ASHRAE®
STANDARD

BACnet™ - A Data Communication Protocol for Building Automation and Control Networks

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 Tullie Circle, NE · Atlanta GA 30329-2305

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other members may or may not be members of ASHRAE, all must be technically qualified in the subject area of the standard. Every effort is made to balance the concerned interests on all Project Committees.

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    a. interpretation of the contents of this Standard,

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    d. permission to reprint portions of the Standard.

Foreword

The purpose of this addendum is to add a number of independent substantive changes to the BACnet standard. These modifications are the result of change proposals made pursuant to ASHRAE continuous maintenance procedures and of deliberations within Standing Standard Project Committee 135. The changes and their rationale are summarized below.

135*d*-1.   Replace Clause 22 Conformance and Specification with a new Clause 22 Conformance and Interoperability, p. 1.

Clause 22 of the 1995 version of BACnet defined the requirements for conforming to the standard. In order to account for the reality that most devices in a building automation system do not need to support the full functionality of BACnet in order to perform their tasks, Clause 22 also defined Conformance Classes and Functional Groups. Conformance Classes and Functional Groups were an attempt to define portions of the BACnet standard that could easily be used by specifiers to write clear and useful specifications. Experience in the field has shown that this approach does not work well.

This addendum replaces Clause 22 in its entirety. The basic requirements for conformance to BACnet remain unchanged but the Conformance Classes and Functional Groups are eliminated. In their place a new approach based on a building block concept and the five areas of interoperability defined in ASHRAE Guideline 13, *Specifying Direct Digital Control Systems,* is presented. The details of this new approach are described in the other parts of this addendum.

135*d*-2.   Replace Annex A - Protocol Implementation Conformance Statement, p. 5.

The elimination of Conformance Classes and Functional Groups, along with changes made in previously approved addenda, make it necessary to change the content of a Protocol Implementation Conformance Statement (PICS). This revision replaces the Conformance Classes Supported and Functional Groups Supported sections with a section to indicate which standardized device profiles (Annex L) are supported. It eliminates the check box format for indicating which standard object types are supported and replaces it with a list of information that is to be provided for each object type that is supported. It also updates the other sections of the PICS to reflect the current amendments to the standard.

135*d*-3.   Add a new normative Annex K - BACnet Interoperability Building Blocks (BIBBs), p. 7.

This annex introduces the concept of BACnet Interoperability Building Blocks (BIBBs). As the name suggests, each BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. The idea is that BIBBs will be combined together to build the BACnet functional requirements for a device in a specification. The BIBBs are defined in pairs denoted "A" and "B." In most cases the "A" device will act as the user of data (client) and the "B" device will be the provider of this data (server). The BIBBs are comprehensive in the sense that all of the functionality of BACnet is captured by the entire set. For an individual BACnet device, only a subset of these BIBBs would be appropriate.

The BIBBs are organized into five interoperability areas defined in ASHRAE Guideline 13, *Specifying Direct Digital Control Systems*. These areas are Data Sharing, Alarm and Event Management, Scheduling, Trending, and Device and Network Management. These groupings guide the specifier to the BIBBs that are appropriate to consider for a particular device. If one of these interoperability areas does not apply, neither do the BIBBs in that section. For interoperability areas that are important for a particular device it is necessary to select the BIBBs from that section that meet the design requirements. Annex L applies this concept to a collection of standardized BACnet devices.

135*d*-4.   Add a new normative Annex L - Descriptions and Profiles of Standardized BACnet Devices, p. 21.

This annex defines six standard BACnet device types: BACnet Operator Workstation, BACnet Building Controller, BACnet Advanced Application Controller, BACnet Application Specific Controller, BACnet Smart Actuator, and BACnet Smart Sensor. For each standard device type, the communication functionality required is described. The concept of BIBBs is applied by specifying which BIBBs must be supported in order to provide the communication functionality indicated for each device.

These standard BACnet device types can be used directly in a PICS to indicate a device's capability or in a specification to indicate what is required. They also serve as an example of how to use the BIBB concept. For a project with special needs, new device types can be defined that have different characteristics and therefore require a support for a different set of BIBBs.

135*d*-1. Replace Clause 22 Conformance and Specification with a new Clause 22 Conformance and Interoperability.

22 CONFORMANCE AND INTEROPERABILITY

BACnet defines a comprehensive set of object types and application services in the sense that communication requirements among all levels of control in a distributed, hierarchical building automation system are addressed. There is a need to account for the reality that not all devices in a building automation system need to support the full functionality of BACnet in order to perform their tasks.

To reach the overarching goal of this standard – communication between disparate building automation and control devices, possibly from different manufacturers – two distinct conditions must be met: 1) each implemented BACnet capability must precisely conform to the requirements of this standard; and 2) devices that seek to interoperate must implement precisely complementary BACnet capabilities appropriate to the desired form of interoperation. This clause defines how these conditions are to be met and what it means to conform to BACnet.

22.1 Conformance to BACnet

This subclause specifies the requirements that shall be met in order to conform with BACnet.

22.1.1 Protocol Implementation Conformance Statement (PICS)

All devices conforming to the BACnet protocol shall have a Protocol Implementation Conformance Statement (PICS) that identifies all of the portions of BACnet that are implemented. This PICS shall contain all of the information described in 22.1.1.1 and shall be in the format found in Annex A.

22.1.1.1 PICS Contents

A PICS is a written document, created by the manufacturer of a device, that identifies the particular options specified by BACnet that are implemented in the device. A BACnet PICS is considered a public document that is available for use by any interested party. As a minimum, a BACnet PICS shall convey the following information.

(a) Basic information identifying the vendor and describing the BACnet device.

(b) The BACnet Interoperability Building Blocks supported by the device (see Annex L).

(c) The standardized BACnet device profile to which the device conforms, if any (see Annex M).

(d) All non-standard application services that are supported along with an indication for each service of whether the device can initiate the service request, respond to a service request, or both.

(e) A list of all standard and proprietary object types that are supported.

(f) For each object type supported,

  1. any optional properties that are supported,
  2. which properties can be written-to using BACnet services,
  3. if the objects can be dynamically created or deleted using BACnet services,
  4. any restrictions on the range of data values for properties.

(g) The data link layer option options, both real and virtual, supported. (See Annexes H and J).

(h) Whether segmented requests are supported.

(i) Whether segmented responses are supported.

22.1.2 Conformance Test

To conform to the BACnet protocol, all devices shall pass a conformance test that verifies the correct implementation of the standard object types and services indicated in the PICS. This conformance test shall consist of a collection of test cases drawn from a standard test suite in such a way as to test each object type and service for which support is claimed (positive test) and to test for an appropriate response to errors and standard services and objects that are not implemented to ensure the absence of detrimental behavior (negative test). The details of these tests are prescribed in the companion standard, "Testing Conformance to BACnet," ASHRAE 135.1.

22.1.3 Data Link and Physical Layers

To conform to the BACnet protocol, all devices shall support one of the five data link layer options, defined in Clauses 7 through 11, and one of the physical layers compatible with that data link layer, except as indicated in 22.1.4.

22.1.4 Conformance with Non-Standard Data Link Layer

Special circumstances may require that a device support a data link and physical layer technology that is not one of the BACnet options in order to interoperate with other networked devices in a particular situation. Such a device may be said to conform to BACnet with a non-standard data link layer, provided that the criteria in 22.1.1 through 22.1.2 are met.

A device conforming to the BACnet protocol under the provisions of this subclause may use non-standard protocol layers other than the data link and physical layers, provided that the non-standard protocol is used to convey a standard BACnet LSDU that contains application and network layer information defined by this standard and encoded according to the rules of Clause 20 and Clause 6. Segmentation of the BACnet LSDU is permitted. Annex H provides examples of this for the Department of Defense Internet protocols and the Novell Internetwork Datagram Protocol.

22.2 BACnet Interoperability

BACnet is intended to provide a single, uniform standard for building control systems, the ultimate goal of which is "interoperability." Interoperability means the ability of disparate control system devices to work together toward a common objective through the digital exchange of relevant information. Although interoperability is often thought of in terms of interconnecting equipment from multiple manufacturers, it is also possible to envision interoperating systems from a single vendor, possibly equipment of different vintages. Thus, while BACnet enables multi-vendor interoperability, it in no way requires it.

22.2.1 Interoperability Areas

"Interoperability areas" (IAs) are intended to describe the functionality that is important in practical automation and control systems to achieve specific operational objectives. The five IAs delineated in this standard are data sharing, alarm and event management, scheduling, trending, and device and network management. Each IA implies a set of capabilities. Each capability, in turn, requires that specific elements of BACnet be implemented in a particular device to enable interoperability in a known and predictable manner with a minimum of field engineering. The selection of which BACnet elements are required for a particular type of device is indicated in the device profiles presented in Annex L. This section describes the specific capabilities associated with each IA.

22.2.1.1 Data Sharing

"Data sharing" is the exchange of information between BACnet devices. It may be uni-directional or bi-directional. Interoperability in this area permits the collection of data for archival storage, graphics, and reports, the sharing of common sensor or calculated values between devices, carrying out interlocked control strategies, and the modification of setpoints or other operational parameters of BACnet objects.

22.2.1.2 Alarm and Event Management

"Alarm and event management" is the exchange of data between BACnet devices related to the occurrence of a predefined condition that meets specific criteria. Such conditions are called "events" and may be the basis for the initiation of a particular control action in response or the simple logging of the event's occurrence. The event may also be deemed to represent a condition that constitutes an "alarm", requiring human acknowledgment and intervention. Interoperability in this area permits the annunciation and acknowledgment of alarms; the display of data indicating the basis for the alarm annunciation; the sharing of events for the purpose of logging or distributed control applications; modification of alarm limits and routing; and the production of summaries of the occurrence of such alarms and events.

BACnet defines two different mechanisms for generating alarms and events. One is called "intrinsic reporting" because it relies on the use of properties that are part of or "intrinsic" to the object that is being monitored for alarms or events. The other mechanism is called "algorithmic change reporting." Algorithmic change reporting is more general but it also requires the overhead of an additional object called the Event Enrollment object. The intrinsic reporting method is preferred under circumstances where it meets the objectives of the intended application. See Clause 13.

22.2.1.3 Scheduling

"Scheduling" is the exchange of data between BACnet devices related to the establishment and maintenance of dates and times at which specified output actions are to be taken. Interoperability in this area permits the use of date and time schedules for starting and stopping equipment and changing control setpoints as well as other analog or binary parameters.

22.2.1.4 Trending

"Trending" is the accumulation of (time, value) pairs at specified rates for a specified duration. The values are those of a specific property of a specific object. "Trending" is distinguished from the real-time plotting of data in that the data are usually destined for long-term storage and the sampling intervals are usually longer. Interoperability in this area permits the establishment of trending parameters and the subsequent retrieval and storage of trend data.

22.2.1.5 Device and Network Management

"Device and network management" is the exchange of data between BACnet devices concerning the operation and status of the devices comprising the BACnet internetwork. Interoperability in this area permits determining which devices are present on a given network and some of their operational capabilities, including which objects they maintain; the ability to start up and shut down communication from a particular device; the ability to synchronize the time in those devices that maintain clocks; the ability to reinitialize the operation of a device's computer; the ability to establish connections as needed; and the ability to change the connection configuration.

[Change, **Table 12-11**, p 176]

Table 12-11. Properties of the Device Object Type

Property Identifier	Property Datatype	Conformance Code
...	...	...
~~Protocol_Conformance_Class~~	~~Unsigned(1..6)~~	~~R~~
...	...	...

[Remove 12.9.13, p 178]

~~12.9.13 Protocol_Conformance_Class~~

~~This property, of type Unsigned, is an integer in the range 1-6, which indicates that the device supports a specific set of standardized protocol services and object types. While the Protocol_Conformance_Class indicates the minimum~~

~~set of standardized services, object types, and properties required to claim a particular level of conformance, an implementation may also support additional services, object types, and properties. The set of all such standardized services and object types is reflected in the next two properties.~~

[Change 21, p377]

BACnetPropertyIdentifier ::= {
        ...
        proportional-constant-units   (94),
        -- protocol-conformance-class (95), This property was deleted in version 1 revision 2.
        protocol-object-types-supported   (96),

[Change Annex C, p 414]
protocol-revision   [139]   Unsigned,
~~protocol-conformance-class   [95]   Unsigned (1..6),~~
protocol-services-supported   [97]   BACnetServicesSupported,

[Change D.10, p425]

Property: Protocol_Revision =   1
~~Property: Protocol_Conformance_Class = 6~~
Property: Protocol_Services_Supported =
        B'11111111111111111111111111111111111'

[Change D.10, p425]

Property: Protocol_Revision =   1
~~Property: Protocol_Conformance_Class =   2~~
Property: Protocol_Services_Supported =
        B'111101000000100100001000001111100011'

135*d*-2. Replace Annex A - Protocol Implementation Conformance Statement.

ANNEX A - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)

(This annex is part of this Standard and is required of its use.)

BACnet Protocol Implementation Conformance Statement

Date: _____
Vendor Name: _____
Product Name: _____
Product Model Number: _
Applications Software Version: _____ **Firmware Revision:** _____ **BACnet Protocol Revision:** _____
Product Description:

_____
_____
_____
_____
_____
_____
_____
_____
_____

BACnet Standardized Device Profile (Annex L):

☐ **BACnet Operator Workstation (B-OWS)**
☐ **BACnet Building Controller (B-BC)**
☐ **BACnet Advanced Application Controller (B-AAC)**
☐ **BACnet Application Specific Controller (B-ASC)**
☐ **BACnet Smart Sensor (B-SS)**
☐ **BACnet Smart Actuator (B-SA)**

List all BACnet Interoperability Building Blocks Supported (Annex K): _____
_____
_____

Segmentation Capability:

☐ Segmented requests supported   Window Size _____
☐ Segmented responses supported   Window Size _____

Standard Object Types Supported:

An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data:
1) Whether objects of this type are dynamically creatable using the CreateObject service
2) Whether objects of this type are dynamically deletable using the DeleteObject service
3) List of the optional properties supported
4) List of all properties that are writable where not otherwise required by this standard
5) List of proprietary properties and for each its property identifier, datatype, and meaning
6) List of any property range restrictions

Data Link Layer Options:

☐ BACnet IP, (Annex J)
☐ BACnet IP, (Annex J), Foreign Device
☐ ISO 8802-3, Ethernet (Clause 7)
☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) _____
☐ MS/TP master (Clause 9), baud rate(s): _____
☐ MS/TP slave (Clause 9), baud rate(s): _____
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): _____
☐ Point-To-Point, modem, (Clause 10), baud rate(s): _____
☐ LonTalk, (Clause 11), medium: _____
☐ Other: _____

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)   ☐Yes   ☐No

Networking Options:

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
☐ Annex H, BACnet Tunneling Router over IP
☐ BACnet/IP Broadcast Management Device (BBMD)
        Does the BBMD support registrations by Foreign Devices?   ☐Yes   ☐No

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☐ ANSI X3.4   ☐ IBM™/Microsoft™ DBCS   ☐ ISO 8859-1
☐ ISO 10646 (UCS-2)   ☐ ISO 10646 (ICS-4)   ☐ JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports:

_____
_____
_____

135*d*-3. Add a new normative Annex K - BACnet Interoperability Building Blocks (BIBBs).

ANNEX K - BACnet INTEROPERABILITY BUILDING BLOCKS (BIBBs) (NORMATIVE)

(This annex is part of this Standard and is required of its use.)

BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork. In most cases, the "A" device will act as the user of data (client), and the "B" device will be the provider of this data (server). In addition, certain BIBBs may also be predicated on the support of certain, otherwise optional, BACnet objects or properties and may place constraints on the allowable values of specific properties or service parameters.

K.1 Data Sharing BIBBs

These BIBBs prescribe the BACnet capabilities required to interoperably perform the data sharing functions enumerated in Clause 22.2.1.1 for the BACnet devices defined therein.

K.1.1 BIBB - Data Sharing - ReadProperty-A (DS-RP-A)

The A device is a user of data from device B.

BACnet Service	Initiate	Execute
ReadProperty	x	

K.1.2 BIBB - Data Sharing-ReadProperty-B (DS-RP-B)

The B device is a provider of data to device A.

BACnet Service	Initiate	Execute
ReadProperty		x

K.1.3 BIBB - Data Sharing-ReadPropertyMultiple-A (DS-RPM-A)

The A device is a user of data from device B and requests multiple values at one time.

BACnet Service	Initiate	Execute
ReadPropertyMultiple	x	

K.1.4 BIBB - Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)

The B device is a provider of data to device A and returns multiple values at one time.

BACnet Service	Initiate	Execute
ReadPropertyMultiple		x

K.1.5 BIBB - Data Sharing-ReadPropertyConditional-A (DS-RPC-A)

The A device is a user of data from device B and requests that values be returned based upon specific criteria that are contained in the message.

BACnet Service	Initiate	Execute
ReadPropertyConditional	x	

K.1.6 BIBB - Data Sharing-ReadPropertyConditional-B (DS-RPC-B)

The B device is a provider of data to device A based, conditionally, upon the selection criteria in the request from device A.

BACnet Service	Initiate	Execute
ReadPropertyConditional		x

K.1.7 BIBB - Data Sharing-WriteProperty-A (DS-WP-A)

The A device sets a value in device B.

BACnet Service	Initiate	Execute
WriteProperty	x	

K.1.8 BIBB - Data Sharing-WriteProperty-B (DS-WP-B)

The B device allows a value to be changed by device A.

BACnet Service	Initiate	Execute
WriteProperty		x

K.1.9 BIBB - Data Sharing-WritePropertyMultiple-A (DS-WPM-A)

The A device sets multiple values in device B at one time.

BACnet Service	Initiate	Execute
WritePropertyMultiple	x	

K.1.10 BIBB - Data Sharing-WritePropertyMultiple-B (DS-WPM-B)

The B device allows multiple values to be changed by device A at one time.

BACnet Service	Initiate	Execute
WritePropertyMultiple		x

K.1.11 BIBB - Data Sharing-COV-A (DS-COV-A)

The A device is a user of COV data from device B.

BACnet Service	Initiate	Execute
SubscribeCOV	x	
ConfirmedCOVNotification		x
UnconfirmedCOVNotification		x

Support for subscriptions of a limited lifetime is required, and support for subscriptions of indefinite lifetime is optional.

K.1.12 BIBB - Data Sharing-COV-B (DS-COV-B)

The B device is a provider of COV data to device A.

BACnet Service	Initiate	Execute
SubscribeCOV		x
ConfirmedCOVNotification	x	
UnconfirmedCOVNotification	x	

Devices claiming conformance to DS-COV-B shall support a minimum of five concurrent subscriptions. Support for subscriptions of a limited lifetime is required, and support for subscriptions of indefinite lifetime is optional.

K.1.13 BIBB - Data Sharing-COVP-A (DS-COVP-A)

The A device is a user of COV data from device B.

BACnet Service	Initiate	Execute
SubscribeCOVProperty	x	
ConfirmedCOVNotification		x
UnconfirmedCOVNotification		x

Support for subscriptions of a limited lifetime is required, and support for subscriptions of indefinite lifetime is optional.

K.1.14 BIBB - Data Sharing-COVP-B (DS-COVP-B)

The B device is a provider of COV data of an arbitrary property of a specified object to device A.

BACnet Service	Initiate	Execute
SubscribeCOVProperty		x
ConfirmedCOVNotification	x	
UnconfirmedCOVNotification	x	

Devices claiming conformance to DS-COVP-B shall support a minimum of five concurrent subscriptions. Support for subscriptions of a limited lifetime is required, and support for subscriptions of indefinite lifetime is optional.

K.1.15 BIBB - Data Sharing-COV-Unsolicited-A (DS-COVU-A)

The A device processes unsolicited COV data from device B.

BACnet Service	Initiate	Execute
UnconfirmedCOVNotification		x

K.1.16 BIBB - Data Sharing-COV-Unsolicited-B (DS-COVU-B)

The B device generates unsolicited COV notifications.

BACnet Service	Initiate	Execute
UnconfirmedCOVNotification	x	

K.2 Alarm and Event Management BIBBs

These BIBBs prescribe the BACnet capabilities required to interoperably perform the alarm and event management functions enumerated in Clause 22.2.1.2 for the BACnet devices defined therein.

K.2.1 BIBB - Alarm and Event-Notification-A (AE-N-A)

The A device processes notifications about alarms and other events.

BACnet Service	Initiate	Execute
ConfirmedEventNotification		x
UnconfirmedEventNotification		x

Devices claiming conformance to AE-N-A shall be able to process notifications from any standard or proprietary event-generating object of any standard or proprietary event type.

K.2.2 BIBB - Alarm and Event-Notification Internal-B (AE-N-I-B)

Device B generates notifications about alarms and other events.

BACnet Service	Initiate	Execute
ConfirmedEventNotification	x	
UnconfirmedEventNotification	x	

Devices claiming conformance to AE-N-I-B shall also support either Intrinsic or Algorithmic reporting. Any device that supports the generation of event notifications that require operator acknowledgment must support AE-ACK-B.

K.2.3 BIBB - Alarm and Event-Notification External-B (AE-N-E-B)

Device B contains an Event Enrollment object that monitors values in another device. Device B is capable of generating event notifications for alarm conditions based on value(s) in another device. Devices conforming to this BIBB must conform to DS-RP-A, AE-N-I-B, and must support at least 1 Event Enrollment object with an Object_Property_Reference property that supports references to properties in objects contained in other devices. Any device that supports the generation of event notifications that require operator acknowledgment must support AE-ACK-B.

K.2.4 BIBB - Alarm and Event-ACK-A (AE-ACK-A)

Device A acknowledges alarm/event notifications.

BACnet Service	Initiate	Execute
AcknowledgeAlarm	x	

K.2.5 BIBB - Alarm and Event-ACK-B (AE-ACK-B)

Device B processes acknowledgments of previously transmitted alarm/event notifications.

BACnet Service	Initiate	Execute
AcknowledgeAlarm		x

To support this BIBB the device must also support acknowledgeable alarms.

K.2.6 BIBB - Alarm and Event-Alarm Summary-A (AE-ASUM-A)

Device A requests summaries of alarms from device B.

BACnet Service	Initiate	Execute
GetAlarmSummary	x	

K.2.7 BIBB - Alarm and Event-Alarm Summary-B (AE-ASUM-B)

Device B provides summaries of alarms to device A.

BACnet Service	Initiate	Execute
GetAlarmSummary		x

K.2.8 BIBB - Alarm and Event-Enrollment Summary-A (AE-ESUM-A)

Device A requests event enrollments from device B.

BACnet Service	Initiate	Execute
GetEnrollmentSummary	x	

K.2.9 BIBB - Alarm and Event-Enrollment Summary-B (AE-ESUM-B)

Device B provides event enrollments to device A.

BACnet Service	Initiate	Execute
GetEnrollmentSummary		x

K.2.10 BIBB - Alarm and Event-Information-A (AE-INFO-A)

Device A requests event information from device B.

BACnet Service	Initiate	Execute
GetEventInformation	x	

K.2.11 BIBB - Alarm and Event-Information-B (AE-INFO-B)

Device B provides event information to device A.

BACnet Service	Initiate	Execute
GetEventInformation		x

K.2.12 BIBB - Alarm and Event-LifeSafety-A (AE-LS-A)

Device A requests silence or reset operations from life safety device B.

BACnet Service	Initiate	Execute
LifeSafetyOperation	x	

K.2.13 BIBB - Alarm and Event-LifeSafety-B (AE-LS-B)

Life safety device B responds to silence or reset requests from device A.

BACnet Service	Initiate	Execute
LifeSafetyOperation		x

Devices claiming conformance to AE-LS-B shall support at least one instance of a Life Safety Point or Life Safety Zone object.

K.3 Scheduling BIBBs

These BIBBs prescribe the BACnet capabilities required to interoperably perform the scheduling functions enumerated in Clause 22.2.1.3 for the BACnet devices defined therein.

K.3.1 BIBB - Scheduling-A (SCHED-A)

The A device manipulates schedules and calendars on the B device. The A device must support the DS-RP-A and DS-WP-A BIBBs.

K.3.2 BIBB - Scheduling-Internal-B (SCHED-I-B)

The B device provides date and time scheduling of the values of specific properties of specific objects within the device. In addition to supporting the DS-RP-B and DS-WP-B BIBBs, each device claiming conformance to SCHED-I-B shall also possess at least one Calendar and one Schedule object. Devices claiming conformance to SCHED-I-B shall also support either DM-TS-B or DM-UTC-B.

The Schedule object must support at least 6 entries per day. The List_of_Object_Property_Reference property shall support at least one entry. The Schedule object must support a non-empty Exception_Schedule property. The Priority_For_Writing property in the Schedule object shall be writable.

K.3.3 BIBB - Scheduling-External-B (SCHED-E-B)

The B device provides date and time scheduling of the values of specific properties of specific objects in other devices. Devices claiming conformance to SCHED-E-B shall also support SCHED-I-B and DS-WP-A. The List_Of_Object_Property_References property shall support references to objects in external devices.

K.4 Trending BIBBs

These BIBBs prescribe the BACnet capabilities required to interoperably perform the trending functions enumerated in clause 22.2.1.4 for the BACnet devices defined therein.

K.4.1 BIBB - Trending-Viewing and Modifying Trends-A (T-VMT-A)

The A device displays trend data from the B device and manipulates trend log collection parameters in the B device.

BACnet Service	Initiate	Execute
ReadRange	x	

K.4.2 BIBB - Trending-Viewing and Modifying Trends Internal-B (T-VMT-I-B)

The B device collects the trend log data records in an internal buffer. Each device claiming conformance to T-VMT-I-B must be able to support at least one Trend Log object.

BACnet Service	Initiate	Execute
ReadRange		x

K.4.3 BIBB - Trending-Viewing and Modifying Trends External-B (T-VMT-E-B)

The B device is capable of trending properties of objects contained in other devices. The B device shall support T-VMT-I-B and DS-RP-A. The Log_Interval and Log_DeviceObjectProperty properties must be writable.

The Trend Log objects must be capable of trending REAL, Unsigned, INTEGER, BOOLEAN, Bit String, Enumerated and NULL values.

K.4.4 BIBB - Trending-Automated Trend Retrieval-A (T-ATR-A)

The A device responds to a notification that a trend log is ready with new data and acquires the new data from the log.

BACnet Service	Initiate	Execute
ConfirmedEventNotification		x
ReadRange	x	

Devices claiming conformance to T-ATR-A must be able to process BUFFER_READY event notifications generated by Trend Log objects and Event Enrollment objects.

K.4.5 BIBB - Trending-Automated Trend Retrieval-B (T-ATR-B)

The B device notifies the A device that a trending buffer has acquired a predetermined number of data samples using the BUFFER_READY event algorithm either intrinsically in the Trend Log object or algorithmically using an Event Enrollment object.

BACnet Service	Initiate	Execute
ConfirmedEventNotification	x	
ReadRange		x

Devices claiming conformance to T-ATR-B must support the Trend Log object.

K.5 Device and Network Management BIBBs

These device management BIBBs prescribe the BACnet capabilities required to interoperably perform the device management functions enumerated in Clause 22.2.1.5 for the BACnet devices defined therein. The network management BIBBs prescribe the BACnet capabilities required to interoperably perform network management functions.

K.5.1 BIBB - Device Management-Dynamic Device Binding-A (DM-DDB-A)

The A device seeks information about device attributes of other devices and interprets device announcements.

BACnet Service	Initiate	Execute
Who-Is	x	
I-Am		x

K.5.2 BIBB - Device Management-Dynamic Device Binding-B (DM-DDB-B)

The B device provides information about its device attributes and responds to requests to identify itself.

BACnet Service	Initiate	Execute
Who-Is		x
I-Am	x	

K.5.3 BIBB - Device Management-Dynamic Object Binding-A (DM-DOB-A)

The A device seeks address information about objects.

BACnet Service	Initiate	Execute
Who-Has	x	
I-Have		x

K.5.4 BIBB - Device Management-Dynamic Object Binding-B (DM-DOB-B)

The B device provides address information about its objects upon request.

BACnet Service	Initiate	Execute
Who-Has		x
I-Have	x	

K.5.5 BIBB - Device Management-DeviceCommunicationControl-A (DM-DCC-A)

The A device exercises communication control over the B device.

BACnet Service	Initiate	Execute
DeviceCommunicationControl	x	

Support for requests of a limited duration is required, and support for requests of an indefinite duration is optional.

K.5.6 BIBB - Device Management-DeviceCommunicationControl-B (DM-DCC-B)

The B device responds to communication control exercised by the A device.

BACnet Service	Initiate	Execute
DeviceCommunicationControl		x

Support for requests of a limited duration is required, and support for requests of an indefinite duration is optional.

K.5.7 BIBB - Device Management-Private Transfer-A (DM-PT-A)

The A device initiates the transmission of non-BACnet data within a BACnet service request. The interpretation of the data is a local matter.

BACnet Service	Initiate	Execute
ConfirmedPrivateTransfer	x	
UnconfirmedPrivateTransfer	x	

K.5.8 BIBB - Device Management-Private Transfer-B (DM-PT-B)

The B device processes the non-BACnet data contained in the BACnet service request.

BACnet Service	Initiate	Execute
ConfirmedPrivateTransfer		x
UnconfirmedPrivateTransfer		x

K.5.9 BIBB - Device Management-Text Message-A (DM-TM-A)

The A device initiates the transmission of text messages. The interpretation and subsequent processing of the messages is a local matter.

BACnet Service	Initiate	Execute
ConfirmedTextMessage	x	
UnconfirmedTextMessage	x	

K.5.10 BIBB - Device Management-Text Message-B (DM-TM-B)

The B device processes the text messages.

BACnet Service	Initiate	Execute
ConfirmedTextMessage		x
UnconfirmedTextMessage		x

K.5.11 BIBB - Device Management-TimeSynchronization-A (DM-TS-A)

The A device provides time synchronization to B devices. The time parameter contained in the service request contains the date and time as determined by the clock in the device issuing the service request. Normally this will be "local time," i.e., the time in the local time zone corrected for daylight savings time as appropriate.

BACnet Service	Initiate	Execute
TimeSynchronization	x	

Devices claiming conformance to DM-TS-A must support the Time_Synchronization_Recipients property of the Device object.

K.5.12 BIBB - Device Management-TimeSynchronization-B (DM-TS-B)

The B device interprets time synchronization messages from the A device.

BACnet Service	Initiate	Execute
TimeSynchronization		x

Devices claiming conformance to DM-TS-B must support the Local_Time and Local_Date properties of the Device object.

K.5.13 BIBB - Device Management-UTCTimeSynchronization-A (DM-UTC-A)

The A device provides time synchronization to B devices. The time parameter contained in the service request contains "Coordinated Universal Time" (UTC). For all practical purposes, UTC is synonymous with Greenwich Mean Time, the time at the zero or Greenwich meridian.

BACnet Service	Initiate	Execute
UTCTimeSynchronization	x	

Devices claiming conformance to DM-TS-A must support the Time_Synchronization_Recipients property of the Device object.

K.5.14 BIBB - Device Management-UTCTimeSynchronization-B (DM-UTC-B)

The B device interprets time synchronization messages from the A device.

BACnet Service	Initiate	Execute
UTCTimeSynchronization		x

Devices claiming conformance to DM-TS-B must support the Local_Time, Local_Date, UTC_Offset, and Daylight_Saving_Status properties of the Device object.

K.5.15 BIBB - Device Management-ReinitializeDevice-A (DM-RD-A)

The A device is authorized to reinitialize the B device.

BACnet Service	Initiate	Execute
ReinitializeDevice	x	

Devices claiming conformance to DM-RD-A shall be able to initiate ReinitializeDevice requests containing the Password parameter. This shall be both for warm and cold start.

K.5.16 BIBB - Device Management-ReinitializeDevice-B (DM-RD-B)

The B device performs reinitialization requests from the A device. The optional password field shall be supported.

BACnet Service	Initiate	Execute
ReinitializeDevice		x

K.5.17 BIBB - Device Management-Backup and Restore-A (DM-BR-A)

The A device reads the files that contain the configuration of the B device and writes those files to the B device should it need to be restored to its previously backed-up state.

BACnet Service	Initiate	Execute
AtomicReadFile	x	
AtomicWriteFile	x	
CreateObject	x	
ReinitializeDevice	x	

Devices claiming conformance to DM-BR-A must support the device A capabilities as described in Clause X (135*c*-5).

K.5.18 BIBB - Device Management-Backup and Restore-B (DM-BR-B)

The B device provides its configuration file to the A device and allows the A device to write this file to recover its configuration in the event of a failure.

BACnet Service	Initiate	Execute
AtomicReadFile		x
AtomicWriteFile		x
ReinitializeDevice		x

Devices claiming conformance to DM-BR-B must support the device B capabilities as described in Clause X (135*c*-5). Once a Restore procedure has been initiated on the device, the Read_Only property of configuration File objects shall contain the value FALSE, and the File_Size property of the configuration File objects shall be writable if the size of the configuration file can change based on the device's configuration.

If the configuration file objects are not guaranteed to exist once a Restore procedure has been initiated, then the device must support execution of the CreateObject service.

K.5.19 BIBB - Device Management-Restart-A (DM-R-A)

The A device processes restart notifications.

BACnet Service	Initiate	Execute
UnconfirmedCOVNotification		x

K.5.20 BIBB - Device Management-Restart-B (DM-R-B)

The B device informs the A device(s) each time it restarts.

BACnet Service	Initiate	Execute
UnconfirmedCOVNotification	x	

Devices claiming conformance to DM-R-B shall support the Time_Of_Device_Restart and Last_Restart_Reason properties of the Device object.

K.5.21 BIBB - Device Management-List Manipulation-A (DM-LM-A)

Many BACnet object types have properties that are lists of a particular datatype. The A device can add and remove list elements in properties of objects in the B device.

BACnet Service	Initiate	Execute
AddListElement	x	
RemoveListElement	x	

K.5.22 BIBB - Device Management-List Manipulation-B (DM-LM-B)

The B device responds to requests to add or remove list elements.

BACnet Service	Initiate	Execute
AddListElement		x
RemoveListElement		x

K.5.23 BIBB - Device Management-Object Creation and Deletion-A (DM-OCD-A)

BACnet allows object instances to be dynamically created and deleted. The A device may dynamically create and delete the object types supported by the B device.

BACnet Service	Initiate	Execute
CreateObject	x	
DeleteObject	x	

K.5.24 BIBB - Device Management-Object Creation and Deletion-B (DM-OCD-B)

The B device creates and deletes object instances based on requests from the A device. The object types whose dynamic creation and deletion is supported shall be enumerated in the Standard Object Types Supported section of device B's PICS.

BACnet Service	Initiate	Execute
CreateObject		x
DeleteObject		x

K.5.25 BIBB - Device Management-Virtual Terminal-A (DM-VT-A)

The A device initiates a virtual terminal session and exchanges data with the B device.

BACnet Service	Initiate	Execute
VT-Open	x	
VT-Close	x	x
VT-Data	x	x

K.5.26 BIBB - Device Management-Virtual Terminal-B (DM-VT-B)

The B devices permits the establishment of a virtual terminal session and exchanges data with the A device.

BACnet Service	Initiate	Execute
VT-Open		x
VT-Close	x	x
VT-Data	x	x

K.5.27 BIBB - Network Management-Connection Establishment-A (NM-CE-A)

The A device commands a half-router to establish and terminate connections as needed for communication with other devices.

BACnet Network Layer Message	Initiate	Execute
Establish-Connection-To-Network	x	
Disconnect-Connection-To-Network	x	

K.5.28 BIBB - Network Management-Connection Establishment-B (NM-CE-B)

The B device executes commands to establish and terminate connections as needed.

BACnet Network Layer Message	Initiate	Execute
Establish-Connection-To-Network		x
Disconnect-Connection-To-Network		x

K.5.29 BIBB - Network Management-Router Configuration-A (NM-RC-A)

The A device may query and change the configuration of routers and half-routers.

BACnet Network Layer Message	Initiate	Execute
Who-Is-Router-To-Network	x	
I-Am-Router-To-Network		x
I-Could-Be-Router-To-Network		x
Initialize-Routing-Table	x	
Initialize-Routing-Table-Ack		x

K.5.30 BIBB - Network Management-Router Configuration-B (NM-RC-B)

The B device responds to router management commands and must meet the requirements for BACnet Routers as stated in Clause 6.

BACnet Network Layer Message	Initiate	Execute
Who-Is-Router-To-Network	x	x
I-Am-Router-To-Network	x	x
Initialize-Routing-Table		x
Initialize-Routing-Table-Ack	x	

135*d*-4. Add a new normative Annex L - Descriptions and Profiles of Standardized BACnet Devices.

ANNEX L - DESCRIPTIONS AND PROFILES OF STANDARDIZED BACnet DEVICES (NORMATIVE)

(This annex is part of this Standard and is required of its use.)

This annex provides descriptions of six "standardized" types of BACnet devices. Any device that implements all the required BACnet capabilities for a particular device type and interoperability area may claim to be a device of that particular type. Devices may also provide additional capabilities and shall indicate these capabilities in their PICS. The devices defined herein are: BACnet Operator Workstation, BACnet Building Controller, BACnet Advanced Application Controller, BACnet Application Specific Controller, BACnet Smart Actuator, and BACnet Smart Sensor.

L.1 BACnet Operator Workstation (B-OWS)

The B-OWS is the operator's window into a BACnet system. While it is primarily used for the operation of a system, it may be used for configuration activities that are beyond the scope of this standard. It is not intended to perform direct digital control. It enables the specification of the following:

Data Sharing
- Archival storage of data
- Presentation of data (i.e., reports and graphics)
- The ability to monitor the value of all BACnet object types, including all required and optional properties
- The ability to modify setpoints and parameters

Alarm and Event Management
- Operator notification and presentation of event information
- Alarm acknowledgment by operators
- Alarm summarization
- Adjustment of alarm limits
- Adjustment of alarm routing

Scheduling
- Modification of schedules
- Display of the start and stop times (schedule) of scheduled devices

Trending
- Modification of the parameters of a trend log
- Display and archive of trend data

Device and Network Management
- Display of information about the status of any device on the BACnet internetwork
- Display of information about any object in the BACnet internetwork
- Ability to silence a device on the network that is transmitting erroneous data
- Ability to synchronize the time in devices across the BACnet internetwork
- Ability to cause a remote device to reinitialize itself
- Ability to backup and restore the configuration of other devices
- Ability to command half-routers to establish and terminate connections
- Ability to query and change the configuration of half-routers and routers

L.2 BACnet Building Controller (B-BC)

A B-BC is a general-purpose, field-programmable device capable of carrying out a variety of building automation and control tasks. It enables the specification of the following:

Data Sharing
- Ability to provide the values of any of its BACnet objects
- Ability to retrieve the values of BACnet objects from other devices
- Ability to allow modification of some or all of its BACnet objects by another device

Alarm and Event Management
- Generation of alarm / event notifications and the ability to direct them to recipients
- Maintaining a list of unacknowledged alarms / events
- Notifying other recipients that the acknowledgment has been received
- Adjustment of alarm / event parameters

Scheduling
- Ability to schedule output actions, both in the local device and in other devices, both binary and analog, based on date and time

Trending
- Collection and delivery of (time, value) pairs

Device and Network Management
- Ability to respond to information about its status
- Ability to respond to requests for information about any of its objects
- Ability to respond to communication control messages
- Ability to synchronize its internal clock upon request
- Ability to perform re-initialization upon request
- Ability to upload its configuration and allow it to be subsequently restored
- Ability to command half-routers to establish and terminate connections

L.3 BACnet Advanced Application Controller (B-AAC)

A B-AAC is a control device with limited resources relative to a B-BC. It may be intended for specific applications and supports some degree of programmability.

Data Sharing
- Ability to provide values for any of its BACnet objects upon request
- Ability to allow modification of some or all of its BACnet objects by another BACnet device

Alarm and Event Management
- Generation of limited alarm and event notifications and the ability to direct them to recipients
- Tracking acknowledgments of alarms from human operators
- Adjustment of alarm parameters

Scheduling
- Ability to schedule actions in the local device based on date and time

Trending
- No requirement

Device and Network Management
- Ability to respond to queries about its status
- Ability to respond to requests for information about any of its objects
- Ability to respond to communication control messages
- Ability to synchronize its internal clock upon request
- Ability to perform re-initialization upon request

L.4 BACnet Application Specific Controller (B-ASC)

A B-ASC is a controller with limited resources relative to a B-AAC. It is intended for use in a specific application and supports limited programmability. It enables specification of the following:

Data Sharing
- Ability to provide the values of any of its BACnet objects
- Ability to allow modification of some or all of its BACnet objects by another device

Alarm and Event Management
- No requirement

Scheduling
- No requirement

Trending
- No requirement

Device and Network Management
- Ability to respond to information about its status

L.5 BACnet Smart Actuator (B-SA)

A B-SA is a simple control device with limited resources; it is intended for specific applications.

Data Sharing
- Ability to provide values for any of its BACnet objects upon request
- Ability to allow modification of some or all of its BACnet objects by another device

Alarm and Event Management
- No requirement

Scheduling
- No requirement

Trending
- No requirement

Device and Network Management
- No requirement

L.6 BACnet Smart Sensor (B-SS)

A B-SS is a simple sensing device with very limited resources.

Data Sharing
• Ability to provide values for any of its BACnet objects upon request

Alarm and Event Management
• No requirement

Scheduling
• No requirement

Trending
• No requirement

Device and Network Management
• No requirement

L.7 Profiles of the Standard BACnet Devices

The following tables indicate which BIBBs must be supported by each device type for each interoperability area.

	B-OWS	B-BC	B-AAC	B-ASC	B-SA	B-SS
Data Sharing	DS-RP-A,B	DS-RP-A,B	DS-RP-B	DS-RP-B	DS-RP-B	DS-RP-B
	DS-RPM-A	DS-RPM-A,B	DS-RPM-B	DS-WP-B	DS-WP-B	
	DS-WP-A	DS-WP-A,B	DS-WP-B			
	DS-WPM-A	DS-WPM-B	DS-WPM-B			
		DS-COVU-A,B				

	B-OWS	B-BC	B-AAC	B-ASC	B-SA	B-SS
Alarm & Event Mgmt	AE-N-A	AE-N-I-B	AE-N-I-B			
	AE-ACK-A	AE-ACK-B	AE-ACK-B			
	AE-INFO-A	AE-INFO-B	AE-INFO-B			
	AE-ESUM-A	AE-ESUM-B				

	B-OWS	B-BC	B-AAC	B-ASC	B-SA	B-SS
Scheduling	SCHED-A	SCHED-E-B	SCHED-I-B			

	B-OWS	B-BC	B-AAC	B-ASC	B-SA	B-SS
Trending	T-VMT-A	T-VMT-I-B				
	T-ATR-A	T-ATR-B				

	B-OWS	B-BC	B-AAC	B-ASC	B-SA	B-SS
Device & Network Mgmt	DM-DDB-A,B	DM-DDB-A,B	DM-DDB-B	DM-DDB-B		
	DM-DOB-A,B	DM-DOB-A,B	DM-DOB-B	DM-DOB-B		
	DM-DCC-A	DM-DCC-B	DM-DCC-B	DM-DCC-B		
	DM-TS-A	DM-TS-B or DM-UTC-B	DM-TS-B or DM-UTC-B			
	DM-UTC-A					
	DM-RD-A	DM-RD-B	DM-RD-B			
	DM-BR-A	DM-BR-B				
	NM-CE-A	NM-CE-A				

HISTORY OF REVISIONS

Protocol		Summary of Changes to the Standard
Version	Revision	
1	**NA**	ANSI/ASHRAE 135-1995
1	**NA**	Addendum *a* to ANSI/ASHRAE 135-1995 1. Add Annex J - BACnet/IP and supporting definitions
1	**1**	Addendum *b* to ANSI/ASHRAE 135-1995 1. Inconsistencies are eliminated in the definitions of the Analog and Binary Value object types 2. Any device that receives and executes UnconfirmedEventNotification service requests must support programmable process identifiers 3. Modify each event-generating object type to contain the last timestamp for each acknowledgeable transition 4. Modify the Notification Class object by requiring that the 'Notification Class' property be equivalent *to* the instance number of the Notification Class object 5. Modify the Event Notification services to make the 'To State' parameter mandatory for notifications of type ACK_NOTIFICATION 6. A new BACnetDeviceObjectPropertyReference production is added and its use in the Event Enrollment and Schedule object types is specified 7. Add a Multi-state Value object type 8. Add an Averaging object type 9. Change all 'Process Identifier' properties and parameters to Unsigned32 10. Change the Multi-state Input object type to correct flaws related to fault detection and reportin*g* and achieve consistency with the proposed Multi-state Value object type 11. Add a Protocol_Revision property to the Device object type 12. The File object type is changed to allow truncation and partial deletion operations 13. A new ReadRange service is added to permit reading a range of data items from a property whose datatype is a list or array of lists 14. A new UTCTimeSynchronization service is introduced and related changes are made to properties in the Device object type 15. Add a Trend Log object type 16. The UnconfirmedCOVNotification service is extended to allow notifications without prior subscription as a means of distributing globally important data to a potentially large number of recipients 17. Add eight new BACnet engineering units.
1	**2**	Addendum *c* to ANSI/ASHRAE 135-1995 1. Add a new Life Safety Point object type that represents the characteristics of initiating and indicating devices in the fire, life safety, and security applications

		2. Add a new Life Safety Zone object type that represents the characteristics associated with an arbitrary group of BACnet Life Safety Point and Life Safety Zone objects
		3. Add functionality to the existing BACnet alarm and event features needed to support the Life Safety Point and Life Safety Zone object types
		4. Add a new LifeSafetyOperation service that provides silence and reset capabilities needed for life safety systems
		5. Add a new subclause to 16 to describe the use of existing BACnet services to provide backup and restore capability
		6. Define a new service, SubscribeCOVProperty, to allow COV notifications for arbitrary properties of an object with subscriber-specified COV increments
		7. Add Vendor ID to proprietary MS/TP frames
		8. Add a new service, GetEventInformation, that provides enough information to acknowledge alarms
1	2	Addendum *d* to ANSI/ASHRAE 135-1995 1. Replace Clause 22 with a new clause entitled "Conformance and Specification". 2. Update Annex A, "Protocol Implementation Conformance Statement". 3. Add a new Annex K entitled "BACnet Interoperability Building Blocks (BIBBs)". 4. Add a new Annex L entitled "Descriptions and Profiles of Standardized BACnet Devices".
1	2	Addendum *e* to ANSI/ASHRAE 135-1995 1. Define the PTP conection status when the half-router can and canot re-establish the connection. 2. Add Object Profiles and Extensions. 3. Add the capability for devices to advertise the maximum number of segments of a segmented APDU that they can receive.

NA = Not Applicable because the Protocol_Revision property was first defined in Addendum *b*