Pilot tips and tricks

Holdings

or how to park an aircraft midair

1. What is the purpose of holdings

One of the key goals of every pilot is to bring his plane with passengers and freight as quickly as possible to the destination. This not only makes passengers happy, but it also minimizes fuel consumption and duty time of the pilots. Delaying a plane is therefore detrimental to this ambition. Nevertheless, there are multiple circumstances, where delaying an aircraft makes good sense, despite the negative effect on customer satisfaction and cost. A holding is the appropriate tool to minimize the movement of an aircraft, without forcing it to drop from the sky. It is almost like stopping a car at the traffic light.

There are multiple reasons to prevent an aircraft from moving further. Without going into detail, these are some of them:

- Waiting for better weather at the landing airport (thunderstorms, low ceilings, …)
- Landing airport/runway blocked by maintenance or other occurrences
- Too much traffic at once in one area
- Pilots need more time for aircraft handling (e.g. malfunctions)
- Others

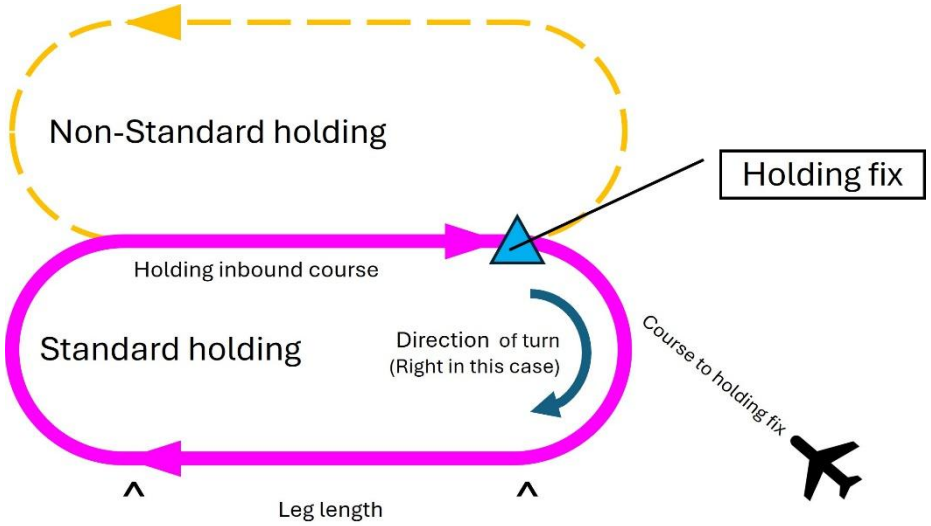
Holdings can be requested by pilots or instructed by ATC.

2. The pattern of a holding

A holding pattern is sort of an oval racetrack, where the aircraft draws an unlimited number of circles until the reasons for holding are removed. As most of the things in aviation, a holding is very clearly specified by a number of parameters:

- Holding fix:
  a defined lateral point, which specifies the anchor point of the holding, usually this is a waypoint or a navigation aid, in can also be a random point described by the radial and the distance from a waypoint/navaid or by GPS coordinates
- Holding inbound course:
  the course on which the holding fix is approached
- Turn direction:
  Right-hand-turns (standards holding) or left-hand-turns (non-standard holding)
- Airspeed:
  usually the minimum clean speed (minimum speed without slats and flaps extended) of the aircraft in order to minimize lateral movement and fuel consumption
- Altitude:
  the altitude which must be maintained while flying in the holding, always instructed by ATC

- Leg-length:
  length of the leg in minutes flying time (occasionally in NM). 1 minute at or below 14’000 ft, 1.5 minutes above 14’000 ft MSL

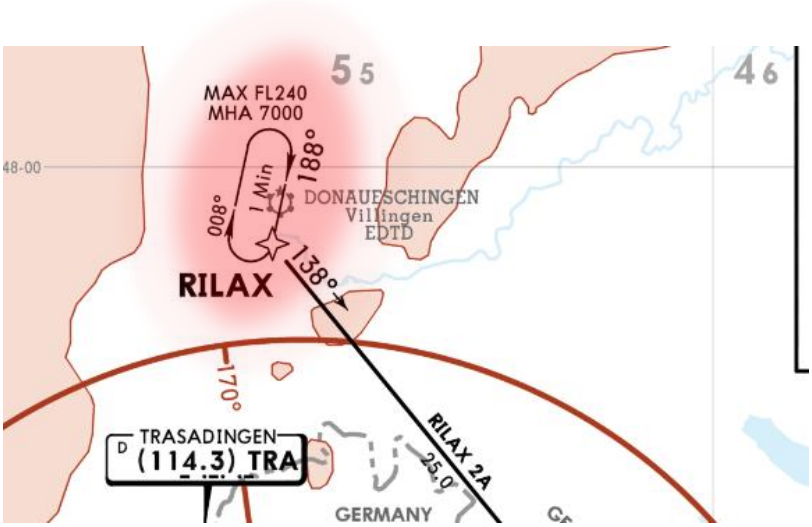


3. Holding instructions

3. A. Published holdings

Published holdings are visible on the enroute or STAR-charts. Its holding fix, inbound course, turn direction and leg length are specified.

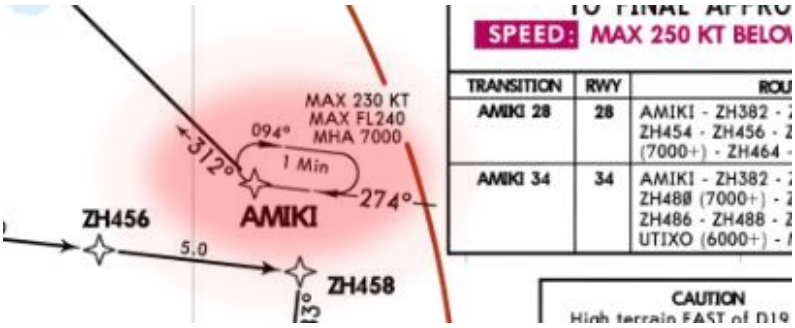
BIGJET 123, HOLD AT RILAX AS PUBLISHED



RILAX holding (published):

- Holding fix: RILAX
- Inbound course: 188
- Right turn
- Leg length: 1 minute

BIGJET123, HOLD AT AMIKI AS PUBLISHED

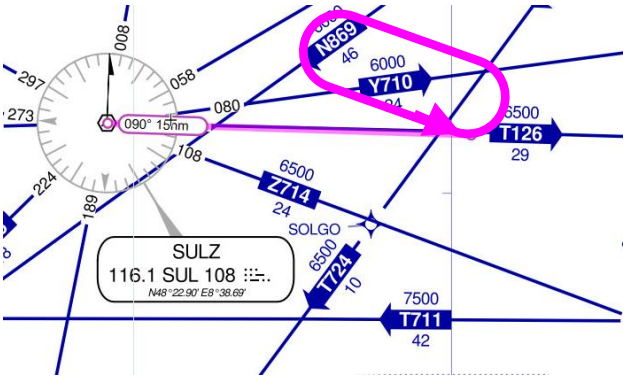


AMIKI holding (published):

- Holding fix: AMIKI
- Inbound course 274
- Right turn
- Leg length 1 minute

3. B. Non-published holdings

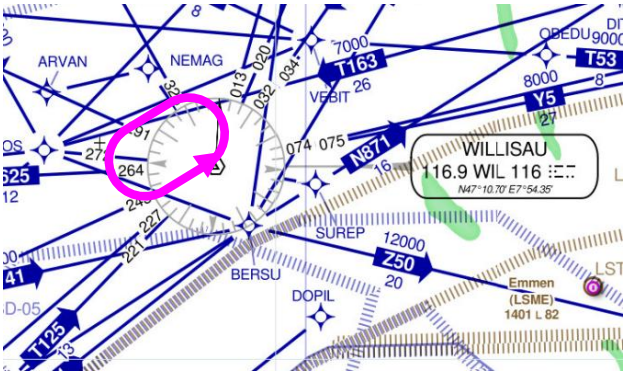
BIGJET123, HOLD EAST OF SUL VOR, RADIAL 090, 15 DME, INBOUND COURSE 110, LEFT TURN, 2 MIN LEG



Ad-hoc holding:

- Holding fix: SUL VOR R090 15DME (SUL090/15)
- Inbound course: 110
- Left turn
- Leg length: 2 minutes

BIGJET123, HOLD AT WIL VOR, INBOUND COURSE 040, LEFT TURN, 1 MIN LEG

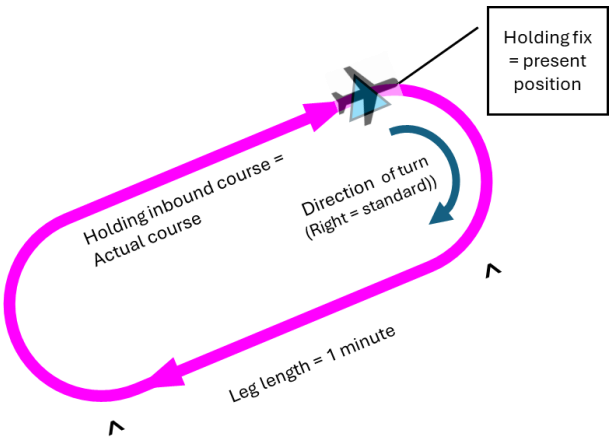


Ad-hoc holding at VORDME:

- Holding fix: WIL VOR
- Inbound course: 040
- Left turn
- Leg length: 1 minute

BIGJET123, HOLD PRESENT POSITION

This instruction includes little specification. The pilot will have to stick to standards everywhere:



Ad-hoc holding at present position:

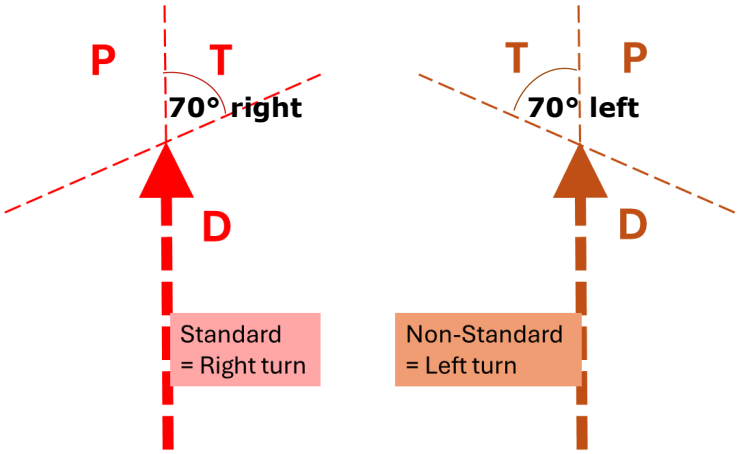
- Holding fix: present position
- Inbound course: present track
- Right turn (standard)
- Leg length: 1 minute
- Altitude: actual altitude or FL

4. How to fly a hold

4. A. Define the entry pattern

Let me introduce the magic wand – in fact, there are two of them. One for standard holdings (right turns) and the other for non-standard holdings (left turns).

Standard holdings Non-standard holdings

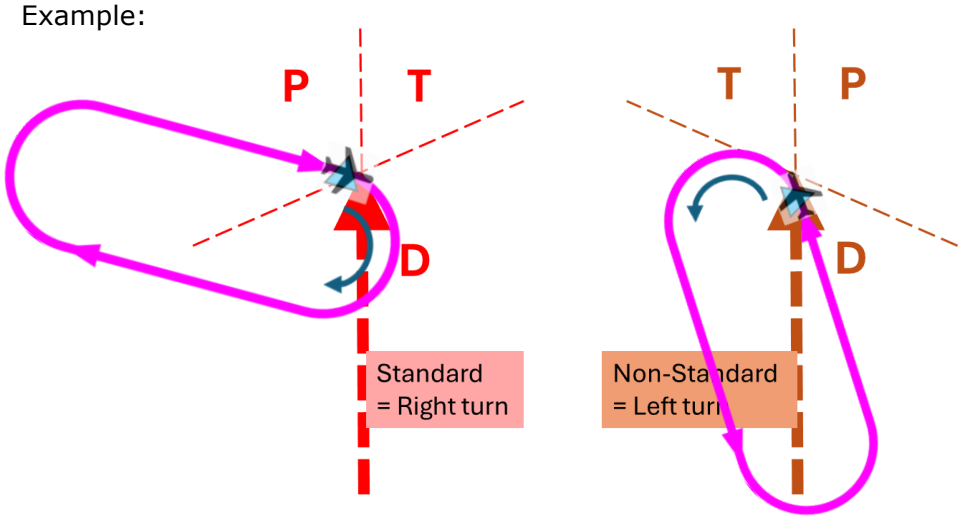


The bold arrow represents your course to the holding fix. The letters P, T and D stand for the holding entry. P for parallel entry, T for teardrop entry and D for direct entry. The teardrop segment covers an angle of 70°, the parallel segment is 110° and the direct segment subsequently 180°. Important question now: which of these 3 sectors is your holding-inbound-leg in?

Note:

Whether standard or non-standard, the smallest segment is always the Teardrop-Segment. The medium one the Parallel-segment

Example:

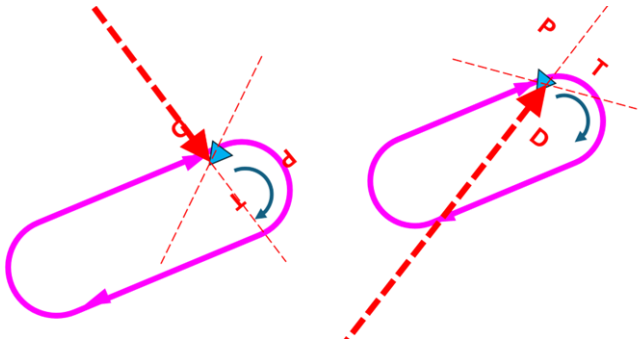


In the left graphics, the inbound course is part of the P segment – parallel entry. On the right the inbound course is located in the D segment – direct entry.

Your course towards the holding fix is non-related to the inbound course of the holding. You therefore will have to turn after overflying the holding fix in order to join the holding pattern. There are three ways to enter the hold. This is no choice to you – there is a clear rule under which circumstances to choose which pattern.

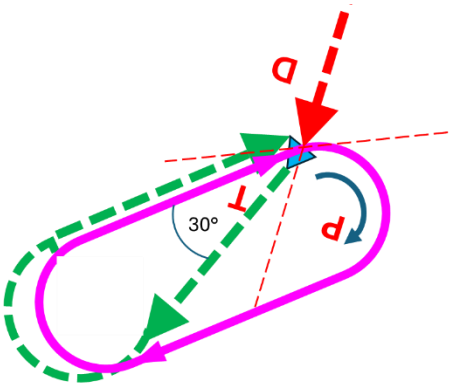
Take the sketch of your holding and put the magic wand (right or left) over it. Turn the wand to the correct course leading from your present position to the holding fix. Then identify in which segment the inbound leg of the holding is positioned. From the letter you can read the entry pattern to be flown.

4.A.1. The direct entry



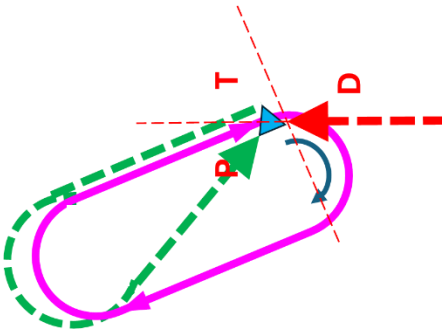
In both of these examples the inbound course is located in the D sector. Direct entry means, after reaching the holding fix the aircraft turns directly to the outbound leg.

4.A.2. The teardrop entry



In this example, the inbound course is located in sector T. Teardrop entry means; after reaching the holding fix, the aircraft follows a heading deviating 30° from the outbound course, aiming for "the other side" of the holding pattern. When reaching the outbound end of the pattern turn by ~210° towards the holding fix.

4.A.3. The parallel entry



Here, the inbound course is in the P sector. Parallel entry means, after the holding fix you follow the inbound leg backwards. When reaching the outbound end, you turn towards the heading fix again. Afterwards you join the pattern as outlined.

4. B. Fully automated flight

With full automation, it should be no problem to fly a holding correctly. Just enter the holding specifications into your FMS and the flight computer will join and fly the holding according to your inputs.

- Holding fix — Enter waypoint specification (examples: WIL, RILAX, RILAX/-15, 5008E, SUL150/20, if this sounds unfamiliar to you, check out the AFM (aircraft flight manual) of your plane for explanation)
- Inbound course — in degrees
- Turn direction — R or L
- Leg length — in minutes or distance (NM)
- Speed — minimum clean speed before entering the holding

Carefully watch the movement of your aircraft to verify, that it flies what is expected. In order to do so, you must have a crystal-clear idea of what is the correct movement – you need to know the entry pattern of the holding. If the movement is not according to plan, switch on heading mode and force the direction of your plane by tuning manually the heading you want it to fly.

4. C. With autopilot in HDG and ALT mode

4.C.1. Approaching the holding fix

While approaching the holding fix,

- Define how the holding relates to your approach course
- Make a drawing on a sheet of paper
- Figure out, which type of holding entry to fly
- Define the headings to be used (to the holding fix, first heading after the holding fix for the entry, second heading for the entry, inbound course, outbound course). Write them down on your little sketch
- Try to assess the wind correction angle inbound and outbound (details follow later).

If your holding-fix is on your flight plan – easy – just let your aircraft continue up to the holding fix. If it isn't – set HDG mode and turn the heading indicator towards the holding fix.

Reduce the speed to minimum clean – to be reached when passing the holding fix.

4.C.2. Fly the entry

When passing the holding fix:

- Tune in your first heading for holding entry
- Set the timer
- When reaching the outbound end (according to timer) – turn to the next heading
- When reaching the holding fix again, turn to the outbound course, restart the timer

4.C.3. Fly the holding

Continue to fly the holding as defined. Watch your altitude and speed permanently. Monitor the endurance – the remaining time allowed in holding, without violating your fuel reserves is indicated on the holding page of your FMS. Make sure the leg length is correct. When on the inbound course, make corrections to the heading, if necessary, to overfly the holding fix precisely. It is likely that ATC will request you to descend to prepare for the approach. In this case, maintain the lateral pattern – just change the altitude.

4.C.4. Wind correction

The wind may blow you away from your desired track. In semi-manual flight apply corrections to the heading. Keep in mind that the correction on the outbound leg is approximately 3-times the correction on the inbound leg.

4. D. Manual flight

To enter and fly a holding pattern in manual flight is a heck of a task. But it can be done. Don't forget – if your automation goes down for any reason, there is no other way to escape than manual flight. Try it out – and have a tissue ready to mop the sweat.

5. Leaving the holding

Everything in life comes to an end, which is equally true for a holding. The termination of a holding can either be requested by the pilots (in case it was them who have requested it in the first place) or it will be instructed by ATC. You can expect the following instructions:

BIGJET123, NEXT TIME PASSING BERSU [CANCEL THE HOLD], PROCEED BERSU2G ARRIVAL

BIGJET123, NEXT TIME PASSING BERSU [CANCEL THE HOLD], LEAVE BERSU HEADING 340

BIGJET123, CANCEL THE HOLD, TURN LEFT HEADING 360

BIGJET123, CANCEL THE HOLD, TURN RIGHT DIRECT ZH408

This latest instruction includes to join the transition at ZH408 of which ZH408 is one of the waypoints. As you are well prepared and have your charts ready, you will have no hassle to identify that you are requested to follow the GIPOL14 transition.

Don't forget to clean up your flight plan. Not only the holding, but also all other meanwhile obsolete waypoints need to disappear from your route.

This concludes the bulletin about holdings. As most things in aviation: "preparation is king". Practice holdings every now and then. Don't be shy to request to hold to ATC for training purposes.

BIGJET 123, REQUEST TO HOLD AT AMIKI FOR TRAINING

6. Brain training:

Which type of holding-entry needs to be flown, when coming from:

BLM 3G -> holding at GIPOL

BERSU 2G -> holding at GIPOL

RILAX 2A -> holding at AMIKI

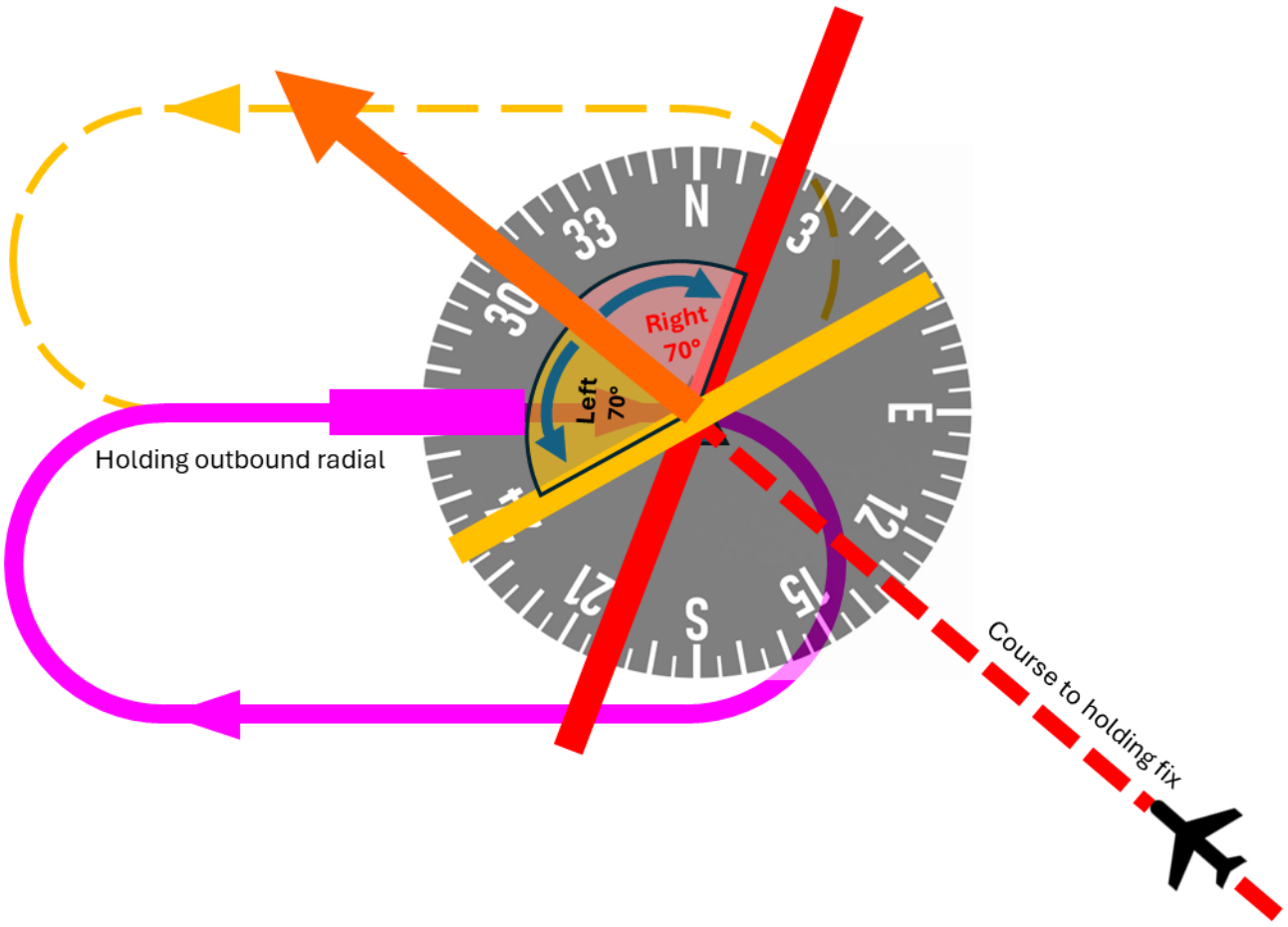
NEGRA 2A -> holding at AMIKI

KELIP 3G -> holding at GIPOL

Enjoy online flying!

vACC Switzerland
Pilot-Training-Department

Annex A. Cheat sheet



<u>In which segment is the radial of the holding-outbound course?</u>	
70° (small)	teardrop entry
110° (medium)	parallel entry
180° (big)	direct entry
270°	Radial of the holding-outbound-course
Standard Holding (right turn)	Medium segment -> Parallel entry
Non-Standard Holding (left turn)	Small segment -> Teardrop entry

Annex B. Identify the entry-pattern step-by-step