U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Air Traffic Organization Policy

ORDER
JO 7900.5C

Effective Date:
12/21/2012

SUBJ: Surface Weather Observing

The Federal Aviation Administration (FAA) surface weather observer program is a component of the National Airspace System (NAS). It combines with other elements of the NAS to ensure the overall safety of air transportation services. The FAA is committed to providing the resources necessary to ensure the vibrancy of this critical aviation service. This order provides the practices and procedures for weather observation services that support the important role it plays in the mission of the FAA.

The practices and procedures set forth in this order apply to all FAA personnel, FAA-contract personnel, and non-Federal Observer personnel who provide aviation weather observation services. Weather observer personnel are required to apply the provision of this order as it pertains to their observational responsibilities. Observers are expected to exercise experienced judgment when encountering situations not covered by this order.

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Vice President, Terminal Services

Distribution:

Initiated By: AJT-2

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Chapter 1. Introduction

1.1. Purpose of This Order. This order prescribes aviation surface weather observing procedures and practices. This order includes practices and procedures for both manual and automated observation locations. Also included are practices and procedures for augmentation of automated observations and backup information in the event of system failure, erroneous or non-representative data. These procedures and practices are intended to provide a framework for identifying meteorological phenomena of importance to aviation and reporting their occurrence.

1.2. Audience. This order applies to all FAA and FAA-contract personnel, Limited Aviation Weather Reporting Stations (LAWRS) personnel, Non-Federal Observation (NF-OBS) Program personnel, as well as United States Coast Guard (USCG) personnel as a component of the Department of Homeland Security and National Weather Service (NWS) personnel engaged in taking and reporting aviation surface observations.

1.3. Where to Find This Order. This order is available on the FAA Web site at http://faa.gov/air_traffic/publications and http://employees.faa.gov/tools_resources/orders_notices/.

1.4. Cancellation. This order cancels FAA Order 7900.5B, Surface Weather Observing - METAR, effective December 1, 2005.

1.5. Explanation Of Changes. This revision is primarily editorial and does not introduce any hazard into the National Airspace System. General changes to the order are documented below, which provides additional information to assist the user in understanding and locating the new changes included in this order. (See Appendix K)

General:

References for equipment system names (i.e., ASOS, AWOS) were deleted and replaced throughout 7900.5C with: Automated Systems With SPECI Capability, and Automated Systems Without SPECI Capability.

Removed outdated procedures and equipment.

Designated Stations: The published order required many procedures to be followed at ‘designated stations.’ Now the order identifies stations and their applicable procedures.

References previously scattered throughout various chapters have been consolidated into dedicated chapters.

LAWRS requirements previously scattered throughout 7900.5, have been consolidated into Appendix C which makes the document more usable.

Chapters and Paragraphs were deleted and renumbered.

Chapters were renamed to coincide with the purpose and content of the chapters.

Figures and Tables have been updated to identify their new locations in 7900.5C.

1.6. Abbreviations and Acronyms. Appendix A. Abbreviations and Acronyms, contains abbreviations and acronyms used in this order.

1.7. Relationship to FMH-1 and Other Documents

a. Federal Meteorological Handbook No. 1, Surface Weather Observations and Reports (FMH-1). FMH-1 prescribes surface weather observing standards applicable to all Federal agencies engaged in taking and reporting surface aviation observations. FMH-1 also prescribes the standard reporting and coding procedures used in the surface aviation observation. Order 7900.5C prescribes the procedures and practices to be followed by FAA, FAA-contract and NF-OBS personnel for observing, reporting, and coding of surface observations that meet the Federal standards. A brief description of the NF-OBS program (FAA owned ASOS/AWSS only) is provided in Appendix B. Non-Federal Observing (NF-OBS) Program. This order complements, but does not change the standards contained in FMH-1.

b. Automated Weather Observing Systems Handbooks. Handbooks are produced by automated systems manufacturers. However, all systems must be operated in accordance with practices and procedures contained in this order. A partial listing of the applicable handbooks necessary to operate the various automated weather observing systems includes:

(1) Federal Aviation Administration, Operator Instructions, Automated Weather Observing System (AWOS), August 1, 1994, U.S. Department of Transportation, Washington, DC.

(2) NWS ASOS Ready Reference Guide (RSM1005-00038 Rev. H)

1.8. Applicability of Procedures and Practices

a. Applicability. The procedures and practices in this order apply to all facilities that have the capability to comply with the stated procedure or practice. Some procedures and practices vary at LAWRS sites. LAWRS requirements are contained in Appendix C, LAWRS Requirements. At sites ranked as Service Level C, the basic weather observing requirements are the same as a LAWRS observation. LAWRS observers are not required to back up the observation if measuring or observing equipment is not available.

b. Conflicting Information. In case of conflicting information, the procedures and practices in this order take precedence. However, any applicable FAA air traffic orders take precedence over any procedures or practices in this order that are in conflict. Such conflicts should be brought to the attention of the originator of this order.

c. Terminology. Throughout this order, the following terminology applies:

(1) “Must” indicates a procedure or practice that is mandatory at all applicable facilities.

(2) "Should" indicates a procedure or practice that is recommended at all applicable facilities.

(3) "May" indicates a procedure or practice that is optional.

(4) "Will" indicates futurity; it is not a requirement to be applied to current practices.

d. Unforeseen Requirements. No set of procedures and practices can cover all possibilities in weather observing. The observer must use good judgment, adhering as closely as possible to this order, to describe phenomena not adequately covered by specific instructions. Suggestions for possible changes in procedures and practices to cover such situations may be made through appropriate channels.

1.9. User Responsibilities. Employee participation in directive writing and upkeep activities is encouraged. Any user who finds a subject matter conflict, an error, obsolete information, or who would like to make recommendations or suggestions should notify Terminal Safety and Operations Support, in writing. FAA Form 1320-19, Directive Feedback Information, is available for this purpose. If clarification or correction is urgently needed, you may call Terminal Safety and Operations Support for guidance, but you should also use the FAA Form 1320-19 as a follow-up to verbal conversation.

1.10. Distribution. This order is distributed to select offices in Washington Headquarters; Air Traffic Organization – Terminal Service Areas; Office of Operations Planning; NAS Weather Office; Flight Standards Service; the Mike Monroney Aeronautical Center; the William J. Hughes Technical Center; the USCG Elizabeth City Facility; the Department of Defense (DOD); all terminal air traffic field facilities; all Alaska flight service stations (FSS); FAA-contract weather; and the National Weather Service (NWS).

1.11. Changing the Order. Changes, additions, deletions, and corrections will be issued as necessary. These changes will be issued by the Director, Terminal Safety and Operations Support.

1.12. Maintaining the Order. Each facility must maintain a copy of the order, complete with changes and supplements for reference purposes. When inserting changes to the order, enter the number, effective date, initials, and date entered on the inside cover of this order.

Chapter 2. Guidelines

2.1. Introduction. This chapter describes the types of aviation surface weather observing facilities for which the FAA may have responsibility or oversight. This chapter also describes the various types of surface weather reports, including the Aviation Routine Weather Report (METAR) and Aviation Selected Special Weather Report (SPECI), and FAA guidelines regarding the content of each of these types. Also presented are general guidelines regarding augmentation and backup of automated observations. Lastly, this chapter presents FAA guidelines on the certification of observers.

2.2. Types of Stations. The generic types of stations that take aviation weather observations are defined as follows:

a. Automated Station. A facility equipped with a "Federally Procured" automated surface weather observing system that prepares the observation without a certified observer on duty. The various types of automated stations are described in Chapter 4. Observations generated by automated stations will always be identified by the inclusion of the word AUTO in the transmitted report.

b. Augmented Station. A facility with a "Federally Procured" automated surface weather observing system that prepares the METAR/SPECI with a certified observer on duty capable of adding operationally significant weather information to the observation. The observer is completely responsible for the observation even though the automated weather observing system generates the report. At facilities where augmentation is not available full time, the facility is classed as automated during the non-augmented periods.

c. Manual Station. A facility, other than LAWRS, where certified weather observers are responsible for observing, evaluating, and preparing the METAR/SPECI.

d. Towered Station. Any facility with an airport traffic control tower operated by the FAA or operated under an FAA contract.

e. Nontowered Station. Any facility without an FAA or FAA contract airport traffic control tower.

f. Limited Aviation Weather Reporting Station (LAWRS). A facility where observations are taken, prepared, and transmitted by certified FAA control tower personnel, FAA-contract control tower personnel, or Flight Service Station (Alaska only) personnel on a limited basis to support aviation requirements. At these facilities, various degrees of automated sensors and/or other automated equipment may be available.

g. Flight Service Station (FSS). Throughout this order, the term flight service station (FSS) refers to any flight service station or automated flight service station (FSS) in Alaska, which has been directed by FAA headquarters or service area office to provide the observing, augmentation, or backup service indicated.

h. Non-Federal Observing (NF-OBS) Station. A program in which non-Federal observers such as non-Federal control tower (NFCT) controllers, airline personnel, or fixed base operator (FBO) personnel may enter into an agreement with the appropriate FAA Service Area to provide backup and augmentation of the automated system with SPECI capability. NF-OBS observers are certified by

NWS. At these facilities, various degrees of automated sensors and/or other automated equipment may be available. However, when on duty, the NF-OBS observer must provide backup and augmentation in accordance with their NF-OBS agreement. Program establishment is contained in Appendix B and responsibilities are described in Chapter 4. General Procedures at Automated Weather Stations.

2.3. General Types of Observations . There are three general types of surface observations:

a. Automated Observation. Any observation which has been prepared and transmitted by an automated observing system without human intervention.

b. Augmented Observation. Any automated observation which has been evaluated by a human observer to which additional weather information has been manually added that is beyond the capabilities of the automated weather observing system and/or is deemed operationally significant. The guidelines concerning augmentation are presented in Paragraph 2.4 Augmentation Requirements. Backup is a method of providing an observation, part of an observation, documentation, or communication of an observation at selected sites when the primary method is unavailable or non-representative. The guidelines concerning backup information are presented in Paragraph 2.5 Backup Requirements.

NOTE-
Backing up a failed automated system is not considered a manual observation.

c. Manual Observation. Any observation for which the human observer observes, evaluates, prepares, records, and transmits the observation without the use of an automated observing system. The guidelines for manual observations are presented in Chapter 3. General Procedures.

2.4. Augmentation Requirements. Certified observers are responsible for the completeness and accuracy of the weather observation. Automated weather observing systems are, by design, viewing a smaller area than a human observer. Therefore, the observer is responsible for providing additional information that covers a larger area when operationally significant. Augmentation of automated observations must be provided in accordance with the guidelines presented in the following subsections and as specified for the station's service level standard (Appendix D. Service Standards). Separate guidelines are presented for the two general types of automated weather observing systems: automated systems with SPECI capability and automated systems without SPECI capability. Procedures and practices to be followed to accomplish the required augmentation are presented in Chapter 4. General Procedures at Automated Weather Stations, and Chapter 5. Augmentation Requirements at Automated Weather Stations.

a. Facilities with an Automated System with SPECI Capability.

(1) ATCT with a Surface-Based Observer. At facilities with an ATCT, and an automated system with SPECI capability, and with a surface-based observer on duty, the surface-based observer must provide augmentation of the automated observation. This augmentation must include, but not be limited to the requirements contained in Service Standards for that level of airport (see Appendix D. Service Standards). At these facilities, the ATCT must routinely provide tower visibility when applicable.

(2) All other facilities with an Automated System with SPECI Capability. At facilities with an ATCT, and an automated system with SPECI capability, but without a surface-based observer on

duty, the tower observer must provide augmentation of the automated observation. At facilities with surface based observers, augmentation will be the responsibility of the co-located FSS (Alaska only) or other weather observers. This augmentation must include, but not be limited to:

(a) Thunderstorm.

(b) Tornadic activity (including tornado, waterspout, and funnel cloud).

(c) Hail.

(d) Virga.

(e) Volcanic ash.

(f) Any weather elements considered operationally significant by the observer.

b. Facilities with an Automated System without SPECI Capability. At these facilities, the observation is the responsibility of the surface-based observer, if one exists. At towered sites without a surface-based observer, the observation is the responsibility of the LAWRS observer.

REFERENCE-
FAAO JO 7210.3 para 2-9-2d, Receipt and Dissemination of Weather Observations

2.5. Backup Requirements

a. Situations Requiring Backup. Certified observers are responsible for the completeness and accuracy of the weather observation. If the complete automated observation is unavailable due to sensor/system malfunction, communications failure, and/or non-representative data, backup information must be provided in accordance with the guidelines in the following subsections. Backup refers to the observer providing the same reporting capability as that provided by the automated weather sensor, consistent with service level standards specified in Appendix D Service Standards. Backup information is required for long-line dissemination for terminal forecast (TAF) production and for local, ground-to-air dissemination to legally sustain local operations at the airport. The "failure" modes mentioned above are defined as follows:

(1) Sensor/system Malfunction. One or more sensors or the entire observing system is (are) not reporting data (for any reason). Provide manual backup and make appropriate maintenance notifications.

(2) Communications Failure. The automated weather observing system and/or long-line communications are malfunctioning, thereby preventing the entry and/or transmission of the observation over long-line networks. When it is apparent that observations are not being transmitted, relay the observations to the tie-in FSS and notify the appropriate office for outage notification.

(3) Non-representative Data. The sensor is reporting data, but the data are incorrect or the sky condition, visibility, and/or present weather sensor(s) is/are accurately reporting conditions in the vicinity of the sensor, but those conditions are not representative of prevailing conditions for the operating areas of the airport and are considered operationally significant. When this occurs, provide manual backup. Outage notification is not required.

b. Level of Support. The information specified in these guidelines is the minimum required for each of the situations discussed in the following subsections. The FAA may specify additional information beyond this minimum. The observer is encouraged to add any other appropriate remarks. Procedures and practices to provide the required backup information are presented in Chapter 6. Backup Requirements at Automated Weather Stations.

c. Communications. Automated weather observing system failure may or may not include loss of long-line communications, local communications, or both. The level of backup information to be provided depends on the status of such communications and whether the information is required for long-line or local, ground-to-air dissemination.

Table 2-1: Guide to Contents of Automated and METAR and SPECI Observations

Element of METAR/SPECI Report(s)							
Type of Station:	**Automated System without SPECI**	**Automated System with SPECI Capability**				**Manual**	
	Stand-Alone			**Augmented**			
Type of Observation:	**M**	**M**	**S[1]**	**M**	**S**	**M**	**S**
Type of Report	X	X	X	X	X	X	X
Station Identifier	X	X	X	X	X	X	X
Date/Time	X	X	X	X	X	X	X
Report Modifier (AUTO or COR)	X	X	X	X[2]	X[2]	X[2]	X[2]
Wind Direction Speed, Character	X	X	X	X	X	X	X
Visibility	X	X	X	X	X	X	X
Runway Visual Range				A/B	A/B	A/B[3]	A/B[3]
Present Weather[4]		X	X	X	X	X	X
Sky Condition							
≤ 12,000 feet	X	X	X	X	X	X	X
> 12,000 feet				A	A	X	X
Temperature	X	X	X	X	X	X	X
Dew Point	X	X	X	X	X	X	X
Altimeter Setting	X	X	X	X	X	X	X
Remarks: **Group 1 - Automated, Manual, and Plain Language**							
Volcanic				X	X	X	X

Element of METAR/SPECI Report(s)							
Type of Station:	**Automated System without SPECI**	**Automated System with SPECI Capability**				**Manual**	
	Stand-Alone			**Augmented**			
Eruptions							
Tornadic Activity				X	X	X	X
Type of Automated Station (AO1, AO2)	X	X	X	X	X		
Peak Wind	X	X				X	
Wind Shift		X	X	X	X	X	X
Tower or Surface Visibility	X	A/B/C	A/B/C	A/B/C	A/B/C	A/B/C	A/B/C
Variable Prevailing Visibility	X	X	X	X	X	X	X
Sector Visibility				A	A	X	X
Visibility at Second Location		X[5]	X[5]	X[5]	X[5]		
Lightning	X	X	X	X	X	X	X
Time of Beginning/Ending of Precipitation		X		X	X[6]	X	X[6]
Time of Beginning/Ending of Thunderstorms	X	X	X	X	X	X	X
Thunderstorm Location				X	X	X	X
Hailstone Size				X	X	X	X
Virga				X	X	X	X
Variable Ceiling Height	X			X	X	X	X
Obscurations[4]				X	X	X	X
Variable Sky Condition				A	A	X	X
Significant Cloud Types				A	A	X	X
Ceiling Height at Second Location		X[5]	X[5]	X[5]	X[5]		

Element of METAR/SPECI Report(s)							
Type of Station:	**Automated System without SPECI**	**Automated System with SPECI Capability**				**Manual**	
	Stand-Alone			**Augmented**			
Pressure Rising/Falling Rapidly	X	X		X		X	
Sea-level Pressure		X	X			X	
Aircraft Mishap				X	X	X	X
No SPECI Reports Taken						X[6]	
Snow Increasing Rapidly				A/B	A/B	X	
Other Significant Information				X	X	X	X
***Remarks:* Group 2 – Additive and Automated Maintenance Data**							
Hourly Precipitation Amount	X	X		X			
Ice Accretion		X	X	X	X		
3-6 Hour Precipitation Amount		X		X		X	
24- Hour Precipitation	X	X		X		X	
Depth of Snow on Ground				X[7]		X	
Water Equivalent of Snow on Ground				X[7]		X	
Hourly Temperature and Dew Point		X		X		X	
6- Hourly Maximum Temperature	X	X		X		X	
6- Hourly Minimum Temperature	X	X		X		X	

Element of METAR/SPECI Report(s)							
Type of Station:	**Automated System without SPECI**	**Automated System with SPECI Capability**				**Manual**	
	Stand-Alone			**Augmented**			
24- Hour Max/Min Temperature	X	X		X		X	
3- Hourly Pressure Tendency		X		X		X	
Sensor Status Indicators		X	X	X	X		
Maintenance Indicator		X	X	X	X		

AO1 - Automated station does not have precipitation discrimination capability
AO2 - Automated station has precipitation discrimination capability
AUTO - Appears in weather report of automated system when observer is not logged on
M - METAR
S - SPECI
X - Indicates elements included at all stations
A - Indicates elements that are at service level A (where so equipped)
B - Indicates elements that are at service level B (where so equipped)
C - Indicates elements that are at service level C (where so equipped)
[1] All hourly reports are METAR, all others are SPECIs except automated stations without SPECI capability, which are all METAR.
[2] COR only
[3] Where so equipped.
[4] Automated stations report only a limited set of present weather and obstruction to vision elements.
[5] At stations equipped with the meteorological discontinuity sensors.
[6] Report if precipitation caused the SPECI
[7] See Appendix G for applicability

d. Equipment for Backup Observations. Weather observing equipment should be maintained to allow certified observers to perform backup responsibilities in the event of an automated sensor failure. Air traffic managers must coordinate with the Service Area Office, local Technical Operations System Management Office, and the appropriate NWS regional office before initiating action to decommission weather observing equipment.

2.6. Long-Line Backup Requirements. Details on the procedures to provide backup are in Chapter 6. Backup Requirements at Automated Weather Stations. This paragraph specifies the type of minimum backup for various types of facilities.

a. LAWRS ATCTs. At LAWRS ATCTs, certified air traffic control specialists (ATCS) must provide the backup information for long-line transmission that is listed in this section. The required information must be entered into the automated systems with SPECI capability via the operator interface device. At locations with automated systems without SPECI capability, the required information must be phoned to the tie-in Flight Service Station. The following information must be provided at a minimum:

(1) Wind.

(2) Visibility to 10 miles.

(3) Present weather and obstructions to vision (see Table 6-6 for required elements).

(4) Sky condition to 12,000 feet.

(5) Temperature/Dew Point.

(6) Altimeter Setting.

(7) Required remarks and operationally significant remarks as deemed appropriate.

NOTE-
Precipitation of unknown form may be reported only if the automated sensor is operational and is reporting precipitation of unknown form. However, if the observer can determine the type of precipitation, it should be reported using the allowable elements listed in Table 6-6.

b. Non-LAWRS ATCTs with a Surface-Based Observer. At non-LAWRS towers with a surface-based observer, the surface-based observer must provide, at a minimum, the back-up information for long-line transmission according to the requirements contained in the Service Standards for the service level of the airport. Backup must also include required remarks and operationally significant remarks as deemed appropriate by the observer. At these facilities, ATCT personnel must routinely provide ATCT visibility information to the surface-based observer as required.

c. Nontowered Facilities with a Surface-Based Observer. At all nontowered facilities, the surface-based observer must provide the backup information required by the Service Standards for the service level of the airport. At all facilities with an operator interface device, the required information must be entered into the automated weather observing system via the operator interface device. Backup must also include required remarks and operationally significant remarks as deemed appropriate by the observer.

2.7. Certification of Personnel and Currency Requirements. Before assuming full responsibility for taking any type of surface observation or any part thereof, each person must be certified. The NWS is responsible for certifying all civilian weather observers in one or more of the following observer types. Definitions of these types are presented in Paragraph 3.2 Definitions. Currency requirements are in FAA Order JO 3120.4, Air Traffic Technical Training.

a. NWS and FAA observers.

b. LAWRS observer.

c. Tower visibility observer is certified by the FAA through eLMS.

2.8. Types and Content of METAR/SPECI Observations. The METAR is the primary code format used in the United States to satisfy requirements for reporting surface meteorological data. The METAR may be prepared by automated weather observing systems (with or without augmentation) or by certified weather observers. These data are primarily reported in an alphanumeric coded format for aviation users.

a. A complete METAR contains the type of report, station identifier, date/time of observation, and whether the report is automated (AUTO) or corrected (COR). Weather phenomena in the METAR include wind, visibility, runway visual range (RVR) (where connected), present weather, sky condition, temperature, dew point, and altimeter setting (collectively referred to as "the body of the report"). In addition, significant information elaborating on data reported in the body of the report or coded and plain language data not included in the body of the report may be appended to the report in a section referred to as "remarks." The content varies according to the type of weather station and the automated weather observing system used (see Table 14-1). Some elements of the remarks section are not required at FAA facilities.

b. The METAR is a scheduled observation between 45 and 59 minutes past the hour. However, at automated stations without SPECI capability, METARs are generated every 20 minutes starting at H+00. A SPECI is an unscheduled observation taken when there is a significant change in the observation since the previous METAR observation was taken or if an aircraft mishap has occurred. If an aircraft mishap occurs close to a scheduled METAR, then it would be transmitted as a METAR. SPECI criteria are applicable only to stations that have the capability of evaluating the event. If it is time for a METAR to be issued and SPECI observation criteria are met, the observation will remain designated as a METAR. The criteria for taking SPECI observations are given in Chapter 3. General Procedures.

c. Table 2-1 summarizes the weather elements that are available at automated observing systems with precipitation discrimination capability (AO2) and those without precipitation discrimination capability (AO1). The precipitation discrimination capability indicator, AO1 or AO2, is included in the remarks section of the applicable METAR or SPECI report. This table also shows the additional elements that are available when an observer is present to add information that is beyond the capabilities of the automated observing system (augmentation). This table does not indicate elements that are required for backup or augmentation. These elements are also found in Appendix D. Service Standards.

Chapter 3. General Procedures

3.1. Introduction. This chapter prescribes procedures and practices applicable to all facilities and to all types of observations. These general procedures also apply to observations taken to fulfill requirements for augmentation or minimum operational requirements during backup. This chapter also describes the various types of surface observations and prescribes the criteria for taking SPECI observations. Chapters 7 through 16 prescribe procedures and practices to be followed by all personnel engaged in observing and reporting surface-based meteorological conditions. In addition to prescribing standard procedures and practices, these chapters also prescribe differences in procedures and practices applicable to LAWRS observers.

3.2. Definitions.

a. Actual Time Of Observation. The actual time of observation is the time the last element of the observation is observed or evaluated. The actual time of a SPECI must be the time the criteria for the SPECI were met or noted.

b. Aircraft Mishap. Aircraft mishap is an inclusive term to denote the occurrence of an aircraft accident or incident.

c. Aviation Routine Weather Report (METAR). A METAR is a measurement or evaluation of meteorological elements that describe the state of the atmosphere at the surface location(s) where the observation is taken. METAR is a scheduled observation. The METAR is the primary observation code used in the United States to satisfy requirements for reporting surface meteorological data. It contains a report of wind, visibility, RVR (where connected), weather, sky condition, temperature, dew point, and altimeter setting (collectively referred to as "the body of the report"). In addition, coded plain language information that elaborates on the data in the body of the report may be appended to the METAR or SPECI. This significant information is referred to as "remarks." At Manual Observations and augmented stations, the METAR may be abridged to include one or more of the above elements. The contents of METAR observations are given in Table 3-1. METAR observations that also meet the criteria for a SPECI observation are called METAR observations.

d. Aviation Selected Special Weather Report (SPECI). A SPECI is a weather observation that is reported at other than a scheduled time. SPECI must be taken when any of the criteria for a special observation is observed or detected. A SPECI observation is an unscheduled observation taken when any of the criteria given in Paragraph 3.12 Criteria for SPECI Observations have been observed. A SPECI observation must contain the elements in a METAR, plus additional coded or plain language information that elaborates on the data in the body of the report. The SPECI criteria are applicable only to stations that have the capability of evaluating the event. All SPECI must be taken as soon as possible after relevant criteria are observed.

e. Basic Weather Watch. During a Basic Weather Watch, the observer may be required to perform other duties as their observing workload permits. Because of this and other restrictions (station location, structural design, etc.) that may limit the observer’s capability to continuously view and evaluate weather conditions, observers performing a Basic Weather Watch cannot be expected to detect and report all weather changes as they occur. In addition to taking and disseminating required observations, facilities performing a Basic Weather Watch must recheck weather conditions to

determine if a new observation (SPECI) is required when advised by any reliable source (for example, tower controller) that existing conditions differ from those reported in the last disseminated observation.

f. Continuous Weather Watch. At facilities performing a Continuous Weather Watch, the observer must monitor weather conditions on a continuous basis. In addition to METAR observations, observers must take and disseminate observations as conditions meeting criteria for SPECI observations occur.

g. Coordinated Universal Time (UTC). UTC is the time in the zero degree meridian time zone, also commonly known as Zulu (Z) time.

h. Local Standard Time (LST). LST is a time based on the geographic location of the facility in one of the legally established time zones of the globe.

i. Observer. The generic term "observer" applies to a number of different types of personnel with various responsibilities for providing weather information. These various types are:

(1) Weather Observer. A person who is certified by the NWS to provide a designated range of weather observation elements. These include NWS, NWS-contract, FAA, and FAA-contract personnel.

(a) LAWRS Observer. An NWS-certified ATCS with weather observation responsibilities for surface aviation weather elements.

(b) Tower Visibility Observer. An ATCS certified by the Meteorological Coordinator and Training Consultant to observe and report airport visibility from the control tower.

(2) NF-OBS Observer. A non-Federal observer working under the guidelines of the NF-OBS program, providing backup and augmentation of the automated system with SPECI capability.

j. Standard Time of Observation. The standard time of observation is the hour to which a METAR observation applies.

k. Weather Watch. Observers must monitor weather conditions via a weather watch. Two types of weather watch are possible: a Basic Weather Watch and a Continuous Weather Watch. Except where specifically indicated throughout this order, all FAA, FAA-contract, and NF-OBS observers including LAWRS must monitor weather conditions via a Basic Weather Watch as described below.

3.3. Aviation Weather Observing Locations. Surface weather observation locations must make routine reports at fixed intervals (METAR reports). Where the capability exists, the routine reports must be supplemented by non-routine reports (SPECI). The observing location is defined as the point or points at which the various elements are observed. In cases where all the measurements are taken at the same point, an observation will be regarded as having a single location. In cases where the various sensors are located to obtain acceptable exposure, the observation location will be regarded as varying with the individual elements in an observation. Normally, multiple observing points are confined to an area within about 2 miles of the station. Weather reports from manual stations may also contain information on phenomena occurring at other than the location of the observation. For example, at a large airport the observation location may be defined as follows:

a. For elements such as clouds, prevailing visibility, present weather, and obscurations, the observing location may be coincident with the observer's physical location or it may be the touchdown area of the primary runway.

b. For temperature, dew point, and wind, the observing location may be the center of the runway complex.

c. For cloud height and ceiling, the observing location may be a point near the approach end of a runway.

d. For the location of lightning, the observing point may be the Airport Reference Point (ARP). The ARP is a permanent airport reference point defined by a latitude/longitude.

e. For tower visibility, the observing location must be the airport traffic control tower (ATCT). (NA LAWRS)

f. Regardless of observing location or the locations of the sensors, there must be only one observation disseminated long-line for an airport. If applicable, a report from a commissioned automated system with SPECI capability must be the observation for that airport. A report from a commissioned automated system without SPECI capability may also be designated as the weather observation for an airport. When the air traffic control facility is not in operation, these systems will be operated in the fully automated mode as the weather observation source.

3.4. General Observing Practices. The general observing practices specified in the following subsections apply to personnel taking either full manual, augmented, backup, or tower visibility observations. They do not necessarily apply to the automated portions of observations, which are controlled by system software. Observers must be alert to situations conducive to significant changes in weather conditions and must take and disseminate SPECI observations as rapidly as feasible whenever changes are noted that meet the criteria specified in Paragraph 3.12 **Criteria for SPECI Observations**.

a. Order of Observing. Elements having the greatest rate of change must be evaluated last. When conditions are relatively unchanging, the observer must evaluate the elements outdoors first, and then evaluate the elements indoors, with pressure being the last element evaluated.

b. Recency of Observed Elements. Individual elements entered in an observation must, as closely as possible, reflect conditions existing at the actual time of observation. At manual locations, elements entered must have been observed within 15 minutes of the actual time of observation. Gusts and squalls must be reported if observed within 10 minutes of the actual time of observation. METAR observations must be made as close to the scheduled time of the observation as possible to meet filing deadlines, but in no case will these observations be started more than 15 minutes before the scheduled time.

c. Dark Adaptation. When taking observations outdoors at night, sufficient time should be allowed for the observer's eyes to become adjusted to the darkness.

d. Weather Not Observed. Observers are not required to report occurrences they have not observed. However, the observer may use information from reliable sources, for example, pilots, airline/airport personnel or other sources deemed acceptable by the observer.

e. Time Disseminated in Reports. All times must refer to the 24-hour clock, for example, 1:47 a.m. must be referred to as 0147; 1:47 p.m. must be referred to as 1347. The times 0000 and 2359 must be used to indicate the beginning and ending of the day, respectively.

f. Time Standards. Times used in weather observations must be:

(1) Local Standard Time (LST). (NA LAWRS). LST is used on MF1M-10Cs to record times of observation and time checks. LST must be entered on all forms throughout the year with no consideration of daylight savings time.

(2) Coordinated Universal Time (UTC). UTC is used on all transmitted data. It is also used on MF1M-10Cs to record times of observations and time checks at LAWRS sites.

g. Accuracy of Time in Observations. The accuracy of the actual time of observation is very important in aviation safety investigations. One clock must be designated as the observing location standard, and a routine procedure set up to assure its accuracy once a day at a minimum. The clock used must be within ± 1 minute of the U.S. Naval Observatory Time. If available, the FAA Coded Time Source (CTS) may be substituted for U.S. Naval Observatory Time.

h. SPECI Observations Upon Resumption Of Observing Function. Observers must take, record, and disseminate a SPECI observation within 15 minutes after returning to duty following a break in normally scheduled observer coverage at the station unless a METAR observation is filed during that 15-minute period

3.5. Dissemination. For purposes of this order, dissemination is the act of delivering a completed report to users. There are two general types of dissemination.

a. Local. Local transmission is the transmission or delivery of a weather report to individuals or groups of users in the service area of the observing location.

b. Long-line. Long-line transmission is the transmission of a weather report beyond the service area of the observing location.

3.6. Dissemination Requirements. All reports must be given local dissemination. At stations with long-line capabilities, reports must be given long-line dissemination. When reports are corrected, the corrected report must be given the same dissemination as the report being corrected. If reports cannot be disseminated simultaneously, local and long-line, they must be disseminated first to the local airport traffic control users, then disseminated long-line. SPECI observations must be completed and transmitted as soon as possible after conditions meeting SPECI criteria are observed or detected. A METAR must be transmitted in accordance with agency guidelines. A METAR entered that also meets the criteria for a SPECI must be disseminated as a METAR. WS Form B-11, METAR/SPECI Report for Transmission, is available from the NWS for those facilities that receive manual observations from observers over the phone. This form is an optional aid for transcribing the observation for transmission. (See Appendix F. Transmission (WS FORM B-11).)

3.7. Corrections to Transmitted Data. Once an error has been detected in a transmitted report, a correction must be transmitted as soon as possible. Do not transmit a correction if the original transmitted observation has been superseded by a later report. Transmit the entire corrected report with (COR) as the report designator. Use the original date and time of the report being corrected.

3.8. Delayed Reports. When transmission of a manual observation is delayed until time for the next regularly scheduled report, only the latest report must be transmitted. In the record of observations, the remark Filed But Impractical to Transmit (FIBI) must be appended in parentheses to the report that was not transmitted. The remark FIBI must not be included in any local dissemination of the report. When a SPECI is not transmitted long-line, later SPECIs must be transmitted long-line only when the overall change between the last transmitted report and the current report satisfies the criteria for a SPECI. If the SPECI is not transmitted long-line, the remark FIBI must be appended to the report as described above. All SPECI reports must be disseminated locally. Reports of volcanic eruption must be disseminated, by any means possible, regardless of the delay.

3.9. Rounding Off Numbers. Except where otherwise designated in this order, when computations require that a number be rounded, if the fractional part of a positive number to be dropped is equal to or greater than one-half, the preceding digit must be increased by one. If the fractional part of a negative number to be dropped is greater than one-half, the preceding digit must be decreased by one. In all other cases, the preceding digit must remain unchanged. For example, 1.5 becomes 2, 1.3 becomes 1, -1.5 becomes -1, and -2.6 becomes -3. Refer to Paragraph 13.19 Rounding Pressure Values for rounding of pressure values.

3.10. Record Keeping and Forms

a. Manual Observations. All manual observations, whether complete or partial, must be recorded on form MF1M-10C (does not include automated stations). After completing the form, it must be archived at the facility completing the form. Facilities must prepare an electronic form and **SEND TO "SURFACE.QC@NOAA.GOV"** Corrected copies of all forms must be retained locally for 90 days. Retention of copies beyond 90 days must be as directed by the Washington Headquarters. All electronic forms must be sent to National Climatic Data Center (NCDC) to the following address: **SURFACE.QC@NOAA.GOV** by the second working day of each month

b. Automated Weather Observations. Automated weather observations and operator terminal entries are archived on site. No further action is required by FAA, FAA-contract, or NF-OBS facilities. In the event of a complete failure of automated equipment, observers are expected to follow manual observation recording requirements.

3.11. Evaluating Weather Sensor Accuracy

Sensor Evaluations. When the observer has reason to believe that the accuracy or validity of indications from meteorological sensors is questionable, the use of such equipment should be discontinued until necessary corrective maintenance has been accomplished. If the use of such equipment is discontinued, any required back-up procedures or practices must be initiated. FAA personnel and NF-OBS providers must make appropriate maintenance notifications in the event of any equipment outages. .

NOTE-
If the observer believes that the AWSS/AWOS information is inaccurate, then contact the local Technical Operations personnel.

a. If the observer believes that the ASOS information is inaccurate, they should notify the ASOS Operations and Monitoring Center (AOMC) at 1-800-242-8194 OR 8895.

b. Notices to Airmen (NOTAMS). The FSS must accept, categorize, and distribute NOTAMs on all systems and system components following instructions in FAA Order JO 7930.2.

3.12. Criteria for SPECI Observations. The observer must take, record, and disseminate a SPECI observation when any of the following is observed to occur:

a. Wind Shift. Wind direction changes by 45 degrees or more in less than 15 minutes, and the wind speed is 10 knots or more throughout the wind shift.

b. Visibility. Visibility as reported in the body of the report decreases to less than, or if below, increases to equal or exceed:

(1) 3 miles.

(2) 2 miles.

(3) 1 mile.

(4) The lowest standard instrument approach procedure minimum as published in the U.S. Terminal Procedures. If none published, use 1/2 mile.

c. Runway Visual Range (NA LAWRS). The highest value from the designated RVR runway decreases to less than, or if below, increases to equal or exceed 2,400 feet during the preceding 10 minutes.

d. Tornado, Funnel Cloud, or Waterspout.

(1) Is observed.

(2) Disappears from sight or ends.

e. Thunderstorm.

(1) Begins (a SPECI report is not required to report the beginning of a new thunderstorm if one is currently reported).

(2) Ends.

f. Precipitation.

(1) Hail begins or ends.

(2) Freezing precipitation begins, ends, or changes intensity.

(3) Ice pellets begin, end, or change intensity.

g. Squall. Wind speed suddenly increases by at least 16 knots and is sustained at 22 knots or more for at least one minute.

h. Ceiling. The height of the base of clouds covering five eighths or more (for example, broken and overcast) of the sky forms or dissipates below, decreases to less than or, if below, increases to equal or exceed:

(1) 3,000 feet.

(2) 1,500 feet.

(3) 1,000 feet.

(4) 500 feet.

(5) The lowest standard instrument approach procedure minimum as published in the U.S. Terminal Procedures. If none published, use 200 feet.

i. Sky Condition. A layer of clouds or obscuring phenomenon aloft is present below 1,000 feet and no layer aloft was reported below 1,000 feet in the preceding METAR or SPECI observation.

j. Volcanic Eruption. When eruption is first noted.

k. Aircraft Mishap. Upon notification of an aircraft mishap, unless there has been an intervening observation.

l. Miscellaneous. Any other meteorological situation that, in the opinion of the observer, is critical.

3.13. Content of METAR/SPECI Observations. Table 3-1contains the content of METAR observations. The first column of the table lists the elements of the observation both for the body of the report and the remarks section. The second column lists a reference to the section in Chapter 14 that discusses coding of the particular element. The third column presents a brief description of the element. The fourth column indicates whether the element is reported in METAR observations, and the fifth column indicates whether the element is reported in SPECI observations.

Table 3-1: Content of METAR

Body of METAR - Consists of 11 Elements				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
Type of Report (METAR/SPECI)	14-7	METAR is the routine (scheduled) report. SPECI is the non-routine (unscheduled) weather report.	X	X
Station Identifier (CCCC)	14-8	ICAO station identifier. Consists of four alphabetic characters, for example, KABC.	X	X
Date/Time (YYGGggZ)	14-9	Day of the month, followed by the actual time of the report or when the criteria for a SPECI is	X	X

Body of METAR - Consists of 11 Elements				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
		met or noted. Group ends with Z to indicate UTC. For example, 251456Z.		
Report Modifier (AUTO or COR)	14-10	AUTO indicates a fully automated report. If not automated report, this field is blank.	X	X
		COR indicates the report is a correction of a previously issued METAR or SPECI	X	X
Wind (dddff(f)G$f_m f_m f_m$KT) ($d_n d_n d_n$V$d_x d_x d_x$)	14-11	True wind direction in tens of degrees using three digits. Speed reported in whole knots (two or three digits). Gusts (G) appended to the speed if observed. Group ends with KT, for example, 23018G26KT. If wind direction varies by 60° or more and speed is >6 knots, a variable wind group may also be reported, for example, 180V250. Direction may be reported VRB (variable) if speed is <6 knots or less. For example, VRB05KT. Calm winds are coded 00000KT.	X	X
Visibility (VVVVVSM)	14-12	Prevailing visibility in statute miles. A space divides whole miles and fractions. Ends with SM: 1 1/2SM. AUTO: M pref. means "less than": M1/4SM.	X	X
Runway Visual Range ($RD_R D_R/V_R V_R V_R V_R$FT or $RD_R D_R/V_N V_N V_N V_N VV_X V_X V_X V_X$FT)	14-13	At service level A&B sites (where so equipped), 10-minute RVR value: Reported in hundreds of feet if visibility is < one statute mile or RVR is < 6000 feet. Group ends with FT to indicate feet, for example, R06L/2000FT. Prefixed with either M or P indicates the value is lower or higher than the RVR reportable values, for example, R06L/P6000FT. If variable during the evaluation period, the variability is reported, for example, R06L/2000V4000FT.	A/B	A/B
Present Weather (w'w')	14-14	Weather phenomena (other than obscurations) occurring at the station are reported in the body of the report. Weather obscurations are generally reported if visibility < 7 miles (see 14-14 for exceptions). Volcanic ash reported with any visibility. Reported in order of decreasing predominance. Maximum of three groups reported (pcpn included in one group; separate groups for other phenomena).	X	X
Sky Condition ($N_s N_s N_s h_s h_s h_s$ or $VVh_s h_s h_s$ or CLR or SKC)	14-15	Automated stations report no more than three layers up to 12,000 feet; if no layers are detected, CLR is reported. At manual stations up to six layers may be reported; if no layers observed, SKC is reported. Each layer contains the amount (FEW, SCT, BKN, OVC) immediately followed by the height using three digits, for example, FEW015, BKN030. A layer containing CB or TCU is indicated by appending the contraction to the layer height, for example, FEW015TCU. All layers are considered opaque. Vertical Visibility (VV) is	X	X

Body of METAR - Consists of 11 Elements				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
		reported in hundreds of feet for a total obscuration (indefinite ceiling), for example, VV002. Surface-based obscuration (manual only) reported using amount (FEW, SCT, BKN) followed by "000", for example, SCT000; remark reported as "FG SCT000."		
Temperature/Dew Point ($T'T'/T'_dT'_d$)	14-16	Temperature and dew point are reported to the nearest whole degree Celsius using two digits, for example, 17/13. Sub-zero values are prefixed with an M, for example, 03/M02.	X	X
Altimeter ($AP_HP_HP_HP_H$)	14-17	Altimeter is prefixed with an A indicating altimeter in inches of mercury. Reported using four digits; tens, units, tenths, and hundredths of inches of mercury, for example, A2990.	X	X

Table 3-2: Remarks Section of Observation

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
Volcanic Eruptions	14-20	Volcanic eruptions must be reported whenever first noted. Pre-eruption activity must not be reported. (Use PIREPs to report pre-eruption activity.) Encode volcanic eruptions as described in Chapter 11.	X	X
Tornadic Activity (Manual and Augmented Auto) (Tornadic activity_B/E(hh)mm LOC/DIR_(MOV))	14-21	Whenever tornadoes, funnel clouds, or waterspouts begin, are in progress, end, or disappear from sight, the event should be described directly after the "RMK" element. This remark must give, insofar as known, the phenomena, time, location and direction from the station, and direction of movement. The time the tornadic activity began must be reported and prefixed with a "B"; the time the tornadic activity ended or disappeared from sight must be reported and prefixed with an "E", for example, TORNADO B13 DSNT NE.	X	X
Type of Automated Station (AO1, AO2)	14-22	This remark identifies the type of automated station. It must be included in all reports from automated stations. AO1 identifies an automated station without a precipitation discriminator; AO2 identifies an automated station with a precipitation discriminator. The absence of the remark indicates a manual station.	X	X
Peak Wind (PK WND dddff(f)/(hh)mm) (NA LAWRS	14-23	When the peak wind exceeds 25 knots, the remark must be included in the next METAR report. ddd is the direction of the peak wind, ff(f)	X	

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
		is the peak wind speed since the last METAR report, and (hh)mm is the time of occurrence (with only the minutes reported if the hour can be inferred from the report time), for example, PK WND 28045/15.		
Wind Shift (WSHFT_(hh)mm)	14-24	At stations with automated systems with SPECI capability and manual stations, when a wind shift occurs, WSHFT followed by a space and the time the wind shift began must be reported (with only the minutes reported if the hour can be inferred from the report time). The contraction FROPA may be entered following the time if it is reasonably certain that the wind shift was the result of frontal passage, for example, WSHFT 30 FROPA.	X	X
Tower or Surface Visibility (TWR VIS) (SFC VIS)	9-3 14-25	If tower visibility or surface visibility is carried in the remarks, use the appropriate set of values and precede the visibility with the appropriate identifier, TWR VIS or SFC VIS, for example, TWR VIS 1.	A/B/C	A/B/C
Variable Prevailing Visibility (VIS minVmax)	14-26	Whenever the prevailing visibility is less than 3 statute miles and is variable, this remark must be entered where min is the lowest visibility evaluated and max is the highest visibility evaluated, for example, VIS 1/2V2.	X	X
Sector Visibility (VIS_dd_vv)	14-27	Sector visibility must be reported when it differs from the prevailing visibility by one or more reportable values and either the prevailing or sector visibility is less than 3 miles or considered to be operationally significant. In the remark, dd defines the sector to 8 points of the compass and vv is the sector visibility in SM, for example, VIS N 2.	X	X
Visibility at Second Location (VIS vv location) (NA LAWRS)	14-28	When an automated station uses meteorological discontinuity sensors, remarks must be added to identify site specific visibilities which differ from conditions reported in the body of the report. vv is the visibility value measured at the secondary location. This remark must only be generated when the condition is lower than that contained in the body of the report.	X[3]	X[3]
Lightning (Frequency_LTG(type)_ [LOC])	14-29	When lightning is observed at a staffed site, the frequency and location must be reported, along with the type of lightning, if known. For example, OCNL LTG AT AP, FRQ LTGCG VC. When lightning is detected by an automated system within 5NM of the ARP, it is reported as "TS" in the body of the report with no remark; within 5-10NM of the ARP, it must be reported as "VCTS" in the body of the report with no remark; and lightning beyond 10NM from the ARP is reported in remarks as "LTG DSNT"	X	X

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
		followed by direction from the ARP, for example, LTG DSNT NE.		
Beginning/Ending Time of Precipitation (WX)B(mm)E(mm) (NA LAWRS	14-30	At stations with automated systems with SPECI capability and Manual Stations, when precipitation begins or ends, the next METAR report must include the type of phenomena, the beginning and/or ending time (prefixed with a B and/or E). If the beginning or ending of the precipitation type (hail, freezing precipitation, or ice pellets) initiated the SPECI report, then that SPECI report must include the type of phenomena, the beginning and/or ending time, and should be reported in the next METAR report, also.	X	X[2]
Beginning/Ending Time of Thunderstorms (TS)B(mm)E(mm)	14-31	When thunderstorms begin or end, the SPECI report must include the type of phenomena, the beginning and/or ending time (prefixed with a B and/or E), and should also be reported in the next METAR report, for example, TSB05E45	X	X
Thunderstorm Location (TS_LOC_(MOV_DIR))	14-32	Thunderstorm location and movement must be encoded. For example, TS SE MOV NE.	X	X
Hailstone Size (GR_ {INCHES})	14-33	At augmented automated stations and at manual stations, the size of the largest hailstone is coded in 1/4 inch increments, identified with the contraction GR. (If GS is encoded in the body of the report, no size remark is required.)	X	X
Virga (VIRGA_{Direction})	14-34	When precipitation is observed to be falling from clouds but is not reaching the ground because of evaporation, report VIRGA; the direction from the station is optional, for example, VIRGA or VIRGA SW.	X	X
Variable Ceiling Height (CIG minVmax)	14-35	Whenever the ceiling is below 3,000 feet and is variable, enter min as the lowest ceiling height evaluated and max as the highest ceiling height evaluated, for example, CIG 005V010.	X	X
Obscurations (w'w'_($N_sN_sN_s$) $h_sh_sh_s$)	14-36	When the sky condition contains an obscuration either at the surface or aloft, other than clouds, the type of phenomena in the layer, plus the sky cover at the layer and the height must be reported in remarks, for example, FG SCT000 or FU BKN015.	X	X
Variable Sky Condition ($N_sN_sN_s(h_sh_sh_s)$_V_$N_sN_sN_s$)	14-37	This remark must identify the layer that is varying and indicate the range of variability. If there are several layers of the same coverage, the variable layer must be identified by including the layer height.	X	X
Significant Cloud Types	14-38	When observed, the following clouds are reported in remarks: 1.) Cumulonimbus (CB) or Cumulonimbus Mammatus (CBMAM), distance, direction from the station, direction of movement, for example, CB W MOV E, CB DSNT W. 2.) Towering Cumulus (TCU),	A	A

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
		distance, and direction from the station, for example, TCU W. 3.) Altocumulus Castellanus (ACC), direction from station, for example, ACC NW. 4.) Standing Lenticular (stratocumulus SCSL; altocumulus ACSL, or cirrocumulus CCSL) or rotor clouds, direction from the station, for example, ACSL SW-W, APRNT ROTOR CLD NE, CCSL S. Cumulonimbus of any kind and towering cumulus are also identified in the body of the report.		
Ceiling Height at Second Location (CIG_ {height}_ {LOC}) (NA LAWRS	14-39	When an automated station uses meteorological discontinuity sensors, remarks must be added to identify site specific sky conditions which differ from conditions reported in the body of the report. This remark must only be generated when the ceiling is lower than that contained in the body of the report. For example, CIG_002_RY11.	X[3]	X[3]
Pressure Rising or Falling Rapidly (PRESRR) (PRESFR) (NA LAWRS)	14-40	When the pressure is rising or falling rapidly at the time of the observation, the remark Pressure Rising Rapidly (PRESRR) or Pressure Falling Rapidly (PRESFR) must be included.	X	X
Sea-Level Pressure (SLPppp) (SLPNO) (NA LAWRS)	14-41	At stations with automated systems with SPECI capability and manual stations, this remark begins with SLP and is coded using the tens, units, and tenths of sea-level pressure in hectopascals, for example, SLP982. If sea-level pressure would normally be reported, but is not available, the remark is coded SLPNO.	X	
Aircraft Mishap (ACFT_ MSHP)	14-42	If a report was taken to document weather conditions when notified of an aircraft mishap, the remark ACFT MSHP is included in the report, but is not transmitted. This is indicated by putting the remark in parenthesis in the record.	X	X
No SPECI Reports Taken (NOSPECI)	14-43	At staffed stations where SPECI reports are not taken, the remark NOSPECI must indicate that no changes in weather conditions will be reported until the next METAR report.	X[2]	
Snow Increasing Rapidly (SNINCR_(ii)/(ii)) (NA LAWRS)	14-44	Report SNINCR if snow depth increases by 0.5 inch to the nearest whole inch or more in the past hour, followed by amounts. The remark SNINCR is followed by the depth of increase in the last hour, a solidus, and the total depth of snow on the ground at the time of the report. For example, a snow depth increase of 2 inches in the past hour with a total depth on the ground of 10 inches would be coded "SNINCR 2/10."	X	
Other Significant Information (Plain Language)	14-45	Other significant information important to operations, such as information on fog dispersal operations, runway conditions, or "Last" report from location, etc.	X	X

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
Group 2`-Additive and Automated Maintenance Data				
Hourly Precipitation Amount (Prrrr) (NA LAWRS)	14-47	At automated stations this remark is included in METAR reports for the water equivalent of all precipitation that has occurred since the last METAR coded in hundredths of an inch, for example, P0009 indicates 9/100^{ths} of an inch of precipitation in the past hour.	X	
1-, 3- and 6-Hourly Ice Accretion Amount, I1nnn, I3nnn, I6nnn (NA LAWRS)	14-48	At automated stations with a freezing rain sensor, this remark is included in METAR/SPECI reports for the ice accretion amount that has occurred in hundredths of an inch during the last 1-hour (I1nnn), 3-hour (I3nnn), and 6-hour (I6nnn) period. No manual backup is required.	X	X
3- and 6-Hourly Precipitation Amount, 6RRRR/ (NA LAWRS)	14-49	At stations equipped with automated systems with SPECI capability and Manual stations, this remark is included in 3- and 6-hourly observation; encoded in inches, using tenths, and hundredths, of the amt. 2.17 inches of precipitation would be encoded 60217. When an indeterminable amount of precipitation has occurred, the 6RRRR group is coded 6////. Note: automated systems with SPECI capability automatically report this data.	X	
24-Hour Precipitation, $7R_{24}R_{24}R_{24}R_{24}$ (NA LAWRS)	14-50	Included in 1200 UTC observation if more than a trace of precipitation has fallen in past 24 hours, coded using the tens, units, tenths, and hundredths of inches, for example, 1.25 inches would be coded 70125.	X	
Depth of Snow on the Ground, 4/sss (NA LAWRS)	14-51	At stations listed in Appendix G, the total snow depth on ground group is coded in the 0000, 0600, 1200, and 1800 UTC observations whenever there is more than a trace of snow on the ground, and more than a trace of precipitation occurred within the past 6 hours. For example, a snow depth of 21 inches would be coded as "4/021."	X	
Water Equivalent of Snow on Ground (933RRR) (NA LAWRS)	14-52	At manual stations, this group reported in 1800UTC report if average snow depth is 2 inches or more. 933 is the code indicator for water equivalent of snow on ground. RRR represents the water equivalent of snow on the ground reported in tens, units and tenths of inches using 3 digits, for example, water equivalent of 3.6 inches would be 933036.	X	

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
Hourly Temperature and Dew Point $Ts_nT'T'T's_nT'_dT'_dT'_d$ (NA LAWRS)	14-53	At automated stations except AWOS-A, this element is used to report temperature and dew point to the tenth of a degree Celsius. T identifies the group, the sn the sign of the temperature - coded as 1 if the value is below 0 degrees Celsius and 0 if the value is 0 degrees Celsius or higher. TaTaTa is the temperature in tens, units, and tenths of degrees and T'aT'aT'a is the dew point in tens, units and tenths of degrees, for example, a temperature of 2.6 and dew point of -1.5 would be coded in the body as 03/M01 and in remarks as T00261015. If the dew point is missing, report the temperature, if the temperature is missing, do not report either.	X	
6-Hour Maximum Temperature, $1s_nT_xT_xT_x$ (NA LAWRS)	14-54	Report the maximum temperature in past 6-hours in tenths of degrees Celsius using 3 digits, where the 1 identifies the maximum temperature group, the s_n the sign of the temperature - coded as 1 if the value is below 0 degrees Celsius and 0 if the value is 0 degrees Celsius or higher. The $T_xT_xT_x$ must be the maximum temperature during the last 6 hours, for example, a temperature of 1.0 degrees Celsius is coded as 10010, a maximum temperature of -2.1 degrees Celsius is coded 11021.	X	
6 Hour Minimum Temperature, $2s_nT_nT_nT_n$ (NA LAWRS)	14-55	Report the minimum temperature in past 6-hours in tenths of degrees Celsius using 3 digits where the 2 identifies the minimum temperature group, the s_n the sign of the temperature - coded as 1 if the value is below 0 degrees Celsius and 0 if the value is 0 degrees Celsius or higher. The $T_nT_nT_n$ must be the minimum temperature during the last 6 hours, for example, a temperature of -2.1 degrees Celsius is coded as 21021, a minimum temperature of 1.2 degrees Celsius is coded 20012.	X	
24-Hour Maximum and Minimum Temperature, $4s_nT_xT_xT_xs_nT_nT_nT_n$ (NA LAWRS)	14-56	Reported at midnight (LST); the maximum and minimum temperatures for the day coded in tenths of degrees Celsius using 3 digits where the 4 identifies the maximum/minimum temperature group, the sn the sign of the temperature - coded as 1 if the value is below 0 degrees Celsius and 0 if the value is 0 degrees Celsius or higher. For example, a 24-hour maximum temperature of 10.0 degrees Celsius and a 24-hour minimum temperature of -1.5 degrees Celsius is coded 401001015.	X	

Remarks Section of Observation				
Element	**Paragraph**	**Brief Description**	**METAR**	**SPECI**
Pressure Tendency, 5appp (NA LAWRS)	14-57	At equipped automated stations, include in 3- and 6-hourly observations where the 5 identifies the pressure tendency group, the a represents the character of pressure change over the past 3 hours, and ppp is the change in pressure in the past 3 hours. the ppp is coded based on the absolute value of the change of either the station pressure or the altimeter in the past 3 hours coded in tenths of hectopascals and using the tens, units, and tenths digits, for example, a steady increase of 3.2 hectopascals in the past 3 hours would be coded 52032.	X	
Sensor Status Indicators	14-58	At equipped automated stations: When automated stations are equipped with a precipitation identifier and that sensor is not working, the remark PWINO is included. When the tipping bucket rain guage is not operating at an automated station equipped with the device, PNO is included in remarks. When automated stations are equipped with a Freezing Rain Sensor and it is not working, the remark FZRANO is included. When automated stations are equipped with a lightning detection system and that sensor is not working, the remark TSNO is included. At an automated station, when the secondary visibility sensor is not working, VISNO_(LOC) is included, and when the cloud height indicator is not working CHINO_(LOC) is included.	X	
Maintenance Indicator	14-59	A maintenance indicator sign, $, is included when an ASOS/AWSS detects that maintenance is needed on the system.	X	X

X – Indicates elements included at all stations
A – Indicates elements that are at service level A (where so equipped)
B – Indicates elements that are at service level B (where so equipped)
[2] Report if precipitation caused the SPECI.
[3] At stations equipped with meteorological discontinuity sensors.

Chapter 4. General Procedures at Automated Weather Stations

4.1. Purpose. This chapter prescribes procedures and practices to be followed by personnel responsible for observing, reporting, and/or transmitting surface weather information required for augmentation, and/or for sustaining minimum operations in the event of partial or total failure of the automated weather observing system. Practices applicable to LAWRS observers are located in Appendix C.

4.2. Types of Automated Stations

a. FAA, FAA-contract and NF-OBS Stations. There are two major classes of automated surface weather observing systems used at FAA, FAA-contract, and NF-OBS sites: Automated systems with SPECI capability and automated systems without SPECI capability. The augmentation and backup of these systems are described in the next two chapters for all FAA, FAA-contract, and NF-OBS site personnel.

(1) Automated systems with SPECI capability.

(a) Automated Surface Observing System (ASOS) is a type of automated surface weather observing system developed through a joint FAA/NWS/DOD agreement. FAA ASOSs are installed at designated airports and maintained by the NWS to meet FAA requirements. There are three configurations of ASOS. The first contains at least one of each of the following sensors:

(i) Wind sensor.
(ii) Visibility sensor.
(iii) Precipitation identification sensor.
(iv) Cloud height indicator sensor.
(v) Temperature and dew point sensors.
(vi) Pressure sensors.
(vii) Precipitation accumulation sensor.
(viii) (Format correctly)

(b) The second ASOS configuration which includes the FAA Automated Weather Sensor System (AWSS) has a freezing precipitation sensor in addition to all of the above sensors. The third configuration has a thunderstorm/lightning sensor. Systems without individual lightning sensors will get thunderstorm reporting via the Automated Lightning Detection and Reporting System (ALDARS). Many sites have an ASOS/ATIS Interface Unit (AAIU) which provides the capability to broadcast current weather from the ASOS over the ATIS ground-to-air radio when the tower is closed. ASOS may also have an interface to new generation RVR equipment. See Chapter 9. Runway Visual Range (RVR).

(c) AWOS-Type FA-29600 -Is an AWOS modified by the FAA to report METAR/SPECI data.

NOTE
Any reference to ASOS includes the FAA AWSS and AWOS-Type FA-29600, and any future NextGen system with SPECI capability.

(2) Automated systems without SPECI capability.

(a) Automated Weather Observing System (AWOS). AWOS is a type of automated surface weather observing system certified and commissioned by the FAA.

(b) The AWOS was developed under a Flight Standards Service-sponsored project specifically to provide weather information at locations without previous weather observation capabilities. There are five types of AWOS, namely, A, 1, 2, 3, and 4. These five types are used throughout the Advisory Circular and recognized in other FAA orders.

(i) AWOS A. The AWOS A system measures and reports altimeter only.

(ii) b. AWOS I. The AWOS I system measures and reports wind data, e.g., speed, direction, and gusts; temperature; dew point; altimeter; and density altitude. "Correct lettering"

(iii) AWOS II. The AWOS II system measures and reports all the parameters of AWOS I system plus visibility.

(iv) d. AWOS III. The AWOS III system measures and reports all the parameters of AWOS II system plus precipitation accumulation (rain gauge) and cloud height. AWOS III can have optional sensors such as precipitation type/intensity (present weather, P) and/or thunderstorm/lightning (T).

i. The addition of an optional sensor will change the designation to AWOS III P or AWOS III T, or AWOS III P/T.

(v) e. AWOS IV. The AWOS IV system measures and reports all the AWOS III P/T (i.e. AWOS III with both present weather and thunderstorm/lightning) parameters plus freezing rain (Z) and/or runway surface condition (R). The addition of an optional sensor will change the designation to AWOS IV Z, AWOS IV R, or AWOS IV Z/R.

(3) Many AWOSs were installed at airports without previous weather observations, so personnel may not be available to augment or back up the automated weather observations. The most common type of AWOS observation is the AWOS-3. It is identified by AUTO (automated report) in the body of the report and AO1 (automated station without precipitation discriminator) in the remarks section if it is a fully automated report. If it is being augmented/backed up by an observer, it will not have AUTO in the body of the report, and it will have AO1 in the remarks section. (See examples in Table 5-2: Examples of Augmented Observations.)

NOTE-
LAWRS observers do not augment automated systems without SPECI capability. See FAA Order 7210.3, Facility Operation and Administration.

b. Non-FAA Stations. In addition to the systems described above, there are various NWS, DOD, and non-Federal automated weather observing systems. All non-Federal automated weather observing systems to be used for aviation must be certified and commissioned by the FAA in accordance with the most current version of FAA Advisory Circular AC 150/5220-16, Automated Weather Observing Systems (AWOS) for Non-Federal Applications.

4.3. Certification. All FAA and contract personnel, including LAWRS personnel, responsible for providing weather observations, augmentation information, tower visibility observations or backup weather information must be certified at least to the level commensurate with current duties. Certification must be in accordance with the provisions of Paragraph 2.7 Certification of Personnel and Currency Requirements.

4.4. General Procedures. At automated weather observing stations, the specified weather information must be taken, recorded and disseminated in accordance with the procedures and practices in this order. Operator procedures for recording and disseminating augmentation and backup information are summarized in Table 4-1: Operator Procedures for Providing Augmentation and Backup Information. Weather information taken and reported should reflect only those conditions seen, or reported by a reliable source, from the usual point of observation and, unless otherwise specified, must have occurred at the time of the observation.

Table 4-1: Operator Procedures for Providing Augmentation and Backup Information

CONDITION	LONG-LINE	LOCAL
AUGMENTATION	Enter data via OID	Enter data via OID
BACKUP INFORMATION:		
Sensor Failure	Edit data via OID	Edit data via OID
OID communications failure	Provide to Associated FSS	Provide to Local Air Traffic Facility and follow other Local Procedures
Erroneous/Non-representative data	Edit data via OID	Edit data via OID
LEGEND: OID – any automated weather observing system operator interface device FSS – Automated Flight Service Stations		

4.5. General Equipment Procedures. General equipment operating instructions to perform the duties associated with automated weather observing systems are contained in the following publications:

a. For all Federal systems, use handbooks, manuals, or Ready Reference Guides as provided by the Government.

b. For all non-Federal systems, use handbooks, manuals, or Ready Reference Guides as provided by the manufacturer.

4.6. Procedures at Non-Federal Observation Sites. See Appendix B.

4.7. Procedures at Non-Federal AWOS Sites. FAA facilities must negotiate a letter of agreement (LOA) with the airport management or appropriate authority at locations where a non-Federal AWOS is installed at an airport with an operating control tower. The LOA must define responsibilities and equipment and coordination requirements; identify special operating conditions; and define local requirements. ATCSs may disseminate only those non-Federal weather observations that are obtained through the weather message switching center or other equivalent documented means. Pilots who want non-Federal AWOS information from sites that do not include automatic long-line dissemination should be provided the appropriate frequency and/or telephone number, if known.

4.8. Procedures for Handling Aircraft Mishaps at Automated Sites. The requirement to record the present weather following an aircraft mishap remains valid at automated sites. At a minimum, a mishap requires weather data from 1 hour before to 1 hour after the mishap occurs. ASOS observations should be archived by the observer or by calling the AOMC (1-800-242-8194). The AOMC has the capability to archive the 5-minute observations from the previous 12 hours of weather observation data from attended and unattended locations. The supervisor or controller-in-charge must ensure that the 5-minute observations are archived following notification of an aircraft mishap at a location where an ASOS is operational. AOMC requests must be made within 10 hours of the incident. Archive AWOS data in accordance with the procedures in the AWOS Technical Instruction Book.

4.9. General Requirements for Record Keeping. Automated weather observation data and operator terminal entries are archived on site. No further action is required by FAA, FAA-contract, or NF-OBS facilities. If the automated weather observing system is completely inoperative, follow the record-keeping procedures for manual stations.

Chapter 5. Augmentation Requirements at Automated Weather Stations

5.1. Introduction. This chapter prescribes procedures and practices applicable to the augmentation of automated surface observations at all FAA, FAA-contract, and NF-OBS facilities. In addition, this chapter also prescribes specific differences in augmentation procedures and practices applicable to LAWRS observers, as well as tower visibility requirements. FAA guidelines applicable to the augmentation of automated surface observations are presented in Paragraph 2.3 General Types of Observations. Table 5-1: Summary of FAA Augmentation Requirements, summarizes the minimum augmentation requirements by type of facility, which was given previously in Chapter 2. Guidelines.

5.2. Validity of Data. Once an observation has been augmented, the observer must ensure the augmented data is correct prior to transmission.

5.3. Sign On/Sign Off the Automated Weather Observing Systems. In order to ensure the observation is correct and to enter augmentation data into the automated weather observing system, the observer must be signed on when on duty. Sign on must be in accordance with the respective automated weather observing system's operator handbook or locally prescribed procedures. The "AUTO" tag at the beginning of the observation will be dropped when the observer signs on.

a. Sign On/Sign Off the ASOS.

(1) When using ASOS, several augmented events (for example, tornadic activity, thunderstorm, or hail) automatically generate SPECI observations for the beginning and ending of the event. If one of these events is occurring at the close of augmentation coverage, it will be necessary to end the event, or it will continue to be reported during the hours when there is no augmentation coverage. The observer must end the event immediately after the last hourly METAR is transmitted before going off duty. The ending of the event will automatically generate a SPECI. The observer must cancel this SPECI, enter the AUTO REMARK, and disable the present weather (PREWX). The observer must then sign off the automated weather observing system. This procedure will end the erroneous ending remark in the next observation.

(2) Virga and volcanic ash are events that do not generate SPECIs. Virga is automatically deleted from the observation after the hourly METAR is transmitted. If virga continues to occur, it must be re-entered. If volcanic ash is occurring at the close of augmentation coverage, it will be necessary to end the event, or it will continue to be reported during the hours when there is no augmentation coverage. The observer must end the event immediately after the last hourly METAR is transmitted before going off duty.

Table 5-1: Summary of FAA Augmentation Requirements

ELEMENT	TOWERED with automated system with SPECI capability		NONTOWERED with automated system with SPECI capability	Automated System without SPECI Capability[4] with OBS	TOWERED w/ Automated System without SPECI Capability[4] w/o OBS
	w/o OBS[1]	w/ OBS[2]	FSS[3] or FAA Contract		
Thunderstorm	T	O	F	O	T
Tornadic Activity[5]	T	O	F	O	T
Hail	T	O	F	O	T
Virga	T	O	F	O	T
Volcanic ash	T	O	F	O	T
Weather[6]	NA[7]	NA[7]	NA[7]	O	T
Tower Visibility		T[8]		T[9]	

[1] Towered site without a surface-based observer. (LAWRS)
[2] Towered site with a surface-based observer.
[3] FSS where the FAA was responsible for observation before automated system. As long as thunderstorm augmentation is required, other elements must be provided if the capability to provide them exists.
[4] At sites that have an operator terminal.
[5] Includes tornado, waterspout, and funnel cloud.
[6] Weather and obstructions to vision. See Table 6-6 for complete list of required elements.
[7] Weather is considered a backup requirement for ASOS.
[8] Tower visibility either provided to observer for input or entered via operator interface device.
[9] At sites with tower.

Legend:
Blank - Augmentation not provided
F - Augmentation provided by certified FSS observer or FAA-contract observer
O - Augmentation provided by surface-based observer
T - Augmentation provided by certified tower observer
OBS - Surface observer

b. Sign On/Sign Off the AWOS. At AWOS sites, the observer must sign on/sign off the automated weather observing system following the procedures stated in the AWOS Operator's Instructions.

5.4. Order for Reporting Weather and Obstructions to Visibility. See Table 14-1: Content of METAR/SPECI and Table 14-2: METAR or SPECI Code Format in Chapter 14. Coding and Dissemination.

5.5. Augmentation Observing Procedures. Except as specified in the following subsections, observing procedures for augmentation must be the same as specified for the corresponding manual observation in Chapters 6 through 13 depicts elements to be augmented for each service level.

a. Observing Tornadic Activity. The term tornadic activity must include funnel clouds, tornadoes, and waterspouts. Observing procedures for tornadic activity are given in Paragraph 10.27 Tornado, Waterspout, or Funnel Cloud. A funnel cloud, tornado, or waterspout is considered to begin at the time it is observed by the observer. A funnel cloud, tornado, or waterspout is considered to end at the time it disappears from sight.

b. Observing Thunderstorms. Observing procedures for thunderstorms are given in Paragraph 10.28 Reporting Thunderstorms and Paragraph 10.29 Beginning and/or Ending of a Thunderstorm. A thunderstorm occurrence begins when thunder is first heard, lightning is observed over the station and the local noise level is sufficient to prevent hearing thunder, or when lightning is detected by an automated sensor within ten miles of the airport. A thunderstorm is considered to end 15 minutes after the last occurrence of any of these criteria.

c. Observing Hail. Observing procedures for hail are given in Paragraph 10.30 Reporting Hail. Hail begins at the time it is first observed and ends when it is no longer falling. No intensity must be assigned to hail; that is, the observer must not characterize hail as light, moderate, or heavy.

d. Observing Volcanic Ash. Observing procedures for volcanic ash are given in Paragraph 10.37 Special Procedures for Volcanic Ash. The observer must report volcanic ash whenever it is observed at the station.

e. Observing Virga. Virga is defined as precipitation falling from clouds but not reaching the ground. The observer must report virga when observed. Virga is not considered to be present weather or an obscuration.

f. Observing Tower Visibility. Observing procedures for tower visibility are given in Paragraph 8.3 Visibility Standards.

5.6. Reporting Procedures

a. General Reporting Procedures. General operator procedures for recording and disseminating augmentation information are summarized in Table 4-1: Operator Procedures for Providing Augmentation and Backup Information.

(1) Automated Systems with SPECI Capability. Report tornadic activity (to include funnel clouds, tornadoes, or waterspouts), thunderstorm, hail, volcanic ash, virga, or tower visibility by making the appropriate entry on the operator's interface device in accordance with procedures in the appropriate handbooks, manuals or Ready Reference Guide.

(2) Automated Systems without SPECI Capability (NA LAWRS). At sites with an automated system without SPECI capability, all augmentation reports must be made in the remarks of the report and must be prefixed with the phrase “WEA:” The reports must be entered in accordance with procedures prescribed in the appropriate automated system without SPECI capability Operator’s Instructions or FAA-approved manufacturer's equipment manual.

b. Reporting Procedures for Each Weather Observation Element.

(1) Reporting Tornadic Activity. The term tornadic activity must include funnel clouds, tornadoes, and waterspouts. These phenomena must be reported in a SPECI observation whenever they are observed or disappear from sight. At sites with an automated system with SPECI capability, the event will continue to be reported automatically until the observer deletes the entry.

(2) Reporting Thunderstorms. At sites with automated systems with SPECI capability, entry or deletion of a thunderstorm report must be made. The event will continue to be reported automatically until the observer deletes the entry. A SPECI observation is generated automatically for the beginning and ending times of thunderstorms. A thunderstorm occurrence begins when thunder is first heard, when lightning is observed at the station and the local noise level is sufficient to prevent hearing thunder, or when lightning is detected by an automated sensor within ten miles of the airport. Location and direction of movement of the thunderstorm and the location, type, and frequency of lightning should be reported, if known. LAWRS personnel are only required to annotate the beginning/ending times of thunderstorms.

(3) Reporting Hail. At sites with an automated system with SPECI capability, entry or deletion of a hail report must be made. The event will continue to be reported automatically until the observer deletes the entry. Hail begins when it is first observed and ends when it is no longer falling. No intensity is assigned to hail; that is, hail must not be characterized as light or heavy. Hail size should be reported, if known.

(4) Reporting Volcanic Ash. "VA" is the standard contraction used for volcanic ash. It will be reported in the body of the report as an obscuration whenever observed. At sites with an automated system with SPECI capability, the event will continue to be reported automatically until the observer deletes the entry. A special observation is not required when volcanic ash is observed. No intensity is assigned to volcanic ash; that is, the observer must not characterize volcanic ash as light, moderate, or heavy. Remarks are optional, but if the volcanic eruption producing the volcanic ash is observed, it must be entered in remarks, and a special observation must be generated.

(5) Reporting Virga. When precipitation is observed to be falling from clouds but is not reaching the ground, the observer must report VIRGA in remarks. There is no standard contraction used for virga. Virga is not considered to be present weather or an obstruction to vision. In remarks, VIRGA is spelled out in full. At sites with an automated system with SPECI capability, the event will continue to be reported automatically until the observer deletes the entry or until after the next hourly observation. The remark VIRGA will not be automatically kept in remarks of the observation past the next hourly observation. If virga persists, it must be re-entered as a remark. No SPECI is required when virga is observed. No intensity is assigned to virga; that is, the observer must not characterize virga as light, moderate, or heavy. The direction of the virga from the site is optional.

(6) Reporting Tower Visibility. At towered sites with an automated system with SPECI capability with a surface-based observer, a tower visibility report must be made by notifying the surface-based observer or using the appropriate entry on the operator's interface device. The reporting of tower visibility must be in accordance with coding and dissemination procedures specified in Paragraph 14.25 Tower or Surface Visibility (TWR_VIS_vvvvv or SFC_VIS_vvvvv).

5.7. Examples of Augmented Observations. Examples of augmented weather observations for a typical condition (for example, thunderstorm) for automated systems without SPECI capability and automated systems with SPECI capability are given in Table 5-2: Examples of Augmented Observations.

Table 5-2: Examples of Augmented Observations

Examples of Augmented Observations	
Automated system without SPECI capability w/o Aug	
METAR KHEF 011755Z AUTO 21020G35KT 1SM OVC010 27/24 A2991 RMK AO1 (NA LAWRS)	
Automated system without SPECI capability w/ Aug	
METAR KHEF 011755Z 21020G35KT 1SM +TSRA OVC010CB 27/24 A2991 RMK AO1 WEA:TSRA OCNL LTGCG OHD TS OHD MOV E	
Automated system with SPECI capability w/o Aug	
METAR KGLD 011755Z AUTO 21020G35KT 1SM +RA OVC010 27/24 A2991 RMK AO2 SLP101	
Automated system with SPECI capability w/ Aug	
METAR KBHM 011755Z 21020G35KT 1SM +TSRA OVC010CB 27/24 A2991 RMK AO2 OCNL LTGCG OHD TSB42 TS OHD MOV E SLP101	
Automated system with SPECI capability w/o Aug with ALDARS	
METAR KSEG 171753Z AUTO 21020G30KT 1SM TSRA OVC010 27/24 A2991 RMK AO2 LTG DSNT E TSB42 SLP101	
Automated system with SPECI capability w/ Aug and ALDARS	
METAR KAOO 011753Z 21020G35KT 1SM TSRA OVC010CB 27/24 A2991 RMK AO2 LTG DSNT E TSB42 TS OHD MOV E SLP101	

Chapter 6. Backup Requirements at Automated Weather Stations

6.1. Introduction. This chapter presents the procedures and practices for providing the backup weather information required in the event of a partial or total failure of the automated weather observing system or if one or more of the elements within the automated weather observing system observation are judged to be erroneous or non-representative. Responsible personnel must provide the backup weather information specified in Chapter 2. Guidelines. During periods when backup is required augmentation must also be performed.

Table 6-1: Summary of Long-line Backup Requirements

ELEMENT	TOWERED		NON TOWERED WITH OBSERVER[1]
	LAWRS	NON-LAWRS WITH OBSERVER[1]	
Wind	T	O	O
Visibility to 10 Miles	T	O	O
Present Weather & Obscurations[2]	T	O	O
Sky Condition to 12K Ft.	T	O	O
Temperature/Dew Point	T	O	O
Altimeter Setting	T	O	O
Tower Visibility		T	

[1] Includes all FSS, FAA-Contract, and non-Federal observers.
[2] See Table 6-6 for required elements.

Legend:
Blank - Element not provided
T - Element provided by certified Air Traffic Control Specialist
O - Element provided by surface-based observer

6.2. Summary of Backup Requirements. Table 6-1 presents a summary of the backup weather information requirements to support the pilots' safety and regulatory requirements and the terminal forecast preparation program of NWS. The table documents the level of backup required in accordance with the service level standards as described in Appendix D. Service Standards. In addition to the observational elements shown in the tables, the minimum functions of communications and observational records to back up the automated weather observing systems must be provided for as specified in this chapter. If a partial system failure or erroneous data involves weather elements not required to be provided in accordance with specifications in this chapter, those elements may be treated as missing. Responsible personnel may disable those automated sensors in accordance with applicable equipment manuals. When reverting to the manual mode, responsible personnel must record justification for reverting on FAA Form 7230-4, Daily Record of Facility Operation or an approved version of the form, and must make appropriate maintenance notifications (Personnel should also record the observation on the NWS meteorological form). When long-line communications are unavailable, the FSS/Automated Flight Service Station (FSS) must disseminate these reports. Dissemination procedures are outlined in Table 4-1: Operator Procedures for Providing Augmentation and Backup Information.

6.3. Validity of Data. Once an observation has been augmented, the observer must ensure the augmented data is correct prior to transmission.

6.4. Equipment Requirements. The following are minimum requirements for equipment required to provide the weather information specified in this chapter. Unless stated otherwise, the equipment is required only if that element is required at your facility. References to an "OID/OT" indicate any automated weather observing system operator interface device.

a. Equipment for Wind Direction and Speed. If available, the primary low-level wind shear alert system (LLWAS) sensor or other approved on-site wind equipment must be used. Otherwise, the wind direction and speed may be estimated during periods when all automated wind sensors are inoperative.

b. Equipment for Visibility. There is no equipment required for automated visibility sensor backup. However, a current list or visibility chart(s) depicting day and night visibility reference points must be maintained and available at the point of observation for use at each facility.

c. Equipment for Present Weather and Obstructions to Vision. Visual procedures must be used to identify the type(s) of present weather and/or obscurations. If necessary, visual procedures must be used to determine the intensity of precipitation.

d. Equipment for Sky Condition. There is no equipment required for automated sky condition sensor backup. Visual estimates must be made. Pilot reports of cloud heights may be used if available.

e. Equipment for Temperature and Dew Point. An approved remote readout hygrothermometer is an acceptable backup for temperature and dew point. Other acceptable backups are a battery-operated self-contained psychrometer or a stand-alone temperature measuring device, as approved by FAA.

f. Equipment for Altimeter Setting. Equipment to back up altimeter setting may be any FAA installed and maintained altimeter setting indicator (ASI), digital altimeter setting indicator (DASI), or any other approved facility station pressure instrument, with certification and calibration traceable to the National Institute of Standards and Technology as defined in FAA Order 7210.3, Facility Operation and Administration.

g. Equipment for OID/OT. If the automated systems with SPECI capability OID fails and the automated systems with SPECI capability observation is currently representative, the observer must continue to maintain oversight of the automated system with SPECI capability through the use of other automated systems with SPECI capability displays (for example, Video Display Unit [VDU]) and must make appropriate maintenance notifications. If significant weather is occurring or expected to occur, after coordinating with ATCT, through appropriate maintenance channels, arrange for local and long-line communications to be disabled. Notify on-site users that have automated systems with SPECI capability displays to turn off power to their display and provide backup observations.

h. Equipment for Communications. No additional equipment is required for the communication of backup weather information. If the primary communications equipment is unavailable, any appropriate communications media may be used. When long-line communications are unavailable, request that weather information be disseminated by the FSS.

i. Equipment Requirements for NF-OBS Providers. The NF-OBS provider must provide and maintain all backup equipment. The cost of procuring, installing, operating, moving (if required), protecting, and maintaining all instruments and equipment in accordance with FAA and NWS specifications is to be borne by the provider. The OID, which is part of the automated systems with SPECI capability, will be maintained and serviced by the Government.

6.5. Procedures for Providing Backup Information. General observer procedures for providing required backup information are summarized in Table 4-1: Operator Procedures for Providing Augmentation and Backup Information. At sites with an automated system with SPECI capability, required weather data elements must be entered into the automated weather observing system using the editing procedures for the automated weather observing system operator interface device. At sites with an automated system without SPECI capability, entry of data must be as specified in the operators instructions for the automated system without SPECI capability or the appropriate FAA approved automated systems without SPECI capability manufacturer's equipment manual. For non-representative data, the observer may turn report processing off (automated system with SPECI capability) or set the channel out of service (automated system without SPECI capability). The turning off of report processing will lead to a "$" sign, and the generation of a trouble ticket for the NWS AOMC. Observers must not turn off report processing for altimeter setting without appropriate maintenance notification. Once the report processing for the altimeter setting is turned off, only the appropriate ASOS or AWOS/AWSS technician can turn the report processing back on.

6.6. Coding of Missing Data. If any element normally included in the body of the observation, except present weather and obscurations, is missing because of sensor failure and that element is not required for backup, that element may be omitted. If the automated weather observing system's processor is operative, the system will do this automatically. If not operative, these missing elements must be omitted and skipped over. When an element or phenomena does not occur or cannot be observed, the corresponding group and preceding space are omitted from that particular report.

6.7. Procedures for Wind Speed and Wind Direction. General procedures for the reporting of backup weather information for wind are given in Table 6-2: Backup Reporting of Wind or Altimeter Setting. Alternate equipment, as specified in Paragraph 6.4 Equipment Requirements must be used to determine wind direction and speed as appropriate. If no backup sensor is available, wind speed and direction must be estimated.

Table 6-2: Backup Reporting of Wind or Altimeter Setting

LOCATION/CONDITION	REPORTING PROCEDURES
ALL LOCATIONS WITH SURFACE-BASED OBSERVER PRESENT	
Sensor Failure	1. Observer reports manually observed wind[1] or altimeter setting[2] in body of observation via designated procedures[3] and makes appropriate maintenance notification.
Non-representative Data	1. Observer may turn report processing off (automated systems with SPECI capability) or set channel out of service (automated systems without SPECI capability). Maintenance notification must be made when report processing is turned off. 2. Observer reports manually observed wind or altimeter setting as above. For sensor failure only make appropriate maintenance

LOCATION/CONDITION	REPORTING PROCEDURES
	notification.
OID/OT/communications failure	1. Observer reports system wind or altimeter setting in body of report via designated procedures and makes appropriate maintenance notification.
LAWRS TOWERS	
All Conditions	Tower follows same procedures as above for observers. Observers must not turn off report processing for altimeter setting without appropriate maintenance notification.

[1] Manual wind observations must be obtained from the best available approved wind sensor.
The LLWAS centerfield wind sensor may be used as an approved wind sensor.
If all approved wind sensors are inoperative, the wind must be estimated.
[2] Manual altimeter settings may be obtained from any approved altimeter setting instruments including DASIs.
[3] Designated procedures are specified in Table 4-1.

a. Estimating Wind Direction. Wind direction must be estimated by observing the wind cone or tee, movement of twigs, leaves, smoke, etc., or by facing into the wind in an unsheltered area. When estimating wind direction, note that even small obstacles may cause variations. The movement of clouds, regardless of how low they are, must not be used for estimating the surface wind direction.

b. Estimating Wind Speed. The Beaufort Scale (see Table 6-3: Estimating Wind Speed) must be used to estimate wind speed if all other wind speed measuring instruments are out of service.

Table 6-3: Estimating Wind Speed

WIND EQUIVALENT -- BEAUFORT SCALE	
KTS	Specifications
<1	Calm; smoke rises vertically
1-3	Direction of wind shown by smoke drift not by wind vanes
4-6	Wind felt on face; leaves rustle; vanes moved by wind
7-10	Leaves and small twigs in constant motion; wind extends light flag
11-16	Raises dust, loose paper; small branches moved
17-21	Small trees in leaf begin to sway; crested wavelets form on inland waters
22-27	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty
28-33	Whole trees in motion; inconvenience felt walking against the wind
34-40	Breaks twigs off trees; impedes progress
41-47	Slight structural damage occurs
48-55	Trees uprooted; considerable damage occurs
56-71	Widespread damage

6.8. Procedures for Visibility. General procedures for the reporting of backup information for visibility are given in Table 6-4: Backup Reporting of Surface Visibility. The visibility must be a prevailing visibility.

NOTE-
RVR is not addressed here because it will not be backed up by FAA controllers (including LAWRS).

Table 6-4: Backup Reporting of Surface Visibility

LOCATION/CONDITION	REPORTING PROCEDURES
ALL LOCATIONS WITH SURFACE-BASED OBSERVER PRESENT	
Sensor Failure	1. Observer reports prevailing surface visibility via designated procedures.[1, 2] 2. At towers, observer reports tower visibility, as required, via augmentation.[2]
Nonrepresentative Data	1. Observer may turn report processing off (automated systems with SPECI capability) or set channel out of service (automated systems without SPECI capability). 2. Observer reports surface/tower visibility as above under sensor failure.
OID/OT/communications failure	1. Observer reports system visibility via designated procedures.[2] 2. At towers, observer reports tower visibility, as required, via augmentation.[2]
1 Designated procedures are specified in Table 4-1. 2 Observer must make appropriate maintenance notification.	

a. Reporting Visibility Values. In backing up visibility, the reportable values for visibility must be the manual visibility values as permitted by the current system software installed; see Table 8-1: Reportable Visibility Values. If the actual visibility falls between two reportable values, the lower value must be reported.

b. Tower Visibility During Backup (with Surface Observer). During backup periods at towered facilities with a surface-based observer, the responsible tower controller must:

(1) Notify the surface-based observer when the tower prevailing visibility is observed to decrease to less than, or if below, increases to equal or exceed, 4 miles.

(2) Report all changes of one or more reportable values to the surface-based observer when the prevailing visibility at the tower or the surface is less than 4 miles.

(3) As required by FAA directives, use the lower of either the tower or weather station visibility as controlling visibility for aircraft operations.

6.9. Procedures for Present Weather and Obscurations. General procedures for the reporting of backup information for present weather and obscurations are given in Table 6-5: Backup Reporting of Weather Phenomena. Present weather and obscurations to vision must be observed and reported in accordance with the manual procedures prescribed in Chapter 10. Weather Phenomena. Reports must include as a minimum those weather phenomena in Table 6-6: Backup and Augmentation Weather and Obscurations, when backing up automated systems with SPECI capability. (If the observer is backing up automated systems with SPECI capability at the close of augmentation/backup coverage, it will be necessary to end the event or it will continue to be reported during the hours when there is no augmentation/backup coverage.) Precipitation of unknown form is generally only reported when the automated weather observing system present weather indicator sensor is operational and is reporting precipitation of unknown form. However, if the observer can determine the type of precipitation, it should be reported according to the guidelines in Table 6-6, via the non-representative data procedures.

Table 6-5: Backup Reporting of Weather Phenomena

LOCATION/CONDITION	REPORTING PROCEDURES
ALL LOCATIONS WITH SURFACE-BASED OBSERVER PRESENT	
Sensor Failure	1. Observer reports manually observed present weather[1] in body of observation via designated procedures.[2, 3]
Non-representative Data	1. Observer may turn report processing off (automated system with SPECI capability or set channel out of service (automated system without SPECI capability. 2. Observer reports manually observed present weather as above for sensor failure.
OID/OT/communications failure	1. Observer reports system weather in body of report via designated procedures.[3]
LAWRS TOWERS	
All Conditions	1. Tower follows same procedures as above for observers.

[1] Weather and obscuration requirements are outlined in Table 6-6.
[2] Designated procedures are specified in Table 4-1.
[3] Observer must make appropriate maintenance notifications.

Table 6-6: Backup and Augmentation Weather and Obscurations

PHENOMENON OBSERVED	REPORT (NOTATION)		PHENOMENON OBSERVED	REPORT (NOTATION)
Tornado	+FC (in body); TORNADO (in remarks)		Snow Pellets or Small Hail	GS
Funnel Cloud	FC (in body); FUNNEL CLOUD (in remarks)		Volcanic Ash	VA
Waterspout	+FC (in body); WATER-SPOUT (in remarks)		Fog (Vsby <5/8)	FG
Thunderstorm	TS		Mist (Vsby ≥ 5/8)	BR
Rain	RA		Shallow (ground) Fog	MIFG
Rain Shower	Report RA for automated systems with SPECI capability*		Patchy Fog	BCFG
Drizzle	DZ		Freezing Fog	FZFG

PHENOMENON OBSERVED	REPORT (NOTATION)		PHENOMENON OBSERVED	REPORT (NOTATION)
Freezing Rain	FZRA		Blowing Snow	BLSN
Freezing Drizzle	FZDZ		Haze	HZ
Ice Crystals	Report SN for automated systems with SPECI capability *		Smoke	FU
Ice Pellets	PL		Squalls	SQ
Ice Pellet Showers	Report PL for automated systems with SPECI capability *		Dust	DU
Hail	GR			
Snow	SN			
Snow Showers	Report SN for automated systems with capability *			
Snow Grains	Report SN for automated systems with SPECI capability*			

* - Due to limitation on what phenomena automated systems with SPECI capability software will accept.
1. A complete list of weather and obscuration elements is provided in Appendix E. METAR User Aids.
2. Augmented sites with an automated system with SPECI capability without ALDARS: Tornadic activity, thunderstorms, hail, volcanic ash, and virga elements are produced via augmentation, with all other elements above produced via backup.
3. Augmented sites with an automated system without SPECI capability without ALDARS: All the elements reported above are produced via augmentation.
4. Augmented sites with an automated system with SPECI capability or sites with an automated system without SPECI capability with ALDARS: Thunderstorm reporting is produced via backup if ALDARS should become inoperative, or is unrepresentative.
5. Present weather elements must be reported in the body of the observation unless software precludes them from being reported in the body, then these elements must be reported in the remarks portion of the METAR or SPECI.

6.10. Procedures for Sky Condition. General procedures for reporting backup weather information for sky condition are given in Table 6-7: Backup Reporting of Sky Condition. More details on procedures for observing sky condition are included in Chapter 11 Sky Condition. If required, the following procedures for reporting sky condition must apply:

Table 6-7: Backup Reporting of Sky Condition

LOCATION/CONDITION	REPORTING PROCEDURES
ALL LOCATIONS WITH SURFACE-BASED OBSERVER PRESENT	
Sensor Failure	1. Observer reports manually observed sky condition to 12K feet, or as specified in the designated service level standard, whichever is greater; in body of report via designated procedures[1].
Non-representative Data	1. Observer may turn report processing off (automated systems with SPECI capability) or set channel out of service (automated systems without SPECI capability). 2. Observer reports sky condition as above for sensor failure.
OID/Communications failure	1. Observer reports system sky condition data in body of report via designated procedures.[1]
LAWRS TOWERS	

LOCATION/CONDITION	REPORTING PROCEDURES
All conditions	1. Tower follows same procedures as above for observers.
All conditions	1. No backup information provided
[1] Procedures are specified in Table 4-1. Make appropriate maintenance notification.	

a. Reporting Procedures.

(1) Report sky cover up to 12,000 feet, or as specified in the designated service level standard, whichever is greater. (See Appendix D. Service Standards.)

(2) Non-opaque cloud layers must be treated as opaque and reported.

(3) No more than three layers must be reported; or as specified in the designated service level standard, whichever is greater. (See Appendix D. Service Standards.)

(4) "CLR" (clear) must be reported at an automated site when no clouds are visible up to 12,000 feet, or as specified in the designated service level standard, whichever is greater.

b. Sky Cover. Sky cover is any clouds or obscuring phenomena aloft detected from the observing location. It must be evaluated with reference to the surface. All clouds or obscuring phenomena aloft must be considered opaque sky cover.

c. Sky Condition Evaluation. Evaluation of sky condition must include the amount and height of cloud bases up to 12,000 feet, or as specified in the designated service level standard, whichever is greater.

d. Reporting Ceiling. The lowest layer that is reported as broken or overcast must be the ceiling. If the sky is totally obscured, the height of the vertical visibility must be the ceiling.

e. Vertical Visibility. Vertical visibility must be either:

(1) The distance that an observer can see vertically into a surface-based obscuring phenomenon.

(2) The height determined by the sensor algorithm at an automated station.

f. Obscuration. The portion of sky (including higher clouds, the moon, or stars) hidden by weather phenomena either surface-based or aloft. Obscurations are indicated in the remarks of augmented and manual reports.

g. Number of Layers Reported. Automated weather observing stations must report no more than three layers of clouds or one layer for an obscuring phenomenon. Manual weather observing stations must report no more than six layers. If multiple cloud layers are observed below 12,000 feet, up to three layers must be reported in accordance with the priorities in Table 6-8.

Table 6-8. Priority for Reporting Cloud Layers

Priority	Layer Description
1	lowest few layer

Priority	Layer Description
2	lowest broken layer
3	overcast layer
4	lowest scattered layer
5	second lowest scattered layer
6	second lowest broken layer
7	highest broken layer
8	highest scattered layer
9	second lowest few layer
10	highest few layer

h. Height of Layers. The height of a layer is the height of the cloud bases or obscurations of the layer being evaluated. Layers of clouds that are 50 feet or less above the surface must be observed as layers with a height of zero (000). When the height of a ceiling layer increases and decreases rapidly during the period of evaluation by the amounts given in Table 6-9: Criteria for Variable Ceiling, it must be considered variable and the ascribed height must be the average of all the values. When the height of the ceiling layer is variable and the reported ceiling is below 3,000 feet, a remark must be added, for example, CIG 010V016.

Table 6-9: Criteria for Variable Ceiling

Ceiling (feet)	Variation (feet)
≤ 1,000	≥ 200
> 1,000 and ≤ 2,000	≥ 400
> 2,000 and < 3,000	≥ 500

i. Height of Sky Cover. If available, a ceilometer, or known heights of unobscured portions of abrupt, isolated objects within 1 1/2 miles of the point of observation must be used to measure the height of layers aloft or the vertical visibility into obscuring phenomena. Otherwise, an alternative method must be used to estimate the height. The height may be estimated by using a pilot report or observer experience (visual estimate).

j. Reportable Values for Sky Cover Height. Heights of layers must be reported in hundreds of feet above the surface, rounded to the nearest reportable increment given in Table 6-10: Increments of Reportable Values of Sky Cover Height. When a value falls halfway between two reportable increments, the lower value must be reported. When a cloud is 50 feet or less above the surface, the height must be reported as 000.

Table 6-10: Increments of Reportable Values of Sky Cover Height

Range of Height Values (feet)	Reportable Increment (feet)
≤ 5,000	To nearest 100
> 5,000 but ≤ 10,000	To nearest 500
> 10,000	To nearest 1,000

k. Layer Amounts. The amount of sky cover for each layer is the eighths of sky cover attributable to the clouds in the layer being evaluated. The report must be based on each layer in combination with any lower layers. The amount of sky cover reported for each layer must be based on the summation amount for that layer and must be reported using the reportable values given in Table 6-11: Reportable Contractions for Sky Cover Amount. The summation amount of sky cover for any given layer is the sum of the sky cover of the layer being evaluated, plus the sky cover of all lower layers. Portions of layers aloft detected through lower layers aloft must not increase the summation amount of the higher layer. No layer can have a summation amount greater than 1.0 (8/8ths).

Table 6-11: Reportable Contractions for Sky Cover Amount

Reportable Value	Meaning	Summation Amount of Layer
VV	Vertical Visibility	8/8
CLR	Clear 12,000 ft and less	0
FEW[1]	Few	1/8 - 2/8
SCT	Scattered	3/8 - 4/8
BKN[2]	Broken	5/8 - 7/8
OVC	Overcast	8/8

[1] Any layer amount less than 1/8 is reported as FEW.
[2] BKN includes sky cover from 5/8 up to, but not including, 8/8.

6.11. Procedures for Temperature and Dew Point. General procedures for the reporting of backup information for temperature and dew point are given in Table 6-12: Backup Reporting of Temperature and Dew Point. If either the temperature module, dew point module, or both of the automated weather observing system are inoperative, both the temperature and dew point must be reported from other equipment as specified in Paragraph 6.4. Equipment Requirements.

a. Units of Measure. The units of measure for temperature and dew point are degrees Celsius. Dew point must be calculated with respect to water at all temperatures.

b. Reporting Procedures for Temperature. The temperature must be entered as two digits to the nearest whole degree Celsius (C). Sub-zero temperatures must be prefixed with an M (minus). For example, a temperature of 4 degrees Celsius with a dew point of -2°C is coded as 04/M02. See Paragraph 3.9 Rounding Off Numbers for rounding off procedures. A temperature of -0.5°C must be reported as M00 to indicate that the actual temperature is below zero but rounded to zero.

c. Reporting Procedures for Dew Point. The dew point temperature must be entered as two digits to the nearest whole degree Celsius. Sub-zero dew point temperatures must be prefixed with an M. When the dry-bulb temperature is -34.4°C or below, the dew point must be reported as unavailable. For example, when the temperature is -36, it will be reported as M36/.

Table 6-12: Backup Reporting of Temperature and Dew Point

LOCATION/CONDITION	REPORTING PROCEDURES
ALL LOCATIONS WITH SURFACE-BASED OBSERVER PRESENT	

LOCATION/CONDITION	REPORTING PROCEDURES
Sensor Failure[1]	1. Observer reports manually observed temperature[2] and dew point[2] in body of observation as specified in Table 4-1.
Non-representative Data	1. Observer may turn report processing off (automated systems with SPECI capability) or set channel out of service (automated systems without SPECI capability). 2. Observer reports manually observed temperature and dew point as above for sensor failure.
OID/communications failure[1]	1. Observer reports system temperature and dew point in body of report as specified in Table 4-1.
LAWRS TOWERS	
All Conditions	1. Tower follows same procedures as above for observers.
NON-LAWRS TOWERS (WITHOUT A SURFACE-BASED OBSERVER)	
All Conditions	1. No backup information provided.
[1] Observer must make appropriate maintenance notification. [2] If the temperature, the dew point, or both are missing or non-representative both the temperature and the dew point must be manually provided.	

6.12. Procedures for Altimeter Setting. General procedures for the reporting of backup information for altimeter setting are given in Table 6-2: Backup Reporting of Wind or Altimeter Setting. The observer must use any FAA installed and maintained ASI or DASI, or any other altimeter setting source approved by the FAA that meets altimeter and comparison check requirements of the latest version of FAA Order JO 7210.3, Facility Operation and Administration.

6.13. Procedures for Documentation. If the automated weather observing system is unable to document the observational data, the data must be recorded on Meteorological Form 1M-10C (MF1M-10C). This only applies to a complete failure of the system. See Chapter 15. Entries on Observational Forms, for details.

6.14. Procedures for Communications. Each facility must establish procedures for local distribution of backup weather data in the event that the automated weather observing system's local communications are out of service.

6.15. Disposition of MFIM-10C. MF1M-10C forms must be handled in accordance with procedures specified in Paragraph 3.10 Record Keeping and Forms.

6.16. Examples of Backup Observations. Examples of backup weather observations for a typical condition (that is, ceilometer and anemometer not operational) are given for automated systems without SPECI capability and automated systems with SPECI capability in Table 6-13: Automated System without SPECI Capability Backup Observation Examples, and

6.17. Table 6-14: Automated System with SPECI Capability Backup Observation **Examples**.

Table 6-13: Automated System without SPECI Capability Backup Observation Examples

Automated system without SPECI capability observation with all sensors fully operational and no observer or augmenter on duty:
METAR JHW 011255Z AUTO 30005KT 7SM BKN110 06/03 A2991 RMK AO1 SLP101
Automated system without SPECI capability observation with ceilometer and anemometer not operational and no backup observer on duty:
METAR JHW 011255Z AUTO 7SM 06/03 A2991 RMK AO1 SLP101
Automated system without SPECI capability observation with ceilometer and anemometer not operational and with backup observer on duty:
METAR JHW 011255Z 30005KT 7SM BKN110 06/03 A2991 RMK AO1 SLP101

Table 6-14: Automated System with SPECI Capability Backup Observation Examples

Automated system with SPECI capability observation with all sensors fully operational and no observer or augmenter on duty:
METAR KIAD 011255Z AUTO 30005KT 7SM BKN110 06/03 A2991 RMK AO2 SLP101
Automated system with SPECI capability observation with ceilometer and anemometer not operational and no backup observer on duty:
METAR KIAD 011255Z AUTO 7SM 06/03 RMK AO2 SLP101 $
Automated system with SPECI capability observation with ceilometer and anemometer not operational and with backup observer on duty:
METAR KIAD 011255Z 30005KT 7SM BKN110 06/03 A2991 RMK AO2 SLP101 $

6.18. Malfunctions/Outages. Automated weather observing systems have a self-monitoring capability. The systems will discontinue reporting the affected weather element when a given weather sensor is out of tolerance or fails. FAA personnel and NF-OBS providers must make appropriate maintenance notifications in the event of any equipment outages. Information on the issuance of NOTAMs is contained in FAA Order JO 7930.2.

Chapter 7. Wind

7.1. Introduction. Wind is the horizontal motion of the air past a given point. Wind is measured in terms of velocity, a vector that includes direction and speed. The absence of apparent motion of the air is termed CALM. The direction and speed of the wind should be measured in an unsheltered, unobstructed area. This will avoid, to a large degree, the measuring of wind directions and speeds disturbed by local obstructions and will result in the reporting of winds more representative of the general weather patterns and more representative for aircraft operations.

7.2. Definitions

a. Direction of Wind. Wind direction is defined as the direction, in tens of degrees, from which the wind is blowing.

b. Gust. A gust is a rapid fluctuation in wind speed with a variation of 10 knots or more between peaks and lulls. The wind speed data for the most recent 10 minutes must be examined to evaluate the occurrence of gusts.

c. Hourly Peak Wind Speed. Peak wind is the highest instantaneous wind speed over 25 knots, recorded since the last METAR report.

d. Magnetic Variation. Magnetic variation is the difference in degrees between true north and magnetic north. It is either "east" or "west" according to whether the compass needle points to the east or west of the geographical meridian.

e. Speed of Wind. Wind speed is the rate of horizontal flow of air past a given point, measured in knots.

f. Variable Wind Direction. Wind direction is considered to be variable when, during the 2-minute evaluation period, it fluctuates by 60 degrees or more and the wind speed is more than 6 knots. The wind direction may also be considered variable if, during the 2-minute evaluation period, the wind speed is 6 knots or less.

g. Wind. As used in this chapter, wind is the horizontal motion of the air past a given point.

h. Wind Shift. Wind shift is a term applied to a change in wind direction of 45 degrees or more which takes place in less than 15 minutes and has sustained winds of 10 knots or more throughout the wind shift.

7.3. Observing, Determining, and Reporting Procedures. Wind direction, speed, and gusts must be determined at all stations.

7.4. Wind Direction. The observer must determine the wind direction by averaging the observed direction over a 2-minute interval when direct-reading dials are used. Wind direction must be reported in all observations. In all observations transmitted long-line, direction must be reported in tens of degrees with reference to true north. The format for reporting wind direction in such observations is given in Paragraph 14.11 Wind Group ((dddff(f)Gfmfm(fm)KT)_(dndndnVdxdxdx)). For local use, wind direction must be reported in tens of degrees with reference to magnetic north.

NOTE-
Local displays of wind direction are always in reference to magnetic north. Direction must be converted to true for observational purposes.

7.5. Estimating Wind Direction. At facilities where instruments are not available for determining wind direction, the observer must estimate the direction by observing the wind cone or tee, movement of twigs, leaves, smoke, etc., or by facing into the wind in an unsheltered area. When estimating wind direction, the observer must note that even small obstacles may cause variations in the wind direction. The observer must not use the movement of clouds in estimating the surface wind direction regardless of how low the clouds are.

7.6. Variable Wind Direction. The wind direction may be considered variable if, during the 2-minute evaluation period, the wind speed is 6 knots or less. Also, the wind direction must be considered variable if, during the 2-minute evaluation period, it varies by 60 degrees or more when the average wind speed is greater than 6 knots. The format for reporting variable wind direction is given in Paragraphs 14.11.b and 14.11.c.

7.7. Wind Shifts

a. The wind data must be examined to determine the occurrence of a wind shift. A wind shift is indicated by a change in wind direction of 45 degrees or more in less than 15 minutes with sustained wind speeds of 10 knots or more throughout the wind shift. Wind shifts are normally associated with some or all of the following phenomena characteristic of a cold-front passage:

(1) Gusty winds shifting clockwise in the Northern Hemisphere.

(2) Rapid drop in dew point.

(3) Rapid drop in temperature.

(4) Rapid rise in pressure.

(5) In summer: lightning, thunder, heavy rain, and hail.

(6) In winter: Frequent rain or snow showers

b. A SPECI must be taken after a wind shift occurs. A remark reporting the wind shift and the time the wind shift occurred must be included in the observation. A wind shift must always be reported when it is observed. When the shift is believed to be associated with a frontal passage, the observer must report FROPA in the remarks section immediately after the shift begins. When a SPECI report containing a wind shift is not given long-line dissemination, the observer must include the wind shift data in the remarks section of the next transmitted report. The format for the remark is given in Paragraph 14.24 Wind Shift (WSHFT_(hh)mm).

7.8. Wind Speed. If possible, the average wind speed should not be determined during a peak or a lull in gusty winds or squalls. The wind speed must be determined by averaging the speed to the nearest knot over a 2-minute period. Where direct-reading dials are used, the observer must determine the speed by averaging the observed values and applying the appropriate correction from Table 7-1: Estimating Wind Speed, to the wind speed obtained from direct-reading dials. Wind speed must be reported in all observations and must always be reported in knots. The format for reporting wind speed is given in Paragraph 14.11 Wind Group ((dddff(f)Gfmfm(fm)KT)_(dndndnVdxdxdx)).

7.9. Estimating Wind Speed. The observer must use the Beaufort scale, Table 7-1: Estimating Wind Speed, to estimate wind speeds if instruments are out of service.

Table 7-1: Estimating Wind Speed

WIND EQUIVALENT -- BEAUFORT SCALE	
KTS	**Specifications**
<1	Calm; smoke rises vertically
1-3	Direction of wind shown by smoke drift not by wind vanes
4-6	Wind felt on face; leaves rustle; vanes moved by wind
7-10	Leaves and small twigs in constant motion; wind extends light flag
11-16	Raises dust, loose paper; small branches moved
17-21	Small trees in leaf begin to sway; crested wavelets form on inland waters
22-27	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty
28-33	Whole trees in motion; inconvenience felt walking against the wind
34-40	Breaks twigs off trees; impedes progress
41-47	Slight structural damage occurs
48-55	Trees uprooted; considerable damage occurs
56-71	Widespread damage

7.10. Wind Character (Gusts). Wind character may be determined from direct-reading dials. When a gust is detected within 10 minutes before an observation, the character of the wind must be reported in the body of the observation. The format for reporting wind character is given in Paragraph 14.11.a.

7.11. Peak Wind Speed. The peak wind speed must be the highest instantaneous speed, greater than 25 knots, observed by automated stations only. Peak wind data must be reported in the remarks section of the next routine METAR report whenever the peak wind speed exceeds 25 knots. The format for the remark is given in Paragraph 14.23 Peak Wind (PK WIND_ddff(f)/(hh)mm) (NA LAWRS).

7.12. Calm Wind. When no motion of the air is detected, the wind must be reported as calm; that is, the direction and speed must be reported as 00000KT. The format for reporting calm winds is given in Paragraph 14.11.d.

7.13. Conversion of True and Magnetic Winds. To convert wind direction from degrees with respect to true north to degrees with respect to magnetic north, or vice versa, the observer must obtain the local magnetic variation from an aeronautical chart and proceed as follows:

a. To convert from true to magnetic wind:

(1) Add westerly variation to true direction.

(2) Subtract easterly variation from true direction.

b. To convert from magnetic to true direction:

(1) Add easterly variation to magnetic direction.

(2) Subtract westerly variation from magnetic direction.

EXAMPLE-
At ABC Airport, the magnetic variation is 10º West. The local wind indicator is reading 250º (magnetic). When transmitting the wind direction in an observation, because the magnetic variation is 10º West, the observer should subtract 10º to transmit a direction of 240º (true).

NOTE-
Local displays of wind direction are always in reference to magnetic north. Automated weather observing systems also show direction with respect to magnetic north locally (when the AUX/WX page is displayed), but adjust wind direction to "true" for transmission.

7.14. Instrumental Evaluation Procedures. At facilities having several types of approved wind equipment, the observer must use the following priority in selecting the wind equipment to be used. Direct-reading dials or estimation must be used for determining gusts.

a. Direct-reading dials.

b. Other.

Chapter 8. Visibility

8.1. Introduction. This chapter presents procedures and practices for measuring and recording visibility. All visibilities referred to in this chapter are horizontal visibilities. An automated instrumentally-derived visibility value is a sensor value converted to an appropriate visibility value using standard algorithms and is considered to be representative of the visibility in the vicinity of the airport runway complex. A manually-observed visibility value is obtained using the "prevailing visibility" concept.

8.2. Definitions

a. Prevailing Visibility. Prevailing visibility is the greatest visibility equaled or exceeded throughout at least half the horizon circle, which does not necessarily have to be continuous. This is the visibility that is considered representative of visibility conditions at the station.

b. Sector Visibility. Sector visibility is the visibility in a specified direction that represents at least a 45 degree arc (portion) of the horizon circle.

c. Surface Visibility. The prevailing visibility determined from the usual point of observation is the surface visibility.

d. Tower Visibility. Tower visibility is the prevailing visibility determined from the airport traffic control tower at locations that also report the surface visibility.

e. Variable Prevailing Visibility. Variable prevailing visibility is a condition where the prevailing visibility is less than 3 miles and rapidly increases and decreases by 1/2 statute mile or more during the period of observation.

f. Visibility. Visibility is a measure of the horizontal opacity of the atmosphere at the point of observation and is expressed in terms of the horizontal distance at which a person should be able to see and identify specific objects.

g. Visibility Markers. Visibility markers are dark or nearly dark objects viewed against the horizon sky during the day, or unfocused lights of moderate intensity (about 25 candela) during the night.

8.3. Visibility Standards. Visibility may be determined at either the surface, the tower level, or both. If visibility observations are made from just one level (for example, the air traffic control tower), that level must be considered the “usual point of observation,” and that visibility must be reported as the surface/prevailing visibility. If visibility observations are made from both levels, the lower value (if less than 4 miles) must be reported as prevailing visibility in the body of the METAR, and the other value must be a remark.

8.4. Unit of Measure. Visibility must be reported in statute miles or fractions thereof. See Table 8-1: Reportable Visibility Values.

Table 8-1: Reportable Visibility Values

Source of Visibility Report							
Automated[1]			**Manual**				
M1/4	2	9	0	5/8	1 5/8	4	12
1/4	2 1/2	10	1/16	3/4	1 3/4	5	13
1/2	3		1/8	7/8	1 7/8	6	14
3/4	4		3/16	1	2	7	15
1	5		1/4	1 1/8	2 1/4	8	20
1 1/4	6		5/16	1 1/4	2 1/2	9	25
1 1/2	7		3/8	1 3/8	2 3/4	10	30
1 3/4	8		1/2	1 1/2	3	11	35[2]

[1] Visibility values of 0, 1/16, and 1/8 can be augmented in the visibility field of automated systems with SPECI capability to meet service level requirements.
[2] Further increments of 5SM may be reported, that is, 40, 45, 50, etc.

8.5. Observing Aids for Visibility. Charts, lists, or other positive means of identifying lights or objects used as visibility markers must be posted near the observer's position. At local direction, separate lists or charts can be used for daytime and nighttime markers. In any case, the markers must be clearly identified as to whether they are daytime or nighttime markers. The observing station is responsible for creating local observing aids for visibility.

8.6. Tower Visibility Aids. If tower visibility is reported, separate charts or lists of markers using the tower as an observation site must be posted in the tower. The observing station is responsible for creating local observing aids for visibility.

8.7. Selection of Visibility Markers. Insofar as possible, markers of the type described in Paragraph 8.2.g should be used for determining visibility markers to construct visibility aids. The red or green course lights, television and radio tower obstruction lights etc., may be used as nighttime visibility markers. Because of their intensity, focused lights such as airport beacons must not be used as markers.

8.8. Observation Sites. Visibility observations must be taken from several viewpoints at one location as necessary to view as much of the horizon as practical. In this respect, natural obstructions, such as trees, hills, etc., are not obstructions to the horizon. These natural obstructions define the horizon.

8.9. Dark Adaptation. Before taking visibility observations at night, the observer should spend as much time as practical in the darkness to allow the eyes to become accustomed to the limited light.

8.10. Evaluating Visibility. Visibility must be evaluated as frequently as practical. Using all available visibility markers, the observer must determine the greatest distances that can be seen in all directions around the horizon circle. When the visibility is greater than the distance to the farthest markers, the observer must estimate the greatest distance that can be seen in each direction. This estimate must be based on the appearance of all visibility markers. If they are visible with sharp outlines and little blurring of color, the visibility is much greater than the distance to them. If a marker can barely be seen and identified, the visibility is about the same as the distance to the marker.

8.11. Evaluating Prevailing Visibility. After visibilities have been determined around the entire horizon circle (Paragraph 8.10), the observer must resolve them into a single value for reporting purposes. To do this, the observer must use either the greatest distance that can be seen throughout at least half the horizon circle, or if the visibility is varying rapidly during the time of observation, use the average of all observed values. The prevailing visibility must be reported in all observations.

8.12. Evaluating Sector Visibility. When the visibility is not uniform in all directions, the horizon circle must be divided into arcs (sectors) that have uniform visibility and represent at least one eighth of the horizon circle (45 degrees). The visibility that is evaluated in each sector is sector visibility. Sector visibility must be reported in the remarks section of weather observations when it differs from the prevailing visibility by one or more reportable values and either the prevailing or sector visibility is less than 3 miles or considered to be operationally significant. The format for the remark is given in Paragraph 14.27 Sector Visibility (VIS_[DIR]_vvvvv).

8.13. Evaluating Variable Visibility. If the prevailing visibility rapidly increases and decreases by 1/2 mile or more during the time of the observation, and the average prevailing visibility is less than 3 miles, the visibility is considered to be variable. When variable visibility conditions are observed, the minimum and maximum visibility values observed must be reported in the remarks section. Variable visibility must not be reported in the body of the report. The format for the remark is given in Paragraph 14.26 Variable Prevailing Visibility (VIS_vnvnvnvnvnVvxvxvxvxvx).

8.14. Reporting Visibility Values. The reportable values for manual visibility observations are listed in Table 8-1. If the visibility falls halfway between two reportable values, the lower value must be reported.

8.15. Control Tower Observations and Actions at Collocated Sites. Control tower personnel certified to take visibility observations must:

a. Notify the weather station or contract observer when they observe tower prevailing visibility to decrease to less than, or increase to equal or exceed, 4 miles.

b. When the prevailing visibility at the tower or the surface is less than 4 miles, report all changes of one or more reportable values to the weather station or contract observer.

c. As required by FAA directives, use the lower of either the tower or the weather station/contract observer visibility for aircraft operations.

8.16. Additional Tower Personnel Action for Tower Visibility. Tower personnel must record the following information for each control tower visibility observation on MF1M-10C, or a separate tabulation sheet:

a. Time of observation.

b. Prevailing visibility at the tower level.

c. Remarks (such as visibility in different sectors).

d. Observer's initials.

NOTE-
This paragraph is not applicable at OID/OT-equipped sites.

8.17. Contract Observer Action at Stations with Control Tower. Procedures for contract observer personnel are as follows:

a. Notify the tower as soon as possible, whenever the prevailing visibility at the contract observation point decreases to less than, or increases to equal or exceed, 4 miles.

b. Re-evaluate contract observer prevailing visibility, as soon as practical, upon initial receipt of a differing control tower value, and upon receipt of subsequent reportable changes at the control tower level.

Chapter 9. Runway Visual Range (RVR)

9.1. Introduction. This chapter presents procedures and practices for measuring and recording RVR. RVR is an estimate of how far a pilot can see down a runway. It is used to define operational limits on the use of precision instrument runways.

9.2. Definitions

a. Designated RVR Runway. The designated RVR runway is the runway officially designated by the airport authority for reporting RVR values. The designated RVR runway is typically the runway with the lowest approach minimums.

b. Long-Line RVR. The RVR reported in surface observations and disseminated long-line is the highest RVR achievable for the measured visibility at the touchdown zone of a specified runway. Typically, this is the RVR calculated for the highest and lowest values of visibility over the previous 10 minutes at runway light intensity step five. With New Generation RVR (NGRVR), this is an automated report. When the automated interface fails, RVR will not be reported long-line.

c. Runway Light Intensity. Runway light intensity is a numerical scale of the brightness of runway lights.

d. Runway Visual Range (RVR). The RVR is an estimate of the maximum distance at which the runway, or the specified lights or markers delineating it, can be seen from a position above a specific point on its center line. This value is normally determined by visibility sensors or transmissometers located alongside and higher than the center line of the runway. RVR is used operationally to assess whether visibility conditions are good enough to allow a particular operation, such as an instrument landing.

9.3. Sensor and Method. An automated RVR system uses three sensors to estimate the RVR value: Extinction coefficient sensor (or visibility), background luminance (or ambient light sensor) and runway light intensity monitor. The transmissometer or forward scatter meter can be used as an RVR visibility sensor.

a. Transmissometer. A transmissometer measures the fraction of light (transmittance) that has not been absorbed or scattered out of a light beam after it has traveled a certain distance through the atmosphere. The extinction coefficient is computed from transmittance. The transmissometer measures the extinction coefficient using a projector and a receiver. A projector transmits a light beam toward a receiver located some specified distance away. The receiver measures the intensity of the beam after it has passed through the atmosphere. RVR is then derived from algorithms that also account for ambient light (background luminance) and runway light intensity. RVR tables are contained in Table 9-1: RVR Transmittance Conversion Table for Tasker 400 and Equivalent Systems with 250-Foot Baseline - Contrast Threshold 5.5 Percent, and Table 9-2: Tasker 500 RVR Transmittance Conversion Table for 250-Foot Baseline - Contrast Threshold 5.0 Percent.

Table 9-1: RVR Transmittance Conversion Table for Tasker 400 and Equivalent Systems with 250-Foot Baseline - Contrast Threshold 5.5 Percent

	DAY	NIGHT
RVR (Ft)	**LS 5**	**LS 5**
400 ----------	.0299	.0013
600 ----------	.1038	.0113
800 ----------	.1974	.0351
1000 ----------	.2905	.0707
1200 ----------	.3746	.1134
1400 ----------	.4479	.1590
1600 ----------	.5107	.2048
1800 ----------	.5644	.2492
2000 ----------	.6104	.2913
2200 ----------	.6499	.3307
2400 ----------	.6840	.3674
2600 ----------	.7136	.4014
2800 ----------	.7395	.4328
3000 ----------	.7774	.4820
3500 ----------	.8194	.5415
4000 ----------	.8431	.5906
4500 ----------	.8584	.6317
5000 ----------	.8710	.6662
5500 ----------	.8815	.6957
6000 ----------	.8905	.7209
LS - Light Setting		
NOTE- *When a given value of RVR is being reported, the transmittance must be between the two adjacent values listed in the table.*		

Table 9-2: Tasker 500 RVR Transmittance Conversion Table for 250-Foot Baseline - Contrast Threshold 5.0 Percent

	DAY	NIGHT

	DAY	NIGHT
RVR (Ft)	**LS 5**	**LS 5**
500 --------- 600	.0449	.0027
--------- 700	.0823	.0075
--------- 800	.1264	.0159
--------- 1000	.1974	.0351
--------- 1200	.2905	.0707
--------- 1400	.3746	.1134
--------- 1600	.4479	.1590
--------- 1800	.5107	.2048
--------- 2000	.5644	.2492
--------- 2200	.6104	.2913
--------- 2400	.6499	.3307
--------- 2600	.6840	.3674
--------- 2800	.7136	.4014
--------- 3000	.7395	.4328
--------- 3500	.7774	.4820
--------- 4000	.8190	.5415
--------- 4500	.8384	.5906
--------- 5000	.8541	.6317
--------- 5500	.8671	.6662
--------- 6000	.8779	.6957
---------	.8871	.7209
LS - Light Setting		
NOTE- *When a given value of RVR is being reported, the transmittance must be between the two adjacent values listed in the table.*		

b. Forward Scatter Meter. A forward scatter meter measures a small portion of light scattered out of a light beam into a narrow band of scattering angles. The scatter meter is used to estimate the extinction coefficient. The forward scatter meter measures the extinction coefficient using an infrared (near visible) transmitter and receiver. The intersection of the transmitter's beam and the receiver's field of view defines the sensor's scatter volume. The transmitter transmits a beam of light into the scatter volume, and the receiver measures the amount of light that is scattered from particles in the scatter

volume to determine the extinction coefficient. RVR is then derived from the larger value calculated from two algorithms.

9.4. Observing Positions. The RVR visibility sensor should be located within 500 feet of the runway center line and, relative to the center of the glide slope antenna, within distances of 1000 feet towards the runway threshold and 1500 feet away from the runway threshold. The midpoint RVR is placed within 1000 feet of half the distance of the runway length.

9.5. Day-Night Observations for Transmissometers. The day scale should be used in the evening until low-intensity lights on or near the airport complex are clearly visible; the night scale should be used in the morning until these lights begin to fade. Alternatively, a day-night switch may be used to determine which scale should be used.

9.6. Automated Long-Line RVR Observations. For automated long-line RVR observing, the RVR transmits the designated runway RVR to the automated systems with SPECI capability for long-line dissemination. Forward scatter meter based RVR systems provide automated long-line service to the automated systems with SPECI capability.

9.7. Multiple RVRs. At service level A & B sites, RVR values for as many as four designated runways may be reported for long-line dissemination. At manual stations, only RVR for the designated runway must be reported. The PC-based RVR system is capable of providing multiple values of RVR.

9.8. Units of Measure. RVR is measured in feet whenever the prevailing visibility is 1 statute mile or less and/or the RVR for the designated instrument runway is 6000 feet or less. Transmissometer based RVR up to 1000 feet is reported in increments of 100 feet. RVR between 1000 and 3000 feet is reported in increments of 200 feet. RVR between 3000 and 6000 feet is reported in increments of 500 feet. For RVR based on the forward scatter meter, RVR up to 800 feet is reported in increments of 100 feet; RVR between 800 and 3000 feet is reported in increments of 200 feet; RVR between 3000 and 6500 feet is reported in increments of 500 feet.

9.9. RVR Based on Transmissometer. At manual stations, 10-minute extreme values (highest and lowest) of transmittance must be read from the transmissometer strip chart. RVR must be reported based on light setting 5 for either day or night time conditions, regardless of the light setting actually in use. One RVR value must be reported if the 10-minute high and low value are the same.

9.10. Automated RVR. RVR is automatically provided to the automated surface observing system (automated systems with SPECI capability). Automated systems with SPECI capability will calculate and report extreme RVR values.

9.11. Limits of RVR. When the observed RVR is above the maximum value that can be determined by the system in use, it should be reported as "P6000FT", where the figure 6000 is the maximum value that can be determined by the system. Similarly, when the RVR is below the minimum value that can be determined by the system in use, it should be reported as "M0600FT", where the figure 600 is the minimum value that can be determined by the system. Automated RVR exceeding its upper reporting limit must be reported as 6500+.

9.12. Variation in RVR. When RVR varies by more than a reportable increment during the 10-minute period preceding the observation time, report the lowest reportable value and the highest reportable value in feet. The RVR format is given in Paragraph 14.13 Runway Visual Range Group (RDRDR/VRVRVRVRFT) or (RDRDR/VnVnVnVnVVxVxVxVxFT) (NA LAWRS).

9.13. Determining and Reporting RVR (NA LAWRS). Observers at stations with the capability of measuring RVR should report RVR in the body of the METAR/SPECI whenever the prevailing visibility is 1 mile or less and/or the RVR is 6000 feet or less (6500 feet or less for automated RVR). The format is given in Chapter 15. Entries on Observational Forms. The 10-minute runway visual range values for the designated RVR runway must be included in METAR and SPECI observations. The values must be based on runway light setting 5 and reported in the increments identified in Paragraph 9.8 Units of Measure. Transmissometer-determined values must be applicable only to the specified runway near which the instrument is located. After transmissivity values are obtained, background correction must be applied and the appropriate figure used to determine runway visual range. Table 9-1: RVR Transmittance Conversion Table for Tasker 400 and Equivalent Systems with 250-Foot Baseline - Contrast Threshold 5.5 Percent, and Table 9-2: Tasker 500 RVR Transmittance Conversion Table for 250-Foot Baseline - Contrast Threshold 5.0 Percent, present RVR transmittance conversion data for two different operating conditions. In determining runway visual range, the observer must select the appropriate time for changing from day to night values or vice versa. In general, the day scale should be used in the evening until low-intensity lights on or near the airport complex are clearly visible, and the night scale should be used in the morning until these lights begin to fade. Alternatively, a day-night switch may be used to determine which scale should be used. When reliable reports are unavailable, or the observer determines that the instrument values are not representative for the associated runway, the data must not be used. Automated RVR values are complete as forwarded to automated systems with SPECI capability and require no external compensation for day/night conditions.

9.14. RVR Procedures (Apply to RVRs Using Transmissometer Technology Only). In order to correctly determine the RVR to be reported, the observer must have the following information:

a. Which recorder indicates RVR values at the approach end of the designated RVR runway.

b. The relation of RVR sensors and readouts to the runway approaches.

c. The lowest RVR instrument minimums for the designated RVR runway.

d. Whether the day or night tables are to be used.

9.15. Ten-minute RVR Values (Apply to RVRs Using Transmissometer Technology Only). Ten-minute extreme values (highest and lowest) of RVR must be determined by selecting the highest and lowest values on the recorder chart and converting them to hundreds of feet by using the appropriate RVR table. Values based on light setting 5 must always be used, regardless of the light setting actually in use. The 10-minute values are considered more representative for longer periods after observation and must be used for long-line transmission.

9.16. Manually Determined One-minute RVR Values (Apply to RVRs Using Transmissometer. Technology Only). When necessary to determine RVR values manually (digital readout inoperative or not available), the observer must obtain readings from the transmissivity meter or the recorder trace. Because of the lag in the transmissometer recording system, these values may be considered nominal one-minute measures of atmospheric transmission. These indications must be converted to RVR equivalents using Table 9-1 or Table 9-2 whenever the appropriate light settings and day or night condition are known. Background correction must be applied to the observed value and the appropriate RVR table used.

9.17. Emergency Reporting of Runway Visibility and RVR (Apply to RVRs Using Transmissometer Technology Only) (NA LAWRS)

a. When notified that RVR readouts in the traffic control facility are inoperative, but a readout (digital, recorder, or meter) in the weather station/contract observer location is operating, the weather station observer must provide to the control facility for the runways(s) of concern:

(1) The RVR at the time of notification.

(2) Notification when the RVR is observed to decrease to equal or become less than, or to increase to equal or become more than 2400 feet RVR, or the lowest landing minimum.

b. The RVR provided in accordance with this paragraph must be the one-minute mean value, based on light setting 5, unless another light setting is specially requested. If digital readouts are unavailable, the observer must manually determine one-minute RVR using the instructions in Paragraph 9.16. Manually Determined One-minute RVR Values (Apply to RVRs Using Transmissometer. Technology Only**)**. All values furnished to the control facility in accordance with this paragraph must be recorded and retained for 30 days. Telewriter copy or voice tapes may serve this purpose.

9.18. Disposing of RVR Recorder Charts (Apply to RVRs Using Transmissometer Technology Only). When the chart on a recorder roll has been exhausted, the observer must insert the used roll into an empty chart carton and enter on the carton the station name, dates for beginning and ending of the roll, and runway identification. The used roll must be held on station for 30 days. If no request is received within this time for review or a copy of any portion of the roll, it may be discarded. It must not be sent to the National Climatic Data Center (NCDC).

9.19. Operation of Equipment. Practices and procedures for the operation of visibility measuring instruments and related equipment are presented in Chapter 16. Operation of Equipment.

Chapter 10. Weather Phenomena

Section 1. General

10.1. Introduction. This chapter contains instructions for identifying, recording, and reporting weather. For the purpose of this order, weather is a category of atmospheric phenomena that includes tornadoes, funnel clouds, waterspouts, thunderstorms, squalls, precipitation, obscurations, and other phenomena. The types of weather phenomena reported vary according to the type of station. Weather phenomena may be evaluated instrumentally, manually, or through a combination of instrumental and manual methods.

10.2. Precipitation. Precipitation is any of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground. The types of precipitation reported in surface observations are:

a. Liquid Precipitation. Liquid precipitation is any form of precipitation that does not fall as frozen precipitation and does not freeze upon impact. Types of liquid precipitation are:

(1) Drizzle (DZ). Drizzle is defined as fairly uniform precipitation composed exclusively of fine drops of liquid water particles (diameter less than 0.02 inch/0.5 mm) very close together. Drizzle appears to float, following air currents, although unlike fog droplets, it falls to the ground.

(2) Rain (RA). Rain is defined as precipitation of liquid water particles, either in the form of drops larger than 0.02 inch/0.5 mm., or smaller drops which, in contrast to drizzle, are widely separated.

b. Freezing Precipitation. Any form of precipitation that freezes upon impact and forms a glaze on the ground or on exposed objects is called freezing precipitation. Types of freezing precipitation are:

(1) Freezing Drizzle (FZDZ). Freezing drizzle is drizzle that freezes upon impact with the ground or other exposed objects.

(2) Freezing Rain (FZRA). Freezing rain is rain that freezes upon impact with the ground or other exposed objects.

c. Frozen Precipitation. Frozen precipitation is any form of precipitation that reaches the ground in solid form. Types of frozen precipitation are:

(1) Snow (SN). Snow is composed of crystals, mostly branched in the form of six-pointed stars. At temperatures higher than about -5°C, the crystals are generally clustered to form snowflakes.

(2) Small Hail and/or Snow Pellets (GS**)**. Small hail or snow pellets are defined as white, opaque grains of ice. The pellets are round or sometimes conical. Diameters range from about 0.08 to 0.2 inch (2 to 5 mm). Snow pellets are brittle and easily crushed. When they fall on hard ground, they bounce and often break up.

(3) Snow Grains (SG). Snow grains are defined as precipitation of very small, white, opaque grains of ice. When the grains hit hard ground, they do not bounce or shatter. They usually fall in small quantities, mostly from stratus type clouds, and never as showers.

(4) Hail (GR). Hail is precipitation in the form of small balls or other pieces of ice falling separately or frozen together in irregular lumps. Diameters are equal to or greater than 0.25 inch (6.35 mm). Hailstones consist of alternate opaque and clear layers of ice in most cases.

(5) Ice Pellets (PL). Ice pellets are transparent or translucent pellets of ice, which are round or irregular, rarely conical, and which have a diameter of 0.2 inch/5 mm or less. The pellets usually rebound when striking hard ground, and make a sound on impact. There are two main types:

(a) One type is composed of hard grains of ice consisting of frozen raindrops, or largely melted and refrozen snowflakes (formerly sleet). This type falls as continuous or intermittent precipitation.

(b) The second type consists of snow encased in a thin layer of ice which has formed from the freezing, either of droplets intercepted by the pellets, or of water resulting from the partial melting of the pellets. This type falls as showers.

(6) Ice Crystals (IC). Ice crystals are unbranched and fall in the form of needles, columns, or plates. (Snow crystals are branched.) These are often so tiny that they seem to be suspended in the air. They may fall from a cloud or from clear air. The crystals are visible mainly when they glitter in the sunshine or other bright light. They may then produce a luminous pillar or other optical phenomena. This hydrometeor (rarely more than the lightest precipitation), which is frequent in polar regions, occurs only at very low temperatures in stable air masses.

d. Unknown Precipitation. Unknown precipitation is the term used by automated weather observing systems to characterize precipitation of an unknown type that cannot be identified any further by the system.

10.3. Obscurations. An obscuration is any phenomenon in the atmosphere, other than precipitation, that reduces horizontal visibility. Except where noted, obscurations are reported when the prevailing visibility is less than 7 miles or considered operationally significant. The types of obscurations reported in surface observations are:

a. Blowing Dust (BLDU). Dust consists of fine particles of earth or other matter raised or suspended in the air by a wind that may have occurred at or far away from the station. Blowing dust is dust raised by the wind to a height of 6 feet or more, sufficient to restrict horizontal visibility. When visibility decreases to 5/8 statute miles (SM) or less, this becomes a duststorm (DS). Note: see 10.4g.

b. Blowing Sand (BLSA). Blowing sand is sand raised by the wind to a height of 6 feet or more, sufficient to restrict horizontal visibility. When visibility decreases to 5/8 SM or less, this becomes a sandstorm (SS). Note: see 10.4f.

c. Blowing Snow (BLSN). Blowing snow is made up of snow particles raised by the wind to a height of 6 feet or more, sufficient to restrict horizontal visibility.

d. Spray (PY). Spray is water droplets torn by the wind from a substantial body of water, generally from the crests of waves, and carried up a short distance into the air.

e. Blowing Spray (BLPY). Blowing spray is made up of water droplets torn by the wind from a body of water, generally from the crest of waves, and carried up into the air to a height of 6 feet or more in such quantities that they reduce the horizontal visibility.

f. Widespread Dust (DU). Widespread Dust gives a tan or gray tinge to distant objects. The sun's disk is pale and colorless, or has a yellow tinge through dust.

g. Fog (FG). Fog is a visible aggregate of minute water particles (droplets) that is based at the earth's surface and reduces horizontal visibility to less than 5/8 SM, and unlike drizzle, does not fall to the ground.

h. Freezing Fog (FZFG). Freezing fog is a suspension of numerous minute ice crystals in the air, or water droplets at temperatures below 0º C, and visibility less than 5/8 SM, based at the earth's surface. A report of freezing fog does not necessarily mean that ice is forming on surfaces.

i. Haze (HZ). Haze is made up of extremely small, dry particles suspended in the air, invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance. This phenomenon resembles a uniform veil over the landscape that subdues all colors. Dark objects viewed through this veil tend to have a bluish tinge while bright objects, such as the sun or distant lights, tend to have a dirty yellow or reddish hue. When haze is present and the sun is well above the horizon, its light may have a peculiar silvery tinge. Haze particles may be composed of a variety of substances; for example, dust, salt, residue from distant fires or volcanoes, and/or pollen. The particles, generally, are well diffused through the atmosphere.

j. Mist (BR). Mist is a visible aggregate of minute water particles suspended in the atmosphere that reduces visibility to less than 7 SM but greater than or equal to 5/8 SM, and unlike drizzle, does not fall to the ground.

k. Shallow (Ground) Fog (MIFG). Shallow ground fog is fog in which the visibility at 6 feet above the ground is 5/8 SM or more and the apparent visibility in the fog layer is less than 5/8 SM.

l. Smoke (FU). Smoke is defined as small particles produced by combustion suspended in the air. This phenomenon may be present either near the Earth's surface or in the free atmosphere. When viewed through smoke, the disk of the sun at sunrise and sunset appears very red. The disk may have an orange tinge when the sun is above the horizon. Evenly distributed smoke from distant sources generally has a light grayish or bluish appearance. A transition to haze may occur when smoke particles have traveled great distances; for example, 25 to 100 miles or more, and when the larger particles have settled out and the remaining particles have become widely scattered through the atmosphere.

m. Volcanic Ash (VA). Volcanic ash consists of fine particles of rock powder that originate from a volcano and that may remain suspended in the atmosphere for long periods. Volcanic ash is always reported when observed, no matter what the value of prevailing visibility.

10.4. Other Phenomena

a. Well-Developed Dust/Sand Whirls (PO). Particles of dust or sand, sometimes accompanied by small litter, raised from the ground in the form of a whirling column of varying height with a small diameter and an approximately vertical axis.

b. Squalls (SQ). A strong wind characterized by a sudden onset, in which the wind speed increases by at least 16 knots and is sustained at 22 knots or more for at least 1 minute.

c. Tornado (+FC). A tornado is a violent, rotating column of air touching the ground. It forms a pendant, usually from a cumulonimbus cloud, nearly always starts as a funnel cloud, and is accompanied by a loud roaring noise.

d. Funnel Cloud (FC). A funnel cloud is a violent, rotating column of air which does not touch the surface. It is usually in the form of a pendant from a cumulonimbus cloud.

e. Waterspout (+FC). A waterspout is a violent, rotating column of air that forms over a body of water, and touches the water surface.

f. Sandstorm (SS). A sandstorm is particles of sand that are carried aloft by a strong wind. The sand particles are mostly confined to the lowest ten feet, and rarely rise more than fifty feet above the ground. A sandstorm is reported when visibility is reduced to between 5/8 and 5/16 SM. If visibility is less than 5/16 SM, then heavy sandstorm (+SS) is reported.

g. Duststorm (DS). A duststorm is a severe weather condition characterized by strong winds and dust-filled air over an extensive area. A duststorm is reported when visibility is reduced to between 5/8 and 5/16 SM. If visibility is less than 5/16 SM, then heavy duststorm (+DS) is reported.

10.5. Qualifiers. Present weather qualifiers fall into two categories: qualifiers and descriptors. Qualifiers may be used in various combinations to describe weather phenomena. Details on the coding of qualifiers are contained in Chapter 14. Coding and Dissemination, and Appendix E. METAR User Aids.

a. Qualifiers.

(1) Intensity. The intensity qualifiers are: Light (-), Moderate (No Entry), Heavy (+).

(2) Proximity. The proximity qualifier is "vicinity" (VC).

b. Descriptors. The descriptors are: Shallow (MI), Partial (PR), Patches (BC), Low Drifting (DR), Blowing (BL), Shower or Showers (SH), Thunderstorm (TS), and Freezing (FZ).

10.6. Order for Reporting Multiple Types of Weather and Obscurations. When more than one type of weather and/or obscuration is reported at the same time, they must be reported in the following order:

a. Tornado, funnel cloud, or waterspout.

b. Thunderstorms, with or without associated precipitation.

c. Weather and obscurations in order of decreasing predominance, for example, the most dominant type is reported first.

d. From left to right in Table 10-1: Present Weather.

Table 10-1: Present Weather

Qualifier		Weather Phenomena		
Intensity or Proximity 1	**Descriptor 2**	**Precipitation 3**	**Obscuration 4**	**Other 5**
- Light	**MI** Shallow	**DZ** Drizzle	**BR** Mist	**PO** Well-Developed Dust/Sand Whirls
Moderate[1]	**PR** Partial	**RA** Rain	**FG** Fog	
+ Heavy	**BC** Patches	**SN** Snow	**FU** Smoke	**SQ** Squalls
VC In the Vicinity[2]	**DR** Low Drifting	**SG** Snow Grains	**VA** Volcanic Ash	**FC** Funnel Cloud Tornado[3] Waterspout[3]
	BL Blowing	**IC** Ice Crystals	**DU** Widespread Dust	
	SH Showers	**PL** Ice Pellets	**SA** Sand	**SS** Sandstorm
	TS Thunderstorm	**GR** Hail	**HZ** Haze	**DS** Duststorm
	FZ Freezing	**GS** Small Hail and/or Snow Pellets	**PY** Spray	
		UP Unknown Precipitation[4]		

General Note: The weather groups must be constructed by considering columns 1 to 5 in sequence, that is, intensity, followed by description, followed by weather phenomena, for example, heavy rain shower(s) is coded as +SHRA.

[1] To denote moderate intensity, no entry or symbol is used.

[2] See Paragraph 10.7 for vicinity definition and paragraph 14.14.a(2) for usage.

[3] Tornadoes and waterspouts are coded as +FC.

[4] "UP" is only used by automated weather observing systems.

10.7. Rules for Phenomena Not Occurring at the Point of Observation

a. Weather occurring at the airport must be coded in the body of the report. Vicinity is defined as between 5 and 10 SM from the usual point of observation for all, but precipitation and up to 10 SM from the usual point of observation for precipitation. (See Paragraph 10.7.b below.) Distant is defined as greater than 10 SM from the usual point of observation. With the exception of volcanic ash, low drifting dust, low drifting sand and low drifting snow, an obscuration must be coded in the body of the report if the surface visibility is less than 7 miles or considered operationally significant. Volcanic ash must always be coded when observed. MIFG, BCFG, and PRFG may be reported when visibility is equal to or greater than 7 miles. Weather and/or obscurations observed, but not occurring at the station or in the vicinity must be coded in the remarks section.

b. If precipitation is not occurring at the station or airport, but is within 10 miles of the usual point of observation, the phenomena must be reported in the body of the report as "showers in the vicinity" (VCSH). For other than precipitation, (VCFG, VCBLSN, etc.), vicinity is 5 SM to 10 SM. Examples of how to use VC correctly are included in Paragraph 14.14.b(2) and Appendix E. METAR User Aids.

c. If the phenomenon is not occurring at the usual point of observation, but is affecting part of the operating areas of the airport, the phenomenon may be reported in remarks with the phrase “at the airport” (AT AP) appended, for example, SHRA AT AP. "At the airport" includes runways, taxiways, ramps, terminals, and/or adjacent areas. Buffer zones around the operating areas of the airport are not included in this area.

d. Weather phenomena beyond 10 SM of the point of observation must be coded as distant (DSNT) followed by the direction from the station. For example, lightning 25 SM west of the station would be coded as LTG DSNT W.

Section 2. Observing and Reporting Precipitation

10.8. Reporting and Documenting Precipitation. The type, intensity, and character of precipitation in any form must be reported in the body of the weather report whenever it is observed to occur at the station. Precipitation observed at a distance from the station must be reported in the remarks section. At LAWRS, the reporting of precipitation observed at a distance is not required, but may be done. To report and document precipitation, the observer must determine:

a. Time of beginning, ending, and changes in intensity (NA LAWRS)

b. Type, character, and intensity

10.9. Beginning and/or Ending Precipitation (NA LAWRS). The observer must note to the nearest minute the time that precipitation of any type is observed to begin and end. These times must be reported in remarks in the next METAR observation. If beginning or ending time for a precipitation type such as: hail, freezing precipitation, or ice pellets is the reason for issuing a SPECI, the beginning/ending time must be included in that SPECI report and in the following METAR. Times for separate periods must be reported only if the intervening time of no precipitation exceeds 15 minutes. Time data must be reported by identifying the type, using the appropriate symbol, followed by B for "began" or E for "ended," as appropriate, and the time in minutes past the hour; for example, RAB04SNB19RASNE43, meaning "rain began at 04, snow began at 19, and both types ended at 43 minutes past the hour."

10.10. Determining and Reporting the Type of Precipitation. The observer must determine and report the type of precipitation by using the definitions in this chapter. The observer must use the order described in Paragraph 10.6 Order for Reporting Multiple Types of Weather and Obscurations to report precipitation.

10.11. Determining the Character of Precipitation. The observer must use the definitions in this section to determine the character of precipitation.

a. Continuous. If precipitation intensity changes, it changes gradually.

b. Intermittent. Precipitation stops and starts at least once within the hour preceding the observation and, if the precipitation intensity changes, it changes gradually.

c. Showery. Abrupt changes in precipitation intensity, or the precipitation starts and stops abruptly. The SH code must only be appended to rain (RA), snow (SN), ice pellets (PL), small hail/snow pellets (GS), or hail (GR), for example, SHRA, SHSN, SHPL, SHGS, SHGR.

10.12. Precipitation Intensity. Intensity of precipitation is an indication of the amount of precipitation falling at the time of observation. It is expressed as light, moderate, or heavy. No intensity is assigned to hail or ice crystals. Each intensity is defined with respect to the type of precipitation occurring. The intensity of rain or freezing rain should be estimated using the guidelines given in Table 10-2: Estimating Intensity of Rain. The intensity of ice pellets should be estimated using the guidelines given in Table 10-3: Estimating Intensity of Ice Pellets. The intensity of rain or ice pellets may also be estimated by rate of fall as given in Table 10-4: Intensity of Rain or Ice Pellets Based on Rate of Fall. Table 10-5: Intensity of Snow or Drizzle Based on Visibility, on the other hand, is based on the visibility at the time of observation, and must be used to determine intensity of snow and drizzle. When more than one form of precipitation is occurring at a time or precipitation is occurring with an obscuration, the intensities determined must be no greater than that which would be determined if any of the forms were occurring alone. The intensity of precipitation must be reported using the symbols in Table 10-6: Precipitation Intensity Symbols. The intensity symbol must precede the precipitation symbol without any intervening space.

Table 10-2: Estimating Intensity of Rain

Intensity	Criteria
Light	From scattered drops that, regardless of duration, do not completely wet an exposed surface up to a condition where individual drops are easily seen.
Moderate	Individual drops are not clearly identifiable; spray is observable just above pavements and other hard surfaces.
Heavy	Rain seemingly falls in sheets; individual drops are not identifiable; heavy spray to height of several inches is observed over hard surfaces.

Table 10-3: Estimating Intensity of Ice Pellets

Intensity	Criteria
Light	Scattered pellets that do not completely cover an exposed surface, regardless of duration. Visibility is not affected.
Moderate	Slow accumulation on ground. Visibility reduced by ice pellets to less than 7 miles.
Heavy	Rapid accumulation on ground. Visibility reduced by ice pellets to less than 3 miles.

Table 10-4: Intensity of Rain or Ice Pellets Based on Rate of Fall

Intensity	Criteria
Light	Up to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.
Moderate	0.11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.
Heavy	More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

Table 10-5: Intensity of Snow or Drizzle Based on Visibility

Intensity	Criteria
Light	Visibility > 1/2 mile.

Intensity	Criteria
Moderate	Visibility > 1/4 mile but ≤ 1/2 mile.
Heavy	Visibility ≤ 1/4 mile.

Table 10-6: Precipitation Intensity Symbols

Intensity	Precipitation Intensity Symbols
Light	-
Moderate	No symbol is assigned to moderate.
Heavy	+
No intensity is assigned to hail or ice crystals.	

10.13. Intensity of Snow, Snow Pellets, Snow Grains, Drizzle, and Freezing Drizzle. If any one of these phenomena occurs alone, Table 10-5: Intensity of Snow or Drizzle Based on Visibility, must be used to determine intensity on the basis of prevailing visibility. If occurring with other precipitation or obscurations, the intensity assigned must be no greater than that determined using visibility criteria if any of the above were occurring alone. With or without other obscuring phenomena, heavy snow (+SN) must not be reported if the visibility is greater than 1/4 mile and moderate snow (SN) must not be reported if the visibility is greater than 1/2 mile.

10.14. Reporting Freezing Precipitation. A SPECI observation must be taken whenever freezing precipitation begins, ends, or changes intensity.

10.15. Beginning and/or Ending of Freezing Precipitation. The time freezing precipitation began and/or ended must be included in the remarks of the first observation after the event is first observed. If a SPECI report is initiated because of the beginning or ending of the freezing precipitation, the beginning and/or ending time must be included in the remarks section of that SPECI and in the following METAR. The time must be repeated in the remarks of the next METAR observation if not previously reported in a METAR observation.

10.16. Intensity of Freezing Precipitation

a. Freezing Drizzle. When freezing drizzle is occurring alone, determine the intensity by using Table 10-5: Intensity of Snow or Drizzle Based on Visibility, using visibility as the criterion. If occurring with other precipitation or obscurations, the intensity assigned must be no greater than that determined using visibility criteria as if freezing drizzle were occurring alone. Note that moderate drizzle reduces the visibility to less than or equal to 1/2 mile. Only if visibility meets this criteria, must moderate drizzle be reported. Likewise, heavy drizzle must be reported only if the visibility is less than or equal to 1/4 mile.

b. Freezing Rain.

c. Table 10-2: Estimating Intensity of Rain, should be used to estimate the intensity of freezing rain.

10.17. Reporting Ice Pellets. A SPECI observation must be taken whenever ice pellets begin, end, or change intensity.

10.18. Beginning and/or Ending of Ice Pellets (NA LAWRS). The time ice pellets began and/or ended must be included in the remarks of the first observation after the event occurs. If a SPECI report is initiated because of the beginning or ending of the ice pellets, the beginning and/or ending time must be included in the remarks section of that SPECI. The times must be repeated again in the remarks of the next transmitted METAR observation if not previously reported in a METAR observation.

10.19. Intensity of Ice Pellets. The intensity of ice pellets must be estimated in accordance with Table 10-3: Estimating Intensity of Ice Pellets.

10.20. Reporting Precipitation Amounts (NA LAWRS). Amounts of precipitation must be expressed in terms of vertical depth. Precipitation measurements must be in inches, tenths of inches, or hundredths of an inch depending on the precipitation being measured (see Table 10-7: Units of Measure for Precipitation). The following paragraphs describe the different manual procedures that must be used in measuring the amount of precipitation.

10.21. Priority of Gauges (NA LAWRS). If more than one type of gauge is available, the observer must use the one appearing highest on the following list.

a. Universal weighing rain gauge or All Weather Precipitation Accumulation Gauge (AWPAG) (where equipped).

b. Eight-inch nonrecording rain gauge.

c. Stick measurement of the tipping bucket gauge.

d. All others.

Table 10-7: Units of Measure for Precipitation

Type of Measurement	Unit of Measure
Liquid Precipitation	0.01 inch
Liquid Equivalent of Solid Precipitation	0.01 inch
Solid Precipitation	0.1 inch
Snow Depth	1 inch

10.22. Stick Measurement of Liquid Precipitation (NA LAWRS). ***(Applies only to the standard 8-inch, nonrecording rain gauge).*** The observer must insert a dry measuring stick into the measuring tube. The observer must permit the stick to rest on the bottom for 2 or 3 seconds. The observer must withdraw the stick and read the depth of precipitation at the upper limit of the wet portion. After measuring the liquid in the measuring tube, the observer must empty it and pour the liquid (if any) from the overflow container into the measuring tube and measure it. The observer must add the two amounts to get the total precipitation. When the measurements are completed, the observer must empty the tube and reassemble the gauge.

10.23. Determining Water Equivalent of Solid Precipitation by Stick Measurement (NA LAWRS). ***(Applies only to the standard 8-inch, nonrecording rain gauge).*** When solid or freezing precipitation is anticipated, the observer must remove the funnel and measuring tube from the gauge. To measure the precipitation, the observer must melt the contents of the overflow container, pour the liquid into the measuring tube and measure it as with liquid precipitation. If, because of strong winds, the amount of precipitation is considered to be unrepresentative, the observer must disregard the catch and obtain a measurement by a vertical core sampling. As an aid in obtaining the measurement of new snowfall, snowboards may be placed on top of the snow after each measurement. Each new snowfall measurement can then be taken from the top of the snow to the snowboard.

10.24. Determination of 6-hour Accumulation of Precipitation (NA LAWRS). At manual stations, insofar as possible, determine the amount of precipitation to be reported in the 6-hour observation. If a weighing gauge is not available, use the stick measurement of the 8-inch gauge or the uncorrected reading of the tipping-bucket gauge. Do not empty the gauge unless it is necessary to obtain a complete measurement of the accumulation (if the precipitation exceeded 2 inches).

10.25. Depth Measurement of Solid Forms (NA LAWRS). For the purposes of depth measurements, the term snow must include ice pellets, glaze, hail, any combination of these, and sheet ice formed directly or indirectly from precipitation. Therefore, if snow falls, melts, and refreezes, the depth of ice formed must be included in depth measurements of snow. Depth must be determined to the nearest 0.1 inch. The measurement should reflect the average depth on the ground at the usual measurement site (not disturbed by human activities). Measurements from rooftops, paved areas, and the like should not be made.

a. Undrifted Snow. Thrust the measuring stick vertically into the snow so that the end rests on the ground surface. Repeat 10 times and take the average of the readings as the snow depth. If the ground is covered with ice, cut through the ice with some suitable implement, and measure the thickness. Add the thickness of the ice to the depth of snow above the ice for the total depth measurement.

b. Drifted Snow (or Uneven Amounts). When the snow has drifted, or there are uneven amounts of snow on the ground, a reasonably accurate depth measurement may be made by taking the average of several measurements over representative areas. These should include the greatest and least depths. For example, if half the ground is bare and the other half is covered with 6 inches of snow, the snow depth should be entered as the average of the two readings, or 3 inches. When in the observer's judgment, less than 50 percent of the exposed ground is covered with snow, even though the covered areas have a significant depth, the snow cover should be recorded as a trace (T). When no snow or ice is on the ground in exposed areas (snow may be present in surrounding forested or otherwise protected areas), record a "0."

c. Hail. The depth of hail, which is usually associated with spring, summer or fall thunderstorms, is reported in the same manner as snow depth. The observer should record in column 65 the remark that the accumulation on ground is from hail.

d. Snow Stakes. Snow stakes should be used as a last resort to obtain depth measurements of a snowpack. They should be placed in the most representative area available, for use when it is likely that routine core sampling may disturb an otherwise representative area for subsequent use. Depth

measurements used in adjusting water equivalent of core samples should be made to tenths of an inch, as far as possible, without disturbing the snow within a few feet of the stake.

10.26. Snowfall Within Specified Periods (NA LAWRS). If practicable, these measurements must be made on a surface that has been cleared of previous snowfall. If such a spot is not available, and snow boards are not in place, the observer must measure the total depth of snow and subtract the depth previously measured. When it is likely that melting and settling of the snow make such measurements of questionable value, they should be considered as estimated. If the previous snowfall has crusted, the new fall may be measured by permitting the end of the measuring stick to rest on the crust. If different falls of snow are mixed by drifting, the observer must measure the total depth of snow and subtract the previously measured depth. The remainder is the approximate depth of the new fall, which must be adjusted, if necessary, to correct for suspected melting, evaporation, and runoff. For example, if several snow showers occur between observations, and each melts before the following one occurs, the total snowfall for the period will be the sum of the maximum depth (measured or estimated) for each occurrence. Estimate the depth only when the maximum is considered to have occurred between scheduled observations, at a time impracticable for measuring depth. If snow melts as it lands, then a trace should be recorded.

Section 3. Observing and Reporting Tornadoes, Waterspouts, and Funnel Clouds

10.27. Tornado, Waterspout, or Funnel Cloud. These phenomena must be reported in a SPECI observation when they are observed to begin, end, appear, or disappear.

a. Tornadic Activity Begins or Appears. In the body of the SPECI observation, insert **+FC** (for tornado or waterspout) or **FC** (for funnel cloud) at the beginning of the present weather group (see Paragraph 14.14 Present Weather Group (w'w')). Insofar as known, the following must be reported in the remarks section for any SPECI when a tornado, waterspout, or funnel cloud appears or begins (see Paragraph 14.21 Funnel Cloud for remarks format):

(1) Type of phenomenon, spelled out

(2) Time of beginning or appearance of the phenomenon, to the nearest minute (only the minutes are required if the hour can be inferred from the report time)

(3) Location and/or direction of the phenomenon from the station

(4) Direction toward which the phenomenon is moving (if unknown, enter MOV UNKN)

(5) Example of remarks for tornadic activity beginning: TORNADO B24 6 NE MOV UNKN

b. Tornadic Activity Ends or Disappears. The following must be reported in the remarks section for any SPECI when a tornado, waterspout, or funnel cloud ends or disappears from sight (see 14.21 Funnel Cloud for remarks format):

(1) Type of phenomenon, spelled out

(2) Time of ending or disappearance of the phenomenon, to the nearest minute (only the minutes are required if the hour can be inferred from the report time)

Example of remarks for a funnel cloud disappearing from site: FUNNEL CLOUD E35.

c. The above elements must also appear in the remarks section of the next METAR observation if not previously reported in a METAR observation.

Section 4. Observing and Reporting Thunderstorms, Hail, Lightning, and Squalls

10.28. Reporting Thunderstorms

a. Reports concerning thunderstorms must be made whenever a thunderstorm begins or ends. In the body of the observation, TS may be coded by itself or with precipitation types such as RA, SN, PL, GS, or GR. The intensity attached to it must be the intensity ascribed to the precipitation as described in Paragraph 14.14.b. In the remarks section, the report must include the following:

(1) Type and frequency of lightning

(2) Time of beginning, ending, or both, to the nearest minute

(3) Location, in accordance with the rules given in Paragraph 10.7 Rules for Phenomena Not Occurring at the Point of Observation or 14.32 Thunderstorm Location (TS_LOC_(MOV_DIR)).

(4) Direction toward which the storm is moving (omit if unknown)

b. Table 10-8, presents the types and frequencies of lightning to be reported. The above remarks must be updated and included with the time of beginning, ending, or both on the next transmitted METAR observation if not previously reported in a METAR observation. The format for the remarks is given in Paragraphs 14.30. Beginning and Ending of Precipitation (w'w'B(hh)mmE(hh)mm) (NA LAWRS);14.31. Beginning and Ending of Thunderstorms (TSB(hh)mmE(hh)mm); 14.32. Thunderstorm Location (TS_LOC_(MOV_DIR)); and 14.33. Hailstone Size (GR_[size]).

Table 10-8: Type and Frequency of Lightning

Type of Lightning		
Type	Contraction	Definition
Cloud-ground	CG	Lightning occurring between cloud and ground.
In-cloud	IC	Lightning that takes place within the thunder cloud.
Cloud-cloud	CC	Streaks of lightning reaching from one cloud to another.
Cloud-air	CA	Streaks of lightning passing from a cloud to the air, but do not strike the ground
Frequency of Lightning		
Frequency	Contraction	Definition
Occasional	OCNL	Less than 1 flash/minute.
Frequent	FRQ	About 1 to 6 flashes/minute.
Continuous	CONS	More than 6 flashes/minute.

10.29. Beginning and/or Ending of a Thunderstorm. A thunderstorm is considered to begin at the station when thunder is heard, overhead lightning is observed and the local noise level is such as might prevent hearing thunder, or lightning is detected by an automated sensor within 10 miles of the airport. A thunderstorm is considered to have ended 15 minutes after the last occurrence of any of the above criteria. When the time of beginning or ending of a thunderstorm is reported in the remarks section of a SPECI observation, it need not be reported again until the next transmitted METAR observation if not previously reported in a METAR observation. If previously reported in a METAR observation, the time need not be reported again.

10.30. Reporting Hail. Hail must be reported in an observation whenever it begins or ends, and in all observations taken while it is occurring. Times of beginnings and endings must be included in the remarks section (NA LAWRS). All observations concerning standard hail (GR) must report the diameter of the largest hailstones in the remarks section in 1/4 inch increments (NA LAWRS). No intensity must be assigned to hail. The format for reporting hail is given in Paragraph 14.33 Hailstone Size (GR_[size]).

10.31. Beginning and/or Ending of Hail. If SPECI is because of hail, then begin/end time must be recorded in the remarks. When the time of beginning or ending of hail is reported in the remarks section of a SPECI observation, it need not be recorded again until the next transmitted METAR observation if not previously reported in a METAR observation. If previously reported in a METAR observation, the time need not be reported again.

10.32. Reporting Lightning

a. When lightning is observed, the type, frequency, and location must be reported in the remarks section of METAR and SPECI observations. The format for reporting lightning is given in Paragraph 14.29 Lightning Frequency (Frequency_LTG(Type)_[LOC]). Table 10-8 presents definitions for the type and frequency of lightning.

b. Lightning (LTG). Lightning is defined as any of the various forms of visible electrical discharge produced by thunderstorms. Four main types of lightning can be distinguished:

(1) Cloud to ground lightning **(CG)** is lightning occurring between a cloud and the ground.

(2) In-cloud discharges **(IC)** are a type of lightning that takes place within a thunder cloud.

(3) Cloud to cloud discharges **(CC)** are streaks of lightning reaching from one cloud to another.

(4) Air Discharges **(CA)** are streaks of lightning which pass from a cloud to the air, but do not strike the ground.

10.33. Reporting Squalls. A squall is reported in the body of a METAR or SPECI only when there is a sudden increase in wind speed of at least 16 knots, the speed rises to 22 knots or more, and lasts for at least 1 minute.

Section 5. Observing and Reporting Procedures for Obscurations

10.34. General. The following paragraphs present observing and reporting procedures for various types of obscurations when reference is made to phenomena not occurring at the station location, the rules given in Paragraph 10-7, Rules for Phenomena Not Occurring at the Point of Observation, must apply.

10.35. Observing Obscurations. Obscurations must be determined by observing the prevailing conditions at the station (usual point of observation) in accordance with the definitions of the various types of obscurations given in Paragraph 10.3 Obscurations.

10.36. Reporting Obscurations. With the exception of volcanic ash, low drifting dust, low drifting sand, and low drifting snow, an obscuration must be coded in the body of the report only if the surface visibility is less than 7 miles or considered operationally significant. Volcanic ash must always be coded when observed. MIFG, BCFG and PRFG may be reported when visibility is equal to or greater than 7 miles. The reporting format is given in Paragraphs 14.14 Present Weather Group (w'w'). If these conditions are not met, but an obscuration is observed that is considered operationally significant, it must be reported in the remarks section as not at the station. If more than one type of obscuration is occurring at the same time, they must be reported in order of decreasing estimated predominance.

10.37. Special Procedures for Volcanic Ash. Volcanic ash (VA) must be reported in the body of the report whenever it is observed. Reporting volcanic ash is different from other obscurations because volcanic ash is reported even if the visibility is greater than 7 miles.

10.38. Operationally Significant Remarks for Obscurations. Any occurrence of an obscuration which the observer judges to be operationally significant and not reported elsewhere in the observation should be reported in the remarks section. Some examples of desirable items to be entered in the remarks section are fog dissipating or increasing, smoke drifting over the field, drifting snow, obscurations at a distance from, but not at the station.

Chapter 11. Sky Condition

Section 1. Introduction

11.1. Introduction. The instructions in this chapter relate to the state or appearance of the sky. Sky condition may be evaluated either automatically by instrument or manually. Clouds include obscuring phenomena aloft. Sky condition must be evaluated at all stations with this capability. Automated stations must have the capability to evaluate sky condition from the surface to 12,000 feet. LAWRS is only required to report to 12,000 feet. Observers at manual stations must evaluate all clouds and obscuring phenomena visible, that is, the 12,000-foot restriction must not apply.

11.2. Sky Condition Evaluation. A complete evaluation of sky condition includes the type of clouds or obscuring phenomena present, their stratification, amount, direction of movement, height of bases, and the effect on vertical visibility of surface-based obscuring phenomena.

11.3. Cloud Forms and Obscuring Phenomena. If available, the WMO International Cloud Atlas, Volumes I and II, and the Abridged Atlas contain detailed instructions and photo-aids for identifying the various cloud forms. Additional aids may be used for identifying cloud forms (types) such as cloud code charts. Commercial products are also available that describe cloud forms and types. Descriptions of obscuring phenomena are included in Chapter 10. Weather Phenomena.

Section 2. Definitions

11.4. Ceiling. The ceiling is the height above the earth's surface (field elevation or ground elevation) ascribed to the lowest non-surface-based layer that is reported broken or overcast, or the vertical visibility into a surface-based obscuration that totally hides the sky.

11.5. Celestial Dome. The celestial dome is that portion of the sky that would be visible if all human-made structures were removed and there was an unobstructed view of the horizon in all directions from the observation site(s).

11.6. Cloud. A cloud is a visible accumulation of minute water droplets and/or ice particles in the atmosphere above the earth's surface. Cloud differs from ground fog, fog, or ice fog only in that the latter are, by definition, in contact with the surface.

11.7. Cloud Movement. When reported in remarks of a surface aviation observation, cloud movement is the direction toward which a cloud is moving.

11.8. Field Elevation. Field elevation is the officially designated elevation (H_a) of an airport above mean sea level. It is the elevation of the highest point on any of the runways of the airport. The field elevation for an airport can be found in the United States Government Flight Information Publication, Airport/Facility Directory or the Chart Supplements for Alaska or the Pacific.

11.9. Horizon. For the purposes of these instructions, the horizon is the actual lower boundary (local horizon) of the observed sky or the upper outline of terrestrial objects, including nearby natural obstructions. It is the distant line along which the earth, or the water surface at sea, and the sky appear to meet. The local horizon is based on the best practical point of observation near the earth's surface and selected to minimize obstruction by nearby buildings, towers, etc.

11.10. Interconnected Cloud Layers. Clouds formed by the horizontal extension of swelling cumulus or cumulonimbus, that are attached to a parent cloud, must be regarded as a separate layer only if their bases appear horizontal and at a different level from the parent cloud. Otherwise, the entire cloud system must be regarded as a single layer at a height corresponding to that of the base of the parent cloud.

11.11. Layer. A layer consists of clouds or obscuring phenomena, not necessarily all of the same type, whose bases are at approximately the same level. A layer may be either continuous or composed of detached elements.

11.12. Layer Amount. The amount of sky cover for each layer must be the eighths of sky cover attributable to the clouds or obscuring phenomena in the layer being evaluated. All cloud layers and obscuring phenomena aloft must be considered. Only that portion of surface-based obscuring phenomena that hide a portion of the sky is considered.

11.13. Layer Height. The height, in feet, of the layer's base above the surface or field elevation is the layer height.

11.14. Multiple Layers. The existence of a layer or layers above a lower layer constitutes multiple layers.

11.15. Obscuring Phenomena. Any collection of particles aloft or in contact with the earth's surface, dense enough to be discernible to the observer, must be considered obscuring phenomena.

11.16. Sky Cover. Sky cover is a term used to denote the amount (to the nearest eighth) of the sky that is:

a. Covered by clouds and/or obscuring phenomena aloft

b. Hidden by surface-based obscuring phenomena, or

c. A combination of paragraphs a and b above

11.17. Sky Cover Classifications

a. VERTICAL VISIBILITY (VV) is:

(1) the distance that an observer can see vertically upward into surface-based obscuring phenomena that totally hide the sky, or

(2) the height determined by the sensor algorithm at automated stations into the surface-based obscuring phenomena that totally hide the sky.

b. CLEAR (SKC or CLR). SKC is the abbreviation used for manual reports to indicate that no clouds are present, and CLR is the abbreviation used for automated reports to indicate that no clouds are detected at or below the design limit of the ceilometer.

c. FEW (FEW) (few clouds) represents sky cover of more than zero to 2/8ths. Any layer amount less than 1/8 is considered 1/8.

d. SCATTERED (SCT) represents sky cover of 3/8ths to 4/8ths at and below the level of a layer aloft.

e. BROKEN (BKN) represents sky cover of 5/8ths up to, but not including, 8/8 at and below the level of a layer aloft.

f. OVERCAST (OVC) represents sky cover of 8/8ths at and below the level of a layer aloft.

11.18. Summation Amount. The summation amount of sky cover for any given layer is the sum of the sky cover of the layer being evaluated, plus the sky cover of all lower layers, including that portion of surface-based obscuring phenomena that hides the sky. Portions of layers aloft detected through lower layers aloft must not increase the summation amount of the higher layer. No layer can have a summation amount greater than 8/8ths.

11.19. Summation Principle. The summation principle states that the sky cover at any level is equal to the summation of the sky cover of the lowest layer, plus the additional sky cover present at all successively higher layers up to and including the layer being considered. No layer can be assigned a sky cover less than a lower layer, and no sky cover can be greater than 8/8ths. This concept is applicable for the evaluation of total sky cover.

11.20. Surface. For height determinations, the term "surface" denotes the horizontal plane whose elevation above sea level equals the field elevation. At stations where the field elevation has not been established, "surface" will refer to the ground or elevation at the observation site. At sea-plane bases, the mean high-tide mark may be regarded as the surface.

11.21. Total Amount. Total amount is the amount, in eighths, of the entire sky covered, not necessarily hidden, by all layers present. This amount cannot be greater than 8/8ths.

11.22. Variable Ceiling. Variable ceiling describes a condition in which a ceiling rapidly increases and decreases during the period of evaluation.

11.23. Variable Sky Condition. Variable sky condition is a sky condition that has varied between reportable conditions (for example, SCT to BKN, OVC to BKN) during the period of observation (normally the past 15 minutes).

Section 3. Observing and Reporting Procedures

11.24. Observing Sites. Observations of stratification, amount, direction of movement and height of bases of clouds, and the effect of obscuring phenomena on vertical visibility must be taken from as many locations as are necessary and practical to view the entire sky.

11.25. Layer Amounts. All layers visible from the station must be reported in sky cover reports. The amount of sky cover for each layer must be the eighths of sky cover attributable to the clouds or obscuring phenomena in the layer being evaluated. Table 11-1: Reporting Contractions for Sky Cover, must be used to determine the reported value for each layer visible. The report must be based on the eighths of sky covered by each layer in combination with any lower layers. Additionally, all layers with associated cumulonimbus or towering cumulus must be identified as such using the contractions CB and TCU, respectively. Automated stations will report no more than three layers of clouds. Automated stations with augmentation may report up to six layers; the layers reported must be selected in accordance with Table 11-2. At manual stations, a maximum of six layers of clouds or surface-based obscuring phenomena must be reported. If more than six layers are observed, they must be selected in accordance with Table 11-2: Priority for Reporting Layers

Table 11-1: Reporting Contractions for Sky Cover

Reportable Value	Meaning	Summation Amount of Layer
VV	Vertical Visibility	8/8
SKC or CLR[1]	Clear	0
FEW[2]	Few	> 0 - 2/8
SCT	Scattered	3/8 - 4/8
BKN[3]	Broken	5/8 - 7/8
OVC	Overcast	8/8

[1] The abbreviation CLR must be used at automated stations when no clouds at or below 12,000 feet are detected. The abbreviation SKC must be used at manual stations when no clouds are reported.
[2] Any layer amount less than 1/8 is reported as FEW.
[3] BKN includes sky cover from 5/8 up to, but not including, 8/8.

Table 11-2: Priority for Reporting Layers

Priority	Layer Description
1	Lowest Few
2	Lowest Broken Layer
3	Overcast Layer
4	Lowest Scattered Layer
5	Second Lowest Scattered Layer
6	Second Lowest Broken Layer
7	Highest Broken Layer
8	Highest Scattered Layer
9	Second Lowest Few Layer
10	Highest Few Layer

11.26. Summation Layer Amount. The summation amount of sky cover for any given layer is the sum of the sky cover of the layer being evaluated, plus the sky cover of all lower layers. Portions of layers aloft detected through lower layers aloft must not increase the summation amount of the higher layer. No layer can have a summation amount greater than 8/8ths. (See Table 11-3: Examples: Summation of Sky Cover.)

Table 11-3: Examples: Summation of Sky Cover

Sky Cover Layers	Summation	Appropriate Contraction	Sky Cover Entries	
			Col. 10	Col. 14
3/8 sky hidden by fog	3/8	SCT		
3/8 sky cover at 1,000 feet	6/8	BKN	SCT000 BKN010	FG
1/8 sky cover at 5,000 feet	7/8	BKN	BKN050	SCT000
Less than 1/8 sky cover at 500 feet				
Less than 1/8 sky cover at 2,000 feet	1/8	FEW		
3/8 sky cover at 3,000 feet	2/8	FEW		
less than 1/8 sky cover at 9,000 feet	5/8	BKN	FEW005 FEW020	
	6/8	BKN	BKN030 BKN090	
5/8 sky cover at 1,000 feet	5/8	BKN		
2/8 sky cover at 5,000 feet	7/8	BKN	BKN010 BKN050	
1/8 sky cover at 30,000 feet	8/8	OVC	OVC300	
1/8 sky cover at 1,000 feet (smoke aloft)	1/8	FEW		
2/8 sky cover at 5,000 feet	3/8	SCT	FEW010 SCT050	FU
1/8 sky cover at 35,000 feet	4/8	SCT	SCT350	FEW010
Sky hidden by snow, vertical visibility 1,000 feet	8/8	VV	VV010	
7/8 sky hidden by fog	7/8	BKN		FG
1/8 sky cover at 500 feet	8/8	OVC	BKN000 OVC005	BKN000

11.27. Layer Heights. The height of a layer will be the height of the cloud bases or obscurations for the layer being evaluated. Layers of clouds that are 50 feet or less above the surface must be reported as layers with a height of zero. At mountain locations, clouds below the level of the station may be observed and are reported with a height of ///. If available, a ceilometer must be used to determine the height of layers aloft and vertical visibility into obscuring phenomena. If a ceilometer is not available, layer heights should be obtained by an alternative method; for example, pilot report, etc. Known heights of unobscured portions of abrupt, isolated objects within 1 ½ SM of a runway can also be used to measure the heights of layers aloft. Heights of layers observed at the station must be reported in hundreds of feet above the surface (not above MSL), rounded to the nearest reportable increment. When a value falls halfway between two reportable increments, the lower value must be reported. Table 11-4: Increments of Reportable Values for Layer or Ceiling Heights, must be used to determine the reportable increments for layer heights. Observers should supplement layer data obtained from ceilometers by visual observations to determine that the instrumental values are representative of the layers to which they are ascribed.

Table 11-4: Increments of Reportable Values for Layer or Ceiling Heights

Range of Height Values (feet)	Reportable Increment (feet)
≤ 5,000	To nearest 100
> 5,000 but ≤ 10,000	To nearest 500
> 10,000	To nearest 1,000

11.28. Evaluation of Multiple Layers. Frequent observations are necessary to evaluate stratification. A series of observations will often show the existence of multiple layers. Through thin lower layers it may be possible to observe higher layers. Differences in the directions of cloud movements often aid in observing and differentiating cloud layers. Ceilometer returns may also be used to determine the existence of multiple layers. Observers should be aware of and use these guidelines to determine and evaluate multiple layers.

11.29. Amount of Obscuration. If a portion of the sky is not visible because of surface-based obscuring phenomena, the observer must determine the portion of sky (in eighths) that is not visible. The amount of sky obscured must be indicated as FEW, SCT or BKN, as appropriate, followed by three zeros (000). In remarks, the obscuring phenomena must precede the amount of obscuration and three zeros. For example, if 5/8ths of the sky is obscured by fog, BKN000 would be in the body of the observation, with FG BKN000 in the remarks section.

11.30. Determining Amount of Sky Cover. The summation amount of sky covered at and below each layer must be determined. Also, the amount of sky cover at and below the layer under evaluation must be determined. Surface-based obscuring phenomena must not be considered sky cover if the sky, higher clouds or obscuring phenomena aloft, or the moon or stars are visible through it.

11.31. Evaluation of Sky Cover Amounts. Sky cover amounts must be evaluated:

a. In eighths of coverage of the entire sky area above the horizon, and

b. In terms of the total amount of sky cover, and

c. With reference to an observation site as near as possible to the earth's surface.

11.32. Sky Cover Classification. Select the appropriate sky cover contraction or combination of contractions to be reported after evaluating the following:

a. Step 1. Estimate (to the nearest eighth) the amount of sky covered by the lowest layer present. If this layer is a surface-based obscuring phenomenon, determine only the amount of sky that is hidden. Transparent surface-based atmospheric phenomena do not constitute sky cover.

b. Step 2. Determine if additional layers of clouds and/or obscuring phenomena aloft are present above the lowest layer. Estimate the eighths of sky covered by each of these layers in combination with the lower layers. Do not add to the total coverage amounts visible through transparencies in lower layers, except those amounts of upper layers visible through transparent surface-based atmospheric phenomena.

c. Step 3. Repeat the evaluation in step 2 for each additional layer present in ascending order of height. Estimate the summation (in eighths) of sky covered by each layer, in combination with all lower layers.

11.33. Variable Sky Cover. The sky cover must be considered variable if it varies by one or more reportable classifications during the period it is being evaluated, for example, SCT V BKN. When a layer amount varies between reportable values during the time the amount is being evaluated, a variable sky condition remark must be included in the observation. The format of the remark is given in Paragraph 14.37 Variable Sky Condition (NsNsNs**(**hshshs)_V_NsNsNs).

11.34. Non-Uniform Sky Cover. Observers must be alert to variations in sky condition that are not reflected in the sky cover reported in the body of the observation. When non-uniform sky conditions are observed (for example, a significant lower ceiling in a particular direction from the station), the observer must describe the condition in the remarks section. Unless a height is available from a reliable source, the height must be described in relation to the heights reported in the body of the report. For example, CIG LWR N would indicate that ceilings are lower to the north.

11.35. Estimated Ceiling Heights. Ceiling heights may be estimated by any of the following methods:

a. Use of height reported by a pilot (converted from height above mean sea level to height above surface).

b. Use of known heights of unobscured portions of abrupt, isolated objects within 1 1/2 miles from any runway of the airport.

c. Use of observational experience; provided that other guides are lacking or, in the opinion of the observer, are considered to be unreliable.

11.36. Variable Ceiling Height. Rapid fluctuations of the ceilometer indications will indicate an irregular base whose height is measured, but also variable. When the height of a ceiling layer increases and decreases rapidly during the period of evaluation by the amounts given in Table 11-5: Criteria for Variable Ceiling, and the ceiling height is below 3,000 feet, it must be considered variable and the ascribed height must be the average of all the values. A remark must be included in the observation giving the range of variability (see Paragraph 14.35 Variable Ceiling Height (CIG_hnhnhnVhxhxhx)). Variable ceilings at or above 3,000 feet may be reported as variable only if considered operationally significant.

Table 11-5: Criteria for Variable Ceiling

Ceiling (feet)	Variation (feet)
≤ 1,000	≥ 200
> 1,000 and ≤ 2,000	≥ 400
> 2,000 and < 3,000	≥ 500

11.37. Significant Clouds. Observers must be alert for the occurrence of cumulonimbus, towering cumulus, altocumulus castellanus, standing lenticular, or rotor clouds and report them whenever they occur. These clouds may be reported by entering a remark in METAR and SPECI observations. The remark must contain the identification of the cloud, and (insofar as known) the direction and distance from the station and, for cumulonimbus clouds, the direction of movement. See Paragraph 14.38 Significant Cloud Type [PLAIN LANGUAGE] for detailed instructions on coding these remarks. Cumulonimbus (CB) or towering cumulus (TCU) must be appended to the appropriate layer in the body of the observation. When TCU or CB is appended to the layer report accompanied by the remark, "TCU NW" or "CB NW MOV E", it is implied that the TCU or CB is associated with the layer and within 10 SM. When TCU or CB is outside 10 SM, a DSNT remark is appropriate, for example, "TCU DSNT NW". (In this case, TCU or CB would not be appended to the layer in the body of the METAR.) Also, see Paragraph 14.38 Significant Cloud Type [PLAIN LANGUAGE].

NOTE-
Not required by LAWRS, may be reported if deemed operationally significant by the controller.

Chapter 12. Temperature and Dew Point

12.1. Introduction. This chapter describes procedures for observing and reporting temperature and dew point in a METAR or SPECI observation. The temperature data obtained using the procedures and practices in this chapter are normally in terms of the Celsius scale. However, temperature may be given in both degrees Fahrenheit and Celsius since some instruments may be marked in only one scale. Dew point must be calculated with respect to water at all temperatures.

Section 1. Definitions

12.2. Temperature

a. Temperature. The degree of hotness or coldness of the ambient air as measured by any approved instrument.

b. Dew Point. The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur, as measured by any approved instrument.

12.3. Psychrometer. A psychrometer is an instrument used to measure the water vapor content of the air.

12.4. Hygrothermometer. A hygrothermometer is an instrument system usually with readouts inside the weather office or observer's building for obtaining ambient temperature and dew point from remote sensors.

Section 2. Temperature and Dew Point Observing and Reporting Practices

12.5. General. The method of obtaining temperature and dew point varies according to the system in use at the station. The data may be read directly from digital or dial readouts. The observer must use the automated weather system for temperature and dewpoint, where available. Whenever the primary system is inoperative or determined to be in error, the observer must obtain the temperature and dewpoint from the station’s backup system. If no backup system is available, report the temperature or dewpoint as missing.

12.6. Maximum and Minimum Temperature. Automated systems report in remarks the maximum and minimum temperatures that occurred in the previous 6 hours to the nearest tenth of a degree Celsius for the 0000, 0600, 1200, and 1800 UTC observations. Automated systems determine and report the calendar day (LST) maximum and minimum temperatures to the nearest tenth of a degree Celsius. If the midnight LST observation is also a 6-hour synoptic observation, the system determines and reports both the 6-hour temperatures and the past 24-hour maximum and minimum temperatures. The format for reporting these temperatures is given in Paragraphs 14.54 6-Hourly Maximum Temperature (1snTxTxTx) (NA LAWRS) through 14.56 24-Hour Maximum and Minimum Temperature (4snTxTxTxsnTnTnTn) (NA LAWRS). The observer must obtain maximum and minimum temperature values from available equipment:

a. Maximum/Minimum Extremes. Obtain maximum/minimum temperature values from the primary automated weather system. This measurement is not backed up when the primary automated weather system does not report the maximum/minimum temperature.

12.7. Hygrothermometer (NA LAWRS). The observer must obtain psychometric data from the station's standby system whenever any of the following occur in relation to the station's hygrothermometer.

a. Errors that exceed 2°F (1.1° C) in ambient air temperature.

b. If the dew point is higher than the temperature, the observer must discontinue use of the sensor until it has been serviced and calibrated.

Chapter 13. Pressure

13.1. Introduction. This chapter presents procedures and practices to be followed for the measuring, recording, and reporting of pressure. Atmospheric pressure is the force exerted by the atmosphere at a given point. Section 1, Definitions, defines pressure related terminology, Section 2, Observing, Determining and Reporting Procedures (NA LAWRS), covers the procedures for observing, determining and reporting pressure at sites other than LAWRS. Observing, Determining and Reporting Procedures at LAWRS are covered in Appendix C.

Section 1. Definitions

13.2. Altimeter Setting (ALTSG). Altimeter setting defines the pressure value to which an aircraft altimeter scale is set so that the altimeter indicates the altitude above mean sea level of an aircraft on the ground at the location for which the value was determined. Altimeter setting must be reported in the body of all reports (METAR and SPECI). Other pressure data (including sea level pressure) must be reported in the remarks section only.

13.3. Atmospheric Pressure. Atmospheric pressure is the pressure exerted by the atmosphere at a given point. The various pressure parameters must be determined from the barometric pressure after appropriate corrections are applied. The method used must depend on the type of sensor and the available computational aids. These aids may be systems that result in a direct readout of the desired parameter.

13.4. Barometric Pressure. The atmospheric pressure measured by a barometer is barometric pressure. In this chapter, the term "barometric pressure" refers to the actual pressure sensor value. The sensor value may be an altimeter setting, station pressure, or simply a direct pressure value without applied corrections depending on the type of sensor.

13.5. Field Elevation, H_a. Field elevation, H_a, is the elevation of the highest point on any of the runways of the airport.

13.6. Pressure Altitude, PA (NA CWO). Pressure altitude is the altitude in feet, in the standard atmosphere, at which a given pressure will be observed. It is the indicated altitude of a pressure altimeter at an altitude setting of 29.92 inches (1013.2 hPa) of mercury and is therefore the indicated altitude above or below the 29.92 inches constant-pressure surface.

13.7. Pressure Change (NA LAWRS). Pressure change is the net difference between the barometric pressure at the beginning and end of a specified interval of time, usually the 3-hour period preceding an observation. If the pressure is rising or falling at a rate of at least 0.06 inch per hour and the pressure change totals 0.02 inch or more at the time of the observation, a pressure change remark must be reported.

13.8. Pressure Falling Rapidly (NA LAWRS). Pressure falling rapidly occurs when station pressure falls at the rate of at least .06 inch (2.03 hPa) or more per hour which totals 0.02 inch (0.68 hPa) or more at time of observation.

13.9. Pressure Rising Rapidly (NA LAWRS). Pressure rising rapidly occurs when station pressure rises at the rate of at least 0.06 inch (2.03 hPa) or more per hour which totals 0.02 inch (0.68 hPa) or more at time of observation.

13.10. Pressure Tendency (NA LAWRS). Pressure tendency is the pressure characteristic and amount of pressure change during a specified period of time, usually the 3-hour period preceding an observation. The pressure tendency includes two parts: the characteristic (an indication of how the pressure has been changing over the past three hours) and the amount of the pressure change in the past three hours. The characteristic must be based on the observed changes in pressure over the past three hours. The amount of pressure change is the absolute value of the change in station pressure or altimeter setting in the past three hours converted to tenths of hectopascals.

13.11. Sea Level Pressure. Sea level pressure is a pressure value obtained by the theoretical reduction of barometric pressure to sea level. Where the earth's surface is above sea level, it is assumed that the atmosphere extends to sea level below the station and that the properties of the hypothetical atmosphere are related to conditions observed at the station. Sea level pressure must be computed by Automated Systems With SPECI Capability and manual stations by adjusting the station pressure to compensate for the difference between the station elevation and sea level. This adjustment must be based on the station elevation and the 12-hour mean temperature at the station. The 12-hour mean temperature must be the average of the present ambient temperature and the ambient temperature 12 hours ago. Stations within $\pm$ 50 feet of sea level may be authorized to use a constant value to adjust station pressure to sea level pressure. When sea level pressure is missing at stations that would normally report sea level pressure, the remark SLPNO must be added in the remarks section. (See Paragraph 14.41 Sea-Level Pressure (SLPppp) (NA LAWRS).)

13.12. Standard Atmosphere. Standard atmosphere is a hypothetical vertical distribution of the atmospheric temperature, pressure, and density, which by international agreement is considered to be representative of the atmosphere for pressure-altimeter calibrations and other purposes.

13.13. Station Elevation, H_p. Station elevation, H_p, is the officially designated height above sea level to which station pressure pertains. There may be occasions when the station elevation differs from the field elevation.

13.14. Station Pressure (NA CWO). Station pressure is the atmospheric pressure at the assigned station elevation (H_p).

13.15. Density Altitude, DA. Density altitude, DA, is the pressure altitude corrected for virtual temperature deviations from the standard atmosphere.

13.16. Barometric Elevation, HZ. Barometer elevation (HZ) is the height of the pressure instrument(s) above mean sea level surveyed accurately to within one foot. At LAWRS, this height is posted on or immediately adjacent to the instrument(s).

13.17. Posted Pressure Correction. At LAWRS, posted pressure correction is the value added to the reading obtained from the station's ASI or DASI to correct it to a comparison standard.

Section 2. Observing, Determining, and Reporting Procedures (NA LAWRS)

13.18. General (NA LAWRS). The provisions of this section are not applicable at LAWRS. Procedures and practices to be followed at LAWRS are given in Appendix C. Observing procedures must include the reading of pressure instruments together with the correction of pressure values. Instructions for determining station pressure are given first, followed by instructions for deriving other forms of pressure data, including significant pressure changes and tendencies. Details regarding the adjustment and reading of pressure measuring equipment are given in Chapter 16. Operation of Equipment. (See Table 13-1: Units of Measure of Pressure Parameters.)

Table 13-1: Units of Measure of Pressure Parameters

Parameter	Units of Measure
Altimeter Setting	Inches of Mercury
Sea Level Pressure	Hectopascals
Station Pressure	Inches of Mercury

13.19. Rounding Pressure Values. When computations of pressure values require that a number be rounded to comply with standards on reportable values, the number must be rounded down to the next reportable value. For example, an altimeter reading of 29.248 inches becomes 29.24 and a station pressure reading of 29.249 inches becomes 29.245.

13.20. Barometers Used to Measure Station Pressure (NA LAWRS/NA CWO). Common pressure measuring instruments are listed in Table 13-2: Barometers Used. Automated systems with SPECI capability, automated systems without SPECI capability, DASIs, and electronic pressure transducers are highly accurate pressure standards and operational barometers that require very little or no correction by the human observer. This equipment has replaced the mercury barometer as the station pressure standard. Procedures for using some of these instruments for the determination of station pressure follow in Paragraphs 13.21 through 13.25.

Table 13-2: Barometers Used

Commissioned Automated Systems with SPECI Capability,
Commissioned Automated Systems without SPECI Capability,
Commissioned Electronic Pressure Transducer,
Precision Aneroid,
Altimeter Setting Indicator (ASI),
Digital Altimeter Setting Indicator (DASI)

13.21. Precision Aneroid (NA LAWRS/NA CWO)

a. Step 1. Tap the face of the instrument lightly with the finger to reduce the effect of friction.

b. Step 2. Read the scale at the pointer, to the nearest 0.005 inch or 0.1 hPa, estimating values between the graduations.

c. Step 3. Apply the posted correction. (See local procedures.)

13.22. Altimeter Setting (NA LAWRS/NA CWO). When using an altimeter setting indicator to determine station pressure, the observer must read the altimeter setting indicator to the nearest 0.005 inch (0.17 hPa) and apply the posted correction. The station pressure must be computed by use of a pressure reduction computer, reduction constant, or altimeter setting table in accordance with the following:

a. Pressure Reduction Computer. The steps for obtaining altimeter setting as printed on the yellow (No. II) side of the computer must be followed in reverse order.

b. Reduction Constant. At low level stations for which an altimeter setting reduction constant has been authorized, the observer must subtract the constant from the altimeter setting and round the remainder to the nearest .005 inch (0.17 hPa) to obtain the station pressure.

c. Altimeter Setting Table.

(1) Use of these tables is authorized at specially designated facilities and at facilities for which a reduction constant or a pressure reduction computer is not available.

(2) At authorized facilities, the observer must find in the altimeter setting table the tabular value which equals the altimeter setting, interpolating to the nearest 0.005 inch (0.17 hPa) when appropriate. The station pressure is the sum of the two station pressure components which correspond to the altimeter setting (that is, the sum of inches and tenths from the left-hand margin, and hundredths or five thousands from the heading of the table).

13.23. Digital Altimeter Setting Indicator (DASI) (NA LAWRS). The primary purpose of the DASI is to obtain an altimeter setting. However, station pressure may also be obtained. The operation of this instrument requires a visual observation of the display and the reporting of the display readout.

13.24. Sea Level Pressure. Sea Level Pressure is provided via the automated weather system. If other agencies determine a need to provide sea level pressure, they must follow their own directives.

13.25. Determining Altimeter Setting (NA LAWRS). The observer must determine the altimeter setting for all observations. The altimeter setting must be determined again, when necessary, to meet local requirements. Altimeter setting values should be obtained or derived from one of the following types of instruments:

a. A commissioned DASI, Automated Systems With SPECI Capability, or Automated Systems Without SPECI Capability.

b. A properly calibrated precision aneroid barometer or altimeter setting indicator.

13.26. Method of Determining Altimeter Setting (NA LAWRS). Altimeter setting must be determined from a certified accurate DASI, Automated Systems with SPECI Capability, Automated Systems without SPECI Capability or a properly calibrated altimeter setting indicator, if one is available. At facilities where this equipment is not available, the altimeter setting must be computed by using a computer, constant, or table.

13.27. Altimeter Setting Indicator (NA LAWRS). The following procedures must be followed when using a nondigital (analog) altimeter setting indicator to determine the altimeter setting:

a. Lightly tap the face of the instrument with the finger to reduce the effect of friction.

b. Read the pressure scale of the indicator at the pointer to the nearest 0.005 inch.

c. Add this reading to the posted correction.

d. Use the sum of the reading and correction, rounded down to the next lower 0.005 inch, when computing the station pressure or pressure altitude from the altimeter setting. Round to the next lower inch and hundredths of an inch when recording and reporting the altimeter setting.

13.28. Pressure Reduction Computer and Altimeter Setting (NA LAWRS). The altimeter setting must be computed in inches and hundredths, using the station pressure to the nearest 0.005 inch and the instructions on the No. II side of the computer.

13.29. Altimeter Setting Reduction Constant (NA LAWRS). At low-level facilities for which an altimeter setting reduction constant has been authorized, the observer must add the constant to the station pressure and round to inches and hundredths of an inch to obtain the altimeter setting.

13.30. Altimeter Setting Table (NA LAWRS). At authorized facilities, the observer must find the altimeter setting in inches and hundredths of an inch corresponding to the station pressure to the nearest 0.005 inch from an altimeter setting table as illustrated in Table 13-3: Portion of an Altimeter Setting Table.

Table 13-3: Portion of an Altimeter Setting Table

Station Pressure (inches)	.00	.01	.02	.03	.04
27.60	29.06	29.07	29.08	29.10	29.11
27.70	29.17	29.18	29.19	29.20	29.21

EXAMPLE-

1. *Given: Station Pressure 27.730" value from table found on line for 27.70 and in column headed 0.03 = 29.20"*

2. *Given: Station Pressure 27.625" value from table found on line for 27.60 and interpolated between columns headed .02 and .03 = 29.09"*

3. *Given: Station Pressure 27.615" value from table found on line for 27.60 and interpolated between columns headed .01 and .02 = 29.075". 29.075" value is rounded to nearest .01 inch = 29.08"*

13.31. Pressure Altitude (PA) (NA LAWRS/NA CWO). The observer must compute pressure altitude as frequently as necessary to meet local needs. The observer must use the station pressure or the altimeter setting, either one to the nearest 0.005 inch (0.17 hPa) in the computations. The military and other agencies involved in aviation require the pressure altitude with reference to the field elevation (H_a). In view of this requirement, the observer should select the most convenient of the methods given below, considering availability of station pressure and altimeter setting data and whether or not station elevation (H_p) is equal to H_a.

13.32. Local Pressure Altitude Tables (NA LAWRS/NA CWO). Special local pressure altitude tables may be prepared for specific locations that are required to use a variable removal correction. Such tables, including temperature corrections, are required for accurate results at locations where the station elevation differs from H_a by approximately 30 feet or more, depending on local variations of temperature from standard atmospheric conditions.

13.33. Altimeter Setting and Pressure Reduction Computer (NA LAWRS/NA CWO). The altimeter setting may be converted to the pressure altitude with the Pressure Reduction Computer No. II side as follows:

a. The observer should set the field elevation on the H scale opposite the altimeter setting on the P, A.S. scale.

b. The observer should read the pressure altitude on the H scale opposite the 29.92 inch graduation index of the P, A.S. scale.

c. Since the computer has two overlapping H scales, the following criteria should be used in selecting the proper pressure altitude value from these scales:

(1) If the altimeter setting reads lower than 29.92", the pressure altitude will be higher than the elevation of the field.

(2) If the altimeter setting reads higher than 29.92", the pressure altitude will be lower than the field elevation.

(3) The pressure altitude will differ from the field elevation by approximately 900 to 1,000 feet for each inch of difference between the altimeter setting and 29.92".

EXAMPLE-
Given: Field elevation 2,963 feet and altimeter setting 30.045 inches. Find the field elevation value of 2,963 on the H scale and set opposite to the altimeter setting value of 30.045" on the P, A.S. scale. Pressure altitude read on the H scale opposite the 29.92" graduation of the P, A.S. scale is 2,848 feet.

13.34. Altimeter Setting and Pressure Altitude Table (NA LAWRS/NA CWO)

a. Table 13-4: Pressure Altitude, or other equivalent standard atmosphere tables may be used to obtain the pressure altitude. Computations based upon the altimeter setting yield pressure altitude with reference to the field elevation (H_a). When using this table, the observer should find in the body of the

table the value corresponding to the altimeter setting and add the field elevation to this value to obtain the pressure altitude.

b. A portion of a Standard Atmosphere Table giving tabular values of pressure altitude is shown in Table 13-4: Pressure Altitude. An example of determining the pressure altitude using a Standard Atmosphere Table is shown below.

EXAMPLE-
Given: Field elevation 2,963 feet and altimeter setting 30.045 inches. Using the table and altimeter setting: Value from table found on line for 30.00 inches and interpolating between columns headed .04 and .05 is -115; add the field elevation and obtain 2,848 feet (that is, -115 + 2963 = 2848).

13.35. Station Pressure and Pressure Reduction Computer (NA LAWRS/NA CWO). The station pressure may be converted to the pressure altitude at the station elevation by using instructions and scales on the No. II side of the Pressure Reduction Computer.

EXAMPLE-
Given: Station Pressure 26.965 inches. Using computer: Set the zero elevation graduation of the H scale opposite 26.965" on the P, A.S. scale. Pressure altitude read on the H scale opposite the 29.92" graduation of the P, A.S. scale is 2850 feet.

13.36. Station Pressure and Pressure Altitude Table (NA LAWRS/NA CWO). This computation, made by direct conversion of station pressure, yields pressure altitude with reference to the station elevation, H_p.

EXAMPLE-
Given: Station Pressure 26.965 inches and value from table found on line 26.90" and interpolating between columns headed .06 and .07 is 2850 feet.

Table 13-4: Pressure Altitude

Standard Atmosphere Table in accordance with specifications of ICAO -- Tabular values give altitude (in feet) in the standard atmosphere as a function of pressure (inches of mercury, shown as side and top argument). Note: Altitudes are strictly in terms of "standard geopotential feet."										
Pressure, inches of mercury	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
20.0	10731	10718	10705	10692	10680	10667	10654	10641	10629	10616
20.1	10603	10590	10577	10565	10552	10539	10526	10514	10501	10488
20.2	10476	10463	10450	10437	10425	10412	10399	10387	10374	10361
20.3	10349	10336	10323	10311	10298	10285	10273	10260	10248	10235
20.4	10222	10210	10197	10185	10172	10159	10147	10134	10122	10109
20.5	10096	10084	10071	10059	10046	10034	10021	10009	9996	9984
20.6	9971	9959	9946	9934	9921	9909	9896	9884	9871	9859
20.7	9846	9834	9821	9809	9796	9784	9772	9759	9747	9734
20.8	9722	9709	9697	9685	9672	9660	9647	9635	9623	9610
20.9	9598	9586	9573	9561	9549	9536	9524	9512	9499	9487
21.0	9475	9462	9450	9438	9425	9413	9401	9388	9376	9364
21.1	9352	9339	9327	9315	9303	9290	9278	9266	9254	9241
21.2	9229	9217	9205	9192	9180	9168	9156	9144	9131	9119
21.3	9107	9095	9083	9071	9058	9046	9034	9022	9010	8998
21.4	8986	8973	8961	8949	8937	8925	8913	8901	8889	8877
21.5	8864	8852	8840	8828	8816	8804	8792	8780	8768	8756

Standard Atmosphere Table in accordance with specifications of ICAO -- Tabular values give altitude (in feet) in the standard atmosphere as a function of pressure (inches of mercury, shown as side and top argument). Note: Altitudes are strictly in terms of "standard geopotential feet."

Pressure, inches of mercury	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
21.6	8744	8732	8720	8708	8696	8684	8672	8660	8648	8636
21.7	8624	8612	8600	8588	8576	8564	8552	8540	8528	8516
21.8	8504	8492	8480	8468	8456	8444	8432	8420	8408	8397
21.9	8385	8373	8361	8349	8337	8325	8313	8301	8289	8278
22.0	8266	8254	8242	8230	8218	8206	8195	8183	8171	8159
22.1	8147	8136	8124	8112	8100	8088	8076	8065	8053	8041
22.2	8029	8018	8006	7994	7982	7971	7959	7947	7935	7924
22.3	7912	7900	7888	7877	7865	7853	7841	7830	7818	7806
22.4	7795	7783	7771	7760	7748	7736	7725	7713	7701	7690
22.5	7678	7666	7655	7643	7631	7620	7608	7597	7585	7573
22.6	7562	7550	7538	7527	7515	7504	7492	7481	7469	7457
22.7	7446	7434	7423	7411	7400	7388	7376	7365	7353	7342
22.8	7330	7319	7307	7296	7284	7273	7261	7250	7238	7227
22.9	7215	7204	7192	7181	7169	7158	7146	7135	7124	7112
23.0	7101	7089	7078	7066	7055	7043	7032	7021	7009	6998
23.1	6986	6975	6964	6952	6941	6929	6918	6907	6895	6884
23.2	6873	6861	6850	6839	6827	6816	6804	6793	6782	6770
23.3	6759	6748	6736	6725	6714	6703	6691	6680	6669	6657
23.4	6646	6635	6624	6612	6601	6590	6578	6567	6556	6545
23.5	6533	6522	6511	6500	6488	6477	6466	6455	6444	6432
23.6	6421	6410	6399	6388	6376	6365	6354	6343	6332	6320
23.7	6309	6298	6287	6276	6265	6253	6242	6231	6220	6209
23.8	6198	6187	6176	6164	6153	6142	6131	6120	6109	6098
23.9	6087	6076	6064	6053	6042	6031	6020	6009	5998	5987
24.0	5976	5965	5954	5943	5932	5921	5910	5899	5888	5877
24.1	5866	5854	5843	5832	5821	5810	5799	5788	5777	5766
24.2	5756	5745	5734	5723	5712	5701	5690	5679	5668	5657
24.3	5646	5635	5624	5613	5602	5591	5580	5569	5558	5548
24.4	5537	5526	5515	5504	5493	5482	5471	5460	5449	5439
24.5	5428	5417	5406	5395	5384	5373	5363	5352	5341	5330
24.6	5319	5308	5297	5287	5276	5265	5254	5243	5233	5222
24.7	5211	5200	5189	5179	5168	5157	5146	5135	5125	5114
24.8	5103	5092	5082	5071	5060	5049	5039	5028	5017	5006
24.9	4996	4985	4974	4963	4953	4942	4931	4921	4910	4899
25.0	4888	4878	4867	4856	4846	4835	4824	4814	4803	4792
25.1	4782	4771	4760	4750	4739	4728	4718	4707	4696	4686
25.2	4675	4665	4654	4643	4633	4622	4611	4601	4590	4580
25.3	4569	4559	4548	4537	4527	4516	4506	4495	4484	4474
25.4	4463	4453	4442	4432	4421	4411	4400	4389	4379	4368
25.5	4358	4347	4337	4326	4316	4305	4295	4284	4274	4263
25.6	4253	4242	4232	4221	4211	4200	4190	4179	4169	4158
25.7	4148	4138	4127	4117	4106	4096	4085	4075	4064	4054
25.8	4044	4033	4023	4012	4002	3991	3981	3971	3960	3950
25.9	3939	3929	3919	3908	3898	3888	3877	3867	3856	3846
26.0	3836	3825	3815	3805	3794	3784	3774	3763	3753	3743
26.1	3732	3722	3712	3701	3691	3681	3670	3660	3650	3639
26.2	3629	3619	3608	3598	3588	3578	3567	3557	3547	3537
26.3	3526	3516	3506	3495	3485	3475	3465	3454	3444	3434
26.4	3424	3414	3403	3393	3383	3373	3362	3352	3342	3332
26.5	3322	3311	3301	3291	3281	3271	3260	3250	3240	3230
26.6	3220	3210	3199	3189	3179	3169	3159	3149	3138	3128
26.7	3118	3108	3098	3088	3078	3067	3057	3047	3037	3027
26.8	3017	3007	2997	2987	2976	2966	2956	2946	2936	2926
26.9	2916	2906	2896	2886	2876	2866	2855	2845	2835	2825

Standard Atmosphere Table in accordance with specifications of ICAO -- Tabular values give altitude (in feet) in the standard atmosphere as a function of pressure (inches of mercury, shown as side and top argument). Note: Altitudes are strictly in terms of "standard geopotential feet."

Pressure, inches of mercury	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
27.0	2815	2805	2795	2785	2775	2765	2755	2745	2735	2725
27.1	2715	2705	2695	2685	2675	2665	2655	2645	2635	2625
27.2	2615	2605	2595	2585	2575	2565	2555	2545	2535	2525
27.3	2515	2505	2495	2485	2475	2465	2455	2445	2435	2426
27.4	2416	2406	2396	2386	2376	2366	2356	2346	2336	2326
27.5	2316	2307	2297	2287	2277	2267	2257	2247	2237	2227
27.6	2218	2208	2198	2188	2178	2168	2158	2148	2139	2129
27.7	2119	2109	2099	2089	2080	2070	2060	2050	2040	2030
27.8	2021	2011	2001	1991	1981	1972	1962	1952	1942	1932
27.9	1923	1913	1903	1893	1884	1874	1864	1854	1844	1835
28.0	1825	1815	1805	1796	1786	1776	1766	1757	1747	1737
28.1	1727	1718	1708	1698	1689	1679	1669	1659	1650	1640
28.2	1630	1621	1611	1601	1592	1582	1572	1562	1553	1543
28.3	1533	1524	1514	1504	1495	1485	1475	1466	1456	1446
28.4	1437	1427	1417	1408	1398	1389	1379	1369	1360	1350
28.5	1340	1331	1321	1312	1302	1292	1283	1273	1264	1254
28.6	1244	1235	1225	1216	1206	1196	1187	1177	1168	1158
28.7	1149	1139	1129	1120	1110	1101	1091	1082	1072	1063
28.8	1053	1044	1034	1024	1015	1005	996	986	977	967
28.9	958	948	939	929	920	910	901	891	882	872
29.0	863	853	844	834	825	815	806	796	787	778
29.1	768	759	749	740	730	721	711	702	693	683
29.2	674	664	655	645	636	627	617	608	598	589
29.3	579	570	561	551	542	532	523	514	504	495
29.4	486	476	467	457	448	439	429	420	411	401
29.5	392	382	373	364	354	345	336	326	317	308
29.6	298	289	280	270	261	252	242	233	224	215
29.7	205	196	187	177	168	159	149	140	131	122
29.8	112	103	94	85	75	66	57	47	38	29
29.9	20	10	1	-8	-17	-27	-36	-45	-54	-64
30.0	-73	-82	-91	-100	-110	-119	-128	-137	-146	-156
30.1	-165	-174	-183	-193	-202	-211	-220	-229	-238	-248
30.2	-257	-266	-275	-284	-294	-303	-312	-321	-330	-339
30.3	-348	-358	-367	-376	-385	-394	-403	-413	-422	-431
30.4	-440	-449	-458	-467	-476	-486	-495	-504	-513	-522
30.5	-531	-540	-549	-558	-567	-577	-586	-595	-604	-613
30.6	-622	-631	-640	-649	-658	-667	-676	-686	-695	-704
30.7	-713	-722	-731	-740	-749	-758	-767	-776	-785	-794
30.8	-803	-812	-821	-830	-839	-848	-857	-866	-875	-884
30.9	-893	-902	-911	-920	-929	-938	-947	-956	-965	-974
31.0	-983	-992	-1001	-1010	-1019	-1028	-1037	-1046	-1055	-1064
31.1	-1073	-1082	-1091	-1100	-1109	-1118	-1127	-1136	-1145	-1154
31.2	-1163	-1172	-1181	-1189	-1198	-1207	-1216	-1225	-1234	-1243
31.3	-1252	-1261	-1270	-1279	-1288	-1297	-1305	-1314	-1323	-1332
31.4	-1341	-1350	-1359	-1368	-1377	-1385	-1394	-1403	-1412	-1421
31.5	-1430	-1439	-1448	-1456	-1465	-1474	-1483	-1492	-1501	-1510-
31.6	-1518	-1527	-1536	-1545	-1554	-1563	-1571	-1580	-1589	1598
31.7	-1607	-1616	-1624	-1633	-1642	-1651	-1660	-1669	-1677	-1686
31.8	-1695	-1704	-1713	-1721	-1730	-1739	-1748	-1757	-1765	-1774
31.9	-1783	-1792	-1800	-1809	-1818	-1827	-1836	-1844	-1853	-1862
32.0	-1871	-1879	-1888	-1897	-1906	-1914	-1923	-1932	-1941	-1949
32.1	-1958	-1967	-1976	-1984	-1993	-2002	-2010	-2019	-2028	-2037
32.2	-2045	-2054	-2063	-2071	-2080	-2089	-2098	-2106	-2115	-2124
32.3	-2132	-2141	-2150	-2158	-2167	-2176	-2184	-2193	-2202	-2210
32.4	-2219	-2228	-2236	-2245	-2254	-2262	-2271	-2280	-2288	-2297

Standard Atmosphere Table in accordance with specifications of ICAO -- Tabular values give altitude (in feet) in the standard atmosphere as a function of pressure (inches of mercury, shown as side and top argument). Note: Altitudes are strictly in terms of "standard geopotential feet."										
Pressure, inches of mercury	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
32.5	-2306	-2314	-2323	-2332	-2340	-2349	-2358	-2366	-2375	-2384
32.6	-2392	-2401	-2409	-2418	-2427	-2435	-2444	-2452	-2461	-2470
32.7	-2478	-2487	-2496	-2504	-2513	-2521	-2530	-2539	-2547	-2556
32.8	-2564	-2573	-2581	-2590	-2599	-2607	-2616	-2624	-2633	-2641
32.9	-2650	-2659	-2667	-2676	-2684	-2693	-2701	-2710	-2718	-2727

13.37. Pressure Related Remarks (NA LAWRS). Each significant change in barometric pressure and its characteristics must be recorded in the remarks section and transmitted.

13.38. Pressure Falling Rapidly (NA LAWRS). Whenever the pressure is falling at the rate of 0.06 inch (2.03 hPa) or more per hour with a total fall of at least 0.02 inch (0.68 hPa) at the time of an observation, the observer must report PRESFR in the remarks section.

13.39. Pressure Rising Rapidly (NA LAWRS). Whenever the pressure is rising at the rate of 0.06 inch (2.03 hPa) or more per hour with a total of at least 0.02 inch (0.68 hPa) at the time of observation, the observer must report PRESRR in the remarks section.

13.40. Pressure Tendency (NA LAWRS). The barometric pressure tendency comprises two elements.

a. The characteristic of the change during the period, based on:

(1) The appearance of the barogram

(2) The direction of change, if any (that is, higher, lower, or no change)

b. The net change within a specified time

13.41. Frequency of Pressure Tendency Remark (NA LAWRS). Pressure tendencies should be determined at the time of each 3- and 6-hour observation. At facilities equipped with a barograph, determine the elements from the trace for the full 3-hour period at the actual time of the observation. Facilities not equipped with a barograph must determine the pressure tendencies from the trend of the altimeter settings entered in column 13 of MF1M-10C.

13.42. Determining Pressure Change (NA LAWRS/NA CWO). Determine the net change in station pressure for the preceding 3 hours to the nearest 0.005 inch by subtraction using the appropriate entries in column 22 (Station Pressure) of MF1M-10C. If an observation was not taken 3 hours earlier, determine the change from the barogram. If the station does not possess a barograph and no observation was taken 3 hours earlier, the pressure change will be considered indeterminable and will not be reported.

13.43. Determining Pressure Tendency Characteristic (NA LAWRS). Using the code figures in Table 14-9, choose the figure which best describes the pattern that would be traced on a barograph during the past 3 hours. This is done as follows:

a. Determine if the present pressure is higher, the same, or lower than 3 hours ago. Find this designation under the Primary Requirements column. This gives the possible code figures.

b. Apply the Description column to arrive at the proper code figure. If there is ambiguity in code figures, choose the one which best describes the latter part of the trace.

c. Facilities not possessing a barograph must determine the characteristic of the trace from altimeter settings recorded in column 13, MF1M-10C, and encode the most appropriate code figure. If an observation was not taken 3 hours earlier and the station does not possess a barograph, the characteristic will be considered indeterminable and not reported.

13.44. The provisions of this section are applicable only at LAWRS.

13.45. The only pressure related measurement required at LAWRS is the altimeter setting.

Chapter 14. Coding and Dissemination

14.1. Introduction. This chapter contains procedures for coding the aviation weather observation for dissemination. The types of dissemination and the general requirements for verifying and making corrections to disseminated observations are also discussed.

14.2. Definitions

a. Contractions. A shortened form of a word, title, or phrase used for the purpose of brevity.

b. COR. A contraction used to indicate that the observation is a correction to a previously disseminated observation.

c. Dissemination. In this order, dissemination is the act of delivering a completed weather report to users.

d. FIBI. A contraction for a weather observation that is "filed, but impracticable to transmit."

e. Local Dissemination. The transmission or delivery of a weather report to users in the service area of the weather station.

f. Long-line Dissemination. The transmission of a weather report by any communication network beyond the service area of the weather station, on a regional or national scale.

14.3. Aviation Weather Reports Code. The METAR/SPECI report has two major sections: the body (consisting of a maximum of 11 groups) and the remarks section (consisting of a maximum of two categories). Together, they make up the complete METAR/SPECI report and, in general, are coded as in Table 14-1.

Table 14-1: Content of METAR/SPECI

Elements in the Body of the Report	Reference	METAR/SPECI
Type of Report (METAR/SPECI)	14-7	X
Station Identifier (CCCC)	14-8	X
Date/Time (YYGGggZ)	14-9	X
Report Modifier (AUTO/COR)	14-10	X[1]
Wind (dddff(f)Gf_m f_m(f_m)KT) ($d_nd_nd_nVd_xd_xd_x$)	14-11	X
Visibility (VVVVVSM)	14-12	X
Runway Visual Range ($RD_RD_R/V_RV_RV_RV_RFT$) or ($RD_RD_R/V_nV_nV_nV_nVV_XV_XV_XV_XFT$)	14-13	A/B
Present Weather (w'w')	14-14	X
Sky Condition ($N_sN_sN_sh_sh_sh_s$ or $VVh_sh_sh_s$ or CLR or SKC)	14-15	X
Temperature/Dew Point (T'T'/$T'_dT'_d$)	14-16	X
Altimeter ($AP_HP_HP_HP_H$)	14-17	X
Categories in Remarks	**Reference**	**METAR/SPECI**
Automated, Manual, and Plain Language	14-19	See Table 3-1 for a detailed breakout of
Additive and Maintenance Data	14-46	

Elements in the Body of the Report	Reference	METAR/SPECI
		remarks
X - Indicates element included at all facilities. X^1 – AUTO for automated stations only, COR for augmented stations with corrections. A/B – Service Level A and B (where so equipped).		

14.4. Format and Content of the METAR/SPECI Report. Table 14-2: METAR or SPECI Code Format, outlines the format of the METAR/SPECI code. The actual content of a surface observation depends on the observation reporting guidelines at the individual facility as defined in Chapter 2. The 0000, 0600, 1200, and 1800 UTC METAR reports include additional data and are known as 6-hourly reports. The 0300, 0900, 1500, and 2100 UTC METAR reports are known as 3-hourly reports and also contain additional information.

Table 14-2: METAR or SPECI Code Format

METAR or SPECI Code Format
METAR or SPECI_CCCC_YYGGggZ_AUTO or COR_ddd ff(f)G$f_m f_m$(f_m)KT_$d_n d_n d_n$V$d_x d_x d_x$_VVVVVSM_$RD_R D_R$/$V_R V_R V_R V_R$FT or $RD_R D_R$/$V_n V_n V_n V_n$V$V_X V_X V_X V_X$FT_w'w'_$N_s N_s N_s h_s h_s h_s$ or VV$h_s h_s h_s$ or SKC or CLR_T'T'/T'$_d$T'$_d$_A$P_H P_H P_H P_H$_RMK_(Automated, manual and plain language)_(Additive data and automated maintenance indicators)
NOTE- *1. The underscore character (_) indicates a required space.* *2. The solidus "/" indicates a required solidus.*

14.5. Coding Missing Data in METAR and SPECI Reports. When an element or phenomenon does not occur, or cannot be observed, the corresponding group and preceding space are omitted from that particular report. However, at stations where sea-level pressure is normally reported, when sea-level pressure is not available it must not be omitted, but must be coded as SLPNO.

14.6. Coding the Body of the METAR or SPECI Report. Table 14-1: Content of METAR/SPECI, indicates the applicability of the elements in the body of the surface observation. References in the figure indicate the sections where the elements are discussed and explained. The figure also indicates whether or not the element must be included in METAR and SPECI reports.

14.7. Type of Report (METAR or SPECI). The type of report, METAR or SPECI, must be included in all reports. The type of report must be separated from elements following it by a space. When SPECI criteria are met at the time of a routine report (METAR), the type of the report must be METAR.

14.8. Station Identifier (CCCC). The station identifier, CCCC, must be included in all reports to identify the station to which the coded report applies. The station identifier must consist of four alphabetic-only characters if the METAR/SPECI is transmitted long-line. A list of approved identifiers can be found in the latest version of FAA Order 7350.7, Location Identifiers. The station identifier must be separated from elements following it with a space.

14.9. Date and Time of Report (YYGGggZ). The date, YY, and time, GGgg, must be included in all reports. The time must be the actual time of the report or when the criteria for a SPECI is met or noted. If the report is a correction to a previously disseminated report, the time of the corrected report must be the same time used in the report being corrected. The date and time group always ends with a "Z" indicating the use of UTC.

EXAMPLE-
0900 scheduled report from KDCA should be taken at 0855 UTC on the 21st of the month: KDCA 210855Z

14.10. Report Modifier (AUTO or COR). The Report Modifier can be either of two elements:

a. **"AUTO"** further identifies the type of report as a fully automated report with no human intervention. The report modifier group does not appear in all reports; the absence of AUTO indicates that the report is either a manual report or an automated report with an observer "logged on" to the system.

b. **"COR"** must be entered into the report modifier group when a corrected METAR or SPECI is transmitted.

c. **AUTO** and **COR** will not be seen in the same observation. If the term **COR** is used, the observation cannot be **AUTO**, because an observer is correcting it.

14.11. Wind Group ((dddff(f)G$f_m f_m(f_m)$KT)_($d_n d_n d_n V d_x d_x d_x$)). The true direction, ddd, from which the wind is blowing is coded in tens of degrees using three figures. Directions less than 100 degrees are preceded by a "0", for example, a wind direction of 90° is coded as "090." The wind speed, ff(f), is entered as a two or three digit group immediately following the wind direction. The speed is coded in whole knots using the hundreds digit (if not zero) and the tens and units digits. The wind group always ends with KT to indicate that wind speeds are reported in knots. Speeds of less than 10 knots are coded using a leading zero.

EXAMPLES-
Wind speed of 8 knots: 08KT
Wind speed of 112 knots: 112KT

a. **Gust**. Wind gusts are coded in the format G$f_m f_m(f_m)$. The wind gust is coded in two or three digits immediately following the wind speed. The wind gust is coded, in whole knots, using the units and tens digits and, if required, the hundreds digit.

EXAMPLE-
A wind from due west at 20 knots with gusts to 35 knots: 27020G35KT

b. **Variable Wind Direction (Speeds 6 Knots or Less)**. The wind direction may be reported as VRB (variable) in place of the ddd whenever the wind speed is 6 knots or less.

EXAMPLE-
Wind variable at 3 knots: VRB03KT

c. **Variable Wind Direction (Speeds Greater than 6 Knots)**. Variable wind direction with wind speed greater than 6 knots is coded in the format, $d_n d_n d_n V d_x d_x d_x$. The variable wind direction

group must immediately follow the wind group preceded by a blank space. The directional variability is coded in a clockwise direction.

EXAMPLE-
Wind variable from 180° to 240° at 10 knots: 21010KT 180V240

d. Calm Wind. Calm wind is coded as "00000KT".

14.12. Visibility Group (VVVVVSM). The surface visibility, VVVVVSM, is coded in statute miles using the values listed in Table 14-3. A space is coded between whole numbers and fractions of reportable visibility values. The visibility group always ends in SM to indicate that visibilities are in statute miles. Only automated stations may use an "M" to indicate "less than" when reporting visibility.

EXAMPLES-
One and a half mile visibility: 1 1/2SM
Visibility less than one-quarter SM as reported by an automated station: M1/4SM

Table 14-3: Reporting Visibility Values

Source of Visibility Report							
Automated[1]			**Manual**				
M1/4	2	9	0	5/8	1 5/8	4	12
¼	2 1/2	10	1/16	3/4	1 3/4	5	13
½	3		1/8	7/8	1 7/8	6	14
¾	4		3/16	1	2	7	15
1	5		1/4	1 1/8	2 1/4	8	20
1 ¼	6		5/16	1 1/4	2 1/2	9	25
1 ½	7		3/8	1 3/8	2 3/4	10	30
1 ¾	8		1/2	1 1/2	3	11	35[2]

[1] Visibility values of 0, 1/8, and 1/16 can be augmented in the visibility field of automated systems with SPECI capability to meet service level requirements.
[2] Further increments of 5SM may be reported, that is, 40, 45, 50, etc.

14.13. Runway Visual Range Group ($RD_RD_R/V_RV_RV_RV_RFT$) or ($RD_RD_R/V_nV_nV_nV_nVV_xV_xV_xV_xFT$) (NA LAWRS)

a. At service level A and B sites (where so equipped), RVR is coded in the format $RD_RD_R/V_RV_RV_RV_RFT$ where R indicates that the runway number follows, D_RD_R is the runway number (an additional DR may be used for runway approach directions, such as R for right, L for left and C for center), $V_RV_RV_RV_R$ is the constant reportable value, and FT indicates that units of measurement are feet.

b. RVR that is varying is coded in the format, $RDRDR/V_nV_nV_nV_nVV_xV_xV_xV_xFT$, where R indicates that the runway number follows, D_RD_R is the runway number (an additional D_R may be used for runway approach directions, such as R for right, L for left and C for center), $V_nV_nV_nV_n$ is the lowest reportable value in feet, V separates lowest and highest visual range values, $V_xV_xV_xV_x$ is the highest reportable value, and FT indicates that units of measurement are feet.

EXAMPLE-
The 10-minute RVR for runway 01L varying between 600 and 1,000 feet: R01L/0600V1000FT

c. The values must be based on light setting 5 at manual stations. RVR values must be coded in increments of 100 feet up to 1,000 feet, increments of 200 feet from 1,000 feet to 3,000 feet and in increments of 500 feet from 3,000 feet to 6,000 feet. Manual RVR must not be reported below 600 feet. For automated stations, RVR may be reported for up to four designated runways. If the RVR is less than its lowest reportable value, the $V_RV_RV_RV_R$ or $V_nV_nV_nV_n$ groups must be preceded by M. If the RVR is greater than its highest reportable value, the $V_RV_RV_RV_R$ or $V_nV_nV_nV_n$ groups must be preceded by a P.

(1) For an RVR with older (transmissometer) technology:

EXAMPLES-
An RVR for runway 01L of less than 600 feet: R01L/M0600FT
An RVR of greater than 6,000 feet: R01L/P6000FT

(2) For the New Generation RVR, the report would be similar, except that the lowest and highest values would be replaced by 100 and 6,500 feet, respectively.

14.14. Present Weather Group (w'w')

a. The appropriate notations in Table 14-4: Present Weather, must be used to code present weather. The following general rules apply when coding present weather for a METAR or SPECI:

(1) Step 1. Weather occurring at or in the vicinity of the station is coded in the body of the report. Weather observed, but not occurring at or in the vicinity of the station, is coded in remarks.

(2) Step 2. Except when the descriptor **low drifting** applies, and for volcanic ash, one or more obscurations are coded in the body of the report only if the surface visibility is less than 7 miles or considered operationally significant. Volcanic ash is always coded when observed. **MIFG**, **BCFG** and **PRFG** may be reported when visibility is equal to or greater than 7 miles.

(3) Step 3. Separate groups must be used for each type of present weather; however, up to 3 types of precipitation can be coded in a single group. Each group must be separated from the other by a space. A METAR/SPECI must contain no more than three present weather groups.

(4) Step 4. The weather groups must be constructed by considering columns 1 to 5 in Table 14-4: Present Weather in sequence, that is, intensity, followed by weather phenomena, for example, heavy rain shower(s) is coded as +SHRA.

b. Intensity or Proximity Qualifier.

(1) Intensity is coded with all precipitation types, except ice crystals and hail, including those associated with a thunderstorm (TS) and those of a showery nature (SH). No intensity must be ascribed to the obscurations of blowing dust (BLDU), blowing sand (BLSA), blowing snow (BLSN), blowing spray (BLPY), well-developed dust/sand whirls (PO), and squalls (SQ). Tornadoes or waterspouts are coded using the indicator +, for example, "+FC", while a funnel cloud must always be coded "FC." Only moderate or heavy intensity must be ascribed to sandstorm (SS) and Dust storm (DS).

(2) The proximity qualifier for vicinity, VC (weather phenomena observed in the vicinity of but not at the point of observation), must only be coded in combination with thunderstorm (TS), fog (FG), shower(s) (SH), well-developed dust/sand whirls (PO), blowing dust (BLDU), blowing sand (BLSA), blowing snow (BLSN), sandstorm (SS), and dust storm (DS). VCTS is only used at automated stations. Intensity qualifiers must not be coded with VC. VCFG is coded to report any type of fog in the vicinity of the point(s) of observation. Precipitation not occurring at the point of observation but within 10 statute miles is coded as showers in the vicinity (VCSH).

c. Descriptor Qualifier. Only one descriptor must be coded for each weather phenomena group, for example, "-FZDZ". Mist (BR) must not be coded with any descriptor.

(1) The descriptors shallow (MI), partial (PR), and patches (BC) must only be coded with FG, for example, "MIFG."

(a) For MIFG (shallow fog) to be coded, fog must cover part of the station, extend no higher than 6 feet above the ground, with visibility more than 6 feet above the ground 5/8SM or more, while the apparent visibility in the fog layer is less than 5/8SM.

(b) For PRFG (partial fog) to be coded, fog must cover a substantial part of the station, extend to at least 6 feet above the ground with visibility in the fog less than 5/8SM.

(c) For BCFG (fog patches) to be coded, fog must randomly cover part of the station, extend to at least 6 feet above the ground, with the apparent visibility in the fog patch or bank less than 5/8SM while visibility over other parts of the station is greater than or equal to 5/8SM.

(2) The descriptors low drifting (DR) and blowing (BL) must only be coded with dust (DU), sand (SA), and snow (SN), for example, "BLSN" or "DRSN". DR is coded for DU, SA, or SN raised by the wind to less than 6 feet above the ground. When blowing snow is observed with snow falling from clouds, both phenomena are reported, for example, "SN BLSN." When, because of blowing snow, the observer cannot determine whether or not snow is also falling, then only "BLSN" must be reported. BL may also be coded with spray (PY).

(3) The descriptor shower(s) (SH) is coded only with one or more of the precipitation types of rain (RA), snow (SN), ice pellets (PL), small hail (GS), or large hail (GR). The SH descriptor indicates showery-type precipitation. When showery-type precipitation is coded with VC (VCSH), the intensity and type of precipitation must not be coded.

(4) The descriptor thunderstorm (TS) may be coded by itself, that is, a thunderstorm without associated precipitation, or it may be coded with the precipitation types of rain (RA), snow (SN), ice pellets (PL), small hail and/or snow pellets (GS), or hail (GR). For example, a thunderstorm with snow and small hail and/or snow pellets would be coded as "TSSNGS." TS must not be coded with SH.

(5) The descriptor freezing (**FZ**) must only be coded in combination with fog (**FG**), drizzle (**DZ**), or rain (**RA**), for example, "FZRA." **FZ** must not be coded with **SH**.

d. Precipitation. Up to three types of precipitation may be coded in a single present weather group. They are coded in decreasing dominance based upon intensity. Only one intensity indicator (+ or -) may be coded and it must refer to the total precipitation.

(1) Drizzle is coded as DZ; rain is coded as RA; snow is coded as SN; snow grains are coded as SG; ice crystals are coded as IC; and ice pellets is coded as PL.

(2) Hail is coded as GR when the diameter of the largest stones observed is 1/4 inch or more. Small hail and/or snow pellets are coded as GS when the diameter of the largest hailstones is less than 1/4 inch.

(3) At automated stations, precipitation of unknown type is coded as **UP** when the precipitation discriminator cannot identify the precipitation with any greater precision.

e. Obscuration.

(1) Mist is coded as BR when the obscuration consists of water droplets or ice crystals and the visibility is at least 5/8 SM but less than 7 statute miles.

(2) Fog is coded as FG when the obscuration consists of water droplets or ice crystals (fog or freezing fog). For FG to be reported without the qualifiers shallow (MI), partial (PR), or patches (BC), the prevailing visibility in the fog must be less than 5/8 SM. Freezing (FZ) is only reported with FG when visibility is less than 5/8 SM and temperature is less than 0 degrees Celsius. Patches of fog (BCFG) and partial fog (PRFG) may be coded with prevailing visibility of 7 statute miles or greater. See Paragraph 14.14.b(1) for more details on coding descriptors with fog.

(3) Smoke is coded as FU and reported only when the prevailing visibility is restricted to less than 7 statute miles.

(4) Volcanic Ash is coded as VA and is reported when present, regardless of the prevailing visibility.

(5) Widespread dust is coded as DU and reported only when the prevailing visibility is restricted to less than 7 statute miles.

(6) Sand is coded as SA and reported only when the prevailing visibility is restricted to less than 7 statute miles.

(7) Haze is coded as HZ and reported only when the prevailing visibility is restricted to less than 7 statute miles.

(8) Spray is coded only when used with descriptor BL when the prevailing visibility is restricted to less than 7 statute miles.

f. Other Weather Phenomena.

(1) Well-developed dust/sand whirls is coded as PO.

(2) Squalls are coded as SQ when a sudden increase in wind speed of at least 16 knots is observed, and is sustained at 22 knots or more for at least one minute.

(3) Tornadic activity: Funnel clouds are coded as FC. Tornadoes or waterspouts are coded as +FC.

(4) Sandstorm is coded as SS; dust storm is coded as DS.

Table 14-4: Present Weather

Qualifier		**Weather Phenomena**		
Intensity or Proximity 1	**Descriptor 2**	**Precipitation 3**	**Obscuration 4**	**Other 5**
- Light	**MI** Shallow	**DZ** Drizzle	**BR** Mist	**PO** Well-Developed Dust/Sand Whirls
Moderate[1]	**PR** Partial	**RA** Rain	**FG** Fog	**SQ** Squalls
+ Heavy	**BC** Patches	**SN** Snow	**FU** Smoke	**FC** Funnel Cloud Tornado[3] Waterspout[3]
VC In the Vicinity[2]	**DR** Low Drifting	**SG** Snow Grains	**VA** Volcanic Ash	**SS** Sandstorm
	BL Blowing	**IC** Ice Crystals	**DU** Widespread Dust	**DS** Duststorm
	SH Shower(s)	**PL** Ice Pellets	**SA** Sand	
	TS Thunderstorm	**GR** Hail	**HZ** Haze	
	FZ Freezing	**GS** Small Hail and/ or Snow Pellets	**PY** Spray	
		UP Unknown Precipitation		

The weather groups must be constructed by considering columns 1 to 5 in this table in sequence, that is, intensity, followed by description, followed by weather phenomena, for example, heavy rain shower(s) is coded as +SHRA.

[1] To denote moderate intensity, no entry or symbol is used.

[2] See Paragraph 10.7 for vicinity definition and paragraph 14.14.a(2) for usage.

[3] Tornadoes and waterspouts are coded as +FC.

Note: The automated systems do not accept the SH entry.

14.15. Sky Condition Group ($N_sN_sN_sh_sh_sh_s$ or $VVh_sh_sh_s$ or CLR or SKC)

a. Sky condition is coded in the format, $N_sN_sN_sh_sh_sh_s$, where $N_sN_sN_s$ is the amount of sky cover and $h_sh_sh_s$ is the height of the layer. There must be no space between the amount of sky cover and the height of the layer.

b. Sky condition is coded in ascending order up to the first overcast layer. At this time, layers above 12,000 feet are not reported by automated sky condition sensors. At mountain stations, if the cloud layer is below station elevation, the height of the layer must be reported in the body of the METAR or SPECI as "///."

c. Partial obscurations by a ground-based phenomenon are coded by indicating the amount of obscuration as **FEW**, **SCT**, or **BKN** followed by three zeros (**000**). (See Paragraph 14.36 Obscuration (w'w'_[$N_sN_sN_s$]$h_sh_sh_s$) for the required remarks.)

d. Automated sky condition sensors may truncate the sky condition group to 3 layers. Otherwise all stations must observe all cloud layers in ascending order up to the first overcast layer. No more than 6 layers must be reported.

e. Vertical visibility is coded in the format, VV$h_sh_sh_s$, where VV identifies an indefinite ceiling and $h_sh_sh_s$ is the vertical visibility into the indefinite ceiling in hundreds of feet. There must be no space between the group identifier and the vertical visibility.

f. Clear skies are coded in the format, **SKC** or **CLR**, where **SKC** is the abbreviation used for manual reports to indicate no clouds are present and **CLR** is the abbreviation used for automated reports to indicate no clouds are detected at or below the design limit of the ceilometer.

g. Each layer must be separated from other layers by a space. The sky covers for each layer reported are coded by using the appropriate reportable contraction from Table 14-5: Reportable Values for Sky Cover Amount. The reports of clear skies (CLR or SKC) are complete layer reports within themselves. The abbreviations FEW, SCT, BKN, and OVC must be followed, without a space, by the height of the cloud layer.

Table 14-5: Reportable Values for Sky Cover Amount

Reportable Value (Contraction)	Meaning	Summation Amount of Layer
VV	Vertical Visibility	8/8
SKC or CLR[1]	Clear	0
FEW[2]	Few	> 0 - 2/8
SCT	Scattered	3/8 - 4/8
BKN[3]	Broken	5/8 - 7/8
OVC	Overcast	8/8

[1] The abbreviation CLR must be used at automated stations when no clouds at or below 12,000 feet or design limit of ceilometer) are detected; the abbreviation SKC must be used at manual stations when no clouds are observed.
[2] Any layer amount less than 1/8 is reported as FEW.
[3] BKN includes sky cover from 5/8 up to, but not including, 8/8.

h. The height of the base of each layer, $h_sh_sh_s$, is coded in hundreds of feet above the surface using three digits in accordance with Table 14-6: Increments of Reportable Values of Sky Cover Height.

Table 14-6: Increments of Reportable Values of Sky Cover Height

Range of Heights (feet)	Reportable Values (feet)
5,000 or less	To nearest 100
>5,000 but ≤10,000	To nearest 500
Above 10,000	To nearest 1,000

i. Observers must identify cumulonimbus or towering cumulus by appending cumulonimbus (**CB**) or towering cumulus (**TCU**), respectively, to the layer report. When the TCU or CB is appended to the layer report, accompanied by the remark, "TCU NW" or "CB NW MOV E", it is implied that the TCU or CB is associated with that layer and is within 10 SM. When the TCU or CB is outside of 10 SM, a DSNT remark is appropriate, for example, "TCU DSNT NW." (In this case, TCU or CB would not be appended to the layer in the body of the METAR.)

14.16. Temperature/Dew Point Group ($T'T'/T'_dT'_d$)

a. The temperature must be separated from the dew point following it by a solidus (/).

b. The temperature and dew point is coded as two digits rounded to the nearest whole degree Celsius (see Paragraph 3.9). Sub-zero temperatures and dew points must be prefixed with an M. For example, a temperature of 4ºC with a dew point of -2ºC is coded as "04/M02." A temperature of -0.5ºC is coded as "M00."

c. If the temperature is not available, the entire temperature/dew point group must not be coded. If the dew point is not available, code the temperature followed by a solidus (/) and no entry made for dew point. For example, a temperature of 1.5^{o}C and a missing dew point would be reported as "02/."

14.17. Altimeter ($AP_HP_HP_HP_H$). The altimeter group always starts with an A (the international indicator for altimeter in inches of mercury). The altimeter is coded as a four digit group immediately following the A using the tens, units, tenths, and hundredths of inches of mercury. The decimal point is not coded.

14.18. Remarks (RMK). Remarks must be included in all METAR and SPECI, if appropriate. Remarks must be separated from the altimeter group by a space and the contraction RMK. If there are no remarks, the contraction RMK must not be entered.

a. Remarks Categories. METAR/SPECI remarks fall into 2 major categories: Automated, Manual and Plain Language Remarks, and Additive and Maintenance Data.

b. General Procedures for Remarks. Remarks must be made in accordance with the following:

(1) **Use of Contractions and Abbreviations**. Where plain language is called for, authorized contractions, abbreviations, and symbols should be used to conserve time and space. However, in no case should an essential remark, of which the observer is aware, be omitted for the lack of readily available contractions. In such cases, the only requirement is that the remark be clear. For a detailed list of authorized contractions, see FAA Order 7340.1, Contractions.

(2) **Time Entries in Remarks**. Time entries must be made in minutes past the hour if the time reported occurs during the same hour the observation is taken. Hours and minutes must be used if the hour is different, or this order prescribes the use of the hour and minutes.

(3) **Location Entries**. With the exception of lightning and thunderstorms detected by an automated weather observing system, the location of phenomena within 5 statute miles of the point of observation must be reported as occurring at the station. Phenomena between 5 and 10 statute miles must be reported as vicinity (**VC**), followed by direction from the station, if known. Phenomena beyond 10 statute miles of the point of observation must be reported as distant (**DSNT**) followed by the

direction from the station. In the case of a tornado, the exact location should be included if possible. See Paragraph 14.21 Funnel Cloud (TORNADIC ACTIVITY_B/E(hh)mm_LOC/DIR_(MOV)).

(4) **Movement Entries**. Movement of clouds or weather, if known, is coded with respect to the direction toward which the phenomenon is moving.

(5) **Direction** Directions must use the eight points of the compass coded in a clockwise order beginning with north.

(6) **Order of Entry**. Insofar as possible, remarks must be entered in the order in which they are presented in the following paragraphs.

14.19. Automated, Manual, and Plain Language Remarks. These remarks generally elaborate on parameters reported in the body of the report. Automated and manual remarks may be generated either by an automated or manual station. Plain language remarks can only be added by an observer.

14.20. Volcanic Eruptions. Volcanic eruptions must be reported, whenever observed. Pre-eruption volcanic activity must not be reported. Pre-eruption refers to unusual and/or increasing volcanic activity which could precede a volcanic eruption. The remark must be plain language and contain the following, if known:

a. Name of volcano.

b. Latitude/longitude or the direction and the approximate distance from the station.

c. Date/time (UTC) of the eruption.

d. Size description, approximate height, and direction of movement of the ash cloud.

e. Any other pertinent data about the eruption.

EXAMPLE-
MT AUGUSTINE VOLCANO 70 MILES SW ERUPTED 231505 LARGE ASH CLOUD EXTENDING TO APRX 30000 FEET MOVING NE

14.21. Funnel Cloud (TORNADIC ACTIVITY_B/E(hh)mm_LOC/DIR_(MOV))

a. At manual stations, tornadoes, funnel clouds, or waterspouts is coded in the above format, where TORNADO, FUNNEL CLOUD, or WATERSPOUT identifies the specific tornadic activity. B/E denotes the beginning and/or ending time, (hh)mm is the time of occurrence (only the minutes are required if the hour can be inferred from the report time). LOC/DIR is the location and/or direction of the phenomenon from the station, and MOV is the movement, if known. Tornadic activity is coded as the first remark after the "RMK" entry, unless a volcanic remark is required.

EXAMPLE-
A tornado 6 statute miles northeast of the station, beginning at 13 minutes past the hour: TORNADO B13 6 NE

b. At augmented sites with an automated system with SPECI capability, +FC is coded for tornadoes and waterspouts. In remarks, TORNADO, along with beginning or end time, would indicate either a tornado, funnel cloud, or waterspout began or ended.

14.22. Type of Automated Station (AO1 or AO2). AO1 or AO2 is coded in all METAR/SPECI from automated stations. Automated stations without a precipitation discriminator are identified as AO1; automated stations with a precipitation discriminator are identified as AO2.

14.23. Peak Wind (PK WIND_ddff(f)/(hh)mm) (NA LAWRS). The peak wind is coded in the above format in the next METAR where PK WND is the remark identifier, ddd is the direction of the peak wind, ff(f) is the peak wind speed since the last METAR, and (hh)mm is the time of occurrence (only the minutes are required if the hour can be inferred from the report time). There must be one space between the two elements of the remark identifier and the wind direction/speed group; a solidus (/) (without spaces) must separate the wind direction/speed group and the time.

EXAMPLE-
A peak wind of 45 knots from 280 degrees that occurred at 15 minutes past the hour:PK WND 28045/15

14.24. Wind Shift (WSHFT_(hh)mm). At stations with automated systems with SPECI capability and manual stations, a wind shift is coded in the above format, where WSHFT is the remark identifier and (hh)mm is the time the wind shift began (only the minutes are required if the hour can be inferred from the report time). The contraction FROPA may be entered following the time if it is reasonably certain that the wind shift was the result of frontal passage. There must be a space between the remark identifier and the time, and if applicable, between the time and the frontal passage contraction.

EXAMPLE-
Wind shift accompanied by a frontal passage that began at 30 minutes after the hour: WSHFT 30 FROPA

14.25. Tower or Surface Visibility (TWR_VIS_vvvvv or SFC_VIS_vvvvv). Tower visibility or surface visibility is coded in the above formats, where vvvvv is the observed tower/surface visibility value. A space must be coded between each of the remark elements.

EXAMPLE-
1 1/2 SM visibility from the control tower:TWR VIS 1 1/2

14.26. Variable Prevailing Visibility (VIS_$v_nv_nv_nv_nv_n$V$v_xv_xv_xv_xv_x$). Variable prevailing visibility is coded in the above format where VIS is the remark identifier, and $v_nv_nv_nv_nv_n$ is the lowest visibility evaluated. V denotes variability between the two values, and $v_xv_xv_xv_xv_x$ is the highest visibility evaluated. There must be a space following the remark identifier; no spaces between the letter V and the lowest/highest values.

EXAMPLE-
Visibility varying between 1/2 and 2 statute miles:VIS 1/2V2

14.27. Sector Visibility (VIS_[DIR]_vvvvv). The sector visibility is coded in the above format when either the prevailing or sector visibility is less than 3 miles or is considered operationally significant and sector visibility differs from the prevailing visibility by one or more reportable values. In the format of the remark, VIS is the remark identifier, [DIR] defines the sector to 8 points of the compass, and vvvvv is the sector visibility in statute miles, using the appropriate set of values in Table 14-3.

EXAMPLE-
2 1/2 mile visibility in the northeastern octant:VIS NE 2 1/2

NOTE-
Not required by LAWRS, may be reported if deemed operationally significant by the controller/observer.

14.28. Visibility at Second Location((VIS_vvvvv_[LOC]) (NA LAWRS). At stations with MET discontinuity sensors, the visibility at a second location is coded in the above format, where VIS is the remark identifier, vvvvv is the measured visibility value, and [LOC] is the specific location of the visibility sensor(s) at the station. This remark must only be generated when the condition is lower than that contained in the body of the report.

EXAMPLE-
2 1/2 statute mile visibility measured by a second sensor located at runway 11: VIS 2 1/2 RWY11

14.29. Lightning Frequency (Frequency_LTG(Type)_[LOC])

a. Manual Location. When lightning is observed at a manual location, the frequency and location must be reported. Type of lightning must be reported, if known. The remark is coded in the above format. The contractions for the type of lightning must be based onTable 14-7. The location and direction are coded in accordance with Paragraph 14.18.b(3).

EXAMPLES-
CONS LTGIC OHD

or

FRQ LTGCG VC

or

OCNL LTG DSNT W

Table 14-7: Type and Frequency of Lightning

Type of Lightning		
Type	**Contraction**	**Definition**
Cloud to Ground	CG	Lightning occurring between cloud and ground.
In the Cloud	IC	Lightning which takes place within the thunder cloud.
Cloud to Cloud	CC	Streaks of lightning reaching from one cloud to another.
Cloud to Air	CA	Streaks of lightning which pass from a cloud to the air, but do not strike the ground.
Frequency of Lightning		
Frequency	**Contraction**	**Definition**
Occasional	OCNL	Less than 1 flash/minute.
Frequent	FRQ	About 1 to 6 flashes/minute.
Continuous	CONS	More than 6 flashes/minute.

b. When lightning is detected by an automated weather observing system with ALDARS:

(1) Within 5 nautical miles of the Airport Reference Point (ARP), it will be reported as "TS" in the body of the report with no remark;

(2) Between 5 and 10 miles of the ARP, it will be reported as "VCTS" in the body of the report with no remark;

(3) Beyond 10 but less than 30 nautical miles of the ARP, it will be reported in remarks as "DSNT" followed by the direction from the ARP.

EXAMPLE-
LTG DSNT W

14.30. Beginning and Ending of Precipitation (w'w'B(hh)mmE(hh)mm) (NA LAWRS). At stations with automated systems with SPECI capability and manual stations, the beginning and ending of precipitation is coded in the above format, where w'w' is the type of precipitation, B denotes the beginning, E denotes the ending, and (hh)mm is the time of occurrence (only the minutes are required if the hour can be inferred from the report time). There must be no spaces between the elements. Report the beginning and ending times of precipitation in a SPECI if that precipitation caused the SPECI. Intensity qualifiers must not be coded.

EXAMPLES-
Rain beginning at 0005 and ending at 0030, and snow beginning at 0020 and ending at 0055: RAB05E30SNB20E55

If the above precipitation is showery:SHRAB05E30SHSNB20E55

14.31. Beginning and Ending of Thunderstorms (TSB(hh)mmE(hh)mm). The beginning and ending of thunderstorm(s) are coded in the above format, where TS indicates thunderstorm, B denotes the beginning, E denotes the ending, and (hh)mm is the time of occurrence (only the minutes are required if the hour can be inferred from the report time). There must be no spaces between the elements. These coded remarks are required in the SPECI and in the next METAR after the event.

EXAMPLE-
Thunderstorm beginning at 0159 and ending at 0230: TSB0159E30

14.32. Thunderstorm Location (TS_LOC_(MOV_DIR))

a. Thunderstorms are coded in the above format, where TS identifies the thunderstorm activity, LOC is the location of the thunderstorm(s) from the station, and MOV_DIR is the movement with direction, if known.

EXAMPLE-
Thunderstorm southeast of the station moving northeast:

TS SE MOV NE

b. Thunderstorms beyond 10 SM are coded as distant.

EXAMPLE-
TS DSNT NW

c. Any other thunderstorm location or movement remarks the observer judges appropriate must be added manually.

14.33. Hailstone Size (GR_[size]). At augmented automated stations and at manual stations the hailstone size is coded in the above format where GR is the remark identifier and [size] is the diameter of the largest hailstone, coded in 1/4 inch increments. When the largest hailstone observed is 1/4 inch or more in diameter, it is coded with the contraction GR. If GS is coded in the body of the report, no size remark is required.

EXAMPLE-
Largest hailstones 1 3/4 inches in diameter: GR 1 3/4

14.34. Virga (VIRGA_(DIR)). At augmented automated stations and at manual stations, virga is coded in the indicated format, when precipitation is observed to be falling from clouds but is not reaching the ground because of evaporation. The direction, DIR, of the phenomenon from the station is optional.

EXAMPLES-
VIRGA

or

VIRGA SW

14.35. Variable Ceiling Height (CIG_$h_nh_nh_nVh_xh_xh_x$). The variable ceiling height is coded in the above format, where CIG is the remark identifier, $h_nh_nh_n$ is the lowest ceiling height evaluated. V denotes variability between two values, and $h_xh_xh_x$ is the highest ceiling height evaluated. There must be one space following the remark identifier, and no spaces between the letter V and the lowest/highest values.

EXAMPLE-
Ceiling varying between 500 and 1,000 feet: CIG 005V010

14.36. Obscuration (w'w'_[$N_sN_sN_s$]$h_sh_sh_s$). Obscurations are coded in the indicated format, where w'w' is the present weather causing the obscuration at the surface or aloft, and $N_sN_sN_s$ is the applicable sky cover amount of the obscuration aloft (FEW, SCT, BKN, OVC) or at the surface (FEW, SCT, BKN), and $h_sh_sh_s$ is the applicable height. Surface-based obscurations must have a height of "000." The type of present weather must be prefixed (separated by a space) to the sky cover layer that represents the obscuration.

EXAMPLES-
Fog is hiding 3 to 4 eighths of the sky: FG SCT000

A broken layer at 2,000 feet composed of smoke: FU BKN020

14.37. Variable Sky Condition ($N_sN_sN_s(h_sh_sh_s)$_V_$N_sN_sN_s$). The variable sky condition remark is coded in the above format, where $N_sN_sN_s(h_sh_sh_s)$ and $N_sN_sN_s$ identify the two operationally significant sky conditions, and V denotes the variability between the two ranges. For example, "SCT V BKN" would identify a scattered layer that is variably broken. If there are several layers with the same sky condition amount in the report, the layer height is coded with the variable layer.

EXAMPLE-
Cloud layer at 1,400 feet, varying between broken and overcast: BKN014 V OVC

14.38. Significant Cloud Type [PLAIN LANGUAGE]. Cumulonimbus or Cumulonimbus Mammatus (CB or CBMAM_LOC_ (MOV_DIR). Cumulonimbus (CB) or cumulonimbus mammatus (CBMAM), as appropriate, (for which no thunderstorm is being reported) is coded in the above format, where CB or CBMAM is the cloud type, LOC is the direction from the station, and MOV_DIR is the movement with direction (if known). The cloud type, location, movement, and direction entries must be separated from each other with a space.

EXAMPLES-
CB up to 10 SM west of the point of observation, moving toward the east: CB W MOV E

Cloud is more than 10 SM away: CB DSNT W

a. Towering Cumulus (TCU_[DIR]). Towering cumulus (TCU) clouds are coded in the format, TCU_[DIR], where TCU is the cloud type and DIR is the direction from the point of observation. The cloud type and direction entries must be separated by a space.

EXAMPLE-
Towering cumulus clouds up to 10 SM west of the point of observation:TCU W

b. Altocumulus Castellanus (ACC_[DIR]). Altocumulus Castellanus (ACC) is coded in the format, ACC_[DIR], where ACC is the cloud type and DIR is the direction from the point of observation. The cloud type and direction entries must be separated by a space.

EXAMPLE-
Altocumulus castellanus up to 10 statute miles northwest of the point of observation:ACC NW

c. Standing Lenticular or Rotor Clouds (CLD_[DIR]). Stratocumulus standing lenticular (SCSL), altocumulus standing lenticular (ACSL), or cirrocumulus standing lenticular (CCSL), or rotor clouds are coded in the format, CLD_[DIR], where CLD is the cloud type and DIR is the direction from the point of observation. The cloud type and direction entries must be separated by a space.

EXAMPLES-
Altocumulus standing lenticular clouds observed southwest through west of the point of observation: ACSL SW-W

Apparent rotor cloud northeast of the point of observation: APRNT ROTOR CLD NE

Cirrocumulus standing lenticular clouds south of the point of observation: CCSL S

14.39. Ceiling Height at Second Location (CIG_hhh_[LOC]) (NA LAWRS). At automated stations equipped with the meteorological discontinuity sensors, the ceiling height at a second location is coded in the above format, where CIG is the remark identifier, hhh is the measured height of the ceiling, and [LOC] is the specific location of the ceilometer(s) at the station. This remark must only be generated when the ceiling is lower than that contained in the body of the report.

EXAMPLE-
Ceiling measured by a second sensor located at runway 11 is broken at 200 feet:CIG 002 RWY11

14.40. Pressure Rising or Falling Rapidly (PRESRR or PRESFR) (NA LAWRS). At automated stations and manual stations, when the pressure is rising or falling rapidly at the time of the observation (METAR AND/OR SPECI) the remark PRESRR or PRESFR must be included in the report.

14.41. Sea-Level Pressure (SLPppp) (NA LAWRS). Sea-level pressure must be reported in the above format. The remark begins with SLP and is coded using the tens, units, and tenths of the sea-level pressure in hectopascals. For example, a sea-level pressure of 998.2 hectopascals would be coded as "SLP982." For a METAR, if sea-level pressure is not available at stations where it would normally be reported, it is coded as "SLPNO."

14.42. Aircraft Mishap (ACFT_MSHP). If a report is taken to document weather conditions when notified of an aircraft mishap, the remark ACFT_MSHP must be included in the report, but not transmitted. The act of non-transmission must be indicated by enclosing the remark in parentheses in the record, that is, "(ACFT MSHP)."

14.43. No SPECI Reports Taken (NOSPECI). At staffed stations where SPECI's are not taken, the remark NOSPECI is coded to indicate that no changes in weather conditions will be reported until the next METAR.

14.44. Snow Increasing Rapidly (SNINCR_(inches-hour/inches on ground)) (NA LAWRS). At Service Level A and B and manual stations, the snow increasing rapidly remark is coded, in the next METAR, whenever the snow depth increases by 0.5 inch (1 inch to the nearest whole inch) or more in the past hour and the reportable value (in whole inches) of the total depth of snow on the ground increases by one inch or more. The remark is coded in the above format, where SNINCR is the remark indicator, "inches-hour" is the depth increase in the past hour, and "inches on ground" is the total depth of snow on the ground at the time of the report. The depth increase in the past hour and the total depth on the ground are separated from each other by a solidus (/).

EXAMPLE-
Snow depth increase of 2 inches in the last hour with a total depth on the ground of 10 inches: SNINCR 2/10

14.45. Other Significant Information. Agencies may have other information significant to their operations, such as information on fog dispersal operations, runway conditions, and other information important to aircraft operations.

14.46. Additive and Automated Maintenance Data. Additive data groups are reported at automated and manual stations. Maintenance data groups are only reported from automated stations.

a. Precipitation Additive Data. The amount of liquid precipitation must be evaluated as the depth of precipitation that accumulates in an exposed vessel during the time period being evaluated. The amount of freezing or frozen precipitation must be the water equivalent of the solid precipitation accumulated during the appropriate time period. Precipitation measurements must be in inches, tenths of inches, or hundredths of inches depending on the precipitation being measured (see Table 14-8: Units of Measure for Precipitation). The depth of freezing and/or frozen precipitation must be the actual vertical depth of the precipitation accumulated on a horizontal surface during the appropriate time period. If snow falls, melts, and refreezes, the depth of ice formed must be included in the measurement.

Table 14-8: Units of Measure for Precipitation

Type of Measurement	Unit of Measure
Liquid Precipitation	0.01 inch
Water Equivalent of Solid Precipitation	0.01 inch
Solid Precipitation	0.1 inch
Snow Depth	1.0 inch

14.47. Hourly Precipitation Amount (Prrrr) (NA LAWRS). At automated stations, the hourly precipitation amount remark is coded in the format, Prrrr, where P is the group indicator, and rrrr is the water equivalent of all precipitation that has occurred since the last METAR. The amount is coded in hundredths of an inch. The group must be omitted if no precipitation occurred since the last METAR.

EXAMPLES-
9/100 of an inch of precipitation fell in the past hour:P0009

Less than 1/100 of an inch of precipitation fell in the past hour:P0000

14.48. 1, 3, and 6 Hourly Ice Accretion Amounts (I1nnn, I3nnn, I6nnn) (NA LAWRS). NWS and FAA have developed an algorithm to be applied to the automated system with SPECI capability freezing rain sensor that can accurately measure and report the amount of surface ice accretion at a specific point over a given time period. The automated system with SPECI capability freezing rain sensor, and the newly developed ice accretion algorithm will generate information that will be included in the remarks section of a METAR/ SPECI. Ice accretion remarks must only be included in the METAR and SPECI reports when accretion is occurring, or has occurred during the reporting period. The remark will be updated each minute when encoded. This requirement is for automated encoding of these remarks, and no manual backup is required. Although the ice accretion remark was not available at the time of this writing, it is scheduled to be available following an upcoming ASOS software revision. The format for the hourly, 3-hourly, and 6-hourly reports follows.

a. Hourly Ice Accretion Amount (I1nnn). This remark provides the ice accretion amount during the preceding hour. The accretion of ice over the past one hour time period in one-hundredths of an inch (0.01 in.) would have the format: "I1nnn"; where "I" is the icing indicator for the group, "1" is the reported time period (one hour), and "nnn" is the thickness accumulated to the nearest one-hundredth of an inch (0.01 in.), during the reported time period (one hour). This remark must be reset immediately after the hourly METAR report is transmitted. When this remark is included in the automated system with SPECI capability software, it will most likely be encoded immediately following the hourly precipitation amount, and before the 3- and 6-hour precipitation amount.

b. 3-Hourly Ice Accretion Amount (I3nnn). This remark provides the ice accretion amount during the last three hours, and is included in the reports taken at the intermediate synoptic times of 0300, 0900, 1500, and 2100 UTC. The accretion of ice over the past three hour time period in one-hundredths of an inch (0.01 in.) would have the format: "I3nnn"; where "I" is the icing indicator for the group, "3" is the reported time period (three hours), and "nnn" is the thickness accumulated to the nearest one-hundredth of an inch (0.01 in.), during the reported time period (three hours). This remark must be reset immediately after the intermediate synoptic or mandatory synoptic METAR is transmitted

(0300, 0600, 0900, 1200, 1500, 1800, 2100 and 0000 UTC). When this remark is included in the automated system with SPECI capability software, it will most likely be encoded immediately following the hourly ice accretion amount, and before the 3- and 6-hour precipitation amount.

c. 6-Hourly Ice Accretion Amount (I6nnn). This remark provides the ice accretion amount during the last six hours, and is included in the reports taken at the synoptic times of 0600, 1200, 1800, and 0000 UTC. The accretion of ice over the past six hour time period in one-hundredths of an inch (0.01 in.) would have the format: "I6nnn"; where "I" is the icing indicator for the group, "6" is the reported time period (six hours), and "nnn" is the thickness accumulated to the nearest one-hundredth of an inch (0.01 in.), during the reported time period (six hours). This remark must be reset immediately after the mandatory synoptic METAR is transmitted (0600, 1200, 1800, and 0000 UTC). When this remark is included in the automated system with SPECI capability software, it will most likely be encoded immediately following the hourly ice accretion amount, and before the 3- and 6-hour precipitation amount.

d. Missing Data. If the freezing rain sensor is inoperative for more than 25 percent of the reporting period, the icing remark must be considered missing. Missing groups must be encoded as I1///, I3///, or I6///, as appropriate. If no icing is detected, then the groups must not be encoded. Note that an automated icing event will always report at least 0.01 in. of ice accretion.

14.49. 3- and 6- Hour Precipitation Amount (6RRRR) (NA LAWRS). At stations equipped with automated systems with SPECI capability and manual stations, the 3- and 6-hourly precipitation group is coded in the above format, where 6 is the group indicator and RRRR is the amount of precipitation. The amount of precipitation (water equivalent) accumulated in the past 3 hours must be reported in the 3-hourly report, and the amount accumulated in the past 6 hours must be reported in the 6-hourly report. The amount of precipitation is coded in inches, using the ten, units, tenths, and hundredths digits of the amount. When an indeterminable amount of precipitation has occurred during the period, RRRR is coded "6////." A trace is coded "60000."

EXAMPLE-
2.17 inches of precipitation: 60217

14.50. 24-Hour Precipitation Amount (7R_{24} R_{24} R_{24} R_{24}) (NA LAWRS). The 24-hour precipitation amount is coded in the above format, where 7 is the group indicator and $R_{24}R_{24}R_{24}R_{24}$ is the 24-hour amount of precipitation included in the 1200 UTC (or other agency-designated time) report whenever more than a trace of precipitation (water equivalent) has fallen in the past 24 hours. The amount of precipitation is coded by using the tens, units, tenths, and hundredths of inches (water equivalent) for the 24-hour period. If more than a trace (water equivalent) has occurred and the amount cannot be determined, the group is coded "7////."

EXAMPLE-
1.25 inches of precipitation (water equivalent) in the past 24 hours: 70125

14.51. Snow Depth on Ground (4/sss) (NA LAWRS). At stations listed in Appendix G, the total snow depth on ground group is coded in the 0000, 0600, 1200, and 1800 UTC observations whenever there is more than a trace of snow on the ground, and more than a trace of precipitation occurred within the past 6 hours . The remark is coded in the format 4/sss, where 4/ is the group indicator and sss is the snow depth in whole inches using three digits.

EXAMPLE-
Snow depth of 21 inches:4/021

14.52. Water Equivalent of Snow on Ground (933RRR) (NA LAWRS). At manual stations and stations listed in Appendix G, the water equivalent of snow on ground group is reported each day in the 1800 UTC report if the average snow depth is 2 inches or more. The remark is coded in the format 933RRR, where 933 is the group indicator and RRR is the water equivalent of snow; that is, snow, snow pellets, snow grains, ice pellets, ice crystals, hail, on the ground. The water equivalent must be reported in tens, units, and tenths of inches, using three digits. Do not code the group if it consists entirely of hail. Estimations, ratios (for example, 10 to 1), or temperature/snow water equivalent tables are not to be used to determine water equivalency of snow for this group.

EXAMPLES-
3.6 inches water equivalent of snow:933036

12.5 water equivalent of snow:933125

14.53. Hourly Temperature and Dew Point ($Ts_nT'T'T's_nT'_dT'_dT'_d$) (NA LAWRS). At automated stations except AWOS-A, the hourly temperature and dew point group is coded in the above format, where T is the group indicator, s_n is the sign of the temperature, T'T'T' is the temperature, and $T'_dT'_dT'_d$ is the dew point. The sign of the temperature and dew point is coded as 1 if the value is below 0^oC and 0 if the value is 0^oC or higher. The temperature and dew point is reported in tens, units, and tenths of degrees Celsius. There are no spaces between the entries. If dew point is missing, report the temperature; if the temperature is missing, do not report the temperature/dew point group.

EXAMPLES-
Temperature of 2.6^oC and dew point of -1.5^oC reported in the body of the report:03/M01

Temperature of 2.6^oC and dew point of -1.5^oC reported in the temperature/dew point group; T00261015

14.54. 6-Hourly Maximum Temperature ($1s_nT_xT_xT_x$) (NA LAWRS). The 6-hourly maximum temperature group is coded in the above format, where 1 is the group indicator, s_n is the sign of the temperature, and $T_xT_xT_x$ is the maximum temperature in tenths of degrees Celsius using three digits. The sign of the maximum temperature is coded as 1 if the maximum temperature is below 0^oC and 0 if the maximum temperature is 0^oC or higher.

EXAMPLES-
A maximum temperature of -0.1^oC:11001

A maximum temperature of 14.2^oC:10142

14.55. 6-Hourly Minimum Temperature ($2s_nT_nT_nT_n$) (NA LAWRS). The 6-hourly minimum temperature group is coded in the above format, where 2 is the group indicator, s_n is the sign of the temperature, and $T_nT_nT_n$ is the minimum temperature in tenths of degrees Celsius using three digits. The sign of the minimum temperature is coded as 1 if the minimum temperature is below 0^oC and 0 if the minimum temperature is 0^oC or higher.

EXAMPLES-
A minimum temperature of -2.1^oC:21021

A minimum temperature of 1.2°C:20012

14.56. 24-Hour Maximum and Minimum Temperature ($4s_nT_xT_xT_xs_nT_nT_nT_n$) (NA LAWRS). The 24-hour maximum temperature and the 24-hour minimum temperature is coded in the above format, where 4 is the group indicator, s_n is the sign of the temperature, $T_xT_xT_x$ is the maximum 24-hour temperature, and $T_nT_nT_n$ is the 24-hour minimum temperature. Temperature is coded in tenths of degrees Celsius using three digits. The sign of the maximum or minimum temperature is coded as 1 if it is below 0°C and 0 if it is 0°C or higher.

EXAMPLE-
A 24-hour maximum temperature of 10.0°C and 24-hour minimum temperature of -1.5°C:401001015

14.57. 3-Hourly Pressure Tendency (5appp) (NA LAWRS). At equipped automated stations, the 3-hourly pressure tendency group is coded in the format 5appp where 5 is the group indicator, a is the character of pressure change over the past 3 hours, and ppp is the amount of barometric change in tenths of hectopascals using the tens, units, and tenths digits (see example below). The character **a** i coded by selecting the code figure from Table 14-9 that best describes the pressure change in the past 3 hours. For example, a steady increase of 3.2 hectopascals in the past three hours would be coded "52032." The ppp is coded based on the absolute value of the change of either the station pressure or the altimeter setting in the past 3 hours in tenths of hectopascals and using the tens, units, and tenths digits.

EXAMPLE-
A steady increase of 3.2 hectopascals in the past 3 hours: 52032

Table 14-9: Characteristics of Barometer Tendency

Primary Requirement	Description	Code Figure
Atmospheric pressure now higher than 3 hours ago.	Increasing, then decreasing.	0
	Increasing, then steady; or increasing, then increasing more slowly.	1
	Increasing steadily or unsteadily.	2
	Decreasing or steady, then increasing; or increasing, then increasing more rapidly.	3
Atmospheric pressure now the same as 3 hours ago.	Increasing, then decreasing.	0
	Steady.	4
	Decreasing, then increasing.	5
Atmospheric pressure now lower than 3 hours ago.	Decreasing, then increasing.	5
	Decreasing, then steady; or decreasing, then decreasing more slowly.	6
	Decreasing steadily or unsteadily.	7
	Steady or increasing, then decreasing; or decreasing, then decreasing more rapidly.	8

14.58. Sensor Status Indicators. At equipped automated stations, sensor status indicators should be reported as indicated below:

a. When automated stations are equipped with a precipitation identifier and that sensor is not operating, the remark **PWINO** is coded.

b. When automated stations are equipped with a tipping bucket rain gauge and that sensor is not operating, **PNO** is coded.

c. When automated stations are equipped with a freezing rain sensor and that sensor is not operating, the remark **FZRANO** is coded.

d. When automated stations are equipped with a lightning detection system and that sensor is not operating, the remark **TSNO** is coded.

e. When automated stations are equipped with a secondary visibility sensor and that sensor is not operating, the remark **VISNO_LOC** is coded.

f. When automated stations are equipped with a secondary ceiling height indicator and that sensor is not operating, the remark **CHINO_LOC** is coded.

g. When equipped with RVR and the sensor is not operating, the remark **RVRNO** is coded. The ASOS does this automatically.

14.59. Maintenance Indicator. A maintenance indicator sign $ is coded when an ASOS/AWSS detects that maintenance is needed on the system.

14.60. Transmission Times. For transmission times of observations.

a. METAR REPORTS. Prepare and code METAR reports for transmission between H+55 and H+00.

b. SPECI AND DELAYED OR CORRECTED REPORTS. Transmit SPECI, delayed or corrected reports as soon as possible after H+00.

Chapter 15. Entries on Observational Forms

15.1. Introduction. This chapter prescribes procedures and practices for making entries on various observational forms. At all manual FAA facilities, all observations must be recorded on Form MF1M-10C, Surface Weather Observations (METAR/SPECI). Many of the instructions in this chapter relating to the observational form (MF1M-10C) are duplicated from Chapter 14. Coding and Dissemination. References to other chapters are noted where applicable.

15.2. Entries on Meteorological Form 1M-10C (MF1M-10C). Certified observers must normally complete all entries on MF1M-10C. Non-certified trainees/observers may make entries on the form under the immediate supervision of a certified observer who assumes responsibility for the validity of the entries by initialing in column 15. Non-certified observers may initial the observation, but the certified observer must initial first. Initials must be separated by a solidus (/).

15.3. Writing Instrument. The same type of writing instrument must be used throughout the form. To ensure legible copies and ample contrast for reproduction, the observer must use a black-inked fine ball-point pen.

15.4. Parenthetical Data. Data entered in columns 3 through 14 of Form MF1M-10C that are not intended to be transmitted must be enclosed in parentheses.

15.5. Missing Data. See Paragraph 14.5 Coding Missing Data in METAR and SPECI Reports. When using Form MF1M-10C, the observer must explain briefly the reasons for any missing data in block 65, Remarks, Notes, and Miscellaneous Phenomena.

15.6. Late Observations. When a METAR observation is taken late, but within 15 minutes of the standard time of observation, and no appreciable changes have occurred since the standard time, the observer must record the observation and transmit it using the actual time of observation. If conditions have changed appreciably or the observation is more than 15 minutes late, the observer must skip a line and record and transmit a SPECI observation containing all the elements in a METAR observation. After transmitting the SPECI, using the actual time of observation, the observer must estimate the conditions probable at the standard time using recording instruments whenever possible. The observer must record this data on the skipped line using the standard time in column 2. The estimated observation must not be transmitted. The observer must make note in column 65 referencing the actual time of observation that the estimated observation was recorded.

15.7. Corrections. To make a correction on Form MF1M-10C, the observer must draw a single line through the erroneous entry. The observer must not erase or otherwise obliterate entries. The observer must record corrected data in the appropriate blocks on the same or next line appropriately identified.

15.8. Heading on Form MF1M-10C at LAWRS. At LAWRS, the observer must enter the official station name and state abbreviation in the block labeled STATION. The four-letter Airport ID must be included in the SID block. Also in the blocks provided, the observer must enter the date and time (in Coordinated Universal Time (UTC)) and the conversion factor used to convert Local Standard Time (LST) to UTC. The observer must check after UTC to indicate that the times used in column 2 of the form are in UTC. In the blocks labeled LATITUDE and LONGITUDE, enter the station's latitude and longitude to the nearest minute of a degree. In the block labeled STATION ELEVATION, enter the station's elevation (H_p) to the nearest foot.

15.9. Heading on Form MF1M-10C at Other Stations (NA LAWRS). In the block labeled STATION, the observer must enter the type of station, the official station name and state abbreviation. The four-letter Airport ID must be included in the SID block. Also in the blocks provided, the observer must enter the date and time (in LST), and conversion factor used to convert LST to UTC. In the blocks labeled LATITUDE and LONGITUDE, enter the station's latitude and longitude to the nearest minute of a degree. In the block labeled STATION ELEVATION, enter the station's elevation (H_p) to the nearest foot.

15.10. Entries on Form MF1M-10C by Columns. The procedures and practices given below are only for those columns applicable at FAA facilities.

a. Type of Observation (Column 1). **M** must be recorded to designate a METAR observation, **S** must be recorded to designate a SPECI observation.

b. Time of Observation (Column 2). At **LAWRS,** the observer must record the actual time of the observation in Coordinated Universal Time (UTC). At all other stations, the observer must record the actual time of observation in Local Standard Time (LST).

c. Wind Direction (Column 3). The observer must record the true wind direction from which the wind is blowing in tens of degrees using three figures. Directions less than 100 degrees must be preceded with a **0**. When the wind is calm, the observer must enter **000** for the direction. When the wind speed is 6 knots or less, the direction may be recorded as **VRB**.

d. Wind Speed (Column 4). The observer must record the wind speed in whole knots using the hundreds digit (if not zero), and the tens and units digit. The observer must record speeds of less than 10 knots with a leading zero. For example, a wind speed of 5 knots must be logged as 05. A wind speed of 105 knots must be logged as 105. Calm winds must be recorded as 00.

e. Wind Gust (Column 5). When gusts have been recorded or observed during the 10 minutes prior to the actual time of observation, the observer must enter the peak speed.

f. Wind Variability (Column 6). When wind direction fluctuates by 60 degrees or more during the 2-minute evaluation period and the wind speed is greater than 6 knots, the observer must enter the range of variability. A wind direction fluctuating between 260 degrees and 40 degrees must be entered as 260V040.

g. Surface Visibility (Column 7a) and Tower Visibility (Column 7b). The observer must record the surface prevailing visibility (column 7a) determined from the weather station's usual point(s) of observation using the nearest reportable value listed in Table 14-3, Reportable Visibility Values.

h. Runway Visual Range (Column 8). At stations with RVR-automated system with SPECI capability interface or a stand alone RVR display, the observer must record the **RVR** to match the coding in Paragraph 14.13 Runway Visual Range Group ($RD_RD_R/V_RV_RV_RV_RFT$) or ($RD_RD_R/V_nV_nV_nV_nVV_xV_xV_xV_xFT$) (NA LAWRS).

i. Present Weather (Column 9). Record weather and obscurations occurring at the station using the order described in Paragraph 10.6 Order for Reporting Multiple Types of Weather and Obscurations. Weather intensity symbols and codes are shown in Table 10-1: Present Weather. Only

record obscurations if the visibility is reduced to less than 7 miles, except for volcanic ash, which is always recorded.

j. Sky Condition (Column 10). The procedures for reporting sky condition are given in Chapter 11. Sky Condition. The observer must record sky cover data according to Paragraph 14.15 Sky Condition Group ($N_sN_sN_sh_sh_sh_s$ or $VVh_sh_sh_s$ or CLR or SKC). The observer must record data for each layer of clouds and obscuring phenomena visible from the station regardless of amount. The observer must make entries in ascending order of height for bases of each layer. An additional line can be added if more space is needed.

(1) **Sky Cover**. The observer must record any sky cover which is visible from the station using the appropriate contractions or combination of contractions from Table 11-1: Reporting Contractions for Sky Cover. If the sky cover is variable, see Paragraphs 11.33 Variable Sky Cover and 14.37 Variable Sky Condition ($N_sN_sN_s(h_sh_sh_s)\_V\_N_sN_sN_s$).

(2) **Height of Sky Cover**. Heights of layers must be reported and rounded to the nearest reportable increment listed in Table 11-4: Increments of Reportable Values for Layer or Ceiling Heights. When a value falls halfway between two reportable increments, the lower value must be reported. When a layer is 50 feet or less above the surface, the height reported is **000**. If the ceiling height is variable, see Paragraph 11.36 Variable Ceiling Height and Paragraph 14.35 Variable Ceiling Height ($CIG\_h_nh_nh_nVh_xh_xh_x$) for reporting procedures.

k. Temperature (Column 11). The observer must record the temperature to the nearest whole degree Celsius (see Paragraph 3.9 Rounding Off Numbers). Sub-zero temperatures must be prefixed with a minus sign (-). An "M" must be prefixed to sub-zero temperatures in the transmitted observation. The observer must add a leading zero to temperatures of only one digit (2 is recorded as 02.).

l. Dew Point Temperature (Column 12). The observer must record the dew point temperature to the nearest whole degree Celsius. Sub-zero dew point temperatures must be prefixed with a minus sign (-). An "M" must be prefixed to sub-zero dew point temperatures in the transmitted observation. When the temperature is -34°C (-30ºF) or below, the dew point is considered to be statistical data. In such cases, the observer must leave column 12 blank and not transmit a value. The observer must add a leading zero to temperatures of only one digit (4 is recorded as 04). If dew point temperature is unavailable, leave the column blank.

m. Altimeter Setting (Column 13). The observer must record the altimeter setting in inches of mercury using only the tens, units, tenths, and hundredths digits (without a decimal point). For example, record 29.94 as 2994. Altimeter settings must never be estimated, however, if the altimeter setting is missing, column 13 is left blank.

n. Remarks (Column 14). The observer must record all remarks in column 14 according to the procedures in Chapter 14. Coding and Dissemination. The procedures for coding remarks are the same procedures for entering the data into column 14, MF1M-10C. The observer may use additional lines of the form, if required.

o. Observers Initials (Column 15). The certified observer responsible for the observation must initial this column.

p. Total Sky Cover (Column 17). For each hourly observation, the observer must record the eighths of sky hidden by surface-based obscuring phenomena and sky covered (not necessarily hidden) by all clouds and obscuring phenomena aloft that are visible from the station. For example, record 1 for any clouds up to one-eighth sky cover, 5 for five-eighths, 8 for eight eighths.

q. Dry Bulb Temperature (Column 19). NA

r. Wet Bulb Temperature (Column 20). NA

s. Station Pressure (Column 22). The observer must record the station pressure in this column to the nearest 0.005 inches of mercury.

t. Time (Column 26). The observer must record the beginning time of the first 6-hourly observation scheduled after 0000 LST on the line captioned "MID TO" and the following line captioned "1" from column 27. On the following three lines, the observer must record in chronological order the beginning times of the subsequent 6-hourly observations. The observer must record entries in hours and minutes (4 digits) to the nearest minute. At stations in the time zone where midnight LST corresponds to the time of a 6-hourly observation, the lines captioned "MID TO" and "MID" must not be used. Observers at stations not open for the full 24 hour calendar day must follow these same instructions.

u. Observation Number (Column 27). The observation number identifies the first, second, third, and fourth 6-hourly observations of the day. No entry is required.

v. Maximum Temperature (Column 31) and Minimum Temperature (Column 32) (NA LAWRS). The observer must record the maximum temperature in column 31 and the minimum temperature in column 32 in tenths of degrees Celsius, using 3-digits that occurred: between midnight and the first 6-hourly observation, in the six hours prior to each 6-hourly observation, and between the last 6-hourly observation and midnight, in the lines labeled "MID TO," "1," "2," "3," "4," and "MID," respectively. The temperature recorded on the last METAR observation of the previous day, having a standard time 0000 LST of the current day, must be considered when determining the maximum and minimum temperature from midnight to the first 6-hourly. At part-time stations, the loss of data can be avoided by using base temperature extremes for the 24-hour period beginning when the station closes to the time the station closes the next day. If the station is open at midnight, temperature extremes should be maintained from midnight to midnight. Otherwise, the observer must do as follows:

(1) Reset the maximum and minimum displays or thermometers at the time of the last 6-hourly taken before the station closes.

(2) At the time of the first 6-hourly after the station opens, record the extremes on the appropriate line of columns 31 and 32 that correspond to the 6-hour time frame. Record in block 65, the period during which the temperature extremes were recorded.

EXAMPLE-
COL31-32 0645 12HR TEMP EXTREMES

(3) Use the extremes that occurred during the 24 hours before the station closes to complete the summary of the day temperature data. Record in block 65, the column numbers and the temperature period covered.

EXAMPLE-
COL66-67 TEMPERATURE DATA FROM 1800 TO 1800

w. Precipitation (Column 33) (NA LAWRS). At 6-hourly observation times, the observer must record the amounts of precipitation that occurred during the periods as indicated below. The observer must record amounts to the nearest hundredth of an inch except that "T" must be recorded for amounts less than 0.005 inch and "0" must be recorded if no precipitation occurred.

(1) At stations taking midnight observations, the observer must record the amount of precipitation that occurred between midnight LST and the first 6-hourly observation time on the line captioned "**MID** TO."

(2) On lines "1," "2," "3," and "4" (as indicated in column 27), the observer must record the amount of precipitation that occurred in the previous six hours.

(3) When midnight observations are taken, the observer must record the amount of precipitation that occurred between the last 6-hourly observation time and the midnight observation on the line captioned "MID."

(4) Whenever the water equivalent of solid precipitation cannot be measured by melting or weighing of the sample or core sampling, the observer must estimate the water equivalent on the basis of a 1/10 ratio method unless a different ratio is more appropriate for the individual storm or station. The observer must record in block 65, the column number, the time of the observation, and the ratio used.

EXAMPLE-
COL33 1245 1/2 RATIO USED

x. Snowfall (Column 34) (NA LAWRS). At 6-hourly observation times, the observer must record the amount of solid precipitation that fell in the six hours prior to the observation on the lines numbered (in column 27) "1," "2," "3," and "4." The 6-hourly is a separate measurement from any one hour snow fall. The 6-hourly is not achieved by adding the hourly snowfall together. It is its own measurement, done once every 6 hours. At stations taking midnight observations, the observer must record the snowfall between midnight and the first 6-hourly observation on the line captioned "MID TO." On the line captioned "MID", the observer must record the amount of snowfall that occurred between the last 6-hourly observation and midnight. "Snow" as used in this and the following snow depth sections includes all types of solid precipitation; for example, SN, GS, SG, PL, IC, and GR. The observer must make entries as follows:

(1) If there is no solid precipitation, record a "**0**."

(2) A trace, but less than 0.05 inch, record a "T."

(3) A measurable amount occurred, record the maximum depth of solid precipitation to the nearest 0.1 inch. If solid precipitation occurred several times during the period, and each fall melted either completely or in part before the next fall, record the total of the maximum depths of each fall.

(4) If an amount consists entirely of hail, record in block 65, the column number, the time of the observation, and HAIL.

EXAMPLE-
COL34 0045 HAIL

(5) In order to preserve climatological snowfall records at stations operating under reduced hours, the following guidelines are presented. It is important that you exercise your acquired skills to make this estimate. If it is reasonable to assume that all new precipitation which fell was frozen and the conditions were rather consistent throughout the period, various methods may be used to estimate the snowfall for the period; for example, basis of 1/10 ratio method unless a different ratio is more appropriate for the individual storm or station, or measurements in protected areas. The estimate should be based upon your best judgment. Record in block 65, the column number, the time of the observation, and ESTIMATED. The reason for the estimation may also be included.

EXAMPLE-
COL34 0045 ESTIMATED DUE TO STATION CLOSURE

(6) If an estimated amount cannot be reasonably made, (for example, several days of closure, mixed precipitation, etc.) missing (**M**) should be recorded in column 34 and column 60 for the day.

(7) It is assumed that if an estimated amount is explained in block 65 for column 34, the summary of the day (column 61) is also considered to be estimated. A second remark to denote that column 61 is estimated is not required. Any estimated amounts in column 34 should be explained in block 65. Record the column number, the time of the observation, and the reason for the estimation.

EXAMPLE-
COL34 1244 ESTIMATED DUE TO MELTING

y. Snow Depth (Column 35) (NA LAWRS). The observer must record the depth of solid precipitation and ice on the ground at the time of each 6-hourly observation and, if taken, at the time of the midnight observation on the lines identified as "1," "2," "3," "4," and "MID," respectively. Entries must be as follows:

(1) No snow or ice on the ground in exposed areas (snow may be present in surrounding forested or otherwise protected areas), record a "**0**."

(2) A trace, but less than 0.5 inch, on the ground in representative areas, record a "**T**."

(3) If there is a measurable amount on the ground, record the depth to the nearest whole inch.

(4) When solid precipitation has occurred in the past six hours and because of melting or sublimation, the current depth is less than at some time during the six hours (reportable value), record the current depth in column 35. In block 65, record the maximum snow depth and the approximate time (LST) of the occurrence. Record the column number, the time of the observation, and the approximate time of the occurrence.

EXAMPLE-
COL35 1846 MAX SNOW DEPTH 1 AT 1530

(5) If the depth consists entirely of hail, record in block 65, the column number, the time of the observation, and HAIL.

EXAMPLE-
COL35 1844 HAIL

(6) Snow depth is entered in column 35 at the main synoptic times (00, 06, 12, and 18 UTC) when measured by observing personnel. When observing personnel are not on duty the entry must be an "**M**."

z. Station Pressure (Column 36) (NA LAWRS/NA CWO). Precision Aneroid Barometer or Altimeter Setting Indicator. If a precision aneroid barometer or altimeter-setting indicator is used to determine station pressure, the observer must record the reading to the nearest 0.005 inch (or 0.1 hectopascal).

aa. Barograph (Column 37). NA

bb. Barograph Correction (Column 38). NA

cc. 24-Hour Maximum Temperature (Column 57) (NA LAWRS).

dd. 24-Hour Minimum Temperature (Column 58) (NA LAWRS).

ee. 24-**Hour Precipitation (Column 59)** (NA LAWRS). The observer must record the total precipitation for the 24 hours ending at midnight (LST) as follows:

(1) No precipitation, record a "**0**."

(2) A trace (less than 0.005 inch), record a "**T**." A trace amount includes the sum of any number of "**T**" observations, unless a recording or totalizing gauge indicates 0.005 inch or more.

(3) A measurable amount has occurred, record the amount (water equivalent) to the nearest 0.01 inch.

(4) Where the 24-hour precipitation is derived from entries in column 33, disregard the entry in column 33 on the line captioned "**1**" if the midnight observation is taken. Record "**M**" if any data are missing.

(5) If the station is closed and unless measurable precipitation has occurred, record "**0**."

(6) If any entries in column 33 are missing, the entry in column 59 will also be missing (**M**).

(7) If any entries in column 33 are estimated (block 65 remark), the entry in column 59 must also be considered estimated. A remark in block 65 is not required to denote an estimated amount in column 59 since a remark is already noted for column 33.

ff. 24-Hour Snowfall (Column 60) (NA LAWRS). The observer must record the total amount (unmelted) of solid precipitation that fell in the 24 hours ending at midnight (LST) as follows:

(1) No 6-hour solid precipitation, record a "**0**."

(2) A trace (less than 0.05 inch), record a "**T**."

(3) A measurable amount occurred, record the total amount that fell in inches and tenths. Note that it is the total amount of fall that is entered. Therefore, the amount entered must be the amount that accumulated in the past 24 hours adjusted for any melting or evaporation that has taken place.

(4) Where the 24-hour precipitation is derived from entries in column 34, disregard the entry in column 34 on the line captioned "**1**" if the midnight observation is taken. Record "**M**" if any data are missing. The sum of all trace entries is a trace.

(5) If any entries in column 34 are estimated (block 65 remark), the entry in column 60 will also be considered estimated. A remark in block 65 is not required to denote an estimated amount in column 60 since a remark is already noted for column 34.

(6) If any entries in column 34 are missing, the entry in column 60 will also be missing (**M**).

gg. Snow Depth (Column 61) (NA LAWRS). The observer must record the depth of solid precipitation or ice on the ground at 1200 UTC. In areas outside the contiguous United States, enter a modified time at the top of the column as necessary to meet regional needs. The observer must make entries to the nearest whole inch, or as follows:

(1) No snow or ice on the ground in exposed areas (snow may be present in surrounding forested or otherwise protected areas), record a "**0**."

(2) For a trace (less than 0.5 inch), in exposed areas, record a "**T**."

(3) Use the 1200 UTC value in column 35, if appropriate.

(4) If personnel are not on duty at 1200 UTC, enter the depth measured as near 1200 UTC as practicable and indicate the time (UTC) in block 65.

EXAMPLE-
COL61 OBSERVED AT 1120 UTC

hh. Remarks, Notes, and Miscellaneous Phenomena (Block 65). The observer must use this block to record data considered significant, but not recorded elsewhere along with information in the following subsections.

(1) The observer must record the Local Standard Time (LST) of occurrence with all entries unless otherwise specified.

(2) The observer must make entries to report:

(a) Conditions affecting the representativeness or accuracy of the recorded data. For example, the possible effect of construction on instrument readings, accumulation of ice or snow on sensors.

(b) Outages, changes in instruments, reasons for change, times of change or outage.

(c) Reasons for omission of mandatory data.

(d) Change in hours of station operation, effective dates, if temporary, or date if permanent. (Fomat properly)

(e) Estimated data.

(f) Miscellaneous items; for example, when a Basic Weather Watch or Continuous Weather Watch began or ended; approximate date/time and location of an aircraft mishap, when notified by the FAA (FSS/TWR) of an aircraft mishap.

(g) Separate individual remarks by a single solidus (/).

EXAMPLE-
COL34 0245 ESTIMATED DUE TO HIGH WINDS/COL45 LAST OF SEVERAL OCCURRENCES/GLAZE 1155-1405

(h) The clock designated as the station standard must be checked at intervals as stated in Paragraph 3.4.g. At least one time check daily must be recorded and annotated. If a facility has another procedure for taking and recording time checks, the time check block may remain blank.

15.11. Additional Instructions for Part-Time Stations. M must be recorded to designate a METAR observation, S must be recorded to designate a SPECI observation.

15.12. Additive Data Groups (NA LAWRS). Although the observer may make entries on the form to suit the data available, all data transmitted shall be in accordance with the instructions in this order. Each character encoded and transmitted in the 3- and 6-hourly observation additive data groups has a meaning as specified in Chapter 14, Coding and Dissemination, and shall not be changes to station's available data.

15.13. Tailoring MF1M-10C, Synoptic Data, and Summary of the Day (NA LAWRS). Columns 26 and higher were designed for stations that operate continuously. Part-time stations must also record data for a 24-hour period, but because many part-time stations are not open at midnight, and do not have continuous recording instruments, their 24 hour day (or their station day) begins when the station closes and ends 24 hours later. Although the station day begins on the previous calendar day, the times entered in column 26 must be the times (LST) of the main 6-hourly synoptic reports made during the calendar day entered in the heading of the form. In column 26, the observer must disregard the "MID TO" and "MID" lines and on the line captioned "1," record the time of the first 6-hourly of the day. The precipitation and temperature extremes entered on that line cover the period from the last 6-hourly observation taken before the station closed (the previous day) to the current 6-hourly observation. The observer must reference the time of observation (column 26) and in block 65, record the number of hours, 12 or more since the last 6-hourly.

EXAMPLE-
COL42 0645 12HR DATA

The times on the following lines must be 6 hours apart and the entries must cover the previous 6 hours:

a. Snowfall, Column 34 (NA LAWRS). The entry on line "**1**" for snowfall, column 34, during the period when observing personnel were not on duty can be either "**0**," an amount, or missing (M).

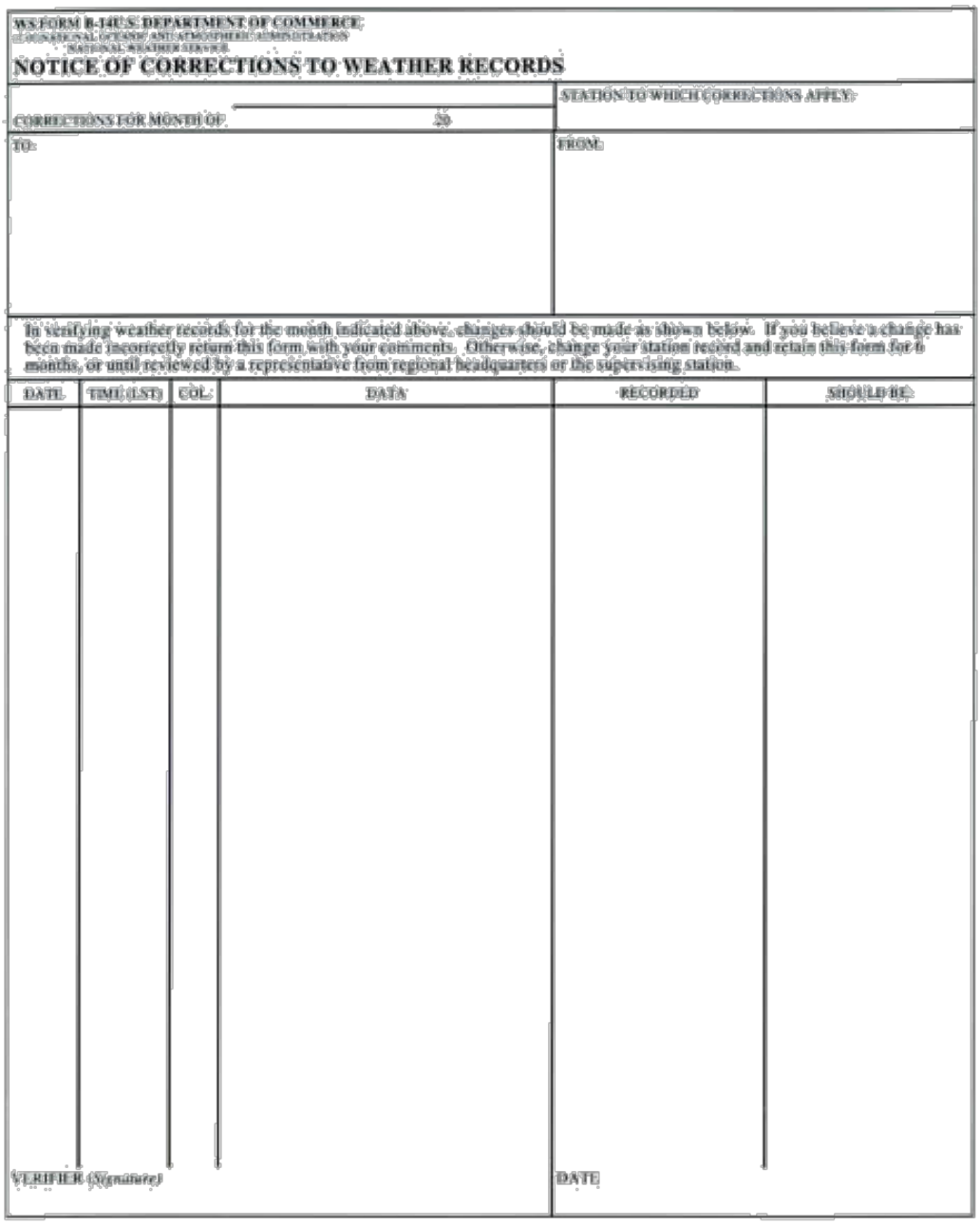
The observer must record "**0**" if, from conditions before the station closed until it opened, it is reasonably certain that no solid precipitation occurred. If the observer is unsure, because of mixed precipitation or several days of station closure, the observer must record "**M**" (missing) in this column and also in column 60. If any amount in column 34 is missing, the **M** must be carried in column 60. The observer must estimate snowfall if conditions were generally consistent throughout the period and all new precipitation was considered to be frozen. If any amount in column 34 is estimated, the observer must reference the column number and the time of observation in block 65, and must record that the data was estimated; for example, COL34 0644 ESTIMATED. The observer may also indicate why the data was estimated. If any amount in column 34 was estimated, and none was considered missing, column 60 must also be considered as estimated.

b. Station Day, Columns 57 through 61 (NA LAWRS). The observer must use the entries in columns 31 through 35 to complete the summary of day columns 57 through 61 for the "station" day. The observer must line out "MIDNIGHT TO MIDNIGHT" and must record the 24-hour period covered unless recording instruments are used for precipitation or temperature. For example, if the station's hours of operation are from 0600 to 1800, the station day is from 1800 the previous day to 1800 the current day (remember the first 6-hourly observation contained data for a 12-hour period).

15.14. Notice of Corrections to Weather Records. The accuracy of weather observations is important after the fact since the National Climatic Data Center (NCDC) utilizes this information to update climatological records for the U.S. If a station discovers that erroneous weather information was transmitted long-line, they are encouraged to send the corrected weather data using WS Form B-14, or, if the form is not available, by letter to the address provided below. (See Figure 15-1: WS Form B-14.)

NCDC Services Center
Rockcastle Business Park South
619 Progress Drive
Mt. Vernon, KY 40456

Figure 15-1: WS Form B-14



WS FORM B-14U.S. DEPARTMENT OF COMMERCE
NATIONAL WEATHER SERVICE

NOTICE OF CORRECTIONS TO WEATHER RECORDS

CORRECTIONS FOR MONTH OF _____ 20__

STATION TO WHICH CORRECTIONS APPLY:

TO:

FROM:

In verifying weather records for the month indicated above, changes should be made as shown below. If you believe a change has been made incorrectly return this form with your comments. Otherwise, change your station record and retain this form for 6 months, or until reviewed by a representative from regional headquarters or the supervising station.

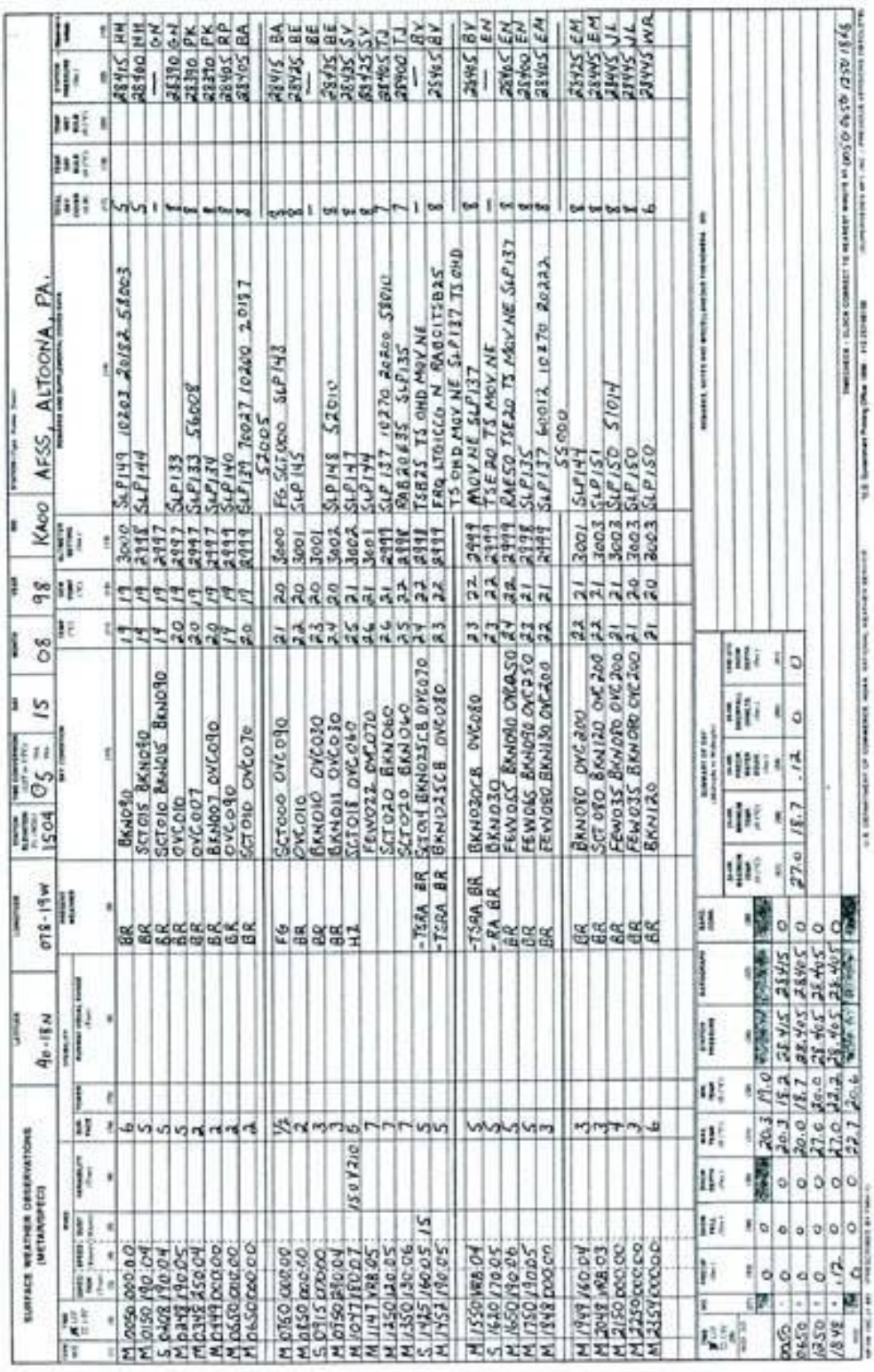
DATE	TIME (LST)	COL.	DATA	RECORDED	SHOULD BE

VERIFIER (Signature)

DATE

Example Form

Figure 15-2: Example of Entries on MF1M-10C, presents an example of a filled-in MF1M-10C form



Chapter 16. Operation of Equipment

16.1. Introduction. This chapter contains instructions for the operation of meteorological instruments, related equipment, care and use, and instrument evaluating procedures of various equipment.

Section 1. Precipitation Measuring Equipment

16.2. Ice Accretion Indicators. Ice-accretion indicators are designed to indicate the occurrence of freezing precipitation. A freezing rain sensor on an automated system with SPECI capability is capable of reporting ice accretion amounts. Ice accretion is determined and reported automatically and there is no manual backup required. When an automated system with SPECI capability freezing rain sensor is not available, a wooden bracket with clamps mounted on each end to hold a strip of aluminum may be used to determine whether freezing precipitation is occurring. Expose a strip of aluminum whenever the possibility of freezing precipitation exists. When precipitation is occurring, exposing a second strip of aluminum (which is near the same temperature as the air) will help to avoid the possibility of reporting freezing rain as occurring when actually the ice on the indicator might have formed some time prior to the observation. When doing this, however, care must be taken to ensure that the strips are at or very close to the same temperature as the air.

Section 2. Barometer Comparisons (NA CWO)

16.3. General. At locations with commissioned automated systems with SPECI capability, automated systems without SPECI capability, or digital altimeter setting indicator (DASI) designated as the station pressure standard, analog aneroid barometers and analog altimeter setting indicators must be standardized. Those analog instruments must be routinely compared to the station pressure standard to ascertain continued reliability and to determine corrections to readings of the analog aneroid instruments. Station pressure standards must be compared with traveling standards that are directly traceable to mercury standards at the National Institute of Standards and Technology (NIST).

Section 3. Performance of Aneroid Instruments

16.4. General. Rapid changes of temperature or exposure to direct heat or sunlight may cause erratic performance of aneroid instruments. Jarring of instruments may dislocate elements of the linkage system. Excessive friction or leaking pressure cells may result in erroneous pressure readings. After verification of erratic or excessive corrections which exceed the limits given in Paragraph 16.5 below, the observer must discontinue use of the unreliable instrument and notify the appropriate headquarters or maintenance shop. However, questionable corrections noted infrequently at the time of strong gusty winds are discouraged.

16.5. Aneroid Barometer or Altimeter Setting Indicator (NA CWO). Whenever the difference between the station pressure derived from the station pressure standard and the corrected reading of the aneroid instrument (preceding column 12 entry applied to column 9) exceeds 0.010 inch Hg (0.3 hPa), the difference should be immediately verified by making a second comparison, preferably by another observer.

a. If the difference between the second set of corrected readings does not exceed 0.010 inch Hg (0.3 hPa), the observer must disregard the first set of readings and use the second set in computing posted corrections.

b. If verified differences between corrected readings exceed 0.015 inch Hg (0.5 hPa), the observer must discontinue use of the aneroid instrument and notify the designated organization or maintenance shop.

16.6. Excessive Drift. Occasionally, a defect in an instrument may cause the correction to increase progressively at an abnormal rate. If the posted correction (column 12) of a standardized aneroid instrument has changed more than 0.020 inch Hg (0.7 hPa) since the instrument was reset, the observer must discontinue use of the aneroid instrument and notify the designated headquarters or maintenance shop.

16.7. Inspection Comparisons (NA CWO). Comparisons of station pressure standards with instruments from a headquarters or maintenance shop are made during visits by a representative of that headquarters or shop.

16.8. Electronic Pressure Transducers. The highly accurate and reliable electronic pressure transducers, including the digital altimeter setting indicator (DASI), the automated system with SPECI capability, the automated system without SPECI capability, and other approved new technologies, are compared by highly reliable traveling standards that are continuously checked against national mercurial standards.

Section 4. Temperature and Dewpoint Measuring Equipment

16.9. Temperature and Dewpoint Indicators

a. Fixed Installation: Follow provided training or manufacturer’s operation handbook.

b. Portable: Follow provided training or manufacturer’s operation handbook.

APPENDIX A. ABBREVIATIONS AND ACRONYMS

The abbreviations and acronyms included in this Appendix are defined in accordance with how they are used in this order.

Terms	Definitions
$	ASOS maintenance check indicator
-	light intensity
+	heavy intensity
/	indicator that runway visual range data follows; separator between temperature and dew point data
ACFT MSHP	aircraft mishap
AFSS	Automated Flight Service Station
ALDARS	Automated Lightning Detection and Reporting System
AO1	automated station without precipitation discriminator
AO2	automated station with precipitation discriminator
AOMC	ASOS Operations and Monitoring Center
ASI	altimeter setting indicator
ASOS	Automated Surface Observing System
AT AP	at airport
ATCS	Air Traffic Control Specialist
ATCT	Airport Traffic Control Tower
AUTO	automated report
AWOS	Automated Weather Observing System
B	began
BC	patches
BKN	broken
BL	blowing
BR	mist
C	Celsius, center (with reference to runway designation)
CA	cloud-air lightning

Terms	Definitions
CB	cumulonimbus cloud
CC	cloud-cloud lightning
CG	cloud-ground lightning
CHI	cloud-height indicator
CHINO	sky condition at secondary location not available
CIG	ceiling
CLR	no clouds detected at, or below, design limit of ceilometer (automated system)
CONS	continuous
COR	correction to a previously disseminated report
DA	density altitude
DASI	Digital Altimeter Setting Indicator
DIR	direction
DOC	Department of Commerce
DOD	Department of Defense
DOT	Department of Transportation
DR	low drifting
DS	duststorm
DSNT	distant
DU	widespread dust
DZ	drizzle
E	east, ended
F	Fahrenheit
FAA	Federal Aviation Administration
FBO	fixed base operator
FC	funnel cloud
FCM-H1	Federal Meteorological Handbook No.1, Surface Weather Observations and Reports
FEW	few clouds
FG	fog

Terms	Definitions
FIBI	filed but impracticable to transmit
FROPA	frontal passage
FRQ	frequent
FSS	Flight Service Station
FT	feet
FU	smoke
FZ	freezing
FZRA	freezing rain
FZRANO	freezing rain sensor not available
G	gust
GR	hail
GS	small hail and/or snow pellets
H	hour
Ha	field elevation
Hp	station elevation
hPa	Hectopascal
HZ	haze
IC	ice crystals, in-cloud lightning
ICAO	International Civil Aviation Organization
KT	knot
L	left (with reference to runway designation)
LAST	last observation before a break in coverage at a manual station
LAWRS	Limited Aviation Weather Reporting Station
LLWAS	Low Level Wind Shear Alert System
LOC	location
LST	Local Standard Time
LTG	lightning
LWR	lower

Terms	Definitions
M	minus, less than, missing
METAR	aviation routine weather report
MF1M-10C	Meteorological Form 1M-10C
MI	shallow
MID	midnight
MOV	moved/moving/movement
MSL	mean sea level
MT	mountains
N	north
NA	not applicable
NCDC	National Climatic Data Center
NE	northeast
NFCT	Non-Federal control tower
NF-OBS	Non-Federal Observer/Observation
NGRVR	New Generation Runway Visual Range
NOAA	National Oceanic and Atmospheric Administration
NOSPECI	no SPECI reports are taken at the station
NOTAM	Notice to Airmen
NW	northwest
NWS	National Weather Service
OBS	observer, observation
OCNL	occasional
OFCM	Office of the Federal Coordinator for Meteorology
OHD	overhead
OID	operator interface device
OT	operator terminal
OVC	overcast
P	greater than

Terms	Definitions
PK WND	peak wind
PL	ice pellets
PNO	precipitation amount not available
PO	dust/sand whirls (dust devils)
PR	partial
PRESFR	pressure falling rapidly
PRESRR	pressure rising rapidly
PREWX	present weather
PWINO	present weather information not available (automated system)
PY	spray
R	right (with reference to runway designation)
RA	rain
RMK	remark
RVR	Runway Visual Range
RWY	runway
S	south
SA	sand
SCT	scattered
SE	southeast
SFC	surface
SG	snow grains
SH	shower(s)
SKC	sky clear (manual observation)
SLP	sea-level pressure
SLPNO	sea-level pressure not available
SM	statute miles
SN	snow
SNINCR	snow increasing rapidly

Terms	Definitions
SPECI	aviation selected special weather report
SQ	squalls
SS	sandstorm
SW	southwest
TAF	aerodrome forecast (terminal)
TCU	towering cumulus
TRACON	Terminal Radar Approach Control
TS	thunderstorm
TSNO	thunderstorm information not available
TWR	tower
UP	unknown precipitation
USCG	United States Coast Guard
UTC	Coordinated Universal Time
V	variable
VA	volcanic ash
VC	in the vicinity
VDU	Video Display Unit
VFR	visual flight rules
VIS	visibility
VISNO	visibility at secondary location not available
VRB	variable
VV	vertical visibility
W	west
WMO	World Meteorological Organization
WND	wind
WSHFT	wind shift
WSOH	NWS Observing Handbook
Z	zulu, that is, Coordinated Universal Time

APPENDIX B. NON-FEDERAL OBSERVING (NF-OBS) PROGRAM

Paragraph 1.7.a states that the NF-OBS Program's procedures and practices must meet federal standards.

The NF-OBS Program was developed to enable local aviation entities such as non-Federal control towers (NFCT), airport personnel or fixed base operators (FBO) to assist with the backup and augmentation of the automated system with SPECI capability. The program is meant to be at no cost to the Government. Oversight of the program is provided at FAA Headquarters but administered by the appropriate service area.

Upon request from a non-Federal entity, a written agreement to provide augmentation and backup of the automated system with SPECI capability will be executed between the service area office and the NF-OBS provider. The agreement must be site-specific and must contain the hours and the service level at which service will be provided. The minimum level of augmentation must be the FAA-validated aviation service standard level for that site. Service may be provided at a higher level; however, the NF-OBS provider must provide that higher level during all hours of operation. As Service Level D is a stand alone ASOS/AWSS site, NF-OBS providers operating at these sites must provide a minimum of level C service.

Upon request by a potential NF-OBS provider, each FAA service area may enter into a cooperative agreement with the provider. Agreements must follow the prescribed format and will define the hours of operation for the NF-OBS and the service level at which the operation will be conducted. They also contain provisions that the NF-OBS provider will provide and train observers, provide suitable storage for instruments and equipment, and provide required backup equipment. Observers must be certified by the National Weather Service and must make all observations in accordance with applicable regulations.

Further information about this program can be obtained from the Aviation Weather Division, Policy and Requirements Branch.

APPENDIX C. LIMITED AVIATION WEATHER REPORTING STATION (LAWRS) REQUIREMENTS

C.1 Purpose

This Appendix contains the general requirements and describes the procedures and practices for LAWRS observers. References to the order (for example, Table C-1: LAWRS Requirements for Body of METAR) are provided for additional information.

C.2 General

LAWRS are facilities where observations are taken, prepared and transmitted by certified FAA control tower personnel, FAA-contract control tower personnel or Flight Service (Alaska only) Station personnel on a limited basis. At these facilities, various degrees of automated sensors and/or other automated equipment may be available. However, when on duty, the LAWRS observer has the complete responsibility for the surface aviation weather elements in the METAR/SPECI.

C.3 Requirements

LAWRS observers at different locations have differing observing requirements based upon whether or not an automated observation system is available, and the type of system they have. This Appendix states minimum requirements for what the LAWRS observer must put into the observation. The observation can be augmented beyond the stated requirements. Table C-1: LAWRS Requirements for Body of METAR gives the requirements for what the LAWRS observer must manually put in the body of the observation, and Table C-2: LAWRS Requirements for Remarks Section gives the requirements for what the LAWRS observer must insert in the remarks section. Additive and automated maintenance data included in the remarks section may be added by an automated system, but are not required to be augmented or backed up by LAWRS. Table C-3: LAWRS Requirements for SPECIs lists SPECI criteria and LAWRS requirements. Listed with each element in these tables is a paragraph reference for how to code the particular element. Details on the procedures for observing each element are given in the appropriate chapter (for example, tornadic activity procedures are included in Chapter 11. Sky Condition; variable visibility procedures are given in Chapter 8. Visibility).

C.4 Requirements for LAWRS without an Automated System

At locations without an automated weather observing system, LAWRS observers must take METAR/SPECI observations in accordance with general instructions for all observers, found in Chapter 3. All observed elements are reported in accordance with the standards of an automated system with SPECI capability as outlined in Paragraph C.5 of this Appendix. Specific instructions on individual elements of the METAR/SPECI are found in Chapters 7 through 16. The last column in Table C-1 through Table C-3 in this Appendix gives an outline of the requirements for providing manual LAWRS observations.

C.5 Procedures for LAWRS Using Automated Systems with SPECI Capability

a. Augmenting observations using automated systems with SPECI capability. An outline of the requirements for augmentation is provided in Table C-1 through Table C-3 of this Appendix. More

detail is given in Chapter 4 and Chapter 5. LAWRS observers must augment the following weather phenomena at sites equipped with automated systems with SPECI capability:

(1) Thunderstorm (at non-ALDARS sites)

(2) Tornadic activity (including tornado, waterspout, and funnel cloud)

(3) Hail

(4) Virga

(5) Volcanic ash

(6) Operationally significant remarks as deemed appropriate by the observer

b. Backup of automated systems with SPECI capability. If portions of, or the complete automated systems with SPECI capability observation is unavailable due to sensor/system malfunction, communications failure, erroneous data and/or non-representative data (see Paragraph 2.5 Backup Requirements and Chapter 6. Backup Requirements at Automated Weather Stations), LAWRS must backup, at a minimum, the following weather elements at sites with an automated system with SPECI capability: (Table C-1 through Table C-3 provides an outline of backup requirements for LAWRS.)

(1) Wind

(2) Visibility to 10 miles

(3) Present weather and obscurations (thunderstorms, at ALDARS sites), see Table 6-6

(4) Sky condition to 12K feet

(5) Temperature/dew point

(6) Altimeter setting

c. Documentation requirements, equipment requirements, and examples of augmented and backup observations are given in Chapters 4, 5 and 6.

C.6 Procedures for LAWRS with Automated Systems without SPECI Capability

a. Observations using automated systems without SPECI capability. At facilities where an automated system without SPECI capability is the automated system, LAWRS certified controllers must only use the automated system without SPECI capability OID (that is, AWOS) information to generate a manual hourly METAR/SPECI observation and distribute via the appropriate manual procedure. Observations using AWOS may not be transmitted long-line. LAWRS certified controllers must use the information displayed on the OID to formulate a METAR/SPECI, which will then be telephoned to the Flight Service Station.

b. An outline of the requirements for automated system without SPECI capability METAR/SPECI reports is provided in Table C-1 of this Appendix. More detail is given in Chapter 4 and Chapter 5.

C.7 Observing, Determining, and Reporting Procedures at LAWRS

a. Applicability. The provisions of this section are applicable only at LAWRS.

b. General. The only pressure related measurement required at LAWRS is the altimeter setting.

c. Determining Altimeter Setting (Only LAWRS). The altimeter setting must be determined by use of an altimeter setting indicator (ASI), a digital altimeter setting indicator (DASI), automated system with SPECI capability, automated system without SPECI capability, or an electronic pressure transducer. These instruments must be routinely compared and corrected as described in this section. The correction for each instrument used to report altimeter setting must be determined. The latest correction, even if zero, must be displayed on the instrument. The posted correction must be added to the instrument's reading before reporting the altimeter setting. Do not change the value of the altimeter setting in the automated system with SPECI capability one-minute page to add a correction. This will turn off report processing, which can only be turned back on by an NWS technician.

C.8 Altimeter Setting From Altimeter Setting Indicators (Only LAWRS). Altimeter setting indicators may be digital or analog. If a digital instrument is used, the altimeter setting must be determined by adding the posted correction to the reading. Some digital altimeter setting indicators including electronic pressure transducers do not require any corrections. If an analog instrument is used, the following procedures must apply:

a. Tap the face of the instrument lightly with the finger to reduce the effect of friction on the pointer mechanism.

b. Read the pressure scale of the indicator at the pointer, to the next lower 0.005 inch.

c. Determine the correct altimeter setting by adding the posted correction to the reading and rounding the sum down to the nearest inch and hundredths of inches.

C.9 Determining the Reliability of Altimeter Setting Indicators (Only LAWRS). The reliability of each altimeter setting indicator (ASI) must be verified as follows:

a. Compare the ASI readings daily with the altimeter setting obtained from an adjacent FSS, LAWRS, or NWS office meeting the criteria of Paragraph 13.49 Daily Comparison with an Adjacent Station (Only LAWRS) or weekly with an approved commissioned pressure standard at the facility as described in Paragraphs 16.4 through 16.7.

b. If the difference between altimeter settings does not exceed .02 inch at precision approach locations or .05 inch at other locations, the ASI is considered reliable and may be used, with the posted correction, to report altimeter setting values.

c. If all ASIs at the facility exceed limits, the altimeter setting must not be reported.

d. Instruments which exceed the stated limits must be reported to maintenance personnel and, for NWS maintained commissioned automated systems with SPECI capability, or other NWS maintained pressure instruments, to the appropriate NWS office.

e. At locations with a commissioned automated system with SPECI capability, or commissioned dual transducer automated system without SPECI capability units, the automated system with SPECI capability/automated system without SPECI capability becomes the pressure standard. At these commissioned locations, mercurial barometers are no longer required. Per FAA Order 7210.3, an ASI must be compared to the pressure standard daily and a DASI must be compared to the pressure standard at least monthly. When the difference is less than the tolerances specified in Paragraph 13.48, the value (+ or ~) is posted on or near the ASI/DASI and applied as the correction factor to determine the operational altimeter setting.

C.10 Daily Comparison with an Adjacent Station (Only LAWRS)

a. Locations without an approved pressure standard may compare their altimeter device against values obtained from an adjacent NWS office, FSS, or a LAWRS with an approved pressure standard provided:

(1) At locations where precision approaches are conducted, the weather station is not more than 10 nautical miles away and, at both locations, the wind speed is 12 knots or less with no gusts above 15 knots.

(2) At all other locations, the distance does not exceed 25 nautical miles and, at both locations, the wind speed must be 15 knots or less with no gusts above 20 knots.

(3) The difference in elevation does not exceed 100 feet at precision approach locations and 200 feet at all other locations.

(4) The station's temperature, at both locations, is within 30 ☐ F (16ºC) of the Atmosphere Temperature for the station's elevation.

b. The observer must not use altimeter setting values from aneroid instruments when the difference exceeds .02 at precision approach locations or .05 at all other locations.

NOTE-
LAWRS locations using an automated sensor, such as automated systems with SPECI capability or automated systems without SPECI capability, are not required to conduct a daily comparison of the sensor output with an adjacent station.

C.11 Altimeter Setting From a DASI. Altimeter settings may be obtained from a DASI through direct readings. Some DASI's may have a correction posted from a travelling standard.

C.12 Electronic Pressure Transducers or Other DASIs. A DASI may be used to determine station pressure from which the altimeter setting may be determined. The altimeter setting may be determined from station pressure by use of a pressure reduction computer, reduction constant, table, or by direct readout.

Table C-1: LAWRS Requirements for Body of METAR

LAWRS Requirements for Body of METAR			
Element	**LAWRS w/ Automated Systems with SPECI Capability**	**LAWRS w/ Automated Systems without SPECI Capability**	**LAWRS w/o Automated Systems without SPECI Capability/ Automated Systems with SPECI Capability**
Type of Report (METAR/SPECI)			X
Station Identifier (CCCC)			X
Date/Time (YYGGggZ)			X
Report Modifier (AUTO or COR)			X[1]
Wind (dddff(f)G$f_m f_m$KT) ($d_n d_n d_n V d_x d_x d_x$)	B	M	X
Visibility (VVVVVSM)	B	M	X[2]
Present Weather (w'w')	X	M	X
Sky Condition ($N_s N_s N_s h_s h_s h_s$ or $VVh_s h_s h_s$ or CLR/SKC)	B	M	X
Temperature/Dew Point (T'T'/$T'_d T'_d$)	B	M	X
Altimeter ($AP_H P_H P_H P_H$)	B	M	X

[1] If applicable.
[2] Tower visibility replaces surface visibility.
Legend:
A = Required to augment automated systems with SPECI capability.
B = Required to backup automated systems with SPECI capability.
M = Manual observation
X = Required.

Table C-2: LAWRS Requirements for Remarks Section

LAWRS Requirements for Remarks Section of Observation (Automated, Manual, and Plain Language)			
Element	**LAWRS w/ Automated Systems with SPECI Capability**	**LAWRS w/ Automated Systems without SPECI Capability**	**LAWRS w/o Automated Systems without SPECI Capability/ Automated Systems with SPECI Capability**
Volcanic Eruptions	A	A	X
Tornadic Activity (Tornadic activity_B/E(hh)mm LOC/DIR_(MOV))	A[1]	A	X
Type of Automated Station (AO1, AO2)			
Peak Wind (PK WND dddff(f)/(hh)mm)			
Wind Shift (WSHFT_(hh)mm)	A	A	A
	A[2]	A[3]	
Variable Prevailing Visibility (VIS minVmax)			X
Sector Visibility (VIS_dd_vv)[4]			
Lightning ({FREQ}_ LTG{TYPE}_{LOC})	A	A	X
Beginning/Ending Time of Precipitation (WX)B(mm)E(mm) \	A[1]		
Beginning/Ending Time of Thunderstorms (TS)B(mm)E(mm)	A[1]		X
Thunderstorm Location (TS_LOC_(MOV_DIR))	A	A	X
Hailstone Size (GR_{INCHES})	A	A	X
Virga (VIRGA_{Direction})	A[5]	A[5]	X[5]
Variable Ceiling (CIG minVmax)			X
Obscurations (w'w'_($N_sN_sN_s$) $h_sh_sh_s$)			X
Variable Sky Condition ($N_sN_sN_s(h_sh_sh_s)$_V_$N_sN_sN_s$)			X

LAWRS Requirements for Remarks Section of Observation (Automated, Manual, and Plain Language)			
Element	**LAWRS w/ Automated Systems with SPECI Capability**	**LAWRS w/ Automated Systems without SPECI Capability**	**LAWRS w/o Automated Systems without SPECI Capability/ Automated Systems with SPECI Capability**
			X
Pressure Rising or Falling Rapidly (PRESRR) (PRESFR)			
Aircraft Mishap (ACFT_ MSHP)			X
No SPECI Reports Taken (NOSPECI)			X
Other Significant Information (Plain Language)			X

[1] Beginning/end time done automatically by automated systems with SPECI capability (for tornadic activity, thunderstorms, and hail).
[2] Tower visibility can be either in remarks or the body of the observations, based upon which visibility is lower.
[3] For automated systems without SPECI capability, tower visibility will always be in remarks.
[4] Note: Not required by LAWRS, may be reported if deemed operationally significant by the controller/ observer
[5] Direction of virga from station is optional.
Legend:
A = Required to augment automated systems with SPECI capability.
B = Required to backup automated systems with SPECI capability.
X = Required.

Table C-3: LAWRS Requirements for SPECIs

LAWRS Requirements for SPECI[1]		
SPECI Criteria	**LAWRS w/ Automated Systems With SPECI Capability**	**LAWRS w/o Automated Systems Without SPECI Capability/ Automated Systems With SPECI Capability**
Wind Shift - Wind direction changes by 45 degrees or more in less than 15 minutes and the wind speed is 10 knots or more throughout the wind shift.	B	X
Visibility - Surface visibility as reported in the body of the report decreases to less than, or if below, increases to equal or exceed: 3 miles, 2 miles, 1 mile, and ~~1~~ 2 mile or the lowest standard instrument approach procedure minimum as published in the National Ocean Survey (NOS) U.S. Terminal Procedures.	A[2]	X
Runway Visual Range - The highest value from the designated RVR runway decreases to less than, or if below, increases to equal or exceed 2,400 feet during the preceding 10 minutes. Note: Criteria applies to automated RVR reporting only.	NA LAWRS	NA LAWRS
Tornado, Funnel Cloud, Or Waterspout - is observed or disappears from sight.	A	X
Thunderstorm - begins (a SPECI report is not required to report the beginning of a new thunderstorm if one is currently reported) or ends.	A	X
Precipitation - hail begins or ends; freezing precipitation begins, ends, or changes intensity; ice pellets begin, end, or change intensity at manual stations.	A[3]	X
Squall - Wind suddenly increases at least 16 knots and is sustained at 22 knots or more for at least one minute.	B	X
Ceiling - When the height of the base of clouds covering five oktas or more (for example, broken and overcast) of the sky forms or dissipates below, decreases to less than or, if below, increases to equal or exceed: 3,000 ft., 1,500 ft., 1,000 ft., 500 ft., and 200 ft. or the lowest standard instrument approach procedure minimum as published in the National Ocean Survey (NOS) U.S. Terminal Procedures.	B	X
Sky Condition - A layer of clouds or obscuring phenomena aloft is present below 1,000 feet and no layer aloft was reported below 1,000 feet in the preceding METAR or SPECI observation.	B	X
Volcanic Eruption - When eruption is first noted.	X	X
Aircraft Mishap - Upon notification of an Aircraft Mishap unless there has been an intervening observation.	[4]	X
Miscellaneous - Any other meteorological situation which, in the opinion of the observer, is critical.	IR	IR

[1] SPECIs are not a capability of the automated system without SPECI capability. (Automated systems without SPECI capability produce METARs every 20 minutes.)
[2] LAWRS augments tower visibility producing SPECI; backs up surface visibility to produce SPECI.
[3] LAWRS observer augments to produce SPECI for hail; backs up initiating SPECI for freezing precipitation.
[4] LAWRS initiates archive action only. In addition, LAWRS will take a backup observations (but will not transmit) if elements of the automated system require backup
Legend:

LAWRS Requirements for SPECI[1]		
SPECI Criteria	**LAWRS w/ Automated Systems With SPECI Capability**	**LAWRS w/o Automated Systems Without SPECI Capability/ Automated Systems With SPECI Capability**
B - LAWRS backs up SPECI initiation X - LAWRS initiates SPECI A - LAWRS initiates SPECI to produce report IR - LAWRS initiates SPECI if required C = Not backed up by LAWRS.		

Table C-4: Backup Reporting of Visibility

BACKUP REPORTING OF VISIBILITY	
LOCATION/CONDITION	**REPORTING PROCEDURES**
LAWRS TOWERS	
Sensor Failure	1. Tower reports visibility.[2]
Non-representative Data	1. Tower reports visibility. 2. Tower may turn report processing off (automated systems with SPECI capability) or set channel out of service (automated systems without SPECI capability).
OID/OT/communications failure	1. Tower reports visibility.[2]
[1] Designated procedures are specified in Table 4-1. [2] Observer must make appropriate maintenance notification.	

APPENDIX D. SERVICE STANDARDS

D.1 Description

The term Service Standards refers to four levels of detail in weather observations at sites where there is a commissioned ASOS/AWSS. The first category, known as Service Level D, is completely automated service in which the ASOS/AWSS observation constitutes the entire observation, that is, no additional weather information is added by a human observer. A large number of airfields that receive level D service have never had weather information available. Service Level D provides information on wind, visibility, precipitation/obstruction to vision, cloud height and sky cover, temperature/dewpoint, altimeter, and in some cases freezing rain and lightning reporting capability.

The second category, known as Service Level C, consists of all the elements of Service Level D, in addition to a human observer, who adds information to the automated observation. This is referred to as "augmentation." The augmented information includes, as a minimum, such weather phenomena as thunderstorms, tornadoes, hail, virga, volcanic ash, and tower visibility. Service Level C also includes "backup" of ASOS elements in the event of an ASOS malfunction or an unrepresentative ASOS report. In the backup mode, the controller inserts the correct or missing value for the automated ASOS elements. Service Level C is provided at all airports with a properly sited, fully qualified Federal facility during facility hours of operation. During hours that the facility is closed, the airport reverts to stand-alone ASOS or Service Level D as described above. Although this category is listed as tower augmented, the service may be provided by Flight Service Station personnel (Alaska only), NWS observers, or contract weather observers.

To enhance air traffic control efficiency and increase system capacity, additional detail beyond Service Level C was required at some airports. These airports were divided into two categories. The highest category, referred to as Service Level A, includes major aviation hubs and high traffic volume airports with average or worse weather. The remaining group of airports (smaller hubs or special airports in other ways, that have worse than average bad weather operations for thunderstorms and/or freezing/frozen precipitation, and/or that are remote airports) are referred to as Service Level B airports.

Service Level B consists of all the elements of Service Levels C and D plus long-line runway visual range (RVR), where connected, freezing drizzle versus freezing rain, ice pellets, and remarks for snow depth and snow increasing rapidly, thunderstorm/lightning location, and observed significant weather not at the station.

Service Level A airports will receive, in addition to the services described above, 10 minute long-line RVR or additional visibility increments of 1/8, 1/16 and 0. If observed, the following elements will be added to the observation; sector visibility, variable sky condition, cloud layers above 12,000 feet and significant cloud types, widespread dust, sand and other obscurations, and volcanic eruptions.

Table D-1: Service Standard Levels lists the available capabilities in each Service Level.

D.2 Determining Level of Service

In order to determine which airports would receive a particular service level of weather support, airports were ranked according to their scores in three areas: (1) occurrence of significant weather weighted by traffic counts; (2) distance to the nearest suitable alternate airport; and (3) critical airport characteristics. These criteria produced a score which determined the airport's level of service.

The significant weather score is calculated by taking into consideration the percentage of times that the airport is impacted by bad weather such as low visibility, thunderstorms, and freezing precipitation. This percentage is then multiplied by the total number of operations at the airport. For sites that did not have climatological weather information available, an alternate method was devised which assigned weather information from the nearest airport with similar weather.

The score for distance to the nearest suitable alternate airport gave credit to airports for which the nearest suitable alternate was a greater distance away.

The airport characteristics score was based upon the tower level of the airport, whether or not the airport is considered a hub, the category qualification of the airport, and other characteristic factors.

The scores from the three areas described above were added together and each airport was assigned a composite score and ranked accordingly. The overall ranking determined the airport's Service Standard Level.

D.3 Procedures

Augmentation and backup at A, B, and C locations is provided by a combination of Federal and non-Federal personnel and existing contract weather observers through implementation of an ASOS basic weather watch. During a basic weather watch, the observer may be required to perform other duties as their observing workload permits. Because of this and other restrictions (station location, structural design, etc.) which limit the observer's capability to continuously view and evaluate weather conditions, observers performing a basic weather watch cannot be expected to detect and report all weather changes as they occur. In addition to taking and disseminating required observations, facilities performing a basic weather watch must recheck weather conditions to determine if a new observation (SPECI) is required when advised by any reliable source (for example, tower controller) that existing conditions differ from those reported in the last disseminated observation. For ASOS augmentation and backup, the observer should augment routine hourly observations in accordance with the appropriate service level standards, periodically check the current observation to determine if a special has been generated requiring augmentation or backup, and conduct a timely evaluation of the representativeness and accuracy of the current observations when advised by any reliable source that existing conditions differ from those being reported.

Table D-1: Service Standard Levels

Service Level A	
Service Level A consists of all the elements of service levels B, C and D plus the elements listed to the right, if observed.	10 minute longline RVR* where connected sites *or* additional visibility increments of 1/8, 1/16 and 0 Sector visibility Variable sky condition Cloud layers above 12,000 feet and significant cloud types (that is, CB, TCU). Widespread dust, sand and other obscurations Volcanic eruptions

Service Level B	
Service Level B consists of all the elements of service levels C and D plus the elements listed to the right, if observed.	Longline RVR* at where connected (may be instantaneous readout) Freezing drizzle versus freezing rain Ice pellets Snow depth and snow increasing rapidly remarks Thunderstorm and lightning location remarks Observed significant weather not at the station remarks

Service Level C	
Service Level C consists of all the elements of Service Level D plus augmentation and backup of the system by a human observer or an air traffic control specialist on location nearby. The National Air Traffic Controllers Association (NATCA), the groups representing the interests of the air traffic controllers, and the FAA have agreed that at this level of service, the air traffic control specialists are allowed the option of adding operationally significant remarks. Backup consists of inserting the correct value if the system malfunctions or is unrepresentative. Augmentation consists of adding the weather elements listed to the right, if observed. During hours that the observing facility is closed, the site reverts to Service Level D.	Thunderstorms Tornadoes Hail Virga Volcanic ash Tower visibility Any reportable weather elements considered operationally significant by the observer

Service Level D	
This level of service consists of an ASOS continually measuring the atmosphere at a point near the runway. The Automated System with SPECI capability senses and measures the weather parameters listed to the right.	Wind Visibility Precipitation/Obstruction to vision Cloud height and sky cover Temperature and dewpoint Altimeter Freezing rain capability Lightning reporting capability

** Longline RVR will be automated at all RVR sites with ASOS and New Generation RVR systems as the interface is fielded at these sites.*

APPENDIX E. METAR USER AIDS

This Appendix is included as a quick reference guide for users. In the event of any discrepancies between the material in this order and this Appendix, the text must take priority.

METAR

User Aids

Contents:

No table of figures entries found.

E.1 U.S. METAR/SPECI Code Format with Remarks

U.S. METARSPECI CODE FORMAT WITH REMARKS	
METAR/SPECI_ CCCC_ YYGGggZ_AUTO_COR_dddff(f)$Gf_mf_m(f_m)$KT_$d_nd_nd_nVd_xd_x$_VVVVSM_[$RD_RD_R/V_RV_RV_RV_R$FT or $RD_RD_R/V_nV_nV_nV_nVV_xV_xV_xV_x$FT]_w'w'_[$N_sN_sN_sh_sh_sh_s$ or $VVh_sh_sh_s$ or SKC/CLR]_T'T'/T'dT'd_$AP_HP_HP_HP_H$_RMK_(Automated, Manual, Plain Language)_(Additive and Automated Maintenance Data)	
Body of Report: PARAMETER	**DESCRIPTION**
Type of Report (METARSPECI)	METAR is the routine (scheduled) report. SPECI is the non-routine (unscheduled) weather report.
Station Identifier (CCCC)	ICAO station identifier. Consists of four alphabetic characters, for example, KABC.
Date/Time (YYGGggZ)	Day of the month, followed by the actual time of the report or when the criteria for a SPECI is met or noted. Group ends with Z to indicate use of UTC. For example, 251456Z.
Report Modifier (AUTO or COR))	AUTO indicates a fully automated report. No human intervention. COR indicates a correction to a previously disseminated report.
Wind (dddff(f)$Gf_mf_m(f_m)$KT) ($d_nd_nd_nVd_xd_xd_x$)	True wind direction in tens of degrees using three digits. Speed is reported in whole knots (two or three digits). Gusts (G) are appended to the speed if required. Group ends with KT to indicate knots. For example, 23018G26KT. If wind direction varies by 60° or more and speed is > 6 knots a variable wind group is also reported, for example, 180V250. Direction may be reported VRB (variable) if speed is ≤ 6 knots, for example, VRB05KT. Calm winds are reported 00000KT.
Visibility (VVVVVSM)	Surface visibility reported in statute miles. A space divides whole miles and fractions. Group ends with SM to indicate statute miles. For example, 1 1/2SM. Auto only: M prefixed to value < 1/4 mile, for example, M1/4SM.
Runway Visual Range ($RD_RD_R/V_RV_RV_RV_R$FT or $RD_RD_R/V_nV_nV_nV_nVV_xV_xV_xV_x$FT)	10-Minute RVR value: Reported in hundreds of feet if visibility is ≤ one statute mile or RVR is ≤ 6000 feet. Group ends with FT to indicate feet. For example, R06L/2000FT. The RVR value is prefixed with either M or P to indicate the value is lower or higher than the RVR reportable values, for example, R06L/P6000FT. If the RVR is variable during the 10-minute evaluation period, the variability is reported, for example, R06L/2000V4000FT.
Present Weather (w'w')	Present weather (other than obscurations) occurring at the station are reported in the body of the METAR/SPECI. Obscurations are reported if visibility < 7 miles. VA may be reported with any visibility. BCFG and PRFG may also be reported if visibility ≥ 7SM. Some present weather and qualifiers may be reported if In-the-Vicinity (not at point-of-observation), for example, TS, FG, SH, PO, BLDU, BLSA, BLSN, SS and DS. Weather is reported in order of decreasing dominance. Maximum of three groups reported (precipitation included in one group; separate groups for other weather). Automated stations can only report RA, SN, UP, FG, BR, FZFG, HZ, and SQ without augmentation. See table on reverse for more information on qualifiers and weather phenomena.
Sky Condition ($N_sN_sN_sh_sh_sh_s$ or $VVh_sh_sh_s$ or SKC/CLR)	Automated stations truncate to three layers up to 12000 feet; if no layers are detected CLR is reported. At manual stations up to six layers can be reported; if no layers observed SKC is reported. Each layer contains the amount (FEW, SCT, BKN, OVC) immediately followed by the height using three digits, for example, FEW015 BKN030. Any layer containing CB or TCU (manual only) the contraction is appended to the layer height, for example, FEW015TCU. All layers are considered opaque. Vertical visibility (VV) is reported in hundreds of feet for an indefinite ceiling, for example, VV002. Surface obscuration (manual only) reported using amount (FEW, SCT, BKN), followed by "000," for example, SCT000; remark required.
Temperature/Dew Point (T'T'/$T'_dT'_d$)	Temperature and dew point are reported to the nearest whole degree Celsius using two digits, for example, 17/13. Sub-zero values are prefixed with an M, for example, 03/M02.
Altimeter ($AP_HP_HP_HP_H$)	Altimeter is prefixed with an A indicating altimeter in inches of mercury. Reported using four digits; tens, units, tenths, and hundredths of inches of mercury, for example, A2990.
Remarks (RMK) -- Divided into two categories: 1. Automated, Manual (Augmented), Plain Language (Manual Only), 2. Additive and Automated Maintenance Data. The following describes the order in which remarks are reported.	
Automated, Manual, Plain Language	Volcanic Eruption, Tornadic Activity (B/E_(hh)mm_LOC/DIR_(MOV)), Type of

U.S. METARSPECI CODE FORMAT WITH REMARKS	
	Automated Station (AO1, AO2), Peak Wind (PK_WND_dddff(f)/(hh)mm), Wind Shift (WSHFT_(hh)mm_FROPA), Tower Visibility (TWR_VIS_vvvvv), Surface Visibility (SFC_VIS_vvvvv), Variable Prevailing Visibility ($VIS\_v_nv_nv_nv_nVv_xv_xv_xv_xv_x$), Sector Visibility (VIS_[DIR]_vvvvv), Visibility at 2nd Location (VIS_vvvvv_[LOC], Lightning ([FREQ]_LTG[type]_[LOC]), Begin/End Pcpn (w'w'B(hh)mmE(hh)mm), Begin/End Thunderstorm (TSB(hh)mmE(hh)mm), Thunderstorm Location (TS_LOC_(MOV_DIR)), Hailstone Size (GR_[size]), Virga (VIRGA_(DIR)), Variable Ceiling Height ($CIG\_h_nh_nh_nVh_xh_xh_x$), Obscurations (w'w'_[$N_sN_sN_s$]($h_sh_sh_s$), Variable Sky Condition ($N_sN_sN_s(h_sh_sh_s)\_V\_N_sN_sN_s$), Significant Cloud Types, Ceiling Height at 2nd Location (CIG_hhh_[LOC], Pressure Rising/Falling Rapidly (PRESRR, PRESFR), Sea-Level Pressure (SLPppp or SLPNO), Aircraft Mishap (ACFT MSHP), No SPECI ReportsTaken (NOSPECI), Snow Increasing Rapidly (SNINCR_[inches-hr/inches on ground]), Other Significant Information (agency specific, for example, LAST)
Additive and Automated Maintenance Data	Hourly Precipitation Amount (Prrrr), 3- and 6-Hour Precipitation Amount (6RRRR), 24-Hour Precipitation Amount ($7R_{24}R_{24}R_{24}R_{24}$), Snow Depth on the Ground (4/sss), Water Equivalent of Snow on Ground (933RRR), Cloud Types ($8/C_LC_MC_H$), Duration of Sunshine (98mmm), Hourly Temperature and Dew point: 0.1 [illegible] ($1s_nT_sT_sT_sT'_dT'_dT'_d$), 6-Hour Maximum Temperature: 0.1°C ($1s_nT_xT_xT_x$), 6-Hour Minimum Temperature: 0.1 [illegible] ($2s_nT_nT_nT_n$), 24-Hour Maximum/Minimum Temperature: 0.1°C ($4s_nT_xT_xT_xs_nT_nT_nT_n$), 3-Hour Pressure Tendency (5appp), Sensor Status Indicators: RVRNO, PWINO, PNO, FZRANO, TSNO, VISNO_LOC, CHINO_LOC, Maintenance Check Indicator: $
If an element or phenomena does not occur, is missing, or cannot be observed, the corresponding group and space are omitted (body and/or remarks) from that particular report, except for Sea-Level Pressure (SLPppp), and 3-, 6-, and 24-Hour precipitation groups. At stations equipped with automated systems with SPECI capability equipped and manual stations, SLPNO must be reported in a METAR when the SLP is not available. Precipitation groups can be reported as missing.	

E.2 Notations for Reporting Weather Phenomena

NOTATIONS FOR REPORTING WEATHER PHENOMENA							
QUALIFIER							
Intensity or Proximity							
-	Light	no sign	Moderate	**+**	Heavy		
VC	In the Vicinity						
Descriptor							
MI	Shallow	**PR**	Partial	**BC**	Patches	**DR**	Low Drifting
BL	Blowing	**SH**	Shower(s)	**TS**	Thunderstorm	**FZ**	Freezing
WEATHER PHENOMENA							
Precipitation							
DZ	Drizzle	**RA**	Rain	**SN**	Snow	**SG**	Snow Grains
IC	Ice Crystals	**PL**	Ice Pellets	**GR**	Hail	**GS**	Small Hail/Snow Pellets
UP	Unknown Precipitation (auto; no intensity)						
Obscuration							
BR	Mist	**FG**	Fog	**FU**	Smoke	**VA**	Volcanic Ash
DU	Widespread Dust	**SA**	Sand	**HZ**	Haze	**PY**	Spray
Other							
PO	Well Developed Dust/Sand Whirls	**SQ**	Squalls	**FC**	Funnel Cloud(s) (Tornado, or Waterspout)	**SS**	Sandstorm
DS	Duststorm						

REPORTABLE CONTRACTIONS FOR SKY COVER			REPORTING OF LAYERS AUTOMATED STATIONS	
Reportable Contraction	Meaning	Summation Amount of Layer	Priority	Layer Description
VV	Vertical Visibility	8/8	1	lowest few layer
SKC or CLR	Clear	0	2	lowest broken layer
FEW	Few	less than 1/8 to 2/8	3	overcast layer
SCT	Scattered	3/8 to 4/8	4	lowest scattered layer
BKN	Broken	5/8 to less than 8/8	5	second lowest scattered layer
OVC	Overcast	8/8	6	second lowest broken layer
SKC is reported at manual stations when no clouds are observed.			7	highest broken layer
CLR is reported at automated stations when no clouds are detected at or below 12000 feet.			8	highest scattered layer

REPORTABLE VISIBILITY VALUES -- Automated	REPORTABLE VISIBILITY VALUES -- Manual
M1/4, 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/2, 3, 4, 5, 6, 7, 8, 9, 10	0, 1/16, 1/8, 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 1 7/8, 2, 2 1/4, 2 1/2, 2 3/4, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 20, 25, 30, 35, 40, etc., in 5 mile increments.

FORMAT AND ORDER OF CODED REMARKS -- Times of Transmission	00	03	06	09	12	15	18	21
Synoptic Cloud Types, $8/C_LC_MC_H$ (manual)	X	X	X	X	X	X	X	X
Snow Increasing Rapidly SNINCR [inches/hr]/[inches on ground] (manual)	Hourly							
Depth of Snow on the Ground, 4/sss (manual)	X[1]		X[1]		X[1]		X[1]	
Water Equivalent of Snow on the Ground, 933RRR (manual)							X	
Duration of Sunshine, 98mmm (manual)	0800 UTC							
Hourly Precipitation Amount, Prrrr (automated stations only)	Hourly							
6-Hour Precipitation Amount, 6RRRR	X[3]	X4	X[3]	X[4]	X[3]	X[4]	X[3]	X[4]
FORMAT AND ORDER OF CODED REMARKS -- Times of Transmission	**00**	**03**	**06**	**09**	**12**	**15**	**18**	**21**
24-Hour Precipitation Amount, $7R_{24}R_{24}R_{24}R_{24}$					X			
Hourly Temperature and Dew Point, $Ts_nT_aT_aT_as_nT'_aT'_aT'_a$	Hourly							
6-Hour Maximum Temperature, $1s_nT_xT_xT_x$	X		X		X		X	

6-Hour Minimum Temperature, $2s_nT_nT_nT_n$	X		X		X		X	
24-Hour Maximum/Minimum Temperature, $4s_nT_xT_xT_xs_nT_nT_nT_n$	Midnight Local Standard Time (LST)							
Pressure Tendency, 5appp	X	X	X	X	X	X	X	X

[1] included whenever there is more than a trace of snow on the ground
[3] 6-hour precipitation amount
[4] 3-hour precipitation amount

E.3 Key to Decode METAR/SPECI Observations

KEY TO DECODE METAR/SPECI OBSERVATIONS		
METAR KABC 121755Z AUTO 21016G24KT 180V240 1SM R11/P6000FT -RA BR BKN015 OVC025 06/04 A2990 RMK AO2 PK WND 20032/25 WSHFT 1715 VIS 3/4V1 1/2 VIS 3/4 RWY11 RAB07 CIG 013V017 CIG 017 RWY11 PRESFR SLP125 P0003 60009 T00640036 10066 21012 58033 TSNO $		
TYPE OF REPORT	METAR: hourly (scheduled) report; SPECI: special (unscheduled) report.	METAR
STATION IDENTIFIER	Four alphabetic characters; ICAO location identifier.	KABC
DATE/TIME	All dates and times in UTC using a 24-hour clock; two-digit date and four-digit time; always appended with Z to indicate UTC.	121755Z
REPORT MODIFIER	Fully automated report, no human intervention; removed when observer signed-on.	AUTO
WIND DIRECTION AND SPEED	Direction to nearest ten degrees from true north (first three digits); next two digits: speed in whole knots; as needed Gusts (character) followed by maximum observed speed; always appended with KT to indicate knots; 00000KT for calm; if direction varies by 60 Variable wind direction group is reported.	21016G24KT 180V240
VISIBILITY	Prevailing visibility in statute miles and fractions (space between whole miles and fractions); always appended with SM to indicate statute miles; values <1/4 reported as M1/4.	1SM
RUNWAY VISUAL RANGE	10-minute RVR value in hundreds of feet; reported if prevailing visibility is ≤ one mile or RVR ≤ 6000 feet; always appended with FT to indicate feet; value prefixed with M or P to indicate value is lower or higher than the reportable RVR value .	R11/P6000FT
WEATHER PHENOMENA	RA: liquid precipitation that does not freeze; SN: frozen precipitation other than hail; UP: precipitation of unknown type; intensity prefixed to precipitation: light (-), moderate (no sign), heavy (+); FG: fog; FZFG: freezing fog (temperature below 0°C); BR: mist; HZ: haze; SQ: squall; maximum of three groups reported; augmented by observer: FC (funnel cloud/tornado/waterspout); TS (thunderstorm); PL (ice pellets); GR (hail); GS (small hail; <1/4 inch); FZRA (intensity; freezing rain); VA (volcanic ash).	-RA BR
SKY CONDITION	Cloud amount and height: CLR (no clouds detected below 12000 feet); FEW (few); SCT (scattered); BKN (broken); OVC (overcast); followed by 3-digit height in hundreds of feet; or vertical visibility (VV) followed by height for indefinite ceiling.	BKN015 OVC025
TEMPERATURE/DEW POINT	Each is reported in whole degrees Celsius using two digits; values are separated by a solidus; sub-zero values are prefixed with an M (minus).	06/04
ALTIMETER	Altimeter always prefixed with an A indicating inches of mercury; reported using four digits: tens, units, tenths, and hundredths.	A2990

E.4 Weather Phenomena Matrix

The shaded blocks indicate which qualifiers and weather phenomena are not accepted by the ASOS and AWOS C software for the present weather field.

WX PHENOMENA	**QUALIFIER**	
Precipitation	**Intensity or Proximity**	**Descriptor**[1]

		Light **-**	Moderate	Heavy **+**	Vicinity **VC**[2]	Shallow **MI**	Partial **PR**	Patches **BC**	Low Drifting **DR**[3]	Blowing **BL**	Shower(s) **SH**	Thunder-storm **TS**[4]	Freezing **FZ**
Drizzle	**DZ**	-DZ	Drizzle	+DZ	-	-	-	-	-	-	-	-	FZDZ
Rain	**RA**	-RA	RA	+RA	-	-	-	-	-	-	SHRA	TSRA	FZRA
Snow	**SN**	-SN	SN	+SN	-	-	-	-	DRSN	BLSN	SHSN	TSSN	-
Snow Grains	**SG**	-SG	SG	+SG	-	-	-	-	-	-	-	-	-
Ice Crystals[5]	**IC**	-	IC	-	-	-	-	-	-	-	-	-	-
Ice Pellets	**PL**	-PL	PL	+PL	-	-	-	-	-	-	SHPL	TSPL	-
Hail[5,6]	**GR**	-	GR	-	-	-	-	-	-	-	SHGR	TSGR	-
Small Hail[5,7]	**GS**	-	GS	-	-	-	-	-	-	-	SHGS	TSGS	-
Unknown Precipitation	**UP**	Automated Stations Only - No Intensity				-	-	-	-	-	-	-	-
Thunderstorms, Showers, Freezing, and their Intensity or Proximity Indicator							-	-	-	-	-	-	-
TS	-	-	TS	-	VCTS[8]	-	-	-	-	-	-	-	-
TSRA	-	-TSRA	TSRA	+TSRA	-	-	-	-	-	-	-	-	-
TSSN	-	-TSSN	TSSN	+TSSN	-	-	-	-	-	-	-	-	-
TSPL	-	-TSPL	TSPL	+TSPL	-	-	-	-	-	-	-	-	-
TSGS	-	-	TSGS	-	-	-	-	-	-	-	-	-	-
TSGR	-	-	TSGR	-	-	-	-	-	-	-	-	-	-
SH	-	-	-	-	VCSH[9]	-	-	-	-	-	-	-	-
SHRA	-	-SHRA	SHRA	+SHRA	-	-	-	-	-	-	-	-	-
SHSN	-	-SHSN	SHSN	+SHSN	-	-	-	-	-	-	-	-	-
SHPL	-	-SHPL	SHPL	+SHPL	-	-	-	-	-	-	-	-	-
SHGR	-	-	SHGR	-	-	-	-	-	-	-	-	-	-
SHGS	-	-	SHGS	-	-	-	-	-	-	-	-	-	-
FZDZ	-	-FZDZ	FZDZ	+FZDZ	-	-	-	-	-	-	-	-	-
FZRA	-	-FZRA	FZRA	+FZRA	-	-	-	-	-	-	-	-	-
FZFG	-	-	FZFG	-	-	-	-	-	-	-	-	-	-
Obscurations		-	-	-	-	-	-	-	-	-	-	-	-
Mist[10]	**BR**	-	BR[10]	-	-	-	-	-	-	-	-	-	-
Fog[11]	**FG**	-	FG[11]	-	VCFG[12]	MIFG[13]	PRFG[14]	BCFG[15]	-	-	-	-	FZFG[16]
Smoke	**FU**	-	FU	-	-	-	-	-	-	-	-	-	-
Obscurations		-	-	-	-	-	-	-	-	-	-	-	-
Volcanic Ash[17]	**VA**	-	VA[17]	-	-	-	-	-	-	-	-	-	-
Widespread Dust	**DU**	-	DU	-	-	-	-	-	DRDU	BLDU	-	-	-
Sand	**SA**	-	SA	-	-	-	-	-	DRSA	BLSA	-	-	-
Haze	**HZ**	-	HZ	-	-	-	-	-	-	-	-	-	-
Spray	**PY**	-	-	-	-	-	-	-	-	BLPY	-	-	-
Blowing Phenomena		-	-	-	-	-	-	-	-	-	-	-	-
BLSN[18]	-	-	BLSN	-	VCBLSN	-	-	-	-	BLSN	-	-	-

BLSA	-	-	BLSA	-	VCBLSA	-	-	-	-	BLSA	-	-	-
BLDU	-	-	BLDU	-	VCBLDU	-	-	-	-	BLDU	-	-	-
Other		-	-	-	-	-	-	-	-	-	-	-	-
Sand/Dust Whirls	**PO**	-	PO	-	VCPO	-	-	-	-	-	-	-	-
Squalls[19]	**SQ**	-	SQ	-	-	-	-	-	-	-	-	-	-
Funnel Cloud	**FC**	-	FC	-	-	-	-	-	-	-	-	-	-
Tornado/Waterspout[20]	**+FC**	-	-	+FC	-	-	-	-	-	-	-	-	-
Sandstorm[21]	**SS**	-	SS	+SS	VCSS	-	-	-	-	-	-	-	-
Duststorm[22]	**DS**	-	DS	+DS	VCDS	-	-	-	-	-	-	-	-

[1] Only 1 descriptor must be included for each weather phenomena group, for example, BCFG. Only 2 exceptions exist to this rule: VCSH and VCTS.

[2] Vicinity is defined as >0SM (not at point of observation) to 10SM of the point of observation for precipitation. Other than precipitation (VCFG, VCBLSN, VCBLSA, VCBLDU, VCPO, VCSS, VCDS), vicinity is 5SM to 10SM.

[3] Raised by wind to less than 6 feet above the ground.

[4] TS may be reported by itself if no precipitation is associated with the thunderstorm.

[5] No intensity is ever given to hail (GR/GS[snow pellets]) or ice crystals (IC).

[6] Largest hailstone observed has a diameter of 1/4 inch or more.

[7] - Hailstone diameter is less than 1/4 inch. No remark is entered for hailstone size.

[8] - VCTS must only be used by automated stations. Not a manual entry. If thunder is heard, TS must be reported.

[9] - Showers (SH), when associated with the indicator VC, the type and intensity of the showery precipitation must not be specified, that is, +VCSHRA is not allowed; only VCSH would be reported. VCSH must be used to report any type of precipitation not at point of observation, but >0 to 10SM.

[10] BR (mist) must only be used when the visibility is at least 5/8SM, but not more than 6SM.

[11] For FG (fog) to be reported without the qualifiers VC[12], MI[13], PR[14], or BC[15] the visibility must be less than 5/8 SM.

[12] VC is used to report any type of fog observed in the vicinity (5-10SM) of the station.

[13] MIFG (shallow fog) to be reported, the visibility at 6 feet above ground level must be 5/8SM or more and the apparent visibility in the fog layer must be less than 5/8SM.

[14] PRFG (partial fog) indicates that a substantial part of the station is covered by fog while the remainder is clear of fog.

[15] BCFG (patches fog) indicates that patches of fog randomly cover the station.

[16] FZFG is any fog consisting predominately of water droplets at temperatures below 0ºC and visibility less than 5/8 statute miles, whether it is depositing rime or not.

[17] Volcanic Ash is always reported in the body of the METAR/SPECI when present. Visibility is not a factor.

[18] SN BLSN indicates snow falling from clouds with blowing snow occurring. If the observer cannot determine whether or not snow is also falling from clouds, then only BLSN must be reported.

[19] SQ (squall) is a sudden increase in wind speed of at least 16 knots, the speed rising to 22 knots or more and lasting for at least one minute.

[20] Tornadoes and Waterspouts must be reported using the indicator "+", that is, +FC.

[21] SS (sandstorm) reported if the visibility is ≥ 5/16SM and ≤ 5/8SM. Report +SS if the visibility is < 5/16SM.

[22] DS (duststorm) reported if the visibility is ≥ 5/16SM and ≤ 5/8SM. Report +DS if the visibility is < 5/16SM.

No more than three weather groups must be used to report weather phenomena at or near the station. If more than one significant weather phenomena is observed, separate weather phenomena groups must be included in the report. If more than one form of precipitation is observed, the appropriate abbreviations must be combined in a single group with the dominant type of precipitation being reported first. In such a single group, the intensity must refer to the first type of precipitation reported, for example, -RASN FG HZ.

METAR.TA3 - Last Update 10/30/98

E.5 Fahrenheit to Celsius

°F	.0 °C	.1 °C	.2 °C	.3 °C	.4 °C	.5 °C	.6 °C	.7 °C	.8 °C	.9 °C	°F	.0 °C	.1 °C	.2 °C	.3 °C	.4 °C	.5 °C	.6 °C	.7 °C	.8 °C	.9 °C
+130	+54.4	+54.5	+54.6	+54.6	+54.7	+54.7	+54.8	+54.8	+54.9	+54.9	**+80**	+26.7	+26.7	+26.8	+26.8	+26.9	+26.9	+27.0	+27.1	+27.1	+27.2
129	53.9	53.9	54.0	54.1	54.1	54.2	54.2	54.3	54.3	54.4	**79**	26.1	26.2	26.2	26.3	26.3	26.4	26.4	26.5	26.6	26.6
128	53.3	53.4	53.4	53.5	53.6	53.6	53.7	53.7	53.8	53.8	**78**	25.6	25.6	25.7	25.7	25.8	25.8	25.9	25.9	26.0	26.1
127	52.8	52.8	52.9	52.9	53.0	53.1	53.1	53.2	53.2	53.3	**77**	25.0	25.1	25.1	25.2	25.2	25.3	25.3	25.4	25.4	25.5
126	52.2	52.3	52.3	52.4	52.4	52.5	52.6	52.6	52.7	52.7	**76**	24.4	24.5	24.6	24.6	24.7	24.7	24.8	24.8	24.9	24.9
+125	+51.7	+51.7	+51.8	+51.8	+51.9	+51.9	+52.0	+52.1	+52.1	+52.2	**+75**	+23.9	+23.9	+24.0	+24.1	+24.1	+24.2	+24.2	+24.3	+24.3	+24.4
124	51.1	51.2	51.2	51.3	51.3	51.4	51.4	51.5	51.6	51.6	**74**	23.3	23.4	23.4	23.5	23.6	23.6	23.7	23.7	23.8	23.8
123	50.6	50.6	50.7	50.7	50.8	50.8	50.9	50.9	51.0	51.1	**73**	22.8	22.8	22.9	22.9	23.0	23.1	23.1	23.2	23.2	23.3
122	50.0	50.1	50.1	50.2	50.2	50.3	50.3	50.4	50.4	50.5	**72**	22.2	22.3	22.3	22.4	22.4	22.5	22.6	22.6	22.7	22.7
121	49.4	49.5	49.6	49.6	49.7	49.7	49.8	49.8	49.9	49.9	**71**	21.7	21.7	21.8	21.8	21.9	21.9	22.0	22.1	22.1	22.2
+120	+48.9	+48.9	+49.0	+49.1	+49.1	+49.2	+49.2	+49.3	+49.3	+49.4	**+70**	+21.1	+21.2	+21.2	+21.3	+21.3	+21.4	+21.4	+21.5	+21.6	+21.6
119	48.3	48.4	48.4	48.5	48.6	48.6	48.7	48.7	48.8	48.8	**69**	20.6	20.6	20.7	20.7	20.8	20.8	20.9	20.9	21.0	21.1
118	47.8	47.8	47.9	47.9	48.0	48.1	48.1	48.2	48.2	48.3	**68**	20.0	20.1	20.1	20.2	20.2	20.3	20.3	20.4	20.4	20.5
117	47.2	47.3	47.3	47.4	47.4	47.5	47.6	47.6	47.7	47.7	**67**	19.4	19.5	19.6	19.6	19.7	19.7	19.8	19.8	19.9	19.9
116	46.7	46.7	46.8	46.8	46.9	46.9	47.0	47.1	47.1	47.2	**66**	18.9	18.9	19.0	19.1	19.1	19.2	19.2	19.3	19.3	19.4
+115	+46.1	+46.2	+46.2	+46.3	+46.3	+46.4	+46.4	+46.5	+46.6	+46.6	**+65**	+18.3	+18.4	+18.4	+18.5	+18.6	+18.6	+18.7	+18.7	+18.8	+18.8
114	45.6	45.6	45.7	45.7	45.8	45.8	45.9	45.9	46.0	46.1	**64**	17.8	17.8	17.9	17.9	18.0	18.1	18.1	18.2	18.2	18.3
113	45.0	45.1	45.1	45.2	45.2	45.3	45.3	45.4	45.4	45.5	**63**	17.2	17.3	17.3	17.4	17.4	17.5	17.6	17.6	17.7	17.7
112	44.4	44.5	44.6	44.6	44.7	44.7	44.8	44.8	44.9	44.9	**62**	16.7	16.7	16.8	16.8	16.9	16.9	17.0	17.1	17.1	17.2
111	43.9	43.9	44.0	44.1	44.1	44.2	44.2	44.3	44.3	44.4	**61**	16.1	16.2	16.2	16.3	16.3	16.4	16.4	16.5	16.6	16.6
+110	+43.3	+43.4	+43.4	+43.5	+43.6	+43.6	+43.7	+43.7	+43.8	+43.8	**+60**	+15.6	+15.6	+15.7	+15.7	+15.8	+15.8	+15.9	+15.9	+16.0	+16.1
109	42.8	42.8	42.9	42.9	43.0	43.1	43.1	43.2	43.2	43.3	**59**	15.0	15.1	15.1	15.2	15.2	15.3	15.3	15.4	15.4	15.5
108	42.2	42.3	42.3	42.4	42.4	42.5	42.6	42.6	42.7	42.7	**58**	14.4	14.5	14.6	14.6	14.7	14.7	14.8	14.8	14.9	14.9
107	41.7	41.7	41.8	41.8	41.9	41.9	42.0	42.1	42.1	42.2	**57**	13.9	13.9	14.0	14.1	14.1	14.2	14.2	14.3	14.3	14.4
106	41.1	41.2	41.2	41.3	41.3	41.4	41.4	41.5	41.6	41.6	**56**	13.3	13.4	13.4	13.5	13.6	13.6	13.7	13.7	13.8	13.8
+105	+40.6	+40.6	+40.7	+40.7	+40.8	+40.8	+40.9	+40.9	+41.0	+41.1	**+55**	+12.8	+12.8	+12.9	+12.9	+13.0	+13.1	+13.1	+13.2	+13.2	+13.3
104	40.0	40.1	40.1	40.2	40.2	40.3	40.3	40.4	40.4	40.5	**54**	12.2	12.3	12.3	12.4	12.4	12.5	12.6	12.6	12.7	12.7
103	39.4	39.5	39.6	39.6	39.7	39.7	39.8	39.8	39.9	39.9	**53**	11.7	11.7	11.8	11.8	11.9	11.9	12.0	12.1	12.1	12.2
102	38.9	38.9	39.0	39.1	39.1	39.2	39.2	39.3	39.3	39.4	**52**	11.1	11.2	11.2	11.3	11.3	11.4	11.4	11.5	11.6	11.6
101	38.3	38.4	38.4	38.5	38.6	38.6	38.7	38.7	38.8	38.8	**51**	10.6	10.6	10.7	10.7	10.8	10.8	10.9	10.9	11.0	11.1
+100	+37.8	+37.8	+37.9	+37.9	+38.0	+38.1	+38.1	+38.2	+38.2	+38.3	**+50**	+10.0	+10.1	+10.1	+10.2	+10.2	+10.3	+10.3	+10.4	+10.4	+10.5
99	37.2	37.3	37.3	37.4	37.4	37.5	37.6	37.6	37.7	37.7	**49**	9.4	9.5	9.6	9.6	9.7	9.7	9.8	9.8	9.9	9.9
98	36.7	36.7	36.8	36.8	36.9	36.9	37.0	37.1	37.1	37.2	**48**	8.9	8.9	9.0	9.1	9.1	9.2	9.2	9.3	9.3	9.4
97	36.1	36.2	36.2	36.3	36.3	36.4	36.4	36.5	36.6	36.6	**47**	8.3	8.4	8.4	8.5	8.6	8.6	8.7	8.7	8.8	8.8
96	35.6	35.6	35.7	35.7	35.8	35.8	35.9	35.9	36.0	36.1	**46**	7.8	7.8	7.9	7.9	8.0	8.1	8.1	8.2	8.2	8.3
+95	+35.0	+35.1	+35.1	+35.2	+35.2	+35.3	+35.3	+35.4	+35.4	+35.5	**+45**	+7.2	+7.3	+7.3	+7.4	+7.4	+7.5	+7.6	+7.6	+7.7	+7.7
94	34.4	34.5	34.6	34.6	34.7	34.7	34.8	34.8	34.9	34.9	**44**	6.7	6.7	6.8	6.8	6.9	6.9	7.0	7.1	7.1	7.2
93	33.9	33.9	34.0	34.1	34.1	34.2	34.2	34.3	34.3	34.4	**43**	6.1	6.2	6.2	6.3	6.3	6.4	6.4	6.5	6.6	6.6
92	33.3	33.4	33.4	33.5	33.6	33.6	33.7	33.7	33.8	33.8	**42**	5.6	5.6	5.7	5.7	5.8	5.8	5.9	5.9	6.0	6.1
91	32.8	32.8	32.9	32.9	33.0	33.1	33.1	33.2	33.2	33.3	**41**	5.0	5.1	5.1	5.2	5.2	5.3	5.3	5.4	5.4	5.5
+90	+32.2	+32.3	+32.3	+32.4	32.4	+32.5	+32.6	+32.6	+32.7	+32.7	**+40**	+4.4	+4.5	+4.6	+4.6	+4.7	+4.7	+4.8	+4.8	+4.9	+4.9
89	31.7	31.7	31.8	31.8	31.9	31.9	32.0	32.1	32.1	32.2	**39**	3.9	3.9	4.0	4.1	4.1	4.2	4.2	4.3	4.3	4.4
88	31.1	31.2	31.2	31.3	31.3	31.4	31.4	31.5	31.6	31.6	**38**	3.3	3.4	3.4	3.5	3.6	3.6	3.7	3.7	3.8	3.8
87	30.6	30.6	30.7	30.7	30.8	30.8	30.9	30.9	31.0	31.1	**37**	2.8	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.3
86	30.0	30.1	30.1	30.2	30.2	30.3	30.3	30.4	30.4	30.5	**36**	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.7
+85	+29.4	+29.5	+29.6	+29.6	+29.7	+29.7	+29.8	+29.8	+29.9	+29.9	**+35**	+1.7	+1.7	+1.8	+1.8	+1.9	+1.9	+2.0	+2.1	+2.1	+2.2
84	28.9	28.9	29.0	29.1	29.1	29.2	29.2	29.3	29.3	29.4	**34**	+1.1	+1.2	+1.2	+1.3	+1.3	+1.4	+1.4	+1.5	+1.6	+1.6
83	28.3	28.4	28.4	28.5	28.6	28.6	28.7	28.7	28.8	28.8	**33**	+0.6	+0.6	+0.7	+0.7	+0.8	+0.8	+0.9	+0.9	+1.0	+1.1
82	27.8	27.8	27.9	27.9	28.0	28.1	28.1	28.2	28.2	28.3	**32**	0.0	+0.1	+0.1	+0.2	+0.2	+0.3	+0.3	+0.4	+0.4	+0.5
81	27.2	27.3	27.3	27.4	27.4	27.5	27.6	27.6	27.7	27.7	**31**	-0.6	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1

	.0 °C	.1 °C	.2 °C	.3 °C	.4 °C	.5 °C	.6 °C	.7 °C	.8 °C	.9 °C	°F	.0 °C	.1 °C	.2 °C	.3 °C	.4 °C	.5 °C	.6 °C	.7 °C	.8 °C	.9 °C
+30	-1.1	-1.1	-1.0	-0.9	-0.9	-0.8	-0.8	-0.7	-0.7	-0.6	**-25**	-31.7	-31.7	-31.8	-31.8	-31.9	-31.9	-32.0	-32.1	-32.1	-32.2
29	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.2	**26**	32.2	32.3	32.3	32.4	32.4	32.5	32.6	32.6	32.7	32.7
28	2.2	2.2	2.1	2.1	2.0	1.9	1.9	1.8	1.8	1.7	**27**	32.8	32.8	32.9	32.9	33.0	33.1	33.1	33.2	33.2	33.3
27	2.8	2.7	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3	**28**	33.3	33.4	33.4	33.5	33.6	33.6	33.7	33.7	33.8	33.8

°F	.0 °C	.1 °C	.2 °C	.3 °C	.4 °C	.5 °C	.6 °C	.7 °C	.8 °C	.9 °C	°F	.0 °C	.1 °C	.2 °C	.3 °C	.4 °C	.5 °C	.6 °C	.7 °C	.8 °C	.9 °C
26	3.3	3.3	3.2	3.2	3.1	3.1	3.0	2.9	2.9	2.8	**29**	33.9	33.9	34.0	34.1	34.1	34.2	34.2	34.3	34.3	34.4
+25	-3.9	-3.8	-3.8	-3.7	-3.7	-3.6	-3.6	-3.5	-3.4	-3.4	**-30**	-34.4	-34.5	-34.6	-34.6	-34.7	-34.7	-34.8	-34.8	-34.9	-34.9
24	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	3.9	**31**	35.0	35.1	35.1	35.2	35.2	35.3	35.3	35.4	35.4	35.5
23	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	**32**	35.6	35.6	35.7	35.7	35.8	35.8	35.9	35.9	36.0	36.1
22	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.2	5.1	5.1	**33**	36.1	36.2	36.2	36.3	36.3	36.4	36.4	36.5	36.6	36.6
21	6.1	6.1	6.0	5.9	5.9	5.8	5.8	5.7	5.7	5.6	**34**	36.7	36.7	36.8	36.8	36.9	36.9	37.0	37.1	37.1	37.2
+20	-6.7	-6.6	-6.6	-6.5	-6.4	-6.4	-6.3	-6.3	-6.2	-6.2	**-35**	-37.2	-37.3	-37.3	-37.4	-37.4	-37.5	-37.6	-37.1	-37.7	-37.7
19	7.2	7.2	7.1	7.1	7.0	6.9	6.9	6.8	6.8	6.7	**36**	37.8	37.8	37.9	37.9	38.0	38.1	38.1	38.2	38.2	38.3
18	7.8	7.7	7.7	7.6	7.6	7.5	7.4	7.4	7.3	7.3	**37**	38.3	38.4	38.4	38.5	38.6	38.6	38.7	38.7	38.8	38.8
17	8.3	8.3	8.2	8.2	8.1	8.1	8.0	7.9	7.9	7.8	**38**	38.9	38.9	39.0	39.1	39.1	39.2	39.2	39.3	39.3	39.4
16	8.9	8.8	8.8	8.7	8.7	8.6	8.6	8.5	8.4	8.4	**39**	39.4	39.5	39.6	39.6	39.7	39.7	39.8	39.8	39.9	39.9
+15	-9.4	-9.4	-9.3	-9.3	-9.2	-9.2	-9.1	-9.1	-9.0	-8.9	**-40**	-40.0	-40.1	-40.1	-40.2	-40.2	-40.3	-40.3	-40.4	-40.4	-40.5
14	10.0	9.9	9.9	9.8	9.8	9.7	9.7	9.6	9.6	9.5	**41**	40.6	40.6	40.7	40.7	40.8	40.8	40.9	40.9	41.0	41.1
13	10.6	10.5	10.4	10.4	10.3	10.3	10.2	10.2	10.1	10.1	**42**	41.1	41.2	41.2	41.3	41.3	41.4	41.4	41.5	41.6	41.6
12	11.1	11.1	11.0	10.9	10.9	10.8	10.8	10.7	10.7	10.6	**43**	41.7	41.7	41.8	41.8	41.9	41.9	42.0	42.1	42.1	42.2
11	11.7	11.6	11.6	11.5	11.4	11.4	11.3	11.3	11.2	11.2	**44**	42.2	42.3	42.3	42.4	42.4	42.5	42.6	42.6	42.7	42.7
+10	-12.2	-12.2	-12.1	-12.1	-12.0	-11.9	-11.9	-11.8	-11.8	-11.7	**-45**	-42.8	-42.8	-42.9	-42.9	-43.0	-43.1	-43.1	-43.2	-43.2	-43.3
9	12.8	12.7	12.7	12.6	12.6	12.5	12.4	12.4	12.3	12.3	**46**	43.3	43.4	43.4	43.5	43.6	43.6	43.7	43.7	43.8	43.8
8	13.3	13.3	13.2	13.2	13.1	13.1	13.0	12.9	12.9	12.8	**47**	43.9	43.9	44.0	44.1	44.1	44.2	44.2	44.3	44.3	44.4
7	13.9	13.8	13.8	13.7	13.7	13.6	13.6	13.5	13.4	13.4	**48**	44.4	44.5	44.6	44.6	44.7	44.7	44.8	44.8	44.9	44.9
6	14.4	14.4	14.3	14.3	14.2	14.2	14.1	14.1	14.0	13.9	**49**	45.0	45.1	45.1	45.2	45.2	45.3	45.3	45.4	45.4	45.5
+5	-15.0	-14.9	-14.9	-14.8	-14.8	-14.7	-14.7	-14.6	-14.6	-14.5	**-50**	-45.6	-45.6	-45.7	-45.7	-45.8	-45.8	-45.9	-45.9	-46.0	-46.1
4	15.6	15.5	15.4	15.4	15.3	15.3	15.2	15.2	15.1	15.1	**51**	46.1	46.2	46.2	46.3	46.3	46.4	46.4	46.5	46.6	46.6
3	16.1	16.1	16.0	15.9	15.9	15.8	15.8	15.7	15.7	15.6	**52**	46.7	46.7	46.8	46.8	46.9	46.9	47.0	47.1	47.1	47.2
2	16.7	16.6	16.6	16.5	16.4	16.4	16.3	16.3	16.2	16.2	**53**	47.2	47.3	47.3	47.4	47.4	47.5	47.6	47.6	47.7	47.7
1	17.2	17.2	17.1	17.1	17.0	16.9	16.9	16.8	16.8	16.7	**54**	47.8	47.8	47.9	47.9	48.0	48.1	48.1	48.2	48.2	48.3
+0	17.8	17.7	17.7	17.6	17.6	17.5	17.4	17.4	17.3	17.3	**-55**	-48.3	-48.4	-48.4	-48.5	-48.6	-48.6	-48.7	-48.7	-48.8	-48.8
-0	-17.8	-17.8	-17.9	-17.9	-18.0	-18.1	-18.1	-18.2	-18.2	-18.3	**56**	48.9	48.9	49.0	49.1	49.1	49.2	49.2	49.3	49.3	49.4
1	18.3	18.4	18.4	18.5	18.6	18.6	18.7	18.7	18.8	18.8	**57**	49.4	49.5	49.6	49.6	49.7	49.7	49.8	49.8	49.9	49.9
2	18.9	18.9	19.0	19.1	19.1	19.2	19.2	19.3	19.3	19.4	**58**	50.0	50.1	50.1	50.2	50.2	50.3	50.3	50.4	50.4	50.5
3	19.4	19.5	19.6	19.6	19.7	19.7	19.8	19.8	19.9	19.9	**59**	50.6	50.6	50.7	50.7	50.8	50.8	50.9	50.9	51.0	51.1
4	20.0	20.1	20.1	20.2	20.2	20.3	20.3	20.4	20.4	20.5	**-60**	-51.1	-51.2	-51.2	-51.3	-51.3	-51.4	-51.4	-51.5	-51.6	-51.6
-5	-20.6	-20.6	-20.7	-20.7	-20.8	-20.8	-20.9	-20.9	-21.0	-21.1	**61**	51.7	51.7	51.8	51.8	51.9	51.9	52.0	52.1	52.1	52.2
6	21.1	21.2	21.2	21.3	21.3	21.4	21.4	21.5	21.6	21.6	**62**	52.2	52.3	52.3	52.4	52.4	52.5	52.6	52.6	52.7	52.7
7	21.7	21.7	21.8	21.8	21.9	21.9	22.0	22.1	22.1	22.2	**63**	52.8	52.8	52.9	52.9	53.0	53.1	53.1	53.2	53.2	53.3
8	22.2	22.3	22.3	22.4	22.4	22.5	22.6	22.6	22.7	22.7	**64**	53.3	53.4	53.4	53.5	53.6	53.6	53.7	53.7	53.8	53.8
9	22.8	22.8	22.9	22.9	23.0	23.1	23.1	23.2	23.2	23.3	**-65**	-53.9	-53.9	-54.0	-54.1	-54.1	-54.2	-54.2	-54.3	-54.3	-54.4
-10	-23.3	-23.4	-23.4	-23.5	-23.6	-23.6	-23.7	-23.7	-23.8	-23.8	**66**	54.4	54.5	54.6	54.6	54.7	54.7	54.8	54.8	54.9	54.9
11	23.9	23.9	24.0	24.1	24.1	24.2	24.2	24.3	24.3	24.4	**67**	55.0	55.1	55.1	55.2	55.2	55.3	55.3	55.4	55.4	55.5
12	24.4	24.5	24.6	24.6	24.7	24.7	24.8	24.8	24.9	24.9	**68**	55.6	55.6	55.7	55.7	55.8	55.8	55.9	55.9	56.0	56.1
13	25.0	25.1	25.1	25.2	25.2	25.3	25.3	25.4	25.4	25.5	**69**	56.1	56.2	56.2	56.3	56.3	56.4	56.4	56.5	56.6	56.6
14	25.6	25.6	25.7	25.7	25.8	25.8	25.9	25.9	26.0	26.1	**-70**	-56.7	-56.7	-56.8	-56.8	-56.9	-56.9	-57.0	-57.1	-57.1	-57.2
-15	-26.1	-26.2	-26.2	-26.3	-26.3	-26.4	-26.4	-26.5	-26.6	-26.6	**71**	57.2	57.3	57.3	57.4	57.4	57.5	57.6	57.6	57.7	57.7
16	26.7	26.7	26.8	26.8	26.9	26.9	27.0	27.1	27.1	27.2	**72**	57.8	57.8	57.9	57.9	58.0	58.1	58.1	58.2	58.2	58.3
17	27.2	27.3	27.3	27.4	27.4	27.5	27.6	27.6	27.7	27.7	**73**	58.3	58.4	58.4	58.5	58.6	58.6	58.7	58.7	58.8	58.8
18	27.8	27.8	27.9	27.9	28.0	28.1	28.1	28.2	28.2	28.3	**74**	58.9	58.9	59.0	59.1	59.1	59.2	59.2	59.3	59.3	59.4
19	28.3	28.4	28.4	28.5	28.6	28.6	28.7	28.7	28.8	28.8	**-75**	-59.4	-59.5	-59.6	-59.6	-59.7	-59.7	-59.8	-59.8	-59.9	-59.9
-20	-28.9	-28.9	-29.0	-29.1	-29.1	-29.2	-29.2	-29.3	-29.3	-29.4	**76**	60.0	60.1	60.1	60.2	60.2	60.3	60.3	60.4	60.4	60.5
21	29.4	29.5	29.6	29.6	29.7	29.7	29.8	29.8	29.9	29.9	**77**	60.6	60.6	60.7	60.7	60.8	60.8	60.9	60.9	61.0	61.1
22	30.0	30.1	30.1	30.2	30.2	30.3	30.3	30.4	30.4	30.5	**78**	61.1	61.2	61.2	61.3	61.3	61.4	61.4	61.5	61.6	61.6
23	30.6	30.6	30.7	30.7	30.8	30.8	30.9	30.9	31.0	31.1	**79**	61.7	61.7	61.8	61.8	61.9	61.9	62.0	62.1	62.1	62.2
24	31.1	31.2	31.2	31.3	31.3	31.4	31.4	31.5	31.6	31.6											

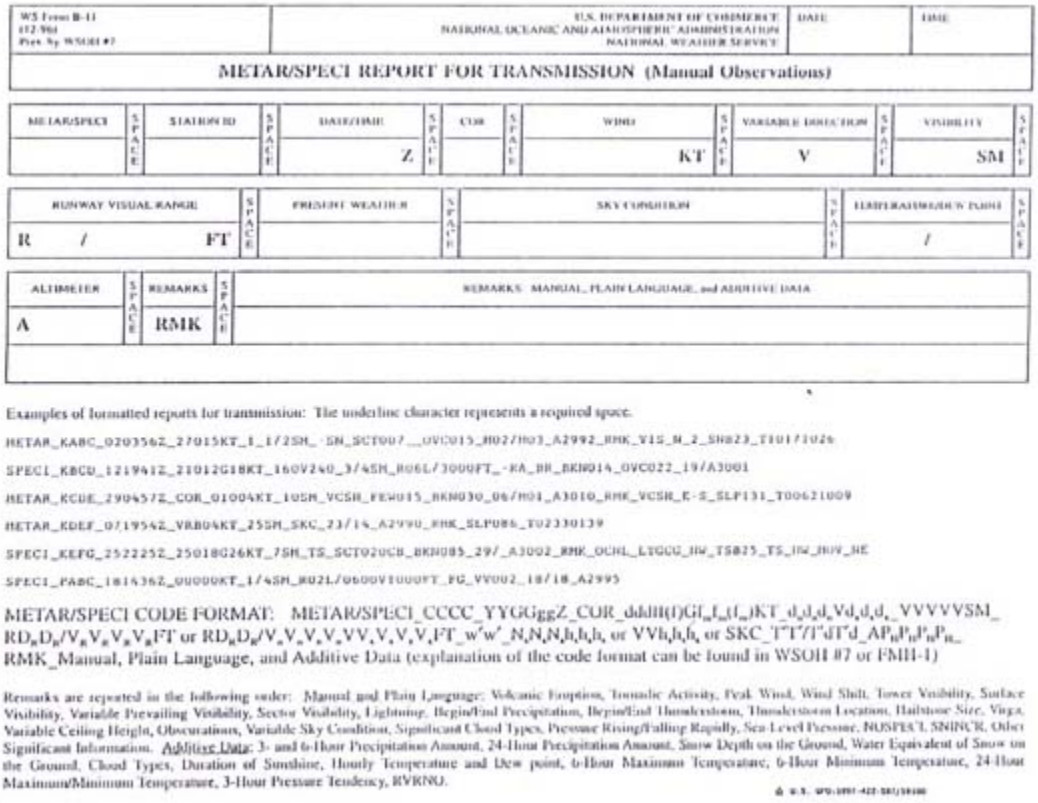
E.6 Tenth of Degrees Celsius to Whole Degrees Fahrenheit

°C	.0 °F	.1 °F	.2 °F	.3 °F	.4 °F	.5 °F	.6 °F	.7 °F	.8 °F	.9 °F	°C	.0 °F	.1 °F	.2 °F	.3 °F	.4 °F	.5 °F	.6 °F	.7 °F	.8 °F	.9 °F
+55	+131	+131	+131	+132	+132	+132	+132	+132	+132	+133	**-0**	+32	+32	+32	+31	+31	+31	+31	+31	+31	+30
54	129	129	130	130	130	130	130	130	131	131	**1**	30	30	30	30	29	29	29	29	29	29
53	127	128	128	128	128	128	128	129	129	129	**2**	28	28	28	28	28	28	27	27	27	27
52	125	126	126	126	126	127	127	127	127	127	**3**	27	26	26	26	26	26	26	25	25	25
51	123	124	124	124	125	125	125	125	125	125	**4**	25	25	24	24	24	24	24	24	23	23
											-5	+23	+23	+23	+22	+22	+22	+22	+22	+22	+21
+50	+122	+122	+122	+123	+123	+123	+123	+123	+123	+124	**6**	21	21	21	21	20	20	20	20	20	20
49	120	120	121	121	121	121	121	121	122	122	**7**	19	19	19	19	19	19	18	18	18	18
48	118	119	119	119	119	119	119	120	120	120	**8**	18	17	17	17	17	17	17	16	16	16
47	117	117	117	117	117	118	118	118	118	118	**9**	16	16	15	15	15	15	15	15	14	14
46	115	115	115	115	116	116	116	116	116	116											
+45	+113	+113	+113	+114	+114	+114	+114	+114	+114	+115	**-10**	+14	+14	+14	+13	+13	+13	+13	+13	+13	+12
44	111	111	112	112	112	112	112	112	113	113	**11**	12	12	12	12	11	11	11	11	11	11
43	109	110	110	110	110	110	110	111	111	111	**12**	10	10	10	10	10	10	9	9	9	9
42	108	108	108	108	108	109	109	109	109	109	**13**	9	8	8	8	8	8	8	7	7	7
41	106	106	106	106	107	107	107	107	107	107	**14**	7	7	6	6	6	6	6	6	5	5
											-15	+5	+5	+5	+4	+4	+4	+4	+4	+4	+3
+40	+104	+104	+104	+105	+105	+105	+105	+105	+105	+106	**16**	+3	+3	+3	+3	+2	+2	+2	+2	+2	+2
39	102	102	103	103	103	103	103	103	104	104	**17**	+1	+1	+1	+1	+1	+1	0	0	0	0
38	100	101	101	101	101	101	101	102	102	102	**18**	0	-1	-1	-1	-1	-1	-1	-2	-2	-2
37	99	99	99	99	99	100	100	100	100	100	**19**	-2	-2	-3	-3	-3	-3	-3	-4	-4	-4
36	97	97	97	97	98	98	98	98	98	98											
+35	+95	+95	+95	+96	+96	+96	+96	+96	+96	+97	**-20**	-4	-4	-4	-5	-5	-5	-5	-5	-5	-6
34	93	93	94	94	94	94	94	94	95	95	**21**	6	6	6	6	7	7	7	7	7	7
33	91	92	92	92	92	92	92	93	93	93	**22**	8	8	8	8	8	8	9	9	9	9
32	90	90	90	90	90	91	91	91	91	91	**23**	9	10	10	10	10	10	10	11	11	11
31	88	88	88	88	89	89	89	89	89	89	**24**	11	11	12	12	12	12	12	12	13	13
											-25	-13	-13	-13	-14	-14	-14	-14	-14	-14	-15
+30	+86	+86	+86	+87	+87	+87	+87	+87	+87	+88	**26**	15	15	15	15	16	16	16	16	16	16
29	84	84	85	85	85	85	85	85	86	86	**27**	17	17	17	17	17	17	18	18	18	18
28	82	83	83	83	83	83	83	84	84	84	**28**	18	19	19	19	19	19	19	20	20	20
27	81	81	81	81	81	82	82	82	82	82	**29**	20	20	21	21	21	21	21	21	22	22
26	79	79	79	79	80	80	80	80	80	80											
+25	+77	+77	+77	+78	+78	+78	+78	+78	+78	+79	**-30**	-22	-22	-22	-23	-23	-23	-23	-23	-23	-24
24	75	75	76	76	76	76	76	76	77	77	**31**	24	24	24	24	25	25	25	25	25	25
23	73	74	74	74	74	74	74	75	75	75	**32**	26	26	26	26	26	26	27	27	27	27
22	72	72	72	72	72	73	73	73	73	73	**33**	27	28	28	28	28	28	28	29	29	29
21	70	70	70	70	71	71	71	71	71	71	**34**	29	29	30	30	30	30	30	31	31	31
											-35	-31	-31	-31	-32	-32	-32	-32	-32	-32	-33
+20	+68	+68	+68	+69	+69	+69	+69	+69	+69	+70	**36**	33	33	33	33	34	34	34	34	34	34
19	66	66	67	67	67	67	67	67	68	68	**37**	35	35	35	35	35	35	36	36	36	36
18	64	65	65	65	65	65	65	66	66	66	**38**	36	37	37	37	37	37	37	38	38	38
17	63	63	63	63	63	64	64	64	64	64	**39**	38	38	39	39	39	39	39	39	40	40
16	61	61	61	61	62	62	62	62	62	62											
+15	+59	+59	+59	+60	60	+60	+60	+60	+60	+61	**-40**	-40	-40	-40	-41	-41	-41	-41	-41	-41	-42
14	57	57	58	58	58	58	58	58	59	59	**41**	42	42	42	42	43	43	43	43	43	43
13	55	56	56	56	56	56	56	57	57	57	**42**	44	44	44	44	44	44	45	45	45	45
12	54	54	54	54	54	55	55	55	55	55	**43**	45	46	46	46	46	46	46	47	47	47
11	52	52	52	52	53	53	53	53	53	53	**44**	47	47	48	48	48	48	48	48	49	49
											-45	-49	-49	-49	-50	-50	-50	-50	-50	-50	-51
+10	+50	+50	+50	+51	+51	+51	+51	+51	+51	+52	**46**	51	51	51	51	52	52	52	52	52	52
9	48	48	49	49	49	49	49	50	50	50	**47**	53	53	53	53	53	53	54	54	54	54
8	46	47	47	47	47	47	47	48	48	48	**48**	54	55	55	55	55	55	55	56	56	56
7	45	45	45	45	45	46	46	46	46	46	**49**	56	56	57	57	57	57	57	57	58	58
6	43	43	43	43	44	44	44	44	44	44											
+5	+41	+41	+41	+42	+42	+42	+42	+42	+42	+43	**-50**	-58	-58	-58	-59	-59	-59	-59	-59	-59	-60
4	39	39	40	40	40	40	40	40	41	41	**51**	60	60	60	60	61	61	61	61	61	61
3	37	38	38	38	38	38	38	39	39	39	**52**	62	62	62	62	62	62	63	63	63	63
2	36	36	36	36	36	37	37	37	37	37	**53**	63	64	64	64	64	64	64	65	65	65
1	34	34	34	34	35	35	35	35	35	35	**54**	65	65	66	66	66	66	66	66	67	67
+0	+32	+32	+32	+33	+33	+33	+33	+33	+33	+34	**-55**	-67	-67	-67	-68	-68	-68	-68	-68	-68	-69
-0	+32	+32	+32	+31	+31	+31	+31	+31	+31	+30											

APPENDIX F. TRANSMISSION (WS FORM B-11)

Paragraph 3.6 states that this form can be used as an aid for transcribing manual observations received from observers over the phone.

Table F-1: WS Form B-11



WS Form B-11
(12-96)
Prev. by WSOH #7

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

DATE | TIME

METAR/SPECI REPORT FOR TRANSMISSION (Manual Observations)

METAR/SPECI	SPACE	STATION ID	SPACE	DATE/TIME	SPACE	COR	SPACE	WIND	SPACE	VARIABLE DIRECTION	SPACE	VISIBILITY	SPACE
				Z				KT		V		SM	

RUNWAY VISUAL RANGE	SPACE	PRESENT WEATHER	SPACE	SKY CONDITION	SPACE	TEMPERATURE/DEW POINT	SPACE
R / FT						/	

ALTIMETER	SPACE	REMARKS	SPACE	REMARKS: MANUAL, PLAIN LANGUAGE, and ADDITIVE DATA
A		RMK		

Examples of formatted reports for transmission: The underline character represents a required space.

METAR_KABC_020356Z_27015KT_1_1/2SM_-SN_SCT007__OVC015_RE27/RE3_A2992_RMK_VIS_N_2_SNB23_T1017/1026

SPECI_KBCU_121941Z_21012G18KT_160V240_3/4SM_RE6L/3000FT_-RA_BR_BKN014_OVC022_19/A3001

METAR_KCDE_290457Z_COR_01004KT_10SM_VCSH_FEW015_BKN030_06/M01_A3010_RMK_VCSH_E-S_SLP131_T00621009

METAR_KDEF_071954Z_VRB04KT_25SM_SKC_23/14_A2990_RMK_SLP086_T02330139

SPECI_KEFG_252225Z_25018G26KT_7SM_TS_SCT020CB_BKN085_29/_A3002_RMK_OCNL_LTGCG_NW_TSB25_TS_NW_RAB9_NE

SPECI_PABC_181436Z_00000KT_1/4SM_RE2L/0600V1000FT_FG_VV002_18/18_A2995

METAR/SPECI CODE FORMAT: METAR/SPECI_CCCC_YYGG$_{gg}$Z_COR_dddff(f)G(f$_m$f$_m$(f$_m$))KT_d$_n$d$_n$d$_n$Vd$_x$d$_x$d$_x$_VVVVVSM_ RD$_R$D$_R$/V$_R$V$_R$V$_R$V$_R$FT or RD$_R$D$_R$/V$_n$V$_n$V$_n$V$_n$VV$_x$V$_x$V$_x$V$_x$FT_w'w'_N$_s$N$_s$N$_s$h$_s$h$_s$h$_s$ or VVh$_s$h$_s$h$_s$ or SKC_T'T'/T'dT'd_AP$_{tt}$P$_{tt}$P$_{tt}$P$_{tt}$_ RMK_Manual, Plain Language, and Additive Data (explanation of the code format can be found in WSOH #7 or FMH-1)

Remarks are reported in the following order: Manual and Plain Language: Volcanic Eruption, Tornadic Activity, Peak Wind, Wind Shift, Tower Visibility, Surface Visibility, Variable Prevailing Visibility, Sector Visibility, Lightning, Begin/End Precipitation, Begin/End Thunderstorm, Thunderstorm Location, Hailstone Size, Virga, Variable Ceiling Height, Obscurations, Variable Sky Condition, Significant Cloud Types, Pressure Rising/Falling Rapidly, Sea-Level Pressure, NOSPECI, SNINCR, Other Significant Information. Additive Data: 3- and 6-Hour Precipitation Amount, 24-Hour Precipitation Amount, Snow Depth on the Ground, Water Equivalent of Snow on the Ground, Cloud Types, Duration of Sunshine, Hourly Temperature and Dew point, 6-Hour Maximum Temperature, 6-Hour Minimum Temperature, 24-Hour Maximum/Minimum Temperature, 3-Hour Pressure Tendency, RVRNO.

APPENDIX G. GENERAL REQUIREMENTS FOR MEASURING SNOW DEPTH

G.1 Purpose

This Appendix contains the agreement between the National Weather Service (NWS) and the FAA and provides general requirements for measuring snow depth. This agreement was developed to enable contract weather observers (CWO) at specified locations with automated systems with SPECI capability to provide snow depth measurement in support of the National Oceanic and Atmospheric Administration's (NOAA) NWS forecast, warning and climate programs. These sites with an automated system with SPECI capability are supported by FAA's CWOs.

G.2 Description

In 2004, the NWS and the FAA entered into a snow measuring agreement with the following provisions. The FAA agreed to provide snow depth reporting at CWO sites, provided the following conditions are met:

a. The measuring location is within 200 feet of the normal point of observation.

*NOTE: If the measuring location is between 200 – 500 feet it must be mutually agreed upon between the two organizations in order for CWOs to perform this function.

NOTE-
If the measuring location is between 200 – 500 feet it must be mutually agreed upon between the two organizations in order for CWOs to perform this function.

b. The NWS agreed to provide initial and follow on training to the observers.

c. The NWS agreed to purchase, install and maintain snow measuring equipment at all agreed to sites.

G.3 FAA Order 7900.5 Guidelines

In accordance with this order, all CWO weather observers at sites that meet the requirements in Paragraph G.2 are required to disseminate and observe only the following weather elements:

a. Snow Depth on Ground (Remarks: 4/sss):
Reference Paragraph 14.51

b. Water Equivalent of Snow on Ground (Remarks: 933RRR):
Reference Paragraph 14.52

c. 6-Hour Snowfall (Column 34):
Reference Paragraph 15.10.x

d. Snow Depth (Column 35)
Reference Paragraph 15.10.y

NOTE-
1. *Weather elements a and b are transmitted long- line. Weather elements c and d are recorded on MF1M-10C.*

2. *Tasks concerning snowfall measurements must not exceed the tasks outlined in FAA Order 7900.5.*

G.4 List of CWO Sites that will be required to perform snow depth measurements

PABI (BIG) Allen AAF (Ft. Greely)

AK PABT (BTT) Bettles Airport

AK PACV Merle K (Mudhole) Smith Airport

AK PAGK (GKN) Gulkana Airport

AK PAJN (JNU) Juneau International Airport

AK PANC Ted Stevens Anchorage International Airport

AK PATA Ralph M. Calhoun Memorial Airport

AK PBET Bethel Airport

AK PCDV Merle K. (Mudhole) Smith

AK PFYU Fort Yukon Airport

AK PILI Illiamna Airport

AK PORT Northway Airport

AK PSIT Sitka Rocky Gutierrez Airport

AK PSSC Prudhoe Bay-Deadhorse Airport

AK PTAL Ralph Calhoun Airport

AL KBHM Birmingham International Airport

AL KHSV Huntsville International Airport/Carl T. Jones Field

AL KMOB Mobile Regional Airport

FL KDAB Daytona Beach International Airport

FL KFLL Forth Lauderdale-Hollywood International Airport

FL KJAX Jacksonville International Airport

FL KMCO Orlando International Airport

FL KTLH Tallahassee Regional Airport

FL KTPA Tampa International Airport

GA KATL Hartsfield-Jackson Atlanta International Airport

GA KSAV Savannah International Airport

HI PHNL Honolulu International Airport/Dillingham Airfield

IA KDLH Duluth Intenational Airport

IA KDSM Des Moines International Airport

ID KFSD Sioux Falls Regional International Airport/Joe Foss Field

IL KMDW Chicago Midway International Airport

IL KORD Chicago O'Hare International Airport

IL KRFD Greater Rockford Airport

IN KFWA Fort Wayne International Airport

IN KIND Indianapolis International Airport

IN KSBN South Bend Regional Airport

KY KCVG Cincinnati/Northern Kentucky International Airport

KY KSDF Louisville International - Stanford Field Airport

LA KMSY New Orleans International Airport/Moisant Field

LA KSHV Shreveport Regional Airport

ME KBGR Bangor International Airport

MI KLAN Capital City Airport

MI KMKG Muskegon County Airport

MI KPTK Pontiac Oakland County International Airport

MI KTVC Traverse City/Cherry Capital Airport

MN KDLH Duluth International Airport

MN KMSP Minneapolis-St. Paul International Airport

MO KMCI Kansas City International Airport

MO KSTL Lambert - St. Louis International Airport

MT KBIL Billings Logan International Airport

NC KCLT Charlotte/Douglas International Airport

NC KGSO Piedmont Triad International Airport

NC KRDU Raleigh - Durham International Airport

ND KGFK Grand Forks Airport

NE KOMA Eppley Airfield

NH KMHT Manchester-Boston Regional Airport

NJ KEWR Newark International Airport

NM KABQ Albuquerque International Airport

NV KRNO Reno-Tahoe International Airport

NY KALB Albany International Airport

NY KISP Long Island MacArthur Airport

NY KJFK John F. Kennedy International Airport

NY KLGA LaGuardia Airport

NY KROC Greater Rochester International Airport

NY KSYR Syracuse Hancock International Airport

OH KCAK Akron - Canton Regional Airport

OH KCLE Cleveland - Hopkins International Airport

OH KCMH Columbus International Airport

OH KDAY James M. Cox Dayton International Airport

OH KYNG Youngstown - Warren Regional Airport

OK KTUL Tulsa International Airport

OK KOKC Will Rogers World Airport

OR KEUG Mahlon Sweet Field Airport

PA KMDT Harrisburg International Airport – Olmsted Field

RI KPVD Theodore Francis Green State Airport

SC KCAE Columbia Metropolitan Airport

SC KCHS Charleston International Airport

SD KFSD Sioux Falls Regional International Airport

TM KCHA Chattanooga Metropolitan Airport-Lovell Field

TN KMEM Memphis International Airport

TN KTRI Tri - Cities Regional TN/VA Airport

TN KTYS Knoxville-McGhee Tyson Airport

TX KAMA Rick Husband Amarillo International Airport

TX KAUS Austin - Bergstrom International Airport

TX KAFW Forth Worth Alliance Airport

TX TN KBNA Nashville International Airport

TX KHOU William P. Hobby Airport

TX KIAH George Bush Intercontinental Airport

TX KLBB Lubbock International Airport

VA KORF Norfolk International Airport

VA KDCA Ronald Regan - Washington National Airport

VA KRIC Richmond International Airport

VA KROA Roanoke Regional Airport

VT KBTV Burlington International Airport

WA KSEA Seattle - Tacoma International Airport

WA KGEG Spokane International Airport

WI KMSN Dane County Regional Airport/Truax Field

WI KMKE General Mitchell International Airport

APPENDIX H. GLOSSARY

Additive Data. A group of coded remarks that includes pressure tendency, amount of precipitation, and maximum/minimum temperature during specified periods of time.

Airport Location Point. ALP, the permanent airport reference point defined by the latitude and longitude published in the Airport Facility Directory.

Altimeter Setting. That pressure value to which an aircraft altimeter scale is set so that it will indicate the altitude above mean sea-level of an aircraft on the ground at the location for which the value was determined.

Archive. A permanent record of surface weather reports and related data used to establish a climatological record for the United States.

ASOS meteorological discontinuity sensors – At location that commonly experience weather affecting only a portion of the airport, multi-sensor algorithms provide information about meteorological discontinuities in sky condition and visibility. The meteorological discontinuity sensor is sited to detect operationally significant discontinuities in ceiling and/or visibility.

The report generated by the primary sensor is used in the body of all official observations. Once ASOS generates the reports, they are compared for significant differences. If the values are different by site determined criteria, the discontinuity sensor observation is included in the remarks of the METAR/SPECI.

Note: ASOS may also have backup sensors that are collocated with the primary sensor group and will automatically report until the primary sensor is returned to service.**Atmospheric Pressure**. The pressure exerted by the atmosphere at a given point (see altimeter setting, pressure, sea-level pressure, station pressure).

Augmented Report. A meteorological report prepared by an automated surface weather observing system for transmission with certified observers signed on to the system to add information to the report.

Automated Report. A meteorological report prepared by an automated surface weather observing system for transmission, and with no certified weather observers signed on to the system.

Backup. An alternate method for providing a meteorological report, parts of reports or documentation of reports when the primary method is unavailable or non-representative.

Barometer. An instrument that measures atmospheric pressure.

Barometric Pressure. The actual pressure value indicated by a pressure sensor.

Blowing. A descriptor used to amplify observed weather phenomena whenever the phenomena are raised to a height of 6 feet or more above the ground.

Blowing Dust. Dust picked up locally from the surface of the earth and blown about in clouds or sheets, reducing the reported horizontal visibility to less than 7 statute miles.

Blowing Sand. Sand particles picked up from the surface of the earth by the wind to moderate heights above the ground, reducing the reported horizontal visibility to less than 7 statute miles.

Blowing Snow. Snow lifted from the surface of the earth by the wind to a height of 6 feet or more above the ground and blown about in such quantities that the reported horizontal visibility is reduced to less than 7 miles.

Blowing Spray. Water droplets torn by the wind from a body of water, generally from the crests of waves, and carried up into the air in such quantities that they reduce the reported horizontal visibility to less than 7 statute miles.

Body of Report. That portion of a METAR or SPECI beginning with the type of report and ending with the altimeter setting.

Broken Layer. A layer covering whose summation amount of sky cover is 5/8ths through 7/8ths.

Calm. A condition when no motion of the air is detected.

Ceiling. The height above the earth's surface of the lowest layer that is reported as broken or overcast; or the vertical visibility into an indefinite ceiling.

Ceiling Light. A type of cloud-height indicator that uses a focused light to project vertically a narrow beam of light onto a cloud base.

Ceilometer. A device used to evaluate the height of clouds or the vertical visibility into a surface-based obscuration.

Certified Observer. An individual approved by designated Federal agencies to take surface observations used in aircraft operations.

Clear Sky. The absence of sky cover.

Cloud. A visible aggregate of minute water droplets or ice particles in the atmosphere above the Earth's surface.

Cloud-Air Lightning (CA). Streaks of lightning which pass from a cloud to the air, but do not strike the ground.

Cloud-Cloud Lightning (CC). Streaks of lightning reaching from one cloud to another.

Cloud-Ground Lightning (CG). Lightning occurring between cloud and ground.

Cloud Height. The height of the base of a cloud or cloud layer above the surface of the earth.

Cloud Layer. An array of clouds whose bases are at approximately the same level.

Contraction. A shortened form of a word, title, or phrase used for brevity.

Coordinated Universal Time (UTC). The time in the zero degree meridian time zone.

Cumulus. A principal cloud type in the form of individual, detached elements which are generally dense and possess sharp non-fibrous outlines.

Cumulonimbus. An exceptionally dense and vertically developed cloud, occurring either isolated or as a line or wall of clouds with separated upper portions. These clouds appear as mountains or huge towers, at least a part of the upper portions of which are usually smooth, fibrous, or striated, and almost flattened.

Designated RVR Runway. A runway at civilian airports designated by the FAA for reporting RVR.

Designated Stations. Weather observing stations that have the capability and have been instructed by their responsible agency to perform a specified task that is not required by standards to be performed at all stations.

Dew Point. The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur.

Drizzle. Fairly uniform precipitation composed exclusively of fine drops (diameter less than 0.02 inch or 0.5 mm) very close together. Drizzle appears to float while following air current, although unlike fog droplets, it falls to the ground.

Dust Storm. A severe weather condition characterized by strong winds and dust-filled air over an extensive area.

Field Elevation. The elevation above sea level of the highest point on any of the runways of the airport.

Fog. A visible aggregate of minute water particles (droplets) which are based at the Earth's surface and reduce horizontal visibility to less than 5/8 statute mile and, unlike drizzle, it does not fall to the ground.

Freezing. A descriptor, FZ, used to describe drizzle and/or rain that freezes on contact with the ground or exposed objects, and used also to describe fog that is composed of minute ice crystals.

Freezing Drizzle. Drizzle that freezes upon impact with the ground, or other exposed objects.

Freezing Fog. A suspension of numerous minute ice crystals in the air, or water droplets at temperatures below 0 Celsius, based at the Earth's surface, which reduces horizontal visibility; also called ice fog.

Freezing Precipitation. Any form of precipitation that freezes upon impact and forms a glaze on the ground or exposed objects.

Freezing Rain. Rain that freezes upon impact and forms a glaze on the ground or exposed objects.

Frozen Precipitation. Any form of precipitation that reaches the ground in solid form (snow, small hail and/or snow pellets, snow grains, hail, ice pellets, and ice crystals).

Funnel Cloud. A violent, rotating column of air which does not touch the surface, usually appended to a cumulonimbus cloud.

Ground Elevation. The official height of a weather station with reference to sea-level when a field elevation has not been established. It is the height of the ground at the base of the ceilometer.

Gust. Rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls.

Hail. Precipitation in the form of small balls or other pieces of ice falling separately or frozen together in irregular lumps.

Haze. A suspension in the air of extremely small, dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance.

Horizon. The actual lower boundary of the observed sky or the upper outline of terrestrial objects, including nearby natural obstructions. It is the distant line along which the earth, or the water surface at sea, and the sky appear to meet.

Ice Crystals (diamond dust). A fall of non-branched (snow crystals are branched) ice crystals in the form of needles, columns, or plates.

Ice Pellets. Precipitation of transparent or translucent pellets of ice, which are round or irregular, rarely conical, and which have a diameter of 0.2 inch (5 mm), or less. There are two main types:

a. Hard grains of ice consisting of frozen raindrops, or largely melted and refrozen snowflakes.

b. Pellets of snow encased in a thin layer of ice which have formed from the freezing, either of droplets intercepted by the pellets, or of water resulting from the partial melting of the pellets.

In-Cloud Lightning (IC). Lightning which takes place within the cloud.

Indefinite Ceiling. The ceiling classification applied when the reported ceiling value represents the vertical visibility upward into surface-based obscuration.

Intensity Qualifier. Intensity qualifiers are used to describe whether a phenomena is light (-), moderate (no symbol used), or heavy (+).

Layer. An array of clouds and/or obscurations whose bases are at approximately the same level.

Layer Amount. The amount of sky covered by clouds and/or obscurations at a given level above the Earth's surface.

Layer Height. The height of the bases of each reported layer of clouds and/or obscuration; or the vertical visibility into an indefinite ceiling.

Lightning. The luminous phenomenon accompanying a sudden electrical discharge (see cloud-air lightning, cloud-cloud lightning, cloud-ground lightning and in-cloud lightning).

Liquid Precipitation. Any form of precipitation that does not fall as frozen precipitation and does not freeze upon impact.

Local Dissemination. The transmission or delivery of a weather report to individuals or groups of users near the observing location.

Local Standard Time (LST). A time based on the geographic location of the station in one of the legally established time zones of the globe.

Long-line Dissemination (also long-line transmission). The transmission of a weather report by a communication media to a group of users on a regional or national scale.

Long-Line RVR. The RVR reported in surface observations and disseminated -line is the highest RVR achievable for the measured visibility at the touchdown zone of a specified runway. Typically, this is the RVR calculated for the highest and lowest values of visibility over the previous 10 minutes at runway light intensity step five. With New Generation RVR (NGRVR), this is an automated report. When the automated interface fails, RVR will not be reported long-line.

Low drifting. A descriptor, DR, used to describe snow, sand, or dust raised to a height of less than 6 feet above the ground.

Low Drifting Dust. Dust that is raised by the wind to less than 6 feet above the ground; visibility is not reduced below 7 statute miles at eye level although objects below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

Low Drifting Sand. Sand that is raised by the wind to less than 6 feet above the ground; visibility is not reduced below 7 statute miles at eye level although objects below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

Low Drifting Snow. Snow that is raised by the wind to less than 6 feet above the ground; visibility is not reduced below 7 statute miles at eye level although objects below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

Manual station. A station, with or without an automated surface weather observing system, where the certified observers are totally responsible for all meteorological reports that are transmitted.

Maximum Temperature. The highest temperature during a specified time period.

METAR/SPECI. An evaluation of select weather elements from a point or points on or near the ground according to a set of procedures. It may include type of report, station identifier, date and time of report, a report modifier, wind, visibility, runway visual range, weather and obstructions to vision, sky condition, temperature and dew point, altimeter setting, and Remarks.

METAR/SPECI Code. WMO code forms (FM 15-X Ext. METAR and FM 16-X Ext. SPECI) consisting of abbreviations, contractions, numbers, plain language, and symbols to provide a uniform means of disseminating surface weather reports.

Minimum Temperature. The lowest temperature during a specified time period.

Mist. A visible aggregate of minute water droplets or ice crystals suspended in the atmosphere that reduces visibility to less than 7 statute miles but greater than or equal to 5/8 statute mile.

Non-Uniform Sky Condition. A localized sky condition which varies from that reported in the body of the report.

Non-Uniform Visibility. A localized visibility which varies from that reported in the body of the report.

Obscured Sky. The condition when the entire sky is hidden by surface-based obscurations.

Obscurations. Any phenomenon in the atmosphere, other than precipitation, that reduces the horizontal visibility in the atmosphere.

Observing Location. The point or points from which an element is evaluated.

Observing Station. The point or points from which the various elements of the report are evaluated.

Overcast. A layer whose summation amount of sky cover is 8/8ths.

Parameter. A subset of the group of evaluations that constitute each element of an observation; for example, sky condition is an element, sky cover and ceiling are parameters.

Peak Wind Speed. The maximum instantaneous wind speed since the last METAR that exceeded 25 knots.

Precipitation. Any of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground.

Precipitation Discriminator. A sensor, or array of sensors, that differentiates between different types of precipitation (liquid, freezing, frozen).

Precipitation Intensity. An indication of the rate at which precipitation is falling at the time of observation.

Precipitation Rate. The amount of water, liquid or solid, that reaches the ground in a specified period of time.

Pressure. The force exerted by a column of air above the point of measurement.

Pressure Characteristic. The indication of how the pressure has been changing during a specified period of time, usually the 3-hour period preceding an observation; for example, decreasing then increasing, pressure same or lower than 3 hours ago.

Pressure Falling Rapidly. A decrease in station pressure at a rate of 0.06 inch of mercury or more per hour which totals 0.02 inch or more.

Pressure Unsteady. A pressure that fluctuates by 0.03 inch of mercury or more from the mean pressure during the period of measurement.

Prevailing Visibility. The visibility that is considered representative of conditions at the station; the greatest distance that can be seen throughout at least half the horizon circle, not necessarily continuous.

Rain. Precipitation, either in the form of drops larger than 0.02 inch (0.5 mm), or smaller drops, which in contrast to drizzle, are widely separated; for automated stations, precipitation that remains in the liquid state upon impact with the ground or other exposed objects.

Remarks. Plain language or coded data added to the body of the METAR/SPECI to report significant information not provided for in the body of the report.

Rotor Cloud. A turbulent cloud formation found in the lee of some large mountain barriers. The air in the cloud rotates around an axis parallel to the mountain range.

Runway Visual Range. The RVR is an estimate of the maximum distance at which the runway, or the specified lights or markers delineating it, can be seen from a position above a specific point on its center line. This value is normally determined by visibility sensors or transmissometers located alongside and higher than the center line of the runway. RVR is used operationally to assess whether visibility conditions are good enough to allow a particular operation, such as an instrument landing.

Sandstorm. Particles of sand carried aloft by a strong wind. The sand particles are mostly confined to the lowest ten feet, and rarely rise more than fifty feet above the ground.

Scattered Layer. A layer whose summation amount of sky cover is 3/8ths through 4/8ths.

Sea-level Pressure. The pressure value obtained by the theoretical reduction or increase of barometric pressure to sea-level.

Sector Visibility. The visibility in a specified direction that represents at least a 45-degree arc of the horizon circle.

Shallow. A descriptor, MI, used only to describe fog when the visibility at 6 feet above the ground is 5/8ths statute mile or more and the apparent visibility in the fog layer is less than 5/8ths statute mile.

Short-term Storage. Storage of data for 4 or more days to assist in sensor/system maintenance and verification of sensor/system records in the event of an aircraft mishap.

Should. A term used to indicate that a standard is recommended.

Shower(s). A descriptor, SH, used to qualify precipitation characterized by the suddenness with which they start and stop, by the rapid changes of intensity, and usually by rapid changes in the appearance of the sky.

Significant Clouds. Cumulonimbus, cumulonimbus mammatus, towering cumulus, altocumulus castellanus, and standing lenticular or rotor clouds.

Sky Condition. The state of the sky in terms of such parameters as sky cover, layers and associated heights, ceiling, and cloud types.

Sky Cover. The amount of the sky which is covered by clouds or obscurations in contact with the surface.

Smoke. A suspension in the air of small particles produced by combustion. A transition to haze may occur when smoke particles have traveled great distances (25 to 100 statute miles or more) and when the larger particles have settled out and the remaining particles have become widely scattered through the atmosphere.

Snow. Precipitation of snow crystals, mostly branched in the form of six-pointed stars; for automated stations, any form of frozen precipitation other than hail.

Snow Depth. The vertical height of frozen precipitation on the ground. For this purpose, frozen precipitation includes ice pellets, glaze, hail, any combination of these, and sheet ice formed directly or indirectly from precipitation.

Snow Grains. Precipitation of very small, white, opaque grains of ice.

Snow Pellets. Precipitation of white, opaque grains of ice. The grains are round or sometimes conical. Diameters range from about 0.08 to 0.2 inch (2 to 5 mm).

Spray. An ensemble of water droplets torn by the wind from an extensive body of water, generally from the crests of waves, and carried up into the air in such quantities that it reduces the horizontal visibility.

SPECI. A surface weather report taken to record a change in weather conditions that meets specified criteria or is otherwise considered to be significant.

Squall. A strong wind characterized by a sudden onset in which the wind speed increases at least 16 knots and is sustained at 22 knots or more for at least one minute.

Standard Atmosphere. A hypothetical vertical distribution of the atmospheric temperature, pressure, and density, which by international agreement is considered to be representative of the atmosphere for pressure-altimeter calibrations and other purposes (29.92INS or 1013hPa).

Standing Lenticular Cloud. A, more or less, isolated cloud with sharp outlines that is generally in the form of a smooth lens or almond. These clouds often form on the lee side of and generally parallel to mountain ranges. Depending on their height above the surface, they may be reported as stratocumulus standing lenticular cloud (SCSL); altocumulus standing lenticular cloud (ACSL); or cirrocumulus standing lenticular cloud CCSL).

Station Elevation. The officially designated height above sea-level to which station pressure pertains. It is generally the same as field elevation at an airport station.

Station Identifier. A four alphabetic character code group used to identify the observing location.

Station Information File. A record that documents the site characteristics of an observing location and the reporting program at the location.

Station Pressure. The atmospheric pressure at the designated station elevation.

Summation Layer Amount. A categorization of the amount of sky cover at and below each reported layer.

Surface. The horizontal plane whose elevation above sea level equals the field elevation. At stations where the field elevation has not been established, the surface refers to the ground elevation at the observation site.

Surface Visibility. The prevailing visibility determined from the usual point of observation.

Temperature. A measure of the hotness or coldness of the ambient air as measured by a suitable instrument.

Thunderstorm. A cumulonimbus cloud that is accompanied by lightning and thunder, or for automated systems, a storm detected by lightning detection systems.

Time of Occurrence. A report of the time weather begins and ends.

Tornadic Activity. The occurrence or disappearance of tornados, funnel clouds, or waterspouts.

Tornado. A violent, rotating column of air touching the ground; funnel cloud that touches the ground (see funnel cloud and waterspout).

Tower Visibility. The prevailing visibility determined from the airport traffic control tower when the surface visibility is determined from another location.

Towering Cumulus. A descriptive term for a cloud with generally sharp outlines and with moderate to great vertical development, characterized by its cauliflower or tower appearance.

Type of Report. A code (METAR, SPECI) included in the weather report to indicate the content of the observation, and to indicate whether certain reporting criteria have been met.

Type of Station. A code figure (AO1, or AO2) for automated stations which is included in the remarks section of the report to indicate the scope of the observation program at the station that generated the report.

Unknown Precipitation. Precipitation type that is reported if the automated station detects the occurrence of light precipitation but the precipitation discriminator cannot recognize the type.

Variable Ceiling. A ceiling of less than 3,000 feet which rapidly increases or decreases in height by established criteria during the period of observation.

Variable Layer Amounts. A condition when the reportable amount of a layer varies by one or more reportable values during the period it is being evaluated.

Variable Prevailing Visibility. A condition when the prevailing visibility is less than 3 statute miles and rapidly increases and decreases by 1/2 mile or more during the period of observation.

Variable Wind Direction. A condition when (1) the wind direction fluctuates by 60 degrees or more during the 2-minute evaluation period and the wind speed is greater than 6 knots; or (2) the direction is variable and the wind speed is 6 knots or less.

Vertical Visibility. A subjective or instrumental evaluation of the vertical distance into a surface-based obscuration that an observer would be able to see.

Vicinity. A proximity qualifier, VC, used to indicate weather phenomena observed between 5 and 10 statute miles of the usual point of observation but not at the station.

Virga. Visible wisps or strands of precipitation falling from clouds that evaporate before reaching the surface.

Visibility. The greatest horizontal distance at which selected objects can be seen and identified or its equivalent derived from instrumental measurements.

Visibility Markers. Visibility markers are dark or nearly dark objects viewed against the horizon sky during the day or unfocused lights of moderate intensity (about 25 candelas) during the night.

Visibility Reference Points. Selected objects at known distances from the weather station used to manually evaluate visibility.

Volcanic Ash. Fine particles of rock powder that originate from a volcano and that may remain suspended in the atmosphere for long periods.

Water Equivalent. The liquid content of solid precipitation that has accumulated on the ground (snow depth). The accumulation may consist of snow, ice formed by freezing precipitation, freezing liquid precipitation, or ice formed by the refreezing of melted snow.

Waterspout. A violent, rotating column of air that forms over a body of water, and touches the water surface; tornado or funnel cloud that touches a body of water (see funnel cloud and tornado).

Weather. A category of individual and combined atmospheric phenomena which must be drawn upon to describe the local atmospheric conditions at the time of observation.

Wind. The horizontal motion of the air past a given point.

Wind Character. The description of the variability of the wind speed in terms of gusts.

Wind Direction. The true direction from which the wind is moving at a given location.

Wind Shift. A change in the wind direction of 45 degrees or more in less than 15 minutes with sustained wind speeds of 10 knots or more throughout the wind shift.

Wind Speed. The rate at which air is moving horizontally past a given point. It may be a 2-minute average speed (reported as wind speed) or an instantaneous speed (reported as a peak wind speed, or gust).

APPENDIX I. INDEX

APPENDIX J. AUTOMATED WEATHER SYSTEM OPERATION AND BROADCAST

When automated weather systems are equipped with local broadcast capabilities the Air Traffic Facility must ensure that weather information being broadcast on the Automated Terminal Information Service (ATIS) and all other weather outlets are the same.

Note: Automated weather system communication outlets include all radio and telephone capabilities.

1. During hours of operation, towers that have ATIS capabilities and automated weather system with broadcast capability shall:

a) Ensure the last transmitted METAR/SPECI weather sequence is broadcast on the ATIS and all automated weather system communications outlets.

b) Ensure ASOS/AWOS ground to air radio weather communications are not simultaneously broadcast with the ATIS.

c) Ensure that the Automated Lightning Detection and Reporting System (ALDARS) is disabled.

Note: Automated weather system communication outlets include all radio and telephone capabilities.

2. During hours of non-operation, towers that have ATIS capabilities and automated weather system with broadcast capability shall:

a) Ensure the one minute weather sequence is broadcast on all automated weather system communications outlets; this includes any automated weather system with ATIS interface capability.

b) Ensure that the ALDARS capability is enabled.

Note: Automated weather system communication outlets include all radio and telephone capabilities.

APPENDIX K. EXPLANATION OF CHANGES

Basic

Direct questions through appropriate facility/service center office staff to the Office of Primary Interest (OPI)

a. Chapter 3
Chapter 4
Chapter 7
Chapter 3, General Procedures, and Chapter 7, General Procedures for Manual Observations, were merged. Chapters 8 through 17 were renumbered.
The definitions in Paragraph 4-2 and Paragraph 3-2 were combined. Paragraph 4-2 was deleted.

b. Chapter 8
Paragraphs 8-15 through 8-20 were deleted due to outdated equipment and procedures.

c. Chapter 11
Paragraphs 11-25 and 11-26 were removed due to outdated equipment and procedures.

d. Chapter 12
Paragraphs 12-38 and 12-39 were deleted due to outdated equipment and procedures.

e. Chapter 13
Paragraphs 13-2 through 13-4, 13-6 through 13-8, 13-10 through 13-20, 13-22 through 13-28, and 13-30 through 13-39 were deleted due to outdated equipment and procedures.

f. Chapter 14
Reference to FMH-1, Chapter 11, in 7900.5C, Paragraph 14-26c was deleted. Pressure altitude and Station Pressure were declared not applicable to CWO. Paragraph 14-8, Pressure Characteristic was deleted.

g. Chapter 15
Paragraphs 15-53 and 15-54 were deleted due to outdated procedures.

h. Chapter 16
Introduction to identify content of Chapter 16 was redefined. Paragraphs 16-11 through 16-44 due to outdated equipment and procedures were deleted. Thermograph equipment was removed from Chapter 16.

i. Chapter 17
The following text was deleted due to outdated equipment and procedures Chapter 17, Section1, Cloud Height Measurement. All equipment and procedures from Chapter 17, Section 2, except Ice Accretion Indicators was removed. Chapter 17, Section 3, Visibility Measuring Equipment was deleted. Chapter 17, Section 4, Pressure Measuring Equipment was deleted. Standardizing Requirements and Procedures from Chapter 17, Section 5, Barometer Comparisons was deleted. Chapter 17, Section 7, Temperature and Humidity Measuring Equipment was deleted. The instructions were replaced with direction to follow training and/or manufacturer manuals. Chapter 17, Section 8, Temperature and Humidity Graphing Equipment was deleted. Chapter 17, Section 9, Hygrothermometers was deleted. Chapter 17, Section 10, Measuring Equipment – Other was deleted. Chapter 17, Section 11, Wind Retransmitter was deleted.

The Table of Content was revised with new chapter's location and name changes.

j. Appendixes
Appendix C was revised and reformatted for LAWRS Requirements. Duties and responsibility of LAWRS at location with an

ASOS was redefined. Table C-1 was updated with references to 7900.5C. Appendix G was created to list a new Snow Depth for 7900.5. Appendix H was created as a Glossary for 7900.5C. Appendix I was created as an Index for 7900.5C. Appendix J was created for Automated Weather Observing System.

k. Figures and Tables
Figures and Tables in Chapters 8 through 17 were validated and updated. Figures and Tables were reorganized to appropriate references in 7900.5C. Figures 2-1, 4-1, 5-1, 6-1, 6-4, 6-5, 7-1, 8-1, 9-1, 10-7, 15-1, 15-9, and 16-2.

NOTE: All chapters and paragraphs listed above are in reference to the paragraphs as numbered in the published order. Due to deletions, Chapters 8-17 and many paragraphs will be numbered differently in the new order.