SKY BALLOONS

HOT AIR BALOON

FLIGHT MANUAL

FOR USE WITH ALL SKY HOT AIR BALLOONS

Statement of Initial Approval

This Flight Manual is approved by the United Kingdom Civil Aviation Authority

Signed ..... Date 15th SEPT 1999

For and on behalf of the Civil Aviation Authority

NOTE: The above approval does not apply to revisions or amendments made after the date of initial approval or by other Organisations. The approval of revisions or amendments will be recorded on separate Amendment Records pages.

This approval applies to all pages in sections 1, 2 and 3 of this manual. Appendices are for information only and are not CAA approved.

Document number SKYFM Issue 1

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CAA Approval No. DAI/9494/95

SKY BALLOONS MUST BE OPERATED IN ACCORDANCE WITH THE LIMITATIONS GIVEN IN SECTION (1) OF THIS MANUAL.

SKY BALLOONS

This manual has been issued for the following balloon:

Registration: _____

Serial number: _____

Volume: _____

Type: _____

Build Standard: _____

I hereby certify that this Flight Manual, incorporating the amendments listed on page iii, and issued for the above Balloon, conforms to the listed Build Standard, and that the listed Build Standard is correct and current at the time of issue of the Certificate of Airworthiness.

Signed:_____Name:_____Date:_____/_____/_____

For Sky Balloons, CAA Approval Number DAI/9494/95

Certification Basis

This manual, and the balloons described herein, are certified to the requirements of BCAR Part 31, issue 1, 31/8/84 and, for Transport Category operation, the additional requirements of Appendix 1 to CAA letter of 16/2/89. This manual provides operating information for Sky Balloons hot air balloons in the following categories:

Private Aerial Work Transport Category (Passenger)

Applicability

This manual is applicable to all Hot Air Balloons made by Sky Balloons.

Approval Statement

The Civil Aviation Authority of the United Kingdom shows approval of the Amendments listed below by stamp and signature in the right hand column.

Record of Amendments

No.	Date	Affected Pages	Approval
1	March 96	iii, v, 1.2.1, 1.2.5, 1.2.6, 1.3.1, 1.3.2, 2.1.3 now at issue 1.1.	23 April 1996
2	May 1996	iii, v, 1.2.1, 1.2.5a, 1.2.5b, 1.2.6a, 1.2.6b, 1.3.1, 1.3.2, now at issue 1.2.	2 July 1996
3	November 96	iii, v, vii, 1.3.1 now at issue 1.3 Pages 1.2.9, 1.2.10 removed.	29 January 97
4	April 97	Pages iii, vi, ix now at issue 1.4	1 May 97
5	June 97	iii, v, viii, 1.3.1, 1.3.2 2.4.1, now at issue 1.5 2.4.3, 2.4.4, 2.4.5 added	22 July 1997
6	April 98	iii, v, 1.3.2, 1..3.3 now at issue 1.6. Page 1.3.2a added.	29 April 1998
7	May 98	iii, v, vi, ix now at issue 1.7	27 July 1998

Record of Amendments (cont)

No.	Date	Affected pages	Approval
8	8/98	iii(a) added, v, vi, ix, 1.2.1 1.2.5(c), 1.2.6(c), 1.3.2(b) added	4th Nov 1998
9	6/99	Header, all pages + iii(a), iv, v, vi, ix, 1.2.1, 1.2.5c, 1.2.6c, 1.3.2b, 1.1.2, 2.6.1	15th SEPT 1999

MANUAL CONTROL

Issue number

Each page of this manual carries a two part issue number, eg 1.0. The first part of the number (1, in this example) refers to the status of the manual as a whole. The second part (0) refers to the amendment status of that particular page.

Page number

Each page in the core of the manual has a three part number, eg 1.2.4. The first part of the number (1) refers to the major section of the manual to which the page belongs. Likewise the second part of the number (2) refers to a sub part of that major section. The final part of the number (4) is the sequential page number within the sub part. The aim of this system is to allow continued logical page numbering when additions/deletions are made to the manual. Appendices page numbers are also in three parts, eg. A1.5. 'A' is for appendix, the first numeral (1) is the appendix number and the third numeral (5) is the page number within the appendix.

Amendment procedure

The introduction of new balloons or components, or modification action, may require the addition of extra pages and/or amendments to existing pages. The table of page iii records such action. As described above all new/amended pages will show the corresponding issue number. A marginal line, as shown here as an example, will indicate the words affected by the last recorded amendment.

Each manual issued carries a checklist of pages and the signatory of page ii will ensure that all listed pages are present at the correct issue/amendment level. This list will be found on page v, over.

Supplements

Information common to all balloons is included within this manual. Information that is required on only a limited number of balloons is provided in supplements. These are listed on page vi and, if applicable, will be added to the appropriate section at the end of this manual. Again the signatory of page ii will ensure this.

Change of ownership or Certificate of Airworthiness Category

Simply return copies of pages ii,v and vi to Sky Balloons and any pages requiring updating will be provided.

Checklist of pages

Page	Issue	Page	Issue	Page	Issue
i	1.9	2.1.1	1.9	A1.1	1.9
ii *	1.9	2.1.2	1.9	A1.2	1.9
iii	1.9	2.1.3	1.9	A1.3	1.9
iiia	1.9	2.1.4	1.9	A1.4	1.9
iv	1.9	2.2.1	1.9	A1.5	1.9
v	1.9	2.2.2	1.9	A2.1	1.9
vi	1.9	2.3.1	1.9		
vii	1.9	2.4.1	1.9		
viii	1.9	2.4.2	1.9		
ix	1.9	2.4.3	1.9		
1.1.1	1.9	2.4.4	1.9		
1.1.2	1.9	2.4.5	1.9		
1.1.3	1.9	2.5.1	1.9		
1.2.1	1.9	2.5.2	1.9		
1.2.2	1.9	2.5.3	1.9		
1.2.3	1.9	2.6.1	1.9		
1.2.4	1.9	2.6.2	1.9		
1.2.5a,b	1.9	2.6.3	1.9		
1.2.5c	1.9	3.1.1	1.9		
1.2.6a,b	1.9	3.2.1	1.9		
1.2.6c	1.9	3.2.2	1.9		
1.2.7	1.9*~	3.3.1	1.9		
1.2.8	1.9	3.3.2	1.9		
1.3.1	1.9	3.3.3	1.9		
1.3.2	1.9	3.3.4	1.9		
1.3.2a	1.9	3.4.1	1.9		
1.3.2b	1.9	3.4.2	1.9		
1.3.3	1.9				

Pages indicated * shall be completed by Sky Balloons before this manual is issued.
Page indicated ~ may also require weight data to be added by the owner/operator.

Checklist of supplements

Supplmnt number	Issue	Title	Tick if required
1	1	RAPID DEFLATION SYSTEM	
2/***		SPECIAL SHAPE (serial no. *** =)	
3	1	SUPER DEFLATION SYSTEM	
4	1	SKY HOPPER ONE MAN BALLOON	
5	1	QUAD BURNER	

CONTENTS

CONTENTS (cont.)

CONTENTS (cont.)

APPENDICES

SUPPLEMENTS (Only included if specific to the balloon for which this manual is issued)

1 - OPERATIONAL LIMITATIONS

The balloon must be operated in accordance with the limitations of this section.

1.1 - FLIGHT

1.1.1 - Weather

a) The maximum surface wind speed for take off and landing is 15Kts.

b) Flight in excessively thermic conditions or in the vicinity of cumulo nimbus clouds is not permitted.

c) Flight when there is gust activity causing more than 10Kts increase over mean wind speed is not permitted.

1.1.2 - Equipment

a) The balloon must not be flown if it has been subject to modifications not approved by the National Authority with which the balloon is registered.

b) The balloon must not be flown if there is any fabric damage above the lowest horizontal load tape (3-5 panels above the nomex base) larger than 25mm (1") in any direction. There must be no damage to load tapes, the basket suspension system or the burner and fuel system. There must be no damage to the basket large enough to permit a hand or foot to pass through.

c) Damage will be repaired in accordance with the maintenance manual and in accordance with the requirements of the appropriate National Airworthiness authority. All such repairs will be recorded in the balloon log-book.

d) If the 100 hour / annual inspection has not been performed the Certificate of Airworthiness will become invalid. A valid C of A is recommended and in some countries is mandatory.

e) The combination of equipment in use must be allowed by the build standard for the envelope in use (see later).

f) The minimum fuel requirement for take off is two full cylinders both capable of operating the pilot lights. Fuel is water free LPG, propane being preferred. Other LPG fuels may be used as long as the pressure, as registered by the burner gauges, is within the range 4 - 12 bar (= 60 - 180psi).

1.1.3 - Flight limitations

a) The maximum permitted rate of climb and descent for all Sky natural shape envelopes is 1000ft/min (5m/sec). At low flying weights (<60% maximum all up weight) a maximum rate of 700ft/min (3.5m/sec) is recommended.

b) The maximum continuous envelope temperature permitted is 120°C. Never exceed 127°C. In the absence of a temperature gauge this will be registered by the warning flag falling down.

c) The take off weight of the balloon shall not exceed the lesser of the maximum all up weight (as section 1.2.1) or that allowed by the load chart (as section 1.2.2).

d) The parachute valve shall not be held open, in flight, for more than 3 seconds. Repeat operation is however permitted.

e) The minimum crew is 1 (pilot only).

f) It is recommended that minumum take off weight is more than 50% of maximum all up weight.

g) The balloon must not be flown into power lines.

h) The parachute vent must be checked for correct functioning after hot inflation prior to each flight.

1.1.4 - Safety equipment

a) Protective gloves must be available to the pilot. Continuous use from initiation of inflation to landing is highly recommended.

b) A fire extinguisher must be carried.

c) In addition to any built in igniters, on the burner, a separate means of ignition will be carried. Care must be taken to ensure that this (or better, these) means are dry and serviceable.

1.1.5 - Additional Limitations for UK transport category operation

a) The maximum number of balloon occupants (including pilot) is 19.
b) There shall be no more than 6 occupants in any basket compartment.
c) The permitted balloon loading (as 1.1.3.c) must not be exceeded.
d) Each passenger shall have access to at least one hand-hold in the basket.
e) Transport category operation is restricted to free flight but the use of a pre-take off safety restraint is permitted.
f) An approved restraint harness for use by the pilot must be available.
g) At least one operational turn vent must be available to permit orientation of the basket for landing.
h) There shall be full redundancy in the burner and fuel system such that no single system failure can prevent continued safe operation.

1.1.6 - Tethered operation

a) Tethered flight for balloons certified in the transport category is not permitted.
b) Tethering is not permitted for balloons of special shape.
c) The weather maxima of 1.1.1 still apply.
d) The maximum operating weight for tethered operation is the lesser of the weight indicated by the load chart or 75% of the maximum all up weight.
e) The basket of a tethered balloon shall not exceed a height of 30m (100ft) above the ground.

1.2 - BALLOON LOADING

1.2.1 - Maximum all up weights

The maximum all up weights for Sky Balloons are set by the envelope structural design. Under no circumstances must the following weights be exceeded.

Balloon type	Volume	Maximum weight	Maximum weight	FAI class
	cu.ft	Kg	Lbs	
16 gore	25,000	250	551	AX4
24 gore	31,000	310	683	AX4
24 gore	42,000	420	926	AX5
24 gore	56,000	560	1235	AX6
16 gore	60,000	600	1323	AX7
24 gore	65,000	650	1433	AX7
16 gore	70,000	700	1543	AX7
24 gore	77,000	750	1653	AX7
16 gore	80,000	800	1764	AX8
24 gore	90,000	900	1984	AX8
24 gore	105,000	1050	2315	AX8
24 gore	120.000	1200	2646	AX9
24 gore	140,000	1330	2932	AX9
24 gore	160,000	1440	3175	AX10
24 gore	180,000	1620	3571	AX10
24 gore	200,000	1800	3968	AX10
24 gore	220,000	1980	4365	AX11
24 gore	240,000	2160	4762	AX11
24 gore	260.000	2340	5159	AX11
24 gore	280,000	2520	5556	AX11
24 gore	300,000	2700	5952	AX11
24 gore	317,000	2853	6290	AX11
28 gore	400,000	3600	7937	AX12
28 gore	500,000	4250	9370	AX13

1.2.2 - Payload Calculation

Whilst the absolute maximum weight of a balloon is set by its structural design under most circumstances the permitted weight will be limited by weather and flight plan parameters. This section will show how to calculate the permitted weight.

This manual is written in the international units of aviation. The following tables are thus given to assist users of other units.

Temperature		Temperature	
°C	°F	°F	°C
-40	-40	-40	-40
-35	-31	-30	-34
-30	-22	-20	-29
-25	-13	-10	-23
-20	-4	0	-18
-15	5	10	-12
-10	14	20	-7
-5	23	30	-1
0	32	40	4
5	41	50	10
10	50	60	16
15	59	70	21
20	68	80	27
25	77	90	32
30	86	100	38
35	95		

Altitude		Altitude	
ft	m	m	ft
0	0	0	0
1000	305	300	984
2000	610	600	1968
3000	914	900	2953
4000	1219	1200	3937
5000	1524	1500	4921
6000	1829	1800	5905
7000	2134	2100	6890
8000	2438	2400	7874
9000	2743	2700	8858
10000	3048	3000	9842
11000	3353	3300	10827
12000	3658	3600	11811
13000	3962	3900	12795
14000	4267	4200	13779
15000	4572	4500	14764
16000	4877	4800	15748
17000	5182	5100	16732
18000	5486	5400	17716

Load chart temperature = 100°C = 212°F

Maximum continuous temp. = 120°C = 248°F

Never exceed temp. = 127°C = 261°F

1.2.2 - Payload calculation (cont.)

There are many factors which affect the available gross lift of a balloon but the most important are ambient temperature and the intended flight maximum altitude. To make the calculations simple the properties of the atmosphere are assumed to follow a standard pattern known as the "International Standard Atmosphere" or, ISA. This will not always be perfectly accurate. In addition to any errors the use of ISA data may cause an allowance has to be made to increase the lift of the balloon beyond its actual weight to allow climbing and emergency action. For this reason the load chart, given on the next page, assumes an envelope temperature of 100°C, rather than the permitted maximum of 120°C.

To use the chart proceed as follows:

a) Establish the take off altitude and ambient temperature. If necessary use the tables of page 1.2.2 to convert this data to ft and °C.

b) Draw a vertical line from the ambient temperature scale to the take off altitude.

c) A horizontal line drawn from this point to the lift scale will give the lift of 1000cu.ft at the take off condition.

d) Having established the take off point draw a line parallel to the nearest ISA± curve to the altitude curve corresponding to the intended maximum flight altitude. Now draw a horizontal line to the lift scale to give the lift/1000cu.ft at altitude. Use the tables of pages 1.2.5 (Kg) or 1.2.6 (lbs) to convert the lift figures to gross lift for the balloon.

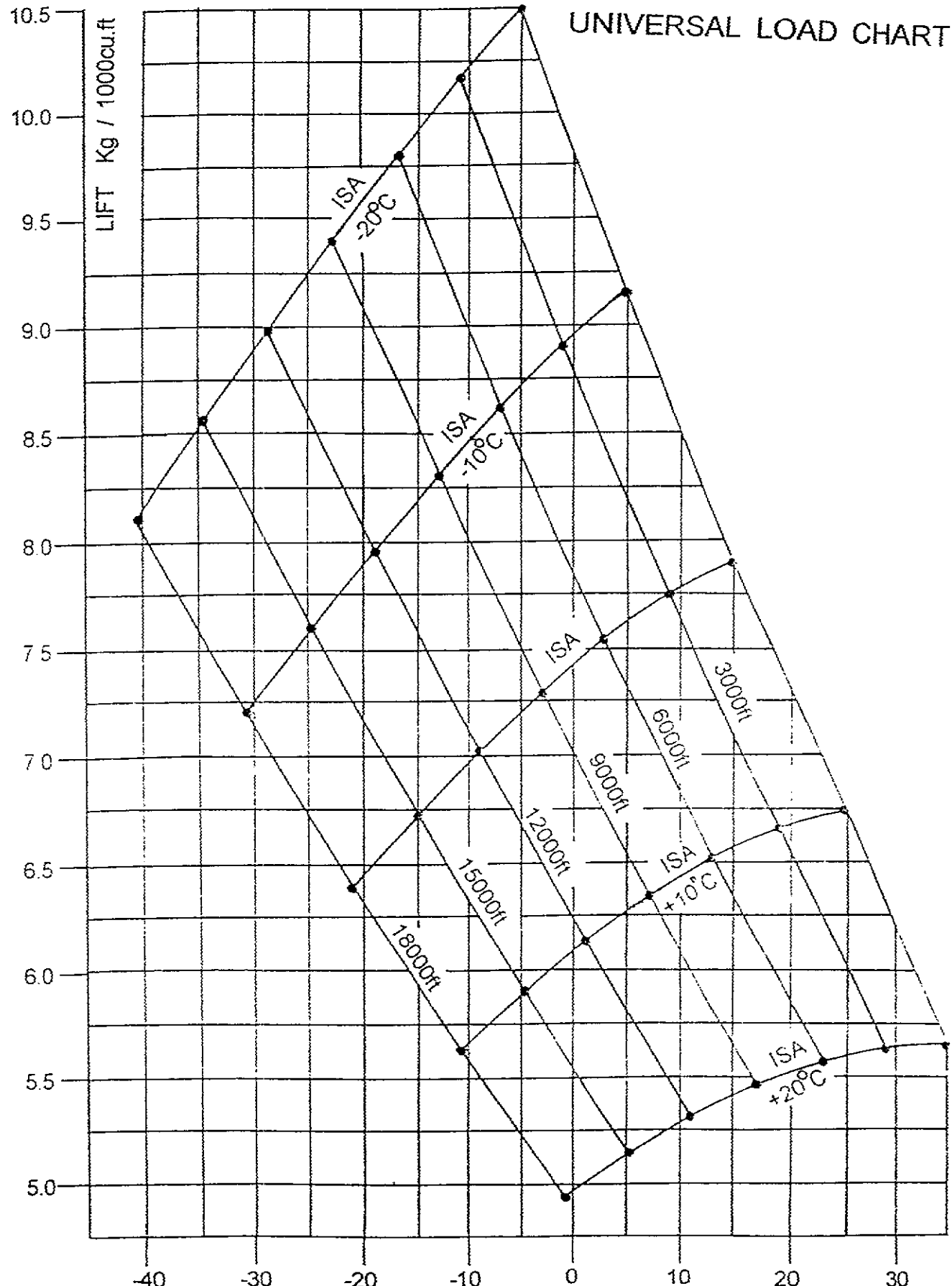
e) Allowing for the fuel used to reach altitude, establish the limiting lift condition.

Example

The take off altitude is 3000ft and the ambient temperature is 5°C. Using the load chart this gives a take off lift of 8.2Kg/1000cu.ft.

The intended flight is to 9000ft and following the ISA curve to the 9000ft altitude curve and then horizontally to the lift scale indicates a lift at altitude of 7.7Kg/ 1000cu.ft.

77 balloon lift at take off = 631Kg, at 9000ft = 593Kg.
Estimated fuel for climb = 30Kg thus take off weight = 593 + 30 = 623Kg. This is thus the limiting figure in this example.


UNIVERSAL LOAD CHART
LIFT Kg / 1000cu.ft
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
ISA -20°C
ISA -10°C
ISA
ISA +10°C
ISA +20°C
3000ft
6000ft
9000ft
12000ft
15000ft
18000ft
-40
-30
-20
-10
0
10
20
30
AMBIENT TEMP. °C

1.2.2 - Payload calculation (cont.) **BALLOON LIFT IN Kg**

	Balloon size(1000 cu.ft)								
Lift / 1000cu.ft	31	42	56	65	77	90	105	120	140
4.8	149	202	269	312	370	432	504	576	672
5.0	155	210	280	325	385	450	525	600	700
5.2	161	218	291	338	400	468	546	624	728
5.4	167	227	302	351	416	486	567	648	756
5.6	174	235	314	364	431	504	588	672	784
5.8	180	244	325	377	447	522	609	696	812
6.0	186	252	336	390	462	540	630	720	840
6.2	192	260	347	403	477	558	651	744	868
6.4	198	269	358	416	493	576	672	768	896
6.6	205	277	370	429	508	594	693	792	924
6.8	211	286	381	442	524	612	714	816	952
7.0	217	294	392	455	539	630	735	840	980
7.2	223	302	403	468	554	648	756	864	1008
7.4	229	311	414	481	570	666	777	888	1036
7.6	236	319	426	494	585	684	798	912	1064
7.8	242	328	437	507	601	702	819	936	1092
8.0	248	336	448	520	616	720	840	960	1120
8.2	254	344	459	533	631	738	861	984	1148
8.4	260	353	470	546	647	756	882	1008	1176
8.6	267	361	482	559	662	774	903	1032	1204
8.8	273	370	493	572	678	792	924	1056	1232
9.0	279	378	504	585	693	810	945	1080	1260
9.2	285	386	515	598	708	828	966	1104	1288
9.4	291	395	526	611	724	846	987	1128	1316
9.6	298	403	538	624	739	864	1008	1152	1330 Maximum
9.8	304	412	549	637	750	882	1029	1176	1330 Weight
10.0	310	420	560	650	750	900	1050	1200	1330
10.2	310	420	560	650	750	900	1050	1200	1330
10.4	310	420	560	650	750	900	1050	1200	1330

1.2.2 - Payload calculation (cont.) **BALLOON LIFT IN Kg**

Lift / 1000cu.ft	Balloon size (1000 cu.ft)									
	160	180	200	220	240	260	280	300	317	
4.8	768	864	960	1056	1152	1248	1344	1440	1522	
5.0	800	900	1000	1100	1200	1300	1400	1500	1585	
5.2	832	936	1040	1144	1248	1352	1456	1560	1648	
5.4	864	972	1080	1188	1296	1404	1512	1620	1712	
5.6	896	1008	1120	1232	1344	1456	1568	1680	1775	
5.8	928	1044	1160	1276	1392	1508	1624	1740	1839	
6.0	960	1080	1200	1320	1440	1560	1680	1800	1902	
6.2	992	1116	1240	1364	1488	1612	1736	1860	1965	
6.4	1024	1152	1280	1408	1536	1664	1792	1920	2029	
6.6	1056	1188	1320	1452	1584	1716	1848	1980	2092	
6.8	1088	1224	1360	1496	1632	1768	1904	2040	2155	
7.0	1120	1260	1400	1540	1680	1820	1960	2100	2219	
7.2	1152	1296	1440	1584	1728	1872	2016	2160	2282	
7.4	1184	1332	1480	1628	1776	1924	2072	2220	2346	
7.6	1216	1368	1520	1672	1824	1976	2128	2280	2409	
7.8	1248	1404	1560	1716	1872	2028	2184	2340	2473	
8.0	1280	1440	1600	1760	1920	2080	2240	2400	2536	
8.2	1312	1476	1640	1804	1968	2132	2296	2460	2599	
8.4	1344	1512	1680	1848	2016	2184	2352	2520	2663	
8.6	1376	1548	1720	1892	2064	2236	2408	2580	2726	
8.8	1408	1584	1760	1936	2112	2288	2464	2640	2790	
9.0	1440	1620	1800	1980	2160	2340	2520	2700	2853	Maximum
9.2	1440	1620	1800	1980	2160	2340	2520	2700	2853	Weight
9.4	1440	1620	1800	1980	2160	2340	2520	2700	2853	
9.6	1440	1620	1800	1980	2160	2340	2520	2700	2853	
9.8	1440	1620	1800	1980	2160	2340	2520	2700	2853	
10.0	1440	1620	1800	1980	2160	2340	2520	2700	2853	
10.2	1440	1620	1800	1980	2160	2340	2520	2700	2853	
10.4	1440	1620	1800	1980	2160	2340	2520	2700	2853	

1.2.2 - Payload calculation (cont.) **BALLOON LIFT IN Kg**

Lift / 1000cu.ft	Balloon size (1000cu.ft)					
	25	60	70	80	400	500
4.8	120	288	336	384	1920	2400
5.0	125	300	350	400	2000	2500
5.2	130	312	364	416	2080	2600
5.4	135	324	378	432	2160	2700
5.6	140	336	392	448	2240	2800
5.8	145	348	406	464	2320	2900
6.0	150	360	420	480	2400	3000
6.2	155	372	434	496	2480	3100
6.4	160	384	448	512	2560	3200
6.6	165	396	462	528	2640	3300
6.8	170	408	476	544	2720	3400
7.0	175	420	490	560	2800	3500
7.2	180	432	504	576	2880	3600
7.4	185	444	518	592	2960	3700
7.6	190	456	532	608	3040	3800
7.8	195	468	546	624	3120	3900
8.0	200	480	560	640	3200	4000
8.2	205	492	574	656	3280	4100
8.4	210	504	588	672	3360	4200
8.6	215	516	602	688	3440	4250
8.8	220	528	616	704	3520	4250
9.0	225	540	630	720	3600	4250
9.2	230	552	644	736	3600	4250
9.4	235	564	658	752	3600	4250
9.6	240	576	672	768	3600	4250
9.8	245	588	686	784	3600	4250
10.0	250	600	700	800	3600	4250
10.2	250	600	700	800	3600	4250
10.4	250	600	700	800	3600	4250

MAXIMUM WEIGHT

1.2.2 - Payload calculation (cont.) **BALLOON LIFT IN lbs**

Balloon size (1000cu.ft)									
Lift / 1000cu.ft	31	42	56	65	77	90	105	120	140
4.8	328	444	593	688	815	982	1111	1271	1481
5.0	342	463	617	716	849	992	1157	1324	1543
5.2	355	481	642	745	883	1032	1204	1376	1605
5.4	369	500	667	773	917	1071	1250	1429	1667
5.6	383	519	691	802	951	1111	1296	1482	1728
5.8	396	537	716	831	985	1151	1343	1535	1790
6.0	410	556	741	860	1019	1190	1389	1588	1852
6.2	424	574	765	888	1052	1230	1435	1641	1914
6.4	437	593	790	917	1086	1270	1481	1694	1975
6.6	451	611	815	946	1120	1310	1528	1747	2037
6.8	465	630	840	974	1154	1349	1574	1800	2099
7.0	478	648	864	1003	1188	1389	1620	1853	2160
7.2	492	667	889	1032	1222	1429	1667	1906	2222
7.4	506	685	914	1060	1256	1468	1713	1958	2284
7.6	519	704	938	1089	1290	1508	1759	2011	2346
7.8	533	722	963	1118	1324	1548	1806	2064	2407
8.0	547	741	988	1146	1358	1587	1852	2117	2469
8.2	560	759	1012	1175	1392	1627	1898	2170	2531
8.4	574	778	1037	1204	1426	1667	1944	2223	2593
8.6	588	796	1062	1232	1460	1706	1991	2276	2654
8.8	601	815	1086	1261	1494	1746	2037	2329	2716
9.0	615	833	1111	1290	1528	1786	2083	2382	2778
9.2	629	852	1136	1318	1562	1825	2130	2435	2840
9.4	642	870	1161	1347	1596	1865	2176	2488	2901
9.6	656	889	1185	1375	1630	1905	2222	2541	2932 Maximum
9.8	669	907	1210	1404	1653	1944	2269	2593	2932 Weight
10.0	683	926	1235	1433	1653	1984	2315	2646	2932
10.2	683	926	1235	1433	1653	1984	2315	2646	2932
10.4	683	926	1235	1433	1653	1984	2315	2646	2932

1.2.2 - Payload calculation (cont.) **BALLOON LIFT IN lbs**

Lift / 1000cu.ft	Balloon size (1000 cu.ft)									
	160	180	200	220	240	260	280	300	317	
4.8	1693	1905	2116	2328	2540	2751	2963	3175	3355	
5.0	1764	1984	2205	2425	2646	2866	3086	3307	3494	
5.2	1834	2064	2293	2522	2751	2981	3210	3439	3634	
5.4	1905	2143	2381	2619	2857	3095	3333	3571	3774	
5.6	1975	2222	2469	2716	2963	3210	3457	3704	3914	
5.8	2046	2302	2557	2813	3069	3325	3580	3836	4053	
6.0	2116	2381	2646	2910	3175	3439	3704	3968	4193	
6.2	2187	2460	2734	3007	3280	3554	3827	4101	4332	
6.4	2258	2540	2822	3104	3386	3668	3951	4233	4473	
6.6	2328	2619	2910	3201	3492	3783	4074	4365	4612	
6.8	2399	2698	2998	3298	3598	3898	4198	4497	4752	
7.0	2469	2778	3086	3395	3704	4012	4321	4630	4892	
7.2	2540	2857	3175	3492	3810	4127	4444	4762	5032	
7.4	2610	2937	3263	3589	3915	4242	4568	4894	5172	
7.6	2681	3016	3351	3686	4021	4356	4691	5026	5311	
7.8	2751	3095	3439	3783	4127	4471	4815	5159	5451	
8.0	2822	3175	3527	3880	4233	4586	4938	5291	5591	
8.2	2892	3254	3616	3977	4339	4700	5062	5423	5731	
8.4	2963	3333	3704	4074	4444	4815	5185	5556	5870	
8.6	3054	3413	3792	4171	4550	4929	5309	5688	6010	
8.8	3104	3492	3880	4268	4656	5044	5432	5820	6149	
9.0	3175	3571	3968	4365	4762	5159	5556	5952	6290	Maximum
9.2	3175	3571	3968	4365	4762	5159	5556	5952	6290	Weight
9.4	3175	3571	3968	4365	4762	5159	5556	5952	6290	
9.6	3175	3571	3968	4365	4762	5159	5556	5952	6290	
9.8	3175	3571	3968	4365	4762	5159	5556	5952	6290	
10.0	3175	3571	3968	4365	4762	5159	5556	5952	6290	
10.2	3175	3571	3968	4365	4762	5159	5556	5952	6290	
10.4	3175	3571	3968	4365	4762	5159	5556	5952	6290	

1.2.2 - Payload calculation (cont.) **BALLOON LIFT IN lbs**

Balloon size (1000cu.ft)						
Lift / 1000cu.ft	25	60	70	80	400	500
4.8	265	635	741	847	4233	5291
5.0	276	661	772	882	4409	5512
5.2	287	688	602	917	4586	5732
5.4	298	714	833	952	4762	5952
5.6	309	741	864	988	4938	6173
5.8	320	767	895	1023	5115	6393
6.0	331	794	926	1058	5291	6614
6.2	342	820	957	1093	5467	6834
6.4	353	847	988	1129	5644	7055
6.6	364	873	1019	1164	5820	7275
6.8	375	899	1049	1199	5997	7496
7.0	386	926	1080	1235	6172	7716
7.2	397	952	1111	1270	6349	7937
7.4	408	978	1142	1305	6526	8157
7.6	419	1005	1173	1340	6702	8377
7.8	430	1032	1204	1376	6878	8598
8.0	441	1058	1235	1411	7055	8818
8.2	452	1085	1265	1446	7231	9039
8.4	463	1111	1296	1481	7407	9259
8.6	474	1138	1327	1517	7583	9370
8.8	485	1164	1358	1552	7760	9370
9.0	496	1191	1388	1587	7937	9370
9.2	507	1217	1420	1623	7937	9370
9.4	519	1243	1451	1658	7937	9370
9.6	529	1270	1481	1693	7937	9370
9.8	540	1296	1512	1728	7937	9370
10.0	551	1323	1543	1764	7937	9370
10.2	551	1323	1543	1764	7937	9370
10.4	551	1323	1543	1764	7937	9370

MAXIMUM WEIGHT

1.2.3 - Equipment weight

Balloon registration_____Serial number_____

ITEM	TYPE	SERIAL NO.	WEIGHT Kg	WEIGHT lbs
Envelope				
Basket				
Burner				
Cylinder 1			/	/ *
Cylinder 2			/	/
Cylinder 3			/	/
Cylinder 4			/	/
Cylinder 5			/	/
Cylinder 6			/	/
Instruments				
Radio				
Total empty weight.				

* Specify empty/full

This chart will be completed by Sky Balloons for items supplied by them. It is the responsibility of the operator to enter other items.

If the make up of the balloon is changed strike out any deleted items and enter the weights of new/replacement items.

1.2.4 - Passenger limitations

Other than the passenger limitations specified for UK transport category operation (section 1.1.5) there are no specific limits. Of course the maximum payload, as calculated in the previous section, must not be exceeded and it is also vital that the pilot has easy movement around the basket to enable proper control and visibility.

Continuing the payload calculation example of section 1.2.2, page 1.2.3, the take off weight of the balloon was found to be 623Kg. If the balloon empty weight, as given by the table of section 1.2.3 (previous page) is 220Kg and 90Kg of fuel is being carried then the passenger allowance is:

Passenger weight = 623 - 220 - 90 = 313Kg.

Taking an average weight of 77Kg/ person the allowable passenger loading becomes 4 persons (including pilot).

1.3 - EQUIPMENT COMBINATIONS

1.3.1 - General

The simple techniques used for assembling balloons components enable many variations. Some combinations are patently unsafe, such as fitting a large envelope to an undersized burner frame. This would cause fabric wrinkling in the balloon mouth and thus compromise descent stability. For this, and other safety reasons, the permitted combinations are well defined by the build standards. These standards are CAA approved and deviation from the rules of this section (1.3) is prohibited.

1.3.2 - Sky equipment

Envelope	Basket Sizes and options Basket number		Burner (BR1) Burner no.	Burner (BR2 Mistral) Burner no.
31 24 gore	1.29m x 1.07m A0/BT/1***/A*		Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
56 24 gore	1.29m x 1.07m A0/BT/1***/A*		Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
65 24 gore	1.29m x 1.07m A0/BT/1***/A*		Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
77 24 gore	1.29m x 1.07m or A0/BT/1***/A*	1.55m x 1.19m A0/BT/2***/A*	Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
90 24 gore	1.55m x 1.19m A0/BT/2***/A*		Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
105 24 gore	1.55m x 1.19m or A0/BT/2***/A*	1.80m x 1.29m A0/BT/3***/A*	Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
120 24 gore	1.80m x 1.29m or A0/BT/3***/A*	2.0m x 1.22m T A0/BT/4***/A	Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
140 24 gore	2.07m x 1.57m Tor A0/BT/10***/A or 2.47m x 1.57m 2T A0/BT/12***/A	2.47m x 1.57m T A0/BT/121**/A	Sky double A0/BR1/2000/A or Sky triple A0/BR1/3000/A	Sky double A0/BR2/2000/A or Sky triple A0/BR2/3000/A

NOTE - * Denotes minor style variations for given floor size, eg. 1m or 1.1m height, flat or swept top, fixed or swivel sockets. T means a single T partition basket, 2T a double T partition basket.

1.3.2 - Sky equipment (cont.)

Envelope	Basket sizes and options Basket number	Burner (BR1) Burner no.	Burner (BR2 Mistral) Burner no.
160 24 gore	2.07m x 1.57m T or 2.47m x 1.57m T A0/BT/10***/A A0/BT/121**/A or 2.47m x 1.57m 2T A0/BT/12***/A	Sky double A0/BR1/2000/A or Sky triple A0/BR1/3000/A	Sky double A0/BR2/2000/A or Sky triple A0/BR2/3000/A
180 24 gore	2.07m x 1.57m T or 2.47m x 1.57m T A0/BT/10***/A A0/BT/121**/A or 2.87m x 1.57m T or 2.47m x 1.57m2T A0/BT/141**/A A0/BT/12***/A or 2.87m x 1.57m 2Tor 3.07m x 1.57m2T A0/BT/14***/A A0/BT/16***/A	Sky double A0/BR1/2000/A or Sky triple A0/BR1/3000/A	Sky double A0/BR2/2000/A or Sky triple A0/BR2/3000/A
200 24 gore	2.47m x 1.57m T or 2.87m x 1.57m T A0/BT/121**/A A0/BT/141**/A or 2.47m x 1.57m 2T or 2.87m x 1.57m T A0/BT/12***/A A0/BT/14***/A or 3.07m x 1.57m 2T or 3.27m x 1.57m2T A0/BT/16***/A A0/BT/18***/A	Sky double A0/BR1/2000/A or Sky triple A0/BR1/3000/A	Sky double A0/BR2/2000/A or Sky triple A0/BR2/3000/A or Sky quad A0/BR2/4000/A
220 24 gore	2.47m x 1.57m T or 2.87m x 1.57m T A0/BT/121**/A A0/BT/141**/A or 2.47m x 1.57m 2T or 2.87m x 1.47m2T A0/BT/12***/A A0/BT/14***/A or 3.07m x 1.57m 2T or 3.27m x 1.57m2T A0/BT/16***/A A0/BT/18***/A	Sky Triple A0/BR1/3000/A	Sky triple A0/BR2/3000/A or Sky quad A0/BR2/4000/A

Note 1 - Burner types BR1 and BR2 (Mistral) are interchangeable on the following basis:

1) Either the original burner frame or a replacement with the same part number must be used. The balloon log book shall be suitably amended.

2) Burners can only be exchanged like for like, eg double for double, triple for triple.

3) Under no circumstances may single units of either type be mixed with the alternative type to form a multiple unit.

Note 2 - "T" is a T partitioned basket having a pilot compartment at one end of the basket and two passenger compartments. "2T" is a double T partitioned basket with a central pilot compartment and four passenger compartments. *Denotes style variations for given size, eg. single or double T, fixed or swivel sockets. All T baskets 1.1m tall with flat top.

These notes also apply to page 1.3.2.a (over)

Sky Balloons

1.3.2 - Sky equipment (cont.)

Envelope	Basket sizes and options Basket number	Burner (BR1) Burner No,	Burner(BR2Mistral) Burner No.
240 24 Gore	2.47m x 1.57m T or 2.47m x 1.57m 2T A0/BT/121**/A A0/BT/12***/A 2.87m x 1.57m T or 2.87m x 1.57m 2T A0/BT/141**/A A0/BT/14***/A 3.07m x 1.57m 2T or3.27m x 1.57m 2T A0/BT/16***/A A0/BT/18***/A 3.47m x 1.57m 2T A0/BT/20***/A	Triple A0/BR1/3000/A	Triple A0/BR2/3000/A Quad A0/BR2/4000/A
260 24 Gore	2.47m x 1.57m 2T A0/BT/12***/A 2.87m x 1.57m T or 2.87m x 1.57m 2T A0/BT/141**/A A0/BT/14***/A 3.07m x 1.57m 2T or3.27m x 1.57m 2T A0/BT/16***/A A0/BT/18***/A 3.47m x 1.57m 2T A0/BT/20***/A	Triple A0/BR1/3000/A	Triple A0/BR2/3000/A Quad A0/BR2/4000/A
280 24 Gore	2.87m x 1.57m T or 2.87m x 1.57m 2T A0/BT/141**/A A0/BT/14***/A 3.07m x 1.57m 2T or3.27m x 1.57m 2T A0/BT/16***/A A0/BT/18***/A 3.47m x 1.57m 2T or 3.47m x 1.57m 2T A0/BT/20***/A A0/BT/21***/A	Triple A0/BR1/3000/A	Triple A0/BR2/3000/A Quad A0/BR2/4000/A
300 24 Gore	3.72m x 1.57m 2T (8 pole version)	Triple A0/BR1/3000/A	Triple A0/BR2/3000/A Quad A0/BR2/4000/A
317 24 Gore	3.72m x 1.57m 2T (8 pole version)	Triple A0/BR1/3000/A	Triple A0/BR2/3000/A Quad A0/BR2/4000/A

1.3.3 - Fuel cylinders and manifolds

Sky baskets are designed for use with vertical cylinders only. Any such cylinders can be used providing:

a) The cylinder has UK airworthiness approval for balloon use.
b) The fuel connectors are compatible with those on the burner hoses, ie. 1 1/4 Acme (commonly called Rego) or Tema 3800. Adaptors to connect the burner hose to the cylinder are for refuelling use only and must not be used in flight.
c) The cylinder is fully functional, not damaged and has passed the annual inspection requirements.

Fuel manifolds may be used if they have UK airworthiness approval. Again no intermediate adaptors are allowed and, when used, no manifold connectors should be left open ended. Regardless of the number of cylinders connected to a manifold only one cylinder should be used at any time. It is highly recommended that, for balloons 140 size and above, at least 1 burner unit is connected directly to a cylinder. This is because the extra connections on manifolds can cause pressure and power reduction.

1.3.4 - Interchangeability with other manufacturers equipment

Sky envelopes may be used on basket/burner assemblies made by Cameron, Thunder and Colt or Lindstrand providing the following conditions are met:

a) The basket, burner and burner frame are all made by the same manufacturer.
b) The assembly is approved for use in the category in which it is to be flown.
c) The assembly has a valid inspection certificate.
d) The assembly is certified for use with the envelope size.
e) Flight manuals are available for all the equipment in use.
f) The loading shall be the lesser of that allowed by this manual or the manual for the basket/burner combination.
g) Single burners shall not be used on balloons larger than 90,000cu.ft. Double burners shall not be used on balloons larger than 200,000cu,ft.
h) The balloon logbook will show the serial numbers of the components in use.

NOTE - The correct matching of Sky envelopes bigger than 120 size to burner frames made by other manufacturers will require a modification to the envelope suspension cables if the burner frame to be used is not rectangular. This modification may only be performed by Sky balloons.

Sky Balloons

1.3.2 - Sky equipment (cont.)

Envelope	Basket Sizes and options Basket number	Burner (BR1) Burner no.	Burner (BR2 Mistral) Burner no.
25 16 gore	Hopper unit A0/HO/1000/A		A0/HOBR/1000/A
60 16 gore	1.29m x 1.07m or 1.05mx 1.05m A0/BT/1***/A* A0/BT/S800/A	Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
70 16 gore	1.29m x 1.07m or 1.55m x 1.19m A0/BT/1***/A* A0/BT/2***/A* 1.05m x 1,05m or 1.25m x 1.05m A0/BT/S800/A A0/BT/S900/A	Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
80 16gore	1.29m x 1.07m or 1.55m x 1.19m A0/BT/1***/A* A0/BT/2***/A* 1.25m x 1.05m A0/BT/S900/A	Sky double A0/BR1/2000/A	Sky double A0/BR2/2000/A
400 28 gore	3.72m x 1.57m 2T (8 pole version)	Triple A0/BR1/3000/A	Triple A0/BR2/3000/A Quad A0/BR2/4000/A
500 28 gore	5.35m x 1.57m 4T* (8 pole version)		Quad A0/BR2/4000/A

* - 4T - A compartmented basket having a central pilots' compartment and 4 passenger compartments at each end.

2 - NORMAL PROCEDURES

2.1- BALLOON ASSEMBLY

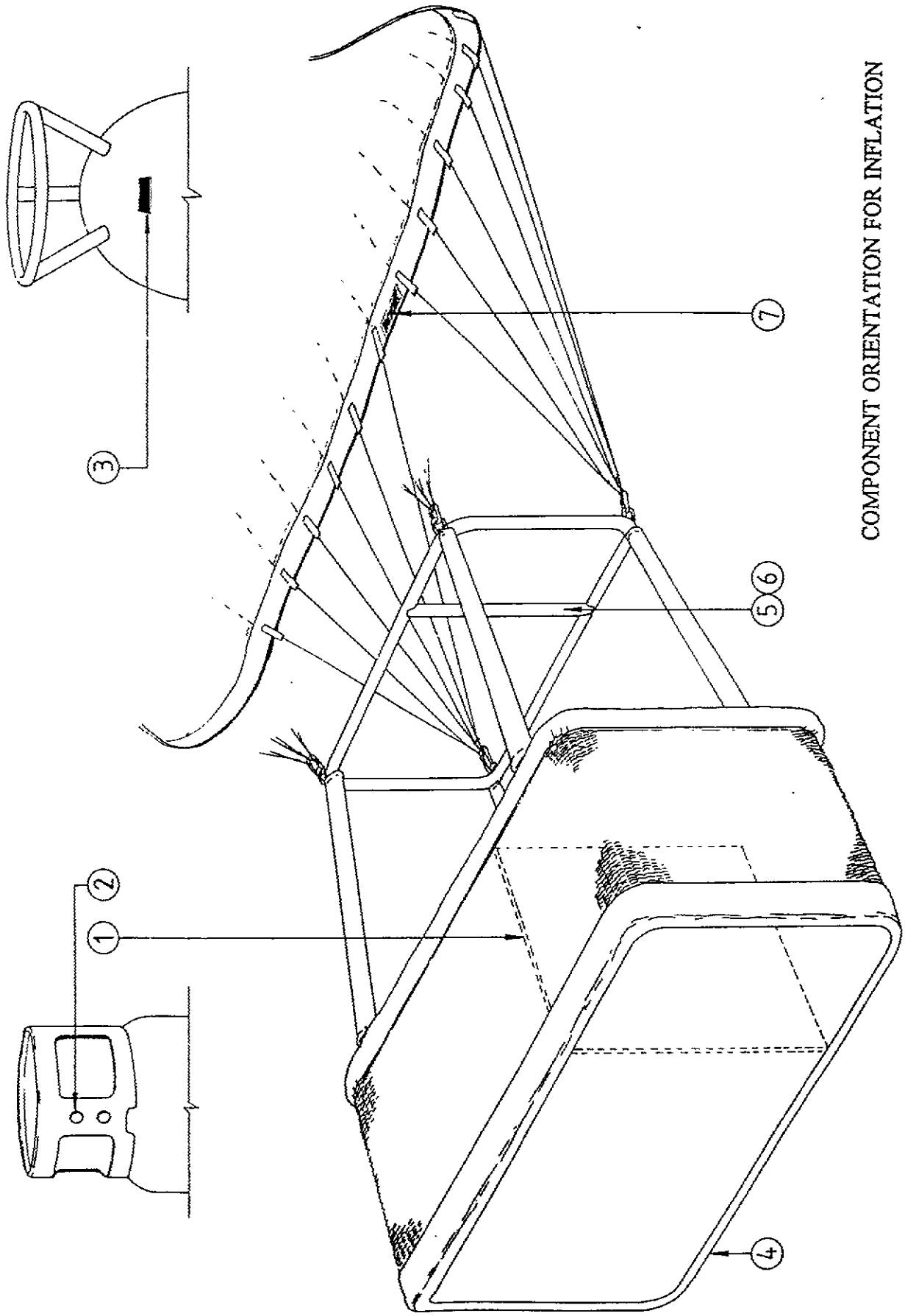
2.1.1 - Component orientation

The basket will be laid on one of its longer sides for inflation. When fitting the burner the central cross bar of the burner frame must be vertical when the basket is laid over. This will ensure that the burner has maximum movement to aim the flame throughout inflation. The envelope shall be connected to the burner frame such that the ground marker (found on the inside of the balloon mouth) is on the ground so that it will be in line with the long edge of the basket when the balloon is inflated. This will ensure that the control lines are well clear of the burner flame on inflation. This orientation is vitally important on balloons with rectangular burner frames. Burners which are offset in their frames shall be orientated such that the burner controls are over the pilot compartment of the basket. Likewise on single T partition baskets the pilot compartment will be on the right hand side, when the basket is laid over, to ensure the envelope control lines are correctly positioned for pilot access.

Sky balloons' burners use liquid fed pilot lights and, as such, cylinder orientation is not important unless older cylinders without central dip tubes are used. In this case the cylinders required for inflation should be correctly orientated. For Worthington cylinders this can be achieved by turning the cylinder such that the two round holes in the top collar face the side of the basket which will be laid on the ground. Those stainless steel balloon cylinders on which orientation is important have a label showing the down side for inflation. Inflation cylinders should always be full prior to commencement of inflation.

The above is illustrated on the diagram (over). On this diagram:

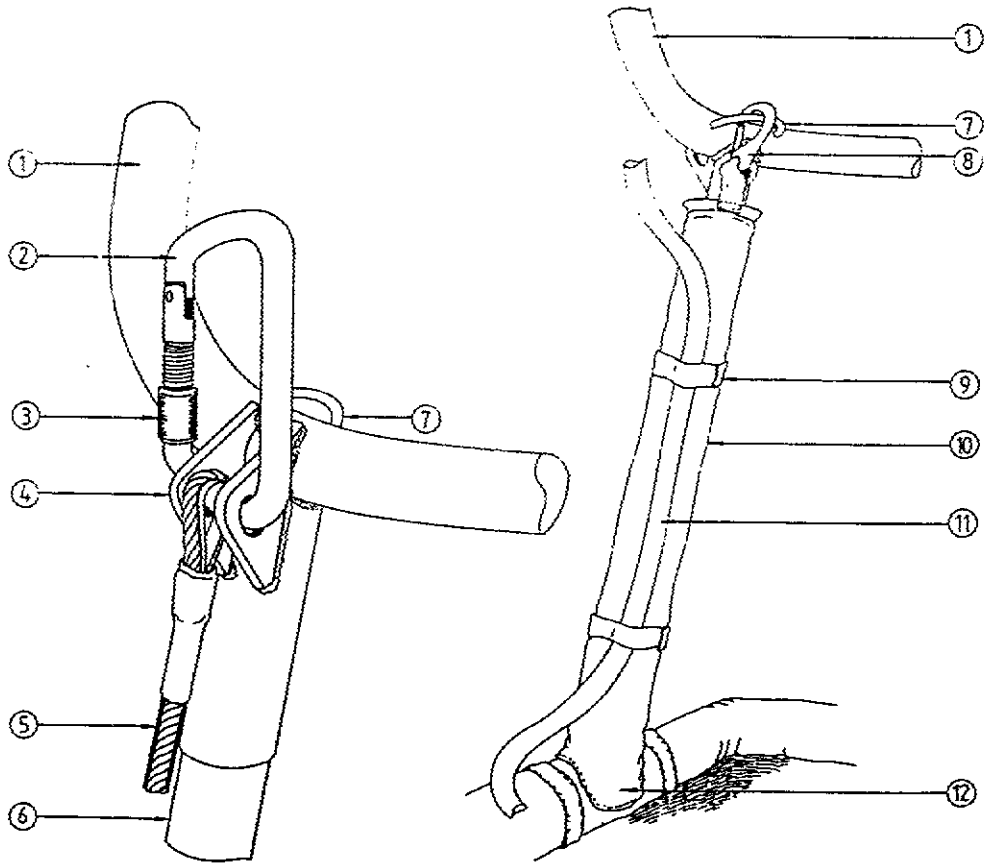
1) Offset pilot compartment on right (if applicable).
2) Down side holes on Worthington cylinder.
3) Down side marker on stainless steel balloon cylinder.
4) Long side of basket on ground.
5) Burner frame crossbar vertical.
6) Offset crossbar over pilot compartment (if applicable)
7) Envelope bottom centre ground marker.


COMPONENT ORIENTATION FOR INFLATION
1
2
3
4
5
6
7

2.1.2 - Fitting the burner

Slide the four nylon rods (6) into the corner stubs of the burner frame (1) and stand this assembly upright on these nylon rods. Swivel the basket stubs into the correct position and fit locking pins. Lift the burner assembly with the lower ends of the nylon rods and, noting the orientation required by section 2.1.1, drop the rods into the basket stubs. Put each eye end of the basket cables (5) between the corresponding lugs (4) on the burner frame, ensuring the cable is not twisted round the rods, and slide a carabiner (2) through the lugs and eye. Some larger basket assemblies have double cables, lugs and carabiners but the assembly process remains the same. **Ensure all carabiner screw gates (3) are fully closed.**

The rod covers (10) can be added at this stage. If fuel hoses (11) are to be transferred from tank to tank, in flight, then the hoses should be left outside the rod covers and retained only with the straps (9) provided. When fitting the rod covers the hook (8) should be at the top. This hook is clipped to the half ring (7) provided on the inner side of the burner frame.



2.1.3 - Installing fuel cylinders

All fuel cylinders shall be installed with two straps. The straps should be woven through the holes provided in the basket leaving the buckle inside. Noting the orientation requirements of section 2.1.1 pass the straps around the tanks and pull the strap buckles tight. Care should be taken to position the buckles where they will not be hazardous to knees or other parts of the occupants. Care should also be taken to distribute the fuel load evenly in the basket and thus keep the basket floor horizontal in flight.

2.1.4 - Fuel connection

Liquid fuel supply from the tank is controlled by either a screw type valve or a 1/4 turn ball valve. Screw valves are off when they have been turned clockwise as far as possible. Ball valves are off when the handle lies flat against the top of the tank.

All burner valves should also be closed. See section 2.4.1 for operation of Sky Balloons burners.

With all cylinder and burner valves off connect a burner hose to a cylinder. If using Tema type connectors do not activate the locking ring. Open the cylinder valve and look, listen and smell for leaks, particularly at the cylinder. Check the burner fuel pressure on the gauge provided. The requirement is 4-12 bar (60-180psi). If everything is in order turn on the pilot light and ignite it. Listen and look for a strong stable flame. Test the main blast valve and liquid fire valve for correct and leak free operation. Turn off the cylinder valve and vent the remaining fuel from the hose by operating the blast or liquid fire valve. The pilot light cannot be used for this purpose as this would take about twenty minutes.

Repeat this test for all burner units and all cylinders. When everything has been tested ensure all valves are turned off again.

2.1.5 - Connecting the envelope

Attach basket restraint, if required ,prior to connecting the envelope. See section 2.2.5.

Noting the orientation requirements of 2.1.1 lay the basket on a long side such that the wind direction will be towards the envelope mouth. Pull the envelope mouth from its bag and locate the flying wires. Also locate the ground marker which is located on the inside of the mouth between two sets of flying wires and at the centre of the scoop (if fitted). Connect the flying wire sets either side of this marker to the lower basket carabiners by simply passing the flying wire carabiners through the basket carabiners. Check that the wires are not twisted or crossed and **screw the carabiner gates fully closed.** Repeat by connecting the remaining flying wire sets to the upper basket carabiners.

2.2 - INFLATION

2.2.1 - Laying out the envelope

Pull the bag downwind away from the basket until all the envelope is out. Spread the envelope out ensuring that it is only handled by the load tapes. Check that the crown line is not tangled with the apex tapes of the balloon and then stretch it out, downwind, to its full length. It is recommended that the scoop is left disconnected at its lower end and turned back under the nomex mouth panels for inflation. Locate the control line ends (these are outside the envelope on Sky Balloons) free any tangles and clip the line ends to the burner frame with the hooks provided. Check that the pulleys, where the lines penetrate the envelope, are free from debris and are functional.

2.2.2 - Passenger briefing

The passenger briefing is best performed at this time as there is no distraction from noise or activity. They should be told when, where and how to enter the basket, what to hold onto and equally important, what not to hold onto. They should also be briefed on landing procedures in case of an emergency termination of the flight.

2.2.3 - Cold inflation

For cold inflation there should be a crew member on each side of the mouth and a person on the crown line. For balloons bigger than 105 size it is better to have two crew on the crown line. The pilot shall be close at hand at all times in case the inflation needs to be abandoned. The pilot and all crew should all wear heavy duty leather gloves and clothing should be of natural fibres. The mouth crew and pilot should wear garments with long sleeves and trousers.

Place the fan close to the mouth of the balloon and close to the basket rods. Unless a person is specifically allocated to the fan it should be placed on the side of the basket which gives the pilot ready access to the off switch.

Signal to the crown crew that inflation is about to commence and start the fan. The mouth crew should hold open the mouth to maximise its size and also prevent air passing underneath the envelope. At an early stage install the parachute valve by pressing the velcro patches together. There are two sets of patches different in colour to the rest to show the correct alignment. Also check, at this stage, that the parachute pulley is free from tangles or debris. Air is free. Put plenty in so that the balloon adopts its' normal flying shape.

2.2.4 - Hot inflation

Check again that the parachute line is free of tangles and accessible to the pilot. Check again that all burner and cylinder valves are off. Connect all the burner hoses to cylinders but only open one cylinder valve. Light the pilot light and commence hot inflation using short bursts with the main blast valve. Liquid fire systems should not be used for inflation. It is best to leave the fan running until the envelope starts to lift off the ground. The crown crew should prevent excessive side to side movement of the balloon and also control its ascent by maintaining tension on the line and slowly walking to the basket as the balloon rises. Continue adding heat until the balloon is upright. The crew should now transfer their weight to the basket.

SAFETY NOTE - The crown crew must be instructed simply to grip the crown line and not wrap it around any part of the body.

The parachute should now be operated sufficiently to break all the velcro tabs and also to check its function. The remaining burners can be turned on and tested. For UK transport category flights the operation of turn vents should also be tested.

With all systems satisfactory the passengers can now board but the crew should maintain their weight on the basket. The crown line should be tied to a basket rod on instruction from the pilot.

2.2.5 - Balloon restraint

The use of a restraint for the balloon throughout inflation is not mandatory but is highly recommended particularly in breezy or gusty conditions. Restraints with a quick release mechanism are best and the restraint system components should be of a robust nature as those supplied by balloon manufacturers.

The restraint is best fixed with extra carabiners to the upwind basket carabiners of the basket but, in calm conditions, it may be fastened around the basket stubs. The anchor end may be fixed to a vehicle or tree.

2.3 - PRE TAKE OFF CHECKS

2.3.1 - Equipment checks

a) All burners fully functional with pilot lights strong and stable.
b) Parachute velcro tabs separated and parachute functional.
c) Turn vents functional.
d) No fabric damage above the lowest horizontal load tape.
e) Control lines secured to burner frame and accessible.
f) Crown line secured to basket.
g) Flying wires free from twists and tangles.
h) All carabiner gates screwed closed.
i) Fuel cylinders properly secured and with sufficient fuel for intended flight.
j) Fuel pressure within range 4-12bar (60-180psi)
k) Fire extinguisher carried.
l) Two sources of ignition carried.

2.3.2 - Paperwork checks

a) Load not excessive for conditions.
b) Correct air and ground maps present.
c) Retrieve telephone number carried.
d) UK transport category documentation complete (if applicable).

2.3.3 - Instruments and radios (if carried)

a) Radio on, set to correct frequency and operation checked.
b) Instruments turned on and correct barometric pressure set.

2.3.4 - Passengers and retrieve

a) Passengers briefed and aboard.
b) Retrieve also has phone number and vehicle keys.
c) Retrieve radio on, set to correct frequency and tested.

2.4 - SKY BALLOONS CONTROL SYSTEMS

2.4.1 - Burners (BR1 type)

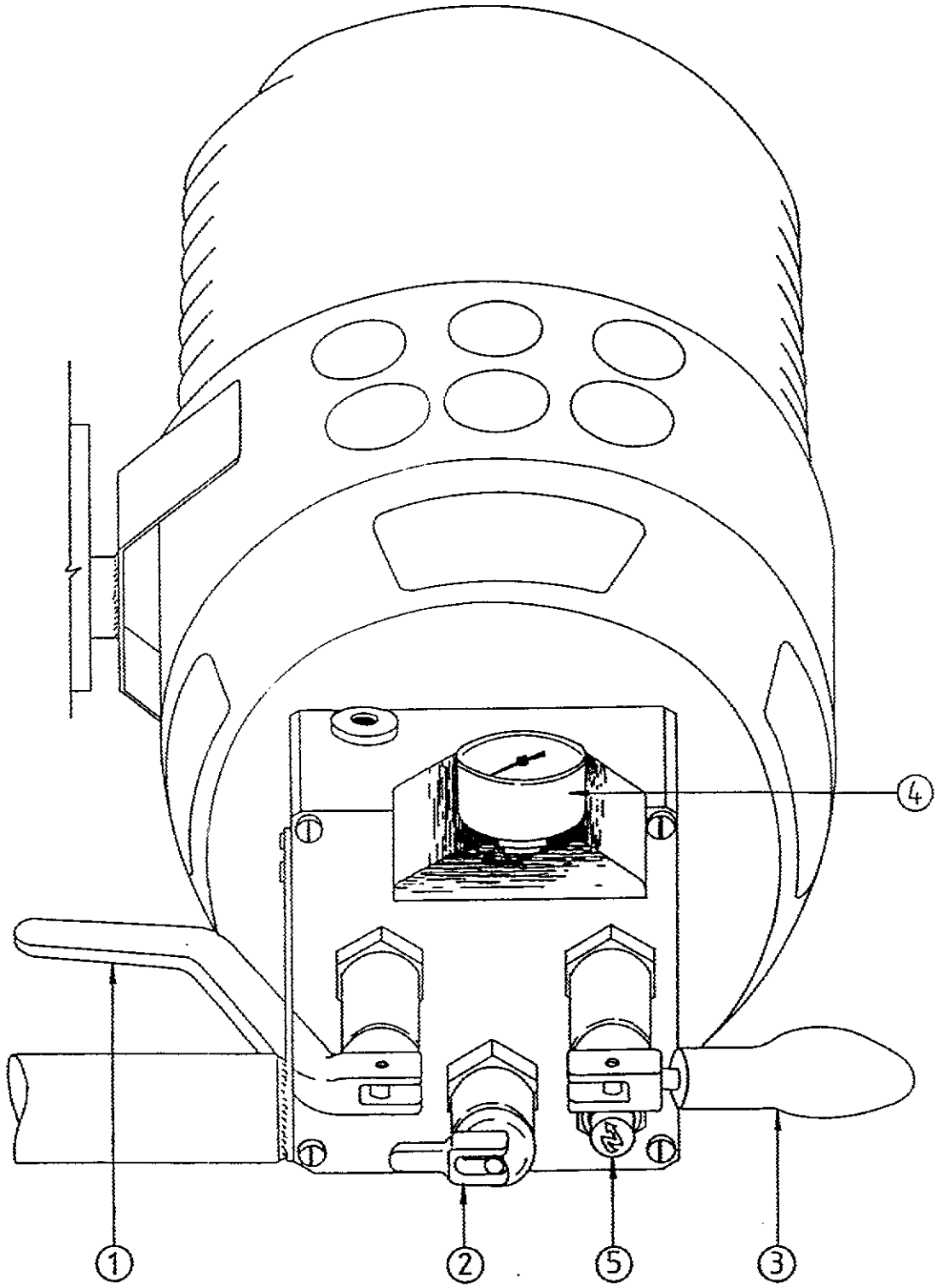
The diagram (over, page 2.4.2) shows one side of a Sky double BR1 burner unit. On this diagram:

1) Squeeze action blast valve. To operate the valve, the lever is pulled towards the handle below. For double power operate both levers simultaneously. This is a single handed operation and gives true double power. Both levers return to off when released.
2) Pilot light valve. This valve is lifted and turned over by a full 180° to move from on to off or vice versa. The valve handle is labelled to show its status.
3) Liquid fire valve. As shown on the diagram the valve is off. To operate the liquid fire system pull the valve downwards but bear in mind that, if pulled to a vertical position, it will not close automatically. Opening to just 45° does allow the valve to close automatically.
4) Pressure gauge.
5) Piezo igniter.

This burner design, as it is supplied, has been well proven to 12,000ft. For sustained flights above this altitude the following procedure must be followed.

The pilot light unit consists of an aluminium bodied regulator, screwed into the main valve block, a brass hexagonal section stem and a stainless steel head. At the lower end of the brass stem is an air inlet hole. Above this hole is a small screw. For high altitude flight this screw should be removed. At low altitude this has no adverse effect but the pilot light will make more noise. In this condition the pilot light will remain reliable to at least 15,000ft. Repeat this procedure for all pilot lights.

SKY DOUBLE BURNER UNIT

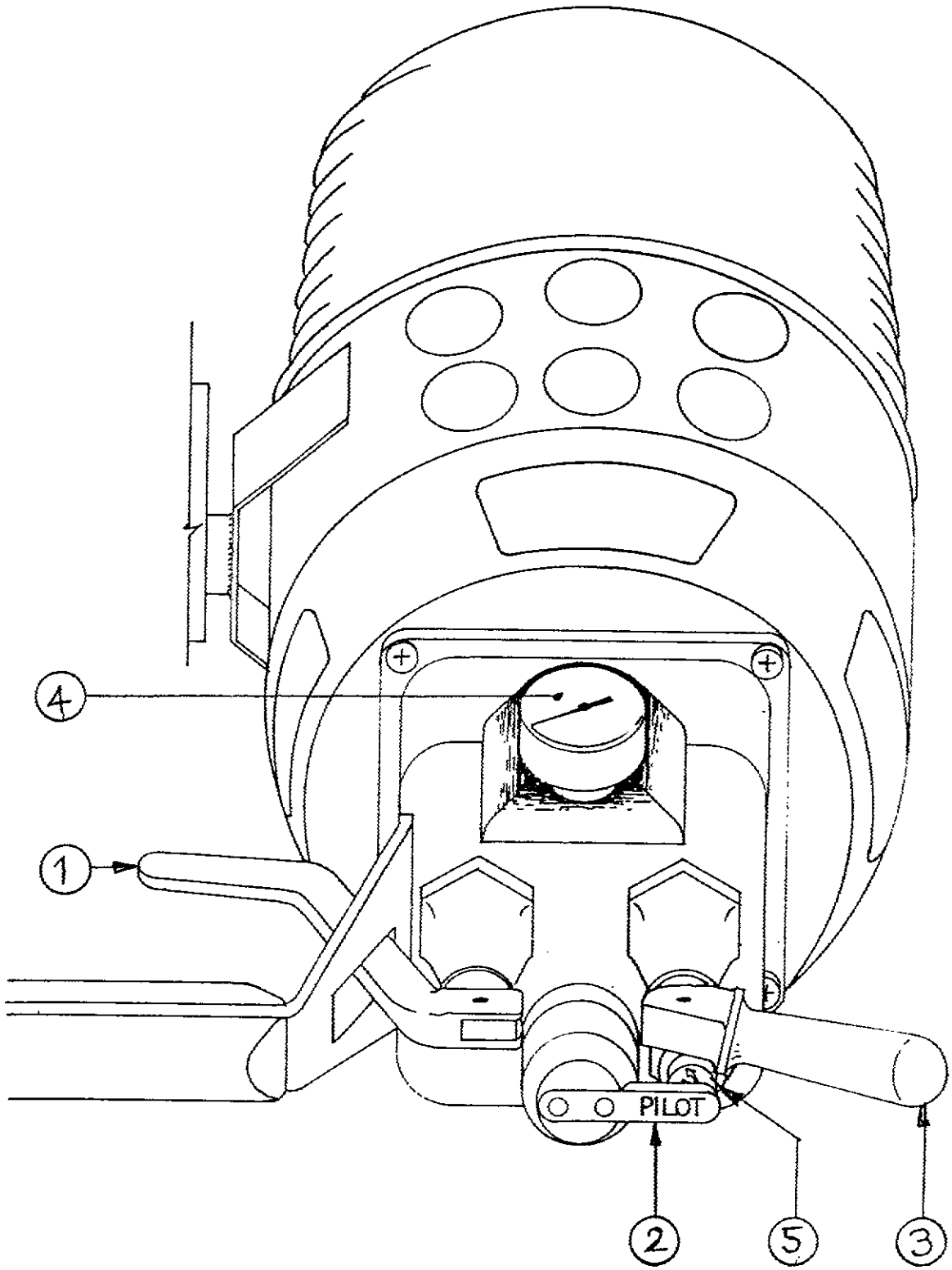


2.4.2 - Burners (BR2 "Mistral" type)

The diagram (over, page 2.4.4) shows one unit of a Sky BR2 Mistral burner. On this diagram:

1) Squeeze action blast valve. To operate the valve the lever is pulled towards the handle below. For double power operate both levers simultaneously. This is a single handed operation and gives true double power. Both levers return to off when released.
2) Pilot light valve. This valve is rotated through 90° between its end stops to move from on to off, or vice versa. The handle is labelled to show its status.
3) Liquid fire valve. As shown on the diagram the valve is off. To operate the liquid fire system pull the valve downwards but bear in mind that, if pulled to a vertical position, it will not close automatically. Opening to just 45° does allow the valve to close automatically.
4) Pressure gauge.
5) Piezo igniter.

SKY BURNER UNIT (BR2 MISTRAL TYPE)



2.4.3 - Envelope controls

There are just three control lines for Sky envelopes. As viewed from inside the basket these are, in order:

a) Black coloured line - Pull to effect left rotation (anti-clockwise when looking down).

b) Red/white striped line - Pull to operate parachute valve.

c) Green coloured line - Pull to effect right rotation.

Simply release lines to cease the control effect.

2.5 - FLIGHT PROCEDURES

2.5.1 - Take off

To assess the buoyancy of the inflated balloon the use of the "hands on - hands off" procedure is recommended. Gradually add heat to the balloon by repeated short bursts on the burner and instruct the ground crew to "hands off". If no lifting motion is perceived, or is thought to be inadequate, then instruct "hands on". Carry on until the desired lift is present and command "hands on" until the ground restraint is released when the final "hands off" order can be given. At ground level the use of the main blast burner is recommended as it has greater resistance to wind than the liquid fire system.

2.5.2 - Flight control

The only positive control axis of a balloon is vertical. To climb increase the temperature of the balloon by use of the burner(s) and to descend allow the balloon to cool down naturally or, for faster response, use the parachute valve. As stated earlier this valve should not be held open, in flight, for more than three seconds. After assessing the effect of this operation the parachute can, if necessary, then be used again.

Turn vents are provided largely to allow basket orientation for landing but their use at any time in the flight is permitted. Bear in mind however that some lift will be lost when the vents are used.

The liquid fire system on the burner is provided for two reasons. Firstly, it gives a quieter flame and secondly it is a useful emergency back up (see later). The relative quietness of this flame is useful when flying low in the vicinity of animals but constant use of the system is not recommended because:

a) The flame is more easily deflected by the wind shear which can occur when climbing or descending and, indeed, by the vertical currents caused by such actions. This could, in extreme circumstances, damage the balloon fabric.
b) Whilst the reduced noise levels may be appreciated by the passengers in the balloon the higher content of radiant heat of liquid flames may not.
c) Excessive use of liquid fire may cause soot deposition in the envelope.
d) The main blast burner will give a faster response in emergency and is easier to use in the double mode.

2.5.3 - Pilot responsibilities

The pilot is responsible for the safe operation of the balloon. He will, at all times:

a) Observe the limitations contained within this manual.
b) Comply with air law and airspace restrictions.
c) Properly brief passengers prior to landing or emergency action.
d) Maintain a vigilant look out for adverse weather changes and fading light.
e) Maintain a vigilant look out for low level obstructions, especially power lines.

In addition the following common courtesies are recommended:

a) Avoid disturbing animals.
b) Respect problem landing and low flying zones.
c) Avoid landing in crops.
d) Keep radio correspondence brief and accurate.
e) Respect the rights and wishes of the landowner at the landing site.

2.5.4 - Fuel management

The minimum requirement for fuel is two full cylinders at take off. More cylinders may of course be carried. With more than two cylinders it is permissible to drain the extra cylinders completely bearing in mind, however, that burner power will drop off very quickly as the cylinders approach empty and thus render emergency action difficult. It is thus recommended that such extra cylinders are used consecutively such that at least one burner is always connected to a cylinder containing in excess of 20% fuel.

The last two cylinders connected are to be used as follows. First check that they are both properly functional. If this is not the case land as soon as possible. Otherwise, use one cylinder to a minimum level of 20%. Use the remaining cylinder for landing approach such that it too has a minimum of 20% for landing. This will allow either burner to be used for landing with the second acting as an emergency back-up. The fuel content remaining will also permit a landing to be safely aborted if previously unseen hazards require this.

2.5.4 - Fuel management (cont.)

To change a fuel cylinder in flight, proceed as follows:

1) Turn off the supply valve of the depleted cylinder. Operate the burner blast valve or liquid fire valve on the burner to drain the fuel line.
2) Disconnect the burner hose from the empty cylinder.
3) Connect the burner hose to a full cylinder.
4) Open the cylinder valve and relight the pilot light.
5) Operate the burner blast valve or liquid fire valve to check the new cylinder.

2.5.5 - Landing

Brief the passengers for landing. The best position for passengers in a single compartment basket is to face the direction of travel, hold onto a basket handle or a cylinder collar and bend the knees, this latter instruction being the most important.

For compartmented baskets the passengers will have their backs towards the direction of travel. Their position will be like sitting but without the chair. Their backs will be resting against the basket or compartment side and they will hold the handles in front of them. Under no circumstances, of course, must they actually sit on the floor.

On compartmented baskets align the long edge of the basket such that the balloon will land on it. This is also recommended for non-compartmented baskets.

Prior to landing stow all loose items. Control the descent into the chosen field with the burner and parachute. The required descent rate is dependant on the forward speed of the balloon and the size of landing field. In general terms faster forward speeds and/or small landing site will require faster descent speeds.

Immediately prior to landing ensure that the passengers have obeyed the landing brief. Turn off the pilot lights and, if time permits, the cylinder valves. Have the parachute line ready and operate it until the balloon has stopped. When sufficient heat has been lost a passenger can be briefed to use the crown line to help control the final deflation. Further passengers must remain in the basket until the pilot says otherwise.

Turn off all fuel cylinders, if this has not already been done, and vent the fuel lines. Do not vent unburnt fuel into the envelope.

2.6 - TETHERED FLIGHT

2.6.1 - Safety of operation

1) The limitations of section 1.1. 6 shall apply.
2) Tether lines and fittings shall have a minimum tensile strength of 4000Kg (=8800lbs).
3) In wind speeds above 5Kts tether rings shall be used between the envelope and basket carabiners.

2.6.2 - Method and aims

There shall be two anchor points on the upwind side of the basket and a third on the downwind side, all securely fixed to suitable strong points. A fourth hand-held line is useful for manoeuvring the balloon for landing but is not essential and must not be considered as an anchor point in its own right.

The three primary lines shall be anchored such that they are at approximately 120° to each other when viewed from below. At no time should the angle of the lines to the ground exceed 60°. Thus the line length should be twice the intended tether height. If the tether site is small the 60° angle should not be compromised, rather the tether height must be reduced below the 30m maximum.

Ground anchor points should be heavy vehicles, trees or substantial metal or concrete structures. Fences are not usually adequate. Lines shall be fixed to the anchor points such that the ropes will not chafe or tangle around other objects. If carabiners are used at anchor points they shall be of the 3000Kg type or stronger.

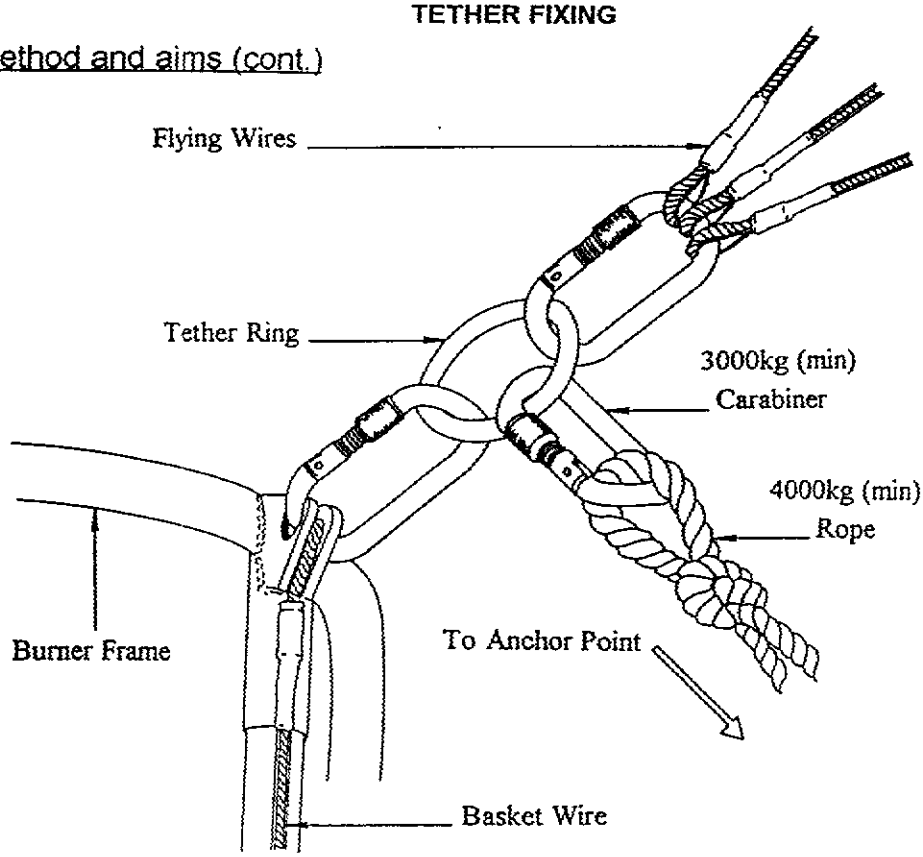
These requirements are illustrated on the next page page.

The aim of these requirements is to tether the balloon at the apex of a tripod as this will properly distribute the load amongst the tether lines.

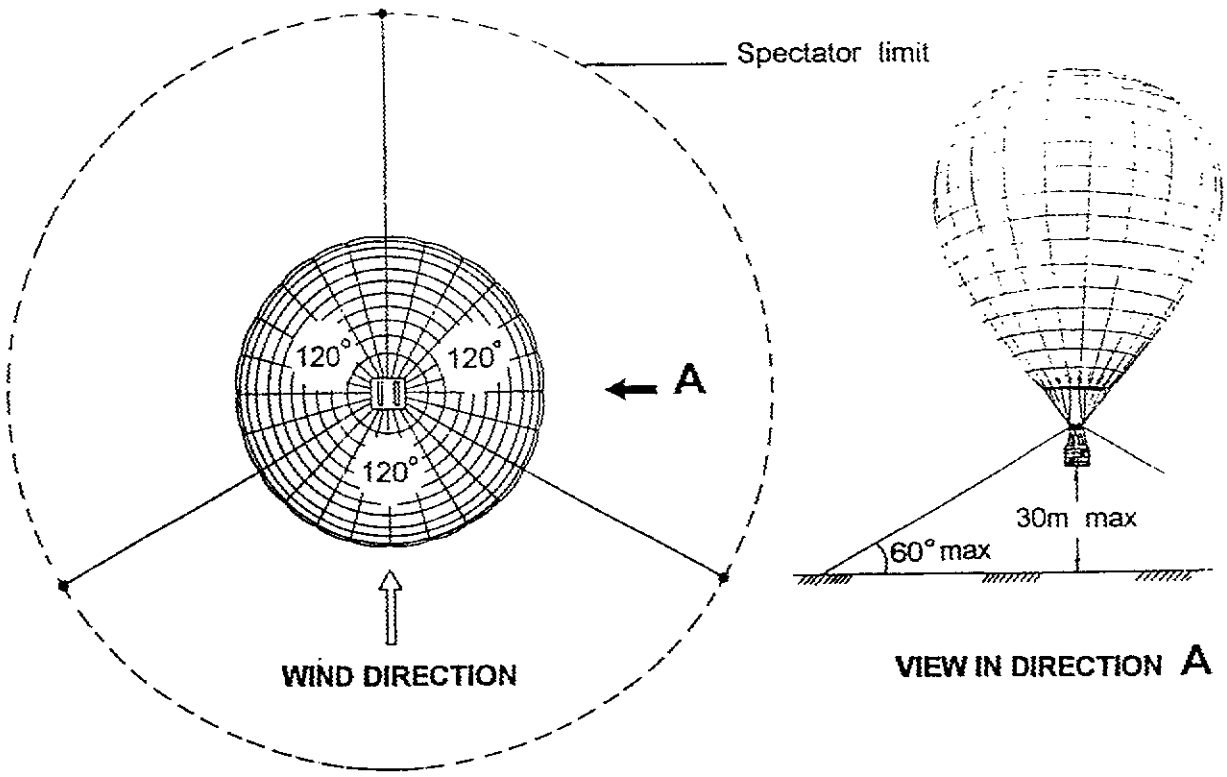
Sky Balloons

TETHER FIXING

2.6.2 - Method and aims (cont.)



VIEW FROM BELOW



2.6.3 - Flight control

At all times the pilot shall ensure the safety of himself, any passengers, and people and property on the ground. The requirements for monitoring weather are as for free flight. If safe free flight is not possible then neither is tethered flight. The pilot shall cease tethered flight if conditions change such that control becomes difficult.

As a general rule the higher the wind speed the lower the height at which the tethered flight should be conducted.

During tethered flight ascent rates shall be be low such that the balloon does not snatch the tether lines when it reaches the top of its ascent. Tether lines are provided to prevent excessive horizontal movement only. The balloon should not be heated further once all the lines are in tension. Landing requirements, including passenger briefing, are as for free flight.

2.6.4 - Site requirements

The site shall be large enough to allow safe conduct of tethered operation. There shall be no overhead cables or ground obstructions (other than the anchor points) which the balloon could contact in the event of any one tether line failing. The balloon crew will ensure that any spectators remain a safe distance form the balloon, as shown on the previous page.

3 - EMERGENCY PROCEDURES

3.1 - GENERAL

3.1.1 - Avoiding emergencies

In flight equipment failures are unlikely in properly maintained balloons. On Sky balloons, burners and fuel systems are fully duplicated, envelopes are fully reinforced with high strength tapes to minimise the spread of damage and baskets are of such strength that even heavy impacts will not result in total failure. Weather induced emergencies can be avoided by proper pre-flight planning and constant monitoring. Proper fuel management, as described in section 2.5.4, and pre-flight checks as described in section 2.3, are also essential in avoiding unnecessary emergencies.

3.1.2 - Ground emergencies

The most serious ground emergency is fire. Avoid inflating on dry grass or other flammable surfaces. In the case of fire, on the ground, the safest course of action is to exit the balloon and move away from it. The pilot should ensure that all passengers exit simultaneously to prevent inadvertent take off. The pilot himself should exit with the parachute deflation line in hand for the same reason. The fire extinguisher should be used if it can be accessed safely. If this is not possible move all personnel as quickly and as far away as possible, preferably upwind. If it can be achieved safely, turn off all cylinder valves.

3.1.3 - Evacuation safety

Leaving a balloon basket whilst it is in flight is extremely dangerous even at very low altitude and is rarely the safest course of action. It is to be avoided.

3.2 - FLIGHT EMERGENCIES

3.2.1 - Emergency landing procedures

All emergencies (as below) will require landing as soon as possible thus landing is described first. Emergency landings may either be hard (ie high rate of descent) or fast (high wind speed at landing site) giving the potential of a long drag.

In either case the following general rules apply:

1) Inform the passengers that an emergency landing is necessary and what position to adopt. The details are given below.
2) Prior to landing ensure that the briefing instructions have been followed.
3) For fast landings the passengers will not be able to see the ground. Inform them when the impact is imminent to avoid shock.
4) On hard landings drop any available "ballast" if this will not endanger people or property on the ground. Note, however, that fuel cylinders, even if empty, are not to be jettisoned.
5) On emergency landings **always** turn off pilot lights. If time permits, also turn off cylinder valves.
6) The pilot must ensure that he cannot leave the basket inadvertently.
7) Instruct the passengers to leave the basket when it is safe for them to do so.

Fast landings

Fast landings occur when unexpected weather changes lead to ground wind speed being high. The forces are thus largely horizontal. This will cause two problems. Firstly, upon impact, the basket is likely to tip over as if rolling in the direction of travel. Secondly the drag will be long, and, depending on the landing site, possibly bumpy. The best position for the passengers in this case is to have their backs towards the direction of travel and pressed firmly against the basket side. Their knees must be bent and proper use of the handholds is essential to avoid being thrown out of the basket. Their heads should not project above the basket edge. The passengers will remain in this position until the pilot instructs them to leave the basket. The pilot will leave last and only after ensuring the balloon has been made safe, ie all fuel systems off and vented, envelope deflated to the point where it cannot be blown further.

3.2.1 - Emergency landing procedures (cont.)

Hard landings

Hard landings may also be caused by adverse weather (thermal activity) or by equipment malfunction (eg. loss of burner power). In this case the forces will be largely vertical. The Passengers should adopt a standing position with knees and feet together and knees slightly bent, They should have their backs to the direction of travel and take a firm grip on the handholds. They must maintain this position until the pilot instructs them otherwise as there may be more than one impact. Other rules are as for fast landings.

3.3 - EQUIPMENT MALFUNCTION

3.3.1 - Pilot light failure

If a pilot light fails and cannot be re-lit continue flying on another burner whilst the problem is investigated as follows:

1) Ensure that the pilot valve and cylinder valve are open and that the cylinder has fuel in it. Check that the fuel connector is correctly assembled.
2) Briefly activate the blast valve of the affected burner, whilst a second burner is in use, to test for fuel flow to the burner as a whole.
3) If no flow is present try another cylinder.
4) If flow is present but pilot light cannot be re-lit proceed, as normal, on a working burner, and land as soon as possible.

In the unlikely event of no pilot lights being operational proceed as follows:

1) Close cylinder valve to one burner. Open the liquid fire valve on this burner fully, to its locked position. Crack open the cylinder valve gradually and light the liquid fire system. Do not rely on the built in igniter to achieve this, matches are better.
2) Adjust the cylinder valve opening to give a liquid fire flame 0.5m (approx 2ft) high.
3) Use this flame as a pilot light for another burner. Land as soon as possible.
4) It is also possible, with care, to use the cylinder valve to regulate the flow to the liquid fire system being used as a pilot light, to switch between pilot light mode and full power mode. This method, however, is only recommended if low fuel levels require two connected cylinders to be used to achieve a safe landing. In this case the fully active burner shall be retained for final approach and landing.

SAFETY NOTE - Partially open valves are subject to cooling by the restricted flow of propane and, as such, this process should only be used in true emergencies. Prolonged operation could freeze the valve to the extent it cannot be turned off or could even freeze the flow altogether. This is one of the reasons for the rule "land as soon as possible."

3.3.2 - Main burner failure

Partial failure

The minimum specification burner available from Sky Balloons is a double. The two halves of this double are totally independent. Each of these halves have both main blast and liquid fire systems. It is thus extremely unlikely that total failure will occur. In the event of one unit becoming in-operative proceed on the remaining unit(s) and land as soon as possible. The possible failure scenarios, with emergency procedures are:

1) Malfunction in coil main blast system - Use liquid fire on failed unit only.
2) Malfunction in liquid fire system - Use main blast on failed unit only.
3) Malfunction in pilot light - as section 3.3.1. Also, it is possible to use a burner without pilot light simultaneously with a working unit to give increased power.
4) Fuel supply leakage - Turn off fuel cylinder, vent the affected burner by using the blast valve. Disconnect the fuel supply to the affected unit to prevent further leakage.
5) Land as soon as possible.

Total failure

If no burner appears operational proceed as follows:

1) Check cylinders not empty, fuel connectors properly assembled, cylinder valves open.
2) Repeat, as necessary, checking all cylinders.
3) If the problem cannot be rectified prepare for a heavy landing as described in section 3.2.1.
4) Disconnecting the lower scoop fixings and pushing the scoop upwards as far as possible will reduce descent rate by allowing more air into the mouth of the balloon.

3.3.3 - Parachute valve malfunction

Parachute remains open after use

In this case proceed as follows:

1) Use burner(s) to control descent rate. Use of maximum power may assist in closing the parachute. If this is not achieved but level flight can be managed then proceed as item (2) below, otherwise go straight to item (4).
2) Briefly but firmly jerk the parachute control line.
3) If this action followed by repeat of (1) effects a cure land as soon as possible without using the parachute again until the balloon has made contact with the ground.
4) If the parachute cannot be closed use the burner(s) to control descent. Do not attempt to use the parachute again until the balloon is in contact with the ground. Land as soon as possible. If fuel remaining is low save as much as possible for slowing final landing descent rate but use the burner sufficiently to prevent excessive envelope mouth distortion.
5) As with section 3.3.2 (total failure paragraph) disconnecting the lower scoop fixings will be beneficial.
6) Brief the passengers for a hard landing, as section 3.2.1.

Parachute valve cannot be opened

In this case proceed as follows:

1) Select a large landing site, the length in the direction of flight being particularly important.
2) Ensure that the chosen landing site has no power lines across the flight path.
3) Brief the passengers as for a fast landing (as section 3.2.1).
4) Initiate descent by allowing natural cooling. Turn vents may be opened simultaneously to further increase descent rate. Practice this if time and fuel permit.
5) Hard landings will reduce landing drag. If this method is chosen brief passengers accordingly.

3.3.4 - Envelope damage

Envelope damage should not occur in flight if the correct pre-flight inspection procedures are followed. Burn damage, if it occurs in flight, will be confined to the lower end of the balloon and will not cause serious problems. Note however that fuel usage will increase a little and that high rates of ascent and descent should be avoided so as not to induce unnecessary stresses or the uncomfortable oscillations that asymmetry of the envelope could cause. Check that the burn damage has not affected the envelope flight controls, particularly the parachute line. If this latter item is damaged proceed as for parachute malfunction, parachute cannot be opened, as section 3.3.3. If parachute line damage is visible do not attempt to use the parachute until the balloon is in contact with the ground. Brief the passengers as for a fast landing.

Damage propagating higher up the balloon will be contained by the tapes provided for this purpose. These tapes are placed such that the burners provided will enable level flight and a controlled descent albeit at the cost of very high fuel consumption. Proceed as for parachute malfunction, parachute remains open, as section 3.3.3. Land as soon as possible. Brief passengers on the possibility of a hard landing. Do not use the parachute valve until the balloon is contact with the ground.

3.4 - OTHER FLIGHT EMERGENCIES

3.4.1 - Arrest of un-premeditated descents

As well as the equipment failures already described un-premeditated descents can also be caused by excessive thermal activity. This can only be counteracted by use of the burner. If necessary use all burner power available to control descent. Brief the passengers for a hard landing. Any excessive weight may be jettisoned, immediately prior to landing, following the rules of section 3.2.1. Land as soon as possible.

3.4.2 - Avoidance of low level obstacles

Great care is required when flying low. A vigilant look out should be maintained for livestock and power lines. The pilot should also be ready to deal with the local wind changes and thermal activity which can occur near the ground.

If livestock is encountered initiate a gentle ascent to 500ft above them as soon as possible using a liquid fire system.

Avoidance of fixed obstacles may be achieved by landing before they are reached or by overflying. In either case the following should be born in mind:

a) It is easier to maintain the vertical motion of the balloon than to reverse it.

b) From straight and level flight it is easier to go down than up.

c) Make a decision and stick to it.

Power lines need particular respect. Do not fly into them. Beware of clipping tree lines as they often conceal powerlines. Remember also that small, local power lines are indistinguishable from telephone lines and may even be carried on the same poles. It is good policy when power lines need to be crossed, when flying low, to have the balloon climbing. All power lines should be crossed with a minimum height clearance of 300ft.

3.4.2 - Avoidance of low level obstacles (cont.)

If, despite the above rules, contact with power lines is inevitable proceed as follows:

a) Descend as fast as possible so that contact is with the envelope fabric, not the basket, burner assembly or flying wires.
b) Close all cylinder valves and vent burners before contact.
c) If the balloon becomes suspended by the power lines make no attempt to remove it until the power is turned off. If the basket is above the ground, at this time, remain in it and do not allow anyone on the ground to touch it.
d) If the basket is on the ground do not touch any metal parts. Leave by jumping off the basket edge such that there is no simultaneous contact with the ground and balloon. The pilot will, as usual, control the evacuation so that there is no danger of the balloon taking off again.
e) Retreat to a safe distance.

3.4.3 - Fire in the air

Proceed as follows:

1) Turn off all cylinder valves.
2) Put out the fire with the extinguisher.
3) Identify the cause of the fire.
4) If the burner, or any one unit of it, can be safely used then use it. Land as soon as possible.
5) If it is not safe to use the burner further then brief the passengers for a hard landing and proceed as for burner failure, as section 3.3.2 (total failure paragraph).

FLIGHT MANUAL APPENDIX 1

PROPANE FUEL

1 - PROPERTIES

Propane is a hydrocarbon with the chemical formula C_3H_8. It is used because it is stored as a liquid under pressure and thus requires no fuel pump. Hot air balloons burn propane as a liquid. If it could be burnt as a vapour burners could be made very simple but, removing large volumes of vapour from a tank rapidly reduces the propane temperature to its boiling point -44°C, after which no more flow will occur. This is why we draw off liquid and vaporise it within the burner itself (on the main blast system).

The required fuel pressure for Sky burners is 4 - 12 bar (=60 - 180psi). The available pressure is dependant on temperature.

Tank pressure = 4bar requires tank temperature = 4°C

Tank pressure = 12bar requires tank temperature = 33°C

Note, however, that even drawing off liquid will reduce the tank temperature a little and, of course, ambient temperature falls with increasing altitude and this can cool the tanks further. Thus if the tank pressure is on the lower limit at the start of a flight it is likely to fall below the minimum allowable during flight. This is why fuel tanks are often pressurised (see later).

Tanks which are too hot, and thus over pressure, may be cooled by immersion in cold water. An alternative is to allow some of the fuel to vaporise by simply opening the tank bleed valve (in a suitable open area). If the burner is connected to the tank its gauge may be used to monitor pressure. In countries where these high temperatures are likely it is advisable to keep tanks in the shade or in a well ventilated building.

Propane has one potentially dangerous property. In its liquid form it has a high coefficient of thermal expansion. This means that as temperature increases the liquid volume also increases. To allow for this balloon cylinders must **never** be filled to more than 80% of their total volume with liquid. If the tank is overfilled and then subject to increase in temperature the tank becomes liquid locked and no further expansion can occur. This will cause an extreme and rapid increase in cylinder pressure to the extent that the safety relief valve, fitted to stop the tank exploding, will discharge large quantities of flammable vapour. Do not overfill balloon fuel cylinders. Always fill cylinders in accordance with the manufacturers recommendations.

2 - COMMERCIAL FUEL

Propane is a product of crude oil. If it was refined to the extent of 99% purity it would not be affordable for use as a balloon fuel. In truth LPG (Liquid Petroleum Gas) is a mixture of oil products but the overall characteristics are similar enough to those of high purity propane.

In some countries, particularly those which are very hot, the properties of LPG are deliberately changed (from those of propane) for safety reasons, particularly to reduce pressure. Only balloonists need high pressure as most other LPG uses require the pressure to be regulated to a very low level anyway. For this reason it still necessary even in some hot countries to pressurise fuel cylinders.

Contamination in propane is also a problem. This can vary from oily substances, which are not harmful, to treacle like substances and even solids, which are. In Central Europe and North America the fuel is usually of a high enough quality to be used as supplied. In other areas it may be necessary to filter the supplied fuel when transferring it to balloon cylinders. Unreliable pilot light performance is the first sign of contamination.

The principle requirement for balloon fuel is that it is water free. Water will not dissolve in propane and so will collect in the bottom of the cylinder to the extent that only water will come out when the cylinder is first used. When using aluminium cylinders (such as the Worthington type) the fuel should also be free of caustic impurities.

3 - REFUELLING FLIGHT CYLINDERS

Refuelling must only be carried out in well ventilated open areas. Refuelling flight cylinders without removing them from the basket is not advised unless a safety device, to conduct the flow from the bleed valve outside the basket, is fitted. There shall of course, be no naked lights in the area and the burner should be removed to avoid accidental triggering of the piezo igniter system.

Cylinders which have been pressurised will have to be vented to remove the excess pressure. To achieve this open the bleed valve and leave the cylinder to vent for 5 minutes or so.

3 - REFUELLING FLIGHT CYLINDERS (cont.)

The best refuelling systems use a pump. The cylinder must be in its normal flight position (vertical on Sky Balloons). Then, proceed as follows:

1) Connect the supply hose to the balloon cylinder liquid outlet.
2) Open the cylinder bleed valve till gas is heard escaping.
3) Open balloon cylinder liquid valve.
4) Open supply line valve.
5) Turn on pump.
6) When the bleed valve discharge changes from vapour to liquid turn off all valves in the following order:

   Balloon cylinder liquid valve

   Bleed valve

   Supply valve

   Then turn off the pump.

Transportable bulk cylinders are usually fitted with just one valve intended to deliver vapour. For this reason the bulk cylinders need to be inverted before use. The filling process will also be quicker if the bulk cylinder can be placed higher than the balloon cylinder but this is not essential. After inverting the cylinder proceed as follows:

1) Connect the bulk cylinder to the flight cylinder with a suitable hose.
2) Open the flight cylinder bleed valve.
3) Open the flight cylinder liquid valve.
4) Open the bulk cylinder valve.
5 Then as item 6, above.

After refuelling flight cylinders it will be necessary to vent the self sealing connectors to avoid possible damage by the expansion of liquid propane, as described above. To achieve this simply depress the centre nipple in the connecter with a blunt instrument.

4 - PRESSURISATION

As discussed earlier pressurisation of flight cylinders is necessary when the required minimum pressure cannot be reached or is unlikely to be maintained in flight. Sometimes it is used to improve burner output, particularly on larger balloons (burner performance is directly related to supply pressure).

Increased pressure can be obtained by warming the cylinders but this effect may not last for the full duration of a long flight. Heating may be achieved by the use of purpose made electrical jackets or simply by storing the cylinders in a warm area prior to use. Monitor the heating process to ensure that the fuel temperature does not exceed 33°C.

Alternatively, and preferred for long flights, is inert gas pressurisation. Nitrogen is preferred for its low cost.

Refuel the flight cylinder before pressurising!

Nitrogen is supplied in high pressure cylinders. These must be fitted with a regulator prior to connection to the balloon cylinder. The regulator should be adjusted to its lowest pressure (usually by turning the handle provided anti-clockwise). With the gas cylinder and flight cylinder both turned off connect the gas supply to the liquid outlet of the flight cylinder. Gradually open the valve on the gas cylinder and check for leaks. Check that the indicated outlet pressure on the gas cylinder is not in excess of 12bar (180psi). If all is OK open the liquid valve on the flight cylinder slowly. Gradually screw the regulator handle back in until the required pressure has been reached. The recommended figure is 10bar, never exceed 12bar. The gas will be heard bubbling through the liquid propane. Continue filling for 2 minutes after this noise ceases. Check that the pressure is at the required level.

Once the process is complete turn off the gas cylinder valve, the flight cylinder valve and carefully disconnect the hose from the flight cylinder. Keep face and eyes away at this stage as a small amount of high pressure gas may escape.

Once the first cylinder has been correctly pressurised the gas cylinder regulator need not be adjusted again. If the regulator is fitted with a lock nut it should be tightened at this stage.

If using a burner assembly with vapour pilot lights two master type cylinders must be left un-pressurised.

Pressurised cylinders should be identified as such to avoid incorrect use or filling.

5 - SAFETY

At the risk of being repetitive:

1) Always perform venting or refuelling in a well ventilated outside area.
2) Ensure that no sources of ignition are present.
3) Store cylinders in a well ventilated area.
4) Always wear leather gloves and full clothing (ie long sleeves & trousers) . **Remember that escaping propane is very cold and has the same capacity to burn as if it were alight.**
5) Always have a fire extinguisher on hand when handling propane.
7) Refuelling equipment (hoses, adaptors) should be made to the same standards as balloon equipment.
8) High pressure gas cylinders should be handled with extreme care. Never point hoses, even if they appear sealed, at people.
9) If pressurised cylinders are to be stored the pressurisation gas should be discharged as described in section 3.

6) - EMPTYING CYLINDERS

Tanks which have been pressurised should be emptied when pressurisation is no longer required. This is best achieved by first emptying the cylinder in normal flight. After this remove the cylinder to a safe area and open the bleed valve and leave it open for 30 minutes after no more gas can be seen or heard escaping. Do not transfer the contents to another cylinder as some of the pressurisation gas will be carried across.

If a cylinder is functional but due for an internal inspection it can be emptied in flight before being submitted to the inspection authority.

A cylinder requiring repair because of leakage can be emptied into another cylinder and then vented as in the first paragraph of this section. **Do not fly with faulty cylinders.**

FLIGHT MANUAL APPENDIX 2 - BALLOON STORAGE AND TRANSPORT

1 - GENERAL

Careful storage and handling of balloon equipment will help achieve maximum balloon life and prevent unattractive weathering, wear and fungal effects.

2 - ENVELOPES

This item is the most likely to be damaged by inappropriate storage and the most expensive to replace. Take care. The bag in which the balloon is stored should be in good condition. As supplied it has a waterproof coating and watertight base. If the coating or base show excessive signs of wear the bag should be renewed. Holes in the bag should always be repaired to prevent the possibility of chafing of the exposed part of the envelope.

Envelopes should not be stored wet. If the envelope has become wet it should be carefully re-inflated as soon as possible, certainly within a week, and kept hot until completely dry.

The packed envelope should be stored in a cool dry area. Beware of vermin which have been known to use well chewed balloons as nest material.

3 - BASKETS

Baskets should be stored in a cool area. Unlike envelopes they benefit from higher humidity as this keeps the cane supple. For this reason baskets should not be stored in heated or unventilated areas.

4 - BURNERS

Always ensure burners are vented (by operating the blast valves) before storage. Avoid excessively humid areas which could lead to corrosion. Burners should not be transported assembled to the basket.

5 - FUEL CYLINDERS

Fuel cylinders must be stored in a well ventilated area, preferably outside but shielded from rain. They should not be stored pressurised (see Flight Manual, appendix 1).

6 - INSTRUMENTS AND RADIOS

These should be removed from the basket for transport and stored in a warm dry area.

7 - TRAILERS - A CAUTIONARY NOTE.

Balloon theft is rare however balloons have been "lost" through the theft of trailers. Likewise fan engines are popular replacements for lawn mowers.