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| HVAC Assessment Report |
| Medical Office Buildings - Meridian Park Hospital |
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**Introduction**

**Project team**

Total Mechanical Inc. (TMI)

Neudorfer Engineers, Inc. (NEI)

MFIA Consulting Engineers, Inc.

Trane, Oregon

**Scope**

The two-existing gas packaged roof top units sized 90T and 60T were installed in the medical office buildings at the Meridian Park Hospital site in 1992 and 1993, respectively. Due to the advanced age of these units, the client has requested replacement of these units as a proactive maintenance measure.

The objective of this report is to validate the RTU selections made by TMI and Trane, and ensure the systems are sized appropriately for the buildings’ square footages and their intended use. Our assessment will be based on “rule of thumb” engineering practices, size of the building, the original design specifications, and current operating performance. The current operating performance was measured by N.E.I., and is reported in the T.A.B report, attached.

**Summary**

For a VAV system serving a medical office building, we expect the performance of the following systems to be in the neighborhoods of:

1. Supply fan: 1 CFM / sqft
2. Cooling System: 400 sqft / ton
3. Heating: 15 BTUH / sqft

**East Building: 3 story, 38,000 sqft Medical Office Building**

Existing system, RTU-M1:

This medical office building is conditioned by 90T Trane VAV Intellipak RTU. This unit consists of (2)30HP supply fans sized for 34,000 CFM, a 20 HP power exhaust fan, 2 compressors , and a 1000 MBH input gas heat exchanger.

The original supply fans with inlet guide vanes have been retrofitted to operate with ABB VFD’s. In addition to the RTU, an independent roof exhaust fan (EF-M1) ventilates the building’s restrooms and janitors closets, and removes large amount of air from the ceiling return air plenums.

The capacity of this unit is consistent with what we would expect for this building:

1. Supply fan: 34,000 CFM, 0.9 CFM / sqft
2. Nominal Cooling Capacity: 90T, 422 sqft / ton
3. Heating: 21 BTUH / sqft

As-built/NEI TAB report:

The TAB report prepared by NEI shows the cooling supply airflow at a significantly less airflow of approximately 25,000 CFM, while the motors were only drawing about half the Full Load Amps. This was not what we would expect as we anticipated the system to be delivering in the 34,000 CFM range, and closer to the fan’s full capacity. 25,000 CFM is not only low with respect to the building size, but also for the size of the unit. Supply fans are typically sized at 300-400 CFM/ton. This system is operating at 278 CFM/sqft, which is not ideal in full cooling mode as the DX coil may potentially become subject to frosting or freezing. We investigated further by studying the 1992 As-built design documents, and found that the sum of all Fan Powered VAV box cooling airflows to be roughly 25,000 CFM. The duct mains and branches were also sized for this airflow. It appears that the Fan Powered VAV boxes and subsequently the supply ductwork were undersized for the spaces they serve, and clearly undersized for the installed supply fans.

The exhaust fan is operating at 24,000 CFM, which is reasonable for the supply airflow measured. A like-for-like replacement of the exhaust fan is appropriate for this unit.

To compensate for the low supply airflow, we suspect the discharge air temp had to be set low to satisfy the building cooling demand. Since we are not aware of any complaints of temperature control from the building occupants, AND the tonnage is appropriate for this building, we believe that the existing roof top unit is sufficiently sized to meet the cooling demand of the building.

Summary/New RTU-M1:

As described above, a 90 ton roof top unit is an appropriate size for this building. As for the supply fans, while the system will still continue to operate at 25,000 CFM, the new fans will be sized for 34,000 CFM to match existing fan capacity. The proposed system is a like-for-like replacement of the existing unit with an improved cooling efficiency. It is a 90T gas pack roof top unit, with (2)30 HP supply fans and 100%, 20-HP power exhaust fan, 1,000 MBH input gas heat, with cooling efficiency of 10.5 EER. We recommend upgrading the heating section with a stainless steel heat exchanger with modulating burner. This upgrade would allow the building to use gas heat during occupied mode, and unload the usage of electric heaters downstream. The current unit utilizes gas heat for morning warm-ups only.

This unit selection should be sufficient to continue to serve the building as currently configured. However, due to the improved overall efficiency of the unit, there is some extra amperage left in the existing feeders to increase the size of the supply and exhaust fan motors. The increased fan motor sizes will be good for future expansion or change in use of space. If the future expansion does not come into fruition, the larger motor sizes will not be penalized because the fans will only use as much HP as needed by use of the VFD’s. To take advantage of larger motor, duct mains will have to be increased. Equipment schedules for the proposed, alternate and existing units are provided below.

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| **NEW RTU-M1 - East Building** |  |  |   |
|  | **Proposed RTU-M1** | **Alternate RTU-M1** | **Existing RTU-M1** |
| **Supply Fan** |  |  |  |
| Supply Airflow | 34,000 CFM |  | 34,000 CFM |
| Supply/Return static pressure (" w.c.) | 2.25"/1.5" |  |   |
| Total S.P. (" w.c.) | 5.773" |  |   |
| Supply Fan HP/bhp | (2)30 HP/44.29 bhp | (2)40 HP | (2)30 HP |
| Supply Fan speed | 1360 RPM |  |   |
| **Exhaust Fan** |  |  |   |
| Exhaust airflow | 34,000 CFM |  |   |
| Exhaust fan HP/bhp | 20 HP/17.97 bhp | 25 HP | 20 HP |
| Exhaust fan speed | 695 rpm |  |   |
| **Cooling Capacity** |  |  |   |
| Total Capacity (Gross) | 1130.6 MBH |  | 1141 MBH |
| Sensible Capacity (Gross) | 1000.4 MBH |  | 860 MBH |
| EAT (db/wb Degree, F) | 80/67 |  | 80/67 |
| LAT (db/wb Degree ,F) | 53.9/52.6 |  |   |
| Ambient Temp (degree, F) | 95 |  | 95 |
| Cooling Efficiency | 10.5 EER | 10.5 EER |   |
| Compressors (qty) | 4 |  | 2 |
| **Gas Heat Exchanger** |  |  |   |
| Heating Capacity (input/output) | 1,000 MBH/800 MBH  | 1,000 MBH/800 MBH  | 1000 MBH/800 MBH |
| Heating Efficiency  | 80% | 80% | 80% |
| Turn Down | 4:01 | 4:01 |   |
| **Electrical** |  |  |   |
| POWER | 460/3 | 460/3 | 460/3 |
| MCA | 273.4 A | 304.3 A | 301 A |
| MOCP | 300 A | 350 A | 350 A |
|   |   |   |   |
| Weight | 15,741 lbs. | 15,741 lbs. | 15,000 lbs. |
| **Equipment Mfr/Model** | **Trane SFHLF 90** | **Trane SFHLF 90** | **Trane SFHEC90** |

**West Building: 3 story, 23,000 sqft Medical Office Building**

Existing System, RTU-M2:

This medical office building is conditioned by 60T Trane VAV Intellipak RTU. This unit consists of a 40 HP supply fans sized for 21,000 CFM, a 15 HP power exhaust fan, a filter section, economizers, compressor and DX Coil, and a 500 MBH input gas heat exchanger. The original supply fans with inlet guide vanes have been retrofitted to operate with ABB VFD’s. In addition to the RTU, an independent roof exhaust fan (EF-M2) ventilates the restrooms and janitors closets, and removes large amount of air from the ceiling return air plenums.

The capacity of this unit is consistent with what we would expect for this building:

1. Supply fan: 21,000 CFM, 0.91 CFM/sqft
2. Nominal Cooling Capacity: 60T, 383 sqft/ton
3. Heating: 17.4 BTUH/sqft

As-built/NEI TAB report:

The TAB report prepared by NEI shows the system operating at approximately 19,000 CFM (0.83 CFM/sqft), at roughly 90% of design. This finding is consistent with the original design and equipment specification, and also falls within a reasonable and expected operating range for this building and the unit cooling capacity.

The exhaust fan is operating at approximately 19,000 CFM, which is in line with the measured supply airflow. A like-for-like replacement of the exhaust fan is appropriate for this unit

Summary/New RTU-M2:

The existing supply fans and cooling capacity are appropriate for this East Building, as they are consistent with the current operating performance and standard engineering practices. The proposed system for this building is also a like-for-like replacement of the existing unit with improved cooling efficiency. It is a 60T gas pack roof top unit, with a 40 HP supply fans and 100%, 15-HP power exhaust fan, 500 MBH input gas heat, with cooling efficiency of 10.4 EER. We also recommend upgrading the heating section with a stainless steel heat exchanger with modulating burner for this unit.

 This unit selection should be sufficient for the building as currently configured, but the supply fan and exhaust fan motors for this unit may also be increased without increasing the existing feeders. Equipment schedules for the proposed, alternate with increased motor sizes, and existing units are provided below.

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| **NEW RTU-M2 -West Building** |  |  |   |
|  | **Proposed RTU-M2** | **Alternate RTU-M2** | **Existing RTU-M1** |
| **Supply Fan** |  |  |   |
| Supply Airflow | 21,000 CFM |  |   |
| Supply/Return static pressure (" w.c.) | 1.5"/1.25" |  |   |
| Total S.P. (" w.c.) | 4.19" |  |   |
| Supply Fan HP/bhp | 40 HP/31.35 bhp | 50 HP | 40 HP |
| Supply Fan speed | 967 RPM |  |   |
| **Exhaust Fan** |  |  |   |
| Exhaust airflow | 21,000 CFM |  |   |
| Exhaust fan HP/bhp | 15 HP/9.75 bhp | 20 HP | 15 HP |
| Exhaust fan speed | 680 rpm |  |   |
| **Cooling Capacity** |  |  |   |
| Total Capacity (Gross) | 721.5 MBH | 721.5 MBH | 698 MBH |
| Sensible Capacity (Gross) | 625.6 MBH | 625.6 MBH | 493 MBH |
| EAT (db/wb Degree, F) | 80/67 | 80/67 | 80/97 |
| LAT (db/wb Degree ,F) | 53.5/52.4 | 53.5/52.4 |   |
| Ambient Temp (degree, F) | 95 | 95 | 95 |
|  Efficiency | 10.4 EER | 10.4 EER |   |
| Compressors (qty) | 3 | 3 | 4 |
| **Gas Heat Exchanger** |  |  |   |
| Heating Capacity (input/output) | 500 MBH/400 MBH  | 500 MBH/400 MBH  | 500 MBH/400 MBH |
| Heating Efficiency  | 80% | 80% | 80% |
| Turn Down | 4:1, Modulating | 4:1, Modulating |   |
| **Electrical** |  |  |   |
| POWER | 460/3 | 460/3 | 460/3 |
| MCA | 178.4 A | 199.7A | 206 A |
| MOCP | 225 A | 250A | 300 A |
|   |   |   |   |
| Weight | 11,684 lbs. | 11, 684 lbs. | 10,400 lbs. |
| **Equipment Mfr/Model** | **Trane SFHLF 60** | **Trane SFHLF 60** | **Trane SFHEC90** |

Please feel free to contact me with any questions.

Thank you,

Takako Baker, P.E.

MFIA, Inc.

**Attachments:**

Legacy Meridian Park MOB1 Survey, Neudorfer Engineers, Inc.

Data Summary Meridian Park Survey, Neudorfer Engineer, Inc.

Proposed RTU-M1 Selection

Alternate RTU-M1 Selection

Proposed RTU-M2 Selection

Alternate RTU-M2 Selection

Existing RTU-M1 and M2 Performance Data