Energy Performance Contract

SUMMARY OF WORK: The following summarizes the Work to be provided by JCI under this Agreement, as further defined below:

FIM 1 Lighting – Fixture Retrofit
FIM 2 Lighting – Fixture Controls
FIM 3 Building Envelope Improvements – Weatherization
FIM 4 Energy Management System Upgrade and Re-Commissioning
FIM 5 Steam Distribution System – Steam Traps Replacement
FIM 6 Heating Distribution System - Pipe and Valve Insulation
FIM 7 Heating System Upgrade - Boiler Replacement
FIM 8 Heating System Upgrade - Boiler Controllers
FIM 9 Domestic Hot Water System Upgrade – High Efficiency Hot Water Heaters
FIM 10 Building Envelope Improvements – Window Replacement
FIM 11 Building Envelope Improvements - Window Film
FIM 12 Building Envelope Improvements – Wall and Attic Insulation
FIM 13 Air Handling Unit Upgrade - VFDs on Fans
FIM 14 VFDs on Hot Water Pumps
FIM 15 Computer Power Management System
FIM 16 Water Valve Controllers
FIM 17 Vending Machine Controllers
FIM 18 Renewable Energy - Photovoltaic Electric Generation
FIM 19 Chiller Replacement
FIM 20 Motorized Pool Cover
FIM 21 Renewable Energy - Wind Power Generation
FIM 22 New wireless Clocks
FIM 23 Block Heater Timers
FIM 24 Waste Oil Heater
FIM 25 Synchronous Belts
FIM 26 Heat Reclaiming System
FIM 27 Install High Efficiency Transformers

FIM 1 Lighting – Fixture Retrofit:

A complete listing of the proposed fixture replacements and relamp/reballast retrofits is included in the detailed lighting survey shown in the appendix (Attachment A).

FIM 2 Lighting – Fixture Controls:

A detailed listing of the rooms receiving the occupancy sensors and bi-level controls per building is included in the appendix (Attachment A).

FIM 3 Building Envelope Improvements – Weatherization:

Johnson Controls Inc. will provide weather stripping, seal roof top ventilators, lubricate roof top ventilator dampers, seal roof-wall joints and insulate the attic with cellulose as shown in the scope of work below.

Cayuga Elementary

47 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
8 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
34 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 232 linear feet
1 Overhead Doors to be weather-stripped
10 Bulkheads to be sealed
1166' Roof/Wall Joint to be sealed

Chippewa Elementary

46 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
9 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
36 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 236 linear feet
10 Bulkheads to be sealed
1266' Roof Wall Joint to be sealed

Gatelot Elementary

56 Single Commercial Door to be weather-stripped (all previously weather-stripped)
12 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
12 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 72 linear feet

240' Roof Wall Joint to be sealed
18 Wall Vents to be sealed (as specified by Steve Stewart)
650' Ventilated Soffits to be sealed (as specified by Steve Stewart)

Grundy Elementary

45 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
11 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
37 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 228 linear feet
10 Bulkheads to be sealed
1585' Roof/Wall Joint to be sealed

Hiawatha Elementary

52 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
9 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
33 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 216 linear feet
10 Bulkheads to be sealed
1200' Roof/Wall Joint to be sealed

Lynwood Elementary

47 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
10 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
23 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 152 linear feet
10 Bulkheads to be sealed
995' Roof Wall Joint to be sealed

Merrimac Elementary

43 Single Commercial Door to be weather-stripped (all previously weather-stripped)
8 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
34 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 228 linear feet
10 Bulkheads to be sealed
1286' Roof/Wall Joint to be sealed

Nokomis Elementary

47 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
11 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
28 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 152 linear feet
10 Bulkheads to be sealed
1113' Roof/Wall Joint to be sealed

Tamarac Elementary

52 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
8 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
38 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 260 linear feet
10 Bulkheads to be sealed
1123' Roof/Wall Joint to be sealed

Tecumseh Elementary

47 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
9 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
39 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 232 linear feet
10 Bulkheads to be sealed
1209' Roof/Wall Joint to be sealed

Waverly Elementary

46 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
9 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
2 Overhead Doors to be weather-stripped
32 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 196 linear feet
11 Bulkheads to be sealed
1122' Roof/Wall Joint to be sealed
40 Square feet of Attic Bypass to be sealed

Wenonah Elementary

48 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
9 Double Commercial Doors to be weather-stripped (8 previously weather-stripped)
38 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 244 linear feet

10 Bulkheads to be sealed
1145' Roof/Wall Joint to be sealed

Sagamore Middle School

21 Single Commercial Doors to be weather-stripped (13 previously weather-stripped)
22 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
43 Roof Top Ventilators to be opened, perimeter, dampers lubricated, 272 linear feet
1 Overhead Door to be weather-stripped
2350' Roof/Wall Joint to be sealed

Seneca Middle School

25 Single Commercial Door to be weather-stripped (17 previously weather-stripped)
22 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
46 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 316 linear feet
1 Overhead Doors to be weather-stripped
1387' Roof/Wall Joint to be sealed

Sequoya Middle School

8 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
16 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
1 Single Commercial (Roof Access) to be weather-stripped (previously weather-stripped)
86 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 640 linear feet

Samoset Middle School

27 Single Commercial Doors to be weather-stripped (11 previously weather-stripped)
38 Double Commercial Doors to be weather-stripped (19 previously weather-stripped)
69 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 368 linear feet
1101' Roof/Wall Joint to be sealed

East High School

43 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
19 Double Commercial Doors to be weather-stripped (all previously weather-stripped)

9 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 76 linear feet

North High School

12 Single Commercial Doors to be weather-stripped (all previously weather-stripped)
29 Double Commercial Doors to be weather-stripped (all previously weather-stripped)
3 Overhead Doors to be weather-stripped
93 Roof Top Ventilators to be opened, perimeter sealed, dampers lubricated, 624 linear feet
2 Bulkheads to be sealed
1502' Roof/Wall Joint to be sealed

District Office

9 Single Commercial Doors to be weather-stripped (3 previously weather-stripped)
2 Double Commercial Doors to be weather-stripped (all previously weather-stripped)

Administration Building and Grounds

3 Single Commercial Doors to be weather-stripped (0 previously weather-stripped)
1 Single Commercial (Attic Access) Door to be weather-stripped

FIM 4 Energy Management System Upgrade and Re-Commissioning:

Johnson Controls will upgrade the Energy Management System to implement the following measures.

- Self Tuning - Boiler Plant Optimization
- Migration to Metasys System Extended Architecture
- Optimal Start
- Elimination of Pneumatic Devices and Air Compressors
- Tying in the proposed new boilers.
- Integration of the Trane/Carrier System with Metasys

	Boiler Plant Optimization - Adaptive Tuning	Metasys Extended Architecture Sytem	Optimal Start (Qty)	Demand Controlled Ventilation	Recommissioning	Air Balancing	Ellimination of Pnuematic Devices & Air Compressors	New Boiler Controls	Integration with other BMS systems
Gatelot Avenue School	x	x	40		x		x		
Samoset MS	x	x	61		x		x		
Sagamore MS	x	x	61	x	x		x		
Hiawatha ES	x	x	52		x		x		
Chippewa ES	x	x	35		x		x		
Wenonah ES	x	x	36		x		x		
Memmac ES	x	x	35		x		x		
Cayuga ES	x	x	43		x		x		
Sachem North HS	x	x	188	x	x		x		
Seneca MS	x	x	62	x	x		x		
Tecumseh ES	x	x	35		x		x		
Tamarac ES	x	x	40		x		x	x	
Sachem HS East	x	x	183	x	x	x			x
Sequoya MS	x	x	145	x	x	x			x
Admin Annex/ Facilities	x	x						x	
Admin/ Union Campus									
Lynwood Ave ES	x	x	36		x		x		
Waverly Ave ES	x	x	37		x		x		
Nokomis ES	x	x	34		x		x		
Grundy Ave ES	x	x	34		x		x	x	

JCI will also provide air balancing and re-commissioning services in certain building as shown in the scope of work below.

1. This scope will include all materials and labor for project management, design engineering (software, programming and graphics), electrical installation, commissioning, and customer training necessary to provide a complete and operating system.
2. The proposed project design and layout is based on using JCI Metasys Extended Architecture BACnet controllers as stated below or N2 controllers as required in order to utilize the existing N2 communication trunk network within the facilities.

<u>Gatelot Elementary</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.

- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet
- Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors

- Verify the operation of control dampers
- Verify operation of control valves
- Replacement of defective devices (no more than 5% of device types)
- Documenting commissioning activities on the applicable checklist

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove pneumatic controls to (3) fan coil units. Install new network thermostat and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (5) fin radiation zones. Furnish new electric actuated control valves to be installed. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 40:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Samoset Middle School</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive
- Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This

enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.

- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install (2) new JCI Network Automation Engine (NAE) supervisory controllers in existing supervisory controller enclosures and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School. Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist

Optimum Start Control of Classroom Unit Ventilators, Quantity of 61:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Outside Air Damper Replacement, Quantity of 3:

- Furnish outside air dampers along with electric actuators for (3) central air handling unit systems as required obtaining low-leakage shutoff. Mechanical installation and any patching of duct insulation will be done.
- Extend wiring to new damper actuator as required.

<u>Sagamore Middle School</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys
- System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central

station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:

- Calibration of space temperature sensors
- Verify the operation of control dampers
- Verify operation of control valves
- Replacement of defective devices (no more than 5% of device types)
- Documenting commissioning activities on the applicable checklist

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (7) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatically actuated control valve and damper actuators for air handling units HV-1, 2, 3, 4, 5 and 6. Install new electric damper actuators for each unit. Furnish and install a total of (14) new electric actuated 3-way control valves for all units. Wire the damper actuators and control valves to the appropriate existing DDC panel.
- Remove pneumatic controls to (13) fan coil units. Install new network thermostat and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (9) fin radiation zones. Furnish and install (15) new electric actuated control valves. Install new network thermostat and wire to associated control valve(s) and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 61:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Outside Air Damper Replacement, Quantity of 3:

- Furnish outside air dampers along with electric actuators for (3) central air handling unit systems as required to obtain low-leakage shutoff. Mechanical installation and any patching of duct insulation will be done by JCI.
- Extend wiring to new damper actuator as required.

Auditorium Air Handling Unit Demand Ventilation, Quantity of 1:

- Install (2) new zone CO2 transmitters to monitor CO2 levels to provide an indication of occupancy in the Auditorium for use in demand controlled ventilation.
- Install (1) new outside air duct mounted CO2 transmitter to monitor outdoor CO2 levels.

- Wire CO2 transmitters to the existing DDC panel for the Auditorium Air Handling Unit.
- Provide programming as required to reset the minimum outside air damper position based on the CO2 levels in the space.

Hiawatha Elementary

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data

communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.

- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist (see sample commissioning documents)

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (1) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (6) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (2) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (1) unit ventilator. Install new DDC controller to monitor all sensors and control system devices. Furnish and install new electric actuated control valve and electric damper actuator. Connect the DDC controller to the existing communication bus in the building.
- Remove pneumatic controls to (8) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 52:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Chippewa Elementary</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.

- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors

- Verify the operation of control dampers
- Verify operation of control valves
- Replacement of defective devices (no more than 5% of device types)
- Documenting commissioning activities on the applicable checklist (see sample commissioning documents)

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (4) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (5) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 35:

- Provide programming as required to implement an optimized warm-up start sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Wenonah Elementary</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist (see sample commissioning documents)

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.

- Remove pneumatic controls to (5) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (3) fin radiation zones. Furnish and install a new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 36:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Merrimac Elementary

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.

- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (1) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (3) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (3) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 35:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Cayuga Elementary

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control

network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:

- Calibration of space temperature sensors
- Verify the operation of control dampers
- Verify operation of control valves
- Replacement of defective devices (no more than 5% of device types)
- Documenting commissioning activities on the applicable checklist

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (4) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (2) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 43:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Sachem North High School</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the

Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Chiller Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Chiller Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components in existing DDC panel enclosure and reconnect existing Chiller Plant field devices to panel.
- The FEC features Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in this school.
- Convert existing database, programming and graphics as required.
- Remove existing PC server and provide new Metasys Extended Application and Data Server (ADX) application software to manage the collection and presentation of data within the Metasys System Extended Architecture. The ADX will manage the long-term storage of trend data, event messages, operator transactions, and system configuration data for measurement and verification activities. As the site director, the ADX provides secure communication to the Network Automation Engines and the existing JCI controllers via the customer's Ethernet. The Metasys user interface of the ADX provides flexible system navigation, user graphics, comprehensive alarm management, and trend analysis and summary reporting capabilities. Via a Web browser, a user is able to efficiently manage occupant comfort and energy usage, quickly respond to critical events, and optimize control strategies. Multiple users can gain access to information from the building automation system that uses Internet protocols and

Information Technology (IT) standards and is compatible with enterprise level communication networks.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable.

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (4) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel. Remove pneumatically actuated control valve and damper actuators for air handling units RTU-8, AHU-B, C, D, E, F, G, H, I, J, K, L, M and N. Install new electric damper actuators for each unit. Furnish and install a total of (15) new electric actuated 3-way control valves for all units. Wire the damper actuators and control valves to the appropriate existing DDC panel.
- Remove pneumatic controls to (6) fan coil units. Install new network thermostat and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (11) fin radiation zones. Furnish and install (21) new electric actuated control valves. Install new network thermostat and wire to associated control valve(s) and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 188:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Outside Air Damper Replacement, Quantity of 12:

Furnish outside air dampers along with electric actuators for (12) central air handling unit systems as required to obtain low-leakage shutoff.

Extend wiring to new damper actuator as required.

Auditorium Air Handling Unit Demand Ventilation, Quantity of 1:

- Install (2) new zone CO2 transmitters to monitor CO2 levels to provide an indication of occupancy in the Auditorium for use in demand controlled ventilation.
- Install (1) new outside air duct mounted CO2 transmitter to monitor outdoor CO2 levels.
- Wire CO2 transmitters to the existing DDC panel for the Auditorium Air Handling Unit.
- Provide programming as required to reset the minimum outside air damper position based on the CO2 levels in the space.

Outside Air Enthalpy Control on Central AHUs, Quantity of 3:

- Install (1) new return air humidity transmitter to determine the return air enthalpy level and wire to the existing air handling unit DDC panel.
- Provide programming as required to modify the sequence of operation for economizer control. When the enthalpy of the outside air is less than the return air, the economizer will act as the initial stage of cooling, working in sequence of the cooling coil.
- The following air handling units will be modified for outside air enthalpy control: AHU-B (Weight Room/Wrestling Room), AHU-C (Locker Rooms) and AHU-N (Little Theatre)

Exhaust Air Heat Reclaim System, Quantity of 1:

- Install system devices to control the operation of two circulating pumps associated with the glycol loop run-around coils for the heat reclaim system.
- Wire the new devices to the nearest DDC panel and modify programming as required.

<u>Seneca Middle School</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the

Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Chiller Replacement, Quantity of 1:

- Remove existing JCI DX9100 DDC panel associated with the chiller plant.
- Install new JCI BACnet Field Equipment Controller (FEC) in a new DDC panel enclosure and wire new Chiller Plant field sensors and control devices to panel.
- Mechanical installation of (3) temperature wells as needed.
- The new chiller shall be furnished with a BACnet MS/TP communication card for connection to the JCI FMS network. The Chiller Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.

- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist (see sample commissioning documents)

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (1) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove pneumatically actuated control valve and damper actuators for air handling units HV-1, 2, 3, 4, 5, 6 and 7. Install new electric damper actuators for each unit. Furnish and install (1) new electric actuated 3- way control valve for each unit. Wire the damper actuators and control valves to the appropriate existing DDC panel.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 62:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.
- **Outside Air Damper Replacement, Quantity of 3:**
- Furnish and install outside air dampers along with electric actuators for (3) central air handling unit systems as required to obtain low-leakage shutoff.
- Extend wiring to new damper actuator as required.

Auditorium Air Handling Unit Demand Ventilation, Quantity of 1:

- Install (2) new zone CO2 transmitters to monitor CO2 levels to provide an indication of occupancy in the Auditorium for use in demand controlled ventilation.
- Install (1) new outside air duct mounted CO2 transmitter to monitor outdoor CO2 levels.
- Wire CO2 transmitters to the existing DDC panel for the Auditorium Air Handling Unit.
- Provide programming as required to reset the minimum outside air damper position based on the CO2 levels in the space.

Outside Air Enthalpy Control on Central AHUs, Quantity of 4:

- Install (1) new return air humidity transmitter to determine the return air enthalpy level and wire to the existing air handling unit DDC panel.

- Provide programming as required to modify the sequence of operation for economizer control. When the enthalpy of the outside air is less than the return air, the economizer will act as the initial stage of cooling, working in sequence of the cooling coil.
- The following air handling units will be modified for outside air enthalpy control: RTU-1A, 2A, 3A and HV-5 (Little Theatre)

Tecumseh Elementary

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc.

will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.

- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist.

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (5) fan coil units. Install new network thermostat and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (4) fin radiation zones. Furnish and install (4) new electric actuated control valves. Install new network thermostat and wire to associated control valve(s) and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 35:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Tamarac Elementary</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-

Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist (see sample commissioning documents)

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (3) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (1) unit ventilator. Install new DDC controller to monitor all sensors and control system devices. Furnish and install new electric actuated control valve and electric damper actuator. Connect the DDC controller to the existing communication bus in the building.
- Remove pneumatic controls to (3) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 40:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Condensing Boilers, Quantity of 2:

- Provide a DDC controller in an enclosure to monitor all sensors and control the system devices. The controls for the new boilers are based on modulating boilers with (2) hot water pumps.
- Mechanical installation of (2) temperature wells.
- Combustion air dampers are not included since it is assumed that combustion air is directly vented from the outdoors to the boiler.
- Boiler room emergency shut-off switches, if required, are furnished and installed.
- Any miscellaneous boiler control devices furnished with the new equipment will be installed and wired.

<u>Sachem East High School – Existing Trane System</u>

Integration of Trane DDC System into Metasys System Extended Architecture:

- Install (2) new JCI Network Automation Engine (NAE) supervisory controllers in the Engineer's office and connect to the existing Trane BCU control network at the site.
- Map approximately 1000 BACnet objects that are currently connected to the Trane BCU's into the NAE's via BACnet IP communication. Any points not connected to the Trane BCU system are not included.

- Provide point-to-point checkout of all the points connected to the Trane BCU system.
- Provide text graphics, trends, schedules and alarms for information into the Metasys System Extended Architecture. Floor plan graphics will still be viewed from the existing Trane Summit front-end PC.
- Provide 4 hours of on-site customer training.
- It is assumed that the existing systems to be integrated are functional and operational. Any work required to modify system programs or repair any system failures shall be the responsibility of the customer.
- As an alternate to the integration of the Trane DDC System, JCI will replace the existing Trane DDC System with a Metasys DDC System

Re-commissioning of the following equipment.

- (35) Air Handling Units
- (1) Chiller with 2 Primary Chilled Water Pumps and 3 Secondary Chilled Water Pumps
- (148) Unit Ventilators
- (58) VAV Boxes
- (2) Fan Coil Units
- (1) Split Air Conditioning Unit
- (5) Unit Heaters
- (33) Cabinet Heaters

Sequoya Middle School – Existing Carrier System

Integration of Carrier DDC System into Metasys System Extended Architecture:

- Install (2) new JCI Network Automation Engine (NAE) supervisory controllers in the Engineer's office and connect to the existing Carrier control network at the site.
- Map approximately 1000 BACnet objects that are currently connected to the Carrier System into the NAE's via BACnet IP communication. Any points not connected to the Carrier system are not included.
- Provide point-to-point checkout of all the points connected to the Carrier system.
- Provide text graphics, trends, schedules and alarms for information into the Metasys System Extended Architecture. Floor plan graphics will still be viewed from the existing Carrier Comfort View front-end PC.
- Provide 4 hours of on-site customer training.
- It is assumed that the existing systems to be integrated are functional and operational. Any work required to modify system programs or repair any system failures shall be the responsibility of the customer.
- As an alternate to the integration of the Carrier DDC System, JCI will replace the existing Carrier DDC System with a Metasys DDC System.

Administration Annex / Facilities

Condensing Boilers, Quantity of 2:

- Provide a DDC controller in an enclosure to monitor all sensors and control the system devices. The controls for the new boilers are based on modulating boilers with (2) hot water pumps.
- Mechanical installation of (2) temperature wells.
- Combustion air dampers are not included since it is assumed that combustion air is directly vented from the outdoors to the boiler.
- Boiler room emergency shut-off switches, if required, are furnished and installed.
- Any miscellaneous boiler control devices furnished with the new equipment will be installed and wired.

Lynwood Ave. Elementary

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each

system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.

- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist. .

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (3) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove pneumatic controls and pneumatically actuated control valve and damper actuators for air handling units HV-1 and 2. Install new electric damper actuators for each unit. Furnish and install a total of (2) new electric actuated 3-way control valves for all units. Wire the damper actuators and control valves to the new DDC panel and wire the new DDC panel to the existing communication bus in the building.
- Remove pneumatic controls to (7) fan coil units. Install new network thermostat and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (10) fin radiation zones. Furnish and install (10) new electric actuated control valves. Install new network thermostat and wire to associated control valve(s) and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 36:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Waverly Ave. Elementary</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents

will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:

- Calibration of space temperature sensors
- Verify the operation of control dampers
- Verify operation of control valves
- Replacement of defective devices (no more than 5% of device types)
- Documenting commissioning activities on the applicable checklist.

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (2) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (3) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatically actuated control valve and damper actuators for air handling units HV-1, 2 and 3. Install new electric damper actuators for each unit. Furnish and install a total of (3) new electric actuated 3-way control valves for all units. Wire the damper actuators and control valves to the appropriate existing DDC panel.
- Remove pneumatic controls to (3) fan coil units. Install new network thermostat and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (5) fin radiation zones. Furnish and install (5) new electric actuated control valves. Install new network thermostat and wire to associated control valve(s) and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 37:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Nokomis Elementary

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM 350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control

network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:

- Calibration of space temperature sensors
- Verify the operation of control dampers
- Verify operation of control valves
- Replacement of defective devices (no more than 5% of device types)

Documenting commissioning activities on the applicable checklist

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (1) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (6) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.
- Remove pneumatic controls to (3) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 34:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

<u>Grundy Ave. Elementary</u>

Boiler Plant Optimization:

- Remove existing JCI DX9100 controller components in the existing Boiler Plant DDC panel.
- Install new JCI BACnet Field Equipment Controller (FEC) components with integral display in existing DDC panel enclosure and reconnect existing Boiler Plant field devices to panel.
- The Boiler Plant optimization is based on the features of the FEC Continuous Adaptive Control with the use of patented Proportional Adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies. It will continuously monitor and adjust tuning parameters based on conditions and handle unmeasured load or process disturbances as well as setpoint changes. The Adaptive Tuning improves stability, dynamic response and accuracy of the control loop thereby minimizing hunting and cycling of loops. In addition, the Auto Tuned Control Loops eliminate change-of-season re-commissioning and reduce wear and tear on mechanical devices.

Metasys System Extended Architecture (MSEA) Migration:

- With the implementation of Boiler Optimization FIM in each school building that has an existing JCI Facility Management System, the existing JCI Metasys N1 Network will be migrated to a new Metasys System Extended Architecture. This enhances the school district's existing investment and provides integration and system migration to a Web-enabled architecture and Web-based user interfaces.
- Remove existing JCI NCM350 supervisory controller components located in the Boiler Room.
- Install new JCI Network Automation Engine (NAE) supervisory controller components in existing Boiler Room enclosure and reconnect existing N2 communication bus to panel.
- Remove existing communication cable and install new CAT5 Ethernet Cable from new NAE to the customer's LAN located in the school's server room for communication to the JCI Server PC located in Sachem North High School.
- Convert existing database, programming and graphics as required.

Re-commissioning of Control Systems:

- Johnson Controls Inc. will provide the services of technically competent and qualified technicians to check out the system operation and document required data while the system in operation. Johnson Controls Inc. will check out each system for function through the entire sequence and will verify proper operation of each item in the sequences of operation, including hardware and software as required. For new equipment installed under this Contract, Johnson Controls Inc. will calibrate field equipment, adjust all parameters and logic (virtual) points including control loops, gain constants and integral constraints and verify data communications before the system is placed on-line. Upon completion of specific commissioning activities, the Project Commissioning Team Leader will transmit the documented commissioning data to the Project Manager.
- For the existing JCI Facility Management System control points within the school building, Johnson Controls Inc. will check each control point within the control network by making a comparison between the control command at the central station and field-controlled device. The existing JCI "as-built" control documents will be utilized for the sequences of operation and control points. This re-commissioning process will include the following:
    - Calibration of space temperature sensors
    - Verify the operation of control dampers
    - Verify operation of control valves
    - Replacement of defective devices (no more than 5% of device types)
    - Documenting commissioning activities on the applicable checklist..

Elimination of Pneumatic Devices and Compressed Air System:

- Remove (1) existing pneumatically actuated combustion air damper actuators and install new electric actuated devices. Wire the actuator to the existing Boiler Plant DDC panel.
- Remove (4) existing pneumatically actuated relief air damper actuators and install new electric actuated devices. Wire the actuator to the appropriate existing DDC panel.

- Remove pneumatic controls to (2) cabinet unit heaters. Install new network thermostat and wire to cabinet unit heater and connect the thermostat to the existing communication bus in the building.
- Remove pneumatic controls to (1) Kitchen H&V units. Install new DDC controller to monitor all sensors and control system devices. Furnish and install new electric actuated control valve and electric damper actuator. Connect the DDC controller to the existing communication bus in the building.
- Remove pneumatic controls to (3) fin radiation zones. Furnish and install new electric actuated control valves. Install new network thermostat and wire to associated control valve and connect the thermostat to the existing communication bus in the building.
- Remove existing air compressor(s) and cap compressed air piping adjacent to air compressor in Mechanical Equipment Room. Existing pneumatic floor cabinets, panels and exposed piping in mechanical rooms to remain.

Optimum Start Control of Classroom Unit Ventilators, Quantity of 34:

- Provide programming as required to implement an optimized warm-up control sequence for unit ventilators in conjunction with occupancy schedules. The warm-up mode will be activated by a network command.

Condensing Boilers, Quantity of 2:

- Provide a DDC controller in an enclosure to monitor all sensors and control the system devices. The controls for the new boilers are based on modulating boilers with (2) hot water pumps.
- Mechanical installation of (2) temperature wells.
- Combustion air dampers are not included since it is assumed that combustion air is directly vented from the outdoors to the boiler.
- Boiler room emergency shut-off switches, if required, are furnished and installed.
- Any miscellaneous boiler control devices furnished with the new equipment will be installed.

Outside Air Damper Replacement, Quantity of 1:

Furnish outside air dampers along with electric actuator for (1) central air handling unit system as required to obtain low-leakage shutoff.

Extend wiring to new damper actuator as required.