BMAA TECHNICAL INFORMATION LEAFLET (TIL)

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CHECK FLYING HANDBOOK

Contents

1. Introduction

This document describes the BMAA's policy on check flights and check flying. Check flights are straightforward 'test' flights to find out whether or not an aircraft is flying as it should.

There are no special flying skills required to fly a check flight; all the manoeuvres are taught as part of a pilot's ab initio training course. Therefore anyone with an appropriate pilot's licence is essentially qualified to check fly an aircraft. The significant difference is one of emphasis: in a check flight the emphasis is on what the aircraft is doing and whether it's working properly or not, whereas during training the emphasis was more on the pilot's performance.

The intention of this document is to brief a pilot on how to perform a check flight and what to look for, and the associated safety considerations.

This document (issue 9) is issued in March 2016 to be used from 1 April 2016. This minor revision (issue 9a) is issued in April 2016 to clarify the requirement for performing the climb at heavy weight. See Section 2.1 (Risk #7), Section 4.2 (table 1, item 8) and Section 4.2.2.

Comments or queries on this document should be emailed to technical.office@bmaa.org.

1.1. Types of Check Flight

This document covers two different types of check flight: Airworthiness Check Flights and Maintenance Check Flights. Both of these check flights 'check' the airworthiness of the aircraft, and should not be confused with a check flight with an instructor to 'check' the ability of the pilot.

1.1.1. Airworthiness Check Flight

An Airworthiness Check Flight is part of the process of revalidating an aircraft's Permit to Fly. Its purpose is to confirm that the aircraft is airworthy from a flying perspective. It involves checking that the aircraft flies and handles as it should, that the aircraft performs as it should, and that the aircraft's instruments and systems operate as they should. The Airworthiness Check Flight can be considered an extension of the annual inspection to check the things that cannot (or cannot easily) be checked on the ground.

1.1.2. Maintenance Check Flight

A Maintenance Check Flight is the final check following maintenance (or repair by replacement) of an aircraft. Its purpose is to confirm that the aircraft is working correctly following the maintenance. What it involves very much depends on what maintenance was performed. The Maintenance Check Flight can be considered an extension of the post-maintenance inspection to check the things that cannot (or cannot easily) be checked on the ground.

1.2. Different control types

The document has been written primarily for 3-axis and weight-shift control aircraft. Where a comment, paragraph or section is specific to one of these, it is prefixed with either **[3-axis control aircraft]** or **[weight-shift control aircraft]**.

Some checks are required to be performed twice: firstly in the cruise (flaps up) configuration and then in the landing (flaps down) configuration. For weight-shift control aircraft, and 3-axis control aircraft without flaps, the aircraft is always in the cruise configuration, and the check in the landing configuration is not applicable.

1.2.1. Powered parachutes and 2-axis control aircraft

The BMAA has a small number of powered parachutes in its fleet, primarily the Aerochute Dual. See Appendix 2 for details of how to check fly these.

The BMAA has a small number of 2-axis control aircraft in its fleet, primarily the Mignet HM1000 Balerit. These should be check flown as a 3-axis control aircraft ignoring those checks that are not applicable.

1.3. Important small print

Please note that this document does not tell you everything you need to know about check flying. This section lists things that are important (from a check flying perspective) but that are outside the scope of this document.

This document does not describe how to fly the basic manoeuvres that go to make up a check flight. These manoeuvres are all normal manoeuvres that are taught as part of the private pilot's licence syllabus. In addition, none of them involves taking the aircraft outside of its normal operating limitations. It is the pilot's responsibility to ensure that they continue to be familiar with how to fly and recover from these manoeuvres, and the normal safety checks and precautions associated with them. It is also the pilot's responsibility to ensure that they are in current practice with flying these manoeuvres prior to commencing a check flight.

This document is, by necessity, a generic document, which means it does not contain information specific to any particular aircraft type. It is the pilot's responsibility to ensure that they are familiar with the type-specific limitations, instructions and guidance in the aircraft's Flight Manual / POH (or other relevant documents). Nothing in this document overrides the contents of these aircraft-specific documents. In case of a conflict contact the BMAA Technical Office prior to proceeding.

The activity of check flying is closely related to the activities of aircraft maintenance and inspection. However, this document does not describe in detail how to properly maintain or inspect an aircraft.

This document does not describe how to safely restrain an aircraft for an extended ground run. Nor does this document describe how to perform a fuel flow test. Both of these activities are potentially hazardous and require proper safety planning should they be required.

2. Safety

It is good practice, and good airmanship, to spend a moment considering the risks associated with any flight beforehand. This is particularly true of a check flight, which - as discussed in this section - can be more hazardous than a normal flight.

The risks associated with any particular check flight are very much dependent on the circumstances of that particular flight. Nonetheless, this section attempts to highlight common risks associated with check flights.

2.1. Routine Airworthiness Check Flights

An airworthiness check flight does not involve taking the aircraft outside of its normal operating envelope, or involve flying any unusual manoeuvres (that are not part of the private pilot's licence syllabus). That said, it is different from an average flight, and has a special set of risks.

Risk #1: the pilot expects the aircraft to behave normally
The Airworthiness Check Flight is performed to see if the aircraft behaves as it should. There is no guarantee that it will; if there was, there would be no point checking! Additionally, the check flight does involve flying to parts of the envelope that many aircraft - even those that are regularly flown - do not regularly visit. Therefore, the pilot should be prepared for something unexpected to happen, and have plenty of height in hand to recover should things not go to plan.

Risk #2: the pilot is not familiar with flying the required manoeuvres
Although the Airworthiness Check Flight does not involve flying any unusual manoeuvres (that are not part of the private pilot's licence syllabus), it does involve flying manoeuvres that many pilots do not regularly practice. At the very least an out-of-practice pilot may not be able to tell if the aircraft is behaving as it should; at worst they may fail to recover from what should be a recoverable situation. Therefore, the pilot must ensure that they are familiar flying, and recovering from, the manoeuvres in the check flight, and know what to do should those manoeuvres go wrong.

Risk #3: the pilot is not familiar or current with flying the type
A check flight should always be flown by a pilot who is familiar with the aircraft type. This is so that they can fly the aircraft safely, as well as recognise whether or not the aircraft is flying as it should. If the pilot is not familiar or current with flying the type it is their responsibility to satisfy themselves that they will be able to fly the aircraft safely prior to agreeing to fly it. Things to consider include:

- It is best practice to learn how to fly, or familiarise on, a new type with an instructor who is qualified and experienced on type.
- There is no excuse for not reading the Flight Manual / POH prior to flying a new type.

Risk #4: the pilot is not familiar with the Flight Manual / POH
The Flight Manual / POH should be reviewed prior to the check flight. In particular, the pilot must ensure that they are familiar with how the manufacturer recommends the type is flown - which is not necessarily how the pilot normally flies the type - and the recommended emergency procedures (such as spin recovery).

Risk #5: the pilot forgets to consider the safety of third parties
In addition to the safety of the aircraft and crew, the safety of third parties - in the air and on the ground - must also be considered. In particular, the pilot should always consider where the aircraft will land in case of an engine failure after take-off, ensure that (at least) the stall and high speed checks are performed over open countryside, and ensure that a good lookout is maintained while performing the check flight.

Risk #6: the check flight is used as a substitute for good inspection
The intention of a check flight is not to check things that can readily be checked on the ground, and certainly not to check things that could result in loss of control if not right.

Risk #7: ballast

While ballast can be used to increase the take-off weight of an aircraft, improper use of ballast can be extremely hazardous. Therefore, for routine check flying, ballast should normally be limited to baggage compartments, noting that:

- Baggage compartment load limits must not be exceeded, and the ballast must be properly secured to stop it shifting or coming loose in flight, or breaking free in an accident.
- The aircraft must be kept in balance. In a Microlight, as long as ballast is located in the baggage compartment (in accordance with its weight limit) the aircraft should remain in balance.

If more significant ballasting is being considered, consult the Technical Office.

2.2. Higher risk Check Flights (Maintenance and Airworthiness Check Flights)

A Maintenance Check Flight has an additional set of risks - owing to not having been flown since having had work done. An Airworthiness Check Flight on an aircraft that has not flown for an extended period of time has a similar additional set of risks. These risks are discussed below.

For a higher risk check flight, the pilot should always consider flying a solo check/shakedown flight first to check for any major problems prior to taking an observer.

2.2.1. Check flights after engine or fuel system maintenance

After significant engine or fuel system maintenance it is good practice to give the engine a ground run. In such a case it is particularly important that the ground run not only achieves maximum static rpm, but that full power is maintained for an extended period to give the best chance of finding any problems before take-off. Monitor engine temperatures to ensure that the engine does not overheat.

Note that, even then, a ground run will not completely simulate a take-off, as the propeller unloads at speed allowing the engine to develop more power and consume more fuel. If there is any question mark about the fuel system, a fuel flow check should be performed in addition to an engine run. The fuel flow check is used to ensure that the fuel system can provide enough fuel for full power on the ground, plus a safety margin for flight.

Ground running and fuel flow testing are potentially hazardous activities in their own right, and require proper safety planning should they be required. Contact a BMAA Inspector or the Technical Office for advice.

2.2.2. Check flights after airframe or control system maintenance

After significant airframe or control system maintenance it is vitally important that the aircraft is very carefully inspected to confirm that it has been put back together correctly prior to the check flight. The check flight is only to see if any relatively minor tuning is required.

To check the airframe is rigged correctly, follow the instructions in the Maintenance Manual/POH. In addition, a visual check for airframe symmetry is advisable. Depending on type, this is best done from either directly in front, or directly behind, the aircraft.

To check the controls are rigged correctly, measure the control deflections against those in the TADS / HADS for the type. In addition, a visual check for aileron symmetry is advisable. Ensure the aileron neutral position is correct, and that deflections are symmetrical: the maximum 'up' deflections are the same on each side, as are the 'down' deflections. Check that there is not excessive friction in the control circuits, and that there is no slack in the systems. Checking for slack is best done with an assistant to 'clamp' one end of each system in turn.

2.2.3. Check flights on aircraft that have not flown for a long time

There is a much higher probability that 'something' is wrong with an aircraft that has not recently flown, than with an aircraft that has. This 'something' may be due to all manner of things including (but not limited to): corrosion; ageing/degradation; hangar rash; wildlife; vandalism; parts cannibalisation.

Return-to-service maintenance and inspection are the primary means of ensuring an aircraft that has not flown for some time is airworthy prior to a check flight. However carefully this is done, there is an increased risk that something unexpected will happen on the first flight.

Specific things to consider on an aircraft that has not flown for a long time include (but are not limited to):

- Friction. Even very mild corrosion on the surfaces of moving parts can cause an increase in friction between those parts. Even a small increase in friction in the control system of an aircraft can have a detrimental effect on the handling and apparent stability of the aircraft. For example, too much friction in the aileron circuit can reduce the lateral stability of the aircraft such that it will no longer tend to level its wings after being disturbed by a gust. A pilot check flying an aircraft should bear in mind that the inspector's primary concern is whether corrosion has a detrimental effect on its strength; it is the pilot's primary responsibility to assess whether the operation of the controls is satisfactory.
- Fuel system. A long period without use can result in all manner of fuel system problems. Problems with the fuel system of an aircraft are notoriously difficult to identify by inspection. The advice in the section about checks following fuel system maintenance apply here too.

3. Important information

3.1. Crew requirements

3.1.1. Pilot

The fundamental requirement of the pilot is that they have a pilot's licence that allows them to legally fly the aircraft.

In addition, the pilot should be familiar and current flying the aircraft type. This is so that they can fly the aircraft safely, as well as recognise whether or not the aircraft is flying as it should. The pilot must also:

- Be familiar with the aircraft's Flight Manual/POH.
- Be familiar with how to fly and recover from the manoeuvres that make up the check flight, and the normal safety checks and precautions associated with them.
- Be in current practice flying these manoeuvres.

For an Airworthiness Check Flight (for revalidation of a Permit to Fly) the pilot must be a current BMAA member.

Note: it is the owner's responsibility to decide who will check fly their aircraft - whether they will fly it themselves, or ask another pilot to fly it for them.

3.1.2. Observer

It is often useful to take an observer on a check flight to share the check flight workload, provide a second pair of eyes, and achieve heavy weight for the climb performance check. However, if the flight is a higher risk check flight - for example if the aircraft has not been flown recently, or significant work has been done on the aircraft since its last flight - the pilot should always consider flying a solo check/shakedown flight first to check for any major problems prior to taking an observer.

An observer should always be briefed by the pilot prior to the check flight. In addition to the normal safety brief, the observer should be made aware of what the check flight entails, and the tasks the pilot expects the observer to perform during the check flight (e.g. recording data or keeping a lookout).

3.2. Legalities

3.2.1. Permit to Fly

If an aircraft's Permit to Fly is valid - has a current, unsuspended, Certificate of Validity - the legal basis for any check flight is the aircraft's Permit to Fly.

If the Permit to Fly is not valid - the Certificate of Validity has expired or been suspended - the legal basis for a check flight is a Permit Flight Release Certificate (PFRC). This is described in the section below.

It is important to note that only aircraft with a Permit to Fly can be check flown as described in this document. The Permit to Fly need not be valid (have a current Certificate of Validity) but must exist and must not have been revoked. The only way to reliably confirm this is by using G-INFO. A brand new aircraft that has not been issued a Permit to Fly yet, or an existing aircraft whose Permit to Fly has been revoked by the CAA (even if the paper Permit to Fly has not been destroyed), can only be check/test flown on BMAA B Conditions, which must be specially arranged through the Technical Office.

3.2.2. Permit Flight Release Certificate (PFRC)

If an aircraft has a Permit to Fly, but it is not valid - the Certificate of Validity has expired or been suspended – the aircraft may not be check flown until the aircraft has been inspected, and a PFRC issued, by a BMAA Inspector.

A PFRC is incorporated in the inspection schedule for revalidation of a Permit to Fly. A PFRC is also incorporated into the Permit to Fly suspension form.

A PFRC normally expires 60 days after being signed. A PFRC only authorises check flying in this period. If a ferry flight is required to be flown on a PFRC, this can only be done with the prior written agreement of the Technical Office. Once the check flight is complete the aircraft may not be flown until the new Certificate of Validity has been issued.

If work is done to the aircraft this invalidates the PFRC. Therefore, if the aircraft fails a check flight and requires work done to the aircraft, this must be done in consultation with the BMAA Inspector who signed the PFRC.

3.2.3. Insurance

The aircraft must have, at least, the legal minimum insurance cover for the check flight. The legal minimum is third party cover, plus passenger cover if not flown solo. If an aircraft is not being flown by the owner, although it is the owner's responsibility to insure the aircraft, it is the pilot's responsibility to check that the aircraft is adequately covered prior to the flight.

An airworthiness check flight does not involve taking the aircraft outside of its normal operating limitations. Therefore, if the aircraft has a valid Permit to Fly, the aircraft's existing insurance is not invalidated by performing the check flight. If the aircraft's Permit to Fly is not valid - and the check flight is, therefore, authorised by a Permit Flight Release Certificate (see above) - it must be confirmed that the aircraft's existing insurance covers this. If not, special insurance cover must be arranged for the flight.

Note: if the aircraft is not being flown by the owner yet the aircraft's hull is not insured, it is advisable to come to an agreement about what will happen should the aircraft be damaged during the check flight. Record the agreement in writing prior to the check flight.

4. Flying the Airworthiness Check Flight

An Airworthiness Check Flight is part of the process of revalidating an aircraft's Permit to Fly. Its purpose is to confirm that the aircraft is airworthy from a flying perspective.

Note that this is not a standalone section, and should be read in conjunction with the previous sections.

4.1. Timing of the Check Flight (with respect to the annual inspection)

In general, the airworthiness check flight for revalidation of a Permit to Fly can be flown anytime within 60 days of the Permit to Fly revalidation inspection: before or after. However, for the check flight to be flown before the inspection, the Permit to Fly's previous Certificate of Validity must still be valid - must not have expired, or have been suspended - at the time of the check flight.

If the check flight is flown before the inspection, the Inspector can require that another check flight be flown. This will typically occur if the aircraft fails the inspection and requires subsequent remedial work that potentially invalidates the results of the first check flight. The Inspector will also require that another check flight be flown if significant work has been done on the aircraft (e.g. maintenance, repair or modification) between the check flight and the inspection. Note that the Technical Office also reserves the right to require another check flight be flown if it has reason to believe that the check flight was unsatisfactory in any way.

4.2. Preparation for the Check Flight

1a 1b	Pilot suitable: pilot familiar and current flying the aircraft type pilot familiar and current flying the check flight manoeuvres pilot current BMAA member Pilot licence: pilot licenced to fly aircraft licence and medical valid	
2a 2b	Permit-to-Fly: confirm using G-INFO that the aircraft has a Permit to Fly, and that the Permit to Fly has not been revoked PFRC: check using G-INFO whether the Permit to Fly has expired or been suspended - if it has, ensure PFRC has been issued by a BMAA Inspector and that it has not expired	
3	Insurance: insurance in place for check flight insurance not invalid if flight authorised by PFRC	
4a 4b 4c	Pilot has, and familiar with: BMAA Check Flying Handbook Aircraft Flight Manual / POH Pilot has access to: Aircraft documentation (logbook(s) etc) TADS / HADS for aircraft type MAAN (amateur-built aircraft only) Pilot has reviewed inspection schedule (if check flight occurring after annual inspection)	
5	Weather	
6	Pre-flight inspection	
7	Risk assessment: identify and assess risks associated with this check flight	
8	Weight and balance: heavy weight; ideally within 20kg of MAUW balance within limits (3-axis control aircraft only) ballast (if fitted) secure in baggage compartments	
9	Observer: briefed (if carried)	

Table 1 - Airworthiness Check Flight preparation checklist

Preparing for an airworthiness check flight is discussed in this section, and summarised in the checklist in Table 1 above.

4.2.1. Important documents

A pilot performing a check flight must have the aircraft's Flight Manual or Pilot Operator's Handbook (POH). Note: sometimes an aircraft has a separate Flight Manual and Maintenance Manual; sometimes these are combined into a POH.

Another important document is the TADS or HADS datasheet for the aircraft type. These are available for all BMAA types on the BMAA website.

Every amateur-built BMAA aircraft has an individual MAAN approval document that contains information specific to that individual aircraft example. The MAAN complements the HADS, which contains information specific to the aircraft type.

4.2.2. Weight & balance

The climb performance measurement must be performed at close to Maximum All-Up Weight (MAUW). This is so that the result can be compared against the published, MAUW climb rate for the type.

For many BMAA aircraft, achieving heavy weight requires the aircraft be flown dual. For a higher risk check flight, the pilot should always consider flying a solo check/shakedown flight first to check for any major problems prior to taking an observer. If, for any reason, the aircraft can only be check flown solo, please contact the Technical Office to discuss, and agree a way forward.

The aircraft should ideally be flown within 20kg of MAUW. For example: an aircraft with a MAUW of 450kg should be flown at a weight between 430kg and 450kg; an aircraft with a MAUW of 390kg should be flown at a weight between 370kg and 390kg. If this cannot be achieved - even with full fuel, an observer and ballast in baggage compartments - include a note explaining why, and the Technical Office will attempt to revalidate the Permit to Fly on the basis of the climb rate achieved at the reduced weight.

While loading the aircraft don't forget to consider the balance of the aircraft. Note that, in a Microlight, as long as the aircraft is loaded in accordance with the aircraft's weight limitations, the aircraft should remain in balance.

4.2.3. Check flight equipment

The equipment required is minimal:

- Check flight schedule
- Something suitable to write with (noting that ink may freeze in cold conditions)
- Stopwatch

It is important that equipment is secure. The check flight schedule should be attached to a kneeboard or similar, and the pen secured with a lanyard. In an open cockpit aircraft - and particularly a trike - it is more challenging. Some pilots put the check flight schedule in a map board and write on the map board with a chinagraph pencil, copying the results to paper after the flight.

4.2.4. Weather

Reasonably calm conditions are required to obtain meaningful results and to perform the high speed dive safely without risk of overstressing the airframe. An adequate ceiling is required for safe execution and recovery from the stalls.

4.2.5. Pre-flight inspection

In addition to a thorough pre-flight inspection using the schedule in the Flight Manual / POH:

- Visually check the airframe for symmetry. Depending on type, this is best done from either directly in front, or directly behind, the aircraft.
- ***[3-axis control aircraft]*** Check that the aerodynamic controls operate in the correct sense. Sanity check the deflections against those in the TADS / HADS for the type (this means judge 'by eye' whether the deflections are correct; measure if in doubt). Ensure the aileron neutral position is correct, and that deflections are symmetrical: the maximum 'up' deflections are the same on each side, as are the 'down' deflections.
- ***[3-axis control aircraft]*** Check that there is not excessive friction in the control circuits, and that there is no slack in the systems. Checking for slack is best done with an assistant to 'clamp' one end of each system in turn.

Irrespective of whether the aircraft has recently been inspected by a BMAA Inspector or not, it is the pilot's responsibility alone to ensure that the aircraft is in an airworthy condition prior to flight.

4.3. The Check Flight itself

This section describes the individual checks that make up the Check Flight:

- Ground run
- Taxy
- Take-off and climb
- Trim
- Pitch stability
- Turns
- Steady-heading sideslips (3-axis control aircraft only)
- Stalls
- Instruments and systems
- High speed flight
- Landing, taxy and shut down

4.3.1. Ground run

This is a check to ensure – as far as is possible on the ground – that the engine, fuel system and related instruments are working properly prior to take off.

Although the ground run can be the first part of the check flight proper, if the aircraft's brakes cannot hold full power (so it needs chocking or otherwise restraining), or an extended ground run is required (after maintenance or an extended lay-off), the ground run can be a separate exercise prior to the check flight.

How to perform this element

- Start the engine as described in the Flight Manual / POH and warm to operating temperature while monitoring the engine instruments.
- Check the ignition system(s) and perform all other pre-flight engine checks, all as described in the Flight Manual / POH.
- Check the idle and the maximum static RPM (wide open throttle).

What to look for

- That the engine and fuel system are working satisfactorily and the engine is achieving the correct maximum static RPM.
- That the engine instruments appear to be functioning correctly.

Most likely problems

- Unserviceable or suspect ignition system (normally indicated by an excessive mag drop, or indeed no mag drop).
- The engine stops on idle, or the idle speed is too high, or the engine 'hunts' on idle.
- The engine does not pick up, or run, cleanly when the throttle is opened.
- Unusual vibration or noise.
- The engine will not produce full power (maximum static RPM too low). This might be an indication that the tachometer is not reading properly.
- Engine instruments are not working, or not working properly.

Safety considerations

- Choose a safe location for the ground run. Ensure that the aircraft is on a good surface – no grit or other loose objects – that the area in front of the aircraft is clear – sufficient to stop the aircraft should it start moving – and that there is nothing behind the aircraft that will be affected by the slipstream.
- Only run the engine from the pilot's seat, wearing the safety harness and any other normal safety equipment (such as, for example, a helmet in an open cockpit aircraft).
- Be prepared to reduce power, and to turn off the ignitions, at a moment's notice.

4.3.2. Taxy

While taxying, check the steering and brakes, and confirm that the compass, and the slip ball on a 3-axis control aircraft, are not stuck.

4.3.3. Take-off and climb

These checks are to confirm that the engine, fuel system and related instruments are working properly, and that the aircraft's performance is satisfactory. It is also an opportunity to confirm that the aircraft appears to be handling satisfactorily before performing more complicated manoeuvres. These checks are performed during the take-off and climb to height prior to the remainder of the check flight.

The climb check involves measuring the time it takes the aircraft to climb 1000 feet (in seconds). The climb rate (in feet per minute) is calculated, or looked up in Appendix 1, after the flight. It is worth working out / looking up the approximate time it should take the aircraft to climb 1000 feet before the flight. Then, if the time taken is very different, the check can be repeated to confirm. The quality of climb performance data can be really badly affected by turbulent or thermic conditions.

How to perform this element

- For this check the aircraft must be loaded close to the maximum all-up weight (MAUW).
- Take-off using the technique and speeds recommended in the Flight Manual / POH.
- After take-off, and once any flaps have been retracted, establish a climb at best climb rate speed.
- Time, in seconds, how long it takes to climb through 1000 feet. It is normal to start the stopwatch when passing through 500 feet above the airfield, and stop when passing through 1500 feet.
- After the flight, lookup, or calculate, the climb rate achieved, as described in Appendix 1.

What to look for

- The climb rate that was achieved and how this compares to the published climb rate for the type.
- Engine temperatures and pressures.

Most likely problems
- The measured climb rate is significantly lower than it should be. This is usually indicative of an engine problem.
- Engine, or fuel system, or cooling problem during the climb.

Safety considerations
- Although this is normally a low risk check, if the aircraft has not flown for some time, or been subject to maintenance or repair since last flying, this is when any serious problems will become apparent. In such cases the pilot should consider flying a solo check/shakedown flight first to check for any major problems prior to taking an observer.
- Before the flight, plan where you will go should the engine fail during the take-off or on climb out.

4.3.4. Trim

This check is to confirm that the aircraft can be trimmed. An aircraft that can be trimmed will continue to fly straight and level - without changing speed or starting to turn - when the controls are released. This check is applicable to all aircraft, not only those with a pitch trimmer!

[Weight-shift control aircraft] Due to their flexible wings, weight-shift control aircraft are susceptible to getting a definite 'turn' in them. Such a turn should not be accepted, but tuned out by following the wing tuning instructions provided with the aircraft. That said, weight-shift control aircraft can behave differently at different weights and at different speeds, and it is not always possible to achieve a wing that will fly dead straight in all possible conditions. If there is any residual tendency to turn, it should be gentle and easily controllable.

[3-axis control aircraft] 3-axis control aircraft will not always fly dead straight in all circumstances, such as solo – due to the pilot in the left hand seat with no one to balance them in the right hand seat – or at particular speeds and/or power settings – due to the fin's location in the wake from the remainder of the aircraft. If there is any tendency to roll or yaw, it should be gentle and easily controllable.

How to perform this element
- Trim the aircraft in straight and level flight (i.e. with power as required to maintain height) at a typical cruise speed.
- Release the controls and see what happens.

What to look for
- That the aircraft continues to fly in trim - in pitch, and in roll/yaw - when the controls are released.

Most likely problems
- The aircraft's speed drifts away - up or down - from the trim speed after releasing the controls. This indicates a lack of pitch stability.
- The aircraft does not continue to fly straight and wings level when the controls are released. If there is any tendency to roll or yaw it should be gentle and easily controllable.

4.3.5. Pitch stability

This check is to confirm that the aircraft is reasonably stable. A stable aircraft tends to return to its trim condition after it is disturbed (by a gust, for example). To check stability the 'disturbance' is caused by the pilot using the controls. In the check flight only pitch stability is checked.

A pitch stable aircraft will tend to return to its trim speed when disturbed. In the check flight the pilot nudges the speed away from the trim speed using the pitch control and then releases the control to see whether the aircraft returns towards its trim speed.

Although all aircraft must be pitch stable, some are, by design, more stable than others. Weight-shift control aircraft are generally very pitch stable, requiring large control forces to change the speed, and returning briskly to the trim speed when the controls are released. Different 3-axis control aircraft types have very different levels of pitch stability. An aircraft with low pitch stability requires very light control forces to change the speed, and will return only leisurely to the trim speed when the controls are released. On such an aircraft, the pitch stability can be masked by friction in the control system.

How to perform this element

- Trim the aircraft in straight and level flight (i.e. with power as required to maintain height) at a typical cruise speed.
- Slowly increase speed (by pitching down) by approximately 5 knots (or 5 mph), release the controls and see what happens. If the speed does not return to the trim speed, increase speed by a further 5 knots (or 5 mph), release the controls and see what happens.
- Repeat the previous check, but decrease speed (from the trim speed) before releasing the pitch control.

What to look for

- That the aircraft is pitch stable: tends to return to its trim speed when disturbed from that speed.
- The aircraft should return to within 10% of its original trim speed. For example, if the trim speed is 70 mph the aircraft should return to below 77 mph after the speed is increased, and above 63 mph after the speed is decreased.

Most likely problems

- The aircraft's speed drifts away from the trim speed – not back towards it - after releasing the controls. This indicates a lack of pitch stability.
- The aircraft does not return to its trim speed, but remains at its new speed, when the controls are released. This can indicate a lack of pitch stability, but it can also be due to excessive friction in the pitch control system.

4.3.6. Turns

These checks are to confirm that the aircraft responds to roll and yaw control inputs as expected. They involve making turns in both directions.

How to perform this element

- Trim the aircraft in straight and level flight (i.e. with power as required to maintain height). Speed should be a typical general handling speed for the type, and in any case not exceed the manoeuvring speed (V_A), or be too close to the stall speed. 1.4 times the flaps-up stall speed is the absolute minimum speed for a 60° bank (+2g) turn to avoid stalling in the turn.
- Perform turns not exceeding the bank angle limit for the type, building up from gentle turns to steep turns. Use pitch and power to maintain height and airspeed.

What to look for

- That the aircraft responds to the controls as expected, and that the behaviour is reasonably symmetrical – broadly the same to the left and to the right.
- ***[3-axis control aircraft]*** That the aircraft can be kept in balance during the manoeuvre.
- ***[Weight-shift control aircraft]*** That the aircraft doesn't roll into the turn.

Safety considerations

- Do not extend a steep turn for more than 270° (to avoid flying through your own wake). This is particularly dangerous in weight-shift control aircraft.

4.3.7. *[3-axis control aircraft]* Steady-heading sideslips

These are to check the lateral and directional stability of the aircraft. They involve executing constant-heading side slips in both directions. A constant-heading side slip is a side slip in which the roll and yaw are 'balanced' so that the aircraft continues to fly in the same direction; the aircraft does not turn. For aircraft with flaps this check is performed in the cruise configuration (flaps up).
Before attempting this manoeuvre confirm that the aircraft is cleared for side-slips (and check for any type-specific guidance or limitations on side-slipping) in the Flight Manual / POH.

How to perform this element

- Trim the aircraft in straight and level flight (i.e. with power as required to maintain height). Speed should be a typical general handling speed for the type, and in any case not exceed the manoeuvring speed for the type (V_A), or be too slow (not too close to the flaps-up stall speed).
- Perform constant heading side-slips to both the left and right. Increase roll and yaw until one of the controls hits the stop. As the side-slip angle is increased drag will increase; maintain speed by pitching down.

What to look for

- That the side slip behaviour is reasonably symmetrical – broadly the same to the left and to the right.
- That the control forces – roll and yaw – increase as the side-slip angle is increased, and that the aircraft tends to return towards balanced flight when the force on the controls is relaxed.

Most likely problems

- Lightening, or even reversal, of control forces.
- Un-commanded rolling or yawing behaviour.
- Excessive buffeting or vibration.

4.3.8. Stalls

These checks are to confirm that the aircraft stalls at the correct speed, and that the aircraft's behaviour during the stall and recovery is typical for type and not dangerous. Aircraft with flaps are stalled with flaps down as well as in the cruise configuration. Note that the check flight only requires gentle, wings level stalls.

Although the airworthiness requirements permit a mild wing drop at the stall (maximum 20°, with normal use of the controls during recovery), the majority of BMAA types do not exhibit a marked wing drop when stalled. Therefore, if an aircraft does drop a wing approaching 20° in a check flight it is important to determine whether this is normal for type (and therefore acceptable) or an indication that something is amiss. After confirming that it is not due to well-timed turbulence or approaching the stall out of balance (3-axis control aircraft), start by seeing what the Flight Manual / POH says. If this does not clarify the situation satisfactorily, refer to the aircraft manufacturer or the BMAA Technical Office for advice.

Some aircraft types do not have sufficient control authority to achieve an aerodynamic stall: the pitch control hits the stop before the aircraft stalls. Such aircraft have a minimum steady flight speed rather than a stall speed. For these aircraft it is sufficient to fly the aircraft down to this minimum steady flight speed and recover. Do not attempt to force an aerodynamic stall with an accelerated stall entry.

How to perform this element

- Start at a safe height, clear of other air traffic, and over open country. Use the HASELL, or similar, check.
- Trim the aircraft at a safe speed, typically 1.3 or 1.4 times the expected stall speed.
- Reduce power to idle, and establish a steady descent with wings level.
- Gently decelerate the aircraft at about 1 knot per second (or 1 mph per second).
- ***[3-axis control aircraft]*** While the aircraft is decelerating keep the aircraft in balance using the rudder.
- Continue decelerating until the aircraft stalls or the pitch control reaches the stop, whichever occurs first.

- Recover using the technique recommended in the Flight Manual / POH.
- ***[3-axis control aircraft]*** If the aircraft has flaps, perform the check in the cruise (flaps up) configuration first, and then repeat in the landing configuration (flaps down).

What to look for

- Any warning the aircraft gives of the approach of the stall, and the speed at which this occurs. This warning can be due to the aircraft's aerodynamics (e.g. pre-stall buffet) or an artificial stall warner.
- The stall, or minimum flying, speed achieved.
- The behaviour of the aircraft at the stall. Does the aircraft stall before the control hits the stop? Is the stall a well-defined stall break or a mush? Does the aircraft tend to drop a wing at the stall?
- How the aircraft behaves as you recover from the stall.

Most likely problems

- A significant wing drop at the stall.
- Significantly different stall speeds to those expected. Stall speeds are defined in the Flight Manual / POH, or the individual MAAN for BMAA amateur-built aircraft.
- Excessive lightening of control forces when approaching the stall.
- An unserviceable artificial stall warner or one that warns at the wrong speed. An artificial stall warner must start warning at between 10 and 5 knots (12 and 6 mph) above the stall speed. This requirement must be met in the cruise (flaps up) and landing (flaps down) configurations.
- Any uncontrollable rolling tendency at any point during the stall and recovery.

Safety considerations

- The check flight requires a gentle entry into the stall. There is no requirement for an accelerated entry or whip stall, which can be dangerous in certain types.
- Entry into an inadvertent spin should always be considered a possibility when stalling. To mitigate this risk ensure familiarity with the spin recovery procedure recommended for the type, and ensure that stalls are performed with enough height to recover in. Refer to the Flight Manual / POH.

4.3.9. Instruments and systems

Each aircraft type has a list of required instruments in its TADS / HADS. This list specifies the flight and engine instruments that must be fitted and working correctly. For example, every type requires an altimeter, and almost every type an airspeed indicator. 3-axis control aircraft also often require a slip-ball. Most types require a tachometer and a cylinder-head or coolant temperature gauge. Aircraft with 4-stroke engines always require oil temperature and pressure gauges too.

Each aircraft also has a collection of 'systems', such as the flaps, wheel brakes, airbrakes, pitch trimmer and fuel system. Each system that cannot be checked properly while stationary on the ground, should be checked during the check flight. For example, although flaps can be deployed and retracted in the hangar, only in flight – subject to air loads – can they be properly checked for correct operation.

Table 2 contains brief guidance on checking important flight instruments, common systems and avionics. Note that, if available, certified test gear can be used for checking the altimeter, airspeed indicator and transponder on the ground prior to the check flight.

How to perform this element

- Prior to the check flight determine from the TADS / HADS the required instruments for the type, and ensure that they are fitted.
- During the check flight check all instruments for correct operation.
- During the check flight, check all other systems - such as flaps and brakes - for correct operation.
- If a required instrument that is found to be not working properly, this must be resolved. If a non-required instrument is found to be not working properly, this is acceptable as long as it is clearly marked unserviceable.

Altimeter Check the pressure setting, typically either by comparing against other aircraft in the hangar, or against the QFE from an AFIS or other weather forecast. Check that the altimeter operates satisfactorily during climbs and descents.
Airspeed indicator During the check flight check that the indicated airspeeds appear broadly correct. Do this prior to the high speed run! If in any doubt, indicated airspeeds can be sanity checked against average GPS speed (into and downwind). Bear in mind that most aircraft types have some error in their indicated airspeeds - particularly at high speed - even when working properly. An indicated versus true airspeed calibration can be found in the Flight Manual / POH (or in the approving MAAN for an amateur-built aircraft).
Flaps Check that the flaps can be deployed and retracted in flight – up to, but not exceeding, the flap limiting speed - without difficulty, and without handling side effects e.g. un-commanded roll.
Brakes Check that the brakes work as expected for the type and, for connected brakes, that they do not pull one way or the other.
Trimmer Check that the trimmer control can be operated throughout its range, and that it has the desired effect on the aircraft's trim speed. An aircraft with a trimmer should be able to be trimmed in the climb (at a sensible climb speed), in the cruise (at a sensible cruise speed), and in a descent (at a sensible descent speed). Most aircraft with a trimmer and flaps can also be trimmed in the approach configuration (at a sensible approach speed - below the maximum flap speed).
Radio and transponder Check that the radio works by getting a radio check. Check that the transponder works – including the altitude reported by a Mode C or Mode S transponder – with a radar-equipped air traffic service.

Table 2 - guidance on checking specific instruments and systems

4.3.10. High speed flight

This check is to confirm that the aircraft can be flown at high speed without undue vibration, buffet or flutter, and without encountering control or stability problems. It involves accelerating gently towards V_{NE}, the never exceed speed, and then gently slowing back down to cruise speed.

This check should be performed using as much power as possible without over-speeding the engine. The use of power results in as shallow a dive as possible to achieve V_{NE}. Then, if a serious problem is encountered at high speed, the throttle can be used to slow the aircraft, not just the pitch control.

It is recommended to aim to fly to within 5 mph or 5 knots of V_{NE}, but do not exceed it.

[Weight-shift control aircraft] Weight-shift control Microlights tend to be very pitch stable, but have limited (weight-shift) pitch control. This results in their being unable to accelerate to V_{NE} without unusual manoeuvring or aggressive use of the controls. For a check flight it is not necessary to accelerate beyond the speed that can be achieved with normal use of the controls: gently pulling the bar back as far as it will go.

How to perform this element

- o Accelerate aircraft to V_{NE} (within 5 mph or 5 knots, or as close as can be achieved with normal use of the controls). Use as much power as possible, making sure not to over-speed the engine.
- o Note the maximum speed achieved.
- o Check that it requires a positive force on the pitch control to keep the aircraft at V_{NE}, and that the aircraft slows down when that control force is relaxed.
- o Recover gently.

Most likely problems

- o Any control vibration, buffet or flutter.
- o Stability or control problems. These could be 'static' stability problems, such as a lightening of the pitch control, or a 'dynamic' stability problem such as Dutch roll (roll / yaw oscillations).
- o The engine over-speeding, even with the throttle closed.

Safety considerations

- o Flutter;
- o Do not exceed V_{NE} as this can overstress the airframe as well as induce flutter. Double-check what V_{NE} is before the check flight. For amateur-built aircraft, use the indicated airspeed (IAS) V_{NE} on the ASI correction placard, not the calibrated airspeed (CAS) value.
- o Do not perform this check in more than mild turbulence. The loads on the airframe due to flying through gusts increase with airspeed.
- o Exercise caution operating a 2-stroke engine at high airspeed. If a 2-stroke engine on a low throttle setting is being driven by the airflow through the propeller, there is an increased risk of cold seizure.

4.3.11. Approach, landing, taxy and shut down

Approach and land using the technique and speeds recommended in the Flight Manual / POH. Ensure everything works as it should.

4.4. After the check flight

4.4.1. Completing the check flight schedule

The check flight schedules contain 2 pages:

- o Page 1 is the 'formal' page containing details of the aircraft, pilot and declaration of airworthiness.
- o Page 2 is the flight schedule which guides the pilot through the check flight.

Page 2 contains the following boxes to be completed by the pilot:

- o Rectangular box with a dotted line - this can, and normally should, be filled in before the check flight. It contains aircraft data either for the pilot's information during the check flight, or to help a future reader.
- o Rectangular box with a continuous line - this must be filled in during the check flight. It contains a result observed during the check flight.
- o Square box - this must be filled in during the check flight. It is either filled in with a tick - meaning SATISFACTORY - or a cross - meaning UNSATISFACTORY - or (sometimes) NA - meaning NOT APPLICABLE.

The climb rate must be calculated - or looked up from Appendix 1 - after the flight.

5. Maintenance Check Flight specifics

A Maintenance Check Flight is the final check following maintenance (or repair by replacement) of an aircraft. Its purpose is to confirm that the aircraft is working correctly following the maintenance.

Note that this is not a standalone section, and should be read in conjunction with the previous sections.

Preparing for a maintenance check flight is summarised in the checklist in Table 3 below.

1a 1b	Pilot suitable: pilot familiar and current flying the aircraft type pilot familiar and current flying the check flight manoeuvres Pilot licence: pilot licenced to fly aircraft licence and medical valid	
2a 2b 2c	Permit-to-Fly: confirm using G-INFO that the aircraft has a Permit to Fly, and that the Permit to Fly has not been revoked PFRC: check using G-INFO whether the Permit to Fly has expired or been suspended - if it has, ensure PFRC has been issued by a BMAA Inspector and that it has not expired Modifications / repairs: approved signed-off by BMAA Inspector	
3	Insurance: insurance in place for check flight insurance not invalid if flight authorised by PFRC	
4a 4b 4c	Pilot has, and familiar with: BMAA Check Flying Handbook Aircraft Flight Manual / POH Pilot has access to: Aircraft documentation (logbook(s) etc) TADS / HADS for aircraft type MAAN (amateur-built aircraft only) Pilot has reviewed maintenance performed	
5	Check flight schedule decided on	
6	Weather	
7	Pre-flight inspection	
8	Risk assessment: identify and assess risks associated with this check flight	
9	Observer: briefed (if carried)	

Table 3 - Maintenance Check Flight preparation checklist

5.1. Legalities

If an aircraft's Permit to Fly is valid - the Certificate of Validity has not expired (or been suspended following an accident, for example) - the legal basis for any maintenance check flight is the aircraft's Permit to Fly, and no special authorisation is required for a check flight following maintenance (or simple repair by replacement). In particular, a BMAA Inspector is not required to sign-off maintenance prior to a maintenance check flight.

If an aircraft's Permit to Fly is not valid - the Certificate of Validity has expired or been suspended – a Permit Flight Release Certificate (PFRC) is required to authorise a maintenance check flight. The aircraft may not be check flown until the aircraft has been inspected, and a PFRC issued, by a BMAA Inspector.

Notes:

- If an aircraft with a valid Permit to Fly is having a modification incorporated, or repairs (other than simple repair by replacement) performed, the aircraft may not be flown until the modification or repair is approved, and been inspected and signed off by a BMAA Inspector.
- There are requirements for second (independent) inspections if safety-critical aircraft structure or systems have been disturbed during maintenance, which must be completed - and recorded in the appropriate logbook(s) - prior to any maintenance check flight.

5.2. Weight & balance

The weight at which a maintenance check flight is flown is not normally important, unless a particular weight is required for a particular check, such as measuring climb performance or stall speed.

5.3. Observer

As for an airworthiness check flight, an observer can be useful on a maintenance check flight. However, due to the potentially increased risk associated with a maintenance check flight, the pilot should always consider flying a solo check/shakedown flight first to check for any major problems prior to taking an observer.

5.4. Maintenance Check Flight schedule

It is important to plan a maintenance check flight before flying it.

In many cases the check flight ‘schedule’ will be very simple. It just needs to properly ‘exercise’ the part(s) of the aircraft that have been affected by the maintenance. Elements of the Airworthiness Check Flight schedule can, of course, be used when applicable.

When possible it is advisable to delay fully exercising the part(s) of the aircraft that have been maintained until at a safe height. For example, if the wings have been re-covered, climb to height before doing anything other than gentle manoeuvring.

In addition to recording the flight in the aircraft’s logbook(s) in the normal manner, it is advisable to record details of the checks that were performed and the results.

Appendix 1 - climb rate calculation

Once the time taken to climb 1000 feet (1000') has been measured, the corresponding climb rate can either be calculated, or looked up using the table below.

If it takes N seconds to climb 1000 feet, then the climb rate is 1000 x 60 / N fpm (feet per minute). For example, if it takes 75 seconds (1 minute 15 seconds) to climb through 1000 feet, the climb rate is 1000 x 60 / 75 = 800 feet per minute.

Time thru 1000' [seconds]	Climb rate [fpm]	Time thru 1000' [min:sec]
< 30	**> 2000**	< 0:30
30	**2000**	0:30
31 - 32	**1900**	0:31 - 0:32
33 - 34	**1800**	0:33 - 0:34
35 - 36	**1700**	0:35 - 0:36
37 - 38	**1600**	0:37 - 0:38
39 - 41	**1500**	0:39 - 0:41
42 - 44	**1400**	0:42 - 0:44
45 - 48	**1300**	0:45 - 0:48
49 - 52	**1200**	0:49 - 0:52
53 - 57	**1100**	0:53 - 0:57
58 - 63	**1000**	0:58 - 1:03
64 - 70	**900**	1:04 - 1:10
71 - 80	**800**	1:11 - 1:20
81 - 92	**700**	1:21 - 1:32
93 - 109	**600**	1:33 - 1:49
110 - 126	**500**	1:50 - 2:06
127 - 141	**450**	2:07 - 2:21
142 - 160	**400**	2:22 - 2:40
161 - 185	**350**	2:41 - 3:05
186 - 218	**300**	3:06 - 3:38
219 - 267	**250**	3:39 - 4:27
268 - 344	**200**	4:28 - 5:44
> 344	**< 200**	> 5:44

The table allows the climb rate to be found whether the time to climb 1000 feet is known in seconds, or in minutes and seconds (min:sec). The table gives the climb rate in feet per minute (fpm). It gives the climb rate to the nearest 100 fpm above 500 fpm, and to the nearest 50 fpm below 500 fpm.

Appendix 2 - Powered Parachute check flights

Check flying a Powered Parachute is very similar to check flying other types of aircraft. However as a Powered Parachute is essentially a single-speed flying machine, some of the checks are not applicable. A new check is also introduced - the slow flight check - which checks the aircraft's behaviour when the aircraft is slowed by pulling both brake lines at once.

- Ground run
- Taxy
- Take-off and climb
- Trim
- (*Pitch stability* - **N/A**)
- Turns
- (*Steady-heading sideslips* - **N/A**)
- (*Stalls* - **N/A**)
- Instruments and systems
- (*High speed flight* - **N/A**)
- **Slow flight - NEW**
- Landing, taxy and shut down

A2.1. Slow flight

How to perform this element
- Start at a safe height, reduce power to idle, and establish a steady descent with canopy level.
- Gently deploy both brake lines to slow the aircraft down.
- Recover by gently releasing the brake lines, and then applying power.

Most likely problems
- The canopy 'pulling' one way or the other.
- The canopy starting to stall or collapse.

Safety considerations
- It should be impossible to collapse the canopy of a regulated powered-parachute using the brake lines (this is a requirement for UK approval, and normally achieved using anti-stall rings). However, this check is to make sure that this requirement remains met, so be prepared for the canopy to collapse (and perform the check with plenty of height to recover should the check fail).
- If check flying an unregulated machine, be aware that the canopy might not have been designed to be impossible to collapse using the brake lines.