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CITY OF KILLEEN FIRE STATION NO. 9 HVAC UPGRADE – BASIS OF DESIGN

Code Analysis

Code of Ordinances of City of Killeen, Supplement 34 Update 2 updated on June 28, 2024
2021 International Building Code with City of Killeen Amendments
2021 International Energy Code with City of Killeen Amendments
2021 International Fire Code with City of Killeen Amendments
2020 National Electrical Codes with City of Killeen Amendments
2021 International Mechanical Code with City of Killeen Amendments
2021 International Plumbing Code with City of Killeen Amendments

Project Description

City of Killeen has requested engineering services for a study and design of modifications of the HVAC system at Fire Station No. 9. The intent of the study and design will be to improve the ventilation and air quality of the Fire Station to meet City of Killeen codes and standards. On the site visit to capture existing conditions, the customer noted humidity issues inside the building and negative building pressure.

Two design solutions will be considered; the first will be adding a dedicated outside air unit (DOAS) to pretreat the outside air and provide outside air to maintain correct building pressurization. The second design option will be a new Variable Refrigerant Volume (VRV) system with a DOAS unit to replace the existing systems in place.

Design Conditions

Outdoor air design conditions for DOAS Killeen, TX 80.8 DB / 76.5 WB
Indoor design conditions 72 DB Summer / 68 DB Winter

Duct Standards

See attached Brandt duct standards, noted by system type

Piping Standards

See attached Brandt piping standards, noted by anticipated system type (Mechanical and Plumbing systems)

Existing Mechanical System

Killeen Fire Station No. 9 is 11,977 square feet. A 4,918 square Apparatus Bay in the middle of the building is heated only and open to ambient with large louvers and a vehicle exhaust system. This area is double height and is not a part of this HVAC design. There is a support area zone on the south side of this bay that is mostly conditioned and another larger area on the north side, also mostly conditioned space that supports the personnel's living space on the north end of the building. On top of this larger area there is a second-floor mezzanine that houses some of the mechanical equipment and an IDF closet.

The original design included twenty-three Daikin Variable Refrigerant Volume FX Model indoor units in combination with one Daikin Condensing Unit Model REYQ264TYDN. The installation diverged from the basis of design manufacturer to LG however appears to closely match the basis of design equipment. The indoor units are 32 tons nominal in total with 368MBH cooling and 415MBH heating. The outside air is

delivered directly to the VRV indoor units by two supply air fans. The outside air is unconditioned. The outside condensing unit is 22 tons nominal with a scheduled cooling capacity of 265 MBH and heating capacity of 222MBH. The outside air is delivered thru two supply fans (SF-1 and SF-2) totaling 875 CFM. The exhaust fans seem to run continuously, although provided with a switch in most cases, totaling 1,630 CFM plus 600 CFM for the kitchen hood/exhaust fan.

Existing Electrical Service

The existing electrical service to the facility is supplied at 208Y/120 V, 3-phase, 4-wire, 60 Hz. from a 112.5 kVA padmount mount utility transformer. The service lateral is routed from the transformer, underground, to the main service disconnect switch located on the exterior of the building. Emergency backup power is supplied from a 175 kW / 219 kVA, 208/120 V 3-phase, 4-wire standby diesel generator. Both power feeders are (2) parallel sets of 350 kcmil copper conductors rated ampacity of 620 amperes (A) terminating on the automatic transfer switch (ATS) normal-utility and emergency-generator source terminals.

Existing Electrical Distribution

The ATS located on the 2nd Floor Electrical Room adjacent to the Main Distribution Panel (MDP). The ATS load terminals source the MDP equipped with 600 A main lugs. Short circuit and overcurrent protection are incorporated into the main service fused disconnect switch and generator output circuit breaker. The MDP is a General Electric (GE) Spectra Series Panelboard with adequate bus spacing to add three (3) power circuit breakers.

Load Analysis

Cavallo Energy Texas confirmed a peak demand of 33 kW occurred twice during the months of August 2023 and January 2024. The calculated peak current is 101.8 A at 0.90 power factor (estimated) at 208/120 V, 3-phase. The electrical system is rated to operate at 350 A continuous load at 0.90 power factor. The system has sufficient capacity to satisfy the proposed electrical demand.

Option A – Pretreated Outside Air / Building Pressurization

A DOAS shall be provided on the roof for this area. This unit is sized at 2,695 CFM at 18 tons. The DOAS unit is sized to keep the building at a slightly positive pressure of 5% while providing make-up air for the building exhaust systems.

This unit shall be curb-mounted on the roof of the second-floor area. The existing supply fans SF-1 and SF-2 will be demolished. Minor duct repairs and replacements are required as marked up on supporting Option A drawings. This new DOAS unit will supply outside air to all existing VRVs and provide additional make up for the kitchen area. Condensate will be conveyed to the nearest code-approved location.

A MERV 8 pre-filter shall be provided within the AHU.

It is recommended that a structural engineer review the new DOAS equipment weight and location to confirm existing structure is adequate to support.

<u>Unit Tag: DOAS-1 Electric Data</u>

Daikin Packaged Rooftop System Model:	DPSC18B
Voltage/Phases/Frequency	208 V, 3-Phase, 60 Hz.
Full Load Current (FLA):	98.8 A
Minimum circuit Ampacity (MCA):	123.5 A
Maximum Overcurrent Prot. (MOCP)	150.0 A

Short Circuit Current Rating: 10 kAIC

A new branch circuit rated for 130 amperes, 208 volts, 3-phase sourced from main distribution panel (MDP) protected by a new circuit breaker 150 A trip setting, short circuit rating 65 kA at 208-240 VAC will be installed. A disconnecting means shall be provided near or within the refrigeration unit. A 20-ampere rated GFCI weatherproof service receptacle shall me located at the make-up air unit.

Option B - Full VRV Replacement Including Pretreated Outside Air / Building Pressurization

A DOAS shall be provided on the roof for this area. This unit is sized at 2,695 CFM at 18 tons. The DOAS unit is sized to keep the building at a slightly positive pressure of 5% while providing make-up air for the building exhaust systems.

This unit shall be curb-mounted on the roof of the second-floor area. The existing supply fans SF-1 and SF-2 will be demolished. Condensate will be conveyed to the nearest code-approved location. A MERV 8 pre-filter shall be provided within the AHU.

The existing CU-1 will be replaced as shown on prints and schedule with a new air-cooled heat recovery condensing unit, 30 nominal tons.

The existing VRV system will be replaced and re-piped as shown on Option B prints and schedule. The existing facility is not currently experiencing issues related to zoning therefore the zones and type of unit are being replaced like for like. The HVAC loads validated the zone capacities with some minor modifications as indicated.

It is recommended that a structural engineer review the new equipment weights and locations to confirm existing structure is adequate to support.

The electrical scope described for DOAS-1 in Option A shall be duplicated for Option B. The two (2) feeder circuits from Panel LM supplying the existing condensing units will be replaced by a new single source 120 ampere, 208 Volt, 3-phase circuit to CU-1 from MDP. A new circuit breaker with adjustable trip setting and new 200 A disconnect switch will also be installed to accommodate the increased circuit capacity.

The existing VRV, multi-split type air conditioning system, units are rated 208 volt, 1-phase, 15 ampere MOCP. Twenty-three branch circuits source from Panelboard LM shall be reused based on MCA ratings. In the event additional VRV units are required, new branch circuit breakers may be installed Panel LM.