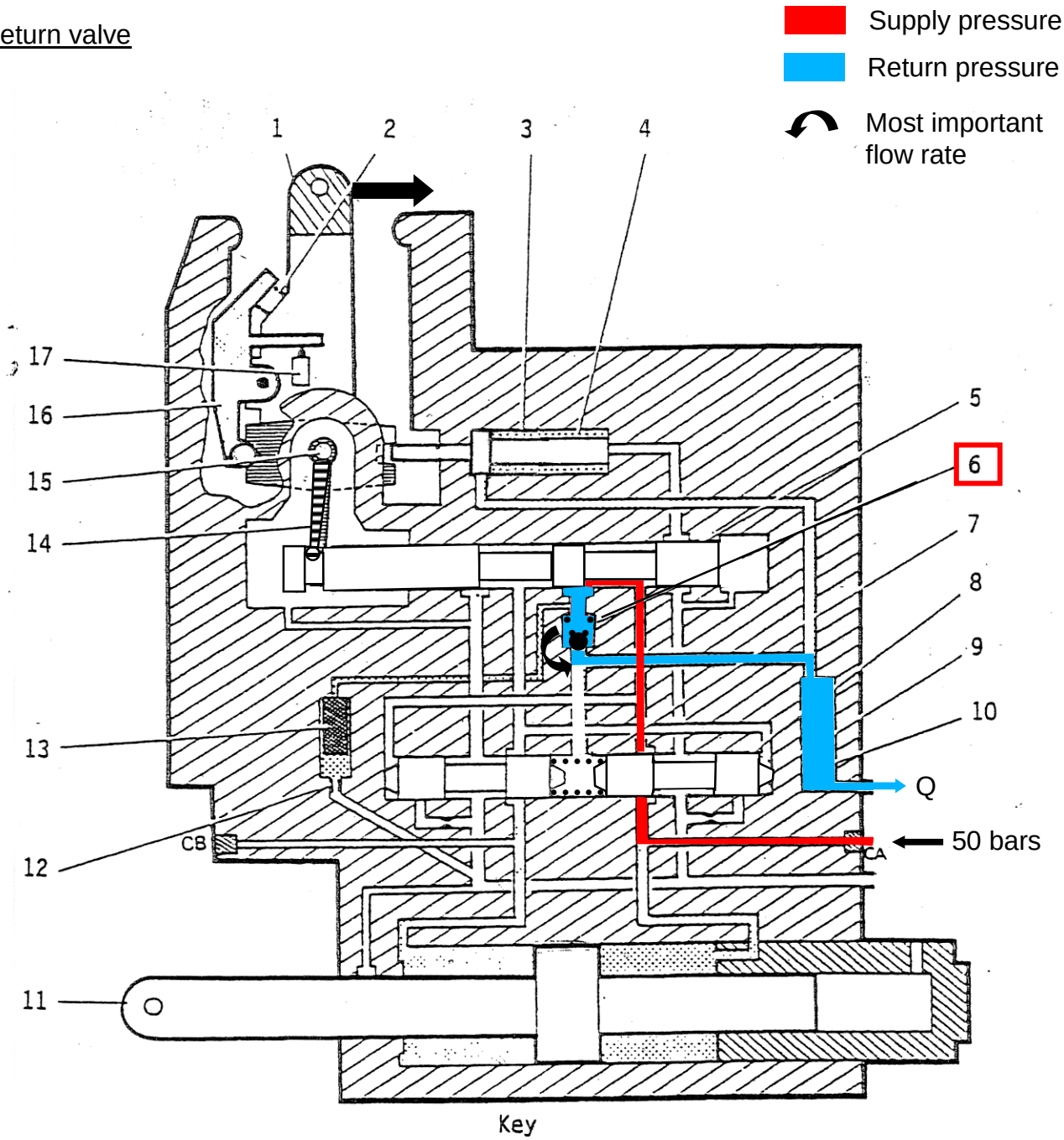
15 - Drive shaft
16 - Intermediate lever
17 - Microswitch

Functional diagram

Non return valve



Key

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13 - Filter
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15 - Drive shaft
16 - Intermediate lever
17 - Microswitch

NOTE FOR STALL LOAD TEST OF THE SERVOCONTROL PNR 31042-130

1- Pressure in the two chambers when the supply pressure is 206 bars

When the servocontrol is bottomed in the retraction position : check the pressure P_B in the chamber C_B.
When the servocontrol is bottomed in the extension position : check the pressure P_A in the chamber C_A.

We obtain the force, by the formula : $P = \frac{F}{S}$

⇨ $F_B = P_B \times S_c$ with S_c the chamber section (see appendix)
⇨ $F_A = P_A \times S_c$

Note : The difference between the supply pressure and the pressure in the chambers (C_A and C_B) is due to internal leakage of the servocontrol.

2- Friction measurement

- The servocontrol is bottomed in the retraction position. Via C_A, we apply a pressure. We increase the pressure from zero to the pressure P_{FA}, which is the pressure needed to move the piston all along the travel of the servocontrol.

- The servocontrol is bottomed in the extension position. Via C_B, we apply a pressure. We increase the pressure from zero to the pressure P_{FB}, which is the pressure needed to move the piston all along the travel of the servocontrol.

We obtain the friction force :
⇨ $F_{FB} = P_{FB} \times S_c$
⇨ $F_{FA} = P_{FA} \times S_c$

3- Stall load

We obtain the stall load by adding the forces at 206 bars and the friction forces :

We obtain the force developed by the servocontrol by subtracting the forces at 206 bars and the friction forces.

$$\mathbf{F_{SA} = F_A - F_{FA}}$$

$$\mathbf{F_{SB} = F_B - F_{FB}}$$

APPENDIX

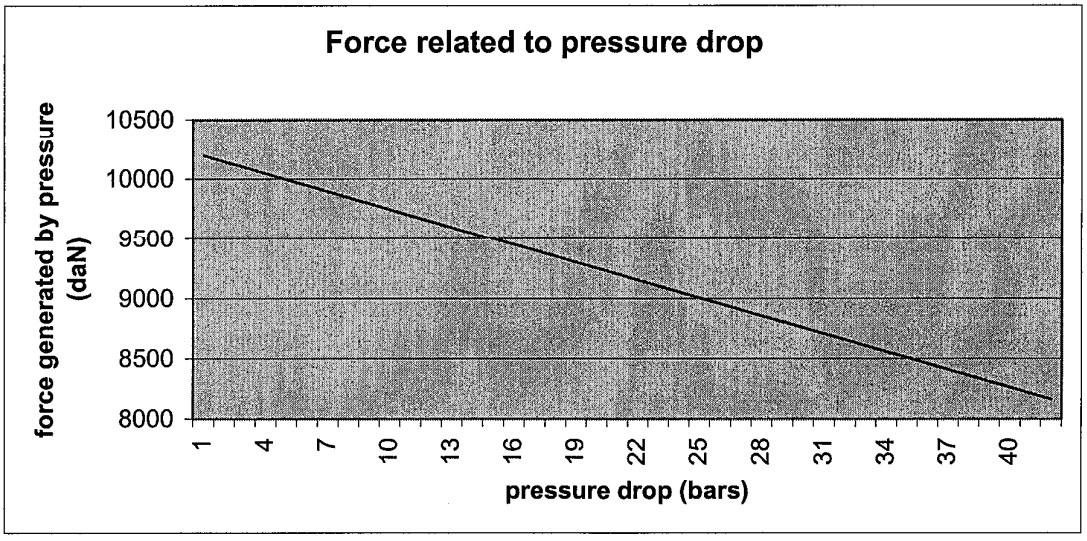
Force generated by pressure

Piston head diameter : $\phi_h = 88$ mm => Piston head section : $S_h = 6082mm^2$
Piston rod diameter : $\phi_r = 38$ mm => Piston rod section : $S_r = 1134mm^2$

Chamber section : $S_c = 4948$ mm^2

chamber pressure (bars)	pressure drop (bars)	force (daN)
206	0	10193
205	1	10143
204	2	10094
203	3	10044
202	4	9995
201	5	9945
200	6	9896
199	7	9847
198	8	9797
197	9	9748
196	10	9698
195	11	9649
194	12	9599
193	13	9550
192	14	9500
191	15	9451
190	16	9401
189	17	9352
188	18	9302
187	19	9253
186	20	9203

chamber pressure (bars)	pressure drop (bars)	force (daN)
185	21	9154
184	22	9104
183	23	9055
182	24	9005
181	25	8956
180	26	8906
179	27	8857
178	28	8807
177	29	8758
176	30	8708
175	31	8659
174	32	8610
173	33	8560
172	34	8511
171	35	8461
170	36	8412
169	37	8362
168	38	8313
167	39	8263
166	40	8214
165	41	8164



NOTE FOR DETERMINATION OF THE MAXIMUM NO-LOAD SPEED

I- Introduction :

The test of the maximum no-load speed is normally done stop to stop.

To avoid too hard chocks on the servocontrol, we want to measure the speed before the stops.

We tried several time to stop the servocontrol before it touches the stop, but it depends of the reaction time of the operator. So, it's too dangerous to do this test.

II- Determination of the speed :

We propose to do the test under a lower pressure, because if the servocontrol goes, unfortunately, on its stops, the shocks will be less hard than at 206 bars.

How to proceed :

We want to know the speed v_1 under $P_1 = 206$ bars.

We know that the pressure is proportional to the speed squared.

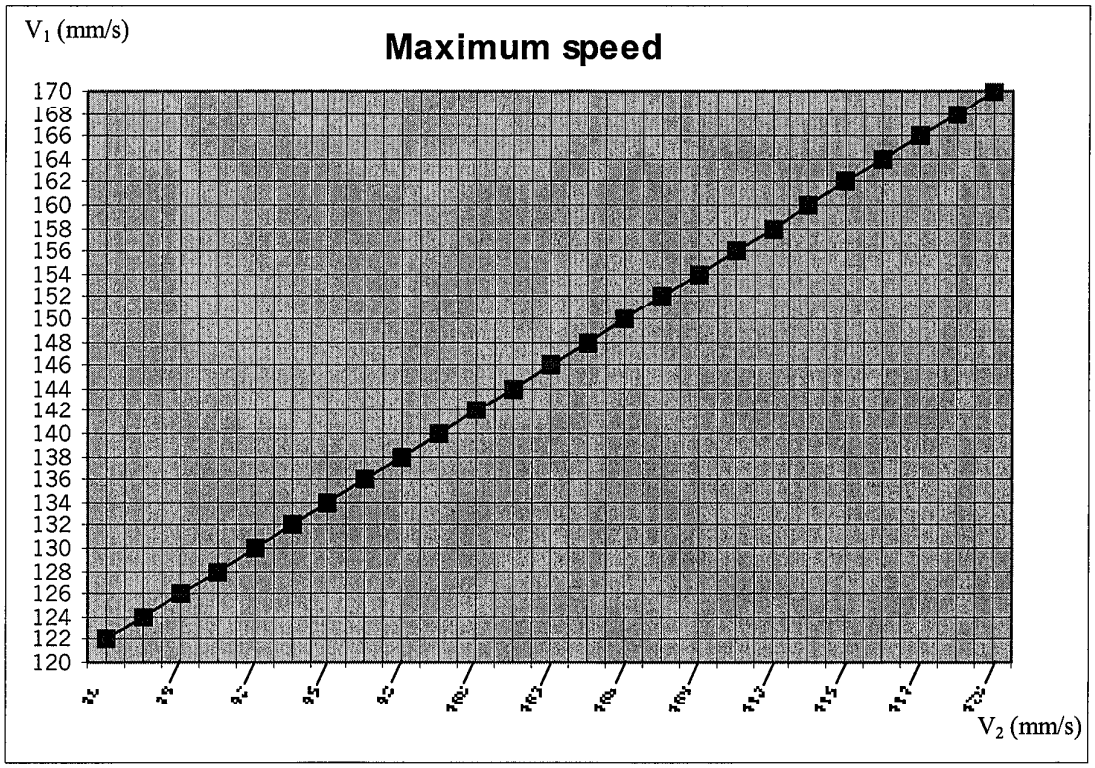
If we choose to do the test under $P_2 = \frac{P_1}{2} = 103$ bars, we can read on the bench a speed v_2.

As the pressure is proportional to the speed squared

=> we obtain the speed $\boxed{v_1 = \frac{v_2}{\sqrt{2}}}$

On the CMM, we have the maximum no-load speed under 206 bars : $122 < v_1 < 170$ (mm/s)

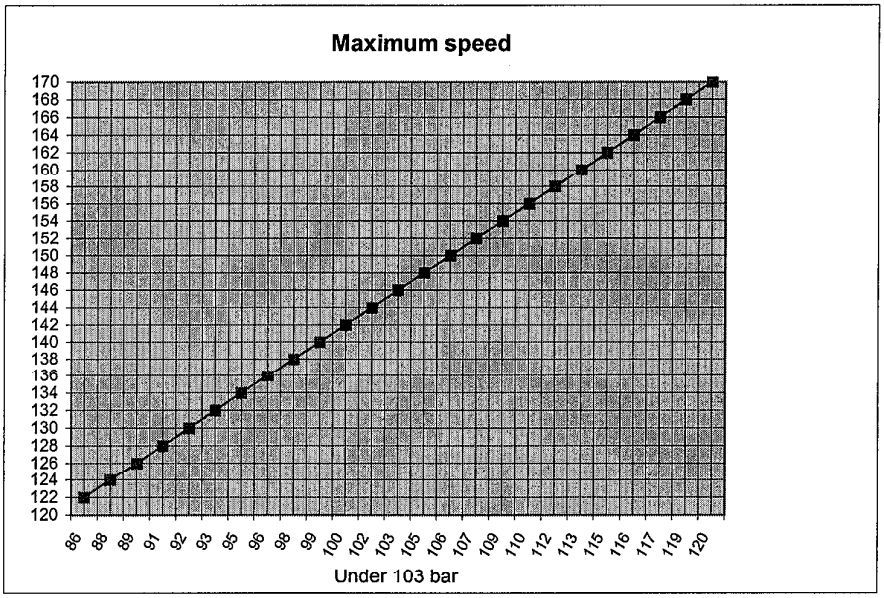
So, under 103 bars : $86 < v_2 < 120$ (mm/s



maximum speed

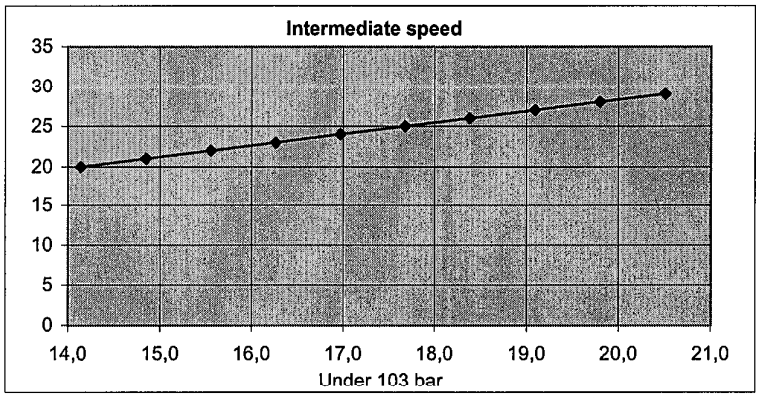
v1 : speed under 206 bars
v2 : speed under 103 bars

v2 (mm/s)	v1 (mm/s)
86	122
88	124
89	126
91	128
92	130
93	132
95	134
96	136
98	138
99	140
100	142
102	144
103	146
105	148
106	150
107	152
109	154
110	156
112	158
113	160
115	162
116	164
117	166
119	168
120	170



Intermediate speed

v2 (mm/s)	v1 (mm/s)
14,1	20
14,8	21
15,6	22
16,3	23
17,0	24
17,7	25
18,4	26
19,1	27
19,8	28
20,5	29



TESTING AND FAULT ISOLATION

NOTE: – The consumable materials to be used are indicated in the "List of Special Materials".
– The special tools and equipment to be used are listed in the list of "Special Tool, Fixtures and Equipment".

1. Test equipment (figure 101)

   A. Special tools and equipment

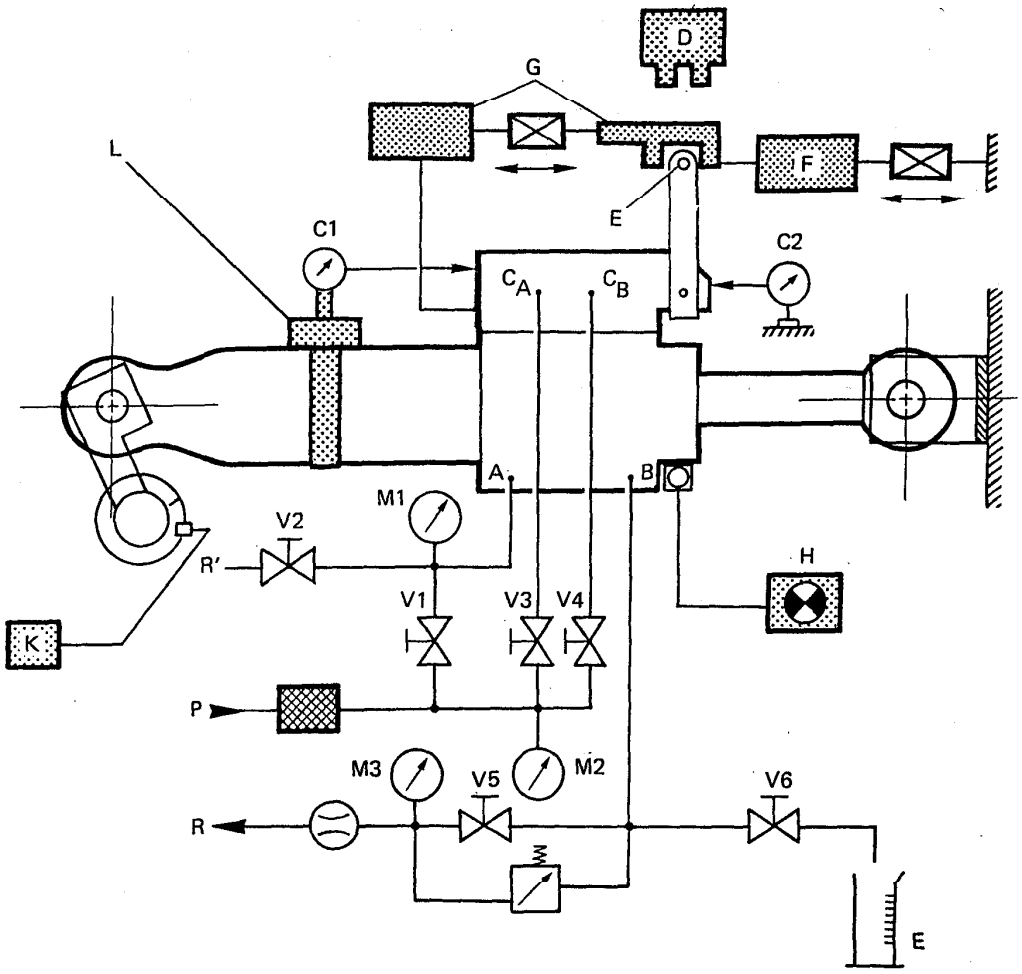
   – 0U190464 Test fixture.
   – 0U190432–001 Dial gage support (tool L).
   – 0U190432–002 Special tool F.
   – 0U190432–003 Special tool D–G. } input lever test set
   – 0U190432–004 Special tool E : pin.
   – 0U190440 Microswitch check box (tool H).
   – 0U190356 Velocity rate sensor and amplifier + digital chronometer (tool K).
   – 0U190482–002 Torque wrench adapter for ball bearing torque inspection.
   – 0U190481 Plate gauges for ball bearing centering inspection.
   – 0U133754 Low pressure test fixture.

   B. Standard tools and equipment

   – A hydraulic power supply capable of providing 0 to 280 bar (0 to 3625 psi) at a throughput of 50 l/min (13.2085 US gal/min).
   – An ohmmeter for measuring ground continuity
   – Two dial gages.

2. Test conditions

   – Fluid temperature between +20°C and +45°C (+68°F and +113°F)
   – Ambient temperature between +10°C and +35°C (+50°F and +95°F).
   – Hydraulic fluid to be Skydrol IV, Hyjet IV or equivalent.
   – Hydraulic fluid filtered to 10 micrometers absolute.



KEY

A - Fluid inlet union
B - Fluid outlet union
P - Pressure
R, R' - Return
E - Test tube
C1, C2 - Dial gages
V1 to V6 - Cocks
C_A - Chamber A pressure tapping
C_B - Chamber B pressure tapping
M1, M2 and M3 - Pressure gages (0-250 bar, 0-60 bar and 0-100 bar)
D - Special tool limiting control lever movement on either side of the neutral position : OU 190432-003.
E - Pin : OU 190432-004.
F - Special tool maintaining the control lever in position relative to the frame (with the servo control at mid travel) : OU 190432-002.
G - Special tool enabling continuous movement of the control lever relative to the jack body without backlash : OU 190432-003.
H - Microswitch check box.
K - Velocity rate sensor and amplifier + digital chronometer.
L - Dial gage support : OU 190432-001.

Test setup
Figure 101

3. Test set up

A. General

The servo control is to be attached to fixture 0U190464 by its two sperical bearings (See figure 101).

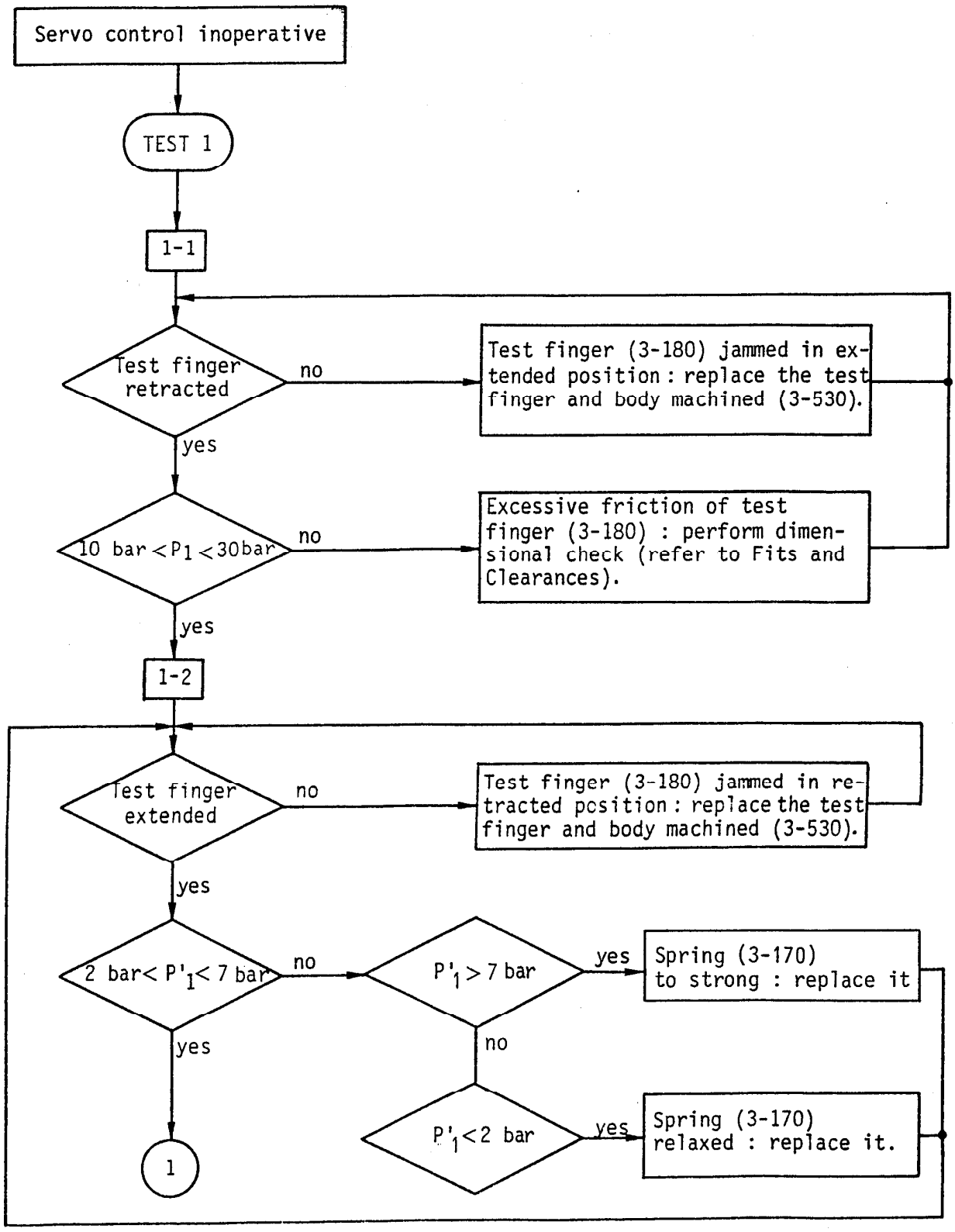
- Unscrew and remove the two screws (1–20) with washers (1–30) (attachment fitting assy (4–230) side).
- Position special tool 0U190432–003 mounting on control valve block (1–10) and secure it with its special screws. Tighten the two screws to a torque load of 0.904 to 1,13 daN.m (80.01 to 100.01 lbf.in).
- Unscrew the two plugs (3–450) and remove them.
  Connect the servo control to the test set as indicated in Figure 101 :
  . Delivery line P to union (5–270), this union is marked "A" on the jack assembly mounting,
  . return line R to union (5–240), this union is marked "B" on the jack assembly mounting.
  . the line from cock V3 of pressure tapping C_A on the valve block,
  . the line from cock V4 of pressure tapping C_B on the valve block.
- Fit pin 0U190432–004 onto the input lever.

B. Bleeding of the servo control

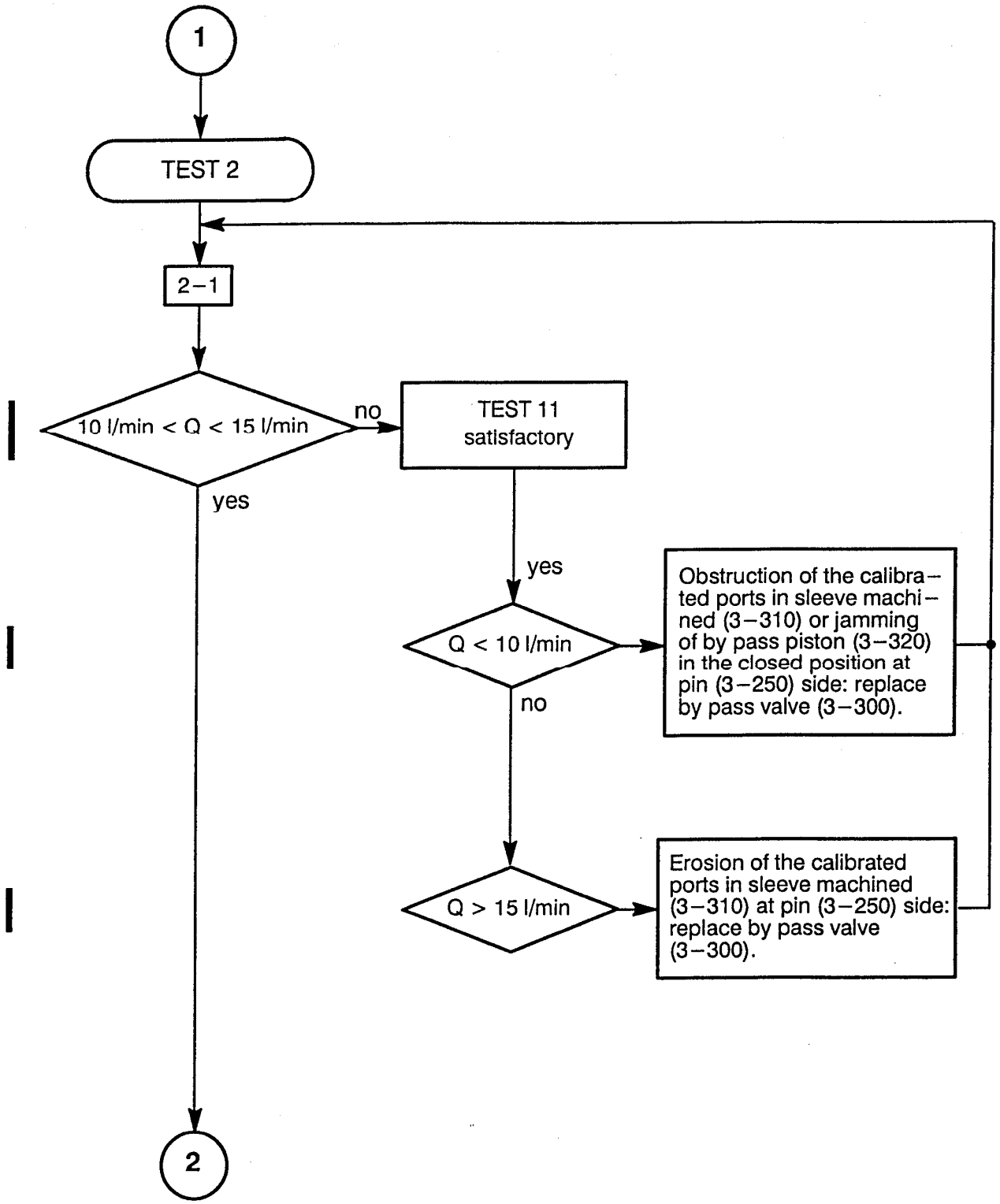
- Open V1 and V5. Close V2, V3, V4 and V6.
- Via union A, apply a pressure of 206 bar (2988 psi) as indicated by pressure gage M1.
- By operating the control lever, cycle the servo control from stop to stop about ten times.
- Wipe cleanly the outside of the servo control , so that if any droplets of fluid form during testing, they will be clearly visible.
- Cut off the pressure form union A.

4. Procedure

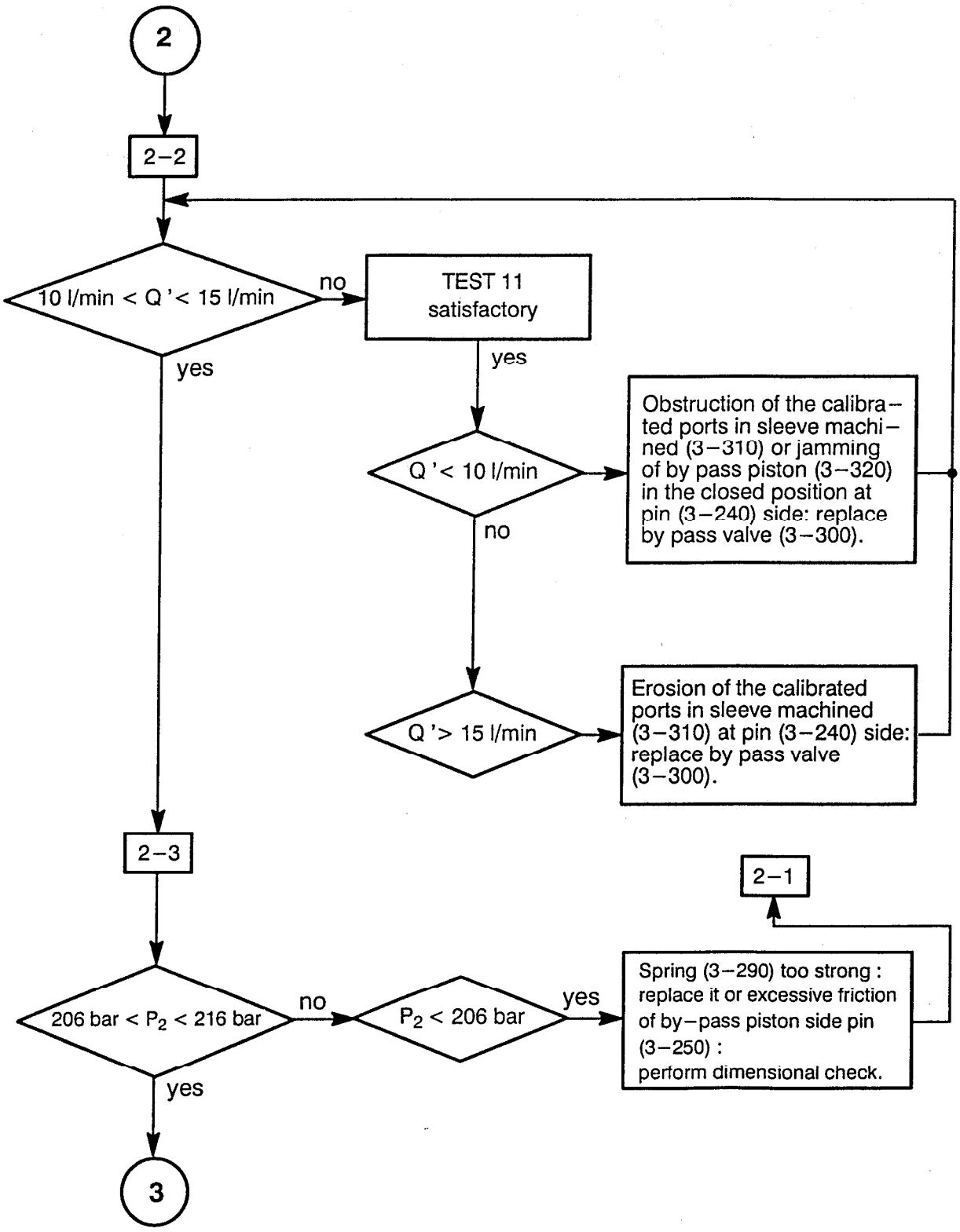
NOTE: – The test procedure is indicated in the tables on the following pages,and the fault isolation procedure is indicated in the corresponding diagrams.
– The reference number used in this sub–heading correspond to the Illustrated Parts List.



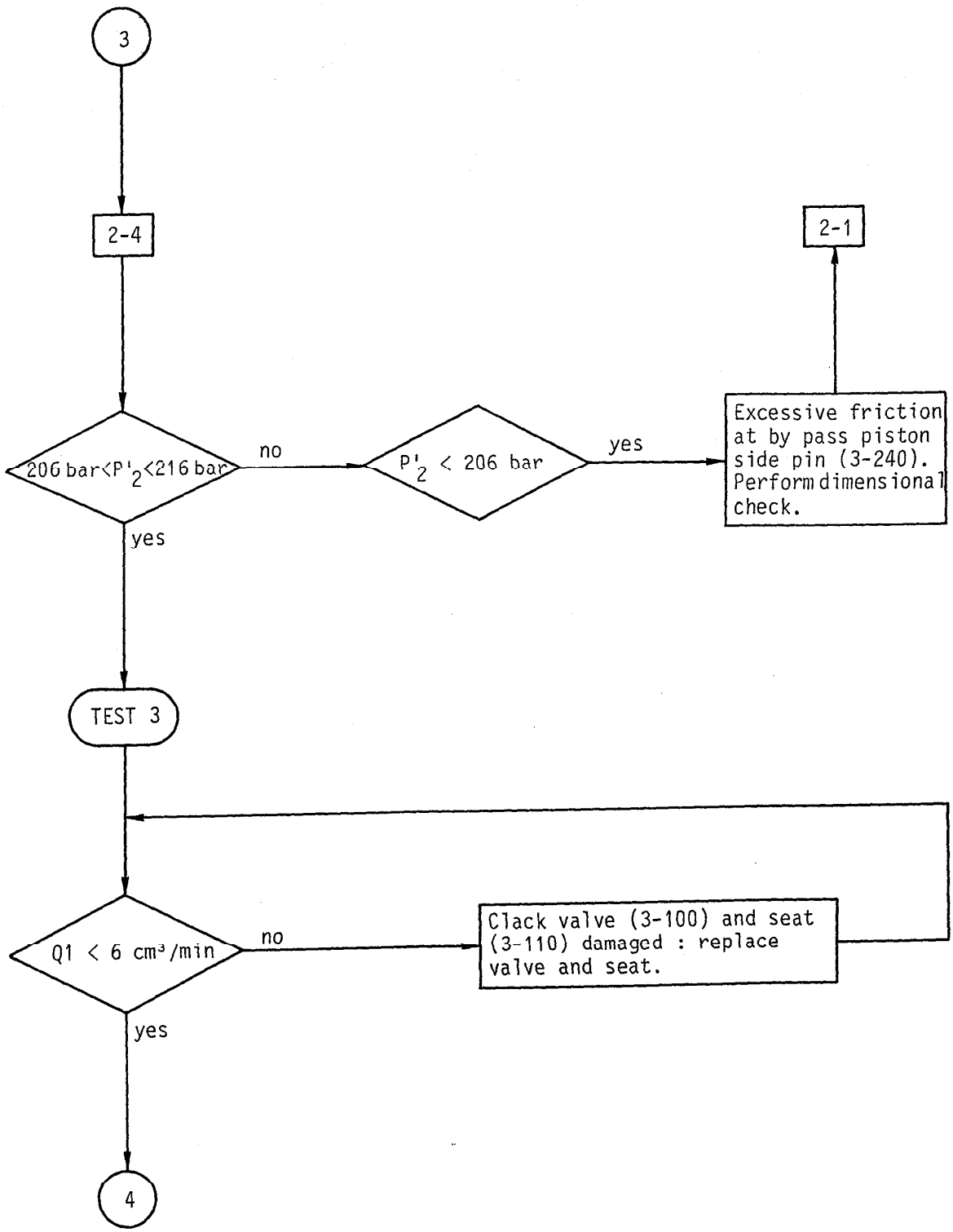
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
	Setting of input lever to neutral position : - Close V2, V3, V4 and V6. Open V1 and V5. - Apply 206 bar (2988 psi) pressure to A. - Operate manualy the control lever to set the servo control at mid travel position. - The tool E being fitted on the control lever : - fit the tool D onto the tool G and connect it to the input lever. - then, set the tool G by turning its knurled nut until the servo control stops. (The servo control should be out of its stops). - this position is corresponding to the neutral position of the input lever.	
1	NOTE : Special tools D, F, H and K and dial gages C1 and C2 shown in Figure 101 are not required for this test. - Close V2, V3, V4 and V5, open V1 and V6. - Using special tool G, keep the servo control stopped.	Functional test of test finger (3-180).
1-1	- Apply pressure via A until the test finger is fully retracted. - Close V1 immediately and take pressure reading P1 on M1. - Check that : 10 bar (145 psi) < P1 < 30 bar (434.10 psi) and the return pressure is zero.	
1-2	- Progressively open V2 until the test finger is fully extended. - Close V2 immediately and take pressure reading P'1 on M1. - Check that : 2 bar (29 psi) < P'1 < 7 bar (101.5 psi) and the return pressure is zero. - Cut off the pressure supply to A.	



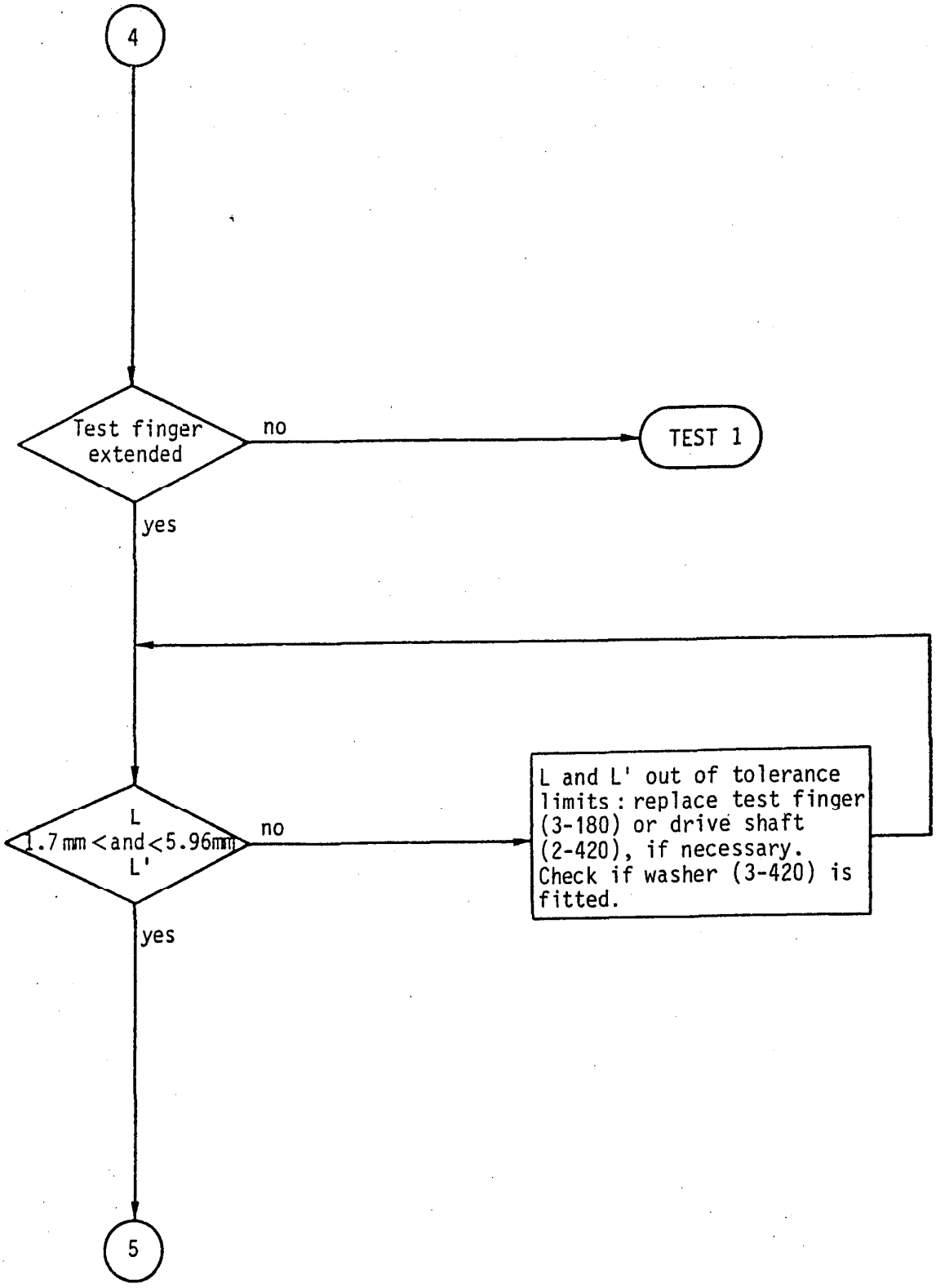
TEST N°	PROCEDURE WORK STEP	SPECIFICATION TEST DESCRIPTION
2	NOTE : Special tools F, H, K and dial gages C1 and C2 shown in Figure 101 are not required for this test.	Checking of by pass valves (3–300) and of the calibrated damping ports (without pressure applied).
2–1	– Close V2, V3, V4 and V6. Open V1 and V5. – Via A, apply a pressure such that the value reading on M1 is 206 bar (2988 psi). – Extend the servo control until bottomed by operating on control lever. – Set the control lever to the neutral position using special tool G, with the special tool D fitted. – Cut off the pressure supply to A. – Close V1 and openV2 (V5 open V6 closed). – Open V3 (V4 closed). – Apply pressure via C_A until pressure differential ΔP between M2 and M3 is 20 bar (290 psi). – Check that flow rate Q, as measured at return R, is between : 10 l/min (2.65 US gal/min) and 15 l/min (3.96 US gal/min) – Cut off the pressure supply at C_A and close V3.	
2–2	– Close V2 and open V1 (V3, V4 and V6 closed, V5 open). – Via A, apply a pressure such that the value reading on M1 is 206 var (2988 psi). – Retract the servo control until bottomed by operating the control lever. – Set the control lever to the neutral position using special tools G and D. – Cut off the pressure supply to A.	



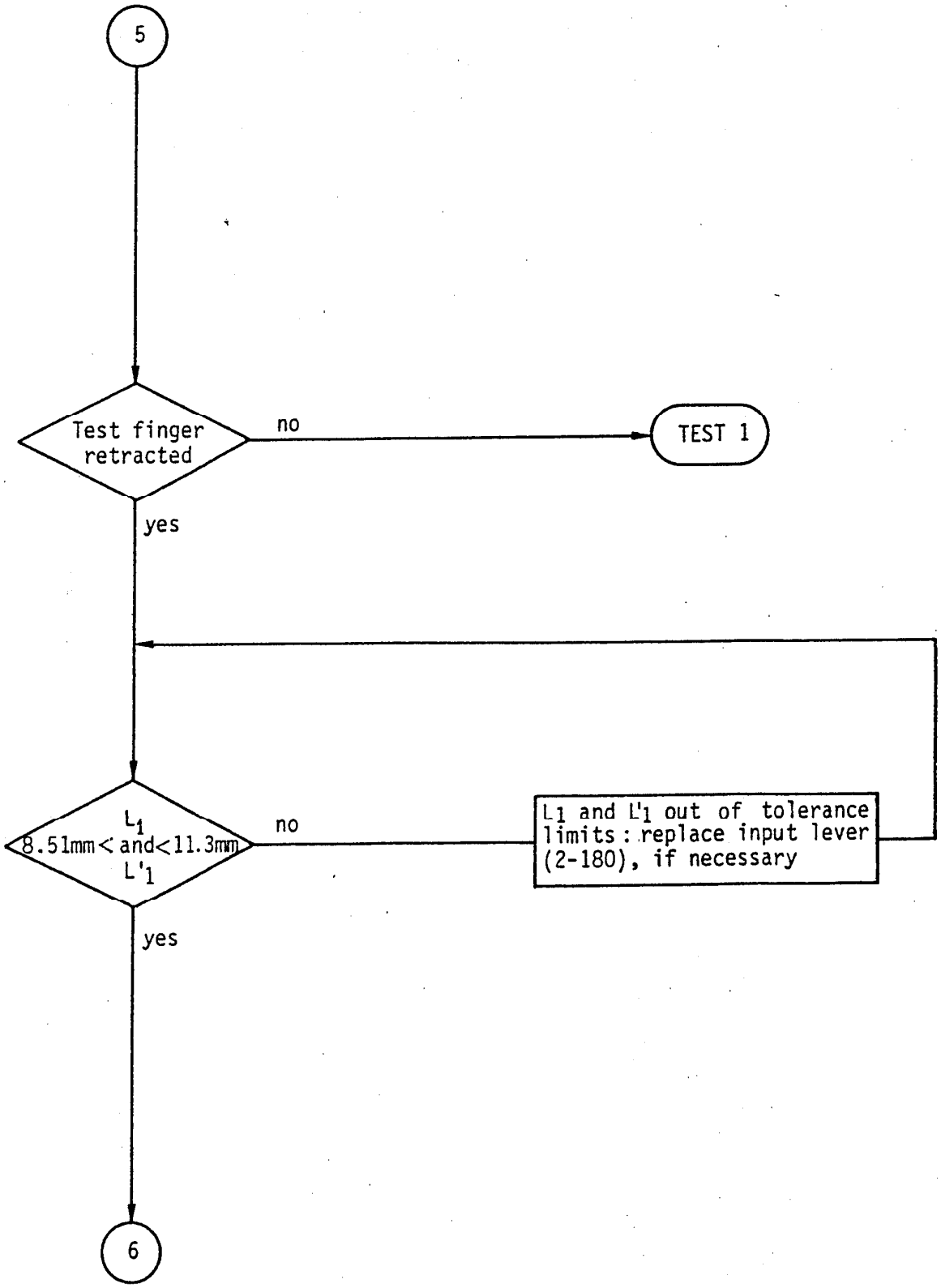
TEST N°	PROCEDURE WORK STEP	SPECIFICATION TEST DESCRIPTION
2–2 (cont'd)	– Close V1 and open V2 (V5 closed and V6 open). – Open V4 (V3 closed). – Apply pressure via C_B until pressure differential ΔP between M2 and M3 is 20 bar (290 psi). – Check that flow rate Q', as measured at return R, is between : 10 l/min (2.65 US gal/min) and 15 l/min (3.96 US gal/min) – Cut off the pressure supply to C_B and close V4.	
2–3	– With the servo control bottomed in the retraction position and the control lever in the neutral position, open V4 (V1 and V5 open, V2, V3 and V6 closed). – Via A and C_B apply pressure such that the valve reading on M1 and M2 is 216 bar (3132.8 psi). – Progressively close V1 so that the flow is considerably reduced. – Progressively open V2 (to reduce the M1 pressure reading) until there is a sudden increase in the flow rate at return R (opening of valve). – Record P_2 pressure reading M1. – Check that : 206 bar (2988 psi) < P_2 < 216 bar (3132.8 psi) – Cut off the pressure supply to A and C_B, close V4.	Checking of by pass valves (3–300) and of the calibrated damping ports (without pressure applied).
2–4	– Close V2, open V1 (V3, V4 and V6 closed, V5 open).	



TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
2-4 (cont'd)	- Via A, apply a pressure such that the M1 value reading is 206 bar (2988 psi). - Extend the servo control until bottomed by operating the control lever. - Set the control lever to the neutral position with special tools G and D. - Open V3. - Increase the pressure applied until M1 and M2 read 216 bar (3132.8 psi). - Progressively close V1 until the flow is considerably reduced. - Progressively open V2 (to reduce the M1 pressure reading) until the discharge rate at R suddenly increases (opening of valve). - Record P'_2 pressure reading M1. - Check that : 206 bar (2988 psi) < P'_2 < 216 bar (3132.8 psi) - Cut off the pressure supply to A and C_A then close V3.	
3	NOTE : Any special tools are required for this test. - With the servo control bottomed in the extension direction, close V1, V2, V4, V5 and V6 and open V3. - Disconnect A. - Via C_A, apply a pressure of 50 bar (725 psi). - Hold the control lever against its stop in the servo control extension position. - After one minute, check that leakage rate Q1, as measured at A, is less than : 6 cm^3/min (0.366 cu.in/min) - Cut the pressure supply to C_A and close V3. - Connect A and open V5.	Checking of non-return valve (3-60) leakage.

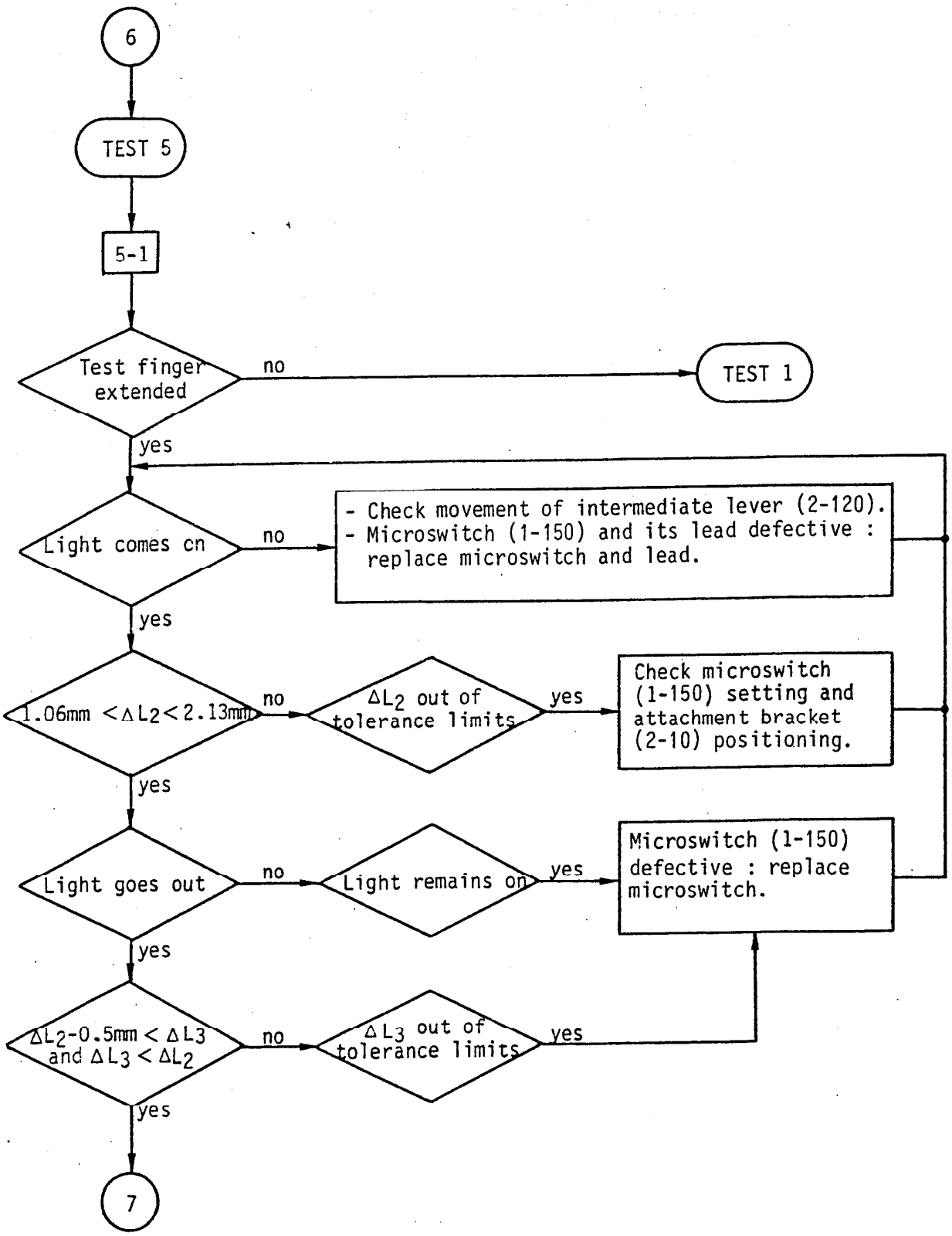


TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
4	NOTE : Special tools F, H, K and dial gage C2 shown in Figure 101 are not required for this test. - Set the input lever to the neutral position with special tools G and D. - Set dial gage C1 to zero. (Dial gage plunger against pin E). - Uncouple the connection between special tools G and D and the input lever.	Checking of input lever assy (2-180) travel.
4-1	- Check that the test finger is extended. - Let : - L be the input lever travel between the neutral point and the test stop in the servo control retraction direction. - L' be the input lever travel between the neutral point and the test stop in the servo control extension direction. - Using dial gage C1, check that : $1.7\ mm\ (0.067\ in) < \frac{L}{L'} < 5.96\ mm\ (0.234\ in)$	a) Between test stops.

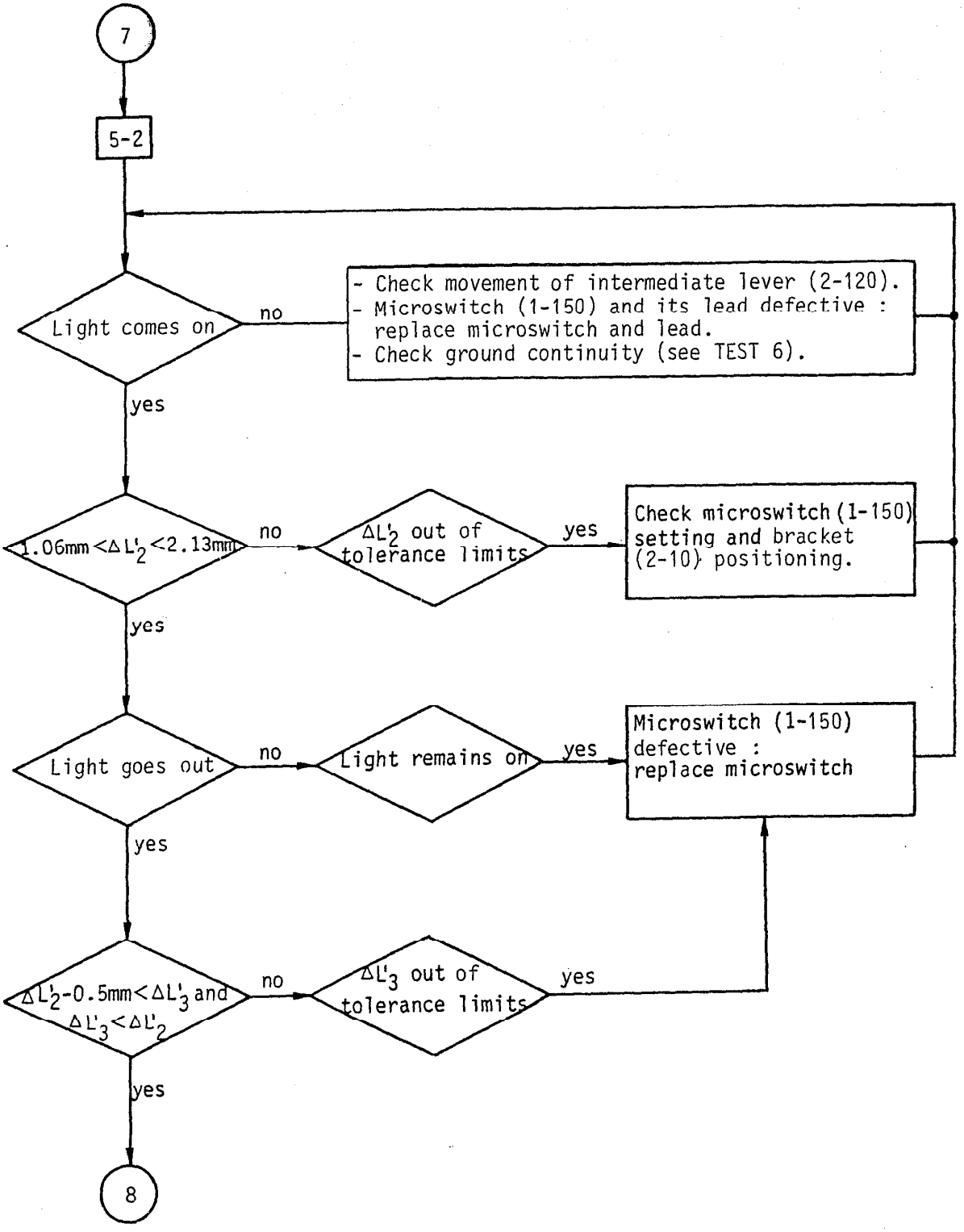


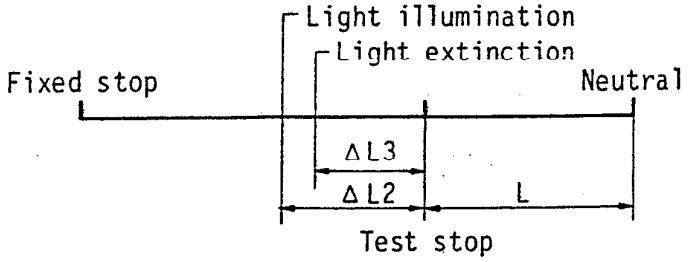
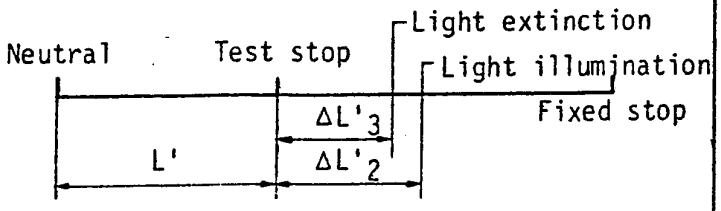
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION

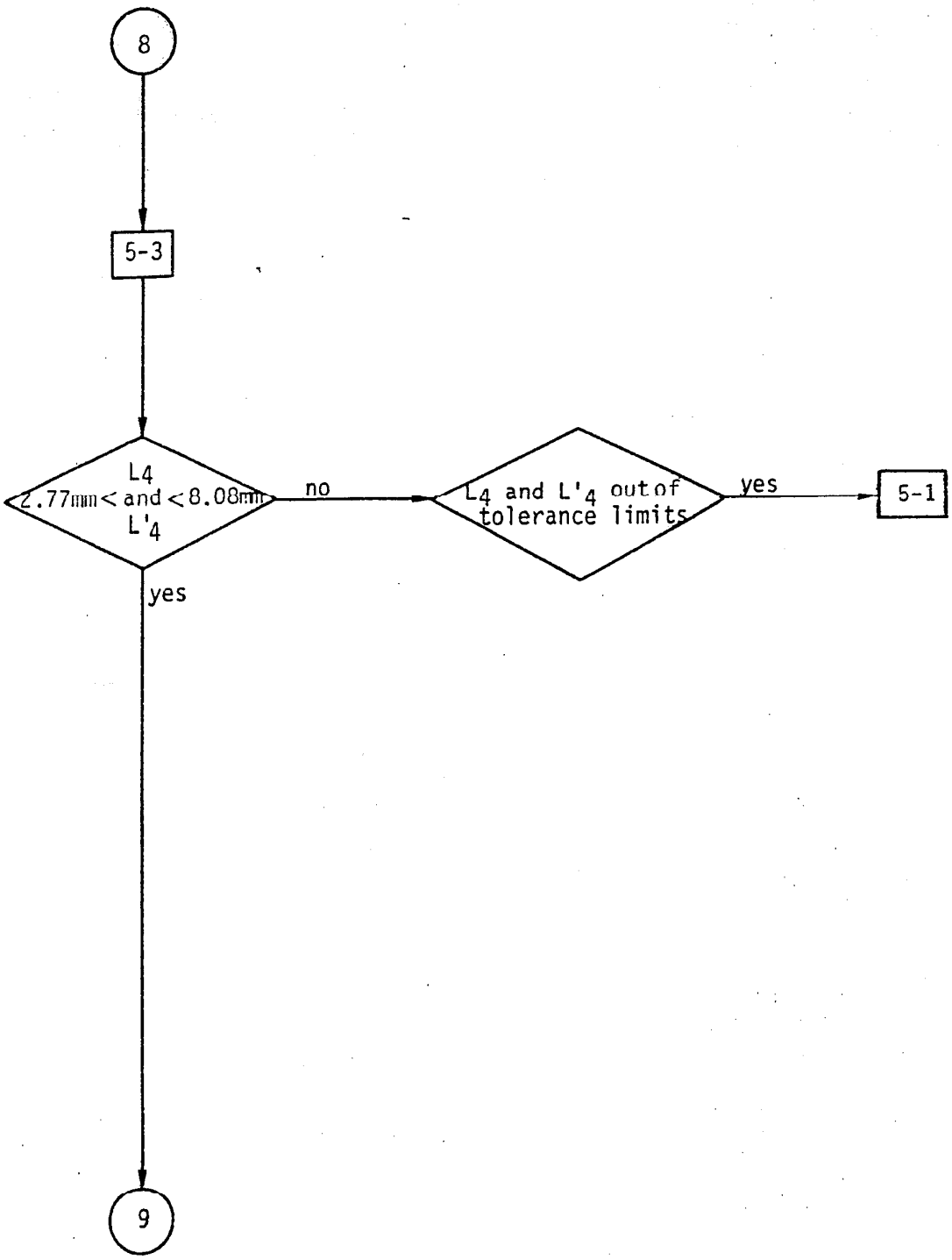
4-2	- Close V2, V3, V4 and V6, open V1 and V5.
	- Via A, apply a pressure such that the M1 value reading is 50 bar (725 psi).
	- Check that the test finger is completely retracted.
	- Let :
	  - L_1 be the input lever travel between the neutral point and the fixed stop in the servo control retraction direction,
	  - L'_1 be the input lever travel between the neutral point and the fixed stop in the servo control extension direction.
	- Using dial gage C1, check that :
	$8.51\ mm\ (0.335\ in) < \frac{L_1}{\text{and}\ L'_1} < 11.3\ mm\ (0.445\ in)$
	- Cut off the pressure supply to A.
		b) Between fixed stops.



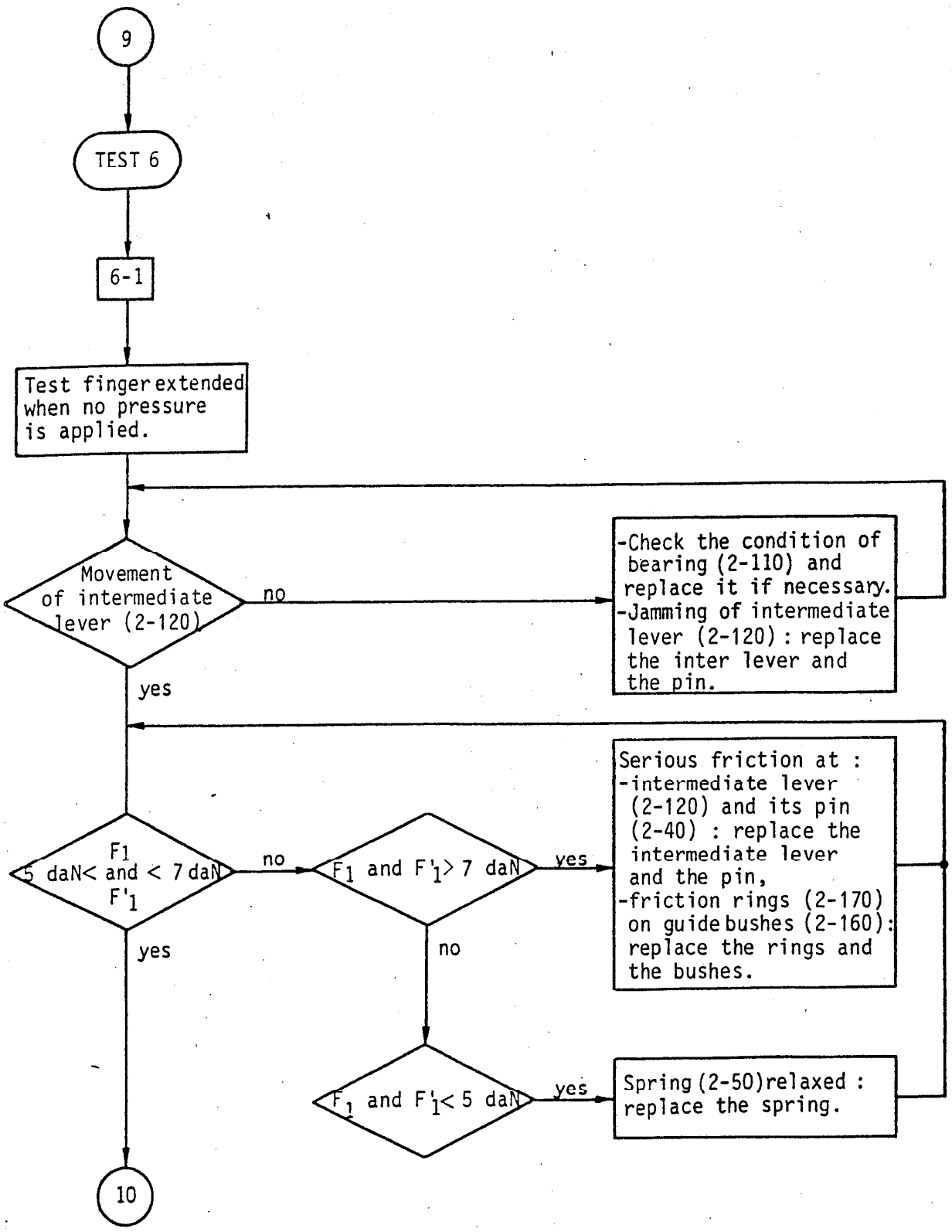
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
5	NOTE 1 : - Special tools F, K and dial gage C2 shown in Figure 101 are not required for this test. - Microswitch check box H is to be connected to the microswitch assembly by means of its connector. NOTE 2 : - The following operations are to be performed without changing the sense in which the input lever is moved. - Set the input lever to the neutral position with special tools G and D. - Set dial gauge C1 to zero.	Functional test of jamming alarm system : microswitch (1-150). This test is carried out at zero pressure.
5-1	- Check that the test finger is extended. - Using special tool G, move input lever by L (value taken in test 4-1). - Continue to move the input lever until the lamp of microswitch check box H illuminates. - Record the amount of additional travel required ΔL_2 and check that : 1.06 mm (0.042 in) < ΔL_2 < 2.13 mm (0.084 in) - Continue to move the input lever until it bottoms on its fixed stop. - Move the input lever back towards its test stop and check that the lamp of microswitch check box H extinguishes. - With respect to this position, note the travel required ΔL_3 to return the input lever to its test stop (see figure below).	a) Additional travel past test stops for light illumination (retraction direction).



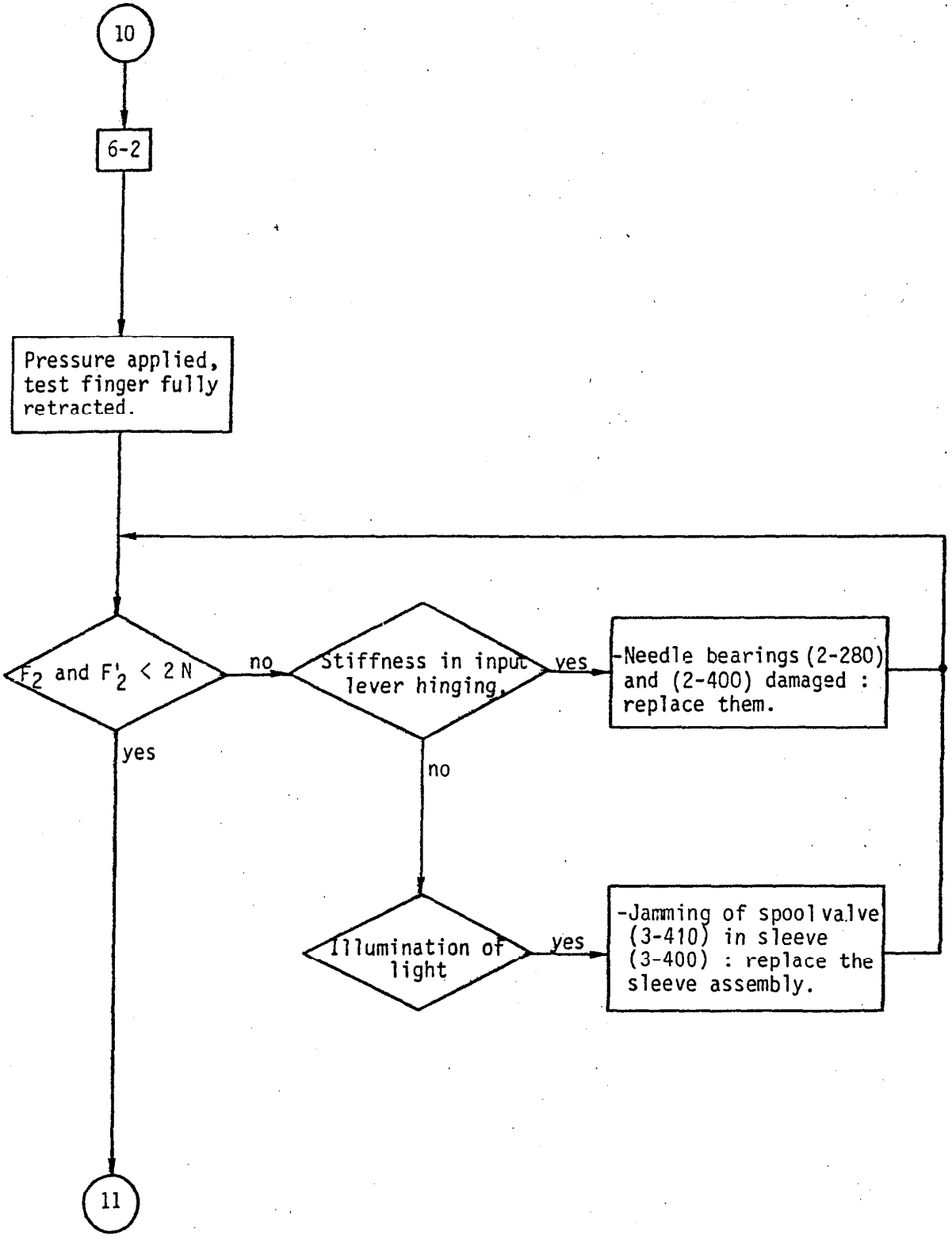
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
5-1 (cont'd)	 - Check that : ΔL_2 - 0.5 mm (0.0196 in) < ΔL_3 < ΔL_2	
5-2	- Start with the input lever in the neutral position. - Using special tool G, move the input lever by L' (value found in test 4-1). - Continue to move the input lever until the lamp of microswitch check box H illuminates. - Record the amount of additional travel required $\Delta L'_2$ and check that : 1.06 mm (0.042 in) < $\Delta L'_2$ < 2.13 mm (0.084 in) - Continue to move the input lever until it bottoms on its fixed stop. - Move the input lever back towards its test stop and check that the lamp of microswitch check box H extinguishes. - With respect to this position, note the travel required $\Delta L'_3$ to return the input lever to its test stop (see figure below).  - Check that : $\Delta L'_2$ - 0.5 mm (0.0196 in) < $\Delta L'_3$ < $\Delta L'_2$	b) Additional travel past test stop for light illumination (extension direction).



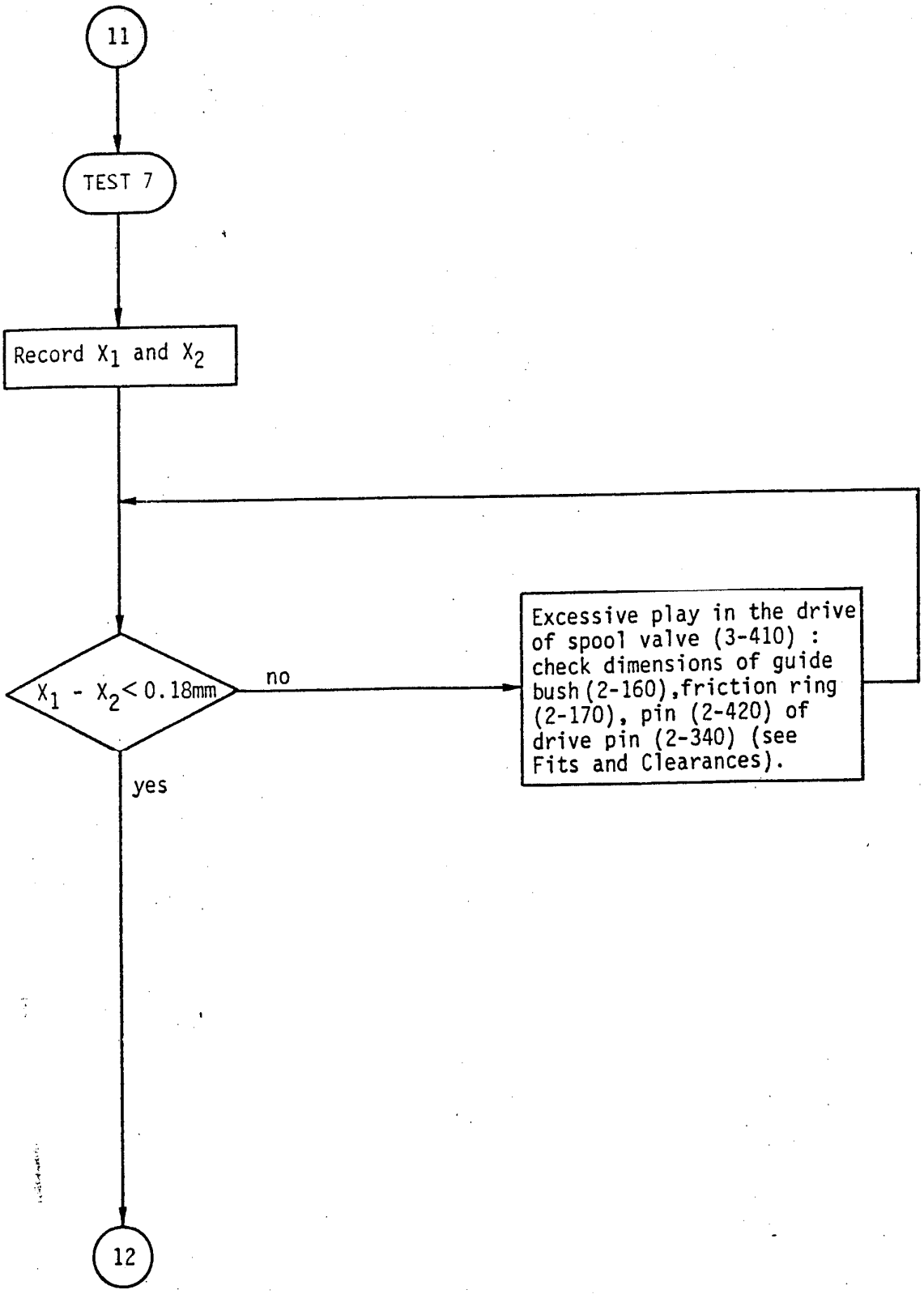
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
5-3	- Start with the input lever in the neutral position and the dial gage C1 at zero. - Disconnect the link between special tools G and D and the input lever. - Let : - L_4 be the movement of the input lever necessary to cause the lamp to illuminate on microswitch check box H, relative to its neutral position in the servo control retraction direction, - L'_4 be the movement of the input lever necessary to cause the lamp to illuminate on microswitch check box H, relative to its neutral position in the servo control extension direction. - Check that : 2.77 mm (0.109 in) < L_4 and L'_4 < 8.08 mm (0.318 in)	a) Additional travel past fixed stops for light illumination.



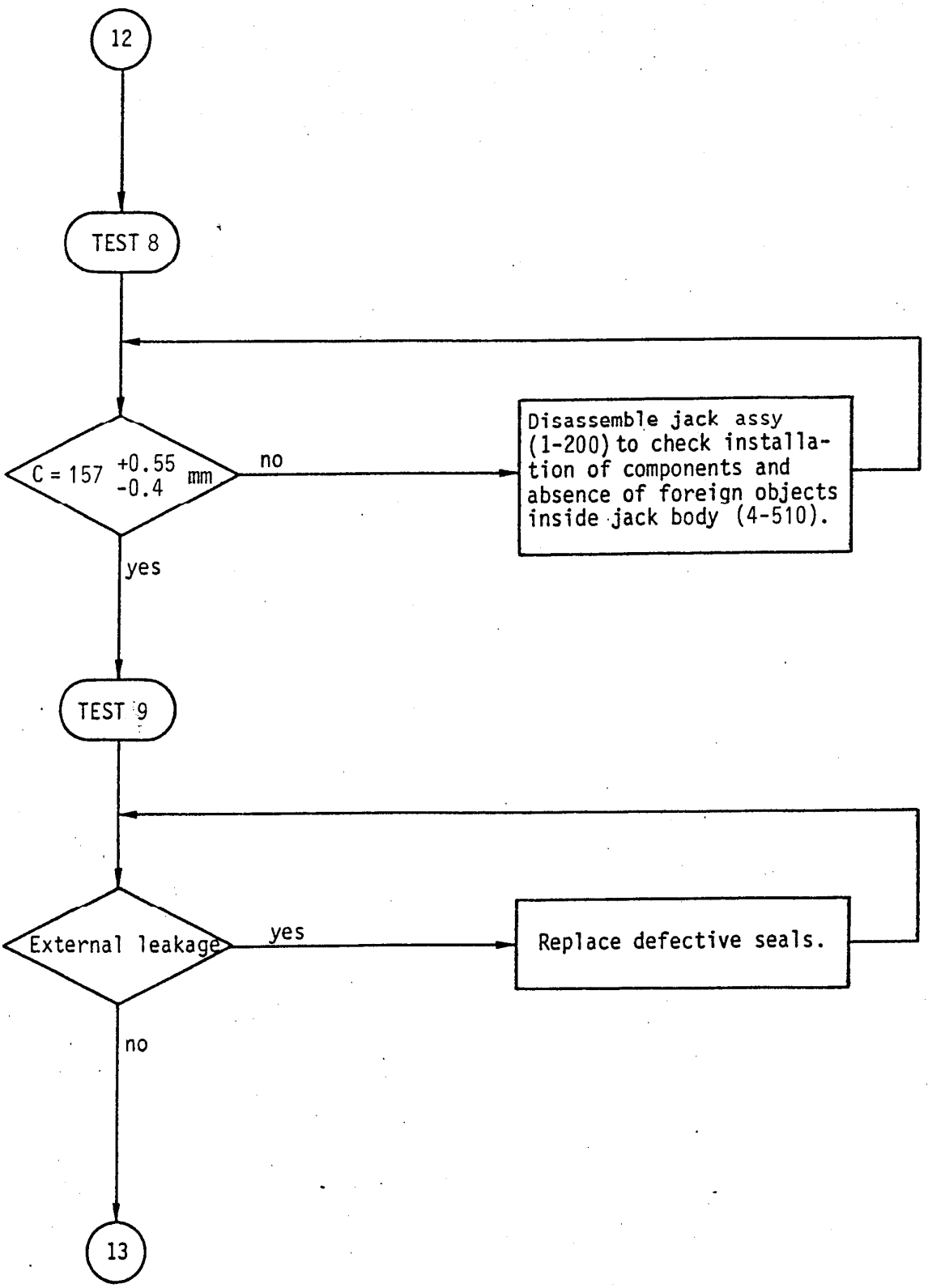
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
6	NOTE : - Special tools D, F, G and K and dial gage C1 shown in Figure 101 are not required for this test. - Microswitch check box H is to be connected via the microswitch assembly receptacle.	Checking of force required to operate the input lever.
6-1	- Let : - F_1 be the force it is necessary to apply to the input lever (at the control rod pin) in the servo control retraction direction to cause illumination of the microswitch check box H lamp. - F'_1 be the force it is necessary to apply to the input lever (at the control rod pin) in the servo control extension direction to cause illumination of the microswitch check box H lamp. - Using a spring scale, check that : $5\ daN\ (11.24\ lbf) < \frac{F_1}{\text{and}} < 7\ daN\ (15.74\ lbf)$ F'_1	a) Under zero pressure (test finger extended).
6-2	- Close V2, V3, V4 and V6, open V1 and V5. - Via A, apply a pressure such that M1 reads 206 bar (2988 psi). - Let : - F_2 be the force it is necessary to apply to the input lever (at the control rod pin) to cause the servo control to retract at a speed of a few millimetres per second. - F'_2 be the force it is necessary to apply to the input lever (at the control rod pin) to cause the servo control to extend at a speed of a few millimetres per second.	b) Under pressure (test finger retracted).



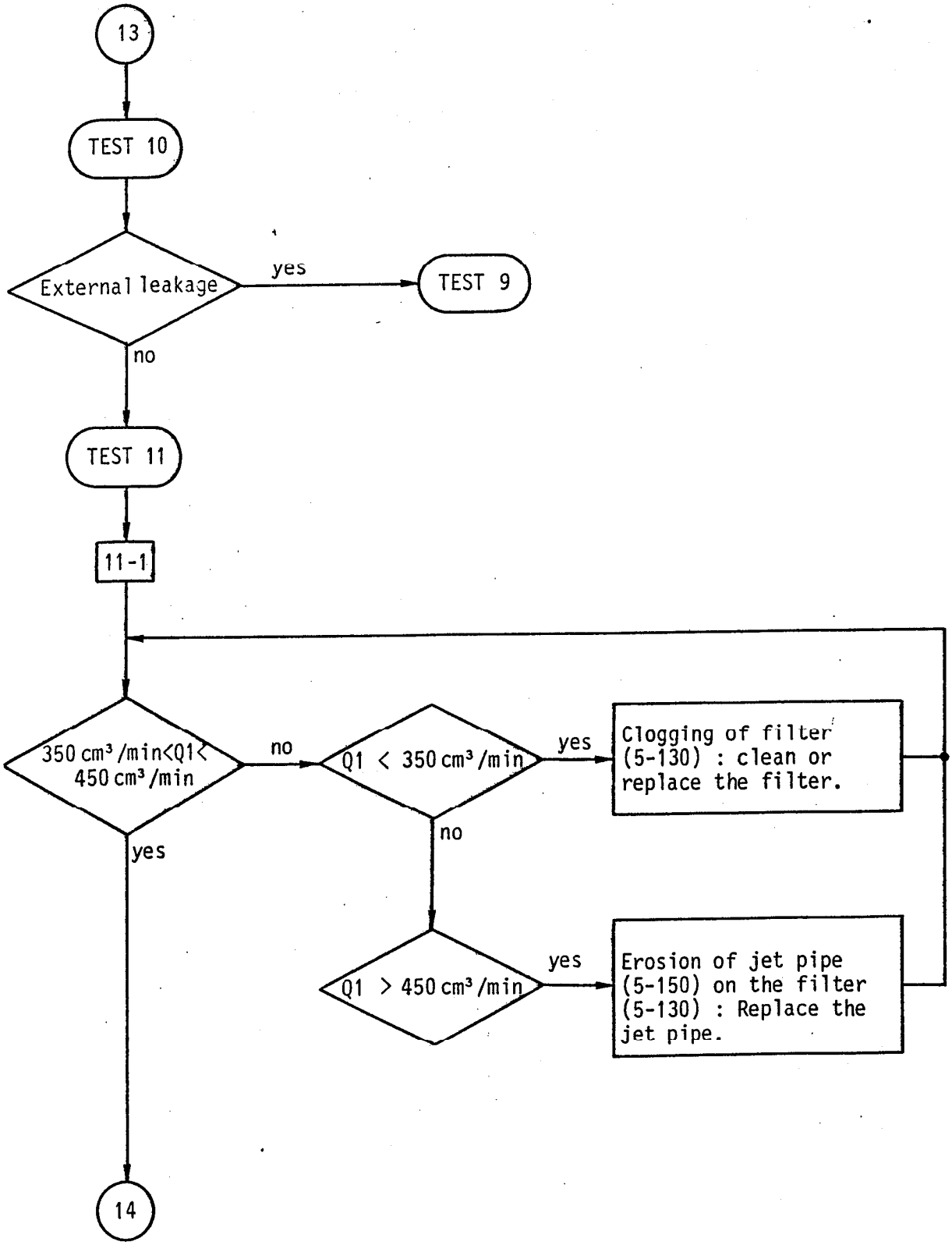
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
6.2 (cont'd)	- Movement of the servo control is detected by dial gage C2. - By operating the input lever, cycle the servo control from stop to stop a number of times. - Stop the servo control in any position in which it is not bottomed and after 1 minute stand by, using a spring scale, check that : F_2 and F'_2 < 2N (0,449 lbf) - Cut off the pressure supply to A.	



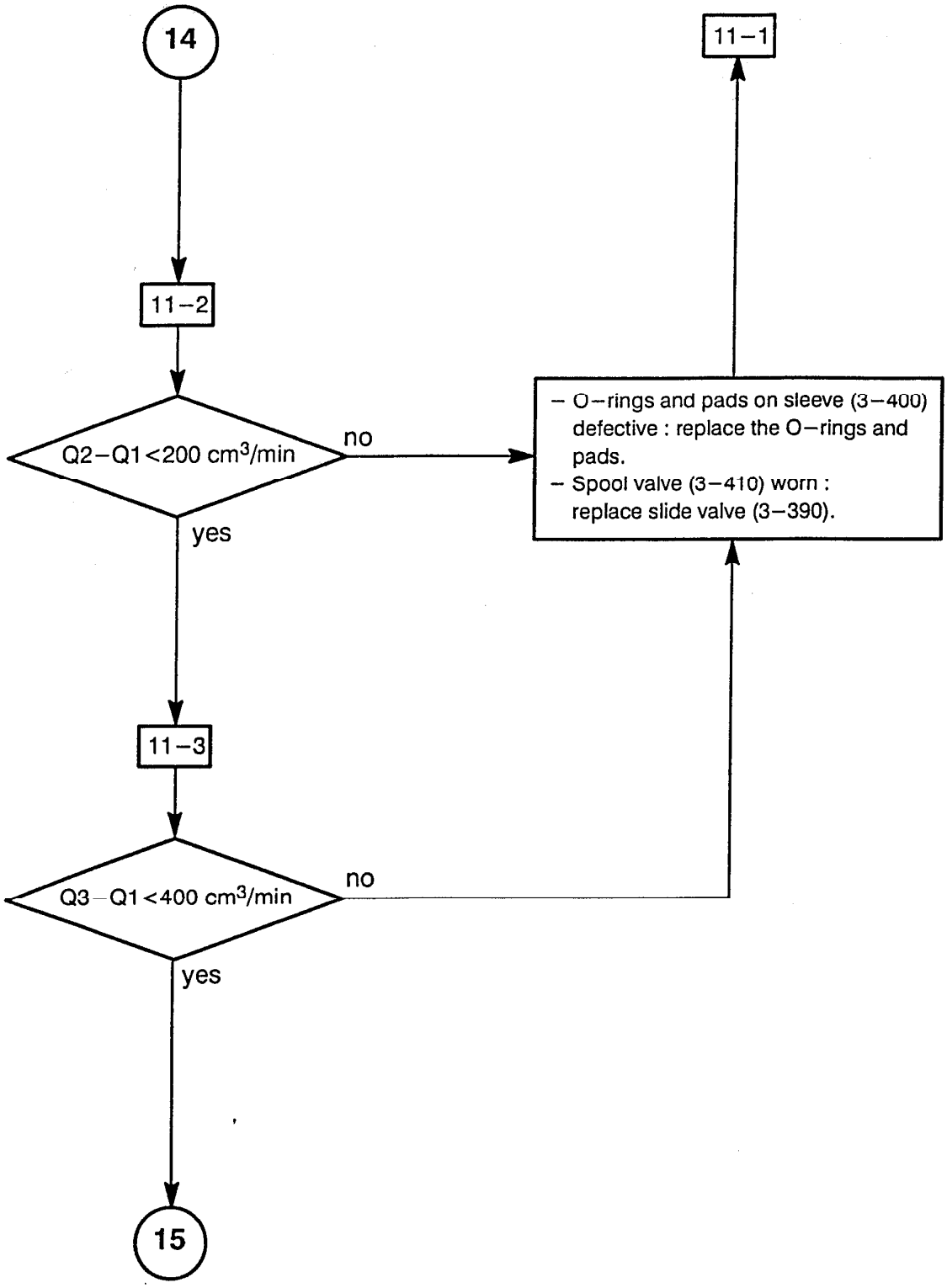
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
7	NOTE : Special tools F, K, H shown in Figure 101 are not required for this test. - Close V2, V3, V4 and V6, open V1 and V5. - Via A, apply a pressure such that M1 reads 206 bar (2988 psi). - Using special tools G and D, set the input lever to the neutral position with the servo control at mid travel. - Set dial gages C1 and C2 to zero. - Let : - X_1 be the displacement of the lever necessary to cause the piston to retract, - X_2 be the displacement of the lever necessary to cause the piston to extend. Retraction and extension of the piston is detected by dial gage C2. Rate of movement is to be 1 mm (0.0393 in) in between 10 and 40 seconds. The values of X_1 and X_2 read on dial gauge C1 are to be designated positive or negative according to their sense relative to the zero of the dial gage. - Check that : $X_1 - X_2 < 0.18$ mm (0.007 in) - Cut off the pressure supply to A.	Checking for dead travel.



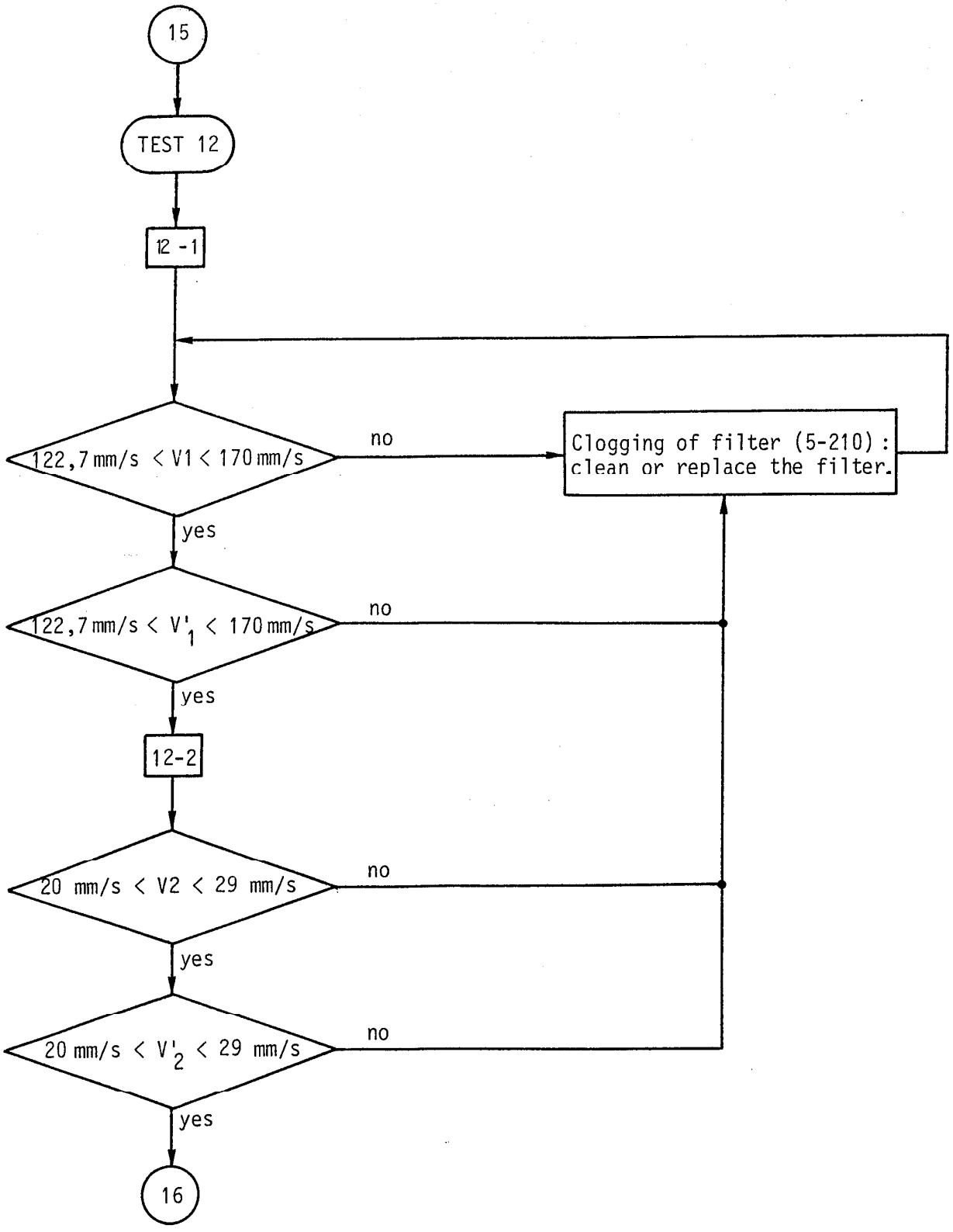
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
8	NOTE : Special tools D, F, G, H and K and dial gages C1 and C2 shown in Figure 101 are not required for this test. - Close V2, V3, V4 and V6, open V1 and V5. - Via A, apply a pressure such that M1 reads 206 bar (2988 psi). - By operating the input lever, cycle the servo control lever from stop to stop. - Check that overall travel C of the servo control is : $157\ ^{+0.55}_{-0.4}$ mm ($6.181\ ^{+0.022}_{-0.016}$ in) - Cut off the pressure supply to A.	Checking of overall travel of the servo control.
9	NOTE : Special tools D, F, G, H and K and dial gages C1 and C2 shown in Figure 101 are not required for this test. - Wipe the outside of the servo control clean. - Close V2, V3, V4 and V6, open V1 and V5. - Via A, gradually apply pressure until M1 reads 237 bar (3437.4 psi). - By operating the input lever, cycle the servo control from stop to stop fifty times. - Check that no leakage is visible on the outside. - Cut off the pressure supply to A.	Functional test with overpressure at A (leak check).



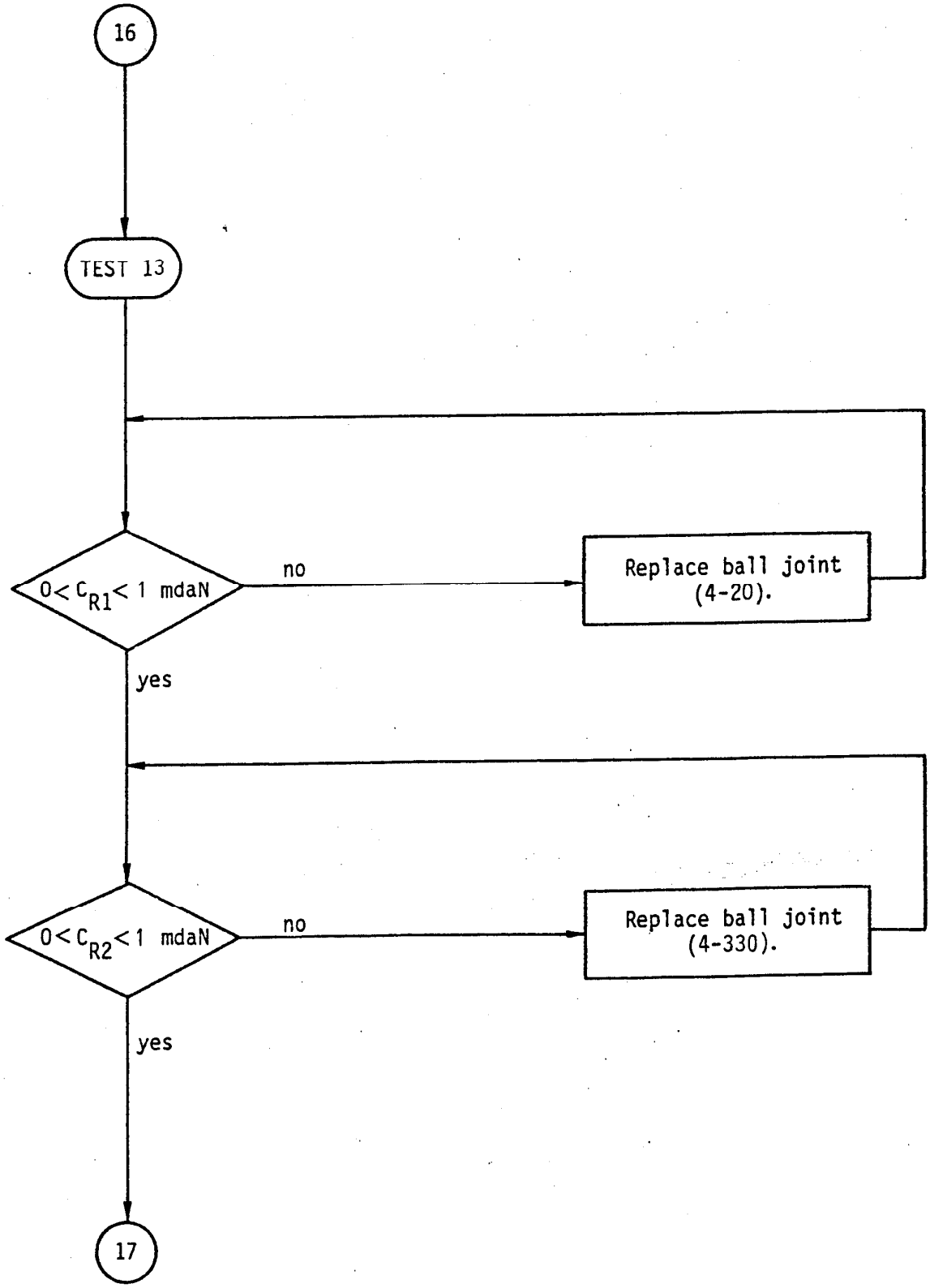
TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
10	NOTE : Special tools D, F, G, H and K and dial gages C1 and C2 shown in Figure 101 are not required for this test. - Wipe the outside of the servo control clean. - Close V2, V3, V4 and V6, open V1 and V5. - Via A, gradually establish a pressure such that M1 reads 100 bar (1450.3 psi), then close V5 (V5 is protected by a pressure relief valve set at 70 bar). - Operate the input lever a number of times. - Check that there are no external leaks. - Cut off the pressure supply to A and open V5.	Overpressure reservoir return test.
11	NOTE : Special tools D, H and K and dial gages C1 and C2 shown in Figure 101 are not required for this test.	
11-1	- Set the input lever to the neutral position with special tool G. - Disconnect C_A and C_B, and leave them open. - Close V2, V3, V4 and V5, open V1 and V6. - Via A, apply a pressure such that M1 reads 206 bar (2988 psi). - Check that the discharge rate Q_1 as measured with test tube E is between $350\ cm^3/min\ (21.3\ cu.in/min) < Q1 < 450\ cm^3/min\ (27.4\ cu.in/min)$ - Cut off the pressure supply to A and uncouple the connection between special tool G and the input lever.	a) Checking of jet pipe consumption.



TEST N°	PROCEDURE WORK STEP	SPECIFICATION TEST DESCRIPTION
11–2	– Close CA and CB with two plugs (3–450) (see Assembly, paragraph 1.B. (1). – Close V2, V3, V4 and V6, open V1 and V5. – Via A, apply a pressure such that M1 reads 206 bar (2988 psi). – By operating the input lever, bottom the servo control (in extension position). – Close V5, open V6. – After the servo control has been stopped for one minute with the input lever in the full extension position, measure the discharge rate Q2 with test tube E. – Repeat the operation in the retraction position. – Check that in both cases: Q2–Q1<200 cm3/min (12.2 cu.in/min) – Close V6, open V5.	b) Checking of permanent consumption of the servo control bottomed (extension and retraction position). Without jet pipe consumption.
11–3	– By operating the input lever, place the servo control in the mid travel position. – Install special tool F on the input lever. – Close V5, open V6. – Measure the discharge rate Q3 with test tube E. – Check that: Q3–Q1<400 cm^3/min (24.4 cu. in/min) – Close V6, open V5. – Cut off the pressure supply to A. – Remove special tool F.	c) Checking of permanent consumption of the servo control in slaving position. Without jet pipe consumption.



TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
12	NOTE : Special tools F, D, H and dial gages C1 and C2 shown in Figure 101 are not necessary for this test.	Check of servo control speeds.
12-1	- Close V2, V3, V4, V6 and open V1, V5. - Supply A with a pressure of 206 bar (2988 psi), read on M1. - Place the servo control in limit-stop position (extension direction) using the input lever. - Manipulate the input lever, keeping it in the full retraction position, to place the servo control in limit-stop position (retraction direction). Using tool K, check that speed V1 is between : 122.7 mm/s (4.83 in/s) and 170 mm/s (6.69 in/s) - Manipulate the input lever, keeping it in the full extension position, to place the servo control in limit-stop position (extension direction). Using tool K, check that speed V1' is between : 122.7 mm/s (4.83 in/s) and 170 mm/s (6.69 in/s) Be careful : A differential pressure ΔP 206 bar (2985 psi) will be applied during all this test.	a) Maximum no-load speeds.
12-2	- Place tool G without tool D on the input lever to limit its displacement by 2.33 mm (0.092 in) on both sides from this neutral position. - Manipulate the input lever to place the servo control in limit-stop position (retraction direction). Using tool K, check that speed V2 is between : 20 mm/s (0.78 in/s) and 29 mm/s (1.14 in/s)	b) Intermediate speeds.



TEST No.	PROCEDURE WORK STEPS	SPECIFICATION TEST DESCRIPTION
12-2 (cont'd)	- Manipulate the input lever to place the servo control in limit-stop position (extension direction). Using tool K, check that special V'2 is between : 20 mm/s (0.78 in/s) and 29 mm/s (1.14 in/s) - Cut the supply to A.	
13	- Remove tool OU 190432, then secure the control valve block (1-10) using screws (1-20) and washers (1-30). - Tighten the screws (1-20) to a torque of 0.904 to 1.13 mdaN (80.01 to 100.01 lbf.in) - Remove the servo control from the test stand. - Using tool OU 190482-002, check nutation torques C_{R1} and C_{R2} : . (4-30) eye-fitting side : $0 < C_{R1} < 1$ mdaN (7.37 lbf.ft) . (4-340) attachment fitting : $0 < C_{R2} < 1$ mdaN (7.37 lbf.ft)	Check of nutation torque.