Breadth 2 Mechanical Analysis: Mechanical Connections at ICRA Partitions

A. Executive Summary

The mechanical analysis performed in this section focuses on identifying mechanical connections that can be used at Infection Control Risk Assessment partitions and help eliminate rework. While mechanical equipment will be looked at the main purpose of this analysis is to reduce cost and schedule by avoiding rework.

In the first section the mechanical connection requirements for ICRA partitions will be researched in order to develop specifications used to develop a list of standard connection types. The requirements in this section are based on ICRA guidelines.

Using the information from the previous section a list of standard connection types will be generated based on the type of partition requirements. Such as fire and smoke rated connections to go with partitions that require fire or smoke ratings.

The cost and schedule impact of the rework required if the correct connection is not used in the beginning of the project are discussed in this section. An example cost and schedule analysis is completed in order to illustrate the impact of building new partitions in order to replace the connections.

B. Overview

The mechanical breadth section of this report focuses on the mechanical connections that are made at the Infection Control Risk Assessment (ICRA) partitions for the Lancaster General Hospital 5th and 6th floor Fit-Out project. This analysis has been completed with the hopes of reducing costs and minimizing schedule impacts that occur when rework is required to move or build new ICRA partitions in order to install mechanical connections. In order to complete this analysis the following steps will be taken:

1. Identify the requirements for mechanical connections at ICRA partitions.
2. Identify some standard sized connection types that satisfy these requirements.
3. Evaluate how this could impact construction costs and schedule.
4. Conclusions

C. Mechanical Connection Requirements

Based on the Infection Control Risk Assessment Guidelines the 5th and 6th floor fit-out project at Lancaster General Hospital is Type D High Risk because it involves new construction in a facility that deals with immunocompromised patients. These ratings dictate class V required infection control precautions being utilized. Class V requires the following precautions be taken during construction project:

i. Construct gypsum board/metal stud dust partition, extend and seal to ceiling.
ii. Isolate HVAC system within work areas to prevent contamination of duct system.
iii. Seal doors opening to adjacent areas with duct tape.
iv. Block off and seal HVAC registers, grills and any openings in ductwork to remain.
v. Maintain negative pressure within work site utilizing HEPA equipped air filtration units.
vi. Place dust mat at entrance and exit of work area.
vii. Cover construction waste before transport in covered containers.
viii. All work associated with a major project that has an approved ICRA authorization form will be assessed on an individual basis.

Upon completion of the project the following steps must be taken:

i. Cover construction waste before transport in covered containers.
ii. Do not remove barriers from work area until a Health System responsible person inspects completed project.
iii. Remove barrier materials carefully to minimize spread of dirt and debris associated with construction.
iv. Wet mop and vacuum with HEPA filtered vacuum before leaving work area.
v. Remove isolation of HVAC system in areas where work was being performed.

vi. Housekeeping to wipe work surfaces with disinfectant.

The most important items for mechanical systems are isolating the construction site from the occupied space by closing off the ducts and all ductwork openings in the space. Since the space above the drop ceiling were all of the ductwork and piping is located must be sealed to the deck above there is limited access to make connections once sealed. This is the focus of the analysis in this section; making sure that the proper connections are put in place avoiding rework. Using the proper connection such as a smoke or fire damper with an access panel will allow for the sealing of duct space without having to remove the damper and therefore the ICRA partition.

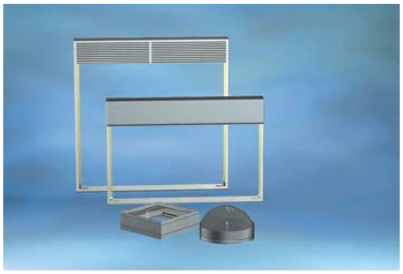
The requirements for mechanical connections are dictated by the wall that the partition is built in or between. For example if the partition is in a wall that has a 2 hour fire rating the ICRA partition must also have a 2 hour fire rating and therefore the duct must have a fire damper located at that position. For a similar example if the wall is a smoke barrier then a smoke damper is required.

D. Standard Connection Types

The basic types of connections used are fire dampers, smoke dampers, and combination smoke/fire dampers. There are also two functionally different HVAC systems; static and dynamic. Static HVAC systems are those required to shut down automatically during fire emergencies. Dynamic HVAC systems are those that continue to operate during the early phases of a fire emergency and, by doing so, provide smoke control functions. To go along with static HVAC systems there are dampers that are static rated and for dynamic HVAC systems there are dampers that are dynamic rated, as well as dampers that are made to work with either system.

Fire and smoke damper requirements are dictated by building codes along with Underwriters Laboratory (UL) Standard 555 Fire Dampers, and UL Standard 555S Smoke Dampers. Within the requirements are standards for temperature ratings, airflow velocity rating levels of 2000, 3000, 4000 fpm, and pressure rating levels of 4, 6, and 8 in. wg.

Examples of static and dynamic fire rated dampers are shown below.



Model FD: Static Rated

Model FDR: Round Static Rated

UL 555 rated models for use in HVAC systems that are automatically shut down in the event of a fire emergency. Available in three frame widths: standard, narrowline, and ultra thin, with optional sleeves and transitions.

Catalog: ***Dynamic and Static Rated Fire Dampers, Ceiling Radiation Dampers***

Model DFD: Dynamic Rated

Model DFDR: Round Dynamic Rated

UL 555 rated models tested to close under airflow, and rated for use in HVAC systems that are operational in the event of a fire emergency. Fire dampers can be mounted either vertically or horizontally with airflow in either direction.

Catalog: ***Dynamic and Static Rated Fire Dampers, Ceiling Radiation Dampers***

In order to gain access to the damper after duct installation is completed access panels can be installed adjacent to damper. This is recommended for inspection and testing purposes but in the case of dampers located at ICRA partitions it allows for the access to seal the duct during construction and removal of seal after construction is complete without having to remove any sections of ductwork.

Model HAD: *Hinged Style*
Model CAD: *Cam Style*
Model RAD: *Round Style*

E. Cost and Schedule Impact

The cost and schedule savings are difficult to calculate on a general basis as they will depend on the quantity and complexity of the ICRA partitions utilized. However, the cost and schedule savings will come from elimination of rework involved in moving and constructing new partitions in order to complete the connection of mechanical systems. On the 5th and 6th floor fit-out at Lancaster General Hospital even though the systems servicing the fit-out space are new systems they are located in an existing mechanical room located outside of the construction zone. This required the tying in of the pre-run piping and ductwork in the occupied space of the hospital to the newly fit-out space. Since the proper connections were not utilized from the start there were several instances in which rework was required.

The additional cost of rework includes the cost of several laborers and at least one carpenter plus any additional material costs. With the laborers costing on average $50 an hour and carpenters at an average of $70 an hour billable rate. An example of additional costs is shown below:

Additional Cost of Rework

Description	Hours	$/Hr.	Total
Laborer	4	$50	$200
Laborer	4	$50	$200
Carpenter	4	$70	$280
Total Labor	12	$170	$680
Misc. Material			$500
Total			$1,180

This is a simple example as actual costs will vary depending on complexity of partition, but it is easy to see that if a number of partitions are utilized on a project that the cost can quickly add up.

Similar to cost the schedule is also impacted in the same manner. As additional rework and partitions are needed the schedule will be impacted in addition to the workers required to perform rework being pulled from their other duties causing further delays.

If these additional costs and impacts to the schedule are not planned for in the beginning of the project they can potentially have a serious impact on the final outcome. However, even if planned for the term “work smarter not harder” comes into play that with a little thinking ahead this unnecessary work can be eliminated. Having to build additional ICRA partitions can also add to the risk of posing a health risk as they would need to be built outside of the existing partition.

F. Conclusions

From the analysis completed above it is easy to see how much of an impact neglecting the mechanical connection requirements for a project can have on the cost and schedule. Rework was required in several locations on the Lancaster General Hospital 5th and 6th Floor Infill project in order to make the mechanical connections above ceiling. This can very easily happen as it is required that the ICRA partitions be up before major construction activities commence. With some pre-planning, however, the mechanical connections required can be ordered before construction begins and be ready to put in place when the ceiling space is being sealed.