

**SUPPLEMENT O1
TO THE AIRPLANE FLIGHT MANUAL DA 40 NG**

**USE OF THE
DA 40 NG
AS TOW-PLANE**

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1. GENERAL

1.1 INTRODUCTION

This Supplement to the Airplane Flight Manual DA 40 NG 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 NG AFM supersedes and supplements the information in the DA 40 NG 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 NG AFM remains valid.

1.2 CERTIFICATION BASIS

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

The implementation of the design change advisory OÄM 40-312 is prerequisite for the use of the DA 40 NG as tow-plane.

1.5 DEFINITIONS AND ABBREVIATIONS

(i) Miscellaneous

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

1.6 UNITS OF MEASUREMENT

1.6.3 CONVERSION CHART CAS / IAS

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

Airspeeds are converted as follows:

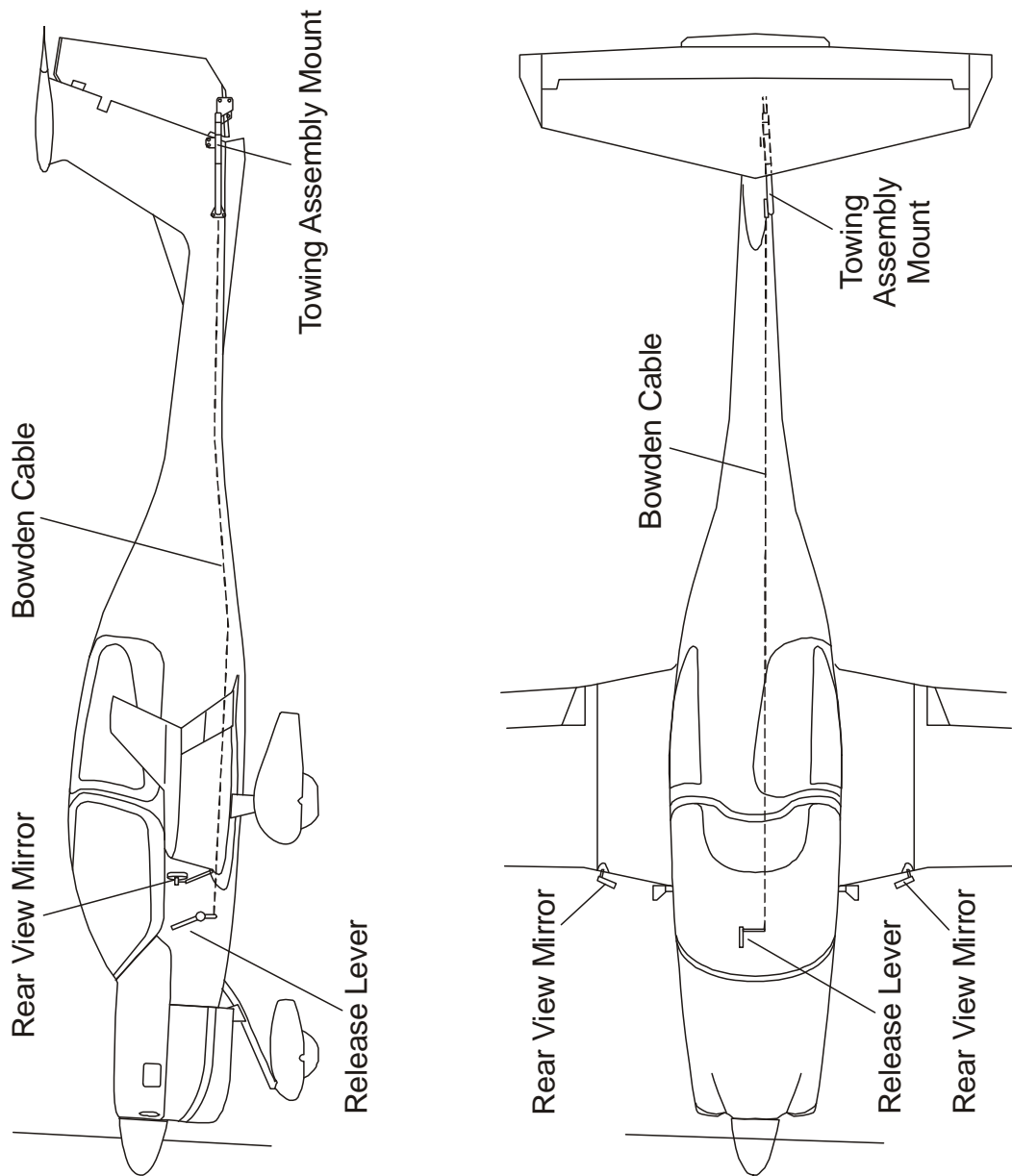
$$[\text{km/h}] / 1.609 = [\text{mph}]$$

$$[\text{km/h}] / 1.852 = [\text{kts}]$$

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 NG AFM remain valid with the following deviations:

- * The maximum permissible speed for tow-plane operation is $v_A = 101$ 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 62 KIAS at 960 kg / 2116 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 $v_T = 62$ KCAS (115 km/h) or more may be towed.

2.7 MASS (WEIGHT)

Aero-towing:

The mass of the towed sailplane must not exceed 560 kg (1235 lb).

The tow-plane take-off mass must not exceed 980 kg (2161 lb).

For valid combinations of the maximum mass of the tow-plane and the sailplane, see chapter 5.

2.12 FLIGHT CREW

Minimum flight crew:	1 (one person)
Maximum number of occupants:	2 (two persons)

NOTE

Tow flights are work flights. All national requirements must be met. The maximum mass of the tow-plane for aerotowing 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.

Minimum Operational Equipment (Serviceable)

- towing assembly installation according to OÄM 40-312,
- 2 rear view mirrors according to OÄM 40-312,
- tow-rope with a length of 30 m to 60 m (98 ft to 197 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**2.16.8 TOW-PLANE OPERATION**

- 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

The sailplane must be approved for aero-tow.

3. EMERGENCY PROCEDURES

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

In addition:

3.3 ENGINE PROBLEMS

3.3.8 ENGINE PROBLEMS DURING TOW-PLANE OPERATION

- 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.

3.5 SMOKE AND FIRE

3.5.4 SMOKE AND FIRE DURING TOW-PLANE OPERATION

- 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.

3.8 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.

3.9 OTHER EMERGENCIES

3.9.4 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).

3.9.5 FAILURE OF THE RELEASE MECHANISM ON THE SAILPLANE

Landing in tow configuration is possible with the air brakes of the sailplane extended at a constant position 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 NG.

4A. NORMAL OPERATING PROCEDURES

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

In addition:

4A.5 CHECKLISTS FOR NORMAL OPERATING PROCEDURES

4A.5.1 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.5.7 TAKE-OFF

Take-Off Procedure as a Tow-Plane

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.5.8 CLIMB

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.

4A.5.12 APPROACH & LANDING

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.9 LANDING IN TOW CONFIGURATION

Approach and landing in tow configuration are possible with the air brakes of the sailplane extended at a constant position and the rate of descent being controlled via the power 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 NG.

4B.10 UNINTENTIONAL SEPARATION OF THE TOW-ROPE

If the connection to the towed sailplane separates unintentionally or if the sailplane pilot performs an emergency release, 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

5.3.6 WIND COMPONENTS

The maximum demonstrated crosswind component during towing is 5 kts.

5.3.7 TAKE-OFF DISTANCE

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

- Flap position: T/O
- Maximum take-off power
- Take-off mass of the DA 40 NG : see table
- Level runway, asphalt surface
- No crosswind component
- Steady headwind: see table
- Maximum Take-Off Mass (MTOM) of sailplane : see table
- Take-off speed : 57 KIAS
- Climb speed : 64 KIAS

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 17 %. The effect on the take-off roll can be greater.

WARNING

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

Pressure Altitude				0 ft		3000 ft		6000 ft		9000 ft	
DA 40 NG Mass [kg] [lb]	Sailplane Wing Span [m] [ft]	Sailplane Mass [kg] [lb]	Head-wind [kts]	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]
980 2161	Single seat min. 15 min. 49.2	up to 300 up to 661	-10	511 1677	745 2444	610 2001	869 2851	742 2434	1037 3402	946 3104	1301 4268
			0	324 1063	510 1673	391 1283	601 1972	482 1581	723 2372	620 2034	911 2989
			10	271 889	442 1450	327 1073	521 1709	406 1332	631 2070	527 1729	798 2618
			20	223 732	379 1243	270 886	449 1473	339 1112	544 1785	441 1477	691 2267
960 2116	Single seat min. 15 min. 49.2	up to 380 up to 838	-10	540 1772	781 2562	645 2116	916 3005	791 2595	1099 3606	1020 3346	1385 4544
			0	339 1112	532 1745	410 1345	629 2064	510 1673	759 2490	663 2175	963 3159
			10	283 928	460 1509	344 1129	545 1788	428 1404	661 2169	560 1837	838 2749
			20	232 761	393 1289	283 928	467 1532	356 1168	568 1864	467 1532	724 2375
960 2116	Single seat min. 18 min. 59.1	up to 480 up to 1058	-10	593 1946	853 2799	715 2346	1004 3294	884 2900	1212 3976	1156 3793	1549 5082
			0	372 1220	580 1903	454 1489	686 2251	567 1860	834 2736	748 2454	1069 3507
			10	310 1017	500 1640	380 1247	594 1949	477 1565	724 2375	631 2070	930 3051
			20	254 833	427 1401	313 1027	508 1667	395 1296	621 2037	525 1722	800 2625
960 2116	Single seat min. 20 min. 65.6	up to 500 up to 1102	-10	602 1975	863 2831	726 2382	1018 3340	899 2949	1231 4039	1176 3858	1574 5164
			0	378 1240	587 1926	461 1512	695 2280	576 1890	847 2779	758 2487	1085 3560
			10	314 1030	506 1660	385 1263	602 1975	484 1588	734 2408	641 2103	942 3091
			20	257 843	432 1417	316 1037	514 1686	400 1312	630 2067	533 1749	811 2661
Increase s ₁ and s ₂ by 15 % for every 10°C (18°F) increase in OAT above ISA condition											

Pressure Altitude				0 ft		3000 ft		6000 ft		9000 ft	
DA 40 NG Mass [kg] [lb]	Sailplane Wing Span [m] [ft]	Sailplane Mass [kg] [lb]	Head-wind [kts]	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]
960 2116	Single seat min. 25 min. 82.0	up to 530 up to 1168	-10	615 2018	878 2881	741 2431	1034 3392	917 3009	1253 4111	1201 3940	1603 5259
			0	385 1263	598 1962	469 1539	706 2316	585 1919	859 2818	771 2530	1102 3615
			10	320 1050	514 1686	391 1283	610 2001	492 1614	746 2447	650 2133	956 3136
			20	261 856	439 1440	322 1056	521 1709	406 1332	639 2096	540 1772	821 2694
940 2072	Single seat min. 25 min. 82.0	up to 560 up to 1235	-10	620 2034	881 2890	748 2454	1042 3419	930 3051	1264 4147	1227 4026	1624 5328
			0	386 1266	597 1959	470 1542	707 2320	590 1936	861 2825	783 2569	1109 3638
			10	319 1047	512 1680	392 1286	609 1998	494 1621	746 2448	657 2156	959 3146
			20	260 853	435 1427	320 1050	519 1703	406 1332	636 2087	544 1785	821 2694
960 2116	Two seats min. 25 min. 82.0	up to 500 up to 1102	-10	598 1962	876 2874	719 2359	1030 3379	887 2910	1245 4085	1158 3799	1585 5200
			0	375 1230	598 1962	456 1496	708 2323	567 1860	859 2818	745 2444	1096 3596
			10	312 1024	517 1696	380 1247	612 2008	477 1565	746 2447	629 2064	955 3133
			20	254 833	442 1450	312 1024	525 1722	395 1296	641 2103	521 1709	822 2697

Increase s₁ and s₂ by 15 % for every 10°C (18°F) increase in OAT above ISA condition

Use the table as follows:

1. Determine the pressure altitude. This defines the table column.

In case of intermediate values between two pressure 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. Apply correction factor if OAT is higher than ISA condition. Use graph in Chapter 5.3.4 in the main part of the AFM for determination of ISA condition.

5. 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).

6. Influence of the DA 40 NG take-off mass:

If the mass of the DA 40 NG 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 NG results in a 30 % longer take-off distance).

Example:

DA 40 NG: 980 kg (2161 lb) take-off mass

Sailplane: 330 kg (728 lb), 16 m (52.5 ft) wing span

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

1. Linear variation between the columns for 0 ft and 3000 ft is done with the following factor:

$$f = (2500 \text{ ft}) / (3000 \text{ ft} - 0 \text{ ft}) = 0.83$$

2. The sailplane wing span exceeds 15 m (49 ft) but is less than 18 m (59 ft), use first row (min. 15 m / 49 ft).

3. Headwind component 0 kts, linear variation between the take-off distance values 510 m (1673 ft) and 601 m (1972 ft) with the computed factor f yields:

$$s_2 = 510 \text{ m} + 0.83 \times (601 \text{ m} - 510 \text{ m}) = 1673 \text{ ft} + 0.83 \times (1972 \text{ ft} - 1673 \text{ ft}) = 586 \text{ m} \\ = 1921 \text{ ft}$$

4. Using the graph in the main part of the AFM, Section 5.3.4, a condition of ISA +10 °C is found. The take-off distance is increased by 15% to 674 m (2209 ft)
5. Mass correction for the sailplane: The sailplane is 10 % heavier than 300 kg (661 lb). The take-off distance increases by 10 % to 741 m (2430 ft).

The take-off distance over a 50 ft (15 m) obstacle is 741 m (2430 ft).

5.3.8 CLIMB PERFORMANCE - TAKE-OFF CLIMB

The climb performance has been determined under the following conditions:

- Flap position : T/O
- Maximum continuous power
- Take - off mass of DA 40 NG : see table
- Maximum take - off mass (MTOM) of sailplane : see table
- Climb speed : 64 KIAS

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

Pressure Altitude			0 ft	3000 ft	6000 ft	9000 ft
DA 40 NG Mass [kg] [lb]	Sailplane Wing Span [kg] [lb]	Sailplane Mass [kg] [lb]	Climb Rate [fpm] [m/s]	Climb Rate [fpm] [m/s]	Climb Rate [fpm] [m/s]	Climb Rate [fpm] [m/s]
980 2161	Single seat min. 15 min. 49.2	up to 300 up to 661	521 2.65	517 2.63	500 2.54	478 2.43
960 2116	Single seat min. 15 min. 49.2	up to 380 up to 838	522 2.65	517 2.63	501 2.54	480 2.44
960 2116	Single seat min. 18 min. 59.1	up to 480 up to 1058	521 2.65	515 2.62	498 2.53	477 2.43
960 2116	Single seat min. 20 min. 65.6	up to 500 up to 1102	521 2.65	515 2.62	498 2.53	478 2.43
960 2116	Single seat min. 25 min. 82.0	up to 530 up to 1168	540 2.74	533 2.71	515 2.61	493 2.51

Decrease climb rate by 3 % for every 10°C (18°F) increase in OAT above ISA conditions

Pressure Altitude			0 ft	3000 ft	6000 ft	9000 ft
DA 40 NG Mass [kg] [lb]	Sailplane Wing Span [m] [ft]	Sailplane Mass [kg] [lb]	Climb Rate [fpm] [m/s]	Climb Rate [fpm] [m/s]	Climb Rate [fpm] [m/s]	Climb Rate [fpm] [m/s]
940 2072	Single seat min. 25 min. 82.0	up to 560 up to 1235	547 2.78	540 2.74	522 2.65	502 2.55
960 2116	Two seats min. 25 min. 82.0	up to 500 up to 1102	549 2.79	541 2.75	523 2.66	502 2.55

Decrease climb rate by 3 % for every 10°C (18°F) increase in OAT above ISA conditions

6. MASS AND BALANCE

6.1 INTRODUCTION

All specifications given in the DA 40 NG AFM remain valid with the restrictions according to 2.7, 2.12 and 2.13 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

7.13 TOW EQUIPMENT

The release mechanism is installed to the fuselage tube using a towing assembly mount which was designed especially for the DA 40 NG. 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).

7.13.1 PLACARDS / MARKINGS

The following additional placards are installed in the DA 40 NG 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 AIRPLANE INSPECTION INTERVALS****8.2.1 TOWING EQUIPMENT INSPECTION INTERVALS**

Refer to the Airplane Maintenance Manual, Doc. No. 6.02.15, latest effective issue.