EXECUTIVE SUMMARY

The Continuous Commissioning® (CC®) process has been applied to the Bush Academic Facility. It is a three-story building consisting of offices and classrooms, is located on the west campus at Texas A&M University, and is part of the George Bush Library complex. The HVAC system is a dual duct VAV system with pretreated outside air, and incorporates 10 air handling units and three outside air handling units. A Siemens DDC controls system operates the equipment.

CC began in this building on January 12, 2007. As of this report date, 9 of 14 recommended CC measures had been implemented. The CC measures recommended included: 1) shutting down AHUs in unoccupied periods, 2) scheduling exhaust fans off at night, 3) setting cooling minimum flow point to zero for terminal boxes, 4) resetting terminal box total minimum flow during unoccupied periods, 5) improving OAHU discharge air temperature control, 6) expanding AHU discharge air temperature reset capability, 7) improving AHU static pressure reset schedule, 8) improving OAHU static pressure set points, 9) setting upper limits on water loop differential pressure set points, 10) using a photocell sensor to control atrium lighting, 11) properly tuning AHU valve control, 12) utilizing lighting timers to turn off half of the hallway lights at night, 13) correcting backwards preheat valve operation on OAHUs, and 14) improving outside air intake for AHUs.

As of the report submittal date, major CC measures have been implemented. The total energy savings for the building based on measured data from the time CC began until May 31 was $12,000. Based on measured energy consumption data, it was predicted that the annual energy cost savings to be $36,615. The savings would reduce the Energy Usage Index (EUI) from 126.2 mBtu/ft²-year (pre-CC) to 90.8 mBtu/ft²-year (post-CC), and would reduce the Energy Cost Index (ECI) from $1.551/ft²-year (pre-CC) to $1.276/ft²-year (post-CC). It was further estimated that implementation of the remaining proposed CC measures would result in another $3,000 per year of savings. These values were based on the utilities rate of $7.347/mmBtu for chilled water, $9.735/mmBtu for heating hot water, and $0.079/kWh for electricity.

Additionally, it was recommended as a retrofit opportunity that supplemental cooling be added to a server room area for further energy savings and better temperature control. It was estimated that this would save $2,000 per year, with a predicted payback period of approximately three years.

---

1 Continuous Commissioning and CC are registered trademarks of the Texas Engineering Experiment Station (TEES), the Texas A&M University System, College Station, Texas. To improve readability, the symbol “®” will sometimes be omitted.
It was noted that the comfort issues identified previously in the building will be resolved by the measures proposed, and by regular building maintenance. Flow blockage in the hot water loop caused a shortage of hot water to some AHUs in the winter time, creating comfort problems in many rooms. Regular cleaning of strainers and coils will help reduce this problem in the future. Additionally, recommendations related to terminal box control, AHU control, and scheduling should reduce comfort problems in the building.
ACKNOWLEDGEMENTS

The Continuous Commissioning process detailed in this report was a collaborative effort among the Office of Energy Management, Area Maintenance, and the Energy Systems Laboratory at Texas A&M University. Many persons from each entity are responsible for the work done in the building, from the field and comfort measurements and CC measures determination, to the maintenance and controls items implemented. This document is designed to serve as a deliverable from the Energy Systems Laboratory to the Office of Energy Management, and primarily details the CC activities and measures in which the Energy Systems Laboratory has been involved. The lead CC investigator for this building was Cory Toole, E.I.T. For additional information regarding the information in this report or the overall Continuous Commissioning program at the Energy Systems Laboratory, please contact Song Deng at (979) 862-1234.
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BACKGROUND

Continuous Commissioning is an ongoing process to resolve operating problems, improve comfort, optimize energy use and identify retrofits for existing commercial and institutional buildings and central plant facilities. The Energy Systems Laboratory, which trademarked this process, has been under contract with the Physical Plant at Texas A&M University since 1997 to systematically commission the campus buildings as requested. During the time period since this began, more than 70 buildings have been commissioned, resulting in energy savings to Texas A&M University of millions of dollars. For the year 2007, 25 buildings (totaling 2.5 million square feet) have been identified to be commissioned, including the Bush Academic Facility. This building was identified as a prime candidate for Continuous Commissioning due to its high energy cost per square foot and comfort problems. Commissioning began on January 12, 2007.

SITE DESCRIPTION

General Facility Description

The Bush Academic Facility, pictured above in Figure 1, was constructed in 1997 and is located on the West Campus of Texas A&M University (see Figure 2 above). It is home to the Political Science and Economics Departments, and consists primarily of offices and classrooms. The building has three floors for a total area of 133,326 square feet. It is generally occupied on weekdays during the day, but also has some occupancy frequently at night and on weekends.
General HVAC System Description

Mechanical

The chilled water system in the building utilizes two 25 hp, 700 gpm pumps with VFD run by EMCS control. Both the pumps and the control valve are DDC controlled by pressure differential. The piping system is two-way variable speed flow without bypass. The heating water system utilizes two 10 hp, 270 gpm pumps with VFD run by EMCS control. Both the pumps and the control valve are DDC controlled by pressure differential. The piping system is two-way variable speed flow without bypass. A summary of the building pumping information is shown in Table A-1 in the Appendix.

The HVAC system in the building is a dual duct VAV system, and consists of ten air handling units and three outside air pre-treat units. The controls system is DDC and is powered by Siemens Apogee. The total design maximum supply flow in the building is 171,000 cfm, of which a maximum of 22,500 cfm is outside air. The total design exhaust flow from the building is 17,130 cfm, and is achieved with nine exhaust fans and four relief fans. Tables A-2 and A-3 in the Appendix give an overview of the air handling units and exhaust fans comprising the building HVAC system, with their design information.

The lighting system in the building is comprised of T8 lamps on all floors, with motion sensors installed in a majority of rooms.

Controls

The pre-CC operation of pumps staged the pumps on according to building demand. The pumps and control valves controlled to allow the loop differential pressures to meet their set points. These set points were reset between fixed limits according to weighted averages of AHU chilled water and hot water valve positions.

The pre-CC operation of AHUs maintained all of the units running at all times. Each unit had different settings for normal, late, and later modes. All terminal boxes served by each AHU were periodically sampled, and their heating and cooling demands and damper positions were averaged with a weighted averaging function. Static pressure set points for each AHU were raised or lowered between fixed limits according to average terminal box damper position, and hot deck and cold deck temperature set points were raised or lowered between fixed limits according to average terminal box heating and cooling demand. Nearly all zone temperature cooling set points were 76°F, while zone heating set points were 70°F.

The pre-CC operation of outside air handling units attempted to utilize the units to temper the outside air somewhat before it was sent to the AHUs. This pre-cooling and preheating was based on outside air dry bulb and dew point temperatures. The amount of outside air allowed to each unit was regulated with pressure independent dampers in the outside air ductwork.
**Energy and Comfort Baselines**

The baseline energy usage for the building before CC occurred is summarized in Table 1. The baseline period chosen was from 5/11/06 through 1/11/07.

<table>
<thead>
<tr>
<th></th>
<th>Annual Use</th>
<th>Unit Cost</th>
<th>Energy Cost</th>
<th>Baseline Period</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELE (kWh/ft²-yr)</td>
<td>10.725</td>
<td>0.079</td>
<td>0.848</td>
<td>5/11/06-1/11/07</td>
<td>Annual use calculated using actual data from 1/12/2006 to 1/11/2007</td>
</tr>
<tr>
<td>CHW (mBtu/ft²-yr)</td>
<td>71.0</td>
<td>7.347</td>
<td>0.522</td>
<td>5/11/06-1/11/07</td>
<td>Annual use calculated using modeled data from 1/12/2006 to 5/10/2006 and actual data during the baseline period of 5/11/2006 - 1/11/2007</td>
</tr>
</tbody>
</table>

The baseline Energy Usage Index (EUI) was 126.2 mBtu/ft²-year. The baseline Energy Cost Index (ECI) was $1.551/ft²-year.

A number of comfort complaints in the building were brought up at the time of commissioning. A general complaint was received that during cold weather many of the exterior zone offices took a long time to warm up to set point in the mornings. Complaints were received that room 1121A experienced large temperature fluctuations during occupied hours. This issue has been addressed in a separate troubleshooting report. Additionally, hot complaints were received regularly from classrooms in the building.

**CONTINUOUS COMMISSIONING ACTIVITIES**

The Continuous Commissioning process involved a thorough evaluation of current building conditions and operation, including field measurements, remote monitoring, and control review. From the investigation performed, the causes of a number of problems with comfort and energy efficiency in the building were identified. CC measures have been recommended to aid in allowing this building to operate more efficiently and to provide better comfort. Additionally, retrofit opportunities and maintenance issues that were noted during the CC process have been documented. The sections that follow describe the conditions found in the building at the time of CC, the CC measures recommended for improved building performance, and the results achieved thus far from those measures that have been implemented.

**Continuous Commissioning Measures**

A total of 14 CC measures have been identified through the CC process, including AHU shut downs, improved discharge air temperature set point scheduling, better outside air control, correcting backwards preheat valve operation, and some lighting opportunities,
among others. These CC measures are summarized in Table 2, with the level of priority and implementation status of each as of the report submittal date. Detailed findings and explanations of the measures are provided in the paragraphs following the table.

Table 2. Recommended CC measures with priority level and implementation status.

<table>
<thead>
<tr>
<th>Number</th>
<th>Brief CC Measure Description</th>
<th>Priority</th>
<th>Implementation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC1</td>
<td>Shut down each AHU when all terminal boxes served are in Night mode, except those with equipment rooms. Utilize SSTO for the units.</td>
<td>High</td>
<td>5/8/2007</td>
</tr>
<tr>
<td>CC2</td>
<td>Schedule exhaust fans to cycle off at night.</td>
<td>High</td>
<td>Pending</td>
</tr>
<tr>
<td>CC3</td>
<td>Set the cooling minimum flow to zero for all terminal boxes.</td>
<td>High</td>
<td>5/8/2007</td>
</tr>
<tr>
<td>CC4</td>
<td>Reset terminal box total minimum flow during unoccupied periods.</td>
<td>High</td>
<td>Pending</td>
</tr>
<tr>
<td>CC5</td>
<td>Improve OAHU heating and cooling temperature set point scheduling.</td>
<td>High</td>
<td>5/8/2007 Needs follow-up</td>
</tr>
<tr>
<td>CC6</td>
<td>Modify limits of AHU cold deck and hot deck temperature set points to allow the possibility of neutral air.</td>
<td>High</td>
<td>5/8/2007</td>
</tr>
<tr>
<td>CC7</td>
<td>Improve static pressure reset limits on AHUs and better utilize available sensors.</td>
<td>Medium</td>
<td>5/8/2007</td>
</tr>
<tr>
<td>CC8</td>
<td>Optimize OAHU static pressure set points based on new flows.</td>
<td>Low</td>
<td>5/8/2007</td>
</tr>
<tr>
<td>CC9</td>
<td>Decrease differential pressure set point upper limits for chilled water and hot water loops.</td>
<td>Medium</td>
<td>5/24/2007</td>
</tr>
<tr>
<td>CC10</td>
<td>Control atrium lighting with a photocell sensor to allow lights to shut off during day.</td>
<td>Low</td>
<td>Upper Management Decision</td>
</tr>
<tr>
<td>CC11</td>
<td>Program AHU valve spring ranges correctly, and properly tune valve PID loops.</td>
<td>High</td>
<td>5/24/2007</td>
</tr>
<tr>
<td>CC12</td>
<td>Utilize available lighting timers to turn off unnecessary lighting at night.</td>
<td>Medium</td>
<td>Pending</td>
</tr>
<tr>
<td>CC13</td>
<td>Correct backwards operation of preheat valves on OAHUs.</td>
<td>High</td>
<td>Completed</td>
</tr>
<tr>
<td>CC14</td>
<td>Set outside air intake properly for all AHUs.</td>
<td>High</td>
<td>Completed</td>
</tr>
</tbody>
</table>

CC1. Shut down each AHU when all terminal boxes served are in Night mode, except those with equipment rooms. Utilize SSTO for the units.

At the onset of commissioning, scheduling existed in the building for the AHUs, OAHUs, and terminal boxes. All equipment ran in normal mode from 6:00 AM to 6:00 PM. At 6:00 PM, the AHUs, OAHUs, and most of the terminal boxes went into “Late” mode. This caused the OAHUs to shut down, the AHUs to have different reset schedules, and some of the terminal boxes to go to night mode. At 8:00 PM, the “Later” mode was implemented. This caused more of the terminal boxes to go to night mode.
Finally, at 10:00 PM, the “Vacant” mode was set, causing all but a few of the terminal boxes to go to night mode, and giving the AHUs a different set of set points. The AHUs were never allowed to shut down, however.

During commissioning, it was recommended that each air handling unit be shut down whenever all of the TECs it served had switched to Night mode. This would allow AHU 3-1 to shut down at 6:00 PM, AHUs 1-1, 1-2, and 1-3 to shut down at 8:00 PM, and AHUs 2-2 and 2-3 to shut down at 10:00 PM. AHUs 1-4, 2-1, 3-2, and 3-3 would not be allowed to shut down due to equipment room requirements. It was also recommended that all units be brought on and off using optimized start/stop programming (SSTO).

This measure was implemented as recommended on 5/8/2007.

**CC2. Schedule exhaust fans to cycle off at night.**

No scheduling was found for the exhaust fans in the building at the time of commissioning, even though the OAHUs were scheduled to turn off at night, which undoubtedly caused infiltration to occur, sometimes of warm, humid air. It was recommended that the exhaust fans in the building be scheduled to shut down from 6:00 PM to 6:00 AM each night in an effort to prevent negative pressurization in the building, and subsequent infiltration.

This recommendation was implemented on 5/8/2007.

**CC3. Set the cooling minimum flow to zero for all terminal boxes.**

The terminal boxes were found to be operated with Siemens Application 2267 for dual duct boxes with two flow controllers. This Application includes two separate points dealing with terminal box minimum flow. One point is the cooling minimum flow, and the other is the total minimum flow. At the time of commissioning, it was found that a number of terminal boxes had the cooling minimum flow point set to a value other than zero.

It was recommended during commissioning that the cooling minimum flow for all boxes be set to zero at all times. The purpose of the cooling minimum flow point is to allow adequate ventilation for systems that have fresh air only in the cold deck side. Since this system receives conditioned fresh air through both the hot and cold decks, the cooling minimum flow point should be set to zero, as the total minimum flow point is expected to provide needed ventilation.

This measure was implemented as recommended on 5/8/2007.

**CC4. Reset terminal box total minimum flow at night.**

A significant amount of energy consumption in the building can be attributed to high minimum flows at the terminal boxes. Because of ventilation requirements, these high flows are sometimes necessary. However, during unoccupied periods, minimum flow is not needed from the terminal boxes for ventilation purposes. It is therefore recommended that a general scheduling be implemented, such that when each terminal box switches to night mode, the total minimum flow is commanded to zero. This option
need only be implemented on those boxes served by AHUs that are not scheduled to shut down at night. If an AHU is off, the minimum flows of the boxes it serves are irrelevant.

As of submittal of this report, this measure has not been implemented. It is suggested that a meeting be coordinated between the ESL and the OEM to discuss the possibility of implementing the measure by the OEM or alternative approaches.

**CC5. Improve OAHU heating and cooling temperature set point scheduling.**

The OAHUs were all programmed to either heat the outside air to 50°F, or to cool it to between 55 and 65°F (depending on outside air dew point temperature). Each of the OAHUs was programmed with a static pressure set point of 0.48 in. W.G. A summary of the control of the OAHUs prior to commissioning is shown in Table 3 below.

<table>
<thead>
<tr>
<th>OAHU</th>
<th>Cooling Temperature Set Point</th>
<th>Preheat Set Point</th>
<th>Static Pressure Set Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>55 65 OADWP - 4</td>
<td>50</td>
<td>0.48</td>
</tr>
<tr>
<td>3-2</td>
<td>55 65 OADWP - 6</td>
<td>50</td>
<td>0.48</td>
</tr>
<tr>
<td>3-3</td>
<td>55 65 OADWP - 4</td>
<td>50</td>
<td>0.48</td>
</tr>
</tbody>
</table>

More energy-efficient control of the OAHU set point temperatures was recommended during commissioning. Figure 3 that follows shows the recommended control for the OAHUs.

On 5/8/2007, a version of this recommendation was implemented, and was later modified. As of submittal of this report, the programming in place for these units was as follows:

1222 TABLE("CAMPUS_OADBT","STEMP1,50,50,78,78")

1230 TABLE("CAMPUS_OADWP","%X%.DAT.S",55,STEMP1,60,55,70,52)

This programming does not fully capture the intent of the CC measure, and creates a situation where considerable energy is wasted in very humid conditions by overcooling the incoming outside air. A temperature of 57°F on the incoming outside air is sufficiently dehumidified to be introduced into the space. It is unnecessary to cool the air to 52°F, and significant energy is consumed in doing so. It is therefore recommended that the programming be modified so that the air is cooled to 57°F whenever outside air dew point temperature is above 55°F.
Figure 3. Proposed control for OAHUs.
**CC6. Modify limits of AHU cold deck and hot deck temperature set points to allow the possibility of neutral air.**

At the onset of commissioning, each of the AHUs was programmed with demand based resets on cold and hot deck temperatures and static pressure. Weighted average heating and cooling loops and damper positions of the terminal boxes served were calculated, and these values were used to increase or decrease set points as needed.

The AHUs were scheduled to have different reset limits during Normal Occupancy, Minimal Occupancy, and Hibernate/Essential Only modes. Table 4 shows the upper and lower reset limits for each AHU at the time of commissioning during normal occupancy. For other occupancy mode set points, see the Appendix.
Table 4. AHU reset limits during normal occupancy at time of commissioning.

<table>
<thead>
<tr>
<th>AHU</th>
<th>Cold Deck Temp Set Point</th>
<th>Modulation Control</th>
<th>Hot Deck Temp Set Point</th>
<th>Modulation Control</th>
<th>Static Pressure Set Point</th>
<th>Modulation Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>1-1</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35 &amp; Max(A138 Room Temp,A142 Room Temp)=75, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or Max(A138 Room Temp,A142 Room Temp)=76, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-4</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35 &amp; Computer Room Temp=74 &amp; Max Rm Temp=76.5, increase by 0.5</td>
<td>75</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or Computer Room Temp=75 or Max Rm Temp=77, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-1</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35 &amp; A226 Room Temp=75, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or A226 Room Temp=76, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-2</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-1</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-2</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35 &amp; A349 Room Temp=75, increase by 0.5</td>
<td>75</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or A349 Room Temp=76, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-3</td>
<td>53</td>
<td>58</td>
<td>ACLP&lt;35 &amp; A309 Room Temp=77, increase by 0.5</td>
<td>72</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or A309 Room Temp=78, decrease by 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Very slow loop control was observed on the chilled water and hot water valves on the AHUs. Deck temperatures were often found to be far from set point in either direction. Additionally, the hot water valves would rarely be allowed to fully shut, since with the pre-cooled outside air mixing with return air, the mixed air entering the AHU often had temperatures below 72°F (the minimum hot deck temperature set point), which meant some heating would occur on the hot deck side to bring the temperature to 72°F.

As noted previously, the terminal boxes were found to be operated with Siemens Application 2267 for dual duct boxes with two flow controllers. Some problems were noted with the boxes that created comfort issues in the building. The Application is set up such that when the box is in heating mode, the hot deck is used to meet the space needs, and the cold deck is used to supplement in order to attain the total minimum flow set point for the box. When the box is in cooling mode, this operation is reversed. Many of the terminal boxes were found to have high minimum flows. During periods of lower occupancy throughout the day, when the boxes were in heating mode, this resulted in the minimum flow being almost entirely cold air. This often resulted in the room staying at or close to the heating set point (70°F), rather than being allowed to slowly drift to the cooling set point (75 or 76°F). This wasted energy due to overcooling of the rooms, since the cold deck temperature set point was not allowed to exceed 58°F for any AHU. Some occupants placed ice bags on the thermostats in order to fool the box into providing more heat.

In order to help combat this problem, as well as to conserve energy in the building, it was recommended during the CC process that the cold and hot deck temperature reset limit ranges on all of the AHUs be expanded. For the hot deck temperature, it was recommended that a low limit of 65°F be used, which would allow hot water valves on the AHUs to fully close during warm weather. For the cold deck, it was recommended that an upper limit of 70°F be used. Since dehumidification would take place at the OAHUs, this high temperature would not be a problem as long as terminal box cooling demand allowed it. Additionally, this would have the advantage of when most or all of the boxes served were in heat, the cooling flow used to makeup total minimum flow would essentially be neutral air, thus saving cooling energy, and allowing space temperatures to slowly rise above heating set point, instead of riding the set point due to the cold air flow.

This measure was implemented on 5/8/2007. The maximum cold deck temperature in the programming is now 72°F. The minimum hot deck temperature is now 65°F. The hot water demand in the building has now been observed to be zero during warm weather, since AHU valves can now fully close.

With the measure implemented as it now is, some concern exists over the ability of the system to respond to sudden changes in building load, especially in classrooms. For example, if the cold deck temperature set point on AHU 1-1 had drifted to 72°F during a period of no occupancy in the classrooms, and suddenly the classrooms were filled (such as at 8:00 AM), it appears that the system would take over an hour for the deck temperature to fall down to a normal level (55°F). This certainly has the potential to create comfort problems in the building.
It is recommended that a faster response time from the system be implemented with this CC measure. For example, the cooling loops might be sampled more frequently, and larger drops in set point temperature might be allowed as the cooling loop rises farther from its set point. Some type of PID loop control might even be considered for modulating the set points. The ability to respond quickly will be important for all of the AHUs in the building in order for this reset strategy to be effective, but it is particularly important in classroom areas where loads can change very rapidly and very dramatically.

**CC7. Improve static pressure reset limits on AHUs and better utilize available sensors.**

For static pressure control, most of the air handling units were found to have two cold deck sensors and two hot deck sensors. However, instead of utilizing the output from all four sensors to determine needed fan speed, the programming sampled only one of the cold deck sensors and one of the hot deck sensors, and used the minimum of these two pressures as the control point.

Static pressure set point tests were run on all of the AHUs to determine if the maximum and minimum limits in the programming were appropriate. It was found that the minimum limits were good, but that many of the upper limits were higher than needed to meet maximum load conditions. Table 5 below presents these findings, along with the recommended limits and which sensors should be considered in the programming.

Table 5. Pre-CC AHU static pressure set point control and recommended modifications.

<table>
<thead>
<tr>
<th>AHU</th>
<th>Pre-CC Static Pressure Control</th>
<th>Recommended Static Pressure Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>1-1</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>1-2</td>
<td>0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>1-3</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>1-4</td>
<td>0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>2-1</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>2-2</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>2-3</td>
<td>0.3</td>
<td>1.4</td>
</tr>
<tr>
<td>3-1</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>3-2</td>
<td>0.3</td>
<td>1.5</td>
</tr>
<tr>
<td>3-3</td>
<td>0.3</td>
<td>1.5</td>
</tr>
</tbody>
</table>
This measure was implemented with some variations on 5/8/2007. The static pressure sensors were taken into account as suggested. The limits on minimum static pressure for all AHUs were changed to 0.1 in. W.G., and the limits on maximum static pressure for all AHUs were changed to vary with demand from 1.25 to 1.75 in. W.G.

**CC8. Optimize OAHU static pressure set points based on new flows.**

As part of the commissioning process, outside air intake to each AHU has been adjusted in accordance with current ASHRAE standards and building usage. After the new flow rates were implemented, testing was conducted to determine what the optimal static pressure set point should be for each of the OAHUs, to allow the maximum outside air damper served to remain around 90% open. For this to occur, the static pressure sensor for OAHU 3-3 had to be relocated in the duct to a place near where it was, but where it could read positive pressure to provide reliable feedback to the controls system. Table 6 below displays the pre-CC OAHU static pressure set points along with the recommended static pressure set points.

<table>
<thead>
<tr>
<th>OAHU</th>
<th>Pre-CC Static Pressure Set Point (in. W.G.)</th>
<th>Recommended Static Pressure Set Point (in. W.G.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>3-2</td>
<td>0.48</td>
<td>0.52</td>
</tr>
<tr>
<td>3-3</td>
<td>0.48</td>
<td>0.26</td>
</tr>
</tbody>
</table>

This measure was implemented as recommended in July of 2007.

**CC9. Set differential pressure set point upper limits correctly for chilled water and hot water loops.**

The pump control for both chilled water and hot water loops was set up to modulate the differential pressure set point of each loop between 5 and 30 psi according to a weighted average of AHU valve positions. It was found for both the hot water loop and the chilled water loop that this control often caused the differential pressure set point to become higher than necessary to meet flow requirements.

Testing was conducted to determine the highest loop differential pressure needed for each loop in order to satisfy demand at the most remote chilled water and hot water coils. From this testing, it was recommended that the upper limit for hot water differential pressure set point be set to 20 psi. For chilled water, it was recommended that this limit be set to 25 psi.

This measure has not been implemented as of submittal of this report. Apparently it was decided that the upper limits of 30 psi on both loops were acceptable.
CC10. **Control atrium lighting with a photocell sensor to allow lights to shut off during day.**

One source of unnecessary energy usage observed related to the lighting, and involved atrium lights near the roof above the main building stairwell. A total of 40, 40-Watt bulbs were found to remain on continuously, though in the daytime these lights provided essentially no additional lighting because of daylighting through the upper windows.

During the CC process, it was recommended for the atrium lighting that these fixtures be controlled with a photocell sensor, to allow them to shut off during the day. This would serve to reduce the electricity consumption somewhat when these lights are not needed.

This measure was deemed an upper management decision and has not been implemented as of submittal of this report.

**CC11. Program AHU valve spring ranges correctly, and properly tune valve PID loops.**

During the commissioning process, it was found that a number of AHU and OAHU chilled water and heating water valves did not have accurate spring range values in the control programming based on current measured ranges. Table 7 summarizes the programmed and measured valve spring ranges for the AHU valves in the building at the onset of commissioning. Additionally, it was noted that for many of the valves, response time was very slow, and discharge temperatures would often swing well above or below set point, suggesting problems with PID loop tuning as well. This was specifically noted on the chilled water valves for AHUs 1-2, 2-1, 2-3, and 3-3, but it was suggested during CC that all the AHUs be checked for this problem.
Table 7. Programmed and measured valve spring ranges for all AHUs at onset of commissioning.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Item</th>
<th>Percentage</th>
<th>Signal from Apogee</th>
<th>Observed PXP Output (PSI)</th>
<th>Measured Range (PSI)</th>
<th>Operation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAHU 3-1</td>
<td>CCV</td>
<td>0</td>
<td>5</td>
<td>12</td>
<td>10</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHV</td>
<td>0</td>
<td>10</td>
<td>18.5</td>
<td>3</td>
<td>Fully close valve</td>
<td>Operation backwards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>Fully open valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td>OAHU 3-2</td>
<td>CCV</td>
<td>0</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>Fully close valve</td>
<td>Operation backwards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>Fully open valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td>PHV</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>Fully close valve</td>
<td>Operation backwards, bad PXP.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>OAHU 3-3</td>
<td>CCV</td>
<td>0</td>
<td>10</td>
<td>15</td>
<td>12</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHV</td>
<td>0</td>
<td>10</td>
<td>19</td>
<td>5</td>
<td>Fully close valve</td>
<td>Operation backwards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>Fully open valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td>AHU 3-1</td>
<td>CCV</td>
<td>0</td>
<td>9</td>
<td>16</td>
<td>12</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
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<td>3</td>
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<td>4</td>
<td>Fully open valve</td>
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</tr>
<tr>
<td></td>
<td>HCV</td>
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<td>5</td>
<td>10</td>
<td>7</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>0</td>
<td>0</td>
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<td>Fully open valve</td>
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</tr>
<tr>
<td>AHU 3-2</td>
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<td>9</td>
<td>17</td>
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<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>Fully open valve</td>
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</tr>
<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 3-3</td>
<td>CCV</td>
<td>0</td>
<td>9</td>
<td>17</td>
<td>10</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 2-1</td>
<td>CCV</td>
<td>0</td>
<td>6</td>
<td>12</td>
<td>11</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>7</td>
<td>11.5</td>
<td>10</td>
<td>Fully close valve</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>100</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 2-2</td>
<td>CCV</td>
<td>0</td>
<td>6</td>
<td>14</td>
<td>10</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>5</td>
<td>11</td>
<td>8</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 2-3</td>
<td>CCV</td>
<td>0</td>
<td>8</td>
<td>13.5</td>
<td>12</td>
<td>Fully close valve</td>
<td></td>
</tr>
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<td></td>
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<td>2</td>
<td>5</td>
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<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>6</td>
<td>10</td>
<td>10</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 1-1</td>
<td>CCV</td>
<td>0</td>
<td>8</td>
<td>14.5</td>
<td>10</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>7</td>
<td>14.5</td>
<td>9</td>
<td>Fully close valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 1-2</td>
<td>CCV</td>
<td>0</td>
<td>9</td>
<td>15</td>
<td>12</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCV</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 1-3</td>
<td>CCV</td>
<td>0</td>
<td>9</td>
<td>15</td>
<td>12</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 1-3</td>
<td>HCV</td>
<td>0</td>
<td>6</td>
<td>12</td>
<td>10</td>
<td>Fully close valve</td>
<td>Inappropriate range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>Fully open valve</td>
<td></td>
</tr>
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<td>AHU 1-4</td>
<td>CCV</td>
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<td>8</td>
<td>14</td>
<td>11</td>
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<td></td>
<td>100</td>
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<td>2</td>
<td>4</td>
<td>Fully open valve</td>
<td></td>
</tr>
<tr>
<td>AHU 1-4</td>
<td>HCV</td>
<td>0</td>
<td>6</td>
<td>13</td>
<td>10</td>
<td>Fully close valve</td>
<td></td>
</tr>
</tbody>
</table>

It was recommended during the CC process that the valve operation for the AHUs be improved by modifying the programming to reflect actual valve spring ranges. It was also recommended that the PID loops for all valves be tuned properly as needed to provide better response and control.

This measure was implemented on 5/24/2007.
CC12. Utilize available lighting timers to turn off unnecessary lighting at night.

Lighting timers were found in the building on each floor, which were designed to turn off approximately half of the hallway lighting. At the time of CC, the timers were not being utilized. It was recommended that these timers be restored to operation, so that when building occupancy is minimal, much of the lighting can be shut off. When operational, these timers will allow enough lighting to be left on during night time hours to provide safety for anyone still inside the building.

As of submittal of this report, this measure has not yet been implemented.

CC13. Correct backwards operation of preheat valves on OAHUs.

The outside air handling units serving the building were found to have significant control problems at the onset of commissioning. It was found that the preheat valves for all three of the units were operating backwards, causing the units to preheat during warm outside air temperatures, and to not be able to preheat during cold outside air temperatures. This caused simultaneous heating and cooling to occur much of the year, and also caused OAHUs to trip in cold weather.

This problem was reported during the commissioning process and was promptly corrected. Significant energy savings have resulted.

CC14. Set outside air intake properly for all AHUs.

Flow controllers at each AHU regulated the amount of outside air entering the unit, and these flows were all found to be higher than needed according to current building usage and ASHRAE ventilation requirements. During the commissioning process, outside air intake to each AHU was set correctly according to current ASHRAE standards and building needs. Table 8 below shows the design, measured, and needed outside air flow to each unit, and the flow that was set during commissioning.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Design OA Flow (CFM)</th>
<th>Measured OA Flow (CFM)</th>
<th>Calculated OA Flow Needed (CFM)</th>
<th>OA Flow Set During CC (CFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHU 1-1</td>
<td>4,800</td>
<td>4,000</td>
<td>3,145</td>
<td>3,250</td>
</tr>
<tr>
<td>AHU 1-2</td>
<td>2,980</td>
<td>1,365</td>
<td>1,997</td>
<td>1,955</td>
</tr>
<tr>
<td>AHU 1-3</td>
<td>2,500</td>
<td>2,100</td>
<td>1,812</td>
<td>1,800</td>
</tr>
<tr>
<td>AHU 1-4</td>
<td>1,400</td>
<td>1,295</td>
<td>1,525</td>
<td>1,495</td>
</tr>
<tr>
<td>AHU 2-1</td>
<td>1,650</td>
<td>2,990</td>
<td>1,395</td>
<td>1,370</td>
</tr>
<tr>
<td>AHU 2-2</td>
<td>1,560</td>
<td>3,120</td>
<td>1,507</td>
<td>1,570</td>
</tr>
<tr>
<td>AHU 2-3</td>
<td>2,500</td>
<td>1,930</td>
<td>1,368</td>
<td>1,350</td>
</tr>
<tr>
<td>AHU 3-1</td>
<td>1,050</td>
<td>1,500</td>
<td>1,095</td>
<td>1,005</td>
</tr>
<tr>
<td>AHU 3-2</td>
<td>1,560</td>
<td>2,250</td>
<td>1,457</td>
<td>1,485</td>
</tr>
<tr>
<td>AHU 3-3</td>
<td>2,500</td>
<td>2,680</td>
<td>1,488</td>
<td>1,540</td>
</tr>
<tr>
<td>Total</td>
<td>22,500</td>
<td>23,230</td>
<td>16,788</td>
<td>16,820</td>
</tr>
</tbody>
</table>
As can be seen in the table, commissioning resulted in a reduction of over 6,000 cfm of outside air intake. However, for some units the amount of outside air intake was actually increased due to changed conditions in the building.

Continuous Commissioning Results

Savings Analysis

Measured Energy Savings

Figure 4 shows time series plots of the pre-CC period, CC period, and post-CC period energy consumption in the building. Figures 5-7 then show the consumption as it relates to average daily outdoor dry bulb temperature, with a comparison between the pre-CC period and the CC and post-CC period.


The total energy savings based on measured data during and after CC (from 1/12/2007 to 5/31/2007) were $12,000. These savings include only CC items implemented before 5/31/2007, which includes all of the major measures.

**Predicted Annual Savings**

Based on the limited amount of post-CC data collected, annualized energy savings expected from the CC activities already performed were predicted, and are shown below in Tables 9 and 10. Table 11 compares the pre-CC Energy Use Index and Energy Cost Index with their predicted values for the post-CC period.

Table 9. Summary of predicted annual energy use based on post-CC period.

<table>
<thead>
<tr>
<th></th>
<th>Annual Use</th>
<th>Unit Cost</th>
<th>Energy Cost</th>
<th>Post CC Period</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELE</td>
<td>10.704 (kWh/ft²-yr)</td>
<td>0.079 ($/kWh)</td>
<td>0.847 ($/ft²-yr)</td>
<td>1/12/07 - 5/31/07</td>
<td>Annual use calculated using 138 days of measured savings from 1/12/2007 to 5/31/2007, then the 138 days were scaled to a year (365 days)</td>
</tr>
<tr>
<td>CHW</td>
<td>41.4 (mBtu/ft²-yr)</td>
<td>7.347 ($/mmBtu)</td>
<td>0.304 ($/ft²-yr)</td>
<td>1/12/07 - 5/31/07</td>
<td>Annual use calculated using 140 days of measured savings from 1/12/2007 to 5/31/2007, then the 138 days were scaled to a year (365 days)</td>
</tr>
<tr>
<td>HHW</td>
<td>12.9 (mBtu/ft²-yr)</td>
<td>9.735 ($/mmBtu)</td>
<td>0.126 ($/ft²-yr)</td>
<td>1/12/07 - 5/31/07</td>
<td>Annual use calculated using 140 days of measured savings from 1/12/2007 to 5/31/2007, then the 138 days were scaled to a year (365 days)</td>
</tr>
</tbody>
</table>
Table 10. Predicted annual post-CC savings for the Bush Academic Building.

<table>
<thead>
<tr>
<th></th>
<th>Predicted Annual Energy Savings</th>
<th>Predicted Annual Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELE</td>
<td>2,800 kWh</td>
<td>$221</td>
</tr>
<tr>
<td>CHW</td>
<td>3,946 mmBtu</td>
<td>$28,995</td>
</tr>
<tr>
<td>HHW</td>
<td>760 mmBtu</td>
<td>$7,398</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$36,615</strong></td>
</tr>
</tbody>
</table>

Table 11. Energy Use and Energy Cost Indexes for both Pre- and Post-CC periods.

<table>
<thead>
<tr>
<th></th>
<th>Energy Use Index (EUI) (mBtu/ft²-yr)</th>
<th>Energy Cost Index (ECI) ($/ft²-yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-CC (Baseline)</td>
<td>126.2</td>
<td>1.551</td>
</tr>
<tr>
<td>Predicted Post CC</td>
<td>90.8</td>
<td>1.276</td>
</tr>
</tbody>
</table>

It is predicted that over $36,000 per year in energy costs will be saved from the CC activities already performed in the building. Additionally, it has been estimated that another $3,000 per year could be saved through implementation of the CC measures that are still pending.

**Comfort Improvements**

One of the primary objectives of Continuous Commissioning is to improve occupant comfort levels in buildings. Some of the major comfort issues that this building experienced before commissioning included cold complaints in many of the exterior rooms during cold weather, large temperature swings in room 1121A, and hot complaints in classroom areas. The cold complaints in many of the rooms were found to be related to a lack of hot water flow, as well as the terminal box minimum flow issues described previously. CC measures 3, 4, and 6 address these issues, and should help eliminate the majority of these cold complaints. The cleaning of strainers and back flushing of coils has already allowed better hot water flow throughout the building, which is also related to this issue.

Room 1121A, which receives air from a terminal box whose thermostat resides in room 1120, complained of large temperature swings. Since room 1121A has higher occupancy, and is located on a corner with two glass walls, it was recommended that the thermostat be relocated from room 1120 to room 1121A. Gaps in the building foundation were noticed outside these two rooms, and it was recommended that they be sealed and insulated. It was further recommended that airflow to the two rooms be balanced. Additionally, CC measures 3, 4, and 6 address issues related to this comfort complaint. A separate troubleshooting report for this area was submitted with more information about the problems and recommended solutions.

For the hot complaints in classroom areas, it was found that the classrooms appeared to maintain the 76°F cooling set point reasonably well. Therefore, this was a comfort issue related more to policy than to operation. Control programming was implemented to attempt to sense if the classrooms were occupied, and to lower the cooling set point to 73°F. This should help reduce discomfort in these areas.
MAINTENANCE ISSUES AND RETROFIT OPPORTUNITIES

Observed Maintenance Related Issues

As a byproduct, during the CC process several maintenance-related issues have been observed that potentially waste energy, cause comfort problems, and sometimes prevent certain CC measures from being implemented. In order to improve building comfort and maximize potential energy savings, it has been recommended that these issues be addressed. These issues are summarized in Table 12 with priorities and implementation status as of the report submittal date.

Table 12. Observed maintenance related issues.

<table>
<thead>
<tr>
<th>#</th>
<th>Maintenance Related Issues</th>
<th>Priority</th>
<th>Implementation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Preheat pumps for OAHUs 3-1 and 3-2 are tripped and will not run.</td>
<td>High</td>
<td>Complete</td>
</tr>
<tr>
<td>4</td>
<td>Check noisy bearings on AHU 1-1 and AHU 1-4</td>
<td>Low</td>
<td>Complete</td>
</tr>
<tr>
<td>5</td>
<td>The CHW valve on 1-4 needs to be replaced.</td>
<td>High</td>
<td>Complete</td>
</tr>
<tr>
<td>6</td>
<td>CHW valve on 2-2 needs to be replaced.</td>
<td>High</td>
<td>Complete</td>
</tr>
<tr>
<td>7</td>
<td>Gaps (2” to 3”) exist on the southeast wall of the building between the glass exterior and the foundation. This is causing air to enter the rooms on this end and creates discomfort for occupants. These gaps should be sealed somehow to prevent infiltration.</td>
<td>Medium</td>
<td>Pending</td>
</tr>
<tr>
<td>8</td>
<td>The 3-way HW valve on OAHU 3-2 is leaking by.</td>
<td>Medium</td>
<td>Complete</td>
</tr>
<tr>
<td>9</td>
<td>Back flush the hot water coils on the following AHUs: 1-1, 3-1, and 3-2.</td>
<td>High</td>
<td>Complete</td>
</tr>
<tr>
<td>10</td>
<td>Back flush the chilled water coils on the following AHUs: 1-1, 3-1, 3-2, 3-3, OAHU 3-1, and OAHU 3-2.</td>
<td>High</td>
<td>4/3/2007</td>
</tr>
<tr>
<td>12</td>
<td>Repair/replace the CHW valve on OAHU 3-3 which is badly corroded and leaking.</td>
<td>Medium</td>
<td>4/12/2007</td>
</tr>
<tr>
<td>13</td>
<td>The front motor bearing in AHU1 is noisy. Check if it needs to be repaired or replaced.</td>
<td>Medium</td>
<td>4/12/2007</td>
</tr>
<tr>
<td>14</td>
<td>OAHU 3-1 tripped out on VFD over speed.</td>
<td>High</td>
<td>5/30/2007</td>
</tr>
<tr>
<td>15</td>
<td>The exhaust fan A3 is running but is noisy.</td>
<td>Low</td>
<td>5/23/2007</td>
</tr>
</tbody>
</table>
The VFD on OAHU 3-2 is tripped on Ground Fault, and the unit will not come back on. Sparks were observed from the motor compartment. | High | 7/11/2007 |
---|---|---|
PXP card on the OA damper for the AHU 1-2 is bad | Medium | Complete |
PXP card for the preheat valve on OAHU 3-2 needs to be replaced. Once this has been done, the valve should be checked to see if it is operating backwards, as was the case with OAHU 3-1 and 3-3, and if so, should be corrected | High | Complete |
Calibrate the following static pressure sensors: A13HD1, A12CD1, A14CD1, A14HD1, A14HD2, A21HD1, and A23CD2 | High | 4/24/2007 |
Repair/replace bad PXP card on the HW valve of AHU2-3 | High | 4/24/2007 |
Calibrate the CHW secondary supply pressure sensor. This sensor is used to calculate building DP to run the pumps | High | 4/24/2007 |
During summertime operation periodically (night time hours) open the AHU HW valves & cycle on the HW pumps to prevent seal problems & to flush the HW loop. | High | Pending |

One item of significance noted in the building at the onset of commissioning related to the hot water loop. Major problems with the hot water pumping system were detected. Both pumps would run at high speeds, while the flow rate remained very small (less than 100 GPM). The loop differential pressure stayed at 30 psi, its maximum set point. However, a number of AHUs still could not receive enough hot water to meet their heating needs. In order to understand this problem better, pressure profiles throughout both the hot water and chilled water loops were measured and documented, and are shown in Figures A - 1 and A - 2 in the Appendix.

A considerable amount of strainers throughout the building on both the hot water and chilled water loops had high differential pressures across them – some as high as 30 psi. Obviously these areas severely restricted flow to the coils, creating control and comfort problems in the building. As part of the investigation, one strainer on the hot water loop with a 30 psi differential pressure was back flushed with no change in pressure. It was then removed, cleaned, and replaced, and the differential pressure fell to almost zero. However, the differential pressure across a valve downstream of the strainer then built up.

During the commissioning process, it was recommended that all hot water and chilled water strainers be cleaned and the coils back flushed. This was completed, and pressure profiles were taken again throughout the building. This time the pressure drops across the strainers were found to be acceptable, and it was noticed that AHUs were better able to meet their discharge air temperature set points.

**Retrofit Opportunities**

Also as a byproduct, during the CC process a potential retrofit opportunity has been identified which would potentially achieve extra energy savings in addition to the above recommended CC measures. The potential retrofit opportunity item is summarized in
Table 13 with its purpose, estimated cost, savings and payback. A detailed explanation of the measure is also provided in this section.

Table 13. Potential retrofit item.

<table>
<thead>
<tr>
<th>Number</th>
<th>Brief Description</th>
<th>Purpose</th>
<th>Est. Cost ($)</th>
<th>Est. Savings ($/yr)</th>
<th>Est. Payback (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Provide independent cooling to the server room area consisting of rooms 2136 and 2137A to serve as the primary air supply for these areas.</td>
<td>Energy Savings</td>
<td>$6,000</td>
<td>$2,000</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**R1. Provide independent cooling to the server room area consisting of rooms 2136 and 2137A to serve as the primary air supply for these areas.**

In assessing the building, it has been determined that adding supplemental cooling to the server room currently served by AHU 1-4 would be beneficial to the building performance and energy consumption. The servers are located in room 2136, and additional equipment is located in room 2137A. These rooms currently dominate the control of AHU 1-4, and prevent the unit from being duty cycled during unoccupied times. Additionally, the personnel in charge of the rooms would like independent conditioning of the spaces due to problems in the past with conditioning the areas. Rough estimates based on incomplete equipment information show around 5 tons of cooling needed to offset the loads from current equipment and desired future equipment. This might be accomplished in several ways, depending on customer needs and price constraints. The server room has the advantage of being located on an exterior wall of the building with the roof right above it. Therefore, a packaged roof top unit might be used, or a split system, or a fan coil unit either with refrigerant or building chilled water. Whichever option is chosen, a full-scale engineering design would need to be conducted to properly size and position the equipment. Having supplemental cooling in this area would allow AHU 1-4 to shut off at night, to further set back during the day, and would provide better control for the personnel in charge of the server room. It is estimated that this retrofit, particularly in conjunction with shutting off AHU 1-4 at night, would save around $2,000 per year.

**CONCLUSIONS**

The Bush Academic Facility has been a part of the A&M system since 1997. High energy consumption and comfort problems in the building made it a good candidate for Continuous Commissioning. It has been shown that the measures that have been implemented up to this time, which includes all of the major measures, have begun to save on energy costs, in addition to improving comfort in the building. Predictions based on initial measured data from the post-CC period indicate that over $36,000 per year is likely to be saved from the CC activities that have already taken place in the building. If the proposed CC measures that are pending are implemented, it is estimated
that an additional $3,000 per year can be saved, and the remaining comfort issues can be resolved. Additionally, a retrofit was recommended to supply supplemental cooling to a main server room, which would save energy and provide better control for the area, with an estimated savings of $2,000 per year. After complete implementation of these measures, better energy efficiency will occur in the building, as well as an increase in the productivity of occupants who will be more comfortable in their working environment. A number of maintenance issues have been identified throughout the commissioning process, a majority of which have been corrected. It is highly recommended that the pending maintenance issues be resolved and the pending CC measures be implemented as quickly and as completely as possible to maximize the value of the Continuous Commissioning of this building, and most importantly, to maximize energy savings and comfort levels in the building. In this way, the Texas A&M University campus can move forward in its quest for energy efficiency, and the Continuous Commissioning process will have been beneficial in aiding in this endeavor.
APPENDIX A – HVAC AS-BUILT INFORMATION

Table A - 1. CHW and HHW pumping information.

<table>
<thead>
<tr>
<th></th>
<th>Chilled Water System</th>
<th>Hot Water System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pumps</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pump control source</td>
<td>APOGEE</td>
<td>APOGEE</td>
</tr>
<tr>
<td>Pump speed control</td>
<td>VFD</td>
<td>VFD</td>
</tr>
<tr>
<td>Pump speed control method</td>
<td>DP</td>
<td>DP</td>
</tr>
<tr>
<td>Bldg Valve control method</td>
<td>DP</td>
<td>DP</td>
</tr>
<tr>
<td>Piping system type</td>
<td>Two-way variable speed flow loop without bypass</td>
<td>Two-way variable speed flow loop without bypass</td>
</tr>
<tr>
<td>Control valve type</td>
<td>DDC</td>
<td>DDC</td>
</tr>
<tr>
<td>Nameplate GPM</td>
<td>700</td>
<td>270</td>
</tr>
<tr>
<td>Nameplate Head (ft)</td>
<td>85</td>
<td>75</td>
</tr>
<tr>
<td>Nameplate HP</td>
<td>25</td>
<td>10</td>
</tr>
</tbody>
</table>

Table A - 2. HVAC system airflow design information.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Design Maximum Supply CFM</th>
<th>Design Maximum OA CFM</th>
<th>Motor HP</th>
<th>Design Cooling Coil Conditions CFM</th>
<th>Design Heating Coil Conditions CFM</th>
<th>Design Cooling Coil Conditions GPM</th>
<th>Design Heating Coil Conditions GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHU 1-1</td>
<td>15,500</td>
<td>4,800</td>
<td>25</td>
<td>15,000</td>
<td>10,500</td>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td>AHU 1-2</td>
<td>17,000</td>
<td>2,980</td>
<td>25</td>
<td>16,000</td>
<td>11,000</td>
<td>53</td>
<td>23</td>
</tr>
<tr>
<td>AHU 1-3</td>
<td>18,000</td>
<td>2,500</td>
<td>25</td>
<td>16,800</td>
<td>11,000</td>
<td>54</td>
<td>21</td>
</tr>
<tr>
<td>AHU 1-4</td>
<td>20,000</td>
<td>1,400</td>
<td>25</td>
<td>20,000</td>
<td>14,000</td>
<td>83</td>
<td>27</td>
</tr>
<tr>
<td>AHU 2-1</td>
<td>16,500</td>
<td>1,650</td>
<td>25</td>
<td>15,000</td>
<td>10,800</td>
<td>50</td>
<td>22</td>
</tr>
<tr>
<td>AHU 2-2</td>
<td>16,000</td>
<td>1,560</td>
<td>25</td>
<td>15,000</td>
<td>10,500</td>
<td>50</td>
<td>21</td>
</tr>
<tr>
<td>AHU 2-3</td>
<td>18,000</td>
<td>2,500</td>
<td>25</td>
<td>16,800</td>
<td>11,500</td>
<td>55</td>
<td>22</td>
</tr>
<tr>
<td>AHU 3-1</td>
<td>15,000</td>
<td>1,050</td>
<td>20</td>
<td>14,000</td>
<td>9,800</td>
<td>48</td>
<td>19</td>
</tr>
<tr>
<td>AHU 3-2</td>
<td>17,000</td>
<td>1,560</td>
<td>25</td>
<td>16,000</td>
<td>11,000</td>
<td>55</td>
<td>21</td>
</tr>
<tr>
<td>AHU 3-3</td>
<td>18,000</td>
<td>2,500</td>
<td>25</td>
<td>16,800</td>
<td>11,000</td>
<td>55</td>
<td>21</td>
</tr>
<tr>
<td>OAHU 3-1</td>
<td>7,500</td>
<td>7,500</td>
<td>7 1/2</td>
<td>7,500</td>
<td>7,500</td>
<td>77</td>
<td>15</td>
</tr>
<tr>
<td>OAHU 3-2</td>
<td>7,500</td>
<td>7,500</td>
<td>7 1/2</td>
<td>7,500</td>
<td>7,500</td>
<td>77</td>
<td>15</td>
</tr>
<tr>
<td>OAHU 3-3</td>
<td>7,500</td>
<td>7,500</td>
<td>7 1/2</td>
<td>7,500</td>
<td>7,500</td>
<td>77</td>
<td>15</td>
</tr>
</tbody>
</table>
### Table A - 3. Relief and exhaust fans with their design specifications.

<table>
<thead>
<tr>
<th>MARK</th>
<th>SERVICE</th>
<th>CFM</th>
<th>RPM</th>
<th>HP</th>
<th>AHU/ AREA SERVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLF A-1</td>
<td>RELIEF</td>
<td>5250</td>
<td>730</td>
<td>1</td>
<td>AHU A1-1, 2-1, 3-1</td>
</tr>
<tr>
<td>RLF A-2</td>
<td>RELIEF</td>
<td>895</td>
<td>1610</td>
<td>1/3</td>
<td>AHU A1-4</td>
</tr>
<tr>
<td>RLF A-3</td>
<td>RELIEF</td>
<td>2550</td>
<td>1365</td>
<td>1</td>
<td>AHU A2-3, 3-2</td>
</tr>
<tr>
<td>EF A-1</td>
<td>MISC. EXH.</td>
<td>1100</td>
<td>1675</td>
<td>1/3</td>
<td>AHU A1-1, 2-1</td>
</tr>
<tr>
<td>EF A-2</td>
<td>MISC. EXH.</td>
<td>3180</td>
<td>1055</td>
<td>3/4</td>
<td>AHU A1-2, 2-2, 3-2</td>
</tr>
<tr>
<td>EF A-3</td>
<td>MISC. EXH.</td>
<td>1255</td>
<td>1360</td>
<td>1/4</td>
<td>AHU A1-3, 2-3, 3-3</td>
</tr>
<tr>
<td>EF A-4</td>
<td>COPIER EXH.</td>
<td>150</td>
<td>1350</td>
<td>1/4</td>
<td>AHU A1-4</td>
</tr>
<tr>
<td>EF A-5</td>
<td>COPIER EXH.</td>
<td>150</td>
<td>1350</td>
<td>105 WATTS</td>
<td>AHU A1-4</td>
</tr>
<tr>
<td>EF A-6</td>
<td>COPIER EXH.</td>
<td>150</td>
<td>1350</td>
<td>105 WATTS</td>
<td>AHU A3-2</td>
</tr>
<tr>
<td>EF A-7</td>
<td>COPIER EXH.</td>
<td>150</td>
<td>1350</td>
<td>105 WATTS</td>
<td>AHU A3-1</td>
</tr>
<tr>
<td>EF A-8</td>
<td>COPIER EXH.</td>
<td>150</td>
<td>1350</td>
<td>105 WATTS</td>
<td>AHU A3-2</td>
</tr>
<tr>
<td>EF A-9</td>
<td>CLOSET EXH.</td>
<td>150</td>
<td>1350</td>
<td>105 WATTS</td>
<td></td>
</tr>
</tbody>
</table>
Figure A - 1. Hot water loop pressure profile at onset of commissioning.
Figure A - 2. Chilled water loop pressure profile at onset of commissioning
### Table A - 4. AHU set points in “Late” or “Later” modes.

<table>
<thead>
<tr>
<th>AHU</th>
<th>Cold Deck Temperature Set Point</th>
<th>Hot Deck Temperature Set Point</th>
<th>Static Pressure Set Point</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Modulation Control</td>
</tr>
<tr>
<td>1-1</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
</tr>
<tr>
<td>1-2</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35 &amp; Max(A138 Room Temp,A142 Room Temp)≤75, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or Max(A138 Room Temp,A142 Room Temp)&gt;76, decrease by 1.0</td>
</tr>
<tr>
<td>1-3</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
</tr>
<tr>
<td>1-4</td>
<td>55</td>
<td>57</td>
<td>ACLP≤35 &amp; Computer Room Temp≤74 &amp; Max Rm Temp≤76.5, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or Computer Room Temp&gt;75 or Max Rm Temp&gt;77, decrease by 1.0</td>
</tr>
<tr>
<td>2-1</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35 &amp; A226 Room Temp≤75, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or A226 Room Temp&gt;76, decrease by 1.0</td>
</tr>
<tr>
<td>2-2</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
</tr>
<tr>
<td>2-3</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
</tr>
<tr>
<td>3-1</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45, decrease by 1.0</td>
</tr>
<tr>
<td>3-2</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35 &amp; A349 Room Temp≤75, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or A349 Room Temp&gt;76, decrease by 1.0</td>
</tr>
<tr>
<td>3-3</td>
<td>55</td>
<td>60</td>
<td>ACLP≤35 &amp; A309 Room Temp≤77, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&gt;45 or A309 Room Temp&gt;78, decrease by 1.0</td>
</tr>
<tr>
<td>AHU</td>
<td>Cold Deck Temp Set Point</td>
<td>Hot Deck Temp Set Point</td>
<td>Static Pressure Set Point</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------</td>
<td>-------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Modulation Control</td>
</tr>
<tr>
<td>1-1</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45, decrease by 1.0</td>
</tr>
<tr>
<td>1-2</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35 &amp; Max(A138 Room Temp,A142 Room Temp)&lt;=75, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45 or Max(A138 Room Temp,A142 Room Temp)&lt;=76, decrease by 1.0</td>
</tr>
<tr>
<td>1-3</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45, decrease by 1.0</td>
</tr>
<tr>
<td>1-4</td>
<td>55</td>
<td>58</td>
<td>ACLP&lt;35 &amp; Computer Room Temp&lt;74 &amp; Max Rm Temp&lt;76.5, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45 or Computer Room Temp&gt;75 or Max Rm Temp&gt;77, decrease by 1.0</td>
</tr>
<tr>
<td>2-1</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35 &amp; A226 Room Temp&lt;75, increase by 0.5</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45 or A226 Room Temp&lt;76, decrease by 1.0</td>
</tr>
<tr>
<td>2-2</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45, decrease by 1.0</td>
</tr>
<tr>
<td>2-3</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45, decrease by 1.0</td>
</tr>
<tr>
<td>3-1</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45, decrease by 1.0</td>
</tr>
<tr>
<td>3-2</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35 &amp; A349 Room Temp&lt;75, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45 or A349 Room Temp&gt;76, decrease by 1.0</td>
</tr>
<tr>
<td>3-3</td>
<td>55</td>
<td>60</td>
<td>ACLP&lt;35 &amp; A309 Room Temp&lt;77, increase by 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACLP&lt;45 or A309 Room Temp&gt;78, decrease by 1.0</td>
</tr>
</tbody>
</table>
APPENDIX D – PRE-CC CONTROL PROGRAMMING
Panel System Name: BUSHACAD Node 01
Program Name: 1607_A11

C --- AHU 1-1 ---
C --- DEFINITIONS ---
DEFINE(X,"BUSHACAD")
DEFINE(MODE,"1607_ECR.AHU 1-1")
DEFINE(GAT,"BUSHACAD.OADP")
DEFINE(SFSS,"BUSHACAD.A11SS")
DEFINE(SVF,"BUSHACAD.A11SP")
DEFINE(SFV,"1607_A11.SVF.V")
DEFINE(CDT,"BUSHACAD.A11CDT")
DEFINE(CDTS,"1607_A11.CDT.S")
DEFINE(CCV,"BUSHACAD.A11CW")
DEFINE(CCV,"1607_A11.CCV.V")
DEFINE(HDT,"BUSHACAD.A11HDT")
DEFINE(HDTS,"1607_A11.HDT.S")
DEFINE(HCV,"BUSHACAD.A11HW")
DEFINE(HCV,"1607_A11.HCV.V")
DEFINE(CDS,"BUSHACAD.A11CD")
DEFINE(HDS,"BUSHACAD.A11HD")
DEFINE(DASS,"1607_A11.DASS.S")
DEFINE(MDAS,"1607_A11.MDAS")
DEFINE(OAF,"BUSHACAD.A11CFM")
DEFINE(OAFS,"1607_A11.OAFS")
DEFINE(OAD,"BUSHACAD.A11OAD")
DEFINE(SMK,"BUSHACAD.A11SMK")
DEFINE(HIS,"BUSHACAD.A11HS")
DEFINE(ACLP,"1607_A11.ACLP")
DEFINE(AHLFP,"1607_A11.AHLFP")
DEFINE(ACDMP,"1607_A11.ACDMP")
DEFINE(AHDMF,"1607_A11.AHDMF")
C --- LOCAL VARIABLES ---
LOCAL(XCDTS,NCDTS,XHATS,NHDTS,KDASS,NDASS)
DEFINE(TM,CONVERT VIRTUAL LAO TO PHYSICAL ---
TABLE("%CCV%",%CCV%,0,8,100,2)
TABLE("%HCV%",%HCV%,0,7,100,1)
TABLE("%SVF%",%SVF%,0,0,100,10)
C --- GLOBAL CALCULATIONS ---
IF("BUSHACAD.A11SS" .OR. "BUSHACAD.A11SS" .EQ. PRECN) THEN O
N("BUSHACAD.RLA1SS") ELSE OFF("BUSHACAD.RLA1SS")
SAMPLE(300) GOTO 520
IF("%ACF%" .EQ. 0 .AND. "%AHLF%" .EQ. 0 .AND. "%ACDMP%" .EQ.
0 .AND. "%AHDMF%" .EQ. 0) THEN GOTO 520
ET 515  GOTO 610
E 520  C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
E 525  $LOC1 = "$X%.A120:CLG LOOPOUT" + "$X%.A121:CLG LOOPOUT" + "$X%.A122:CLG LOOPOUT" + "$X%.A123:CLG LOOPOUT"
E 527  $LOC1 = $LOC1 + "$X%.A124:CLG LOOPOUT" + "$X%.A125:CLG LOOPOUT" + "$X%.A126:CLG LOOPOUT"
E 530  $LOC1 = $LOC1 + "$X%.A127:CLG LOOPOUT"
E 532  $LOC1 = $LOC1 + "$X%.A130:CLG LOOPOUT" + "$X%.A131:CLG LOOPOUT"
E 535  $LOC1 = ($LOC1 + "$X%.A136:CLG LOOPOUT") / 17
E 537  "$ACLP" = $LOC1 .ROOT. 2
E 540  C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HDT.S *
E 545  $LOC1 = "$X%.A120:HTG LOOPOUT" + "$X%.A121:HTG LOOPOUT" + "$X%.A122:HTG LOOPOUT" + "$X%.A123:HTG LOOPOUT"
E 547  $LOC1 = $LOC1 + "$X%.A124:HTG LOOPOUT" + "$X%.A125:HTG LOOPOUT" + "$X%.A126:HTG LOOPOUT" + "$X%.A130:HTG LOOPOUT" + "$X%.A131:HTG LOOPOUT"
E 550  $LOC1 = $LOC1 + "$X%.A132:HTG LOOPOUT" + "$X%.A133:HTG LOOPOUT" + "$X%.A134:HTG LOOPOUT" + "$X%.A135:HTG LOOPOUT"
E 552  $LOC1 = $LOC1 + "$X%.A136:HTG LOOPOUT"
E 555  $LOC1 = ($LOC1 + "$X%.A137:HTG LOOPOUT") / 17
E 557  "$AHLP" = $LOC1 .ROOT. 2
E 560  C * FIND AVG TEC HTG DMP POS, USE TO RESET DAS.S *
$LOC1 = "$X%.A120:HTG DMP CMD" * "$X%.A120:HTG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A121:HTG DMP CMD" * "$X%.A121:HTG DMP CMD" * "$X%.A122:HTG DMP CMD" * "$X%.A122:HTG DMP CMD"

$LOC1 = $LOC1 + "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD" * "$X%.A123:HTG DMP CMD"

$LOC1 = $LOC1 + "$X%.A127:HTG DMP CMD" * "$X%.A127:HTG DMP CMD" * "$X%.A127:HTG DMP CMD" * "$X%.A130:HTG DMP CMD" * "$X%.A130:HTG DMP CMD" * "$X%.A130:HTG DMP CMD" * "$X%.A130:HTG DMP CMD" * "$X%.A130:HTG DMP CMD"

$LOC1 = $LOC1 + "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD" * "$X%.A131:HTG DMP CMD"


%AHDFM% = $LOC1 .ROOT. 2

C * FIND AVG TEC CLG DMP POS, USE TO RESET DAS.S *

$LOC1 = "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD" * "$X%.A120:CLG DMP CMD"

$LOC1 = $LOC1 + "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD" * "$X%.A123:CLG DMP CMD"


$LOC1 = $LOC1 + "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD" * "$X%.A131:CLG DMP CMD"


%ACDFM% = $LOC1 .ROOT. 2

C "BUSHACADAP.A11CFM" = SQRT($LOC1) * 4005 * 3.33 * 1

C --- SAFETIES ---

C * SMOKE *

IF("%SMK%" .NE. 'ON') THEN GOTO 710

OFF(%SMK%,%SFSS%)

SET(0,"%CCVV%", "%HCVV%","%SVFV%")
ET 710  C * HIGH STATIC *
ET 712  IF("$HIS$" .NE. ON) THEN GOTO 718
E  714  OFF($EMER","$SFSS$")
E  716  SET(0,"$CCVV$","$HCVV$","$SVFV$")
ET 718  IF("$HIS$" .NE. ON) THEN RELEASE($EMER","$SFSS$")
ET 720  IF("$SMK$" .NE. ON .AND. "$HIS$" .NE. ON) THEN RELEASE($SMOE ","$SFSS$")
ET 722  IF("$HIS$" .OR. "$SMK$") THEN GOTO 30000
ET 724  C * VF0 IN BYPASS *
ET 726  IF("$BUSHACD.A11BP$" .NE. ON) THEN GOTO 736
E  728  SET(75,"$BUSHACD.A120$:CLG DMP CMD","$BUSHACD.A121$:CLG DMP CM 
D","$BUSHACD.A122$:CLG DMP CMD","$BUSHACD.A123$:CLG DMP CMD","$BUSHAC 
D.A124$:CLG DMP CMD","$BUSHACD.A125$:CLG DMP CMD","$BUSHACD.A126$:CL 
G DMP CMD","$BUSHACD.A127$:CLG DMP CMD")
E  730  SET(75,"$BUSHACD.A128$:CLG DMP CMD","$BUSHACD.A129$:CLG DMP CM 
D","$BUSHACD.A130$:CLG DMP CMD","$BUSHACD.A131$:CLG DMP CMD","$BUSHAC 
D.A132$:CLG DMP CMD","$BUSHACD.A133$:CLG DMP CMD","$BUSHACD.A134$:CL 
G DMP CMD","$BUSHACD.A135$:CLG DMP CMD")
E  732  SET(75,"$BUSHACD.A136$:CLG DMP CMD")
E  734  GOTO 800
ET 736  RELEASE("$BUSHACD.A120$:CLG DMP CMD","$BUSHACD.A121$:CLG DMP CM 
D","$BUSHACD.A122$:CLG DMP CMD","$BUSHACD.A123$:CLG DMP CMD","$BUSHAC 
D.A124$:CLG DMP CMD","$BUSHACD.A125$:CLG DMP CMD","$BUSHACD.A126$:CL 
G DMP CMD","$BUSHACD.A127$:CLG DMP CMD")
ET 738  RELEASE("$BUSHACD.A128$:CLG DMP CMD","$BUSHACD.A129$:CLG DMP CM 
D","$BUSHACD.A130$:CLG DMP CMD","$BUSHACD.A131$:CLG DMP CMD","$BUSHAC 
D.A132$:CLG DMP CMD","$BUSHACD.A133$:CLG DMP CMD","$BUSHACD.A134$:CL 
G DMP CMD","$BUSHACD.A135$:CLG DMP CMD")
ET 740  RELEASE("$BUSHACD.A136$:CLG DMP CMD")
ET 800  C --- DETERMINE MODE / REDIRECT ---
ET 805  IF("$MODE%" .EQ. 0) THEN GOTO 900
ET 810  IF("$MODE%" .EQ. 1) THEN GOTO 1000
E  815  IF("$MODE%" .EQ. 2) THEN GOTO 2000
E  820  IF("$MODE%" .EQ. 3) THEN GOTO 2000
E  825  IF("$MODE%" .EQ. 4) THEN GOTO 2000
E  830  IF("$MODE%" .EQ. 5) THEN GOTO 2000
E  835  IF("$MODE%" .EQ. 6) THEN GOTO 2000
E  840  IF("$MODE%" .EQ. 7) THEN GOTO 2000
E  845  IF("$MODE%" .EQ. 8) THEN GOTO 2000
E  850  IF("$MODE%" .EQ. 9) THEN GOTO 2000
E  855  IF("$MODE%" .EQ. 10) THEN GOTO 2000
E  860  IF("$MODE%" .EQ. 11) THEN GOTO 2000
E  865  GOTO 2000
E  900  C --- HIBERNATE - ESSENTIAL ONLY ---
E  910  ON("$SFSS%")

- 4 -
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 920 $XCDTS = 60
E 930 $NCDTS = 55
E 940 $XHDT5 = 90
E 950 $NHDT5 = 72
E 960 $XDASS = 0.8
E 970 $NDASS = 0.1
E 980 GOSUB 20000
E 990 GOTO 30000
ET 1000 C --- NORMAL OCCUPATION ---
ET 1010 ON("%SFSS%")
ET 1020 $XCDTS = 50
ET 1030 $NCDTS = 53
ET 1040 $XHDT5 = 120
ET 1050 $NHDT5 = 72
ET 1060 $XDASS = 1.5
ET 1070 $NDASS = 0.3
ET 1080 GOSUB 20000
ET 1090 GOTO 30000
E 2000 C --- LOW OCCUPATION ---
E 2010 ON("%SFSS%")
E 2020 $XCDTS = 60
E 2030 $NCDTS = 55
E 2040 $XHDT5 = 100
E 2050 $NHDT5 = 72
E 2060 $XDASS = 0.9
E 2070 $NDASS = 0.1
E 2072 GOSUB 20000
E 2074 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
ET 20030 $LOC1 = "%CDTS%"
ET 20040 IF("%ACLP%" .LT. 35) THEN $LOC1 = $LOC1 + 0.5
ET 20050 IF("%ACLP%" .GT. 45) THEN $LOC1 = $LOC1 - 1.0

- 5 -
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET  20060  MIN($LOC1,$LOC1,$XCDTS)
ET  20070  MAX("$CDTS$",$LOC1,$NCDS)
ET  20080  LOOP(0, "$CDT$","$CCWV$","$CDTS$",300,10,1,1,50,0,100,0)
ET  20090  SAMPLE(900) GOTO 20100
ET  20100  GOTO 20160
ET  20110  $LOC1 = "$HDS$"
ET  20120  IF("$AHLP$","LT. 35") THEN $LOC1 = $LOC1 - 5
ET  20130  IF("$AHLP$","GT. 45") THEN $LOC1 = $LOC1 + 10
ET  20140  MIN($LOC1,$LOC1,$XHDS$)
ET  20150  MAX("$HDS$",$LOC1,$XHDS$)
ET  20160  LOOP(120, "$HDT$","$HCVV$","$HDS$",200,5,1,1,25,0,100,0)
ET  20170  SAMPLE(900) GOTO 20190
ET  20180  GOTO 20240
ET  20190  $LOC1 = "$DASS$"
ET  20192  MAX($LOC2,"$AHMP$","$ACMP$")
ET  20200  IF($LOC2,"LT. 30") THEN $LOC1 = $LOC1 - 0.1
ET  20210  IF($LOC2,"GT. 40") THEN $LOC1 = $LOC1 + 0.2
ET  20220  MIN($LOC1,$LOC1,$XDASS$)
ET  20230  MAX("$DASS$",$LOC1,$NDASS$)
ET  20240  MIN("$MDASS$","$CDS$","$HDS$")
ET  20250  LOOP(120, "$MDASS$","$SVFU$","$DASS$",2500,250,29,0,60,20,100,0)
ET  20260  RETURN
ET  30000  GOTO 10

Panel System Name: BUSHACAD Node 01
Program Name: 1607_A21

ET  10  C --- AHU 2-1 ---
ET  102  C --- DEFINITIONS ---
ET  104  DEFINE(MODE,"1607_ECR.AHU 2-1")
ET  106  DEFINE(GAT,"BUSHACAD.OADB")
ET  108  DEFINE(SFSS,"BUSHACAD.A21SS")
ET  110  DEFINE(SVF,"BUSHACAD.A21SPD")
ET  112  DEFINE(SVF,"1607_A21.SVF")
ET  114  DEFINE(CDT,"BUSHACAD.A21CDT")
ET  116  DEFINE(CDTS,"1607_A21.CDTS")
ET  118  DEFINE(CCV,"BUSHACAD.A21CW")
ET  120  DEFINE(CCV,"1607_A21.CCV")
ET  122  DEFINE(HDT,"BUSHACAD.A21HDT")
ET  124  DEFINE(HDTS,"1607_A21.HDTS")
ET  126  DEFINE(HCV,"BUSHACAD.A21HCV")
ET  128  DEFINE(HCV,"1607_A21.HCV")
ET  130  DEFINE(CDS,"BUSHACAD.A21CD1")
ET 132  DEFINE(HDS,"BUSHACAD.A21D01")
ET 134  DEFINE(DASS,"1607.A21.DASS")
ET 136  DEFINE(NDAS,"1607.A21.NDAS")
ET 138  DEFINE(OAF,"BUSHACAD.A21CFM")
ET 140  DEFINE(OAFS,"1607.A21.OAFS")
ET 142  DEFINE(OAD,"BUSHACAD.A21OAD")
ET 144  DEFINE(SMK,"BUSHACAD.A21SMK")
ET 146  DEFINE(HIS,"BUSHACAD.A21HIS")
ET 148  DEFINE(ACLEP,"1607.A21.ACLEP")
ET 150  DEFINE(AHLE,"1607.A21.AHLE")
ET 152  DEFINE(ACDMP,"1607.A21.ACDMP")
ET 154  DEFINE(AHDMF,"1607.A21.AHDMF")
ET 300  C --- LOCAL VARIABLES ---
ET 302  LOCAL(XCDTS,NCDTS,XHDTS,NHDTS,XDASS,NDASS)
ET 400  C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET 410  TABLE("%CCV%","%SVF%",0,6,100,1)
ET 420  TABLE("%MCV%","%HCV%",0,7,100,2)
ET 430  TABLE("%SCV%","%SVF%",0,0,100,10)
ET 500  C --- GLOBAL CALCULATIONS ---
ET 505  SAMPLE(300) GOTO 520
ET 510  IF("%ACLP%".EQ.0 .AND. "%AHLP%".EQ.0 .AND. "%ACDMP%".EQ.0 .AND. "%AHDMF%".EQ.0) THEN GOTO 520
ET 515  GOTO 610
ET 520  C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
ET 525  $LOC1 = "$X%.A220:CLG LOOPOUT" + "$X%.A220:CLG LOOPOUT" + "$X%.A221:CLG LOOPOUT" + "$X%.A222:CLG LOOPOUT" + "$X%.A223:CLG LOOPOUT" + "$X%.A224:CLG LOOPOUT" + "$X%.A225:CLG LOOPOUT" + "$X%.A226:CLG LOOPOUT" + "$X%.A227:CLG LOOPOUT" + "$X%.A228:CLG LOOPOUT" + "$X%.A229:CLG LOOPOUT" + "$X%.A230:CLG LOOPOUT" + "$X%.A231:CLG LOOPOUT" + "$X%.A232:CLG LOOPOUT" + "$X%.A233:CLG LOOPOUT" + "$X%.A234:CLG LOOPOUT" + "$X%.A235:CLG LOOPOUT" + "$X%.A236:CLG LOOPOUT" + "$X%.A237:CLG LOOPOUT" + "$X%.A238:CLG LOOPOUT" + "$X%.A239:CLG LOOPOUT") / 20
ET 537  "%ACLP%" = $LOC1 .ROOT. 2
ET 540 C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HDT.S *
ET 557 "$AHPL$" = $LOC1 . $ROOT. 2
ET 560 C * FIND AVG TEC HTG DMP POS, USE TO RESET DAS.S *
ET 580 "$AHDMP$" = $LOC1 . $ROOT. 2
ET 585 C * FIND AVG TEC CLG DMP POS, USE TO RESET DAS.S *


ET 595 $LOC1 = $LOC1 + "%X%.A228:CLG DMP CMD" + "%X%.A228:CLG DMP CMD" + "%X%.A229:CLG DMP CMD" + "%X%.A229:CLG DMP CMD" + "%X%.A230:CLG DMP CMD" + "%X%.A230:CLG DMP CMD" + "%X%.A231:CLG DMP CMD" + "%X%.A231:CLG DMP CMD"


ET 605 "$ACDMPE" = $LOC1 .ROOT. 2
ET 610 C "$X%.A21CFM" = SQRT($LOC1) * 4005 * 1.5 * 1
ET 700 C --- SAFETIES ---
ET 702 C * SMOK Em
ET 704 IF("$SMK%" .NE. ON) THEN GOTO 710
ET 706 OFF(@SMOKE,"$SFSS%")
ET 708 SET(0,"$CCVV%","$HCCV%","$SVVF%")
ET 710 C * HIGH STATIC *
ET 712 IF("$HIS%" .NE. ON) THEN GOTO 718
ET 714 OFF(@EMER,"$SFSS%")
ET 716 SET(0,"$CCVV%","$HCCV%","$SVVF%")
ET 718 IF("$HIS%" .NE. ON) THEN RELEASE(@EMER,"$SFSS%")
ET 720 IF("$SMK%" .NE. ON .AND. "$HIS%" .NE. ON) THEN RELEASE(@SMOKE,"$SFSS%")
ET 722 IF("$HIS%" .OR. "$SMK%") THEN GOTO 30000
ET 724 C * VFD IN BYPASS *
ET 726 IF("$X%.A21BP" .NE. ON) THEN GOTO 736
ET 734
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 734  GOTO 800
ET 740  RELEASE("%X%.A236:CLG DMP CMD","%X%.A237:CLG DMP CMD","%X%.A238:CLG DMP CMD")
ET 800  C  ---  DETERMINE  MODE  /  REDIRECT  ---
ET 805  IF("%MODE%" .EQ. 0) THEN GOTO 900
ET 810  IF("%MODE%" .EQ. 1) THEN GOTO 1000
E 815  IF("%MODE%" .EQ. 2) THEN GOTO 2000
E 820  IF("%MODE%" .EQ. 3) THEN GOTO 3000
E 825  IF("%MODE%" .EQ. 4) THEN GOTO 4000
E 830  IF("%MODE%" .EQ. 5) THEN GOTO 5000
E 835  IF("%MODE%" .EQ. 6) THEN GOTO 6000
E 840  IF("%MODE%" .EQ. 7) THEN GOTO 7000
E 845  IF("%MODE%" .EQ. 8) THEN GOTO 8000
E 850  IF("%MODE%" .EQ. 9) THEN GOTO 9000
E 855  IF("%MODE%" .EQ. 10) THEN GOTO 10000
E 860  IF("%MODE%" .EQ. 11) THEN GOTO 11000
E 865  GOTO 2000
E 900  C  ---  HIBERNATE  -  ESSENTIAL  ONLY  ---
E 910  ON("%SFSS%")
E 920  $XCDTS = 60
E 930  $NCDTS = 55
E 940  $XHDTTS = 100
E 950  $NHDTTS = 72
E 960  $XDASS = 0.8
E 970  $NDASS = 0.1
E 980  GOSUB 20000
E 990  GOTO 30000
ET 1000  C  ---  NORMAL  OCCUPATION  ---
ET 1010  ON("%SFSS%")
ET 1020  $XCDTS = 58
ET 1030  $NCDTS = 53
ET 1040  $XHDTTS = 120
ET 1050  $NHDTTS = 72
ET 1060  $XDASS = 1.5
ET 1070  $NDASS = 0.3
ET 1080  GOSUB 20000
ET 1090  GOTO 30000
E 2000  C  ---  MINIMAL  OCCUPATION  ---
E 2010  ON("%SFSS%")
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 2020 $XCDTS = 60
E 2030 $NCDTS = 55
E 2040 $XHDTS = 100
E 2050 $NHDT5 = 72
E 2060 $XDASS = 0.8
E 2070 $NDASS = 0.1
E 2080 GOSUB 20000
E 2090 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
E 20030 $LOC1 = "$CDTS"
E 20040 IF("%ACLP%" .LT. 35 .AND. "%X8.A226:ROOM TEMP" .LT. 75) THEN
  $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACLP%" .GT. 45 .OR. "%X8.A226:ROOM TEMP" .GT. 76) THEN
  $LOC1 = $LOC1 - 1.0
E 20060 MIN($LOC1,$LOCI,$XCDTS)
E 20070 MAX( "$CDTS","$LOC1","$NCDTS"
ET 20080 LOOP(0,"$CDTS","$CCV8","$CDTS",300,10,1,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
E 20110 $LOC1 = "$HDTS"
E 20120 IF("%AHLF%" .LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("%AHLF%" .GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOCI,$XHDTS)
E 20150 MAX("$HDTS","$LOC1","$NHDT5"
ET 20160 LOOP(128,"$HDTS","$HCV8","$HDTS",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20250
E 20190 $LOC1 = "$DASS"
E 20200 MAX($LOC2,"%AHDFP%","%ACDFP%"
E 20210 IF($LOC2 .LT. 30 .AND. "%X8.A226:ROOM TEMP" .LT. 75) THEN $L
  OCI = $LOC1 - 0.1

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 920 $XCDTS = 60
E 930 $NCDS = 55
E 940 $XHDT = 100
E 950 $NHDT = 72
E 960 $XDASS = 0.8
E 970 $NDASS = 0.1
E 980 GOSUB 20000
E 990 GOTO 30000
ET 1000 C --- NORMAL OCCUPATION ---
ET 1010 ON("%SFSS%")
ET 1020 $XCDTS = 58
ET 1030 $NCDS = 53
ET 1040 $XHDT = 120
ET 1050 $NHDT = 72
ET 1060 $XDASS = 1.5
ET 1070 $NDASS = 0.3
ET 1080 GOSUB 20000
ET 1090 GOTO 30000
E 2000 C --- MINIMAL OCCUPATION ---
E 2010 ON("%SFSS%")
E 2020 $XCDTS = 60
E 2030 $NCDS = 55
E 2040 $XHDT = 100
E 2050 $NHDT = 72
E 2060 $XDASS = 0.8
E 2070 $NDASS = 0.1
E 2080 GOSUB 20000
E 2090 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALUES / RESET SETPOINT
  S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
E 20030 $LOC1 = "%CDTS%"
E 20040 IF("%ACL%" .LT. 35) THEN $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACL%" .GT. 45) THEN $LOC1 = $LOC1 - 1.0

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 20060 MIN($LOC1,$LOC1,$XCDTS$)
E 20070 MAX("$XCDTS$",$LOC1,$XCDTS$)
ET 20080 LOOP (0,"$XCDT$","$XCVV$","$XCDTS$",300,10,1,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
E 20110 $LOC1 = "$HDT$S"
E 20120 IF("$AHLP$" .LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("$AHLP$" .GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOC1,$XHDT$)
E 20150 MAX("$XHDT$",$LOC1,$XHDT$)
ET 20160 LOOP (128,"$XHDT$","$HVYV$","$XHDT$",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20250
ET 20190 $LOC1 = "$XASS$"
E 20200 MAX($LOC2,"$AHMP$","$ACTMP$")
E 20210 IF($LOC2 .LT. 30) THEN $LOC1 = $LOC1 - 0.1
E 20220 IF($LOC2 .GT. 40) THEN $LOC1 = $LOC1 + 0.2
E 20230 MIN($LOC1,$LOC1,$XDASS$)
E 20240 MAX("$XDASS$",$LOC1,$XDASS$)
ET 20250 MIN("$NDASS$","$CDSS$","$HDS$")
ET 20260 LOOP (128,"$NDASS$","$SUFT$","$NDASS$",2500,250,20,1,68,20,100,0)
ET 20270 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 01
Program Name: 1607_OA31

ET 10 C --- OAHU 3-1 ---
ET 100 C --- DEFINITIONS ---
ET 102 DEFINE(X,"BUSHACAD")
ET 104 DEFINE(MODE,"1607_ECR.OAHU 3-1")
ET 106 DEFINE(OAT,"BUSHACAD.OA0BT")
ET 108 DEFINE(SFSS,"BUSHACAD.OA3ISS")
ET 110 DEFINE(SVF,"BUSHACAD.OA3ISP")
ET 112 DEFINE(SVFV,"1607_OA31.SVF.V")
ET 114 DEFINE(DAT,"BUSHACAD.OA3IDT")
ET 116 DEFINE(DATS,"1607_OA31.DAT.S")
ET 118 DEFINE(CCV,"BUSHACAD.OA3ICW")
ET 120 DEFINE(CCVV,"1607_OA31.CCV.V")
ET 122 DEFINE(PHT,"BUSHACAD.OA3IPT")
ET 124 DEFINE(PHTS,"1607_OA31.PHT.S")
ET 126 DEFINE(PHV,"BUSHACAD.OA3IRW")
ET 128 DEFINE(PHVV,"1607_OA31.PHV.V")
ET 130 DEFINE(PFH,"BUSHACAD.OA3IFF")
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)

Programs: *

Line Range: 1 - 32767

ET  132  DEFINE(DAS,"BUSHACAD.OA31DS")
ET  134  DEFINE(DASS,"1607_OA31.DAS.S")
ET  136  DEFINE(SMK,"BUSHACAD.OA31SM")
ET  138  DEFINE(HIS,"BUSHACAD.OA31HS")
ET  140  DEFINE(FRS,"BUSHACAD.OA31FRS")
ET  142  DEFINE(DWP,"1607_YOADWFP")
ET  300  C --- LOCAL VARIABLES ---
ET  310  C LOCAL()
ET  400  C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET  410  TABLE("%CCV%","%CCV%",0,5,100,1)
ET  420  TABLE("%PHV%","%PHV%",0,10,100,0)
ET  430  TABLE("%SVFV%","%SVF%",0,0,100,10)
ET  500  C --- GLOBAL CALCULATIONS ---
ET  510  IF("%OAP%".LE.30) THEN ON("%PHP%")
ET  520  IF("%OAP%".GT.41) THEN OFF("%PHP%")
ET  700  C --- SAFETIES ---
ET  705  C * SMOKE *
ET  710  IF("%SMK%".NE.0) THEN GOTO 730
ET  715  OFF("%SMK%")
ET  720  SET(0,"%CCV%","%PHV%","%SVFV%")
ET  725  GOTO 30000
ET  730  C * FREEZE *
ET  735  IF("%FRS%".NE.0) THEN GOTO 755
ET  740  OFF("%FRS%")
ET  745  SET(100,"%CCV%","%PHV%")
ET  750  SET(0,"%SVFV%")
ET  755  GOTO 30000
ET  760  C * HIGH STATIC *
ET  765  IF("%HIS%".NE.0) THEN GOTO 780
ET  770  OFF("%HIS%")
ET  775  GOTO 30000
ET  780  RELEASE("%SMK%")
ET  800  C --- DETERMINE MODE / REDIRECT ---
ET  805  IF("%MODE%".EQ.0) THEN GOTO 900
ET  810  IF("%MODE%".EQ.1) THEN GOTO 1000
ET  815  IF("%MODE%".EQ.2) THEN GOTO 2000
ET  820  IF("%MODE%".EQ.3) THEN GOTO 2000
ET  825  IF("%MODE%".EQ.4) THEN GOTO 2000
ET  830  IF("%MODE%".EQ.5) THEN GOTO 2000
ET  835  IF("%MODE%".EQ.6) THEN GOTO 2000
ET  840  IF("%MODE%".EQ.7) THEN GOTO 2000
ET  845  IF("%MODE%".EQ.8) THEN GOTO 2000
ET  850  IF("%MODE%".EQ.9) THEN GOTO 2000
ET  855  IF("%MODE%".EQ.10) THEN GOTO 2000
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 860 IF("%MODE%" .EQ. 11) THEN GOTO 2000
E 865 GOTO 2000
E 900 C ---- UNOCCUPIED ----
E 910 OFF("%SFSS%")
E 920 SET(0,"%CCVV%","%PHV%","%SVFV%")
E 930 GOTO 30000
ET 1000 C ---- NORMAL OCCUPATION ----
ET 1010 ON("%SFSS%")
ET 1020 $LOC1 ="%DNP%" - 4
ET 1030 MAX($LOC1,$LOC1,55)
ET 1040 MIN("%DATS%",$LOC1,65)
ET 1050 "%PHTS%" = 50
ET 1060 "%DASS%" = 0.48
ET 1070 GOSUB 20000
ET 1080 GOTO 30000
E 2000 C ---- MINIMAL OCCUPATION ----
E 2010 OFF("%SFSS%")
E 2020 SET(0,"%CCVV%","%PHV%","%SVFV%")
E 2030 GOTO 30000
E 3000 C ---- OCC3 ----
E 4000 C ---- OCC4 ----
E 5000 C ---- OCC5 ----
E 6000 C ---- WARMUP ----
E 7000 C ---- COOLDOWN ----
E 8000 C ---- NIGHT HEATING ----
E 9000 C ---- NIGHT COOLING ----
E 10000 C ---- STOP HEATING ----
E 11000 C ---- STOP COOLING ----
E 11999 GOTO 30000
ET 20000 C ---- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT ----
ET 20010 LOOP(0,"%DAT%","%CCVV%","%DATS%",600,20,1,1,50,0,100,0)
ET 20020 LOOP(128, "%PHT%","%PHV%","%PHTS%",200,5,1,1,25,0,100,0)
ET 20030 LOOP(128,"%DASS%","%SVFV%","%DASS%",2500,250,20,1,60,20,100,0)
ET 20040 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 01
Program Name: 1607_EF A1

ET 10 C ---- EF A1 ----
ET 100 IF("BUSHACAD.A1SS" .OR. "BUSHACAD.A21SS" .OR. "BUSHACAD.A31 SS") THEN ON("BUSHACAD.EFA1SS") ELSE OFF("BUSHACAD.EFA1SS")
ET 10000 GOTO 10
Panel System Name:  BUSHACAD Node 01
Program Name:  1607_ND01.XVLV

ET  10  C --- CALCULATE CUBE-ROOT MEAN CUBE OF VALVE POSITIONS FOR NODE ----
ET  20  C --- (USED BY CHW AND HW ADAPTIVE RESET) (WEIGHT THE AVG TO THE OPEN SIDE)
ET 1000  SAMPLE(300) GOTO 1020
ET 1010  GOTO 10000
E 1020  $LOC10 = 0
E 1030  IF("BUSHACAD.A11SS" .AND. "BUSHACAD.A11PR") THEN $LOC10 = $LOC1 + 1
E 1040  $LOC1 = "1607_A11.CCV.V" + "1607_A11.CCV.V" + "1607_A11.CCV.V" + "BUSHACAD.A11SS" + "BUSHACAD.A11FR"
E 1050  IF("BUSHACAD.A21SS" .AND. "BUSHACAD.A21PR") THEN $LOC10 = $LOC1 + 1
E 1060  $LOC2 = "1607_A21.CCV.V" + "1607_A21.CCV.V" + "1607_A21.CCV.V" + "BUSHACAD.A21SS" + "BUSHACAD.A21FR"
E 1070  IF("BUSHACAD.A31SS" .AND. "BUSHACAD.A31PR") THEN $LOC10 = $LOC1 + 1
E 1080  $LOC3 = "1607_A31.CCV.V" * "1607_A31.CCV.V" + "1607_A31.CCV.V" * "BUSHACAD.A31SS" + "BUSHACAD.A31FR"
E 1082  IF("BUSHACAD.A31SS" .AND. "BUSHACAD.A31PR") THEN $LOC10 = $LOC1 + 1
E 1084  $LOC1 = "1607_A31.CCV.V" + "1607_A31.CCV.V" + "1607_A31.CCV.V" + "BUSHACAD.A31SS" + "BUSHACAD.A31FR"
E 1090  $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
E 1100  "1607_ND01.ACCV" = $LOC5 .ROOT. 3
E 2000  $LOC10 = 0
E 2010  IF("BUSHACAD.A11SS" .AND. "BUSHACAD.A11PR") THEN $LOC10 = $LOC10 + 1
E 2020  $LOC1 = "1607_A11.HCV.V" + "1607_A11.HCV.V" + "1607_A11.HCV.V" + "BUSHACAD.A11SS" + "BUSHACAD.A11FR"
E 2030  IF("BUSHACAD.A21SS" .AND. "BUSHACAD.A21PR") THEN $LOC10 = $LOC10 + 1
E 2040  $LOC2 = "1607_A21.HCV.V" + "1607_A21.HCV.V" + "1607_A21.HCV.V" + "BUSHACAD.A21SS" + "BUSHACAD.A21FR"
E 2050  IF("BUSHACAD.A31SS" .AND. "BUSHACAD.A31PR") THEN $LOC10 = $LOC10 + 1
E 2060  $LOC3 = "1607_A31.HCV.V" + "1607_A31.HCV.V" + "1607_A31.HCV.V" + "BUSHACAD.A31SS" + "BUSHACAD.A31FR"
E 2062  IF("BUSHACAD.A31SS" .AND. "BUSHACAD.A31PR") THEN $LOC10 = $LOC10 + 1
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 2064 $LOC4 = "1607_OA31.PHV.V" * "1607_OA31.PHV.V" * "1607_OA31.PHV.V" * "BUSHACAD.OA31SS" * "BUSHACAD.OA31PR"
ET 2070 $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
ET 2080 "1607_ND01.AHCV." = $LOC5 .ROOT. 3
ET 10000 GOTO 10

******************************************************************************************
Panel System Name: BUSHACAD Node 02
Program Name: 1607_A12
ET 10  C --- AHU 1-2 ---
ET 100  C --- DEFINITIONS ---
ET 101  DEFINE(X,"BUSHACAD")
ET 102  DEFINE(MODE,"1607_ECR.AHU 1-2")
ET 104  DEFINE(QAT,"BUSHACAD.QADBT")
ET 106  DEFINE(SFSS,"BUSHACAD.A12SS")
ET 108  DEFINE(SVF,"BUSHACAD.A12SPD")
ET 109  DEFINE(SVFV,"1607_A12.SVF.V")
ET 110  DEFINE(CDT,"BUSHACAD.A12CDT")
ET 112  DEFINE(CDTS,"1607_A12.CDT.S")
ET 114  DEFINE(CCV,"BUSHACAD.A12CW")
ET 115  DEFINE(CCCV,"1607_A12.CCV.V")
ET 116  DEFINE(HDT,"BUSHACAD.A12HDT")
ET 118  DEFINE(HDTS,"1607_A12.HDT.S")
ET 120  DEFINE(HCV,"BUSHACAD.A12HW")
ET 121  DEFINE(HCVV,"1607_A12.HCV.V")
ET 122  DEFINE(CDS,"BUSHACAD.A12CD1")
ET 124  DEFINE(HDS,"BUSHACAD.A12HD1")
ET 126  DEFINE(DASS,"1607_A12.DAS.S")
ET 128  DEFINE(MDAS,"1607_A12.MDAS")
ET 130  DEFINE(OAF,"BUSHACAD.A12CFM")
ET 132  DEFINE(OAFS,"1607_A12.OAFS")
ET 134  DEFINE(OAD,"BUSHACAD.A12OAD")
ET 136  DEFINE(SMK,"BUSHACAD.A12SMK")
ET 138  DEFINE(HIS,"BUSHACAD.A12HS")
ET 140  DEFINE(ACLE,"1607_A12.ACLE")
ET 142  DEFINE(AHLE,"1607_A12.AHLE")
ET 144  DEFINE(ACDMP,"1607_A12.ACDMP")
ET 146  DEFINE(AHMMP,"1607_A12.AHMMP")
ET 300  C --- LOCAL VARIABLES ---
ET 302  LOCAL(XCDTS,NCDTS,XHDT,NHDT,NXASS,NDASS)
ET 400  C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET 410  TABLE("%CCV%","%CCV%",0,9,100,3)
ET 420  TABLE("%HCV%","%HCV%",0,5,100,0)
ET 430  TABLE("%$VEV%", "%$V%", 0, 0, 100, 10)
ET 500  C --- GLOBAL CALCULATIONS ---
ET 502  IF("BUSHACAD.A12SS", OR, "BUSHACAD.A12SS", EQ, PRFON) THEN O
N("BUSHACAD.RLA4SS") ELSE OFF("BUSHACAD.RLA4SS")
ET 505  SAMPLE(300) GOTO 520
ET 510  IF( "%AELP%", EQ, 0, AND, "%AHLP%", EQ, 0, AND, "%ACDMP%", EQ

ET 515  GOTO 610
E 520  C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
E 525  $LOC1 = "$XX.A137:CLG LOOPOUT" + "$XX.A137:CLG LOOPOUT" + "$XX.A138:CLG LOOPOUT" + "$XX.A138:CLG LOOPOUT" + "$XX.A139:CLG LOOPOUT" + "$XX.A139:CLG LOOPOUT" + "$XX.A140:CLG LOOPOUT" + "$XX.A140:CLG LOOPOUT"
E 527  $LOC1 = $LOC1 + "$XX.A141:CLG LOOPOUT" + "$XX.A141:CLG LOOPOUT" + "$XX.A142:CLG LOOPOUT" + "$XX.A142:CLG LOOPOUT" + "$XX.A143:CLG LOOPOUT" + "$XX.A143:CLG LOOPOUT" + "$XX.A144:CLG LOOPOUT" + "$XX.A144:CLG LOOPOUT"
E 530  $LOC1 = $LOC1 + "$XX.A145:CLG LOOPOUT" + "$XX.A145:CLG LOOPOUT" + "$XX.A146:CLG LOOPOUT" + "$XX.A146:CLG LOOPOUT" + "$XX.A147:CLG LOOPOUT" + "$XX.A147:CLG LOOPOUT" + "$XX.A148:CLG LOOPOUT" + "$XX.A148:CLG LOOPOUT"
E 532  $LOC1 = $LOC1 + "$XX.A149:CLG LOOPOUT" + "$XX.A149:CLG LOOPOUT" + "$XX.A150:CLG LOOPOUT" + "$XX.A150:CLG LOOPOUT" + "$XX.A151:CLG LOOPOUT" + "$XX.A151:CLG LOOPOUT" + "$XX.A152:CLG LOOPOUT" + "$XX.A152:CLG LOOPOUT"
E 537  "$AELP%" = "$LOC1, "ROOT. 2"
E 540  C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HDT.S *
E 545  $LOC1 = "$XX.A137:HTG LOOPOUT" + "$XX.A137:HTG LOOPOUT" + "$XX.A138:HTG LOOPOUT" + "$XX.A138:HTG LOOPOUT" + "$XX.A139:HTG LOOPOUT" + "$XX.A139:HTG LOOPOUT" + "$XX.A140:HTG LOOPOUT" + "$XX.A140:HTG LOOPOUT"
E 547  $LOC1 = $LOC1 + "$XX.A141:HTG LOOPOUT" + "$XX.A141:HTG LOOPOUT" + "$XX.A142:HTG LOOPOUT" + "$XX.A142:HTG LOOPOUT" + "$XX.A143:HTG LOOPOUT" + "$XX.A143:HTG LOOPOUT" + "$XX.A144:HTG LOOPOUT" + "$XX.A144:HTG LOOPOUT"
E 550  $LOC1 = $LOC1 + "$XX.A145:HTG LOOPOUT" + "$XX.A145:HTG LOOPOUT" + "$XX.A146:HTG LOOPOUT" + "$XX.A146:HTG LOOPOUT" + "$XX.A147:HTG LOOPOUT" + "$XX.A147:HTG LOOPOUT" + "$XX.A148:HTG LOOPOUT" + "$XX.A148:HTG LOOPOUT"
E 552 $LOC1 = $LOC1 + "$X%.A149:HTG LOOPOUT" + "$X%.A149:HTG LOOPUT" + "$X%.A150:HTG LOOPOUT" + "$X%.A150:HTG LOOPUT" + "$X%.A151:HTG LOOPOUT" + "$X%.A151:HTG LOOPUT" + "$X%.A152:HTG LOOPOUT" + "$X%.A152:HTG LOOPUT"

E 555 $LOC1 = ( $LOC1 + "$X%.A153:HTG LOOPOUT" + "$X%.A153:HTG LOOPUT" + "$X%.A154:HTG LOOPOUT" + "$X%.A154:HTG LOOPUT" + "$X%.A155:HTG LOOPOUT" + "$X%.A155:HTG LOOPUT" + "$X%.A156:HTG LOOPOUT" + "$X%.A156:HTG LOOPUT" ) / 20

E 557 "$AHLIP" = $LOC1 .ROUT, 2

E 560 C * FIND AVG TEC HTG DMP P08, USE TO RESET DA8.S *

E 565 $LOC1 = "$X%.A137:HTG DMP CMD" + "$X%.A137:HTG DMP CMD" + "$X%.A138:HTG DMP CMD" + "$X%.A138:HTG DMP CMD" + "$X%.A139:HTG DMP CMD" + "$X%.A139:HTG DMP CMD" + "$X%.A140:HTG LOOPOUT" + "$X%.A140:HTG LOOPOUT"

E 567 $LOC1 = $LOC1 + "$X%.A141:HTG DMP CMD" + "$X%.A141:HTG DMP CMD" + "$X%.A142:HTG DMP CMD" + "$X%.A142:HTG DMP CMD" + "$X%.A143:HTG DMP CMD" + "$X%.A143:HTG DMP CMD" + "$X%.A144:HTG DMP CMD" + "$X%.A144:HTG DMP CMD"

E 570 $LOC1 = $LOC1 + "$X%.A145:HTG DMP CMD" + "$X%.A145:HTG DMP CMD" + "$X%.A146:HTG DMP CMD" + "$X%.A146:HTG DMP CMD" + "$X%.A147:HTG DMP CMD" + "$X%.A147:HTG DMP CMD" + "$X%.A148:HTG DMP CMD" + "$X%.A148:HTG DMP CMD"

E 572 $LOC1 = $LOC1 + "$X%.A149:HTG DMP CMD" + "$X%.A149:HTG DMP CMD" + "$X%.A150:HTG DMP CMD" + "$X%.A150:HTG DMP CMD" + "$X%.A151:HTG DMP CMD" + "$X%.A151:HTG DMP CMD" + "$X%.A152:HTG DMP CMD" + "$X%.A152:HTG DMP CMD"

E 575 $LOC1 = ( $LOC1 + "$X%.A153:HTG DMP CMD" + "$X%.A153:HTG DMP CMD" + "$X%.A154:HTG DMP CMD" + "$X%.A154:HTG DMP CMD" + "$X%.A155:HTG DMP CMD" + "$X%.A155:HTG DMP CMD" + "$X%.A156:HTG DMP CMD" + "$X%.A156:HTG DMP CMD" ) / 20

E 577 "$AHDMP" = $LOC1 .ROUT, 2

E 585 C * FIND AVG TEC CLG DMP P08, USE TO RESET DA8.S *

E 590 $LOC1 = "$X%.A137:CLG DMP CMD" + "$X%.A137:CLG DMP CMD" + "$X%.A138:CLG DMP CMD" + "$X%.A138:CLG DMP CMD" + "$X%.A139:CLG DMP CMD" + "$X%.A139:CLG DMP CMD" + "$X%.A140:CLG LOOPOUT" + "$X%.A140:CLG LOOPOUT"

E 592 $LOC1 = $LOC1 + "$X%.A141:CLG DMP CMD" + "$X%.A141:CLG DMP CMD" + "$X%.A142:CLG DMP CMD" + "$X%.A142:CLG DMP CMD" + "$X%.A143:CLG DMP CMD" + "$X%.A143:CLG DMP CMD" + "$X%.A144:CLG DMP CMD" + "$X%.A144:CLG DMP CMD"

E 595 $LOC1 = $LOC1 + "$X%.A145:CLG DMP CMD" + "$X%.A145:CLG DMP CMD" + "$X%.A146:CLG DMP CMD" + "$X%.A146:CLG DMP CMD" + "$X%.A147:CLG DMP CMD" + "$X%.A147:CLG DMP CMD" + "$X%.A148:CLG DMP CMD" + "$X%.A148:CLG DMP CMD"
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)

Programs: *

Line Range: 1 - 32767

E  597 $LOC1 = $LOC1 + "$%%.A149:CLG DMP CMD" + "$%%.A149:CLG DMP CMD" + "$%%.A150:CLG DMP CMD" + "$%%.A149:CLG DMP CMD" + "$%%.A151:CLG DMP CMD" + "$%%.A151:CLG DMP CMD" + "$%%.A152:CLG DMP CMD" + "$%%.A152:CLG DMP CMD"
E  602 "$ACDMF%" = $LOC1 . ROOT. 2
ET  610 C "BUSHACAD.A12CFM" = SQRT($LOC1) * 4005 * 2.2218 * 1
ET  700 C --- SAFETIES ---
ET  702 C + SMOKE +
ET  704 IF("%SMK%" .NE. ON) THEN GOTO 710
E  706 OFF(@SMOKIE,"@SFSS%")
E  708 SET(0,"%CCVV%","%HCCVV%","%SVFV%")
ET  710 C + HIGH STATIC +
ET  712 IF("%HIS%" .NE. ON) THEN GOTO 718
E  714 OFF(@EMER,"@SFSS%")
E  716 SET(0,"%CCVV%","%HCCVV%","%SVFV%")
ET  718 IF("%HIS%" .NE. ON) THEN RELEASES(@EMER,"@SFSS%")
ET  720 IF("%SMK%" .NE. ON .AND. "%HIS%" .NE. ON) THEN RELEASES(@SMOKE,"@SFSS%")
ET  722 IF("%HIS%" .OR. "%SMK%") THEN GOTO 30000
ET  724 C + VFD IN BYPASS +
ET  726 IF("BUSHACAD.A12BF" .NE. ON) THEN GOTO 736
E  734 GOTO 800

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Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET  740  RELEASE("BUSHACAD.A153:CLG DMP CMD","BUSHACAD.A154:CLG DMP CMD"
D","BUSHACAD.A155:CLG DMP CMD","BUSHACAD.A156:CLG DMP CMD")
ET  800  C --- DETERMINE MODE / REDIRECT ---
ET  805  IF("%MODE%".EQ. 0) THEN GOTO 900
ET  810  IF("%MODE%".EQ. 1) THEN GOTO 1000
E  815  IF("%MODE%".EQ. 2) THEN GOTO 2000
E  820  IF("%MODE%".EQ. 3) THEN GOTO 2000
E  825  IF("%MODE%".EQ. 4) THEN GOTO 2000
E  830  IF("%MODE%".EQ. 5) THEN GOTO 2000
E  835  IF("%MODE%".EQ. 6) THEN GOTO 2000
E  840  IF("%MODE%".EQ. 7) THEN GOTO 2000
E  845  IF("%MODE%".EQ. 8) THEN GOTO 2000
E  850  IF("%MODE%".EQ. 9) THEN GOTO 2000
E  855  IF("%MODE%".EQ.10) THEN GOTO 2000
E  860  IF("%MODE%".EQ.11) THEN GOTO 2000
E  865  GOTO 2000
E  900  C --- HIBERNATE - ESSENTIAL ONLY ---
E  910  ON("%SFSS%")
E  920  $XCDTS = 60
E  930  $NCDTS = 55
E  940  $XHDTS = 90
E  950  $NHDTS = 72
E  960  $XDASS = 0.8
E  970  $NDASS = 0.1
E  980  GOSUB 20000
E  990  GOTO 30000
ET 1000  C --- NORMAL OCCUPATION ---
ET 1010  ON("%SFSS%")
ET 1020  $XCDTS = 58
ET 1030  $NCDTS = 53
ET 1040  $XHDTS = 120
ET 1050  $NHDTS = 72
ET 1060  $XDASS = 1.7
ET 1070  $NDASS = 0.3
ET 1080  GOSUB 20000
ET 1090  GOTO 30000
E  2000  C --- MINIMAL OCCUPATION ---
E  2010  ON("%SFSS%")
E  2020  $XCDTS = 60
E  2030  $NCDTS = 55
E  2040  $XHDTS = 100
E  2050  $NHDTS = 72
E  2060  $XDASS = 0.8
E  2070  $NDASS = 0.1
E  2072  GOSUB 20000

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 2074 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
E 20030 $LOC1 = "$CDTS8"
E 20032 MAX($LOC2,"%X8.A138:ROOM TEMP","%X8.A142:ROOM TEMP")
E 20040 IF("%ACP%" .LT. 35 .AND. $LOC2 .LE. 75) THEN $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACP%" .GT. 45 .OR. $LOC2 .GE. 76) THEN $LOC1 = $LOC1 - 1.0
E 20060 MIN($LOC1,$LOC1,$XCDTS)
E 20070 MAX("%CDTS8",$LOC1,$NCDTS)
ET 20080 LOOP(0,"%CDTS8","%CCVFW","%CDTS8",950,25,1,1,60,0,100,0)
ET 20090 SAMPLE(900) GOTO 20100
ET 20100 GOTO 20160
E 20110 $LOC1 = "$HDT88"
E 20120 IF("%AHLP%" .LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("%AHLP%" .GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOC1,$XHDT8)
E 20150 MAX("%HDT88",$LOC1,$NHDT8)
ET 20160 LOOP(128,"%HDT88","%HCVF","%HDT88",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20240
E 20190 $LOC1 = "$DASS8"
E 20192 MAX($LOC2,"%AHDMF","%ACMF")
E 20200 IF($LOC2 .LT. 30 .AND. $LOC2 .LE. 75) THEN $LOC1 = $LOC1 - 0.1
E 20210 IF($LOC2 .GT. 40 .OR. $LOC2 .GE. 76) THEN $LOC1 = $LOC1 + 0.2
E 20220 MIN($LOC1,$LOC1,$XHASS)
E 20230 MAX("%DASS8",$LOC1,$NASS)
ET 20240 MIN("%MDASS8","%CDAS","%HDS8")
ET 20250 LOOP(128,"%MDASS8","%SVFV","%DASS8",2500,250,20,1,60,20,100,0)
Panel System Name: BUSHACAD Node 02
Program Name: 1607_A22

ET  10  C      ---   AHU 2-2  ---
ET  100 C      ---   DEFINITIONS ---
ET  101 DEFINE(X,"BUSHACAD")
ET  102 DEFINE(MODE,"1607_ECR.AHU 2-2")
ET  104 DEFINE(OAT,"BUSHACAD.OADT")
ET  106 DEFINE(SFS,"BUSHACAD.A22SS")
ET  108 DEFINE(SVF,"BUSHACAD.A22SPD")
ET  109 DEFINE(SVFV,"1607_A22.SVF.V")
ET  110 DEFINE(CDT,"BUSHACAD.A22CDT")
ET  112 DEFINE(CDTS,"1607_A22.CDT.S")
ET  114 DEFINE(CCV,"BUSHACAD.A22CW")
ET  115 DEFINE(CCVV,"1607_A22.CCV.V")
ET  116 DEFINE(HDT,"BUSHACAD.A22HDT")
ET  118 DEFINE(HDTS,"1607_A22.HDT.S")
ET  120 DEFINE(HCV,"BUSHACAD.A22HW")
ET  121 DEFINE(HCVV,"1607_A22.HCV.V")
ET  122 DEFINE(CDS,"BUSHACAD.A22CD1")
ET  124 DEFINE(HDS,"BUSHACAD.A22HD1")
ET  126 DEFINE(DASS,"1607_A22.DAS.S")
ET  128 DEFINE(MDAS,"1607_A22.MDAS")
ET  130 DEFINE(OAF,"BUSHACAD.A22CFM")
ET  132 DEFINE(OAFS,"1607_A22.OAFS")
ET  134 DEFINE(OAD,"BUSHACAD.A22OAD")
ET  136 DEFINE(SMK,"BUSHACAD.A22SMK")
ET  138 DEFINE(HIS,"BUSHACAD.A22HS")
ET  140 DEFINE(ACLP,"1607_A22.ACLP")
ET  142 DEFINE(AHLF,"1607_A22.AHLF")
ET  144 DEFINE(ACDMF,"1607_A22.ACDMF")
ET  146 DEFINE(AHDFM,"1607_A22.AHDFM")
ET  300 C      ---   LOCAL VARIABLES ---
ET  302 LOCAL(XCDTS,NCDTS,XHDT,NDTS,XDASS,NDASS)
ET  400 C      ---   CONVERT VIRTUAL LAO TO PHYSICAL ---
ET  410 TABLE("%CCVV%","%CCV%",0,6,100,0)
ET  420 TABLE("%HCVV%","%HCV%",0,5,100,0)
ET  430 TABLE("%SVFV%","%SVF%",0,0,100,10)
ET  500 C      ---   GLOBAL CALCULATIONS ---
ET  505 SAMPLE(300) GOTO 520
ET  510 IF("%ACLF%" .EQ. 0 .AND. "%AHLF%" .EQ. 0 .AND. "%ACDMF%" .EQ.
          0 .AND. "%AHDFM%" .EQ. 0) THEN GOTO 520
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

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ET 515 GOTO 610
E 520 C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
E 525 $LOC1 = "$X%.A240:CLG LOOPOUT" + "$X%.A240:CLG LOOPOUT" + "$X%.A241:CLG LOOPOUT" + "$X%.A241:CLG LOOPOUT" + "$X%.A242:CLG LOOPOUT" + "$X%.A242:CLG LOOPOUT" + "$X%.A243:CLG LOOPOUT" + "$X%.A243:CLG LOOPOUT"
E 527 $LOC1 = $LOC1 + "$X%.A244:CLG LOOPOUT" + "$X%.A244:CLG LOOPOUT" + "$X%.A245:CLG LOOPOUT" + "$X%.A245:CLG LOOPOUT" + "$X%.A246:CLG LOOPOUT" + "$X%.A246:CLG LOOPOUT" + "$X%.A247:CLG LOOPOUT" + "$X%.A247:CLG LOOPOUT"
E 530 $LOC1 = $LOC1 + "$X%.A248:CLG LOOPOUT" + "$X%.A248:CLG LOOPOUT" + "$X%.A249:CLG LOOPOUT" + "$X%.A249:CLG LOOPOUT" + "$X%.A250:CLG LOOPOUT" + "$X%.A250:CLG LOOPOUT" + "$X%.A251:CLG LOOPOUT" + "$X%.A251:CLG LOOPOUT"
E 532 $LOC1 = $LOC1 + "$X%.A252:CLG LOOPOUT" + "$X%.A252:CLG LOOPOUT" + "$X%.A253:CLG LOOPOUT" + "$X%.A253:CLG LOOPOUT" + "$X%.A254:CLG LOOPOUT" + "$X%.A254:CLG LOOPOUT" + "$X%.A255:CLG LOOPOUT" + "$X%.A255:CLG LOOPOUT"
E 535 $LOC1 = ($LOC1 + "$X%.A256:CLG LOOPOUT" + "$X%.A256:CLG LOOPOUT" + "$X%.A256:CLG LOOPOUT" + "$X%.A256:CLG LOOPOUT" + "$X%.A257:CLG LOOPOUT" + "$X%.A257:CLG LOOPOUT" + "$X%.A258:CLG LOOPOUT" + "$X%.A258:CLG LOOPOUT") / 20
E 537 "$AHELP" = "$LOC1 .ROOT. 2
E 540 C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HDT.S *
E 545 $LOC1 = "$X%.A240:HTG LOOPOUT" + "$X%.A240:HTG LOOPOUT" + "$X%.A241:HTG LOOPOUT" + "$X%.A241:HTG LOOPOUT" + "$X%.A242:HTG LOOPOUT" + "$X%.A242:HTG LOOPOUT" + "$X%.A243:HTG LOOPOUT" + "$X%.A243:HTG LOOPOUT"
E 547 $LOC1 = $LOC1 + "$X%.A244:HTG LOOPOUT" + "$X%.A244:HTG LOOPOUT" + "$X%.A245:HTG LOOPOUT" + "$X%.A245:HTG LOOPOUT" + "$X%.A246:HTG LOOPOUT" + "$X%.A246:HTG LOOPOUT" + "$X%.A247:HTG LOOPOUT" + "$X%.A247:HTG LOOPOUT"
E 550 $LOC1 = $LOC1 + "$X%.A248:HTG LOOPOUT" + "$X%.A248:HTG LOOPOUT" + "$X%.A249:HTG LOOPOUT" + "$X%.A249:HTG LOOPOUT" + "$X%.A250:HTG LOOPOUT" + "$X%.A250:HTG LOOPOUT" + "$X%.A251:HTG LOOPOUT" + "$X%.A251:HTG LOOPOUT"
E 552 $LOC1 = $LOC1 + "$X%.A252:HTG LOOPOUT" + "$X%.A252:HTG LOOPOUT" + "$X%.A253:HTG LOOPOUT" + "$X%.A253:HTG LOOPOUT" + "$X%.A254:HTG LOOPOUT" + "$X%.A254:HTG LOOPOUT" + "$X%.A255:HTG LOOPOUT" + "$X%.A255:HTG LOOPOUT"
E 555 $LOC1 = ($LOC1 + "$X%.A256:HTG LOOPOUT" + "$X%.A256:HTG LOOPOUT" + "$X%.A256:HTG LOOPOUT" + "$X%.A256:HTG LOOPOUT" + "$X%.A257:HTG LOOPOUT" + "$X%.A257:HTG LOOPOUT" + "$X%.A258:HTG LOOPOUT" + "$X%.A258:HTG LOOPOUT") / 20
E 557 "$AHELP" = "$LOC1 .ROOT. 2

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 560  C * FIND AVG TEC HTG DMP POS, USE TO RESET DAS.S *
E 565  $LOC1 = "$X%.A240:HTG DMP CMD" + "$X%.A240:HTG DMP CMD" + "$X%.A241:HTG DMP CMD" + "$X%.A241:HTG DMP CMD" + "$X%.A243:HTG DMP CMD" + "$X%.A243:HTG DMP CMD" + "$X%.A242:HTG DMP CMD" + "$X%.A242:HTG DMP CMD"
E 566  $LOC1 = $LOC1 + "$X%.A244:HTG DMP CMD" + "$X%.A244:HTG DMP CMD" + "$X%.A245:HTG DMP CMD" + "$X%.A245:HTG DMP CMD" + "$X%.A246:HTG DMP CMD" + "$X%.A246:HTG DMP CMD" + "$X%.A247:HTG DMP CMD" + "$X%.A247:HTG DMP CMD"
E 570  $LOC1 = $LOC1 + "$X%.A248:HTG DMP CMD" + "$X%.A248:HTG DMP CMD" + "$X%.A249:HTG DMP CMD" + "$X%.A249:HTG DMP CMD" + "$X%.A250:HTG DMP CMD" + "$X%.A250:HTG DMP CMD" + "$X%.A251:HTG DMP CMD" + "$X%.A251:HTG DMP CMD"
E 572  $LOC1 = $LOC1 + "$X%.A252:HTG DMP CMD" + "$X%.A252:HTG DMP CMD" + "$X%.A253:HTG DMP CMD" + "$X%.A253:HTG DMP CMD" + "$X%.A254:HTG DMP CMD" + "$X%.A254:HTG DMP CMD" + "$X%.A255:HTG DMP CMD" + "$X%.A255:HTG DMP CMD"
E 575  $LOC1 = ($LOC1 + "$X%.A256:HTG DMP CMD" + "$X%.A256:HTG DMP CMD" + "$X%.A257:HTG DMP CMD" + "$X%.A257:HTG DMP CMD" + "$X%.A258:HTG DMP CMD" + "$X%.A258:HTG DMP CMD" + "$X%.A259:HTG DMP CMD" + "$X%.A259:HTG DMP CMD") / 20
E 577  "$X%.A254:HTG DMP CMD") / 20
E 580  C * FIND AVG TEC CLG DMP POS, USE TO RESET DAS.S *
E 585  $LOC1 = "$X%.A240:CLG DMP CMD" + "$X%.A240:CLG DMP CMD" + "$X%.A241:CLG DMP CMD" + "$X%.A241:CLG DMP CMD" + "$X%.A242:CLG DMP CMD" + "$X%.A242:CLG DMP CMD" + "$X%.A243:CLG DMP CMD" + "$X%.A243:CLG DMP CMD"
E 587  $LOC1 = $LOC1 + "$X%.A244:CLG DMP CMD" + "$X%.A244:CLG DMP CMD" + "$X%.A245:CLG DMP CMD" + "$X%.A245:CLG DMP CMD" + "$X%.A246:CLG DMP CMD" + "$X%.A246:CLG DMP CMD" + "$X%.A247:CLG DMP CMD" + "$X%.A247:CLG DMP CMD"
E 590  $LOC1 = $LOC1 + "$X%.A248:CLG DMP CMD" + "$X%.A248:CLG DMP CMD" + "$X%.A249:CLG DMP CMD" + "$X%.A249:CLG DMP CMD" + "$X%.A250:CLG DMP CMD" + "$X%.A250:CLG DMP CMD" + "$X%.A251:CLG DMP CMD" + "$X%.A251:CLG DMP CMD"
E 592  $LOC1 = $LOC1 + "$X%.A252:CLG DMP CMD" + "$X%.A252:CLG DMP CMD" + "$X%.A253:CLG DMP CMD" + "$X%.A253:CLG DMP CMD" + "$X%.A254:CLG DMP CMD" + "$X%.A254:CLG DMP CMD" + "$X%.A255:CLG DMP CMD" + "$X%.A255:CLG DMP CMD"
E 595  $LOC1 = ($LOC1 + "$X%.A256:CLG DMP CMD" + "$X%.A256:CLG DMP CMD" + "$X%.A257:CLG DMP CMD" + "$X%.A257:CLG DMP CMD" + "$X%.A258:CLG DMP CMD" + "$X%.A258:CLG DMP CMD" + "$X%.A259:CLG DMP CMD" + "$X%.A259:CLG DMP CMD") / 20
E 597  "$X%.A254:HTG DMP CMD") / 20
ET 610  C "BUSHACAD.A22CFM" = SQRT($LOC1) * 4005 * 2.0 * 1
Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...  
(4 Field Panels)  
Programs:  *  
Line Range:  1 - 32767

ET 700  C    --- SAFETIES ---
ET 702  C * SMOKE *
ET 704  IF("%SMK%" .NE. ON) THEN GOTO 710
E 706  OFF(@SMOKE,"%$SFS%")
E 708  SET(0,"%CCVV%","%HCVV%","%SVFV%")
ET 710  C * HIGH STATIC *
ET 712  IF("%HIS%" .NE. ON) THEN GOTO 718
E 714  OFF(@EMER,"%$SFS%")
E 716  SET(0,"%CCVV%","%HCVV%","%SVFV%")
ET 718  IF("%HIS%" .NE. ON) THEN RELEASES(@EMER,"%$SFS%")
ET 720  IF("%SMK%" .NE. ON .AND. "%HIS%" .NE. ON) THEN RELEASES(@SMOKE ,"%$SFS%")
ET 722  IF("%HIS%" .OR. "%SMK%") THEN GOTO 30000
ET 724  C * VFD IN BYPASS *
ET 726  IF("BUSHACAD.A22BP" .NE. ON) THEN GOTO 736
E 732  SET(75,"BUSHACAD.A256:CLG DMP CMD","BUSHACAD.A257:CLG DMP CMD D","BUSHACAD.A258:CLG DMP CMD","BUSHACAD.A259:CLG DMP CMD")
E 734  GOTO 800
ET 740  RELEASES("BUSHACAD.A256:CLG DMP CMD","BUSHACAD.A257:CLG DMP CMD D","BUSHACAD.A258:CLG DMP CMD","BUSHACAD.A259:CLG DMP CMD")
ET 800  C    --- DETERMINE MODE / REDIRECT ---
ET 805  IF("%MODE%" .EQ. 0) THEN GOTO 900
E 810  IF("%MODE%" .EQ. 1) THEN GOTO 1000
E 815  IF("%MO" .EQ. 2) THEN GOTO 2000
E 820  IF("%MO" .EQ. 3) THEN GOTO 2000
E 825  IF("%MO" .EQ. 4) THEN GOTO 2000
E 830  IF("%MO" .EQ. 5) THEN GOTO 2000
E 835  IF("%MO" .EQ. 6) THEN GOTO 2000
E 840  IF("%MO" .EQ. 7) THEN GOTO 2000
Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E  845 IF("%MODE%" .EQ. 8) THEN GOTO 2000
E  850 IF("%MODE%" .EQ. 9) THEN GOTO 2000
E  855 IF("%MODE%" .EQ. 10) THEN GOTO 2000
E  860 IF("%MODE%" .EQ. 11) THEN GOTO 2000
E  865 GOTO 2000
E  900 C --- HIBERNATE - ESSENTIAL ONLY ---
E  910 ON("%SFSS%")
E  920 $XCDTS = 60
E  930 $NCDTS = 55
E  940 $XHDT5 = 100
E  950 $NHDT5 = 72
E  960 $XDA55 = 0.8
E  970 $NDASS = 0.1
E  980 GOSUB 20000
E  990 GOTO 30000
ET 1000 C --- NORMAL OCCUPATION ---
ET 1010 ON("%SFSS%")
ET 1020 $XCDTS = 58
ET 1030 $NCDTS = 53
ET 1040 $XHDT5 = 120
ET 1050 $NHDT5 = 72
ET 1060 $XDA55 = 1.5
ET 1070 $NDASS = 0.3
ET 1080 GOSUB 20000
ET 1090 GOTO 30000
E  2000 C --- MINIMAL OCCUPATION ---
E  2010 ON("%SFSS%")
E  2020 $XCDTS = 60
E  2030 $NCDTS = 55
E  2040 $XHDT5 = 100
E  2050 $NHDT5 = 72
E  2060 $XDA55 = 0.8
E  2070 $NDASS = 0.1
E  2072 GOSUB 20000
E  2074 GOTO 30000
E  3000 C --- OCC3 ---
E  4000 C --- OCC4 ---
E  5000 C --- OCC5 ---
E  6000 C --- WARMUP ---
E  7000 C --- COOLDOWN ---
E  8000 C --- NIGHT HEATING ---
E  9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
     S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
E 20030 $LOC1 = "$CDTS%"
E 20040 IF("%ACL%" .LT. 35) THEN $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACL%" .GT. 45) THEN $LOC1 = $LOC1 - 1.0
E 20060 MIN($LOC1,$LOC1,$XCDTS)
E 20070 MAX("%CDTS%",$LOC1,$NCCTS)
ET 20080 LOOP(0,"%CDT%","%CCVV%","%CDTS%",300,10,1,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
E 20110 $LOC1 = "$HDTS%"
E 20120 IF("%AHLP%" .LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("%AHLP%" .GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOC1,$XHTDS)
E 20150 MAX("%HDTS%",$LOC1,$NHDTDS)
ET 20160 LOOP(128,"%HTDS%","%HCVV%","%HDTS%",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20240
E 20190 $LOC1 = "$DASS%"
E 20192 MAX($LOC2,"%AHMDP%","%ACDM%")
E 20200 IF($LOC2 .LT. 30) THEN $LOC1 = $LOC1 - 0.1
E 20210 IF($LOC2 .GT. 40) THEN $LOC1 = $LOC1 + 0.2
E 20220 MIN($LOC1,$LOC1,$XDASS)
E 20230 MAX("%DASS%",$LOC1,$NDASS)
ET 20240 MIN("%MDASS%","%CDS%","%HDS%")
ET 20250 LOOP(128,"%MDASS%","%SVFV%","%DASS%",2500,250,20,1,60,20,100,0)
ET 20260 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 02
Program Name: 1607_A32

ET 10 C --- AHU 3-2 ---
ET 100 C --- DEFINITIONS ---
ET 101 DEFINE(X,"BUSHACAD")
ET 102 DEFINE(MODE,"1607_ECR.AHU 3-2")
ET 104 DEFINE(LOG,"BUSHACAD.OADB")
ET 106 DEFINE($FSS,"BUSHACAD.A32SS")
ET 108 DEFINE(SVF,"BUSHACAD.A32SD")
ET 109 DEFINE(SVF,"1607_A32.SVF.V")
ET 110 DEFINE(CDT,"BUSHACAD.A32CD")
ET 112 DEFINE(CDTS,"1607_A32.CDT.S")
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET 114 DEFINE (CCV, "BUSHACAD.A32CW")
ET 115 DEFINE (CCVV, "1607_A32.CCV.V")
ET 116 DEFINE (HDT, "BUSHACAD.A32HDT")
ET 118 DEFINE (HDTX, "1607_A32.HDT.X")
ET 120 DEFINE (HCV, "BUSHACAD.A32HCV")
ET 121 DEFINE (HCVV, "1607_A32.HCV.V")
ET 122 DEFINE (CDT, "BUSHACAD.A32CDT")
ET 124 DEFINE (HDS, "BUSHACAD.A32HDS")
ET 126 DEFINE (DASS, "1607_A32.DASS")
ET 128 DEFINE (MDASS, "1607_A32.MDASS")
ET 130 DEFINE (OAFL, "BUSHACAD.A32OFL")
ET 132 DEFINE (OAF, "1607_A32.OAF")
ET 134 DEFINE (OAO, "BUSHACAD.A32OAO")
ET 136 DEFINE (SMK, "BUSHACAD.A32SMK")
ET 138 DEFINE (HOS, "BUSHACAD.A32HOS")
ET 140 DEFINE (ACLP, "1607_A32.ACLP")
ET 142 DEFINE (AHL, "1607_A32.AHL")
ET 144 DEFINE (ACDM, "1607_A32.ACDM")
ET 146 DEFINE (ADMP, "1607_A32.ADMP")
ET 300 C --- LOCAL VARIABLES ---
ET 302 LOCAL (XCDTS, NCRTS, XHRTS, NHRTS, XDASS, NDASS)
ET 400 C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET 410 TABLE( "%CCVX", "%CCV", 0, 9, 100, 3)
ET 420 TABLE( "%HCVX", "%HCV", 0, 6, 100, 2)
ET 430 TABLE( "%SFX", "%SFX", 0, 0, 10, 10)
ET 500 C --- GLOBAL CALCULATIONS ---
ET 505 SAMPLE(300) GOTO 520
ET 510 IF( "%ACLP", .EQ. 0 AND. "%AHL", .EQ. 0 AND. "%ACDM", .EQ. 0 AND. "%ADMP", .EQ. 0) THEN GOTO 520
ET 515 GOTO 610
E 520 C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 532 $LOC1 = $LOC1 + "$X%.A348:CLG LOOPOUT" + "$X%.A348:CLG LOOPPO
DT" + "$X%.A349:CLG LOOPOUT" + "$X%.A349:CLG LOOPOUT" + "$X%.A350:CLG LOOPOUT" + "$X%.A350:CLG LOOPOUT" + "$X%.A351:CLG LOOPOUT"

E 535 $LOC1 = $LOC1 + "$X%.A352:CLG LOOPOUT" + "$X%.A352:CLG LOOPPO
DT" + "$X%.A353:CLG LOOPOUT" + "$X%.A353:CLG LOOPOUT" + "$X%.A354:CLG LOOPOUT" + "$X%.A354:CLG LOOPOUT" + "$X%.A355:CLG LOOPOUT"

E 536 $LOC1 = $LOC1 + "$X%.A356:CLG LOOPOUT" + "$X%.A356:CLG LOOPPO
DT" + "$X%.A357:CLG LOOPOUT" + "$X%.A357:CLG LOOPOUT" + "$X%.A358:CLG LOOPOUT" + "$X%.A358:CLG LOOPOUT"

E 537 $LOC1 = $LOC1 / 23
E 538 "$ACLFLR" = $LOC1 .ROOT. 2
E 540 C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HDT.S *
E 545 $LOC1 = "$X%.A336:HTG LOOPOUT" + "$X%.A336:HTG LOOPOUT" + "$X%.A337:HTG LOOPOUT" + "$X%.A337:HTG LOOPOUT" + "$X%.A338:HTG LOOPOUT" + "$X%.A338:HTG LOOPOUT" + "$X%.A339:HTG LOOPOUT" + "$X%.A339:HTG LOOPOUT"

E 547 $LOC1 = $LOC1 + "$X%.A340:HTG LOOPOUT" + "$X%.A340:HTG LOOPPO
DT" + "$X%.A341:HTG LOOPOUT" + "$X%.A341:HTG LOOPOUT" + "$X%.A342:HTG LOOPOUT" + "$X%.A342:HTG LOOPOUT" + "$X%.A343:HTG LOOPOUT"

E 550 $LOC1 = $LOC1 + "$X%.A344:HTG LOOPOUT" + "$X%.A344:HTG LOOPPO
DT" + "$X%.A345:HTG LOOPOUT" + "$X%.A345:HTG LOOPOUT" + "$X%.A346:HTG LOOPOUT" + "$X%.A346:HTG LOOPOUT" + "$X%.A347:HTG LOOPOUT"

E 552 $LOC1 = $LOC1 + "$X%.A348:HTG LOOPOUT" + "$X%.A348:HTG LOOPPO
DT" + "$X%.A349:HTG LOOPOUT" + "$X%.A349:HTG LOOPOUT" + "$X%.A350:HTG LOOPOUT" + "$X%.A350:HTG LOOPOUT" + "$X%.A351:HTG LOOPOUT"

E 555 $LOC1 = $LOC1 + "$X%.A352:HTG LOOPOUT" + "$X%.A352:HTG LOOPPO
DT" + "$X%.A353:HTG LOOPOUT" + "$X%.A353:HTG LOOPOUT" + "$X%.A354:HTG LOOPOUT" + "$X%.A354:HTG LOOPOUT" + "$X%.A355:HTG LOOPOUT"

E 556 $LOC1 = ($LOC1 + "$X%.A356:HTG LOOPOUT" + "$X%.A356:HTG LOOPPO
DT" + "$X%.A357:HTG LOOPOUT" + "$X%.A357:HTG LOOPOUT" + "$X%.A358:HTG LOOPOUT" + "$X%.A358:HTG LOOPOUT") / 23
E 557 "$AHFLF" = $LOC1 .ROOT. 2
E 560 C * FIND AVG TEC HTG DMP FOS, USE TO RESET DAS.S *
E 565 $LOC1 = "$X%.A336:HTG DMP CMD" + "$X%.A336:HTG DMP CMD" + "$X%.A337:HTG DMP CMD" + "$X%.A337:HTG DMP CMD" + "$X%.A338:HTG DMP CMD" + "$X%.A338:HTG DMP CMD" + "$X%.A339:HTG DMP CMD" + "$X%.A339:HTG DMP CMD"
E 567 $LOC1 = $LOC1 + "$\%X%\%.A340;HTG DMP CMD" + "$\%X%\%.A340;HTG DMP CMD" + "$\%X%\%.A341;HTG DMP CMD" + "$\%X%\%.A341;HTG DMP CMD" + "$\%X%\%.A342;HTG DMP CMD" + "$\%X%\%.A342;HTG DMP CMD" + "$\%X%\%.A343;HTG DMP CMD" + "$\%X%\%.A343;HTG DMP CMD"

E 570 $LOC1 = $LOC1 + "$\%X%\%.A344;HTG DMP CMD" + "$\%X%\%.A344;HTG DMP CMD" + "$\%X%\%.A345;HTG DMP CMD" + "$\%X%\%.A345;HTG DMP CMD" + "$\%X%\%.A346;HTG DMP CMD" + "$\%X%\%.A346;HTG DMP CMD" + "$\%X%\%.A347;HTG DMP CMD" + "$\%X%\%.A347;HTG DMP CMD"

E 572 $LOC1 = $LOC1 + "$\%X%\%.A348;HTG DMP CMD" + "$\%X%\%.A348;HTG DMP CMD" + "$\%X%\%.A349;HTG DMP CMD" + "$\%X%\%.A349;HTG DMP CMD" + "$\%X%\%.A350;HTG DMP CMD" + "$\%X%\%.A350;HTG DMP CMD" + "$\%X%\%.A351;HTG DMP CMD" + "$\%X%\%.A351;HTG DMP CMD"

E 575 $LOC1 = $LOC1 + "$\%X%\%.A352;HTG DMP CMD" + "$\%X%\%.A352;HTG DMP CMD" + "$\%X%\%.A353;HTG DMP CMD" + "$\%X%\%.A353;HTG DMP CMD" + "$\%X%\%.A354;HTG DMP CMD" + "$\%X%\%.A354;HTG DMP CMD"

E 576 $LOC1 = ($LOC1 + "$\%X%\%.A355;HTG DMP CMD" + "$\%X%\%.A355;HTG DMP CMD" + "$\%X%\%.A356;HTG DMP CMD" + "$\%X%\%.A356;HTG DMP CMD" + "$\%X%\%.A357;HTG DMP CMD" + "$\%X%\%.A357;HTG DMP CMD" + "$\%X%\%.A358;HTG DMP CMD"

E 577 "$\%\%.A358;HTG DMP CMD") / 23

E 577 "$\%\%.A358;HTG DMP CMD") / 23

E 580 $LOC1 = "$\%X%\%.A336;CLG DMP CMD" + "$\%X%\%.A336;CLG DMP CMD" + "$\%X%\%.A337;CLG DMP CMD" + "$\%X%\%.A337;CLG DMP CMD" + "$\%X%\%.A338;CLG DMP CMD" + "$\%X%\%.A338;CLG DMP CMD" + "$\%X%\%.A339;CLG DMP CMD" + "$\%X%\%.A339;CLG DMP CMD"

E 587 $LOC1 = $LOC1 + "$\%X%\%.A340;CLG DMP CMD" + "$\%X%\%.A340;CLG DMP CMD" + "$\%X%\%.A341;CLG DMP CMD" + "$\%X%\%.A341;CLG DMP CMD" + "$\%X%\%.A342;CLG DMP CMD" + "$\%X%\%.A342;CLG DMP CMD" + "$\%X%\%.A343;CLG DMP CMD" + "$\%X%\%.A343;CLG DMP CMD"

E 590 $LOC1 = $LOC1 + "$\%X%\%.A344;CLG DMP CMD" + "$\%X%\%.A344;CLG DMP CMD" + "$\%X%\%.A345;CLG DMP CMD" + "$\%X%\%.A345;CLG DMP CMD" + "$\%X%\%.A346;CLG DMP CMD" + "$\%X%\%.A346;CLG DMP CMD" + "$\%X%\%.A347;CLG DMP CMD" + "$\%X%\%.A347;CLG DMP CMD"

E 592 $LOC1 = $LOC1 + "$\%X%\%.A348;CLG DMP CMD" + "$\%X%\%.A348;CLG DMP CMD" + "$\%X%\%.A349;CLG DMP CMD" + "$\%X%\%.A349;CLG DMP CMD" + "$\%X%\%.A350;CLG DMP CMD" + "$\%X%\%.A350;CLG DMP CMD" + "$\%X%\%.A351;CLG DMP CMD" + "$\%X%\%.A351;CLG DMP CMD"

E 595 $LOC1 = $LOC1 + "$\%X%\%.A352;CLG DMP CMD" + "$\%X%\%.A352;CLG DMP CMD" + "$\%X%\%.A353;CLG DMP CMD" + "$\%X%\%.A353;CLG DMP CMD" + "$\%X%\%.A354;CLG DMP CMD" + "$\%X%\%.A354;CLG DMP CMD" + "$\%X%\%.A355;CLG DMP CMD" + "$\%X%\%.A355;CLG DMP CMD"

E 596 $LOC1 = ($LOC1 + "$\%X%\%.A356;CLG DMP CMD" + "$\%X%\%.A356;CLG DMP CMD" + "$\%X%\%.A357;CLG DMP CMD" + "$\%X%\%.A357;CLG DMP CMD" + "$\%X%\%.A358;CLG DMP CMD" + "$\%X%\%.A358;CLG DMP CMD") / 23

E 597 "$\%\%.ACDMP8" = $LOC1 . ROOT. 2
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Line Range: 1 - 32767

ET 610 C "BUSHACAD.A32CFM" = SQRT($LOC1) * 4005 * 2.0 * 1
ET 700 C --- SAFETIES ---
ET 702 C * SMOKE *
ET 704 IF("%SMK%" .NE. ON) THEN GOTO 710
E 706 OFF($SMOKE,"%SFSS%")
E 708 SET(0, "%CCVV%","%HCVV%","%SVFV%")
ET 710 C * HIGH STATIC *
ET 712 IF("%HIS%" .NE. ON) THEN GOTO 718
E 714 OFF($EMER,"%SFSS%")
E 716 SET(0, "%CCVV%","%HCVV%","%SVFV%")
ET 718 IF("%HIS%" .NE. ON) THEN RELEASE($EMER,"%SFSS%")
ET 720 IF("%SMK%" .NE. ON .AND. "$HIS%" .NE. ON) THEN RELEASE($SMOKE,"%SFSS%")
ET 722 IF("%HIS%" .OR. "$SMK%") THEN GOTO 30000
ET 724 C * VFD IN BYPASS *
ET 726 IF("BUSHACAD.A32BF" .NE. ON) THEN GOTO 736
E 734 GOTO 800
ET 800 C --- DETERMINE MODE / REDIRECT ---
ET 805 IF("%MODE%" .EQ. 0) THEN GOTO 900
ET 810 IF("%MODE%" .EQ. 1) THEN GOTO 1000
E 815 IF("%MODE%" .EQ. 2) THEN GOTO 2000
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 820 IF("%MODE%".EQ. 3) THEN GOTO 2000
E 825 IF("%MODE%".EQ. 4) THEN GOTO 2000
E 830 IF("%MODE%".EQ. 5) THEN GOTO 2000
E 835 IF("%MODE%".EQ. 6) THEN GOTO 2000
E 840 IF("%MODE%".EQ. 7) THEN GOTO 2000
E 845 IF("%MODE%".EQ. 8) THEN GOTO 2000
E 850 IF("%MODE%".EQ. 9) THEN GOTO 2000
E 855 IF("%MODE%".EQ. 10) THEN GOTO 2000
E 860 IF("%MODE%".EQ. 11) THEN GOTO 2000
E 865 GOTO 2000
E 900 C --- HIBERNATE - ESSENTIAL ONLY ---
E 910 ON("%SFSS%")
E 920 $XCDTS = 60
E 930 $NCDTS = 55
E 940 $XHDTST = 100
E 950 $NHDTS = 72
E 960 $XDASS = 0.8
E 970 $NDAASS = 0.1
E 980 GOSUB 20000
E 990 GOTO 30000
ET 1000 C --- NORMAL OCCUPATION ---
ET 1010 ON("%SFSS%")
ET 1020 $XCDTS = 58
ET 1030 $NCDTS = 53
ET 1040 $XHDTST = 120
ET 1050 $NHDTS = 75
ET 1060 $XDASS = 1.5
ET 1070 $NDAASS = 0.3
ET 1080 GOSUB 20000
ET 1090 GOTO 30000
E 2000 C --- MINIMAL OCCUPATION ---
E 2010 ON("%SFSS%")
E 2020 $XCDTS = 60
E 2030 $NCDTS = 55
E 2040 $XHDTST = 100
E 2050 $NHDTS = 72
E 2060 $XDASS = 0.8
E 2070 $NDAASS = 0.1
E 2072 GOSUB 20000
E 2074 GOTO 30000
E 3000 C --- COOL3 ---
E 4000 C --- COOL4 ---
E 5000 C --- COOL5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20060
E 20030 $LOC1 = "%CDTS%"
E 20040 IF("%ACLPE" .LT. 35 .AND. "%X%.A349:ROOM TEMP" .LT. 75) THEN
E 20050 $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACLPE" .GT. 45 .OR. "%X%.A349:ROOM TEMP" .GT. 76) THEN
E 20060 $LOC1 = $LOC1 - 1.0
E 20060 MIN($LOC1,$LOC1,$XCDTS)
E 20070 MAX("%CDTS%",$LOC1,$XCDTS)
ET 20080 LOOP (0,"%CDT%","%CCV%","%CDT%",300,10,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
E 20110 $LOC1 = "%HDT%"
E 20120 IF("%AHLP" .LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("%AHLP" .GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOC1,$XHDTS)
E 20150 MAX("%HDTS%",$LOC1,$XHDTS)
ET 20160 LOOP (128,"%HDT%","%CV%","%HDTS%",200,5,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20240
E 20190 $LOC1 = "%DASS%"
E 20190 MAX($LOC2,"%AHDMFA","%ACHMK%")
E 20200 IF($LOC2 .LT. 30 .AND. "%X%.A349:ROOM TEMP" .LT. 75) THEN $LOC1 = $LOC1 - 0.1
E 20210 IF($LOC2 .GT. 40 .OR. "%X%.A349:ROOM TEMP" .GT. 76) THEN $LOC1 = $LOC1 + 0.2
E 20220 MIN($LOC1,$LOC1,$XDASS)
E 20230 MAX("%DASS%",$LOC1,$NDASS)
ET 20240 MIN("%MDASS%","%CDT%","%DASS%")
ET 20250 LOOP (128,"%MDASS%","%VFV%","%DASS%",2500,250,20,1,60,20,100,0)
ET 20260 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 02
Program Name: 1607_OA32

ET 10 C --- OAHU 3-2 ---
**Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ... (4 Field Panels)**

Programs: *

Line Range: 1 - 32767

```fortran
ET  100 C --- DEFINITIONS ---
ET  102 DEFINE(X,"BUSHACAD")
ET  104 DEFINE(MODE,"1607_ECR.OAHU 3-2")
ET  106 DEFINE(OAT,"BUSHACAD.OADBT")
ET  108 DEFINE(SFSS,"BUSHACAD.OA323S")
ET  110 DEFINE(SVF,"BUSHACAD.OA32SP")
ET  112 DEFINE(SVFV,"1607_OA32.SVF.V")
ET  114 DEFINE(DAT,"BUSHACAD.OA32DT")
ET  116 DEFINE(DATS,"1607_OA32.DAT.S")
ET  118 DEFINE(CCV,"BUSHACAD.OA32CW")
ET  120 DEFINE(CCCV,"1607_OA32.CCV.V")
ET  122 DEFINE(PHT,"BUSHACAD.OA32PT")
ET  124 DEFINE(PHTS,"1607_OA32.PHT.S")
ET  126 DEFINE(PHV,"BUSHACAD.OA32HW")
ET  128 DEFINE(PHVV,"1607_OA32.PHV.V")
ET  130 DEFINE(PHP,"BUSHACAD.OA32PP")
ET  132 DEFINE(DAS,"BUSHACAD.OA32DS")
ET  134 DEFINE(DASS,"1607_OA32.DAS.S")
ET  136 DEFINE(SMK,"BUSHACAD.OA32SM")
ET  138 DEFINE(HIS,"BUSHACAD.OA32HS")
ET  140 DEFINE(FRZ,"BUSHACAD.OA32LL")
ET  142 DEFINE(DWE,"1607_VOADWE")
ET  300 C --- LOCAL VARIABLES ---
ET  310 C LOCAL{
ET  400 C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET  410 TABLE("%CCVV","%CCV",0,8,100,4)
ET  420 TABLE("%PHVV","%PHV",0,7,100,1)
ET  430 TABLE("%SVFV","%SVF",0,0,100,10)
ET  500 C --- GLOBAL CALCULATIONS ---
ET  510 IF("%OAT%".LT.38) THEN ON("%PHP%")
ET  520 IF("%OAT%".GT.41) THEN OFF("%PHP%")
ET  700 C --- SAFETIES ---
ET  705 C * SMOKE *
ET  710 IF("%SMK%".NE.ON) THEN GOTO 730
ET  715 OFF("SMOKE","%SFSS%")
ET  720 SET(0,"%CCVV","%PHVV","%SVFV")
ET  725 GOTO 30000
ET  730 C * FREEZE *
ET  735 IF("%FSS%".NE.ON) THEN GOTO 755
ET  740 OFF("EMER","%SFSS%")
ET  745 SET(100,"%CCVV","%PHVV")
ET  750 SET(0,"%SVFV")
ET  752 GOTO 30000
ET  755 C * HIGH STATIC *
ET  760 IF("%HIS%".NE.ON) THEN GOTO 780
```

---

66
E  765  OFF (@EMER, "%SFSS")
E  770  SET (0, "%CVVV", "%PHV%, "%SFV%")
E    775  GOTO 30000
ET    780  RELEASE (@SMOKE, "%SFSS");
ET    800  C --- DETERMINE MODE / REDIRECT ---
ET    805  IF("%MODE%", .EQ. 0) THEN GOTO 900
ET    810  IF("%MODE%", .EQ. 1) THEN GOTO 1000
E    815  IF("%MODE%", .EQ. 2) THEN GOTO 2000
E    820  IF("%MODE%", .EQ. 3) THEN GOTO 3000
E    825  IF("%MODE%", .EQ. 4) THEN GOTO 4000
E    830  IF("%MODE%", .EQ. 5) THEN GOTO 5000
E    835  IF("%MODE%", .EQ. 6) THEN GOTO 6000
E    840  IF("%MODE%", .EQ. 7) THEN GOTO 7000
E    845  IF("%MODE%", .EQ. 8) THEN GOTO 8000
E    850  IF("%MODE%", .EQ. 9) THEN GOTO 9000
E    855  IF("%MODE%", .EQ. 10) THEN GOTO 10000
E    860  IF("%MODE%", .EQ. 11) THEN GOTO 11000
E    865  SET (2, "%MODE%");
E    870  GOTO 30000
E    900  C --- UNOCCUPIED ---
E    910  OFF ("%SFSS")
E    920  SET (0, "%CVVV", "%PHV", "%SFV%")
E    930  GOTO 30000
ET  1000  C --- NORMAL OCCUPATION ---
ET  1010  ON ("%SFSS")
ET  1020  $LOC1 = "$DWP%" - 6
ET  1030  MAX ($LOC1, $LOC1, 55)
ET  1040  MIN ("%DAYS", $LOC1, 65)
ET  1050  "%PHTS%" = 50
ET  1060  "$DASS%" = 0.48
ET  1070  GOSUB 20000
ET  1080  GOTO 30000
E  2000  C --- MINIMAL OCCUPATION ---
E  2010  OFF("%SFSS%");
E  2020  SET (0, "%CVVV", "%PHV", "%SFV%")
E  2030  GOTO 30000
E  3000  C --- DCC3 ---
E  4000  C --- DCC4 ---
E  5000  C --- DCC5 ---
E  6000  C --- WARMUP ---
E  7000  C --- COOLDOWN ---
E  8000  C --- NIGHT HEATING ---
E  9000  C --- NIGHT COOLING ---
E 10000  C --- STOP HEATING ---
E 11000  C --- STOP COOLING ---

- 40 -
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 LOOP(0,"%DAT%","%CCVV%","%DATS%",600,20,1,1,50,0,100,0)
ET 20020 LOOP(128,"%PHT%","%PHV%","%PHTS%",200,5,1,1,25,0,100,0)
ET 20030 LOOP(128,"%DAS%","%SFV%","%DASS%",2500,250,20,1,60,20,100,0)
ET 20040 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 02
Program Name: 1607_EF A2

ET 10 C --- EF A2 ---
ET 100 IF("BUSHACAD.A12SS" .OR. "BUSHACAD.A22SS" .OR. "BUSHACAD.A32SS") THEN ON("BUSHACAD.EFA2SS") ELSE OFF("BUSHACAD.EFA2SS")
ET 10000 GOTO 10

Panel System Name: BUSHACAD Node 02
Program Name: 1607_ND02.XVLY

ET 10 C --- CALCULATE CUBE-ROOT MEAN CUBE OF VALVE POSITIONS FOR NODE ----
ET 20 C --- (USED BY CHW AND HW ADAPTIVE RESET)(WEIGHT THE AVG TO THE OPEN SIDE)
ET 1000 SAMPLE(300) GOTO 1020
ET 1010 GOTO 10000
E 1020 $LOC10 = 0
E 1030 IF("BUSHACAD.A12SS" .AND. "BUSHACAD.A12ER") THEN $LOC10 =$LOC10 + 1
E 1040 $LOC1 = "1607_A12.CCV.V" * "1607_A12.CCV.V" * "1607_A12.CCV.V" * "BUSHACAD.A12SS" + "BUSHACAD.A12ER"
E 1050 IF("BUSHACAD.A22SS" .AND. "BUSHACAD.A22ER") THEN $LOC10 =$LOC10 + 1
E 1060 $LOC2 = "1607_A22.CCV.V" * "1607_A22.CCV.V" * "1607_A22.CCV.V" * "BUSHACAD.A22SS" + "BUSHACAD.A22ER"
E 1070 IF("BUSHACAD.A32SS" .AND. "BUSHACAD.A32ER") THEN $LOC10 =$LOC10 + 1
E 1080 $LOC3 = "1607_A32.CCV.V" * "1607_A32.CCV.V" * "1607_A32.CCV.V" * "BUSHACAD.A32SS" + "BUSHACAD.A32ER"
E 1090 IF("BUSHACAD.OA32SS" .AND. "BUSHACAD.OA32ER") THEN $LOC10 =$LOC10 + 1
E 1090 $LOC4 = "1607_OA32.CCV.V" * "1607_OA32.CCV.V" * "1607_OA32.CCV.V" * "BUSHACAD.OA32SS" + "BUSHACAD.OA32ER"
E 1090 $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10

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Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E  1100  "1607_MD02.ACCV" = $LOC5 .ROUT. 3
E  2000  $LOC1G = 0
E  2010  IF("BUSHACAD.A12SS" .AND. "BUSHACAD.A12PR") THEN $LOC10 = $L
E  2020  $LOC1 = "1607_A12.HCV.V" + "1607_A12.HCV.V" + "1607_A12.HCV.V" + "BUSHACAD.A12SS" + "BUSHACAD.A12PR"
E  2030  IF("BUSHACAD.A22SS" .AND. "BUSHACAD.A22PR") THEN $LOC10 = $L
E  2040  $LOC2 = "1607_A22.HCV.V" + "1607_A22.HCV.V" + "1607_A22.HCV.V" + "BUSHACAD.A22SS" + "BUSHACAD.A22PR"
E  2050  IF("BUSHACAD.A32SS" .AND. "BUSHACAD.A32PR") THEN $LOC10 = $L
E  2060  $LOC3 = "1607_A32.HCV.V" + "1607_A32.HCV.V" + "1607_A32.HCV.V" + "BUSHACAD.A32SS" + "BUSHACAD.A32PR"
E  2062  IF("BUSHACAD.OA32SS" .AND. "BUSHACAD.OA32PR") THEN $LOC10 = $L
E  2064  $LOC4 = "1607_OA32.PHV.V" + "1607_OA32.PHV.V" + "1607_OA32.PHV.V" + "$BUSHACAD.OA32SS" + "$BUSHACAD.OA32PR"
E  2070  $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
E  2080  "1607_MD02.AHCV" = $LOC5 .ROUT. 3
ET 10000  GOTO 10

-----------------------------------------------------------------------------------
Panel System Name:  BUSHACAD Node 03
Program Name:  1607_A13

ET  10  C --- AHU 1-3 ---
ET  100  C --- DEFINITIONS ---
ET  101  DEFINE(X,"BUSHACAD")
ET  102  DEFINE(MODE,"1607_ECR.AHU 1-3")
ET  104  DEFINE(OAT,"BUSHACAD.OADBT")
ET  106  DEFINE(SFSS,"BUSHACAD.A13SS")
ET  108  DEFINE(SVF,"BUSHACAD.A13SPD")
ET  109  DEFINE(SV,F,"1607_A13.SVF.V")
ET  110  DEFINE(CDT,"BUSHACAD.A13CDT")
ET  112  DEFINE(CDTS,"1607_A13.CDT.S")
ET  114  DEFINE(CCV,"BUSHACAD.A13CW")
ET  115  DEFINE(CCV,"1607_A13.CCV.V")
ET  116  DEFINE(HDT,"BUSHACAD.A13HDT")
ET  118  DEFINE(HDTS,"1607_A13.HDT.S")
ET  120  DEFINE(HCV,"BUSHACAD.A13HCV")
ET  121  DEFINE(HCV,"1607_A13.HCV.V")
ET  122  DEFINE(CDS,"BUSHACAD.A13CD1")
ET  124  DEFINE(HDS,"BUSHACAD.A13HD1")

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Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET 126 DEFINE(DASS,"1607_A13.DAS.S")
ET 128 DEFINE(MASD,"1607_A13.MASD")
ET 130 DEFINE(OAF("BUSHACAD.A13CFM")
ET 132 DEFINE(OAFS,"1607_A13.OAFS")
ET 134 DEFINE(OAD,"BUSHACAD.A13OAD")
ET 136 DEFINE(SMK,"BUSHACAD.A13SMK")
ET 138 DEFINE(HIS,"BUSHACAD.A13HS")
ET 140 DEFINE(ACLP,"1607_A13.ACLP")
ET 142 DEFINE(AHLP,"1607_A13.AHLP")
ET 144 DEFINE(ACLMP,"1607_A13.ACLMP")
ET 146 DEFINE(AIDLMP,"1607_A13.AIDLMP")
ET 300 C --- LOCAL VARIABLES ---
ET 302 LOCAL(XCDTS,NCDTS,XHDT,NDT,NDASS)
ET 400 C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET 410 TABLE("%CCV8",%CCV8,0,9,100,3)
ET 420 TABLE("%HCV8",%HCV8,0,6,100,0)
ET 430 TABLE("%SVF8",%SVF8,0,0,100,0)
ET 500 C --- GLOBAL CALCULATIONS ---
ET 502 IF("BUSHACAD.A13S" .OR. "BUSHACAD.A13S" .EQ. FRON) THEN O
ET 504 N("BUSHACAD.RLA3S") ELSE OFF("BUSHACAD.RLA3S")
ET 505 SAMPLE(300) GOTO 520
ET 510 IF("%ACLP" .EQ. 0 .AND. "%AHLP" .EQ. 0 .AND. "%ACMP" .EQ
ET 515 .0 .AND. "%AHDP" .EQ. 0) THEN GOTO 520
ET 515 GOTO 610
E 520 C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
E 537 "%ACLP" = $LOC1 / 2
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 597 "%ACDF%" = $LOC1 . ROOT. 2
ET 610 C "BUSHACAD.A100" = SQUARE($LOC1) + 4005 + 2.2221 + 1
ET 700 C --- SAFETIES ---
ET 702 C * SMOKE *
ET 704 IF("%SMK%", NE, ON) THEN GOTO 710
E 706 OFF("SMOE", "%SFSS%")
E 708 SET(0,"%CVVV%","%CVVV%","%SVFV%")
ET 710 C * HIGH STATIC *
ET 712 IF("%HIS%", NE, ON) THEN GOTO 718
E 714 OFF("EMEER","%SFSS%")
E 716 SET(0,"%CVVV%","%CVVV%","%SVFV%")
ET 718 IF("%HIS%", NE, ON) THEN RELEASE(EMEER,"%SFSS%")
ET 720 IF("%SMK%", NE, ON AND, "%HIS%", NE, ON) THEN RELEASE(SMOKE,"%SFSS%")
ET 722 IF("%HIS%", OR, "%SMK%") THEN GOTO 30000
ET 724 C * VFD IN BYPASS *
ET 726 IF("BUSHACAD.A13F", NE, ON) THEN GOTO 736

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E  732  SRT(75, "BUSHACAD.A117:CLG DMP CMD","BUSHACAD.A118:CLG DMP CM
D","BUSHACAD.A119:CLG DMP CMD")
E  734  GOTO 800
ET  736  RELRAS("BUSHACAD.A101:CLG DMP CMD","BUSHACAD.A102:CLG DMP CM
D","BUSHACAD.A103:CLG DMP CMD","BUSHACAD.A104:CLG DMP CMD","BUSHAC
AD.A105:CLG DMP CMD","BUSHACAD.A106:CLG DMP CMD","BUSHACAD.A107:CL
G DMP CMD","BUSHACAD.A108:CLG DMP CMD")
ET  738  RELRAS("BUSHACAD.A109:CLG DMP CMD","BUSHACAD.A110:CLG DMP CM
D","BUSHACAD.A111:CLG DMP CMD","BUSHACAD.A112:CLG DMP CMD","BUSHAC
AD.A113:CLG DMP CMD","BUSHACAD.A114:CLG DMP CMD","BUSHACAD.A115:CL
G DMP CMD","BUSHACAD.A116:CLG DMP CMD")
ET  740  RELRAS("BUSHACAD.A117:CLG DMP CMD","BUSHACAD.A118:CLG DMP CM
D","BUSHACAD.A119:CLG DMP CMD")
ET  800  C --- DETERMINE MODE / REDIRECT ---
ET  805  IF("%MODE%" .EQ. 0) THEN GOTO 900
ET  810  IF("%MODE%" .EQ. 1) THEN GOTO 1000
E  815  IF("%MODE%" .EQ. 2) THEN GOTO 2000
E  820  IF("%MODE%" .EQ. 3) THEN GOTO 2000
E  825  IF("%MODE%" .EQ. 4) THEN GOTO 2000
E  830  IF("%MODE%" .EQ. 5) THEN GOTO 2000
E  835  IF("%MODE%" .EQ. 6) THEN GOTO 2000
E  840  IF("%MODE%" .EQ. 7) THEN GOTO 2000
E  845  IF("%MODE%" .EQ. 8) THEN GOTO 2000
E  850  IF("%MODE%" .EQ. 9) THEN GOTO 2000
E  855  IF("%MODE%" .EQ. 10) THEN GOTO 2000
E  860  IF("%MODE%" .EQ. 11) THEN GOTO 2000
E  865  GOTO 2000
E  900  C --- Hibernate - Essential Only ---
E  910  ON("%SFSS%")
E  915  "$XCDTS = 60
E  920  "$NCRTS = 55
E  925  "$XHDS = 100
E  930  "$NHDS = 72
E  935  "$XDASS = 0.3
E  940  "$NDASS = 0.1
E  945  "$GOSUB 20000
E  950  "$GOTO 30000
ET  1000  C --- Normal Occupation ---
ET  1010  ON("%SFSS%")
ET  1015  "$XCDTS = 58
ET  1020  "$NCRTS = 53
ET  1025  "$XHDS = 120
ET  1030  "$NHDS = 72
ET  1035  "$XDASS = 1.5
ET  1040  "$NDASS = 0.3

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

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ET 1080 GOSUB 20000
ET 1090 GOTO 30000
E 2000 C --- MINIMAL OCCUPATION ---
E 2010 ON("%SFSS%")
E 2020 $XCDTS = 60
E 2030 $NCNTS = 55
E 2040 $XHDTST = 100
E 2050 $NHDTST = 72
E 2060 $XDASS = 0.8
E 2070 $NDASS = 0.1
E 2072 GOSUB 20000
E 2074 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
ET 20030 $LOC1 = "$CDTS%"
ET 20040 IF("%AHLP%" .LT. 35) THEN $LOC1 = $LOC1 + 0.5
ET 20050 IF("%AHLP%" .GT. 45) THEN $LOC1 = $LOC1 - 1.0
ET 20060 MIN($LOC1,$LOC1,$XCDTS)
ET 20070 MAX("%CDTST%",$LOC1,$NCNTS)
ET 20080 LOOP(0,"%CDT%","%CCVV%","%CDTST%",300,10,1,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
ET 20110 $LOC1 = "$HDTST%"
ET 20120 IF("%AHLP%" .LT. 35) THEN $LOC1 = $LOC1 - 5
ET 20130 IF("%AHLP%" .GT. 45) THEN $LOC1 = $LOC1 + 10
ET 20140 MIN($LOC1,$LOC1,$XHDTST)
ET 20150 MAX("%HDTST%",$LOC1,$NHDTST)
ET 20160 LOOP(128,"%HDT%","%HCVV%","%HDTST%",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20240
ET 20190 $LOC1 = "$DASS%"
ET 20192 MAX($LOC2,"%AHDMP%","%ACDMP%"
ET 20200 IF($LOC2 .LT. 30) THEN $LOC1 = $LOC1 - 0.1
```
Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 20210 IF($LOC1 .GT. 40) THEN $LOC1 = $LOC1 + 0.2
E 20220 MIN($LOC1,$LOC1,$XDASS)
E 20230 MAX("%DASS%",$LOC1,$NDASS)
ET 20240 MIN("%MDAS%","%CDS%","%HDS%")
ET 20250 LOOP(128,"%MDAS%","%SVFV%","%DASS%",2500,250,20,1,60,20,100,0)
ET 20260 RETURN
ET 30000 GOTO 10

Panel System Name:  BUSHACAD Node 03
Program Name:  1607_A23

ET 10  C --- AHU 2-3 ---
ET 100  C --- DEFINITIONS ---
ET 101  DEFINE(X,"BUSHACAD")
ET 102  DEFINE(MODE,"1607_ECR.AHU 2-3")
ET 104  DEFINE(OAT,"BUSHACAD.OADBT")
ET 106  DEFINE(SFSS,"BUSHACAD.A23SS")
ET 108  DEFINE(SVF,"BUSHACAD.A23SPD")
ET 109  DEFINE(SVFV,"1607_A23.SVF.V")
ET 110  DEFINE(CDT,"BUSHACAD.A23CDT")
ET 112  DEFINE(CDTS,"1607_A23.CDT.S")
ET 114  DEFINE(CCV,"BUSHACAD.A23CCV")
ET 115  DEFINE(CCVV,"1607_A23.CCV.V")
ET 116  DEFINE(HDT,"BUSHACAD.A23HDT")
ET 118  DEFINE(HDTS,"1607_A23.HDT.S")
ET 120  DEFINE(HCV,"BUSHACAD.A23HCV")
ET 121  DEFINE(HCVO,"1607_A23.HCV.V")
ET 122  DEFINE(CDS,"BUSHACAD.A23CD1")
ET 124  DEFINE(HDS,"BUSHACAD.A23HDS")
ET 126  DEFINE(DASS,"1607_A23.DASS")
ET 128  DEFINE(MDAS,"1607_A23.MDAS")
ET 130  DEFINE(OAF,"BUSHACAD.A23CFN")
ET 132  DEFINE(OAFS,"1607_A23.OAFS")
ET 134  DEFINE(OAD,"BUSHACAD.A23OAD")
ET 136  DEFINE(SMK,"BUSHACAD.A23SMK")
ET 138  DEFINE(HIS,"BUSHACAD.A23HS")
ET 140  DEFINE(ACLF,"1607_A23.ACLF")
ET 142  DEFINE(AHLF,"1607_A23.AHLF")
ET 144  DEFINE(ACDMP,"1607_A23.ACDMP")
ET 146  DEFINE(AHDMP,"1607_A23.AHDMP")
ET 300  C --- LOCAL VARIABLES ---
ET 302  LOCAL(XCDTS,NCDTS,XHDT,NHDT,XDASS,NDASS)
ET 400  C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET 410  TABLE("%CCVV%","%CCV%",0,8,100,2)
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...  
(4 Field Panels)  
Programs: * 
Line Range: 1 - 32767
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E  555  $LOC1 = ($LOC1 + "$X%.A217:HTG LOOPOUT" + "$X%.A217:HTG LOOP OUT" + "$X%.A218:HTG LOOPOUT" + "$X%.A218:HTG LOOPOUT" + "$X%.A219 :HTG LOOPOUT" + "$X%.A219:HTG LOOPOUT") / 19
E  557  "$AHLP%"  =  $LOC1  .ROOT.  2
E  560  C * FIND AVG TEC HTG DMP POS, USE TO RESET DAS.S *
E  565  $LOC1 = "$X%.A201:HTG DMP CMD" + "$X%.A201:HTG DMP CMD" + "$X%.A202:HTG DMP CMD" + "$X%.A202:HTG DMP CMD" + "$X%.A203:HTG DMP CMD" + "$X%.A203:HTG DMP CMD" + "$X%.A204:HTG DMP CMD" + "$X%.A204:HTG DMP CMD"
E  567  $LOC1 = $LOC1 + "$X%.A205:HTG DMP CMD" + "$X%.A205:HTG DMP CMD" + "$X%.A206:HTG DMP CMD" + "$X%.A206:HTG DMP CMD" + "$X%.A207:HTG DMP CMD" + "$X%.A207:HTG DMP CMD" + "$X%.A208:HTG DMP CMD" + "$X%.A208:HTG DMP CMD"
E  570  $LOC1 = $LOC1 + "$X%.A209:HTG DMP CMD" + "$X%.A209:HTG DMP CMD" + "$X%.A210:HTG DMP CMD" + "$X%.A210:HTG DMP CMD" + "$X%.A211:HTG DMP CMD" + "$X%.A211:HTG DMP CMD" + "$X%.A212:HTG DMP CMD" + "$X%.A212:HTG DMP CMD"
E  572  $LOC1 = $LOC1 + "$X%.A213:HTG DMP CMD" + "$X%.A213:HTG DMP CMD" + "$X%.A214:HTG DMP CMD" + "$X%.A214:HTG DMP CMD" + "$X%.A215:HTG DMP CMD" + "$X%.A215:HTG DMP CMD" + "$X%.A216:HTG DMP CMD" + "$X%.A216:HTG DMP CMD"
E  575  $LOC1 = ($LOC1 + "$X%.A217:HTG DMP CMD" + "$X%.A217:HTG DMP CMD" + "$X%.A218:HTG DMP CMD" + "$X%.A218:HTG DMP CMD" + "$X%.A219 :HTG DMP CMD" + "$X%.A219:HTG DMP CMD") / 19
E  577  "$AHDP%"  =  $LOC1  .ROOT.  2
E  580  C * FIND AVG TEC CLG DMP POS, USE TO RESET DAS.S *
E  585  $LOC1 = "$X%.A201:CLG DMP CMD" + "$X%.A201:CLG DMP CMD" + "$X%.A202:CLG DMP CMD" + "$X%.A202:CLG DMP CMD" + "$X%.A203:CLG DMP CMD" + "$X%.A203:CLG DMP CMD" + "$X%.A204:CLG DMP CMD" + "$X%.A204:CLG DMP CMD"
E  587  $LOC1 = $LOC1 + "$X%.A205:CLG DMP CMD" + "$X%.A205:CLG DMP CMD" + "$X%.A206:CLG DMP CMD" + "$X%.A206:CLG DMP CMD" + "$X%.A207:CLG DMP CMD" + "$X%.A207:CLG DMP CMD" + "$X%.A208:CLG DMP CMD" + "$X%.A208:CLG DMP CMD"
E  590  $LOC1 = $LOC1 + "$X%.A209:CLG DMP CMD" + "$X%.A209:CLG DMP CMD" + "$X%.A210:CLG DMP CMD" + "$X%.A210:CLG DMP CMD" + "$X%.A211:CLG DMP CMD" + "$X%.A211:CLG DMP CMD" + "$X%.A212:CLG DMP CMD" + "$X%.A212:CLG DMP CMD"
E  592  $LOC1 = $LOC1 + "$X%.A213:CLG DMP CMD" + "$X%.A213:CLG DMP CMD" + "$X%.A214:CLG DMP CMD" + "$X%.A214:CLG DMP CMD" + "$X%.A215:CLG DMP CMD" + "$X%.A215:CLG DMP CMD" + "$X%.A216:CLG DMP CMD" + "$X%.A216:CLG DMP CMD"
E  595  $LOC1 = ($LOC1 + "$X%.A217:CLG DMP CMD" + "$X%.A217:CLG DMP CMD" + "$X%.A218:CLG DMP CMD" + "$X%.A218:CLG DMP CMD" + "$X%.A219 :CLG DMP CMD" + "$X%.A219:CLG DMP CMD") / 19

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 597 "%ACMP%" = $LOC1 .ROOT. 2
ET 610 C "BUSHACAD.A23FM" = SQRT($LOC1) + 4005 + 2.2218 + 1
ET 700 C --- SAFETIES ---
ET 702 C * SMK *
ET 704 IF("%SMK%" .NE. ON) THEN GOTO 710
E 706 OFF(0SMK, "%SFFS%")
E 707 SET(0, "%CCV¥","%HCV¥","%SV¥")
ET 710 C * HIGH STATIC *
ET 712 IF("%HIS%" .NE. ON) THEN GOTO 718
E 714 OFF(0EMER, "%SFSS%")
E 716 SET(0, "%CCV¥","%HCV¥","%SV¥")
ET 718 IF("%HIS%" .NE. ON) THEN RELEASE(SMOK, "%SFSS%")
ET 720 IF("%SMK%" .NE. ON.AND. "%HIS%" .NE. ON) THEN RELEASE(SMOK, "%SFSS%")
ET 722 IF("%HIS%" .OR. "%SMK%") THEN GOTO 30000
ET 724 C * VFD IN BYPASS *
ET 726 IF("BUSHACAD.A23BP" .NE. ON) THEN GOTO 736
E 732 SET(75,"BUSHACAD.A217:CLG DMP CMD","BUSHACAD.A218:CLG DMP CMD","BUSHACAD.A219:CLG DMP CMD")
E 734 GOTO 800
ET 740 RELEASE("BUSHACAD.A217:CLG DMP CMD","BUSHACAD.A218:CLG DMP CMD","BUSHACAD.A219:CLG DMP CMD")
ET 800 C --- DETERMINING MODE / REDIRECT ---
ET 805 IF("%MODE%" .EQ. 0) THEN GOTO 900
ET 810 IF("%MODE%" .EQ. 1) THEN GOTO 1000
E 815 IF("%MODE%" .EQ. 2) THEN GOTO 2000
E 820 IF("%MODE%" .EQ. 3) THEN GOTO 2000
E 825 IF("%MODE%" .EQ. 4) THEN GOTO 2000
E 830 IF("%MODE%" .EQ. 5) THEN GOTO 2000

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E  835  IF("%MODE%".EQ. 6) THEN GOTO 2000
E  840  IF("%MODE%".EQ. 7) THEN GOTO 2000
E  845  IF("%MODE%".EQ. 8) THEN GOTO 2000
E  850  IF("%MODE%".EQ. 9) THEN GOTO 2000
E  855  IF("%MODE%".EQ.10) THEN GOTO 2000
E  860  IF("%MODE%".EQ.11) THEN GOTO 2000
E  865  GOTO 2000
E   900  C --- HIBERNATE - ESSENTIAL ONLY ---
E   910  ON("%SFSS%")
E   920  $XCDTS = 60
E   930  $NCMTS = 55
E   940  $XHDT5 = 100
E   950  $NDTT5 = 72
E   960  $XDASS = 0.8
E   970  $NDASS = 0.1
E   980  GOSUB 20000
E   990  GOTO 30000
ET  1000  C --- NORMAL OCCUPATION ---
ET  1010  ON("%SFSS%")
ET  1020  $XCDTS = 58
ET  1030  $NCMTS = 53
ET  1040  $XHDT5 = 120
ET  1050  $NDTT5 = 72
ET  1060  $XDASS = 1.4
ET  1070  $NDASS = 0.3
ET  1080  GOSUB 20000
ET  1090  GOTO 30000
E  2000  C --- MINIMAL OCCUPATION ---
E  2010  ON("%SFSS%")
E  2020  $XCDTS = 60
E  2030  $NCMTS = 55
E  2040  $XHDT5 = 100
E  2050  $NDTT5 = 72
E  2060  $XDASS = 0.8
E  2070  $NDASS = 0.1
E  2072  GOSUB 20000
E  2074  GOTO 30000
E  2074  GOTO 30000
E  3000  C --- OCC3 ---
E  4000  C --- OCC4 ---
E  5000  C --- OCC5 ---
E  6000  C --- WARMUP ---
E  7000  C --- COOLDOWN ---
E  8000  C --- NIGHT HEATING ---
E  9000  C --- NIGHT COOLING ---
E 10000  C --- STOP HEATING ---
Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT
S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
E 20030 SLOC1 = "$CDTS$"
E 20040 IF("%ACLP%" .LT. 35) THEN $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACLP%" .GT. 45) THEN $LOC1 = $LOC1 - 1.0
E 20060 MIN($LOC1,$LOC1,$CDTS)
E 20070 MAX("%CDTS$",$LOC1,$NCDTS)
ET 20080 LOOP(0,"%CDTS$","%CCVV%","%CDTS$",300,10,1,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
E 20110 $LOC1 = "$HDT$"
E 20120 IF("%AHLP%" .LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("%AHLP%" .GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOC1,$XHDTs)
E 20150 MAX("%HDT$",$LOC1,$NHDTs)
ET 20160 LOOP(128,"%HDT$","%HVV%","%HDT$",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20230
E 20190 $LOC1 = "$DASS$"
E 20192 MAX($LOC2,"%AHMDP%","%ACMP%")
E 20200 IF($LOC2 .LT. 30) THEN $LOC1 = $LOC1 - 0.1
E 20210 IF($LOC2 .GT. 40) THEN $LOC1 = $LOC1 + 0.2
E 20220 MIN($LOC1,$LOC1,$XDASS)
E 20230 MAX("%DASS$",$LOC1,$NDASS)
ET 20240 MIN("%DASS$","%CD$","%HDS$")
ET 20250 LOOP(128,"%DASS$","%SVF%","%DASS$",2500,250,20,1,60,20,100,0)
ET 20260 RETURN
ET 30000 GOTO 10

Panel System Name:  BUSHACAD Node 03
Program Name:  1607_A33

ET 10 C --- AHU 3-3 ---
ET 100 C --- DEFINITIONS ---
ET 101 DEFINE(XL,"BUSHACAD")
ET 102 DEFINE(MODE,"1607_ERC.AHU 3-3")
ET 104 DEFINE(OAT,"BUSHACAD.OADBT")
ET 106 DEFINE(SFSS,"BUSHACAD.A33SS")
ET 108 DEFINE(SVF,"BUSHACAD.A33SPD")
ET 109 DEFINE(SVFV,"1607_A33.SVF.V")

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)

Programs: *

Line Range: 1 - 32767

ET 110 DEFINE(CDT,"BUSHACAD.A33CDT")
ET 112 DEFINE(CDTS,"1607_A33.CDT.S")
ET 114 DEFINE(CCV,"BUSHACAD.A33CW")
ET 115 DEFINE(CCCV,"1607_A33.CCV.V")
ET 116 DEFINE(HDT,"BUSHACAD.A33HDT")
ET 118 DEFINE(HDTS,"1607_A33.HDT.S")
ET 120 DEFINE(HCV,"BUSHACAD.A33HW")
ET 121 DEFINE(HCCV,"1607_A33.HCV.V")
ET 122 DEFINE(CDS,"BUSHACAD.A33CD1")
ET 124 DEFINE(HDS,"BUSHACAD.A33HD1")
ET 126 DEFINE(DASS,"1607_A33.DASS.S")
ET 128 DEFINE(MDAS,"1607_A33.MDAS")
ET 130 DEFINE(OAF,"BUSHACAD.A33CFM")
ET 132 DEFINE(OAFS,"1607_A33.OAFS")
ET 134 DEFINE(OAD,"BUSHACAD.A33OAD")
ET 136 DEFINE(SMK,"BUSHACAD.A33SMK")
ET 138 DEFINE(HIS,"BUSHACAD.A33HS")
ET 140 DEFINE(ACLF,"1607_A33.ACLF")
ET 142 DEFINE(AHLP,"1607_A33.AHLP")
ET 144 DEFINE(ACDMP,"1607_A33.ACDMP")
ET 146 DEFINE(AHDMP,"1607_A33.AHDMP")
ET 300 C --- LOCAL VARIABLES ---
ET 302 LOCAL(XCDTS,NCDTS,XHDT,NHDT,XDASS,NDASS)
ET 400 C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET 410 TABLE("%CCV%",%CCV%,0,9,100,0)
ET 420 TABLE("%HCV%",%HCV%,0,6,100,0)
ET 430 TABLE("%SVF%",%SVF%,0,6,100,10)
ET 500 C --- GLOBAL CALCULATIONS ---
ET 505 SAMPLE(300) GOTO 520
ET 510 IF(ACLFS.EQ.0.AND.ASCIIHLPS.EQ.0.AND.ACDMP.EQ.0) THEN GOTO 520
ET 515 GOTO 610

E 520 C * FIND AVG TEC CLG LOOPUT, USE TO RESET CDT.S *
$LOC1 = $LOC1 + "$X%.A313:CLG LOOPOUT" + "$X%.A313:CLG LOOPUT" + "$X%.A314:CLG LOOPOUT" + "$X%.A314:CLG LOOPUT" + "$X%.A315:CLG LOOPOUT" + "$X%.A315:CLG LOOPUT" + "$X%.A316:CLG LOOPOUT" + "$X%.A316:CLG LOOPUT"

$LOC1 = ($LOC1 + "$X%.A317:CLG LOOPOUT" + "$X%.A317:CLG LOOPUT" + "$X%.A318:CLG LOOPOUT" + "$X%.A318:CLG LOOPUT") / 18

"%AARCHP" = "$LOC1 .ROOT. 2

C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HTD.S *

$LOC1 = "$X%.A301:HTG LOOPOUT" + "$X%.A301:HTG LOOPUT" + "$X%.A302:HTG LOOPOUT" + "$X%.A302:HTG LOOPUT" + "$X%.A303:HTG LOOPOUT" + "$X%.A303:HTG LOOPOUT" + "$X%.A304:HTG LOOPOUT" + "$X%.A304:HTG LOOPUT"

$LOC1 = $LOC1 + "$X%.A305:HTG LOOPOUT" + "$X%.A305:HTG LOOPUT" + "$X%.A306:HTG LOOPOUT" + "$X%.A306:HTG LOOPUT" + "$X%.A307:HTG LOOPOUT" + "$X%.A307:HTG LOOPOUT" + "$X%.A308:HTG LOOPOUT" + "$X%.A308:HTG LOOPOUT"

$LOC1 = $LOC1 + "$X%.A309:HTG LOOPOUT" + "$X%.A309:HTG LOOPUT" + "$X%.A310:HTG LOOPOUT" + "$X%.A310:HTG LOOPUT" + "$X%.A311:HTG LOOPOUT" + "$X%.A311:HTG LOOPOUT" + "$X%.A312:HTG LOOPOUT" + "$X%.A312:HTG LOOPOUT"

$LOC1 = $LOC1 + "$X%.A313:HTG LOOPOUT" + "$X%.A313:HTG LOOPUT" + "$X%.A314:HTG LOOPOUT" + "$X%.A314:HTG LOOPUT" + "$X%.A315:HTG LOOPOUT" + "$X%.A315:HTG LOOPOUT" + "$X%.A316:HTG LOOPOUT" + "$X%.A316:HTG LOOPOUT"

$LOC1 = ($LOC1 + "$X%.A317:HTG LOOPOUT" + "$X%.A317:HTG LOOPOUT") / 18

"%AARCHP" = "$LOC1 .ROOT. 2

C * FIND AVG TEC HTG DMP POS, USE TO RESET DAS.S *

$LOC1 = "$X%.A301:HTG DMP CMD" + "$X%.A301:HTG DMP CMD" + "$X%.A302:HTG DMP CMD" + "$X%.A302:HTG DMP CMD" + "$X%.A303:HTG DMP CMD" + "$X%.A303:HTG DMP CMD" + "$X%.A304:HTG DMP CMD" + "$X%.A304:HTG DMP CMD"

$LOC1 = $LOC1 + "$X%.A305:HTG DMP CMD" + "$X%.A305:HTG DMP CMD" + "$X%.A306:HTG DMP CMD" + "$X%.A306:HTG DMP CMD" + "$X%.A307:HTG DMP CMD" + "$X%.A307:HTG DMP CMD" + "$X%.A308:HTG DMP CMD" + "$X%.A308:HTG DMP CMD"

$LOC1 = $LOC1 + "$X%.A309:HTG DMP CMD" + "$X%.A309:HTG DMP CMD" + "$X%.A310:HTG DMP CMD" + "$X%.A310:HTG DMP CMD" + "$X%.A311:HTG DMP CMD" + "$X%.A311:HTG DMP CMD" + "$X%.A312:HTG DMP CMD" + "$X%.A312:HTG DMP CMD"

$LOC1 = $LOC1 + "$X%.A313:HTG DMP CMD" + "$X%.A313:HTG DMP CMD" + "$X%.A314:HTG DMP CMD" + "$X%.A314:HTG DMP CMD" + "$X%.A315:HTG DMP CMD" + "$X%.A315:HTG DMP CMD" + "$X%.A316:HTG DMP CMD" + "$X%.A316:HTG DMP CMD"
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 575  $LOC1 = ( $LOC1 + "%X%.A317:HTG DMP CMD" + "%X%.A317:HTG DMP CMD" + "%X%.A318:HTG DMP CMD" + "%X%.A318:HTG DMP CMD") / 16
E 577  "%ADMPS%" = $LOC1 . ROOT . 2
E 580  C * FIND AVG TEC CLG DMP POS, USE TO RESET DAS.S *
E 585  $LOC1 = "$X%.A301:CLG DMP CMD" + "$X%.A301:CLG DMP CMD" + "$X%.A302:CLG DMP CMD" + "$X%.A302:CLG DMP CMD" + "$X%.A303:CLG DMP CMD" + "$X%.A303:CLG DMP CMD" + "$X%.A304:CLG DMP CMD" + "$X%.A304:CLG DMP CMD"
E 587  $LOC1 = $LOC1 + "$X%.A305:CLG DMP CMD" + "$X%.A305:CLG DMP CMD" + "$X%.A306:CLG DMP CMD" + "$X%.A306:CLG DMP CMD" + "$X%.A307:CLG DMP CMD" + "$X%.A307:CLG DMP CMD" + "$X%.A308:CLG DMP CMD" + "$X%.A308:CLG DMP CMD"
E 590  $LOC1 = $LOC1 + "$X%.A309:CLG DMP CMD" + "$X%.A309:CLG DMP CMD" + "$X%.A310:CLG DMP CMD" + "$X%.A310:CLG DMP CMD" + "$X%.A311:CLG DMP CMD" + "$X%.A311:CLG DMP CMD" + "$X%.A312:CLG DMP CMD" + "$X%.A312:CLG DMP CMD"
E 592  $LOC1 = $LOC1 + "$X%.A313:CLG DMP CMD" + "$X%.A313:CLG DMP CMD" + "$X%.A314:CLG DMP CMD" + "$X%.A314:CLG DMP CMD" + "$X%.A315:CLG DMP CMD" + "$X%.A315:CLG DMP CMD" + "$X%.A316:CLG DMP CMD" + "$X%.A316:CLG DMP CMD"
E 595  $LOC1 = ( $LOC1 + "$X%.A317:CLG DMP CMD" + "$X%.A317:CLG DMP CMD" + "$X%.A318:CLG DMP CMD" + "$X%.A318:CLG DMP CMD") / 18
E 596  "%ACMPS%" = $LOC1 . ROOT . 2
ET 610  C "BUSHACAD.A33CPF" = SQRT($LOC1) * 4005 * 2.2221 * 1
ET 700  C --- SAFETIES ---
ET 702  C + SMKE *
ET 704  IF("%SMK%" . NE. ON) THEN GOTO 710
E 706  OFF(@SMKE,."SFSS%")
E 708  SET(0,."CCCV%","SCCV%","SVFV%")
ET 710  C + HIGH STATIC *
ET 712  IF("%HIS%" . NE. ON) THEN GOTO 718
E 714  OFF(@EMER,."SFSS%")
E 716  SET(0,."CCCV%","SCCV%","SVFV%")
ET 718  IF("%HIS%" . NE. ON) THEN RELEASE(@EMER,."SFSS%")
ET 720  IF("%SMK%" . NE. ON . AND. "%HIS%" . NE. ON) THEN RELEASE(@SMKE,."SFSS%")
ET 722  IF("%HIS%" . OR. "%SMK%") THEN GOTO 30000
ET 724  C + VFD IN BYPASS *
ET 726  IF("BUSHACAD.A33BP" . NE. ON) THEN GOTO 736
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Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs:  *
Line Range: 1 - 32767

E 730  SET('75,"BUSHACAD.A309:CLG DMP CMD","BUSHACAD.A310:CLG DMP CM
D","BUSHACAD.A311:CLG DMP CMD","BUSHACAD.A312:CLG DMP CMD","BUSHAC
AD.A313:CLG DMP CMD","BUSHACAD.A314:CLG DMP CMD","BUSHACAD.A315:CL
G DMP CMD","BUSHACAD.A316:CLG DMP CMD")
E 732  SET('75,"BUSHACAD.A317:CLG DMP CMD","BUSHACAD.A318:CLG DMP CM
D")
E 734  GOTO 800
ET 736  RELEASE('BUSHACAD.A301:CLG DMP CMD","BUSHACAD.A302:CLG DMP CM
D","BUSHACAD.A303:CLG DMP CMD","BUSHACAD.A304:CLG DMP CMD","BUSHAC
AD.A305:CLG DMP CMD","BUSHACAD.A306:CLG DMP CMD","BUSHACAD.A307:CL
G DMP CMD","BUSHACAD.A308:CLG DMP CMD")
ET 738  RELEASE('BUSHACAD.A309:CLG DMP CMD","BUSHACAD.A310:CLG DMP CM
D","BUSHACAD.A311:CLG DMP CMD","BUSHACAD.A312:CLG DMP CMD","BUSHAC
AD.A313:CLG DMP CMD","BUSHACAD.A314:CLG DMP CMD","BUSHACAD.A315:CL
G DMP CMD","BUSHACAD.A316:CLG DMP CMD")
ET 740  RELEASE('BUSHACAD.A317:CLG DMP CMD","BUSHACAD.A318:CLG DMP CM
D")
ET 800  C --- DETERMINE MODE / REDIRECT ---
ET 805  IF("%MODE%" .EQ. 0) THEN GOTO 900
ET 810  IF("%MODE%" .EQ. 1) THEN GOTO 1000
E 815  IF("%MODE%" .EQ. 2) THEN GOTO 2000
E 820  IF("%MODE%" .EQ. 3) THEN GOTO 2000
E 825  IF("%MODE%" .EQ. 4) THEN GOTO 2000
E 830  IF("%MODE%" .EQ. 5) THEN GOTO 2000
E 835  IF("%MODE%" .EQ. 6) THEN GOTO 2000
E 840  IF("%MODE%" .EQ. 7) THEN GOTO 2000
E 845  IF("%MODE%" .EQ. 8) THEN GOTO 2000
E 850  IF("%MODE%" .EQ. 9) THEN GOTO 2000
E 855  IF("%MODE%" .EQ. 10) THEN GOTO 2000
E 860  IF("%MODE%" .EQ. 11) THEN GOTO 2000
E 865  GOTO 2000
E 900  C --- HIBERNATE - ESSENTIAL ONLY ---
E 910  ON("SFSS")
E 920  $XCDTS = 60
E 930  $NCDDS = 55
E 940  $XHDTS = 100
E 950  $NHDTS = 72
E 960  $XDDAS = 0.8
E 970  $NDDAS = 0.1
E 980  GOSUB 20000
E 990  GOTO 30000
ET 1000  C --- NORMAL OCCUPATION ---
ET 1010  ON("SFSS")
ET 1020  $XCDTS = 58
ET 1030  $NCDDS = 53
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ... 
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

```
ET  1040  $XHDT5 = 120
ET  1050  $NHDT5 = 72
ET  1060  $XDASS = 1.5
ET  1070  $NDASS = 0.3
ET  1080  GOSUB 20000
ET  1090  GOTO 30000
E  2000  C  --- MINIMAL OCCUPATION ---
E  2010  ON("%SFSS%")
E  2020  $XCDTS = 60
E  2030  $NCDTS = 55
E  2040  $XHDT5 = 100
E  2050  $NHDT5 = 72
E  2060  $XDASS = 0.8
E  2070  $NDASS = 0.1
E  2072  GOSUB 20000
E  2074  GOTO 30000
E  3000  C  --- OCC3 ---
E  4000  C  --- OCC4 ---
E  5000  C  --- OCC5 ---
E  6000  C  --- WARMUP ---
E  7000  C  --- COOLDOWN ---
E  8000  C  --- NIGHT HEATING ---
E  9000  C  --- NIGHT COOLING ---
E  10000  C  --- STOP HEATING ---
E  11000  C  --- STOP COOLING ---
E  11999  GOTO 30000
ET  20000  C  --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT S ---
ET  20010  SAMPLE(900)  GOTO 20030
ET  20020  GOTO 20060
E  20030  $LOC1 = "%CDTS%"
E  20040  IF("%ACLPS%".LT. 35 .AND. "%X$.A309:ROOM TEMP".LT. 77) THEN
 E $LOC1 = $LOC1 + 0.5
E  20050  IF("%ACLPS%".GT. 45 .OR. "%X$.A309:ROOM TEMP".GT. 78) THEN
 E $LOC1 = $LOC1 - 1.0
E  20060  MIN($LOC1,$LOC1,$XCDTS)
E  20070  MAX("%CDTS%",$LOC1,$NCDTS)
ET  20080  LOOP(0,"%CDTS%","%CCVVA%","%CDTS%",300,10,1,1,50,0,100,0)
ET  20090  SAMPLE(900)  GOTO 20110
ET  20100  GOTO 20160
E  20110  $LOC1 = "$HDT5%"
E  20120  IF("%AHLP%".LT. 35) THEN  $LOC1 = $LOC1 - 5
E  20130  IF("%AHLP%".GT. 45) THEN  $LOC1 = $LOC1 + 10
E  20140  MIN($LOC1,$LOC1,$XHDT5)
E  20150  MAX("%HDT5%",$LOC1,$NHDT5)

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```
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)

Programs: *

Line Range: 1 - 32767

```
ET 20160 LOOP(128,"%HDT%","%HCVV%","%HDTS%",200,5,1,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20240
E 20190 $LOC1 = "%DASS%"
E 20192 MAX($LOC2, "%AHDMP%", "%ACDMP%")
E 20200 IF($LOC2 .LT. 30 .AND. "%X%.A309:ROOM TEMP" .LT. 77) THEN $LOC1 = $LOC1 - 0.1
E 20210 IF($LOC2 .GT. 40 .OR. "%X%.A309:ROOM TEMP" .GT. 78) THEN $LOC1 = $LOC1 + 0.2
E 20220 MIN($LOC1, $LOC1, $XDASS)
E 20230 MAX("%DASS%", $LOC1, $NDASS)
ET 20240 MIN("%DASS%", "%CDS%", "%DDS%")
ET 20250 LOOP(128, "%MDAS%", "%SVFV%", "%DASS%", 2500, 250, 20, 1, 60, 20, 100, 0)
ET 20260 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 03
Program Name: 1607_OA33

ET 10 C --- OAHU 3-3 ---
ET 100 C --- DEFINITIONS ---
ET 102 DEFINE(X, "BUSHACAD")
ET 104 DEFINE(MODE, "1607_ECR.OAHU 3-3")
ET 106 DEFINE(OAT, "BUSHACAD.0ADBT")
ET 108 DEFINE(SFSS, "BUSHACAD.OA33SS")
ET 110 DEFINE(SVF, "BUSHACAD.OA33SP")
ET 112 DEFINE(SVFV, "1607_OA33.SVF.V")
ET 114 DEFINE(DAT, "BUSHACAD.OA33DT")
ET 116 DEFINE(DATS, "1607_OA33.DAT.S")
ET 118 DEFINE(CCV, "BUSHACAD.OA33CW")
ET 120 DEFINE(CCVV, "1607_OA33.CCV.V")
ET 122 DEFINE(PHT, "BUSHACAD.OA33PT")
ET 124 DEFINE(PHTS, "1607_OA33.PHT.S")
ET 126 DEFINE(PHV, "BUSHACAD.OA33HW")
ET 128 DEFINE(PHVV, "1607_OA33.PHV.V")
ET 130 DEFINE(FHP, "BUSHACAD.OA33PF")
ET 132 DEFINE(DAS, "BUSHACAD.OA33DS")
ET 134 DEFINE(DASS, "1607_OA33.DAS.S")
ET 136 DEFINE(SMK, "BUSHACAD.OA33SM")
ET 138 DEFINE(HIS, "BUSHACAD.OA33HS")
ET 140 DEFINE(FRZ, "BUSHACAD.OA33LL")
ET 142 DEFINE(DWP, "1607_VOADWP")
ET 300 C --- LOCAL VARIABLES ---
ET 310 C LOCAL()
```
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
TABLE("%CCV%", "%CCV%", 0, 10, 100, 0)
TABLE("%PHV%", "%PHV%", 0, 10, 100, 0)
TABLE("%SFV%", "%SFV%", 0, 10, 100, 8)
C --- GLOBAL CALCULATIONS ---
IF("%GAT%".LE. 38) THEN ON("%PHP%")
IF("%GAT%".GT. 41) THEN OFF("%PHP%")
C --- SAFETIES ---
C + SMOKE *
IF("%SMK%".NE. ON) THEN GOTO 730
OFF(@SMOKE,"%SFSS%")
SET(0,"%CCV%","%PHV%","%SFV%")
GOTO 30000
C + FREEZE *
IF("%FRZ%".NE. ON) THEN GOTO 755
OFF(@EMER,"%SFSS%")
SET(100,"%CCV%","%PHV%")
SET(0,"%SFV%")
GOTO 30000
C + HIGH STATIC *
IF("%HS%".NE. ON) THEN GOTO 780
OFF(@EMER,"%SFSS%")
SET(0,"%CCV%","%PHV%","%SFV%")
GOTO 30000
RELEASE(@SMOKE,"%SFSS%")
C --- DETERMINE NODE / REDIRECT ---
IF("%MODE%".EQ. 0) THEN GOTO 900
IF("%MODE%".EQ. 1) THEN GOTO 1000
IF("%MODE%".EQ. 2) THEN GOTO 2000
IF("%MODE%".EQ. 3) THEN GOTO 3000
IF("%MODE%".EQ. 4) THEN GOTO 4000
IF("%MODE%".EQ. 5) THEN GOTO 5000
IF("%MODE%".EQ. 6) THEN GOTO 6000
IF("%MODE%".EQ. 7) THEN GOTO 7000
IF("%MODE%".EQ. 8) THEN GOTO 8000
IF("%MODE%".EQ. 9) THEN GOTO 9000
IF("%MODE%".EQ. 10) THEN GOTO 10000
IF("%MODE%".EQ. 11) THEN GOTO 11000
SET(2,"%MODE%")
GOTO 30000
C --- UNOCCUPIED ---
OFF("%SFSS%")
SET(0,"%CCV%","%PHV%","%SFV%")
GOTO 30000
C --- NORMAL OCCUPATION ---
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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 1010 ON("%SFSS%")
E 1020 $LOC1 = "$DMP%" - 4
E 1030 MAX($LOC1,$LOC1,55)
E 1040 MIN("%DATS%",$LOC1,65)
E 1050 "$EHTS%" = 50
E 1060 "$DASS%" = 0.48
E 1070 GOSUB 20000
E 1080 GOTO 30000
E 2000 C --- MINIMAL OCCUPATION ---
E 2010 OFF("%SFSS%")
E 2020 SET(0,"%CCVV%","%PHV%","%SVFV%")
E 2030 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
E 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT S --
E 20010 LOOP(0,"%DAT%","%CCVV%","%DATS%",600,20,1,1,50,0,100,0)
E 20020 LOOP(128,"%EHT%","%PHV%","%EHTS%",200,5,1,1,25,0,100,0)
E 20030 LOOP(128,"%DAS%","%SVFV%","%DASS%",2500,250,20,1,60,20,100,0)
E 20040 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 03
Program Name: 1607_EF A3

ET 10 C --- EF A3 ---
ET 100 IF("BUSHACAD.A13SS" .OR. "BUSHACAD.A23SS" .OR. "BUSHACAD.A33 SS") THEN ON("BUSHACAD.EFA3SS") ELSE OFF("BUSHACAD.EFA3SS")
ET 11000 GOTO 10

Panel System Name: BUSHACAD Node 03
Program Name: 1607_ND03.XVLL

ET 10 C --- CALCULATE CUBE-ROOT MEAN CUBE OF VALVE POSITIONS FOR NODE ----

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Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range:  1 - 32767

ET  20  C --- (USED BY CHW AND HW ADAPTIVE RESET) (WEIGHT THE AVG TO
       THE OPEN SIDE)
ET 1000    SAMPLE(300) GOTO 1020
ET 1010           GOTO 10000
E   1020          $LOC10 = 0
E  1030          IF("BUSHACAD.A13SS" .AND. "BUSHACAD.A13PR") THEN $LOC10 = $L
         OCl0 + 1
E  1040          $LOC1 = "1607_A13.CCV.V" + "1607_A13.CCV.V" + "1607_A13.CCV.
         V" + "BUSHACAD.A13SS" + "BUSHACAD.A13PR"
E  1050          IF("BUSHACAD.A23SS" .AND. "BUSHACAD.A23PR") THEN $LOC10 = $L
         OCl0 + 1
E  1060          $LOC2 = "1607_A23.CCV.V" + "1607_A23.CCV.V" + "1607_A23.CCV.
         V" + "BUSHACAD.A23SS" + "BUSHACAD.A23PR"
E  1070          IF("BUSHACAD.A33SS" .AND. "BUSHACAD.A33PR") THEN $LOC10 = $L
         OCl0 + 1
E  1080          $LOC3 = "1607_A33.CCV.V" + "1607_A33.CCV.V" + "1607_A33.CCV.
         V" + "BUSHACAD.A33SS" + "BUSHACAD.A33PR"
E  1082          IF("BUSHACAD.OA33SS" .AND. "BUSHACAD.OA33PR") THEN $LOC10 =
         $LOC10 + 1
E  1084          $LOC4 = "1607_OA33.CCV.V" + "1607_OA33.CCV.V" + "1607_OA33.C
         CV.V" + "BUSHACAD.OA33SS" + "BUSHACAD.OA33PR"
E  1090          $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
E  1100          "1607_ND03.ACCV" = $LOC5 .ROOT. 3
E   200          $LOC10 = 0
E  2010          IF("BUSHACAD.A13SS" .AND. "BUSHACAD.A13PR") THEN $LOC10 = $L
         OCl0 + 1
E  2020          $LOC1 = "1607_A13.HCV.V" + "1607_A13.HCV.V" + "1607_A13.HCV.
         V" + "BUSHACAD.A13SS" + "BUSHACAD.A13PR"
E  2030          IF("BUSHACAD.A23SS" .AND. "BUSHACAD.A23PR") THEN $LOC10 = $L
         OCl0 + 1
E  2040          $LOC2 = "1607_A23.HCV.V" + "1607_A23.HCV.V" + "1607_A23.HCV.
         V" + "BUSHACAD.A23SS" + "BUSHACAD.A23PR"
E  2050          IF("BUSHACAD.A33SS" .AND. "BUSHACAD.A33PR") THEN $LOC10 = $L
         OCl0 + 1
E  2060          $LOC3 = "1607_A33.HCV.V" + "1607_A33.HCV.V" + "1607_A33.HCV.
         V" + "BUSHACAD.A33SS" + "BUSHACAD.A33PR"
E  2062          IF("BUSHACAD.OA33SS" .AND. "BUSHACAD.OA33PR") THEN $LOC10 =
         $LOC10 + 1
E  2064          $LOC4 = "1607_OA33.PHV.V" + "1607_OA33.PHV.V" + "1607_OA33.P
         HV.V" + "BUSHACAD.OA33SS" + "BUSHACAD.OA33PR"
E  2070          $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
E  2080          "1607_ND03.AHCV" = $LOC5 .ROOT. 3
ET 100000    GOTO 10

*******************************************************************************
Panel System Name: BUSHACAD Node 04
Program Name: BLDG. 1607 UTILITY METERING

BT  10 C THE FOLLOWING LINES CALCULATE THE DELTA T
BT  20 C THE FOLLOWING LINES TIME AVERAGE THE DELTA T FOR A 1 MINUT
     E AVERAGE ALSO STORE
BT  30 TIMAVG("BUSHACAD.ACDWTD",6,10,"BUSHACAD.ACDWDT")
BT  40 TIMAVG("BUSHACAD.AHWDDT",6,10,"BUSHACAD.AHWDT")
BT  50 C THE FOLLOWING LINES SET THE GPM INTO ANOTHER POINT THAT IS
     TOTALIZED IN MINUT
BT  60 "BUSHACAD.AHGPMT" = "BUSHACAD.MAGHWPM"
BT  70 "BUSHACAD.ACGPMT" = "BUSHACAD.MAGCHWPM"
BT  80 IF("BUSHACAD.MAGCHWPM1" .LE. 0.0) THEN SET (0.0,"BUSHACAD.MA
     GCHWPM1")
BT  90 IF("BUSHACAD.MAGHWPM1" .LE. 0.0) THEN SET (0.0,"BUSHACAD.NAG
     HWPM1")
BT 100 C THE FOLLOWING LINES CALCULATE THE METU'S BASED DENSITY
BT 110 "BUSHACAD.ACDWT" = "BUSHACAD.CHWPRT" - "BUSHACAD.CHWPST"
BT 120 IF("BUSHACAD.ACDWT" .LE. 0.0) THEN SET (0.0,"BUSHACAD.ACDW
     DT")
BT 130 "BUSHACAD.MAGCHWPM1" = "BUSHACAD.MAGCHWPM"
BT 140 "BUSHACAD.LVCWRT" = ("BUSHACAD.CHWSRT" - 32) * 5 / 9
BT 150 "BUSHACAD.T2" = "BUSHACAD.LVCWRT" * "BUSHACAD.LVCWRT"
BT 160 "BUSHACAD.T3" = "BUSHACAD.LVCWRT" * "BUSHACAD.LVCWRT" * "BU
     SHACAD.LVCWRT"
BT 170 "BUSHACAD.T4" = "BUSHACAD.LVCWRT" * "BUSHACAD.LVCWRT" * "BU
     SHACAD.LVCWRT" * "BUSHACAD.LVCWRT"
BT 180 "BUSHACAD.T5" = "BUSHACAD.LVCWRT" * "BUSHACAD.LVCWRT" * "BU
     SHACAD.LVCWRT" * "BUSHACAD.LVCWRT" * "BUSHACAD.LVCWRT"
BT 190 "BUSHACAD.CHWDENSITY" = (999.8395 + 0.06798 * "BUSHACAD.LVCW
     RT" - 0.00911 * "BUSHACAD.T2" + 0.0001 * "BUSHACAD.T3" - 1.127e-06
     + "BUSHACAD.T4" + 6.592e-09 * "BUSHACAD.T5") / 16.01846
BT 200 $LOC1 = "BUSHACAD.MAGCHWPM1" * "BUSHACAD.ACDWT" * "BUSHACAD
     .CHWDENSITY" * 1.0005 * 60
BT 210 $LOC2 = $LOC1 / 7.4805
BT 220 "BUSHACAD.ACMBTU" = $LOC2 / 1000 / 1000
BT 230 "BUSHACAD.ACMBTMIN" = "BUSHACAD.ACMBTU"
BT 260 "BUSHACAD.MAGCHWPM1" = "BUSHACAD.MAGCHWPM"
BT 270 "BUSHACAD.AHWDT" = "BUSHACAD.HWPRT" - "BUSHACAD.HWPUT"
BT 280 IF("BUSHACAD.AHWDT" .LE. 0.0) THEN SET (0.0,"BUSHACAD.AHWDT")
BT 290 "BUSHACAD.LVHWRT" = ("BUSHACAD.HWRT" - 32) * 5 / 9
BT 300 "BUSHACAD.T2" = "BUSHACAD.LVHWRT" * "BUSHACAD.LVHWRT"
BT 310 "BUSHACAD.T3" = "BUSHACAD.LVHWRT" * "BUSHACAD.LVHWRT" * "BU
     SHACAD.LVHWRT"
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

```plaintext
ET 320 "BUSHACAD.TH4" = "BUSHACAD.LVHRVT" * "BUSHACAD.LVHRVT" * "BU
SHACAD.LVHRVT" * "BUSHACAD.LVHRVT"
ET 330 "BUSHACAD.TH5" = "BUSHACAD.LVHRVT" * "BUSHACAD.LVHRVT" * "BU
SHACAD.LVHRVT" * "BUSHACAD.LVHRVT" * "BUSHACAD.LVHRVT"
ET 340 "BUSHACAD.HWDENSITY" = (999.8395 + 0.06798 * "BUSHACAD.LVHR
T" - 0.00911 * "BUSHACAD.TH2" + 0.0001 * "BUSHACAD.TH3" - 1.127e-0
6 * "BUSHACAD.TH4" + 6.592e-09 * "BUSHACAD.TH5") / 16.01846
ET 350 SAMPLE(1) "BUSHACAD.CALC1" = "BUSHACAD.CALC1" + 1
ET 360 $LOC3 = "BUSHACAD.MAGHWPRT" * "BUSHACAD.AHWRT" * "BUSHACAD.
HWDENSITY" / 0.999 * 60
ET 370 $LOC4 = $LOC3 / 7.4805
ET 380 "BUSHACAD.AHMBTU" = $LOC4 / 1000 / 1000
ET 390 SECONDS = 0.0
ET 400 C THE FOLLOWING LINES ARE USED TO GET THE AVERAGE 15 MIN DAT
A
ET 405 IF(CRTIME .GE. 0.0 .AND. CRTIME .LE. 0.03 .AND. "BUSHACAD.NE
XTSP1" .GE. 24.0) THEN "BUSHACAD.NEXTSP1" = 0.0
ET 410 IF(CRTIME .LT. "BUSHACAD.NEXTSP1") THEN GOTO 560
E 415 "BUSHACAD.NEXTSP1" = "BUSHACAD.NEXTSP1" + "BUSHACAD.SAMPL1"
E 420 C EACH POINT TO THE LEFT IS TRENDED AND SENT TO DATACENTER S
ERVER AT THE END OF EA
E 470 "BUSHACAD.ACMWT" = TOTAL("BUSHACAD.ACMBTU")
E 480 "BUSHACAD.AHWMT" = TOTAL("BUSHACAD.AHMBTU")
E 490 C "BUSHACAD.AHWWT" = "BUSHACAD.KWH"
E 500 "BUSHACAD.ACWMBTU" = "BUSHACAD.ACMWTU" + TOTAL("BUSHACAD.ACM
BTU")
E 510 "BUSHACAD.AHWMBTU" = "BUSHACAD.AHWMWTU" + TOTAL("BUSHACAD.AH
MBTU")
E 520 C THE FOLLOWING LINE RESETS THE TOTALS OF THE ABOVE TOTAL FU
CTIONS AFTER EACH PAS
E 530 INITITO(0.0, "BUSHACAD.ACWD","BUSHACAD.AHWD","BUSHACAD.AHGPM
T","BUSHACAD.ACGPMT","BUSHACAD.ACWTU","BUSHACAD.AHWDTA","BUSHACAD.
ACMBTU","BUSHACAD.AHMBTU")
E 540 IF(DADOFM .EQ. 1.0 .AND. CRTIME .EQ. 0.01) THEN SET(0.0,"BUSH
ACAD.ACMTU","BUSHACAD.AHMTU")
ET 560 SET("BUSHACAD.ACMBTU","UCMBUSHACAD.ACMBTU")
ET 570 SET("BUSHACAD.AHMBTU","UCMBUSHACAD.AHMBTU")
ET 574 SET("BUSHACAD.ACMWTU","UCMBUSHACAD.ACMWTU")
ET 576 SET("BUSHACAD.AHMBTU","UCMBUSHACAD.AHMBTU")
ET 580 IF(CRTIME .GE. 0.0 .AND. CRTIME .LE. 0.03 .AND. "BUSHACAD.NE
XTSP" .GE. 24.0) THEN "BUSHACAD.NEXTSP" = 0.0
ET 590 IF(CRTIME .LT. "BUSHACAD.NEXTSP") THEN GOTO 690
E 600 "BUSHACAD.NEXTSP" = "BUSHACAD.NEXTSP" + "BUSHACAD.SAMPL"
E 610 "BUSHACAD.LASTVALUEH" = TOTAL("UCMBUSHACAD.AHMBTU")
E 620 "BUSHACAD.LASTVALUE" = TOTAL("UCMBUSHACAD.ACMBTU")
```

Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 621 "BUSHACAD.HW15MINDATA" = TOTAL("UCM15BUSHACAD.AHMBTU")
E 622 "BUSHACAD.CW15MINDATA" = TOTAL("UCM15BUSHACAD.ACMBTU")
E 625 INITTO(0.0,"UCM15BUSHACAD.AHMBTU","UCM15BUSHACAD.ACMBTU")
E 630 IF(DAYOFM .EQ. 1) THEN GOTO 670
E 640 IF("BUSHACAD.LASTVALUEH" .GE. "UCM.BUSHACAD.HWMBTU") THEN "U"
E CM.BUSHACAD.HWMBTU" = "BUSHACAD.LASTVALUEH" ELSE "UCM.BUSHACAD.HWMBTU" = "UCM.BUSHACAD.HWMBTU"
E 650 IF("BUSHACAD.LASTVALUEC" .GE. "UCM.BUSHACAD.CWMBTU") THEN "U"
E CM.BUSHACAD.CWMBTU" = "BUSHACAD.LASTVALUEC" ELSE "UCM.BUSHACAD.CWMBTU" = "UCM.BUSHACAD.CWMBTU"
E 660 GOTO 690
E 670 "UCM.BUSHACAD.HWMBTU" = "BUSHACAD.LASTVALUEH"
E 680 "UCM.BUSHACAD.CWMBTU" = "BUSHACAD.LASTVALUEC"
ET 690 IF(MONTH .EQ. 1 .OR. MONTH .EQ. 3 .OR. MONTH .EQ. 5 .OR. MONTH .EQ. 7 .OR. MONTH .EQ. 8 .OR. MONTH .EQ. 10 .OR. MONTH .EQ. 12) THEN GOTO 720
E 700 IF(MONTH .EQ. 4 .OR. MONTH .EQ. 6 .OR. MONTH .EQ. 9 .OR. MONTH .EQ. 11) THEN GOTO 740
E 710 IF(MONTH .EQ. 2) THEN GOTO 760
ET 720 IF(DAYOFM .EQ. 31 .AND. CTIME .GT. 23.98) THEN INITTO(0.0,"UCMBUSHACAD.AHMBTU","UCMBUSHACAD.ACMBTU")
ET 730 GOTO 770
E 740 IF(DAYOFM .EQ. 30 .AND. CTIME .GT. 23.98) THEN INITTO(0.0,"UCMBUSHACAD.AHMBTU","UCMBUSHACAD.ACMBTU")
E 750 GOTO 770
E 760 IF(DAYOFM .EQ. 28 .AND. CTIME .GT. 23.98) THEN INITTO(0.0,"UCMBUSHACAD.AHMBTU","UCMBUSHACAD.ACMBTU")
ET 770 GOTO 10

Panel System Name: BUSHACAD Node 04
Program Name: 1607_A14

ET 10 C --- AHU 1-4 ---
ET 100 C --- DEFINITIONS ---
ET 101 DEFINE(X,"BUSHACAD")
ET 102 DEFINE(MODE,"1607_ECR.AHU 1-4")
ET 104 DEFINE(OAT,"BUSHACAD.OADT")
ET 106 DEFINE(SFSS,"BUSHACAD.A14SS")
ET 108 DEFINE(SVF,"BUSHACAD.A14SPD")
ET 109 DEFINE(SFVY,"1607_A14.SVF.Y")
ET 110 DEFINE(CD7,"BUSHACAD.A14CDT")
ET 112 DEFINE(CDTS,"1607_A14.CDT.S")
ET 114 DEFINE(CCV,"BUSHACAD.A14CW")
ET 115 DEFINE(CCVY,"1607_A14.CCV.V")
ET 116 DEFINE(HDT,"BUSHACAD.A14HDT")

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ET  118  DEFINE(HDTS,"1607_A14.HDT.S")
ET  120  DEFINE(HCV,"BUSHACAD.A14HW")
ET  121  DEFINE(HCVV,"1607_A14.HCV.V")
ET  122  DEFINE(CDS,"BUSHACAD.A14CDL")
ET  124  DEFINE(HDS,"BUSHACAD.A14HDL")
ET  126  DEFINE(DASS,"1607_A14.DASS.S")
ET  128  DEFINE(MDAS,"1607_A14.MDAS")
ET  130  DEFINE(DAF,"BUSHACAD.A14CFM")
ET  132  DEFINE(OAFS,"1607_A14.OAFS")
ET  134  DEFINE(OAR,"BUSHACAD.A14OAD")
ET  136  DEFINE(SMK,"BUSHACAD.A14SMK")
ET  138  DEFINE(HS,"BUSHACAD.A14HS")
ET  140  DEFINE(ACLP,"1607_A14.ACLF")
ET  142  DEFINE(AHLF,"1607_A14.AHLF")
ET  144  DEFINE(ACDMP,"1607_A14.ACDMP")
ET  146  DEFINE(AHMP,"1607_A14.AHMP")
ET  300  C --- LOCAL VARIABLES ---
ET  302  LOCAL(XCCTS,NCCTS,XHCTS,NHDTS,XDASS,NDASS,MAXRT)
ET  400  C --- CONVERT VIRTUAL LAO TO PHYSICAL ---
ET  410  TABLE("%CVV%","%CVV%",0,8,100,1)
ET  420  TABLE("%CVV%","%CVV%",0,6,100,1)
ET  430  TABLE("%CVV%","%CVV%",0,0,100,10)
ET  500  C --- GLOBAL CALCULATIONS ---
ET  502  IF("BUSHACAD.A14SS".OR."BUSHACAD.A14SS".EQ.PRON) THEN 0
    N("BUSHACAD.RLA2SS") ELSE OFF("BUSHACAD.RLA2SS")
ET  505  SPRINTF(300) GOTO 520
ET  510  IF("%AHLP%".EQ.0.AND."%AHLP%".EQ.0.AND."%ACMP%".EQ.0.AND."%AHMP%".EQ.0) THEN GOTO 520
ET  515  GOTO 610
E  520  C * FIND AVG TEC CLG LOOPOUT, USE TO RESET CDT.S *
E  525  $LOC1 = "$%A157:CLG LOOPOUT" "$%A158:CLG LOOPOUT" "$%A158:CLG LOOPOUT" "$%A158:CLG LOOPOUT" "$%A158:CLG LOOPOUT" "$%A158:CLG LOOPOUT" "$%A160:CLG LOOPOUT" "$%A160:CLG LOOPOUT"
E  527  $LOC1 = $LOC1 + "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT" "$%A161:CLG LOOPOUT"
E  529  $LOC1 = $LOC1 + "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT" "$%A165:CLG LOOPOUT"
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ... (4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 537 \$LOC1 = \$LOC1 + "%X.A169;CLG LOOPOUT" + "%X.A169;CLG LOOP
UT" + "%X.A260;CLG LOOPOUT" + "%X.A260;CLG LOOPOUT" + "%X.A261:
CLG LOOPOUT" + "%X.A261;CLG LOOPOUT" + "%X.A262;CLG LOOPOUT"
\$X.A262;CLG LOOPOUT"

E 540 \$LOC1 = \$LOC1 + "%X.A263;CLG LOOPOUT" + "%X.A263;CLG LOOP
UT" + "%X.A264;CLG LOOPOUT" + "%X.A264;CLG LOOPOUT" + "%X.A265:
CLG LOOPOUT" + "%X.A265;CLG LOOPOUT" + "%X.A266;CLG LOOPOUT" + "%X
.A266;CLG LOOPOUT"

E 542 \$LOC1 = (\$LOC1 + "%X.A267;CLG LOOPOUT" + "%X.A267;CLG LOOP
OUT" + "%X.A268;CLG LOOPOUT" + "%X.A268;CLG LOOPOUT" + "%X.A269:
CLG LOOPOUT" + "%X.A269;CLG LOOPOUT" + "%X.A269;CLG LOOPOUT"
"%X.COMFRM;CLG LOOPOUT"
+ "%X.COMFRM;CLG LOOPOUT") / 24

E 544 "%ACLIP" = \$LOC1 .ROOT. 2

E 545 C * FIND AVG TEC HTG LOOPOUT, USE TO RESET HTD.S *

E 550 \$LOC1 = "%X.A157;HTG LOOPOUT" + "%X.A157;HTG LOOPOUT" + "%X
.A158;HTG LOOPOUT" + "%X.A158;HTG LOOPOUT" + "%X.A159;HTG LOOP
OUT" + "%X.A159;HTG LOOPOUT" + "%X.A160;HTG LOOPOUT" + "%X.A160
:HTG LOOPOUT"

E 552 \$LOC1 = \$LOC1 + "%X.A161;HTG LOOPOUT" + "%X.A161;HTG LOOP
UT" + "%X.A162;HTG LOOPOUT" + "%X.A162;HTG LOOPOUT" + "%X.A163:
HTG LOOPOUT" + "%X.A163;HTG LOOPOUT" + "%X.A164;HTG LOOPOUT" + "%X
.A164;HTG LOOPOUT"

E 555 \$LOC1 = \$LOC1 + "%X.A165;HTG LOOPOUT" + "%X.A165;HTG LOOP
OUT" + "%X.A166;HTG LOOPOUT" + "%X.A166;HTG LOOPOUT" + "%X.A167:
HTG LOOPOUT" + "%X.A167;HTG LOOPOUT" + "%X.A168;HTG LOOPOUT" + "%X
.A168;HTG LOOPOUT"

E 557 \$LOC1 = \$LOC1 + "%X.A169;HTG LOOPOUT" + "%X.A169;HTG LOOP
UT" + "%X.A260;HTG LOOPOUT" + "%X.A260;HTG LOOPOUT" + "%X.A261:
HTG LOOPOUT" + "%X.A261;HTG LOOPOUT" + "%X.A262;HTG LOOPOUT" + "%X
.A262;HTG LOOPOUT"

E 560 \$LOC1 = \$LOC1 + "%X.A263;HTG LOOPOUT" + "%X.A263;HTG LOOP
OUT" + "%X.A264;HTG LOOPOUT" + "%X.A264;HTG LOOPOUT" + "%X.A265:
HTG LOOPOUT" + "%X.A265;HTG LOOPOUT" + "%X.A266;HTG LOOPOUT" + "%X
.A266;HTG LOOPOUT"

E 562 \$LOC1 = (\$LOC1 + "%X.A267;HTG LOOPOUT" + "%X.A267;HTG LOOP
OUT" + "%X.A268;HTG LOOPOUT" + "%X.A268;HTG LOOPOUT" + "%X.A269:
HTG LOOPOUT" + "%X.A269;HTG LOOPOUT" + "%X.A269;HTG LOOPOUT"
+ "%X.COMFRM;HTG LOOPOUT") / 24

E 564 "%AHLP" = \$LOC1 .ROOT. 2

E 565 C * FIND AVG TEC HTG DMP POS, USE TO RESET DAS.S *

E 570 \$LOC1 = "%X.A157;HTG DMP CMD" * "%X.A157;HTG DMP CMD" + "%X
.A158;HTG DMP CMD" * "%X.A158;HTG DMP CMD" + "%X.A159;HTG DMP
CMD" * "%X.A159;HTG DMP CMD" + "%X.A160;HTG DMP CMD" + "%X.A160
:HTG DMP CMD"

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 572 $LOC1 = $LOC1 + "$%X.A161:HTG DMP CMD" + "$%X.A161:HTG DMP CMD" + "$%X.A162:HTG DMP CMD" + "$%X.A162:HTG DMP CMD" + "$%X.A163:HTG DMP CMD" + "$%X.A163:HTG DMP CMD" + "$%X.A164:HTG DMP CMD" + "$%X.A164:HTG DMP CMD"

E 575 $LOC1 = $LOC1 + "$%X.A165:HTG DMP CMD" + "$%X.A165:HTG DMP CMD" + "$%X.A166:HTG DMP CMD" + "$%X.A166:HTG DMP CMD" + "$%X.A167:HTG DMP CMD" + "$%X.A167:HTG DMP CMD" + "$%X.A168:HTG DMP CMD" + "$%X.A168:HTG DMP CMD"

E 577 $LOC1 = $LOC1 + "$%X.A169:HTG DMP CMD" + "$%X.A169:HTG DMP CMD" + "$%X.A260:HTG DMP CMD" + "$%X.A260:HTG DMP CMD" + "$%X.A261:HTG DMP CMD" + "$%X.A261:HTG DMP CMD" + "$%X.A262:HTG DMP CMD" + "$%X.A262:HTG DMP CMD"

E 580 $LOC1 = $LOC1 + "$%X.A263:HTG DMP CMD" + "$%X.A263:HTG DMP CMD" + "$%X.A264:HTG DMP CMD" + "$%X.A264:HTG DMP CMD" + "$%X.A265:HTG DMP CMD" + "$%X.A265:HTG DMP CMD" + "$%X.A266:HTG DMP CMD" + "$%X.A266:HTG DMP CMD"

E 582 $LOC1 = ($LOC1 + "$%X.A267:HTG DMP CMD" + "$%X.A267:HTG DMP CMD" + "$%X.A268:HTG DMP CMD" + "$%X.A268:HTG DMP CMD" + "$%X.A269:HTG DMP CMD" + "$%X.A269:HTG DMP CMD" + "$%X.COMPRM:HTG DMP CMD" + "$%X.COMPRM:HTG DMP CMD") / 24

E 584 "$%ADMP%" = $LOC1 .ROOT. 2
E 585 C * FIND AVG TEC CLG DMP POS. USE TO RESET DAS.S + 11/06 JHG MODIFIED TO DRIVE OFF
E 590 C $LOC1 = "$%X.A157:CLG DMP CMD" + "$%X.A157:CLG DMP CMD" + "$%X.A158:CLG DMP CMD"
E 592 C $LOC1 = $LOC1 + "$%X.A161:CLG DMP CMD" + "$%X.A161:CLG DMP CMD" + "$%X.A162:CLG DM"
E 595 C $LOC1 = $LOC1 + "$%X.A165:CLG DMP CMD" + "$%X.A165:CLG DMP CMD" + "$%X.A166:CLG DM"
E 597 C $LOC1 = $LOC1 + "$%X.A169:CLG DMP CMD" + "$%X.A169:CLG DMP CMD" + "$%X.A260:CLG DM"
E 600 C $LOC1 = $LOC1 + "$%X.A263:CLG DMP CMD" + "$%X.A263:CLG DMP CMD" + "$%X.A264:CLG DM"
E 602 C $LOC1 = ($LOC1 + "$%X.A267:CLG DMP CMD" + "$%X.A267:CLG DMP CMD" + "$%X.COMPRM:CLG DMP CMD") / 2
E 604 "$%DMP%" = $LOC1 .ROOT. 2
ET 610 C "BUSHACAD.A14CFM" = SQRT($LOC1) + 4005 + 2.0 + 1
ET 620 C * FIND MAX ROOM TEMP *
ET 622 MAX($LOC1,"$%X.A15:ROOM TEMP","$%X.A159:ROOM TEMP","$%X.A160:ROOM TEMP","$%X.A161:ROOM TEMP","$%X.A162:ROOM TEMP","$%X.A163:ROOM TEMP","$%X.A164:ROOM TEMP")
ET 624 MAX($LOC1,$LOC1,"%X%.A165:ROOM TEMP","%X%.A166:ROOM TEMP","%X%.A167:ROOM TEMP","%X%.A168:ROOM TEMP","%X%.A169:ROOM TEMP","%X%.A260:ROOM TEMP","%X%.A261:ROOM TEMP","%X%.A262:ROOM TEMP")
ET 626 MAX($LOC1,$LOC1,"%X%.A263:ROOM TEMP","%X%.A264:ROOM TEMP","%X%.A265:ROOM TEMP","%X%.A266:ROOM TEMP","%X%.A267:ROOM TEMP","%X%.A268:ROOM TEMP","%X%.A269:ROOM TEMP","%X%.A260:CONFIRM:ROOM TEMP")
ET 628 "SMAKRM1" = $LOC1
ET 700 C --- SAFETIES ---
ET 702 C * SMOKE *
ET 704 IF("%SMK%" .NE. ON) THEN GOTO 710
E 706 OFF(0SMOKE,"%SFSS%")
E 708 SET(0,"%CCVVF%","%HCVVF%","%SFVF%")
ET 710 C * HIGH STATIC *
ET 712 IF("%HIS%" .NE. ON) THEN GOTO 718
E 714 OFF(0EMER,"%SFSS%")
E 716 SET(0,"%CCVVF%","%HCVVF%","%SFVF%")
ET 718 IF("%HIS%" .NE. ON) THEN RELEASE(0EMER,"%SFSS%")
ET 720 IF("%SMK%" .NE. ON .AND. "%HIS%" .NE. ON) THEN RELEASE(0SMOKE,"%SFSS%")
ET 722 IF("%HIS%" .OR. "%SMK%") THEN GOTO 30000
ET 724 C * VFD IN BYPASS *
ET 726 IF("BUSACAD.A14B%" .NE. ON) THEN GOTO 736
E 734 GOTO 800
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET  740  RELEASE("BUSHACAD.A263:CLG DMP CMD", "BUSHACAD.A264:CLG DMP CM
D", "BUSHACAD.A265:CLG DMP CMD", "BUSHACAD.A266:CLG DMP CMD", "BUSHAC
AD.A267:CLG DMP CMD", "BUSHACAD.A268:CLG DMP CMD", "BUSHACAD.A269:CLG
DMP CMD", "$X\%.COMPRM(=CLG DMP CMD")")
ET  800  C ----- DETERMINE MODE / REDIRECT ----- 
ET  805  IF("$MODE$" .EQ. 0) THEN GOTO 900
ET  810  IF("$MODE$" .EQ. 1) THEN GOTO 1000
E   815  IF("$MODE$" .EQ. 2) THEN GOTO 2000
E   820  IF("$MODE$" .EQ. 3) THEN GOTO 2000
E   825  IF("$MODE$" .EQ. 4) THEN GOTO 2000
E   830  IF("$MODE$" .EQ. 5) THEN GOTO 2000
E   835  IF("$MODE$" .EQ. 6) THEN GOTO 2000
E   840  IF("$MODE$" .EQ. 7) THEN GOTO 2000
E   845  IF("$MODE$" .EQ. 8) THEN GOTO 2000
E   850  IF("$MODE$" .EQ. 9) THEN GOTO 2000
E   855  IF("$MODE$" .EQ. 10) THEN GOTO 2000
E   860  IF("$MODE$" .EQ. 11) THEN GOTO 2000
E   865  GOTO 2000
E   900  C ----- HIBERNATE - ESSENTIAL ONLY ----- 
E   910  ON("$SFSS$")
E   920  $XCDTS = 58
E   930  $NCDDTS = 55
E   940  $XHDTSS = 100
E   950  $NHDTSS = 72
E   960  $XDAASS = 0.8
E   970  $NDASS = 0.1
E   980  GOSUB 20000
E   990  GOTO 30000
ET  1000  C ----- NORMAL OCCUPATION ----- 
ET  1010  ON("$SFSS$")
ET  1020  $XCDTS = 57
ET  1030  $NCDDTS = 53
ET  1040  $XHDTSS = 120
ET  1050  $NHDTSS = 75
ET  1060  $XDAASS = 1.7
ET  1070  $NDASS = 0.3
ET  1080  GOSUB 20000
ET  1090  GOTO 30000
E  2000  C ----- MINIMAL OCCUPATION ----- 
E  2010  ON("$SFSS$")
E  2020  $XCDTS = 57
E  2030  $NCDDTS = 55
E  2040  $XHDTSS = 100
E  2050  $NHDTSS = 72
E  2060  $XDAASS = 1.2

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Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

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E 2070 $NDASS = 0.2
E 2072 GOSUB 20000
E 2074 GOTO 30000
E 3000 C --- OCC3 ---
E 4000 C --- OCC4 ---
E 5000 C --- OCC5 ---
E 6000 C --- WARMUP ---
E 7000 C --- COOLDOWN ---
E 8000 C --- NIGHT HEATING ---
E 9000 C --- NIGHT COOLING ---
E 10000 C --- STOP HEATING ---
E 11000 C --- STOP COOLING ---
E 11999 GOTO 30000
ET 20000 C --- SUBROUTINE TO MODULATE VFD AND VALVES / RESET SETPOINT S ---
ET 20010 SAMPLE(900) GOTO 20030
ET 20020 GOTO 20080
E 20030 $LOC1 = "$CDTS%"
E 20040 IF("%ACL$%.LT. 35 .AND. "%X%.COMPRM:ROOM TEMP" .LT. 74 .AND. 
   "%MAXRMT" .LT. 76.5) THEN $LOC1 = $LOC1 + 0.5
E 20050 IF("%ACL$%.GT. 45 .OR. "%X%.COMPRM:ROOM TEMP" .GT. 75 .OR. 
   "%MAXRMT" .GT. 77) THEN $LOC1 - $LOC1 - 1.0
E 20060 MIN($LOC1,$LOC1,$XCDTS)
E 20070 MAX("$CDTS%",$LOC1,$NCDS)
ET 20080 LOOP(0,"$CDTS%","$CCVS%","$CDTS%",300,10,1,50,0,100,0)
ET 20090 SAMPLE(900) GOTO 20110
ET 20100 GOTO 20160
E 20110 $LOC1 = "$HDT$"
E 20120 IF("%AHL$%.LT. 35) THEN $LOC1 = $LOC1 - 5
E 20130 IF("%AHL$%.GT. 45) THEN $LOC1 = $LOC1 + 10
E 20140 MIN($LOC1,$LOC1,$XHDT)
E 20150 MAX("$HDT%",$LOC1,$NHDT)
ET 20160 LOOP(128,"$HDT%","$HCYS%","$HDT%",200,5,1,25,0,100,0)
ET 20170 SAMPLE(900) GOTO 20190
ET 20180 GOTO 20240
E 20190 $LOC1 = "$DASS%"
E 20192 MAX($LOC2,"$AHDF%","$ACDF%")
E 20200 IF($LOC2 .LT. 30 .AND. "%X%.COMPRM:ROOM TEMP" .LT. 74 .AND. 
   "%MAXRMT" .LT. 76.5) THEN $LOC1 = $LOC1 - 0.1
E 20210 IF($LOC2 .GT. 40 .OR. "%X%.COMPRM:ROOM TEMP" .GT. 75 .OR. "$ 
   MAXRMT" .GT. 77) THEN $LOC1 = $LOC1 + 0.3
E 20220 MIN($LOC1,$LOC1,$XDASS)
E 20230 MAX("$DASS%",$LOC1,$NDASS)
ET 20240 MIN("$MDASS%","$CDS%","$HDS%")
```
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET 20250 LOOP(128,"%NDAS%","%SVFS%","%DASS%",2500,250,20,1,60,20,100,
   0)
ET 20260 RETURN
ET 30000 GOTO 10

Panel System Name: BUSHACAD Node 04
Program Name: 1607_CHW SYS

ET 10  C --- CHW SYSTEM ---
ET 100 DEFINE(X,"BUSHACAD")
ET 102 DEFINE(Y,"1607_CHW")
ET 104 DEFINE(PST,"BUSHACAD.CHWPRF")
ET 106 DEFINE(SST,"BUSHACAD.CHWSST")
ET 108 DEFINE(SRT,"BUSHACAD.CHWSRT")
ET 110 DEFINE(ERT,"BUSHACAD.CHWFRT")
ET 112 DEFINE(DT,"1607_CHW.DT")
ET 114 C DEFINE(PSP,"")
ET 116 DEFINE(SSP,"BUSHACAD.CHWSSP")
ET 118 DEFINE(SRP,"BUSHACAD.CHWSRP")
ET 120 C DEFINE(FSP,"")
ET 122 DEFINE(DP,"BUSHACAD.ACWDP")
ET 124 DEFINE(PFS,"BUSHACAD.ACPFS")
ET 126 DEFINE(CPFM,"BUSHACAD.MASCWCPF")
ET 128 DEFINE(PFSS,"BUSHACAD.ACPS")
ET 130 DEFINE(PFPR,"1607_CHW.PFR")
ET 132 DEFINE(PFVR,"BUSHACAD.ACPFS")
ET 134 DEFINE(PFSS,"BUSHACAD.ACPSS")
ET 136 DEFINE(PFVR,"1607_CHW.P2PR")
ET 138 DEFINE(PFVR,"BUSHACAD.ACP2PS")
ET 140 DEFINE(LDP,"1607_CHW.LDP")
ET 142 DEFINE(RTV,"BUSHACAD.ACWRV")
ET 144 DEFINE(TTS,"1607_CHW.TTS")
ET 200 C --- LOCAL VARIABLES ---
ET 210 LOCAL(FMPEDLY,DPEDLO,LDENA,LGENA)
ET 300 C --- GLOBAL ---
ET 310 SAMPLE(5) "$PMPDLY" = "$PMPDLY" + 5
ET 320 "1607_CHWPTD" = "1607_CHWPRF" - "1607_CHWPS" "1607_CHWPTD" = "1607_CHWPTD" - "1607_CHWPS"
ET 330 $LOC1 = "$SSP%" - "$SPP%"
ET 340 TIMAVG("$DP%",2,5,$LOC1)
ET 800 C --- DETERMINE LEAD/LAG ---
ET 810 $LOC1 = TOTAL("%PSS%") - TOTAL("%P2SS%")
ET 812 IF($LOC1 .GT. 0) THEN "$TTS%" = 100 - $LOC1 ELSE "$TTS%" = 1
00 + $LOC1
ET 820 IF($LOC1 .LT. 100 .AND. $LOC1 .GT. -100) .AND. {$"LDP%" .EQ. 1 .OR. "$LDP%" .EQ. 2}) THEN GOTO 900

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Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ... (4 Field Panels)
Programs: *
Line Range: 1 - 32767

E  830  IF($LOC1 .GT. 100) THEN SET(2, "%LDP%%") ELSE SET(1, "%LDP%%")
E  840  INITTO(0,"%P1SS%","%P2SS%")
E  850  $LOC1 = "%P1SS%" + "%P2SS%"
E  860  IF($LOC1 .EQ. 1) THEN SET(0,"%P1SS%","%P2SS%","$PMPDL")
ET  900  C --- REDIRECT ---
ET  905  IF("BUSHACAD.A11SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  910  IF("BUSHACAD.A12SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  915  IF("BUSHACAD.A13SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  920  IF("BUSHACAD.A14SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  925  IF("BUSHACAD.A21SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  930  IF("BUSHACAD.A22SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  935  IF("BUSHACAD.A23SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  940  IF("BUSHACAD.A31SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  945  IF("BUSHACAD.A32SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  950  IF("BUSHACAD.A33SS" .OR. "BUSHACAD.A11SS" .EQ. PR Fon) THEN GOTO 2000
E  955  IF("BUSHACAD.OA31SS" .OR. "BUSHACAD.OA31SS" .EQ. PR Fon) THEN GOTO 2000
E  960  IF("BUSHACAD.OA32SS" .OR. "BUSHACAD.OA32SS" .EQ. PR Fon) THEN GOTO 2000
E  965  IF("BUSHACAD.OA33SS" .OR. "BUSHACAD.OA33SS" .EQ. PR Fon) THEN GOTO 2000
E  970  IF("BUSHACAD.OA31LL" .OR. "BUSHACAD.OA32LL" .OR. "BUSHACAD.OA33LL") THEN GOTO 2000
E  1000  C --- ALL STOP - NO DEMAND ---
E  1010  OFF("%P1SS%","%P2SS%")
E  1020  SET(0,"%RTV%","%P1VF%","%P2VF%")
E  1030  GOTO 10000
ET  2000  C --- DETERMINE DP STPT BASED ON DEMAND ---
ET  2010  $LOC10 = 3
ET  2020  IF("BUSHACAD.A14SS" .AND. "BUSHACAD.A14PR") THEN $LOC10 = $LOC10 + 1
ET  2030  $LOC1 = "1607_ND01.ACCV" + "1607_ND01.ACCV" + "1607_ND01.ACCV"
ET  2040  $LOC2 = "1607_ND02.ACCV" + "1607_ND02.ACCV" + "1607_ND02.ACCV"
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

ET 2050 $LOC3 = "1607_ND03.ACCT" * "1607_ND03.ACCT" * "1607_ND03.ACCT"
ET 2060 $LOC4 = "1607_A14.CCYY.V" * "1607_A14.CCYY.V" * "1607_A14.CCYY.V" * "BUSHACAD.A14SS" * "BUSHACAD.A14PR"
ET 2070 $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
ET 2080 "$Y% . ACC" = $LOC5 . ROOT . 3
ET 2090 SAMPLE(900) GOTO 2110
ET 2100 GOTO 3000
ET 2110 $LOC1 = "$DFS%"
ET 2120 IF("$Y%. ACC" . GT. 70) THEN $LOC1 = $LOC1 + 2
ET 2130 IF("$Y%. ACC" . GT. 60 . AND. "$Y%. ACC" . LT. 70) THEN $LOC1 = $LOC1 + 1
ET 2140 IF("$Y%. ACC" . GT. 40 . AND. "$Y%. ACC" . LT. 50) THEN $LOC1 = $LOC1 - 0.5
ET 2150 IF("$Y%. ACC" . LT. 40) THEN $LOC1 = $LOC1 - 1
ET 2160 MIN($LOC1,$LOC1,30)
ET 2170 MAX("$DFS%",$LOC1,5)
ET 3000 C --- MODULATE SYSTEM TO DP STFT ---
ET 3010 LOOP(128,"$DP%","$DPLOOP","$DFS%",1125,110,5,1,33,0,100,0)
ET 3020 IF("$LDP%" . EQ. 2) THEN GOTO 3050
ET 3030 GOSUB 9000 "$P1SS%","$P1VF%","$P2SS%","$P2VF%"
ET 3040 JU40 GOTO 10000
ET 3050 GOSUB 9000 "$P2SS%","$P2VF%","$P1SS%","$P1VF%"
ET 3060 GOTO 10000
ET 9000 C * 0-33 : BOTH PUMPS OFF, MODULATE RTV 10-100% *
ET 9010 C * 33-66 : LEAD PUMP ON @ MIN, MODULATE RTV 20-100% *
ET 9020 C * 66-100 : RTV @ 100%, LEAD PUMP 20-100% *
ET 9030 C * LAG PUMP TRIGGERED BASED ON LEAD PUMP'S SPEED *
ET 9040 TABLE("$DPLOOP","$RTV%",0,15,20,30,33,100,34,20,66,100)
ET 9050 DBSWT(0,"$DPLOOP",33,38,$LDENA)
ET 9060 IF("$MPDLY" . GT. 30) THEN $ARG1 = $LDENA
ET 9070 IF($ARG1 . OR. $ARG2 . EQ. .FRON) THEN TABLE("$DPLOOP",$ARG2,3
ET 9080 ELSE SET(0,$ARG2)
ET 9090 DBSWT(0,$ARG2,$ARG3,$ARG4)
ET 9100 IF($ARG3 . OR. $ARG3 . EQ. .FRON) THEN $ARG4 = $ARG2 ELSE SET(0,$ARG4)
ET 9110 RETURN
ET 10000 GOTO 10

Panel System Name: BUSHACAD Node 04
Program Name: 1607_ND04.MISC

ET 10 C --- 1607_ND04.MISC ---
ET 100 C DEFINE(RH, "1607_VOAHUM")
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

Panel System Name: BUSHACAD Node 04
Program Name: 1607_HW SYS

ET 10  C --- HW SYSTEM ---
ET 100 DEFINE(X,"BUSHACAD")
ET 102 DEFINE(Y,"1607_HW")
ET 104 DEFINE(PST,"BUSHACAD.HWFRT")
ET 106 DEFINE(SST,"BUSHACAD.HWSST")
ET 108 DEFINE(SRT,"BUSHACAD.HWSRT")
ET 110 DEFINE(PRT,"BUSHACAD.HWPRT")
ET 112 DEFINE(DT,"1607_HW.DT")
ET 114 C DEFINE(FSP,"")
ET 116 DEFINE(SSP,"BUSHACAD.HWSSP")
ET 118 DEFINE(SSRE,"BUSHACAD.HWSRE")
ET 120 C DEFINE(PRRE,"")
ET 122 DEFINE(DP,"BUSHACAD.AHWD")
ET 124 DEFINE(DFS,"BUSHACAD.AHWDPS")
ET 126 DEFINE(GPM,"BUSHACAD.MAHGWPM")
ET 128 DEFINE(PLSS,"BUSHACAD.AHFLSS")
ET 130 DEFINE(P1PR,"1607_HW.P1PR")
ET 132 DEFINE(P1PYF,"BUSHACAD.AHFLSP")
ET 134 DEFINE(P2SS,"BUSHACAD.AHF2SS")
ET 136 DEFINE(P2PR,"1607_HW.P2PR")
ET 138 DEFINE(P2VF,"BUSHACAD.AHF2SP")
ET 140 DEFINE(LDP,"1607_HW.LDP")
ET 142 DEFINE(RTY,"BUSHACAD.AHWRTV")
ET 144 DEFINE(TTS,"1607_HW.TTTSWAP")
ET 200 C --- LOCAL VARIABLES ---
ET 210 LOCAL(PMPDLY,DPLOOP,LDENA,LGENA)
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

C --- GLOBAL ---
SAMPLE(5) "$PMPDLY" = "$PMPDLY" + 5
"1607_HWPDT" = "1607_HWPST" - "1607_HWPRT"
$LOC1 = "$SSP%" - "$SRP%"
TIMAVG("%DP%",1,3,$LOC1)
C --- DETERMINE LEAD/LAG ---
$LOC1 = TOTAL("%P1SS%") - TOTAL("%P2SS%")
IF($LOC1 .GT. 0) THEN "%TTS%" = 100 - $LOC1 ELSE "%TTS%" = 1
00 + $LOC1
IF($LOC1 .LT. 100 .AND. $LOC1 .GT. -100) .AND. ("%LDP%" .EQ. 1 .OR. "%LDP%" .EQ. 2) THEN GOTO 900
E
IF($LOC1 .GT. 100) THEN SET(2,"%LDP") ELSE SET(1,"%LDP")
INITTO(0,"%P1SS%","%P2SS%")
$LOC1 = "%P1SS%" + "%P2SS%"
IF($LOC1 .EQ. 1) THEN SET(0,"%P1SS%","%P2SS%","$PMPDLY")
C --- REDIRECT ---
IF("BUSHACAD.A11SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A12SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A13SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A14SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A21SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A22SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A23SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A31SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A32SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.A33SS" .OR. "BUSHACAD.A11SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.OA31SS" .OR. "BUSHACAD.OA31SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.OA32SS" .OR. "BUSHACAD.OA32SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.OA33SS" .OR. "BUSHACAD.OA33SS" .EQ. PRFON) THEN GOTO 2000
E
IF("BUSHACAD.OA31LL" .OR. "BUSHACAD.OA32LL" .OR. "BUSHACAD.OA33LL") THEN GOTO 2000
E
C --- ALL STOP - NO DEMAND ---
Field Panels: BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

E 1010 OFF("%P1S%","%P2S%")
E 1020 SET(0,"%RTV%","%P1VF%","%P2VF%")
E 1030 GOTO 10000
ET 2000 C --- DETERMINE DP STPT BASED ON DEMAND ---
ET 2010 SLOC10 = 3
ET 2020 IF("BUSHACAD.A14SS" .AND. "BUSHACAD.A14FR") THEN $LOC10 = $LOC10 + 1
ET 2030 $LOC1 = "1607_ND01.AHCV" + "1607_ND01.AHCV" + "1607_ND01.AHCV"
ET 2040 $LOC2 = "1607_ND02.AHCV" + "1607_ND02.AHCV" + "1607_ND02.AHCV"
ET 2050 $LOC3 = "1607_ND03.AHCV" + "1607_ND03.AHCV" + "1607_ND03.AHCV"
ET 2060 $LOC4 = "1607_A14.HCV.V" + "1607_A14.HCV.V" + "1607_A14.HCV.V"
ET 2070 $LOC5 = ($LOC1 + $LOC2 + $LOC3 + $LOC4) / $LOC10
ET 2080 "%Y%.AHCV" = $LOC5 .ROOT. 3
ET 2090 SAMPLE(900) GOTO 2110
ET 2100 GOTO 3000
E 2110 $LOC1 = "$DPS%"
E 2120 IF("%Y%.AHCV" .GT. 65) THEN $LOC1 = $LOC1 + 2
E 2130 IF("%Y%.AHCV" .GT. 55 .AND. "%Y%.AHCV" .LT. 65) THEN $LOC1 = $LOC1 + 1
E 2140 IF("%Y%.AHCV" .GT. 30 .AND. "%Y%.AHCV" .LT. 40) THEN $LOC1 = $LOC1 - 0.5
E 2150 IF("%Y%.AHCV" .LT. 30) THEN $LOC1 = $LOC1 - 1
E 2160 MKN($LOC1,$LOC1,30)
E 2170 MAX("%DPS%",$LOC1,5)
ET 3000 C --- MODULE SYSTEM TO DP STPT ---
ET 3010 LOOP(128,"%DPS%","%DPL%",300,15,0,1,65,0,100,0)
ET 3020 IF("%LDP%" .EQ. 2) THEN GOTO 3050
ET 3030 GOSUB 9000 "%P1S%","%P1VF%","%P2S%","%P2VF%"
ET 3040 GOTO 10000
E 3050 GOSUB 9000 "%P2S%","%P2VF%","%P1S%","%P1VF%"
E 3060 GOTO 10000
ET 9000 C * 0-33 : BOTH PUMPS OFF, MODULATE RTV 10-100% *
ET 9010 C * 33-66 : LEAD PUMP ON & MIN. MODULATE RTV 20-100% *
ET 9020 C * 66-100: RTV @ 100%, LEAD PUMP 20-100% *
ET 9030 C * LAG PUMP TRIGGERED BASED ON LEAD PUMP'S SPEED *
ET 9040 TABLE("%DPL%","%RTV%",0,10,33,30,100,34,20,66,100)
ET 9050 DBSWIT(0,"%DPL%",33,36,$LDENA)
ET 9060 IF("%PMDLY" .GT. 30) THEN $ARG1 = $LDENA
ET 9070 IF($ARG1 .OR. $ARG1 .EQ. PREON) THEN TABLE("%DPL%",$ARG2,34,20,66,20,100,100) ELSE SET(0,$ARG2)
ET 9080 DBSWIT(0,$ARG2,65,65,$LDENA)
Field Panels:  BUSHACAD Node 01, BUSHACAD Node 02, BUSHACAD Node 03, ...
(4 Field Panels)
Programs: *
Line Range: 1 - 32767

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ET  9090  IF("$PMPDLY" .GT. 30) THEN $ARG3 = $LGENA
ET  9100  IF($ARG3 .OR. $ARG3 .EQ. PRFON) THEN $ARG4 = $ARG2 ELSE SET(0,$ARG4)
ET  9110  RETURN
ET  10000  GOTO 10
```

******************************************************************************
******************************************************************************  End of Report  ******************************************************************************