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FATIGUE TEST OF THE MAIN ROTOR RETENTION COMPONENTS USED ON MODEL OH-58A/206A-1 HELICOPTER

(P.I.P. TASK 69-29)

APRIL 1971

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BELL HELICOPTER COMPANY

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REFERENCES

1. Bell Drawing No. 206-011-100, "Hub Assembly, Main Rotor."
2. Bell IOM:81:GM:ds-277, "Fatigue Test of OH-58A Main Rotor Retention Components."
3. Bell Drawing No. 206-010-105, "Strap Assembly, Tension Torsion, Main Rotor."
4. Bell Drawing No. 206-010-123, "Pin-Strap Retaining, Main Rotor."
5. Bell Drawing No. 206-010-155, "Fitting-Retention Strap, Main Rotor, Assembly of."
6. Bell Drawing No. 206-010-169, "Bolt-Strap Retaining," Main Rotor."
7. Bell Engineering Order 206HA86, "To Provide Parts for Fatigue Test."
8. Bell Drawing No. 299-098-015, Sheet 5, "Fatigue Machine for Model 206 Main Rotor Blade Retention Strap."
9. Bell Engineering Laboratories Notebook No. N70-25.
10. Bell Report No. 206-099-114, "Fatigue Life Substantiation for the Dynamic Components of Model 206A-1 Helicopter."
11. Bell Engineering Order 206HA1818, "Rework the Test Specimen Used in the Fatigue Test of OH-58A/206A-1 Main Rotor Retention Components."

INTRODUCTION

This report presents the results of a fatigue test conducted on eight sets of main rotor retention components used in the main rotor hub assembly of the Model OH-58A/206A-1 helicopter, Ref. 1. The test was conducted to justify an extension of the recommended service life of the retention components. The fatigue test was conducted in accordance with Ref. 2, except for a subsequent addition in the test program. A total of eight sets of components were tested as against the four sets specified.

Each set of the components tested consisted of one 206-010-105-3 strap assembly, Ref. 3, Fig. 1, one 206-010-123-1 pin, Ref. 4, Fig. 2, and one 206-010-155-7 or 206HA86-1 fitting, Ref. 5 and 7, Figs. 3 and 4. In the last four sets tested the -155-7 fittings were replaced by the 206HA86-1 fittings, Ref. 7, Fig. 4. The 206HA86-1 fitting, Ref. 7, is the same as the -155-7 fitting except that the 45 degree angular cuts were deleted. In each set tested, one new 206-010-169-1 strap retaining bolt, Ref. 6, was used as a supporting part, Fig. 5. A detailed description of all the test parts is given under Test Specimen section.

The strap assemblies are used in the main rotor hub assembly, Ref. 1, to transmit the main rotor centrifugal load to the 206-010-101-9 yoke assembly. The strap assembly is designed to be flexible in torsion in order to permit pitch change of the rotor blade during helicopter operation. It is located along the pitch change axis between the main rotor yoke and grip assembly.

The fittings are located along the pitch change axis inside the yoke assembly and accept the inboard end of the strap assembly. The pin locks the strap assembly in the fitting. The outboard end of the strap assembly is accepted by a pair of tangs in the grip assembly, and is locked in by a retaining bolt.

Each of the eight sets of components tested were subjected to mean and oscillatory angular twist and centrifugal loads based on the loads specified in Ref. 2. The test was conducted in two phases. During the first phase each set of the components were subjected to an oscillatory twist loading with a steady axial load which simulated the centrifugal force. During the second phase the components were subjected to start-stop cycle loading which simulated the starting and stopping of the helicopter. The angular twist loads in degrees are specified with reference to the angular twist of the strap assembly. A detailed description of the loads is given under Test Loads.

The testing of the components was accomplished using a test machine designed especially for this purpose, Ref. 8. The test setup is shown in Figs. 6, 7, and 8. In the test setup, two sets of components were tested simultaneously utilizing actual helicopter components wherever possible. The eight sets of components were tested in a sequence of four tests. The axial load simulating centrifugal force was applied with a hydraulic cylinder. The start-stop cycling was accomplished by cycling the hydraulic cylinder with a four way valve. Each strap assembly was pretwisted at the inboard end, and the desired oscillatory twist applied at the outboard end by means of an eccentric driven by an electric motor. Each component of a test set was removed from the test machine after a predetermined number of test cycles and inspected for failure. The inspection cycle intervals and a detailed description of the test setup are presented in Apparatus and Methods.

All the test data is recorded in Ref. 9. The test was conducted in the Mechanical Test Laboratory of Bell Helicopter Company, Fort Worth, Texas between Sept. 9, 1970 and Jan. 15, 1971.

RESULTS

A summary of the fatigue test results for the eight sets of main rotor retention components is given in Tables I through III. Photographs of the condition of the retention components and supporting parts are given in Figs. 9 through 16.

Each set of the retention components was first subjected to ten million cycles of oscillatory twist of 20 ±14 degrees combined with a steady axial load of 44,000 lbs. Following the oscillatory twist loading, each set of components was subjected to a 34,500 start-stop cycle test, during which the axial load was varied from 0 to 44,000 lbs. at 14 cycles per minute with a steady twist of 23 degrees. During the oscillatory twist phase of testing, there were no failures of any components. All failures occurred during the start-stop phase of the test.

There were no failures of the eight 206-010-105-3 strap assemblies tested. However, two straps were damaged by compressive buckling as a result of a test machine failure and one strap was damaged due to a 206HA86-1 fitting failure.

Nine of the ten -123-1 pins were tested without failure. One -123-1 pin indicated fatigue failure after 34,568 start-stop cycles.

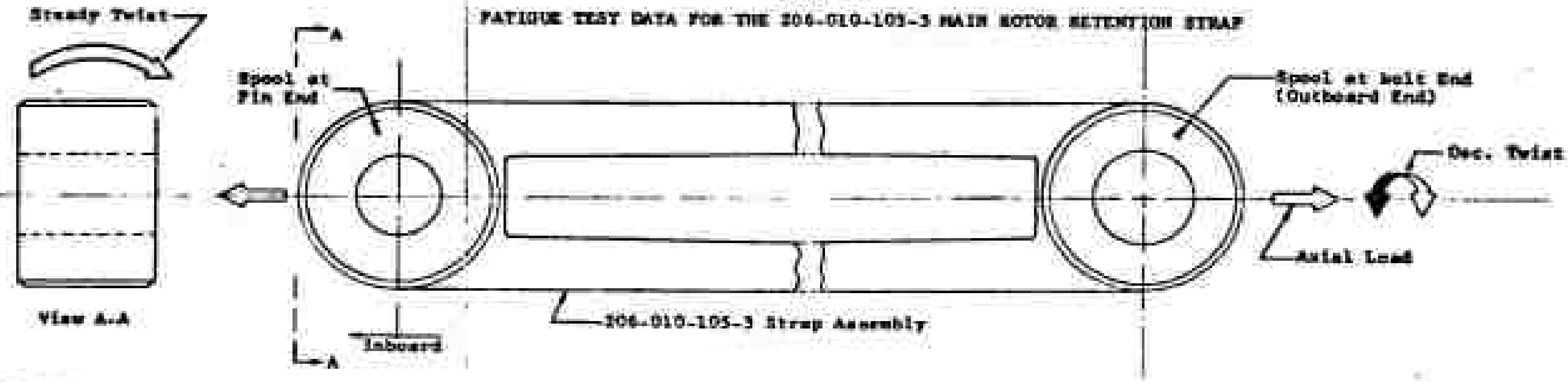
Each of the four -155-7 fittings tested indicated fatigue cracks after completing 13,000 start-stop cycles, but each part continued to react axial load. The four 206HA86-1 fittings used to replace the -155-7 fittings completed the required 34,500 start-stop cycles without failure.

At the end of the test program, the start-stop phase of the test for the last two sets of the retention components with the 206HA86-1 fittings was continued until a failure occurred. After 72,326 start-stop cycles, the 206HA86-1 fitting, ML-4, used with strap specimen No. 8 failed as shown in Fig. 14. The -1 fitting, ML-3, used with set No. 7, showed fatigue cracks at the pin hole as shown in Figs. 14 and 16.

Test results of each retention components are discussed in detail under Discussion of Results.

TABLE I

FATIGUE TEST DATA FOR THE 206-010-105-3 MAIN ROTOR RETENTION STRAP



Test No.	Strap Specimen No.	Serial No.	Type of Loading in Sequence	Test Loads: Twist Angle, Degrees, Steady	Test Loads: Twist Angle, Degrees, Oscillatory	Test Loads: Axial Load in Pounds	Applied Test Cycles	Summary of Results	Ref. Fig. No.
1	1	1447	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 34,568	No failure. No failure. Light to medium fretting on end spool faces. ⚠	10
	2	1455	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 34,568	No failure. No failure. Fretting on end spools same as above. ⚠	
2	3	6005	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 20,292	No failure. No failure. Light to medium fretting on end spool faces. Test discontinued due to the damage caused by test machine failure.	9
	4	6025	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 20,292	No failure. Result similar to specimen No. 3.	9
3	5	6027	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 34,325	No failure. No failure. Medium fretting on spool faces. The outboard end shows heavier fretting.	10
	6	6054	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 34,325	No failure. No failure. Fretting condition similar to specimen No. 5.	10
4	7	6688	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 72,326	No failure. No failure. Fretting conditions were the same as for specimen No. 5.	11
	8	6711	Twist Start-Stop	20 25	14 None	44,000 0 to 44,000	10,000,000 72,326	No failure. After 34,540 cycles there were no failure. Fretting was similar to specimen Nos. 5 and 6. After 72,326 cycles, the straps were damaged when the 206A486-1 fitting failed.	11

⚠ Test machine failed after 24,291 start-stop cycles, but test was continued.

TABLE 11

FATIGUE TEST DATA FOR THE 206-010-123-1 MAIN ROTOR RETENTION STRAP RETAINING PIN

Test No.	Strap Specimen No.	Pin Specimen No.	Pin Serial No.	Test Loads △: Type of Loading in Sequence	Twist Angle, Degrees: Steady	Twist Angle, Degrees: Oscillatory	Axial Load in Pounds	Applied Test Cycles	Summary of Results
1	1	1	Q1-2289	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 34,568	No failure. No failure. Medium fretting on contact-areas.
	2	2	Q1-2282	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 34,568	No failure. Failed at midsection. Medium fretting on contour area. See Fig. 12.
2	3	3	Q1-2284	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 13,411	No failure. No failure. Medium fretting.
	4	4	Q1-2232	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 13,411	No failure. No failure. Medium fretting.
	3	△ 5	ML-1	Start-Stop	23	None	0 to 44,000	6,881	No failure.
	4	△ 6	ML-2	Start-Stop	23	None	0 to 44,000	6,881	No failure.
3	△ 5	7	Q1-2377	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 34,525	No failure. No failure. Medium to severe fretting.
	6	8	Q1-2112	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 34,525	No failure. No failure. Medium to severe fretting.
4	7	9	Q1-2895	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 34,540	No failure. No failure. Fretting was similar to pin Specimen Nos. 7 and 8.
	8	10	Q1-2977	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 34,540	No failure. No failure. Fretting was similar to pin Specimen Nos. 7 and 8

NOTES: △ Test loads are same as listed for the corresponding -105-3 retention straps in Table 1.

△ Pin specimen Nos. 5 and 6 were used with re-worked -135-7 fittings, Ref. 11, and were used in place of pin specimen Nos. 3 and 4 to continue the test.

△ The new fittings, P/N 206A686-1, were used with specimen Nos. 7 through 10.

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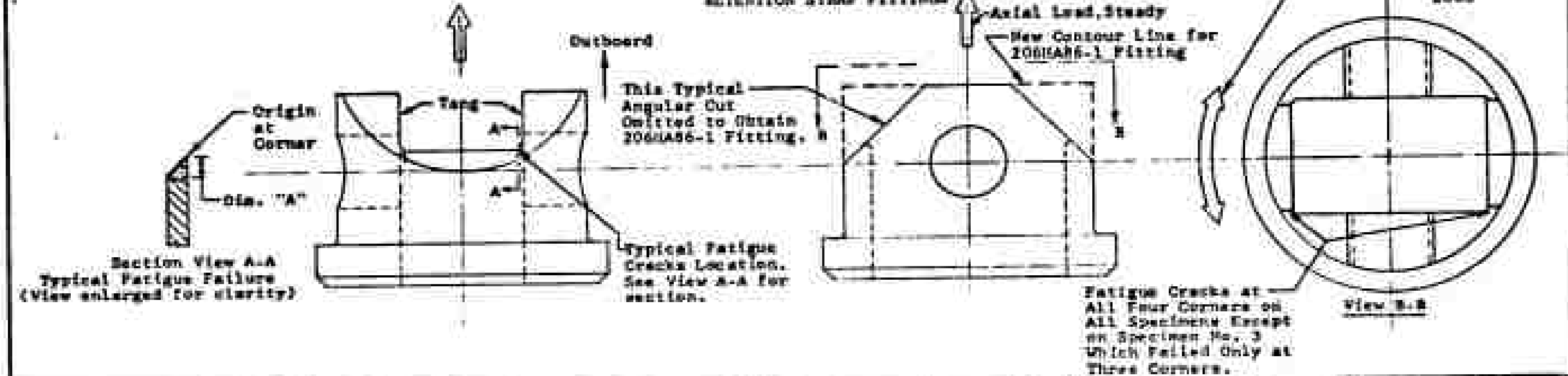
TABLE III

FATIGUE TEST DATA FOR THE 206-010-155-7 AND 206HA86-1 MAIN ROTOR RETENTION STRAP FITTINGS



Test No.	Strap Spec. No.	Fitting Specimen No. and Part No.	Fitting Serial No.	△ Test Loads: Type of Loading	Twist Angle, Degrees: Steady	Twist Angle, Degrees: Oscillatory	Axial Load In Pounds	Applied Test Cycles	Summary of Results
1	1	1 -155-7	J11-2078	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 13,400	No failure. Fatigue cracks at all four corners. Maximum Dia. "A" 0.17 Inches. See Section A-A.
	2	2 -155-7	J11-2088	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 13,400	No failure. Fatigue cracks at all four corners. Ref. Fig. 13. Maximum Dia. "A" .17 inches. See Section A-A.
2	3	△ 3 -155-7	J11-2098	Twist Start-Stop	20 23	14 None	44,000 0 to 44,000	10,000,000 13,411	No failure. Breakwire opened after 6550 cycles. Fatigue cracks found at three corners after 13,411 cycles. Maximum Dia. "A" 0.24 inches. See Section A-A.
	4	4 -155-7	J11-2111	Twist Start-Stop	20 23	14 Non-	44,000 0 to 44,000	10,000,000 13,411	No failure. No breakwire was open, but fatigue cracks were found at four corners. Maximum Dia. "A" 0.21 Inches. See Section A-A.

(Table Continued on Next Page)

TABLE III (Continued)

Test No.	Strap Spec. No.	Fitting Specimen No. and Part No.	Fitting Serial No.	(2) Test Loads: Type of Loading	Twist Angle, Degrees: Steady	Twist Angle, Degrees: Oscillatory	Axial Load in Pounds	Applied Test Cycles	Summary of Results
2	1, 3	(1) 5 -155-7	ML-1	Start-Stop	23	None	0 to 44,000	28,000	Failed at all the four corners. Crack location similar to earlier cracks after 13,175 cycles.
	2, 4	(1) 6 -155-7	ML-2	Start-Stop	23	None	0 to 44,000	28,000	Fatigue cracks found at all four corners similar to specimen No. 5, but the breakwires did not break.
3	5	1 206HA86-1	ML-1	Twist	20	14	44,000	10,000,000	No failure.
				Start-Stop	23	None	0 to 44,000	34,525	No failure. Minor fretting at the hole and innerface. Ref. Fig. 14.
	6	2 206HA86-1	ML-2	Twist	20	14	44,000	10,000,000	No failure.
				Start-Stop	23	None	0 to 44,000	34,525	No failure. Minor fretting at the hole and innerface.
4	7	3 206HA86-1	ML-3	Twist	20	14	44,000	10,000,000	No failure.
				Start-Stop	23	None	0 to 44,000	72,326	Failed at the pin hole. There were no failures when inspected last at 34,500 cycles. Ref. Fig. 14.
	8	4 206HA86-1	ML-4	Twist	20	14	44,000	10,000,000	No failure.
				Start-Stop	23	None	0 to 44,000	72,326	Failed circumferentially across the hole. There were no failures when inspected after 34,500 cycles. Ref. Fig. 15 and 16.

NOTES:

(1) These two fittings were modified per and identified by E.O. 206HES1818, Ref. 11. The modification consisted of increasing the corner radii at the location of failures noted in specimen Nos. 1 through 4 and shot peening the re-machined surfaces. These were used only for start-stop cycles and were not subjected to twist cycles.

(2) Test loads are as applied on the corresponding -105-3 retention strap.

(3) The fittings in test Nos. 2, 3, and 4 were breakwired at possible locations of failure to stop the test machine in case of a fitting failure.

DISCUSSION OF RESULTS

All the test parts used in the eight sets of retention components completed ten million oscillatory twist cycles without any failure. All the failures noted herein occurred during the start-stop cycle tests.

One new 206-010-169-1 strap retaining bolt, Fig. 5, was used in each set of retention components as a supporting part. None of the -169-1 bolts used in the test indicated any failure. At the end of the test all the test parts were subjected to metallurgical examination. All the failed parts were checked and found to be within corresponding blueprint requirements except the -155-7 fitting, S/N JI1-2070. The metallurgical examination results on this fitting are given under discussion of results of the -155-7 fitting.

A brief discussion of each component tested is given below:

206-010-105-3 Retention Strap

A summary of the fatigue test results on eight -105-3 strap assemblies is given in Table I. Specimen Nos. 1 through 4 were tested with the -155-7 fittings and specimens Nos. 5 through 8 were tested with the 206HA86-1 fittings. The eight specimens completed 10^7 cycles of oscillatory twist loading without failure.

During the test for start-stop cycles, the six straps, specimen Nos. 1, 2, 5, 6, 7 and 8 completed 34,500 cycles without failure. Inspection of the specimens 1 and 2 after 34,568 cycles revealed a slight bulge near the ends, which was the damage caused due to the failure of a hydraulic cylinder in the test machine after 24,291 cycles of testing. The resulting shock load buckled the straps, but the damage did not adversely affect the test results.

Two straps, specimen Nos. 3 and 4, completed 20,292 start-stop cycles without failure but testing was stopped because the straps were severely buckled in compression, Fig. 9, as a result of a second hydraulic cylinder failure which resulted in a high compressive shock load.

Strap specimen Nos. 5 and 6 completed 34,525 cycles without failure, and specimen Nos. 7 and 8 completed 72,326 cycles without failure. The inboard end of strap specimen No. 7 was damaged, as shown in Fig. 11, due to the failure of corresponding -86-1 strap fitting, Specimen ML-4, after 72,326 cycles, Fig. 15.

At the conclusion of each test, light to medium fretting was found on the faces of the end spools. In general, the spool at the inboard end, which attached to the -155-7 fitting, showed less fretting than the spool at the outboard end. Typical fretting conditions of the straps after 20,292 cycles, 14,000 cycles and 72,326 cycles are shown in Figs. 9, 10, and 11, respectively. The amount of fretting noted did not have any significant effect on the fatigue test results.

206-010-123-1 Strap Retaining Pin

A summary of the test results on ten -123-1 pins is presented in Table II.

Eight of the ten pins used were subjected to 10^7 oscillatory twist cycles and then the start-stop loading cycles as discussed below. Two of the ten pins were subjected to only start-stop cycles because they were used to complete a block of 34,500 start-stop cycles on strap specimen Nos. 3 and 4.

Five of the eight pins subjected to 10^7 twist cycles also completed the required block of 34,500 start-stop cycles without failure. Two other pins completed 10^7 twist cycles and 13,411 start-stop cycles without failure. Testing was stopped at 13,411 cycles because of failure of the -155-7 fittings.

One of the eight pins, specimen No. 2, subjected to 10^7 twist cycles and 34,568 start-stop cycles was found to have a fatigue crack upon inspection after completion of 34,568 start-stop cycles. The fatigue crack originated in a heavily fretted area, Fig. 12. This pin was used with two -155-7 fittings during the test. The original -155-7 fitting was found to contain fatigue cracks after 13,400 start-stop cycles and a new fitting identified as Part No. 206HES-1818-1 was installed to complete the 34,568 cycles on the strap and pins.

The magnitude of the fretting was heavy on the bearing surfaces of all ten pins tested. However, no significant difference in fretting was apparent because of replacing the -155-7 fittings with the 206HA86-1 fittings.

206-010-155-7 and 206HA86-1 Retention Strap Fittings

A summary of the test data and results of six -155-7 and four 206HA86-1 fittings are given in Table II. All of the four -155-7 fittings, specimen Nos. 1 through 4, successfully withstood 10^7 cycles in twist loading without any failure. Specimen Nos. 5 and 6 were not subjected to any oscillatory twist loading.

During the start-stop cycle test, each of the four fittings, specimen Nos. 1 through 4, showed fatigue cracks at the top corners of the rectangular cavity after 13,400 cycles, Fig. 13. The fatigue cracks were located at all of the four corners for three specimens, the crack-lengths varying from 1/8 to 3/8 of an inch. The fourth specimen, S/N JI1-2098, had fatigue cracks at three of the four corners. The first inspection on specimen Nos. 1 and 2 was conducted after 13,400 start-stop cycles, and hence the exact number of cycles to failure was not known. During the test specimen Nos. 3 and 4 were breakwired on the possible locations of failure to stop the test machine in the event of a fitting failure. The breakwire on specimen No. 3, S/N JI1-2098, failed after 6550 cycles. Inspection of specimen No. 3 after 13,411 cycles, revealed fatigue cracks at three corners of the fitting. The longest crack was located at the location of the breakwire failure. Since the breakwire was open at this place after 6550 cycles, specimen No. 3 is considered to have failed after 6550 start-stop cycles.

Specimen No. 4 fitting, S/N JI1-2111, did not show any breakwire failure, though during the inspection after 13,411 cycles it showed fatigue cracks at all four corners.

The metallurgical examinations of all the -155-7 fittings revealed that all the fatigue cracks origins were located at the chamfered radii of the corners. Typical origin and extent of fatigue crack is shown in Fig. 13. The material properties of all fittings was checked subsequent to test and found to be within blueprint specification except for fitting S/N JI1-2070.

The metallurgical examination of the -155-7 fitting, S/N JI1-2070, indicated a surface heat treat of 214,000 psi, tensile, which is above the blueprint requirement of 180,000 - 200,000 psi, tensile. Chemical analysis revealed that the carbon content is higher on the surface than the core. The core was found to be at C42 on Rockwell Scale, which corresponds to a heat treat of 194,000 psi tensile.

Following the failures of the -155-7 fittings, two -155-7 fittings, specimen Nos. 5 and 6 were modified by Engineering Order 206HES1818, and used to complete the required number of start-stop cycles on strap specimen Nos. 1 through 4.

The four 206HA86-1 fittings used with strap specimen Nos. 5 through 8 completed 10^7 twist cycles followed by 34,520 start-stop cycles without any failure. The test of specimen Nos. 7 and 8 were continued past the 34,520 start-stop cycles, until a failure occurred at 72,326 cycles. After 72,326 cycles the 206HA86-1 fitting, ML-4, with strap specimen No. 8 failed at the hole as shown in Figs. 15 and 16. At the conclusion of the test, the fitting used with strap specimen No. 7, ML-3, also showed fatigue cracks at the inside corners of the pin hole, Figs. 14 and 16. Typical areas and extent of fretting are given in Fig. 14.

The metallurgical examination of the failed 206HA86-1 fittings indicate that all the fatigue origins were located at the inside chamfer radius of the pin hole in the fitting.

CONCLUSIONS

Based on the test results reported herein, it is concluded that the 206-010-155-7 is the weakest of the main rotor strap components and did not meet the specified requirements for an increase in fatigue life. However, the 206HA86-1 fitting that replaced the -155-7 fitting did meet the specified requirements for an increased service life.

Final conclusions and recommendations as to the service life of the retention components tested will be the subject of another report, Bell Report 206-099-114, Ref. 10.

TEST SPECIMEN

Each of the eight sets of the main rotor retention components tested consisted of one 206-010-105-3 strap assembly, one 206-010-123-1 pin and one 206-010-155-7 or 206HA86-1 fitting. The -155-7 fitting was replaced by the 206HA86-1 fitting for the last four sets of the components.

The 206-010-105-3 strap assembly, Ref. 3, shown in Fig. 1, is made of AM-355 stainless steel wires of 0.0058 to 0.0062 inch in diameter wrapped around two end spools set at 9.50 inches apart. The spools are made out of stainless steel which are heat treated to a tensile strength of 180,000 to 200,000 psi. The wire material has a tensile strength of 440,000 psi and is wound in 46 layers with 179 wires per layer bonded with urethene rubber per Bendix ES-1170. The rubber impregnation is done such that the final belt and spool width is 1.199/1.197 inches and the depth of each belt at the center is 0.442/0.412 inch. At each spool a 0.005 inch thick teflon buffer is bonded between the spool and the bonded wire belt. The inboard spool has a pin hole of 0.7505/0.7500 inch in diameter. The outboard spool has a bolt hole of 0.8755/0.8750 inch in diameter.

The 206-010-123-1 pin, shown in Fig. 2, is made out of AISI 4140 steel and is heat treated to a tensile strength of 180,000 - 200,000 psi. The pin is 0.7495/0.7485 inch in diameter and is 2.290 inches long. The ends of the pin are chamfered to 0.060 X 45 degrees.

The 206-010-155-7 strap fitting, shown in Fig. 3, is made out of SAE 4340 steel and heat treated to a tensile strength of 180,000 to 200,000 psi. The -155-7 fitting is essentially cylindrical in shape with a diameter of 2.435/2.438 inches, and has a length of 1.575 inches. At one end it has a flange 0.425 inch long and 2.845 inches in diameter. The outer edge of the flange is chamfered 0.100 x 45 degrees. At the opposite end, the fitting ends in a pair of tangs, which has sides at 45 degrees to the axis of the fitting and is 0.785/0.815 inches long. There is a rectangular cavity through the center of the fitting. At the tang-end of the fitting there is a 0.7500/0.7505 diameter pin hole at 0.785/0.815 inch from the end and runs perpendicular to the axis of the fitting. The inboard end of the -105-3 strap assembly fits between the tangs and is located in position by the -123-1 strap retaining pin.

The modification of the -155-7 fitting specified by EO206HES1818 consisted of increasing the fitting tang corner radii, Ref. 11, and shot peening the reworked area.

The 206HA86-1 strap fitting, shown in Fig. 4, is essentially same as the -155-7 fitting except for the 45 degree sides of the tangs. These two cuts are eliminated to form a cylindrical fitting which is 1.575 inches long.

Conformity of Test Specimen

All of the eight -105-3 strap assemblies. ten -123-1 pins and four each of the -155-7 and 206HA86-1 fittings were subjected to conformity inspection prior to test. During the inspection, none of the parts were found to have any deviations from the production drawings. The Bell and FAA Conformity Reports are presented on page 35 through 48.

TEST LOADS

The magnitudes of the fatigue test loads as specified in Ref. 2, were based on reference loads calculated for various conditions of operation of the Model 206A-1/OH-58A helicopter. The axial load of 44,000 pounds represents the centrifugal force on the strap assembly and the other components at the redline rotor speed of 390 rpm. The oscillatory twist of ±14 degrees is the result of the constantly varying angle of attack of the blade which occurs during normal helicopter operation. The mean strap-twist angle used in testing was 20 degrees.

The repeated axial loading, also called as the start-stop loading, corresponds to the main rotor starting and stopping during the operational life of the helicopter. The axial load was oscillated from 0 to 44,000 pounds, which corresponds to the maximum main rotor centrifugal force acting on the components. The steady twist of 23 degrees applied on the strap assembly during this part of the test corresponds to the maximum obtainable twist at full down collective.

Each test of the main rotor retention components consisted of applying 10,000,000 oscillatory twist cycles, followed by 34,500 start-stop cycles. These were the blocks of cycles required per Ref. 2 to be met without failure of any component in order to justify an increase in service life.

APPARATUS AND METHOD

Fatigue Test Machine

The test machine was designed to test two sets of the main rotor retention component specimens simultaneously. The machine components which mated with production parts were designed to duplicate the respective helicopter parts, in the area of contact, in order to simulate the helicopter installation. The machine is shown in Figs. 6, 7 and 8.

Two sets of straps, fittings and pins were connected in series, Fig. 6. An axial load was applied at one end of the test assembly and reacted at the opposite end. The inboard ends of the two -105-3 straps were set at the desired angles of pretwist and then the straps were subjected to oscillatory angular twist motion by a constant displacement eccentric mechanism at a bearing supported center fitting.

The eccentric drive mechanism for applying the oscillatory twist cycles was driven by V-belts from an electric motor. The test machine applied approximately 1100 oscillatory twist cycles per minute.

Limit switches were positioned on the machine to stop the drive motor in the event of a decrease in axial load, malfunction of a test machine component, or failure of a test specimen. These switches were used to permit unattended operation during the application of the oscillatory twist cycles.

After the -155-7 fitting failures were noted during test No. 1, break wires were installed on the fittings to stop the test machine in case of a fitting failure.

The axial load was applied by a hydraulic cylinder through a bank of elastic shock cord and a splined fitting, Fig. 6. The strap specimens experienced axial shortening as they were twisted. This required axial freedom. This was obtained by the elastic shock cord and guided axially by the splined fitting, which was allowed to slide in its housing. The elastic shock cord bank also eliminated any axial oscillatory load.

A hydraulic pressure accumulator was used in the hydraulic system to maintain a constant pressure in the cylinder during long unattended periods of operation. After the hydraulic cylinder failed during test Nos. 1 and 2, a lever assembly with a 2:1 mechanical advantage was used in the axial load system to reduce the load on the hydraulic cylinder.

The repeated axial load cycles, simulating rotor start and stop cycles, were applied by alternately applying and releasing the pressure to the hydraulic cylinder. A portable hydraulic test stand was used as a pressure source and a four-way solenoid valve was used in conjunction with an electrical timer to apply and release the pressure to the cylinder. Application of the repeated axial loading was accomplished at approximately 14 cpm. The test was continuously monitored during the application of the repeated axial load cycles.

Each of the eight sets of components tested were subjected to magnaflux and zyglo inspection after the 10^7 twist cycles were completed. They were also required to be subjected to magnaflux and zyglo inspection after 13,000, 19,000, 26,000, and 34,500 cycles in start-stop loading. Though, this was accomplished during test Nos. 3 and 4, the inspection during test Nos. 1 and 2 was interrupted due to test machine failures. During test No. 1 inspection was conducted after 13,400 cycles and after 34,568 cycles. During test No. 2 inspection was conducted after 13,411 cycles and after 20,292 cycles when the test machine failed and the test was discontinued due to damaged strap specimen.

FATIGUE TEST OF THE MAIN ROTOR RETENTION COMPONENTS USED ON MODEL OH-58A/206A-1 HELICOPTER

Each set of the main rotor retention components tested consisted of one 206-010-105-3 strap assembly, one 206-010-123-1 pin, and one of the 206-010-155-7 fitting or the 206HA86-1 fitting.

The fatigue tests of four sets of components containing the -155-7 fitting, and four sets of components containing the 206HA86-1 fitting were witnessed by the undersigned:

Witnessed and Approved by: C E Robertson
C. E. Robertson
Army Engineering Systems
Bell Helicopter Company

Witnessed and Approved by: G. W. McLeod
G. McLeod, DER SW-261
Fatigue Evaluation Group
Bell Helicopter Company

Date of Test: September 25, 1970 to January 15, 1971.

Test Location: Mechanical Laboratory
Bell Helicopter Company
Fort Worth, Texas

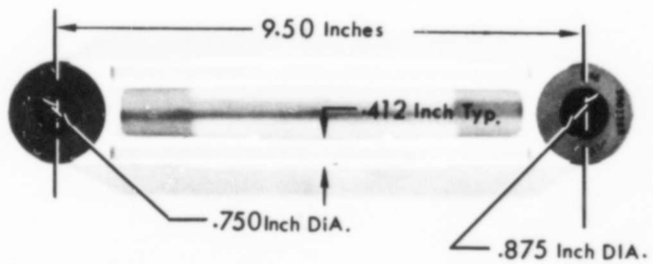


Photo No. 33612

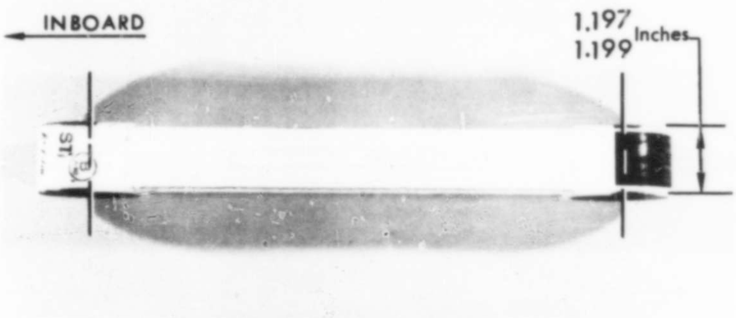


Photo No. 33611

FIG. 1

206-010-105-3 MAIN ROTOR RETENTION STRAP TEST SPECIMEN

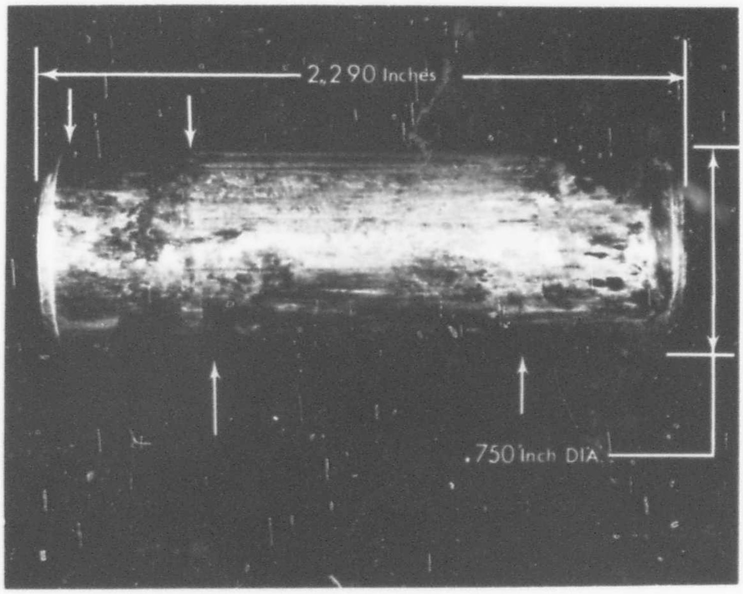


Photo No. 32868

FIG. 2

206-010-123-1 MAIN ROTOR STRAP RETAINING PIN TEST SPECIMEN

The photograph shows the retaining pin specimen, S/N Q1-2289, after completing 13,400 start-stop cycles subsequent to 10^7 twist cycles. The arrows enclose the typical areas of fretting.

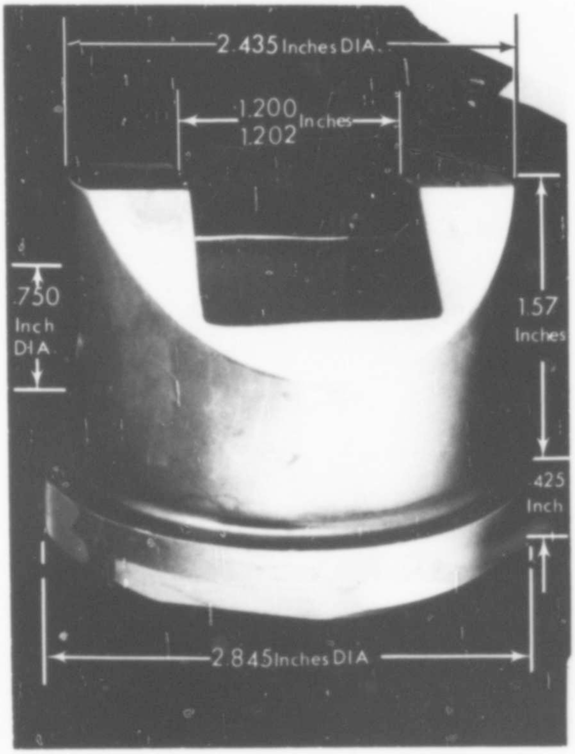


Photo No. 34097

FIG. 3

206-010-155-7 MAIN ROTOR RETENTION STRAP FITTING TEST SPECIMEN

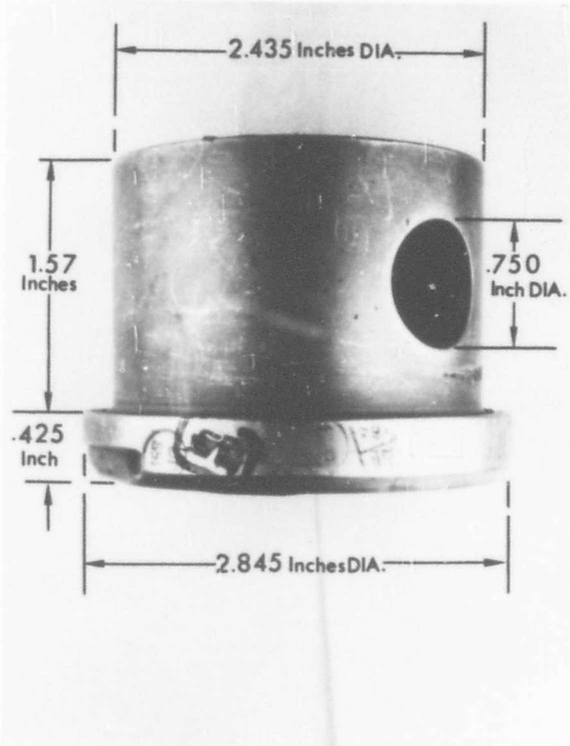


Photo No. 33701

FIG. 4

206HA86-1 MAIN ROTOR RETENTION STRAP FITTING

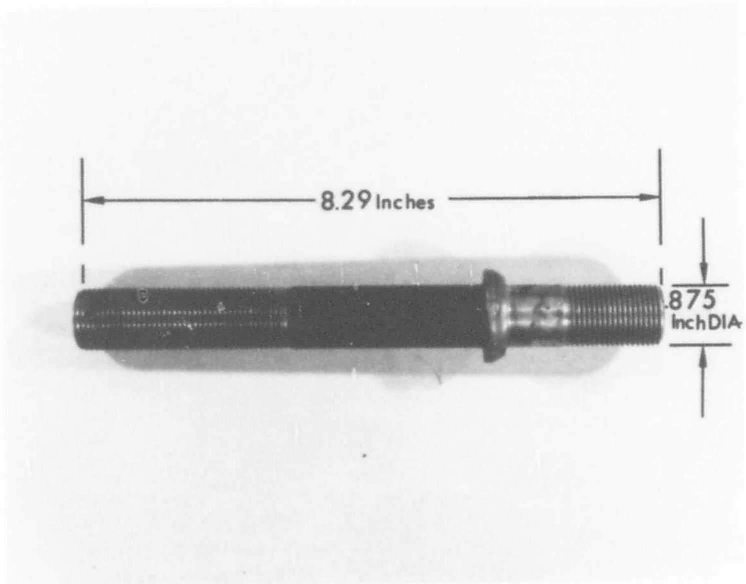
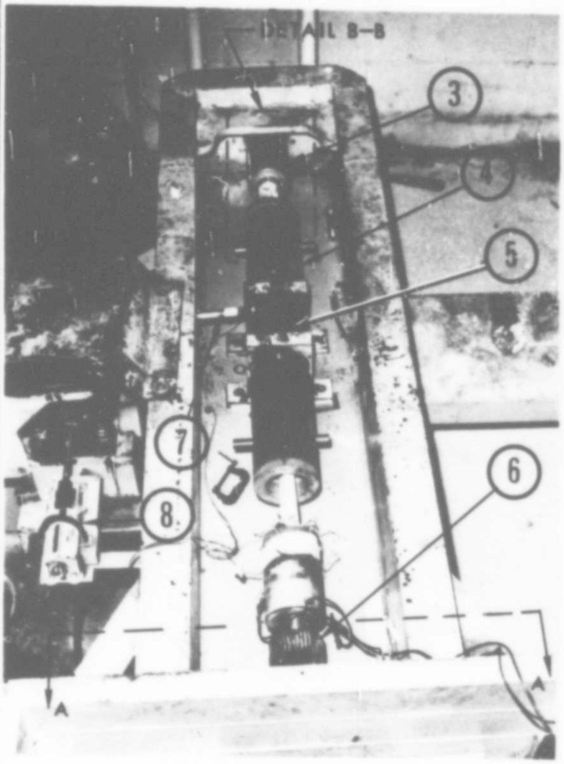


Photo No.
33613

FIG. 5

206-010-169-1 BOLT USED AS A SUPPORTING PART



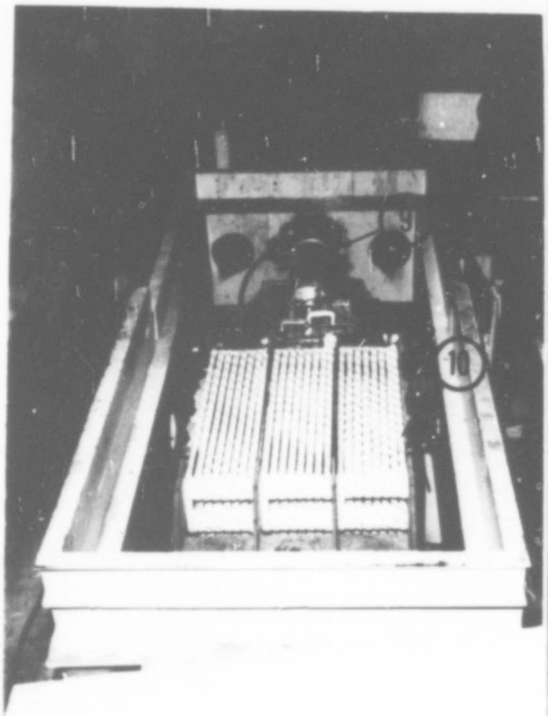


Photo No. 32942

View A-A
Photo No. 32714

FIG. 6

TEST SETUP FOR THE FATIGUE TEST OF THE MAIN ROTOR RETENTION COMPONENTS USED ON MODEL 206A-1/OH-58A HELICOPTER

Arrows indicate:
1. Housing for electric motor with eccentric drive
2. Test machine frame
3. Housing for retention fitting (2 required)
4. Dummy grip tang housing (2 required)
5. Center slide with clevis end lever
6. Splined shaft to allow axial movement while reacting the applied torsion
7. Eccentric-driven push rod
8. Cycle counter, with 100:1 speed reducer, for measuring oscillatory twist cycles
9. Hydraulic cylinder
10. Elastic shock cord.

Fig. 7 shows detail B-B.

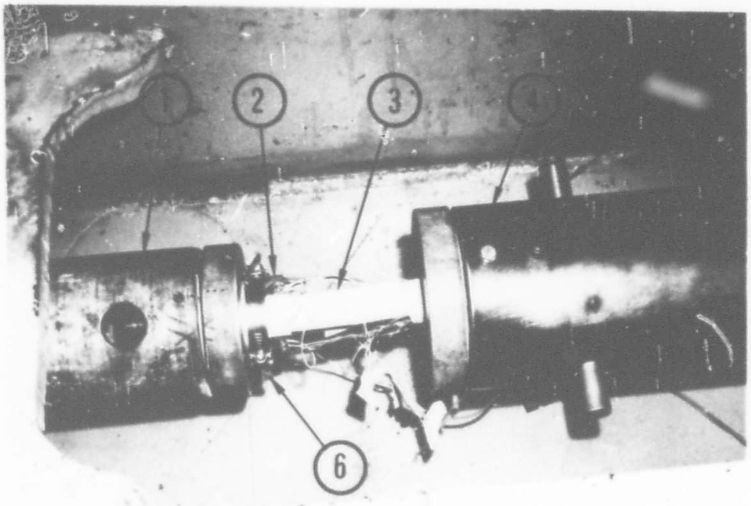


Photo No. 32944

FIG. 7

DETAILS OF TEST INSTALLATION OF THE MAIN ROTOR RETENTION COMPONENTS USED ON MODEL 206A-1/OH-58A HELICOPTER

Arrows indicate:

1. Housing for the 206-010-155-7 retention fitting
2. Retention fitting, P/N 206-010-155-7
3. Retention strap, P/N 206-010-105-3
4. Dummy grip housing
5. Strap retaining bolt, P/N 206-010-169-1
6. Clamp holding the 206-010-123-1 strap retaining pin in place.

This is detail B-B shown in Fig. 6.

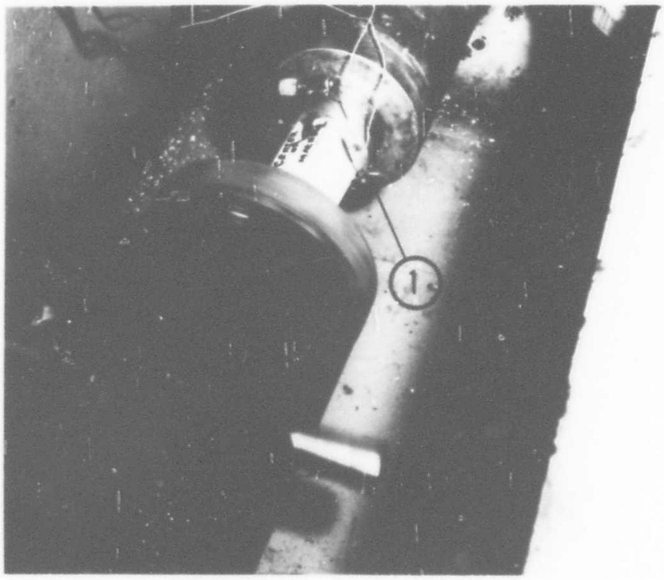


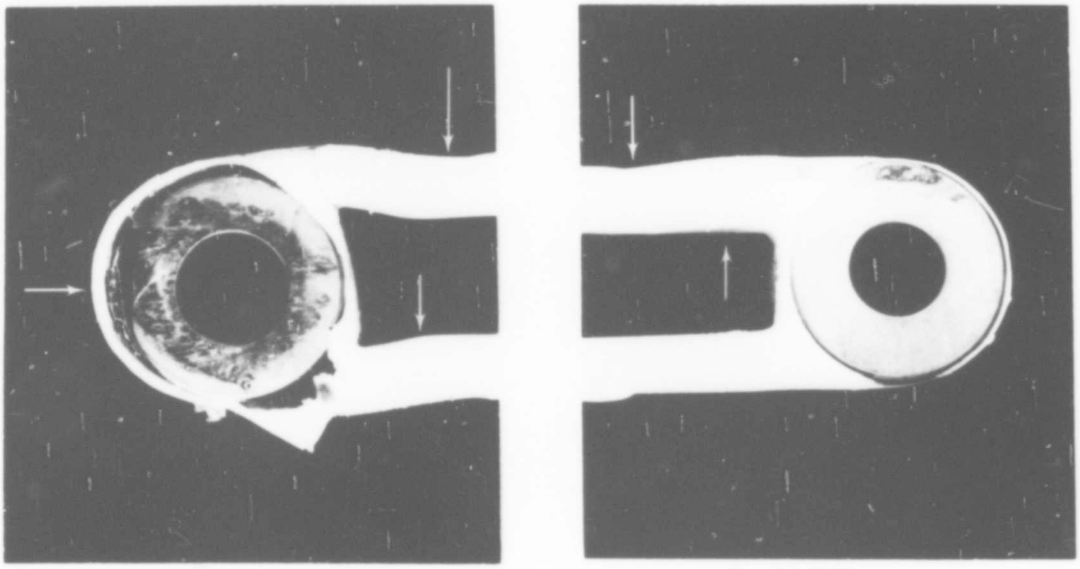
Photo No. 33315

FIG. 8

DETAILS OF TEST SETUP SHOWING THE INSTALLATION OF THE 206HA86-1 RETENTION FITTING

The test setup shown is the same as the setup shown in Fig. 7 except the 206-010-155-7 fitting is replaced by the 206HA86-1 fitting.

Arrows indicate:
1. Retention fitting, P/N 206HA86-1.



Outboard End
Photo No. 33289

Inboard End
Photo No. 33288

FIG. 9

TYPICAL DAMAGE OF THE 206-010-105-3 STRAP ASSEMBLY DUE TO THE TEST MACHINE (HYDRAULIC CYLINDER) FAILURE

Strap shown is specimen No. 3 after 20,292 cycles. Note the fretting of the faces of both the end spools. Arrows indicate the areas of damage due to buckling. Strap specimen No. 4 also had similar damage. The damage on strap specimens Nos. 1 and 2 was similar, but not as severe.

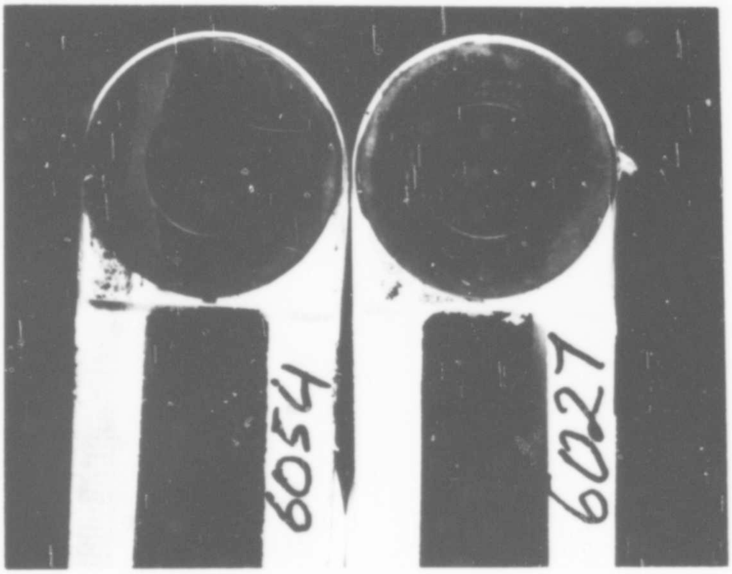


Photo No.
33450

FIG. 10

TYPICAL CONDITION OF THE 206-010-105-3 STRAP ASSEMBLY OUTBOARD END SPOOL AREA AFTER 14,000 CYCLES

Straps shown are specimen Nos. 5 and 6 that were used in test No. 3.

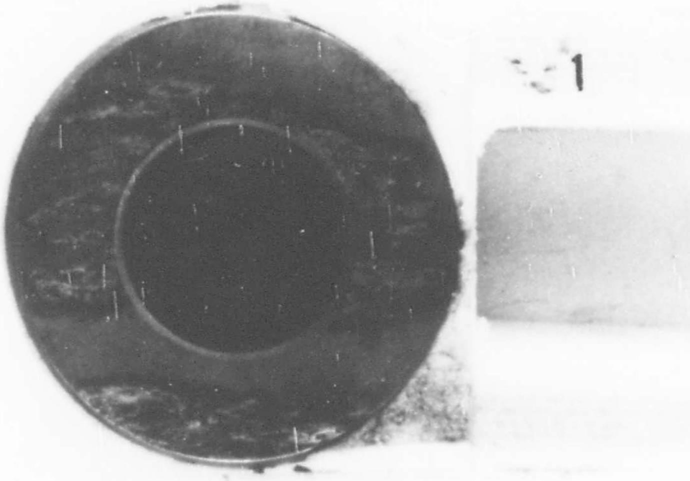


Photo No. 33819

(a) Outboard End

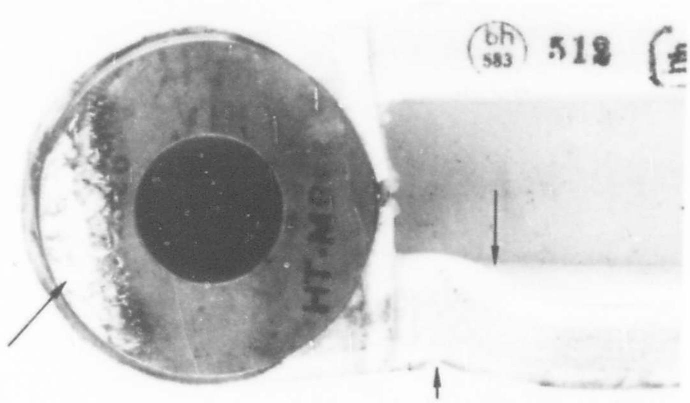


Photo No. 33820

(b) Inboard End

FIG. 11

TYPICAL CONDITION OF THE 206-010-105-3 STRAP ASSEMBLY AFTER 72,326 START-STOP CYCLES

The -105-3 strap, S/N 6711, shown was used with 206HA86-1 fitting, ML-4. Arrows indicate the damage at the inboard end due to failure of the mating strap fitting shown in Fig. 15.

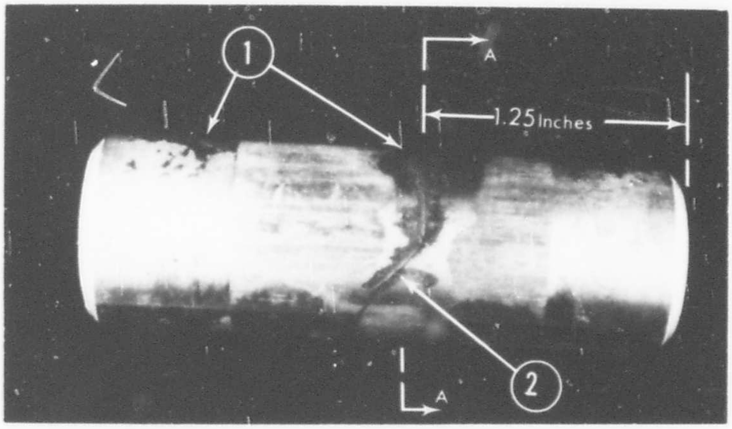


Photo No. 33862

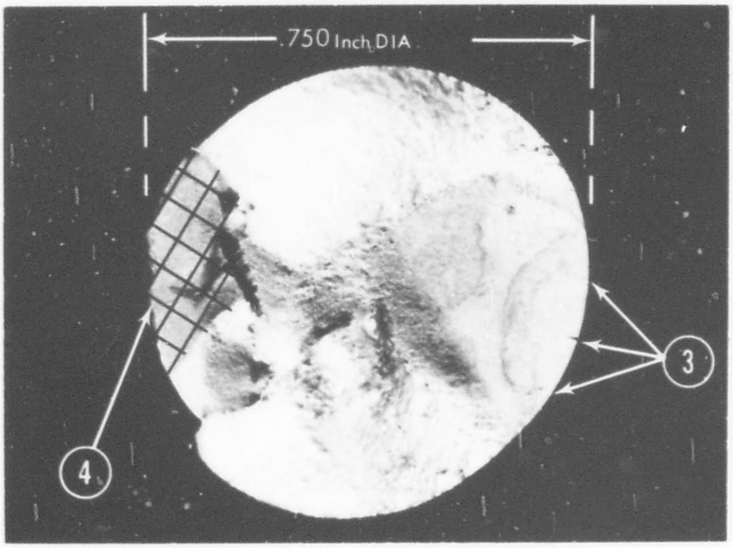


Photo No. 33863

View A-A (Turned 90° Clockwise)

FIG. 12

FAILURE OF THE 206-010-123-1 RETAINING PIN, S/N Q1-2382 USED WITH STRAP SPECIMEN NO. 2

Failure was noted during inspection after 34,568 start-stop cycles.
Arrows indicate:
1. Areas of severe fretting
2. Fatigue crack
3. Fatigue origins at areas of severe fretting
4. Area of static failure.

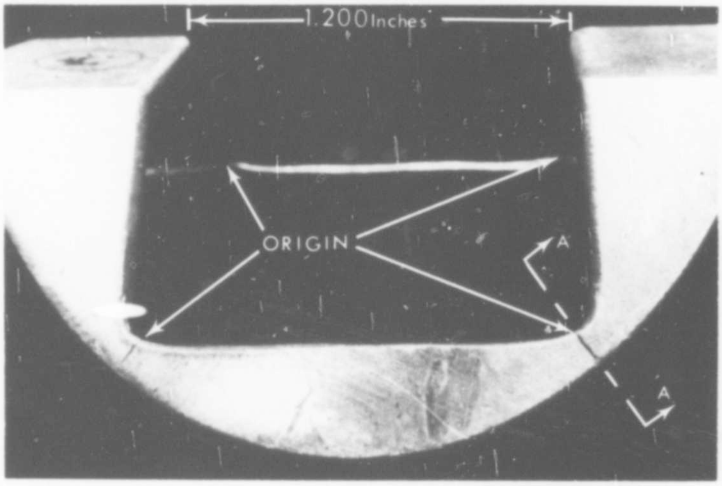


Photo No. 33881

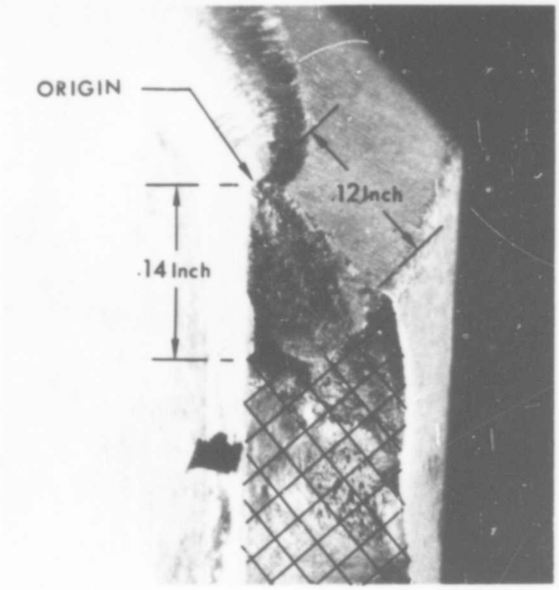


Photo No. 33873

SECTION A-A

FIG. 13

TYPICAL FAILURE OF THE 206-010-155-7 FITTING

The specimen shown, S/N JI1-2088, was used with strap specimen No. 2. Fatigue cracks were discovered during inspection after 13,906 start-stop cycles. The cross-hatched area shown in the lower photograph denotes static failure. See Fig. 3 for overall view of the fitting.

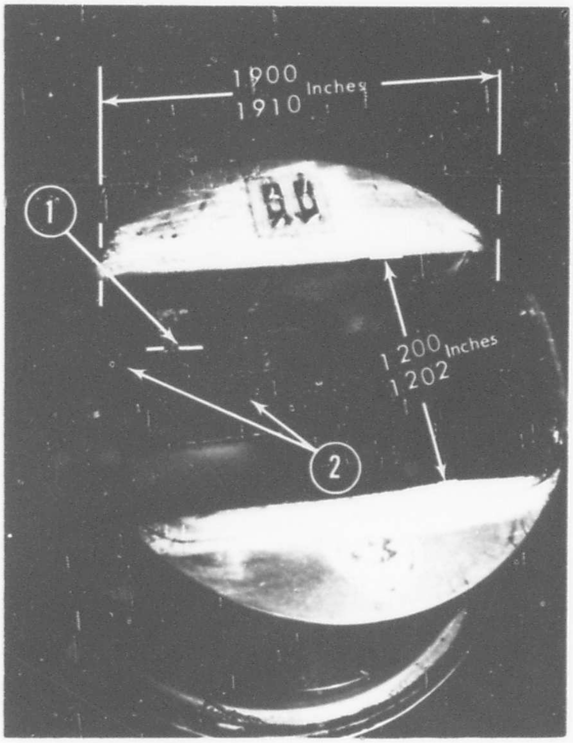


Photo No. 33449

FIG. 14

TYPICAL CONDITION OF THE 206HA86-1 FITTING
AFTER 14,380 START-STOP CYCLES

Arrows indicate:
1. Typical location of fatigue cracks for Specimen ML-3 used in Set No. 7.
2. Areas of minor fretting

The fitting shown, ML-1, was used with strap specimen No. 5. Fig. 16 shows the details of the failure of specimen ML-3 used with strap specimen No. 7.

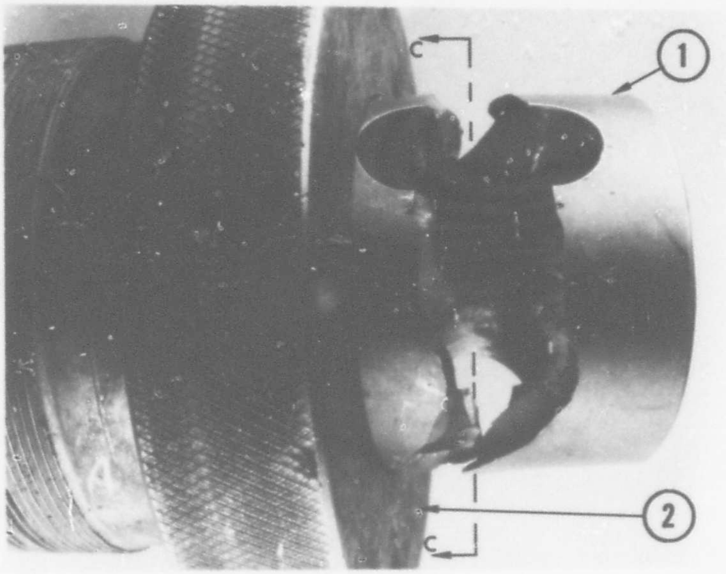


Photo No. 33814

Outboard →

FIG. 15

FAILURE OF THE 206HA86-1 FITTING, S/N ML-4, AFTER 72,326 START-STOP CYCLES

Arrows indicate:
1. 206HA86-1 fitting
2. Dummy grip assembly.

The fitting was used in set No. 8. Section C-C is shown in Fig. 16.

BY R. Amancharla	BELL HELICOPTER COMPANY	MODEL OH-58A/206A-1 PAGE 34
CHECKED J. K. Sen		RPT 206-098-164

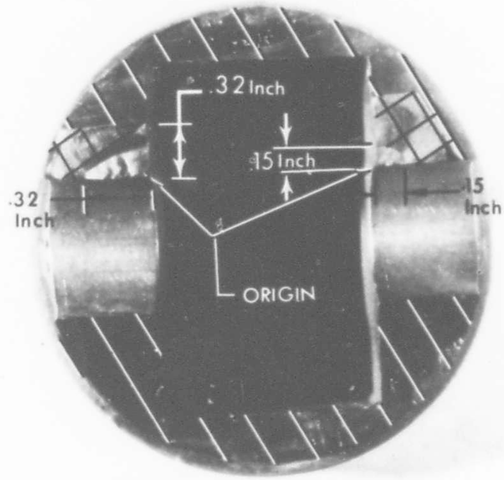


Photo No. 33816

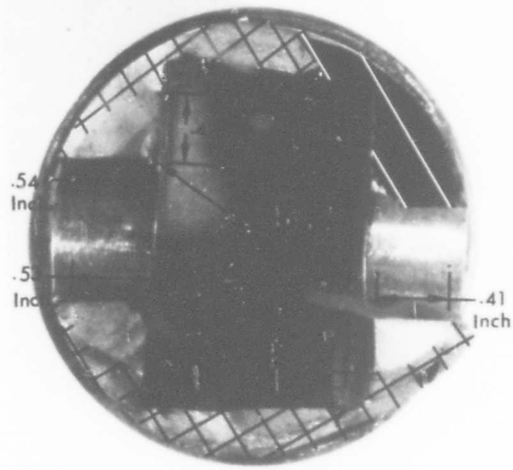


Photo No. 33815

FIG. 16

DETAILS OF FAILURES OF THE 206HA86-1 FITTINGS, S/N ML-3 AND ML-4

Top photograph shows failure details of fitting ML-3. Bottom photograph shows View C-C of fitting ML-4 shown in Fig. 15. The crosshatched areas indicate the static failure during the test or the metallurgical examination. The straight section lines indicate the areas saw cut during metallurgical examination.

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.

2. MANUFACTURER: Bell

3. MODEL: 206

4. PERIOD COVERED BY THIS REPORT: FROM 8-2-70 TO

5. INSPECTED BY W. O. ARMSTRONG DMIR NO. [illegible]
W. O. Armstrong

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

ST E-0206EE-2

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
STRAP ASSY	206-016-105-3	C 12-5-68	2		SN 1447-1455

Delegated By B-W-20.
8-27-70

Delegated by: [illegible] Date: [illegible]-15-70

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.: DTG SUND
2. MANUFACTURER: Bell Helicopter
3. MODEL: 206 A-1
4. PERIOD COVERED BY THIS REPORT — FROM: 15 Dec 1970 — TO: 15 Dec 1970
5. INSPECTED BY: [illegible] DMIR #5065

INSTRUCTIONS

(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.

10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

Ref. E.O. 206 H687 N/A 206-011-100 (Fatigue test)

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
Strap Assy, H/R	206-010-105-3	E.O. 206 [illegible] 1970 "E" 12-5-63	✓ 4		
S/N 6671, 6688, 6708, and 6711					

FAA Form 8100-1 (4-66) FORMERLY FAA FORM 1257 C FAA AC 69-8291 0052-039-3000

2-??

MANUFACTURER		DEPT.
Bendix Corp		
MODEL	206	34-2-5
BASIC COMPONENT NO.	206-010-105-3	

CONFORMITY INSPECTION REPORT

DATE 8-26-70

PAGES 1

INSPECTED BY [illegible signature]

	NOMENCLATURE OF PART INSPECTED	DRAWING (PART) NUMBER	STATUS OF DRAWING & PLANNING				QUALITY		CONTROL			
	1	2	LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED E.O'S AFFECTING PART (+) 3	ARE DRAWINGS ADEQUATE? 4	LATEST PLANNING CHANGE 5	IS PLANNING ADEQUATE? 6	ARE TOOLS ADEQUATE? 7	MATERIAL 8	TREATMENT 9	WORKMANSHIP 10	DIMENSIONAL 11	INSPECTION STAMP 12
1	Strap Ass'y	206-010-105	*	*	*	*	*	*	*	*	*	bh 651 136
2		S/NS. 1447,										
3		1455										
4												
5												
6												
7												
8												
9												
10												
11												
12												

KEY: AFFIRMATIVE OR SATISFACTORY – •, NEGATIVE OR UNSATISFACTORY – X, NOT REQUIRED OR NOT APPLICABLE – LEAVE BLANK. LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. – +

NOTE 1: ONLY THOSE ITEMS PASSED BY THE MANUFACTURER'S INSPECTION SYSTEM SHOULD BE INSPECTED FOR CONFORMITY.

NOTE 2: LIST REMARKS ON BACK NUMERICALLY FOR ALL UNSATISFACTORY CONDITIONS.

37

7878 55536 REV 363

(4 pcs.)

CONFORMITY INSPECTION REPORT

MANUFACTURER: [illegible] Corp.	DATE: 12-15-70
MODEL: 206	DEPT.: 34-35
PAGES: 1 of 1	
BASIC COMPONENT NO.: 206-010-105	INSPECTED BY: J. E. [illegible]

	NOMENCLATURE OF PART INSPECTED 1	DRAWING (PART) NUMBER 2	STATUS OF DRAWING & PLANNING: LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED E.O'S AFFECTING PART (+) 3	ARE DRAWINGS ADEQUATE? 4	LATEST PLANNING CHANGE 5	IS PLANNING ADEQUATE? 6	QUALITY CONTROL: ARE TOOLS ADEQUATE? 7	MATERIAL 8	TREATMENT 9	WORKMANSHIP 10	DIMENSIONAL 11	INSPECTION STAMP 12
1	Strap Assy.	206-010-105-3	"J" 12-5-68	*	*	*	*	*	*	*	*	bh 523
2		4 Pcs.										
3												
4												
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6												
7												
8												
9												
10												
11												
12												

[illegible]12

KEY: AFFIRMATIVE OR SATISFACTORY – *, NEGATIVE OR UNSATISFACTORY – X, NOT REQUIRED OR NOT APPLICABLE – LEAVE BLANK, LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. – +

NOTE 1: ONLY THOSE ITEMS PASSED BY THE MANUFACTURER'S INSPECTION SYSTEM SHOULD BE INSPECTED FOR CONFORMITY.

NOTE 2: LIST REMARKS ON BACK NUMERICALLY FOR ALL UNSATISFACTORY CONDITIONS.

7878 55536 REV 563

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO. DT6 SWD
2. MANUFACTURER Bell Helicopter Co
3. MODEL 206
4. PERIOD COVERED BY THIS REPORT — FROM 9-2-70 TO
5. INSPECTED BY Roye Kennemale OMIR 2036

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
STRAP ASSY TENSION	206-010-105-3	G 12-5-68	4		S/N 6005, 6027, 6054, 6025
TORSION MAIN ROTOR					
WASHER, BLADE BOLT, M/R	206-010-154-1	B 7-19-68	6		
WASHER BLADE BOLT M/R	206-010-153-1	"C" 11-27-68	REM [illegible]	6	MANUFACTURING DATE NOT ON PARTS.
			6		ADDED OK. REM
FITTING RETENTION STRAP M/R	206-010-155-7	D 1-21-69	4		S/N JL-2098, 2070, 2111, 2088
RING, BACK UP TENSION	206-010-113-5	B 7-18-68	4		
STRAP RETAINER,					
PIN STRAP RETAINING	206-010-123-1	"B" 7-18-68	6		SN BL-2112, 2382, 2377, 2284
					2289, 2232

FAA Form 8100-1 (4-66) FORMERLY FAA FORM 1257 — Page 64 — 0052-039-3000

EO 206 HA87 AVIANCHARLA

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.

2. MANUFACTURER: Bell

3. MODEL: 206A

4. PERIOD COVERED BY THIS REPORT: FROM 11-6-70 TO 11-9-70

5. INSPECTED BY: W. O. ARMSTRONG DMIR NO. 4018 — W.O. Armstrong 4018

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

Test E-0206HA-87

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
PIN	206-010-123-1	B 7-15-68	4		SN Ø12894 - 2854 - 2845 & Ø1-2470.
FITTING	206-010-155-7	D 1-21-69	4		SN J1-2600 J1-2599-J1-2616 J1-2618.
	Delegated 11-6-70 R.H.E.				

4 PCS.

CONFORMITY INSPECTION REPORT

206H4-N8

MANUFACTURER: BENDIX CORP.		DATE: 9-1-'70
MODEL: 206	DEPT.: 34/25	PAGES: ONE OF ONE
BASIC COMPONENT NO.: 206-010-105		INSPECTED BY: J A Willis

			STATUS OF DRAWING & PLANNING				QUALITY CONTROL					
	NOMENCLATURE OF PART INSPECTED	DRAWING (PART) NUMBER	LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED EO'S AFFECTING PART (+)	ARE DRAWINGS ADEQUATE?	LATEST PLANNING CHANGE	IS PLANNING ADEQUATE?	ARE TOOLS ADEQUATE?	MATERIAL	TREATMENT	WORKMANSHIP	DIMENSIONAL	INSPECTION STAMP
	1	2	3	4	5	6	7	8	9	10	11	12
1	STRAP ASSY.	206-010-105-3	'G' 12-5-68	*	3-5-69 [illegible]	*	*	*	*	*	*	BH 243
2		4 Pcs.										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

4 4

KEY: AFFIRMATIVE OR SATISFACTORY – *, NEGATIVE OR UNSATISFACTORY – X, NOT REQUIRED OR NOT APPLICABLE – LEAVE BLANK,
LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. – +

NOTE 1: ONLY THOSE ITEMS PASSED BY THE MANUFACTURER'S INSPECTION SYSTEM SHOULD BE INSPECTED FOR CONFORMITY.

NOTE 2: LIST REMARKS ON BACK NUMERICALLY FOR ALL UNSATISFACTORY CONDITIONS.

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6 PCS

MANUFACTURER: CRESCENT PRECISION PROD.		# CONFORMITY INSPECTION REPORT	DATE: 9-1-70
MODEL: 206	DEPT.: 34/25		PAGES: ONE OF ONE
BASIC COMPONENT NO.: 206-010-123			INSPECTED BY: J.A. Willis

	Nomenclature of Part Inspected (1)	Drawing (Part) Number (2)	Status of Drawing & Planning: Latest Change on Drawing, Include Date, Unincorporated E.O's Affecting Part (+) (3)	Are Drawings Adequate? (4)	Latest Planning Change (5)	Is Planning Adequate? (6)	Quality Control: Are Tools Adequate? (7)	Material (8)	Treatment (9)	Workmanship (10)	Dimensional (11)	Inspection Stamp (12)
1	PIN	206-010-123-1	'B' 7-18-68	*	3-10-69	*	*	*	*	*	*	[stamp] 41
2		6 Pcs.										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

KEY: AFFIRMATIVE OR SATISFACTORY – *, NEGATIVE OR UNSATISFACTORY – X, NOT REQUIRED OR NOT APPLICABLE – LEAVE BLANK.
LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. – +

NOTE 1: ONLY THOSE ITEMS PASSED BY THE MANUFACTURER'S INSPECTION SYSTEM SHOULD BE INSPECTED FOR CONFORMITY.

NOTE 2: LIST REMARKS ON BACK NUMERICALLY FOR ALL UNSATISFACTORY CONDITIONS.

7828 B55.16 REV 3-64

CONFORMITY INSPECTION REPORT

MANUFACTURER:

MODEL: 206

DEPT.: 34/25

BASIC COMPONENT NO.: TEST E.O206HA-87

DATE: 11-2-70

PAGES:

INSPECTED BY: J. C. Pruitt

E-0206HA-87

	NOMENCLATURE OF PART INSPECTED (1)	DRAWING (PART) NUMBER (2)	STATUS OF DRAWING & PLANNING: LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED E.O'S AFFECTING PART (+) (3)	ARE DRAWINGS ADEQUATE? (4)	LATEST PLANNING CHANGE (5)	IS PLANNING ADEQUATE? (6)	QUALITY CONTROL: ARE TOOLS ADEQUATE? (7)	MATERIAL (8)	TREATMENT (9)	WORKMANSHIP (10)	DIMENSIONAL (11)	INSPECTION STAMP (12)
1	STRAP ASSY	206-010-105-3										[illegible]
2	PIN, 4 Pcs	206-010-123-1	B 7-18-68	*	—	—	—	*	*	*	*	51
3	FITTING, 4 Pcs	206-010-155-7	D 1-21-69	*	—	—	—	*	*	*	*	51
4	BOLT	206-010-169-1										[illegible]
5												
6												
7												
8												
9												
10												
11												
12												

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7878 88836 REV 363

4 Pcs.

CONFORMITY INSPECTION REPORT

MANUFACTURER	AUTOMATION IND. INC.
MODEL	206
DEPT.	34/25
BASIC COMPONENT NO.	206-010-155
DATE	9-1-70
PAGES	ONE OF ONE
INSPECTED BY	J A Willis

	NOMENCLATURE OF PART INSPECTED 1	DRAWING (PART) NUMBER 2	STATUS OF DRAWING & PLANNING: LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED E.O'S AFFECTING PART (+) 3	ARE DRAWINGS ADEQUATE? 4	LATEST PLANNING CHANGE 5	IS PLANNING ADEQUATE? 6	QUALITY CONTROL: ARE TOOLS ADEQUATE? 7	MATERIAL 8	TREATMENT 9	WORKMANSHIP 10	DIMENSIONAL 11	INSPECTION STAMP 12
1	FITTING ASSY	206-010-155-7	'D' 1-21-69	*	9-10-69	*	*	*	*	*	*	BH 243
2		4 Pcs.										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

44

KEY: AFFIRMATIVE OR SATISFACTORY – *, NEGATIVE OR UNSATISFACTORY – X, NOT REQUIRED OR NOT APPLICABLE – LEAVE BLANK.
LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. – +

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NOTE 2: LIST REMARKS ON BACK NUMERICALLY FOR ALL UNSATISFACTORY CONDITIONS.

7878 B5536 REV 363

Accepted by: RWC

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.: DTL SWD

2. MANUFACTURER: BELL Helicopter

3. MODEL: 206A-1

4. PERIOD COVERED BY THIS REPORT: FROM 12 NOV 1970 TO 12 NOV 1970

5. INSPECTED BY: J.W. Kraeter DMIR #SO65

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.

9. Indicate the number of items inspected found to be satisfactory (to conformity and of acceptable workmanship) or unsatisfactory.

10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

For Fatigue Test

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
F.O. D479318 Retention Strap Fitting	Test 206HA86-1	NC 10-26-70	4		Note: Same as 206-010-153-7 Fitting assy excepted as noted on EO 206HA86 206-010-153 Rev D dated 1-21-69

(4 [illegible].)

CONFORMITY INSPECTION REPORT

MANUFACTURER: Automation Ind., Inc.	DATE: 10-26-70
MODEL: 206 / DEPT.: 34-25	PAGES: 1 of 1
BASIC COMPONENT NO.: 206-010-155	INSPECTED BY: J. C. Perritt *J. C. Perritt*

			STATUS OF DRAWING & PLANNING				QUALITY CONTROL					
	NOMENCLATURE OF PART INSPECTED 1	DRAWING (PART) NUMBER 2	LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED E.O'S AFFECTING PART (+) 3	ARE DRAWINGS ADEQUATE? 4	LATEST PLANNING CHANGE 5	IS PLANNING ADEQUATE? 6	ARE TOOLS ADEQUATE? 7	MATERIAL 8	TREATMENT 9	WORKMANSHIP 10	DIMENSIONAL 11	INSPECTION STAMP 12
1	Fitting	206-010-155-7	"D" 1-21-69	*	9-10-69	*	*	*	*	*	*	[stamp] 51
2		4 Pcs.										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

KEY: AFFIRMATIVE OR SATISFACTORY - *, NEGATIVE OR UNSATISFACTORY - X, NOT REQUIRED OR NOT APPLICABLE - LEAVE BLANK, LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. - +

NOTE 1: ONLY THOSE ITEMS PASSED BY THE MANUFACTURER'S INSPECTION SYSTEM SHOULD BE INSPECTED FOR CONFORMITY.

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7878 55536 REV 363

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.: DT6-SWD
2. MANUFACTURER: Bell Helicopter Co.
3. MODEL: 206
4. PERIOD COVERED BY THIS REPORT: FROM 9-9-70 TO
5. INSPECTED BY: Roy E. Neuendorff DMIR 2026

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
Bolt, Strap Retaining	206-010-169-1	C 3-7-69	6		
Main Rotor					

FAA Form 8100-1 (4-66) FORMERLY FAA FORM 1257 Page 64 0052-039-3000

5 PCS.

CONFORMITY INSPECTION REPORT

MANUFACTURER: AUTOMATION IND. INC.
MODEL: 206
DEPT.: 34/25
BASIC COMPONENT NO.: 206-010-169

DATE: 9-8-70
PAGES: ONE OF ONE
INSPECTED BY: J. A. Willis

	NOMENCLATURE OF PART INSPECTED 1	DRAWING (PART) NUMBER 2	STATUS OF DRAWING & PLANNING: LATEST CHANGE ON DRAWING, INCLUDE DATE, UNINCORPORATED E.O'S AFFECTING PART (+) 3	ARE DRAWINGS ADEQUATE? 4	LATEST PLANNING CHANGE 5	IS PLANNING ADEQUATE? 6	QUALITY CONTROL: ARE TOOLS ADEQUATE? 7	MATERIAL 8	TREATMENT 9	WORKMANSHIP 10	DIMENSIONAL 11	INSPECTION STAMP 12
1	BOLT	206-010-169-1	'C' 3-7-69	*	7-7-70	*	*	*	*	*	*	66 213
2		6 Pcs.										
3												
4												
5												
6												
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8												
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10												
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12												

444

KEY: AFFIRMATIVE OR SATISFACTORY – *, NEGATIVE OR UNSATISFACTORY – X, NOT REQUIRED OR NOT APPLICABLE – LEAVE BLANK. LIST UNINCORPORATED E.O'S. ON REVERSE SIDE IN CORRESPONDING BLOCK. – +

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7878 55516 REV 369

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