

Courses

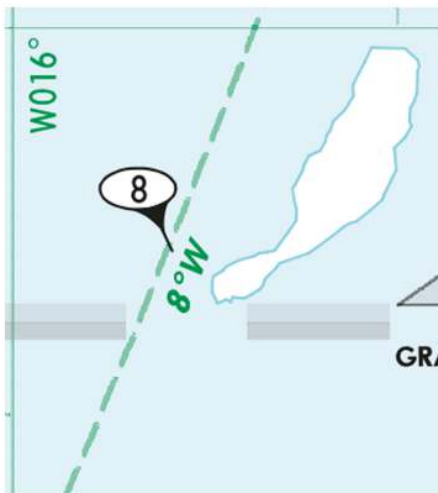
Courses on an en-route chart are (almost) always magnetic. To convert the magnetic course to true, the variation will have to be considered. On a paper chart the magnetic variation is indicated by a green, dashed line running between waypoints. On a digital chart, the line is solid.

One way airway

Some airways are valid for one way only. The airway designator box is formed as an arrow, like L727-996 on the chart.

Non standard flight levels

Some airways are non-standard compared to the semi circular rule. They are marked with an E for EVEN levels and O for ODD levels and an arrow in the direction valid.



< E E >
 < O O >
 < E & O E & O >
 E & O

Left: Magnetic variation of 8° W (marked as no. 8)
 Right: Non-standard flight levels on an airway.

DIRECTIONS

You will have to know how to do all calculations when it comes to compass, magnetic and true courses.

If you remember the letters CDMVT, this becomes quite easy. It may help to use the acronym “*Can Dead Men Vote Twice*” or “*Cadbury Dairy Milk Very Tasty*”.

C Compass

D Deviation

M Magnetic

V Variation

T True

Let us explain this by using an example:

A compass heading of 124° is given and we have a variation of 4° WEST and compass deviation of -3°. What is the magnetic and true heading being flown?

Let’s fill out this table:

Compass Heading	Deviation	Magnetic Heading	Variation	True Heading
124°	-3°		4° W	

We can find our magnetic and true heading by going through the magnetic heading.

A negative deviation is westerly. And west is to the left. Let’s use an arrow to visualize this in the table.

It will then look like this:

Compass Heading	Deviation	Magnetic Heading	Variation	True Heading
124°	-3°		4° W	
	←			

In order to go from compass to magnetic (via deviation) we now follow the direction of the arrow. The arrow will point to the larger number.

The magnetic heading will then be 124° minus 3° , which is 121° :

Compass Heading	Deviation	Magnetic Heading	Variation	True Heading
124°	-3°		4° W	
	←			
124°	-3°	121°	4° W	

The same will apply to the variation. The arrow will point to the larger number.

Compass Heading	Deviation	Magnetic Heading	Variation	True Heading
124°	-3°		4° W	
	←		←	
124°	-3°	121°	4° W	117°

The true heading will be magnetic heading minus the westerly variation, therefore 117° .

CALCULATING TRUE AIR SPEED (TAS)

As you remember from *Instrumentation*, the airspeed indicator (ASI) is driven by ram air into a pitot tube and shows what is called indicated airspeed (IAS). However, the differential pressure is affected by air density/temperature.

At sea level in the International Standard Atmosphere (ISA) and at low speeds where air compressibility is negligible (i.e., assuming a constant air density), indicated airspeed corresponds to true airspeed.

When the air density or temperature around the aircraft differs from standard sea level conditions, IAS will no longer correspond to TAS, thus it will no longer reflect aircraft performance. The ASI will indicate less than TAS when the air density decreases due to a change in altitude or air temperature. For this reason, TAS cannot be measured directly and we will have to calculate the TAS.

TAS will also be used when filing an ATS flight plan, in the “cruising speed” box (item 15).

Calculation example

Since temperature variations are of a smaller influence, the ASI error can be roughly estimated as indicating about **2% less than TAS per 1,000 feet** of altitude above sea level.

An aircraft flying at 15,000 feet in the ISA with an IAS of 100 knots will then be flying at 126 knots TAS.

For more precise calculations (including temperature) we will use our CRP-1/5 or CR-3 computer.

CALCULATING THE WIND CORRECTION ANGLE (WCA)

Wind correction angle will be added or subtracted from our heading to establish a heading so that track coincides with course.

The wind correction angle is not to be confused with the drift angle (which is the difference between heading and track).

The wind correction angle can be fairly easily calculated with this formula:

$$\frac{\text{Difference between wind and track} \times \text{Wind speed}}{\text{TAS}} = \text{WCA}$$

Example question

Your TAS is 100 knots.

The wind is from 330° (magnetic) at 20 kts.

Your magnetic heading is 360°.

What is your wind correction angle (WCA)?

Answer

Let us put this into the given formula:

$$\frac{30^\circ \times 20 \text{ kts}}{100 \text{ kts}} = 6^\circ \text{ WCA}$$

Now, should you add or subtract? If the wind is from the right = ADD the wind correction angle to the heading and the other way around if the wind is from the left.

In this case, the WCA should be *subtracted* to give a heading of 354° (which is the correct answer).

CALCULATING THE GROUND SPEED (GS)

Knowing the wind correction angle (WCA) and the wind speed, the ground speed (GS) can be easily calculated as well with this formula:

$$\cos(\text{WCA}) \times \text{wind speed} = \text{Head or tail component}$$

This answer will be within 1%.

Example question

We are using the same parameters as in the example above:

Your TAS is 100 kts.

The wind is from 330° at 20 kts.

Aircraft heading is 360°.

We found (from our previous calculation) that the WCA (wind correction angle) was -6°.

Answer

$$\cos(6^\circ) \times 20 \text{ kts} = 19.89 \text{ kts}$$

This headwind component will then be subtracted from the TAS (and a tailwind component would be added).

Your GS will then be around 80 kts.

ITEM 16 - DESTINATION AERODROME, TOTAL ESTIMATED ELAPSED TIME AND ALTERNATE AERODROME(S)

Destination aerodrome and total estimated elapsed time

Insert the ICAO 4-letter location indicator of the destination aerodrome followed by the total estimated elapsed time of your flight (NOT the planned time of landing).

Alternate aerodrome(s)

Insert the ICAO 4-letter location indicator(s) of not more than two alternate aerodromes, separated by a space.

If no location indicator has been assigned to the alternate aerodrome, insert **ZZZZ** and specify in item 18 the name of the aerodrome, preceded by ALTN/.

Rules concerning indicating alternate aerodromes positions (if not listed by ICAO code) are the same as for DEP/ and ARR/ elements (described in the explanation of item 18).

ITEM 18 - OTHER INFORMATION

This item is for all other additional, important or helpful information.

Arrival

If the name of the arrival point is not listed in any aeronautical publication, to indicate it you must use:

ARR/ and:

- Degrees and minutes of latitude and longitude.
Example: ARR/5417N02005E

Or:

- Bearing and distance to a navigation point or navigational aid.
Example: ARR/BAMBI320008 (which means bearing 320 degrees and distance 8 NM from BAMBI point)

Departure

DEP/ followed by the name of the departure airport or bearing and distance to navaid/navigation point closest to departure point (if no designator is assigned and “ZZZZ” is inserted in item 13). Up to 50 characters may be used.

Example: DEP/SMALL AIRPORT

Destination

DEST/ followed by the name of the destination airport or bearing and distance to navaid/navigation point closest to destination point (if no designator is assigned and “ZZZZ” is inserted in item 16). Up to 50 characters may be used.

Example: DEST/BIG AIRPORT