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SERVICE LETTER

Service Letter No. L 105, Rev. 1
August 18, 2011

TO: **Sault College Aviation Technology**

MODELS AFFECTED: **Z 242 L aircraft, S/N 0679, 0682 and 0684**

SUBJECT: **Operation limits – Increase of safe life limit to 18000 flight hours**

According to analysing the data from the AMU 1, with respect to actual:

- kind of operation,
- number of flight hours,
- number of landings,
- approved safe life limits for aircraft parts,

we determine as follows:

The aircraft can be operated up to total safe life limit of 18000 flight hours according to special limits and instructions stated in the report Z242L-0567. Number of flight hours shall be calculated according to Aircraft Journey Log Book.

Recalculation of number of flight hours with respect to a difference between Aircraft Journey Log Book and AMU 1 records might be possible after final AMU 1 records evaluation in the end of aircraft safe life.

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Chief Designer

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Z 242L Assessment Report - Aircraft Safe-life prolongation up to 18 000 flight hours Sault College Aviation Technology

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Date of issue: 16. 8. 2011 Issue No : 2
Number of pages: 37
Number of Appendices: 1

CONTENT

MARKING USED

FAR Part 23		Federal Aviation Regulations for Small Airplanes, USA
AFS-120-73-2		FAA Fatigue Evaluation of Wing and Associated Structure on Small Airplanes
AMU1		Acceleration Monitoring Unit
A		Acrobatic category according to FAR 23
U		Utility category according to FAR 23
N		Normal category according to FAR 23
SFL		Safe Fatigue Life
FAA		Federal Aviation Administration of the USA
CAA		Civil Aviation Authority of the Great Britain
ZLIN-A		Measured operating loading spectrum for acrobatic category
ZLIN-N		Measured operating loading spectrum for normal category
CAA-FAA		CAA operation acrobatic spectrum for the Z 40 series, modified FAA
ENVELOPE		Safe envelope of loading spectrum Canada-Operation
SCAT		Sault College Aviation Technology
S-N curve		Fatigue curve (Wöhler curve)
n	[-]	Load factor according to the FAR 23
σ_{+1g}	[MPa]	Stress in flight at n = +1g
σ_{-1g}	[MPa]	Stress at the ground stay n = -1g
D_i	[1/hod]	Fatigue damage in individual phases of flight
D_C	[1/hod]	Total fatigue damage
L_B	[hod]	Safe fatigue life value
L_S	[hod]	Mean fatigue life value
j_N	[-]	Safety factor (scatter factor)
V_P	[km/h]	Average airspeed.

1 INTRODUCTION

The Sault College Aviation Technology (SCAT) is operated a fleet of 9 ZLIN Z242L aircrafts. The list of aircraft is available in the Table No.1-1 bellow.

Type [-]	S/N [-]	Reg. mark [-]	Flight hrs. [Hrs]	Landings [-]	Monitored by AMU1 [Hrs]	Acro (A) [Hrs]	Acro (U) [Hrs]	Acro (A+U) [Hrs]	Safe-life limit [%]
Z242L	**679**	**C-FQHT**	**10999:42**	**11018**	**4722:05:08**	**–**	**–**	**–**	**38.24%**
Z242L	681	C-FANU	9391:00	9441	3676:14:26	–	–	–	49.35%
Z242L	**682**	**C-FHTU**	**10597:42**	**10548**	**4729:02:57**	**–**	**–**	**–**	**40.97%**
Z242L	683	C-FVWH	9692:48	9711	3520:25:07	–	–	–	49.61%
Z242L	**684**	**C-FCSB**	**10896:30**	**10882**	**6941:34:07**	**–**	**–**	**–**	**36.79%**
Z242L	685	C-FVWT	9899:54	9811	3737:37:28	–	–	–	49.95%
Z242L	742	C-GHXG	6191:42	6108	6027:54:44	–	–	–	76.96%
Z242L	745	C-GHXF	5599:36	5440	5422:33:04	–	–	–	82.12%
Z242L	746	C-GJOR	5790:24	5597	5535:54:25	–	–	–	79.28%

Table No. 1-1 - ZLIN Z242L operated by Sault College Aviation Technology

The basic operational life of the Z242L aircraft is 5500 flight hours. The aircraft are monitored by the acceleration monitoring unit (AMU1). Based on the AMU1 monitoring a new operational limit has been set in the year 2003 by the Report No. Z242L-0554, [1]. The operational limit was increased from 5500 to 11000 flight hours.

At present days the aircraft (S/N 679, 682 and 684) are reaching the operational limit 11000 flight hours. The aim of this assessment report is to prove Safe Fatigue Life (SFL) of the Z 242L aircraft primary structure up to 18000 flight hours for aircraft (S/N 679, 682 and 684) operated in aviation school Sault College Aviation Technology in Canada. The long time monitoring by AMU1 system is used as an input source for the aircraft prolongation.

2 Z 242L AIRCRAFT

2.1 Brief description of the Z 242L aircraft

The Z 242L aircraft (Fig. 2-1) is designed in the category A, U and N according to FAR Part 23 - Amdt. 23-36 inclusive.

The Z 242L aircraft is intended for basic and advanced training, acrobatic training and practice, practice in night and instrument flying and glider towing.

The Z 242L aircraft is a two-seats, low-wing, single engine, self-supporting monoplane of all metal structure with side by side seats. The aircraft is equipped with nose-wheel tricycle fixed landing gear.

The aircraft is powered with the TEXTRON Lycoming AEIO-360-A1B6 piston air cooled flat 4-cylindre engine with the MTV-9-B-C/C-188-18a hydraulic controlled three-blade constant speed propeller. The engine is not equipped with reducer and is capable for acrobatics and inverted flights. The propeller is made of wood with composite covering. The propeller is capable for acrobatic manoeuvres.

Dimensions	
Span	9.340 m
Length	6.940 m
Height	2.950 m

Table 2-1; Basic dimensions of the Z 242L aircraft

Category	Cent. of gr. (% MAC)	Max. take-off weight (kg)	Max. landing weight (kg)	Max. range of permissible maneuvering load factors (g)
Acrobatic (A)	19.0 - 24.5	970	970	+6.0 -3.50
Utility (U)	19.0 - 24.5	1020	1020	+4.4 -1.76
Normal (N)	19.0 - 26.0	1090	1050	+3.8 -1.52

Table 2-2; Centre of gravity position, weight, manoeuvring load factors

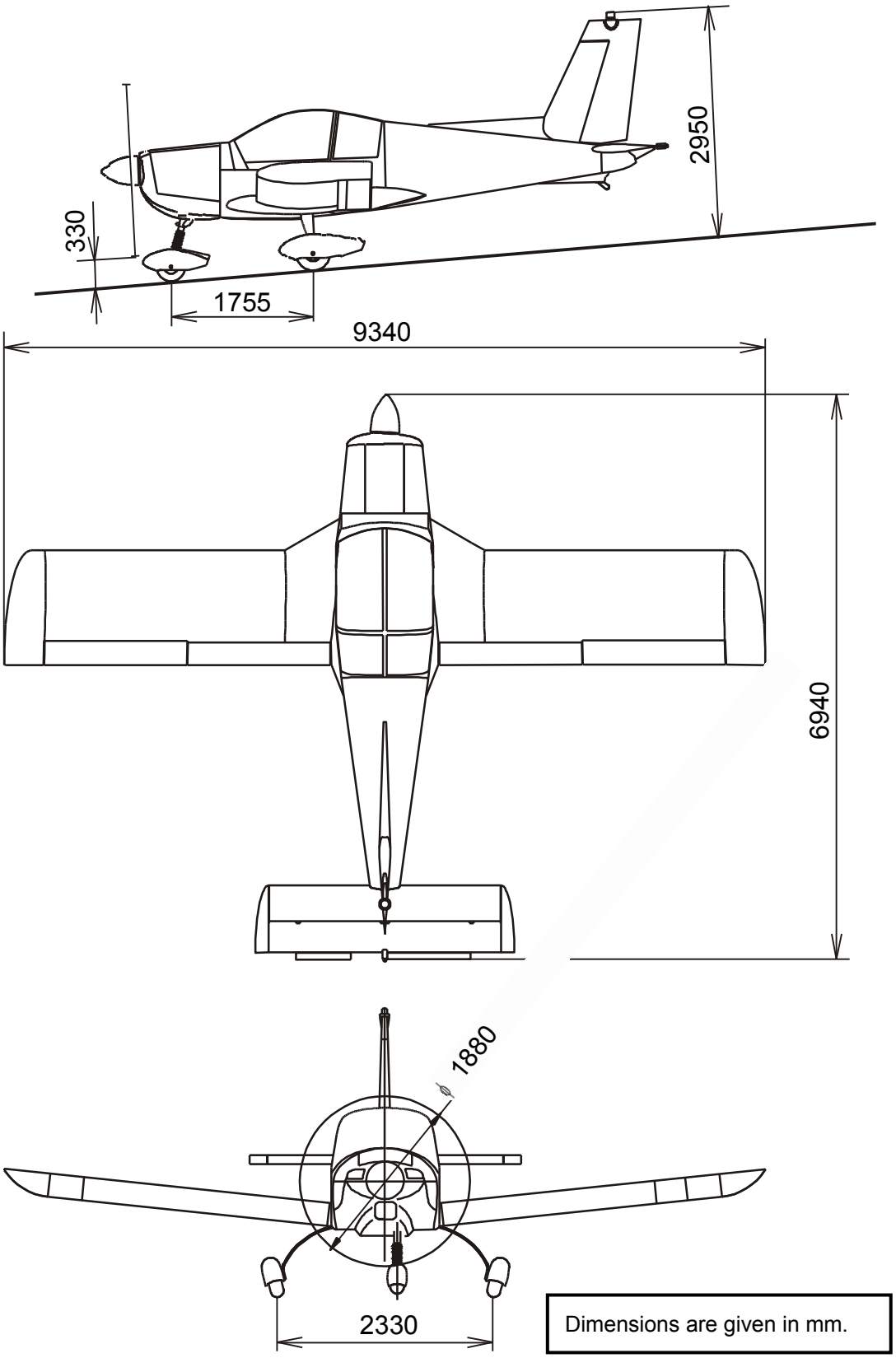
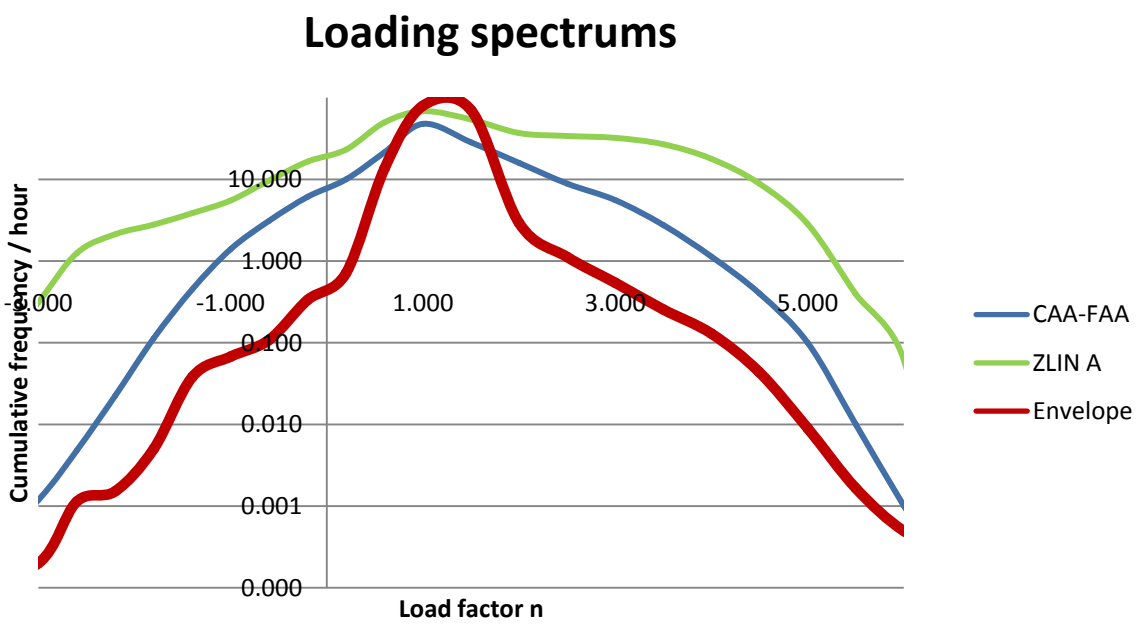


Fig. 2-1; Z 242L aircraft

2.2 Considered spectrum of Z 242L aircraft loading

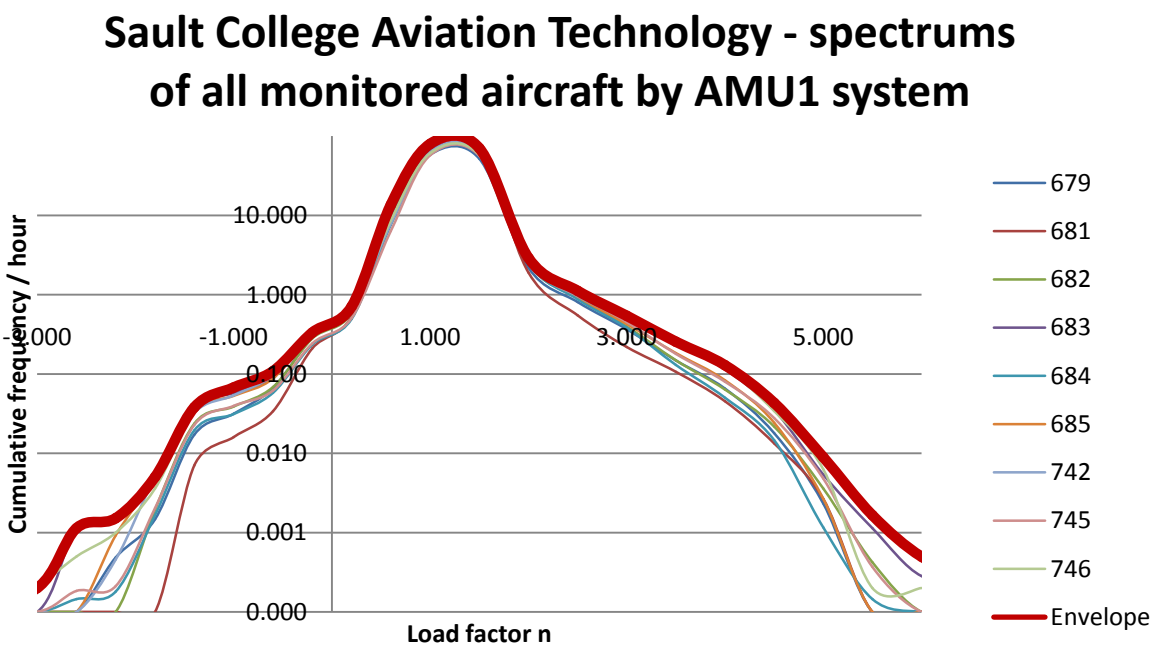
There are considered following manoeuvring loading spectrums in this report:

- ZLIN-A spectrum, the loading spectrum was gained experimentally by means of accelerometer AMU1 - see the Z242L-0530 report; (A category)
- CAA-FAA spectrum, the loading spectrum was gained after consultations between aviation authorities CAA and FAA for common acrobatic operation; (U category)
- ENVELOPE spectrum, the loading spectrum was gained as a safety envelope from all aircrafts operated by Sault College Aviation Technology. Monitored period is mentioned in the Table No. 1-1. (N category or non separable categories)



Load factor	Loading spectrums - Cumulative frequency/hour		
	CAA-FAA	ZLIN A	Envelope
-3.800	0.000	0.019	0.000
-3.000	0.001	0.311	0.000
-2.600	0.005	1.250	0.001
-2.200	0.023	2.128	0.002
-1.800	0.113	2.786	0.005
-1.400	0.450	3.855	0.038
-1.000	1.399	5.508	0.068
-0.600	3.109	9.705	0.109
-0.200	6.106	16.520	0.333
0.200	10.000	23.121	0.710
0.600	21.488	49.774	13.609
1.000	47.858	68.234	79.744
1.500	28.410	54.200	70.192
2.000	15.858	36.813	2.907
2.500	8.840	33.963	1.120
3.000	5.562	32.137	0.541
3.500	2.747	26.853	0.255
4.000	1.131	17.824	0.129
4.500	0.398	8.831	0.043
5.000	0.100	2.838	0.009
5.500	0.010	0.396	0.002
6.000	0.001	0.061	0.000
6.500	0.000	0.000	0.000

Table 2-3; Considered spectrum of Z 242L aircraft loading



Load factor	Recorded spectrums by AMU1 system - Cumulative frequency/hour									
	679	681	682	683	684	685	742	745	746	ENVELOPE
-3.800										0.000
-3.000									0.000	0.000
-2.600				0.001	0.000			0.000	0.001	0.001
-2.200	0.000			0.002	0.000	0.001	0.000	0.000	0.001	0.002
-1.800	0.001		0.002	0.005	0.002	0.005	0.005	0.002	0.004	0.005
-1.400	0.017	0.007	0.024	0.038	0.019	0.035	0.032	0.023	0.033	0.038
-1.000	0.032	0.016	0.039	0.058	0.031	0.053	0.054	0.040	0.068	0.068
-0.600	0.067	0.034	0.068	0.091	0.058	0.088	0.097	0.062	0.109	0.109
-0.200	0.287	0.210	0.280	0.316	0.235	0.332	0.333	0.242	0.331	0.333
0.200	0.609	0.536	0.587	0.640	0.494	0.710	0.644	0.508	0.639	0.710
0.600	9.586	13.609	8.610	10.548	7.605	12.610	7.878	6.363	8.652	13.609
1.000	58.177	79.744	63.077	65.679	60.531	77.939	62.281	57.282	60.904	79.744
1.500	51.805	67.377	59.812	58.104	58.128	70.192	59.938	56.236	57.879	70.192
2.000	2.186	1.897	2.493	2.520	2.525	2.644	2.603	2.907	2.849	2.907
2.500	0.807	0.549	0.918	0.983	0.877	0.948	0.958	1.014	1.120	1.120
3.000	0.367	0.218	0.396	0.489	0.383	0.427	0.497	0.452	0.541	0.541
3.500	0.148	0.107	0.149	0.233	0.130	0.183	0.255	0.179	0.237	0.255
4.000	0.065	0.045	0.064	0.114	0.050	0.083	0.129	0.080	0.120	0.129
4.500	0.018	0.013	0.022	0.035	0.015	0.024	0.043	0.028	0.034	0.043
5.000	0.002	0.003	0.004	0.005	0.001	0.003	0.009	0.005	0.006	0.009
5.500			0.000	0.001	0.000		0.002	0.000	0.000	0.002
6.000				0.000			0.000		0.000	0.000
6.500				0.000						0.000

Table 2-4; Recorded spectrums by AMU1 system - Cumulative frequency/hour

3 SAFE FATIGUE LIFE OF THE Z 242L AIRCRAFT

The safe fatigue life calculation was performed according to AFS-120-73-2 methodology, [2].

Wing of the Z 242L aircraft was loaded by this loading spectrum:

- Manoeuvre + Gust: Envelope, (A, U, N category)
- Landing: Fig. No.:9 Curve for "Private Trainer", AFS-120-73-2, [2] or [3]
- Taxi: Fig. No.:10R Curve for "All Others (Rev)", AFS-120-73-2, [2] or [3]

The critical point of wings, drawing No. L242.2100/2200 of Z 242L aircraft from the fatigue life point of view is lower duralumin flange close behind the attachment fittings.

Loading at flight as well as at standing on the ground was taken over from the flight measurements of Z 242L aircraft OK-VNP, S/N 0490. Results of stress measurements for the wing of the Z 242L are mentioned in [3].

S-N curves were taken over:

- For duralumin flanges from FAA methodology AFS 120-73-2, [2]
- Fatigue test of main spar of the fuselage frame specimens - Report Z242L-0564, [3].

3.1 The fatigue test of the wing made on the basis of ZLIN-A and ZLIN-N loading spectrums

The results of the fatigue test are given in detail in the Z242L-0553 report, [4].

Conclusion:

The result value of safe fatigue life of airframe of the Z 242L aircraft for the ZLIN-A and ZLIN-N manoeuvring spectrums is 5500 flight hours, 700 acrobatic hours from it.

3.2 Results of fatigue tests of three main wing spars of the Z 242L aircraft at the CAA-FAA load spectrum impact

Fatigue tests of three main wing spars of the Z 242L aircraft were made. Results of fatigue tests are given in Report Z 242L-0520, [5].

Conclusion:

The result value of safe fatigue life of airframe of the Z 242L aircraft for the CAA-FAA manoeuvring spectrum is 5500 flight hours without acrobatic limitation.

4 SAFE FATIGUE LIFE OF THE WING

4.1 Stress values in critical section A-A

A category LOWER FLANGE, A-A Section – flange margin

Section	Strain gauge	Strain gauge location	Distance from		Flight measurements n = +6.0g		Flight measurements n = -3.5g	
			syst. 1 [mm]	air. axis [mm]	Strain gauge [MPa]	Flange margin [MPa]	Strain gauge [MPa]	Flange margin [MPa]
A – A	t222101.37	Lower flange	227	1250	88.53	146.53	-51.64	-80.83
	t222101.39	Lower flange	227	1250	84.19	130.78	-48.04	-72.60

Table 4-1; Stress values in A-A section, flight measurements Z 242L - A category

Configuration: m=970 kg, centre of gravity = 23.50%MAC, main tank fuel: 30+30 l, aux. tank fuel: 0 l

Total double amplitude CR < + 6.0g, -3.50g >
CR = (146.53+130.78)/2 +ABS((-80.83-72.60)/2) = 215.37 MPa 22.67 MPa/1g
Positive amplitude KR < +6.0g , 0 > = 138.66 MPa 23.11 MPa/1g
Negative amplitude ZR < -3.5g , 0 > = -76.72 Mpa -21.92 MPa/1g

With regard to the above given values we appoint:

Loading in flight: n= +1 g **σ_{+1g} = 23.2 MPa** /flange margin/
Loading at the ground stay: n= -1 g **σ_{-1g} = -7.0 MPa** /flange margin/

4.2 Individual phases of flight and fatigue damage (Category A)

Phases of flight	Fatigue damage D_i [1 per flight hour]
Taxi	9.6734E-12
Gust and Manoeuvres	7.2514E-06
Landing – (Impact-Rebound)	1.0518E-08
G-A-G cycle	1.1123E-06
Total fatigue damage D_C	8.3742E-06

Table 4-2; A category operation; fatigue damage caused by ENVELOPE spectrum

$L_S = 1/D_C$ = 119 415 flight hours

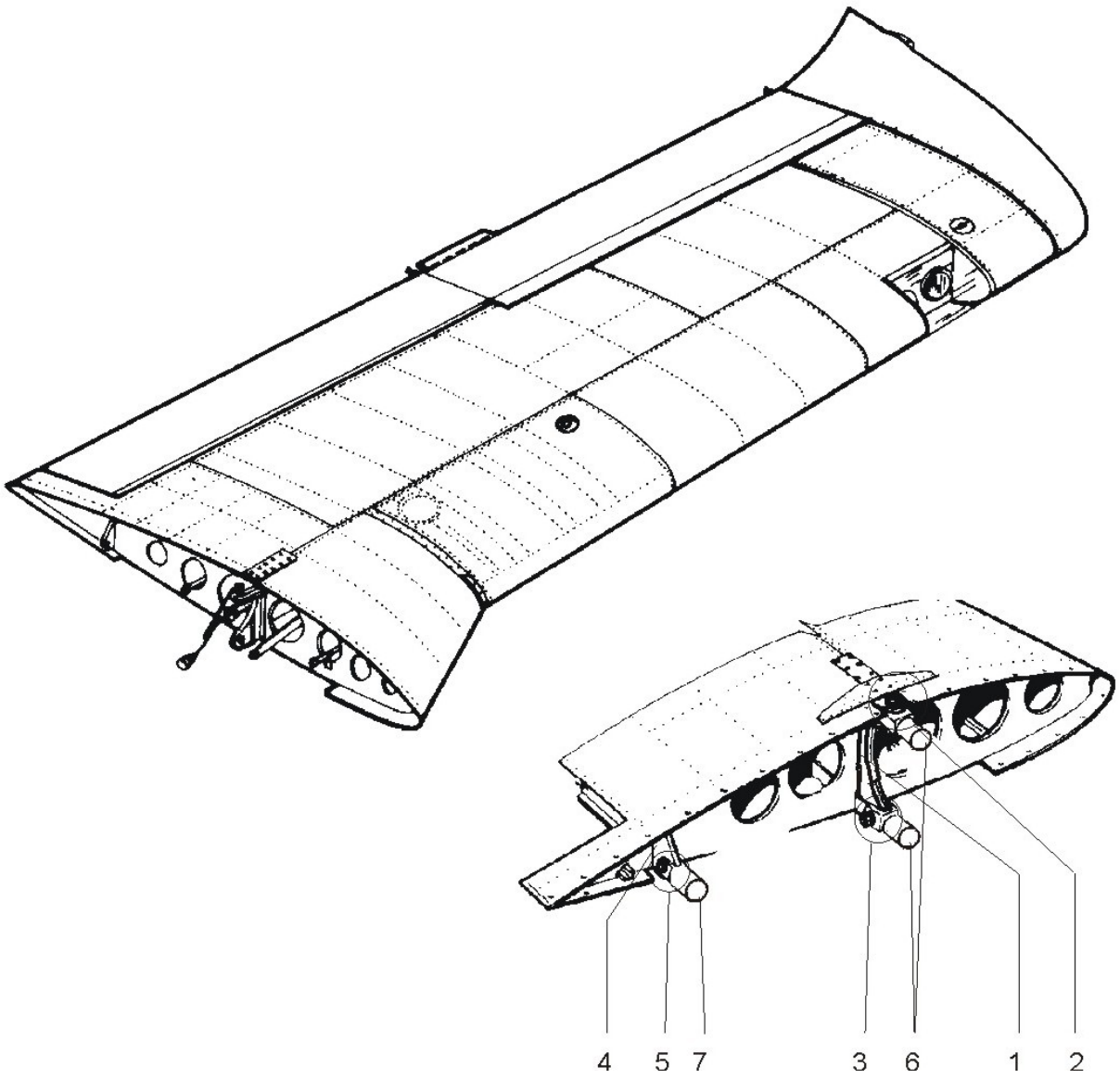


Fig. 4-1; Wing of the Z 242L aircraft

1 .... main wing spar
2 .... wing upper attachment fitting
3 .... wing lower attachment fitting
4 .... rear wing spar
5 .... rear wing attachment fitting
6 .... main spar of the fuselage frame
7 .... rear spar of the fuselage frame

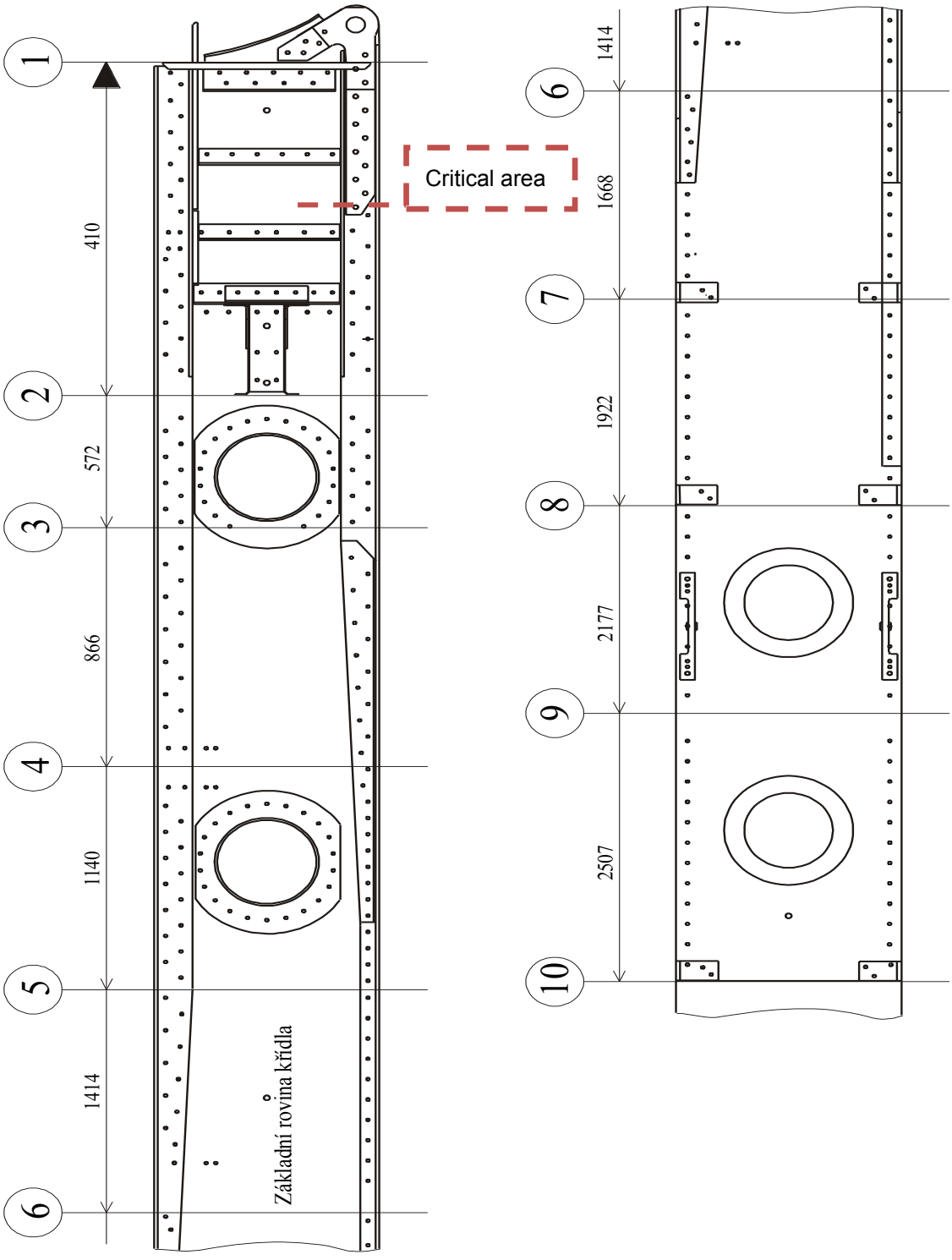


Fig. 4-2; Main wing spar of the Z 242L aircraft

4.3 Stress values in critical section A-A (Category U)

The loading conditions for UTILITY category are recalculated on the base of the maximum take off weight, Report Z242-0564, [3]. The input values are presented lower:

Loading in flight :	n= +1 g	**σ_{+1g} = 24.90 MPa**	/flange margin/
Loading at the ground stay :	n= -1 g	**σ_{-1g} = -7.4 MPa**	/flange margin/

Phases of flight	Fatigue damage D_i [1 per flight hour]
Taxi	1.1712E-11
Gust and Manoeuvres	8.6250E-06
Landing – (Impact-Rebound)	1.3561E-08
G-A-G cycle	1.3878E-06
Total fatigue damage D_C	1.0026E-05

Table 4-2; U category operation; fatigue damage caused by ENVELOPE spectrum

$L_S = 1/D_C$ = 99 737 flight hours

4.4 Stress values in critical section A-A (Category N)

The loading conditions for NORMAL category are recalculated on the base of the maximum take off weight, Report Z242-0564, [3]. The input values are presented lower:

Loading in flight :	n= +1 g	**σ_{+1g} = 26.63 MPa**	/flange margin/
Loading at the ground stay :	n= -1 g	**σ_{-1g} = -8.0 MPa**	/flange margin/

Phases of flight	Fatigue damage D_i [1 per flight hour]
Taxi	1.5246E-11
Gust and Manoeuvres	5.9526E-06
Landing – (Impact-Rebound)	1.9071E-08
G-A-G cycle	1.8862E-06
Total fatigue damage D_C	7.8579E-06

Table 4-3; N category operation; fatigue damage caused by ENVELOPE spectrum

$L_S = 1/D_C$ = 127 261 flight hours

4.5 Safety factor determination

Based on the period of monitoring by AMU1 and results of wing fatigue tests, the safety factor is set to $j_N = 5.0$.

4.6 Safe fatigue life calculation for Canada-Operation loading spectrum

The safe fatigue life of the wing is calculated according lower mentioned formula. For this purposes the Category A results are used for the safe fatigue life calculation.

$L_B = L_S^{(Category\ A)} / j_N = 119\ 415 / 5 = 23\ 883$ flight hours.

Type [-]	S/N [-]	Reg. mark [-]	Flight hrs. (16.3.2011) [Hrs]	Landings [-]	Monitored by AMU1 [Hrs]	Safe-life limit [%]	Possible operation time [Hrs]	Possible total operation time [Hrs]
Z242L	679	C-FQHT	10999:42	11018	4722:05:08	38.24%	9 133	20 133
Z242L	682	C-FHTU	10597:42	10548	4729:02:57	40.97%	9 594	20 191
Z242L	684	C-FCSB	10896:30	10882	6941:34:07	36.79%	8 787	19 683

Table 4-4; Possible total operational life for Z 242L aircraft wing under ENVELOPE spectrum

4.7 Safe fatigue life determination of Z 242L aircraft wing

Conclusion:

On the basis of executed fatigue tests and calculations and with respect to other groups of airframe of the aircraft, we appoint the value of safe fatigue life for the wing of the Z 242L aircraft to:

LB= 18 000 flight hours.

Other procedures:

Proposed regular checks according to: Maintenance Manual for aircraft Z 242L - Part I, II

Replacement:

- Conic pins and bushings for attaching the wings to the fuselage
  - after every 6000 flight hours

5 SAFE FATIGUE LIFE OF MAIN SPAR OF THE FUSELAGE FRAME

The main spar of the fuselage frame is a complicated weldment that is made of steel tubes from L-CM3 material according to valid regulations and procedures. There are installed upper and lower attachments of the wing, attachments of the front seats and attachments of the main landing gear on the main spar of the fuselage frame. The lower flange of the main spar is equipped with pressure probe which signalises to the pilot contingent appearance of a crack on the flange.

Frame of the fuselage including main spar is shown on the Fig. 5-1.

Numbers of drawings and values of diameter and thickness of the upper and lower flange of the main spar of the fuselage frame for the Z 42 series are given in the Table 5-1.

Aircraft	Main spar	Upper flange		Lower flange	
	drawing No.	drawing No.	Tube ∅	drawing No.	Tube ∅
Z42 to S/N 0059 including	Z42.1110	Z42.1111-00.17	Tube 55x3.0	Z42.1112-00.17	Tube 50x3
Z42 from 3rd series from S/N 0060	M42.1110	M42.1111-00.17	Tube 55x3.5	M42.1112-00.17	Tube 50x4
Z 142	M42.1110	M42.1111-00.17	Tube 55x3.5	M42.1112-00.17	Tube 50x4
Z 142C	M42.1110	M42.1111-00.17	Tube 55x3.5	M42.1112-00.17	Tube 50x4
Z 242L	**L242.1110**	**M42.1111-00.17**	**Tube 55x3.5**	**M42.1112-00.17**	**Tube 50x4**

Table 5-1; Drawings numbers and parameters of the upper and lower flange of the main spar of the fuselage frame

	C	Mn	Si	Cr	Mo		Ni	Cu	P	S
Chemical composition (%)	0.22 to 0.29	0.50 to 0.80	0.17 to 0.37	0.90 to 1.20	0.15 to 0.25		max. 0.30	max. 0.25	max. 0.030	max 0.030
Permitted deviations of chemical composition (%)	±0.01	±0.05	+0.05 -0.02	+0.10 -0.05	+0.07 -0.03					

Table 5-2; Chemical composition of L-CM3 material according to ONL 2100

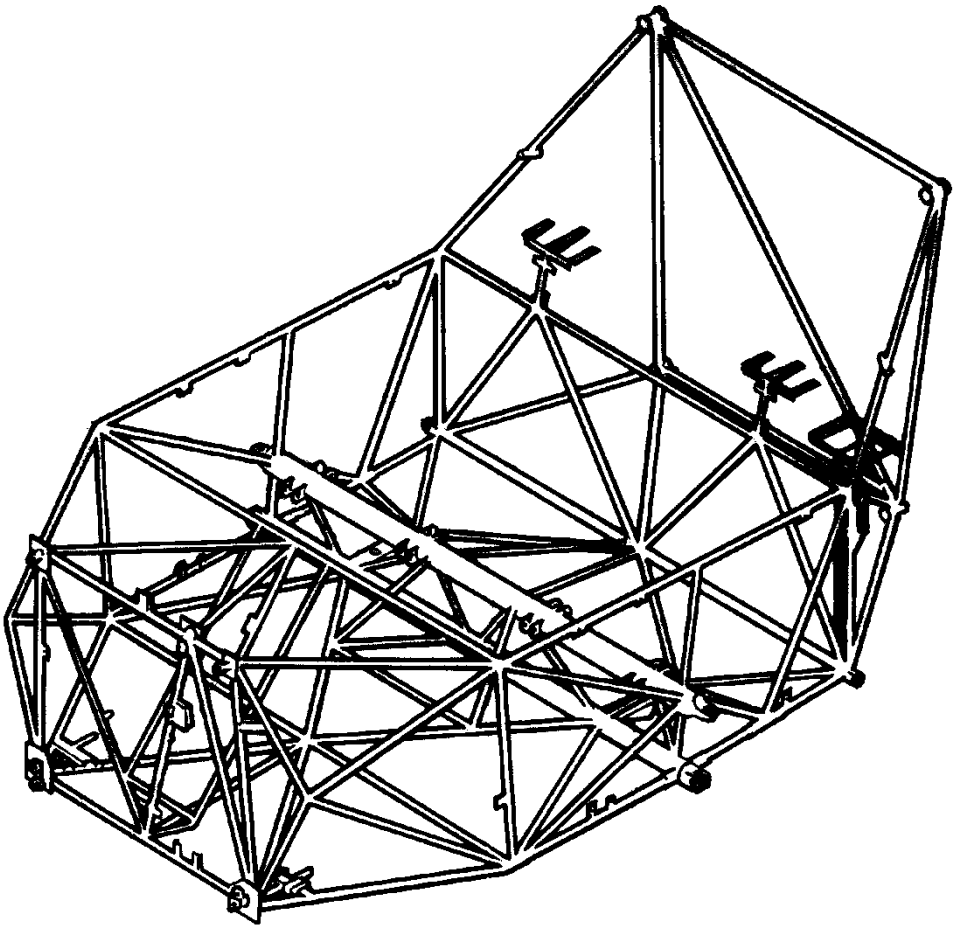


Fig. 5-1; Fuselage frame of the Z 242L aircraft

5.1 Results of flight measurements on the main spar of the fuselage frame of the Z 242L aircraft

A category MAIN SPAR of the fuselage frame

Flight measurements were executed on the Z 242L aircraft OK-VNP, S/N 0490.

Section	Strain gauge	Strain gauge loctaion	Distance from		Flight meas. n = +6.0g	Flight meas. n = -3.5g
			syst. 1 [mm]	air.axis [mm]	Strain gauge [MPa]	Strain gauge [MPa]
---	t211101.15	Main spar		200	327.89	-191.27
	t212101.15	Main spar		200	201.19	-117.41

Table 5-3; Stress reached on the main spar of the fuselage frame Z 242L A category

Configuration: m=970 kg, centre of gravity = 23.50%, main tank 30+30 l, aux. tank 0 l

Total double amplitude	CR < +6.0g, -3.50g >		
CR = 327.89 +ABS(-191.27)=		540.93 MPa	54.65 MPa/1g
Positive amplitude KR < +6.0g , 0 > =		327.89 MPa	54.65 MPa/1g
Negative amplitude ZR < -3.5g , 0 > =		-191.27 MPa	-54.65 MPa/1g

With regard to the above given values we appoint:

Loading in flight:	n= +1 g	σ_{+1g} **= 54.7** MPa
Loading at the ground stay:	n= -1 g	σ_{+1g} **= -2.0** MPa

We used S-N curves from fatigue test of lower flange specimens of main spar of the fuselage frame Z 242L for SFL calculation - see Report Z242L-0564, [3].

5.2 Individual phases of flight and fatigue damage (Category A)

Phases of flight	Fatigue damage D_i [1 per flight hour]
Taxi	0.0000E+00
Gust and Manoeuvres	1.4918E-06
Landing – (Impact-Rebound)	2.7475E-09
G-A-G cycle	2.0666E-07
Total fatigue damage D_C	1.7012E-06

Table 5-4; A category operation; fatigue damage caused by ENVELOPE spectrum

$L_S = 1 / D_C =$ 587 825 flight hours

5.3 Stress values in critical section A-A (Category U)

The loading conditions for UTILITY Category are recalculated on the base of the maximum take off weight, Report Z242-0564. The input values are presented lower:

Loading in flight : n= +1 g **σ_{+1g} = 57.9 MPa**
Loading at the ground stay : n= -1 g **σ_{-1g} = -2.2 MPa**

Phases of flight	Fatigue damage D_i [1 per flight hour]
Taxi	0.0000E+00
Gust and Manoeuvres	1.8959E-06
Landing – (Impact-Rebound)	3.6771E-09
G-A-G cycle	2.6881E-07
Total fatigue damage D_C	2.1684E-06

Table 5-5; U category operation; fatigue damage caused by ENVELOPE spectrum

$L_S = 1 / D_C =$ 461 180 flight hours

5.4 Stress values in critical section A-A (Category N)

The loading conditions for NORMAL Category are recalculated on the base of the maximum take off weight, Report Z242-0564. The input values are presented lower:

Loading in flight : n= +1 g **σ_{+1g} = 62.6 MPa**
Loading at the ground stay : n= -1 g **σ_{-1g} = -2.3 MPa**

Phases of flight	Fatigue damage D_i [1 per flight hour]
Taxi	0.0000E+00
Gust and Manoeuvres	1.7225E-06
Landing – (Impact-Rebound)	4.8278E-09
G-A-G cycle	3.4516E-07
Total fatigue damage D_C	2.0725E-06

Table 5-5; N category operation; fatigue damage caused by ENVELOPE spectrum

$L_S = 1 / D_C =$ 482 507 flight hours

5.5 Safety factor determination

According to AFS-20-73-2 methodology safety factor j_N = 7 - 8 is specified for safe fatigue life calculation. Based on the origin of S-N curve (samples) and the mentioned methodology, it is recommended to choose value of j_N = 8 for standard cases.

5.6 Safe fatigue life calculation for ENVELOPE loading spectrum

The safe fatigue life of the fuselage frame is calculated according lower mentioned formula. For this purposes the Category A results are used for the safe fatigue life calculation.

$L_B = L_S^{(Category\ A)} / j_N$ = 587 825 / 8 = 73 748 flight hours.

5.7 Safe fatigue life determination of the fuselage frame main spar

Conclusion:

On the basis of executed calculation and with respect to other groups of airframe of the aircraft, we appoint the value of safe fatigue life for the main spar of the fuselage frame to:

LB= 18 000 flight hours.

Other procedures:

Proposed regular checks according to: Maintenance Manual for aircraft Z 242L - Part I, II

System function check:

- Lower flange pressure following-up - every 500 flight hours or once a year

Replacement of the pressure probe in system:

- Lower flange pressure following-up - after every 6000 flight hours

6 SAFE FATIGUE LIFE OF THE REAR PART OF THE FUSELAGE AND BOLTS /Z42.1300-00.11/, CONNECTING CENTRAL AND REAR PART OF THE FUSELAGE

Fatigue life was appointed on the basis of fatigue tests of fuselage rear part including connecting bolts – see Report Z242L-009, [6]. Conclusion of the fatigue tests analysis is given in Report Z242L-0564 Appendix No. 1, [3].

Rear part of the fuselage is shown on the Fig. 6-1 and connection of front and rear part of the fuselage is shown on the Fig. 6-1.

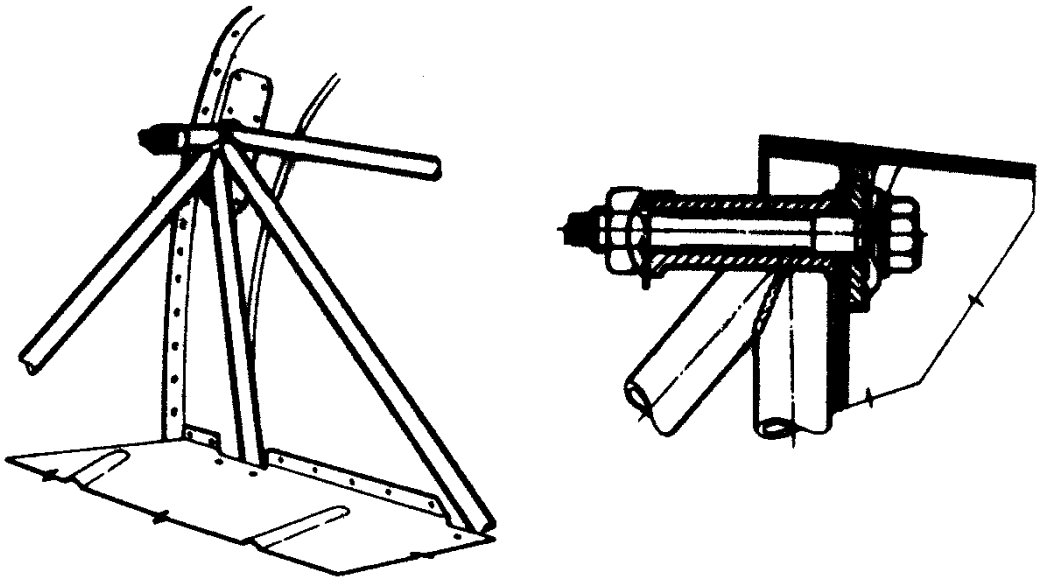


Fig. 6-1; Connection of fuselage front and rear part of the Z 242L aircraft

Conclusion:

We appoint the value of safe fatigue life of bolts connecting central and rear part of the fuselage, with respect to present maintenance system to:

LB= 6 000 flight hours.

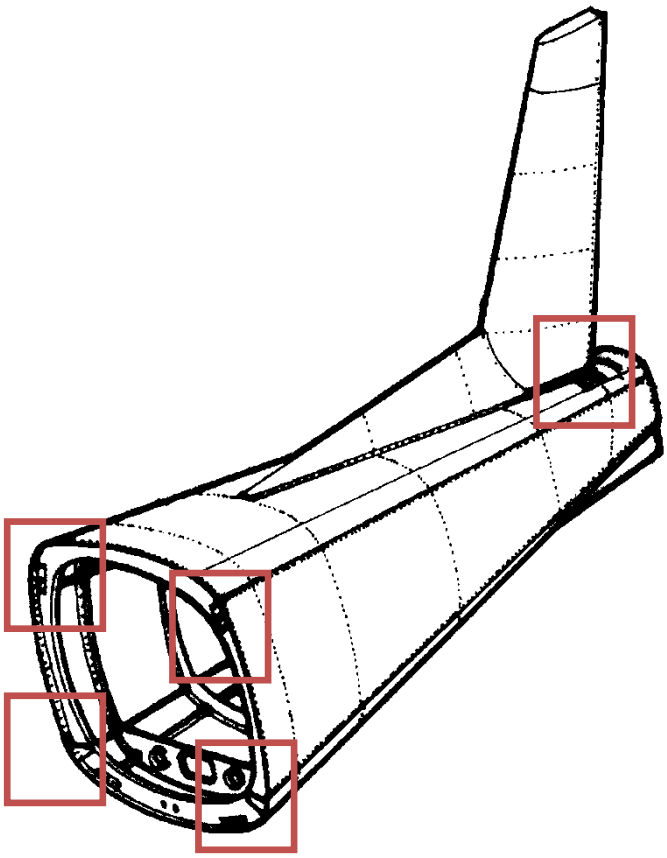


Fig. 6-2; Fuselage rear part of the Z 242L aircraft with market areas for visual inspection check

The safe fatigue life of rear part of the fuselage will be secured with regular inspections and repairs in operation in accordance with specified maintenance system.

Conclusion:

We appoint the safe fatigue life value of rear part of the fuselage to:

LB= 18 000 flight hours.

Other procedures:

Proposed regular inspections acc. to: Maintenance Manual Z 242L - Part I, II

Replacement of the bolts connecting central and rear part of the fuselage:
- after every 6000 flight hours

Visual inspection checks for crack, damage, deformation; see Fig. 6-2
- after every 500 flight hours

7 SAFE FATIGUE LIFE OF TAIL SURFACES

Safe fatigue life of tail surfaces was specified neither by calculation, nor by test. Safe fatigue life of tail units will be secured by regular checks and contingent repairs in operation in accordance with specified maintenance system.

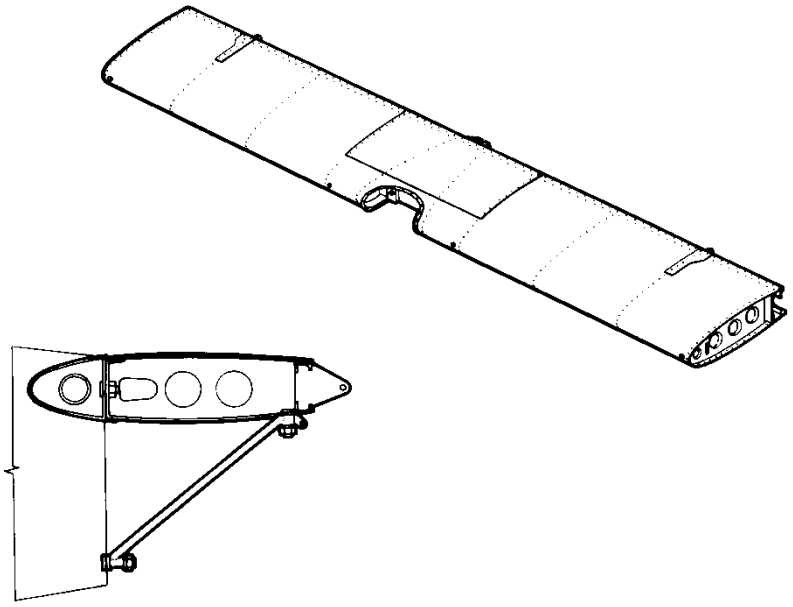


Fig. 7- 1; Stabilizer including supports

Conclusion:

We appoint the value of safe fatigue life of tail surfaces according to the above-given and with respect to other groups of primary frame to:

LB= 18 000 flight hours.

Other procedures:

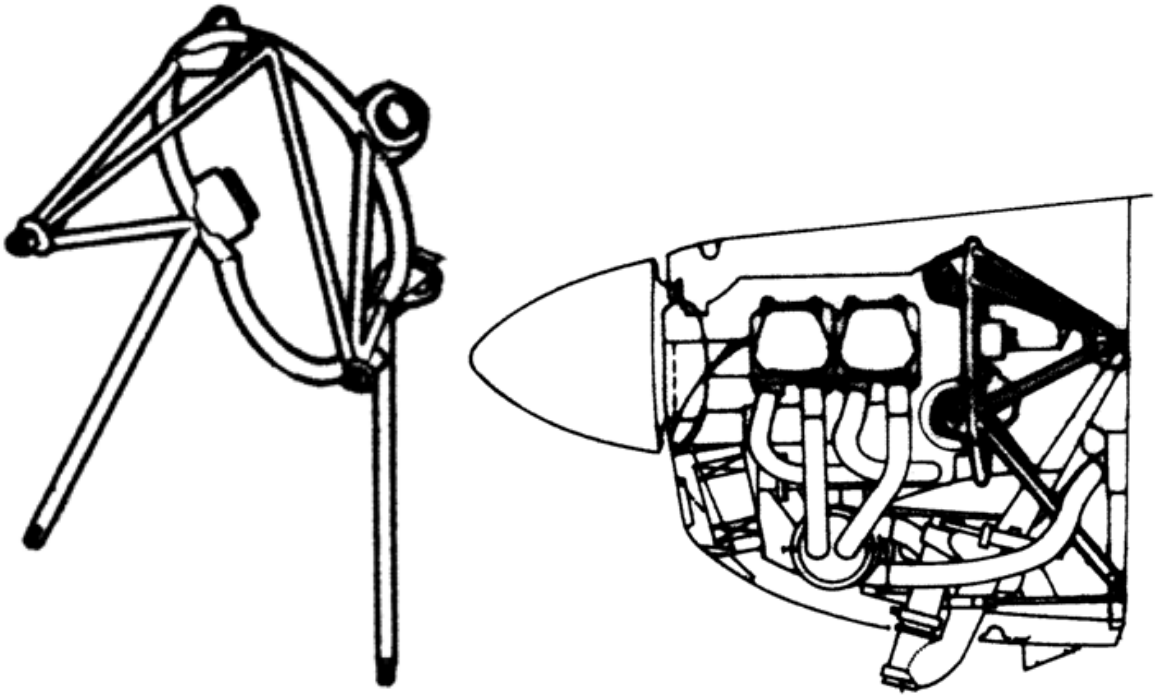
Proposed regular checks according to: Maintenance Manual for Z 242L - Part I, II

Replacement:

- Stabilizer supports replacement including connecting bolts - after every 6000 flight hours
- Connecting bolts attachment fittings of the stabilizer - after every 6000 flight hours

8 SAFE FATIGUE LIFE OF ENGINE MOUNT

Safe fatigue life of engine mount was specified neither by calculation, nor by test. Safe fatigue life of engine mount will be secured by regular checks and repairs in operation in accordance with specified maintenance system.



Engine mount including engine clamping is shown on the Fig. 8-1.

Conclusion:

We appoint the value of safe fatigue life value of engine mount according to the above-given to:

LB= 6 000 flight hours.

Other procedures:

Proposed regular checks according to:	Maintenance Manual for aircraft Z 242L - Part I, II
Replacement:	
• Engine mount	- after every 6000 flight hours

9 REGULAR REPLACEMENTS OF PARTS OF THE Z 242L AIRCRAFT

• Main landing gear	2500 flight hours (11000 landings)
• Main landing gear hinges screw	2500 flight hours (11000 landings)
• Nose landing gear (without wheel)	3500 flight hours (15000 landings)

10 AIRCRAFT PARTS AT WHICH OVERHAUL IS MADE

• Engine	according to engine manufacturer data
• Engine aggregates	together with engine
• Magnetos	according to engine manufacturer data
• Propeller	according to propeller manufacturer data
• Propeller governor	according to governor manufacturer data
• Nose landing gear (without wheel)	according to manufacturer data

11 INSTRUMENTS AND AGGREGATES

Instruments and aggregates are kept “on condition”. Maintenance and checks are performed according to Maintenance Manual Z 242L - Part I, II.

12 OPERATION INFORMATION ANALYSIS

From the accessible information about the Z 242L aircraft operation in the aviation school SCAT) results that there arised no significant failures of primary structure of the aircraft caused by operation loading of the aircraft. Increased number of defects was recorded at the brake system, propeller including propeller blades and flaps system.

13 CONCLUSION

The Z 242L aircraft is designed in the category A, U and N in according to FAR Part 23 - Amdt. 23-36 including. The aircraft is intended for basic and advanced training or acrobatic training and practice.

Calculations and analyses of primary structure of Z 242L aircraft were executed in accordance with AFS-120-73-2 methodology and according to FAR 23 Amdt. 23-36 inclusive. The critical place from the fatigue life point of view is on the lower duralumin flange, close behind the attachments. Loading at flight as well as at standing on the ground was taken-over from flight measurements of the Z 242L aircraft. The S-N curves were taken-over for duralumin flanges from the FAA AFS-120-73-2 methodology, for the main spar of the fuselage frame from the fatigue test of Z 242L main spar of the fuselage frame specimens.

All SCAT aircrafts are monitored for the long time by the AMU1 system. The envelope of all AMU1 records was used as an input source for the aircraft prolongation.

From the calculations and fatigue tests follows that aircraft Z 242L operated in aviation school SCAT (S/N 679, 682 and 684) can be safely operated up to 18 000 flight hours.

The safe fatigue life value of the Z 242L aircraft primary structure is determined with respect to operation in SCAT to:

LB= 18 000 flight hours.

APPENDIX NO. 1

TECHNICAL COMMISSION REPORT BASED ON THE REQUEST TO INCREASE THE OPERATIONAL LIFE TIME UP TO 18 000 FLIGHT HOURS (S/N 0679, 682 AND 0684)

ZLIN AIRCRAFT

ZLIN AIRCRAFT a.s.
Letiště 1578, 765 82 Otrokovice, Czech Republic
Design OrganisationApproval Certificate EASA.21J.110

Protocol from the aircraft inspection conducted by the Technical Commission

Protocol No. 04/2011	**Type: Z 242L**	**Owner: Sault College, Canada**

Registration mark	S/N	Year of production	TTSN	TLSN	TT from the last inspection	TL from the last inspection	Last Overhaul	
							Number of Rev. C	Date
C-FQHT	0679	1995	10 999,6	11 018	10 000,4	10 107	"C"	March 3. 2009

Based on the service order from the owner of the aircraft, Technical Commission of aircraft Manufacturer - ZLIN AIRCRAFT a.s. Otrokovice - performed technical inspection of the airframe of the above specified aircraft.

After removing the failures stated in this Protocol, the Technical Commission recommended to:

☐ Transfer the aircraft into operation maintenance system with **performing 100-hour or 1-year inspections only** (depending on what comes earlier) according to **Information bulletin** No. **Z 242L/19b.**

☐ Technical Commission conducted technical inspection based on the request to increase the life time of the aircraft **up to 18 000 flight hours.**

Recommended restrictions: The aircraft must be operated in **NORMAL** and **UTILITY** category only.

Sault College, March 16, 2011

ZLIN AIRCRAFT a.s.
Technická komise
765 81 Otrokovice

Technical Commission

No.	Brief description of the failures	Probe pressure: 230 kPa
1.	Fuselage –	L242.1000-00.00 – O.K.
2.	Carrier system - wing L.H. and R.H. - assembly clearance of the back hinge (pins Z 42.2100-00.22). - aileron L.H., R.H. - wing flap L.H., R.H.	L242.0200-00.00: Z42.2300-00.00/Z42.2400-00.00 – O.K. Z42.2501-00.00/Z42.2601-00.00 – O.K.
3.	Stabilizer	L242.3100-00.00 – O.K.
4.	Elevator	L242.0320-00.00 – O.K.
5.	Rudder	C142.0340-00.00 – O.K.
6.	Control system	L242.4000-00.00 – O.K.
7.	Main landing gear - loose on the landing gear R.H.	L242.5100-00.00:
8.	Nose landing gear - loose (2x) on the strut	Z42.5210-00.00: Z42.5210-02.00
9.	Engine installation – - oil leak in the engine space.	L242.6000-00.00:
10.	Oil system	L242.7100-00.00K – O.K.
11.	Fuel system	L242.7200-00.00 – O.K.
12.	Throttle control	L242.7300-00.00 – O.K.
13.	Fuel shut-off valve control	L242.7400-00.00 – O.K.

1

14.	Mixture control	L242.7500-00.00 – O.K.
15.	Propeller control	L242.7800-00.00 – O.K.
16.	Electrical system	L242.8500-00.00 – O.K.
17.	Equipment: Parachute seat L.H., R.H. Safety belts	 L242.8110-00.00/L242.8120-00.00 – O.K. L242.8130-00.00 – O.K.
18.	Recover internal and external labels.	
19.	Recover main landing gear leg painting.	

Note:
The failures mentioned in this protocol could be repaired or removed during the next 100 FH/ 1year inspection.

The failures have been introduced to Mr. Rick Legros 

ZLIN AIRCRAFT a.s.
Letiště 1578, 765 82 Otrokovice, Czech Republic
Design OrganisationApproval Certificate EASA.21J.110

Protocol from the aircraft inspection conducted by the Technical Commission

Protocol No. 06/2011	**Type: Z 242L**	**Owner: Sault College, Canada**

Registration mark	S/N	Year of production	TTSN	TLSN	TT from the last inspection	TL from the last inspection	Last Overhaul	
							Number of Rev. C	Date
C-FHTU	0682	1995	10 653,7	10 598	9 999,6	9 970	"C"	Dec.4 2009

Based on the service order from the owner of the aircraft, Technical Commission of aircraft Manufacturer - ZLIN AIRCRAFT a.s. Otrokovice - performed technical inspection of the airframe of the above specified aircraft.

After removing the failures stated in this Protocol, the Technical Commission recommended to:

☐ Transfer the aircraft into operation maintenance system with **performing 100-hour or 1-year inspections only** (depending on what comes earlier) according to **Information bulletin** No. **Z 242L/19b.**

☐ Technical Commission conducted **validation of AMU1 installation**.

Recommended restrictions: The aircraft must be operated in **NORMAL** and **UTILITY** category only.

Sault College, March 17, 2011

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Technical Commission

No.	Brief description of the failures	Probe pressure: 210 kPa
1.	Fuselage –	L242.1000-00.00 – O.K.
2.	Cockpit canopy – sliding - cracks on the glass L.H. and R.H.	L242.1800-00.00:
3.	Carrier system - wing L.H., R.H. - assembly clearance of the back hinge (pins Z 42.2100-00.22). - aileron L.H., R.H. - wing flap L.H., R.H.	L242.0200-00.00: Z42.2300-00.00/Z42.2400-00.00 – O.K. Z42.2501-00.00/Z42.2601-00.00 – O.K.
4.	Stabilizer - nut (M10x1 CSN 021402.44) for connection of bottom part of stabilizer support L.H. and R.H. exchanged with nut (M10x1 CSN 021401.44) for connection of stabilizer to the back part of the fuselage.	L242.3100-00.00
5.	Elevator	L242.0320-00.00 – O.K.
6.	Rudder	C142.0340.00-00 – O.K.
7.	Control system	L242.4000-00.00 – O.K.
8.	Main landing gear	L242.5100-00.00 – O.K.
9.	Nose landing gear	Z42.5210-00.00 – O.K.
10.	Engine installation – - damaged clamp on right side of the engine – L242.6670-11.00	L242.6000-00.00:
11.	Oil system	L242.7100-00.00K – O.K.
12.	Fuel system	L242.7200-00.00 – O.K.

1

13.	Throttle control	L242.7300-00.00 – O.K.
14.	Fuel shut-off valve control	L242.7400-00.00 – O.K.
15.	Mixture control	L242.7500-00.00 – O.K.
16.	Propeller control	L242.7800-00.00 – O.K.
17.	Electrical system	L242.8500-00.00 – O.K.
18.	Equipment: Parachute seat L.H., R,H. Safety belts	 L242.8110-00.00/L242.8120-00.00 – O.K. L242.8130-00.00 – O.K.
19.	AMU1 installation - secure and seal the cover of the fuse on the AMU1 instrument. - secure and seal connection of pull rod (Z42.8572-00.00) and terminal (Z42.8574-00.00) of stall speed warning signal adjustment.	L242.8588-00.00:
20.	Local repair of painting on the leading edge of the R.H. wing.	

Note:
The failures mentioned in this protocol could be repaired or removed during the next 100 FH/ 1year inspection.

The failures have been introduced to Mr. Rick Legros 

ZLIN AIRCRAFT a.s.
Letiště 1578, 765 82 Otrokovice, Czech Republic
Design OrganisationApproval Certificate EASA.21J.110

Protocol from the aircraft inspection conducted by the Technical Commission

Protocol No. 11 /2011	**Type: Z 242L**	**Owner: Sault College, Canada**

Registration mark	S/N	Year of production	TTSN	TLSN	TT from the last inspection	TL from the last inspection	Last Overhaul	
							Number of Rev. C	Date
C-FCSB	0684	1995	10945.7	10924	9 994,5	10 049	"C"	Aug.19. 2009

Based on the service order from the owner of the aircraft, Technical Commission of aircraft Manufacturer - ZLIN AIRCRAFT a.s. Otrokovice - performed technical inspection of the airframe of the above specified aircraft.

After removing the failures stated in this Protocol, the Technical Commission recommended to:

☐ Transfer the aircraft into operation maintenance system with **performing 100-hour or 1-year inspections only** (depending on what comes earlier) according to **Information bulletin** No. **Z 242L/19b.**

☐ Technical Commission conducted technical inspection based on the request to increase the life time of the aircraft **up to 18 000 flight hours**.

Recommended restrictions: The aircraft must be operated in **NORMAL** and **UTILITY** category only.

Sault College, March 21, 2011

ZLIN AIRCRAFT a.s.
Technická komise
765 81 Otrokovice

Technical Commission

No.	Brief description of the failures	Probe pressure: 180 kPa
1.	Fuselage –	L242.1000-00.00 – O.K.
2.	Carrier system - wing L.H. and R.H. - assembly clearance of the back hinge (pins Z 42.2100-00.22). - aileron L.H., R.H. Z42.2300-00.00/Z42.2400-00.00 – O.K. - wing flap L.H., R.H. Z42.2501-00.00/Z42.2601-00.00 – O.K.	L242.0200-00.00:
3.	Stabilizer	L242.3100-00.00 – O.K.
4.	Elevator - loose on balance tab hinge L242.3640-00.00 - Loose on the trim tab control in elevator unit L242.4420-00.00	L242.0320-00.00:
5.	Rudder	C142.0340-00.00 – O.K.
6.	Control system	L242.4000-00.00 – O.K.
7.	Main landing gear	L242.5100-00.00 – O.K.
8.	Nose landing gear - loose (2x) on the strut Z42.5210-02.00	Z42.5210-00.00:
9.	Engine installation	L242.6000-00.00 – O.K.
10.	Oil system	L242.7100-00.00K – O.K.
11.	Fuel system	L242.7200-00.00 – O.K.
12.	Throttle control	L242.7300-00.00 – O.K.
13.	Fuel shut-off valve control	L242.7400-00.00 – O.K.

1

14.	Mixture control	L242.7500-00.00 – O.K.
15.	Propeller control	L242.7800-00.00 – O.K.
16.	Electrical system	L242.8500-00.00 – O.K.
17.	Cockpit canopy – sliding - loose on the map lamp	L242.1800-00.00:
18.	Equipment: Parachute seat L.H., R.H. Safety belts	 L242.8110-00.00/L242.8120-00.00 – O.K. L242.8130-00.00 – O.K.

Note:
The failures mentioned in this protocol could be repaired or removed during the next 100 FH/ 1year inspection.

The failures have been introduced to Mr. Rick Legros 

LITERATURE

[1] Bělohradský, T.; Růžička, P.; Z 242L Assessment Report from point of view of the Safe Fatigue Life of 11 000 flight hours - Sault College Aviation Technology operation; 26. 9. 2003; Report Z242L-0554.

[2] Report No. AFS-120-73-2; Fatigue Evaluation of Wing and Associated Structure on Small Airplanes - FAA, May 1973.

[3] Bělohradský, T.; Carbol, V.; Totek, D.; Evaluation report for Z42 series aircrafts from the safe-life point of view 5500 flight hours and possible intensive aerobatics usage, aircrafts equipped by strengthened wings; 28. 11. 2007; Report Z242L-0564.

[4] Bělohradský, T.; Růžička, P.; Final report concerning evaluation of Z242L wing fatigue test; 30. 6. 2003; Report Z242L-0553.

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[6] Fišer; J.: Safe fatigue life of the fuselage tail part and of the joint of the fuselage tail and middle parts; 29. 9. 1967; Report Z242L-009.