

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*

First Public Review (September 2007)  
(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, use the comment form and instructions provided with this draft. 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).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE web site @ <http://www.ashrae.org>.

The appearance of any technical data or editorial material in this public review document does not constitute endorsement, warranty, or guaranty by ASHRAE of any product, service, process, procedure, or design, and ASHRAE expressly disclaims such.

© September 21, 2007. This draft is covered under ASHRAE copyright. Permission to reproduce or redistribute all or any part of this document must be obtained from the ASHRAE Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. Phone: 404-636-8400, Ext1125. Fax: 404-321-5478. E-mail: [standards.section@ashrae.org](mailto:standards.section@ashrae.org).

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



**[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 needed 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. 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 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 local IP subnet and for 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 BDT 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**

...

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 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.

...

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

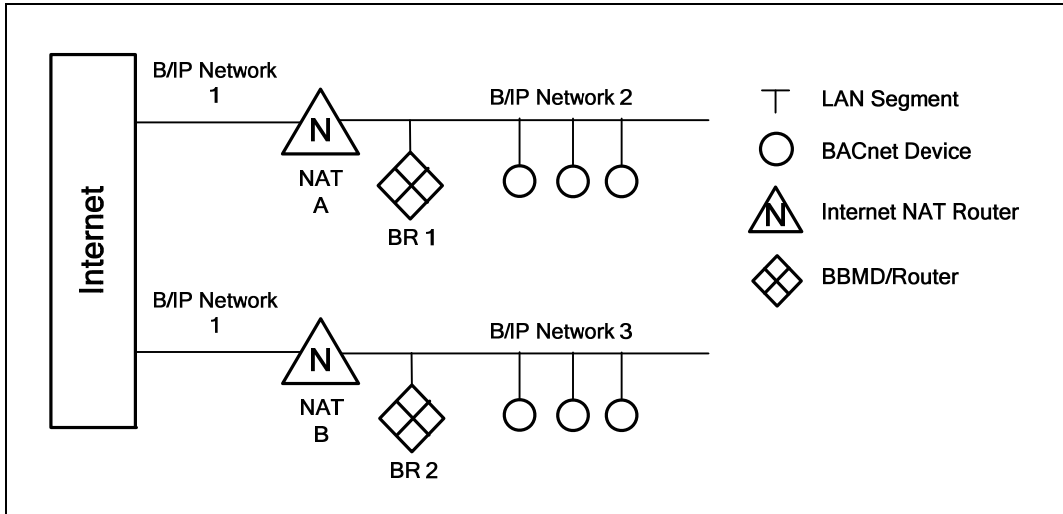
#### **J.7.2 BBMD Operation with Network Address Translation**

Network Address Translation (NAT) is in widespread use by IP routers and firewalls to connect private subnets to the global Internet. Multiple hosts on the subnet can access the Internet using a single public IP address. NAT does a many-to-one IP address translation, meaning that many inside (local) IP addresses are mapped to an outside (global) IP address and vice versa. BBMD operation supporting NAT routers is optional for BBMD devices.

NAT adds configuration and operational requirements for a B/IP network as follows:

- 1) The NAT router at each subnet location is 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 and is a standard feature of NAT routers.
- 2) 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.
- 3) Except when propagating a received Forwarded-NPDU message, the "B/IP Address of Originating Device" field in Forwarded-NPDU messages shall contain the global IP address of the NAT Router. 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
- 4) 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 shall be on different BACnet networks, and the globally accessible device shall contain a BACnet router to those networks. The globally accessible device may be either a BBMD or a foreign device.
- 5) 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.
- 6) 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                      201.1.1.1:47808 → 192.168.1.1:47809

**NAT B Configuration**

Internet IP                    202.2.2.2  
 Forward                      202.2.2.2:47808 → 192.168.1.1:47809

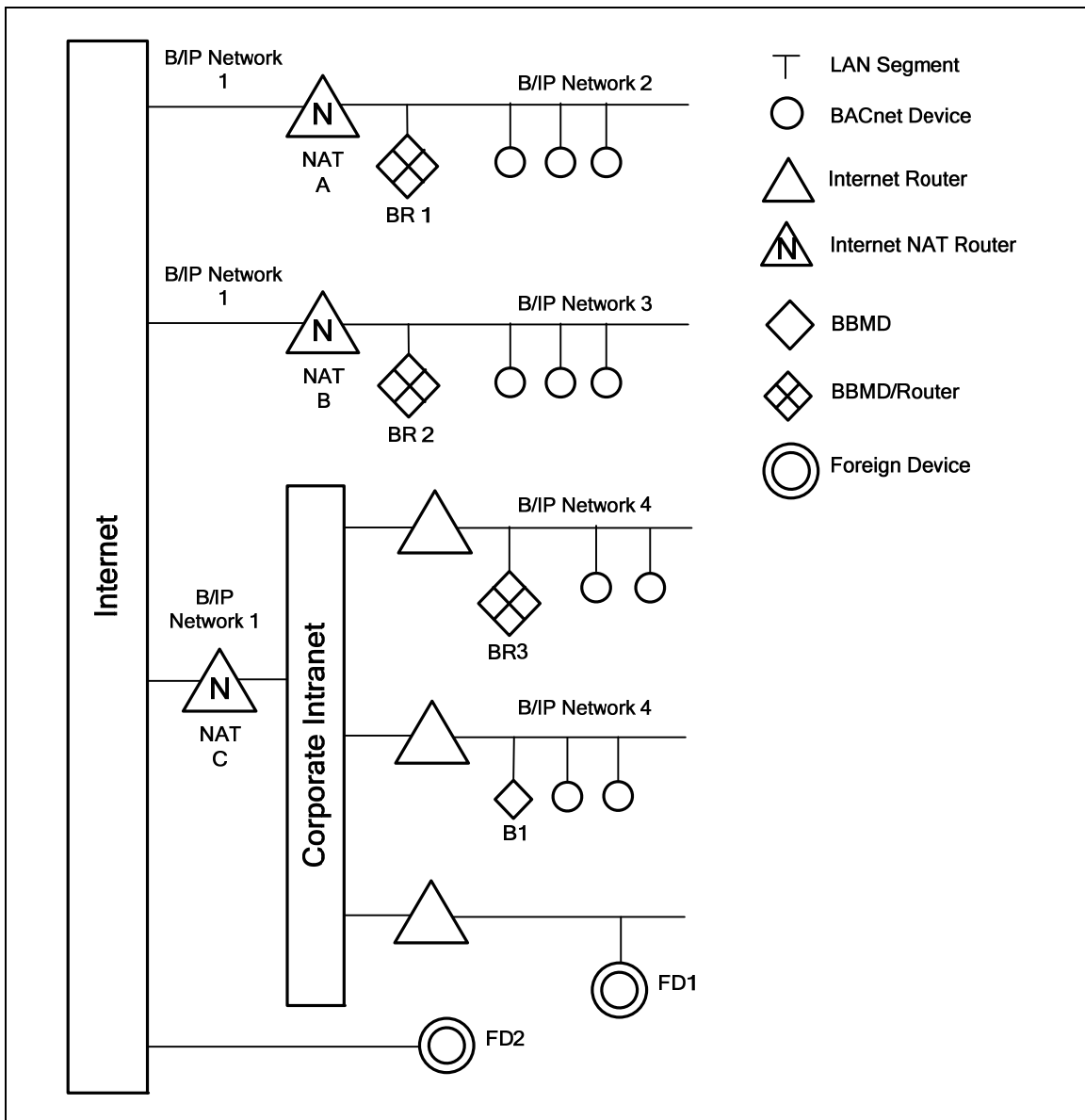
**BR1 - BBMD/Router Configuration**

Global IP Address          201.1.1.1:47808 (public B/IP address of NAT A)  
 B/IP Address Net 1        192.168.1.1:47809  
 BDT Net 1                    192.168.1.1:47809 (self), 202.2.2.2:47808 (public B/IP of NAT B)  
 B/IP Address Net 2        192.168.1.1:47808  
 BDT Net 2                    192.168.1.1:47808 (self)

**BR2 - BBMD/Router Configuration**

Global IP Address          202.2.2.2:47808 (public B/IP address of NAT B)  
 B/IP Address Net 1        192.168.1.1:47809  
 BDT Net 1                    192.168.1.1:47809 (self), 201.1.1.1:47808 (public B/IP of NAT A)  
 B/IP Address Net 3        192.168.1.1:47808  
 BDT Net 3                    192.168.1.1:47808 (self)

The NAT devices translate public 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, and a corporate Intranet being connected via BACnet. In this configuration, the Foreign device FD1 can connect to any of the BBMD's or BBMD/Routers in the network which it can reach from its IP address. 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                        201.1.1.1:47808 → 192.168.1.1:47809

**NAT B Configuration**

Internet IP                    202.2.2.2  
 Forward                        202.2.2.2:47808 → 192.168.1.1:47809

**NAT C Configuration**

Internet IP                    203.3.3.3  
 Forward                        203.3.3.3:47808 → 192.168.1.1:47809

**BR1 - BBMD/Router Configuration**

Global IP Address	201.1.1.1:47808 (public B/IP address of NAT A)
B/IP Address Net 1	192.168.1.1:47809
BDT Net 1	192.168.1.1:47809 (self), 202.2.2.2:47808 (public B/IP of NAT B), 203.3.3.3:47808 (public B/IP of NAT C)
B/IP Address Net 2	192.168.1.1:47808
BDT Net 2	192.168.1.1:47808 (self)

**BR2 - BBMD/Router Configuration**

Global IP Address	202.2.2.2:47808 (public B/IP address of NAT B)
B/IP Address Net 1	192.168.1.1:47809
BDT Net 1	192.168.1.1:47809 (self), 201.1.1.1:47808 (public B/IP of NAT A), 203.3.3.3:47808 (public B/IP of NAT C)
B/IP Address Net 3	192.168.1.1:47808
BDT Net 3	192.168.1.1:47808 (self)

**BR3 – BBMD/Router Configuration**

Global IP Address	203.3.3.3:47808 (public B/IP address of NAT C)
B/IP Address Net 1	192.168.20.1:47809
BDT Net 1	192.168.20.1:47809 (self), 201.1.1.1:47808 (public B/IP of NAT A), 202.2.2.2:47808 (public B/IP of NAT B)
B/IP Address Net 4	192.168.20.1:47808
BDT Net 4	192.168.20.1:47808 (self) 192.168.21.1:47808 (BBMD B1)

**B1 – BBMD Configuration**

B/IP Address	192.168.20.2:47808
BDT Net 4	192.168.20.1:47808 (B/IP of BR3 Net4 BBMD ) 192.168.21.1:47808 (BBMD B1)