Diamond AIRCRAFT

SUPPLEMENT NO. 1 TO THE AIRPLANE FLIGHT MANUAL FOR THE POWERED SAILPLANE HK 36 TTS

TOW-PLANE OPERATION

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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

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SECTION 1
GENERAL

1.1 INTRODUCTION

Pages 9-1-1 through 9-1-28 constitute Supplement No. 1 of the Airplane Flight Manual for the Powered Sailplane HK 36 TTS and are valid only for the operation of the Powered Sailplane as a tow-plane.

1.2 CERTIFICATION BASIS

Tow-plane operation of this airplane has been approved in within the framework of Austrian type certification requirements in agreement with national operational requirements, CRI - O1, “Use as a Tow-Plane for Sailplane Towing and Banner Towing”.

1.4 EXPLANATIONS

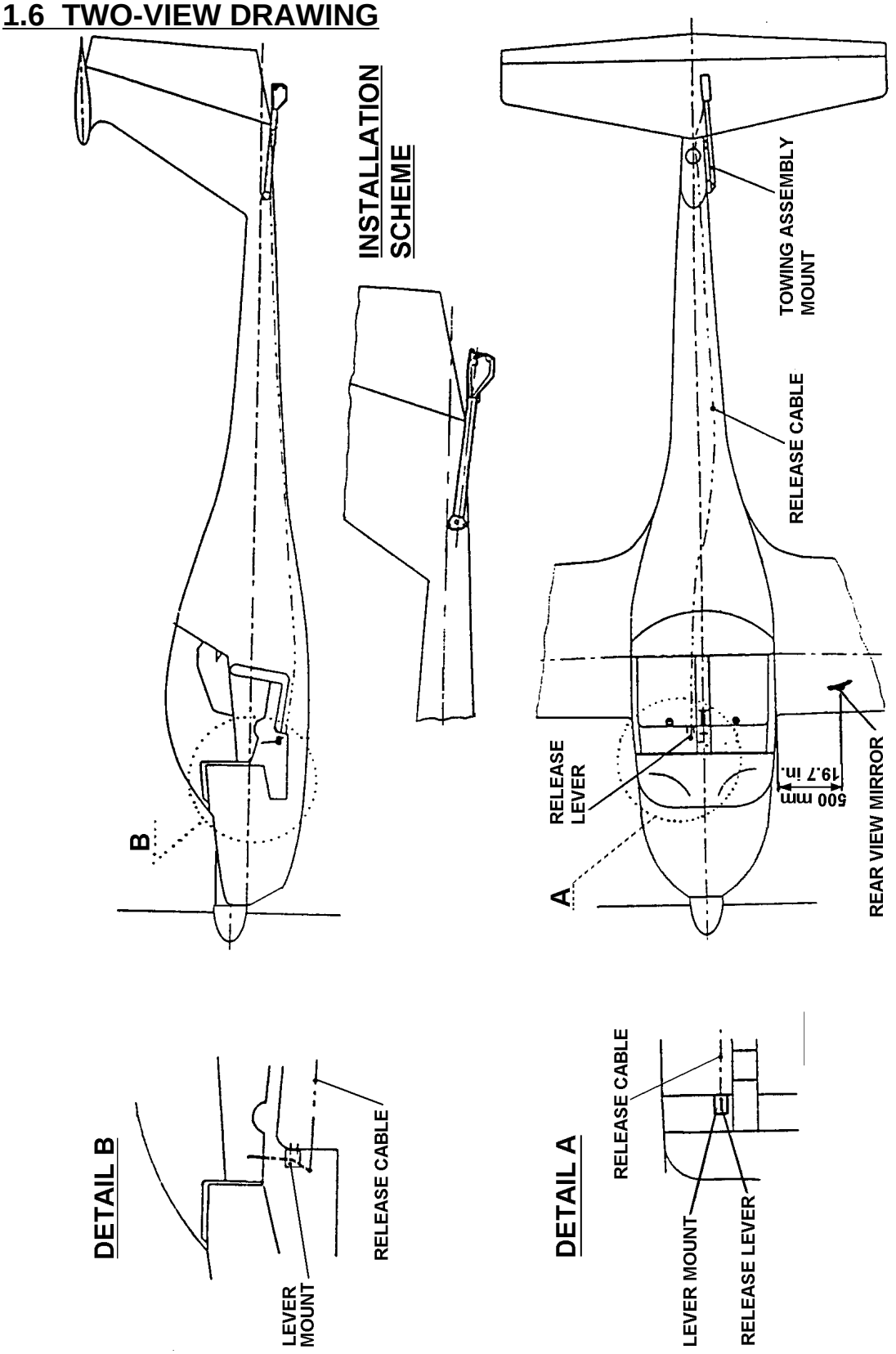
Sailplane — In this Supplement, this term is used to denote the towed sailplane or the towed powered sailplane

1.5 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 TTS. 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 Paragraph 1.6, TWO VIEW DRAWING).

1.6 TWO-VIEW DRAWING



SECTION 2
LIMITATIONS

2.2 AIRSPEED

NOTE

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

(a) Sailplane Towing

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

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.

Only sailplanes with a design aerotow speed (v_T) of at least 110 km/h (59 kts. / 68 mph).

(b) Banner Towing

The maximum permissible speed for banner towing is 135 km/h (73 kts / 84 mph).

The minimum permissible speed for banner towing is 97 km/h (52 kts / 60 mph).

2.6 MASS (WEIGHT)

For sailplane towing, the flight mass (weight) of the sailplane to be towed must not exceed 750 kg (1653 lbs.).

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

2.10 FLIGHT CREW

When used as a tow-plane, the HK 36 TTS must be flown by a solo-pilot.

For instruction purposes, dual flight is permissible, provided that the take-off mass (weight) of the tow-plane does not exceed 770 kg (1698 lbs.) and the flight mass of the sailplane to be towed does not exceed 380 kg (838 lbs.).

2.14 OTHER LIMITATIONS

(a) 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 600 kg / 1323 lbs, sailplanes of open class up to 750 kg / 1653 lbs) were towed without restrictions 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.

(b) 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 lbs.) 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 m^2 (430 sq.ft.) have been tested.

* Take-off with banner is not approved.

SECTION 3
EMERGENCY PROCEDURES

3.7 ENGINE FAILURE

1. Release tow-rope or advise sailplane pilot (via radio or by giving signs) to release.
2. Proceed according to the Emergency Procedures in the main part of the Airplane Flight Manual for the Powered Sailplane HK 36 TTS.

3.9 OTHER EMERGENCIES

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

CAUTION

Be prepared to counteract if the airplane swings!

SECTION 4
NORMAL PROCEDURES

4.3 DAILY INSPECTION

1. Check towing device and release mechanism for excessive dirt and improper operation (perform release test).
2. If installed, check tow rope caution light for improper operation.
3. Check tow rope, connection rings and breaking piece for excessive wear, damage and improper arrangement.
4. Check rear view mirror for insecure attachment.
5. 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 115 km/h (62 kts. / 71 mph). If, due to the construction of the sailplane, a low flight speed is necessary, the flying speed may be reduced down to the minimum speed for 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 115 km/h (62 kts. / 71 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 97 km/h (52 kts / 60 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 Airplane 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 6.9 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. 110 km/h (59 kts / 68 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.

SECTION 5

PERFORMANCE

5.2 ACG-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 towing plane 720 kg (1587 lbs)
- 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 climb speeds above 97 km/h (52 kts., 66 mph), the take-off distance (s_2) increases by up to 220 meters for each speed increment of 10 km/h (1337 ft for each 10 kts., 1162 ft for each 10 mph).

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 lbs.) but a lift-to-drag ratio of 35 the table „above 450 kg (992 lbs.) up to 600 kg (1323 lbs.) and lift-to-drag ratio min 25" must be used. For sailplanes in the range above 450 kg (992 lbs.) up to 600 kg (1323 lbs.) with a lift-to-drag ratio of less than 25, and in the range above 600 kg (1323 lbs.) up to 750 kg (1653 lbs.) 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 lbs.), 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	197	363	219	395	242	433	271	475
	15	226	410	251	448	280	492	313	540
	30	259	463	288	507	326	564	371	632
5	0	158	309	177	338	198	370	222	408
	15	183	350	204	383	229	421	258	465
	30	211	397	236	436	269	486	306	547

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	647	1191	719	1296	794	1421	890	1559
	59	742	1346	824	1470	919	1615	1027	1772
	86	850	1520	945	1664	1070	1851	1218	2074
5	32	519	1014	581	1109	650	1214	729	1339
	59	601	1149	670	1257	752	1382	847	1526
	86	693	1303	775	1431	883	1595	1004	1795

Take-off distance sailplane towing

Sailplane above 300 kg (661 lbs.) up to 450 kg (992 lbs.), 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	240	439	267	479	297	524	331	576
	15	277	497	307	543	342	595	383	655
	30	316	559	352	613	398	686	453	768
5	0	196	376	218	411	243	451	272	496
	15	226	426	252	466	282	513	316	567
	30	260	482	291	529	330	593	377	666

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	788	1441	876	1572	975	1720	1086	1890
	59	909	1631	1008	1782	1123	1953	1257	2149
	86	1037	1834	1155	2012	1306	2251	1487	2520
5	32	644	1234	716	1349	798	1480	893	1628
	59	742	1398	827	1529	926	1684	1037	1861
	86	854	1582	955	1736	1083	1946	1237	2186

Take-off distance sailplane towing

Sailplane above 450 kg (992 lbs.) up to 600 kg (1323 lbs.), lift-to-drag ratio min. 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	289	525	324	577	364	635	410	703
	15	337	598	378	660	426	730	482	811
	30	390	682	440	754	505	852	584	969
5	0	234	446	262	491	296	542	335	602
	15	273	510	307	565	348	625	396	696
	30	319	583	360	647	416	732	484	836

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	949	1723	1063	1894	1195	2084	1346	2307
	59	1106	1962	1241	2166	1398	2396	1582	2661
	86	1280	2238	1444	2474	1657	2796	1917	3180
5	32	768	1464	860	1611	972	1779	1100	1976
	59	896	1674	1008	1854	1142	2051	1300	2284
	86	1047	1913	1182	2123	1365	2402	1588	2743

Take-off distance sailplane towing

Sailplane above 600 kg (1323 lbs.) up to 750 kg (1653 lbs.), 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	291	530	324	579	361	636	403	698
	15	336	600	373	657	416	722	467	796
	30	385	678	428	743	486	830	555	933
5	0	233	450	261	494	292	543	327	597
	15	270	511	302	561	340	618	383	682
	30	312	579	350	637	399	713	458	804

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	955	1739	1063	1900	1185	2087	1323	2291
	59	1103	1969	1224	2156	1365	2369	1533	2612
	86	1264	2225	1405	2438	1595	2724	1821	3062
5	32	765	1477	857	1621	959	1782	1073	1959
	59	886	1677	991	1841	1116	2028	1257	2238
	86	1024	1900	1149	2090	1310	2340	1503	2638

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 towing plane 770 kg (1698 lbs.)
- Take-off mass of towed sailplane max. 380 kg (838 lbs.)
- Lift-to-drag ratio of the towed sailplane of 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

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	224	412	249	449	276	490	308	538
	15	258	464	286	507	319	557	357	612
	30	294	523	328	573	372	639	423	718
5	0	180	350	201	383	224	419	252	462
	15	209	397	234	435	261	477	293	527
	30	240	447	269	493	306	550	350	619

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	735	1352	817	1474	906	1608	1011	1766
	59	847	1523	939	1664	1047	1828	1172	2008
	86	965	1716	1077	1880	1221	2097	1388	2356
5	32	591	1149	660	1257	735	1375	827	1516
	59	686	1303	768	1428	857	1565	962	1730
	86	788	1467	883	1618	1004	1805	1149	2031

5.3 ADDITIONAL INFORMATION

5.3.5 CLIMB PERFORMANCE

When towing a sailplane with a mass of 600 kg (1323 lbs.), the maximum rate of climb is 2.3 meters per second (453 ft./min.) at sea level in Standard Atmosphere conditions.

When towing a sailplane with a mass of 750 kg (1653 lbs.), the maximum rate of climb is 2.1 meters per second (413 ft./min.) at sea level in Standard Atmosphere conditions.

The maximum rate of climb with a banner in accordance with 2.14.2 is 4.35 m/s (856 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 Airplane Flight Manual remains valid. Cruising speed and range are significantly lower, depending on the type of the sailplane or the size of the banner.

SECTION 6
MASS (WEIGHT) AND BALANCE / EQUIPMENT LIST

6.1 INTRODUCTION

For the operation of the HK 36 TTS 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 and 2.10 of this Supplement No. 1 must be observed.

6.9 EQUIPMENT LIST

Additional Equipment for Tow-Plane Operation:

1 Tost towing device E 85

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

1 Release mechanism

1 Caution light (amber), if required by national regulations.

NOTE

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

Sailplane Towing

1 Tow-rope[1)], 30 to 50 m (100 to 165 ft.) long
1 Pair of connection rings complying with LN 65091
1 Breaking piece on tow plane: ultimate load 400 daN (899 lbs.), yellow
1 Rear view mirror
1 Breaking piece on tow plane, if required by national regulations or by sailplane manufacturer; see national 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, or equivalent).
1 Pair of connection rings complying with LN 65091
1 Rear view mirror
1 Breaking Piece on tow plane: Ultimate load 400 daN (899lbs.), yellow
1 Suitable Pick-up mounting on the ground

NOTE

The applicable national requirements for operation, 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.

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1) *Translated extract of the applicable airworthiness requirements (see Paragraph 1.2 of this Supplement No. 1):*

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.

SECTION 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 is installed (if required) in the instrument panel, which illuminates as long as the tow-rope is held by the towing device.

7.14 PLACARDS / INSCRIPTIONS

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

Next to the caution light for the tow-rope (if required):	Tow-Rope
On the release lever:	Tow-Rope Release
On the towing assembly mount:	Ultimate load of breaking point: 400 daN (899 lbs.)

SECTION 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, the system must be cleaned, lubricated, and checked for poor condition and improper operation.

If damage is detected during the 100 hour inspection, the towing device must be removed from the airplane and sent to the manufacturer for overhaul.

Regardless of any damage, the towing device must be overhauled after 2000 tows.