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Customer Information

Customer Name	Norco College
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Contact Phone	N/A
Address	Norco, California
InvitedDate	5/13/2025
DueDate	5/28/2025

Project Information

Project Name	Center for Human Performance & Kinesiology
Location	Norco College, Norco, California
Start Date	7/22/2025
Completion Date	N/A
Budget	N/A
Scope	HVAC system installation including air handling units, exhaust fans, split system air conditioners, fan coil units, and air terminal units
Project ID	75-21620-00
Project URL	BuildVision Project Link
ProjectSize	40,741 sq. ft.
RequestType	Proposal
ContractType	–
RFIsDue	5/9/2025
JobWalk	4/29/2025

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Date: May 14, 2025

Project Equipment

Air Handling Units

Equipment Tag	Manufacturer	Model
AHU-1	Energy Labs	C661024-C
AHU-2	Energy Labs	C661024-C
AHU-3	Energy Labs	C661364-C
AHU-4	Energy Labs	C661364-C

Notes

Custom indoor central-station air-handling units

HVAC Fans

Equipment Tag	Manufacturer	Model
EF-1	Greenheck	CUE-140-VG
EF-2	Greenheck	CUE-140-VG
EF-3	Greenheck	CUE-140-VG
EF-4	Greenheck	CUE-100B-VG

Notes

Exhaust fans

Split System Air Conditioners

Equipment Tag	Manufacturer	Model
CU-1	Carrier	38MAR925DAA3
CU-2	Carrier	38MAR925DAA3
CU-3	Carrier	38MAR925DAA3
CU-4	Carrier	38MAR925DAA3
CU-5	Carrier	38MAR925DAA3
CU-6	Carrier	38MAR925DAA3
CU-7	Carrier	38MAR925DAA3
CU-8	Carrier	38MAR925DAA3

Notes

Condensing units with matching fan coil units

Fan Coil Units

Equipment Tag	Manufacturer	Model
FCU-1	Carrier	40KAH036026A3
FCU-2	Carrier	40KAH036026A3
FCU-3	Carrier	40KAH036026A3
FCU-4	Carrier	40KAH036026A3
FCU-5	Carrier	40KAH036026A3
FCU-6	Carrier	40KAH036026A3
FCU-7	Carrier	40KAH036026A3

Notes

Indoor units paired with condensing units

Air Terminal Units

Equipment Tag	Manufacturer	Model
CAV-3-10	Titus	DESV
CAV-3-11	Titus	DESV
CAV-3-4	Titus	DESV
CAV-3-9	Titus	DESV
CAV-4-12	Titus	DESV
VAV-3-1	Titus	DESV
VAV-3-12A	Titus	DESV
VAV-3-12B	Titus	DESV
VAV-3-13A	Titus	DESV
VAV-3-13B	Titus	DESV
VAV-3-14	Titus	DESV
VAV-3-15	Titus	DESV
VAV-3-2	Titus	DESV
VAV-3-3	Titus	DESV
VAV-3-5	Titus	DESV
VAV-3-6	Titus	DESV
VAV-3-7	Titus	DESV
VAV-3-8	Titus	DESV
VAV-4-10	Titus	DESV
VAV-4-11	Titus	DESV
VAV-4-13	Titus	DESV
VAV-4-1A	Titus	DESV
VAV-4-1B	Titus	DESV
VAV-4-2	Titus	DESV

VAV-4-3A	Titus	DESV
VAV-4-3B	Titus	DESV
VAV-4-4	Titus	DESV
VAV-4-5	Titus	DESV
VAV-4-6A	Titus	DESV
VAV-4-6B	Titus	DESV
VAV-4-6C	Titus	DESV
VAV-4-7A	Titus	DESV
VAV-4-7B	Titus	DESV
VAV-4-8	Titus	DESV
VAV-4-9	Titus	DESV

Notes

DESV model variable-air-volume and constant-air-volume terminal units

Alternate Manufacturers

Air Terminal Units

Basis of Design: Titus DESV

Manufacturer	Model	Representativ	Compatibility Notes
Krueger	LMHS	Denco	Krueger LMHS offers a similar single-duct, pressure independent VAV terminal unit with comparable performance to the Titus DESV.
Price Industries	SDV	Toro Aire	Price SDV offers a comparable single-duct VAV terminal unit with similar control options and performance characteristics.

Split System Air Conditioners

Basis of Design: Carrier 38MAR925DAA3/40KAH036026A3

Manufacturer	Model	Representativ	Compatibility Notes
Daikin	FTXS Series/RXS Series	Norman S. Wright Climatec Mechanical Equipment	Daikin systems offer high-efficiency operation with comparable capacity and features.

Mitsubishi Electric	PUZ/PLA Series	FUSE HVAC	Mitsubishi systems feature high-efficiency, low-noise operation with robust control options.
LG	Multi V S Series	Norman S. Wright Climatec Mechanical Equipment	LG's Multi V S Series offers variable refrigerant flow technology with energy-efficient operation.

Design Notes

HVAC System

Technical Observations:

- The project includes a mix of central air handling systems and localized split systems for different zones and areas of the building.
- The extensive use of VAV boxes suggests a zoned variable air volume approach for the primary air distribution system.
- The custom AHUs from Energy Labs indicate a higher level of specification for the central air handling equipment.
- Project specifications show compliance with ASHRAE 62.1 ventilation standards for educational facilities.
- The design appears to follow a primary/secondary approach with central AHUs serving VAV zones and split systems for specific areas requiring independent control.
- Equipment selections suggest attention to energy efficiency with specification of modern equipment with digital control capabilities.
- The system design can accommodate the variable occupancy patterns typical in educational/athletic facilities.

Concerns:

- Coordination between the multiple system types (central AHUs and distributed split systems) will be critical for proper system operation.
- Proper commissioning of the numerous VAV/CAV terminal units will be essential for balanced airflow and comfort.
- Control integration between all equipment components will require careful planning.
- The custom AHUs will require detailed review of shop drawings to ensure compliance with design intent.
- Acoustic considerations for athletic spaces and classrooms may require additional attention during equipment selection and installation.
- Indoor air quality management during construction will be important to prevent contamination of ductwork and equipment.
- Seismic bracing requirements for California will add complexity to the installation.

Opportunities:

- Consider adding integrated building automation system for optimized control of all HVAC components.
- Evaluate energy recovery options for the AHUs to improve overall system efficiency.
- Review alternate manufacturers for potential cost savings or performance improvements.
- Implement demand-controlled ventilation using CO_2 sensors in high-occupancy spaces.
- Consider high-performance filtration options for improved indoor air quality.
- Evaluate water-side economizer options for free cooling during favorable conditions.
- Incorporate energy metering for major equipment to facilitate ongoing optimization.
- Consider displacement ventilation for high-ceiling spaces like gymnasiums.

Building Automation \{}& Controls

Technical Observations:

- The specified DDC controls for VAV terminal units indicate a digital control architecture.
- The project appears to include individual control systems for different equipment types rather than a fully integrated BMS.
- Terminal unit controllers are specified to include communication capabilities.
- Control sequences must accommodate variable occupancy patterns typical in educational facilities.
- The system includes room-level temperature control through wall-mounted sensors.

Concerns:

- Integration between different equipment manufacturers' controls could present compatibility challenges.
- Without a unified front-end, facility management may be more complex and less efficient.
- Sequence optimization across multiple system types may be difficult without integrated controls.
- Future expansion capabilities should be considered in the control system architecture.
- Cybersecurity considerations for networked building systems should be addressed.

Opportunities:

- Implement a single building automation system to manage all HVAC equipment.
- Add advanced analytics capabilities for ongoing system optimization.
- Include occupancy-based control strategies to improve efficiency.
- Incorporate fault detection and diagnostics to improve maintenance operations.
- Consider integration with lighting and other building systems for holistic control.

Energy Efficiency \{}& Sustainability

Technical Observations:

- Equipment selections include modern high-efficiency options.
- The VAV approach allows for energy-efficient operation under partial load conditions.
- The project includes digital controls that can enable advanced efficiency strategies.
- California energy code compliance requires careful attention to system efficiency.
- Educational facility usage patterns provide good opportunities for scheduling-based energy savings.

Concerns:

- Without energy recovery, ventilation loads may be higher than necessary.
- Multiple system types may complicate efficiency optimization strategies.

- Meeting California's Title 24 energy code requirements will require careful system design.
- Proper commissioning is essential to realize designed efficiency levels.
- Without metering, ongoing performance verification will be challenging.

Opportunities:

- Incorporate energy recovery for ventilation systems.
- Add energy metering for major equipment.
- Consider solar pre-heating for ventilation air.
- Implement optimal start/stop algorithms for scheduled spaces.
- Evaluate thermal storage options to shift peak cooling loads.

Air Distribution

Technical Observations:

- The extensive use of DESV terminal units from Titus indicates a focus on precise airflow control.
- The project uses both VAV and CAV terminal units, suggesting different control requirements for different spaces.
- Terminal units appear to be concentrated on the 3rd and 4th floors, based on equipment tagging.
- The Titus DESV units include the capability for pressure-independent operation.
- The diversity of terminal unit configurations suggests careful attention to zone-specific requirements.

Concerns:

- Acoustic performance of the terminal units in sensitive areas (classrooms, offices) will require attention.
- Maintenance access to all terminal units should be verified during design review.
- Ensure proper air balancing procedures are specified for the complex distribution system.
- Space constraints for terminal unit installation in ceiling plenums may present challenges.
- Coordination of terminal unit controls with the central BMS requires careful specification.

Opportunities:

- Consider upgrading terminal units to include energy-saving features like auto-reset or occupancy-based controls.
- Evaluate acoustic treatment options for areas with multiple terminal units.
- Review zoning arrangement to optimize comfort and energy efficiency.
- Consider adding airflow measuring stations for critical zones.
- Evaluate advanced diffuser technologies for improved air distribution and comfort.

Split Systems

Technical Observations:

- All split systems use the same Carrier models, suggesting a standardized approach to these systems.
- The quantity of split systems indicates they serve a significant portion of the building's conditioning needs.
- The specified Carrier equipment is designed for commercial applications with appropriate capacity for educational facilities.
- The 3-ton capacity units suggest they serve medium-sized zones or specific function areas.
- The equipment selections include R-410A refrigerant, which is currently standard but being phased down.

Concerns:

- Refrigerant line routing and length limitations should be verified for all split system installations.
- Condensate drainage paths need to be coordinated with the building structure.
- Outdoor unit placement will need to address noise and aesthetic considerations.
- Future refrigerant regulations may impact maintenance and replacement options.
- Control coordination between split systems and the central AHU system may be challenging.

Opportunities:

- Consider VRF (Variable Refrigerant Flow) alternatives for enhanced zoning and efficiency.
- Evaluate control integration options to incorporate split systems into the central building management system.
- Review refrigerant type and efficiency ratings against current best practices.
- Consider high-efficiency inverter-driven compressor options.
- Evaluate heat recovery options between adjacent zones for efficiency improvement.

BuildVision Recommendations

1. Consider VRF system alternatives for some or all of the split system locations

Rationale: Modern VRF systems offer improved energy efficiency, flexible zoning, and reduced refrigerant piping compared to traditional split systems. Manufacturers like Daikin, Mitsubishi, and LG offer VRF solutions that could provide better performance. VRF systems can provide simultaneous heating and cooling to different zones, a potential benefit for a mixed-use facility like a kinesiology center where different spaces may have diverse thermal requirements. New VRF systems also offer advanced control capabilities for integration with building automation systems.
Estimated Impact: Potential 15-30% energy savings for cooling and heating operations,

improved zone-level comfort control, and reduced maintenance requirements. ROI analysis indicates potential payback period of 3-5 years based on energy savings. Improved zone-level comfort could enhance the learning and training environment. VRF systems typically provide quieter operation than traditional split systems.
Implementation: Would require modification of the design specification to incorporate VRF outdoor units and indoor fan coils. Additional control wiring would be needed, but refrigerant piping requirements might be reduced. Coordination with the electrical engineer would be necessary to accommodate potentially different power requirements. The design team would need to identify suitable locations for outdoor units with attention to service access and noise considerations. The project timeline could accommodate this change if implemented early in the design phase.
Priority: Medium

2. Integrate all HVAC components into a unified building automation system

Rationale: The project includes multiple system types (AHUs, VAV boxes, split systems) that would benefit from centralized control. A unified BMS would optimize overall system performance and provide better data for operations. For an educational facility with varying usage patterns, centralized scheduling capabilities are particularly valuable. A modern BMS can provide data analytics for continuous commissioning and system optimization, reducing long-term operational costs. Integration would also facilitate compliance with California's Title 24 energy monitoring requirements.
Estimated Impact: Improved energy efficiency through coordinated control, enhanced troubleshooting capabilities, and better management of indoor environmental conditions. Studies indicate potential 5-15% operational energy savings through integrated control strategies. Centralized facility management would reduce staff time requirements and potentially allow remote monitoring and control. Better data collection would support ongoing commissioning and verification of system performance.
Implementation: Specify compatible controls for all equipment and include BACnet or similar protocol for integration. Include front-end software for monitoring and control. Coordination with the IT department would be necessary to establish network infrastructure requirements. The specification should include comprehensive commissioning of the integrated system. Include training for facilities staff on system operation and optimization. Consider cloud-based options for enhanced remote capabilities and reduced on-site infrastructure requirements.
Priority: High

3. Add energy recovery to the air handling units

Rationale: For a facility like the Center for Human Performance & Kinesiology, ventilation requirements are likely significant due to high occupancy in classrooms and athletic spaces. Energy recovery devices could capture waste energy from exhaust air and reduce overall HVAC energy consumption. In California's climate, both sensible and latent recovery can provide substantial benefits throughout the year. Modern energy recovery technologies can achieve effectiveness rates of 70-80%, substantially reducing the energy required for conditioning outside air. This approach aligns with California's aggressive energy efficiency goals.
Estimated Impact: Potential 10-20% reduction in heating and cooling energy for the ventilation load, improving overall building efficiency. Payback analysis indicates typical ROI within 2-4 years depending on utility rates and usage patterns. Reduced peak loads may

also allow for smaller central plant equipment. Carbon emissions reduction of approximately 15-25 tons CO_2e annually based on typical California electrical grid emissions factors.
Implementation: Work with Energy Labs to incorporate energy recovery wheels or plates into the custom AHU designs. May require some additional space allocation for the equipment. Perform detailed analysis to select the optimal energy recovery technology based on the specific application. Include bypass options for economizer operation when outdoor conditions are favorable. Specify appropriate filtration to protect energy recovery media from contamination. Coordinate with the controls contractor to ensure proper sequencing with other system components.
Priority: Medium-High

4. Evaluate acoustic treatment for areas with multiple terminal units

Rationale: Educational facilities require good acoustic conditions for effective learning. The extensive use of VAV and CAV terminal units could create noise issues if not properly addressed. ANSI/ASA S12.60 establishes background noise criteria for learning spaces that might be difficult to meet without specific acoustic treatments. Athletic spaces have unique acoustic challenges due to high ceilings and hard surfaces. The combination of multiple mechanical noise sources (terminal units, diffusers, etc.) can create cumulative noise levels that exceed recommended thresholds.
Estimated Impact: Improved learning environment, reduced complaints, better speech intelligibility in classrooms and meeting spaces. Studies indicate that reducing background noise levels by 5-10 dBA can improve speech comprehension by 10-15% in educational settings. Enhanced acoustic environment supports better concentration and learning outcomes. Potential contribution to achieving LEED or WELL certification acoustic requirements.
Implementation: Add sound attenuators downstream of terminal units, specify low-noise diffusers, and ensure proper equipment selection for noise-sensitive areas. Conduct room-by-room acoustic analysis to identify spaces requiring special attention. Consider lined ductwork in critical areas rather than just terminal unit discharge attenuators. Coordinate with the architectural team on room acoustic treatments that can complement HVAC noise reduction measures. Specify maximum NC (Noise Criteria) levels for different space types and require field testing during commissioning.
Priority: Medium-High

5. Consider demand-controlled ventilation for high-occupancy spaces

Rationale: Spaces with variable occupancy like gymnasiums, classrooms, and assembly areas can benefit from CO_2-based ventilation control to match fresh air delivery with actual occupancy. Educational facilities typically have widely varying occupancy patterns throughout the day. DCV can significantly reduce energy consumption during periods of partial occupancy while ensuring adequate ventilation during peak usage. ASHRAE Standard 62.1 specifically allows for DCV as a means of ventilation control. California's Title 24 energy code encourages DCV for certain space types and occupancy patterns.
Estimated Impact: Reduced energy consumption while maintaining or improving indoor air quality. Typical savings of 5-15% on ventilation-related energy costs. Lower peak heating and cooling loads due to reduced outside air during partial occupancy periods. Improved air quality awareness through monitoring and control capabilities. Potential contribution to meeting California energy code requirements.

Implementation: Add CO2 sensors in key spaces, ensure VAV terminal units serving these areas are properly configured for demand control, and program the BMS accordingly. Develop detailed control sequences that balance energy savings with IAQ requirements. Specify sensor locations carefully to ensure representative sampling. Include regular calibration requirements in the maintenance protocols. Provide operator training on DCV principles and troubleshooting. Consider adding occupancy sensors to complement CO2 monitoring for rapid response to changing conditions.
Priority: Medium-High

6. Implement enhanced filtration and IAQ monitoring for athletic spaces

Rationale: Athletic facilities have unique indoor air quality challenges due to increased occupant respiration, perspiration, and potential for elevated particulate levels. Enhanced filtration (MERV 13+) and dedicated IAQ monitoring can improve the learning and training environment. In a post-pandemic context, improved ventilation and filtration have become increasingly important for building occupants. For a kinesiology center where respiratory health is particularly relevant to activities, superior IAQ offers both health and performance benefits.
Estimated Impact: Improved indoor environmental quality leading to potential health benefits, reduced absenteeism, and better athletic/academic performance. Studies indicate that enhanced IAQ can contribute to 3-8% improvements in cognitive performance. Potential reduction in respiratory issues and increased occupant satisfaction. May contribute to pursuing WELL Building certification or similar wellness-focused recognition.
Implementation: Upgrade filtration systems on AHUs and terminal units to higher MERV ratings. Add dedicated IAQ sensors for CO2, VOCs, and particulates in key spaces. Integrate monitoring into the BMS with dashboard displays for occupant awareness. Consider UV-C or bipolar ionization for additional air treatment. Develop maintenance protocols for filter replacement to maintain system performance.
Priority: Medium-High

7. Consider thermal displacement ventilation for high-ceiling spaces

Rationale: Kinesiology facilities typically include gymnasiums, training rooms, and other high-ceiling spaces that can benefit from thermal displacement ventilation (TDV). TDV systems deliver air at low velocity near the floor, allowing it to rise naturally through the space as it warms, creating a stratified environment with excellent ventilation effectiveness. This approach improves both energy efficiency and thermal comfort in these challenging spaces. TDV is particularly effective in spaces with high ceilings and significant heat loads from occupants.
Estimated Impact: Improved ventilation effectiveness (potential 20-30% increase), enhanced thermal comfort, reduced energy consumption (typically 10-20% compared to overhead mixing systems), and improved acoustics due to lower fan energy. TDV systems can provide better air quality in the occupied zone while reducing overall ventilation requirements. The system would be particularly beneficial in gymnasiums and similar spaces with high ceilings and variable occupancy.
Implementation: Evaluate specific spaces like gymnasiums for TDV application. Design would require low-level supply diffusers and high-level return/exhaust. Careful coordination with architectural elements is essential. Air handling equipment would need to be selected for lower supply air temperatures than conventional systems. Provide training for facilities staff on the principles and maintenance of displacement ventilation systems.

Priority: Medium

8. Implement advanced commissioning and measurement \{}& verification

Rationale: Complex HVAC systems like those in this project benefit significantly from enhanced commissioning processes. Advanced commissioning goes beyond standard testing to include detailed functional testing, monitoring-based approaches, and ongoing performance verification. For an educational institution, this provides long-term value through optimized system performance. Documented baseline performance enables ongoing verification that systems continue to operate as designed throughout the building lifecycle.
Estimated Impact: Studies indicate that advanced commissioning typically yields 5-10% additional energy savings compared to standard commissioning. Improved system documentation and verification of performance leads to better facility operation over time. Reduced operational issues and system failures result in longer equipment life and lower maintenance costs. Establish a performance baseline for future energy conservation measures.
Implementation: Specify enhanced commissioning in accordance with LEED v4 or similar standard. Include monitoring-based commissioning with ongoing data collection and analysis. Develop detailed functional testing procedures specific to the unique systems in the facility. Create comprehensive system manuals and training for facilities staff beyond standard O and M materials. Include seasonal testing to verify performance across various conditions.
Priority: High

Conclusion

Key Findings

- The project employs a mixed-system approach with central AHUs and multiple split systems, requiring careful coordination for optimal performance.
- Extensive use of VAV terminal units provides good zone-level control capabilities but requires proper commissioning and acoustic treatment.
- Standard equipment selections are suitable for the application, but opportunities exist for enhanced efficiency through VRF technology and energy recovery.
- Control integration will be critical for optimal system performance, with a unified BMS offering substantial operational benefits.
- Alternative manufacturers could provide comparable performance with potential advantages in specific areas.
- The athletic facility requires special attention to ventilation effectiveness, indoor air quality, and acoustic performance.
- California energy code compliance requires careful attention to system efficiency and control strategies.
- Comprehensive commissioning will be essential to ensure systems perform as designed.

Highest Priority Actions

- Integrate all HVAC components into a unified building automation system for coordinated control, monitoring, and optimization.
- Implement advanced commissioning and measurement & verification to ensure systems perform as designed and maintain efficiency over time.
- Evaluate VRF alternatives for the split system locations to improve efficiency, zoning capabilities, and control flexibility.
- Incorporate energy recovery into the air handling units to reduce ventilation energy consumption.
- Address acoustic considerations for terminal units, particularly in learning environments and athletic spaces.
- Implement demand-controlled ventilation in variable occupancy spaces to balance energy efficiency with indoor air quality.
- Consider enhanced filtration and IAQ monitoring specific to the needs of athletic and educational spaces.
- Establish a comprehensive maintenance program with regular verification of system performance.

Summary

The HVAC system design for the Norco College Center for Human Performance & Kinesiology utilizes a combination of central air handling units with VAV distribution and distributed split systems. The equipment specification includes quality manufacturers with appropriate commercial-grade equipment for an educational/athletic facility. The design demonstrates attention to zoning and control requirements specific to this building type.

Several opportunities exist to enhance the design through system integration, energy efficiency improvements, and careful attention to acoustics and controls. By implementing the recommended improvements, the project could achieve significant energy savings, improved occupant comfort, and reduced operational costs over the building lifecycle.

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