NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

September 14, 2021

Attachment 2 –Airbus Hydraulic Check Valves Test Report

POWERPLANTS

DCA18LA163

Hydraulic Test_A330 MSN 578 ATA29 Check Valves

A/C APPLICABILITY	ENGINE APPLICABILITY	A/C SYSTEM	A/C SUBASSEMBLY	A/C EQUIPMENT	A/C ITEM
A330-300	N/A	Yellow Hydraulic System	N/A	N/A	N/A

REQUEST ORIGIN	LTR REFERENCE-ISSUE	LTR COVERING	TEST ITEM	TEST MEAN
LTR	G29RE1901614	Partial	Check Valves	#470 HWT

TEST REQUESTED DATE	TESTED DEVICE AVAILABILITY	TEST PERIOD
12 Jul 2019		19 Aug 2019 to 25 Sep 2019

SUMMARY:

The purpose of this test was to evaluate the functional behaviour of following listed check valves of Yellow Hydraulic System of A330-300 MSN578 under normal conditions at test bench facility in Bremen

DESIGNATION	FIN	P/N	S/N
CHECK VALVE-R ENG PUMP CASE DRAIN, Y	5206JM301	CAR101	7443
CHECK VALVE-R ENG THR REV, Y	5210JM301	CAR201	9135
CHECK VALVE-R ENG PUMP DELIVERY, Y	5216JM301	CAR370	6621
CALIBRATED CHECK VALVE-R ENG THR REV, Y	5190JM3	CART33	2573T01

CONCLUSION:
All Samples passed the test.

SUB-CONTRACTOR

	NAME	SIGLUM - FUNCTION	DATE	SIGNATURE

LIST OF DISTRIBUTION

DEPARTMENT/ COMPANY	NAME	P.O. BOX	COVER PAGE ONLY	NOTE WITHOUT ATTACH-MENT	NOTE WITH ATTACH-MENT
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RECORD OF REVISIONS

ISSUE	DATE	EFFECT ON		REASONS FOR REVISION
		PAGE	PARA	
1.0	13.11.2019	All	All	First Issue

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N°	TITLE	REFERENCE	ISSUE	DATE	SOURCE	
					SIGLUM	NAME
1	A330 MSN578 ATA29 Check Valves, Lab Test	G29RE1901614	1	12.07.2019		
2	ACMM • CAR101 • CAR201 • CAR370	F1688	3	Jan. 1991	SAMM	
3	ACMM • CART33	F1688	OO	Jan. 1995	SAMM	
4	QTR Calibrated Check Valve CART33	807603	1	16.03.1992	SAMM	

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1 PURPOSE OF DOCUMENT AND TEST

IVYAT was requested to evaluate the functional behaviour of check valves listed in Table 1 of the Yellow Hydraulic System of A330-300 (MSN578) under normal conditions.

The LTRA covers the testing and test results for these four check valves.

2 TESTED DEVICE IDENTIFICATION

The tested check valves are listed in the following table. The test objects can be uniquely identified by the engraved part and serial number.

DESIGNATION	FIN	P/N	S/N
CHECK VALVE-R ENG PUMP CASE DRAIN, Y	5206JM301	CAR101	7443
CHECK VALVE-R ENG THR REV, Y	5210JM301	CAR201	9135
CHECK VALVE-R ENG PUMP DELIVERY, Y	5216JM301	CAR370	6621
CALIBRATED CHECK VALVE-R ENG THR REV, Y	5190JM3	CART33	2573T01

Table 1: tested specimens

Every object was subjected to a visual inspection. There were no visible damages or anomalies. The following pictures show the tested specimens.

Figure 1: CAR101

Figure 2: CAR201

Figure 3: CAR370

Figure 4: CART33

3 TEST MEANS/TOOLS AND PROCEDURES IDENTIFICATION

3.1 TEST MEANS AND TOOLS

The Test Means and all measuring equipment mentioned herein and used for the test are adequate for the test and appropriately calibrated.

The test objects can be uniquely identified by the engraved part and serial number. Before and after test, each specimen was subjected to a visual inspection. There were no visible damages or anomalies.

The hydraulic fluid used for the tests was according to NSA 307110, type V.

The check valves poppet was not be touched in any way prior to the functional test. The required ambient temperature and fluid temperature were all met.

Ambient temperature: 25 ± 10°C

Fluid temperature: 35 ± 10°C

DESCRIPTION	VENDOR	TYPE RANGE	S/N	IVYA INTERNAL SENSOR-ID	ACCURACY
Pressure gauge	Maximator	0 – 250bar	PR200381	PR200381	1,6%
Pressure gauge	Wika	0 – 2,5bar	PR200379	PR200379	0,6%
Pressure gauge	Tecsis	0 – 400bar	PR200392	PR200392	1,6%
Flow meter	VSE	RS400/25 1,00 – 400 L*min^{-1}	050/12172	Q200025	0,5%
Pressure transducer	Burster	81530-500 0 – 500bar	1279509	PR200298	1,0%
Temperature sensor	HySense	TE110 -50 - +200°C	15265	T200269	±1,0%
Differential pressure transducer	Honeywell	HL-A-5 0 – 10bar	145694	PR200053	±0,5%
Differential pressure transducer	Honeywell	HL-A-5 0 – 50bar	192767	PR200088	±0,5%
Measurement system	IMC	CS7008	123579	X200252	n/a

3.2 PROCEDURES

3.2.1 Test TITLE 1

TEST TITLE 1	CHECK VALVE-R ENG PUMP CASE DRAIN, (Y SYSTEM) Functional Test **FIN:5206JM301** *P/N:CAR101* S/N:7443
TEST OBJECTIVE/CASE 1	Performance evaluation of CAR101
TEST CONDITIONS: As specified in chapter 3.1	

TEST DESCRIPTION:

1) Visual Inspection

- Take photographs of the unit from every side.
- Take additional close-up photographs of all ports and note any anomaly.

2) Weight

- Weigh the check valve & note it down.

3) Hydraulic Performance Characteristics

Setup P/N: CAR101 S/N: 7443 in a safe environment for the operator and observer, and perform following tests with stated fluid, starting with low pressure, increasing as/if appropriate. Record data of test. Review to ensure safety and test stand capabilities (In the event of external leakage identified, if leakage rate is more than 3 litre at pressure lower than 3000 PSI, stop test, if not increase to 3000 PSI and hold for 2 min, record leakage rate)

(1) Internal Leakage:

- Test set up in accordance to Figure 5.
- The required pressure was applied by a hand pump.
- Apply 1.5 bar pressure on the outlet port, after 4 stabilization minutes, do check for internal leakage & note it down.
- Reduce inlet pressure to 0 bar.
- Apply 210 bar pressure on the outlet port, After 4 stabilization minutes do check for internal leakage.
- A piece of paper lay below the check valve to indicate the dropped Skydrol.
-

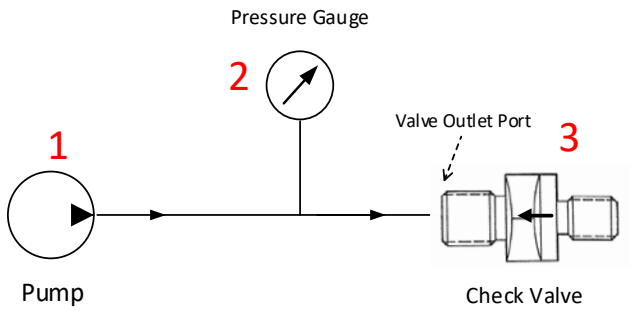

Figure 5: test setup Test Title 1 - 3(1)

- equipment used for the test

ITEM	*DESCRIPTION*	*TYPE*	*S/N*	*IVYA INTERNAL SENSOR-ID*
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Maximator 0-250 bar	PR200381	PR200381
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 2: equipment Test Title 1 - 3(1)

(2) Flushing

- This test was not performed.

(3) Cracking Pressure

- Test set up in accordance to Figure 6.
- Apply hydraulic pressure using a hand pump to inlet fitting and slowly increase pressure until flow is observed at the outlet port.
- The test was repeated vive times. After each test the outlet port of the valve was cleaned.

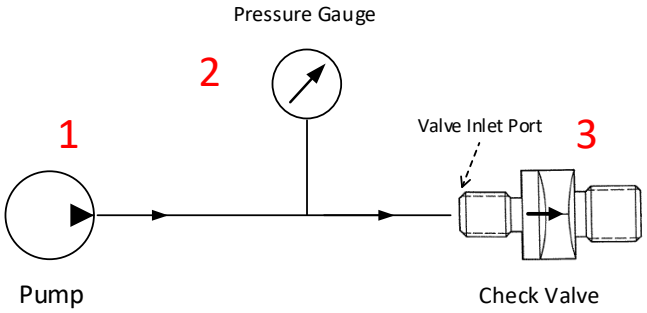

Figure 6: test setup Test Title 1 - 3(3)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 3: equipment Test Title 1 - 3(3)

(4) Pressure Drop at Rated Flow

- Test set-up in accordance to Figure 7.
- Apply nominal pressure on the inlet port, after 4 stabilization minutes, do check for pressure drop at rated flow & note it down.
  Nominal Pressure: 210 bar
  Rated Flow: 40 l/min
- All sensors were measured by the IMC measurement system CS7008 test item 6.

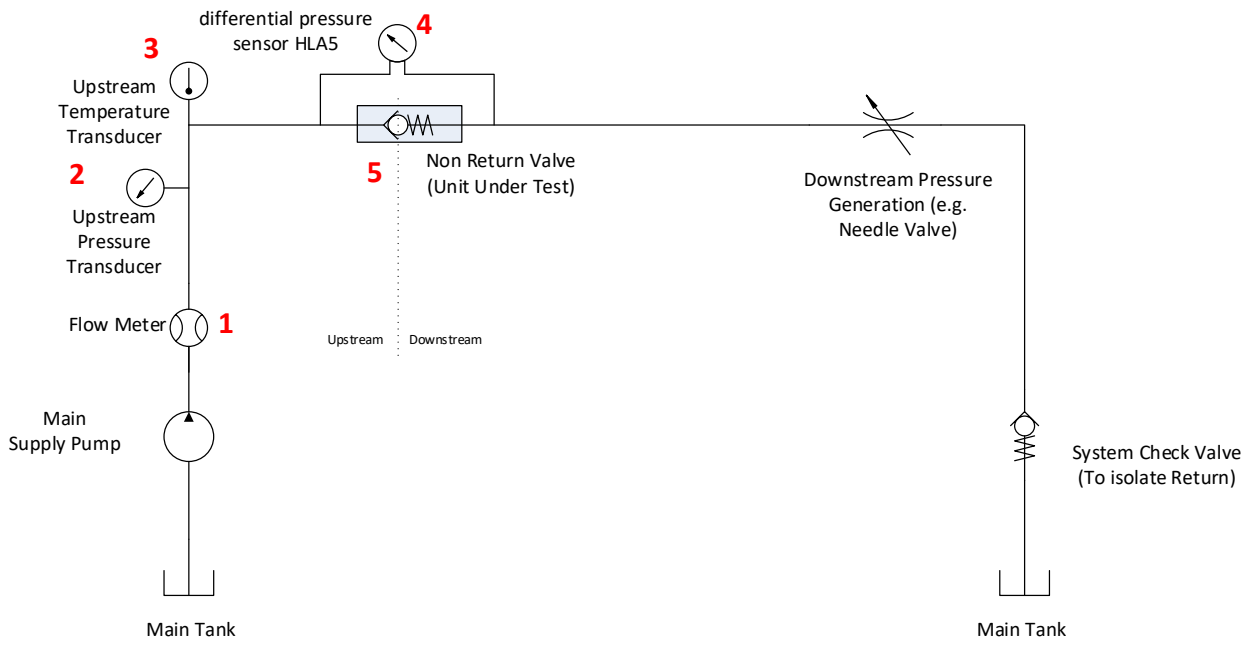

Figure 7: test setup Test Title 1 - 3(4)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Flow meter	RS400/25	050/12172	Q200025
2	Pressure transducer	81530-500	1279509	PR200298
3	Temperature sensor	TE110	15265	T 200269
4	Differential pressure transducer	HL-A-5	145694	PR200053
5	Test specimen	CAR101	7443	n/a
6	Measurement system	CS7008	123579	X200252

Table 4: equipment Test Title 1 - 3(4)

(5) Proof Pressure Test:

- Test set up in accordance to test setup Test Title 1 - 3(3)Figure 6
- After plugging the outlet port, apply a proof pressure of 320bar at the inlet port for at least 3 minutes. Check for external leakage, failure, or permanent set

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Tecsis 0-400 bar	PR200392	PR200392

3	Test specimen	CAR101	7443	n/a

Table 5: equipment Test Title 1 - 3(5)

(6) External Leakage:

- External leakage shall be checked during the whole test.
  In the event of external leakage identified, if leakage rate is more than 3 litre at pressure lower than 3000 PSI, stop test, if not increase to 3000 PSI and hold for 2 min, record leakage rate.

EXPECTED RESULTS:

- Weight: ≤ 45 g
- External Leakage: none
- Internal Leakage:
  a. 1.5 bar pressure on the outlet port, After 4 stabilization minutes, maximum of 5 drops/hour.
  b. 210 bar pressure on the outlet port, After 4 stabilization minutes, no leakage.
- Cracking Pressure: between 0.15 and 0.5 bar for a nominal flow of 100 cm3/min.
- Pressure Drop: ≤ 2.5 bar at Rated Flow : 40 l/min
- Proof Pressure: No external leakage, failure, or permanent set.

COVERED REQUIREMENT(S):

1. Weight
2. External Leakage
3. Internal Leakage
4. Cracking Pressure
5. Pressure Drop
6. Rated Flow
7. Proof Pressure

3.2.2 Test TITLE 2

TEST TITLE 2	CHECK VALVE-R ENG THR REV (Y SYSTEM) Functional Test **FIN:5210JM301** *P/N:CAR201* S/N:9135
TEST OBJECTIVE/CASE 2	Performance evaluation of CAR201

TEST CONDITIONS:

As specified in chapter 3.1.

TEST DESCRIPTION:

Note: Photographs or and video recording of complete testing is requested. Do not dismantle or damage the unit during any of the following test.

1) Visual Inspection

- Take photographs of the unit from every side.
- Take additional close-up photographs of ALL ports and note any anomaly.

2) Weight

- Weigh the check valve & note it down.

3) Hydraulic Performance Characteristics

Setup P/N: CAR201 S/N: 9135 in a safe environment for the operator and observer, and perform following tests with stated fluid, starting with low pressure, increasing as/if appropriate. Record data of test. Review to ensure safety and test stand capabilities (In the event of external leakage identified, if leakage rate is more than 3 litre at pressure lower than 3000 PSI, stop test, if not increase to 3000 PSI and hold for 2 min, record leakage rate)

(1) Internal Leakage:

- Test set up in accordance to Figure 8.
- The required pressure was applied by a hand pump.
- Apply 1.5 bar pressure on the outlet port, after 4 stabilization minutes, do check for internal leakage & note it down.
- Reduce inlet pressure to 0 bar.
- Apply 210 bar pressure on the outlet port, After 4 stabilization minutes do check for internal leakage.
- A piece of paper lay below the check valve to indicate the dropped Skydrol.

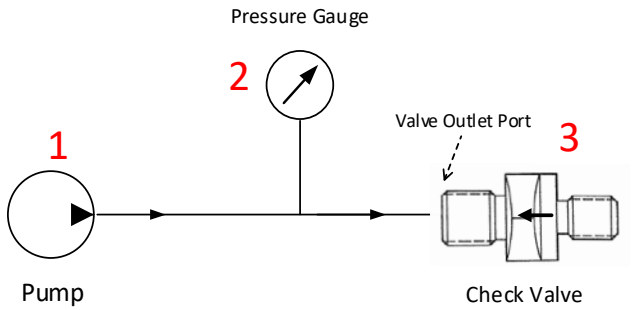

Figure 8: test setup Test Title 2 - 3(1)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Maximator 0-250 bar	PR200381	PR200381
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 6: equipment Test Title 2 - 3(1)

(2) Flushing

- This test was not performed.

(3) Cracking Pressure

- Test set up in accordance to Figure 9.
- Apply hydraulic pressure using a hand pump to inlet fitting and slowly increase pressure until flow is observed at the outlet port.
- The test was repeated vive times. After each test the outlet port of the valve was cleaned.

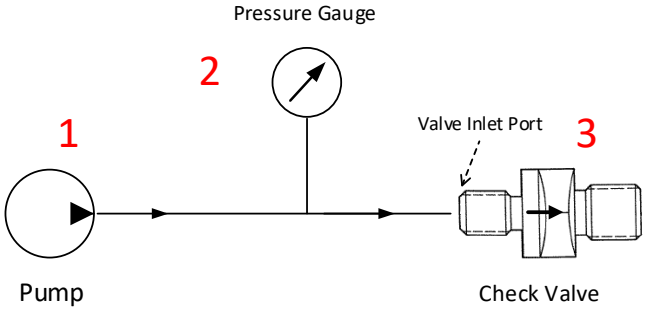

Figure 9: test setup Test Title 2 - 3(3)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 7: equipment Test Title 2 - 3(3)

(4) Pressure Drop at Rated Flow

- Test set-up in accordance to Figure 10.
- Apply nominal pressure on the inlet port, after 4 stabilization minutes, do check for pressure drop at rated flow & note it down.
  Nominal Pressure: 210 bar
  Rated Flow: 80 l/min
- All sensors were measured by the IMC measurement system CS7008 test item 6.

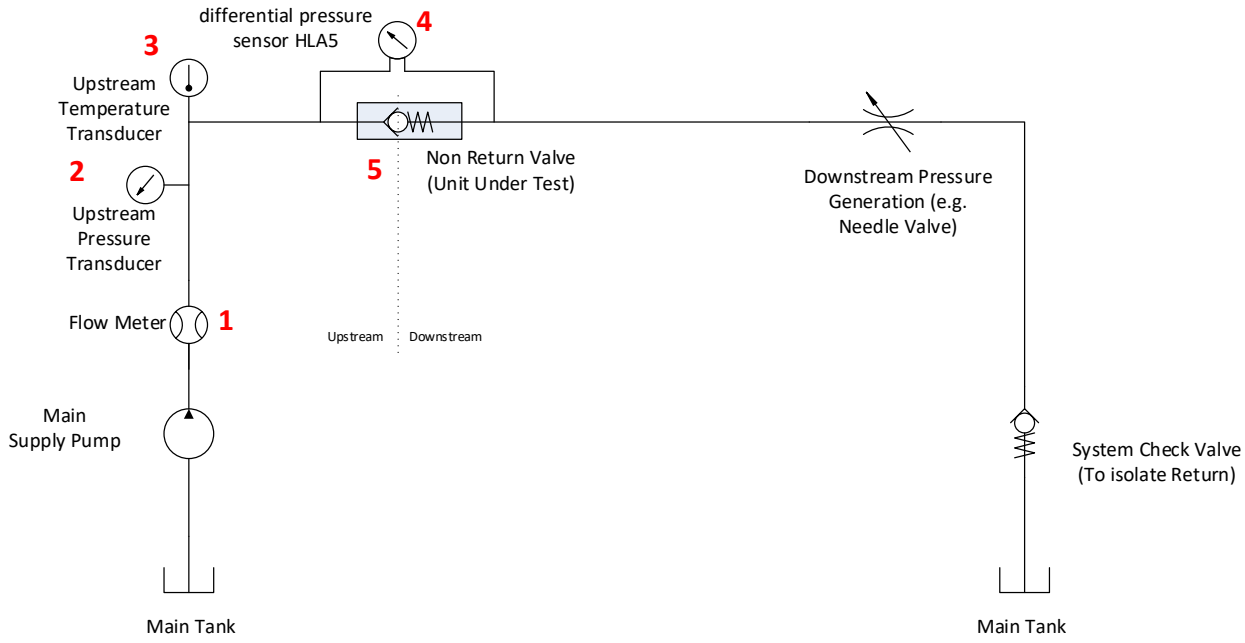

Figure 10: test setup Test Title 2 - 3(4)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Flow meter	RS400/25	050/12172	Q200025
2	Pressure transducer	81530-500	1279509	PR200298
3	Temperature sensor	TE110	15265	T 200269
4	Differential pressure transducer	HL-A-5	145694	PR200053
5	Test specimen	CAR101	7443	n/a
6	Measurement system	CS7008	123579	X200252

Table 8: equipment Test Title 2 - 3(4)

(5) Proof Pressure Test:

- Test set up in accordance to Figure 9.
- After plugging the outlet port, apply a proof pressure of 320bar at the inlet port for at least 3 minutes. Check for external leakage, failure, or permanent set

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Tecsis 0-400 bar	PR200392	PR200392
3	Test specimen	CAR101	7443	n/a

Table 9: equipment Test Title 2 - 3(5)

(6) External Leakage:

- External leakage shall be checked during the whole test.
  In the event of external leakage identified, if leakage rate is more than 3 litre at pressure lower than 3000 PSI, stop test, if not increase to 3000 PSI and hold for 2 min, record leakage rate.

EXPECTED RESULTS:

- Weight: ≤ 125 g
- External Leakage: none
- Internal Leakage:
  c. 1.5 bar pressure on the outlet port, After 4 stabilization minutes, maximum of 5 drops/hour.
  d. 210 bar pressure on the outlet port, After 4 stabilization minutes, no leakage.
- Cracking Pressure: between 0.15 and 0.5 bar for a nominal flow of 100 cm3/min.
- Pressure Drop: ≤ 1.5 bar at Rated Flow : 80 l/min
- Proof Pressure: No external leakage, failure, or permanent set.

COVERED REQUIREMENT(S):

1. Weight
2. External Leakage
3. Internal Leakage
4. Cracking Pressure
5. Pressure Drop
6. Rated Flow
7. Proof Pressure

3.2.3 Test TITLE 3

TEST TITLE 3	CHECK VALVE-R ENG PUMP DELIVERY (Y SYSTEM) Functional Test **FIN:5216JM301** *P/N:CAR370* S/N:6621
TEST OBJECTIVE/CASE 3	Performance evaluation of CAR370

TEST CONDITIONS:

As specified in chapter 3.1.

TEST DESCRIPTION:

Note: Photographs or and video recording of complete testing is requested. Do not dismantle or damage the unit during any of the following test.

1) Visual Inspection

- Take photographs of the unit from every side.
- Take additional close-up photographs of ALL ports and note any anomaly.

2) Weight

- Weight the check valve & note it down.

3) Hydraulic Performance Characteristics

Setup P/N: CAR370 S/N: 6621 in a safe environment for the operator and observer, and perform following tests with stated fluid, starting with low pressure, increasing as/if appropriate. Record data of test. Review to ensure safety and test stand capabilities (In the event of external leakage identified, if leakage rate is more than 3 litre at pressure lower than 3000 PSI, stop test, if not increase to 3000 PSI and hold for 2 min, record leakage rate)

(1) Internal Leakage:

- Test set up in accordance to Figure 11.
- The required pressure was applied by a hand pump.
- Apply 1.5 bar pressure on the outlet port, after 4 stabilization minutes, do check for internal leakage & note it down.
- Reduce inlet pressure to 0 bar.
- Apply 210 bar pressure on the outlet port, After 4 stabilization minutes do check for internal leakage.
- A piece of paper lay below the check valve to indicate the dropped Skydrol.

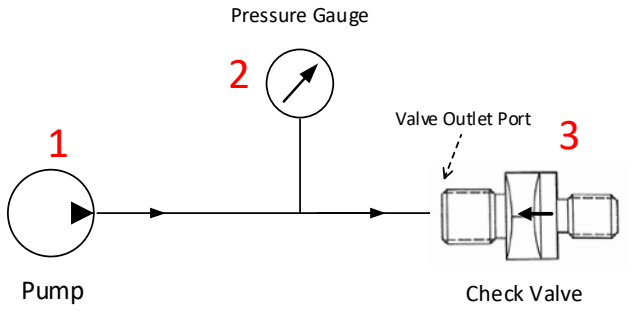

Figure 11: test setup Test Title 3 - 3(1)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Maximator 0-250 bar	PR200381	PR200381
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 10: equipment Test Title 3 - 3(1)

(2) Flushing

- This test was not performed.

(3) Cracking Pressure

- Test set up in accordance to Figure 12.
- Apply hydraulic pressure using a hand pump to inlet fitting and slowly increase pressure until flow is observed at the outlet port.
- The test was repeated vive times. After each test the outlet port of the valve was cleaned.

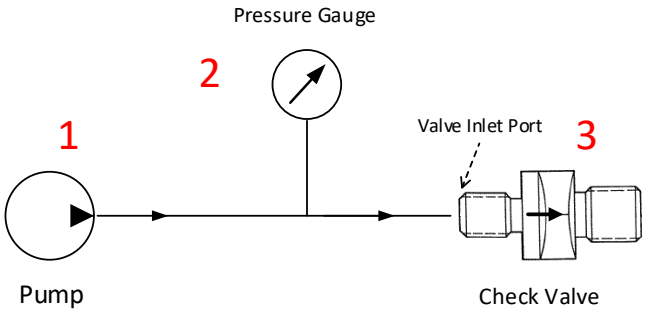

Figure 12: test setup Test Title 3 - 3(3)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 11: equipment Test Title 3 - 3(3)

(4) Pressure Drop at Rated Flow

- Test set-up in accordance to Figure 13.
- Apply nominal pressure on the inlet port, after 4 stabilization minutes, do check for pressure drop at rated flow & note it down.
  Nominal Pressure: 210 bar
  Rated Flow: 175 l/min
- All sensors were measured by the IMC measurement system CS7008 test item 6.

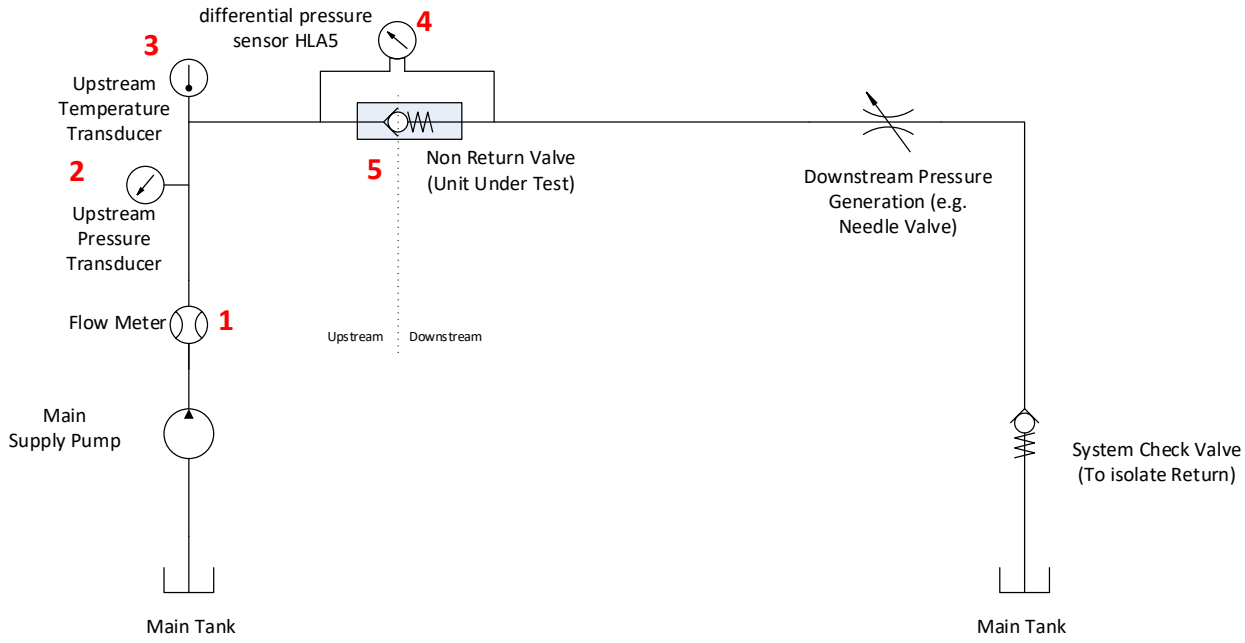

Figure 13: test setup Test Title 3 - 3(4)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Flow meter	RS400/25	050/12172	Q200025
2	Pressure transducer	81530-500	1279509	PR200298
3	Temperature sensor	TE110	15265	T 200269
4	Differential pressure transducer	HL-A-5	145694	PR200053
5	Test specimen	CAR101	7443	n/a
6	Measurement system	CS7008	123579	X200252

Table 12: equipment Test Title 3 - 3(4)

(5) Proof Pressure Test:

- Test set up in accordance to Figure 9.
- After plugging the outlet port, apply a proof pressure of 320bar at the inlet port for at least 3 minutes. Check for external leakage, failure, or permanent set

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Tecsis 0-400 bar	PR200392	PR200392
3	Test specimen	CAR101	7443	n/a

Table 13: equipment Test Title 3 - 3(5)

(6) External Leakage:

- External leakage shall be checked during the whole test.

In the event of external leakage identified, if leakage rate is more than 3 litre at pressure lower than 3000 PSI, stop test, if not increase to 3000 PSI and hold for 2 min, record leakage rate.
EXPECTED RESULTS: • Weight: ≤ 340 g • External Leakage: none • Internal Leakage: e. 1.5 bar pressure on the outlet port, After 4 stabilization minutes, maximum of 5 drops/hour. f. 210 bar pressure on the outlet port, After 4 stabilization minutes, no leakage. • Cracking Pressure: between 0.15 and 0.5 bar for a nominal flow of 100 cm3/min. • Pressure Drop: ≤ 1.5 bar at Rated Flow : 175 l/min • Proof Pressure: No external leakage, failure, or permanent set.
COVERED REQUIREMENT(S): 1. Weight 2. External Leakage 3. Internal Leakage 4. Cracking Pressure 5. Pressure Drop 6. Rated Flow 7. Proof Pressure

3.2.4 Test TITLE 4

TEST TITLE 4	CALIBRATED CHECK VALVE-R ENG THR REV (Y SYSTEM) Functional Test **FIN:5190JM3** *P/N:CART33* S/N:2573T01
TEST OBJECTIVE/CASE 4	Performance evaluation of CART33
TEST CONDITIONS: As specified in chapter 3.1.	
TEST DESCRIPTION: *Note: Photographs or and video recording of complete testing is requested. Do not dismantle or damage the unit during any of the following test.* **1) Visual Inspection** • Take photographs of the unit from every side. • Take additional close-up photographs of ALL ports and note any anomaly. **2) Weight** • Weigh the check valve & note it down.	

3) Hydraulic Performance Characteristics

Setup P/N: CART33 S/N: 2573T01 in a safe environment for the operator and observer, and perform following tests with stated fluid, starting with low pressure, increasing as/if appropriate. Record data of test.

(1) Internal Leakage:

- Test set up in accordance to Figure 14.
- The required pressure was applied by a hand pump.
- Apply 0.2 bar pressure on the outlet port, after 2 stabilization minutes, do check for internal leakage & note it down.
- Reduce inlet pressure to 0 bar.
- Apply 33 bar pressure on the outlet port, After 4 stabilization minutes do check for internal leakage.
- A piece of paper lay below the check valve to indicate the dropped Skydrol.

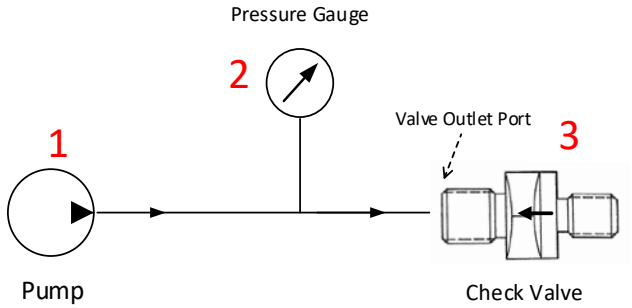

Figure 14: test setup Test Title 4 - 3(1)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Ashcroft 0-40 bar	PR200394	PR200394
2	Pressure gauge	Wika 0-2,5 bar	PR200379	PR200379
3	Test specimen	CAR101	7443	n/a

Table 14: equipment Test Title 4 - 3(1)

(2) Flushing

- This test was not performed.

(3) Cracking Pressure

- Test set up in accordance to Figure 15.
- Apply hydraulic pressure using a hand pump to inlet fitting and slowly increase pressure until flow is observed at the outlet port.
- The test was repeated vive times. After each test the outlet port of the valve was cleaned.

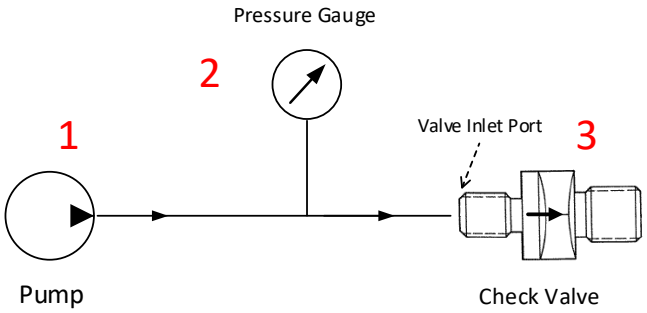

Figure 15: test setup Test Title 4 - 3(3)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Ashcroft 0-40 bar	PR200394	PR200394
3	Test specimen	CAR101	7443	n/a

Table 15: equipment Test Title 4 - 3(3)

(4) Reseat Pressure

- This test was not performed.

(5) Pressure Drop at Rated Flow

- Test set-up in accordance to Figure 16.
- Apply nominal pressure on the inlet port, after 4 stabilization minutes, do check for pressure drop at rated flow & note it down.
  Nominal Pressure: 33 bar
  Rated Flow: 2 l/min
- All sensors were measured by the IMC measurement system CS7008 test item 6.

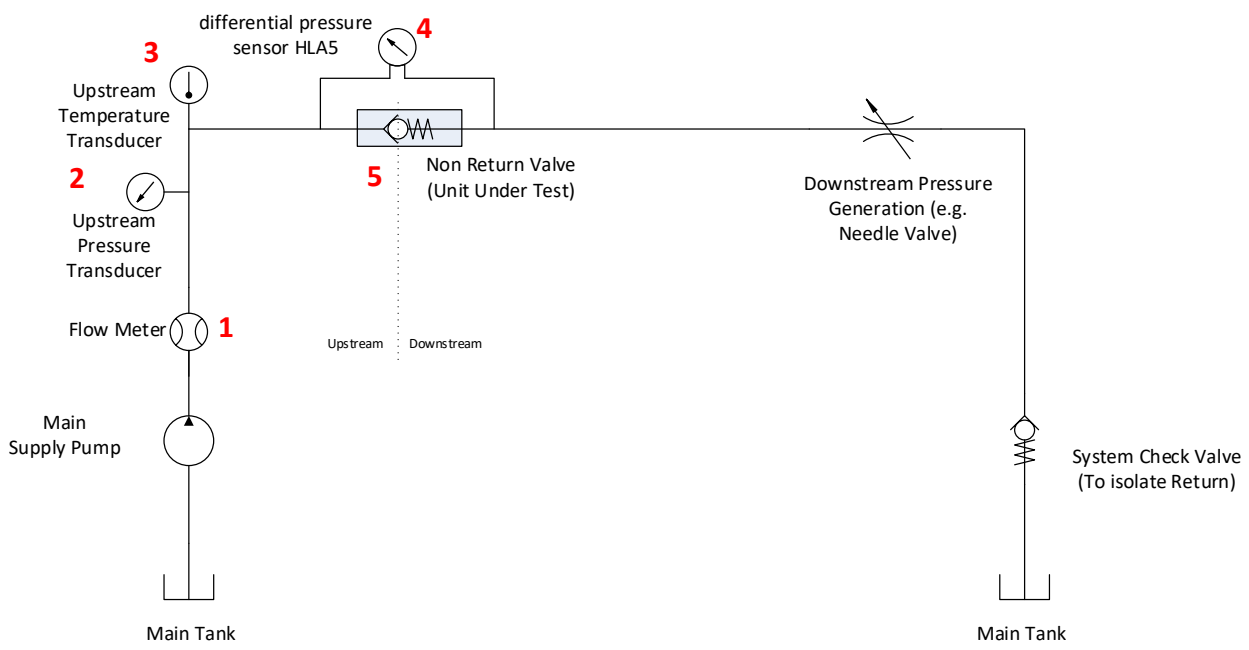

Figure 16: test setup Test Title 4 - 3(5)

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Flow meter	RS400/25	050/12172	Q200025
2	Pressure transducer	81530-500	1279509	PR200298
3	Temperature sensor	TE110	15265	T 200269
4	Differential pressure transducer	HL-A-5	192767	PR200088
5	Test specimen	CAR101	7443	n/a
6	Measurement system	CS7008	123579	X200252

Table 16: equipment Test Title 4 - 3(5)

(7) Proof Pressure Test:

- Test set up in accordance to Figure 15.
- After plugging the outlet port, apply a proof pressure of 50 bar at the inlet port for at least 3 minutes. Check for external leakage, failure, or permanent set

- equipment used for the test

ITEM	DESCRIPTION	TYPE	S/N	IVYA INTERNAL SENSOR-ID
1	Hand pump Enerpac	P801 max 700bar	n/a	n/a
2	Pressure gauge	Tecsis 0-400 bar	PR200392	PR200392
3	Test specimen	CAR101	7443	n/a

Table 17: equipment Test Title 4 - 3(7)

(6) External Leakage:

- External leakage shall be checked during the whole test.

EXPECTED RESULTS:

- Weight: ≤ 50 g
- External Leakage: none
- Internal Leakage:
    a. At 0.2 bar pressure to the outlet port. After 2 minutes of stabilization, no leakage.
    b. 33 bar pressure on the outlet port, after 2 stabilization minutes, maximum leakage of 0.5 cm3/min.
- Cracking Pressure: The cracking pressure with a pressure drop (Supply pressure - Back pressure) equal to 13 bar at flow 0.2 l/h.
- Pressure Drop: the rated flow Q = 2 l/min is with a pressure drop (Supply pressure - Back pressure) lower or equal to 18 bar.
- Proof Pressure: No external leakage, failure, or permanent set.

COVERED REQUIREMENT(S):

1. Weight
2. External Leakage
3. Internal Leakage
4. Cracking Pressure
5. Pressure Drop
6. Rated Flow
7. Proof Pressure

4 RESULTS AND ANALYSIS OF THE TEST/DEFECT ANALYSIS

All samples passed the performed tests. No abnormalities or deformations were detected.

All tests that were not performed as required have been omitted after consultation with department IYCEH.

The following tables give an overview of the test results of the tests carried out.

Test			CAR101		
			short description	expected results	results
1			visual inspection		*ok*
2			weight	≤45 g	*44,365 g*
3	1	1,5 bar	internal leakage	≤5 drops/h	*0 drops/h*
		210 bar		=0 drops/h	*0 drops/h*
	2		flushing		
	3		cracking pressure	≥0,15 bar & ≤0,5 bar	*0,326 bar*
	4		pressure drop	≤2,5	*1,7 bar*
	5		proof pressure	no leakage	*ok*
	6		external leakage	no leakage	*ok*
	7				
		P	*test passed*		
		F	*test failed*		
		N	*test not executed*		
		Comments:			

Figure 17: test results CAR101

Test			CAR201		
			short description	expected results	results
1			visual inspection		
2			weight	≤125 g	*125,318 g*
3	1	1,5 bar	internal leakage	≤5 drops/h	*0 drops/h*
		210 bar		=0 drops/h	*0 drops/h*
	2		flushing		
	3		cracking pressure	≥0,15 bar & ≤0,5 bar	*0,26 bar*
	4		pressure drop	≤1,5	*1,4 bar*
	5		proof pressure	no leakage	*ok*
	6		external leakage	no leakage	*ok*
	7				
		P	*test passed*		
		F	*test failed*		
		N	*test not executed*		
		Comments:			

Figure 18: test results CAR201

Test			CAR370		
			short description	expected results	results
1			visual inspection		
2			weight	≤340 g	*323,3 g*
3	1	1,5 bar	internal leakage	≤5 drops/h	*0 drops/h*
		210 bar		=0 drops/h	*0 drops/h*
	2		flushing		
	3		cracking pressure	≥0,15 bar & ≤0,5 bar	*0,304 ba*
	4		pressure drop	≤1,5	*0,54 bar*
	5		proof pressure	no leakage	*ok*
	6		external leakage	no leakage	*ok*
	7				
		P	*test passed*		
		F	*test failed*		
		N	*test not executed*		
		Comments:			

Figure 19: test results CAR370

Test			CART33		
			short description	expected results	results
1			visual inspection		
2			weight	≤50 g	*40,769 g*
3	1	0,2 bar	internal leakage	no leakage	*0 drops/h*
		33 bar		≤ 0,5cm^3/min	*4 drops/h*
	2		flushing		
	3		cracking pressure	ΔP = 13 bar	*11,8 bar*
	4		reseat pressure	ΔP ≥ 6 bar	
	5		pressure drop	≤18 bar	*16.9 bar*
	6		proof pressure	no leakage	*ok*
	7		external leakage	no leakage	*ok*
		P	*test passed*		
		F	*test failed*		
		N	*test not executed*		
		Comments:			

Figure 20: test results CART33

5 CONCLUSION

The tests have been performed in order described in paragraph 4.4 of the LTR G29RE1901614 from 12.07.2019. None of the specimens did not pass the test. All samples passed the test.

TEST	TEST RESULT	COMMENTS
TEST TITLE 1	PASSED	CAR101 passed the test.
TEST TITLE 2	PASSED	CAR201 passed the test.
TEST TITLE 3	PASSED	CAR370 passed the test.
TEST TITLE 4	PASSED	CART33 passed the test.

6 LIST OF ATTACHED DOCUMENTS