The Bureau of Meteorology

Aviation services

METAR/SPECI

Aviation products

Aerodrome meteorological reports (METAR/SPECI) are reports of observations of meteorological conditions at an aerodrome.

METAR/SPECI

METAR/SPECI reports are generated by automatic weather stations (AWS) and may have manual input of visibility, weather and cloud by approved observers.

Due to the variability of meteorological elements, and the limitations of observing techniques and definitions of some elements in METAR/SPECI, the specific values of elements should be understood to be the best approximation to actual conditions at the time of observation.

METAR

A **METAR** is a routine report issued on the hour and half hour.

SPECI

A **SPECI** is a special report of meteorological conditions, issued when one or more elements meet specified criteria significant to aviation. SPECI is also used to identify reports of observations recorded 10 minutes following an improvement (in visibility, weather or cloud) to above SPECI conditions.

Location

The location is indicated by either the International Civil Aviation Organization (ICAO) location indicator or another approved abbreviation.

Date/time

The day of month and the time of the report is given in UTC (Coordinated Universal Time) using 6 figures followed by the letter Z. The first 2 digits are the day of the month; the following 4 digits are the time in hours and minutes, e.g. 291741Z (time of report is 1741 UTC on the 29th day of the month).

AUTO

The abbreviation **AUTO** will be included when the report contains only automated observations.

Surface wind

The wind direction, given in degrees true rounded to the nearest 10 degrees, is the mean value over the sampling period which is normally 10 minutes. A variable wind direction is given as VRB.

The wind speed, given in knots (KT), is the mean value over the sampling period. The maximum gust during the sampling period is reported when it exceeds the mean speed by 10 KT or more. It is indicated by the letter G which is followed by the gust value. In Australia, mean wind is sampled over 10 minutes and a 2 minute period is used for maximum gust.

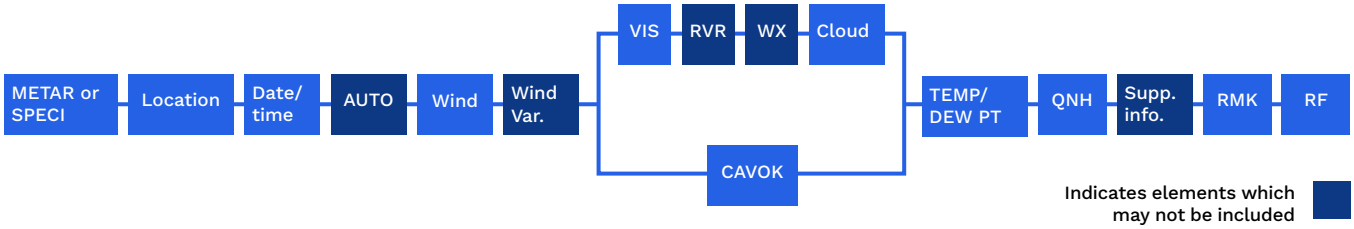
At selected aerodromes, an additional wind group will be given when the direction varies by 60 degrees or more during the sampling period. The group gives the extreme range of directions in clockwise order, e.g. 360V090.

Visibility

The visibility is given in metres up to 9,000 m, with 9999 used to indicate 10 km or greater. When visibility is estimated manually, 2 groups – prevailing visibility (greatest visibility reached in at least half the horizon circle) and minimum visibility – will be reported when:

- the visibility is not the same in different directions and is not fluctuating rapidly, and
- the minimum visibility is not the prevailing visibility, and
- the minimum visibility is less than 1,500 m, or is between 1,500 and 5,000 m and less than 50% of the prevailing visibility.

In these cases, the prevailing visibility will be given first, followed by the minimum visibility with its direction (using one of the 8 points of the compass) from the observing station e.g. 9000 2000N.



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In AUTO METAR/SPECI only one group will be reported, i.e. any variation in visibility that may exist will not be given.

Runway Visual Range (RVR)

RVR will be reported from aerodromes with RVR instrumentation whenever the RVR or the visibility are less than 1,500 m. It will be reported in the format RDD[r]/[n] $V_1V_1V_1V_1$ [V[n]$V_2V_2V_2V_2$][i]. The elements in [ ] are included only when applicable.

Code	Description
R	A fixed indicator denoting that RVR information follows
DD	Designates runway threshold for which RVR is being reported
r	Parallel runways will be distinguished by the letter L, C or R indicating the left, centre or right runway respectively
/	A fixed separator
n	n will only be reported when the RVR is assessed to be one of the following: • greater than 2,000 m, in which case n will be reported as P, and the group will be reported as P2000 • greater than the maximum value which can be assessed by the system, and this maximum value is 2,000 m or less, in which case n will be reported as P, and VVVV will report the maximum value, e.g. P1700 • less than 50 m, in which case n will be reported as M, and the group will be reported as M0050 • less than the minimum value which can be assessed by the system, and this minimum value is 50 m or more, in which case n will be reported as M, and VVVV will report the minimum value, e.g. M0100.
$V_1V_1V_1V_1$	Gives the last 10-minute average RVR value, except when the RVR has varied significantly during the 10 minutes, in which case it gives the minimum one-minute average value during this period (and is followed by V[n]$V_2V_2V_2V_2$)
V	A conditional indicator, included only when RVR has varied significantly during the last 10 minutes
$V_2V_2V_2V_2$	Gives the maximum one-minute average value during the last 10 minutes; only included when RVR has varied significantly during the 10 minutes
i	Gives any distinct RVR tendency over the sampling period – either U (upward), D (downward) or N (nil). Is not reported if tendency not available.

Weather

In Australia, present weather information in METAR/SPECI is for the area within a radius of 8 km of the aerodrome reference point, and for certain specified weathers in its vicinity (i.e. the area between 8–16 km of the aerodrome).

Weather phenomena are reported using the codes listed in the tables on the right. (Not all weather types are included in AUTO METAR/SPECI.) Intensity is indicated for precipitation, dust storms, sandstorms and funnel clouds by appending:

- the prefix - for light, e.g. -DZ
- the prefix + for heavy, e.g. +RA
- no prefix for moderate, e.g. SHRA

When precipitation is reported with TS, the intensity indicator refers to the precipitation, e.g. -TSRA = thunderstorm with light rain.

Prefix	Weather intensity
+	Heavy
no prefix	Moderate
-	Light

Code	Weather descriptor
BC*	Patches
BL*	Blowing
DL	Distant lightning
DR*	Drifting
FZ	Freezing
MI*	Shallow
PR*	Partial
SH	Showers
TS	Thunderstorm
VC	in the Vicinity

Code	Weather phenomenon
BR	Mist
DU	Dust
DS*	Dust storm
DZ	Drizzle
FC*	Funnel cloud
FG	Fog
FU*	Smoke
GR	Hail
GS	Small hail/snow pellets
HZ	Haze
PL	Ice pellets
PO*	Dust devil
RA	Rain
SA*	Sand
SG	Snow grains
SN	Snow
SQ*	Squall
SS*	Sandstorm
VA*	Volcanic ash
UP	Unidentified precipitation

* not included in AUTO METAR/SPECI

One or more codes may be grouped, e.g. +TSGR, -TSRASN.

A report from an AWS may include information on vicinity thunderstorms (VCTS) or distant lightning (DL), where vicinity refers to 8–16 km from the aerodrome reference point and distant refers to greater than 16 km but no more than 56 km. The direction in which vicinity thunderstorms or distant lightning are detected may also be reported in the remarks section, e.g. DL-NE means distant lightning to the north-east and VCTS-E means thunderstorm in the vicinity to the east.

Cloud

Cloud information is reported from the lowest to the highest layers in accordance with the following rules:

- 1st group: the lowest layer regardless of amount
- 2nd group: the next layer covering more than 2 oktas of the sky
- 3rd group: the next highest layer covering more than 4 oktas of the sky
- Extra groups: for cumulonimbus (CB) and/or towering cumulus (TCU) clouds, whenever observed and not reported in any of the above.

Note: Cloud types, including CB and TCU, are not included in AUTO reports.

Cloud amount is described using the codes in the table below.

Code	Definition	Oktas
FEW	Few	1 to 2
SCT	Scattered	3 to 4
BKN	Broken	5 to 7
OVC	Overcast	8
NSC	Nil significant cloud	
NCD*	Nil cloud detected	

* NCD is only reported in fully automated reports when a cloud sensor detects nil cloud.

Cloud height is given as a 3-figure group in hundreds of feet above the aerodrome elevation, e.g. cloud at 700 ft is shown as 007.

Cloud type is identified only for cumulonimbus and towering cumulus, e.g. FEW030CB, SCT045TCU, where manual observations are available.

When an individual layer is composed of cumulonimbus and towering cumulus with a common base, the cloud is reported as CB only (manual reports only).

CAVOK

The abbreviation CAVOK (cloud and visibility and weather OK) is used when the following conditions are observed simultaneously:

- Visibility is 10 km or more
- No cloud below 5,000 ft or below the highest 25 nm minimum sector altitude, whichever is the higher, and no CB and no TCU
- No weather of significance to aviation, i.e. none of the weather phenomena listed in the weather table.

CAVOK is not used in AUTO METAR/SPECI.

Temperature

Air temperature and dew point values are rounded to the nearest whole degree. Negative values are indicated by M (minus) before the numeral, e.g. 34/M04.

Pressure (QNH)

The QNH value is rounded down to the next whole hectopascal (hPa) and is given using 4 figures prefixed by Q, e.g. 999.9 is given as Q0999.

Supplementary information

Supplementary information is used to report:

- Recent weather – significant weather observed since the last report but not at the time of observation is given after the prefix RE, e.g. RERA
- Wind shear – reports of wind shear experienced on take-off or landing are given after the indicator WS, e.g. WS R16. Not included in AUTO reports.

Remarks

The Remarks section (indicated by RMK) may contain:

- Quantitative information on past rainfall is given in mm in the form RFRR.R/RRR.R. E.g. RF00.2/004.2 gives the rainfall recorded in the 10 minutes prior to the observation time, followed by the rainfall recorded in the period since 0900 local time.
- Information of operational significance not reported in the body of the message, for example:
  - information about significant conditions (such as bushfires and distant thunderstorms) beyond the immediate vicinity of the aerodrome (not available in AUTO reports)
  - any BKN or OVC low or middle-level cloud present at or above 5,000 ft when CAVOK has been included in the body of the message (not available in AUTO)
  - CLD: SKY MAY BE OBSC may be reported in AUTO reports when the ceilometer detects nil cloud and the visibility sensor estimates horizontal visibility to be less than 1,000 m.

Data not available

Where a data group is not available, solidi will be reported in lieu of the missing group, e.g. //// for visibility, // for weather and ////// for cloud.

SPECI criteria

SPECI is used to identify reports of observations when:

- conditions are below specified levels of visibility and cloud base
- certain weather phenomena are present
- temperature, pressure or wind change by defined amounts (outlined in the table on the following page).

SPECI is also used to identify reports of observations recorded 10 minutes following an improvement in visibility, weather or cloud to above SPECI conditions.

Element	SPECI criterion
Wind direction	Changes of 30° or more, the mean speed before or after the change being 20 KT or more
Wind speed	Changes of 10 KT or more, the mean speed before or after the change being 30 KT or more
Wind gust	• Gusts of 10 KT or more above a mean speed of 15 KT or more • Gust exceeds the last reported gust by 10 KT or more
Visibility	When the prevailing visibility is below the aerodrome's highest alternate minimum visibility or 5,000 m, whichever is greater*
Weather**	When any of the following begins, ends, changes in intensity, or is occurring at a routine reporting time • thunderstorm • hailstorm • mixed snow and rain • freezing precipitation • drifting snow • squall • fog (including shallow fog, fog patches and fog at a distance) • dust storm • sandstorm • funnel cloud • moderate or heavy precipitation
Cloud	When there is BKN or OVC cloud below the aerodrome's highest alternate minimum cloud base or 1,500 ft, whichever is greater*
Temperature	When the temperature changes by 5°C or more since last report
Pressure	When the QNH changes by 2 hPa or more since last report
Other	• Upon receipt of advice of the existence of wind shear (manual reports only) • The incidence of any other phenomenon likely to be significant

* Where no descent procedure is established for an aerodrome, the aerodrome's alternate ceiling and visibility are 1,500 ft and 8 km respectively.
** Not all weather types are included in AUTO reports.

METAR/SPECI example

SPECI YMML 221945Z 14003KT 0600 R16/0600D R27/0550N FG ////// 08/08
Q1026 RMK RF000.0/001.8

Report	Explanation
SPECI	Special meteorological observation (for visibility and presence of fog)
YMML	ICAO location indicator for Melbourne Airport
221945Z	Time of observation is 1945 UTC on the 22nd day of the month
14003KT	Average wind during sampling period (normally 10 minutes) is from 140 degrees true at 3 KT
0600	Visibility is 600 m
R16/0600D	Runway visual range on runway 16 threshold is 600 m, and is trending down
R27/0550N	Runway visual range on runway 27 threshold is 550 m, nil trend
FG	Present weather is fog
//////	Cloud observation not made (as sky obscured due fog)
08/08	The air temperature and the dewpoint temperature are both 8°C
Q1026	The QNH is between 1026 and 1026.9 hPa
RMK	Remarks section follows
RF00.0/001.8	There has been nil rain in the last 10 minutes and 1.8 mm has fallen since 0900 local time

Further aviation educational resources produced by the Bureau of Meteorology can be found at www.bom.gov.au/aviation/knowledge-centre.

| A vertical line in the margin indicates a text amendment since last update.

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