SUPPLEMENT O1
TO THE AIRPLANE FLIGHT MANUAL DA 40

USE OF THE
DA 40
AS TOW-PLANE

Doc. No. : **6.01.01-E**
Date of Issue of the Supplement : **11 Jul 2001**
Design Change Advisory : **OÄM 40-063**

Signature :

Authority :

AUSTRO CONTROL GmbH
Abteilung Flugtechnik
Zentrale
A-1030 Wien, Schnirchgasse 11

Stamp :

Date of Approval : 10. JAN. 2002

This Supplement has been approved for the Joint Aviation Authorities (JAA) by the Austrian Civil Aviation Authority Austro Control (ACG) as Primary Certification Authority (PCA) in accordance with the JAA Certification Procedures of the Joint Aviation Authorities (JAA JC/VP).

DIAMOND AIRCRAFT INDUSTRIES GMBH
N.A. OTTO-STR. 5
A-2700 WIENER NEUSTADT
AUSTRIA

0.1 RECORD OF REVISIONS

Rev. No.	Reason	Chap-ter	Page(s)	Date of Revision	Approval	Date of Approval	Date Inserted	Signature
1	inclusion of imperial units, corrections (OÄM 40-063/b)	all	all	28 Nov 2001				

0.2 LIST OF EFFECTIVE PAGES

Chapter	Page	Date
0	9-O1-0	11 Jul 2001
	9-O1-1	28 Nov 2001
	9-O1-2	28 Nov 2001
	9-O1-3	28 Nov 2001
1	9-O1-4	28 Nov 2001
	9-O1-5	28 Nov 2001
	9-O1-6	28 Nov 2001
2	9-O1-7	28 Nov 2001
	9-O1-8	28 Nov 2001
	9-O1-9	28 Nov 2001
3	9-O1-10	28 Nov 2001
	9-O1-11	28 Nov 2001
4A	9-O1-12	28 Nov 2001
	9-O1-13	28 Nov 2001
4B	9-O1-14	28 Nov 2001
5	9-O1-15	28 Nov 2001
	9-O1-16	28 Nov 2001
	9-O1-17	28 Nov 2001
	9-O1-18	28 Nov 2001
	9-O1-19	28 Nov 2001
	9-O1-20	28 Nov 2001
6	9-O1-21	28 Nov 2001
	9-O1-22	28 Nov 2001
7	9-O1-23	28 Nov 2001
8	9-O1-24	28 Nov 2001

0.3 TABLE OF CONTENTS

1. GENERAL

1.1 INTRODUCTION

This Supplement to the “Airplane Flight Manual DA 40" must be included in the AFM when the airplane is operated as a tow-plane.

The information contained in this Supplement to the DA 40 AFM supersedes and supplements the information in the DA 40 AFM only as far as included in this Supplement. For all operating limitations, procedures and performance specifications not included in this Supplement, the DA 40 AFM remains valid.

1.2 CERTIFICATION BASIS

The towing operation with this airplane is certified in accordance with CRI O-01 "Glider Towing".

The implementation of the design change advisory OÄM 40-063 is prerequisite for the use of the DA 40 as tow-plane.

1.5 DEFINITIONS AND ABBREVIATIONS

Sailplane In this Supplement, "sailplane" stands for the towed sailplane or the towed powered sailplane.

1.6 UNITS OF MEASUREMENT

The following table applies only to the DA 40 with flaps in T/O position.

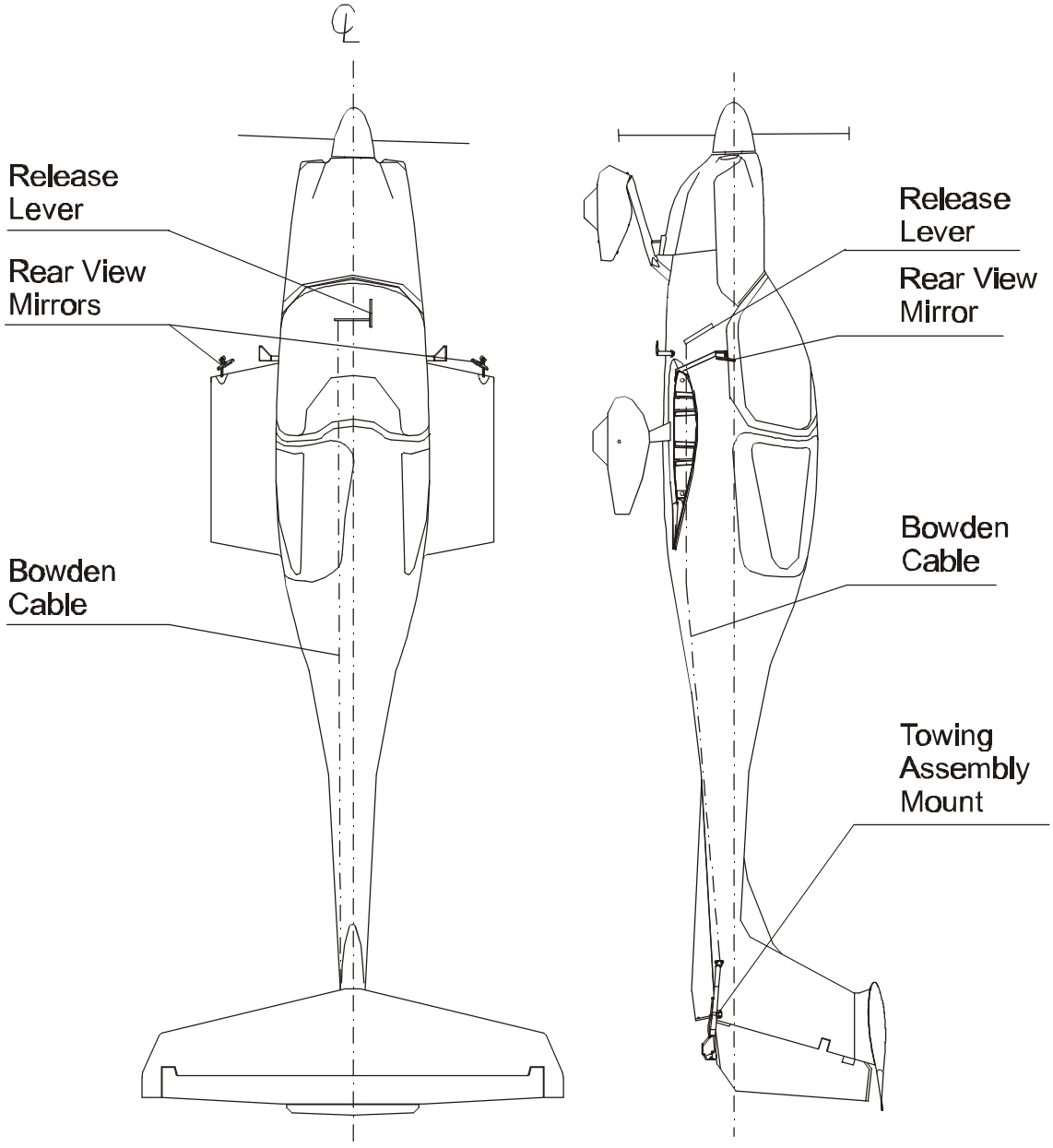
Airspeeds are converted as follows:

[km/h] / 1.609 = [mph]
[km/h] / 1.852 = [kts]

The conversion between CAS and IAS is done in accordance with the main part of the AFM, Section 5.3.1 AIRSPEED CALIBRATION.

CAS [km/h]	CAS [mph]	CAS [kts]	IAS [kts]
90	56	49	44
95	59	51	46
100	62	54	49
105	65	57	52
110	68	59	54
115	71	62	58
120	75	65	62
125	78	67	65
130	81	70	68
135	84	73	72
140	87	76	75
145	90	78	78
150	93	81	81
160	99	86	86
170	106	92	93
180	112	97	100

1.7 TWO-VIEW DRAWING



2. OPERATING LIMITATIONS

2.2 AIRSPEED

The operating limitations specified in the DA 40 AFM remain valid with the following deviations:

* The maximum permissible speed for tow-plane operation is v_A = 94 KIAS. However, the design aerotow speed v_T of the towed sailplane must not be exceeded.

* The minimum permissible speeds for the tow formation are 53 KIAS at 850 kg / 1874 lb and 57 KIAS at 980 kg / 2161 lb (flap position of tow-plane: T/O), but not less than 1.2 times the minimum airspeed of the towed sailplane.

* Only sailplanes with a design aerotow speed of v_T = 67 KCAS (125 km/h) or more may be towed.

2.7 MASS (WEIGHT)

Aero-towing:

The mass of the towed sailplane must not exceed:

* 750 kg (1653 lb), at a maximum tow-plane take-off mass of 850 kg (1874 lb).

* 380 kg (838 lb), at a maximum tow-plane take-off mass of 980 kg (2161 lb).

2.8 CENTER OF GRAVITY

The center of gravity limitations specified in the DA 40 AFM remain valid with the following deviations:

* The most rearward CG is 2500 mm (98.43 in) aft of the DP.

2.12 FLIGHT CREW

Minimum flight crew: 1 Pilot

Maximum number of occupants: 2 Persons

NOTE

Tow flights are work flights. All national requirements must be met. The maximum mass of the tow-plane for aero-towing according to Section 2.7 must not be exceeded.

2.13 KINDS OF OPERATION

Provided that national operational requirements are met and the minimum equipment according to the main part of the AFM is installed and operative, the following kinds of operation are approved:

* tow flights according to visual flight rules during daytime,

* tow flights according to visual flight rules during nighttime.

Operative minimum operational equipment:

- towing assembly installation according to OÄM 40-063,
- 2 rear view mirrors according to OÄM 40-063,
- tow-rope with a length of 30 to 55 m (98 ft to 180 ft), including a ring pair according to LN 65091,
- weak link with a maximum breaking load of 400 daN (899 lbf).

2.16 OTHER LIMITATIONS

- Towing of sailplanes and powered sailplanes is approved as far as these are approved for aerotowing.
- Towing of more than one sailplane at a time is not permitted.
- The auto pilot must not be activated during aero-towing operation.
- Banner towing is not approved.

NOTE

A towing device certified for aero-towing must be used on the sailplane.

3. EMERGENCY PROCEDURES

Proceed according to the emergency procedures given in the main part of the Airplane Flight Manual.

In addition:

3.2 ENGINE PROBLEMS

- In case of engine problems during the tow-flight, advise the sailplane pilot to release the tow-rope via signals or radio. If this is not possible or unsuccessful, the tow-rope must be released immediately.
- Proceed according to the emergency procedures given in the main part of the Aircraft Flight Manual.

3.3 SMOKE AND FIRE

- In case of smoke or fire during the tow-flight, advise the sailplane pilot to release the tow-rope via signals or radio, or release the tow-rope.
- Proceed according to the emergency procedures given in the main part of the Airplane Flight Manual.

3.6 RECOVERY FROM AN UNINTENTIONAL SPIN

If during the tow-flight the airplane fails to react normally to elevator and aileron operation, immediately release the tow-rope and push the control stick forward. If this does not prevent spinning, proceed according to the emergency procedures given in the main part of the AFM.

3.7 OTHER EMERGENCIES

3.7.4 ABNORMAL ATTITUDE OF THE TOWED SAILPLANE

- If maneuverability is no longer ensured due to an abnormal attitude of the towed sailplane, the tow-rope must be released immediately.
- If the sailplane is apparently outside of a 60° cone behind the tow-plane (i.e., if the angle between the tow-rope and the longitudinal axis of the tow-plane exceeds 30°), the tow-rope must be released immediately.

WARNING

The most critical configuration is usually the one in which the sailplane climbs above the tow-plane during take-off and climb, especially when using a tow-rope connector located at the CG of the sailplane (if approved).

3.7.5 FAILURE OF THE RELEASE MECHANISM ON THE SAILPLANE

Landing in tow configuration is possible with the air brakes of the sailplane fully extended and the rate of descent being controlled via the performance setting of the tow-plane.

WARNING

The airspeed must be kept constant during the extension of the flaps of the DA 40.

4A. NORMAL OPERATING PROCEDURES

Proceed according to the normal operating procedures given in the main part of the Airplane Flight Manual.

In addition:

4A.3 CHECKLISTS FOR NORMAL OPERATING PROCEDURES

4A.3.1 PRE-FLIGHT INSPECTION

II. Walk-around check, visual inspection

1. Check coupling and release mechanism for excessive dirt and improper function (perform release test).
2. Check tow-rope, ring pair and weak link for excessive wear, damage and incorrect configuration.
3. Check rear view mirrors for damage and insecure attachment.

NOTE

The check of the weak link and the check for incorrect configuration is conducted according to Chapter 6.

4A.3.7 TAKE-OFF

1. Tighten tow-rope prior to take-off.
2. Lift off the tow-plane after the sailplane has lifted off.
3. Accelerate to minimum towing speed while still in close proximity to the ground.
4. Change to climb steadily.

4A.3.8 CLIMB

Except for the recommended tow speeds shown below, the climb procedure given in the main part of the AFM shall be applied.

CAUTION

During the acceleration phase, care must be taken to ensure that the sailplane lifts off first and that the minimum towing speed is reached while still in close proximity to the ground.

The best climb rates are achieved at the minimum permissible tow speeds. When towing a sailplane with a high stall speed and/or in rough air, higher towing speeds shall be used.

Recommended tow speeds for typical sailplanes	
54 KIAS to 60 KIAS	Sailplanes with a mass of up to 400 kg (882 lb) and a stall speed of less than 60 km/h (32 KCAS)
57 KIAS to 65 KIAS	Sailplanes with a mass from 400 to 500 kg (882 to 1102 lb) and a stall speed of less than 70 km/h (38 KCAS)
62 KIAS to 70 KIAS	Sailplanes with a mass of up to 750 kg (1653 lb) and a stall speed of more than 75 km/h (40 KCAS)

4A.3.12 LANDING APPROACH

Prior to landing the tow-rope should be dropped and the successful release should be verified in the rear view mirror. Dropping of the tow-rope must not endanger persons or objects on the ground.

Landing with the tow-rope attached is only possible when an approach along an obstacle-free path at increased airspeed is possible.

Dragging the tow-rope on the ground results in a shorter flare phase.

4B. ABNORMAL OPERATING PROCEDURES

4B.7 LANDING IN TOW CONFIGURATION

Approaching and landing in tow configuration are possible with the air brakes of the sailplane fully extended and the rate of descent being controlled via the performance setting of the tow-plane.

Landings in tow configuration are permissible for training and instruction purposes.

WARNING

The airspeed must be kept constant during the extension of the flaps of the DA 40.

4B.8 UNINTENTIONAL SEPARATION OF THE TOW-ROPE

If the connection to the towed sailplane separates unintentionally or if the sailplane pilot performs an emergency release, then the pilot of the tow-plane must continue his flight maintaining direction, airspeed and attitude. The sailplane must be observed in the rear view mirror, until it is certain that the sailplane will not be obstructed in its continuation of flight or landing and roll out.

5. PERFORMANCE

5.3 PERFORMANCE TABLES AND DIAGRAMS

5.3.5 WIND COMPONENTS

The maximum demonstrated crosswind component during towing is 5 kts.

5.3.6 TAKE-OFF DISTANCE

The take-off data has been determined under the following conditions:

- Flap position: T/O
- Maximum take-off power (FULL throttle, prop HIGH RPM)
- Take-off mass of the DA 40: 850 kg (1874 lb) or 980 kg (2161 lb)
- Level runway, asphalt surface
- No crosswind component
- Steady headwind: see table
- Maximum Take-Off Mass (MTOM) of sailplane: see table

- Take-off speed:	49 KIAS at 850 kg (1874 lb) 52 KIAS at 980 kg (2161 lb)
- Climb speed:	54 KIAS at 850 kg (1874 lb) 57 KIAS at 980 kg (2161 lb)

CAUTION

On dry, level grass runways with short grass a 20% longer take-off roll must be expected.

CAUTION

A ground slope of 2 % (2 m per 100 m, or 2 ft per 100 ft) results in an increase in the take-off distance of approximately 10 %. The effect on the take-off roll can be greater.

WARNING

The take-off distance values given do not include any kind of safety margin.

The condition of the ground (grass height, soft ground, uneven terrain), a poorly maintained airplane, deviation from the prescribed procedures and unfavorable external factors (rain, cross-wind, wind shear) can all lead to a considerable increase in the take-off distance.

For a safe take-off the available runway length in front of the tow-plane must be at least equal to the take-off distance over a 15 m (50 ft) obstacle.

The take-off distances for the tow formation for sailplanes with different minimum wing spans and maximum masses should be taken from the table on the following page.

s_1: Take-off roll

s_2: Take-off distance over a 15 m (50 ft) obstacle

Density Altitude						0 ft		3000 ft		6000 ft		9000 ft	
Sailplane Wing Span [m] *[ft]*	Sailplane Mass [kg] *[lb]*	DA 40 Mass [kg] *[lb]*	Head-wind [kts]	v_{rot} [KIAS]	v_{50} [KIAS]	s_1 [m] *[ft]*	s_2 [m] *[ft]*	s_1 [m] *[ft]*	s_2 [m] *[ft]*	s_1 [m] *[ft]*	s_2 [m] *[ft]*	s_1 [m] *[ft]*	s_2 [m] *[ft]*
min. 24 min. 78.7	up to 750 *up to 1653*	850 *1874*	0	48	54	268 *879*	494 *1621*	359 *1178*	649 *2129*	495 *1624*	877 *2877*	712 *2336*	1143 *3750*
			10			180 *591*	368 *1207*	247 *810*	490 *1608*	348 *1142*	669 *2195*	510 *1673*	874 *2867*
			20			110 *361*	259 *850*	155 *509*	351 *1152*	225 *738*	487 *1598*	340 *1115*	637 *2090*
min. 17 *min. 55.8*	600 *1323*	850 *1874*	0	48	54	239 *784*	447 *1467*	320 *1050*	588 *1929*	440 *1444*	795 *2608*	*631* *2070*	*1061* *3481*
			10			162 *531*	335 *1099*	221 *725*	446 *1463*	311 *1020*	610 *2001*	456 *1496*	820 *2690*
			20			99 *325*	236 *774*	140 *459*	321 *1053*	204 *669*	446 *1463*	308 *1010*	605 *1985*
min. 15 *min. 49.2*	450 *992*	850 *1874*	0	48	54	210 *689*	391 *1283*	277 *909*	508 *1667*	377 *1237*	680 *2231*	534 *1752*	946 *3104*
			10			142 *466*	294 *965*	192 *630*	385 *1263*	268 *879*	523 *1716*	387 *1270*	736 *2415*
			20			87 *285*	208 *682*	122 *400*	277 *909*	175 *574*	383 *1257*	261 *856*	548 *1798*
min. 10 *min. 32.8*	300 *661*	850 *1874*	0	48	54	183 *600*	347 *1138*	243 *797*	453 *1486*	332 *1089*	611 *2005*	470 *1542*	855 *2805*
			10			125 *410*	261 *856*	170 *558*	346 *1135*	237 *778*	472 *1549*	342 *1122*	669 *2195*
			20			77 *253*	185 *607*	108 *354*	250 *820*	156 *512*	348 *1142*	233 *764*	502 *1647*
min. 15 *min. 49.2*	up to 380 *up to 838*	980 *2161*	0	52	57	275 *902*	499 *1637*	370 *1214*	670 *2198*	516 *1693*	923 *3028*	756 *2480*	1187 *3894*
			10			193 *633*	382 *1253*	266 *873*	519 *1703*	379 *1243*	725 *2379*	566 *1857*	934 *3064*
			20			125 *410*	278 *912*	178 *584*	385 *1263*	260 *853*	546 *1791*	401 *1316*	705 *2313*

Use the table as follows:

1. Determine the density altitude according to the main part of the AFM, Section 5.3.3. This defines the table column.

   In case of intermediate values between two density altitudes, apply linear variation between two neighboring columns, or use the higher value.

2. Define the table row by the wing span of the sailplane.

3. Read take-off distance according to headwind component, apply linear variation if necessary.

4. Influence of the sailplane mass:

   If the mass of the sailplane exceeds the given values, the take-off distances must be increased by the same percentage as the mass (e.g.: a 10 % higher sailplane mass results in a 10 % longer take-off distance).

5. Influence of the DA 40 take-off mass.

   If the mass of the DA 40 exceeds the given values, the take-off distances must be increased by three times the mass surplus (e.g.: a 10 % higher mass of the DA 40 results in a 30 % longer take-off distance).

Example:

DA 40: 880 kg (1940 lb) take-off mass

Sailplane: 500 kg (1102 lb), 16 m (52.5 ft) wing span

Airfield elevation 762 m (2500 ft) MSL, 20 °C (68 °F), no wind

1. Using the graph in the main part of the AFM, Section 5.3.3, a density altitude of 3700 ft is found.

   Linear variation between the columns for 3000 ft and 6000 ft is done with the following factor:

   f = (3700 ft - 3000 ft) / (6000 ft - 3000 ft) = 0.23

2. The sailplane wing span exceeds 15 m (49 ft), use third row (min. 15 m / 49 ft).

3. Headwind component 0 kts, linear variation between the take-off distance values 508 m (1666 ft) and 680 m (2230 ft) with the computed factor f yields:

   s_2 = 508 m + 0.23 × (680 m - 508 m) = 1666 ft + 0.23 x (2231 ft - 1666 ft) = 548 m = 1798 ft

4. Mass correction for the sailplane: The sailplane is 11 % heavier than 450 kg (992 lb). The take-off distance increases by 11 % to 608 m (1995 ft).

5. Mass correction for the DA 40: The DA 40 is 3.5 % heavier than 850 kg (1874 lb). The take-off distance increases by 10.5 % to 672 m (2205 ft).

The take-off distance over a 50 ft (15 m) obstacle is 672 m (2205 ft).

5.3.7 CLIMB PERFORMANCE - TAKE-OFF CLIMB

The maximum rates of climb are shown in the following table.

Density Altitude					***0 ft***	***3000 ft***	***6000 ft***	***9000 ft***
Sailplane Wing Span [m] *[ft]*	**Sailplane Mass [kg] *[lb]***	**DA 40 Mass [kg] *[lb]***	**v_{rot} [KIAS]**	**v_{50} [KIAS]**	**Climb Rate [fpm] *[m/s]***	**Climb Rate [fpm] *[m/s]***	**Climb Rate [fpm] *[m/s]***	**Climb Rate [fpm] *[m/s]***
min. 24 *min. 78.7*	up to 750 *up to 1653*	850 *1874*	48	54	660 *3.35*	550 *2.8*	450 *2.3*	350 *1.8*
min. 17 *min. 55.8*	600 *1323*	850 *1874*	48	54	720 *3.65*	590 *3.0*	480 *2.45*	370 *1.9*
min. 15 *min. 49.2*	450 *992*	850 *1874*	48	54	830 *4.2*	710 *3.6*	570 *2.9*	450 *2.3*
min. 10 *min. 32.8*	300 *661*	850 *1874*	48	54	930 *4.7*	770 *3.9*	630 *3.2*	470 *2.4*
min. 15 *min. 49.2*	up to 380 *up to 838*	980 *2161*	52	57	750 *3.8*	610 *3.1*	470 *2.4*	370 *1.9*

6. MASS AND BALANCE

6.1 INTRODUCTION

All specifications given in the DA 40 AFM remain valid with the restrictions according to 2.7, 2.8 and 2.12 of this Supplement.

6.5 EQUIPMENT LIST

Additional equipment for aero-towing:

* 1 Tost release E 85
* 1 towing assembly mount , Dwg. No. DA4-2551-00-00
* 1 release mechanism, Dwg. No. DA4-2551-00-00
* 2 rear view mirrors, Dwg. No. DA4-2553-00-00
* 1 tow rope: length between 30 m (98 ft) and 55 m (180 ft), textile rope with a minimum breaking load of 1000 daN (2248 lbf).
* 1 pair of connection rings according to LN 65091 on the tow-plane end of the rope.
* at least 1 weak link, maximum breaking load 400 daN (899 lbf).

Optionally:

* 1 weak link on the sailplane end of the rope: breaking load according to the specifications of the sailplane manufacturer.
* 1 connection ring on the sailplane end of the rope according to the specifications of the sailplane manufacturer.

CAUTION

A weak link with less than 400 daN (899 lbf) must be used if required by the sailplane manufacturer.

CAUTION

The pilot must ensure that the correct weak link is installed in the tow-rope, as the structure may otherwise become overstressed.

NOTE

Even though rear view mirrors, tow-rope, connection ring pair and weak links are necessary for aero-towing, they are not considered for the determination of the CG.

7. DESCRIPTION OF THE AIRPLANE AND ITS SYSTEMS

7.15 TOW EQUIPMENT

The release mechanism is installed to the fuselage tube using a towing assembly mount which was designed especially for the DA 40. The tow-rope is released via a Bowden cable with a yellow/red release lever in the cockpit.

For aero-towing operation two additional rear view mirrors must be attached on the LH and RH stub wing (refer to two-view drawing, Section 1.7).

7.15.1 PLACARDS/MARKINGS

The following additional placards are installed in the DA 40 if used as a tow-plane.

Placard	Place
Tow-rope Release	on the release lever
Ultimate load of weak link: max. 400 daN (899 lbf)	on the towing assembly mount

8. AIRPLANE HANDLING, CARE AND MAINTENANCE

8.2 TOWING EQUIPMENT INSPECTION INTERVALS

Refer to the Airplane Maintenance Manual, Doc. No. 6.02.01, latest effective issue.