

# METAR Decode

This page is designed to help Internet users decode a METAR (Meteorological Aviation Report). It will not necessarily cover the finer points of coding (though I have tried to cover many such), and therefore should not be quoted as the 'final authority': users wishing to know the correct procedures for coding, usage etc., should consult their national 'meteorological authority' for guidance, or the appropriate ICAO or WMO regulations.

The code-form follows the pattern:

**LOCATOR - DATE/TIME - WIND - VISIBILITY - CLOUD - TEMPERATURE - PRESSURE - ADDITIONAL INFORMATION - TREND FORECAST**

In the list below, I have tried to build up from the 'basic' version (via CAVOK) to the more complex issues. I have colour-coded as follows:

|  |  |
|--|--|
|  | always included in a report (provided station so equipped).                |
|  | always included, unless for a CAVOK report.                                |
|  | added/inserted when necessary, as required by coding convention.           |
|  | optional: added as available - often to national or regional (ICAO) rules. |

Although the basic code-form should always be recognisable, many nations have adapted the METAR (or merged / integrated with their own national form of same) to produce hybrids. Where possible, I have tried to indicate these variants. Military users in particular will have extra information - e.g. Colour States. Also note that there is an increasing use of **automatic weather stations** to provided some or all of the data when airfields are closed, or an observer is not available for some reason. In these cases the word **AUTO** is inserted after the date/time group - other variations follow and are listed in the appropriate sections below. However, in general, if there is a failure of all/some of the systems with these units, then the appropriate element will be replaced by solidi in varying numbers.

## METAR:- "BASIC/MINIMUM"

EGKK 021950Z 24015KT 8000 FEW008 SCT012 BKN020 18/15 Q1007  
EGKK 021350Z 17009KT 8000 NSC 23/12 Q1018

**EGKK** .. airfield identifier according to the ICAO listing. This one is Gatwick airport.

**021950Z** .. date/time of report, in this case 2nd day of month, at 1950 GMT (or UTC).  
[in the second example, 1350 GMT]

**24015KT** .. 'surface' **wind direction** (usually at 10 metres, but some take as low as 2 metres) and **mean speed**: wind blowing from 240deg True, with an averaged speed (over 10 minutes usually, but some use 1 or 2 minute sampling periods) of 15 knots (KT); some countries use metres per second (MPS) or kilometres per hour (KPH). If the wind direction is 'variable',

then the direction is replaced by VRB; dead-calm would be 00000KT.  
[in the second example wind direction from 170deg, speed 9 kt]

**8000** .. horizontal **prevailing visibility**\*\* representative of the airfield in metres up to 9 km (9000): if the prevailing visibility (as defined below) is 10 km or more, then this group is given as 9999 & if < 50 metres, it is coded as 0000.

[\*\* the '**prevailing visibility**' is defined as the value that is reached or exceeded over at least 50% of the horizon (contiguous or in fragments), or within at least half of the airfield / airport surface. See examples [below](#) for the reporting of significant variations from this value.

\*\* prior to November 2004, the convention long adopted (except in the US & Canada), was to report the *lowest* visibility as the primary value, with 'better' values appended to defined rules. Note, however, that this use of 'prevailing visibility' is only applicable to the METAR code; SYNOP visibility reports continue to show the **lowest** visibility figure.

**FEW008 SCT012 BKN020** .. amounts and height-of-base of **clouds** over/in near vicinity of airfield. SKC (some use CLR) = no cloud; FEW = 1 or 2 eighths cover; SCT = 3 or 4 eighths cover; BKN = 5, 6 or 7 eighths cover & OVC = 8/8 cover. Heights are given in 100's of feet above airfield level, thus 008 = 800ft, 012 = 1200ft, 020 = 2000ft etc.

[ When there is **more than one layer of cloud**, the convention for inclusion of cloud groups is ....

(a): the lowest layer

(b): the next highest layer, covering 3 oktas or more of the sky (SCT or more)

(c): the next highest layer, covering 5 oktas or more of the sky (BKN or more)

(d): any CB not already included by these rules - the group being inserted in 'natural' height order.]

When **fog** or **heavy snow** is occurring, and it is not possible to determine cloud structure, then these groups are replaced by **VVhhh** or **VV///**, where either the vertical visibility can be determined (hhh) in hundreds of feet, or impossible to determine (///)

**NSC**: increasingly (outside North America), cloud information above 5000 ft / 1500m (or the highest minimum sector altitude, whichever is greater) is being omitted from METAR reports, unless it is 'significant' e.g. when CB or TCU are observed (i.e. the bases of these latter may be above 5000 ft / 1500 m). You will therefore see such replacing the cloud groups: **note carefully**, that 'NSC' (no significant cloud), means just that .... it does NOT mean no cloud at all!

**NCD**: in reports from **automatic** stations (e.g. 'AUTO' obs.), then you may see this abbreviation used to mean .. "no cloud detected". It is important to understand that such means exactly that - there is no cloud below 5000 ft / 1500 m overhead the cloud sensor: there may indeed be cloud floating around well below this level - e.g. 2 oktas of stratus over the airfield approach, or 1 okta cumulus associated with a nearby shower. Also, because of the coding convention now used, there may be cloud higher up, but it will not now be reported under these rules.

[ The formerly-used abbreviation 'SKC', meaning sky clear of cloud, should no longer be used under any circumstances. ]

**18/15** .. air and dew-point **temperatures** (screened), both generally around 1.25m above station level, in degC. Negative values preceded by 'M', thus M02/M05 would indicate air temperature minus 2degC, and dew-point minus 5degC.

[in the second example, air temperature 23 and dew point 12 degC]

**Q1007** .. atmospheric (i.e. mean sea level) **pressure/QNH**, in whole mbar (or hPa). In North America in particular (and associated reporting stations), then this is reported in inches of mercury multiplied by 100, thus **A2997** = 29.97 inches. The value in mbar may then be appended to the end of the report as **SLPppp**, where ppp = QNH in whole mbar, with the 'thousand & hundred' figures missed off where necessary: thus SLP987 would be 998.7 mbar, SLP030 would be 1003.0 mbar. [in the second example, QNH=1018]

## METAR:- "CAVOK version"

EGKK 132020Z 22013KT **CAVOK** 18/15 Q1016

Provided the visibility is  $\geq 10$  km, AND the height of the lowest cloud (any amount) is  $\geq 5000$  ft (or highest minimum sector altitude) AND there are no cumulonimbus clouds (CB, any height) within sight AND there is no significant weather (see list below), then the visibility and cloud part of the standard METAR is replaced by **CAVOK** (say "cav-oh-kay": '**C**eiling **A**nd **V**isibility **O**K'). (not used by certain countries, e.g. the United States)

**METAR:- with additional WIND information**

EGKK 312355Z 24028G42KT 210V280 9999 SCT018 12/06 Q0984

**24028G42KT**.. if over the period that the mean wind is assessed (1, 2 or 10 minutes), the 'peak' **gust** is greater than the mean by 10KT or more (or equivalent in MPS or KPH), then the gust is appended as 'Gff' .. in above, gust is 42 knots. Note carefully when comparing with SYNOP data, the period of the gust is only for the past 10 minutes at most, NOT the past hour, 3-hours, 6-hours etc., as in SYNOP. For this reason, METAR gusts do not give the true picture of peak winds for any one synoptic situation.

**210V280** .. if over the period of observation the wind direction is varying between defined limits, and is in excess of a pre-set level (generally 3 knots or more - national variations), then the 'outer limits' of variation are given, in a clockwise direction: .. in this example between 210degT and 280degT.

**METAR:- Example of WIND SHEAR report**

EDDS 120820Z 24028G45KT 210V280 9999 SCT018 12/06 Q0984 WS RWY28

Some (not all) airfields add **wind shear** information to the end of the METAR when above a certain threshold: this example would be interpreted as " critical wind shear has been exceeded on approach to runway 28 ".

**METAR:- with additional VISIBILITY information**

EGZZ 231020Z 02006KT 4000 0900NE R27/0600U R32/0150D PRFG OVC007 12/11 Q1028

**4000 .. 0900NE**.. The first figure given is the 'prevailing visibility', which can be regarded as the 'best' figure that can be applied to at least 50% of the horizon (contiguously or otherwise). So, for example, if the visibility varies from 8km down to 4000m for at least half of the visible horizon, the prevailing visibility is 4000m. It is important to note that the visibility may be lower than this figure elsewhere, but for deviations to be reported, they must obey certain rules: if the visibility in one particular direction is less than 1500m or is less than half of the prevailing figure, then the lowest visibility observed (900m in above) is reported, with the direction shown (NE). If the lowest value applies in several directions, then the 'most operationally significant' direction is given. If the visibility is fluctuating wildly (e.g. rapid shower transistion), then only the lowest visibility is reported. Where the observation is a fully-automated one (e.g. an 'AUTO' ob.), then no variation with direction of visibility is usually possible, and the letter-group **NDV** is appended to the visibility value.

**R27/0600U .. R32/0150D**.. The visibility given above is not necessarily the most useful indicator of what a pilot would actually 'see' along a particular runway. To try and overcome this limitation, for airfields so equipped, the '**Runway Visual Range**' (**RVR**) is given when general visibility is poor. In this example, the RVR along runway 27 is 600metres, and along runway 32 it is 150metres. In addition, the letters U, D & N are sometimes used to denote respectively increasing (**Up**), decreasing (**Down**) and unchanged (**Nochange**) RVR values since last report. If the RVR is less than 50 metres, then the group is coded as **M0050**. If the RVR is more than 2000 m (but general visibility is poor), then the group is coded as **P2000**: however, many systems only have a maximum operating limit of 1500 m, so you will then seen **P1500** in these cases. There are other variants - see current regulations for exact style, meaning etc.

**METAR:- with additional WEATHER information**

EGKK 111150Z 24018KT 8000 -RA SCT012 OVC015 12/10 Q0984 RETS

Weather information follows the format:

**Intensity .. Description .. Precipitation .. Obscuration .. Other**

This table sets out the full list. (See note 4 below).

| INTENSITY                             | DESCRIPTION  | PRECIPITATION                  | OBSCURATION                                 | OTHER  |
|---------------------------------------|--|--------------------------------|---|--|
| - Light                               | <b>MI</b> shallow  | <b>DZ</b> drizzle              | <b>BR</b> mist (see note 5)                 | <b>PO</b> well developed dust / sand whirls          |
| Moderate (no symbol)                  | <b>PR</b> partial (e.g. fog bank - see note 1 below)                         | <b>RA</b> rain                 | <b>FG</b> fog                               | <b>SQ</b> squalls                                    |
| + Heavy                               | <b>BC</b> patches (see note 1 below)   | <b>SN</b> snow                 | <b>FU</b> smoke (see note 5)                | <b>FC</b> funnel clouds, inc tornadoes / waterspouts |
| <b>VC</b> Vicinity (see note 3 below) | <b>DR</b> low drifting (less than 2 m height)                                | <b>SG</b> snow grains          | <b>VA</b> volcanic ash                      | <b>SS</b> sandstorm                                  |
|                                       | <b>BL</b> blowing (2 m or more agl; i.e. affecting visibility significantly) | <b>IC</b> ice crystals         | <b>DU</b> widespread dust haze (see note 5) | <b>DS</b> duststorm                                  |
|                                       | <b>SH</b> showers  | <b>PL</b> ice pellets          | <b>SA</b> sand                              |  |
|                                       | <b>TS</b> thunderstorm   | <b>GR</b> hail                 | <b>HZ</b> haze (see note 5)                 |  |
|                                       | <b>FZ</b> freezing (see note 2 below)  | <b>GS</b> small hail           | <b>PY</b> spray                             |  |
|                                       |  | <b>UP</b> unknown (automatics) |   |  |

.. up to three weather groups can be included.

.. the individual categories are used from left-to-right in the table above, when more than one applies: thus ... -SHRA light shower of rain; +TSRA heavy thunderstorm with rain; DZ BR moderate drizzle and mist; SN moderate snow; VCPO dust/sand whirls in vicinity (but not over airfield); -SHRAPL FC light shower of rain, with ice pellets and funnel cloud observed.

**Note 1:** When used with FG, the qualifier 'PR' is used for fog banks, i.e. an extensive area of fog impinges upon an airfield, reducing visibility over part of same to less than 1 km; 'BC' [ patches ] would be used when a discrete, small-scale area of fog drifts/forms over the airfield, again reducing visibility below 1 km but not in all directions. In practice, it is not easy to tell the two apart!

**Note 2:** When used with FG, DZ, RA etc., the qualifier 'FZ' is now used to mean BOTH fog (drizzle, rain) depositing rime AND fog (drizzle, rain) occurring with an air-temperature below zero deg.C; this latter may or may not be depositing rime-ice. This definition is therefore not the same as that for the SYNOP code (but I wonder how carefully the distinction is going to be maintained!)

**Note 3:** all phenomena are considered to be 'at the station' unless prefixed by VC = vicinity; thus VCFG is fog in the area, but not affecting the airfield. Vicinity is defined as within 8 km of the airfield. )

**Note 4:** in observations from fully-automated units (e.g. 'AUTO' obs.), then if present weather cannot be assessed due to failure (or otherwise) of the system, then the present weather will be given at //. If the system is functioning correctly but there is no 'significant' weather, then as for manual observations, the 'weather' group is blank.

**Note 5:** the present weather mist (BR), dust (DU), smoke (FU) and haze (HZ) should only be encoded when the prevailing visibility is 5000 metres or less (though in practice this rule is not often followed).

.. **RExx**.. significant 'recent' weather may be added after the pressure group, using the list below.

|   |        |  |        |
|---|--------|--|--------|
| Thunderstorm                                | RETS   | Freezing Rain  | REFZRA |
| Freezing Drizzle                            | REFZDZ | Moderate/heavy rain  | RERA   |
| Moderate/heavy snow                         | RESN   | Moderate/heavy small hail                                      | REGS   |
| Moderate/heavy snow pellets                 | REGS   | Moderate/heavy ice pellets                                     | REPL   |
| Moderate/heavy hail                         | REGR   | Moderate/heavy snow grains                                     | RESG   |
| Moderate/heavy rain showers                 | RESHRA | Moderate/heavy snow showers                                    | RESHSN |
| Moderate/heavy small hail shower            | RESHGS | Moderate/heavy snow pellet shower                              | RESHGS |
| Moderate/heavy ice pellet shower            | RESHPL | Moderate/heavy hail shower                                     | RESHGR |
| Moderate/heavy ice crystals                 | REIC   | Moderate/heavy blowing snow (visibility significantly reduced) | REBLSN |
| Sandstorm                                   | RESS   | Dust Storm   | REDS   |
| Funnel Cloud                                | REFC   | Volcanic Ash   | REVA   |
| Unidentified precipitation (AUTO obs. only) | REUP   |  |        |

### METAR:- with additional CLOUD information

ENBR 232350Z 32017G36KT 270V010 9999 FEW009 SCT018TCU 02/M03 Q0992 WS RWY28

**SCT018TCU**.. this group indicates 3 or 4 eighths of cloud with base 1800ft, cloud type '**towering Cumulus**' (TCU); the only other cloud type allowed (in the official METAR code) is **Cumulonimbus (CB)**. However, some national services use additional types: **CBMAM**.. Cumulonimbus mammatus (implying turbulent air in the vicinity); **ACC**.. Altocumulus castellatus (medium level vigorous instability); **CLD**.. standing lenticular or rotor clouds.

Where the observation is an 'AUTO' ob, and as such cannot determine such variations, then the group **///** is added after each cloud group.

### METAR:- with TREND appended

EGKK 151550Z 24018KT 8000 -RA SCT012 0VC015 12/11 Q0984 RERA TEMPO 3000 RA BKN008

For some major airports (and many military airfields with forecasters attached), a TREND forecast is added to airfield weather reports, usually covering the following 2 hours. If there is no significant change expected (as defined in both international and national regulations), then "**NOSIG**" is added. Otherwise, the TREND will indicate the expected change in wind direction/speed, visibility, significant weather and cloud base using conventions applied to the TAF code. Some abbreviations you might see: **BECMG**= becoming (with time groups); **TEMPO** = temporarily; **NSW** = no significant weather; **AT** = at (time); **TL** = until (time); **NSC** = no significant cloud.

### METAR:- additional (non-standard) variants

Some nations (e.g. US, Australia), add more information to the end of the METAR. This list below is not exhaustive but covers some of the more usual inclusions:

**RMK** .. additional remarks are added after this group.

**Volcanic eruptions** .. plain language, to include name of volcano, lat/long or direction/distance, date/time of eruption, size/description of ash cloud etc.

**Funnel cloud** .. format: Type B(hh)mm LOC: type can be one of TORNADO, FUNNEL CLOUD, WATERSPOUT; B(hh)mm: beginning time (can also be used to show end time/E(hh)mm). hh is the hour of the sighting, which can be left out if redundant. mm is the minute of occurrence; LOC: location or direction of movement.

**Type of automatic station** .. A01 - without precipitation sensor; A02 - with precipitation sensor.

**Peak wind** .. format: PK WND dddff(f)/hh)mm: ddd wind direction; ff(f) wind speed in knots; (hh)mm time at which wind speed occurred, with hh being left out if redundant.

**Wind shift** .. format: WSHIFT (hh)mm [FROPA]: (hh)mm time wind shift occurred; FROPA added if windshift is at frontal passage; again, hh is left off if redundant.

**Visibility** .. format: TWR VIS vvvvv - shows ATC tower visibility; SFC VIS vvvvv shows surface visibility; VIS llllVuuuuu - shows variable visibility, lower to upper; VIS [DIR] - sector visibility with additional direction (e.g. VIS S 1 1/2 .. visibility to south 1 and a half miles).

**Lightning** .. format: Frequency LTG(type) [LOC]: frequency can be one of OCNL - less than 1 flash per minute, FRQ - 1 to 6 flashes per minute & CONS - more than 6 flashes per minute; CG: cloud-to-ground, IC: in-cloud, CC: cloud-to-cloud, CA: cloud-to-air.

**Tsttsddd** .. the actual temperature and dew-point temperature in degrees and tenths (C), with "s" indicating the 'sign' of temperature: 0 for positive, and 1 for negative: thus T00081016 would be interpreted as air temperature +00.8degC and dew-point temperature -01.6degC.

**1sTxTxTx 2sTxTxTx** .. as for the SYNOP code, where TxTxTx is the maximum temperature and TnTnTn is the minimum temperature - but the period is the last 6 hours. Code 's' indicates the sign of temperature, 0 for at or above zero degC, 1 for below.

**4sTxTxTx TnTnTn** .. 24hr maximum and minimum temperature, with s indicating sign as before.

**Prrrr**.. hourly precipitation amount.

**6rrrr**.. 3 and 6 hour precipitation amounts (3hr at intermediate hours, 6hr at 'main' hours).

**7rrrr**.. 24hr precipitation amount.

**4/sss**.. snow depth on ground (not runway).

**CIghhh**.. ceiling in hundreds of feet (hhh), generally the lowest layer with 5 oktas or more, but USAF bases have variations on this.

**Colour states:** METAR reports from military airfields operated by the RAF, some USAF and others may have a 'colour-code' appended (usually only when ATC is open), which describes the airfield 'fitness': these run from **BLU** best, through **WHT GRN YLO** (1 and 2), **AMB** and **RED**. The colour is based on the lowest cloud base (usually 3 oktas or more cover, but some use 5 oktas) and the horizontal 'MET' visibility. **BLACK** is also used, for airfield closed for non-weather reasons.