Diamond AIRCRAFT

SUPPLEMENT NO. 1
to the Airplane Flight Manual
for the Powered Sailplane
HK 36 TC with ROTAX 912 S

TOW-PLANE OPERATION

Date of Issue of the Supplement : January 9, 2002
Doc. No. : 3.01.12-E

Pages identified by "ACG-appr." in the List of Effective Pages are approved by:

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Date of approval : 10. MAI 2002

This powered sailplane must be operated in compliance with the information and limitations contained herein.

Prior to operating the powered sailplane, the pilot must take notice of all the information contained in this Airplane Flight Manual.

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0.1 RECORD OF REVISIONS

Rev. No.	Reason	Chapter(s)	Page(s)	Date of Revision	EASA Approval No.	ACG verification	Date Inserted	Signature
1	Banner towing in Germany	0	9-1-1 9-1-2	2002-05-06	[approved by Ing. Andreas Winkler for ACG]	2002-06-19		
		2	9-1-10					
2	Increase in tow mass	all	all except cover sheet	2003-04-23	[approved by Ing. Andreas Winkler for ACG]	2003-05-08		
3	FAA requirements	all	all	2003-10-06	2004-03-30	2004-03-30		
4	Removable Release Lever for Towing Device	0	9-1-1, 9-1-2	2011-10-24	Revision 4 of the AFM Supplement Doc. No. 3.01.12-E to AFM Doc. No. 3.01.12-E is approved with EASA Approval No. 10037909	2012-01-05		
		4	9-1-13, 9-1-16					

0.2 LIST OF EFFECTIVE PAGES

Chapter	Page	Date
0	9-1-0 9-1-1 9-1-2 9-1-3	06 Oct 2003 24 Oct 2011 24 Oct 2011 06 Oct 2003
1	9-1-4 9-1-5	06 Oct 2003 06 Oct 2003
2	EASA-appr. 9-1-6 EASA-appr. 9-1-7 EASA-appr. 9-1-8 EASA-appr. 9-1-9 EASA-appr. 9-1-10	06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003
3	EASA-appr. 9-1-11 EASA-appr. 9-1-12	06 Oct 2003 06 Oct 2003
4	EASA-appr. 9-1-13 EASA-appr. 9-1-14 EASA-appr. 9-1-15 EASA-appr. 9-1-16	24 Oct 2011 06 Oct 2003 06 Oct 2003 24 Oct 2011
5	EASA-appr. 9-1-17 EASA-appr. 9-1-18 EASA-appr. 9-1-19 EASA-appr. 9-1-21 EASA-appr. 9-1-22 EASA-appr. 9-1-23 EASA-appr. 9-1-24 9-1-25	06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003 06 Oct 2003
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1. GENERAL

1.1 INTRODUCTION

These pages constitute Supplement No. 1 to the "Flight Manual for the Powered Sailplane HK 36 TC with ROTAX 912 S3" and are valid only for the operation of the powered sailplane as a tow-plane.

Translation of this Supplement has been done by best knowledge and judgement. In any case, the original document in the German language is authoritative.

1.2 CERTIFICATION BASIS

Tow-plane operation of this powered sailplane has been approved in compliance with the draft of the LBA airworthiness requirements for tow-plane operation dated February 1971.

1.4 EXPLANATIONS

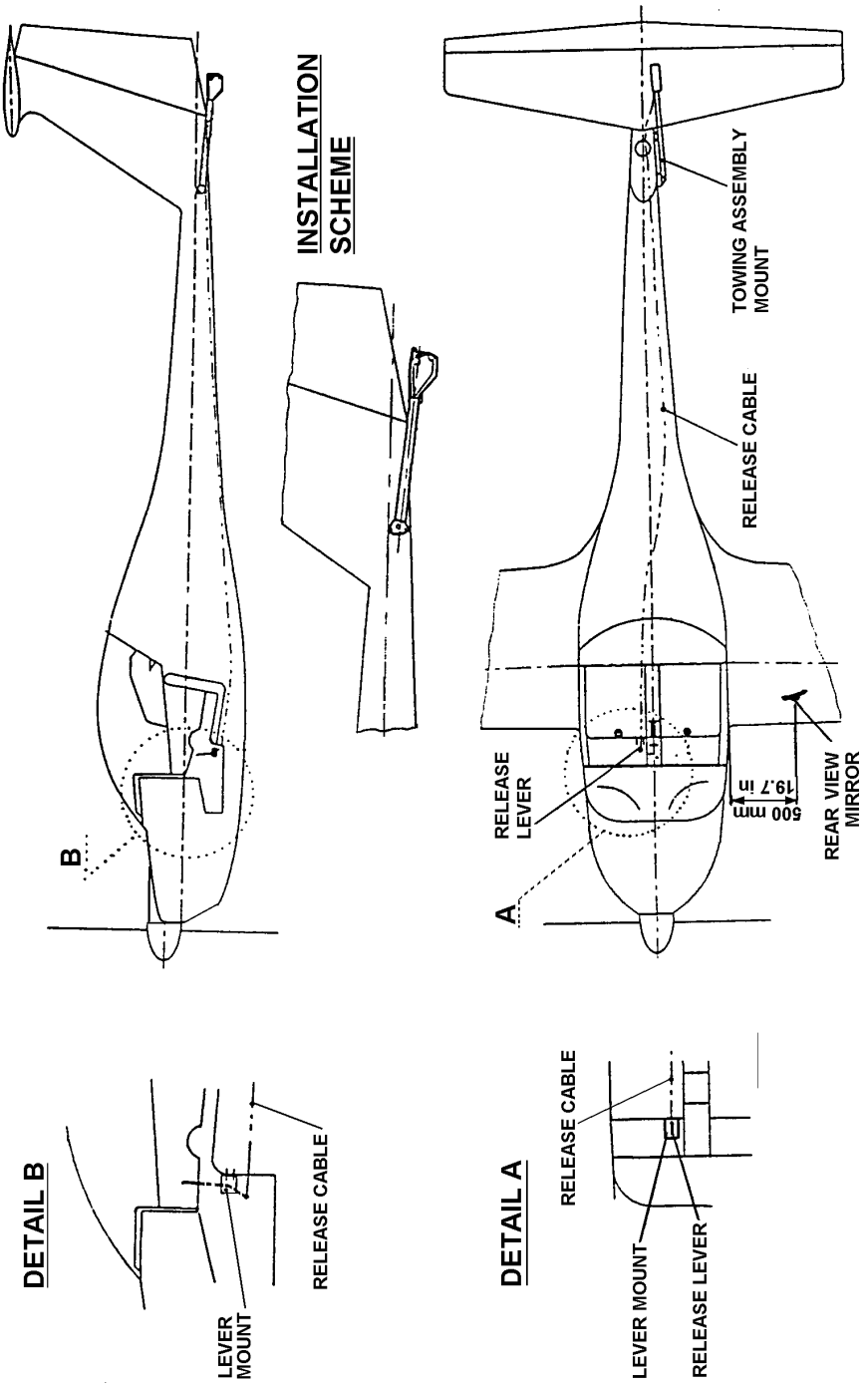
Sailplane In this Supplement, this term is used to denote the towed sailplane or the towed powered sailplane.

1.6 DESCRIPTIVE DATA

The towing device E 85, manufactured by Tost, is attached to the fuselage tube by means of a steel fitting specially designed for the HK 36 TC. The tow-rope is released through a cable mechanism connected to a release lever in the cockpit.

For tow-plane operation, an additional rear view mirror must be attached to the left wing using two camlocs (see Section 1.7, TWO-VIEW DRAWING).

1.7 TWO-VIEW DRAWING



2. OPERATING LIMITATIONS

2.2 AIRSPEED

NOTE

All airspeeds given in this Supplement are to be understood as indicated airspeeds (IAS).

The maximum permissible speed for sailplane or banner towing is 135 km/h (73 kts / 84 mph) or the maximum permissible towing speed of the towed sailplane or banner, whichever is the lowest.

The minimum permissible speed for the combination is 90 km/h (49 kts / 56 mph) or 1.2 times v_{S1} of the towed sailplane, whichever is the greatest.

The minimum permissible speed for banner towing is 90 km/h (49 kts / 56 mph).

Only sailplanes with a design aerotow speed (v_T) of at least 105 km/h (57 kts / 65 mph) may be towed.

2.6 MASS (WEIGHT)

2.6.1 AEROTOWING

The flight mass of the towed sailplane must not exceed 600 kg (1323 lb).

The maximum take-off mass of the tow-plane is 720 kg (1587 lb).

2.10 FLIGHT CREW

When used as a tow-plane, the HK 36 TC must be flown by a solo-pilot. For instruction purposes, dual flight is permissible, provided that the take-off mass of the tow-plane does not exceed 770 kg (1698 lb) and the flight mass of the sailplane to be towed does not exceed 380 kg (838 lb).

2.12 MINIMUM EQUIPMENT LIST

(a) Additional equipment for tow-plane operation

1 Tost towing device E 85

1 Fitting, Dwg. No. 820-2550-00-00, Sheet 2

1 Release mechanism

1 Caution light (amber) for the tow-rope, if required by national regulations

NOTE

The following equipment is not taken into account for CG determination, is however required for the respective kind of operation:

Sailplane towing:

1 Tow-rope[1)], 30 to 55 m (100 to 180 ft) long
1 Pair of connection rings complying with LN 65091
1 Breaking piece on tow-plane: ultimate load 300 daN (674 lbf), green
1 Rear view mirror

if required by national regulations or by the sailplane manufacturer:

1 Breaking piece on the sailplane, see applicable regulations for required ultimate load

Banner towing:

1 Catch rope, approximately 35 m (115 ft) long
1 Catch hook with turned back ends (Holland Aviation, Part No. 1607)
1 Pair of connection rings complying with LN 65091
1 Rear view mirror
1 Breaking piece on tow-plane: ultimate load 300 daN (674 lbf), green
1 Suitable pick-up mounting on the ground

NOTE

The applicable national requirements for use, approval and suitability of the banner must be observed.

CAUTION

The pilot must ensure that the correct breaking piece (see above) is installed in the tow-rope, as the structure may otherwise become overstressed.

[1)] Translated extract of the applicable airworthiness requirement (see Section 1.2 of this Supplement No. 1):

2.8 Tow-Rope and Breaking Piece

Only plastic ropes may be used, e.g., polyamide, polyester, polypropylene, etc. in accordance with aeronautical standards, DIN standards or factory specifications, provided that these standards (specifications) contain sufficient data and ensure delivery with continuous quality. The rope connections should be suitably covered to provide wear protection.

[...] At the permissible load on the rope, the strain of the rope should not exceed 30 %.

[...] The owner/operator of the tow-plane is responsible for the selection, use, and maintenance of the tow-rope.

2.15 OTHER LIMITATIONS

2.15.1 SAILPLANE TOWING

* Towing of sailplanes and powered sailplanes is permitted, as long as these are approved for aerotowing.

* The towing of more than one sailplane at a time is not permitted.

* A towing device approved for aerotow launching must be used on the sailplane.

During test flights, the most common sailplane models (light single-seater, single-seater with and without water ballast, dual-seater up to 500 kg / 1102 lbs, sailplanes of open class up to 600 kg / 1323 lbs) were towed without restrictions on the operating limitations. However, the pilot must verify in each case whether the sailplane can be towed without exceeding the operating limitations of the tow-plane or the sailplane.

2.15.2 BANNER TOWING

* For banner towing the drag of the banner is the relevant item. The drag of the banner must not exceed 70 daN (157 lbf) at an airspeed of 135 km/h (73 kts / 84 mph). Should no drag data be available, the banner must be tested in accordance with a test program agreed upon with the competent authority.

NOTE

Low-drag banners with areas up to 40 m² (430 sq. ft.) have been tested.

* Take-off with a banner is not approved.

3. EMERGENCY PROCEDURES

3.7 ENGINE FAILURE

* In case of engine failure during tow-flight, release tow-rope or advise sailplane pilot (via radio or by giving signs) to release.

* Proceed according to the Emergency Procedures in the main part of the Flight Manual.

3.9 OTHER EMERGENCIES

3.9.1 ABNORMAL POSITION OF TOWED SAILPLANE

* If maneuverability is no longer ensured, due to an abnormal position of the towed sailplane, the tow-rope must be released immediately.

* If the towed 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 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).

3.10 FAILURE OF THE RELEASE MECHANISM ON THE SAILPLANE

Landing of the complete combination is possible with the air brakes of the sailplane fully extended and the rate of descent being controlled via the power setting of the tow-plane.

WARNING

During towing, the air brakes of the tow-plane must not be extended.

3.11 BANNER CAUGHT ON LANDING GEAR OR BANNER CANNOT BE DROPPED

* If possible, communicate with ground personnel to ascertain where the banner is caught on the powered sailplane.

* Land with increased approach speed on an asphalt or concrete runway.

CAUTION

Be prepared to counteract if the powered sailplane swings!

4. NORMAL PROCEDURES

4.3 DAILY INSPECTION

* Check towing device and release mechanism for excessive dirt and improper operation (perform release test).

* If installed, check tow-rope caution light for improper operation.

* Check tow-rope, connection rings and breaking piece for excessive wear, damage and improper arrangement.

* Check rear view mirror for insecure attachment.

* Check removable release lever for towing device is properly mounted and secured (if installed).

4.5 NORMAL PROCEDURES AND RECOMMENDED SPEEDS

4.5.2 TAKE-OFF AND CLIMB

(a) Sailplane Towing

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 normal flying speed during towing is 105 km/h (57 kts / 65 mph). If, due to the construction of the sailplane, a lower flying speed is necessary, the flying speed may be reduced down to the minimum permissible speed for sailplane towing. When towing a sailplane with a high wing loading and/or when turbulence is encountered, towing speeds up to 120 km/h (65 kts / 75 mph) are recommended.

CAUTION

At towing speeds below 105 km/h (57 kts / 65 mph), special attention must be paid to the engine temperatures.

(b) Banner towing

After pick-up of the banner, climb to a safe height with at least 90 km/h (49 kts / 56 mph).

When a safe height has been reached, switch the electric fuel pump OFF.

4.5.3 FLIGHT

During cruise, select power setting as required.

CAUTION

Monitor the engine temperatures!

4.5.5 APPROACH AND LANDING

* Prior to landing, drop tow-rope or banner.
* Verify successful release (check amber caution light, if installed).
* Proceed according to the Normal Procedures in the main part of the Flight Manual.

Landing with the tow-rope attached is only possible if an approach sector totally clear of obstacles is available and only at an increased approach speed.

Landing with the banner attached is not approved.

4.5.12 PICK-UP OF THE BANNER

CAUTION

Over an appropriate distance in front of and behind the pick-up mounting, the ground must be examined for holes, wires, expansion joints, tufts of grass or other obstacles that the hook could get caught on. Unless otherwise stated by the banner manufacturer, the banner is placed on the ground, opposite to the direction of approach, on the departure side of the pick-up mounting. The banner is picked up in flight. Take-off is performed with the catch-rope attached and pulled behind the tow-plane. A suitable catch hook must be used (with turned back ends, see Section 2.12 MINIMUM EQUIPMENT LIST) to avoid getting caught on the ground.

The approach to the banner pick-up mounting must be sufficiently high and free of obstacles to prevent the hook from getting caught. Any risk for persons or property must be avoided.

The height above the pick-up mounting must be chosen such that the catch hook does not touch the ground. This requires practice. It is advisable to have a marshaller standing in a safe distance to the pick-up mounting.

CAUTION

Do not approach too low!

The conditions for banner pick-up are:

Electric fuel pump	ON
Cowl flap	OPEN
Propeller speed control	TAKE-OFF
Approach speed	min. 100 km/h (54 kts / 62 mph) max. 135 km/h (73 kts / 84 mph)
Throttle control	as required; after picking up the banner: FULL THROTTLE

4.5.13 INSTALLATION AND REMOVAL OF RELEASE LEVER FOR TOWING DEVICE

(a) Installation of the Release Lever for the Towing Device (if installed)

- The handle of the release lever must be screwed into the lever tap in the release lever mechanism. The release lever must be secured using the Fokker Needle.

(b) Removal of the Release Lever for the Towing Device (if installed)

- The Fokker Needle must be removed from the release lever. The release lever is unscrewed from the lever tap in the release lever mechanism and should be stored with the Fokker Needle.

5. PERFORMANCE

5.2 EASA-APPROVED DATA

5.2.3 TAKE-OFF PERFORMANCE

The following data does not include any safety reserve. It was determined under the following conditions:

- Take-off mass of tow-plane 720 kg (1587 lb)
- Take-off mass and lift-to-drag ratio of towed sailplane as given in table
- Maximum take-off power
- Propeller setting: TAKE-OFF
- Level runway, short and dry grass
- No crosswind component
- Constant headwind component
- Lift-off speed: approximately 90 km/h (49 kts., 56 mph)
- Climb speed: approximately 97 km/h (52 kts., 66 mph)

CAUTION

The minimum permissible speed for the combination is 97 km/h (52 kts. / 60 mph) or 1.2 times v_{S1} of the towed sailplane, whichever is the greatest.

CAUTION

For a safe take-off, the available length of the runway must at least be equal to the take-off distance over a 15 m (50 ft.) obstacle (s_2), in order to provide a safety reserve for emergencies (rupture of tow rope, etc.).

CAUTION

If the sailplane has a suitable mass but a lower lift-to-drag ratio than that given in the table, the next higher table must be used for the determination of the take-off distance. Example: For a sailplane with 400 kg (882 lb) but a lift-to-drag ratio of 35 the table „above 430 kg (948 lb) up to 500 kg (1102 lb) and lift-to-drag ratio min 25" must be used. For sailplanes in the range above 430 kg (948 lb) up to 500 kg (1102 lb) with a lift-to-drag ratio of less than 25, and in the range above 500 kg (1102 lb) up to 600 kg (1323 lb) with a lift-to-drag ratio of less than 58, no data is available.

WARNING

Under unfavorable conditions such as long grass, soft or uneven ground, crosswinds or gusting winds, or wet or dirty wings, especially on the sailplane, the take-off distance can become considerably extended. Under very unfavorable conditions, a safe take-off can become impossible.

5.2.3.1 Take-off distance for sailplane towing

The take-off distances for the towing combination are contained in the following tables, where

s_1 = Take-off roll, and

s_2 = Take-off distance to clear a 15 m (50 ft.) obstacle.

Take-off distance sailplane towing Sailplane up to 300 kg (661 lb), lift-to-drag ratio minimum 25									
Head-wind comp. [kts.]	OAT [°C]	Pressure altitude above MSL [m] / QFE [hPa]							
		0 / 1013		400 / 966		800 / 921		1200 / 877	
		s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]
0	0	237	391	272	441	314	502	366	574
	15	276	447	319	508	370	580	435	667
	30	322	511	373	585	436	671	515	778
5	0	191	330	221	374	257	426	300	489
	15	224	379	261	431	304	495	359	572
	30	262	435	307	499	360	574	429	668

Head-wind comp. [kts.]	OAT [° F]	Pressure altitude above MSL [ft.] / QFE [inHg]							
		0 / 29.9		1310 / 28.5		2620 / 27.2		3940 / 25.9	
		s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]
0	32	776	1282	890	1445	1030	1645	1199	1881
	59	904	1466	1045	1666	1213	1902	1425	2189
	86	1054	1676	1223	1917	1431	2201	1687	2551
5	32	625	1081	725	1226	841	1398	984	1603
	59	734	1241	854	1412	997	1622	1176	1876
	86	859	1427	1006	1637	1181	1882	1407	2190

Take-off distance sailplane towing Sailplane above 300 kg (661 lb) up to 430 kg (948 lb), lift-to-drag ratio minimum 38									
Head-wind comp. [kts.]	OAT [°C]	Pressure altitude above MSL [m] / QFE [hPa]							
		0 / 1013		400 / 966		800 / 921		1200 / 877	
		s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]
0	0	279	504	322	572	374	651	435	746
	15	327	579	379	659	441	756	520	873
	30	381	665	445	761	523	877	621	1021
5	0	225	429	261	488	304	557	357	641
	15	264	494	309	565	362	649	429	751
	30	311	568	364	653	430	755	513	882

Head-wind comp. [kts.]	OAT [° F]	Pressure altitude above MSL [ft.] / QFE [inHg]							
		0 / 29.9		1310 / 28.5		2620 / 27.2		3940 / 25.9	
		s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]
0	32	914	1654	1055	1875	1226	2134	1427	2445
	59	1071	1898	1242	2161	1447	2479	1705	2864
	86	1250	2181	1460	2494	1714	2875	2035	3350
5	32	736	1407	854	1599	996	1827	1171	2101
	59	869	1621	1011	1854	1186	2128	1405	2461
	86	1019	1867	1194	2142	1410	2477	1681	2891

Take-off distance sailplane towing Sailplane above 430 kg (948 lb) up to 500 kg (1102 lb), lift-to-drag ratio minimum 25									
Head-wind comp. [kts.]	OAT [°C]	Pressure altitude above MSL [m] / QFE [hPa]							
		0 / 1013		400 / 966		800 / 921		1200 / 877	
		s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]
0	0	320	517	374	590	439	682	520	792
	15	379	600	446	691	528	802	634	941
	30	450	696	531	808	636	946	774	1123
5	0	259	434	303	498	358	577	427	673
	15	308	507	363	585	433	682	523	803
	30	366	588	437	686	525	807	641	960

Head-wind comp. [kts.]	OAT [° F]	Pressure altitude above MSL [ft.] / QFE [inHg]							
		0 / 29.9		1310 / 28.5		2620 / 27.2		3940 / 25.9	
		s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]
0	32	1049	1694	1225	1935	1439	2236	1706	2598
	59	1243	1969	1461	2264	1731	2631	2078	3088
	86	1476	2281	1742	2648	2086	3101	2537	3683
5	32	847	1424	993	1634	1174	1891	1401	2207
	59	1010	1662	1191	1918	1421	2238	1713	2632
	86	1201	1929	1431	2249	1721	2645	2103	3147

Take-off distance sailplane towing Sailplane above 500 kg (1102 lb) up to 600 kg (1323 lb), lift-to-drag ratio min. 58									
Head-wind comp. [kts.]	OAT [°C]	Pressure altitude above MSL [m] / QFE [hPa]							
		0 / 1013		400 / 966		800 / 921		1200 / 877	
		s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]
0	0	323	518	373	589	434	672	509	774
	15	379	596	440	681	517	782	611	907
	30	443	686	520	787	615	911	734	1066
5	0	258	433	300	494	351	565	413	652
	15	305	502	355	573	419	660	498	767
	30	358	578	422	665	500	771	601	904

Head-wind comp. [kts.]	OAT [° F]	Pressure altitude above MSL [ft.] / QFE [inHg]							
		0 / 29.9		1310 / 28.5		2620 / 27.2		3940 / 25.9	
		s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]
0	32	1058	1698	1222	1932	1424	2202	1670	2540
	59	1243	1955	1444	2233	1694	2564	2004	2974
	86	1454	2249	1704	2581	2015	2986	2406	3496
5	32	844	1421	982	1620	1149	1853	1355	2139
	59	999	1646	1165	1880	1374	2164	1633	2516
	86	1174	1895	1384	2180	1640	2528	1970	2964

5.2.3.2 Take-off distance for instruction purposes

The following data does not include any safety reserve. It was determined under the following changed conditions:

- Take-off mass of tow-plane 770 kg (1698 lb)
- Take-off mass of towed sailplane max. 380 kg (838 lb)
- Lift-to-drag ratio of the towed sailplane min. 38

The take-off distances for the towing combination are contained in the following tables, where

s_1 = Take-off roll, and

s_2 = Take-off distance to clear a 15 m (50 ft.) obstacle.

Take-off distance sailplane towing - Instruction Flight
Sailplane max. 380 kg (837 lb), lift-to-drag ratio min. 38

Head-wind comp. [kts.]	OAT [°C]	Pressure altitude above MSL [m] / QFE [hPa]							
		0 / 1013		400 / 966		800 / 921		1200 / 877	
		s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]
0	0	277	449	319	510	370	581	434	669
	15	325	517	377	590	440	675	518	781
	30	379	593	443	679	521	784	620	916
5	0	223	378	259	430	302	492	355	567
	15	262	436	306	500	359	574	426	666
	30	309	502	362	578	429	669	512	781

Head-wind comp. [kts.]	OAT [°F]	Pressure altitude above MSL [ft.] / QFE [inHg]							
		0 / 29.9		1310 / 28.5		2620 / 27.2		3940 / 25.9	
		s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]
0	32	908	1472	1044	1672	1214	1904	1424	2192
	59	1065	1695	1234	1936	1443	2214	1700	2562
	86	1242	1944	1452	2228	1709	2572	2033	3003
5	32	731	1239	848	1411	989	1613	1163	1860
	59	859	1428	1004	1639	1178	1881	1396	2185
	86	1012	1647	1186	1895	1405	2195	1679	2563

5.3 ADDITIONAL INFORMATION

5.3.5 CLIMB PERFORMANCE

When towing a sailplane with a mass of 370 kg (816 lb), the maximum rate of climb is 2.3 meters per second (450 fpm) at sea level in Standard Atmosphere conditions.

When towing a sailplane with a mass of 600 kg (1323 lb), the maximum rate of climb is 2.1 meters per second (410 fpm) at sea level in Standard Atmosphere conditions.

The maximum rate of climb with a banner in accordance with 2.15.2 is 3.05 m/s (600 fpm) at 105 km/h (57 kts / 65 mph) at sea level in Standard Atmosphere conditions.

5.3.7 FUEL CONSUMPTION, CRUISING SPEED, ENDURANCE, RANGE

The fuel consumption and endurance data given in the main part of the Flight Manual remains valid. Cruising speed and range are significantly lower, depending on the type of the sailplane or the size of the banner.

6. MASS (WEIGHT) AND BALANCE

6.1 INTRODUCTION

For the operation of the HK 36 TC as a tow-plane, the permissible empty mass CG range and the permissible CG range during flight remain unchanged. The loading restrictions under 2.6 MASS (WEIGHT) and 2.10 FLIGHT CREW of this Supplement No. 1 must be complied with.

7. POWERED SAILPLANE AND SYSTEMS DESCRIPTION

7.8 COCKPIT

The release lever for the towing device is yellow and is located to the right of the throttle quadrant. It should have a dead travel of approximately 10 millimeters (0.4 inches). By pulling on the lever, the rope is released.

A caution light (if required) is installed in the instrument panel. It illuminates as long as the tow-rope is being held by the towing device.

7.14 PLACARDS / INSCRIPTIONS

The following additional placards are installed for tow-plane operation of the HK 36 TC:

Placard	Place	Remark
Tow-Rope	next to the caution light for the tow-rope	only if caution light is required
Tow-Rope Release	on the release lever	
Ultimate load of breaking piece: 300 daN (674 lbs.)	on the towing assembly mount	

8. POWERED SAILPLANE HANDLING, CARE AND MAINTENANCE

8.2 POWERED SAILPLANE INSPECTION PERIODS

8.2.1 INSPECTION PERIODS FOR THE TOWING DEVICE

At each 100 hour inspection of the powered sailplane, the system must be cleaned, lubricated, and checked for poor condition and improper operation.

The towing device must be removed from the powered sailplane and sent to the manufacturer for overhaul -

* if defects are found during the 100 hour inspection, or
* after 2000 tows,

whichever comes first.