Winnipeg

Pan Am Pool
Mechanical and Electrical Systems Upgrade Definition Study
FINAL DRAFT REPORT
June, 2010

Prepared By

Adam Pawlikewich, P.Eng.
Electrical Engineer

Approved By

Rudy Derksen, P.Eng.
Senior Mechanical Engineer

KGS
GROUP
CONSULTING
ENGINEERS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The Pan-Am Pool was built in 1967 for the Pan-Am Games which were being held in Winnipeg that year. The pool along with its subsequent additions is a premier swimming and diving facility in Canada. However over the past 43 years, many of its mechanical and electrical systems have either reached the end of their useful life or require significant upgrading.

As a result the City of Winnipeg requested KGS Group to assess the various mechanical and electrical systems in the building, and determine to what degree each system should be replaced or upgraded. Once this was established, replacement or upgrade alternatives were evaluated to determine the most appropriate upgrade system that would reflect current technologies, current code requirements, and that would address operational issues that are currently a problem.

The overall objective of this report is to document the scope of work involved in upgrading all mechanical and electrical systems over the coming years, defining a budget for this work, and an implementation schedule that will permit work to be completed in a logical fashion, while not interfering with on-going facility programs.

The systems assessed as part of this study include the following.

Mechanical Systems

1. All Heating, Ventilation and Air Conditioning (HVAC) systems
2. Plumbing Systems
   a. Cold Water
   b. Hot Water
   c. Sewage drainage systems inside the building
   d. Roof drainage
3. Main pool water treatment and circulation systems
4. Main pool air bubbler system
5. Lap pool water treatment and circulation systems
6. Sprinkler systems

Electrical Systems

1. Power distribution systems.
2. Lighting systems.
3. Emergency and Exit Lighting Systems
4. Back-up Power Supply - Standby Generator and UPS Systems
5. Fire Alarm System
6. HVAC Controls
7. Public Address System
8. Low Voltage Lighting Controls
9. Drown- Alarm and Similar Systems

The following systems have been excluded from this study.

Mechanical Systems

1. Natural gas piping system.

Electrical Systems

1. Security System
2. Phone/Network Systems (Structured Cable)
3. Scoreboard

The following section provides a description of the overall Pan-Am Pool facility, including its more recent additions and an outline as to how report information is organized.

2.0 BACKGROUND

2.1 POOL DESCRIPTION

As noted the Pan-Am pool was built in 1966-67 as part of preparations for the 1967 Pan-Am Games. The original building lower level, where the change rooms and the pool itself are located, has a footprint of 50,000 ft^2 (4645 m^2). The main floor where the spectator seating is located includes north and south building overhangs for the building perimeter walkway or track area. This brings the footprint at this level to 59,000 ft^2 (5481 m^2). The building is 46.25 ft^2 (14 m) high from pool level to underside of the roof trusses.

The pool itself is 72' x 225' with a perimeter walkway space of 13 ft (4m). At the main pool west end are diving platforms of various heights.

The main pool mechanical room is located below the lower level just west of the main pool. It houses the building heating boilers, domestic and main pool water heaters, pool filtration systems, and main electrical systems.

In 1994, a lap pool was added at the west end of the main pool. It also includes a kiddie pool and a hot tub. The area of this building is 27,000 ft^2 (2,508 m^2).

In 1998-99 a multi-purpose building was added to the west end of the main pool building. This addition is referred to as the Hall of Fame. It occupies two levels with the lower level providing a small restaurant space, washrooms, and various multipurpose activity rooms. The upper area is a large open space currently used for lawn bowling.

The overall building layout on the main and lower levels is presented in Figures 1 and 2 that follow later in this report. Figures are located at the end of this report.

2.2 SYSTEM ASSESSMENT CRITERIA

When assessing each system to determine which should remain and which should be replaced, and what they should be replaced with, the following criteria were used to make these decisions. (Note not all criteria would apply to assessment of each subsystem).

1. Input from operations personnel was collected to determine the type of operational, maintenance and performance issues that are being experienced with each system or its components. This input was considered as an important part of the decision making process.

2. The intent is to recommend system upgrades that will provide improved access, safety and maintainability over existing systems, many of which have proven to be very difficult to access and therefore to maintain.

3. This facility rework study is a midlife assessment of mechanical and electrical systems that require replacement or significant rework in order for the system to survive without major capital upgrades until the facility itself reaches its projected end of life. For purposes of this study, the facility's life is assumed to be 80 years. Therefore if a system is projected to be able to function in an acceptable fashion until then (2047), then a replacement cost for that system has not been presented.

4. If current technology provides significant advantages over existing systems, and this factor together with the age of existing systems would warrant replacement, this would be seriously considered.

5. Chlorine will remain as part of the pool environment for the foreseeable future. This would be considered when selecting replacement systems or proposed system layouts.

6. Facility programs must be kept operational during the transition from old to new systems.

7. Energy efficiency would be considered when selecting replacement systems.

8. When evaluating system replacement alternatives, an important factor in selecting a preferred option would be the comparative life cycle costs for each alternative.

9. Given that the Pan-Am Pool is a premier swimming and diving facility that continues to host significant national and international events, an effort will be made to provide design concepts that will improve the ability of operations personnel to access and maintain the upgraded mechanical and electrical systems and therefore to more effectively achieve the operating environment and conditions that are appropriate for this type of facility.

2.3 ASSESSMENT OF EXISTING M & E SYSTEMS

Unless noted otherwise, the assessment of existing M & E systems involved:

- Numerous walk-throughs of the existing facility with City personnel;
- Meetings with City personnel to discuss the status of and concerns with each system.
- Review of existing reports and drawings provided by the City. The documents reviewed are listed in Appendix A.

2.4 REPORT OUTLINE

The information presenting our assessment of each M & E system is organized as follows. All mechanical systems are presented in Section 3.0 below. This is followed by electrical systems in Section 4.0.

Each M & E system is reviewed in 3 separate sections, one for the main pool building, one for the Lap Pool building, and one for the Hall of Fame building. This has been done to reflect the fact that the Lap Pool and Hall of Fame M & E systems are only 17 to 12 years old respectively instead of 43 years for the main pool systems. Therefore they may warrant a different approach.

However, a system may be discussed only once under the Main Pool section, if the Upgrade Plan proposed for that system suggests it is best addressed as one upgrade instead of three.

Each mechanical or electrical system has been reviewed and presented in its own separate section. The intent of this format is to include all discussion relating to one system in one place. This should permit the City to pull one section for either discussion or implementation. To achieve this each M & E system section will include the following subsections.

1. **Existing System Description** – General description of the existing system.

2. **Condition Assessment/Issues** – Results of condition assessment and issues raised.

3. **Recommendations** – Based on the condition assessment, this section lists recommendations as to whether the system should be replaced, and whether or not certain components for example should be retained.

4. **Upgrade Alternatives Considered** – Based on the recommendations made, this section will describe alternatives considered for moving forward. In many cases this may be a relatively straightforward process of replacing existing systems with similar new systems. However in some cases there may be more than one approach to be considered to ensure this opportunity of bringing new technologies, improved performance or best life cycle value to the Pan Am Pool facility is not missed. In addition efforts would be made to eliminate existing system operating problems identified by the City.

5. **Upgrade Plan** – This section will define the proposed way forward for this system.

6. **Cost Estimate** – A cost estimate of the Upgrade Plan will be presented in this section.

An overall cost estimate and proposed implementation schedule for the upgrade plans for all M&E systems will follow in sections 5.0 and 6.0 respectively.

2.5 ESTIMATE ASSUMPTIONS

As a cost estimate for the proposed upgrade of each mechanical and electrical system in the facility has been included with each M&E system section, it should be noted the following assumptions apply to these cost estimates.

1. A contingency allowance of 20% has been included with each individual project.

2. PST and GST taxes are included but shown as separate items for each project cost estimate.

3. Costs are presented in 2010 dollars. That is for work performed beyond this date, an allowance for inflation would have to be added.

4. Cost estimates include allowances for having work performed while maintaining operation of facility programs. The assumption has been made that all areas will be available for 8 hours of construction work during a night shift when work can be completed that cannot be performed while pool programs are underway.

5. Each cost estimate includes an allowance of 15% for detailed design engineering in a retrofit environment, and follow-up construction administration support services to the City's Project Manager.

6. An allowance of 3% for City divisional administration costs and 3% for City corporate finance and distribution costs have also been allowed for.

7. Structural costs related to supporting air handling units, access walkways, and wall and floor openings required to bring in large equipment have been allowed for.

8. Potential funding from Federal or Provincial programs that might be available to reduce the City's costs, have not been allowed for.

9. Asbestos removal costs have not been included.

3.0 MECHANICAL SYSTEMS

3.1 MAIN POOL

3.1.1 Boilers

Existing System Description

The main pool building has 3 – 200 boiler-horsepower natural gas fired hot water boilers installed in the basement mechanical room. The units are original equipment, but have had their tubes replaced over the years. Their seasonal efficiency is likely in the range of 70 to 75%.

The boilers are currently providing heat for the following systems:

1. The main pool building space heating system heating coils located in various Air Handling Units (AHUs) and ductwork throughout the building.
2. The building outside air heating coils located inside AHU's in the main pool area roof truss space.
3. Domestic hot water heating system for the entire facility.
4. Main pool water heating system.
5. Lap pool water heating system.
6. Main entrance vestibule heating system heat exchanger.
7. Two vestibule heating system heat exchangers.
8. Hall of Fame lower level and main floor space and ventilation air heating requirements via 2 AHU's and several wall fin radiant heaters.
9. Main level weight room ventilation air heating system.

According to the original system drawings, the boilers were intended to provide 200°F water to the various heating systems and receive 180°F water back. The boiler system is currently operated at a supply water temperature of 170°F. It seems the various heating systems connected to the boilers are able to meet their obligations under this lower water temperature. Operations personnel noted that at peak conditions, one and a half boilers can meet current connected heating load requirements. The third boiler is currently acting as backup should one boiler be out of service.

The boiler main chimney to the outside was replaced 6 or 7 years ago.

Condition Assessment/Issues

As noted the boilers have been retubed, and would likely be able to continue on for some time. However maintenance costs would continue to increase with parts becoming more difficult to obtain. It should also be noted that the VFA report indicates the boilers are antiquated and should be replaced before they fail entirely. In addition new technology can increase efficiency substantially, say from an annual average of 70% to 75% to 87% to 90%. This can translate into significant annual natural gas cost savings.

The existing boilers currently generate a lot of heat into the boiler room making it an uncomfortable work environment. New well insulated boilers would substantially reduce the heat dissipated into the boiler room.

The current boiler insulation has asbestos in it. Removing the boilers would address this issue as well.

Recommendations

The boilers should be replaced.

Upgrade Alternatives Considered

In considering alternatives for a new heat source for the existing boilers, electric boilers were not considered further as the size of electrical service required would be unacceptably large. Therefore natural gas fired boilers are recommended.

Currently high efficiency boilers that condense flue gas water vapour are available that can provide much higher operating efficiencies. They are not available in the large size units currently in place. However by adding multiple units, they can accommodate the various heating loads in the building and easily fit into the existing boiler room.

One such boiler receiving wide acceptance is the Aerco high efficiency boiler. Its efficiency is related to the return water temperature to the boiler. The lower the return temperature, the higher the boiler efficiency. The maximum input capacity available for each boiler is 3.0 MMBH.

Each boiler also has the ability to turndown its output 15:1. This significantly reduces boiler cycling losses, minimizes wear and improves temperature control.

As the Pan-Am boiler system runs at much less than full load for most of the year, this installation would certainly benefit from the fact this style of boiler increases its efficiency the lower the load on the boiler. Efficiencies under partial loads can increase well above 90%.

Advantages of smaller boilers and more of them, reduces the size of standby boiler capacity required. For example the current installation has 3 – 200 hp boilers with one unit just for standby. If there were say 9 units, the installed spare capacity could be reduced from 50% to 11%.

New boiler capacity should allow for all the heating requirements currently being served by the existing boilers. In addition they should be sized to take over the space and outside air heating load from the lap pool AHU's which are currently stand alone gas fired units.

Additional boiler capacity for domestic hot water heating has been included as this will permit significant reduction in the size of the existing hot water storage tanks. This approach will provide several benefits including freeing up significant mechanical room floor space.

Upgrade Plan

Develop a plan to remove the original 3 boilers in a staged program to ensure service is maintained. Replace these boilers with a series of smaller high efficiency condensing boilers similar to the Aerco units.

The boiler replacement project should include a heat exchanger to allow the new boilers, which should operate on glycol, to provide heat to new equipment, while one or more of the existing boilers also continue to provide heat to the existing piping system. This arrangement will prevent the treated water in the old system from getting in contact with the new boiler and related piping system. It will also simplify on-going transition options as upgrades to the existing heating piping and air handling units proceed.

Cost Estimate

This cost estimate assumes the boilers would be replaced as a separate project and not in conjunction with the piping and AHU replacement project. It allows for replacement of the existing 3 boilers on a staged basis with 9 new high efficiency boilers. The estimate also allows for supply and installation of new circulation pumps (2 at 100% capacity), and as noted above, a heat exchanger to interface with the existing hot water circulating loop. The circulating pumps will have variable speed drives. Efforts will be made to select pumps that can also be used for the new piping loop once it is installed.

Description	Replace Boilers
Mechanical	$1,232,000
Electrical	
Structural	25,000
Subtotal	**1,257,000**
PST - 7%	88,000
Subtotal	**1,345,000**
General Requirements - 12%	162,000
Fee - 3%	46,000
Subtotal	**1,553,000**
Contingency - 20%	311,000
Construction Subtotal	**1,864,000**
Detailed Engineering & Construction Admin Support - 15%	280,000
City Divisional Administration Fee - 3%	56,000
City Corporate Finance & Administration Fee - 3%	56,000
Subtotal	**2,256,000**
GST - 5%	113,000
Total Project Cost	**$2,369,000**

3.1.2 Main Air Handling Units

Existing System Description

Natural gas fired boilers deliver heat to various air handling units located in the roof truss space. These units are the primary method by which outside air is heated to provide space ventilation. These units are also used to provide space heating requirements. There are 4 main units that provide ventilation air and space heat for the main pool and surrounding track and front entrance area. They also provide air to the main floor washrooms and other spaces located under the spectator stands. They circulate 20,000 cfm each, and together are designed to bring in and heat up to 60,000 cfm of outside air. The rate of ventilation is currently based on trying to maintain the space humidity between 50 and 60%. It provides the main pool area with an air change rate (based on outside air only) of 2.5 air changes per hour (ACH). The overall ventilation rate with outside and return air combined is 3.3 ACH.

A 5th unit provides ventilation air for the lower level locker/shower and related support facility rooms. It was designed to bring in 13,000 cfm of either outside or recirculation air for space heating or for free cooling these areas as required. This system has reheat coils installed in various branch ducts to provide a level of zone temperature control.

A 6th unit provides 8,000 cfm of makeup air only for the basement boiler room. This air is used as a source of combustion air for the boilers and to provide boiler room ventilation.

Condition Assessment/Issues

All these units have exceeded their design life. They are corroded, and require significant attention to keep them operational. The related dampers and their operators are rusted and either not working well or not working at all.

Aside from their age and condition, the roof trusses and tight work spaces make access to and therefore maintenance of these units very difficult in generally hot/humid conditions. Also working on these units and their accessories above the spectator areas, contributes to safety concerns because existing work platforms are not without significant gaps where equipment, tools or equipment leakage can end up on the floor below.

Operations personnel noted that during warm outdoor summer conditions the temperatures and humidity levels inside the building are difficult to control. Humidity can rise to 80%. Conditions can get very warm and uncomfortable. During a major summer swim meet in 1997, the uncomfortable conditions in the pool area made local news headlines.

In winter the pool deck area can get uncomfortably cool. There were at one time infra-red electric heaters installed along the pool deck perimeter wall. They were removed for reasons of safety and the fact they were no longer reliable.

The existing control systems are primarily pneumatic based with a Johnson Controls Metasys monitoring portion. As the control system has reached the end of its useful life, and all related systems are being recommended for replacement, it is assumed that all existing controls will be demolished and replaced with new.

Recommendations

These air handling units should be replaced in the next few years as part of a refurbishment of the entire heating/ventilation system.

A review of the ventilation rates, and alternatives to lowering space temperature and humidity conditions during summer should be performed. In addition the location of these units should be reviewed so as to improve their accessibility and the related improvement in safety that would result.

The controls for the new system would be a complete new digitally addressable control system on an open network such as BACnet. The new controls would have an interface with Johnson Controls Metasys for remote operation and monitoring.

Upgrade Alternatives Considered

In reviewing the outdoor air ventilation rates for the main pool area, it was found that maximum ventilation required to meet *ASHRAE standard 62.1-Ventilation for Acceptable Indoor Air Quality* is 30,000 CFM. The amount of outdoor air required to maintain acceptable humidity levels, at an outdoor temperature of 50°F at 80% RH, is 40,000 CFM. (50°F is typically the starting point for mechanical cooling.) The amount of outside air required to maintain acceptable humidity levels decreases as the outdoor air temperature decreases and drops below 30,000 CFM at a winter design temperature of -28°F (-33°C). Therefore the design outdoor air flow rate for the main pool area can be reduced from the original building design rate of 60,000 CFM to 40,000 CFM.

To address the current shortcomings in terms of the ventilation system's ability to provide acceptable space temperature and humidity conditions in the main pool area during summer periods, some level of space cooling and therefore dehumidification is warranted for a facility like the Pan-Am Pool that hosts significant National and International events.

In trying to find a location for new air handling units that will significantly improve accessibility, the following alternatives were considered.

1. Locating these units on the roof.
2. Locating them at ground level outside in a new building under the track overhangs on the north and south main pool walls.
3. Mounting new units just below the roof trusses in the track and perimeter areas around the main pool area.

Locating these units on the roof would take this equipment and the related piping systems further from the boiler plant and maintenance personnel. An enclosure for these air handling units should be provided. Given the size of these systems, any new penthouse enclosures would be very large and therefore costly.

Locating the units outside at ground level has its advantages in terms of easier access. But again very large new enclosures to house this equipment would be required. They would take grade level space currently used for other purposes and be subject to vandalism. In addition, given the large air volumes they handle, it would be very difficult to reconnect their ductwork with existing building ductwork, or for that matter to provide a reasonable new ductwork layout. Space constraints make this option almost unworkable.

Installing the units inside the existing building below the existing roof trusses as shown in Figures 3 & 4 brings them out of the truss space. This substantially improves operation's access to the equipment, while also making use of existing heated space. The existing track and entrance area ceiling heights are such that air handling units and related ductwork can be accommodated in this area. However the ceiling heights in the track areas would have to be lowered. In any event, there is currently no ceiling in the track areas, as the existing tile ceilings were removed due to significant deterioration.

Man access to this area could be provided by extending the existing elevator located in the front lobby up to the new AHU equipment mezzanine (See Figure 3). Note when the elevator between the lower level and main floor was first installed, it was extended down to the basement level mechanical room to improve operations staff efficiency and safety. Once at the new mechanical mezzanine level, a mezzanine walkway level would be created to permit operations staff access to all the new equipment located at this level. This type of equipment mezzanine level can also create an opportunity to run easily accessible piping and cable trays in an area where installation of these items and later access for maintenance or modifications can be made with much less difficulty and therefore less cost. The floor would extend full width of the lobby/track and be provided with a waterproof liner to contain leaks or cleaning related water. Walkway areas where carts could be used to move materials would be provided with a steel or other durable surface.

Upgrade Plan

The 4 main air handling units should be replaced with new units that provide 40,000 cfm of outside air for ventilation and also humidity control during non-summer periods. For summer conditions, when bringing in more outside air will not drop space temperatures and humidity levels to an acceptable range, a level of mechanical cooling and also dehumidification should be provided for the main pool area.

Mechanical cooling would be sized to maintain indoor temperature and humidity of the pool areas at 78°F with 60% RH on summer design days (at an outdoor temperature of 86°F (30°C and humidity of 50%)). More information on HVAC system design criteria used in preparing this report are presented in Appendix A.

New air handling units for the main pool area and lower level should be mounted below the roof trusses in the pool perimeter track and lobby area. A layout of the proposed air handling units is presented in Figures 3 & 4. This layout would include 5 main units. Four units each sized to circulate 20,000 cfm would ventilate and heat the main pool and surrounding lobby area. A 5th unit (8,000 CFM) would provide make-up air for the boiler room. For purposes of this study, the assumption has been made that each AHU would bring in an equal amount of outside air and similarly also exhaust / relieve the same amount of air. This arrangement will provide an excellent opportunity for installing exhaust air heat recovery equipment. (During detailed design, the outside air brought in by each unit may change with some units bringing in more and others less.)

The existing main pool ventilation system has a 6th AHU (13,000 CFM) that provides ventilation and heat for the lower level locker room and other support services rooms. The intent is to replace this unit with 3 smaller units that would draw air from adjacent space and supply it into the locker rooms and other areas. Existing ductwork would be reused wherever possible. Two units would be located under the stands with a third unit (if required) located in the lower level to service the staff locker room and other rooms located at the west end of the pool.

Breaking this 6th unit into 3 will provide several advantages including the following.

1. Air drawn from low level in adjacent spaces to the lower level rooms to be ventilated, will bring more air in the main pool area down. Currently to much of the outside air brought into the main pool area does not reach the lower occupied areas where it is most needed.

2. Providing 3 separate smaller units will improve operation's ability to provide better space temperature control within each zone.

3. Equipment congestion at the new mezzanine level will be reduced.

Heating coils would be installed in the air handling units to heat outside air and provide space heat. The units would have return air dampers to permit the units to vary the amount of outside air being brought in and replacing it with return air as required to suit space requirements and energy conservation design criteria.

The overall concept proposed for the heating system is to use a central gas fired boiler system to meet space and ventilation air heating requirements and to distribute this heat to the air handling units using a glycol piping loop. Natural gas fired air handling units were considered. However this approach would have several disadvantages:

1. Gas-fired equipment would be located indoors at numerous locations throughout the facility with chimney's penetrating the roof. The efficiency of these units would be significantly less than the efficiency offered by the high efficiency boilers proposed.

2. Gas fired AHU's involve more equipment that will require more maintenance being distributed throughout the building. A key design intent is to reduce the amount of systems and their level of complexity. It is also the design intent to center as much of the mechanical systems in the main mechanical/boiler room as possible. This will assist in reducing overall long-term maintenance costs and the disruption that can occur to the public when repairs are required.

3. Fire rated mechanical rooms would be required for gas fired AHU's installed indoors.

For these reasons, gas fired AHU's were not considered further.

The intent would be to reconnect the new AHU's to the existing supply air ductwork where possible. The ductwork although 43 years old, is still performing well. It appears the existing ductwork by enlarge should be able to serve the facility for a very long time. Therefore unless determined otherwise during the detailed design phase, the intent is to reuse most existing ductwork. This includes the main duct runs for the main pool area AHU's. However, any ductwork requiring insulation will have its existing insulation removed and replaced with new insulation complete with a protective covering where appropriate.

Cost Estimate

Work related to replacement of the air handling units should be completed in conjunction with upgrades to the existing two pipe heating water piping system. Therefore costs for this work are presented in the next Section (3.1.3) on the heating piping system.

3.1.3 Space Heating Hot Water Piping System

Existing System Description

Existing boiler hot water distribution piping is a schedule 40 steel two pipe insulated loop that supplies the various AHU's and heat exchangers throughout the facility with hot water. It provides hot water to the two Hall of Fame AHU's but not the roof mounted Lap Pool AHU's, which are currently, stand alone gas-fired units.

Where outdoor air is being heated, there is hot water to glycol heat exchangers where the glycol is pumped via separate glycol loops to the outside air heating coils located inside the various AHU's.

Condition Assessment/Issues

Piping has aged significantly and reached the end of its useful life. There have been recorded incidents where piping has worn through.

Also with proposals for new AHU's mounted at new locations, and for the new Lap Pool AHU's to be tied into the hot water loop, a lot of the existing piping will have to be replaced regardless as the pipe routing and sizing will change.

The 2 hot water circulating pumps are original equipment. Parts are hard to find.

Recommendations

Based on the fact that the main pool AHU's need replacement, and that hot water piping and related valving has reached it's useful life, and as the system would need significant modification to accommodate new air handling units, the system should be replaced at the same time as the new AHU's are installed. This would include the circulation pumps.

Upgrade Alternatives Considered

The existing heating hot water system circulates water. As noted this system requires various glycol loops be used to prevent fresh air heating coil freezing. However even the mixed air heating coils have on occasion frozen. In an on-going effort to minimize the amount of mechanical systems required to serve the facility and thereby reduce long term maintenance costs, replacing both the hot water and the numerous glycol heating loops with one glycol loop was considered. Reasons include the following.

1. Concern for equipment freezing is eliminated.
2. The heat exchangers, pumps and controls involved in numerous glycol loops would be eliminated, thus significantly simplifying the overall heating piping and control system. Glycol loops for existing AHU's and for the vestibule heating systems would be eliminated.
3. A glycol heating system loop requires less attention to chemical treatment than a water system would.

Piping for the loop would be schedule 40 steel. It would be insulated and provided with a protective cover.

Upgrade Plan

Replace the existing hot water heating piping loop & its various related glycol loops with a single glycol heating loop. This work would be done at the same time as when the AHU's are replaced.

Cost Estimate

This cost estimate includes costs for both the AHU replacement work described in the previous section, as well as costs for the heating piping loop.

As noted, costs to replace the existing AHU's are included here. Included with this cost are the heating coils, related dampers, space for future installation of a heat recovery coil from a potential future energy recovery system.

Also included are cost allowances for an access elevator extension to the mezzanine level and mezzanine floor system to permit operations to access all equipment at this level. The floor system will have to be waterproof to minimize the impact of coil cleaning activities or system leaks.

The mezzanine level access floor and walkway system and structures to support the new equipment has also been included.

Costs for a central cooling system and the related cooling coils mounted inside the AHU's are included in a separate section.

Cost of demolishing the existing hot water piping system and installing a new glycol piping loop is presented in the following table. An allowance for equipment isolation valves, control valves, air vents and related accessories has also been included.

Description	Replace AHU's, Provide Access & New Piping System
Mechanical	1,838,000
Electrical	690,000
Structural	973,000
Subtotal	**3,501,000**
PST - 7%	246,000
Subtotal	**3,747,000**
General Requirements - 12%	450,000
Fee - 3%	126,000
Subtotal	**4,323,000**
Contingency - 20%	865,000
Construction Subtotal	**5,188,000**
Detailed Engineering & Construction Admin Support - 15%	779,000
City Divisional Administration Fee - 3%	156,000
City Corporate Finance & Administration Fee - 3%	156,000
Subtotal	**6,279,000**
GST - 5%	314,000
Total Project Cost	**$6,593,000**

3.1.4 Space Cooling – Entire Facility

Existing System Description

The main pool area currently has no mechanical cooling system. The Lap Pool area currently also has no mechanical cooling. In spring and fall, outside air can be used to provide some level of free cooling. However in summer when outside temperatures do not permit space cooling to achieve 78°F the main facility currently has no ability to cool or for that matter to dehumidify.

The main level weight room had a 20 ton split system installed in 2004. The Hall of Fame lower level AHU, located in the main mechanical room has a split system air conditioning system. In addition the Hall of Fame's 2 main floor AHU's located in the ceiling space, also have split system air conditioning systems. All 3 systems were installed in 1998/99 and have air cooled condensers mounted on the main pool roof.

There are approximately 14 small rooms where year round cooling is required. These rooms have window, floor mounted, or split system air conditioning systems installed.

Following is a complete listing of cooling systems not just in the main pool building, but in the Lap Pool and Hall of Fame building as well.

Type of Units and Area Served	Cooling Capacity (Tons)
Split Units:	
Timing Office	1.3
UPS Room (P.A. Room)	1.3
Lower Weight Room	1.5
Community Services Office	1.5
VIP Room	1.5
Portable Units:	
Nursery	1
Computer Room	1
IG3 Office	1
Sport Group (office in stands (x5))	1

Type of Units and Area Served	Cooling Capacity (Tons)
Window Units:	
Engineers Office	0.8
First Air Office	0.4
IG3 (lap pool)	0.4
Staff Kitchen (Guards)	0.5
Water Cooled Units:	
Candy's Office/IG3/AER Office (Water Cooled)	2.5
Total	**15.7**

Condition Assessment/Issues

The small window and split system air conditioners have a limited life. Their current age varies. As noted earlier these units are causing significant maintenance concerns and often when they are not working, staff and the public are placed in an uncomfortable situation.

The main level weight room air conditioning system is 6 years old and in good condition.

The Hall of Fame cooling systems are 11 years old and in good condition.

As discussed in the section on AHU's, the main and lap pool areas warrant additional summer cooling and dehumidification capacity during warm summer periods.

Recommendations

In order to reduce the overall amount of cooling equipment in the facility and thereby reduce overall long term maintenance costs, installation of a central chiller cooling system for the entire facility is recommended. The proposal to add significant cooling and dehumidification capacity for the main pool makes this approach viable. This central system would initially provide cooling/dehumidification for the main pool area AHU's (a new cooling load). Then as they fail or reach their end of useful life, the existing split cooling systems for the main floor weight room and the 3 Hall of Fame systems, could be replaced with chilled water coils. The central system would be designed to accommodate these existing loads when they are transferred to the central system.

Upgrade Alternatives Considered

The 4 main pool area AHU's that service public areas would have cooling coils installed to not only cool the air but provide summer dehumidification capacity as well. The 5th unit that serves the mechanical room would not be provided with mechanical cooling. The 3 new smaller lower level AHU's would have cooling coils installed.

Providing cooling using split cooling systems with evaporator cooling coils mounted inside the AHU's and compressor/condenser packages mounted on the roof instead of a central system was considered. However this approach has several disadvantages.

1. More mechanical equipment requiring ongoing maintenance is then located in hard to access places, such as on the roof. Not only is it harder to access but there is much more equipment to fail then there is with a central chiller system.
2. Central systems will provide the required cooling more efficiently that incremental refrigeration systems in each air handling unit.
3. If at some time a ground water or ground source heat pump system were to be installed, it would be much easier for this energy efficient system to connect to an existing chilled water system than to AHU's that each have their own refrigerant cooling system.

The long term intent of a central cooling system would be to replace all existing building cooling systems and connecting them to a central chilled water piping system. This would include the two Hall of Fame AHU's, and the main level weight room cooling unit. That is central chillers would be designed now to accommodate these loads once the existing equipment is due to be replaced.

Small existing window air conditioning units or split system air conditioning systems could be replaced with similar equipment once they reach end of life or they fail. This is what is currently happening. However as new cooling capacity is proposed for the main pool area, a central cooling system is warranted. If a central cooling system is going to be installed then it would be reasonable to replace the current window and split system air conditioning systems with a connection to the central cooling system instead. This would significantly reduce the amount of separate cooling equipment installed in the facility and therefore reduce long term operation and maintenance costs. In addition the condenser heat from the cooling system could become available for other uses such as pool or domestic water preheating.

Adding up the new cooling capacity proposed above and adding the capacity of the existing building cooling systems, then including a 15% allowance for potential future cooling loads, a total central cooling load of 400 tons was arrived at.

At first installing 2 – 200 ton chillers appeared reasonable. They would fit into the mechanical room if an opening was cut in the ceiling. This type of ceiling opening has been checked structurally and can be accommodated.

However on review of this proposal with the Department of Labour, it was noted that units of this size would trigger the need for continuous attendance of staff with Refrigeration Certification. This was seen as an onerous requirement. Therefore 4 - 100 ton chillers are proposed. These units would not require special operator classification requirements.

Upgrade Plan

1. Install 4-100 ton chillers in the main mechanical room.
2. Install a two pipe chilled water system that will deliver chilled water to the AHU's and small fan coil units proposed for the very small cooling loads in the building.
3. Provide cooling coils for each of the AHU's as shown on the cooling system schematic, Figure 7.
4. Install fan-coil units in the rooms currently served by small 1 to 3 ton window or split system air conditioning systems.
5. Provide a roof mounted fluid cooler complete with a glycol loop, circulating pump and heat exchanger that can transfer an estimated 40 tons of cooling to the chilled water loop when it is to cold outside for the chillers to run. There are numerous small rooms where using outside air for free cooling is not viable, yet cooling in winter is required.

Before proceeding with a central cooling system, a study should be performed to investigate the viability of incorporating a ground water or ground source heat exchange system into the proposed cooling system. If proven viable, this study would significantly change the chiller system design, and result in not only cooling system operating cost savings, but also reductions in the amount of natural gas used for heating. This study could also consider using waste heat from the nearby hockey arena in the Pan-Am pool. The estimated cost to thoroughly assess this issue, including the drilling of test wells would be in the range of $80,000 to $100,000.

Cost Estimate

The cost estimate for the central cooling system proposed includes the items listed in the implementation plan section above. The cost to assess groundwater or ground source heat recovery alternatives has not been included in this capital cost estimate.

An allowance for replacement cost of the main level weight room and the 3 Hall of Fame cooling systems has been included here as well.

Description	**Space Cooling Entire Facility**
Mechanical	1,113,000
Electrical	80,000
Structural	25,000
Subtotal	**1,218,000**
PST - 7%	86,000
Subtotal	**1,304,000**
General Requirements - 12%	157,000
Fee - 3%	44,000
Subtotal	**1,505,000**
Contingency - 20%	301,000
Construction Subtotal	**1,806,000**
Detailed Engineering & Construction Admin Support - 15%	271,000
City Divisional Administration Fee - 3%	55,000
City Corporate Finance & Administration Fee - 3%	55,000
Subtotal	**2,187,000**
GST - 5%	110,000
Total Project Cost	**$2,297,000**

3.1.5 Exhaust Fans

Existing System Description

There are various exhaust fans in the building each with their own purpose. Following is a listing of the exhaust fans, their purpose and nominal capacity, based on existing drawings.

1. Lower level - men's locker room/shower area – 4,000 cfm.
2. Lower level - women's locker washroom/shower area – 4,000 cfm.
3. Main level washroom and boiler room exhaust – 8,000 cfm.
4. Four – main pool area exhaust fans – 20,000 cfm each.
5. Chlorine Exhaust fan – 300 cfm.
6. Transformer room exhaust fan – 600 cfm.
7. Hall of Fame Lower Level washroom exhaust fan – 1,400 cfm.

The two lower level shower room exhaust fans are located under the spectator stands, one on the north side and one on the south side. They discharge up through the roof via vertical duct chases at the east end of the main pool building.

The combined main level washroom, lower level locker room, and boiler room exhaust fan is located in the main pool front lobby at the roof truss level. It discharges through the roof there. Note it is currently against the code to combine washroom exhaust with exhaust from other areas.

The 4 main pool area exhaust fans (20,000 CFM each) are primarily intended to exhaust fresh air brought into the main pool area by the AHU's for ventilation and humidity control. They are located at the center of the main pool area in the truss space above. They draw air from this location and discharge directly up through the roof. One of these 4 exhaust fans has a glycol heat recovery system installed.

Condition Assessment/Issues

All fans are existing original equipment. They can provide continued service, however they along with related accessories such as pneumatically operated dampers will require more maintenance. The exhaust fans should all be replaced due to their age. The four main exhaust fans located above the main pool area are very difficult to reach and should be relocated to a more accessible location, particularly if a more comprehensive glycol run-around loop or other heat recovery system was to be added.

Recommendations

1. Replace all exhaust fans. Retain most ductwork.
2. Split washroom/shower room/locker room type exhaust from all other exhaust points.
3. Incorporate an exhaust air heat recovery system for as much of the building exhaust air as is reasonably possible.
4. Move the main pool exhaust system to a more suitable location.

Upgrade Alternatives Considered

Although this study does not allow for detailed assessment of heat recovery alternatives, it would appear that recovering heat from the significant volumes of exhaust air being continuously vented from the building should be considered as part of this study. The primary reason for considering this option at this stage is that any exhaust air heat recovery system could significantly affect the configuration, location and arrangement of exhaust fans and possibly the AHU's as well.

As noted earlier, the new main pool exhaust fans should be located in a more accessible area. Given the proposed layout of the new AHU's there is no space available along the north wall mechanical mezzanine to locate new main pool exhaust fans here. Locating them at the south side mezzanine level would require extension of the mezzanine. In addition the size of the related ductwork, and say glycol heat recovery coils would be such that the system would be very difficult to fit into a south side mezzanine extension.

An alternative would be to locate the exhaust fan system on the roof, say directly above their current location at the center of the pool. At this location the exhaust system and glycol heat recovery loop would require significant space and would require a large penthouse to house the system. At this location the exhaust penthouse would be difficult to access. In addition the size of the roof penthouse structure and related snow loads created may make this location structurally unfeasible.

Another alternative would be to incorporate the main building exhaust /relief system into the AHU's that bring outside air into the building. This arrangement would essentially replace the need for a large central exhaust system and related glycol run-around heat recovery loop. Instead exhaust fans along with heat pipe heat recovery systems could be mounted inside the AHU's. This arrangement would eliminate the complexities of a glycol run around loop and replace it with fixed heat pipe heat recovery coils that have no pumps, pipe loop or glycol system. The heat pipes would likely require addition of bypass dampers to permit the AHU's to perform satisfactorily through the full range of operating conditions that occur during 4 season operation (free cooling, etc.).

AHU layout drawings incorporating the heat pipes are attached in Appendix B. The unit height width and length required are reflected in the AHU layout shown previously in Figure 3 and 4.

Note the return air to the AHU's would enter the side of the unit with the mezzanine area acting somewhat as a return air plenum.

At this stage 3 of the 4 main pool AHU's and the 2 lap pool AHU's would have heat pipes and exhaust fans incorporated. This means that during winter when the heat pipes are working to recover heat from the exhaust air stream, only three of the 6 main AHU's would be introducing outside air into the building with the other 3 units working as 100% return air recirculation units, while providing their share of the required space cooling or heating. This would be the most cost effective way to recover heat from the exhaust air stream. Installing heat pipes into all 6 units would cost more.

Washroom/locker/shower room type exhaust cannot be combined with exhaust from other areas, specifically the main pool area. Yet heat recovery from this estimated 12,000 CFM of air would save significant energy. Currently 3 exhaust fans exhaust the main level and lower level washroom areas. Replacing these three fans with one exhaust fan located inside MP-1 AHU was considered. This would permit heat recovery to be performed cost efficiently on this exhaust air stream. Make-up air from MP-1 would be vented into the main pool area instead of directly into the locker/shower room areas. In this way this make-up air would serve two purposes. First it would assist in dehumidifying and conditioning the main lap pool area. Once mixed with the general pool air, it would be drawn down by the 3 new transfers AHU's, located at the main floor and lower level, and then would ventilate the lower level washroom/locker areas.

Upgrade Plan

1. Incorporate main/lap pool exhaust/relief into the AHU's.
2. Combine washroom exhaust systems and duct into one of the 4 main pool AHU's.
3. Incorporate heat pipe heat recovery systems into the AHU's to recover heat from the main exhaust/relief air systems.

Cost Estimate

Costs for this exhaust system upgrade, including the heat pipe heat recovery system has been included with the AHU replacement project described in Section 3.1.2, because the exhaust fans and heat recovery are integral to the AHU configuration.

3.1.6 Main Level Weight Room HVAC System

Existing System Description

The weight room had its own heating, ventilation and air conditioning system which was added in 2004. It includes a split system air conditioning system, as well as fresh air and free cooling ductwork.

Condition Assessment/Issues

The system is new and would not need attention for some time.

Recommendations

None.

Upgrade Alternatives Considered

However if the central cooling system proposed is implemented, it may be appropriate to replace the existing air handling unit split system refrigerant cooling system and related truss space mounted condenser system with a chilled water cooling coil from the central chilled water system. This would reduce the amount of mechanical equipment in the building, simplify and reduce overall maintenance costs, and make mechanical systems more accessible by removing equipment from the roof.

In addition heat rejected by this space to the chilled water loop could be recovered for use to meet domestic hot water, pool or space heating requirements occurring at the same time, if the central chiller system incorporates this capability.

Upgrade Plan

No action proposed.

Cost Estimate

There are no costs associated with this equipment. Costs related to tying a new central cooling system to the existing air handling unit are included in Section 3.1.4.

3.1.7 Vestibule Heating System

Existing System Description

Vestibules in the main and lap pool areas, 4 in total, were icing up in winter making them very difficult to use. In 2006 new heating systems were provided for each vestibule. Boiler hot water was run through plate and frame heat exchangers to a glycol loop. The glycol was then run to fan-coil units in the vestibules. One heat exchanger is located in the main mechanical room and the other in the Lap Pool mechanical room.

Condition Assessment/Issues

The systems are relatively new and are performing well.

Recommendations

No changes to these systems are proposed.

Upgrade Alternatives Considered

However, if the central hot water heating system is replaced by a central glycol loop as proposed, the need for the vestibule heat exchangers and related pumping systems could be eliminated. The boiler glycol loop could supply glycol directly to the vestibule fan-coil units, thus significantly reducing the amount of equipment and the number of subsystems in the building.

Upgrade Plan

If the central hot water heating piping system is replaced with a new glycol loop, then eliminate the vestibule heat exchangers, and the related circulating pumps and controls. Care would be required to ensure the main glycol heating system and controls would address the specific flow and pressure drop requirements of the existing vestibule heating systems.

Cost Estimate

Costs for renovating the vestibule heating systems to incorporate them into a new central glycol piping system, are included in a previous section (2.1.3) on replacing the existing hot water heating piping system and are not listed separately here.

3.1.8 Main Pool Heating System

Existing System Description

The main pool is maintained at 82°F. It receives its heat from the central boiler plant. Heat is transferred to the pool water via a heat exchanger. A pool water circulating pump (and a standby pump) circulate pool water through the heat exchanger.

Condition Assessment/Issues

The heat exchanger is original and therefore has exceeded its' normal life span. The pool operations personnel indicate that it is unable to bring pool temperature up to normal operating temperature quickly after special events (where the pool temperature is lowered by a few degrees for the event). The main pool circulating pumps are in very good condition. The circulating pumps were replaced in 1997.

Recommendations

Replace existing heat exchanger with a new and larger plate and frame heat exchanger. The capacity of the new heat exchanger should be able to bring pool temperatures up a specified amount and within a time frame defined by the City.

Cost Estimate

Cost to replace the main pool heating heat exchanger and increase its heating capability is included in Section 3.1.3, Space Heating Water Piping system. It would be most efficient to replace this heat exchanger at the same time as the related hot water piping is being upgrade.

3.1.9 Domestic Cold Water Piping and Fixtures

Existing System Description

Original domestic cold water (DCW) piping was galvanized steel. Over time it has been replaced with copper piping, with significant sections upgraded in 2005.

The water line into the building is 4" in size. It is original and is located in the main mechanical room. Piping material at this point is galvanized steel with sections of stainless and carbon steel piping. Some of these piping sections may have been added as part of repairs or renovations to sections of the piping around the water meter. The piping is generally insulated.

Washroom fixtures including sinks and toilets are generally original equipment. Urinals were all replaced several years ago with waterless units.

Condition Assessment/Issues

In general the DCW piping system is in good condition. No real performance or leak issues were raised by operations staff. Most of the piping has been recently replaced and is not original. The current piping should not require replacement.

4" piping from the building outside wall through to the water meter is steel or galvanized steel and should be replaced. The water supply into the building does not have a backflow preventer. This will be required as part of any upgrade program.

The waterless urinals are causing operations a lot of problems, including the following;

1. They require significant time and material cost to replace the special consumable seal liquids that must be poured into each urinal on a regular basis.
2. It has been difficult to control the odour coming from the urinals.
3. A calcium buildup inside the urinal occurs over time. This has required significant attention and cleaning by outside contractors.

Replacement of these units with touchless low flush urinals should be considered.

Given constantly improving health standards, replacing existing sink faucets with touchless faucets should be considered. Toilets should be replaced with low flow units with electronic operators as there are those in the public who do not flush, thus contributing to a range of operational problems including odour and plugging.

Recommendations

See Upgrade Plan below.

Upgrade Alternatives Considered

See Upgrade Plan below.

Upgrade Plan

Main Water Supply Upgrade in Mechanical Room (Project 3.1.9-1)

1. Replace the section of water line into the building from the building wall to where the piping reduces in size and changes to copper.
2. Install a backflow preventer on the main water line into the building.

Plumbing Fixture Upgrade Project (Project 3.1.9-2)

1. Replace existing sinks with touchless faucets and new sinks (21 of).
2. Replace existing waterless urinals with new low flush touchless units in both the main pool and Hall of Fame lower level washroom (15 of).
3. Replace toilets with low flush touchless units (25 of).

Cost Estimate

Items listed in the Upgrade plan are included in the cost estimate.

Description	Replace Inlet Water Line
Mechanical	40,000
Electrical	
Structural	
Subtotal	**40,000**
PST - 7%	2,800
Subtotal	**43,000**
General Requirements - 12%	5,200
Fee - 3%	1,500
Subtotal	**50,000**
Contingency - 20%	10,000
Construction Subtotal	**60,000**
Detailed Engineering & Construction Admin Support - 15%	9,000
City Divisional Administration Fee - 3%	2,000
City Corporate Finance & Administration Fee - 3%	2,000
Subtotal	**73,000**
GST - 5%	4,000
Total Project Cost	**$77,000**

Description	Plumbing Fixture Upgrade Project
Mechanical	119,000
Electrical	23,000
Structural	15,000
Subtotal	**157,000**
PST - 7%	11,000
Subtotal	**168,000**
General Requirements - 12%	21,000
Fee - 3%	6,000
Subtotal	**195,000**
Contingency - 20%	39,000
Construction Subtotal	**234,000**
Detailed Engineering & Construction Admin Support - 15%	36,000
City Divisional Administration Fee - 3%	8,000
City Corporate Finance & Administration Fee - 3%	8,000
Subtotal	**286,000**
GST - 5%	15,000
Total Project Cost	**$301,000**

3.1.10 Domestic Hot Water System

Existing System Description

Domestic hot water is provided mainly to the men's and women's showers, and various sinks throughout the building. Domestic water is heated via a heat exchanger which uses central boiler hot water. The heat exchanger is located in the main mechanical room. Also in the main mechanical room are two large steel hot water storage tanks. The water is currently stored at 140°F and is heated by the boiler hot water system which is currently supplied to the heat exchanger at 170°F.

The building has a hot water recirculation system which runs in parallel with the domestic hot water piping.

The main men's and women's showers appear to be original equipment. There are 4 showers mounted per post with 30 showers in total in each room. The staff change rooms and family area change rooms also have showers.

Condition Assessment/Issues

The two large domestic hot water tanks located in the main mechanical room were relined 6 or 7 years ago. They are original equipment and are due for replacement.

The copper hot water piping and recirculation system piping system is in good condition. No concerns regarding leakage or other operational issues related to the piping were raised. Therefore it is anticipated that no upgrade work to the piping itself would be required.

Indications are that the number of showers are adequate for public requirements. However the men's and women's showers themselves are old and causing significant operating problems, and should be replaced.

The hot water showers are provided with 115F water via a water mixing system and related on-off controls located in the space under the spectator stands. These controls have been custom developed and are working well. They do not need replacement.

Recommendations

Replace the existing hot water tanks, heat exchanger and main men's and women's showers.

Upgrade Alternatives Considered

Much smaller hot water tanks should be considered to reduce the time that hot water is stored on-site without being used. In addition this change would free up significant space in the mechanical room that would be useful in accommodating a new chiller system. To compensate for smaller hot water tanks, a larger capacity heat exchanger and boiler capacity would have to be provided to ensure sufficient hot water is available to meet peak demand requirements.

Upgrade Plan

1. Replace the existing domestic hot water storage tanks and related heat exchanger system. Confirm the size of tanks required and the temperature at which water must be stored given the supply water temperature to the showers is 115F. Lower hot water storage temperatures will save energy. Heat exchangers will have to be double wall type.

2. Replace current men's and women's shower room showers with new units. This may involve a new room and floor layout as well.

Cost Estimate

Costs for the items listed in the Upgrade Plan are included in this cost estimate. Costs related to additional boiler capacity required to heat hot water more quickly as small storage tanks are proposed are included in the boiler replacement work item discussed earlier (Section 3.1.1).

Description	Domestic Hot Water System
Mechanical	117,000
Electrical	28,000
Structural	
Subtotal	**145,000**
PST - 7%	11,000
Subtotal	**156,000**
General Requirements - 12%	19,000
Fee - 3%	6,000
Subtotal	**181,000**
Contingency - 20%	37,000
Construction Subtotal	**218,000**
Detailed Engineering & Construction Admin Support - 15%	33,000
City Divisional Administration Fee - 3%	7,000
City Corporate Finance & Administration Fee - 3%	7,000
Subtotal	**265,000**
GST - 5%	14,000
Total Project Cost	**$279,000**

3.1.11 Wastewater Piping Systems

Existing System Description

Wastewater piping is original equipment. It is generally bell and spigot cast iron piping.

Condition Assessment/Issues

Piping has performed well for the last 43 years with no real complaints from operations as to leakage or other operating problems.

However the main mechanical room sump pump discharge pipe has twice caused equipment damage due to leakage. This appears to be a local problem that can be addressed by rework of this system, or relocation of the adjacent electrical equipment.

Recommendations

Keep the existing drainage piping system in operation until significant signs of the system not being able to perform are noted.

Upgrade Alternatives Considered

Not applicable.

Upgrade Plan

No upgrades are proposed.

Cost Estimate

No expenditures are proposed.

3.1.12 Rainwater Piping System

Existing System Description

Rainwater piping is original and is mostly constructed of asbestos cement pipe. It drains from the roof down into one main connection at a main sewer line connection, down in the main mechanical room.

Condition Assessment/Issues

There have been significant leakage and repairs required to this piping system, particularly on the north wall piping.

Recommendations

This piping has reached the end of its useful life and should be replaced.

Upgrade Alternatives Considered

Different pipe materials for replacement of the existing piping were considered including cast iron and PVC. PVC piping will provide a long term durable and reliable system at a lower cost than cast iron piping.

Upgrade Plan

Replace existing rainwater piping and roof drains with a PVC piping system.

Cost Estimate

The cost estimate presented includes the cost to replace the entire rain water piping system.

Description	Rainwater Piping System
Mechanical	115,000
Electrical	
Structural	
Subtotal	**115,000**
PST - 7%	9,000
Subtotal	**124,000**
General Requirements - 12%	15,000
Fee - 3%	5,000
Subtotal	**144,000**
Contingency - 20%	29,000
Construction Subtotal	**173,000**
Detailed Engineering & Construction Admin Support - 15%	26,000
City Divisional Administration Fee - 3%	6,000
City Corporate Finance & Administration Fee - 3%	6,000
Subtotal	**211,000**
GST - 5%	11,000
Total Project Cost	**$222,000**

3.1.13 Sprinkler System

Existing System Description

The sprinkler system for the entire facility including the main pool and lap pool and Hall of Fame was installed in 2002. The Hall of Fame sprinkler system was installed in 1999.

Condition Assessment/Issues

The sprinkler system in all 3 parts of the facility is in excellent condition and should require no further attention, other than on-going maintenance work that might be related to revised room layouts that result in piping requirements. The contractor currently maintaining the sprinkler system can best comment on minor upgrades required.

Recommendations

No action required.

3.1.14 Pool Systems

Existing System Description

The pool water filtration and treatment system is located mainly in the main mechanical room. It consists of water filters, sodium hypochlorite disinfection and CO_2 pH control treatment systems. There are two large circulating pumps that circulate water through the pool and heat exchanger for pool heating. Piping is generally schedule 40 PVC. Some of the circulation piping is under the main pool floor and essentially inaccessible. Piping and equipment is generally original equipment. The circulating pumps were replaced in 1997 when the filter capacity was also increased.

Condition Assessment/Issues

The PVC piping system is in good condition. No operating concerns with this system were raised.

For the main filter station it was noted that some PVC valves had recently been replaced.

An operational concern was the lack of access to the filters for cleaning. The lap pool has a much better access platform to permit routine filter cleaning required to be performed more safely and easily. An improved platform for access should be provided.

Recommendations

Provide a new filter access platform

Upgrade Alternatives Considered

NA

Upgrade Plan

Provide an improved filter access platform for filter maintenance. It is anticipated the filter system as a whole will last until the facility reaches its end of life.

Cost Estimate

The cost estimate includes the cost of a new filter access platform similar to the one provided for the lap pool.

3.1.15 Compressed Air System

Existing System Description

There are air operated heating system controls throughout the building. They are provided with compressed air by a control air compressor and receiver tank. The tank is 10 years old and the air dryer is less than 10 years old.

There is a second compressed air system that supplies compressed air into the main pool diving area to improve water line visibility for divers. This system also has the ability to produce 100 psi air. Therefore it has been used to provide backup compressed air for the control system compressed air system. The air compressors are 15 years old and are serviced by Air Unlimited.

Condition Assessment/Issues

The control air system is small and is currently performing well.

Recommendations

Work to eliminate the control air compressed air system.

Upgrade Alternatives Considered

As it has been recommended that HVAC system control valves using compressed air be replaced and as electronic controls are recommended instead of compressed air, the amount of compressed air required will continue to decrease significantly. For the few remaining pool system controls running on compressed air, replacing these valve actuators with electronic units should be considered. This would eliminate the need for control system compressed air altogether.

A side effect of this change is that the diving area compressed air system would no longer have to act as backup to the control system compressed air system.

Upgrade Plan

When existing pneumatic controls are eliminated, remove the control air compressed air system.

Cost Estimate

Costs to delete pneumatic HVAC controls and replace 2 pool water treatment system pneumatic valve actuators are included in the piping system replacement work item (Section 3.1.3).

3.2 LAP POOL

The lap pool was added to the Pan-Am pool in 1994 as an initiative by Swim Manitoba.

3.2.1 Lap Pool Heating/Ventilation System

Existing System Description

The lap pool outside air ventilation and space heating requirements are currently met by two gas-fired rooftop AHU's. Outside air brought in by these two units is also exhausted through these units by exhaust fans located inside.

The lap pool ventilation system distributes air along three sides of the pool. The fourth side up against the main pool did not originally have ventilation air provided there. Subsequently air was taken from one of the main pool air handling units and ducted down to provide air along the lap pool west side.

The lap pool currently has no space cooling or dehumidification equipment required to achieve acceptable space conditions during warm summer days.

Condition Assessment/Issues

The 2 roof mounted AHU's are 16 years old and have caused significant operating problems over the years. Their location on the roof also makes maintenance more difficult than necessary. These 2 units are reaching their end of life and should be replaced soon. Existing ductwork is in good condition and does not need attention.

The AHU's are roof mounted. Over the years there have been a range of operational problems related to the equipment being on the roof. Dampers have frozen and snow has entered the air intake systems.

Although the space conditions in the lap pool area are better than in the main pool area, the lap pool does not have summer cooling or dehumidification capabilities. This is a shortcoming that should be addressed.

Recommendations

Replace the existing 2 AHU's.

Upgrade Alternatives Considered

Since the units are gas-fired, their heat exchangers and related controls require on-going maintenance. If these units are tied into the central boiler heating system, these heat exchangers and related controls can be eliminated and replaced with much simpler glycol coils and flow control valves to regulate flow to the coils as required. The central system would be more energy efficient than the current gas-fired AHU's.

Rather than mounting the new AHU's on the roof, installing them inside the main pool building on the proposed new mezzanine level, would be preferred. This significantly improves access for maintenance and reduces operational issues related to roof mounted equipment (See Figure 3).

Ductwork would be run from the unit's new location through the main pool east wall/windows onto the roof where the new roof mounted ductwork would connect to existing ductwork connections at the lap pool roof level.

Upgrade Plan

Install two new AHU's inside the main pool area. The units should have glycol coils fed from the main boiler plant heating loop.

If a central cooling plant is installed, the 2 lap pool AHU units should have chilled water coils installed to provide some level of cooling and dehumidification for summer conditions.

Cost Estimate

The cost estimate for this item includes the supply and installation of 2 new AHU's and the related ductwork required to connect them to existing ductwork.

Description	Lap Pool - Replace 2 Main Air Handling Units
Mechanical	338,000
Electrical	16,000
Structural	40,000
Subtotal	**394,000**
PST - 7%	28,000
Subtotal	**422,000**
General Requirements - 12%	51,000
Fee - 3%	15,000
Subtotal	**488,000**
Contingency - 20%	98,000
Construction Subtotal	**586,000**
Detailed Engineering & Construction Admin Support - 15%	88,000
City Divisional Administration Fee - 3%	18,000
City Corporate Finance & Administration Fee - 3%	18,000
Subtotal	**710,000**
GST - 5%	36,000
Total Project Cost	**$746,000**

Costs related to installing cooling coils inside the new AHU's has not been included here. It is included in the central cooling system project for the overall facility (section 3.1.4).

3.2.2 Vestibule Heating System

Existing System Description

The two vestibule heating systems in the lap pool area are addressed in the Main Pool section on vestibule heaters as all vestibule heating systems were installed at the same time and can best be addressed in one section.

3.2.3 Lap Pool Space Cooling System

Existing System Description

The lap pool area is provided with outside air cooling (free cooling during the spring and fall seasons). There is no mechanical space cooling or dehumidification currently provided. The need for space cooling and dehumidification for this area is addressed in the section on cooling for the main pool as this issue is best addressed as one issue for both the main pool and lap pool areas.

3.2.4 Lap and Kiddie Pool Water Heating System

Existing System Description

Originally the lap pool was heated by two gas fired hot water boilers. These boilers were removed in 2003-04 and replaced by a hot water piping loop connected to the main pool boilers. A small plate and frame heat exchanger transfers heat from the central boiler hot water loop to the lap pool water. The lap pool has two water circulating pumps (one as standby).

There is a separate kiddie pool which has its own water filter and heating system because this system must be drained and disinfected on a much more frequent basis. Also water temperatures are maintained at a somewhat higher temperature of 86F.

Condition Assessment/Issues

System is 16 years old and in good condition. No operational concerns were noted.

Recommendations

No changes to the existing arrangement are proposed.

3.2.5 Domestic Cold Water Piping and Plumbing Fixtures

Existing System Description

A 100 mm (4") cold water line supplies water to the lap pool area for pool fill, deck washdown and other such uses. This line is connected to the main pool's water supply service located in the basement mechanical room. There are very few plumbing fixtures as these are included in the main pool building.

Condition Assessment/Issues

The relatively small amount of domestic cold water piping is 16 years old and in very good condition.

Recommendations

No capital works are recommended.

3.2.6 Domestic Hot Water System

Existing System Description

There is no domestic hot water piping in the lap pool area.

3.2.7 Wastewater Piping Systems

Existing System Description

Pool deck drainage piping is PVC and original.

The lap pool mechanical room sump pumps are new this year.

Condition Assessment/Issues

Drainage piping is in excellent condition and no upgrades are anticipated.

The lap pool deck drains are linear and are located right up against the pool itself. Therefore when the deck is routinely cleaned, the related cleaning chemicals and dirty water end up to some degree in the pool and not just in the drain. The main pool on the other hand has drains set back from the pool which prevents this from happening.

Recommendations

No capital works are recommended.

3.2.8 Rainwater Piping System

Existing System Description

Rainwater piping material is PVC. It is original piping.

Condition Assessment/Issues

No concerns with this system were noted. This system should require no upgrades.

3.2.9 Sprinkler System

Existing System Description

The sprinkler system description and assessment is covered in the main pool section as the sprinkler system for the entire facility was installed in 2004. Therefore no further description has been included here.

3.2.10 Pool Systems

Existing System Description

The pool water filtration and treatment system is located in the lap pool lower level mechanical room with pool filters and related chlorine and CO2 treatment systems located on the main floor. The system is original 1994 equipment and very similar to the one used for the main pool. There are two large circulating pumps that circulate water through the pool and heat exchanger for pool heating. One pump is original equipment and the second was installed as a standby about 5 years ago. Piping is generally schedule 40 PVC.

There is a parallel kiddie pool water treatment system with pressure vessel tank type filters. Piping is also PVC. This system is also original equipment.

Condition Assessment/Issues

The system is in very good condition and should require no significant capital expenditures.

Recommendations

Given the system piping is PVC, and that the main pool filters have performed well for over 40 years, there is good reason to believe the lap pool circulation and treatment systems should perform well for a long time with only maintenance type attention required.

3.3 HALL OF FAME BUILDING

The Hall of Fame addition, both the lower level and the upper level were built in 1998-99. The lower level includes space for reception services, washrooms, cafeteria and various space for exercise and other program activities. The upper level is more of a single space open area which is currently used for lawn bowling. The future use for the space remains uncertain although various options are being considered.

3.3.1 Hall of Fame Heating/Cooling AHU's

Existing System Description

The Hall of Fame represents an addition to the west end of the main pool building. Work was completed in 1998-99. The lower level consists of a small restaurant, washrooms, and multipurpose rooms for exercising and other public programs.

The lower level is heated and ventilated by an AHU mounted in the main mechanical room. Ductwork runs below the lower level floor and then up into the ceiling space. Hot water baseboard heaters provide supplementary heat to rooms with outside walls. The AHU contains a split system refrigeration cooling system with condenser equipment mounted on the main pool roof.

The Hall of Fame main level is currently vacant. However this space is ventilated by 2 AHU's located in the ceiling space. One unit receives heat for heating outside ventilation air and space heating from a hot water coil served by the main boiler plant. Cooling inside the AHU is provided by a split system refrigeration cooling system.

The second main floor AHU provides cooling only to the space and contains a split system cooling system. Both main floor AHU units have their air-cooled condensers mounted on the main pool roof.

Condition Assessment/Issues

This equipment is about 12 years old and has not yet reached its end of useful life. The hot water coil on one of the units froze and has recently been replaced. Also compressors in one of the units were replaced 5 to 6 years ago.

As noted earlier, the main floor level is currently not occupied. Therefore there may be merit in waiting to make changes to the existing AHU until a use for this space has been found. Depending on the final use found for this space, its ventilation or cooling requirements may change.

The lower level HVAC system controls are not achieving the required space temperatures for many situations. Some spaces require cooling while at the same time other spaces require heating and the existing AHU and its related controls do not seem to be able to address this problem. Changes are required to address this issue.

One of the main level AHU's is difficult to access for maintenance.

Recommendations

1. Upgrade the 2 main floor AHU's once a final use for this main floor space has been established.
2. Upgrade the lower level HVAC system controls.

Upgrade Alternatives Considered

Upgrade alternatives for the main floor HVAC system should be deferred until a final use for the space has been established.

For the lower level HVAC system a more thorough review which is beyond the scope of this project should be completed before a final upgrade plan is established.

Upgrade Plan

As noted above, for the main floor level, no immediate action is proposed.

The immediate plan for the Hall of Fame lower level would involve upgrade of the system to permit cooling in some spaces while others receive heating. Additional cooling capacity is required in some areas such as the nursery. This would likely involve replacing the Zoneall control system, elimination of the flow control boxes, and addition of cooling coils from the proposed central chilled water loop. However the details of this upgrade are best addressed in a preliminary design report before detailed design is initiated.

Cost Estimate

Costs to convert the 3 existing split system cooling systems to run off the proposed central chiller system have been included in Section 3.1.4.

Description	Hall of Fame Lower Level - Heat/Cool System Upgrade
Mechanical	100,000
Electrical	10,000
Structural	
Subtotal	**110,000**
PST - 7%	7,700
Subtotal	**118,000**
General Requirements - 12%	15,000
Fee - 3%	4,000
Subtotal	**137,000**
Contingency - 20%	28,000
Construction Subtotal	**165,000**
Detailed Engineering & Construction Admin Support - 15%	25,000
City Divisional Administration Fee - 3%	5,000
City Corporate Finance & Administration Fee - 3%	5,000
Subtotal	**200,000**
GST - 5%	10,000
Total Project Cost	**$210,000**

The cost estimate presented here includes an allowance to upgrade the lower level HVAC system to address the temperature control issues occurring there. An allowance for completing a preliminary design study before proceeding with detailed design has not been included.

3.3.2 Outside Air and Space Heating Hot Water Piping System

Existing System Description

The Two Hall of Fame AHU's receive heat to their hot water heating coils via hot water piping connected to the main pool central boiler plant.

Condition Assessment/Issues

This piping is 11 years old and in very good condition. AHU heating coils are currently receiving water at 170^{0}F and are working well. If the new proposed boiler and hot water heating piping system hot water supply temperature changes significantly, caution will be required to ensure these AHU's can still provide the required space and outside air heating requirements. If loop temperatures are dropped, significantly, new heating coils and perhaps new piping may be required. This issue would best be addressed at the time the new air handling units and related hot water piping system is replaced in the main pool area.

Recommendations

No current changes required.

Upgrade Alternatives Considered

As noted above the piping system may require upgrade when the main pool area heating piping system is replaced. This can best be determined during the detailed design phase of the main pool AHU's and hot water heating piping system replacement project.

Upgrade Plan

Replacement of the existing 2 AHU space heating coils with higher capacity units should be allowed for at the time the main pool area AHU's are upgraded. The piping system will not require an upgrade.

Cost Estimate

The cost estimate includes replacement of the 2 hot water coils located in the 2 Hall of Fame AHU's This cost is included with the main heating system upgrade project costs presented in Section 3.1.3.

3.3.3 Domestic Water Piping and Plumbing Fixtures

Existing System Description

Water for this building is supplied from the main pool building mechanical room. The domestic cold water piping system is copper and supplies water primarily to public washrooms in the lower level. There are also sinks and water fountains in several of the multi-purpose rooms.

The men's washroom urinals were replaced with waterless units in the last few years.

Condition Assessment/Issues

The system is 12 years old and in good condition. The washroom fixtures are also in good condition. As noted in the main pool section, the waterless urinals are causing significant operating problems and should be replaced with low flow urinals to reduce overall maintenance and operating costs.

Recommendations

Replace the waterless urinals. Costs for this work is included with the parallel recommendation for the main pool washrooms (Section 3.1.9-2).

3.3.4 Domestic Hot Water System

Existing System Description

The domestic hot water system supplies hot water to the public washrooms and several sinks in the multi purpose rooms. The restaurant facility at the lower level south end is also connected to the domestic hot water system.

Condition Assessment/Issues

The system is 12 years old and in good condition.

Recommendations

No capital upgrades are proposed.

3.3.5 Wastewater Piping System

Existing System Description

Drainage piping is generally cast iron piping under the floor. It is all original piping.

Condition Assessment/Issues

The piping is original equipment and is performing well.

Recommendations

No capital upgrades are proposed.

3.3.6 Rainwater Piping System

Existing System Description

Rainwater piping is PVC. It drains the roof down into the main pool mechanical room where it connects to the building wastewater discharge pipe.

Condition Assessment/Issues

The system is 12 years old and in good condition.

Recommendations

No capital upgrades are proposed.

3.3.7 Sprinkler System

Existing System Description

The lower level and main floor level are sprinklered. The system was installed with the original facility in 1998-99. For simplicity this portion of the overall sprinkler system, along with the lap pool system was discussed, in the main pool section on sprinkler systems (Section 3.1.13).

4.0 ELECTRICAL SYSTEMS

4.1 MAIN POOL

4.1.1 Power Distribution Systems

Existing System Description

Main Service entrance/ Electrical Room

The main electrical service entrance for Pan-am Pool is original to the building and is rated at 2000A 600V 3-phase. There are a number of modifications which have been completed over the years which include:

- Addition of sub-distribution breakers for additions over the years.
- Addition of Sprinkler drip-shields
- installation of fabricated plates to cover busswork which has been exposed over the years.

Further to this main 600V distribution, there is a 600V sub-distribution and a large (300kVA) 600/120/208V transformer and several 120/208V sub distribution and CDP panels. These panels are primarily original and have a variety of vintages of breakers.

Motor Starters / Motor Control Centers (MCCs)

There are a number of miscellaneous starters in individual enclosures and some small sections of MCC for the main pool building. There is also one large MCC with a variety of vintages of starters in the center of the boiler room. The original equipment has also been upgraded with sprinkler drip shields in recent years during a sprinkler upgrade.

Sub-Distribution Panels

There are a number of sub-distribution panels distributed throughout the main pool building. These are primarily in service spaces accessible from the pool deck level and the main electrical room and some located in the office space at the mezzanine level of the original building. These panels are predominantly original with the exception of emergency distribution panels.

General Wiring and Wiring Devices

Wiring throughout the main pool building was primarily run in conduit which was embedded in the original concrete structure. Much of the original wiring has proven difficult to trace out or re-run over the years and many additions have been done with surface wiring and conduit in services spaces where possible. The current wiring devices are generally a mix of new and old. These devices and their condition are typical for this vintage of building.

Condition Assessment/Issues

Main Service Entrance / Electrical Room

The equipment in the main electrical room has been upgraded and maintained as modifications have been done to the building over the years. The result has unfortunately been distribution equipment with a variety of vintages with inconsistent configuration.

Inconsistent configuration and abandonment of a variety of sections of equipment in this room have resulted in an electrical room which has a significant footprint of equipment which could be reduced and made safer.

Given the age and configuration of the equipment in this room, it may be reaching the end of its useful life. A test performed by Schneider in 1999 showed some of the equipment beginning to fail. This is a good indication that original equipment has begun to fail and should be replaced.

Further, when reviewing distribution equipment of this capacity, the following items need to be considered:

- Fault current interrupting capacity
- Arc-Flash Considerations
- Long-Term operation and maintainability
- Enclosures

In general, the equipment is adequate for its interrupting current needs.

A Study in 1999 identified that the equipment within this space has adequate fault-current capacity. This type of equipment, however would likely lead to long term difficult operation and maintenance, especially given newer standards slowly coming into play with regards to arc-flash

Motor Starters / Motor Control Centers (MCCs)

There are limited number of starters which have been installed in the recent years which are in good condition. The majority of the starters, however, are located within MCC-1. MCC-1 is located in the middle of the mechanical equipment room. This panel has been marginal in terms of fault interrupting capability according to a short-circuit study performed by Manengco Engineering in 1999. Further to that, there was some deterioration of equipment found by Schneider in 1999 when they did a review of the equipment. This deterioration was repaired, however, it is an indicator of the condition of the MCC.

Another item which relates to operation of the equipment was learned via interviews with the staff.

There had been failures of piping near the location of the MCC which have resulted in the MCC being sprayed with water. This resulted in a dangerous condition for operators to get under control in which the MCC equipment was arcing on the surface. While there is no specific rule which says that the MCC cannot be in the space, due to the nature of the maintenance work which is performed in the space, it is recommended that when the MCC is changed out, that it be removed from it's existing location and installed where less subject to water spray either during failure or maintenance.

Sub-distribution Panels

The sub-distribution panels throughout the facility are in reasonable condition for their age, however, they are reaching the end of their useful life and should be replaced.

The panels which were installed for emergency lighting upgrades in 2006 are in good condition and can be maintained.

General Wiring and Wiring Devices

While wiring devices are of various vintages and various conditions, they are generally in reasonable shape and could be maintained as required.

The wiring within the building is generally in good condition, however, its configuration makes it difficult to expand/ maintain or change systems. It would be appropriate for a long term facility of this type to establish electrical pathways outside the embedded conduit to allow for proper maintenance and upgrades in the future.

Recommendations

Much of the electrical equipment within this facility has reached the end of its useful life. We recommend that the electrical distribution equipment be addressed as four items to help aid in the staging of the installation:

1. Main distribution equipment / Electrical Room
2. Mechanical equipment services upgrades including MCC relocate
3. Upgrade of all vintage facility sub-distribution equipment
4. Establishing of a facility-wide electrical pathway system.
5. Ongoing wiring device upgrades.

Upgrade Alternatives Considered

Generally given the upgrades required, there are little options which should be considered. One could use the existing electrical space to install the new equipment, however, that would lead to a long term outage of the facility which is not desired.

The electrical pathways arrangement could be omitted, however, given the amount of work which has to be performed for the mechanical equipment; it would be prudent to pursue this option. The incremental cost is minimal and the long term benefits in terms of maintenance and building adaptability are significant.

Upgrade Plan

It is anticipated that the upgrades to the facility would begin with the upgrade to the main electrical room. As there is a room adjacent to the main service room which can be re-purposed to electrical, it is recommended that the new systems be installed in this new room and the systems transferred to the new service. This would allow for minimal down-time of the facility.

Once the main electrical equipment has been upgraded, it would be prudent to pursue the upgrades to the MCC and installation of the electrical pathways with the upgrade of the HVAC equipment. Should the main electrical service entrance and room already be upgraded, the new MCC could be located in the current electrical room.

Cost Estimate

Description	Main Service/ Electrical Room Upgrade
Mechanical	10,000
Electrical	545,000
Structural	25,000
Subtotal	**580,000**
PST - 7%	40,600
Subtotal	**620,600**
General Requirements - 12%	74,500
Fee - 3%	20,900
Subtotal	**716,000**
Contingency - 20%	143,200
Construction Subtotal	**860,000**
Detailed Engineering & Construction Admin Support - 15%	129,000
City Divisional Administration Fee - 3%	25,800
City Corporate Finance & Administration Fee - 3%	25,800
Subtotal	**1,041,000**
GST - 5%	53,000
Total Project Cost	**$1,094,000**

Upgrades for the MCCs have been carried as components of the Boiler and HVAC upgrades in sections 3.1.1 and 3.1.2.

Description	Sub-Distribution Panel Upgrades
Mechanical	
Electrical	240,000
Structural	20,000
Subtotal	**260,000**
PST - 7%	18,200
Subtotal	**278,200**
General Requirements - 12%	33,400
Fee - 3%	9,400
Subtotal	**321,000**
Contingency - 20%	64,200
Construction Subtotal	**386,000**
Detailed Engineering & Construction Admin Support - 15%	57,900
City Divisional Administration Fee - 3%	11,600
City Corporate Finance & Administration Fee - 3%	11,600
Subtotal	**468,000**
GST - 5%	24,000
Total Project Cost	**$492,000**

Description	Wiring Devices Upgrades
Mechanical	
Electrical	29,000
Structural	10,000
Subtotal	**39,000**
PST - 7%	2,800
Subtotal	**41,800**
General Requirements - 12%	5,100
Fee - 3%	1,500
Subtotal	**48,400**
Contingency - 20%	9,700
Construction Subtotal	**59,000**
Detailed Engineering & Construction Admin Support - 15%	8,900
City Divisional Administration Fee - 3%	1,800
City Corporate Finance & Administration Fee - 3%	1,800
Subtotal	**72,000**
GST - 5%	4,000
Total Project Cost	**$76,000**

4.1.2 Lighting Systems

Existing System Description

There are three key areas of lighting in the main pool building. These are:

1. Main Pool Lighting
2. Pool Niche Lighting
3. Auxiliary area / Corridor Lighting

In general the existing pool lighting is composed of a series of 1000 W Metal Halide light fixtures located above the pool and accessed from the service catwalk. While these fixtures provide an appropriate level and quality of lighting, they have proven to be difficult to maintain over the years. Further to that, as there is minimum lighting levels required for pools, the fixtures are all kept on even during service hours.

One additional item relating to the existing lights relates to the low voltage lighting control system. As the system has failed in a number of areas, the lights are kept on at all times. HID light fixtures of this type can suffer from "Non-Passive" Failure. HID lights can "Burn-out" while still maintaining the plasma arc in the tube until the fixture is turned off. If this condition is maintained for too long, the arc-tube and the associated lamp can explode. While the fixtures are contained, this could make it very difficult to contain the glass within the fixture when changing lamps.

The pool niche lighting is generally not used; however, it would be considered a requirement for competition and could be considered a safety requirement to have clear visibility of swimmers under the surface of the water. The pool niche lighting is typically an older style of mercury vapor fixtures with remote mounted ballasts. The niche for the lighting is a lens to the area surrounding the pool and the fixture is essentially outside the pool area itself.

The general area lighting for the remainder of the facility is generally a number of original fixtures which were T-12 Fluorescent fixtures of incandescent fixtures. These fixtures have typically been upgraded to have more modern T-8 lamps and screw in style compact fluorescent lamps. Access to the fixtures is often difficult given the height or vandal resistant covers.

Condition Assessment/Issues

In general, all forms of lighting in the pool area are reaching the end of their useful life and replacement options should be reviewed for the complete original facility.

The original pool deck lights, while reaching the end of their life were an appropriate fixture for the purpose as the following issues are important when selecting pool lights.

1. Small aperture / lumens of the fixture. The larger the fixtures lit surface, the large the area of glare will be on the water surface potentially causing visibility issues below the surface of the water. As the original fixture has a large lumen output of a single fixture they presented minimal glare areas to the surface of the water.
2. Sufficient power to edge light the pool. By placing the lights at the edges of the pool as they are configured, it allows for further reduction in the reflecting glare on the surface of the water.
3. Overall adequate illumination. Generally the fixture selected provided a proper light level for the whole main pool area.
4. Fixtures are generally sealed, gasketted and corrosion resistant due to the corrosive nature of a pool environment.

While the lights should be replaced, the new configuration should keep the above considerations in mind.

The existing pool deck lights also have no ability to set-back light levels to minimum pool levels during maintenance hours. The ability to add control to the lights would be beneficial from an energy use perspective.

The Pool Niche lights are generally non-functional and should be replaced. They were made to operate for the last Pan-Am Games, however, they have not been used since.

The general auxiliary area and corridor lights are generally reaching the end of their useful life as fixtures, however, replacement can often lead to a significant disruption of the space. Much of the existing lighting for corridors would need to be upgraded as part of the reconfiguration for mechanical upgrades.

Recommendations

The Main Pool deck lights should be replaced with a new set of light fixtures with the same basic performance capability. It is anticipated that similar fixtures would be used with modern 1000W Metal Halide Lamps due to the overall performance of the light source and the required number of lumens.

In general, the pool niche lights should be upgraded with an appropriate modern fixture.

The general area lighting not related to the pool should all be upgraded over the next 15 years. In generally a large portion of this lighting could be replaced as part of other capital project. Further to the above replacements, it is recommended that a general upgrade program be implemented for areas where there is likely to be very little direct upgrade over the years. Generally the areas which will need to be upgraded at some point in the next fifteen years would include the following, generally ranked according to priority:

1. Change Areas
2. Stairwells
3. Washrooms
4. Corridors (areas which area not affected by HVAC and would be upgraded already)
5. Public use areas / Boardroom areas.
6. Offices
7. Maintenance spaces
8. Catwalk lighting.

Due to the long term nature of the facility and the high profile of events which take place at the facility, it is recommended that upgrades to lighting for the facility which are done in public space be reviewed with not only an engineer, but also an interior designer to ensure that the long term aesthetic of the facility is maintained.

Upgrade Alternatives Considered

Use of T5HO lamp based fixtures for the main pool area was reviewed. These fixtures would have the following benefits:

- They would give better controllability of light levels (Lighting could be dimmed)
- The fixture would not suffer from non-Passive failure.

For this specific pool application, however, the following items were considered sufficient to discount this option at this time.

- There would be approximately 20 lamps required for each 1000W lamp required which would likely mean approximately 4 times the fixtures. This would make it difficult to control glare on the surface of the pool.
- T5HO Lamps perform best when allowed to be semi-ventilated. Having sealed fixtures in a warm environment may lead to significant early burn-out of the lamps and ballasts.
- At the time of this report, there was not a T5HO fixture which was found which could meet the performance requirements of the unique configuration of such a large pool.

Since this technology is rapidly changing, however, this option should be revisited at the time of detailed design, it is not anticipated to impact cost significantly if there is an appropriate fixture.

LED Fixtures were also reviewed, but at the time of this report, there were insufficient fixtures which could be used for this specific application. This technology is also rapidly changing and may be a viable option in the next five years.

Upgrade Plan

Pool Lighting Upgrades are relatively independent and can be performed as a separate item.

In general, lighting upgrades are best performed when there is other work being performed in an area. As there will be significant modifications to certain areas of the facility to accommodate the HVAC upgrades, these areas would be best addressed for lighting upgrades at that time. For other areas, lighting upgrades can generally be performed at any time; however, the logistics of the lighting upgrade would be better if done during or after general panel upgrades.

Cost Estimate

The cost estimate for the general area lighting is carried with the HVAC upgrade in 3.1.2 as it should be done in parallel.

The remainder of the items are below.

Description	Main Pool Lighting
Mechanical	5,000
Electrical	272,000
Structural	15,000
Subtotal	**292,000**
PST - 7%	20,500
Subtotal	**312,500**
General Requirements - 12%	37,500
Fee - 3%	10,500
Subtotal	**360,500**
Contingency - 20%	72,100
Construction Subtotal	**433,000**
Detailed Engineering & Construction Admin Support - 15%	65,000
City Divisional Administration Fee - 3%	13,000
City Corporate Finance & Administration Fee - 3%	13,000
Subtotal	**524,000**
GST - 5%	27,000
Total Project Cost	**$551,000**

Description	Pool Niche Lighting
Mechanical	
Electrical	111,000
Structural	5,000
Subtotal	**116,000**
PST - 7%	8,200
Subtotal	**124,200**
General Requirements - 12%	15,000
Fee - 3%	4,200
Subtotal	**143,400**
Contingency - 20%	28,700
Construction Subtotal	**173,000**
Detailed Engineering & Construction Admin Support - 15%	26,000
City Divisional Administration Fee - 3%	5,200
City Corporate Finance & Administration Fee - 3%	5,200
Subtotal	**210,000**
GST - 5%	11,000
Total Project Cost	**$221,000**

4.1.3 Emergency and Exit Lighting Systems

Existing System Description

The bulk of the emergency lighting in the entire Pan-Am Pool is provided by an on-site generator and UPS. This equipment was installed in 2006 and is generally in good condition (See next section). At the time, there were a number of battery-packs left in place to provide emergency lighting to a number of auxiliary areas and provide additional illuminance on some of the exit paths from the public area bleachers.

The existing exit lighting is a number of different vintages throughout the building. These fixtures could be revisited and systematically upgraded over the course of other work.

Emergency Lighting Battery Banks

The emergency battery banks are generally tested and upgraded as required. As is typical, in this type of facility, this equipment will require continuous maintenance. At the time of the additional of the emergency Generator and UPS, this equipment was left in place to cover off some auxiliary area requirements.

Emergency Lighting Heads

The emergency lighting heads on DC supply in use at the site are standard incandescent emergency lighting heads and are generally maintained, but require annual maintenance.

The emergency lighting heads which are used on the emergency generator system are comprised of a number of fluorescent fixtures for the general area lights.

For the pool level emergency lighting, the emergency lights are the 1000W MH pool lights. These lights are fed from a UPS system to ensure that they maintain the arc during a power failure and transfer to the emergency generator.

In general, the pool has adequate light levels for emergency lighting.

The existing Exit signs are a variety of vintages and generally provide the rough direction of exit. The exit signs should be reviewed to ensure direction of exiting is clearly maintained when any upgrades are performed.

Condition Assessment/Issues

The emergency lighting from the generator/UPS system is generally in good condition. There are also a number of individual battery banks and incandescent heads in place which act supplemental to the new system. This equipment is a variety of vintages throughout the facility and would normally be maintained and upgraded as required during the annual tests.

Since the installation of the new generator system, a few of the areas where the battery banks are in place could be reviewed and the existing battery banks deleted.

The existing exit lights are generally powered from the emergency battery packs. Should these fixtures be switched over to generator power, the emergency battery banks could be nearly eliminated.

Recommendations

The existing emergency lighting system is adequate and meets the needs of life safety, however, given that there are essentially two types of systems, one on generator, and one on emergency battery banks (including exit signs), it would be worthwhile from a maintenance perspective to transfer these all to the generator where possible. (Note there will always be a need for some small unitized emergency lighting packs near the emergency generator and transfer equipment). In general, this would allow for significantly simplified maintenance over the years and consistency for the facility.

Upgrade Plan

The removal of existing battery bank systems and installation of any upgrades required to take the system to being completely on the generator can easily be done as in independent project. It should be noted, however, that it may be beneficial to do this upgrade after main electrical pathways/cable trays have been installed to support the facility.

Cost Estimate

Description	Transfer Remaining Battery Packs to Generator
Mechanical	
Electrical	18,000
Structural	2,000
Subtotal	**20,000**
PST - 7%	1,400
Subtotal	**21,400**
General Requirements - 12%	2,600
Fee - 3%	800
Subtotal	**24,800**
Contingency - 20%	5,000
Construction Subtotal	**29,800**
Detailed Engineering & Construction Admin Support - 15%	4,500
City Divisional Administration Fee - 3%	900
City Corporate Finance & Administration Fee - 3%	900
Subtotal	**36,100**
GST - 5%	1,900
Total Project Cost	**$38,000**

Description	Transfer Exit Signage to Generator
Mechanical	
Electrical	6,000
Structural	1,000
Subtotal	**7,000**
PST - 7%	500
Subtotal	**7,500**
General Requirements - 12%	900
Fee - 3%	300
Subtotal	**8,700**
Contingency - 20%	1,800
Construction Subtotal	**10,500**
Detailed Engineering & Construction Admin Support - 15%	1,600
City Divisional Administration Fee - 3%	400
City Corporate Finance & Administration Fee - 3%	400
Subtotal	**12,900**
GST - 5%	700
Total Project Cost	**$14,000**

4.1.4 Backup Power Supply – Generator and UPS System

Existing System Description

A new 100 kW (125kVA) Generator and a 30 kVA UPS were installed in 2006 as part of an emergency lighting upgrade. There are new distribution panels associated with this equipment which connects it to the existing lighting to provide emergency lighting for the facility. This equipment is generally in good condition.

Condition Assessment/Issues

The equipment is in good condition.

Recommendations

There are no recommendations.

4.1.5 Fire Alarm System

Existing System Description

The existing fire alarm system is a Notifier zoned fire alarm system connected to conventional devices. The existing system has bells around the facility and no strobe lights. The system is tested in accordance with CAN/ULC requirements.

Condition Assessment/Issues

The existing fire alarm system is generally in reasonable condition, however, it is anticipated that given the vintage of the system and the type of building that the following issues likely exist:

1. The existing bells do not appear sufficient to provide adequate audibility throughout the facility.
2. There are not currently strobe lights associated with the fire alarm system. Given the nature of the facility and the likelihood of occupants being hearing impaired, there would likely, in a modern building, be strobe lights installed as part of the fire alarm system in all the public spaces.

3. Given the size and complexity of the building, having a zoned system can make it very difficult to locate faults when they occur. Switching to a modern Addressable system would alleviate this problem.

The fire alarm system that is in place is limited and typically would be replaced over being upgraded.

Recommendations

It is recommended that the City pursue an upgrade to the fire alarm system to a new fully addressable system with complete strobe coverage throughout to ensure that all public can be properly notified of a fire alarm situation.

Upgrade Alternatives Considered

Some consideration was given to the "Maintain-only" option which would involve retaining the existing system. This is likely a poor choice in the long term as lack of audibility in areas and potential for sudden failure in the future would likely force an upgrade at some point over the next five years.

Upgrade Plan

The fire alarm system is relatively independent and could be upgraded as a separate project. It would be beneficial to establish this upgrade after the installation of electrical pathways.

Cost Estimate

Description	Fire Alarm System Upgrades
Mechanical	
Electrical	435,000
Structural	22,000
Subtotal	**457,000**
PST - 7%	32,000
Subtotal	**489,000**
General Requirements - 12%	58,700
Fee - 3%	16,500
Subtotal	**564,200**
Contingency - 20%	112,900
Construction Subtotal	**678,000**
Detailed Engineering & Construction Admin Support - 15%	101,700
City Divisional Administration Fee - 3%	20,400
City Corporate Finance & Administration Fee - 3%	20,400
Subtotal	**821,000**
GST - 5%	42,000
Total Project Cost	**$863,000**

4.1.6 Public Address System

Existing System Description

The Existing PA system is a zoned system with the amplifiers in a central room. It has been reported that the coverage of the existing system is poor and the ability to control the PA zones no longer functions adequately.

Condition Assessment/Issues

The Existing PA system has reached the end of its useful life and no longer functions adequately.

Recommendations

The existing PA system should be replaced with a new zone controllable PA system.

Upgrade Plan

This system is generally independent of the rest of the building systems and could be done as a separate project. This upgrade should be done after the establishment of main electrical pathways.

Cost Estimate

Description	PA System Upgrade
Mechanical	
Electrical	239,000
Structural	5,000
Subtotal	**244,000**
PST - 7%	17,100
Subtotal	**261,100**
General Requirements - 12%	31,400
Fee - 3%	8,800
Subtotal	**301,300**
Contingency - 20%	60,300
Construction Subtotal	**362,000**
Detailed Engineering & Construction Admin Support - 15%	54,300
City Divisional Administration Fee - 3%	10,900
City Corporate Finance & Administration Fee - 3%	10,900
Subtotal	**439,000**
GST - 5%	22,000
Total Project Cost	**$461,000**

4.1.7 Low Voltage Lighting Controls

Existing System Description

The existing lighting controls are comprised of a GE low voltage relay based system and control stations original to the building. Many of the low voltage controls no longer function properly.

Condition Assessment/Issues

As many of the existing switches do not function properly, many of the existing lights are left on at all times. This can be a significant issue with energy consumption as well as in the case of HID lamps, of "Non-passive" failure.

Modern lighting control systems would not only involve direct switching, but would likely incorporate occupancy sensors for some areas and daylight sensors for areas where there is sufficient daylight contribution.

Recommendations

It is recommended that the lighting control system be upgraded with a new lighting control system throughout the facility. This lighting control upgrade should be done in parallel with lighting upgrades to ensure proper interaction of the systems for optimal energy savings. A Lutron Eco-System has been designed for other City of Winnipeg pools and would be an appropriate selection for this application as well. It is anticipated that the configuration would involve dimming ballasts for areas where there could be significant setback during use.

Cost Estimate

Description	Low Voltage Lighting Controls
Mechanical	
Electrical	345,000
Structural	
Subtotal	**345,000**
PST - 7%	24,200
Subtotal	**369,200**
General Requirements - 12%	44,400
Fee - 3%	12,500
Subtotal	**426,100**
Contingency - 20%	85,300
Construction Subtotal	**512,000**
Detailed Engineering & Construction Admin Support - 15%	76,800
City Divisional Administration Fee - 3%	15,400
City Corporate Finance & Administration Fee - 3%	15,400
Subtotal	**620,000**
GST - 5%	31,000
Total Project Cost	**$651,000**

4.1.8 Drown Alarm System

Existing System Description

There is no functional drawn alarm system.

Condition Assessment/Issues

It has been indicated that a drown alarm system is required for the site.

Recommendations

It is recommended to install a drown alarm.

Cost Estimate

Description	Drown Alarm System Installation
Mechanical	
Electrical	45,000
Structural	
Subtotal	45,000
PST - 7%	3,200
Subtotal	48,200
General Requirements - 12%	5,800
Fee - 3%	1,700
Subtotal	55,700
Contingency - 20%	11,200
Construction Subtotal	67,000
Detailed Engineering & Construction Admin Support - 15%	10,100
City Divisional Administration Fee - 3%	2,100
City Corporate Finance & Administration Fee - 3%	2,100
Subtotal	82,000
GST - 5%	5,000
Total Project Cost	$87,000

4.2 LAP POOL

4.2.1 Power Distribution Systems

Existing System Description

The Main power distribution for the lap pool area is fed from the main pool. In general, there are three main 600V feeds for normal power (225A for the MCC, 200A for 600V Distribution and 200A for the 150kVA distribution transformer). Further to that there is one 150A 600V feed for the transfer switch.

All electrical distribution equipment was installed in 1994 with the lap-poll extension with the exception of the emergency distribution equipment which was installed in 2006.

Condition Assessment/Issues

In general, the distribution equipment at for this building is in good condition.

Recommendations

There are no recommendations for upgrade at this time.

4.2.2 Lighting Systems

Existing System Description

The lighting for this area is new with the facility as of 1994. The pool area lighting is generally HID style lighting. All other lighting is T-8 style lighting.

It has been reported that a number of the pool fixtures are showing significant interior corrosion of the fixture and will need to be replaced.

Condition Assessment/Issues

The lighting design and layout for this portion of the facility is adequate. The HID lighting for the pool is generally adequate, but given the reported deterioration, it should be replaced in kind with a more corrosion resistant fixture.

All other fluorescent fixtures are generally vapor-tight Fluorescent T-8 fixtures and are generally in reasonable condition. Some fixtures at the track level show signs of deterioration and wear and could be considered for the overall lighting upgrade of the facility.

The niche lighting has reportedly reached the end of it's useful life.

Recommendations

All pool lighting should be replaced with new lighting. Special attention to detail on fixture selection should be paid to ensure that there are no part subject to corrosion on the outside or inside of the fixture. These fixtures could be replaced in kind with HID, or T5HO should be reviewed for this area. Given the lower ceiling height and generally better proportions of the building as they relate to lighting, T5HO may potentially be a good choice in this area.

Further advantages to these fixtures would be dimming control and capability to dim lights to minimal levels during maintenance occupancy for significant energy savings.

General area lighting could be upgraded as part of routine maintenance. Fixtures incorporating dimmable ballasts should be considered when reviewing the areas near existing fenestration. These could then be tied into any updated lighting control system.

Niche lighting should be upgraded to match the main pool.

Upgrade Plan

The lighting upgrade in this area is predominantly independent of other system upgrades and can be considered at any time.

Cost Estimate

Description	Lap Pool Area and Niche Lighting
Mechanical	4,000
Electrical	95,000
Structural	3,000
Subtotal	**102,000**
PST - 7%	7,200
Subtotal	**109,200**
General Requirements - 12%	13,200
Fee - 3%	3,700
Subtotal	**126,100**
Contingency - 20%	25,300
Construction Subtotal	**152,000**
Detailed Engineering & Construction Admin Support - 15%	22,800
City Divisional Administration Fee - 3%	4,600
City Corporate Finance & Administration Fee - 3%	4,600
Subtotal	**184,000**
GST - 5%	10,000
Total Project Cost	**$194,000**

4.2.3 Emergency and Exit Lighting Systems

Existing System Description

The emergency and exit lighting systems for this area generally consist of fixtures on emergency power and a few additional battery-pack heads. The HID fixtures which are used as emergency are on UPS power to ensure that they do not go out on the transfer to the emergency generator.

Condition Assessment/Issues

The emergency lighting systems generally have the same comments at the main pool area.

Exit lighting is generally in acceptable condition.

Recommendations

As with the main pool area, it is recommended to transfer all emergency lighting to the generator with the exception of the unitized head near the transfer switch.

Cost Estimate

Description	Lap Pool Emergency and Exit Lighting
Mechanical	
Electrical	3,000
Structural	1,000
Subtotal	**4,000**
PST - 7%	300
Subtotal	**4,300**
General Requirements - 12%	600
Fee - 3%	200
Subtotal	**5,100**
Contingency - 20%	1,100
Construction Subtotal	**7,000**
Detailed Engineering & Construction Admin Support - 15%	1,100
City Divisional Administration Fee - 3%	300
City Corporate Finance & Administration Fee - 3%	300
Subtotal	**9,000**
GST - 5%	1,000
Total Project Cost	**$10,000**

4.2.4 Backup Power Supply – Generator and UPS System

This system was installed facility wide. The system is discussed as a whole in section 4.1.4.

4.2.5 Fire Alarm System

This system is a facility wide system and should not be addressed by areas. As such this is discussed under section 4.1.5.

4.2.6 Public Address System

This system is a facility wide system and should not be addressed by areas. As such this is discussed under Section 4.1.7.

4.2.7 Lighting Controls

Existing System Description

The lighting controls for the lap pool are predominantly manual light switches with some lighting contactors.

Condition Assessment/Issues

The general condition of the switching for the lap pool is acceptable; however, given the nature of the facility, these items should likely be tied into a central control system.

Recommendations

It is recommended that this lighting be tied into the central lighting control system when the main pool is completed.

Cost Estimate

As this portion of work would be done with the main Pool upgrades, the cost estimates are carried as part of 4.1.8.

4.3 HALL OF FAME BUILDING

4.3.1 Power Distribution Systems

Existing System Description

There are some existing sub-distribution panels for the hall of fame area which were installed when the addition was put on the building. These are generally 120/208V equipment.

Condition Assessment/Issues

Distribution equipment in this area is generally in good condition.

Recommendations

There are no recommendations.

4.3.2 Lighting Systems

Existing System Description

The lighting for the Hall of Fame addition generally consists of fluorescent lighting for the areas outside the main hall of fame room. Inside the hall of fame room, the lighting is generally metal halide lighting.

Condition Assessment/Issues

The lighting in this area is generally in good condition.

Recommendations

There are no recommendations.

4.3.3 Emergency and Exit Lighting Systems

Existing System Description

The emergency lighting in this area is predominantly supplied from the generator from the upgrade in 2006. There are still some areas in room supplied by battery banks. These areas are not code required emergency lights, but given the use of the facility are generally good ideas.

Condition Assessment/Issues

The emergency and exit lighting in this area is generally in good condition.

Recommendations

There are no recommendations.

4.3.4 Backup Power Supply – Generator and UPS System

This system was installed facility wide. The system is discussed as a whole in section 4.1.4.

4.3.5 Fire Alarm System

This system is a facility wide system and should not be addressed by areas. As such this is discussed under section 4.1.5.

4.3.7 Public Address System

This system is a facility wide system and should not be addressed by areas. As such this is discussed under Section 4.1.7.

4.3.8 Lighting Controls

Existing System Description

The lighting controls for this area are comprised primarily of light switches.

Condition Assessment/Issues

The light switching for this area is generally in reasonable condition; however, it may be beneficial to tie the lighting into a new central system if installed.

Recommendations

It is recommended that this lighting be tied into the central lighting control system when the main pool is completed.

Cost Estimate

As this portion of work would be done with the main Pool upgrades, the cost estimates are carried as part of 4.1.8.

5.0 SUMMARY COST ESTIMATES

The individual cost estimate for each M & E system has already been included in the body of this report. Following are summary mechanical and electrical Tables 1 and 2 presenting costs for all projects. Note the estimate assumptions presented in Section 2.5 apply to this cost estimate.

M & E total upgrade costs in 2010 dollars are presented in Table 3 below.

Description	Mechanical	Electrical	Total
Mechanical	5,012,000	19,000	5,031,000
Electrical	1,042,000	2,383,000	3,425,000
Structural	1,093,000	109,000	1,202,000
Subtotal	**7,147,000**	**2,511,000**	**9,658,000**
	0	0	0
PST - 7%	501,000	176,000	677,000
Subtotal	**7,648,000**	**2,687,000**	**10,335,000**
	0	0	0
General Requirements - 12%	918,000	323,000	1,241,000
Fee - 3%	257,000	91,000	348,000
Subtotal	**8,823,000**	**3,101,000**	**11,924,000**
	0	0	0
Contingency - 20%	1,765,000	621,000	2,386,000
Construction Subtotal	**10,588,000**	**3,722,000**	**14,310,000**
Detailed Engineering & Construction Admin Support - 15%	1,589,000	559,000	2,148,000
City Divisional Administration Fee - 3%	318,000	112,000	430,000
City Corporate Finance & Administration Fee - 3%	318,000	112,000	430,000
Subtotal	**12,813,000**	**4,505,000**	**17,318,000**
GST - 5%	641,000	226,000	867,000
Total Project Cost	**13,454,000**	**4,731,000**	**18,185,000**

6.0 PROPOSED IMPLEMENTATION SCHEDULE

In reviewed the facility's M & E systems, it became clear that although various upgrades and fixes have occurred over the years, in general existing systems are essentially original equipment. With this being the case, projects proposed in this report can all be implemented as soon as funding is available. The projects proposed are for systems that are past their useable life or have deteriorated to the point where replacement is warranted.

Given that there are good reasons to implement listed upgrades now, there are also good reasons to perform certain key projects in a specific order, so as to avoid rework that could result if the order of work changed.

Most importantly, the main electrical service and electrical room upgrade project (4.1.1) should be completed before other projects involving electrical system changes are implemented. Reasons for this include the following:

- By upgrading this system early, it frees up space for the new MCC room which will allow easy upgrade of HVAC systems with minimal rework.
- This system is the power source for all systems and an early upgrade would allow for good timing on the upgrades.

The HVAC project also encapsulates several electrical items. Notably these are:

- Electrical Pathways upgrades
- MCC upgrades
- General area lighting upgrades.

As these electrical works are substantially impacted by the HVAC upgrades, it makes sense form a logistical point of view to do them at one time. These items should all proceed directly following the main electrical room upgrade.

Once the HVAC upgrades have been done, the established electrical pathways can then be used for items such as fire alarm and paging system upgrades. These upgrades would be highly disruptive prior to establishing these key routes.

The Lighting upgrades for the pool and lighting controls should proceed relatively soon as well. These items are at the end of their useful life and need replacement.

Finally the upgrade of the distribution panels, wiring devices and general emergency and exit signage can proceed relatively independent of the other projects. While these items have reached the end of their useful life they are relatively easy to upgrade and replace and should perhaps be added to a maintenance schedule over the years following the primary upgrades.

7.0 REFERENCES

1. Air Movement & Mechanical Services Ltd., Pan-Am Pool, Filter System Upgrade, Waterflow Distribution Report, December 1997.

2. Pan-Am Pool, Recirculation System Upgrade & Painting, Operation & Maintenance Manual, 1997.

3. City of Winnipeg – Asbestos Inventory Control Summary Report, October 31, 2008.

4. City of Winnipeg, Bid Opportunity No. 663-2006, Emergency System Upgrades at Pan-Am, Bonivital and St. James Centennial Pool.

5. Mikkelson-Coward & Co., Ltd., Pan-Am Pool, Mechanical Renovations, Operation and Maintenance Manual, May 2002.

6. Koliger Schmidt, Indoor Air Quality Evaluation, February 1996.

7. Demand Side Energy Consultants Inc., An Evaluation of GHG Reduction Alternatives – Pan-Am Pool, October 20, 2009.

8. The Public Health Act, Swimming Pools and Other Water Recreational Facilities Regulation, Jun 13, 1997.

9. ASHRAE Standard 62.1 – 2004.

10. City of Winnipeg, Pan-Am Pool, Room Programming Inventory, November 2009.

11. VFA, Asset Detail Report, 2005.

12. VFA, Asset Detail Report, 2009.

13. Neil Cooper Architect Inc., Tuplin Group Inc., Pan-Am Pool, Building Envelope Retrofit, Phase 1, 2 & 3, Drawings and Specifications, June 22, 2009.

14. Hanscomb, Work Definition Study Estimate, Mechanical Services Only, May 21, 2010.

15. Abraxas Energy Consulting, Bill Ledger Report for Area: 25 Poseidon Bay, 2008-09.

16. Dynamic Energy Services Inc., Commissioning Documents, Specifications & Warranties, November 2003.

17. Schneider Electric, Service Report, June 1999.

18. Manengco Engineering, Electrical Distribution Study, Load and Harmonic Study, Volume 1 to 4, November 1, 1999.

19. Reid Crowther and Partners Limited, Filter System Upgrade to Pan-Am Pool. May 26, 1997, Contract drawings, 1997.

20. City of Winnipeg, File No. B14-45-01-61, Pan-Am Pool Radiant Heaters, Contract drawings, January 1977.

21. City of Winnipeg, File No. B14-45-01-61, Pan-Am Pool Non-Freeze Air Intakes, September 1976.

22. Ralph W. Shilling Architect, Aquatic Hall Of Fame, Contract drawings, December 1998.

23. MCW/AGE Consulting Professional Engineers, Weight Room Enclosure Project, As-built drawings, 2004.

24. Cooper Rankin Architects, Swim Manitoba – Pan-Am Pool Addition, Contract drawings, 1993.

25. City of Winnipeg, Pan-Am Pool Lighting, Contract drawings, 1978.

26. KGS Group, Installation of Sprinkler System, Contract drawings, 2003.

Table 1

Pan-Am Pool

Mechanical and Electrical Upgrade Study

Capital Cost Estimate - Mechanical Projects

Description	Replace Boilers	Replace AHU's, Provide Access & New Piping System	Space Cooling Entire Facility	Replace Inlet Water Line	Plumbing Fixture Upgrade Project	Domestic Hot Water System	Rainwater Piping System	Lap Pool - Replace 2 Main Air Handling Units	Hall of Fame Lower Level - Heat/Cool System Upgrade	Total Line Item Costs
Report Section Number	3.1.1, 4.1.1	3.1.2,3 &5	3.1.4	3.1.9 - 1	3.1.9 - 2	3.1.10	3.1.12	3.2.1	3.3.1	
Mechanical	1,232,000	1,838,000	1,113,000	40,000	119,000	117,000	115,000	338,000	100,000	5,012,000
Electrical	195,000	690,000	80,000		23,000	28,000		16,000	10,000	1,042,000
Structural	40,000	973,000	25,000		15,000			40,000		1,093,000
Subtotal	**1,467,000**	**3,501,000**	**1,218,000**	**40,000**	**157,000**	**145,000**	**115,000**	**394,000**	**110,000**	**7,147,000**
PST - 7%	103,000	246,000	86,000	2,800	11,000	11,000	9,000	28,000	7,700	501,000
Subtotal	**1,570,000**	**3,747,000**	**1,304,000**	**43,000**	**168,000**	**156,000**	**124,000**	**422,000**	**118,000**	**7,648,000**
General Requirements - 12%	189,000	450,000	157,000	5,200	21,000	19,000	15,000	51,000	15,000	918,000
Fee - 3%	53,000	126,000	44,000	1,500	6,000	6,000	5,000	15,000	4,000	257,000
Subtotal	**1,812,000**	**4,323,000**	**1,505,000**	**50,000**	**195,000**	**181,000**	**144,000**	**488,000**	**137,000**	**8,823,000**
Contingency - 20%	363,000	865,000	301,000	10,000	39,000	37,000	29,000	98,000	28,000	1,765,000
Construction Subtotal	**2,175,000**	**5,188,000**	**1,806,000**	**60,000**	**234,000**	**218,000**	**173,000**	**586,000**	**165,000**	**10,588,000**
Detailed Engineering & Construction Admin Support - 15%	327,000	779,000	271,000	9,000	36,000	33,000	26,000	88,000	25,000	1,589,000
City Divisional Adminstration Fee - 3%	66,000	156,000	55,000	2,000	8,000	7,000	6,000	18,000	5,000	318,000
City Corporate Finance & Administration Fee - 3%	66,000	156,000	55,000	2,000	8,000	7,000	6,000	18,000	5,000	318,000
Subtotal	**2,634,000**	**6,279,000**	**2,187,000**	**73,000**	**286,000**	**265,000**	**211,000**	**710,000**	**200,000**	**12,813,000**
GST - 5%	132,000	314,000	110,000	4,000	15,000	14,000	11,000	36,000	10,000	641,000
Total Project Cost	**$2,766,000**	**$6,593,000**	**$2,297,000**	**$77,000**	**$301,000**	**$279,000**	**$222,000**	**$746,000**	**$210,000**	**$13,454,000**

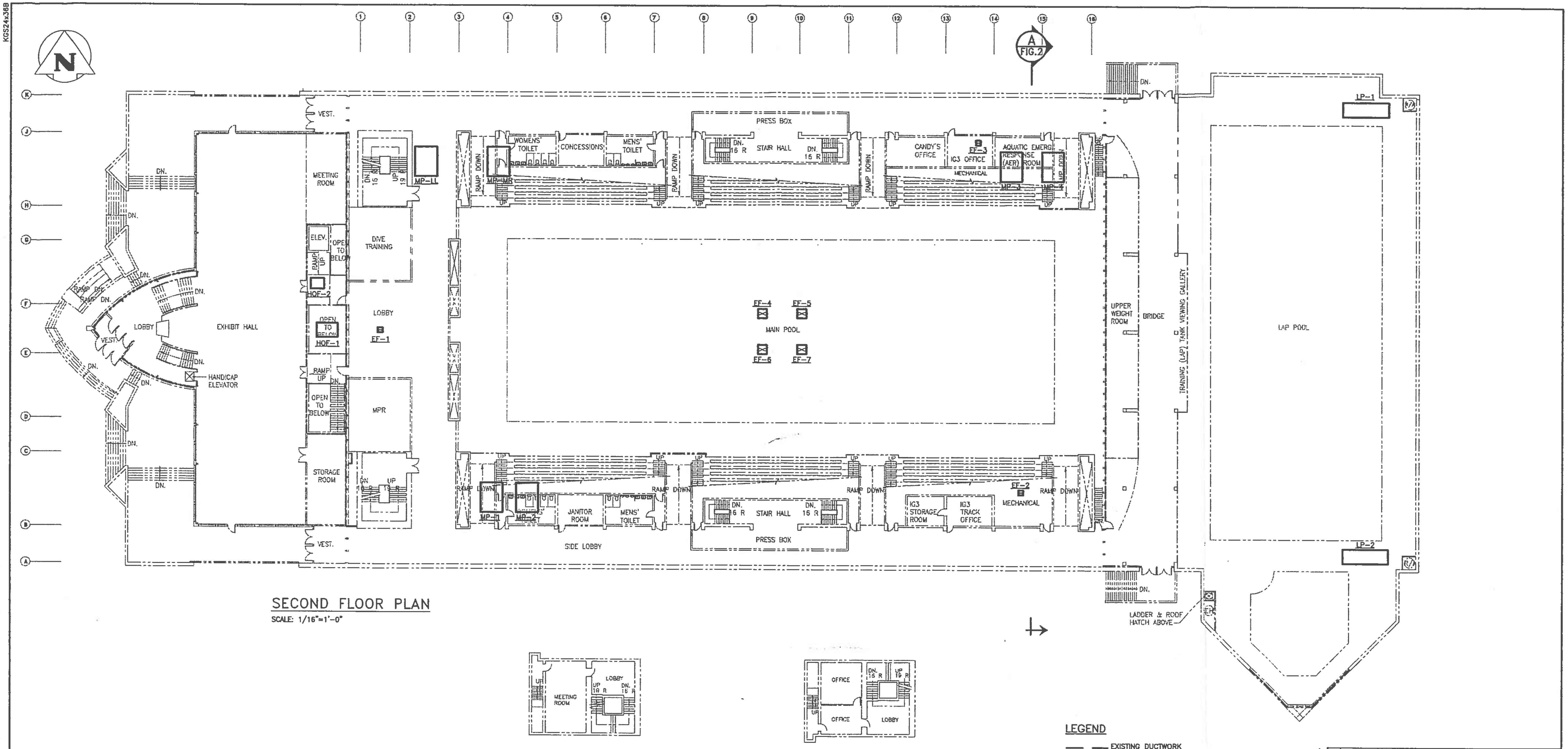
Table 2
Pan-Am Pool
Mechanical and Electrical Upgrade Study
Capital Cost Estimate - Electrical Projects

Description	Main Service/ Electrical Room Upgrade	Sub-Distribution Panel Upgrades	Wiring Devices Upgrades	Main Pool Lighting	Pool Niche Lighting	Transfer Remaining Battery Packs to Generator	Transfer Exit Signage to Generator	Drown Alarm System Installation	Fire Alarm System Upgrades	PA System Upgrade	Low Voltage Lighting Controls	Lap Pool area and Niche Lighting	Lap Pool Emergency and Exit Lighting	Total Line Item Costs
Report Section Number	4.1.1 - 1	4.1.1 - 2	4.1.1 - 3	4.1.2 - 1	4.1.2 - 2	4.1.3 - 1	4.1.3 - 2	4.1.8	4.1.5	4.1.6	4.1.7	4.2.1	4.2.3	
Mechanical	10,000			5,000								4,000		19,000
Electrical	545,000	240,000	29,000	272,000	111,000	18,000	6,000	45,000	435,000	239,000	345,000	95,000	3,000	2,383,000
Structural	25,000	20,000	10,000	15,000	5,000	2,000	1,000		22,000	5,000		3,000	1,000	109,000
Subtotal	**580,000**	**260,000**	**39,000**	**292,000**	**116,000**	**20,000**	**7,000**	**45,000**	**457,000**	**244,000**	**345,000**	**102,000**	**4,000**	**2,511,000**
PST - 7%	40,600	18,200	2,800	20,500	8,200	1,400	500	3,200	32,000	17,100	24,200	7,200	300	176,000
Subtotal	**620,600**	**278,200**	**41,800**	**312,500**	**124,200**	**21,400**	**7,500**	**48,200**	**489,000**	**261,100**	**369,200**	**109,200**	**4,300**	**2,687,000**
General Requirements - 12%	74,500	33,400	5,100	37,500	15,000	2,600	900	5,800	58,700	31,400	44,400	13,200	600	323,000
Fee - 3%	20,900	9,400	1,500	10,500	4,200	800	300	1,700	16,500	8,800	12,500	3,700	200	91,000
Subtotal	**716,000**	**321,000**	**48,400**	**360,500**	**143,400**	**24,800**	**8,700**	**55,700**	**564,200**	**301,300**	**426,100**	**126,100**	**5,100**	**3,101,000**
Contingency - 20%	143,200	64,200	9,700	72,100	28,700	5,000	1,800	11,200	112,900	60,300	85,300	25,300	1,100	621,000
Construction Subtotal	**860,000**	**386,000**	**59,000**	**433,000**	**173,000**	**29,800**	**10,500**	**67,000**	**678,000**	**362,000**	**512,000**	**152,000**	**7,000**	**3,722,000**
Detailed Engineering & Construction Admin Support - 15%	129,000	57,900	8,900	65,000	26,000	4,500	1,600	10,100	101,700	54,300	76,800	22,800	1,100	559,000
City Divisional Adminstration Fee - 3%	25,800	11,600	1,800	13,000	5,200	900	400	2,100	20,400	10,900	15,400	4,600	300	112,000
City Corporate Finance & Administration Fee - 3%	25,800	11,600	1,800	13,000	5,200	900	400	2,100	20,400	10,900	15,400	4,600	300	112,000
Subtotal	**1,041,000**	**468,000**	**72,000**	**524,000**	**210,000**	**36,100**	**12,900**	**82,000**	**821,000**	**439,000**	**620,000**	**184,000**	**9,000**	**4,505,000**
GST - 5%	53,000	24,000	4,000	27,000	11,000	1,900	700	5,000	42,000	22,000	31,000	10,000	1,000	226,000
Total Project Cost	**$1,094,000**	**$492,000**	**$76,000**	**$551,000**	**$221,000**	**$38,000**	**$14,000**	**$87,000**	**$863,000**	**$461,000**	**$651,000**	**$194,000**	**$10,000**	**$4,731,000**

FIGURES

KGS24x36B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG.1.dwg – Tab: FIG1 Plotted By: VHewitt 06/29/2010 [Tue 10:35am]
24"x36"/PLOT SCALE: 1"=1"



SECOND FLOOR PLAN

SCALE: 1/16"=1'-0"

NORTH MEZZANINE FLOOR

SCALE: 1/16"=1'-0"

SOUTH MEZZANINE FLOOR

SCALE: 1/16"=1'-0"

LEGEND

— —	EXISTING DUCTWORK
——	NEW DUCTWORK & EQUIPMENT
	ACCESS WALKWAY
MP 1–4	NEW MAIN POOL AHU
LP 1–2	NEW LAP POOL AHU
MP–LL	MAIN POOL LOWER LEVEL AHU
MP–MR	MAIN POOL – MECHANICAL ROOM AHU
EF–1	MAIN FLOOR WASHROOM EXHAUST – IN ROOF TRUSS SPACE
EF–2	LOWER LEVEL WOMEN'S WASHROOM EXHAUST – UNDER STANDS
EF–3	LOWER LEVEL MEN'S WASHROOM EXHAUST – UNDER STANDS
EF–4–7	MAIN POOL AREA EXHAUST FANS
HOF–1	HALL OF FAME AHU–HEAT/COOL
HOF–2	HALL OF FAME AHU–COOL

10 0 10 20 30 40 50 FT.

SCALE: 1/16"=1'-0" (24" X 36")
1/32"=1'-0" (11" X 17")

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RED
NO.	YY/MM/DD	DESCRIPTION	BY

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN – AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

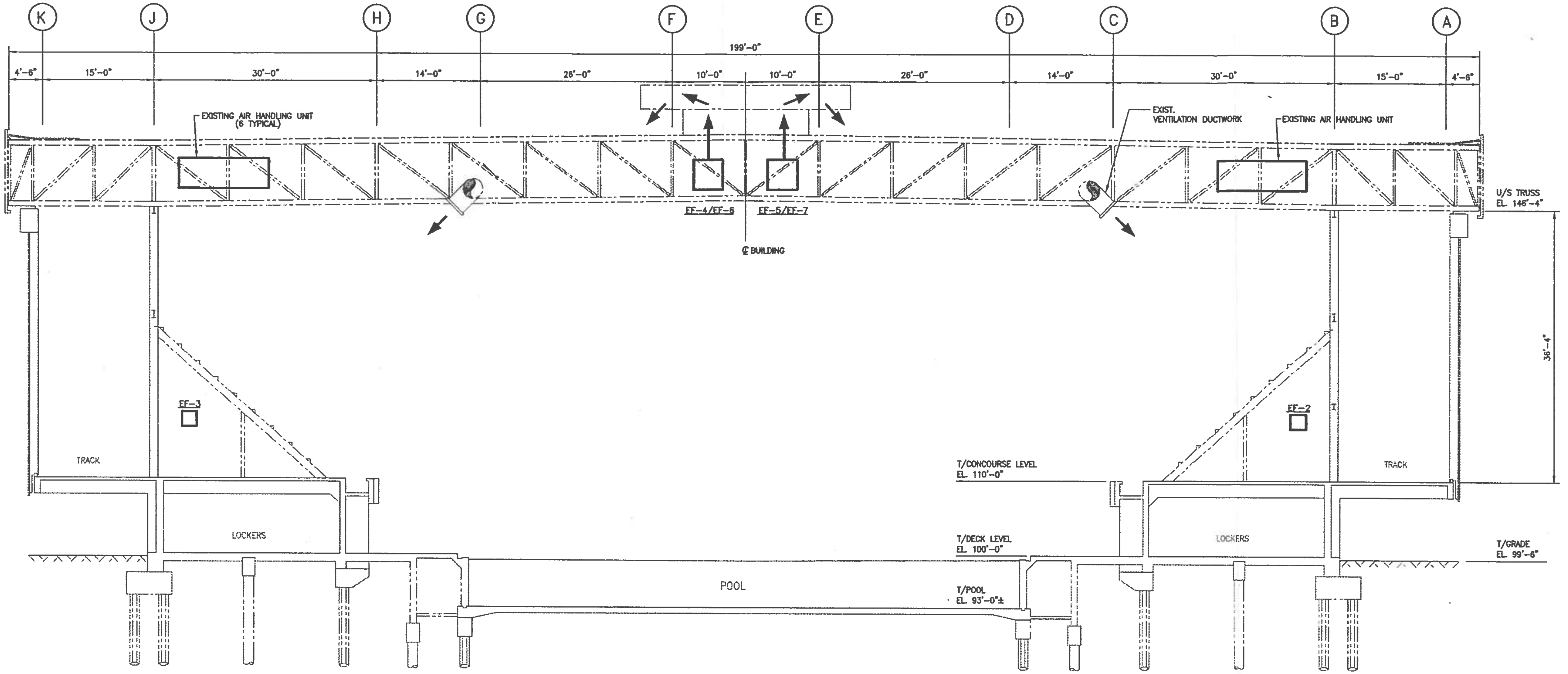
DWG. DESCRIPTION:
AIR HANDLING UNITS
EXISTING LAYOUT – PLAN

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY:	XXX	DATE:	10/02/25
DESIGN CHECK:	XXX	DATE:	10/02/25
DRAWN BY:	VJH	DATE:	10/03/25
DWG CHECK:	XXX	DATE:	10/02/25

DWG. NO.: FIGURE 1
REV: B

KGS24x36B



A FIG.1 ELEVATION
SCALE: 1/8"=1'-0"

10 5 0 5 10 15 20 FT.
SCALE: 1/8"=1'-0" (24" X 36")
1/16"=1'-0" (11" X 17")

LEGEND

———	EXISTING
MP 1-4	NEW MAIN POOL AHU
LP 1-2	NEW LAP POOL AHU
MP-LL	MAIN POOL LOWER LEVEL AHU
MP-MR	MAIN POOL - MECHANICAL ROOM AHU
EF-1	MAIN FLOOR WASHROOM EXHAUST
EF-2	LOWER LEVEL WOMEN'S WASHROOM EXHAUST UNDER STANDS
EF-3	LOWER LEVEL MEN'S WASHROOM EXHAUST UNDER STANDS
EF-4-7	MAIN POOL AREA EXHAUST FANS

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

NO.	YY/MM/DD	DESCRIPTION	BY
B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RED

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN - AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

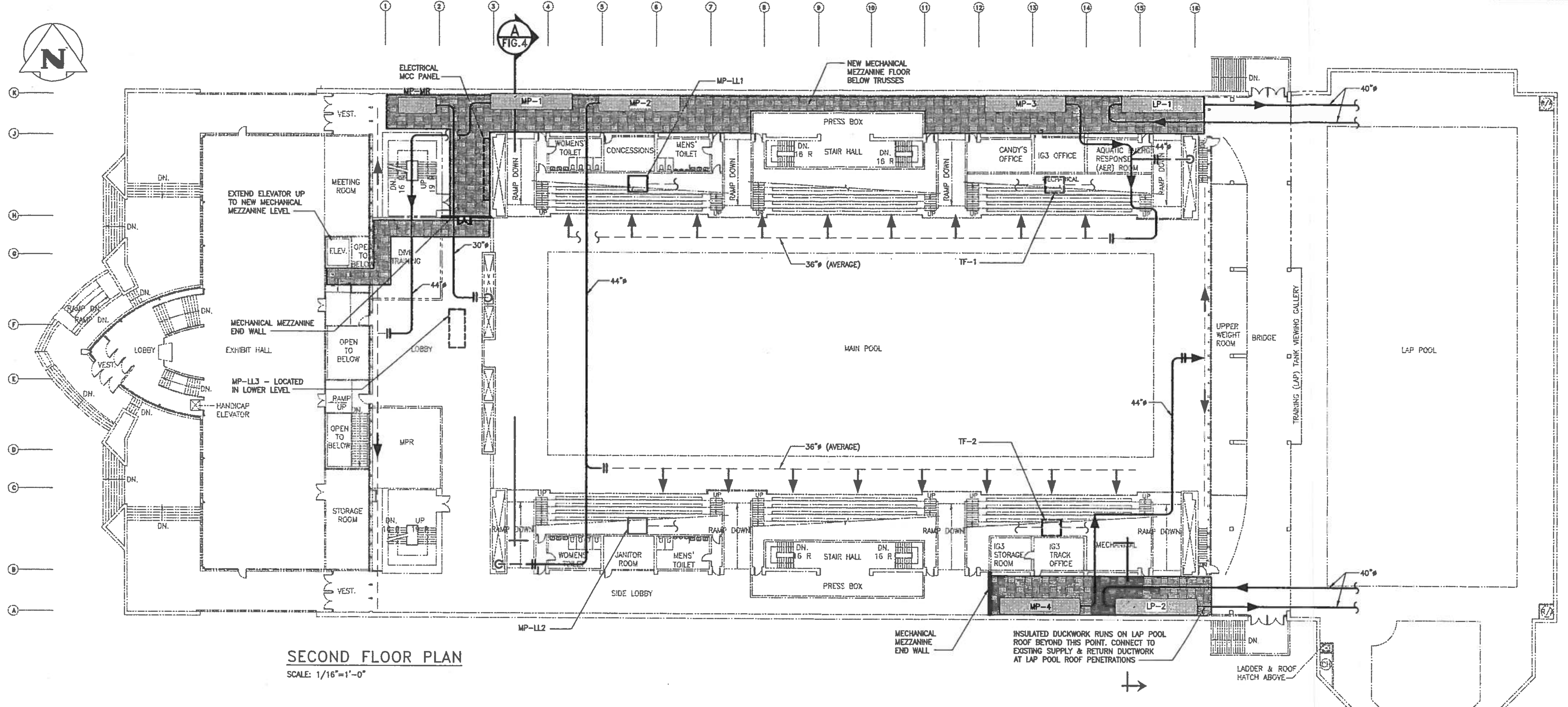
DWG. DESCRIPTION:
AIR HANDLING UNITS
EXISTING LAYOUT - ELEVATION

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY: XXX	DATE: 10/02/25
DESIGN CHECK: XXX	DATE: 10/02/25
DRAWN BY: VJH	DATE: 10/03/25
DWG CHECK: XXX	DATE: 10/02/25

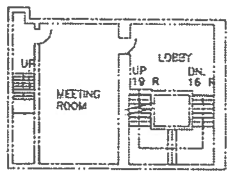
DWG. NO. FIGURE 2
REV: B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG.2.dwg - Tab: FIG2 Plotted By: VHewitt 06/29/2010 [Tue 11:09am]
24"x36"/PLOT SCALE: 1"=1"



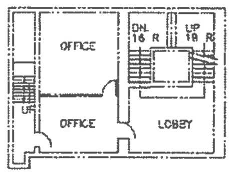
SECOND FLOOR PLAN

SCALE: 1/16"=1'-0"



NORTH MEZZANINE FLOOR

SCALE: 1/16"=1'-0"



SOUTH MEZZANINE FLOOR

SCALE: 1/16"=1'-0"

LEGEND

— — —	EXISTING DUCTWORK
———	NEW DUCTWORK & EQUIPMENT
▨	ACCESS WALKWAY
MP 1-4	NEW MAIN POOL AHU
LP 1-2	NEW LAP POOL AHU
MP-LL	MAIN POOL LOWER LEVEL AHU
MP-MR	MAIN POOL MECHANICAL ROOM AHU
HC	HEATING COIL
TF1 & 2	TRANSFER FAN - EXISTING
MP-LL1	MEN'S LOCKER ROOM - LOCATE UNDER STANDS
MP-LL2	WOMEN'S LOCKER ROOM - LOCATE UNDER STANDS
MP-LL3	STAFF LOCKER ROOM - LCCATE IN LOWER LEVEL

10 0 10 20 30 40 50 FT.

SCALE: 1/16"=1'-0" (24" X 36")
1/32"=1'-0" (11" X 17")

NO.	YY/MM/DD	DESCRIPTION	BY
B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RED

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN - AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

DWG. DESCRIPTION:
AIR HANDLING UNITS AND SUPPLY
DUCTWORK
PROPOSED LAYOUT - PLAN

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY:	XXX	DATE:	10/02/25
DESIGN CHECK:	XXX	DATE:	10/02/25
DRAWN BY:	VJH	DATE:	10/03/26
DWG CHECK:	XXX	DATE:	10/02/25

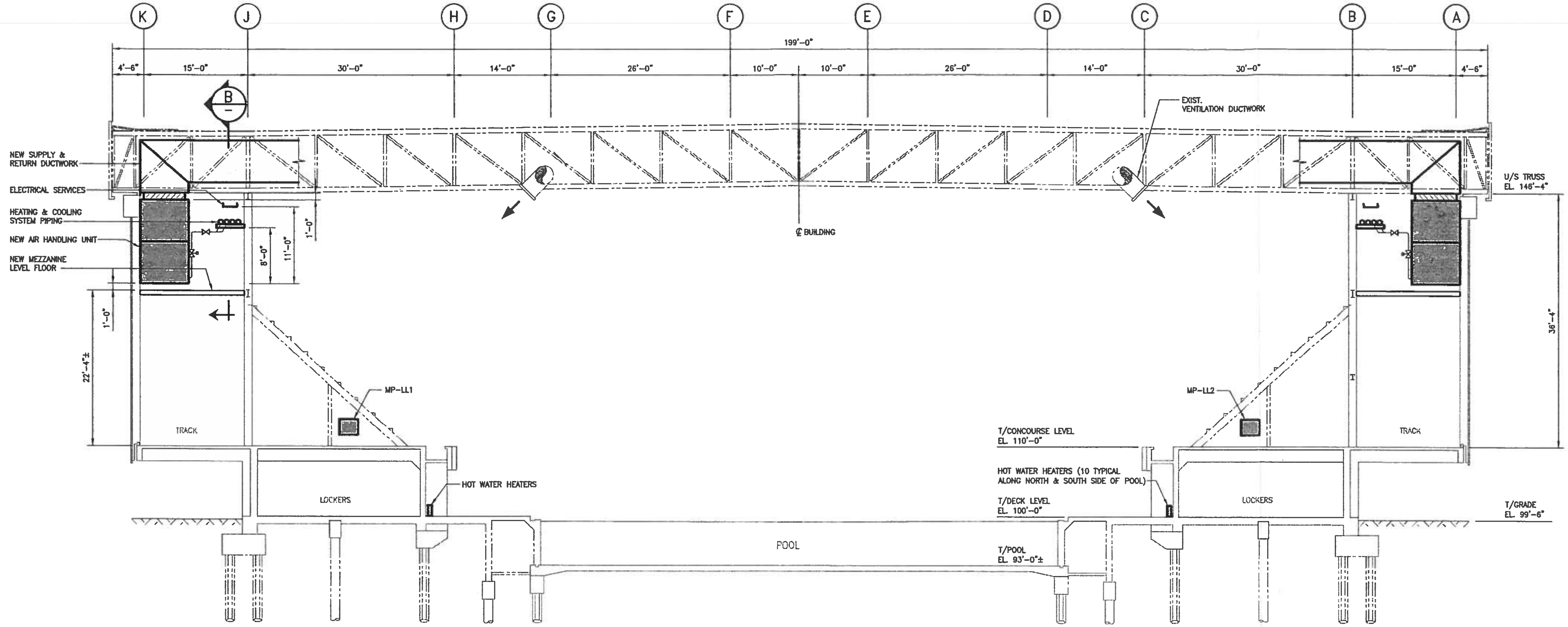
ENG. STAMP

DWG. NO.
FIGURE 3
REV:
B

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

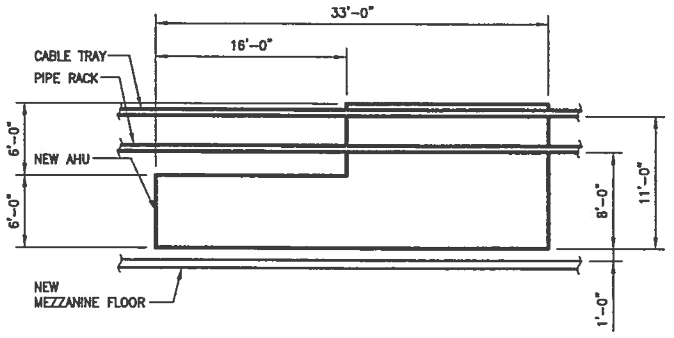
KGS24x36B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG3.dwg - Tab: FIG3 Plotted By: VHewitt 06/29/2010 [Tue 10:51am]
24"x36"/PLOT SCALE: 1"=1"



A
FIG.3
ELEVATION
SCALE: 1/8"=1'-0"

SCALE: 1/8"=1'-0" (24" X 36")
1/16"=1'-0" (11" X 17")



B
—
ELEVATION
SCALE: 1/8"=1'-0"

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

NO.	YY/MM/DD	DESCRIPTION	BY
B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RED

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN – AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

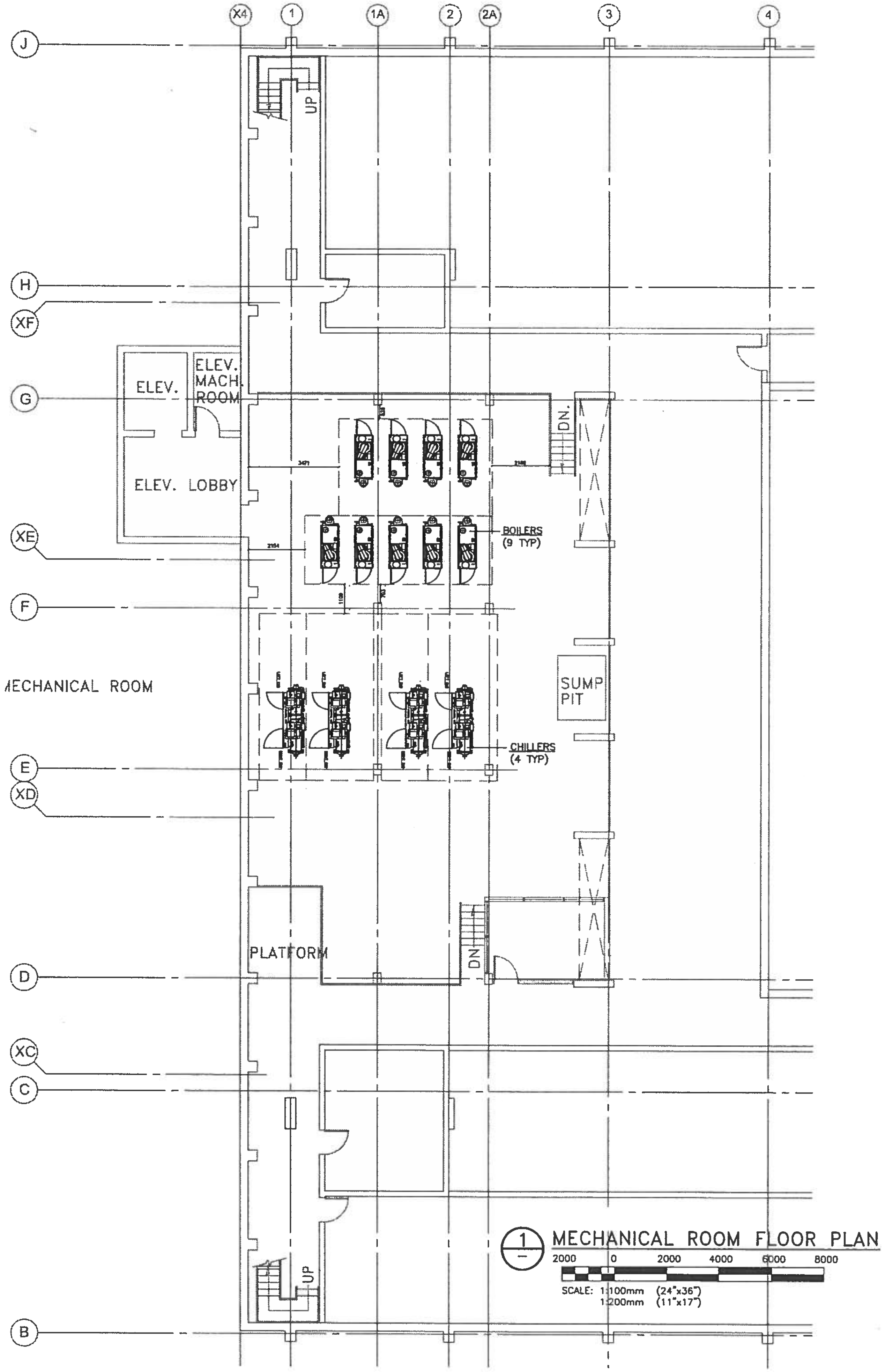
DWG. DESCRIPTION:
AIR HANDLING UNITS
PROPOSED LAYOUT – ELEVATION

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY:	XXX	DATE: 10/02/25
DESIGN CHECK:	XXX	DATE: 10/02/25
DRAWN BY:	EDC	DATE: 10/02/25
DWG CHECK:	XXX	DATE: 10/02/25

DWG. NO. FIGURE 4
REV: B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG.4.dwg – Tab: FIG4 Plotted By: VHewitt 06/29/2010 [Tue 11:14am]
24"x36"/PLOT SCALE: 1"=1"



1 MECHANICAL ROOM FLOOR PLAN

SCALE: 1:100mm (24"x36")
1:200mm (11"x17")

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

NO.	YY/MM/DD	DESCRIPTION	BY
B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RBB

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN – AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

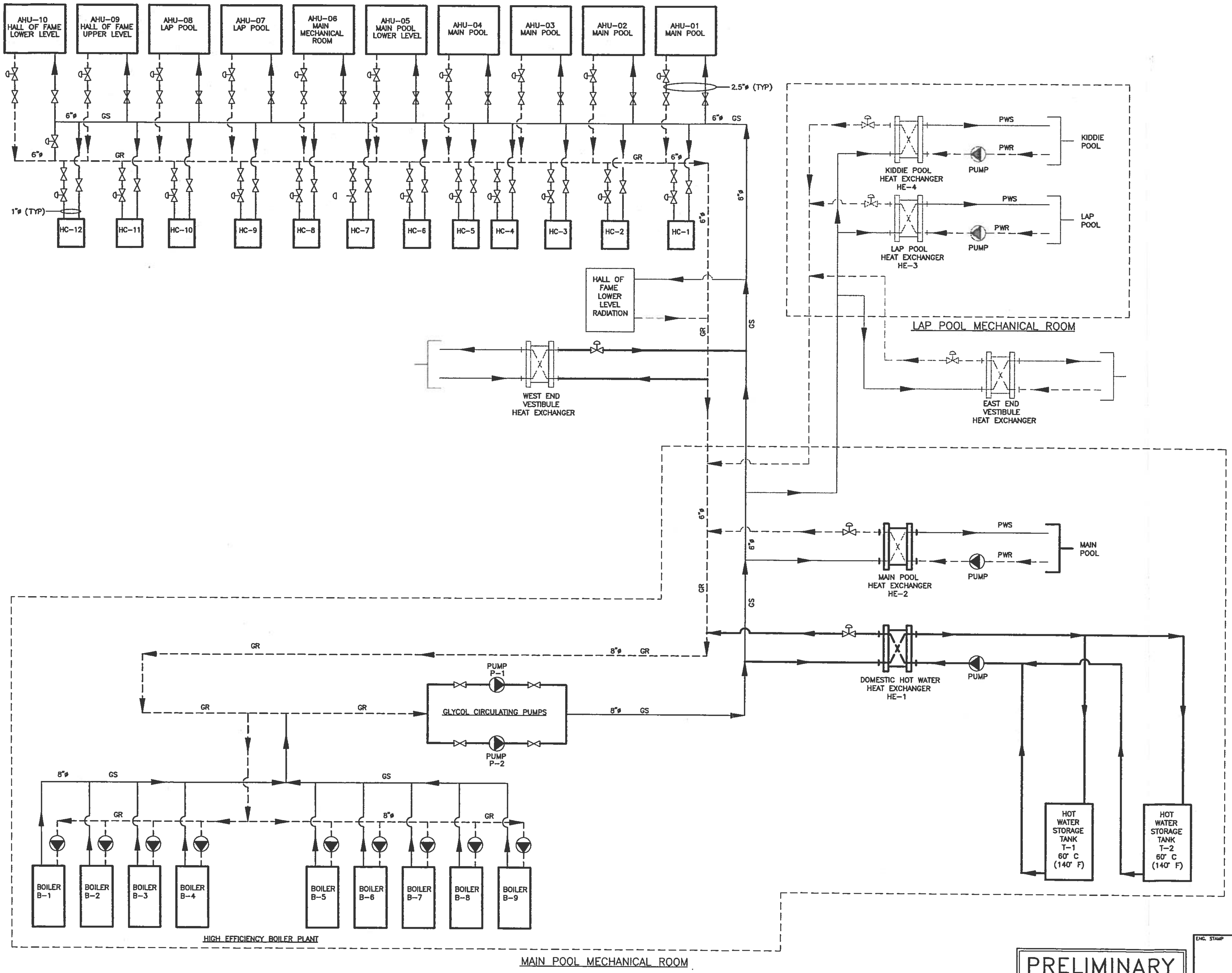
DWG. DESCRIPTION:
MECHANICAL ROOM FLOOR PLAN
PROPOSED EQUIPMENT LAYOUT

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY:
DATE (YY/MM/DD):
DESIGN CHECK:
DATE:
DRAWN BY: VJH
DATE: 10/03/24
DWG CHECK:
DATE:

DWG. NO.: FIGURE 5
REV: B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG.5.dwg - Tab: FIG5 Plotted By: VHewitt 10/06/29 [Tue 11:17am]
24"x36" / PLOT SCALE: 1:1 (METRIC)



LEGEND:

━━	NEW PIPING OR EQUIPMENT
——	EXISTING PIPING OR EQUIPMENT
●	CIRCULATING PUMP
	CONTROL VALVE
➔	FLOW ARROW
AHU	AIR HANDLING UNIT
GS	GLYCOL SUPPLY
GR	GLYCOL RETURN
PWS	POOL WATER SUPPLY
PWR	POOL WATER RETURN
DHW	DOMESTIC HOT WATER
HC-1 TO 12	HEATING COILS

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

NO.	YY/MM/DD	DESCRIPTION	BY
B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RED

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN – AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

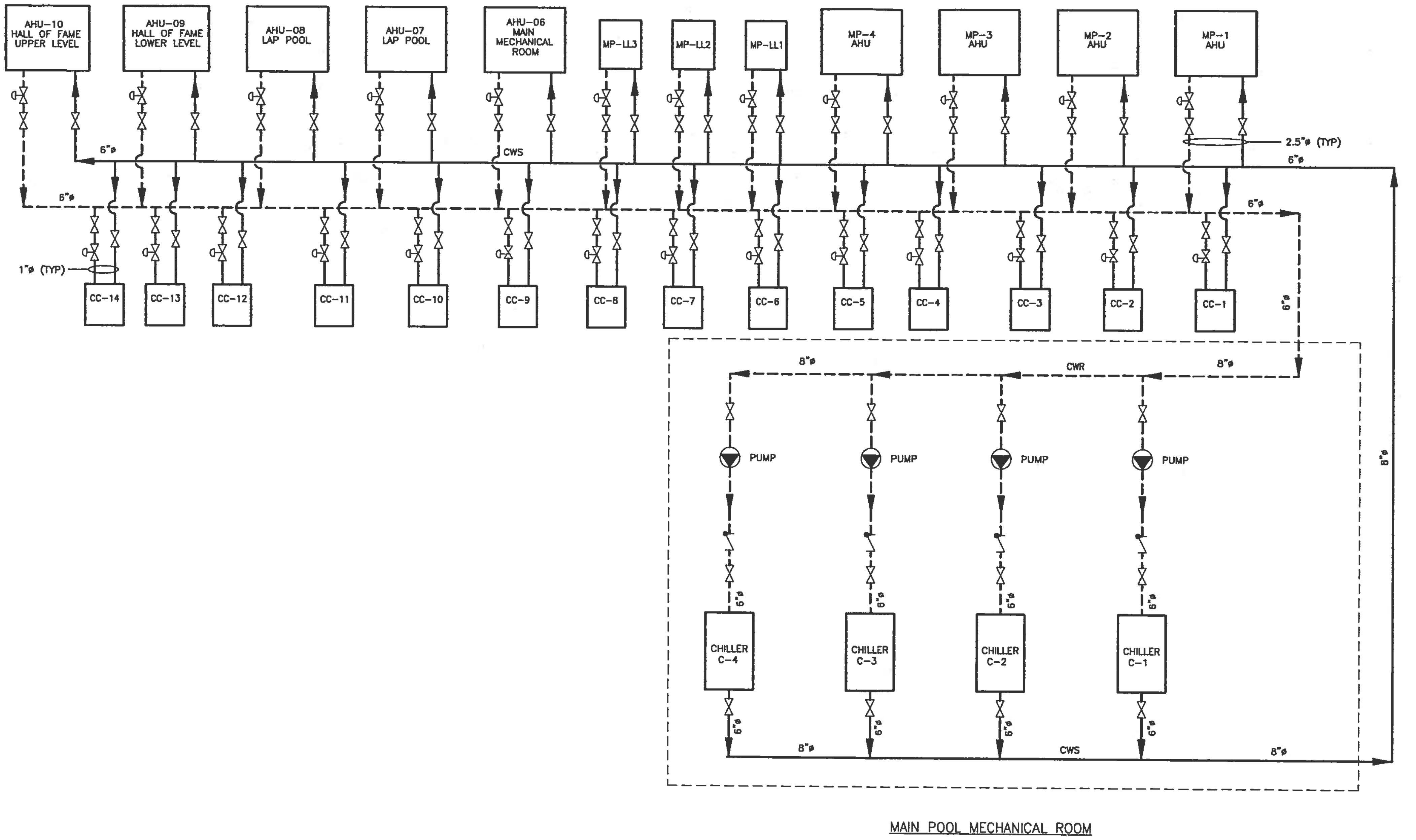
DWG. DESCRIPTION:
PROPOSED HEATING SYSTEM
FLOW DIAGRAM

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY: RED/PSS	DATE (YY/MM/DD): 10/03/24
DESIGN CHECK:	DATE:
DRAWN BY: VJH	DATE: 10/03/24
DWG CHECK:	DATE:

DWG. NO. FIGURE 6
REV: B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG.6.dwg – Tab: FIG6 Plotted By: VHewitt 10/06/29 [Tue 11:27am]
24"x36"/PLOT SCALE: 1:1 (METRIC)



LEGEND:

━━━	NEW PIPING OR EQUIPMENT
───	EXISTING PIPING OR EQUIPMENT
◐	CIRCULATING PUMP
─⋈─	CONTROL VALVE
─⋈─	ISOLATION VALVE
─►─	FLOW ARROW
AHU	AIR HANDLING UNIT
CC	COOLING COILS
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
FC-1 TO 14	COOLING ONLY FAN COOL UNITS
MP-LL1	MEN'S LOCKER ROOM - LOCATE UNDER STANDS
MP-LL2	WOMEN'S LOCKER ROOM - LOCATE UNDER STANDS
MP-LL3	STAFF LOCKER ROOM - LOCATE IN LOWER LEVEL

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

NO.	YY/MM/DD	DESCRIPTION	BY
B	10/06/29	ISSUED FOR FINAL REVIEW	
A	10/04/16	ISSUED FOR REVIEW	RED

REVISIONS / ISSUE

CLIENT:
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN - AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

DWG. DESCRIPTION:
PROPOSED CENTRAL COOLING SYSTEM
FLOW DIAGRAM

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY: RED/PSS	DATE (YY/MM/DD): 10/03/24
DESIGN CHECK:	DATE:
DRAWN BY: VJH	DATE: 10/03/24
DWG CHECK:	DATE:

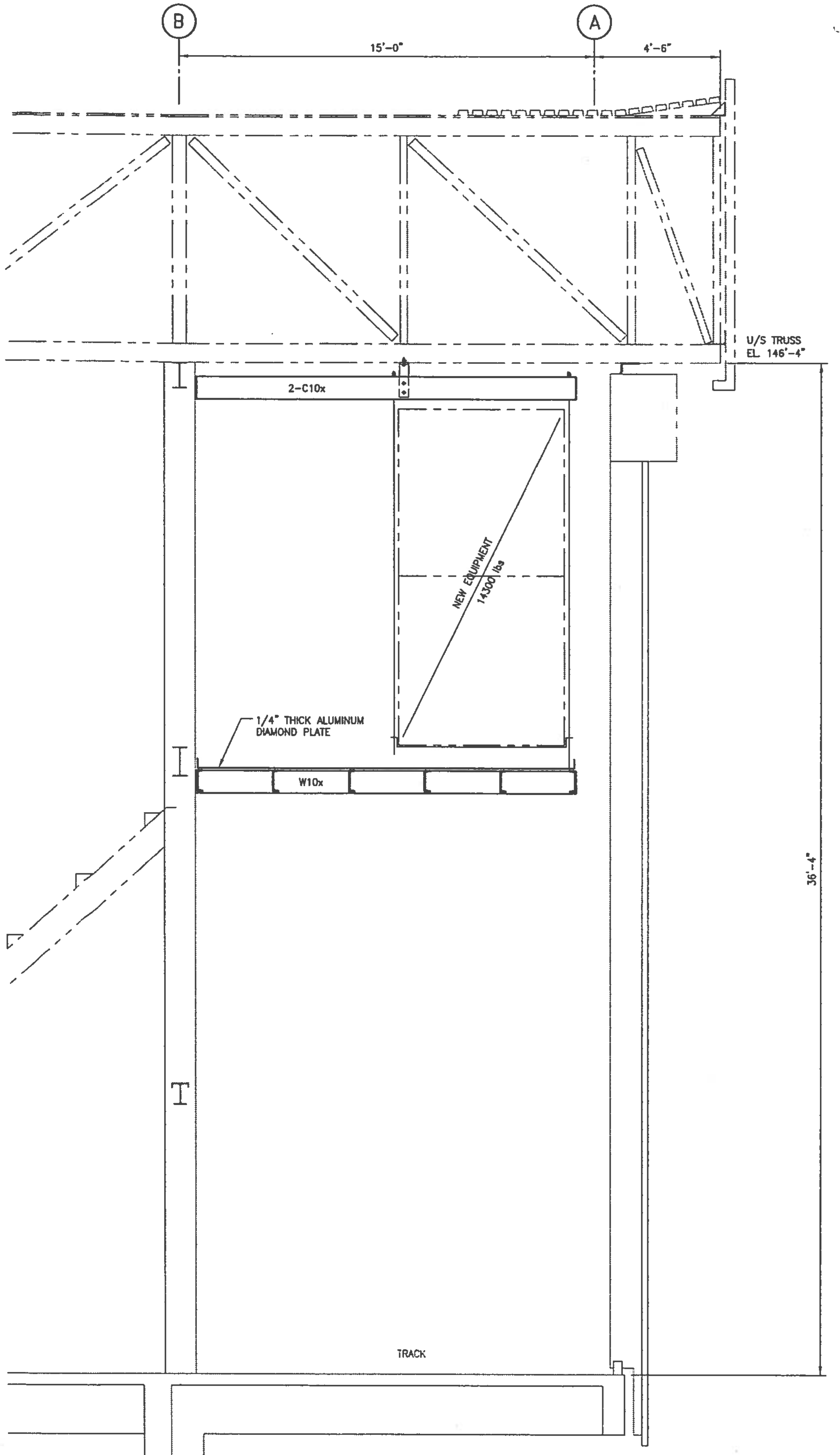
DWG. NO. FIGURE 7
REV: B

FileName: P:\Projects\2009\09-0107-22\Dwg\Mech\09-0107-22FIG.7.dwg - Tab: FIG7 Plotted By: VHewitt 10/06/29 [Tue 11:47am]
24"x36"/PLOT SCALE: 1:1 (METRIC)

FileName: P:\Projects\2009\09-0107-22\Dwg\Struct\09-0107-22-FIG.8.dwg – Tab: S01 Plotted By: VHewitt 10/06/29 [Tue 11:51am]
24"x36"/PLOT SCALE: AS NOTED

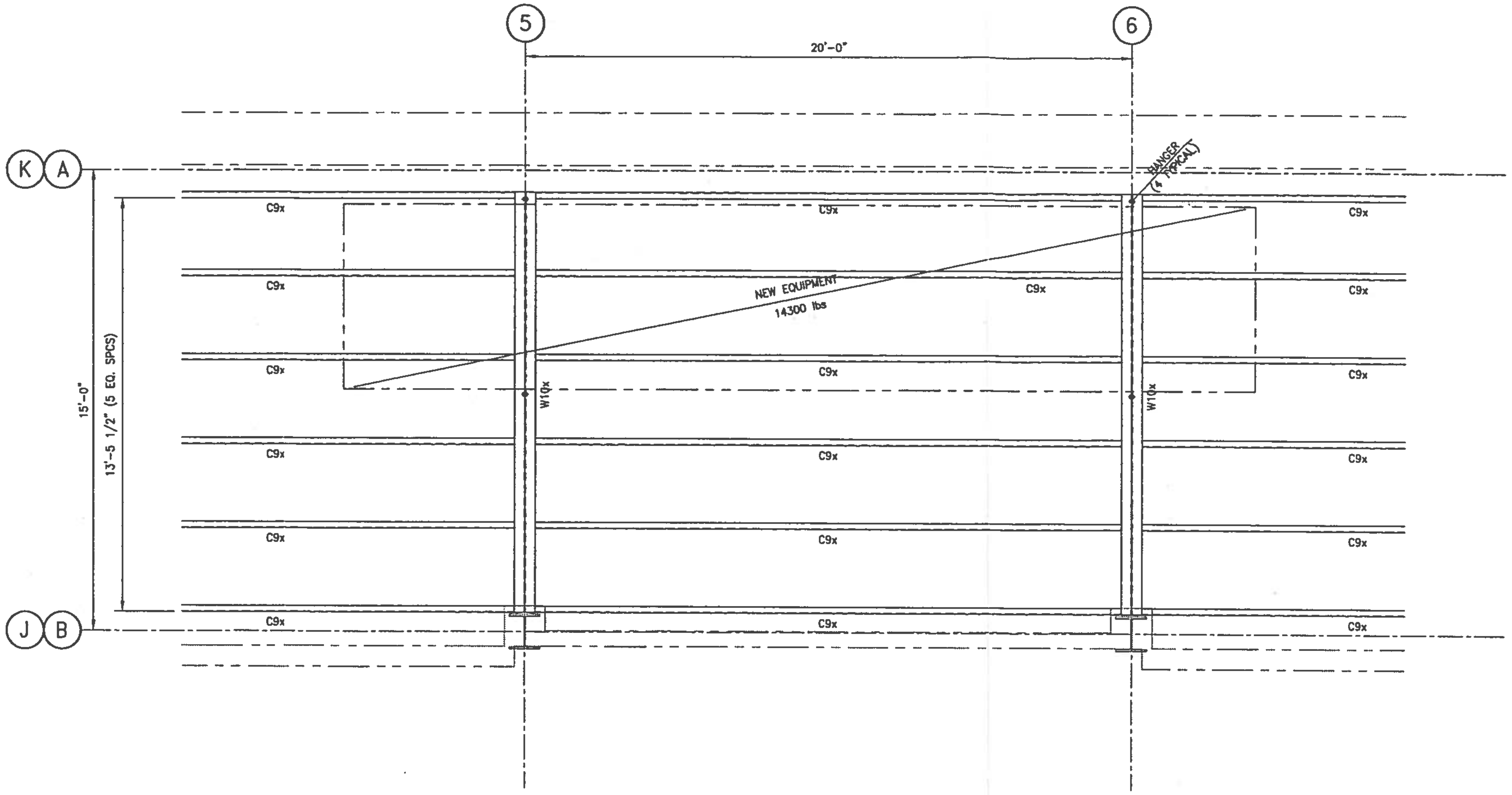
NOTES:

1. –



B MEZZANINE SECTION

SCALE: 3/8"=1'-0" (24x36)
3/16"=1'-0" (11x17)



A PARTIAL CATWALK FLOOR PLAN – DESIGN FLOOR LIVE LOAD – 25 psf

SCALE: 3/8"=1'-0" (24x36)
3/16"=1'-0" (11x17)

SCALE: 3/8"=1'-0" (24" X 36")
3/16"=1'-0" (11" X 17")

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ENG. STAMP

NO.	YY/MM/DD	DESCRIPTION	BY
A	10/06/29	ISSUED FOR FINAL REVIEW	

REVISIONS / ISSUE

CLIENT:
Winnipeg
THE CITY OF WINNIPEG
PLANNING, PROPERTY AND DEVELOPMENT DEPT.

PROJECT:
PAN – AM POOL
M & E SYSTEMS UPGRADE
DEFINITION STUDY

DWG. DESCRIPTION:
STRUCTURAL
AIR HANDLING UNIT SUPPORT
DETAIL

KGS GROUP
CONSULTING ENGINEERS

DESIGN BY: RJL
DATE (YY/MM/DD): 10/04/06
DESIGN CHECK:
DATE:
DRAWN BY: MBB
DATE: 10/04/06
DWG CHECK:
DATE:

DWG. NO.: FIGURE 8
REV: A

APPENDIX A

HVAC DESIGN CRITERIA

PAN-AM POOL – Mechanical and Electrical Systems Upgrade Definition Study

Design Criteria:

Heating, Air Conditioning, and Dehumidification

Winter:

Outdoor temperature:		-28 °F (-33 °C)
Indoor temperature – pools:		78 °F (26 °C)
Relative humidity – pools:		60% @ 78 °F (26 °C)
Indoor temperature – other areas:		70 °F (21 °C)
Pool Water Temperature –	Main & Lap pool:	82 °F (28 °C)
	Kiddie Pool:	86 °F (30 °C)

Summer:

Outdoor temperature:		86 °F (30 °C) @ 50% RH
Indoor temperature – pools:		78 °F (26 °C)
Indoor Relative humidity – pools:		60% @ 78 °F (26 °C)
Indoor temperature – other areas:		74 °F (24 °C)
Pool Water Temperature –	Main & Lap pool:	82 °F (28 °C)
	Kiddie Pool:	86 °F (30 °C)

Ventilation[1]

Pool and Deck – Main, Lap, and Kiddie Pools:	0.48 CFM/ft^2
Spectator Area – Main Pool	7.5 CFM/person plus 0.06 CFM/ft^2

---

[1] Ventilation rates based on ASHRAE Standard 62.1 – 2004.

Heating Loads:

Item	**Area**	**Heating Load** BTUH
Space Heating:		
	Main Pool	9,083,000
	Lap Pool	3,902,000
	Hall of Fame (HOF) - Upper Level	1,254,000
	Entrance and HOF basement	738,000
	Sub-Total	**14,977,000**
Pool Water Heating:		
	Main Pool	666,000
	Lap Pool	421,000
	Kiddie Pool	121,000
	Sub-Total	**1,208,000**
Domestic Water Heating:		
	Allowance:	5,000,000
	Total	**21,185,000**

Note:
Domestic Water Heating Load is based on 1 hour peak duration (where all 64 showers would operate continuously for one hour). It includes a 97 gpm recovery rate and a 2000 USG storage.

Cooling Loads

Existing Cooling Loads:

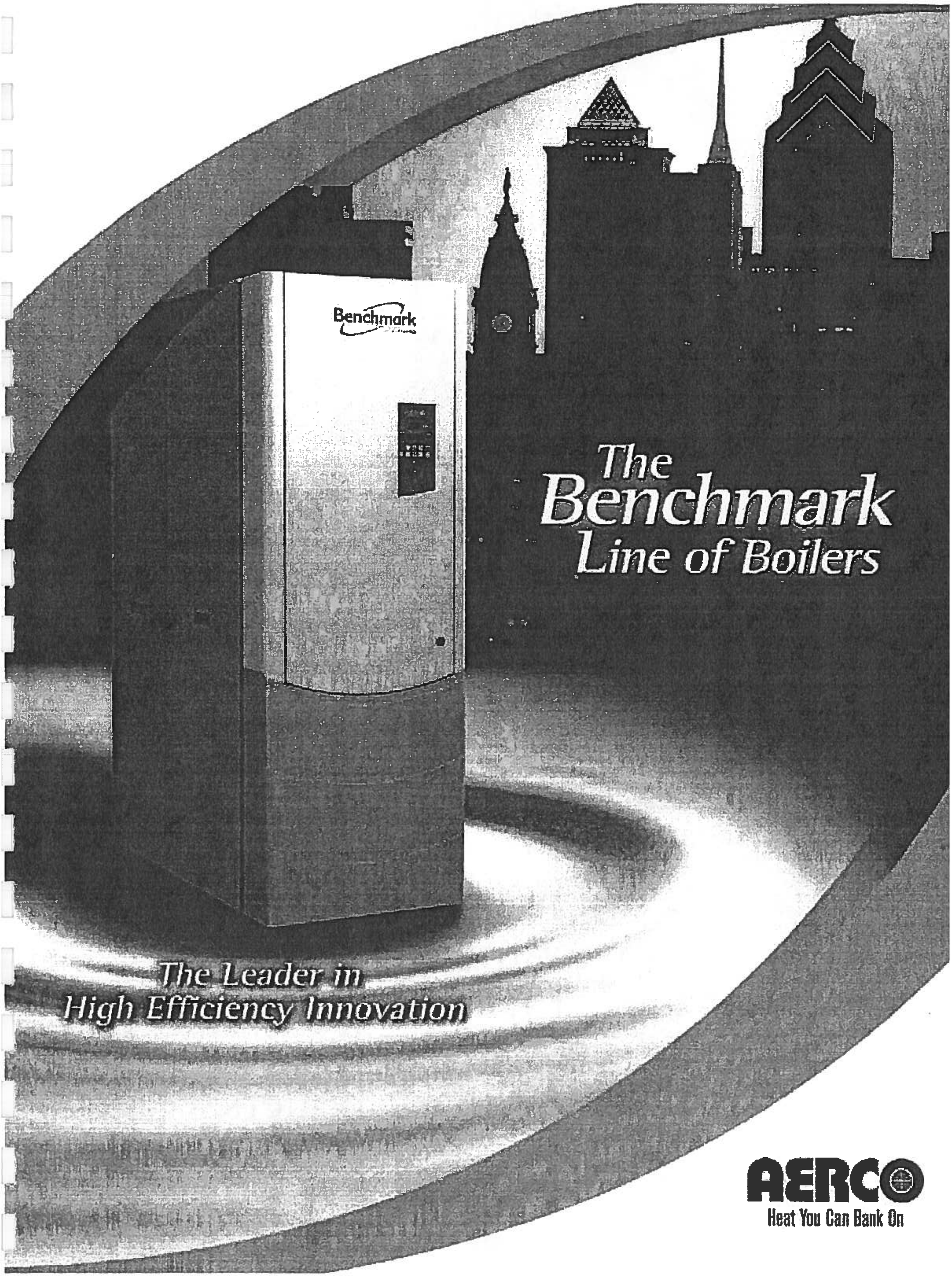
Area	Cooling Capacity	
	Ton	BTUH
Upper Weight Room (Carrier - Gemini Split Unit)	20	240,000
AHOF (Trane)	25	300,000
Front Lobby (Trane)	15	180,000
Hall of Fame Basement	35	420,000
Timing Office	1.3	15,000
UPS Room (P.A. Room)	1.3	15,000
Lower Weight Room	1.5	18,000
Community Services Office	1.5	18,000
Nursery	1	12,000
Computer Room	1	12,000
IG3 Office	1	12,000
Sport Group (office in stands (x5))	1	12,000
Engineers Office	0.8	10,000
First Air Office	0.4	5,000
IG3 (lap pool)	0.4	5,200
Staff Kitchen (Guards)	0.5	6,000
Candy's Office/IG3/AER Office	2.5	30,240
Sub-Total	**111**	**1,328,440**

New & Existing Cooling Loads:

Area	Cooling Capacity	
	Ton	BTUH
Main Pool Cooling	160	1,920,000
Lap Pool Cooling	80	960,000
Sub-Total	**240**	**2,880,000**
Total (New and Existing Loads)	**351**	**4,208,440**
Future Cooling Load Allowance	**49**	588,000
Grand Total	**400**	**4,796,440**

APPENDIX B

EQUIPMENT LITERATURE



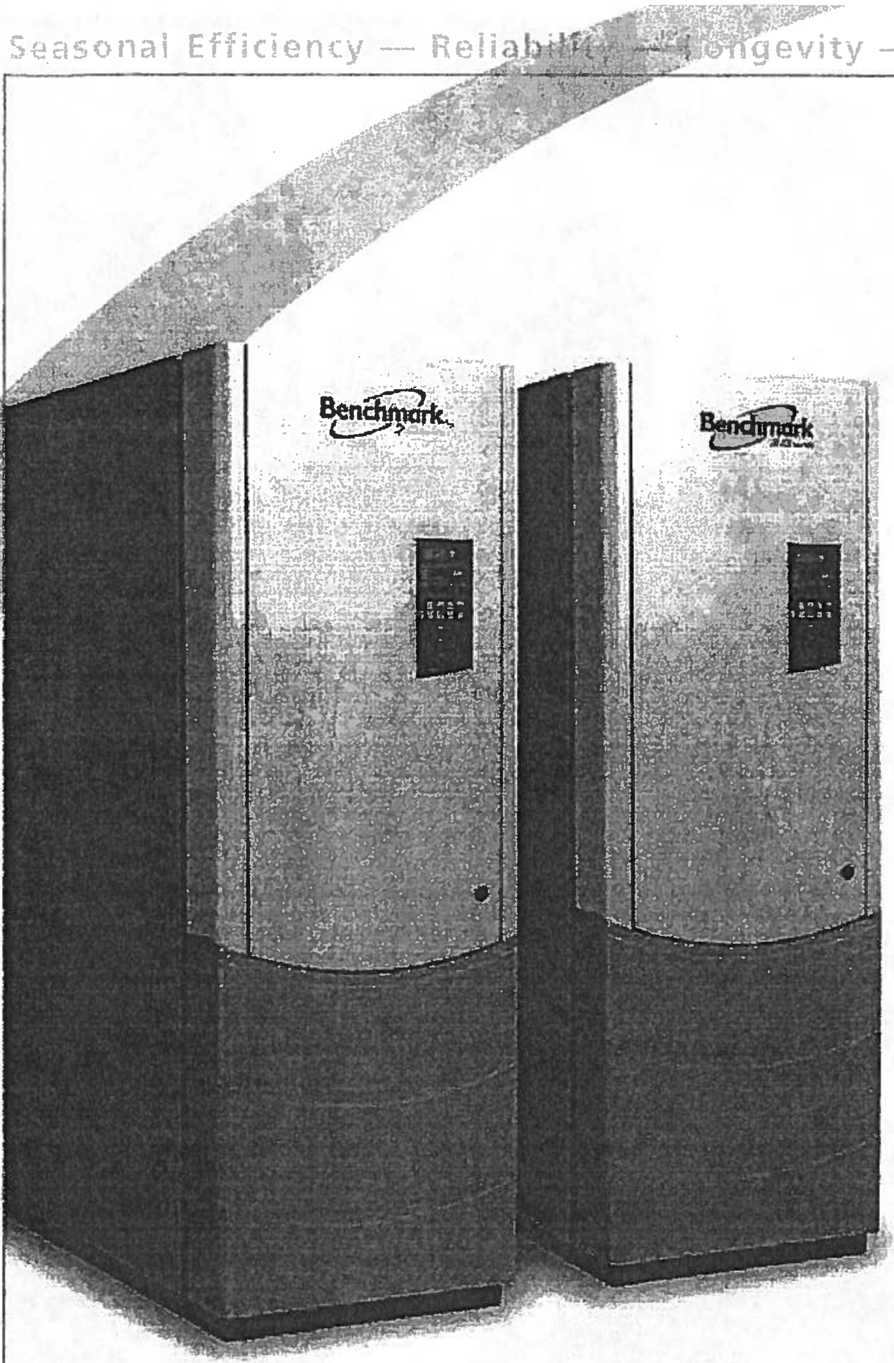
The Benchmark Line of Boilers

The Leader in
High Efficiency Innovation

AERCO
Heat You Can Bank On

Seasonal Efficiency — Reliability — Longevity — Fast ROI — Part-Load Efficienc

Seasonal Efficiency — Reliability — Longevity — Fast ROI — Part-Load Efficiency — Condensing Operation



"No one comes close to matching the 20:1 and 15:1 turndown of our condensing Benchmark boilers."

Seasonal Efficiency — Reliability — Longevity — Fast ROI — Part-Load Efficienc

THE AERCO STORY

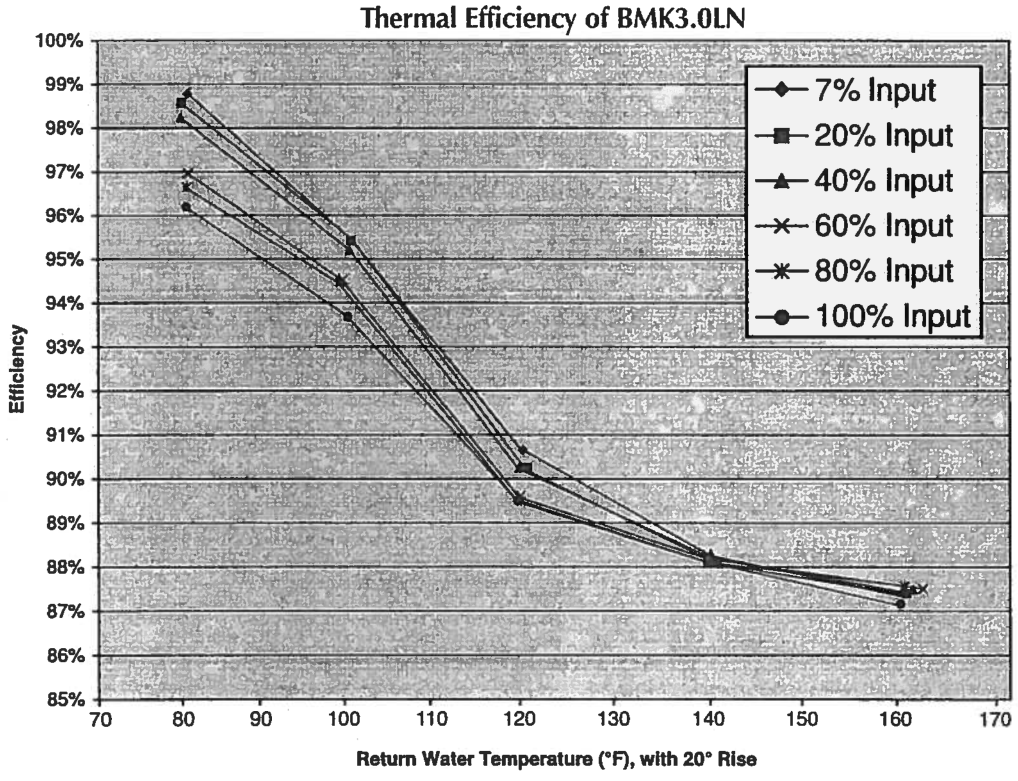
Ever since AERCO created the market for commercially sized, high-efficiency, hydronic heating products in the U.S. a generation ago, we have remained the category leader. A technology leader, we have focused exclusively on condensing and fully modulating solutions. An education leader, we have challenged conventional system design practices. A standards leader, we were the first manufacturer to publish part-load efficiency curves. And with our expanded line of Benchmark boilers, we have taken the lead once again…

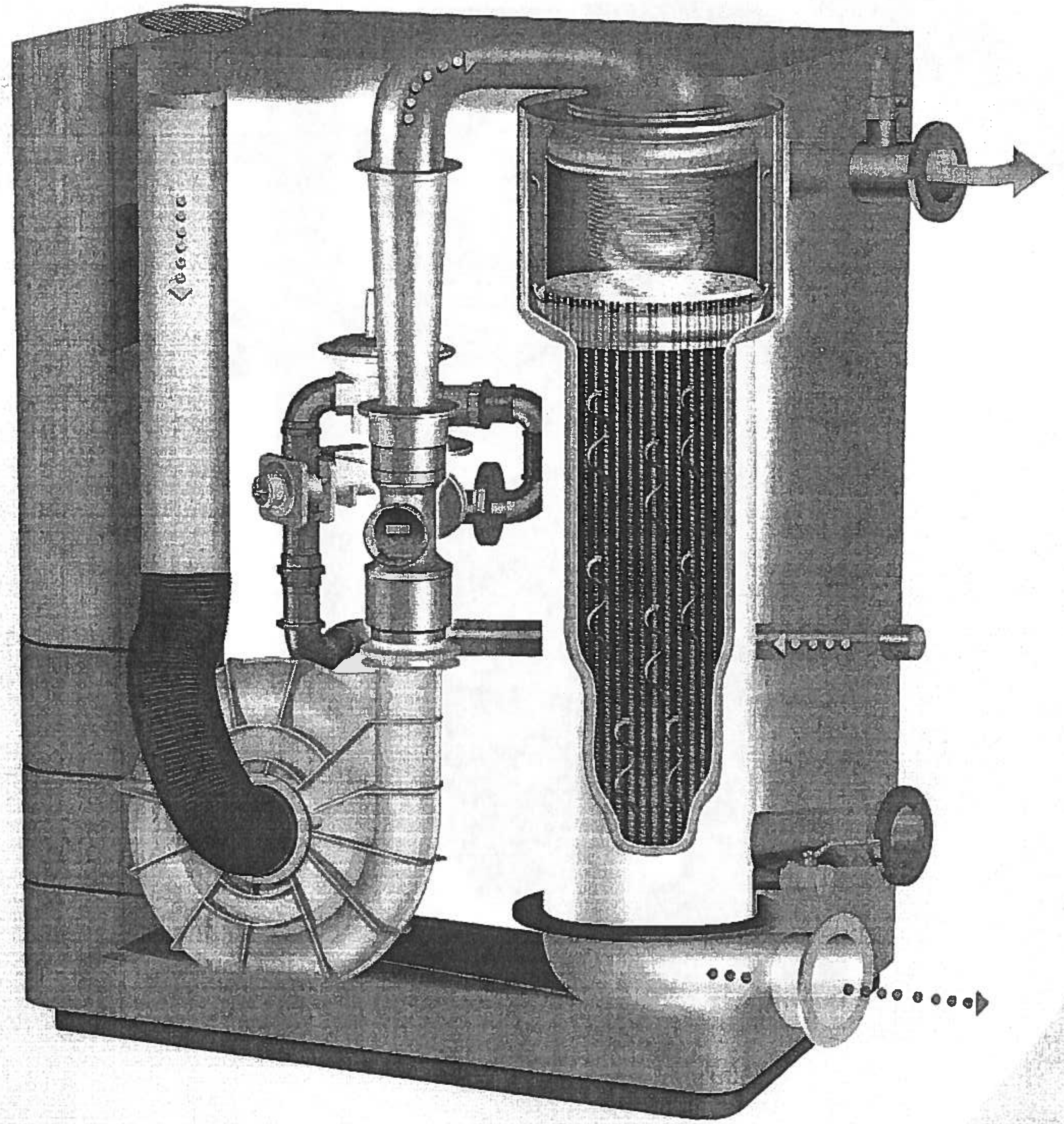
Seasonal Efficiency — Reliability — Longevity — Fast ROI — Part-Load Efficiency — Condensing Operation

EFFICIENCY YOU CAN TRUST

Both Benchmark 2 million and 3 million BTU/hr. boilers reflect AERCO's multidimensional approach to maximizing system efficiency:

- **Designed – and warranted – for condensing operation and thermal shock**
- **Unmatched 20:1 and 15:1 turndown maximizes seasonal efficiency**
  - Virtually eliminates cycling losses
  - Minimizes wear and tear
  - Improves temperature control
- **Highest efficiencies achieved at lowest firing rates**
- **AERCO BMS controller maximizes multiple-unit efficiency**
  - Operate boiler plants with 40:1, 60:1, 80:1 and better turndown
  - Leverage inverse efficiency profile to maximize fuel savings
- **Simplify and streamline overall systems design for greater savings**

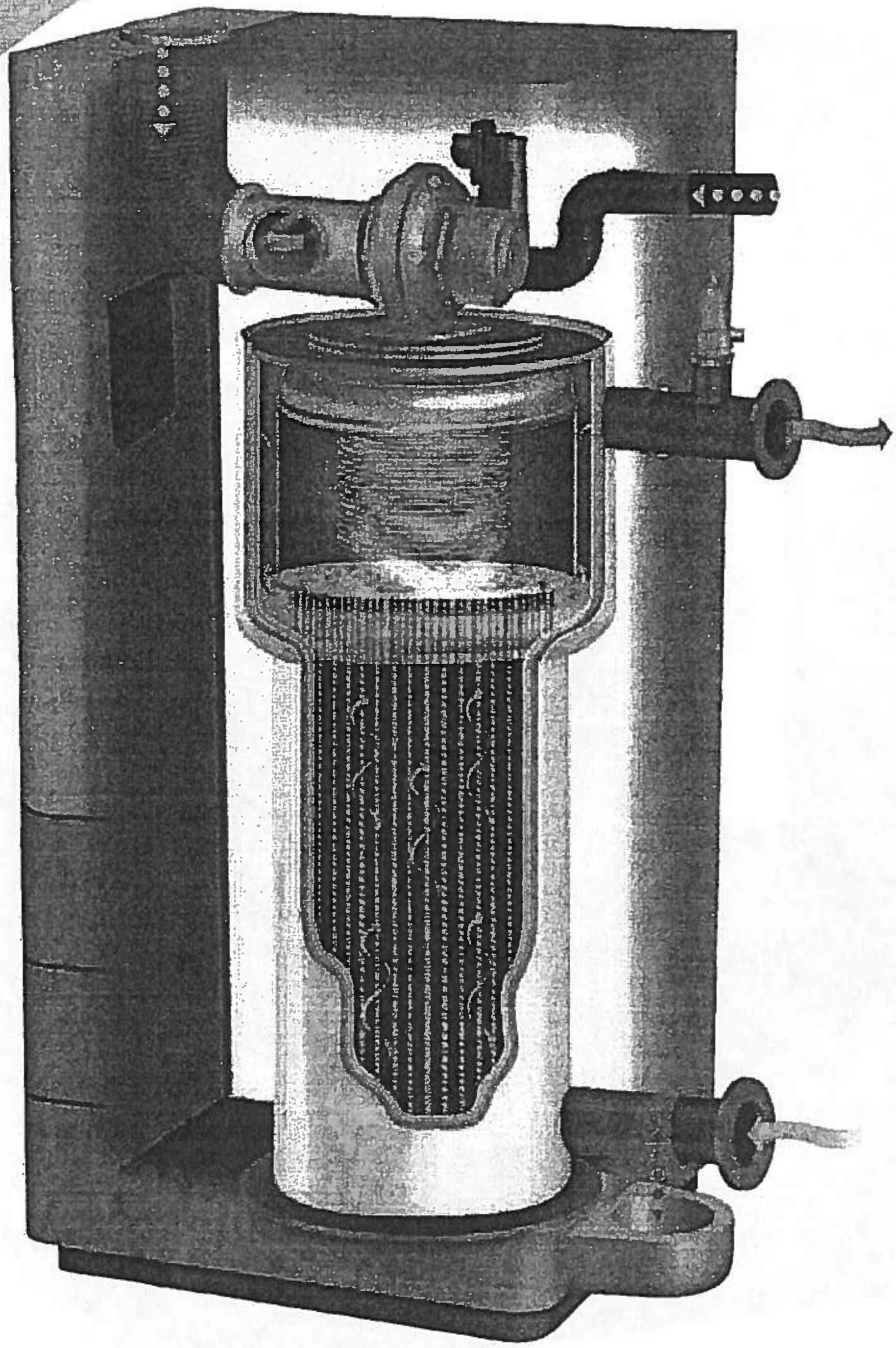

Thermal Efficiency of BMK3.0LN



Benchmark 2.0 Low NOx (original)

BTU Input	2,000,000 BTU/hr.
BTU Output	1,720,000–1,860,000 BTU/hr.
Efficiency	99.2% at low fire with 60°F inlet water
Turndown Ratio	20:1
Dimensions	79"H x 28"W x 55"D
Gas Requirements	5.3" W.C. minimum at full load
Weight, Wet	1,750 lbs.

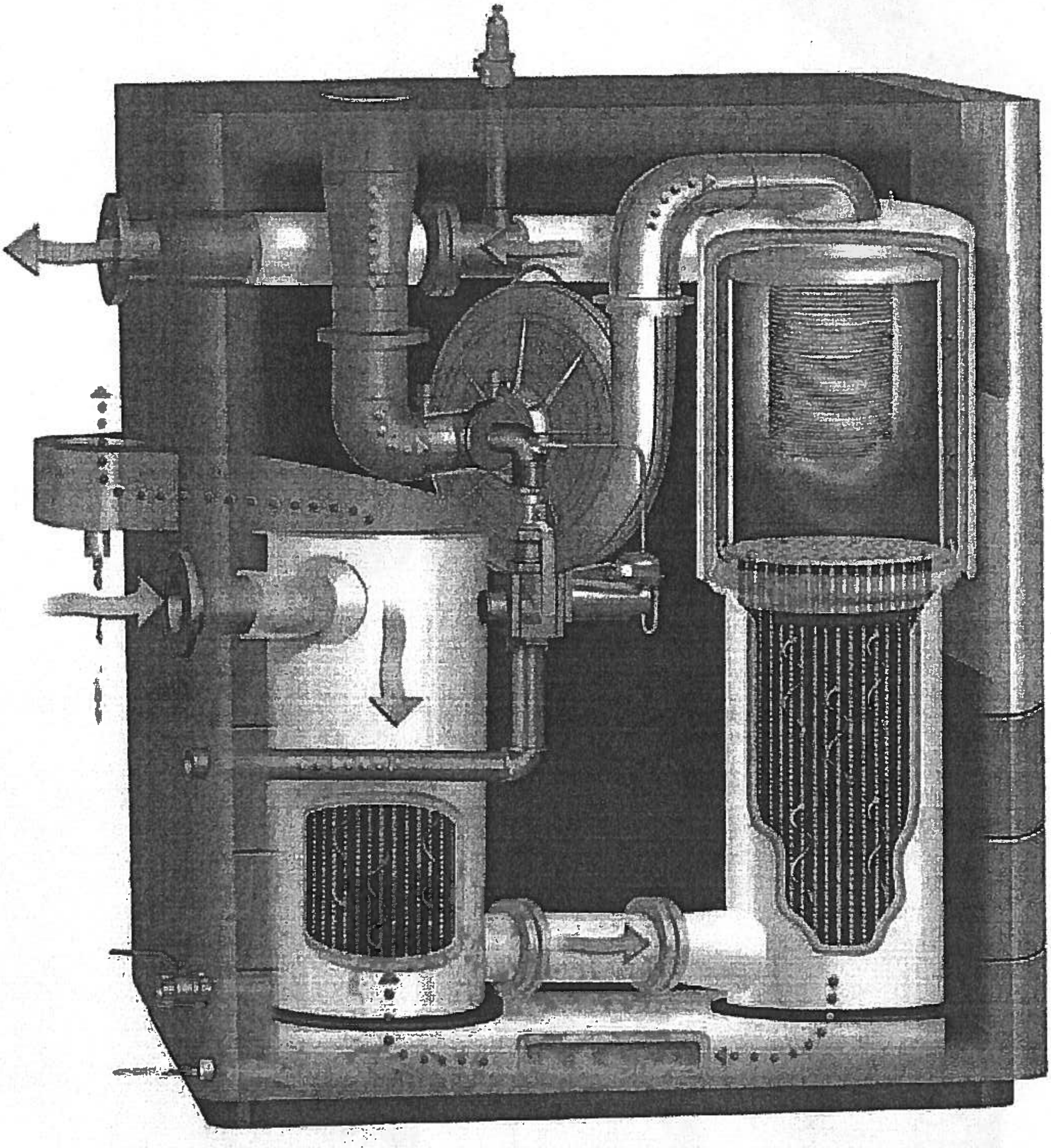
⇨ = Cold Water
➡ = Hot Water
● ● ● ● ● = Air
● ● ● ● ● = Natural Gas
● ● ● ● ● = Air/Gas Mix
● ● ● ● ● = Cool Exhaust



➞ = Cold Water
➞ = Hot Water
●●●●● = Air
●●●●● = Natural Gas
●●●●● = Air/Gas Mix
●●●●● = Cool Exhaust

New Benchmark 2.0 Low NOx

BTU Input	**2,000,000 BTU/hr.**
BTU Output	**1,720,000–1,860,000 BTU/hr.**
Efficiency	**99.3% at low fire with 60°F inlet water**
Turndown Ratio	**20:1**
Dimensions	**79"H x 28"W x 36"D**
Gas Requirements	**4" W.C. minimum at full load**
Weight, Wet	**1,650 lbs.**



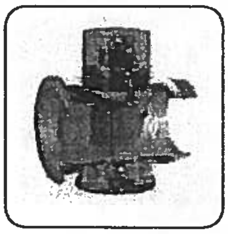
⇨ = Cold Water
➡ = Hot Water
● ● ● ● ● = Air
● ● ● ● ● = Natural Gas
● ● ● ● ● = Air/Gas Mix
● ● ● ● ● = Hot Exhaust
● ● ● ● ● = Cool Exhaust
→ = Condensate

Benchmark 3.0 Low NOx

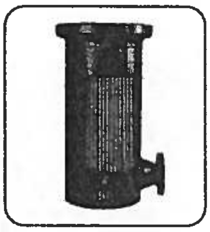
BTU Input	3,000,000 BTU/hr.
BTU Output	2,610,000–2,883,000 BTU/hr.
Efficiency	99.4% at low fire with 60°F inlet water
Turndown Ratio	15:1
Dimensions	79"H x 28"W x 64"D
Gas Requirements	4" W.C. minimum at full load
Weight, Wet	2,580 lbs.

RELIABILITY THAT'S BEEN FIELD-PROVEN FOR A DECADE

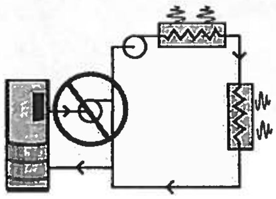
First introduced in 1997, the Benchmark boiler is among the oldest high-efficiency products available in the US. The market leader for the last decade, several thousand Benchmark units have been installed throughout North America and have continued to operate flawlessly season after season. Their performance proven reliability can be credited to:



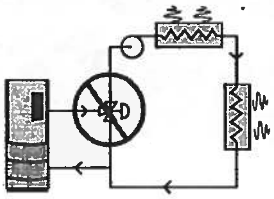
- **Advanced Design and Components**
  - Patented air/fuel delivery system and fully modulating burner reduces cycling losses and wear and tear
  - Gravity condensate drain offers added protection against corrosion
  - Key components (blower, burner, controls) developed by AERCO and life cycle tested for specific application



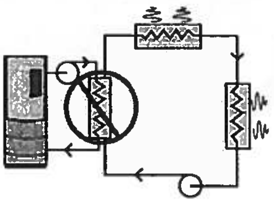
- **Superior Materials of Construction**
  - Stainless steel provides maximum resistance to condensate corrosion
  - All fireside surfaces – combustion chamber, tubesheets and fire tubes – are stainless steel
- **Support Simplified System Designs**
  - Fewer system parts mean fewer potential points of failure



No primary boiler pumps



No three-way valves



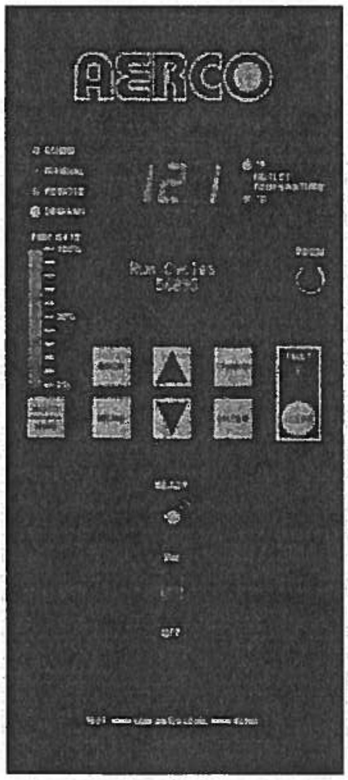
No extra heat exchangers

The Benchmark's design is based on the same technology and manufacturing practices that AERCO itself introduced in 1987 with its KC1000 line – the first high-efficiency heater and boiler ever available in the United States. With more than 20 years field experience, AERCO brands are dispelling the early market predictions that condensing equipment would not last the test of time.

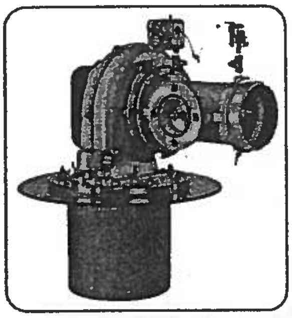
C-MORE™ CONTROL SYSTEM SUPPORTS OPERATION, TROUBLESHOOTING AND FULL BAS INTEGRATION

Developed specifically to support the fully modulating operation of AERCO boilers, the C-More™ Control System combines temperature and operating controls, combustion safeguards and fault enunciator functions in a single, state-of-the-art controller that also supports full BAS/EMS integration. In addition to basic boiler operation, the controller simplifies diagnostic troubleshooting and allows full integration with BAS and EMS systems for extensive data tracking and trend analysis.

- **User-friendly interface for control and troubleshooting**
- **Easy-to-understand English – not confusing codes**
- **Step-by-step diagnostics menus and status messages**
- **Read system status during start-up sequence and operation**
- **One-touch access to operating parameters and recent fault history**
- **Flash-upgradeable platform**
- **Supports remote monitoring and control**
- **BMS and EMS system integration via Modbus with optional support for LonWorks, BACnet, N2, etc.**
- **Supports tracking of more than 100 data points via BAS and EMS software**
- **Ensures fail-safe boiler operation if external building controls fail**



ROBUST DESIGN OFFERS FUEL SAVINGS TO A WIDE VARIETY OF APPLICATIONS



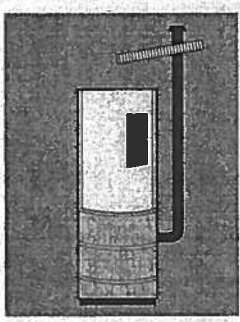
Benchmark boilers can deliver significant fuel savings to many types of hydronic systems – conventional space heating loops, heat pump, radiant heat, snow-melt systems and as well as process applications. Their robust design supports even the most challenging project requirements. Please consult individual data sheets for each unit's specific operating parameters.

- **Low Flow**
  – Variable flow systems won't automatically require ancillary pumps at the boiler.
- **Low Gas Pressure**
  – Benchmark boilers support low gas pressure applications without sacrificing their unmatched turndown.
- **Low NOx Emissions**
  – Benchmark's patented fuel delivery system and burner design ensure low NOx emissions at all firing rates. Units have been SCAQMD certified where appropriate and can also be configured in the factory or in the field to meet more stringent emission levels where required.
- **Low Water Temperatures**
  – Benchmark's condensing design actually increases operating efficiency when return water temperatures fall below 135°F.
- **Low or High ΔT Systems**
  – Benchmark's high turndown ratio ensures extremely tight temperature control that is critical to fault-free operation of many systems designed with a low ΔT. In addition, the condensing boiler design can withstand thermal shock and/or low return water temperatures commonly associated with high ΔT systems.
- **Dual Fuel Applications**
  – Consult your AERCO sales representative about projects that require dual fuel (natural gas/propane backup).

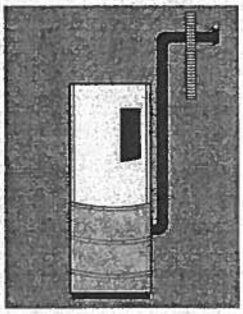
INSTALLATION ADVANTAGES REDUCE PROJECT COSTS

Benchmark boilers reduce costs by eliminating and/or minimizing ancillary equipment requirements in both new installations and retrofits. Simplified system designs can lower both initial project costs and long-term maintenance and replacement expenses for the life of the building.

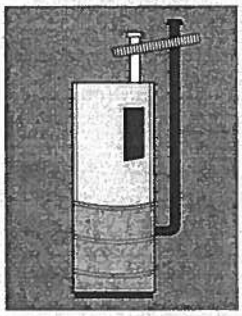
- **Small footprint**
  - Install pairs with zero side clearance
- **Delivered as a single, fully assembled unit**
  - Fits through standard doorways
- **No primary/secondary piping required**
- **Combination SSOV and ventless gas pressure regulator is built in**
- **Supports sealed combustion and/or room air intake**
- **No seasonal recalibration required to support variance in ambient air temperature**
- **Flexible venting**
  - Vent multiple units through a common ceiling vent
  - Vent individual units through a sidewall
  - Positive pressure design supports long runs without extra fans
  - Narrow diameter venting materials



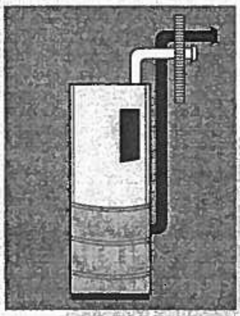
Conventional–vertical



Conventional–sidewall



Sealed Direct Vent–vertical



Sealed Direct Vent–sidewall

AERCO

Heat You Can Bank On

SALES REPRESENTATIVES THROUGHOUT THE WORLD

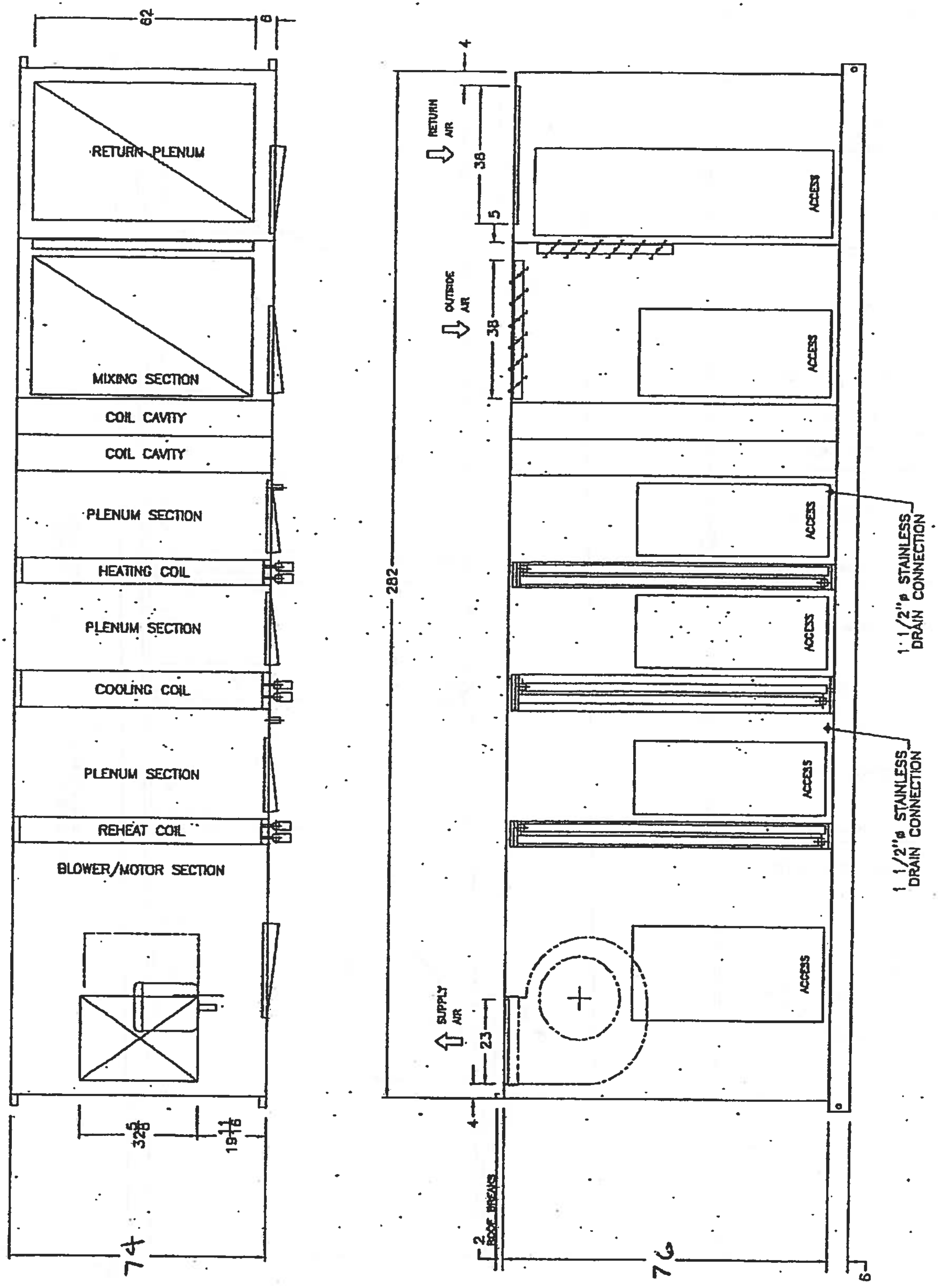
HEAT EXCHANGERS • WATER HEATERS • BOILERS • CONTROL VALVES • STEAM GENERATORS

AERCO INTERNATIONAL, INC. • NORTHVALE, NJ 07647
201-768-2400 • FAX 201-768-7789 • 1-800-526-0288
www.aerco.com • email: info@aerco.com

BK-2000
5K 8/09
New Doc 8/09

WINNIPEG SALES

DRAWING SUBJECT TO CHANGE



DOOR SIZES AND INTERNAL COMPONENTS ARE APPROX. VALUES. DIMENSIONS SHOWN IN INCHES ONLY UNLESS OTHERWISE NOTED.

DRAWING PATH:

LM/5C

TAG: LAP POOL – LP-1

PRELIMINARY DRAWING ONLY - NOT FOR CONSTRUCTION.

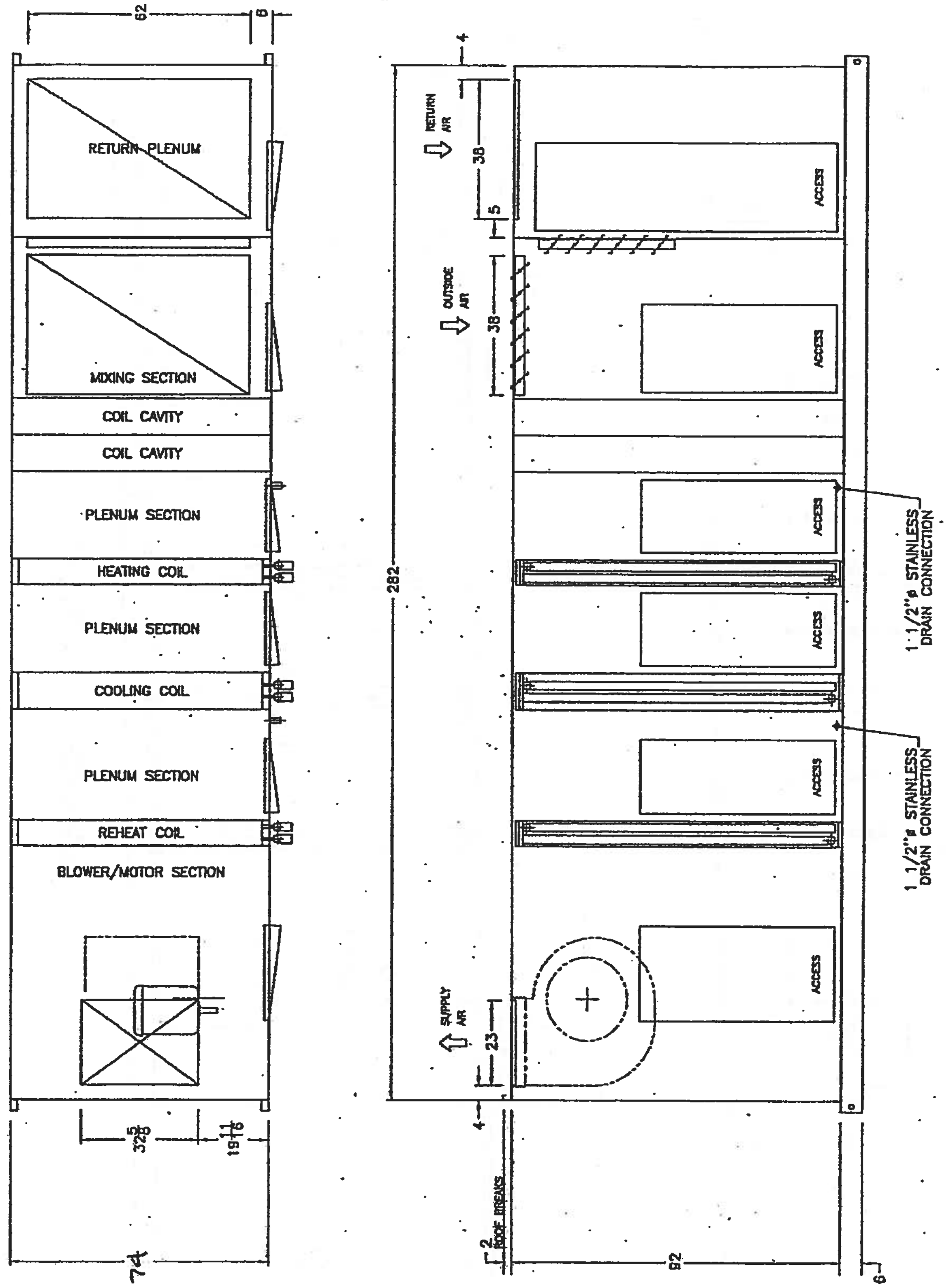
EngA®

ENGINEERED AIR®

REVISIONS:

DATE:	DRWN BY:	CHKD BY:	DRWG NO.:
MAR 05 2010	JLS	-	

WINNIPEG SALES DRAWING SUBJECT TO CHANGE



PROUNIT

DOOR SIZES AND INTERNAL COMPONENTS ARE APPROX. VALUES. DIMENSIONS SHOWN IN INCHES ONLY UNLESS OTHERWISE NOTED.

DRAWING PATH:

LM21/C

TAG: Main Pool - MP-2, MP-3,

PRELIMINARY DRAWING ONLY - NOT FOR CONSTRUCTION.

EngA®

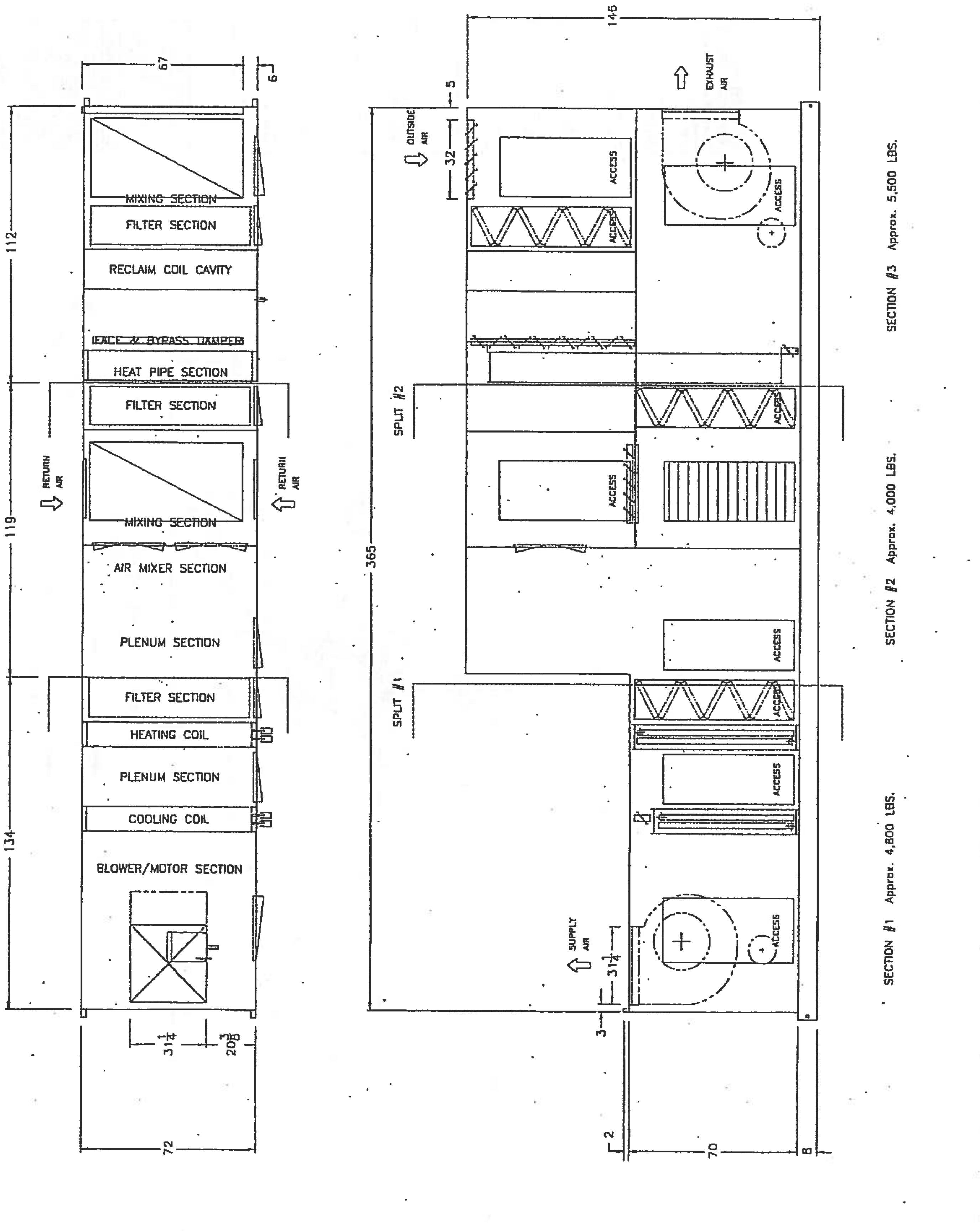
ENGINEERED AIR®

REVISIONS:

DATE:	DRWN BY:	CHKD BY:	DRWG NO.:
MAR 05 2010	JLS	-	

WINNIPEG SALES

DRAWING SUBJECT TO CHANGE



DOOR SIZES AND INTERNAL COMPONENTS ARE APPROX. VALUES. DIMENSIONS SHOWN IN INCHES ONLY UNLESS OTHERWISE NOTED.

DRAWING PATH:

LM15/C/HRP

TAG: ~~MUA-1~~ MP-1, MP-4, LP-2

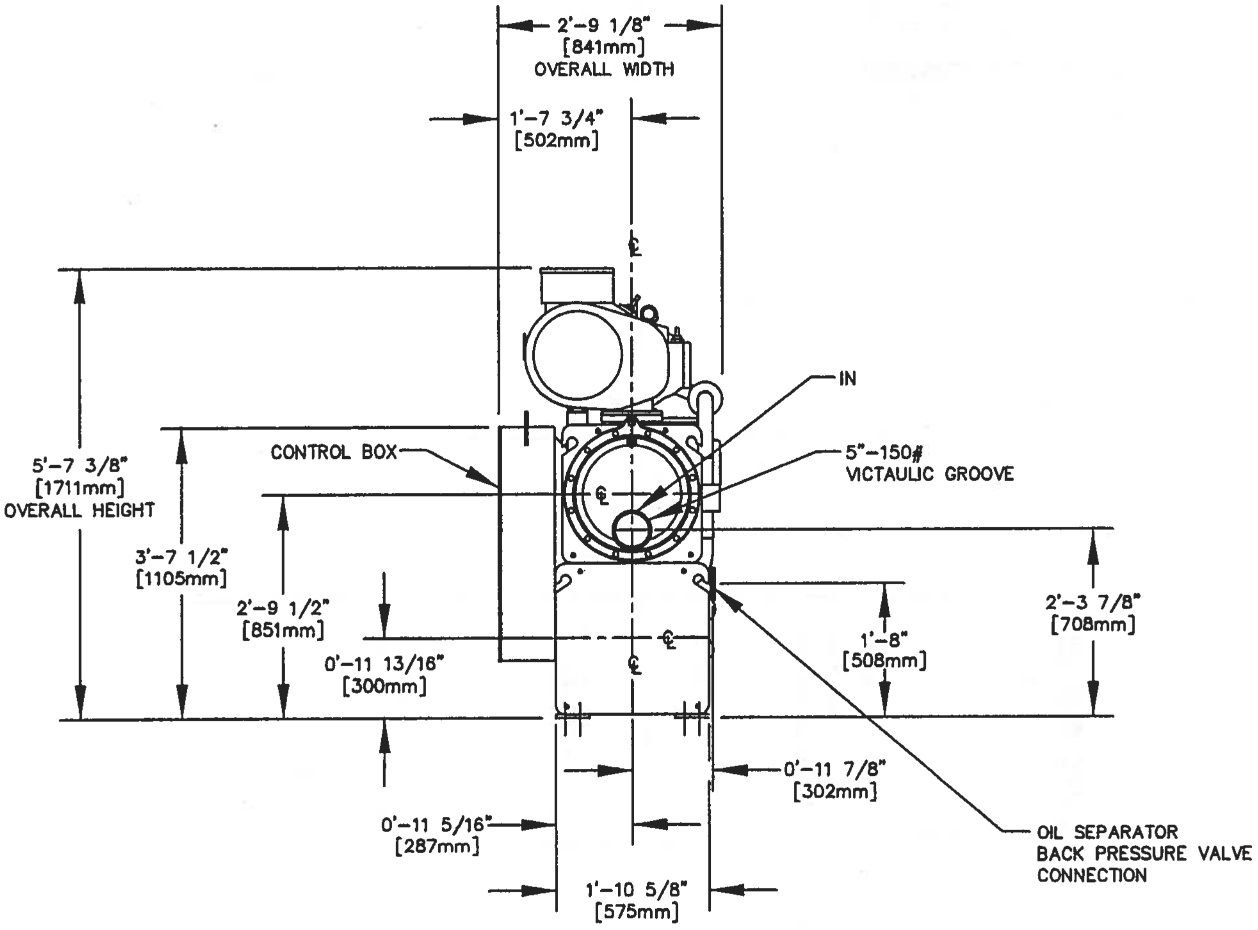
PRELIMINARY DRAWING ONLY - NOT FOR CONSTRUCTION.

EngA®

ENGINEERED AIR®

REVISIONS:

DATE:	DRWN BY:	CHKD BY:	DRWG NO.:
MAR 30 2010	JLS	-	



RIGHT END VIEW

Carrier
A United Technologies Company
P.O. BOX 4808, SYRACUSE, N.Y. 13221

JOB NAME:

BUYER:

SALES ENG.:

MODEL NO.:

JOB NO.:

P.O. NO.:

PREPARED BY:

ELECTRICAL CHARACTERISTICS:

JOBSITE LOCATION:

SALES OFFICE:

REFRIGERANT NO.:

NOTES:

30HXA106
HERMETIC SCREW
LIQUID CHILLING PACKAGE
WITH
COMFORT LINK™ CONTROLS
RIGHT END VIEW

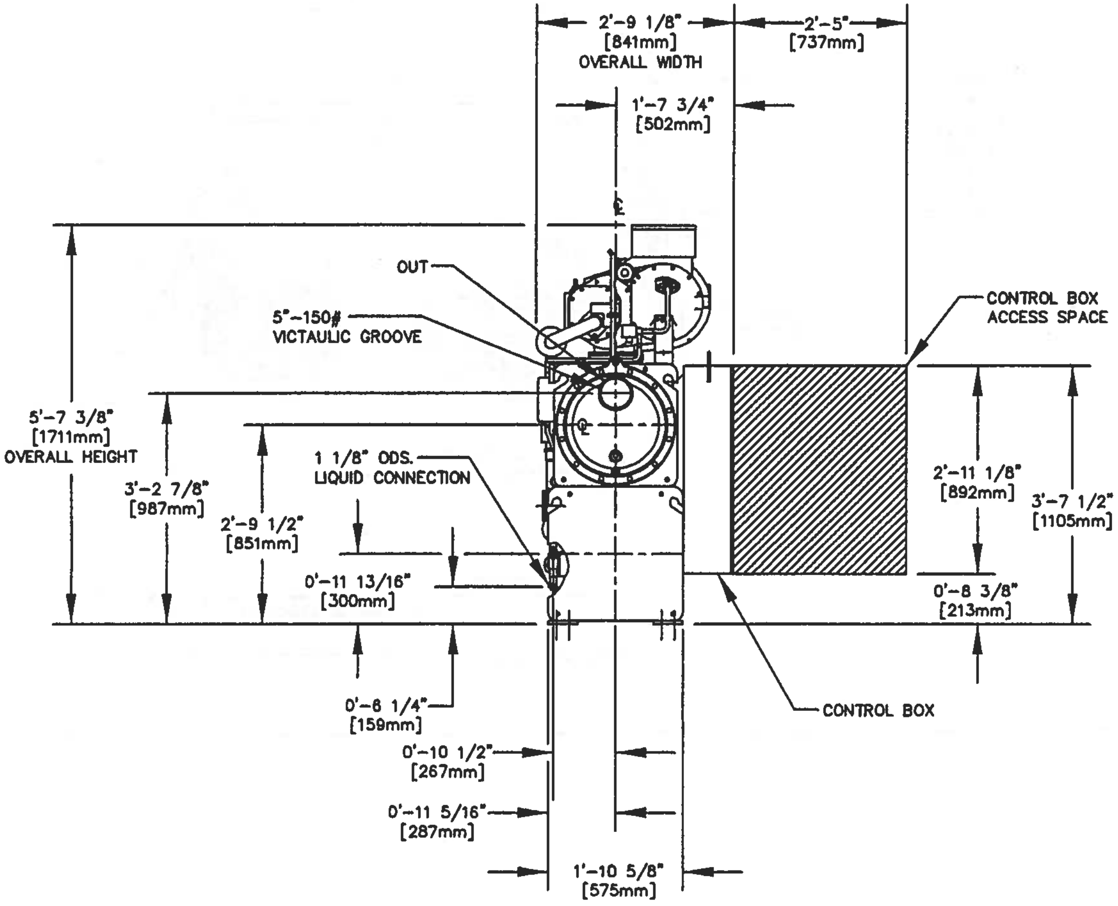
DATE: 3/23/2010

REVISION: ——

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORP. AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORP. WRITTEN CONSENT.

SUBMISSION OF THESE DWG'S. OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

CARRIER DWG # 30HXA106-C



LEFT END VIEW

NOTES:

1. TOLERANCES ON NOZZLE LOCATIONS AND OVERALL DIMENSIONS ARE ± 1" [25mm].
2. CARRIER DOES NOT RECOMMEND PRE-FAB WATER PIPING.
3. FLOW SWITCH IS FACTORY INSTALLED IN COOLER INLET WATER NOZZLE.

NOZZLE ARRANGEMENTS	
COOLER ARRANGEMENT	STANDARD (3 PASS)

Carrier
A United Technologies Company
P.O. BOX 4808, SYRACUSE, N.Y. 13221

JOB NAME:

BUYER:

SALES ENG.:

MODEL NO.:

JOB NO.:

P.O. NO.:

PREPARED BY:

ELECTRICAL CHARACTERISTICS:

JOBSITE LOCATION:

SALES OFFICE:

REFRIGERANT NO.:

NOTES:

30HXA106
HERMETIC SCREW
LIQUID CHILLING PACKAGE
WITH
COMFORT LINK CONTROLS
LEFT END VIEW

DATE: 3/23/2010

REVISION: ——

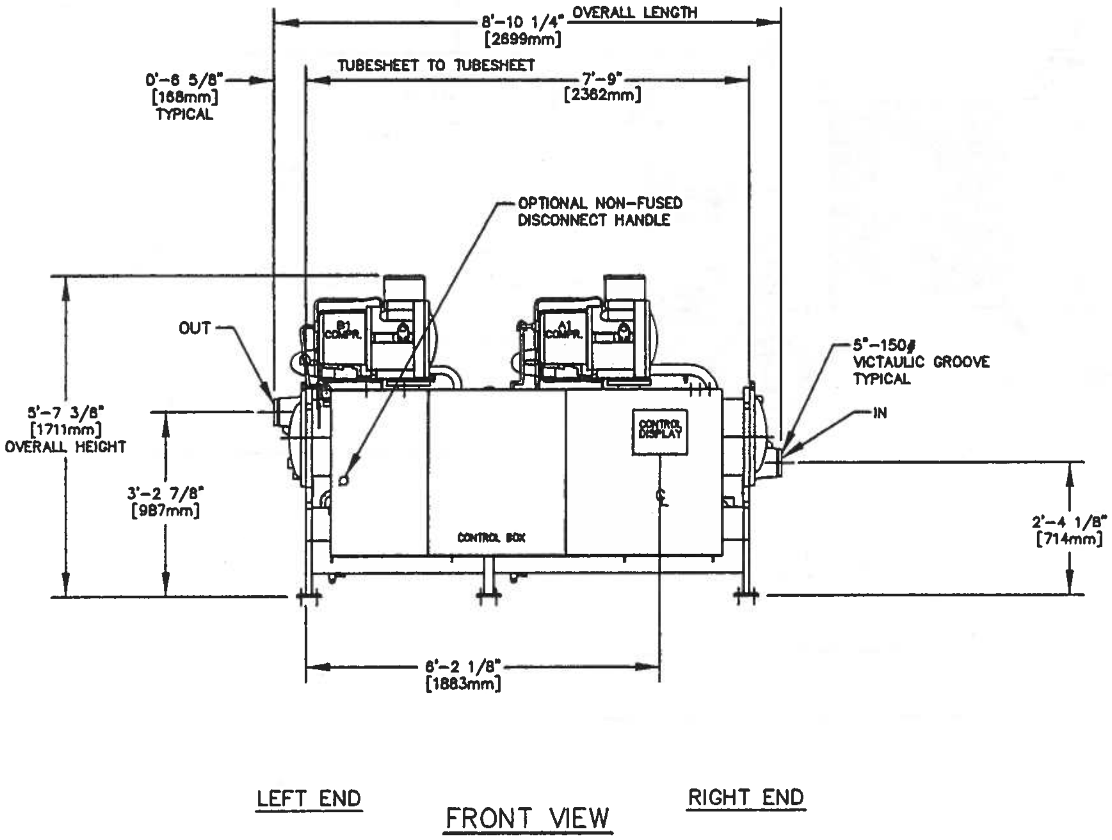
THIS DOCUMENT IS THE PROPERTY OF CARRIER CORP. AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORP. WRITTEN CONSENT.

SUBMISSION OF THESE DWG'S. OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

CARRIER DWG # 30HXA106-D
REV. -- SHT 01 OF 01
DATE: 8/12/2005
SUPERSEDES DWG. DATED:
-

30HXA

SHT 2 OF 4



NOTES:

1. TOLERANCES ON NOZZLE LOCATIONS AND OVERALL DIMENSIONS ARE ± 1" [25mm].
2. CARRIER DOES NOT RECOMMEND PRE-FAB WATER PIPING.
3. FLOW SWITCH IS FACTORY INSTALLED IN COOLER INLET WATER NOZZLE.

NOZZLE ARRANGEMENTS	
COOLER ARRANGEMENT	STANDARD (3 PASS)

Carrier
A United Technologies Company
P.O. BOX 4808, SYRACUSE, N.Y. 13221

JOB NAME:

BUYER:

SALES ENG.:

MODEL NO.:

JOB NO.:

P.O. NO.:

PREPARED BY:

ELECTRICAL CHARACTERISTICS:

JOBSITE LOCATION:

SALES OFFICE:

REFRIGERANT NO.:

NOTES:

30HXA106
HERMETIC SCREW
LIQUID CHILLING PACKAGE
WITH
COMFORT LINK CONTROLS
FRONT VIEW

DATE: 3/23/2010

REVISION: ——

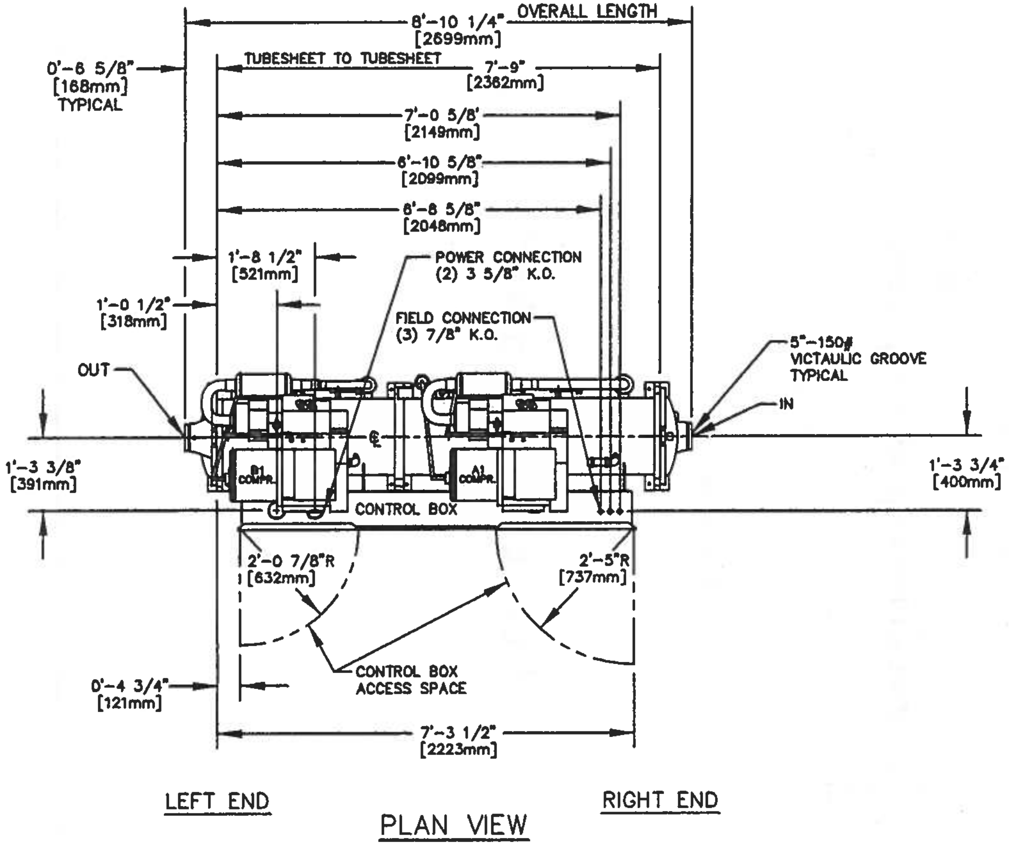
THIS DOCUMENT IS THE PROPERTY OF CARRIER CORP. AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORP. WRITTEN CONSENT.

SUBMISSION OF THESE DWG'S. OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

CARRIER DWG # 30HXA106-F
REV. - SHT 01 OF 01
DATE: 8/12/2005
SUPERSEDES DWG. DATED:
-

30HXA

SHT 3 OF 4



PLAN VIEW

NOTES:
1. TOLERANCES ON NOZZLE LOCATIONS AND OVERALL DIMENSIONS ARE ± 1" [25mm].
2. CARRIER DOES NOT RECOMMEND PRE-FAB WATER PIPING.
3. FLOW SWITCH IS FACTORY INSTALLED IN COOLER INLET WATER NOZZLE.

NOZZLE ARRANGEMENTS	
COOLER ARRANGEMENT	STANDARD (3 PASS)

Carrier

JOB NAME:

BUYER:

SALES ENG.:

MODEL NO.:

JOB NO.:

P.O. NO.:

PREPARED BY:

ELECTRICAL CHARACTERISTICS:

JOBSITE LOCATION:

SALES OFFICE:

REFRIGERANT NO.:

NOTES:

30HXA106
HERMETIC SCREW
LIQUID CHILLING PACKAGE
WITH
COMFORT LINK CONTROLS
PLAN VIEW

DATE: 3/23/2010

REVISION: ——

THIS DOCUMENT IS THE PROPERTY OF CARRIER CORP. AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORP. WRITTEN CONSENT.

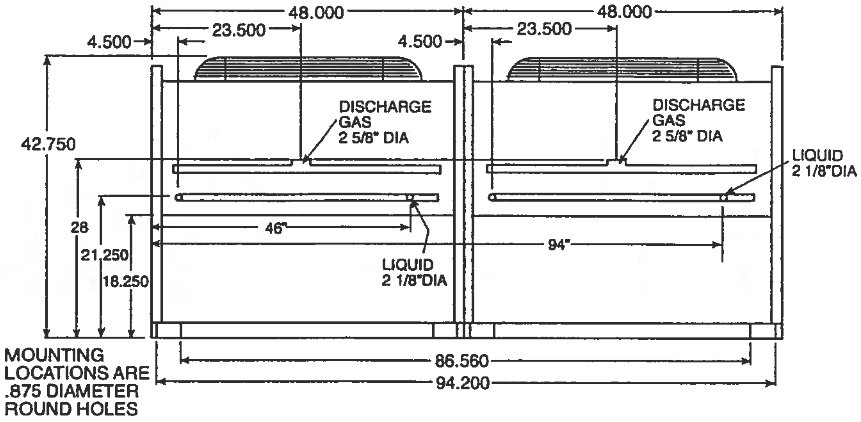
SUBMISSION OF THESE DWG'S. OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

CARRIER DWG # 30HXA106-P
REV. – SHT 01 OF 01
DATE: 8/12/2005
SUPERSEDES DWG. DATED: –

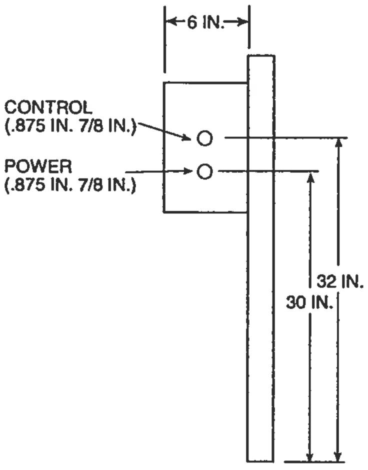
30HXA

SHT 4 OF 4

09AZV---2-E DUAL CIRCUIT

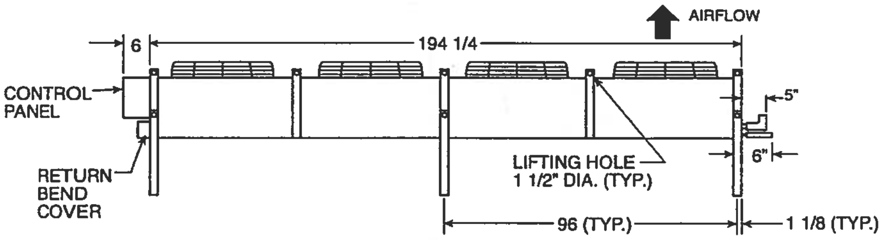


NOTE: Service clearances must be at least 48 in. on all sides.



CONTROL PANEL DETAIL

09AZV SIDE VIEW



09AZV102

1 per chiller required