

BSR/ASHRAE Addendum o  
to ANSI/ASHRAE Standard 135-2004

# Public Review Draft

ASHRAE® Standard

## Proposed Addendum o to Standard 135-2004, *BACnet*®—A *Data Communication Protocol for Building Automation and Control Networks*

Second Public Review (September 2008)  
(Draft Shows Proposed Changes  
to Current Standard)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed addendum, go to the ASHRAE website at <http://www.ashrae.org/technology/page/331> and access the online comment database. The draft is subject to modification until it is approved for publication by the responsible project committee, the ASHRAE Standards Committee, and the Board of Directors. Then it will be submitted to the American National Standards Institute Board of Standards Review (BSR) for approval. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE web site) remains in effect. The current edition of any standard may be purchased from the ASHRAE Bookstore @ <http://www.ashrae.org> or by calling 404-636-8400 or 1-800-527-4723 (for orders in the U.S. or Canada).

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**[This foreword and the “rationale” on the following page are not part of this standard. They are merely informative and do not contain requirements necessary for conformance to the standard.]**

## **FOREWORD**

The purpose of this addendum is to present a proposed change for public review. These modifications are the result of change proposals made pursuant to the ASHRAE continuous maintenance procedures and of deliberations within Standing Standard Project Committee 135. The proposed changes are summarized below.

### **135-2004o-1. Accommodate remote operator access and NAT in Annex J BACnet/IP, p. 1.**

In the following document, language to be added to existing clauses of ANSI/ASHRAE 135-2004 and Addenda is indicated through the use of *italics*, while deletions are indicated by ~~strike through~~. Where entirely new subclauses are proposed to be added, plain type is used throughout. Only this new and deleted text is open to comment as this time. All other material in this addendum is provided for context only and is not open for public review comment except as it relates to the proposed changes.

### 135-2004o-1. Accommodate remote operator access and NAT in Annex J BACnet/IP.

#### Rationale

Two common uses cases for Annex J BACnet/IP are not sufficiently well accommodated by Annex J: Network Address Translation (NAT) and operator access across the Internet to multiple remote subnets. Some small changes are proposed to accommodate these cases.

#### Addendum 135-2004o-1

[Add new acronym to Clause 3.3, pp. 5-7, in alphabetic order.]

NAT Network Address Translation – RFC 2663

[Change ANNEX A, p. 451.]

#### 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

Does the BBMD support network address translation?  Yes  No

[Change Annex J.2.5, p. 567.]

#### J.2.5 Forwarded-NPDU: Purpose

This BVLL message is used in broadcast messages from a BBMD as well as in messages forwarded to registered foreign devices. It contains the ~~source address of the original node~~ address with which the original node is accessed as well as the original BACnet NPDU.

[Change Annex J.4.3, p. 569.]

#### J.4.3 BBMD Concept

Each IP subnet that is part of a B/IP network comprised of two or more subnets shall have ~~one, and only one, BBMD.~~ at least one BBMD. Each BBMD shall possess a table called a Broadcast Distribution Table (~~BDT~~ which shall be the same in every BBMD in a given B/IP network. (BDT). If there are two or more BBMDs on a single subnet, their BDTs shall not overlap. The BDT determines which remote IP subnets receive forwarded BACnet broadcasts. To reduce BACnet broadcast traffic, it is possible to configure the BDT to forward broadcasts to IP subnets only where they are required. If the BBMD has also been designated to register foreign devices as described below, it shall also possess a Foreign Device Table (FDT).

[Change Annex J.4.3.2, p. 570.]

#### J.4.3.2 Broadcast Distribution Table Format

The BDT consists of one entry for ~~each BBMD within a B/IP network.~~ the address of the BBMD for the local IP subnet and an entry for the BBMD on each remote IP subnet to which broadcasts are to be forwarded. Each entry consists of the 6-octet B/IP address ~~of the BBMD serving the IP subnet with which the BBMD is accessed~~ and a 4-octet broadcast distribution mask. If the IP router to the subnet performs network address translation (NAT), then the address shall contain the global IP address of the IP router. The operation of BBMDs in the presence of NAT is described in J.7.2. If messages are to be distributed on the remote IP subnet using directed broadcasts, the broadcast distribution mask shall be identical to the subnet mask associated with the subnet, i.e., all 1's in the network portion of the 4-octet IP address field and all 0's in the host portion. If messages are to be distributed on the remote IP subnet by sending the message directly to the remote BBMD, the broadcast distribution mask shall be all 1's. The broadcast distribution masks referring to the same subnet shall be identical in each BDT. The use of the broadcast distribution mask is described in J.4.5.

[Change Annex J.4.5 p. 570.]

#### J.4.5 BBMD Operation - Broadcast Distribution

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Upon receipt of a BVLL Forwarded-NPDU message, a BBMD shall process it according to whether it was received from a peer BBMD as the result of a directed broadcast or a unicast transmission. A BBMD may ascertain the method by which Forwarded-NPDU messages will arrive by inspecting the broadcast distribution mask field in its own BDT entry since ~~all BDTs are required to be identical.~~ *masks referring to the same subnet are required to be identical in all BBMDs.* If the message arrived via directed broadcast, it was also received by the other devices on the BBMD's subnet. In this case the BBMD merely retransmits the message directly to each foreign device currently in the BBMD's FDT. If the message arrived via a unicast transmission it has not yet been received by the other devices on the BBMD's subnet. In this case, the message is sent to the devices on the BBMD's subnet using the B/IP broadcast address as well as to each foreign device currently in the BBMD's FDT. A BBMD on a subnet with no other BACnet devices (*such as a NAT-supporting BBMD, see J.7.2*) may omit the broadcast using the B/IP broadcast address. The method by which a BBMD determines whether or not other BACnet devices are present is a local matter.

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[Insert new Annex J.7.2, BBMD Operation with Network Address Translation, p. 574, and renumber subsequent clauses.]

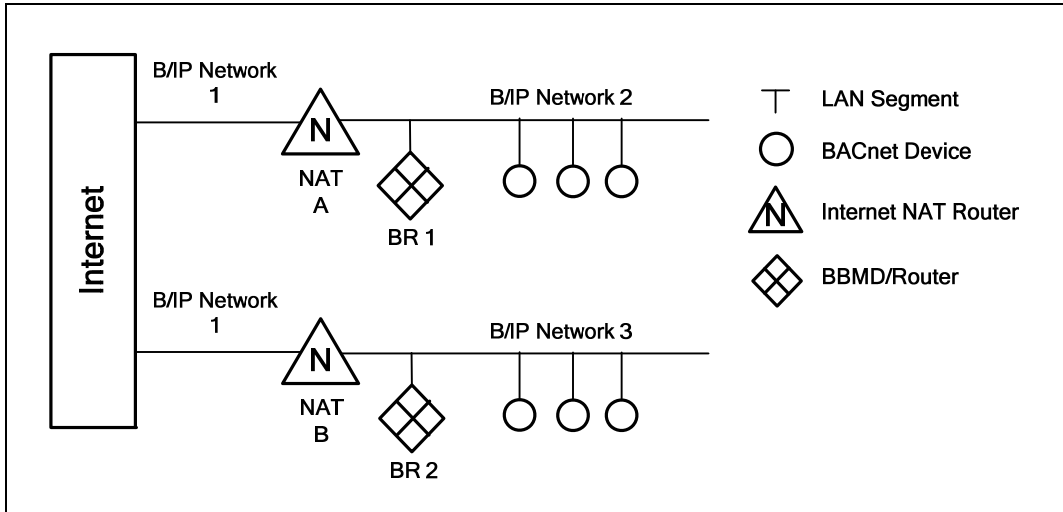
#### J.7.2 BBMD Operation with Network Address Translation

Network Address Translation (NAT) is in widespread use by IP routers and firewalls to connect private subnets to the global Internet. Using NAT, multiple hosts on a subnet can access the Internet using a single public IP address. BBMD operation supporting NAT routers is optional for BBMD devices. A single BACnet device may contain several B/IP network ports, each with its own internal BBMD.

For those B/IP networks that communicate through a NAT router, there are several additional considerations:

- a) The NAT router at each subnet location should be configured to port forward B/IP messages to the BBMD. Port forwarding causes all messages directed to the specified port to be forwarded to a specific local address.
- b) To enable messages to traverse the Internet, the destination IP address and UDP port in all Forwarded-NPDU messages shall be the global IP address and UDP port of the destination subnet. This is facilitated by entering the global B/IP address of each BBMD in the BDT.
- c) Except when propagating a received Forwarded-NPDU message, the "B/IP Address of Originating Device" field in Forwarded-NPDU messages is the global IP address and port of the NAT Router through which the BBMD communicates. This is required so responding devices on the remote subnet may communicate with the originating device. Received Forwarded-NPDU messages are propagated as-is to foreign devices and to the local IP subnet as defined in J.4.5
- d) For any single B/IP network, only one device on the local side of the NAT router may be accessible from the global side. All other devices on the local side of that NAT router need to be on different BACnet networks so that they can be uniquely addressed using the BACnet network layer. The globally accessible device will contain a BACnet router to those networks. The globally accessible device may be either a BBMD or a foreign device.
- e) A foreign device behind a NAT router should register often with a BBMD to maintain a return path through the NAT router back to the foreign device. The maximum allowed time between registrations is dependent on the NAT router, and may be 30 seconds or less.
- f) Two-hop distribution shall be used in B/IP networks that contain NAT routers, since one-hop distribution is not possible through NAT routers.

A B/IP internetwork containing NAT Routers can be configured several ways. See Figures J-7 and J-8 for some common applications.



**Figure J-7.** The configuration of the NAT and BBMD / Router devices is described as follows:

**NAT A Configuration**

Internet IP                    201.1.1.1  
 Forward                      201.1.1.1:47809 → 192.168.1.10:47809

**NAT B Configuration**

Internet IP                    237.2.2.2  
 Forward                      237.2.2.2:47809 → 192.168.1.10:47809

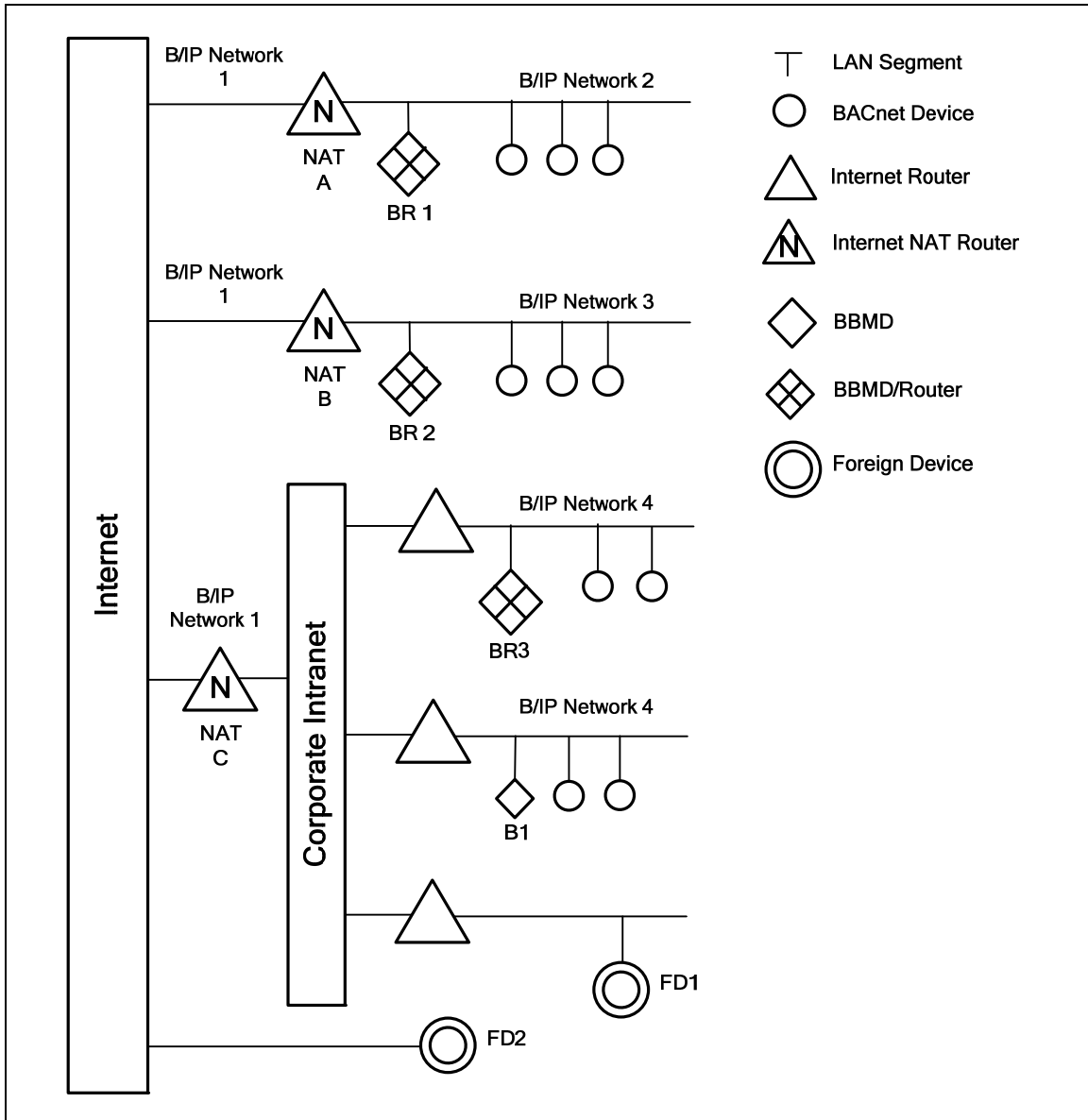
**BR1 - BBMD/Router Configuration**

Global IP Address        201.1.1.1:47809 (global B/IP address of NAT A)  
 B/IP Address Net 1      192.168.1.10:47809  
 BDT Net 1                201.1.1.1:47809 (global B/IP address of NAT A, self),  
                                  237.2.2.2:47809 (global B/IP address of NAT B)  
 B/IP Address Net 2      192.168.1.10:47808  
 BDT Net 2                192.168.1.10:47808 (self)

**BR2 - BBMD/Router Configuration**

Global IP Address        237.2.2.2:47809 (global B/IP address of NAT B)  
 B/IP Address Net 1      192.168.1.10:47809  
 BDT Net 1                237.2.2.2:47809 (global B/IP address of NAT B, self),  
                                  201.1.1.1:47809 (global B/IP address of NAT A)  
 B/IP Address Net 3      192.168.1.10:47808  
 BDT Net 3                192.168.1.10:47808 (self)

The NAT devices translate global Internet IP/Port addresses into private addresses. Different networks behind NAT devices may use the same IP/Port address range as demonstrated here.



**Figure J-8.** This figure represents a potential WAN with multiple remote sites, with BACnet being connected via a corporate intranet. In this configuration, the foreign device FD1 can connect to Network 4 using local addresses and to Networks 2 and 3 using the global IP address of the NAT routers. The foreign device FD2 can only connect to the global IP addresses on the Internet side of the NAT routers.

**NAT A Configuration**

Internet IP                    201.1.1.1  
 Forward                      201.1.1.1:47809 → 192.168.1.10:47809

**NAT B Configuration**

Internet IP                    237.2.2.2  
 Forward                      237.2.2.2:47809 → 192.168.1.10:47809

**NAT C Configuration**

Internet IP                    203.3.3.3  
 Forward                      203.3.3.3:47809 → 192.168.20.10:47809

**BR1 - BBMD/Router Configuration**

Global IP Address	201.1.1.1:47809 (global B/IP address of NAT A)
B/IP Address Net 1	192.168.1.10:47809
BDT Net 1	201.1.1.1:47809 (global B/IP address of NAT A, self), 237.2.2.2:47809 (global B/IP address of NAT B), 203.3.3.3:47809 (global B/IP address of NAT C)
B/IP Address Net 2	192.168.1.10:47808
BDT Net 2	192.168.1.10:47808 (self)

**BR2 - BBMD/Router Configuration**

Global IP Address	237.2.2.2:47809 (global B/IP address of NAT B)
B/IP Address Net 1	192.168.1.10:47809
BDT Net 1	237.2.2.2:47809 (global B/IP address of NAT B, self), 201.1.1.1:47809 (global B/IP of NAT A), 203.3.3.3:47809 (global B/IP of NAT C)
B/IP Address Net 3	192.168.1.10:47808
BDT Net 3	192.168.1.10:47808 (self)

**BR3 – BBMD/Router Configuration**

Global IP Address	203.3.3.3:47809 (global B/IP address of NAT C)
B/IP Address Net 1	192.168.20.10:47809
BDT Net 1	203.3.3.3:47809 (global B/IP address of NAT C, self), 201.1.1.1:47809 (global B/IP address of NAT A), 237.2.2.2:47809 (global B/IP address of NAT B)
B/IP Address Net 4	192.168.20.10:47808
BDT Net 4	192.168.20.10:47808 (self), 192.168.21.10:47808 (B/IP address of BBMD B1)

**B1 – BBMD Configuration**

B/IP Address	192.168.21.10:47808
BDT Net 4	192.168.21.10:47808 (self), 192.168.20.10:47808 (B/IP address of BBMD BR3)