

WHF015

Homologated Fans



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1. INTRODUCTION

1.1 General

- A. The purpose of this document is not to give a definitive list of fan systems that **MUST** be used, merely provide data and limits of known systems in common use.
- B. The following fans and hubs have been tested and approved for use in hovercraft. Use of these fans is to be limited to a Tip speed of less than that shown in the table below.
- C. The tipspeed limits have been given for a range of fans, for convenience. As the limit is based on the actual size of the fan, users that are running close to this limit may find that they can exceed the given limit for their installation.
- D. Users must carry out the exact calculation for their installation.
- E. The fans and hubs have been tested in accordance with WHF010.
- F. This list may be upissued at any time, to add or remove fans and hubs.
- G. Any deviation in the design of the hubs or blades from those tested must be reported to the WHF and components must not be used without first obtaining approval.
- H. Drilling, boring, or machining of the hubs other than to the same specification as those tested is not permitted.
- I. Homologation is only valid when the given tip speeds and restrictions are complied with.

1.2 Interchangeability

- A. It is **NOT** permitted to interchange fan blades and hubs from different manufacturers.
- B. Blades and Hubs have only been tested and approved as manufacturers sets. It cannot be assumed that components will perform to the same performance levels when fitted in mixed combinations.

2. HOMOLOGATED MULTIWING FAN SYSTEMS

2.1 3H Blades

- A. 3H Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size		Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material					m/s	ft/s	
3 H	PAG	Glass Filled Polyamide (Nylon) (White or Grey) See 2.1B.a)	Fixed Pitch (H)	8 10 14 20		A	168	551	2.1B

- B. Restrictions

- Blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- It is recommended that all Type H PAG blades fitted to size 8, 10, 14, 20 Hubs SHOULD be fitted with additional perimeter bolts (M5 or M6) through the blade root. (See 6.1 Appendix A for example)
- The Multiwing Type H, 6 and 8 blade PPG (Glass filled Polypropylene) **Hub** SHALL NOT be used).
- The Multiwing Type H, 3 blade PAG (Glass filled Polyamide) **Hub** SHALL NOT be used).

2.2 4Z Blades

- A. 4Z Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size		Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material					m/s	ft/s	
4 Z	PAG	Glass Filled Polyamide (Nylon) (White or Grey) See 2.2B.a)	Adjustable Pitch (Z)	5		A	168	551	2.2B
				8					
				9					
				12	<800		150	492	>6 Blades 2.2B.c)
					>800		160	525	
					>1000		147	482	
							168	551	6 blades equi-spaced 2.2B.c)

- B. Restrictions

- 4Z Blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- The Multiwing Type Z, 5 blade PPG (Glass filled Polypropylene) **Hub** SHALL NOT

be used).

- c) The Multiwing 12 Blade hub had a particularly low failure load when tested. If only 6 blades are fitted, then full clearance is given, if blades are fitted in consecutive lobes, then the lower limits must be used.

2.3 5Z Blades

- A. 5Z Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size	Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material				m/s	ft/s	
5Z	PAG	Glass Filled Polyamide (Nylon) (White or Grey) See 2.3B.a)	Adjustable Pitch (Z)	5	<800	135	443	
					>800	140	459	
					>900	145	476	
					>1000	150	492	
				8	<900	165	541	
					>900	168	551	
				9	<900	160	525	
					>900	168	551	
				12	<850	135	443	>6 Blades 2.3B.c)
					>850	140	459	
					>1000	147	482	
						168	551	6 blades equi-spaced 2.3B.c)

- B. Restrictions

- a) 5Z Blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- b) The Multiwing Type Z, 5 blade PPG (Glass filled Polypropylene) **Hub** SHALL NOT be used).
- c) The Multiwing 12 Blade hub had a particularly low failure load when tested. If only 6 blades are fitted, then full clearance is given, if blades are fitted in consecutive lobes, then the lower limits must be used.

2.4 Hub Variations

- A. Multiwing have made changes to the hub casting in recent years, the figures used for the clearances given in the tables use the weaker of the two variants.
- B. Earlier hubs can be identified by 2 thin webs between the blade lobes, later hubs have a solid section.



Earlier Style



Later Style

3. HOMOLOGATED HASCONWING SYSTEMS

3.1 Type L Fans

A. Type L Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size	Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material				m/s	ft/s	
L	PAG	Glass Filled Polyamide (Nylon) (White) (Ref 3.1B.a)	Fixed Pitch (HF)	6	N/A	168	551	3.1B.b)
				8				3.1B.c)
				10				
				14				
				20				

B. Restrictions

- Type L blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- Type L White PAG blades fitted to size 6 HV Hubs SHALL be fitted with additional perimeter bolts (M5 or M6) through the blade root. See 6.1.
- Type L White PAG blades fitted to size 8, 10, 14, 20 Hubs SHOULD be fitted with additional perimeter bolts (M5 or M6) through the blade root. See 6.1.

3.2 Type M Fans

A. Type M Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size	Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material				m/s	ft/s	
M	PAG	Glass Filled Polyamide (Nylon) (White) (Ref 3.2B.a)	Adjustable Pitch (HV)	5	A	140	459	Error! Reference source not found.
				5		150	492	
				5		168	551	
				5		168	551	
				9 12 16		168	551	

B. Restrictions

- Type M blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.

3.3 Type B Fans

A. Type B Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size		Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material			mm		m/s	ft/s	
B	PAG	Glass Filled Polyamide (Nylon) (White) (Ref 3.3B.a)	Adjustable Pitch (HV)	5	< 850	A	145	476	
					850 > 1000		150	492	
					>1000		159	522	
				9	N/A		168	551	3.3B.b)
				12	700 < 850		160	525	
					>850		168	551	
				16	N/A	B	164	538	3.3B.c)
							168	551	

B. Restrictions

- Type B blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- Type B blades are NOT homologated for use in Size 12 Type HV hubs in ducts smaller than 700mm. Users in this range must provide satisfactory calculations to support use of the blade at the size and speed required.
- Type B blades may be used blades in the 16 Blade hub with Grade A guarding upto the tip speed limits given in the table above. Use of these at greater than 164m/s requires Grade B guarding.

4. HOMOLOGATED WINGFAN SYSTEMS

4.1 Type P3H Fans

A. Type P3H Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size		Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material			mm		m/s	ft/s	
P3H	PAG	Glass Filled Polyamide (Nylon) (Beige) (Ref 4.1B.a)	Fixed Pitch (H)	8 10 14 20	N/A	A	168	551	4.1B.b)

B. Restrictions

- Type P3H blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- Type P3H White PAG blades fitted to size 8, 10, 14, 20 Hubs SHOULD be fitted with additional perimeter bolts (M5 minimum) through the blade root. See 6.1.

4.2 Type P4Z Fans

A. Type P4Z Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size		Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes	
	Code	Material			mm		m/s	ft/s		
P4Z	PAG	Glass Filled Polyamide (Nylon) (Beige) (Ref 4.2B.a)	Adjustable Pitch (Z)	5	>700	A	168	551	4.2B	
					550 > 700		155	509		
					<550		150	492		
				7 8 9 12 16	N/A		168	551		

B. Restrictions

- Type P4Z blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- Type P4Z White PAG blades have restricted Tip Speed when used with the Size 5 HV Hub.

4.3 Type P5Z Fans

A. Type P5Z Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size	Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes	
	Code	Material		mm		m/s	ft/s		
P5Z	PAG	Glass Filled Polyamide (Nylon) (Beige) (Ref 4.3B.a)	Adjustable Pitch (Z)	5	< 850	A	150	492	4.3B
					850 > 950		155	509	
					>950		160	525	
				7 8 9	N/A		168	551	
							168	551	
							160	525	
				12	>800		164	538	
					<800		164-168	538-551	
				16	N/A	B	164-168	538-551	

B. Restrictions

- Type B blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- Type B blades may be used blades in the 16 Blade hub with Grade A guarding upto the tip speed limits given in the table above. Use of these at greater than 164m/s requires Grade B guarding.

4.4 Type P6Z Fans

A. Type P6Z Blades are homologated in the following configurations:

Fan Blade	Material		Hub Type and Size	Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes	
	Code	Material		mm		m/s	ft/s		
P6Z	PA PAG	Glass Filled Polyamide (Black) (Beige) (Ref 4.4B.a)	Adjustable Pitch (Z)	7	N/A	A	133	436	4.4B
					>1000	B	133	436	
					>1000		133-140	436-459	
				8	N/A	A	127	417	
					<1000	B	127-130	417-427	
					>1000		127-135	417-443	
				9	N/A	A	132	433	
					<1050	B	132-138	433-453	
					>1050		132-141	433-463	
				12	N/A	A	126	413	
					<1050	B	126-132	413-433	
					>1050		126-140	413-459	

B. Restrictions

- Type P6Z blades of any other material or colour, do not meet homologation requirements and SHALL NOT be used.
- The P6Z blades can exceed the Kinetic Energy limits for guarding Category A, therefore there is a tipspeed limit to use these blades with Category A guarding, if users wish to use Category B guarding then the higher limits may be used.

5. OTHER VERIFIED SYSTEMS

5.1 General

A. The following individual installations have been verified by the WHF technical team.

5.2 Individual user systems

Fan Blade	Material		Hub Type and Size		Duct Size Limits	Guarding Category Required	MAXIMUM TIP SPEED		Notes
	Code	Material			mm		m/s	ft/s	
AL46	N/A	Carbon / Kevlar	AL46 Hub	8	1100 only	A	168	551	None

6. APPENDIX A:- PERMISSABLE HUB MODIFICATIONS

6.1 Multiwing, HasconWing and Wingfan Fixed Pitch Hubs

- A. M5 or M6 Bolts fitted through the blade root.

