The Guild of Air Pilots and Air Navigators

TEACHING STALLING

A GUIDE FOR INSTRUCTORS

Teaching Stalling – A Guide for Instructors.

Introduction.

The subject of teaching stalling and spinning during the JAR PPL (A) and NPPL courses has come into the spotlight recently with the publication of GASCo's report into the subject in recent months.

The following is not intended as a comprehensive step-by-step syllabus and rigid teaching formula, but more as a guide for instructors to refer to and adapt for their particular circumstances. Most instructors will be aware that the precise handling methods employed when teaching stalling in different aircraft types can vary quite markedly. However, regardless of aircraft type the training should follow a similar thread with the same learning outcomes. The threat and error management issues will be similar for most aircraft but not necessarily universal. The constant variables of student ability, weather and airspace considerations will always have a significant effect on the structure of any piece of airborne instruction delivered.

The teaching of stall/spin awareness should not be considered as a stand-alone package of work delivered once during the syllabus of training. The early fundamental exercises in which the student is taught basic attitude flying techniques are the bedrock upon which the rest of the syllabus is built. Stall/spin awareness is no different in this respect. If the student is not aware of what a "normal" flight attitude is during a particular phase of flight, then how will he recognise the abnormal attitude that could lead to a stall/spin situation. A further example of this is the teaching of Straight & Level – in this exercise slow cruising flight is explored and the principle of a higher nose attitude is introduced. If taught well, then when teaching stalling, it will be of no mystery to the student that if the nose attitude is further increased there will be a further reduction in speed with the increased angle of attack. The correlation of speed, angle of attack and attitude is thus further explored during stall/spin training rather than being a new principle. The student will readily accept that attitude and indicated airspeed can be deduced as warnings of an impending stall.

After the preliminary stall/spin awareness exercises are completed (Ex 10 and 11), stall/spin must be revisited and indeed built upon throughout the rest of the training. It is not sufficient to merely practice the set-piece stalls that are required during the Skill Test. As instructors we must resist the temptation to sign off the basic stalling exercises and then "teach to the test" as far as the rest of the stall/spin awareness training is concerned.

Ex 10A – Slow Flight

Some manuals suggest that slow flight is taught utilising periods of flight instruction and student practice during which the aircraft is manoeuvred whilst maintaining the airspeed at between 5 and 10 knots above the stalling speed. Whilst applauding the intention of exposing the student to the handling characteristics of the aircraft close to the stall, it does mean that the stall warner on a certified aircraft will inevitably be activated almost continuously throughout the exercise. This is likely to be counter-productive as it can undermine the immediate reaction to any stall warning which should, of course, be to instigate immediate and appropriate recovery action. For the instructor to continue flying the aircraft in the same manner whilst telling the student to ignore the stall warning is probably, at best, negative teaching.

The object of PPL(A) flight training should principally be to concentrate on giving the pilot the skills to operate the aircraft close to the centre of the "normal" operating envelope for the phase of flight. Any excursion away from "the centre" should be met with immediate action to return the aircraft to safety. Slow Flight exercises taught using the method above are perhaps teaching the student to operate the aircraft for a lengthy period at close to the edge of the envelope – a situation in which the basic PPL(A) holder should not be operating in any circumstance.

Additionally, on some aircraft types, the nose attitude attained to replicate the speed profiles described gives minimal forward field of view from a cockpit perhaps not blessed with the best view in the first place. In busy airspace this in itself could present a serious risk, the value of the training probably doesn't warrant this risk being undertaken.

Experience suggests that the more effective way to deal with the slow flight exercises is to introduce them at the relevant part of the course in combination with other exercises.

During the straight and level exercises the teaching of the "slow, safe cruise", introduces cruising at minimum practical speed. Cruising at speeds for best range and endurance should also be covered. These skills naturally lead into the teaching of the "bad weather circuit" later in the PPL course – again a practical use of slow flight techniques avoiding the stall.

An area of concern highlighted in the GASCo Report was the mishandling of the short-field take-off and climb at best angle. This was implicated in a high number of accidents. At the appropriate point in the PPL course – probably during the lessons following the solo consolidation of circuits – the short-field take-off and climb at best angle should be thoroughly taught and practised. Within this training the instructor should demonstrate the full stall during a simulated mishandled climb at best angle after take-off (use full power and, if appropriate, take-off flap). This should then be developed into recognition of the impending stall in this situation with both teaching and student practice of recovery at the incipient stage.

Another opportunity to explore the characteristics of slow flight is presented during the teaching of forced landings, with and without power. With power, it can be demonstrated that this exercise is an extension of the "bad weather circuit" already covered earlier in the course. As part of the teaching of forced landings without power, the instruction should include recovery at the incipient stage from a mishandled glide. Again point out

that close control of attitude and speed will be the best way of preventing a stall situation from developing.

As part of the exercise of teaching advanced turning (steep turns), the recovery from the incipient stall in the turn should be included with appropriate student practice.

In summary, it can be seen that slow flight and recovery from the incipient stall situations that may develop is a theme which runs through many of the PPL syllabus items. Exercise 10B will give the building blocks of stall recognition and prevention, but for full instruction and learning in stall prevention to have been achieved the subject needs to be explored within many of the flight exercises.

Ex 10B Stalling

The stalling exercises must be taught before instruction in circuit flying. This will ensure that the student, once in the circuit, can recognise a hazardous situation developing and take prompt action to prevent the stall. Prior to first solo, a third stalling exercise should be scheduled to revise and practise stall recovery at the incipient stages to ensure currency in stalling. Certainly with part-time students there can be a protracted time period between the stalling exercises and the completion of circuit training to first solo standard. This third visit to stall recognition and recovery can do much to reduce the threat of stalling during first solo and the subsequent solo circuit practices.

Exercise 10B(1) – Stalling Part One

This exercise covers stalling only in the clean configuration. During the exercise the student will learn to recognise the signs of the full and incipient stall, the main emphasis being the incipient stall signs. Recovery from both a full stall and incipient stall are taught and practised. Initially, the student's recoveries may be a little mechanical, it is important to get the recovery technique correct first, before honing the technique to achieve minimum height loss. It may be that minimum height loss is not achieved during this first lesson – it is probably better to keep the lesson moving along than get bogged down in full stall recovery trying to achieve this aim. This can lead to frustration on both the part of the instructor and student! Additionally, stall recovery may be a little uncomfortable for some students so a prolonged exposure could result in them feeling airsick.

Aim

The aims of this exercise are:

a. To recognise the full and incipient stall.
b. To recover from the full and incipient stall with minimum height loss.

Considerations

Ideally the student should have had a full stall and recovery demonstrated during a previous lesson. This will have the positive effect of dispelling some of the "crewroom" myths about how dreadful the stalling exercises are. Even so, most students are a little apprehensive about this exercise. Indeed, the instructor must display a positive attitude to the exercise. Any perceived apprehension of the instructor by the student will only further increase the student's anxiety. In no circumstance should this exercise be delivered in the manner of "we've got to do this so let's get it over with". Each briefing session should give reassurance regarding the safety of the exercise at the start to try to settle the student.

The long brief should cover at least the following points:

a. Lift, angle of attack, critical angle and relation to stalling speed.
b. Characteristics of the stall.
c. Factors affecting stall speed.
d. Stall recovery techniques – with and without power.

Threat & Error Management / Airmanship

Checks Prior to Stalling:

Prior to getting airborne, try to ensure that the student has learned the contents of the HASELL (& HELL) checks. This allows airborne instruction to be concentrated on how to conduct the checks whilst maintaining a good lookout and adequate aircraft control. Again, this can be demonstrated on a previous exercise as part of the stall demonstration. Typical contents of the HASELL check are as follows:

HEIGHT For initial training sufficient to recover **by** 3000' above ground level. This assumes that weather and airspace allows for this. Note that some height will be lost during the demonstrations of the incipient and full stall signs, this often equates to some 1000'.

AIRFRAME Flaps as required. [on some aircraft brakes may limit rudder travel]

SECURITY No loose articles in footwells, on the coaming, or the area behind the seats. Pockets all secure. Harnesses tight, seat position locked, canopy/doors closed and secure.

ENGINE Check for Carb' icing. Fuel contents sufficient and balanced. Fuel selector checked ON - fullest tank. Oil temp' and pressure normal.

LOCATION "ABCCD"-

Not above active airfields, built up areas, controlled airspace, clear of cloud (maintain VMC) and danger areas (equally applies to prohibited and restricted areas).

LOOKOUT Either 2 x 90 degree turns or 1 x 180 degree turn. Note that the emphasis on looking out during the turn rather than turn accuracy should be emphasised as part of the teaching.

Checks After Stalling:

On completion of the Stalling exercise teach the student to conduct a full FREDA check. In addition to resetting the DI and reviewing the fuel contents/balance this will also double up as the FREDA check required before rejoin.

The Air Exercise

A typical format for the air exercise is included at Annex A. The following notes should be read in conjunction with this Annex.

During the entry, ensure that rudder is used to prevent yaw when the throttle is closed. Progressively pitch the aircraft nose up and trim for approximately Vref whilst attempting to maintain straight and level. The trim setting is not vitally important, but it does give a consistent feel to the aircraft and on those aircraft where pitch control is heavy this will ensure that full deflection of the elevator can be achieved without the student feeling that they are working out in the gym. Most training aircraft will require full elevator deflection, or at least pretty close to it, for the critical AoA to be achieved. Once the entry has been taught, the student should perform each subsequent entry. Remember to take control early enough during the entry to enable your teaching and demonstrations not to be rushed.

Subject to specific aircraft type considerations, include each of the following items when teaching the signs of the approaching stall:

a. Low and reducing airspeed.
b. Decreasing control effectiveness.
c. High nose attitude.
d. Stall warner.
e. Light buffet.

Demonstrate the decreasing control effectiveness by showing the low rate of pitching using relatively large pitch inputs – take care not to be too heavy handed or you will stall prematurely! Previously, some instructors have used aileron inputs to illustrate this point. Some now believe that showing the student use of coarse aileron close to the stall is inappropriate. An important learning objective is for the student to recognise the stall warner and buffet. To establish this, gently pitch nose up to activate the stall warner and generate buffet pointing out to the student when each occurs. Gently pitch nose down and demonstrate that this action removes the buffet and silences the stall warner. Repeat these pitching manoeuvres but elicit from the student recognition of when the stall warner sounds and the buffet is felt. Accept that you will lose altitude during this demonstration (hence the earlier comment regarding height in the HASELL check).

Again subject to the type specific aircraft considerations, teach each of the following signs of the full stall, if and when they appear:

a. Heavy buffet.
b. Nose drop.
c. Sink.
d. Possible wing drop.

To allow each of these signs to be taught effectively will require the aircraft to be held in a fully stalled condition sufficiently long to teach these signs. Make it clear to the student that recovery is normally initiated on the first incipient stall sign, the delay in recovery on this occasion is to allow the student to see the full range of full stall signs.

Recovery at the incipient stage should be taught first with recovery action being initiated by the sounding of the stall warner and/or onset of buffet. Individual aircraft type stalling characteristics will determine which is best to use. Stress during the teaching that in a real situation, recovery should be carried out at the first sign of the approaching stall whatever it may be. Note that the recovery action is standard stall recovery (SSR), but the forward movement of the control column / wheel is very small, only sufficient to remove the buffet / stall warner. Whilst not essential, it can be useful to note the altitude at which the stall warning occurred so that the height lost can be noted. Ensure that the student maintains balance throughout the recovery.

Standard Stall Recovery (SSR) from a fully stalled condition is then taught. Recovery action should be initiated at the first full stall sign. Noting the entry height will again enable the height lost during recovery to be demonstrated illustrating the increased height loss in the event of a full stall. This emphasises the benefit of early recognition and recovery at the incipient stage.

Recovery without power can then follow. This clarifies that to recover from the stall the angle of attack must be reduced using the elevator, which remains effective in the stall. The other teaching point that is worthy of mention to the student is that this recovery technique would have to be used should they inadvertently stall whilst carrying out a forced landing without power. For this reason once stall recovery is complete it may be wise to teach that the next action is to establish the aircraft at the recommended gliding speed. This also provides a clear situation in which both student and instructor can recognise that the teaching/practice is complete. There can then be no confusion regarding the application of power for climbing back to the start height, which might be the case if a climb is initiated straight after recovery without power.

Again, if the height loss is noted, the student will see that without the use of power a greater height loss is experienced to achieve recovery.

Common Student Errors

a. Not keeping the aircraft in balance when closing the throttle during the entry to the stall.
b. Not continuing to lookout during the stall entry and recovery – indeed recovery is easier if the eyes are out of the cockpit. There is a tendency to fixate on the ASI and altimeter during the entry, this fixation continues into the recovery.
c. Moving the control column/wheel too far forward during stall recoveries resulting in excessive height loss. In all recoveries it needs only to be moved forward sufficiently to stop the stall warner / buffet.

Common Instructor Errors

a. Teaching the student to recover from the stall by selecting a specific attitude, rather than pitching to stop the buffet/stall warner. Whilst it is possible to achieve a sound recovery using a recovery attitude during this exercise it will not be possible to do this in the later exercises or in a real situation.
b. Taking control from the student during stall entry too late. This will result in a hurried teach and possibly an inaccurate demonstration.
c. In the past it has been considered acceptable to use rudder to pick-up any wing drop whilst teaching the signs of the full stall. This technique is dangerous and has been cited as one of the causes of more than one stall/spin fatal accident. Use of the rudder should be restricted to preventing any further yaw, should any develop. If significant yaw/wing drop occurs whilst trying to teach the full stall signs, recovery action should be taken immediately. If all of the full stall signs were not taught before recovery proved necessary, then it will be necessary to give an additional demonstration.

Exercise 10B(2) – Stalling Part Two

Exercise 10B(1) teaches the student to recognise and recover from a clean, power off stall. This lesson will teach recovery from more realistic situations that might be encountered. It could be described as teaching the student the skills to prevent him from stalling in the circuit. As part of this exercise the effects of power and flap will be demonstrated. As such, reference to the Pilots Operating Handbook/Flight Manual prior to flight can prove useful as this will give some insight into these effects which can then be reinforced during the airborne exercise. This exercise will also enable approximate speeds to be derived for V_{s1} and V_{so} which, again, can be demonstrated when airborne. A guide to the format of the airborne lesson is contained at Annex B.

Aim

The aims of this exercise are:

a. To recognise the signs of the full and incipient stalls in the approach / landing configurations.
b. To recover from incipient stalls in the approach/landing configurations particularly on a simulated final approach and a simulated turn from base to final.

Considerations

This exercise is primarily aimed at stall prevention. Recovery at the incipient stage is the important part of this exercise. All too often instructors spend so much time dealing with full stall recovery from stalls with power and/or flap that the incipient recoveries are rapidly covered at the end of the lesson as if just a small, academic part. It may be that the student has a lot of problems dealing with the power/flapped stall recoveries at first, particularly if wing drop is present. Don't get bogged down in these recoveries at the expense of the recovery at the incipient stage being taught and practised thoroughly.

Threat & Error Management / Airmanship

The HASELL checks are the same as for the previous exercise. A convenient method for achieving the correct configuration for the stall and setting the scenario is to fly the latter part of a simulated circuit incorporating the checks – the lookout turns can be from a simulated downwind to base and then base to final.

Air Exercise

The exercise should begin with revision of recovery from the stall at the incipient stage followed by revision of SSR from a full stall (clean configuration, power off). Brief the student to note the following during his entry to the full stall;

a. Rate of deceleration.
b. The nose attitude at a speed approximately 10 knots above stalling speed. This would ideally be the attitude at the stall, but this is almost impossible for the student to note given that there is much happening at the point of stall, not least the need for recovery action to be initiated.
c. Control effectiveness – point out the relatively large elevator inputs required to maintain level flight.
d. IAS at the stall.

This should provide a datum with which the student can then compare the effects of power and flap. With a less able student, it may be necessary for the instructor to perform a datum stall to provide a basis for the student to use.

Having set a datum the next part will be to teach the effect of power and flap on the stall. The exact power settings and flap extension to be used will be aircraft type specific. As a general guide try to use approach power and landing flap whenever possible. Explore and teach the effects of power and flap individually. With both of these stalls, ensure that a full stall and recovery is demonstrated and, if possible, practised by the student. Should wing drop occur, teach the correct use of rudder as part of the recovery. The amount of rudder used should be sufficient **only** to prevent further yaw developing. On no account should an attempt be made to “pick-up” the wing drop with rudder.

A full stall in the landing configuration with typical approach power should then be taught. The main points to come out of this instruction are as follows:

a. The rate of deceleration depends on the attitude and power, but may be relatively slow.
b. The nose attitude is higher than would be normal on the approach.
c. The stall warner will activate.
d. The duration of the pre-stall buffet is short.
e. The stalling speed is further reduced as both flap and power are in use.
f. Wing drop is likely.

Point out that there were plenty of clues to alert the pilot to the impending stall situation. The height loss incurred, especially if wing drop is present, is such that recovery from a full stall on final might not be possible, hence the need to recover at the incipient stage.

Recoveries at the incipient stage should be taught and practised both for a stall on final and in the base to final turn. When setting up for these stalls it is important to make the situation as realistic as possible. For the stall on the final approach, suggest to the student that during the base leg the power is incorrectly set too low, this results in being low on the final approach once the wings are level hence the higher nose attitude to try to regain the correct approach path. If this attitude is maintained without any power increase then a stall situation will inevitably develop.

A similar situation will be appropriate for the stall in the base to final turn. This time, brief that the aircraft has become low during the base leg with the power incorrectly set too low, the aircraft has flown through the runway centreline, so a level turn at 30 degrees angle of bank is attempted to rectify these errors. The combination of the power being mis-set and the attempted level turn will mean the stall will follow. If excessive bank angle is used for this teaching/demonstration, on most training aircraft the nose will tend to drop into the turn and achieving a stall will prove extremely difficult. This will not assist the credibility of the teaching. Recovery from the stall in the turn is still SSR but note that it is important to ensure that the wing is unstalled prior to using the roll controls to achieve a laterally level attitude.

Exercise 10(B)3 - Stalling Part Three

As the student progresses towards first solo standard, this exercise gives essential stalling recognition and recovery practice. A guide for this exercise is given at Annex C.

The exercise begins with a normal departure from the circuit and climb to a safe height for the stalling revision. The student should be able to perform the HASELL checks, prompt or re-teach as required. The student should then perform the following stalls as revision:

a. Full stall and recovery from a clean, power off stall.
b. Recover at the incipient stage from a stall on a simulated final approach to land.
c. Recover at the incipient stage from a stall in the approach configuration whilst on a simulated base to final turn.

During the exercise the quality of the entry to the stall is relatively unimportant as long as an effective stall in the correct configuration is achieved. The standard of the recoveries are of prime importance. The recovery must be timely, with minimum height loss and result in the aircraft being safely established into a climb at recommended speed – effectively a go-around. An experienced pilot might be able to re-establish the aircraft on final after an incipient stall but it is important to insist on a go-around from any incipient stall recovery. Any shortfall in the required standard should be addressed with either further practice or teaching as necessary.

Once stalling revision is completed any time remaining can be utilised for further circuit practice or teaching as required.

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Annex A

EX 10B(1) – STALLING PART ONE

Aim: To learn to recognise and recover from the full and incipient stall with minimum loss of height.

Airmanship: Lookout; HASELL/HELL Checks; Anchor Point;

AIREX:

- Normal take-off
- Revise climbing and climbing turns to headings.

- **Introduction to the stall;**

- Teach HASELL and Entry.
- *Student Practice – HASELL & Entry*
- Demonstrate Full Stall and Recovery
- Teach Signs of the Approaching Stall
- Teach Full Stall Features

- **Recovery from the stall;**

- Teach recovery at Incipient Stage (warner or onset of buffet)
- *Student Practice – Recovery at incipient stage*
- Teach SSR
- *Student practice – SSR*
- Teach recovery without power
- *Student practice – Recovery without power*
- Teach checks after stalling – FREDA

- **Recovery to Airfield;**

- Revise cruise descent
- *Student practice - R/T for Rejoin*
- Teach Landing – particularly attitude at touch-down

Post flight Report:

Syllabus Item:	**JAR Ref'**	**Demo**	**Revise**	**Competent**
Airmanship	-----	☐	☐	☐
HASELL / HELL Cx's	10B.1.1	☐	☐	☐
Signs of Approaching Stall	10B.1.2	☐	☐	☐
Full Stall Features	10B.1.2	☐	☐	☐
Recovery without Power	10B.1.3	☐	☐	☐
Standard Stall Recovery	10B.1.4	☐	☐	☐
Recovery at the Incipient Stage	10B.1.6	☐	☐	☐

Comments:

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Instructor:
Name:
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Signature:
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Student:
Name:
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Signature:
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Annex B

EX 10B(2) - STALLING PART TWO

Aim: To learn to recognise and recover from the full and incipient stall in the approach and landing configuration with minimum loss of height.

Airmanship: Lookout; HASELL/HELL Checks; Anchor Point; Flap Limitations

AIREX:

- Teach crosswind take-off (if conditions allow)
- Revise climbing.
- Revise recovery at the incipient stage
- Revise SSR (point out features during entry/stall)

- **Stalling With Power / Flap / Landing Config';**
- Teach entry with power - SSR.
- *Student Practice – Entry & recovery from stall with power*
- Teach entry with landing flap - SSR (include wing drop)
- *Student practice – Entry and recovery stalling with flap*
- Teach entry and recovery from full stall in landing config'
- *Student practice – Entry and recovery from full stall in landing config'.*
- **Recovery from the stall at the incipient stage;**

- Teach recovery at incipient stage from stall in landing config' (simulated final approach).
- *Student Practice – Recovery at incip' stage, landing config'.*
- Teach recovery at incipient stage from stall in the turn with approach configuration (simulated base to final turn)
- *Student practice – Recovery at incipient stage, stall in the turn with approach config'.*
- *Student practice - checks after stalling – FREDA*

- **Recovery to Airfield;**
- *Student Practice - cruise descent*
- *Student practice - R/T for Rejoin*

Post flight Report:

Syllabus Item:	**JAR Ref'**	**Demo**	**Revise**	**Competent**
Airmanship	---	☐	☐	☐
Full stall with landing flap	10B.2.1	☐	☐	☐
Full stall in landing config' with power	10B.2.2 10B.2.3	☐	☐	☐
Incipient recovery – stall on final approach	10B.2.4	☐	☐	☐
Incipient recovery – stall in turn (base to final)	10B.2.5	☐	☐	☐

Comments:

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Instructor:
Name:
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Student:
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Annex C

EX 10B (3) - STALLING PART THREE

Aim: To revise recognition and recovery from the incipient stall with minimum loss of height.

Airmanship: Lookout; HASELL/HELL Checks; Anchor Point; Flap Limitations

AIREX:

- Revise normal or crosswind take-off.
- Revise climbing and climbing turns on to headings.

- **Revision of Full Stall. Clean, Power off**.

- *Student Practice – HASELL, Entry and SSR*

- **Revision of Incipient Recoveries;**

- *Student practice – Recovery at the incipient stage, stall in the approach configuration (simulated turn from base to final)*
- *Student practice – Recovery at the incipient stage, stall in the landing configuration (simulated final approach)*
- *Student Practice - checks after stalling – FREDA*

- **Recovery to Airfield;**

- *Student practice - cruise descent*
- *Student practice - R/T for Rejoin*

- **Normal circuits;**
- *Student practice – normal circuits*

Post flight Report:

Syllabus Item:	**JAR Ref'**	**Demo**	**Revise**	**Competent**
Airmanship	-----	☐	☐	☐
HASELL / HELL Cx's	10B.1.1	☐	☐	☐
Standard Stall Recovery	10B.1.4	☐	☐	☐
Normal circuit & landing	12.1.2 13.1.2 13.1.3 13.2	☐	☐	☐

Comments:

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Instructor:
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Student:
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