**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**THIS IS A DRAFT DOCUMENT EDITED BY PNNL TO**

1. **EXCLUDE ANY SPECS IN REGARDS TO LON/LONWORKS**
2. **ADD SPECS RELATED TO THE EBCS**

**DOCUMENT IS CURRENTLY FOR REFERENCE ONLY AND SHALL NOT BE USED FOR SOLICITATION OR PROJECT DEVELOPMENT.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**USACE / NAVFAC / AFCEC / NASA UFGS 23 09 00 (February 2019)**

**---------------------------------**

**Preparing Activity: USACE Superseding**

**UFGS-23 09 00 (November 2015)**

**UNIFIED FACILITIES GUIDE SPECIFICATIONS**

**References are in agreement with UMRL dated July 2019**

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**02/19**

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QC Checklist for Niagara Framework Based BACnet Systems

QC CHECKLIST FOR NIAGARA FRAMEWORK BASED LONWORKS SYSTEMS

QC CHECKLIST FOR BACNET SYSTEMS

QC CHECKLIST FOR NIAGARA FRAMEWORK BASED BACNET SYSTEMS

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**USACE / NAVFAC / AFCEC / NASA UFGS 23 09 00 (February 2019)**

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SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

**02/19**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This guide specification covers the**

**requirements for HVAC control systems, including**

**tailoring options for LNS-Based LonWorks, Niagara**

**Framework-Based LonWorks, BACnet and Niagara**

**Framework-Based BACnet systems.**

**Adhere to** UFC 1-300-02 **Unified Facilities Guide**

**Specifications (UFGS) Format Standard when editing**

**this guide specification or preparing new project**

**specification sections. Edit this guide**

**specification for project specific requirements by**

**adding, deleting, or revising text. For bracketed**

**items, choose applicable item(s) or insert**

**appropriate information.**

**Remove information and requirements not required in**

**respective project, whether or not brackets are**

**present.**

**Comments, suggestions and recommended changes for**

**this guide specification are welcome and should be**

**as a** Criteria Change Request (CCR)**. CCRs for this**

**specification can be submitted through the Whole**

**Building Design Guide page for this section:**

http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The use of this UFGS, and the design of**

**control systems, must be in accordance with UFC**

**3-410-02, DIRECT DIGITAL CONTROL FOR HVAC AND OTHER**

**BUILDING CONTROL SYSTEMS. This specification MUST**

**be used in conjunction with UFGS 23 09 23.01**

**LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER**

**BUILDING CONTROL SYSTEMS or UFGS 23 09 23.02 BACNET**

**DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING**

**CONTROL SYSTEMS as well as UFGS 23 09 13**

**INSTRUMENTATION AND CONTROL DEVICES FOR HVAC and**

**UFGS 23 09 93 SEQUENCES OF OPERATION FOR HVAC**

**CONTROL in order to specify a complete and**

SECTION 23 09 00 Page 7

**functional system.**

**Except as otherwise indicated, edit this guide**

**specification for project specific requirements ONLY**

**by selecting appropriate tailoring options, choosing**

**applicable items(s), or inserting appropriate**

**information in bracketed items. Do not make edits**

**outside of bracketed items except as noted without**

**prior approval as indicated in UFC 3-410-02 DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING SYSTEMS.**

**When used with UFGS 23 09 23.01 LONWORKS DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS, this specification covers installation of**

**local (building-level) controls using LonWorks-based**

**DDC using either LNS or the Niagara Framework.**

**When used with UFGS 23 09 23.02 BACNET DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS, this specification covers installation of**

**local (building-level) controls using BACnet-based**

**DDC, and may include the Niagara Framework.**

**This specification is primarily intended for**

**building level control systems which are to be**

**integrated into a Utility Monitoring and Control**

**System (UMCS) as specified in Section 25 10 10**

**UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT**

**END AND INTEGRATION (where Section 25 10 10 has also**

**used the matching protocol tailoring option).**

**For projects that require the building system to**

**provide UMCS functionality (without connection to a**

**UMCS), include the necessary requirements from**

**Section 25 10 10 UTILITY MONITORING AND CONTROL**

**SYSTEM (UMCS) FRONT END AND INTEGRATION in the**

**project specifications.**

**Template drawings in electronic format for use with**

**this section are available online at the Whole**

**Building Design Guide page for this section:**

http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This specification makes use of SpecsIntact**

**Tailoring Options. This note describes these**

**options and how to use them.**

**"TAILORING OPTION NOTES" Tailoring Option**

**Each time tailoring options are used there is an**

**accompanying designer note describing the text that**

**is tailored. As this Section makes heavy use of**

**tailoring options there are many of these notes and**

**they can distract from designer notes describing**

**other decisions. The designer notes describing**

**tailoring options are all in a "TAILORING OPTION**

**NOTES" tailoring option which can be hidden (in**

**SpecsIntact select View-Tailoring Options and then**

SECTION 23 09 00 Page 8

**deselect "TAILORING OPTION NOTES") once this section**

**is tailored and the tailoring option notes are no**

**longer needed.**

**Protocol Tailoring Options**

**This specification includes tailoring options for**

**selection of protocol, and whether the Niagara**

**Framework is required. There are four tailoring**

**options, of which EXACTLY ONE must be used (the**

**remaining three must be DESELECTED when managing**

**tailoring options):**

**1) BACNET: A (non-Niagara Framework) BACnet**

**system: When this tailoring option is**

**included this Section will reference**

**Section 23 09 23.02 BACNET DIRECT DIGITAL**

**CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS. Use UFGS 23 09 23.02 with**

**the "NOT Niagara Framework" tailoring option**

**selected (DESELECT the "Niagara**

**Framework" tailoring option in**

**UFGS 23 09 23.02).**

**2) LNS: A LonWorks system using LNS. When**

**this tailoring option is included this**

**Section will reference Section 23 09 23.01**

**LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND**

**OTHER BUILDING CONTROL SYSTEMS.**

**Use UFGS 23 09 23.01 with the "LNS" tailoring**

**option selected (and DESELECT the**

**"Niagara Framework" tailoring option in**

**UFGS 23 09 23.01).**

**3) NIAGARA BACNET: A Niagara Framework**

**system using BACnet controllers. When**

**this tailoring option is included this**

**Section will reference Section 23 09 23.02**

**BACNET DIRECT DIGITAL CONTROL FOR HVAC AND**

**OTHER BUILDING CONTROL SYSTEMS.**

**Use UFGS 23 09 23.02 with the "Niagara**

**Framework" tailoring option selected (DESELECT**

**the "NOT Niagara Framework" tailoring option**

**in UFGS 23 09 23.02).**

**4) NIAGARA LONWORKS: A Niagara Framework system**

**using LonWorks controllers. When**

**this tailoring option is included this**

**Section will reference Section 23 09 23.01**

**LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND**

**OTHER BUILDING CONTROL SYSTEMS.**

**Use UFGS 23 09 23.01 with the "Niagara**

**Framework" tailoring option selected (DESELECT**

**the "LNS" tailoring option in**

**UFGS 23 09 23.01).**

**You have currently included the following options:**

**----------**

**NIAGARA BACNET**

**NIAGARA LONWORKS**

**BACNET**

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**LNS**

**----------**

**If you don't see any text between dashes above, you**

**have DESELECTED all protocol tailoring option and**

**this specification is not valid. SELECT ONE of the**

**tailoring options.**

**If you see more than one line of text between the**

**dashes above you have left multiple tailoring**

**options related to protocol selected. DESELECT one**

**or more tailoring options until a SINGLE protocol**

**tailoring option is selected.**

**Service Tailoring Option**

**This specification also includes tailoring options**

**for the Service (Air Force, Army, Navy) the**

**specification is used for. There is a "NAVY**

**ACCEPTANCE ENGINEER" tailoring option that is used**

**on Navy projects which have an Acceptance Engineer.**

**There is a "Service Generic" tailoring option that**

**can also be used when none of the other services**

**tailoring options apply. Only ONE of the five**

**tailoring options related to the services should be**

**used. You have currently included the following**

**options:**

**----------**

**AIR FORCE**

**ARMY**

**NAVY**

**NAVY WITH ACCEPTANCE ENGINEER**

**SERVICE GENERIC**

**-----------**

**If more than one item appears between the dashes**

**above you have included more than one services**

**tailoring option and need to DESELECT all but one of**

**them. If there is no text between the dashes above**

**you have not included any services tailoring**

**options. Select ONE of the services tailoring**

**options for inclusion.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

PART 1 GENERAL

1.1 SUMMARY

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: If sequences of operation are provided in**

**Section 23 09 93 SEQUENCES OF OPERATION FOR HVAC**

**CONTROL, keep the bracketed text referring to that**

**section. If Section 23 09 93 is not provided remove**

**the bracketed text.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to UFGS 23 09 23.01 will be**

**included if the LNS or NIAGARA LONWORKS tailoring**

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**options are selected.**

**2) Text referring to UFGS 23 09 23.02 will be**

**included if the BACNET or NIAGARA BACNET tailoring**

**options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide a complete Direct Digital Control (DDC) system, except for the

Front End which is specified in Section 25 10 10 UTILITY MONITORING AND

CONTROL (UMCS) FRONT END AND INTEGRATION, suitable for the control of the

heating, ventilating and air conditioning (HVAC) and other building-level

systems as indicated and shown and in accordance with Section 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC,[ Section 23 09 93 SEQUENCES

OF OPERATION FOR HVAC CONTROL,] Section 23 09 23.02

BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS

for BACnet or Niagara BACnet systems, and other referenced Sections.

1.1.1 System Requirements

Provide systems meeting the requirements this Section and other Sections

referenced by this Section, and which have the following characteristics:

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Select where sequences of operation are**

**specified. UFGS 23 09 93 SEQUENCES OF OPERATION FOR**

**HVAC CONTROL contains template sequences of**

**operation.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

a. The system implements the control sequences of operation [shown in the

Contract Drawings][\_\_\_] using DDC hardware to control mechanical and

electrical equipment

b. The system meet the requirements of this specification as a

stand-alone system and does not require connection to any other system.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The requirement ", unless otherwise**

**pre-approved by the Contracting Officer" in the**

**following paragraph is required only for Air Force**

**projects and is in AIR FORCE tailoring tags.**

**(Deselect the AIR FORCE tailoring option if not**

**specifying an Air Force owned system.)**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

c. Control sequences reside in DDC hardware in the building. The

building control network is not dependent upon connection to a Utility

Monitoring and Control System (UMCS) Front End or to any other system

for performance of control sequences. To the greatest extent

practical, the hardware performs control sequences without reliance on

the building network, unless otherwise pre-approved by the Contracting

Officer.

d. The hardware is installed such that individual control equipment can

be replaced by similar control equipment from other equipment

manufacturers with no loss of system functionality.

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e. All necessary documentation, configuration information, programming

tools, programs, drivers, and other software are licensed to and

otherwise remain with the Government such that the Government or their

agents are able to perform repair, replacement, upgrades, and

expansions of the system without subsequent or future dependence on

the Contractor, Vendor or Manufacturer.

f. Sufficient documentation and data, including rights to documentation

and data, are provided such that the Government or their agents can

execute work to perform repair, replacement, upgrades, and expansions

of the system without subsequent or future dependence on the

Contractor, Vendor or Manufacturer.

g. Hardware is installed and configured such that the Government or their

agents are able to perform repair, replacement, and upgrades of

individual hardware without further interaction with the Contractor,

Vendor or Manufacturer.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following list paragraph is included only**

**when the NIAGARA BACNET or NIAGARA LONWORKS**

**tailoring options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

h. All Niagara Framework components have an unrestricted interoperability

license with a Niagara Compatibility Statement (NiCS) following the

Tridium Open NiCS Specification and have a value of "ALL" for "Station

Compatibility In", "Station Compatibility Out", "Tool Compatibility

In" and "Tool Compatibility Out". Note that this will result in the

following entries in the license file:

accept.station.in="\*"

accept.station.out="\*"

accept.wb.in="\*"

accept.wb.out="\*"

1.1.2 End to End Accuracy

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This paragraph is referenced (by subpart**

**title) elsewhere in the specification. If this**

**paragraph is edited, removed, renamed, etc. make**

**sure to verify that all references to it are updated**

**as needed.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Select products, install and configure the system such that the maximum

error of a measured value as read from the DDC Hardware over the network

is less than the maximum allowable error specified for the sensor or

instrumentation.

1.1.3 Verification of Dimensions

After becoming familiar with all details of the work, verify all

dimensions in the field, and advise the Contracting Officer of any

discrepancy before performing any work.

1.1.4 Drawings

The Government will not indicate all offsets, fittings, and accessories

SECTION 23 09 00 Page 12

that may be required on the drawings. Carefully investigate the

mechanical, electrical, and finish conditions that could affect the work

to be performed, arrange such work accordingly, and provide all work

necessary to meet such conditions.

1.2 RELATED SECTIONS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Select whether Section 01 91 00.15 10 TOTAL**

**BUILDING COMMISSIONING is used for commissioning or**

**provide appropriate reference to the Commissioning**

**specification.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart used tailoring options:**

**1) Text referring to UFGS 23 09 23.01 is included**

**only when the LNS or NIAGARA LONWORKS tailoring**

**option is selected.**

**2) Text referring to UFGS 23 09 23.02 is included**

**only when the BACNET or NIAGARA BACNET tailoring**

**option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Related work specified elsewhere:

a. Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR

HVAC AND OTHER BUILDING CONTROL SYSTEMS for BACnet systems with or

without Niagara Framework.

b. Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

c. Section 23 09 93 SEQUENCES OF OPERATIONS FOR HVAC CONTROLS

d. Section 25 08 10 UTILITY MONITORING AND CONTROL SYSTEMS TESTING

e. Section 25 10 10 UTILITY MONITORING AND CONTROL SYSTEMS (UMCS) FRONT

END AND INTEGRATION

f. Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS

g. [Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING][\_\_\_\_\_]

1.3 REFERENCES

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This paragraph is used to list the**

**publications cited in the text of the guide**

**specification. The publications are referred to in**

**the text by basic designation only and listed in**

**this paragraph by organization, designation, date,**

**and title.**

**Use the Reference Wizard's Check Reference feature**

**when you add a Reference Identifier (RID) outside of**

SECTION 23 09 00 Page 13

**the Section's Reference Article to automatically**

**place the reference in the Reference Article. Also**

**use the Reference Wizard's Check Reference feature**

**to update the issue dates.**

**References not used in the text will automatically**

**be deleted from this section of the project**

**specification when you choose to reconcile**

**references in the publish print process.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

The publications listed below form a part of this specification to the

extent referenced. The publications are referred to within the text by

the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING

ENGINEERS (ASHRAE)

ASHRAE 135 (2016) BACnet—A Data Communication

Protocol for Building Automation and

Control Networks

ASHRAE FUN IP (2017) Fundamentals Handbook, I-P Edition

ASHRAE FUN SI (2017) Fundamentals Handbook, SI Edition

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D (2014) Control Network Protocol

Specification

CEA-709.3 (1999; R 2015) Free-Topology Twisted-Pair

Channel Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Recommended Practice on

Surge Voltages in Low-Voltage AC Power

Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2018) Enclosures for Electrical Equipment

(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;

TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6;

TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;

TIA 17-11; TIA 17-12; TIA 17-13; TIA

17-14; TIA 17-15; TIA 17-16; TIA 17-17 )

National Electrical Code

NFPA 90A (2018) Standard for the Installation of

Air Conditioning and Ventilating Systems

SECTION 23 09 00 Page 14

TRIDIUM, INC (TRIDIUM)

Niagara Framework (2012) NiagaraAX User's Guide or newest User Guide from Niagara

Tridium Open NiCS (2005) Understanding the NiagaraAX or newest Guide from Niagara

Compatibility Statement (NiCS)

UNDERWRITERS LABORATORIES (UL)

UL 5085-3 (2006; Reprint Nov 20121) Low Voltage

Transformers - Part 3: Class 2 and Class 3

Transformers

1.4 DEFINITIONS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Other sections (UFGS 23 09 23.01 LONWORKS**

**DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING**

**CONTROL SYSTEMS, UFGS 23 09 23.02 BACNET DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS, UFGS 23 09 13 INSTRUMENTATION AND CONTROL**

**DEVICES FOR HVAC, UFGS 23 09 93 SEQUENCES OF**

**OPERATION FOR HVAC CONTROL) reference this section**

**for relevant definitions.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

The following list of definitions includes terms used in Sections

referenced by this Section and are included here for completeness. The

definitions contained in this Section may disagree with how terms are

defined or used in other documents, including documents referenced by this

Section. The definitions included here are the authoritative definitions

for this Section and all Sections referenced by this Section.

After each term the protocol related to that term is included in

parenthesis.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following subparts use tailoring options**

**to include or exclude terms based on the which**

**tailoring options are selected. Each individual**

**term does not have a designer note associated with**

**it as this makes the list of definitions very**

**difficult to read. The parenthesis after the**

**subpart title will also indicate when the term is in**

**tailoring option tags:**

**1) Subparts including "(LonWorks)" in the title are**

**included when the LNS or NIAGARA LONWORKS tailoring**

**options are selected.**

**2) Subparts including "(BACnet)" in the title are**

**included when the BACNET or NIAGARA BACNET tailoring**

**options are selected.**

**3) Subparts including "(Niagara Framework)" in the**

**title are included when the NIAGARA BACNET or**

**NIAGARA LONWORKS tailoring options are selected.**

**4) Subparts including "(All protocols)" are not in**

SECTION 23 09 00 Page 15

**any tailoring options and are always included.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

1.4.1 Alarm Generation (All protocols)

Alarm Generation is the monitoring of a value, comparison of the value to

alarm conditions and the creation of an alarm when the conditions set for

the alarm are met. Note that this does NOT include delivery of the alarm

to the final destination (such as a user interface) - see paragraph ALARM

ROUTING in Section 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS)

FRONT END AND INTEGRATION.

1.4.1a Alarm extensions will be added to the data points as designated in the “Point Naming Convention”. Alarm messages will be added to each alarm as outlined

i. Out of Range (Analog Points). The message will display the current value of the point and either the high or low threshold.

ii. Command Failure (Boolean Point). The massage will display the current command of the point and the current status.

iii. Change of Value (Boolean or Enumerated Points). The message will display the current value of the points.

iv. Change of Status (Niagara Components). The message will display the current value of the component.

1.4.4 Building Automation and Control Network (BACnet) (BACnet)

The term BACnet is used in two ways. First meaning the BACnet Protocol

Standard - the communication requirements as defined by ASHRAE 135

including all annexes and addenda. The second to refer to the overall

technology related to the ASHRAE 135 protocol.

1.4.5 BACnet Advanced Application Controller (B-AAC) (BACnet)

A hardware device BTL Listed as a B-AAC, which is required to support

BACnet Interoperability Building Blocks (BIBBs) for scheduling and

alarming, but is not required to support as many BIBBs as a B-BC.

1.4.6 BACnet Application Specific Controller (B-ASC) (BACnet)

A hardware device BTL Listed as a B-ASC, with fewer BIBB requirements than

a B-AAC. It is intended for use in a specific application.

1.4.7 BACnet Building Controller (B-BC) (BACnet)

A hardware device BTL Listed as a B-BC. A general-purpose,

field-programmable device capable of carrying out a variety of building

automation and control tasks including control and monitoring via direct

digital control (DDC) of specific systems and data storage for trend

information, time schedules, and alarm data. Like the other BTL Listed

controller types (B-AAC, B-ASC etc.) a B-BC device is required to support

the server ("B") side of the ReadProperty and WriteProperty services, but

unlike the other controller types it is also required to support the

client ("A") side of these services. Communication between controllers

requires that one of them support the client side and the other support

the server side, so a B-BC is often used when communication between

controllers is needed.

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1.4.8 BACnet Broadcast Management Device (BBMD) (BACnet)

A communications device, typically combined with a BACnet router. A BBMD

forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs

connected to the same BACnet/IP network. Each IP subnet that is part of a

BACnet/IP network must have at least one BBMD. Note there are additional

restrictions when multiple BBMDs share an IP subnet.

1.4.9 BACnet/IP (BACnet)

An extension of BACnet, Annex J, defines the use of a reserved UDP socket

to transmit BACnet messages over IP networks. A BACnet/IP network is a

collection of one or more IP subnets that share the same BACnet network

number. See also paragraph BACNET BROADCAST MANAGEMENT DEVICE.

1.4.10 BACnet Internetwork (BACnet)

Two or more BACnet networks, connected with BACnet routers. In a BACnet

Internetwork, there exists only one message path between devices.

1.4.11 BACnet Interoperability Building Blocks (BIBBs) (BACnet)

A BIBB is a collection of one or more ASHRAE 135 Services intended to

define a higher level of interoperability. BIBBs are combined to build the

BACnet functional requirements for a device in a specification. Some BIBBs

define additional requirements (beyond requiring support for specific

services) in order to achieve a level of interoperability. For example,

the BIBB DS-V-A (Data Sharing-View-A), which would typically be used by a

front-end, not only requires the client to support the ReadProperty

Service, but also provides a list of data types (Object / Properties)

which the client must be able to interpret and display for the user.

In the BIBB shorthand notation, -A is the client side and -B is the server

side.

The following is a list of some BIBBs used by this or referenced Sections:

DS-COV-A Data Sharing-Change of Value (A side)

DS-COV-B Data Sharing-Change of Value (B side)

NM-RC-B Network Management-Router Configuration (B side)

DS-RP-A Data Sharing-Read Property (A side)

DS-RP-B Data Sharing-Read Property (B side)

DS-RPM-A Data Sharing-Read Property Multiple (A Side)

DS-RPM-B Data Sharing-Read Property Multiple (B Side)

DS-WP-A Data Sharing-Write Property (A Side)

DM-TS-B Device Management-Time Synchronization (B Side)

SECTION 23 09 00 Page 17

The following is a list of some BIBBs used by this or referenced Sections:

DM-UTC-B Device Management-UTC Time Synchronization (B Side)

DS-WP-B Data Sharing-Write Property (B side)

SCHED-E-B Scheduling-External (B side)

DM-OCD-B Device Management-Object Creation and Deletion (B side)

AE-N-I-B Alarm and Event-Notification Internal (B Side)

AE-N-E-B Alarm and Event-Notification External (B Side)

T-VMT-I-B Trending-Viewing and Modifying Trends Internal (B Side)

T-VMT-E-B Trending-Viewing and Modifying Trends External (B Side)

1.4.12 BACnet Network (BACnet)

In BACnet, a portion of the control Internetwork consisting of one or more

segments connected by repeaters. Networks are separated by routers.

1.4.13 BACnet Operator Display (B-OD) (BACnet)

A basic operator interface with limited capabilities relative to a B-OWS.

It is not intended to perform direct digital control. A B-OD profile

could be used for LCD devices, displays affixed to BACnet devices,

handheld terminals or other very simple user interfaces.

1.4.14 BACnet Segment (BACnet)

One or more physical segments interconnected by repeaters (ASHRAE 135).

1.4.15 BACnet Smart Actuator (B-SA) (BACnet)

A simple actuator device with limited resources intended for specific

applications.

1.4.16 BACnet Smart Sensor (B-SS) (BACnet)

A simple sensing device with limited resources.

1.4.17 BACnet Testing Laboratories (BTL) (BACnet)

Established by BACnet International to support compliance testing and

interoperability testing activities and consists of BTL Manager and the

BTL Working Group (BTL-WG). BTL also publishes Implementation Guidelines.

1.4.18 BACnet Testing Laboratories (BTL) Listed (BACnet)

A device that has been listed by BACnet Testing Laboratory. Devices may

be certified to a specific device profile, in which case the listing

indicates that the device supports the required capabilities for that

profile, or may be listed as "other".

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1.4.19 Binary (All protocols)

A two-state system where an "ON" condition is represented by a high signal

level and an "OFF" condition is represented by a low signal level.

'Digital' is sometimes used interchangeably with 'binary'.

1.4.21 Broadcast (BACnet)

Unlike most messages, which are intended for a specific recipient device,

a broadcast message is intended for all devices on the network.

1.4.22 Building Control Network (BCN) (All protocols)

The network connecting all DDC Hardware within a building (or specific

group of buildings).

1.4.23 Building Point of Connection (BPOC) (All protocols)

A FPOC for a Building Control System. (This term is being phased out of

use in preference for FPOC but is still used in some specifications and

criteria. When it was used, it typically referred to a piece of control

hardware. The current FPOC definition typically refers instead to IT

hardware.)

1.4.25 Commandable (All protocols)

See Overridable.

1.4.26 Commandable Objects (BACnet)

Commandable Objects have a Commandable Property, Priority\_Array, and

Relinquish\_Default Property as defined in ASHRAE 135, Clause 19.2, Command

Prioritization.

1.4.27 Configurable (All protocols)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to "Non-Niagara Framework BACnet**

**system" is included only when the NIAGARA BACNET**

**tailoring options is selected.**

**2) Text referring to "Niagara Framework BACnet**

**system" is included only when the BACNET tailoring**

SECTION 23 09 00 Page 19

**options is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

A property, setting, or value is configurable if it can be changed via

hardware settings on the device, via the use of engineering software or

over the control network from the front end, and is retained through

(after) loss of power.

In a non-Niagara Framework BACnet system, a property, setting, or value is

configurable if it can be changed via one or more of:

1) via BACnet services (including proprietary BACnet services)

2) via hardware settings on the device

In a Niagara Framework BACnet system, a property, setting, or value is

configurable if it can be changed via one or more of:

1) via BACnet services (including proprietary BACnet services)

2) via hardware settings on the device

3) via the Niagara Framework

Note this is more stringent than the ASHRAE 135 definition.

1.4.29 Control Logic Diagram (All protocols)

A graphical representation of control logic for multiple processes that

make up a system.

1.4.30 Device (BACnet)

A Digital Controller that contains a BACnet Device Object and uses BACnet

to communicate with other devices.

1.4.31 Device Object (BACnet)

Every BACnet device requires one Device Object, whose properties represent

the network visible properties of that device. Every Device Object

requires a unique Object Identifier number on the BACnet Internetwork.

This number is often referred to as the device instance or device ID.

1.4.32 Device Profile (BACnet)

A collection of BIBBs determining minimum BACnet capabilities of a device,

defined in ASHRAE 135. Standard device profiles include BACnet Advanced

Workstations (B-AWS), BACnet Building Controllers (B-BC), BACnet Advanced

Application Controllers (B-AAC), BACnet Application Specific Controllers

(B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS).

1.4.33 Digital Controller (All protocols)

An electronic controller, usually with internal programming logic and

digital and analog input/output capability, which performs control

functions.

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1.4.34 Direct Digital Control (DDC) (All protocols)

Digital controllers performing control logic. Usually the controller

directly senses physical values, makes control decisions with internal

programs, and outputs control signals to directly operate switches,

valves, dampers, and motor controllers.

1.4.38 Field Point of Connection (FPOC) (All protocols)

The FPOC is the point of connection between the UMCS IP Network and the

field control network (either an IP network, a non-IP network, or a

combination of both). The hardware at this location which provides the

connection is generally an IT device such as a switch, IP router, or

firewall.

In general, the term "FPOC Location" means the place where this connection

occurs, and "FPOC Hardware" means the device that provides the

connection. Sometimes the term "FPOC" is used to mean either and its

actual meaning (i.e. location or hardware) is determined by the context in

which it is used.

1.4.39 Fox Protocol (Niagara Framework)

The protocol used for communication between components in the

Niagara Framework. All communications between Niagara devices and the server will be secured with SSL, using the following points.

1. Internet Browser Interface: HTTPS Protocol: Port 443
2. Niagara Station Interface: FOXS Protocol: Port 4911
3. Niagara Station Interace: TLSv1 Protocol: Port 5011

1.4.41 Gateway (All protocols)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options: Text**

**referring to Niagara Framework is included only when**

**the NIAGARA LONWORKS or NIAGARA BACNET tailoring**

**options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

SECTION 23 09 00 Page 21

A device that translates from one protocol application data format to

another. Devices that change only the transport mechanism of the protocol

- "translating" from BACnet MS/TP to

BACnet over IP for example - are not gateways as the underlying data

format does not change. Gateways are also called Communications Bridges or

Protocol Translators.

A Niagara Framework Supervisory Gateway is one type of Gateway.

1.4.43 IEEE 802.3 Ethernet (All protocols)

A family of local-area-network technologies providing high-speed

networking features over various media, Cat 6

twisted pair copper or fiber optic cable.

1.4.44 Internet Protocol (IP, TCP/IP, UDP/IP) (All protocols)

A communication method, the most common use is the World Wide Web. At the

lowest level, it is based on Internet Protocol (IP), a method for

conveying and routing packets of information over various LAN media. Two

common protocols using IP are User Datagram Protocol (UDP) and

Transmission Control Protocol (TCP). UDP conveys information to well-known

"sockets" without confirmation of receipt. TCP establishes connections,

also known as "sessions", which have end-to-end confirmation and

guaranteed sequence of delivery.

1.4.45 Input/Output (I/O) (All protocols)

Physical inputs and outputs to and from a device, although the term

sometimes describes network or "virtual" inputs or outputs. See also

"Points".

1.4.46 I/O Expansion Unit (All protocols)

An I/O expansion unit provides additional point capacity to a digital

controller

1.4.47 IP subnet (All protocols)

A group of devices which share a defined range IP addresses. Devices on a

common IP subnet can share data (including broadcasts) directly without

the need for the traffic to traverse an IP router.

1.4.48 JACE (Niagara Framework)

Java Application Control Engine. See paragraph NIAGARA FRAMEWORK

SUPERVISORY GATEWAY

1.4.49 Local-Area Network (LAN) (All protocols)

A communication network that spans a limited geographic area and uses the

SECTION 23 09 00 Page 22

same basic communication technology throughout.

1.4.50 Local Display Panels (LDPs) (All protocols)

A DDC Hardware with a display and navigation buttons, and must provide

display and adjustment of points as shown on the Points Schedule and as

indicated.

1.4.58 MAC Address (All protocols)

Media Access Control address. The physical device address that identifies

a device on a Local Area Network. All communications between Niagara devices and the server will be secured with SSL, using the following points.

1. Internet Browser Interface: HTTPS Protocol: Port 443
2. Niagara Station Interface: FOXS Protocol: Port 4911
3. Niagara Station Interace: TLSv1 Protocol: Port 5011

1.4.59 Master-Slave/Token-Passing (MS/TP) (BACnet)

Data link protocol as defined by the BACnet standard. Multiple speeds

(data rates) are permitted by the BACnet MS/TP standard.

SECTION 23 09 00 Page 23

1.4.60 Monitoring and Control (M&C) Software (All protocols)

The UMCS 'front end' software which performs supervisory functions such as

alarm handling, scheduling and data logging and provides a user interface

for monitoring the system and configuring these functions.

1.4.61 Network Number (BACnet)

A site-specific number assigned to each network. This network number must

be unique throughout the BACnet Internetwork.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options: The**

**parenthetical referring to LNS is included only when**

**the LNS tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

1.4.64 Niagara Framework (Niagara Framework)

A set of hardware and software specifications for building and utility

control owned by Tridium Inc. and licensed to multiple vendors. The

Framework consists of front end (M&C) software, web based clients, field

level control hardware, and engineering tools. While the Niagara

Framework is not adopted by a recognized standards body and does not use

an open licensing model, it is sufficiently well-supported by multiple

HVAC vendors to be considered a de-facto Open Standard.

1.4.65 Niagara Framework Supervisory Gateway (Niagara Framework)

DDC Hardware component of the Niagara Framework. A typical Niagara

architecture has Niagara specific supervisory gateways at the IP level and

other (non-Niagara specific) controllers on field networks (TP/FT-10,

MS/TP, etc.) beneath the Niagara supervisory gateways. The Niagara

specific controllers function as a gateway between the Niagara framework

protocol (Fox) and the field network beneath. These supervisory gateways

may also be used as general purpose controllers and also have the

capability to provide a web-based user interface.

Note that different vendors refer to this component by different names.

The most common name is "JACE". The approved vendor is VYKON. Other vendors must be approved in advance.

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1.4.69 Object (BACnet)

An ASHRAE 135 Object. The concept of organizing BACnet information into

standard components with various associated Properties. Examples include

Analog Input objects and Binary Output objects.

1.4.70 Object Identifier (BACnet)

A grouping of two Object properties: Object Type (e.g. Analog Value,

Schedule, etc.) and Object Instance (in this case, a number). Object

Identifiers must be unique within a device.

1.4.71 Object Instance (BACnet)

See paragraph OBJECT IDENTIFIER

1.4.72 Object Properties (BACnet)

Attributes of an object. Examples include present value and high limit

properties of an analog input object. Properties are defined in ASHRAE 135;

some are optional and some are required. Objects are controlled by

reading from and writing to object properties.

1.4.73 Operator Configurable (All protocols)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to Niagara Framework is included**

**only when the NIAGARA LONWORKS or NIAGARA BACNET**

**tailoring options are selected.**

**2) Text referring to LNS is included only when the**

**LNS tailoring option is included.**

**3) Text referring to non Niagara-based BACnet is**

**only included when the BACNET tailoring option is**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Operator configurable values are values that can be changed from a single

common front end user interface across multiple vendor systems.

For Niagara Framework Systems, a property, setting, or value is Operator

Configurable when it is configurable from a Niagara Framework Front End.

For non Niagara-based BACnet systems, a property, setting, or value in a

device is Operator Configurable when it is Configurable and is either:

a. a Writable Property of a Standard BACnet Object; or

b. a Property of a Standard BACnet Object that is Writable when

Out\_Of\_Service is TRUE and Out\_Of\_Service is Writable.

1.4.74 Override (All protocols)

Changing the value of a point outside of the normal sequence of operation

where the change has priority over the sequence and where there is a

mechanism for releasing the change such that the point returns to the

normal value. Overrides persist until released or overridden at the same

or higher priority but are not required to persist through a loss of power.

Overrides are often used by operators to change values, and generally

originate at a user interface (workstation or local display panel).

1.4.75 Packaged Equipment (All protocols)

Packaged equipment is a single piece of equipment provided by a

manufacturer in a substantially complete and operable condition, where the

controls (DDC Hardware) are factory installed, and the equipment is sold

and shipped from the manufacturer as a single entity. Disassembly and

reassembly of a large piece of equipment for shipping does not prevent it

from being packaged equipment. Package units may require field

installation of remote sensors. Packaged equipment is also called a

"packaged unit".

Note industry may use the term "Packaged System" to mean a collection of

equipment that is designed to work together where each piece of equipment

is packaged equipment and there is a network that connects the equipment

together. A "packaged system" of this type is NOT packaged equipment; it

is a collection of packaged equipment, and each piece of equipment must

individually meet specification requirements.

1.4.76 Packaged Unit (All protocols)

See packaged equipment.

1.4.77 Performance Verification Test (PVT) (All protocols)

The procedure for determining if the installed BAS meets design criteria

prior to final acceptance. The PVT is performed after installation,

testing, and balancing of mechanical systems. Typically the PVT is

performed by the Contractor in the presence of the Government.

1.4.78 Physical Segment (BACnet)

A single contiguous medium to which BACnet devices are attached (ASHRAE 135

).

1.4.79 Polling (All protocols)

A device periodically requesting data from another device.

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1.4.80 Points (All protocols)

Physical and virtual inputs and outputs. See also paragraph INPUT/OUTPUT

(I/O).

1.4.82 Proportional, Integral, and Derivative (PID) Control Loop (All

protocols)

Three parameters used to control modulating equipment to maintain a

setpoint. Derivative control is often not required for HVAC systems

(leaving "PI" control).

1.4.83 Proprietary (BACnet)

Within the context of BACnet, any extension of or addition to object

types, properties, PrivateTransfer services, or enumerations specified in

ASHRAE 135. Objects with Object\_Type values of 128 and above are

Proprietary Objects. Properties with Property\_Identifier of 512 and above

are proprietary Properties.

1.4.84 Protocol Implementation Conformance Statement (PICS) (BACnet)

A document, created by the manufacturer of a device, which describes which

portions of the BACnet standard may be implemented by a given device.

ASHRAE 135 requires that all ASHRAE 135 devices have a PICS, and also

defines a minimum set of information that must be in it. A device as

installed for a specific project may not implement everything in its PICS.

1.4.85 Repeater (All protocols)

A device that connects two control network segments and retransmits all

information received on one side onto the other.

1.4.86 Router (All protocols)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to LonWorks is included if the LNS**

**or NIAGARA LONWORKS tailoring options are selected.**

**2) Text referring to BACnet is included if the**

**BACNET or NIAGARA BACNET tailoring options are**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

A device that connects two ASHRAE 135 networks (in a BACnet system) and controls traffic between

the two by retransmitting signals received from one side onto the other

based on the signal destination. Routers are used to subdivide a BACnet internetwork and to limit network traffic.

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1.4.87 Segment (All protocols)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options: The**

**TP/FT-10 example is included only if the LNS or**

**NIAGARA LONWORKS tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

A 'single' section of a control network that contains no repeaters or

routers. There is generally a limit on the number of devices on a

segment, and this limit is dependent on the topology/media and device

type.

1.4.89 Standard BACnet Objects (BACnet)

Objects with Object\_Type values below 128 and specifically enumerated in

Clause 21 of ASHRAE 135. Objects which are not proprietary. See

paragraph PROPRIETARY.

1.4.90 Standard BACnet Properties (BACnet)

Properties with Property\_Identifier values below 512 and specifically

enumerated in Clause 21 of ASHRAE 135. Properties which are not

proprietary. See Proprietary.

1.4.91 Standard BACnet Services (BACnet)

ASHRAE 135 services other than ConfirmedPrivateTransfer or

UnconfirmedPrivateTransfer. See paragraph PROPRIETARY.

1.4.99 UMCS (All protocols)

UMCS stands for Utility Monitoring and Control System. The term refers to

all components by which a project site monitors, manages, and controls

real-time operation of HVAC and other building systems. These components

include the UMCS "front-end" and all field building control systems

connected to the front-end. The front-end consists of Monitoring and

Control Software (user interface software), browser-based user interfaces

and network infrastructure.

The network infrastructure (the "UMCS Network"), is an IP network

connecting multiple building or facility control networks to the

Monitoring and Control Software.

1.4.100 UMCS Network (All protocols)

The UMCS Network connects multiple building or facility control networks

to the Monitoring and Control Software.

1.4.101 Writable Property (BACnet)

A Property is Writable when it can be changed through the use of one or

more of the WriteProperty services defined in ASHRAE 135, Clause 15

regardless of the value of any other Property. Note that in the ASHRAE 135

standard, some Properties may be writable when the Out of Service

Property is TRUE; for purposes of this Section, Properties that are only

writable when the Out of Service Property is TRUE are not considered to be

Writable.

1.5 PROJECT SEQUENCING

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Table I provides bracketed text in which the**

**number of days between items may be specified. In**

**many cases this information will be specified**

SECTION 23 09 00 Page 29

**elsewhere. When project schedule is specified**

**elsewhere remove bracketed text and Table I will**

**provide sequencing but not specific intervals. If**

**time intervals are to be specified here keep the**

**bracketed text and enter the number of days in the**

**space provided.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

TABLE I: PROJECT SEQUENCING lists the sequencing of submittals as

specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column)

and activities as specified in PART 3 EXECUTION (denoted by an 'E' in the

'TYPE' column). TABLE I does not specify overall project milestone and

completion dates[; these dates are specified in the contract

documents][\_\_\_\_\_].

a. Sequencing for Submittals: The sequencing specified for submittals is

the deadline by which the submittal must be initially submitted to the

Government. Following submission there will be a Government review

period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the

submittal is not accepted by the Government, revise the submittal and

resubmit it to the Government within [14][\_\_\_\_\_] days of notification

that the submittal has been rejected. Upon resubmittal there will be

an additional Government review period. If the submittal is not

accepted the process repeats until the submittal is accepted by the

Government.

b. Sequencing for Activities: The sequencing specified for activities

indicates the earliest the activity may begin.

c. Abbreviations: In TABLE I the abbreviation AAO is used for 'after

approval of' and 'ACO' is used for 'after completion of'.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For Navy Projects with an Acceptance**

**Engineer, a different PROJECT SEQUENCING table is**

**required. If this note is visible, the NAVY WITH**

**ACCEPTANCE ENGINEER tailoring option has been**

**selected on this project, and the relevant PROJECT**

**SEQUENCING table has been added below. Remove the**

**bracketed PROJECT SEQUENCING table which does not**

**apply to Navy projects with an Acceptance Engineer.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

[

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following table uses tailoring options:**

**1) Items referring to LNS are included only when the**

**LNS tailoring option is selected.**

**2) XIF Files is included only when the LNS or**

**NIAGARA FRAMEWORK tailoring option is selected**

**3) Items referring to Niagara Framework are included**

**only when the NIAGARA LONWORKS or NIAGARA BACNET**

**tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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TABLE I. PROJECT SEQUENCING

ITEM

#

TYPE DESCRIPTION SEQUENCING (START OF

ACTIVITY OR DEADLINE FOR

SUBMITTAL)

1 S Existing Conditions Report

2 S DDC Contractor Design Drawings

3 S Manufacturer's Product Data

4 S Pre-construction QC Checklist

5 E Install Building Control System AAO #1 thru #4

6 E Start-Up and Start-Up Testing ACO #5

7 S Post-Construction QC Checklist [[\_\_\_\_\_] days ]ACO #6

8 S Programming Software

Configuration Software

Niagara Framework Engineering Tool

Niagara Framework Wizards

XIF Files

LNS Plug-Ins

[[\_\_\_\_\_] days ]ACO #6

9 S Draft As-Built Drawings

Draft LNS Database

[[\_\_\_\_\_] days ]ACO #6

10 S Start-Up Testing Report [[\_\_\_\_\_] days ]ACO #6

11 S PVT Procedures [[\_\_\_\_\_] days ]before

schedule start of #12 and

AAO #10

12 E Execute PVT AAO #9 and #11

13 S PVT Report [[\_\_\_\_\_] days ]ACO #12

14 S Controller Application Programs

Controller Configuration Settings

Niagara Framework Supervisory Gateway Backups

Final LNS Database

[[\_\_\_\_\_] days ]AAO #13

15 S Final As-Built Drawings [[\_\_\_\_\_] days ]AAO #13

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TABLE I. PROJECT SEQUENCING

ITEM

#

TYPE DESCRIPTION SEQUENCING (START OF

ACTIVITY OR DEADLINE FOR

SUBMITTAL)

16 S O&M Instructions AAO #15

17 S Training Documentation AAO #10 and [[\_\_\_\_\_] days

]before scheduled start of

#18

18 E Training AAO #16 and #17

19 S Closeout QC Checklist ACO #18

]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following table uses tailoring options:**

**1) Items referring to LNS are included only when the**

**LNS tailoring option is selected.**

**2) XIF Files is included only when the LNS or**

**NIAGARA FRAMEWORK tailoring option is selected**

**3) Items referring to Niagara Framework are included**

**only when the NIAGARA LONWORKS or NIAGARA BACNET**

**tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

TABLE I. PROJECT SEQUENCING

(FOR NAVY PROJECTS WITH AN ACCEPTANCE ENGINEER)

ITEM

#

TYPE DESCRIPTION SEQUENCING (START OF

ACTIVITY OR DEADLINE FOR

SUBMITTAL)

1 S Existing Conditions Report

2 S DDC Contractor Design Drawings

3 S Manufacturer's Product Data

4 S Pre-construction QC Checklist

5 E Install Building Control System AAO #1 thru #4

6 E Start-Up and Start-Up Testing ACO #5

7 S Post-Construction QC Checklist [[\_\_\_\_\_] days ]ACO #6

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TABLE I. PROJECT SEQUENCING

(FOR NAVY PROJECTS WITH AN ACCEPTANCE ENGINEER)

ITEM

#

TYPE DESCRIPTION SEQUENCING (START OF

ACTIVITY OR DEADLINE FOR

SUBMITTAL)

8 S Programming Software

Configuration Software

Niagara Framework Engineering Tool

Niagara Framework Wizards

XIF Files

LNS Plug-Ins

[[\_\_\_\_\_] days ]ACO #6

9 S Draft As-Built Drawings

Draft LNS Database

[[\_\_\_\_\_] days ]ACO #6

10 S,E PVT Testing Activities As indicated in PART 3 of

this Section.

11 S PVT Report As indicated in PART 3 of

this Section.

12 S Controller Application Programs

Controller Configuration Settings

Niagara Framework Supervisory Gateway Backups

Final LNS Database

[[\_\_\_\_\_] days ]AAO #11

13 S Final As-Built Drawings [[\_\_\_\_\_] days ]AAO #11

14 S O&M Instructions AAO #13

15 S Training Documentation [\_\_\_\_\_] days before

scheduled start of #16

16 E Training AAO #14 and #15

17 S Closeout QC Checklist ACO #16

1.6 SUBMITTALS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Review submittal description (SD) definitions**

**in Section 01 33 00 SUBMITTAL PROCEDURES and edit**

**the following list to reflect only the submittals**

**required for the project.**

SECTION 23 09 00 Page 33

**The Guide Specification technical editors have**

**designated those items that require Government**

**approval, due to their complexity or criticality,**

**with a "G." Generally, other submittal items can be**

**reviewed by the Contractor's Quality Control**

**System. Only add a “G” to an item, if the submittal**

**is sufficiently important or complex in context of**

**the project.**

**For submittals requiring Government approval on Army**

**projects, a code of up to three characters within**

**the submittal tags may be used following the "G"**

**designation to indicate the approving authority.**

**Codes for Army projects using the Resident**

**Management System (RMS) are: "AE" for**

**Architect-Engineer; "DO" for District Office**

**(Engineering Division or other organization in the**

**District Office); "AO" for Area Office; "RO" for**

**Resident Office; and "PO" for Project Office. Codes**

**following the "G" typically are not used for Navy,**

**Air Force, and NASA projects.**

**The "S" following a submittal item indicates that**

**the submittal is required for the Sustainability**

**eNotebook to fulfill federally mandated sustainable**

**requirements in accordance with Section 01 33 29**

**SUSTAINABILITY REPORTING. Locate the "S" submittal**

**under the SD number that best describes the**

**submittal item.**

**Choose the first bracketed item for Navy, Air Force**

**and NASA projects, or choose the second bracketed**

**item for Army projects.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for [Contractor Quality

Control approval.] [information only. When used, a designation following

the "G" designation identifies the office that will review the submittal

for the Government.] Submittals with an "S" are for inclusion in the

Sustainability eNotebook, in conformance to Section 01 33 29

SUSTAINABILITY REPORTING. Submit the following in accordance with Section

01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

DDC Contractor Design Drawings; G[, [\_\_\_\_\_]]

Draft As-Built Drawings; G[, [\_\_\_\_\_]]

Final As-Built Drawings; G[, [\_\_\_\_\_]]

SD-03 Product Data

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Certificate of Networthiness Documentation is**

SECTION 23 09 00 Page 34

**only required for Army projects and is included only**

**when the ARMY tailoring options is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Certificate of Networthiness Documentation; G[, [\_\_\_\_\_]]

Programming Software; G[, [\_\_\_\_\_]]

Controller Application Programs; G[, [\_\_\_\_\_]]

Configuration Software; G[, [\_\_\_\_\_]]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Controller Configuration Settings is only**

**required for BACnet and is included only when BACNET**

**or NIAGARA BACNET tailoring options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Controller Configuration Settings; G[, [\_\_\_\_\_]]

Manufacturer's Product Data; G[, [\_\_\_\_\_]]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: XIF files and the three LNS-related**

**submittals are only required for LNS-based LonWorks**

**systems and are included when the LNS tailoring**

**option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Niagara Framework Supervisory Gateway**

**Backups, Niagara Framework Engineering Tool and**

**Niagara Framework Wizards are only required for**

**Niagara Framework systems and are included when the**

**NIAGARA LONWORKS or NIAGARA BACNET**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Niagara Framework Supervisory Gateway Backups; G[, [\_\_\_\_\_]]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The Niagara Framework Engineering Tool is**

**specified in Section 23 09 23.01 LONWORKS DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS and Section 23 09 23.02 BACNET DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS, but is a designer option in these**

**Sections. If the Niagara Framework Engineering Tool**

**is not required for the project, remove the**

**submittal requirements in this Section.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

[ Niagara Framework Engineering Tool; G[, [\_\_\_\_\_]]]

Niagara Framework Wizards; G[, [\_\_\_\_\_]]

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SD-05 Design Data

Boiler Or Chiller Plant Gateway Request

SD-06 Test Reports

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For Navy Projects with an Acceptance**

**Engineer, a different set of SD-6 submittals are**

**used. If this note is visible the NAVY WITH**

**ACCEPTANCE ENGINEER tailoring option has been**

**selected on this project, and the relevant**

**submittals have been added below. Remove the**

**bracketed submittals which do no apply to Navy**

**projects with an Acceptance Engineer (or deselect**

**the NAVY WITH ACCEPTANCE ENGINEER if this is not a**

**Navy project with an acceptance engineer).**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

[ Existing Conditions Report

Start-Up Testing Report; G[, [\_\_\_\_\_]]

PVT Procedures; G[, [\_\_\_\_\_]]

PVT Report; G[, [\_\_\_\_\_]]

Pre-Construction Quality Control (QC) Checklist; G[, [\_\_\_\_\_]]

Post-Construction Quality Control (QC) Checklist; G[, [\_\_\_\_\_]]

]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following four submittals apply only to**

**Navy projects with an acceptance engineer and are**

**included when the NAVY WITH ACCEPTANCE ENGINEER**

**tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Control Contractor’s Performance Verification Testing Plan; G

Equipment Supplier’s Performance Verification Testing Plan; G

Endurance Testing Results; G

Performance Verification Test Report; G

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G[, [\_\_\_\_\_]]

Training Documentation; G[, [\_\_\_\_\_]]

SD-11 Closeout Submittals

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The Enclosure Keys are needed by the project**

**site DPW.**

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**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Enclosure Keys; G[, [\_\_\_\_\_]]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The Password Summary Report is needed by the**

**project site DPW.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Password Summary Report; G[, [\_\_\_\_\_]]

Closeout Quality Control (QC) Checklist; G[, [\_\_\_\_\_]]

1.7 DATA PACKAGE AND SUBMITTAL REQUIREMENTS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The acquisition of all technical data, data**

**bases and computer software items that are**

**identified herein will be accomplished strictly in**

**accordance with the Federal Acquisition Regulation**

**(FAR) and the Defense Acquisition Regulation**

**Supplement (DFARS). Those regulations as well as**

**the Services implementation thereof should also be**

**consulted to ensure that a delivery of critical**

**items of technical data is not inadvertently lost.**

**Specifically, DFARS 252.227-7013 Rights in Technical**

**Data - Noncommercial Items, as well as any requisite**

**software licensing agreements will be made a part of**

**the CONTRACT CLAUSES or SPECIAL CONTRACT**

**REQUIREMENTS.**

**In addition, the appropriate DD Form 1423 Contract**

**Data Requirements List, will be filled out for each**

**distinct deliverable data item and made a part of**

**the contract. Where necessary, a DD Form 1664, Data**

**Item Description, will be used to explain and more**

**fully identify the data items listed on the DD Form**

**1423. It is to be noted that all of these clauses**

**and forms are required to ensure the delivery of the**

**data in question and that such data is obtained with**

**the requisite rights to use by the Government.**

**Include with the request for proposals a completed**

**DD Form 1423, Contract Data Requirements List. This**

**form is essential to obtain delivery of all**

**documentation. Each deliverable will be clearly**

**specified with both description and quantity being**

**required.**

**Coordinate the review of all submittals with the**

**project site. The site may have a System Integrator**

**or other individual/office that should review all**

**submittals before acceptance of the system.**

**Most of the submittals included in this Section are**

**critical and require Government review. Any added**

**submittals, normally, should be for information only**

**and reviewed through the Contractor Quality Control**

**system.**

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**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Technical data packages consisting of technical data and computer software

(meaning technical data which relates to computer software) which are

specifically identified in this project and which may be defined/required

in other specifications must be delivered strictly in accordance with the

CONTRACT CLAUSES and in accordance with the Contract Data Requirements

List, DD Form 1423. Data delivered must be identified by reference to the

particular specification paragraph against which it is furnished. All

submittals not specified as technical data packages are considered 'shop

drawings' under the Federal Acquisition Regulation Supplement (FARS) and

must contain no proprietary information and be delivered with unrestricted

rights.

1.8 SOFTWARE FOR DDC HARDWARE AND GATEWAYS

Provide all software related to the programming and configuration of DDC

Hardware and Gateways as indicated. License all Software to the project

site. The term "controller" as used in these requirements means both DDC

Hardware and Gateways.

~~1.8.1 Programming Software~~

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to LonWorks systems**

**and is only included when the LNS or NIAGARA**

**LONWORKS tailoring option is selected.**

**In addition, the sentence referring to Application**

**Generic Controllers and Wizards is included only**

**when the NIAGARA LONWORKS tailoring option is**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to LonWorks systems**

**and is only included with the LNS and NIAGARA**

**LONWORKS tailoring options.**

**In addition, "(LNS plug-in)" is only included when**

**the LNS tailoring options is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

1.8.3 Configuration Software

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to BACnet systems**

**and is only included with the BACNET and NIAGARA**

**BACNET tailoring options.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For type of controller, provide the configuration tool software in

accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC

AND OTHER BUILDING CONTROL SYSTEMS. Submit hard copies of the software

user manuals for each software with the software submittal.

Submit Configuration Software on CD-ROM as a Technical Data Package.

Submit [\_\_\_\_\_] hard copies of the software user manual for each piece of

software.

1.8.4 Controller Configuration Settings

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to BACnet systems**

**and is only included with the BACNET and NIAGARA**

**BACNET tailoring options.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For each controller, provide copies of the installed configuration

settings as source code compatible with the configuration tool software

for that controller in accordance with Section 23 09 23.02 BACNET DIRECT

DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Submit Controller Configuration Settings on CD-ROM as a Technical Data

Package. Include on the CD-ROM a list or table of contents clearly

indicating which files are associated with each device. Submit [2][\_\_\_\_\_]

copies of the Controller Configuration Settings CD-ROM.

1.8.5 Programming Software

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to BACnet systems**

**and is only included with the BACNET and NIAGARA**

**BACNET tailoring options.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For each type of programmable controller, provide the programming software

in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR

HVAC AND OTHER BUILDING CONTROL SYSTEMS. Submit hard copies of software

user manuals for each software with the software submittal.

Submit Programming Software on CD-ROM as a Technical Data Package.

Submit [\_\_\_\_\_] hard copies of the software user manual for each piece of

software.

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1.8.6 Controller Application Programs

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to BACnet systems**

**and is only included with the BACNET and NIAGARA**

**BACNET tailoring options.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For each programmable controller, provide copies of the application

program as source code compatible with the programming software for that

controller in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL

CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Submit Controller Application Programs on CD-ROM as a Technical Data

Package. Include on the CD-ROM a list or table of contents clearly

indicating which application program is associated with each device.

Submit [2][\_\_\_\_\_] copies of the Controller Application Programs CD-ROM.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to Niagara**

**Framework Based LonWorks systems and is only**

**included with the NIAGARA LONWORKS tailoring option.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

1.8.9 Niagara Framework Supervisory Gateway Backups

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to Niagara**

**Framework systems and is only included with the**

**NIAGARA LONWORKS and NIAGARA BACNET tailoring**

**options.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For each Niagara Framework Supervisory Gateway, provide a backup of all

SECTION 23 09 00 Page 40

software within the Niagara Framework Supervisory Gateway, including

configuration settings. This backup must be sufficient to allow the

restoration of the Niagara Framework Supervisory Gateway or the

replacement of the Niagara Framework Supervisory Gateway.

Submit backups for each Niagara Framework Supervisory Gateway on CD-ROM as

a Technical Data Package. Mark each backup indicating clearly the source

Niagara Framework Supervisory Gateway.

[1.8.10 Niagara Framework Engineering Tool(for all Niagara Framework

system)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to Niagara**

**Framework systems and is only included with the**

**NIAGARA LONWORKS and NIAGARA BACNET tailoring**

**options.**

**In addition, this subpart uses tailoring options:**

**1) Text referring to UFGS 23 09 23.01 will be**

**included if the NIAGARA LONWORKS tailoring option is**

**selected.**

**2) Text referring to UFGS 23 09 23.02 will be**

**included if the NIAGARA BACNET tailoring option is**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The Niagara Framework Engineering Tool is**

**specified in Section 23 09 23.01 LONWORKS DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS and Section 23 09 23.02 BACNET DIRECT**

**DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL**

**SYSTEMS, but is a designer option in these**

**Sections. If the Niagara Framework Engineering Tool**

**is not required for the project, remove the**

**submittal requirements in this Section.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide a Niagara Framework Engineering Tool in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR

HVAC AND OTHER BUILDING CONTROL SYSTEMS. Submit software user manuals

with the Niagara Framework Engineering Tool submittal.

Submit the Niagara Framework Engineering Tool on CD-ROM as a Technical

Data Package. Submit [\_\_\_\_\_] hard copies of the software user manual for

the Niagara Framework Engineering Tool.

]1.8.11 Certificate of Networthiness Documentation

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is only required for Army**

**projects and is only included when the ARMY**

**tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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**NOTE: Include a copy of a blank Certificate of**

**Networthiness (CoN) "Application Checklist" in the**

**contract package. This document is available at**

**https://portal.netcom.army.mil/apps/networthiness/SitePages/Home.aspx**

**(as of December 2014), but this website requires a**

**CAC login so may not be directly accessible to a**

**Contractor.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For all software provided, provide documentation that an Enterprise

Certificate of Networthiness exists, that a Limited Certificate of

Networthiness for the project site exists, or provide a completed

Certificate of Networthiness "Application Checklist". Submit Certificate

of Networthiness Documentation in PDF format on CD-ROM.

1.9 BOILER OR CHILLER PLANT GATEWAY REQUEST

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Before approving the use of a gateway to**

**multiple chillers or boilers ensure that the**

**sequence of operation for the units requires**

**information be shared between them and cannot be**

**readily performed by a third-party controller.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to UFGS 23 09 23.01 and LonWorks**

**will be included if the LNS or NIAGARA LONWORKS**

**tailoring options are selected.**

**2) Text referring to UFGS 23 09 23.02 and BACnet**

**will be included if the BACNET or NIAGARA BACNET**

**tailoring options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

If requesting the use of a gateway to a boiler or chiller plant as

indicated in Section 23 09 23.02 BACNET DIRECT

DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS, submit a

Boiler or Chiller Plant Gateway Request describing the configuration of

the boilers or chillers including model numbers for equipment and

controllers, the sequence of operation for the units, and a justification

for the need to operate the units on a shared non-LonWorks non-BACnet

network.

1.10 QUALITY CONTROL CHECKLISTS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options. Each**

**checklist is included only when appropriate**

**tailoring option is selected.**

**~~\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*~~**

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The QC Checklist for Niagara Framework Based LonWorks Systems in APPENDIX

A of this Section must be completed by the Contractor's Chief Quality

Control (QC) Representative and submitted as indicated.

The QC Checklist for BACnet Systems in APPENDIX A of this Section must be

completed by the Contractor's Chief Quality Control (QC) Representative

and submitted as indicated.

The QC Checklist for Niagara Framework Based BACnet Systems in APPENDIX A

of this Section must be completed by the Contractor's Chief Quality

Control (QC) Representative and submitted as indicated.

The QC Representative must verify each item indicated and initial in the

space provided to indicate that the requirement has been met. The QC

Representative must sign and date the Checklist prior to submission to the

Government.

1.10.1 Pre-Construction Quality Control (QC) Checklist

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Indicate the required number of**

**Pre-Construction QC Checklists.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Complete items indicated as Pre-Construction QC Checklist items in the QC

Checklist. Submit [four][\_\_\_\_\_] copies of the Pre-Construction QC

Checklist.

1.10.2 Post-Construction Quality Control (QC) Checklist

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Indicate the required number of**

**Post-Construction QC Checklists.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Complete items indicated as Post-Construction QC Checklist items in the QC

Checklist. Submit [four][\_\_\_\_\_] copies of the Post-Construction QC

Checklist.

1.10.3 Closeout Quality Control (QC) Checklist

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Indicate the required number of Closeout QC**

**Checklists.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Complete items indicated as Closeout QC Checklist items in the QC

Checklist. Submit [four][\_\_\_\_\_] copies of the Closeout QC Checklist.

PART 2 PRODUCTS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to UFGS 23 09 23.01 will be**

**included if the LNS or NIAGARA LONWORKS tailoring**

**options are selected.**

**2) Text referring to UFGS 23 09 23.02 will be**

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**included if the BACNET or NIAGARA BACNET tailoring**

**options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide products meeting the requirements of Section 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.01 LONWORKS

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for LNS

LonWorks systems or Niagara LonWorks systems, Section 23 09 23.02 BACNET

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for

BACnet or Niagara BACnet systems, other referenced Sections, and this

Section.

2.1 GENERAL PRODUCT REQUIREMENTS

Units of the same type of equipment must be products of a single

manufacturer. Each major component of equipment must have the

manufacturer's name and address, and the model and serial number in a

conspicuous place. Materials and equipment must be standard products of a

manufacturer regularly engaged in the manufacturing of these and similar

products. The standard products must have been in a satisfactory

commercial or industrial use for two years prior to use on this project.

The two year use must include applications of equipment and materials

under similar circumstances and of similar size. DDC Hardware not meeting

the two-year field service requirement is acceptable provided it has been

successfully used by the Contractor in a minimum of two previous

projects. The equipment items must be supported by a service

organization. Items of the same type and purpose must be identical,

including equipment, assemblies, parts and components.

2.2 PRODUCT DATA

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to UFGS 23 09 23.01 will be**

**included if the LNS or NIAGARA LONWORKS tailoring**

**options are selected.**

**2) Text referring to UFGS 23 09 23.02 will be**

**included if the BACNET or NIAGARA BACNET tailoring**

**options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide manufacturer's product data sheets documenting compliance with

product specifications for each product provided under Section 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.01 LONWORKS

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS,

Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER

BUILDING CONTROL SYSTEMS, or this Section. Provide product data for all

products in a single indexed compendium, organized by product type.

For all BACnet hardware: for each manufacturer, model and version

(revision) of DDC Hardware provide the Protocol Implementation Conformance

Statement (PICS) in accordance with Section23 09 23.02 BACNET DIRECT

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DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Submit Manufacturer's Product Data on CD-ROM.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart only applies to LonWorks systems**

**and is only included when the LNS or NIAGARA**

**LONWORKS tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

2.3 OPERATION ENVIRONMENT

Unless otherwise specified, provide products rated for continuous

operation under the following conditions:

a. Pressure: Pressure conditions normally encountered in the installed

location.

b. Vibration: Vibration conditions normally encountered in the installed

location.

c. Temperature:

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Designer must decide if suggested outside air**

**temperature range is sufficient, and provide a range**

**if it's not.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

(1) Products installed indoors: Ambient temperatures in the range of

0 to 50 degrees C 32 to 112 degrees F and temperature conditions

outside this range normally encountered at the installed location.

(2) Products installed outdoors or in unconditioned indoor spaces:

Ambient temperatures in the range of [-37 to +66 degrees C -35 to

+151 degrees F] [\_\_\_\_\_] and temperature conditions outside this

range normally encountered at the installed location.

d. Humidity: 10 to 95 percent relative humidity, noncondensing and

humidity conditions outside this range normally encountered at the

installed location.

2.4 WIRELESS CAPABILITY

For products incorporating any wireless capability (including but not

limited to radio frequency (RF), infrared and optical), provide products

for which wireless capability can be permanently disabled at the device.

Optical and infrared capabilities may be disabled via a permanently

affixed opaque cover plate.

2.5 ENCLOSURES

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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**NOTE: In outdoor applications specify Type 3 unless**

**hosedown of the enclosure is anticipated, in which**

**case specify Type 4.**

**For retrofit projects in older mechanical rooms or**

**where hosedown of the enclosure is anticipated**

**specify Type 4 enclosures. Type 4 provides a**

**greater degree of protection in dirty and wet**

**environments than does Type 2.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Enclosures supplied as an integral (pre-packaged) part of another product

are acceptable. Provide two Enclosure Keys for each lockable enclosure on

a single ring per enclosure with a tag identifying the enclosure the keys

operate. Provide enclosures meeting the following minimum requirements:

2.5.1 Outdoors

For enclosures located outdoors, provide enclosures meeting NEMA 250 [Type

3][Type 4] requirements.

2.5.2 Mechanical and Electrical Rooms

For enclosures located in mechanical or electrical rooms, provide

enclosures meeting NEMA 250 [Type 2][Type 4] requirements.

2.5.3 Other Locations

For enclosures in other locations including but not limited to occupied

spaces, above ceilings, and in plenum returns, provide enclosures meeting

NEMA 250 Type 3 with associated wiring, fusing, and mounting blocks.

2.6 WIRE AND CABLE

Provide wire and cable meeting the requirements of NFPA 70 and NFPA 90A in

addition to the requirements of this specification and referenced

specifications.

2.6.1 Terminal Blocks

For terminal blocks which are not integral to other equipment, provide

terminal blocks which are insulated, modular, feed-through, clamp style

with recessed captive screw-type clamping mechanism, suitable for DIN rail

mounting, and which have enclosed sides or end plates and partition plates

for separation.

2.6.2 Control Wiring for Binary Signals

For Control Wiring for Binary Signals, provide 18 AWG (1.02 mm diameter)

18 AWG copper or thicker wire rated for 300-volt service.

2.6.3 Control Wiring for Analog Signals

For Control Wiring for Analog Signals, provide 18 AWG (1.02 mm diameter)

18 AWG or thicker, copper, single- or multiple-twisted wire meeting the

following requirements:

a. minimum 50 mm (2 inch) 2 inch lay of twist

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b. 100 percent shielded pairs

c. at least 300-volt insulation

d. each pair has a 20 AWG tinned-copper drain wire and individual overall

pair insulation

e. cables have an overall aluminum-polyester or tinned-copper cable-shield

tape, overall 20 AWG tinned-copper cable drain wire, and overall cable

insulation.

2.6.4 Power Wiring for Control Devices

For 24-volt circuits, provide insulated copper 18 AWG or thicker wire

rated for 300 VAC service. For 120-volt circuits, provide 14 AWG or

thicker stranded copper wire rated for 600-volt service.

2.6.5 Transformers

Provide UL 5085-3 approved transformers. Select transformers sized so

that the connected load is no greater than 80 percent of the transformer

rated capacity.

PART 3 EXECUTION

[3.1 EXISTING CONDITIONS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For Navy projects with an Acceptance**

**Engineer, the Existing Conditions report is not**

**required. If this note is visible the NAVY WITH**

**ACCEPTANCE ENGINEER tailoring option has been**

**selected for this project. If this is not a Navy**

**project with an Acceptance Engineer deselect the**

**NAVY WITH ACCEPTANCE ENGINEER tailoring option.**

**Otherwise remove the EXISTING CONDITIONS requirement.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For renovation or retrofits keep this**

**paragraph dealing with existing conditions. For new**

**constructions existing conditions generally does not**

**apply and this paragraph can be removed.**

**Indicate the required number of copies of the**

**Existing Conditions Report.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

3.1.1 Existing Conditions Survey

Perform a field survey, including testing and inspection of the equipment

to be controlled and submit an Existing Conditions Report documenting the

current status and its impact on the Contractor's ability to meet this

specification. For those items considered nonfunctional, document the

deficiency in the report including explanation of the deficiencies and

estimated costs to correct the deficiencies. As part of the report,

define the scheduled need date for connection to existing equipment. Make

written requests and obtain Government approval prior to disconnecting any

controls and obtaining equipment downtime.

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Submit [four][\_\_\_\_\_] copies of the Existing Conditions Report.

3.1.2 Existing Equipment Downtime

Make written requests and obtain Government approval prior to

disconnecting any controls and obtaining equipment downtime.

3.1.3 Existing Control System Devices

Inspect, calibrate, and adjust as necessary to place in proper working

order all existing devices which are to be reused.

]3.2 INSTALLATION

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) Text referring to UFGS 23 09 23.01 will be**

**included if the LNS or NIAGARA LONWORKS tailoring**

**options are selected.**

**2) Text referring to UFGS 23 09 23.02 will be**

**included if the BACNET or NIAGARA BACNET tailoring**

**options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Fully install and test the control system in accordance Section 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.01 LONWORKS

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for LNS

LonWorks systems or Niagara LonWorks systems, Section 23 09 23.02 BACNET

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for

BACnet or Niagara BACnet systems, and this Section.

3.2.1 Dielectric Isolation

Provide dielectric isolation where dissimilar metals are used for

connection and support. Install control system in a matter that provides

clearance for control system maintenance by maintaining access space

required to calibrate, remove, repair, or replace control system devices.

Install control system such that it does not interfere with the clearance

requirements for mechanical and electrical system maintenance.

3.2.2 Penetrations in Building Exterior

Make all penetrations through and mounting holes in the building exterior

watertight.

3.2.3 Device Mounting Criteria

Install devices in accordance with the manufacturer's recommendations and

as indicated and shown. Provide a weathershield for all devices installed

outdoors. Provide clearance for control system maintenance by maintaining

access space required to calibrate, remove, repair, or replace control

system devices. Provide clearance for mechanical and electrical system

maintenance; do not not interfere with the clearance requirements for

mechanical and electrical system maintenance.

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3.2.4 Labels and Tags

Key all labels and tags to the unique identifiers shown on the As-Built

drawings. For labels exterior to protective enclosures provide engraved

plastic labels mechanically attached to the enclosure or DDC Hardware.

Labels inside protective enclosures may be attached using adhesive, but

must not be hand written. For tags, provide plastic or metal tags

mechanically attached directly to each device or attached by a metal chain

or wire.

a. Label all Enclosures and DDC Hardware. Label JACE with station name and Port 1 and Port 2 MAC addresses.

b. Tag Airflow measurement arrays (AFMA) with flow rate range for signal

output range, duct size, and pitot tube AFMA flow coefficient.

c. Tag duct static pressure taps at the location of the pressure tap

3.2.5 Surge Protection

3.2.5.1 Power-Line Surge Protection

Protect equipment connected to AC circuits to withstand power-line surges

in accordance with IEEE C62.41. Do not use fuses for surge protection.

3.2.5.2 Surge Protection for Transmitter and Control Wiring

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Determine if any additional inputs or outputs**

**require surge protection and show the requirement**

**for them on the drawings.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Protect DDC hardware against or provided DDC hardware capable of

withstanding surges induced on control and transmitter wiring installed

outdoors and as shown. Protect equipment against the following two

waveforms:

a. A waveform with a 10-microsecond rise time, a 1000-microsecond decay

time and a peak current of 60 amps.

b. A waveform with an 8-microsecond rise time, a 20-microsecond decay

time and a peak current of 500 amperes.

3.2.6 Basic Cybersecurity Requirements

3.2.6.1 Passwords

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Provide a POC for password coordination.**

**This will generally be a supervisor or other senior**

**member of the project site maintenance organization.**

**This report is required to be delivered as hardcopy**

**in a sealed envelope to keep passwords more**

**confidential.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For all devices with a password, change the password from the default

password. Do not use the same password for more than one device. Usernames, passwords, and passphrases will be provided by the project POC using a “User Profiles” guide.

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Coordinate selection of passwords with [\_\_\_\_\_]. Provide a Password

Summary Report documenting the password for each device and describing the

procedure to change the password for each device.

Provide [two][\_\_\_\_\_] hardcopies of the Password Summary Report, each copy

in its own sealed envelope.

3.2.6.2 Wireless Capability

Unless otherwise indicated, disable wireless capability (including but not

limited to radio frequency (RF), infrared and optical) for all devices

with wireless capability. Optical and infrared capabilities may be

disabled via a permanently affixed opaque cover plate. Password

protecting a wireless connections does not meet this requirement; the

wireless capability must be disabled.

3.2.6.3 IP Network Physical Security

Install all IP Network media in conduit. Install all IP devices including

but not limited to IP-enabled DDC hardware and IP Network Hardware in

lockable enclosures.

3.3 DRAWINGS AND CALCULATIONS

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Most contractor drawings are updated Contract**

**Drawings. Therefore, it is important that the**

**contract drawing package is complete.**

**Drawing package content is discussed in UFC 3-410-02**

**and UFC 3-410-07. Template drawings are available**

**online at Whole Building Design Guide page for this**

**section:**

http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-**Many requirements in this specification refer to the**

**Points Schedules so it is critical that complete**

**Points Schedules are part of the Contract Drawings.**

**A Riser Diagram is not a required part of the**

**Contract Drawings but you may wish to include a**

**Riser Diagram in the contract drawings to show**

**project specific requirements such as DDC Hardware**

**locations etc.**

**Select a drawing size, (approx 279x432 mm 11x17 inch**

**or 557x860 mm 22x34 inch) or to leave to leave it up**

**to the Contractor.**

**Select an electronic submittal format in**

**coordination with the project site. Be sure to**

**require drawings in a format that is usable by the**

**site maintenance staff. This may require including**

**multiple format requirements here.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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Provide drawings in the form and arrangement indicated and shown. Use the

same abbreviations, symbols, nomenclature and identifiers shown. Assign a

unique identifier as shown to each control system element on a drawing.

When packaging drawings, group schedules by system. When space allows, it

is permissible to include multiple schedules for the same system on a

single sheet. Except for drawings covering all systems, do not put

information for different systems on the same sheet.

Submit hardcopy drawings on [ISO A1 841 by 594 mm 34 by 22 inches][or][A3

420 by 297 mm 17 by 11 inches] sheets, and electronic drawings in PDF and

in [AutoCAD][Microstation][Bentley BIM V8][Autodesk Revit 2013] format.

In addition, submit electronic drawings in editable Excel format for all

drawings that are tabular, including but not limited to the Point Schedule

and Equipment Schedule.

a. Submit DDC Contractor Design Drawings consisting of each drawing

indicated with pre-construction information depicting the intended

control system design and plans. Submit DDC Contractor Design

Drawings as a single complete package: [\_\_\_\_\_] hard copies and

[\_\_\_\_\_] copies on CD-ROM.

b. Submit Draft As-Built Drawings consisting of each drawing indicated

updated with as-built data for the system prior to PVT. Submit Draft

As-Built Drawings as a single complete package: [\_\_\_\_\_] hard copies

and [\_\_\_\_\_] copies on CD-ROM.

c. Submit Final As-Built Drawings consisting of each drawing indicated

updated with all final as-built data. Final As-Built Drawings as a

single complete package: [\_\_\_\_\_] hard copies and [\_\_\_\_\_] copies on

CD-ROM.

3.3.1 Sample Drawings

Sample drawings in electronic format are available at the Whole Building

Design Guide page for this section:

http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-23-09-00

These drawings may prove useful in demonstrating expected drawing

formatting and example content and are provided for illustrative purposes

only. Note that these drawings do not meet the content requirements of

this Section and must be completed to meet project requirements.

3.3.2 Drawing Index and Legend

Provide an HVAC Control System Drawing Index showing the name and number

of the building, military site, State or other similar designation, and

Country. In the Drawing Index, list all Contractor Design Drawings,

including the drawing number, sheet number, drawing title, and computer

filename when used. In the Design Drawing Legend, show and describe all

symbols, abbreviations and acronyms used on the Design Drawings. Provide

a single Index and Legend for the entire drawing package.

3.3.3 Thermostat and Occupancy Sensor Schedule

Provide a thermostat and occupancy sensor schedule containing each

thermostat's unique identifier, room identifier and control features and

functions as shown. Provide a single thermostat and occupancy sensor

schedule for the entire project.

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3.3.4 Valve Schedule

Provide a valve schedule containing each valve's unique identifier, size,

flow coefficient Kv (Cv), pressure drop at specified flow rate, spring

range, positive positioner range, actuator size, close-off pressure to

torque data, dimensions, and access and clearance requirements data. In

the valve schedule include actuator selection data supported by

calculations of the force required to move and seal the valve, access and

clearance requirements. Provide a single valve schedule for the entire

project.

3.3.5 Damper Schedule

Provide a damper schedule containing each damper's unique identifier, type

(opposed or parallel blade), nominal and actual sizes, orientation of axis

and frame, direction of blade rotation, actuator size and spring ranges,

operation rate, positive positioner range, location of actuators and

damper end switches, arrangement of sections in multi-section dampers, and

methods of connecting dampers, actuators, and linkages. Include the AMCA

511 maximum leakage rate at the operating static-pressure differential for

each damper in the Damper Schedule. Provide a single damper schedule for

the entire project.

3.3.6 Project Summary Equipment Schedule

Provide a project summary equipment schedule containing the manufacturer,

model number, part number and descriptive name for each control device,

hardware and component provided under this specification. Provide a

single project equipment schedule for the entire project.

3.3.7 Equipment Schedule

Provide system equipment schedules containing the unique identifier,

manufacturer, model number, part number and descriptive name for each

control device, hardware and component provided under this specification.

Provide a separate equipment schedule for each HVAC system.

3.3.8 Occupancy Schedule

Provide an occupancy schedule drawing containing the same fields as the

occupancy schedule Contract Drawing with Contractor updated information.

Provide a single occupancy schedule for the entire project.

3.3.9 DDC Hardware Schedule

Provide a single DDC Hardware Schedule for the entire project and

including following information for each device.

3.3.9.1 DDC Hardware Identifier

The Unique DDC Hardware Identifier for the device. This includes the “Request for DHCP Reservation” form and station name.

3.3.9.2 HVAC System

The system "name" used to identify a specific system (the name used on the

system schematic drawing for that system). HVAC point names will follow the “EBCS Naming Convention” guide.

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3.3.9.3 LonWorks Device Information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart and its subparts are required**

**only for LonWorks systems and are included only when**

**the LNS or NIAGARA LONWORKS tailoring options are**

**selected.**

3.3.9.4 BACnet Device Information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart and its subparts are required**

**only for BACnet systems and are included only when**

**the BACNET or NIAGARA BACNET tailoring options are**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

3.3.9.4.1 Device Object Identifier

The Device Object Identifier: The Object\_Identifier of the Device Object

3.3.9.4.2 Network Number

The Network Number for the device.

3.3.9.4.3 MAC Address

The MAC Address for the device

3.3.9.4.4 BTL Listing

The BTL Listing of the device. If the device is listed under multiple BTL

Profiles, indicate the profile that matches the use and configuration of

the device as installed.

3.3.9.4.5 Proprietary Services Information

If the device uses non-standard ASHRAE 135 services as defined and

permitted in Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC

AND OTHER BUILDING CONTROL SYSTEMS, indicate that the device uses

non-standard services and include a description of all non-standard

services used. Describe usage and content such that a device from another

vendor can interoperate with the device using the non-standard service.

Provide descriptions with sufficient detail to allow a device from a

different manufacturer to be programmed to both read and write the

non-standard service request:

a. read: interpret the data contained in the non-standard service

and;

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b. write: given similar data, generate the appropriate non-standard

service request.

3.3.9.4.6 Alarming Information

Indicate whether the device is used for alarm generation, and which types

of alarm generation the device implements: intrinsic, local algorithmic,

remote algorithmic. Alarms will be designated according to the “Point Naming Convention” guide. Alarm messages will be added to each alarm as outlined below.

1. Out of Range (Analog Points). The message will display the current command of the point and the current status.
2. Command Failure (Boolean Points). The message will display the current command of the point and the current status.
3. Change of Value (Boolean or Enumerated Points). The message will display the current value of the component.
4. Change of Status (Niagara Components). The message will display the current value of the component.

3.3.9.4.7 Scheduling Information

Indicate whether the device is used for scheduling. All scheduling will be controlled and implemented locally at the building level. Integration to the server will mimic the local schedules.

3.3.9.4.8 Trending Information

Indicate whether the device is used for trending, and indicate if the

device is used to trend local values, remote values, or both. Trend extensions will be added to the data points according to the “Point Naming Convention” guide. The trend extension configuration will be set to allow for a minimum three-day rolling window of data, but not to exceed 1800 records per JACE. The data types that will be used for the trend extensions are outline below.

1. Internal Trends. Assigned to analog points that are fast changing in nature. Trend extensions will be configured to record a data point every 5-15 minutes.
2. Change-of-Value Trends. Assigned to analog or Boolean points that are not fast changing in nature. The trend extension will automatically be configured to record a data point whenever there is a change of value in the point.

3.3.9.5 Niagara Station ID

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for Niagara**

**Framework systems and is included only when the**

**NIAGARA LONWORKS or NIAGARA BACNET tailoring options**

**are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

The Niagara Station ID for each Niagara Framework Supervisory Gateway

3.3.10 Points Schedule

Provide a Points Schedule in tabular form for each HVAC system, with the

indicated columns and with each row representing a hardware point, network

point or configuration point in the system. The point names will follow the “Point Naming Convention” guide.

a. When a Points Schedule was included in the Contract Drawing package,

use the same fields as the Contract Drawing with updated information

in addition to the indicated fields.

b. When Point Schedules are included in the contract package, items

requiring contractor verification or input have been shown in angle

brackets ("<" and ">"), such as <\_\_\_> for a required entry or <value>

for a value requiring confirmation. Complete all items in brackets as

well as any blank cells. Do not modify values which are not in

brackets without approval.

Points Schedule Columns must include:

3.3.10.1 Point Name

The abbreviated name for the point using the indicated naming convention.

3.3.10.2 Description

A brief functional description of the point such as "Supply Air

Temperature".

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3.3.10.3 DDC Hardware Identifier

The Unique DDC Hardware Identifier shown on the DDC Hardware Schedule and

used across all drawings for the DDC Hardware containing the point.

3.3.10.4 Settings

The value and units of any setpoints, configured setpoints, configuration

parameters, and settings related to each point.

3.3.10.5 Range

The range of values, including units, associated with the point, including

but not limited to a zone temperature setpoint adjustment range, a sensor

measurement range, occupancy values for an occupancy input, or the status

of a safety.

3.3.10.6 Input or Output (I/O) Type

The type of input or output signal associated with the point. Use the

following abbreviations for entries in this column:

a. AI: The value comes from a hardware (physical) Analog Input

b. AO: The value is output as a hardware (physical) Analog Output

c. BI: The value comes from a hardware (physical) Binary Input

d. BO: The value is output as a hardware (physical) Binary Output

e. PULSE: The value comes from a hardware (physical) Pulse Accumulator

Input

f. NET-IN: The value is provided from the network (generally from

another device). Use this entry only when the value is received from

another device as part of scheduling or as part of a sequence of

operation, not when the value is received on the network for

supervisory functions such as trending, alarming, override or display

at a user interface.

g. NET-OUT: The value is provided to another controller over the

network. Use this entry only when the value is transmitted to another

device as part of scheduling or as part of a sequence of operation,

not when the value is transmitted on the network for supervisory

functions such as trending, alarming, override or display at a user

interface.

3.3.10.7 Object and Property Information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for BACnet**

**systems and is included only when the BACNET or**

**NIAGARA BACNET tailoring options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

The Object Type and Instance Number for the Object associated with the

point. If the value of the point is not in the Present\_Value Property,

then also provide the Property ID for the Property containing the value of

the point. Any point that is displayed at the front end or on an LDP, is

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trended, is used by another device on the network, or has an alarm

condition must be documented here.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

3.3.10.10 Niagara Station ID

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for Niagara**

**Framework systems and is included only when the**

**NIAGARA LONWORKS or NIAGARA BACNET tailoring options**

**are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

The Niagara Station ID of the Niagara Framework Supervisory Gateway the

point is mapped into. Station names and hostnames will adhere to the following format.

1. Station Name for HVAC Controls: FACID\_FACNUM\_C01
2. Station Name for MDMS: FACID\_FACNUM\_M01
3. Hostname for HVAC Controls: FACID-FACNUM-C01
4. Hostname for MDMS: FACID-FACNUM-M01

3.3.10.11 Network Data Exchange Information (Gets Data From, Sends Data To)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for BACnet**

**systems and is included only when the BACNET or**

**NIAGARA BACNET tailoring options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide the DDC Hardware Identifier of other DDC Hardware the point is

shared with.

3.3.10.12 Override Information (Object Type and Instance Number)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for BACnet**

**systems and is included only when the BACNET or**

**NIAGARA BACNET tailoring options are selected.**

**In addition this subpart uses tailoring options: The**

**text referring to Niagara Framework is only included**

**when the NIAGARA BACNET tailoring option is selected.**

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**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For each point requiring an Override and not residing in a Niagara

Framework Supervisory Gateway, indicate if the Object for the point is

Commandable or, if the use of a separate Object was specifically approved

by the Contracting Officer, provide the Object Type and Instance Number of

the Object to be used in overriding the point.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for LonWorks**

**systems and is included only when the LNS or NIAGARA**

**LONWORKS tailoring options are selected.**

**In addition this subpart uses tailoring options: The**

**text referring to Niagara Framework is only included**

**when the NIAGARA LONWORKS tailoring option is**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

3.3.10.14 Trend Object Information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for non Niagara**

**Framework based BACnet systems and is included only**

**when the NIAGARA BACNET tailoring option is**

**selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For each point requiring a trend, indicate if the trend is Local or

Remote, the trend Object type and the trend Object instance number. For

remote trends provide the DDC Hardware Identifier for the device

containing the trend Object in the Points Schedule notes. All data points will follow the “Point Naming Convention” guide.

3.3.10.15 Alarm Information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for BACnet**

**systems and is included only when the BACNET or**

**NIAGARA BACNET tailoring options are selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following paragraph is included only when**

**the BACNET tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Indicate the Alarm Generation Type, Event Enrollment Object Instance

Number, and Notification Class Object Instance Number for each point

requiring an alarm. (Note that not all alarms will have Event Enrollment

Objects.) Alarms will be designated according to the “Point Naming Convention” guide. Alarm messages will be added to each alarm as outlined below.

1. Out of Range (Analog Points). The message will display the current command of the point and the current status.
2. Command Failure (Boolean Points). The message will display the current command of the point and the current status.
3. Change of Value (Boolean or Enumerated Points). The message will display the current value of the component.
4. Change of Status (Niagara Components). The message will display the current value of the component.

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**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following paragraph is included only when**

**the NIAGARA BACNET tailoring option is selects.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

For Niagara BACnet systems: Indicate the Alarm Generation Type and

Notification Class Object Instance Number for each point requiring an

alarm. (Note that not all alarms will have a Notification Class Object.)

3.3.10.16 Configuration Information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The next paragraph uses tailoring options.**

**Text after the first sentence is included only when**

**the NIAGARA BACNET or NIAGARA LONWORKS tailoring**

**option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Indicate the means of configuration associated with each point. For

points in a Niagara Framework Supervisory Gateway, indicate the point

within the Niagara Framework Supervisory Gateway used to configure the

value. For other points:

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following TWO list paragraphs are**

**included only when the BACNET or NIAGARA BACNET**

**tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

a. For Operator Configurable Points indicate BACnet Object and Property

information (Name, Type, Identifiers) containing the configurable

value. Indicate whether the property is writable always, or only when

Out\_Of\_Service is TRUE.

b. For Configurable Points indicate the BACnet Object and Property

information as for Operator Configurable points, or identification of

the configurable settings from within the engineering software for the

device or identification of the hardware settings on the device.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The following TWO list paragraphs are**

**included only when the LNS or NIAGARA LONWORKS**

**tailoring option is selected. In addition:**

**1) References to LNS plug-ins are included only when**

**the LNS tailoring option is selected.**

**2) References to Niagara Framework Wizards are**

**included only when the NIAGARA LONWORKS tailoring**

**option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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3.3.11 Riser Diagram

The Riser Diagram of the Building Control Network may be in tabular form,

and must show all DDC Hardware and all Network Hardware, including network

terminators. For each item, provide the unique identifier, common

descriptive name, physical sequential order (previous and next device on

the network), room identifier and location within room. A single riser

diagram must be submitted for the entire system.

3.3.12 Control System Schematics

Provide control system schematics in the same form as the control system

schematic Contract Drawing with Contractor updated information. Provide a

control system schematic for each HVAC system.

3.3.13 Sequences of Operation[ Including Control Logic Diagrams]

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Require Control Logic Diagrams if they have**

**been included in the contract drawing or if the**

**intent is to require the contractor to develop**

**them. If requiring contractor to develop control**

**logic diagrams provide at least one sample to**

**establish format. If not requiring control logic**

**diagrams remove bracketed text.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide HVAC control system sequence of operation and [control logic

diagrams] in the same format as the Contract Drawings. Within these

drawings, refer to devices by their unique identifiers. Submit sequences

of operation[ and control logic diagrams] for each HVAC system

3.3.14 Controller, Motor Starter and Relay Wiring Diagram

Provide controller wiring diagrams as functional wiring diagrams which

show the interconnection of conductors and cables to each controller and

to the identified terminals of input and output devices, starters and

package equipment. Show necessary jumpers and ground connections and the

labels of all conductors. Identify sources of power required for control

systems and for packaged equipment control systems back to the panel board

circuit breaker number, controller enclosures, magnetic starter, or

packaged equipment control circuit. Show each power supply and

transformer not integral to a controller, starter, or packaged equipment.

Show the connected volt-ampere load and the power supply volt-ampere

rating. Provide wiring diagrams for each HVAC system.

3.4 CONTROLLER TUNING

Tune each controller in a manner consistent with that described in the

ASHRAE FUN SI ASHRAE FUN IP and in the manufacturer's instruction manual.

Tuning must consist of adjustment of the proportional, integral, and where

applicable, the derivative (PID) settings to provide stable closed-loop

control. Each loop must be tuned while the system or plant is operating

at a high gain (worst case) condition, where high gain can generally be

defined as a low-flow or low-load condition. Upon final adjustment of the

PID settings, in response to a change in controller setpoint, the

controlled variable must settle out at the new setpoint with no more than

two (2) oscillations above and below setpoint. Upon settling out at the

new setpoint the controller output must be steady. With the exception of

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naturally slow processes such as zone temperature control, the controller

must settle out at the new setpoint within five (5) minutes. Set the

controller to its correct setpoint and record and submit the final PID

configuration settings with the O&M Instructions and on the associated

Points Schedule.

3.5 START-UP

3.5.1 Start-Up Test

Perform the following startup tests for each control system to ensure that

the described control system components are installed and functioning per

this specification.

Adjust, calibrate, measure, program, configure, set the time schedules,

and otherwise perform all necessary actions to ensure that the systems

function as indicated and shown in the sequence of operation and other

contract documents.

3.5.1.1 Systems Check

An item-by-item check must be performed for each HVAC system

3.5.1.1.1 Step 1 - System Inspection

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: If the specification has been edited to**

**include M&C Software (from Section 25 10 10 UTILITY**

**MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND**

**INTEGRATION), include the requirement to inspect M&C**

**Clients to make sure they display shutdown**

**conditions. Otherwise, remove the bracketed text**

**referring to M&C Client**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

With the system in unoccupied mode and with fan hand-off-auto switches in

the OFF position, verify that power and main air are available where

required and that all output devices are in their failsafe and normal

positions. Inspect each local display panel [and each M&C Client] to

verify that all displays indicate shutdown conditions.

3.5.1.1.2 Step 2 - Calibration Accuracy Check

Perform a two-point accuracy check of the calibration of each HVAC control

system sensing element and transmitter by comparing the value from the

test instrument to the network value provided by the DDC Hardware. Use

digital indicating test instruments, such as digital thermometers,

motor-driven psychrometers, and tachometers. Use test instruments with

accuracy at least twice as accurate as the specified sensor accuracy and

with calibration traceable to National Institute of Standards and

Technology standards. Check one the first check point in the bottom

one-third of the sensor range, and the second in the top one-third of the

sensor range. Verify that the sensing element-to-DDC readout accuracies

at two points are within the specified product accuracy tolerances, and if

not recalibrate or replace the device and repeat the calibration check.

3.5.1.1.3 Step 3 - Actuator Range Check

With the system running, apply a signal to each actuator through the DDC

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Hardware controller. Verify proper operation of the actuators and

positioners for all actuated devices and record the signal levels for the

extreme positions of each device. Vary the signal over its full range,

and verify that the actuators travel from zero stroke to full stroke

within the signal range. Where applicable, verify that all sequenced

actuators move from zero stroke to full stroke in the proper direction,

and move the connected device in the proper direction from one extreme

position to the other. For valve actuators and damper actuators, perform

the actuator range check under normal system pressures.

3.5.1.2 Weather Dependent Test

Perform weather dependent test procedures in the appropriate climatic

season.

3.5.2 Start-Up Testing Report

Submit [4] [\_\_\_\_\_] copies of the Start-Up Testing Report. The report may

be submitted as a Technical Data Package documenting the results of the

tests performed and certifying that the system is installed and

functioning per this specification, and is ready for the Performance

Verification Test (PVT).

3.5.3 Draft LNS Database

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for LNS-based**

**LonWorks systems and is included only when the LNS**

**tailoring options is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Upon completion of the Start-Up Test, submit the Draft LNS Database

reflecting the system as installed and configured at the completion of the

Start-Up and Start-Up-Testing. The Draft LNS Database must be a complete,

fully commissioned LNS database for the complete control network

provided under this specification. The Draft LNS database submittal must

consist of the entire folder structure of the LNS database (e.g.

c:\Lm\DB\{database name}. For versions of LNS which use credits, the

provided LNS Database must include all device credits.

Submit two copies of the fully commissioned, valid draft LNS Database

(including all LNS credits) as a Technical Data Package. Submit each copy

on a CD-ROM and clearly mark the CD-ROM identifying it as the LNS Database

for the work covered under this specification and with the date of the

most recent database modification.

[3.6 PERFORMANCE VERIFICATION TEST (PVT)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For Navy Projects with an Acceptance**

**Engineer, different PERFORMANCE VERIFICATION TEST**

**requirements are used and the other PVT requirements**

**must be removed..**

**If this note is visible the NAVY WITH ACCEPTANCE**

**ENGINEER tailoring option has been selected on this**

**project, the relevant PERFORMANCE VERIFICATION TEST**

SECTION 23 09 00 Page 61

**requirements have been added below and the**

**requirements to remove have been put in brackets.**

**If this is not a Navy project with an Acceptance**

**Engineer DESELECT the NAVY WITH ACCEPTANCE ENGINEER**

**tailoring option. Otherwise, remove the bracketed**

**PERFORMANCE VERIFICATION TEST (PVT) requirements**

**which do not apply to Navy projects with an**

**Acceptance Engineer**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

3.6.1 PVT Procedures

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The designer must decide whether to require a**

**one-point accuracy check and/or inlet and outlet air**

**temperature measurements. Project specific**

**requirements should be added, particularly for**

**problematic controls based on designer and user**

**experience.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Prepare PVT Procedures based on Section 25 08 10 UTILITY MONITORING AND

CONTROL SYSTEM TESTING explaining step-by-step, the actions and expected

results that will demonstrate that the control system performs in

accordance with the sequences of operation, and other contract documents.

Submit [4] [\_\_\_\_\_] copies of the PVT Procedures. The PVT Procedures may

be submitted as a Technical Data Package.

3.6.1.1 Sensor Accuracy Checks

Include a one-point accuracy check of each sensor in the PVT procedures.

3.6.1.2 Temporary Trending Hardware

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for LNS-based**

**LonWorks systems and is included only when the LNS**

**tailoring options is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For LNS-based LonWorks, trending is**

**accomplished at the UMCS Front End, and the building**

**control system will generally not be integrated into**

**the UMCS during PVT. In this case additional**

**hardware to perform trending will be required.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Unless trending capability exists within the building control system or

the building control system is connected to a UMCS or other system which

can perform trending, temporarily install hardware on the building control

network to perform trending during the endurance test as indicated.

Remove the temporary hardware at the completion of all commissioning

activities.

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3.6.1.3 Endurance Test

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Select the duration of the endurance test.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart uses tailoring options:**

**1) The paragraph requiring the use of BACnet Trend**

**Log Objects is included only when the BACNET**

**tailoring option is selected.**

**2) The paragraph requiring the use of a Niagara**

**Trend Log Object is included only when the NIAGARA**

**LONWORKS or NIAGARA BACNET tailoring option is**

**selected. The last sentence of the paragraph (which**

**requires measuring TP/FT-10 bandwidth) is only**

**included when the NIAGARA LONWORKS tailoring option**

**is selected.**

**3) The paragraph referring to existing trend**

**capabilities and temporary trending hardware is**

**included only when the LNS tailoring option is**

**selected.**

**4) The sentence requiring the measurement of**

**bandwidth on TP/FT-10 is included only when the LNS**

**or NIAGARA LONWORKS tailoring option is selected**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Include a [one-week] [\_\_\_\_\_] endurance test as part of the PVT during

which the system is operated continuously.

Use the building control system BACnet Trend Log or Trend Log Multiple

Objects to trend all points shown as requiring a trend on the Point

Schedule for the entire endurance test. If insufficient buffer capacity

exists to trend the entire endurance test, upload trend logs during the

course of the endurance test to ensure that no trend data is lost.

Use the building control system Niagara Trend Log Objects to trend all

points shown as requiring a trend on the Point Schedule for the entire

endurance test. If insufficient buffer capacity exists to trend the

entire endurance test, upload trend logs during the course of the

endurance test to ensure that no trend data is lost. The PVT must include

a methodology to measure and record the network bandwidth usage on each

TP/FT-10 channel during the endurance test.

Use the existing trending capabilities or the Temporary Trending Hardware

as indicated to trend all points shown as requiring a trend on the Point

Schedule for the entire endurance test. The PVT must include a methodology

to measure and record the network bandwidth usage on each TP/FT-10 channel

during the endurance test.

3.6.1.4 PVT Equipment List

Include in the PVT procedures a control system performance verification

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test equipment list that lists the equipment to be used during performance

verification testing. For each piece of equipment, include manufacturer

name, model number, equipment function, the date of the latest

calibration, and the results of the latest calibration

3.6.2 PVT Execution

Demonstrate compliance of the control system with the contract documents.

Using test plans and procedures approved by the Government, software

capable of reading and writing COV Notification Subscriptions,

Notification Class Recipient List Properties, event enrollments,

demonstrate all physical and functional requirements of the project.

Show, step-by-step, the actions and results demonstrating that the control

systems perform in accordance with the sequences of operation. Do not

start the performance verification test until after receipt of written

permission by the Government, based on Government approval of the PVT Plan

and Draft As-Builts and completion of balancing. UNLESS GOVERNMENT

WITNESSING OF A TEST IS SPECIFICALLY WAIVED BY THE GOVERNMENT, PERFORM ALL

TESTS WITH A GOVERNMENT WITNESS. Do not conduct tests during scheduled

seasonal off periods of base heating and cooling systems. If the system

experiences any failures during the endurance test portion of the PVT,

repair the system repeat the endurance test portion of the PVT until the

system operates continuously and without failure for the specified

endurance test period.

3.6.3 PVT Report

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Indicate the required number of copies for**

**the PVT Report.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Prepare and submit a PVT report documenting all tests performed during the

PVT and their results. Include all tests in the PVT procedures and any

additional tests performed during PVT. Document test failures and repairs

conducted with the test results.

Submit [four][\_\_\_\_\_] copies of the PVT Report. The PVT Report may be

submitted as a Technical Data Package.

3.6.4 Final LNS Database

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for LNS-based**

**LonWorks systems and is included only when the LNS**

**tailoring options is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Submit a Final LNS Database consisting of the complete, fully commissioned

LNS database for the complete control network provided under this

specification. Provide the the entire folder structure of the LNS

database (e.g. c:\Lm\DB\{database name}. For versions of LNS which use

credits, include all device credits in the provided LNS Database.

Submit two copies of the fully commissioned, valid as-built LNS Database

(including all LNS credits) for the complete control network provided

under this specification as a Technical Data Package. Submit each copy on

CD-ROM and clearly mark the CD-ROM identifying it as the LNS Database for

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the work covered under this specification and with the date of the most

recent database modification.

] 3.7 PERFORMANCE VERIFICATION TESTING

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart and its subparts are the PVT**

**requirements for Navy projects with an Acceptance**

**Engineer and are included only when the NAVY WITH**

**ACCEPTANCE ENGINEER tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

3.7.1 General

PVT testing must demonstrate compliance of controls work with contract

document requirements and must be performed by the Controls Contractor and

Equipment Suppliers.

3.7.2 Performance Verification Testing and Commissioning

PVT testing is a Government quality assurance function that includes

systems trending and field tests. Commissioning is a quality control

function that is the Commissioning Team’s responsibility to the extent

required by this contract.

3.7.3 Performance Verification Testing of Equipment with Packaged Controls

Controls Contractor and Equipment Supplier(s) must share and coordinate

PVT testing responsibilities for equipment provided with on-board factory

packaged controls such as boiler controllers, dedicated outside air

systems (DOAS’s), and packaged pumping systems.

3.7.3.1 Controls Contractor Responsibilities

The Controls Contractor must provide a PVT Plan separate from Equipment

Supplier’s performance verification testing plan, perform endurance

testing, and perform PVT testing concurrent with Equipment Suppliers’

testing for equipment provided with on-board factory packaged controls to

demonstrate the following:

a. Equipment enabling and disabling.

b. Equipment standard and optional control points necessary to accomplish

functionality regardless if specified in contract documents or not.

c. Equipment standard and optional alarms critical to safe operation

regardless if specified in contract documents or not.

d. All control points added by Controls Contractor in addition to onboard

factory packaged controls regardless if specified in contract

documents or not.

Refer to paragraphs titled “Performance Verification Test Plan” and

“Endurance Testing” for additional information.

3.7.3.2 Equipment Supplier Responsibilities

Each Equipment Supplier must provide PVT Plans separate from Controls

Contractor’s plans and perform PVT testing concurrent with Controls

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Contractor’s testing for their equipment provided with on-board factory

packaged controls to demonstrate the following:

a. Equipment standard and optional control features necessary to

accomplish functionality regardless if specified in contract documents

or not.

b. Equipment standard and optional operation modes necessary to

accomplish functionality regardless if specified in contract documents

or not.

c. Equipment standard and optional alarm conditions for safe operation

regardless if specified in contract documents or not.

Refer to all paragraphs under paragraph titled “Performance Verification

Testing” except for section titled “Endurance Testing” for additional

information.

3.7.4 Sequencing of Performance Verification Testing Activities

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: For items 17, 18 and 19, consult PM to**

**determine if project requires Endurance Testing and**

**Performance Verification Testing within 10 months of**

**beneficial occupancy.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

PVT activities must be sequenced with major activities listed below for

Test and Balance (TAB) Contractor, Equipment Suppliers, Commissioning

Specialists, and others to demonstrate fully functioning systems. Major

activities as applicable to this contract must be sequenced as indicated

in TABLE II: SEQUENCING OF PVT TESTING ACTIVITIES

TABLE II: SEQUENCING OF PVT TESTING ACTIVITIES

SEQUENCE ITEM

1 Submission, review, and approval of Control Contractors PVT Plans.

2 Submission, review, and approval of Equipment Suppliers PVT Plans.

3 Submission, review, and approval of certified final Test and Balance

Report.

4 Conduct endurance testing.

5 Submission, review, and approval of all of the Commissioning

Specialists completed functional performance tests.

6 Submission, review, and approval of endurance testing.

7 Request Contracting Officer to allow beginning of Government-witnessed

PVT testing.

8 Contracting Officers approval to begin PVT testing.

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TABLE II: SEQUENCING OF PVT TESTING ACTIVITIES

SEQUENCE ITEM

9 Conduct PVT field work.

10 Governments verbal approval of PVT field work for all systems.

11 Conduct Test and Balance verification field work.

12 Governments written approval of Test and Balance verification field

work.

13 Governments written approval of PVT field work for all systems.

14 Facility acceptance recommendation.

15 Submission, review, and approval of Control Contractors PVT Report.

16 Submission, review, and approval of Equipment Suppliers PVT Report.

17 Conduct endurance testing within 10 months of beneficial occupancy.

18 Submission, review, and approval of endurance testing within 10 months of

beneficial occupancy.

19 Conduct PVT field work within 10 months of beneficial occupancy.

3.7.4.1 PVT Testing for Multi-Phase Construction

For air moving systems except outside air systems serving multiple phases,

all major activities listed in TABLE II through Government’s verbal

approval of Test and Balance verification field work can be completed by

phase if all ductwork construction is completed for that phase.

For primary systems such as chilled water systems, HVAC heating hot water

systems, and outside air systems serving multiple phases, all major

activities listed listed in TABLE II through Government’s verbal approval

of Test and Balance verification field work for all air moving systems

served by that primary system for that phase must be completed prior to

conducting PVT field work for that primary system.

3.7.5 Control Contractor's Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed control systems testing in this

contract for approval prior to its use. Develop and use a single PVT Plan

for each system with a unique control sequence. Systems sharing an

identical control sequence can be tested using copies of the PVT Plan

intended for these systems.

PVT Plans must include system-based, step-by-step test methods

demonstrating system performs in accordance with contract document

requirements. The Government may provide sample PVT Plans upon request.

PVT Plans must include the following:

a. Control sequences from contract documents segmented such that each

control algorithm, operation mode, and alarm condition is immediately

followed by numbered test methods required to initiate a response,

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expected response, space for comments, and “pass" or "fail” indication

for each expected response.

b. PVT Plans with control sequences from contract documents that are not

segmented into parts will not be accepted.

c. Indication where assisting personnel are required such as Mechanical

Contractor.

d. Signature and date lines for the Contractor's PVT administrator,

Contractor's quality assurance representative, and Contracting

Officer's representative acknowledging completion of testing.

3.7.6 Performance Verification Testing Sample Size

PVT testing sample sizes will be as follows:

a. 100-Percent of the following systems:

(1) primary systems including, but not limited to, chilled water and

HVAC heating hot water systems

(2) air handling unit systems including all associated fans except

for remote exhaust air fans

(3) DOAS’s including all associated fans except for remote exhaust

air fans

b. 20-Percent of each set of systems with a shared identical control

sequence for systems such as:

(1) air terminal units

(2) exhaust air fans

(3) terminal equipment such as fan coil units and unit heaters

3.7.6.1 Selection of Systems to Test

For sample sets less than 100-percent, the Government will choose which

systems will be tested. The Government may require additional testing if

previous testing results are inconsistent or demonstrate improper system

control as follows:

a. An additional 25-percent after five-percent failure rate of first

sample set.

b. 100-percent after any failures occurring in additional sample set.

3.7.7 Conducting Performance Verification Testing

At least 15 days prior to preferred test date, request the Contracting

Officer to allow the beginning of Government-witnessed PVT testing.

Provide an estimated time table required to perform testing of each

system. Furnish personnel, equipment, instrumentation, and supplies

necessary to perform all aspects of testing. Testing personnel must be

regularly employed in the testing and calibration of control systems.

After receipt of Contracting Officer’s approval to begin testing, perform

PVT testing using project's as-built (shop) control system drawings,

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project's design drawings, and approved PVT Plans.

During testing, identify deficiencies that do not meet contract document

requirements. Deficiencies must be investigated, corrected with

corrections documented, and re-tested at a later date following procedures

for the initial PVT testing. The Government may require re-testing of any

control system components affected by the original failed test.

3.7.8 Endurance Testing

3.7.8.1 General

Conduct endurance testing for each system subject to PVT testing beginning

when indicated in “Sequencing of Performance Verification Testing

Activities”. Systems must be operating as normally anticipated during

occupancy throughout endurance testing.

3.7.8.2 Hardware

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Select “Use hardware provided in this**

**contract for testing.” only when a workstation is**

**provided in this scope of work.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

[Use hardware provided in this contract for testing.] [Use Government

furnished hardware for testing if available when endurance testing

begins. If unavailable, the Contractor must provide suitable hardware for

required testing.]

If insufficient buffer capacity exists to trend the entire endurance test,

upload trend data during the course of endurance testing to ensure all

trend data is retained. Lost trend data will require retesting of all

control points for affected system(s).

3.7.8.3 Endurance Testing Results Format

Submit endurance testing results for each tested system in a graphical

format complete with clear indication of value(s) for y-axis, value for

x-axis, and legend identifying each trended control point. The number of

control points contained on a single graph must be such that all control

points can be clearly visible. Control points must be logically grouped

such that related points appear on a single graph. In addition, submit a

separate comma separated value (CSV) file of raw trend data for each

trended system. Each trended control point in CSV file must be clearly

identified.

For control points recorded based on change of value, change of value for

recording data must be clearly identified for each control point.

3.7.8.4 Endurance Testing Start, Duration, and Frequency

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Select duration and frequency of data**

**collection.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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Trending of all control points for a given system must start at an

identical date and time regardless of the basis of data collection.

Duration of all endurance tests must be at least [one-week][\_\_\_\_\_].

Unless specified otherwise for control points recorded based on time,

frequency of data collection must be [15-minutes] [\_\_\_\_\_]. Frequency of

data collection for specific types of control points is as follows:

3.7.8.4.1 Points Trended at One Minute Intervals

a. Temperature for supply air, return air, mixed air, supply water, and

return water

b. Temperature for outside air, supply air, return air and exhaust air

entering and leaving energy recovery device

c. Flow for supply air, return air, outside air, chilled water, and HVAC

heating hot water

d. Flow for exhaust air associated with energy recovery

e. Relative humidity for outside air and return air

f. Relative humidity for outside air, supply air, return air and exhaust

air entering and leaving energy recovery device

g. Command and status for control dampers and control valves

h. Speed for fans and pumps

i. Pressure for fans and pumps

3.7.8.4.2 Points Trended at 15 Minute Intervals

a. Temperature and relative humidity for zones

b. Temperature and relative humidity for outside air not associated with

energy recovery

c. Command and status for equipment

d. Pressure relative to the outside for facility

3.7.8.5 Trended Control Points

Trended control points for each system must demonstrate each system

performs in accordance with contract document requirements. Trended

control points must include, but not be limited to, control points listed

in contract document points list.

Minimum control points that are required to be trended for selected

systems are listed below. These control points must be trended as

applicable to this contract in addition to control points necessary to

demonstrate systems perform in accordance with contract document

requirements and those listed in contract document’s points list.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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**NOTE: Delete systems below if certain they are not**

**in this project. If uncertain, then keep.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

[3.7.8.5.1 Air-Cooled Chiller Chilled Water System.

a. Chiller(s) command and status

b. Chiller isolation valve(s) command and status

c. Chilled water pump(s) actual speed

d. Chilled water pump(s) setpoint and actual differential pressure

e. Minimum flow bypass control valve command

f. Minimum system flow setpoint and actual flow

g. Chilled water supply setpoint and actual temperature

h. Chilled water return actual temperature

i. Chilled water actual flow

j. Outside air actual dry-bulb temperature

][3.7.8.5.2 HVAC Heating Hot Water System with Boiler.

a. Boiler(s) command and status

b. Boiler(s) isolation valve command and status

c. HVAC heating hot water pump(s) actual speed

d. HVAC heating hot water pump(s) setpoint and actual differential

pressure

e. Minimum flow bypass control valve command

f. Minimum system setpoint and actual flow

g. HVAC heating hot water supply setpoint and actual temperature

h. HVAC heating hot water return actual temperature

i. HVAC heating hot water actual flow

j. Outside air actual dry-bulb temperature

][3.7.8.5.3 HVAC Heating Hot Water System with Steam-to-Hot Water Heat

Exchanger.

a. Steam control valve(s) command

b. Heat exchanger isolation valve(s) command and status

c. HVAC heating hot water pump(s) actual speed

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d. HVAC heating hot water pump(s) setpoint and actual differential

pressure

e. Minimum flow bypass control valve command

f. Minimum system setpoint and actual flow

g. HVAC heating hot water supply setpoint and actual temperature

h. HVAC heating hot water return actual temperature

i. HVAC heating hot water actual flow

j. Outside air actual dry-bulb temperature

][3.7.8.5.4 Air Handling Unit with Relief Air Fan

a. Outside air actual dry-bulb temperature

b. Outside air actual relative humidity

c. Outside air setpoint and actual airflow

d. Minimum outside air control damper command

e. Economizer outside air control damper command

f. Facility setpoint and actual relative pressure

g. Return air actual dry-bulb temperature

h. Return air actual relative humidity

i. Return air control damper command

j. Relief air control damper command

h. Relief air fan actual speed

i. Mixed air setpoint and setpoint and actual temperature

j. Preheat coil leaving air setpoint and actual temperature

k. Preheat coil control actuator command

l. Cooling coil leaving air setpoint and actual temperature

m. Cooling coil control valve command

n. Supply air fan actual speed

o. Discharge air actual temperature

p. Supply air fan setpoint and actual static pressure

][3.7.8.5.5 Dedicated Outside Air System (DOAS)

a. Outside air actual dry-bulb temperature

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b. Outside air actual relative humidity

c. Outside air isolation damper command and status

d. Outside air setpoint and actual airflow

e. Energy recovery wheel command, status, and actual speed

f. Energy recovery wheel’s OA bypass control damper command and status

g. Energy recovery wheel’s defrost cycle command and status

h. Energy recovery wheel’s OA discharge air actual dry-bulb temperature

i. Energy recovery wheel’s OA discharge air actual relative humidity

j. Preheat coil leaving air setpoint and actual temperature

h. Preheat coil control actuator command

i. Cooling coil leaving air setpoint and actual temperature

j. Cooling coil control valve command

k. Supply air fan actual speed

l. Reheat coil control valve command

m. Discharge air setpoint and actual temperature

n. Supply air fan setpoint and actual static pressure

o. Facility setpoint and actual relative pressure

p. Return air actual dry-bulb temperature

q. Return air actual relative humidity

r. Energy recovery wheel’s EA bypass control damper command and status

s. Energy recovery wheel’s EA discharge air actual dry-bulb temperature

t. Energy recovery wheel’s EA discharge air actual relative humidity

u. Exhaust air fan actual speed

v. Exhaust air isolation damper command and status

][3.7.8.5.6 Series Fan-Powered Supply Air Terminal Units

a. Zone setpoint and actual dry-bulb temperature

b. Zone actual relative humidity

c. Control damper command

d. Fan command and status

e. Heating coil valve command

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f. Airflow actual value

g. Leaving air actual temperature

]3.7.8.6 Endurance Testing Sample Size

Endurance Testing sample sizes ware as follows:

a. 100-Percent of the following systems:

(1) primary systems including, but not limited to, chilled water and

HVAC heating hot water systems

(2) air handling unit systems including all associated fans except

for remote exhaust air fans

(3) DOAS’s including all associated fans except for remote exhaust

air fans

b. 20-Percent of each set of systems with a shared identical control

sequence for systems such as:

(1) air terminal units

(2) exhaust air fans

(3) terminal equipment such as fan coil units and unit heaters

3.7.8.6.1 Selection of Systems to Test

For sample sets less than 100-percent, the Government will choose which

systems will be tested. The Government may require additional testing if

previous testing results are inconsistent or demonstrate improper system

control as follows:

a. An additional 25-percent after five-percent failure rate of first

sample set.

b. 100-percent after any failures occurring in additional sample set.

3.7.9 Performance Verification Test Report

Submit a PVT Report after receiving Government’s written approval of PVT

field work that is intended to document test results and final control

system sequences and settings prior to turnover. The PVT Report must

contain the following:

a. Executive summary that briefly discusses results of each system’s

endurance testing and PVT testing and conclusions for each system.

b. Endurance testing for each system.

c. Completed PVT Plan for each system used during testing that includes

hand written field notes and participant signatures.

d. Blank PVT Plan for each system approved prior to testing that is

edited to reflect changes occurring during testing. Edits must be

typed and must reflect changes to control sequences from contract

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documents, must reflect changes to numbered test methods required to

initiate a response, and must reflect changes to expected response.

Only one blank PVT Plan is required for each set of systems sharing an

identical control sequence, such as air terminal units, exhaust air

fans, fan coil units and unit heaters.

e. Written certification that the installation and testing of all systems

are complete and meet all contract document requirements.

3.8 FINAL LNS DATABASE

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: This subpart is required only for LNS-based**

**LonWorks systems and is included only when the LNS**

**tailoring option is selected.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Submit a Final LNS Database consisting of the complete, fully commissioned

LNS database for the complete control network provided under this

specification. Provide the the entire folder structure of the LNS

database (e.g. c:\Lm\DB\{database name}. For versions of LNS which use

credits, include all device credits in the provided LNS Database.

Submit two copies of the fully commissioned, valid as-built LNS Database

(including all LNS credits) for the complete control network provided

under this specification as a Technical Data Package. Submit each copy on

CD-ROM and clearly mark the CD-ROM identifying it as the LNS Database for

the work covered under this specification and with the date of the most

recent database modification.

3.9 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

Provide HVAC control System Operation and Maintenance Instructions which

include:

a. "Data Package 3" as indicated in Section 01 78 23 OPERATION AND

MAINTENANCE DATA for each piece of control equipment.

b. "Data Package 4" as described in Section 01 78 23 OPERATION AND

MAINTENANCE DATA for all air compressors.

c. HVAC control system sequences of operation formatted as indicated.

d. Procedures for the HVAC system start-up, operation and shut-down

including the manufacturer's supplied procedures for each piece of

equipment, and procedures for the overall HVAC system.

e. As-built HVAC control system detail drawings formatted as indicated.

f. Routine maintenance checklist. Provide the routine maintenance

checklist arranged in a columnar format, where the first column lists

all installed devices, the second column states the maintenance

activity or that no maintenance required, the third column states the

frequency of the maintenance activity, and the fourth column is used

for additional comments or reference.

g. Qualified service organization list, including at a minimum company

name, contact name and phone number.

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h. Start-Up Testing Report.

i. Performance Verification Test (PVT) Procedures and Report.

Submit [2] [\_\_\_\_\_] copies of the Operation and Maintenance Instructions,

indexed and in booklet form. The Operation and Maintenance Instructions

may be submitted as a Technical Data Package.

[3.10 MAINTENANCE AND SERVICE

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: The maintenance and service to be provided by**

**the Contractor for the duration of the maintenance**

**contract is specified in this paragraph. The**

**Maintenance and Service may need to be a separate**

**bid item funded by O&M funds.**

**Requirements should be coordinated with "WARRANTY**

**MANAGEMENT" in Section 01 78 00 CLOSEOUT SUBMITTALS**

**If not requiring 1 year maintenance and service,**

**delete this subpart. Most Navy projects will not**

**use this requirement.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide services, materials and equipment as necessary to maintain the

entire system in an operational state as indicated for a period of one year

after successful completion and acceptance of the Performance Verification

Test. Minimize impacts on facility operations.

a. The integration of the system specified in this section into a Utility

Monitoring and Control System must not, of itself, void the warranty

or otherwise alter the requirement for the one year maintenance and

service period. Integration into a UMCS includes but is not limited

to establishing communication between devices in the control system

and the front end or devices in another system.

b. The changing of configuration properties must not, of itself, void the

warranty or otherwise alter the requirement for the one year

maintenance and service period.

3.10.1 Description of Work

Provide adjustment and repair of the system including the manufacturer's

required sensor and actuator (including transducer) calibration, span and

range adjustment.

3.10.2 Personnel

Use only service personnel qualified to accomplish work promptly and

satisfactorily. Advise the Government in writing of the name of the

designated service representative, and of any changes in personnel.

3.10.3 Scheduled Inspections

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Indicate when inspections are to be scheduled.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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Perform two inspections at six-month intervals and provide work required.

Perform inspections in [June and December][\_\_\_\_\_]. During each inspection

perform the indicated tasks:

a. Perform visual checks and operational tests of equipment.

b. Clean control system equipment including interior and exterior

surfaces.

c. Check and calibrate each field device. Check and calibrate 50 percent

of the total analog inputs and outputs during the first inspection.

Check and calibrate the remaining 50 percent of the analog inputs and

outputs during the second major inspection. Certify analog test

instrumentation accuracy to be twice the specified accuracy of the

device being calibrated. Randomly check at least 25 percent of all

binary inputs and outputs for proper operation during the first

inspection. Randomly check at least 25 percent of the remaining

binary inputs and outputs during the second inspection. If more than

20 percent of checked inputs or outputs failed the calibration check

during any inspection, check and recalibrate all inputs and outputs

during that inspection.

d. Run system software diagnostics and correct diagnosed problems.

e. Resolve any previous outstanding problems.

3.10.4 Scheduled Work

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Include bracketed text to accept default work**

**times or indicate permissible work times in the**

**space provided.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

This work must be performed [during regular working hours, Monday through

Friday, excluding Federal holidays][\_\_\_\_\_].

3.10.5 Emergency Service

The Government will initiate service calls when the system is not

functioning properly. Qualified personnel must be available to provide

service to the system. A telephone number where the service supervisor

can be reached at all times must be provided. Service personnel must be

at the site within 24 hours after receiving a request for service. The

control system must be restored to proper operating condition as required

per Section 01 78 00 CLOSEOUT SUBMITTALS.

3.10.6 Operation

After performing scheduled adjustments and repairs, verify control system

operation as demonstrated by the applicable tests of the performance

verification test.

3.10.7 Records and Logs

Keep dated records and logs of each task, with cumulative records for each

major component, and for the complete system chronologically. Maintain a

continuous log for all devices, including initial analog span and zero

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calibration values and digital points. Keep complete logs and provide

logs for inspection onsite, demonstrating that planned and systematic

adjustments and repairs have been accomplished for the control system.

3.10.8 Work Requests

Record each service call request as received and include its location,

date and time the call was received, nature of trouble, names of the

service personnel assigned to the task, instructions describing what has

to be done, the amount and nature of the materials to be used, the time

and date work started, and the time and date of completion. Submit a

record of the work performed within 5 days after work is accomplished.

3.10.9 System Modifications

Submit recommendations for system modification in writing. Do not make

system modifications, including operating parameters and control settings,

without prior approval of the Government.

]3.11 TRAINING

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Training requirements should be coordinated**

**with the relevant shop organization at the project**

**site. Extent of training should be based on the**

**needs of the installation personnel.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Conduct a training course for [\_\_\_\_\_] operating staff members designated

by the Government in the maintenance and operation of the system,

including specified hardware and software. Conduct [32] [\_\_\_\_\_] hours of

training at the project site within 30 days after successful completion of

the performance verification test. The Government reserves the right to

make audio and visual recordings (using Government supplied equipment)of

the training sessions for later use. Provide audiovisual equipment and

other training materials and supplies required to conduct training. A

training day is defined as 8 hours of classroom instruction, including two

15 minute breaks and excluding lunchtime, Monday through Friday, during

the daytime shift in effect at the training facility.

3.11.1 Training Documentation

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Designer must choose appropriate shop**

**supervisor(s) to coordinate training attendance.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Prepare training documentation consisting of:

a. Course Attendee List: Develop the list of course attendees in

coordination with and signed by the [Controls][HVAC][Electrical] shop

supervisor.

b. Training Manuals: Provide training manuals which include an agenda,

defined objectives for each lesson, and a detailed description of the

subject matter for each lesson. When presenting portions of the

course material by audiovisuals, deliver copies of those audiovisuals

as a part of the printed training manuals.

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3.11.2 Training Course Content

For guidance in planning the required instruction, assume that attendees

will have a high school education, and are familiar with HVAC systems.

During the training course, cover all of the material contained in the

Operating and Maintenance Instructions, the layout and location of each

controller enclosure, the layout of one of each type of equipment and the

locations of each, the location of each control device external to the

panels, the location of the compressed air station, preventive

maintenance, troubleshooting, diagnostics, calibration, adjustment,

commissioning, tuning, and repair procedures. Typical systems and similar

systems may be treated as a group, with instruction on the physical layout

of one such system. Present the results of the performance verification

test and the Start-Up Testing Report as benchmarks of HVAC control system

performance by which to measure operation and maintenance effectiveness.

3.11.3 Training Documentation Submittal Requirements

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**NOTE: Indicate number of additional copies of**

**training material required.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Submit hardcopy training manuals and all training materials on CD-ROM.

Provide one hardcopy manual for each trainee on the Course Attendee List

and [2][\_\_\_\_\_] additional copies for archive at the project site. Provide

[2][\_\_\_\_\_] copies of the Course Attendee List with the archival copies.

Training Documentation may be submitted as a Technical Data Package.

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**APPENDIX A**

**QC CHECKLIST FOR LNS-BASED LONWORKS SYSTEMS**

This checklist is not all-inclusive of the requirements of this specification and

should not be interpreted as such.

Instructions: Initial each item in the space provided (|\_\_\_\_|) verifying that the

requirement has been met.

This checklist is for (circle one:)

Pre-Construction QC Checklist Submittal

Post-Construction QC Checklist Submittal

Close-out QC Checklist Submittal

Items verified for Pre-Construction, Post-Construction and Closeout QC Checklist

Submittals:

1 All DDC Hardware is numbered on Control System Schematic Drawings. |\_\_\_\_|

2 Signal lines on Control System Schematic are labeled with the signal type. |\_\_\_\_|

3 Local Display Panel (LDP) Locations are shown on Control System Schematic

drawings.

|\_\_\_\_|

Items verified for Post-Construction and Closeout QC Checklist Submittals:

4 All sequences are performed as specified using DDC Hardware. |\_\_\_\_|

5 Training schedule and course attendee list has been developed and

coordinated with shops and submitted.

|\_\_\_\_|

6 All DDC Hardware is installed on a TP/FT-10 Channel. |\_\_\_\_|

7 All Application Specific Controllers (ASCs) are LonMark certified. |\_\_\_\_|

8 Communication between DDC Hardware is only via CEA-709.1-D using SNVTs.

Other protocols have not been used. Network variables other than SNVTs

have not been used.

|\_\_\_\_|

9 Explicit messaging has not been used. |\_\_\_\_|

10 Scheduling is performed in DDC Hardware meeting the Simple Schedule

Functional Profile

|\_\_\_\_|

Items verified for Closeout QC Checklist Submittal:

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**QC CHECKLIST FOR LNS-BASED LONWORKS SYSTEMS**

11 Final As-built Drawings, including all Points Schedule drawings,

accurately represent the final installed system.

|\_\_\_\_|

12 Programming software has been submitted for all programmable controllers. |\_\_\_\_|

13 All software has been licensed to the Government.

14 O&M Instructions have been completed and submitted. |\_\_\_\_|

15 Training course has been completed. |\_\_\_\_|

16 LonWorks Network Services (LNS) Database is up-to-date and accurately

represents the final installed system.

|\_\_\_\_|

17 LNS Plug-ins have been submitted for all Application Specific Controllers

(ASCs).

|\_\_\_\_|

18 Programming software has been submitted for all General Purpose

Programmable Controllers (GPPCs) and all Application Generic Controllers

(AGCs).

|\_\_\_\_|

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(QC Representative Signature) (Date)

**QC CHECKLIST FOR NIAGARA FRAMEWORK BASED LONWORKS SYSTEMS**

This checklist is not all-inclusive of the requirements of this specification and

should not be interpreted as such.

Instructions: Initial each item in the space provided (|\_\_\_\_|) verifying that the

requirement has been met.

This checklist is for (circle one:)

Pre-Construction QC Checklist Submittal

Post-Construction QC Checklist Submittal

Close-out QC Checklist Submittal

Items verified for Pre-Construction, Post-Construction and Closeout QC Checklist

Submittals:

1 All DDC Hardware is numbered on Control System Schematic Drawings. |\_\_\_\_|

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**QC CHECKLIST FOR NIAGARA FRAMEWORK BASED LONWORKS SYSTEMS**

2 Signal lines on Control System Schematic are labeled with the signal type. |\_\_\_\_|

3 Local Display Panel (LDP) Locations are shown on Control System Schematic

drawings.

|\_\_\_\_|

Items verified for Post-Construction and Closeout QC Checklist Submittals:

4 All sequences are performed as specified using DDC Hardware. |\_\_\_\_|

5 Training schedule and course attendee list has been developed and

coordinated with shops and submitted.

|\_\_\_\_|

6 All DDC Hardware except Niagara Framework Supervisory Gateways is

installed on a TP/FT-10 Channel.

|\_\_\_\_|

7 All Application Specific Controllers (ASCs) are LonMark certified. |\_\_\_\_|

8 Except for communication between two Niagara Framework Supervisory

Gateways, Communication between DDC Hardware is only via CEA-709.1-D

using SNVTs. Other protocols have not been used. Network variables

other than SNVTs have not been used. Communication between Niagara

Framework Supervisory Gateways is via Fox Protocol.

|\_\_\_\_|

9 Explicit messaging has not been used. |\_\_\_\_|

10 Scheduling is performed in Niagara Framework Supervisory Gateways. |\_\_\_\_|

Items verified for Closeout QC Checklist Submittal:

11 Final As-built Drawings, including all Points Schedule drawings,

accurately represent the final installed system.

|\_\_\_\_|

12 Programming software has been submitted for all programmable controllers. |\_\_\_\_|

13 All software has been licensed to the Government.

14 O&M Instructions have been completed and submitted. |\_\_\_\_|

15 Training course has been completed. |\_\_\_\_|

16 The database in each Niagara Framework Supervisory Gateway is up-to-date

and accurately represents the building control network beneath that

Niagara Framework Supervisory Gateway.

|\_\_\_\_|

17 Niagara Wizards have been submitted for all Application Specific

Controllers (ASCs) for which a Wizard is available and for all

Application Generic Controllers (AGCs).

|\_\_\_\_|

18 Programming software has been submitted for all General Purpose

Programmable Controllers (GPPCs) and all Application Generic Controllers

(AGCs).

|\_\_\_\_|

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**QC CHECKLIST FOR NIAGARA FRAMEWORK BASED LONWORKS SYSTEMS**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(QC Representative Signature) (Date)

**QC CHECKLIST FOR BACNET SYSTEMS**

This checklist is not all-inclusive of the requirements of this specification and

should not be interpreted as such.

Instructions: Initial each item in the space provided (|\_\_\_\_|) verifying that the

requirement has been met.

This checklist is for (circle one:)

Pre-Construction QC Checklist Submittal

Post-Construction QC Checklist Submittal

Close-out QC Checklist Submittal

Items verified for Pre-Construction, Post-Construction and Closeout QC Checklist

Submittals:

1 All DDC Hardware is numbered on Control System Schematic Drawings. |\_\_\_\_|

2 Signal lines on Control System Schematic are labeled with the signal type. |\_\_\_\_|

3 Local Display Panel (LDP) Locations are shown on Control System Schematic

drawings.

|\_\_\_\_|

Items verified for Post-Construction and Closeout QC Checklist Submittals:

4 All sequences are performed as specified using DDC Hardware. |\_\_\_\_|

5 Training schedule and course attendee list has been developed and

coordinated with shops and submitted.

|\_\_\_\_|

Items verified for Closeout QC Checklist Submittal:

6 Final As-built Drawings, including all Points Schedule drawings,

accurately represent the final installed system.

|\_\_\_\_|

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**QC CHECKLIST FOR BACNET SYSTEMS**

7 Programming software has been submitted for all programmable controllers. |\_\_\_\_|

8 All software has been licensed to the Government.

9 O&M Instructions have been completed and submitted. |\_\_\_\_|

10 Training course has been completed. |\_\_\_\_|

11 All DDC Hardware is installed on a BACnet ASHRAE 135 network using either

MS/TP in accordance with Clause 9 or IP in accordance with Annex J.

|\_\_\_\_|

12 All DDC Hardware is BTL listed. |\_\_\_\_|

13 Communication between DDC Hardware is only via BACnet using standard

services, except as specifically permitted by the specification.

Non-standard services have been fully documented in the DDC Hardware

Schedule.

|\_\_\_\_|

14 Scheduling, Alarming, and Trending have been implemented using the

standard BACnet Objects for these functions.

|\_\_\_\_|

15 All Properties indicated as required to be Writable are Writable and

Overrides have been provided as indicated

|\_\_\_\_|

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(QC Representative Signature) (Date)

**QC CHECKLIST FOR NIAGARA FRAMEWORK BASED BACNET SYSTEMS**

This checklist is not all-inclusive of the requirements of this specification and

should not be interpreted as such.

Instructions: Initial each item in the space provided (|\_\_\_\_|) verifying that the

requirement has been met.

This checklist is for (circle one:)

Pre-Construction QC Checklist Submittal

Post-Construction QC Checklist Submittal

Close-out QC Checklist Submittal

Items verified for Pre-Construction, Post-Construction and Closeout QC Checklist

Submittals:

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**QC CHECKLIST FOR NIAGARA FRAMEWORK BASED BACNET SYSTEMS**

1 All DDC Hardware is numbered on Control System Schematic Drawings. |\_\_\_\_|

2 Signal lines on Control System Schematic are labeled with the signal type. |\_\_\_\_|

3 Local Display Panel (LDP) Locations are shown on Control System Schematic

drawings.

|\_\_\_\_|

Items verified for Post-Construction and Closeout QC Checklist Submittals:

4 All sequences are performed as specified using DDC Hardware. |\_\_\_\_|

5 Training schedule and course attendee list has been developed and

coordinated with shops and submitted.

|\_\_\_\_|

Items verified for Closeout QC Checklist Submittal:

6 Final As-built Drawings, including all Points Schedule drawings,

accurately represent the final installed system.

|\_\_\_\_|

7 Programming software has been submitted for all programmable controllers. |\_\_\_\_|

8 All software has been licensed to the Government.

9 O&M Instructions have been completed and submitted. |\_\_\_\_|

10 Training course has been completed. |\_\_\_\_|

11 All DDC Hardware is installed on a BACnet ASHRAE 135 network using either

MS/TP in accordance with Clause 9 or IP in accordance with Annex J.

|\_\_\_\_|

12 All DDC Hardware is BTL listed. |\_\_\_\_|

13 Communication between DDC Hardware is only via BACnet using standard

services, except as specifically permitted by the specification.

Non-standard services have been fully documented in the DDC Hardware

Schedule.

|\_\_\_\_|

14 Scheduling, Alarming, and Trending have been implemented using Niagara

Framework objects and services, and BACnet Instrinsic Alarming as

indicated.

|\_\_\_\_|

15 All Properties indicated as required to be Writable are Writable and

Overrides have been provided as indicated

|\_\_\_\_|

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(QC Representative Signature) (Date)

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-- End of Section --

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