

PHASE 5 BEYOND PLAN
SECOND FLOOR

8.0 MECHANICAL SYSTEMS

► GENERAL OVERVIEW

Introduction

This report defines the proposed HVAC, controls and BMS, plumbing, fire protection and life safety systems for the YLW Kelowna Airport Expansion. Mechanical systems have been selected to address the service needs generated by airport passenger traffic projections and realignment of international and domestic gates.

Estimates of mechanical system capacities have been based on preliminary cooling and heating load calculations and preliminary architectural layouts. System capacities will be finalized with detailed heating and cooling load calculations through the design development phase and in conjunction with the details of the building envelope construction to be developed by the architectural team.

General Mechanical Design Criteria are as follows;

- ◆ Cost Effective Design for the Mechanical Systems. This is particularly important to obtain the best mechanical value in terms of life cycle while meeting the budget constraints.
- ◆ High ventilation effectiveness for increased indoor air quality. The general mechanical HVAC design concept of Airport Facilities is to provide sufficient ventilation to support high occupant loads that vary depending on flight schedules, security processing, holding, and baggage claim requirements. It is undesirable, however, to continue to supply high outdoor air rates to unoccupied areas. At the Kelowna Airport, there may be long time periods with minimal occupancy in some areas.
- ◆ Utilize hydronic based systems wherever possible to save fan energy utilized by continuously operated fan systems.
- ◆ Limit water use in the new facility while maintaining important characteristics such as maintainability and performance for plumbing fixtures.
- ◆ Reduce energy usage wherever possible to provide long term sustainable performance from the facility.
- ◆ Flexibility in servicing common spaces to allow for future renovations.
- ◆ Elegance and simplicity of design to allow ease of operation of the mechanical systems.
- ◆ Reduction of the Carbon footprint for the existing and new airport expansion to levels below the existing condition today, even with a substantial increase in floor area.

Design Criteria

Design Criteria for the typical room types has followed BC Building Code and ASHRAE Guidelines as follows:

- ◆ Heating and Cooling capacities will be based on the following criteria for peak winter design conditions, and defined in the BC Building Code.
 - » Outdoor design temperature: -20°C 1% winter design condition, 33°C DB/20°C WB 2.5% summer design conditions as prescribed in the BC Building Code. The percentages indicate for example that 99% of the time the temperature will be above -20°C and 97.5% of the time the temperature will be below 33°C.
 - » In addition, ASHRAE weather data will be used to determine dehumidification conditions for the space. Therefore, the 1% dehumidification condition for Kelowna is 14.6°C dewpoint at 20.7°C dry bulb, which is the most humid outdoor condition.
 - » Indoor space temperature: 21°C winter, 24°C summer.
 - » Indoor space relative humidity to be maintained at a maximum of 60% in summer and will not be controlled in the winter. The intent is not to provide humidification for the air handling units.
 - » Elevation = 350 m, Rainfall = 10 mm in 15 minutes
 - » Seismic Data Sa(0.2)=0.28, Sa(0.5)=0.17, Sa(1.0)=0.094, Sa(2.0)=0.056, PGA=0.14

- ♦ Load calculations have been carried out to determine the building envelope heat loss. Overall thermal resistance values in walls, roof and glazing have been calculated using catalogued data and methods in ASHRAE. This work has been closely coordinated with the rest of the design team and represents recommended values from the Energy Analysis.
- ♦ Overall “R” values for the building envelope exceed those prescribed in the National Energy Code. The assumed R values for the walls are RSI 4.07 (R23.1), roofs are RSI 5.42 (R30.8), and the windows are high performance with an USI 0.99 (R5.75) with a Solar Heat Gain Coefficient SHGC = 0.30 (shading coefficient of 0.26). The windows are currently selected as triple glazed, this is to be confirmed during value analysis. This may drop the window performance, which will have to be compensated by the mechanical heating and cooling systems.
- ♦ High thermal massing has been assumed utilizing the concrete floor as the primary mass element (Note: without carpet), as well as utilizing rammed earth walls strategically placed in the space, and block walls that would typically be provided for some rooms. The added thermal mass tends to lower the peak heating and cooling loads and even out the heating and cooling loads in the space over the day.

Code and Code-Referenced Standards

The mechanical system design will be in accordance with all applicable codes and regulations of the local inspection authorities having jurisdiction, and City of Kelowna requirements.

- ♦ BC Building Code 2006
- ♦ BC Fire Code 2006
- ♦ BC Building Code - Plumbing Services Part 7 2006
- ♦ National Plumbing Code of Canada current edition
- ♦ ASHRAE 55 - Thermal Environmental Conditions for Human Occupancy
- ♦ ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality
- ♦ CSA B51 Boiler, Pressure Vessel and Pressure Piping Code.
- ♦ CSA B52 Mechanical Refrigeration Code.
- ♦ CSA B64.10 Manual for the Maintenance and Field Testing of Backflow Prevention Devices
- ♦ CSA B149.1 Natural Gas Installation Code
- ♦

♦ National Fire Protection Association (NFPA) Standards:

- » NFPA 10: Portable Fire Extinguishers
- » NFPA 13: Installation of Sprinkler Systems
- » NFPA 14: Installation of Standpipe and Hose Systems
- » NFPA 90A: Installation of Air Conditioning and Ventilation Systems
- » NFPA 96: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

- ♦ SMACNA Standards for Ductwork and IAQ During Construction

Standards and Guidelines

The Mechanical Systems will be designed to meet the following Standards and Guidelines:

- ♦ Model National Energy Code of Canada current edition
- ♦ ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
- ♦ LEED NC 1.0 - New Construction

Ventilation Calculations

Ventilation rates to the spaces have been calculated based on ASHRAE 62.1, assumed occupancy rates, and space type. The intent of the mechanical system design is to de-couple ventilation requirements from cooling loads, therefore the assumed ventilation rates determine air handling unit sizes.

The International CBSA and Bag Claim will be all new and will require a dedicated air handling unit to provide ventilation to all of the new spaces. The Domestic expansion is a mixture of new areas and renovation to existing areas. Therefore, some of the areas are partly served by existing equipment such as existing Screening Areas noted in bold.

NORTH SIDE	ZONE INFO						
	ASHRAE 62.1 AIR FLOW RATES						
	Area(sq ft)	People	cfm/ person	cfm/ft²	Max cfm	Min	Exhaust
CBSA	3,500	250	7.5	0.06	2,085	210	
CBSA Washroom	330			2.00			660
Bag. Claim North Int 1	6,600	200	7.5	0.06	1,896	396	
Bag. Claim North Int 2	8,400	200	7.5	0.06	2,004	504	
W2	688			2			1,376
Bag Delayed 1	363	2	5.0	0	32	22	
Mech Elec 1							
Mech Elec 2							
Total:	19,881				6,017 cfm	1,132 cfm	2,036 cfm

SOUTH SIDE	ZONE INFO						
	ASHRAE 62.1 AIR FLOW RATES						
	Area(sq ft)	People	cfm/ person	cfm/ft²	Max cfm	Min	Exhaust
Hallway7	2,860	0		0.06	172	172	
hold room east (new)	10,691	416	7.5	0.06	3,761	641	
Bag./Jen	244	0		0.06	15	15	
Office Area 12	388	2	5.0	0.06	33	23	
Entrance 1	419	0		0.06	25	25	
Retail 6	1,073	35	7.5	0.06	327	64	
W7	1,107			2.00			2,214
Retail 11	387	13	7.5	0.06	121	23	
Office Area 11	1,254	6	5.0	0.06	105	75	
W8	815			2.00			1,630
Office Area 10	438	2	5.0	0.06	36	26	
bag claim domestic	25,697	874	7.5	0.06	8,097	1,542	
Bag Drop 2	1,262	0	7.5	0.06	76	76	
Screening Old	5,062	600	7.5	0.06	4,804	304	
Screnning (new)	919	24	7.5	0.06	235	55	
Loading Dock	2,898	0		0.06	174	174	
Total:					17,981 cfm	3,216 cfm	3,844 cfm

► PLUMBING SYSTEMS

Storm Drainage

Storm drainage will consist of internally mounted rainwater leaders connected to storm water piping below grade. The roof drains will either provide storm water retention on the roof or will be a full flow design, depending on the final site servicing plan to meet City of Kelowna storm water management guidelines. This will be determined by the Civil consultant.

Storm drainage will consist of cast iron piping with MJ fittings above ground and PVC piping below ground. There will be new storm connections required on the north end expansion and the south end expansion.

Sanitary Drainage

Sanitary drainage will be provided for new washrooms located in the International Bag Claim expansion. A new main washroom group will be provided in Phase 4 for International Bag Claim, therefore a new main sanitary line will be provided to support this washroom group and will be sized to support additional washroom groups added in the future. The new 150 mm sanitary line will be connected to the street connection in the front of the airport.

Sanitary drainage will be provided for new large washrooms located in Phase 3 expansion. A new main sanitary line will be provided to support this washroom group and will be sized to support additional washroom groups added in the future. The new 150 mm sanitary line will be connected to the street connection in the front of the airport.

Miscellaneous sanitary connections will be required to support retail areas, mechanical rooms, and janitor/support rooms. The main sanitary lines will be coordinated with radiant slab piping to ensure sanitary is accessible and expandable to future loads.

Trap primers will be provided for all floor drain traps to ensure a positive seal is maintained on the trap, primer lines in concrete slabs will be plastic.

Sanitary drainage will consist of cast iron piping with MJ fittings above ground and PVC piping below ground (except for mechanical room areas).

Domestic Water Supply

Domestic water will be supplied from the City of Kelowna piped utility distribution system. Domestic water quality will be evaluated during Design Development to determine if the existing micro-filtration system is necessary for the proposed expansions.

Domestic water for the PIL and International Bag Claim washrooms will be extended from existing domestic water mains. Existing domestic water mains will be evaluated for sizing and upgraded as required.

Domestic water for the Domestic Bag Claim washrooms will be connected to the existing water meter room. The main water supply line from the City supply in the street will be upgraded if required to supply the existing airport and the new Phase 3 expansion. This will eliminate repetition of water meters and backflow prevention. Determination of existing DCW tie-in points to the street is to be verified by the Civil consultant.

Double-check valves will be provided for premises isolation between the Airport and City of Kelowna utility services.

Domestic water piping will consist of Type L copper minimum with Type K copper on domestic hot water recirculation lines. Two 150 mm domestic water supply lines will be provided to the building to serve domestic water and fire protection. A 50 mm takeoff for irrigation supply will be provided where required to serve landscaped areas.

Domestic Hot Water

Domestic hot water will be supplied to serve plumbing fixtures such as lavatories and sinks. The hot water system must typically be maintained at 60°C minimum, which is mandated by CSA codes, to prevent the growth of Legionella bacteria. New domestic hot water heaters will be provided in the North mechanical room and South Penthouse to support the new washroom groups. Individual plumbing fixtures will typically be tempered to a single supply temperature at the fixture through a below counter mixing valve.

Domestic hot water will be distributed to the washroom groups through the mechanical room. Domestic hot water recirculation piping will be provided to each washroom group. Automatic balancing valves will be provided on each individual vertical riser to ensure flow is balanced between risers and excessive velocities don't occur. A domestic hot water recirculation pump will be located back in the mechanical room.

Domestic hot water piping will consist of Type L copper minimum with Type K copper on domestic hot water recirculation lines.

Plumbing Fixtures

Plumbing fixtures will be selected based on the following criteria:

- ◆ Provision of high performance fixtures capable of performing the required service at lower water flows. Therefore, all water closets must have a Maximum Performance Test (MAP) rating of 1000 to ensure high performance. This testing is undertaken to verify manufacturer claims of high performance using test media.
- ◆ Provision of hands free infra-red plumbing fixtures throughout all public washrooms. These fixtures will provide low water consumption and reliable operation is an important characteristic for the high loading of these washrooms.
- ◆ Provide wall hung toilets and a substantial service chase for the toilets to allow ease of servicing. The toilets can utilize an exposed infrared flushometer as shown or a completely concealed flushometer located flush with the wall, depending on Owner preferences.

Examples of typical plumbing fixtures proposed are as follows:



► HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

Heating

Introduction

The primary methodology for providing energy efficiency for the heating system is to provide a combination of ground-source geothermal heat pumps and condensing boilers.

Ground source geothermal heat pumps utilize the relatively constant ground temperature to provide heat in the winter and reject heat in the summer. Ground source geothermal heat pumps are one of the most effective methodologies for reduction of green-house gases such as carbon dioxide, particularly in hydro-electric dominated areas. The intent is to provide a closed loop heat pump system to vertical bore fields located in fixed areas of the airport site. Vertical bore fields typically extend 60-90 m below the ground and utilize a non-freeze solution to extract and reject heat to the ground. Ground bore field piping is typically installed in a 100 mm well and sealed with a thermally conductive grout, then routed to a header for connection to the main pumps. It is intended that the headers be located in remote concrete header boxes to allow the use of main supply and return pipes from the Airport.

Ground source heat pumps can provide a Coefficient of Performance (COP) in heating mode of 4.1 - 4.9, which is much more efficient than even condensing boilers when ground temperatures are favorable. The determining factor in sizing the external geothermal field is the difference between electric and natural gas energy rates, and source energy carbon content.

Condensing boilers recover up to 15% of the energy contained in the flue gases that is normally lost up the chimney, and is one of the most efficient energy savings methodologies in a heating dominated climate. It is recommended that all new boiler installations utilize condensing boilers to provide this additional efficiency.

The mechanical terminal systems must be designed to force the boilers to condense, which requires low temperature return back to the boilers. Therefore, all mechanical distribution systems will be designed to lower the return water temperature as low as possible.

Primary Source

The primary heating source for the new PIL expansions and International Bag Claim will be two (2) 116 kW wall mount condensing boilers and one (1) 30 ton heat pump. This hybrid system utilizes primary heat pump operation to provide a minimum of 20-25% of the peak heating load, which will form a substantial portion of the annual heating load. The condensing boilers will be utilized on extreme peak days or when the geothermal heat pump is not operable. The condensing boilers will utilize low temperature return water to condense flue gases.

The primary heating source for the new Domestic Bag Claim will be two (2) 234 kW floor mount condensing boilers and two (2) 30 ton heat pumps. This hybrid system utilizes primary heat pump operation to provide a minimum of 20-25% of the peak heating load, which will a substantial portion of the annual heating load. The condensing boilers will be utilized on extreme peak days or when the geothermal heat pump is not operable. The condensing boilers will utilize low temperature return water to condense flue gases.

The condensing boilers and geothermal heat pumps will require a small constant speed boiler pump to maintain constant flow. These pumps will only operate when the associated equipment is required to operate.

Building Distribution

The building distribution system will be structured to provide heating to perimeter heating loads first to serve radiation and cabinet unit heaters. Hot water will be the primary heating medium for the perimeter heating system. The intent is to provide a maximum of 71.1°C supply water temperature to the radiation and hot water terminal units. The return water from the radiation will be 60°C or less, which will then be used for slab heating and air handling unit heating coils.

The slab heating and air handling unit heating coils will further drop the return water temperature down to as low as 43°C prior to returning the water to the boilers. This will create condensing in the boilers and increase boiler efficiency to approximately 92%. The control system will automatically reset the maximum supply water temperature based on outdoor air temperature to obtain even better boiler efficiency at partial load, up to 95% at 32.2°C. The design hot water temperatures will be optimized to provide the lowest possible hot water temperature at all times.

Propylene Glycol at a concentration of 40% will be provided in air handling unit heating coils to prevent freeze-up concerns, particularly in 100% outdoor air units. Variable speed drives will be provided for the glycol pre-heat pumps serving 2-way control valves on the pre-heat coils.

Heating Terminal Units

Radiation will be provided below perimeter windows and clerestory windows. Radiant floor heating will be utilized in large open spaces in conjunction with radiant floor cooling. The floor slabs close to the perimeter will be switchable between heating and cooling. Unit heaters will be provided for support spaces such as baggage hall and baggage loading areas.

The design intent is to minimize the required hot water temperature by providing a more insulated and sealed building envelope, reducing heating requirements. This can be accomplished by increasing the wall and glazing RSI values and providing high performance glazing and frames. The radiation maximum hot water temperature will be limited to 71.1°C instead of a typical design temperature of 93.3°C.

Force flow units, cabinet unit heaters, and unit heaters will be provided in support spaces, entrances, stairways, and unoccupied areas to provide heating.

Cooling

Introduction

Cooling for the new expansion will be provided by a combination of ground source geothermal heat pumps and centrifugal chillers. Approximately 20-25% of the cooling load will be supplied by geothermal heat pumps with the remainder provided by the centrifugal chillers. This will provide the best balance between external borehole field size, energy consumption, and initial capital cost.

Primary Source

The primary cooling source for the new PIL and International Bag Claim will be a single 105 kW (30 ton) geothermal heat pump with R-410A refrigerant. The geothermal heat pump will provide a cooling coefficient of performance (COP) of 5.2-5.4 by utilizing the ground for heat rejection. The future phases will include a new 421 kW (120 ton) centrifugal chiller and closed circuit fluid cooler to provide cooling to the new expansion and a portion of the existing building.

The primary cooling source for the new Domestic Bag Claim will be two 105 kW (30 ton) geothermal heat pumps with R-410A refrigerant. The geothermal heat pumps will provide a cooling coefficient of performance (COP) of 5.2-5.4 by utilizing the ground for heat rejection. The future phases will include a new 738 kW (210 ton) centrifugal chiller and two closed circuit fluid coolers to provide cooling to the new expansion and a portion of the existing building. The intent is to replace the existing centrifugal chiller and reroute the chilled water to the new penthouse. This will open up much needed electrical room space on the main floor.

The centrifugal chiller will be selected for maximum efficiency and in compliance with energy code requirements. New centrifugal chillers with sophisticated controls, variable speed drives, and increased surface area can provide a COP of 5.5 and Integrated Part Load Value of 5.9 which can exceed the performance of geothermal heat pumps. This performance requires a water cooled centrifugal chiller with an associated cooling tower.

Closed circuit fluid coolers will be provided to allow the use of glycol through the cooling tower circuit and to allow cross connection with the geothermal heat pumps. The closed circuit fluid coolers will utilize evaporative sprays during peak conditions to provide heat rejection.

Building Distribution

The building cooling distribution will consist of variable speed primary chilled water pumps supplying a 2-way control valves on the cooling coils. The primary distribution medium will be chilled water for the fan coils, chilled slabs, and chilled beams.

Various sensible cooling solutions can be adapted to use in high load spaces to augment the cooling provided by displacement. Fan coils are a poor solution for most spaces as are chilled beams because they disrupt floor to ceiling temperature stratification necessary for acceptable displacement performance. Radiant cooling technology can provide additional cooling and is compatible with displacement. Radiant ceiling, floor or panel systems are all compatible systems for displacement. Radiant floor system capacity varies based on type but typical capacity is shown below.

- ♦ Radiant Ceiling Panels 90W/m2
- ♦ Radiant Concrete Ceiling 75W/m2
- ♦ Radiant Concrete Floor (without carpet) 75W/m2 (note: 100 W/m2 in sunlit areas)

Radiant cooling and the accompanying higher comfort levels for occupants rely on good view factors to the cooling surfaces. Studies completed by the Centre for Built Environment in Berkeley indicated that overhead radiant panels/slabs are as effective as floor radiant systems in providing proper comfort in low ceiling areas. High ceiling areas (over 5 meters) perform better with floor based systems. Sedentary occupant foot temperature must be limited (when applying radiant floor) with a warmer surface temperatures than overhead system explaining the higher ceiling cooling capacities for overhead. The cooling limits to ceiling system capacities are controlling surface temperatures above room dewpoint to avoid sweating. Cooling mode for radiant floors in direct sunlight can be 2.5 to 3 times the capacity listed above due to the floor acting as a solar sponge also making it highly effective in daylit atria spaces. Typical radiant floor as installed in a similar application, the University of Calgary EEEL project is shown below:



Radiant slab systems can provide heating duty but in spaces with highly variable loads, radiant heated slabs can be slow to respond. Radiant panels both in cooling and heating mode can provide quick response to space load changes. Radiant slab systems provide a self regulating capacity, idling at low load and absorbing loads as required up to their design loads as the loads “appear” in the space.

Radiant slabs can be developed into a concept known as a Thermally Active Building Systems (TABS). Developing the building with high thermal mass, radiant slabs can be “charged” at night using more favourable cool night conditions, this enables the space conditioning systems to be downsized and also take advantage of charged thermal slabs to allow the spaces to flywheel through the next day’s loads with reduced energy use. Kelowna’s high diurnal temperature swings and the building’s primary daytime use patterns are ideal for implementing this concept. Self learning night time purge algorithms will be necessary to fine tune this concept during the first year of occupancy. A balance of slab charging and stopping short of overcooling the space for early morning conditions is the largest challenge for effective use of the system but the technologies and control sequences are well established.

It is proposed that the base mechanical concept for the project be ventilation using a 100% outdoor air system, primarily delivered by displacement techniques, augmented with radiant cooling/heating as required. There are several types of spaces characterized by their individual load and use patterns. Based on preliminary cooling load calculations the following configurations are proposed.

Ventilation

Air Supply - General Description

Ventilation systems will provide adequate ventilation air to meet minimum air changes required by ASHRAE 62.1. The intent is to reduce airflow to unoccupied or lightly occupied spaces from the minimum ventilation volumes by utilizing carbon dioxide demand control. For example, baggage hall areas are lightly occupied most of the day and may be completely empty at night. The carbon dioxide sensors would provide variable volume between the area ventilation rate and the occupant ventilation rate. Occupancy sensors will be used in office spaces to reduce air volumes in unoccupied spaces.

An innovative solution for the large common areas is to decouple the ventilation and cooling loads by the use of Displacement Ventilation and Chilled Slabs. Displacement Ventilation provides supply airflow at a low level at a higher temperature. This provides several advantages for the Airport as follows:

- ♦ Improved ventilation effectiveness in open areas. Air is supplied at low level and contaminants are directed upwards towards return/exhaust grilles.
- ♦ Provision of higher temperature supply air, minimizing reheat and maximizing free-cooling capabilities from the air handling units. Free-cooling hours are extended by approximately 1000 hours/year.
- ♦ More effective cooling at higher supply air temperatures. The rooms can be effectively cooled with minimal cooling energy.
- ♦ Fan power relatively lower than conventional systems
- ♦ System compatible with lower grade cooling sources such as geothermal heat pumps, allowing higher chilled water supply water temperatures.

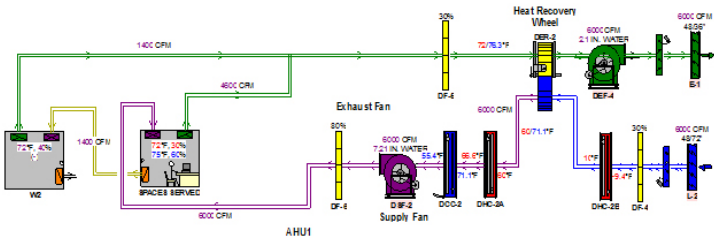
Displacement is the favoured choice to ventilate the majority of the large open spaces, which is the primary space type for the expansion. Displacement ventilation is well adapted to being coupled with a room based sensible cooling system for high load spaces. This would allow the air supply system to be 100% outdoor air and simplify the building systems by avoiding an extensive return air duct systems such as required for VAV systems. Typical displacement diffusers are shown below, but custom made solutions can also be utilized for low velocity air supply.



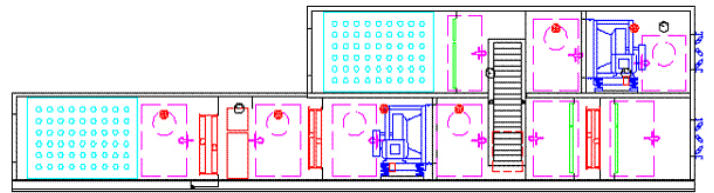
Air Supply Equipment

Air handling units will be indoor units supplied with glycol heating coils and chilled water cooling coils. Vertical duct shafts will facilitate ducted supply, return and exhaust air to the floors. Typical air supply units will be custom construction with 100 mm insulated walls, multiple split sections, and configurations to suite the mechanical room requirements.

- AHU-1 - PIL/International Bag Claim: The air handler for the PIL/International Bag Claim area will be a 2830 l/s, variable volume, 100% outside air complete with supply and exhaust fans, glycol cooling coil, glycol heating coils, heat recovery wheel, and with Dynamic air filtration. The air handling unit will be zoned to allow demand reduction based on carbon dioxide sensors. Low pressure ductwork will supply low wall mounted displacement diffusers or custom diffusers integrated with architectural features such as ticket booths, thermal mass walls, and baggage carousels. Return fans on the units will in fact be exhaust fans as all return air will be exhausted after heat recovery. The heat wheels will provide both sensible and latent recovery, which will save substantial heating energy and provide some humidification in the winter.
- AHU-2 - Domestic Bag Claim: The air handler for the Domestic Bag Claim area will be a 5660 l/s, variable volume, 100% outside air complete with supply and exhaust fans, glycol cooling coil, glycol heating coils, heat recovery wheel, and with Dynamic air filtration. The air handling unit will be zoned to allow demand reduction based on carbon dioxide sensors. Low pressure ductwork will supply low wall mounted displacement diffusers or custom diffusers integrated with architectural features such as ticket booths, thermal mass walls, and baggage carousels. Return fans on the units will in fact be exhaust fans as all return air will be exhausted after heat recovery. The heat wheels will provide both sensible and latent recovery, which will save substantial heating energy and provide some humidification in the winter. A typical schematic air handling layout with heat wheel for the CBSA PIL/International Bag Claim is shown below:



The air handling unit physical configuration is as shown below:



Air Distribution

Air distribution will be provided through medium pressure ductwork to VAV boxes and low pressure ductwork to displacement diffusers. Outdoor air will be distributed to the inlet of fan coils and chilled beams where utilized in retail and smaller high load spaces.

Exhaust Systems

Exhaust from individual washrooms and common spaces in the will be ducted back to central locations adjacent to the roof mounted air handlers where it will be directed through heat recovery wheels prior to discharging to the outside. Remote washrooms which will be difficult to return back to the air handling unit will be individually exhausted.

► CONTROLS

General

The control system for the new YLW Kelowna Airport Expansion will be a full direct digital control (DDC) system capable of monitoring all equipment, providing remote dial-out, and capable of energy saving scheduling and setback sequences. All control valves and damper actuators will be low voltage electric units to avoid the requirement for an air compressor. The new DDC will be BACNet compatible to allow communication with the existing Airport Base Building control system. The intent is to provide a coordinated control system operable from a single operator work station.

The control system will be provided with an operator’s workstation complete with intuitive operator graphics to allow ease of operation of the systems. The control system will provide full PID control of each system which will be tuned during the commissioning process. The control system will also have trending and energy management capabilities to ensure energy use is monitored.

► FIRE PROTECTION AND LIFE SAFETY PROTECTION

Fire Protection

The facility will be fully sprinklered throughout with exposed sprinkler heads in common areas. Fire extinguishers will be located in flush mounted cabinets located at exits and intermediate locations where required.

► SUSTAINABILITY CONSIDERATIONS

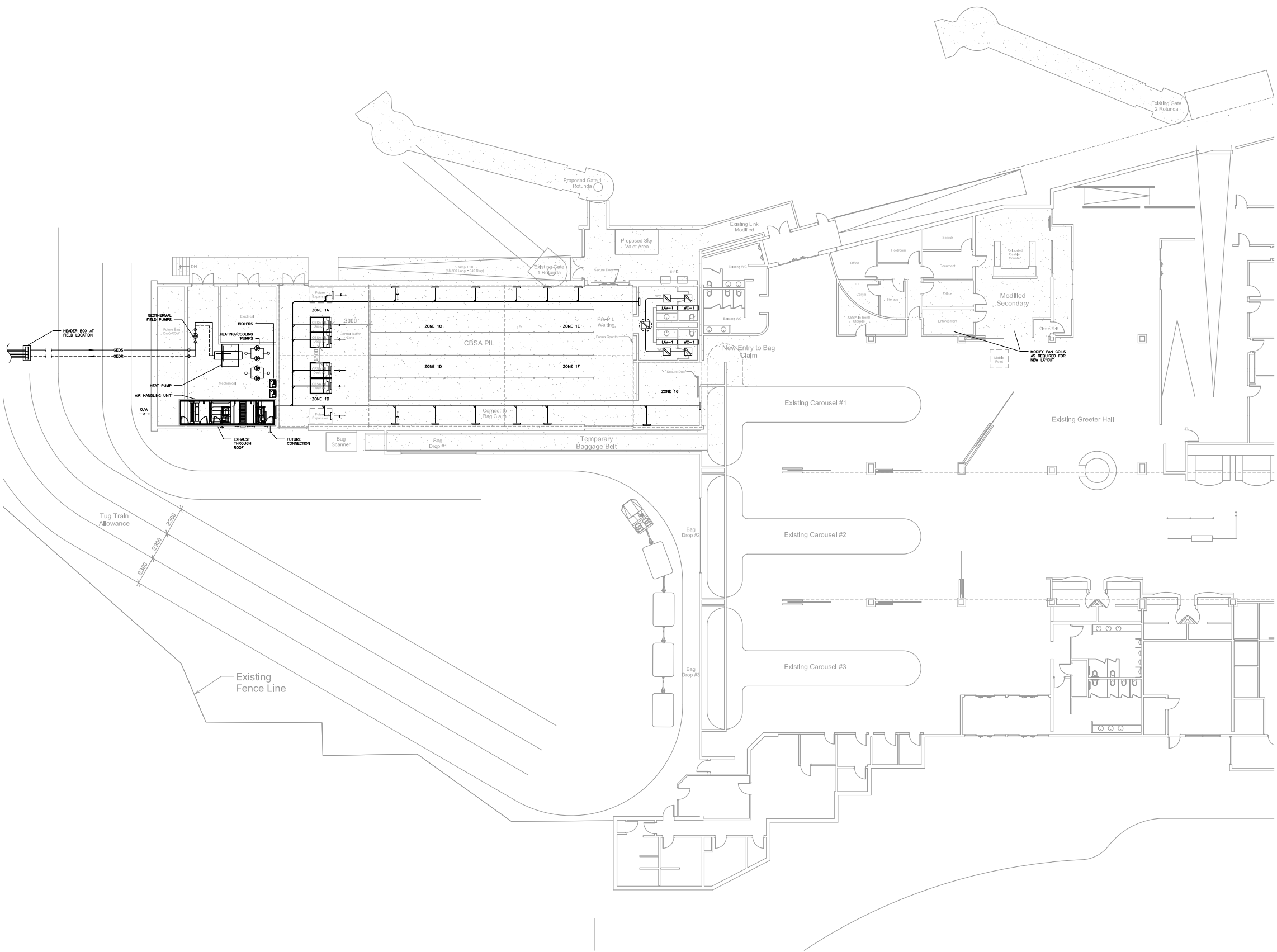
Mechanical Sustainable initiatives for this facility to meet City of Kelowna and YLW goals are as follows:

- ◆ Incorporation of total energy heat recovery wheels on the air handling systems.
- ◆ Ground Source Geothermal Heat Pumps
- ◆ Central water cooled chillers.
- ◆ Low flow plumbing fixtures
- ◆ High efficiency condensing boilers
- ◆ Cooling and Heating slabs located in large open areas.
- ◆ Variable speed drives on all variable hydronic loops.
- ◆ Occupancy sensors in variable occupancy rooms.
- ◆ Reduced air flow volumes in unoccupied times.
- ◆ Displacement ventilation to provide better ventilation effectiveness and provide extended free-cooling hours.
- ◆ Use of thermal mass and night purge cycles in the large open areas such as baggage claim areas and holding areas.

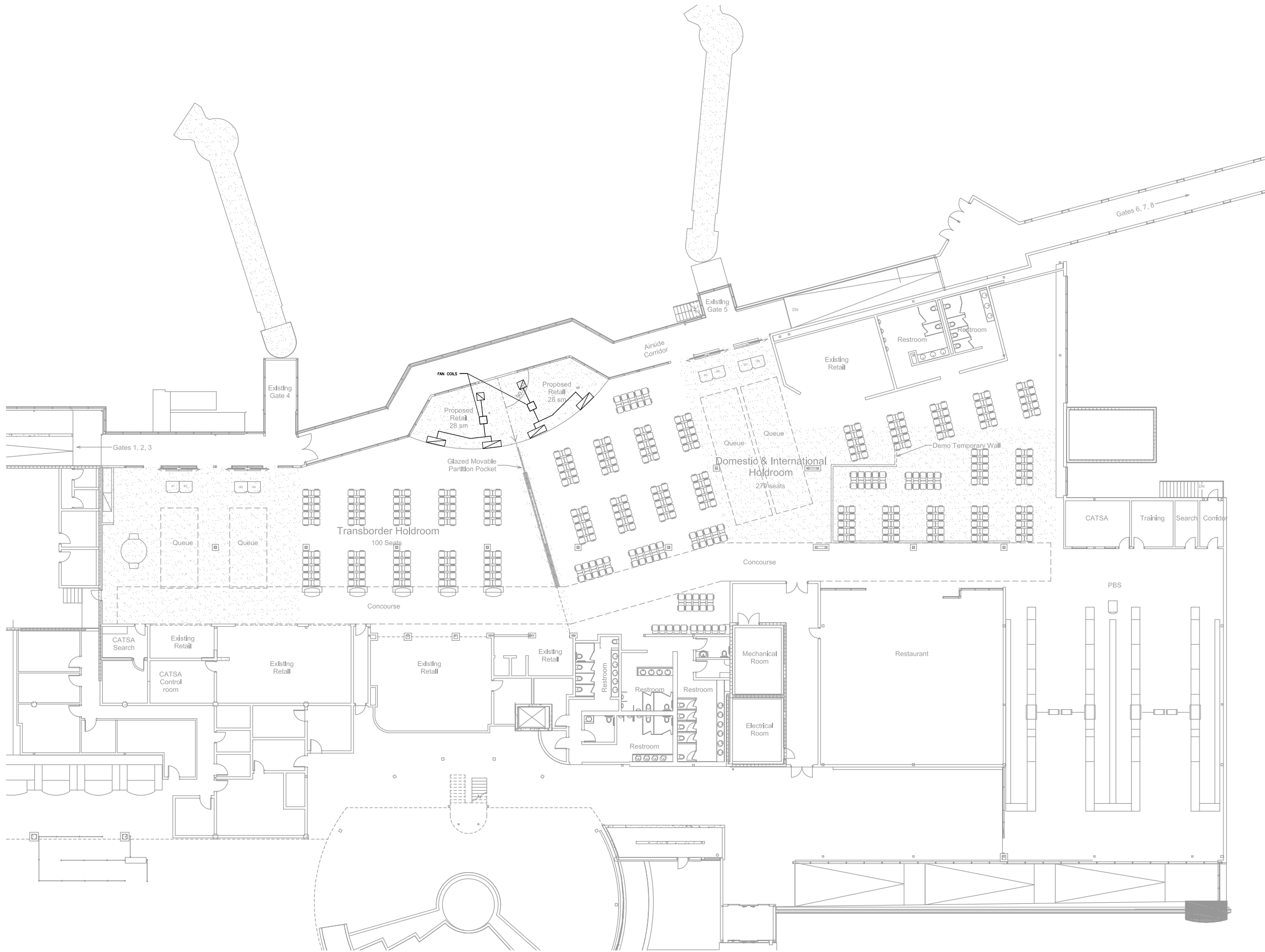
► DRAWINGS

Mechanical Drawings

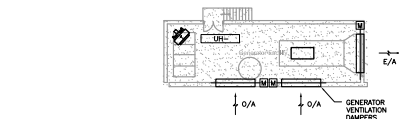
Preliminary mechanical drawings provide general layout information, mechanical room layouts, and general routing of mechanical services.



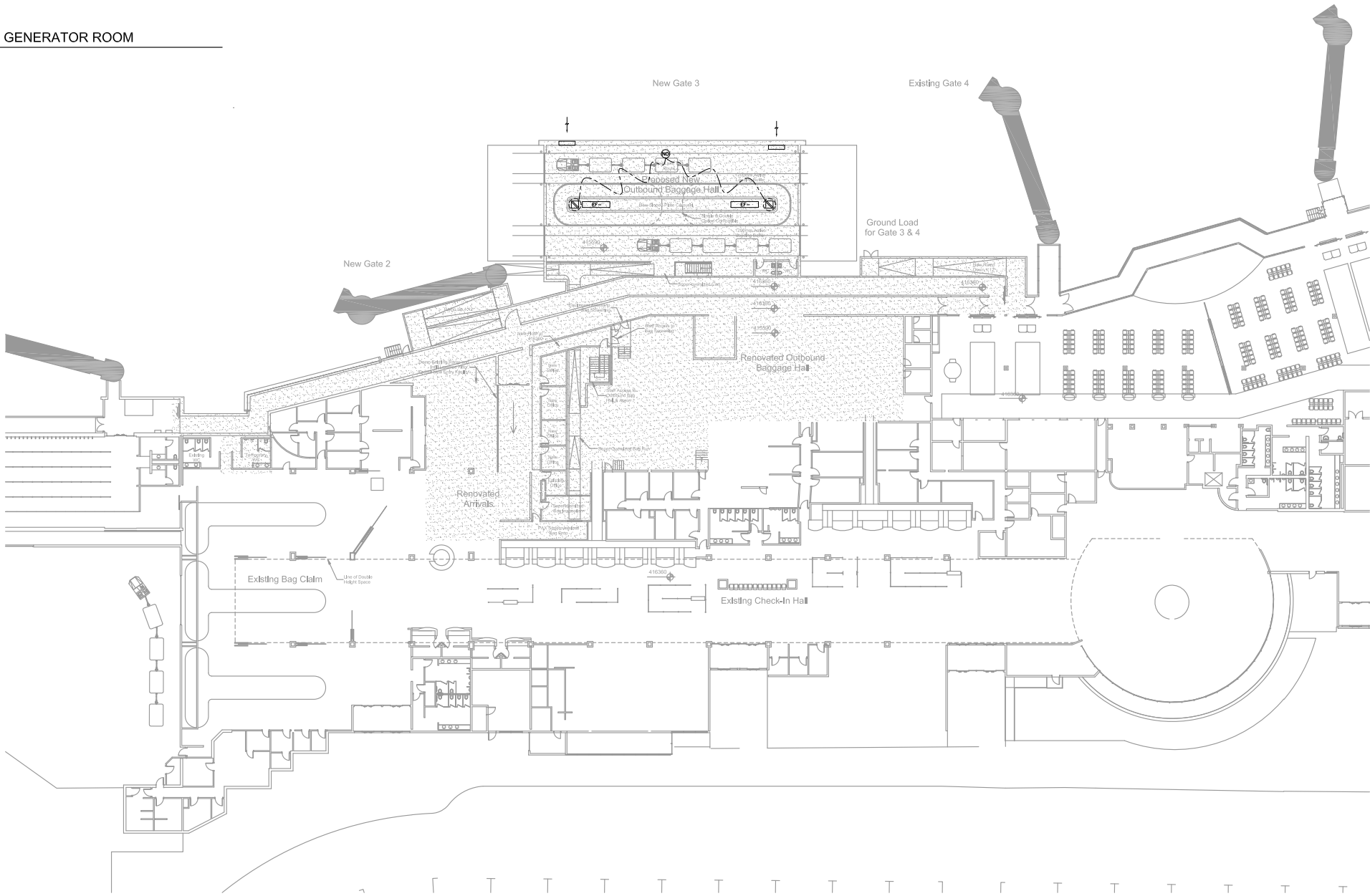
1 MAIN FLOOR NORTH VENTILATION PLAN
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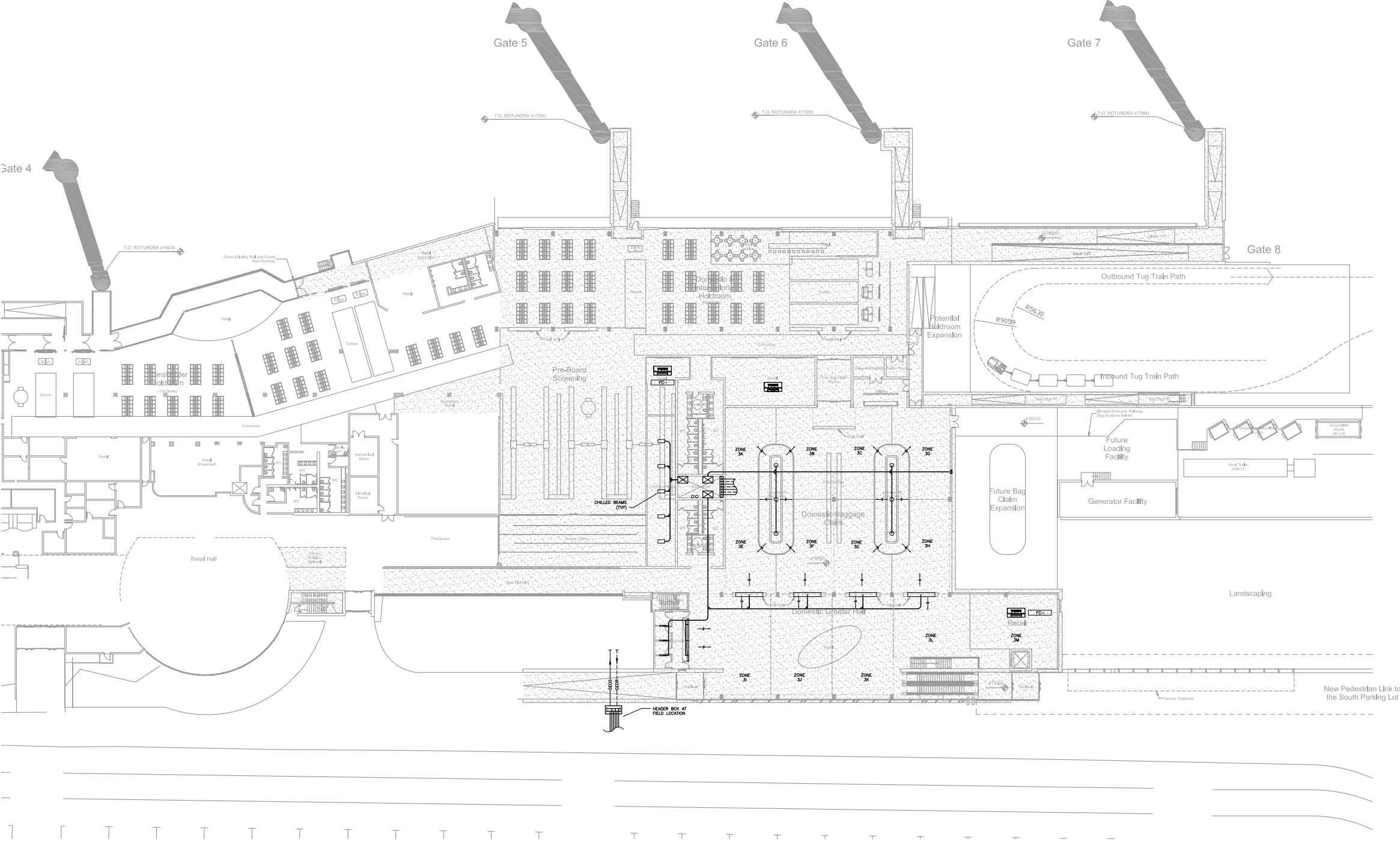
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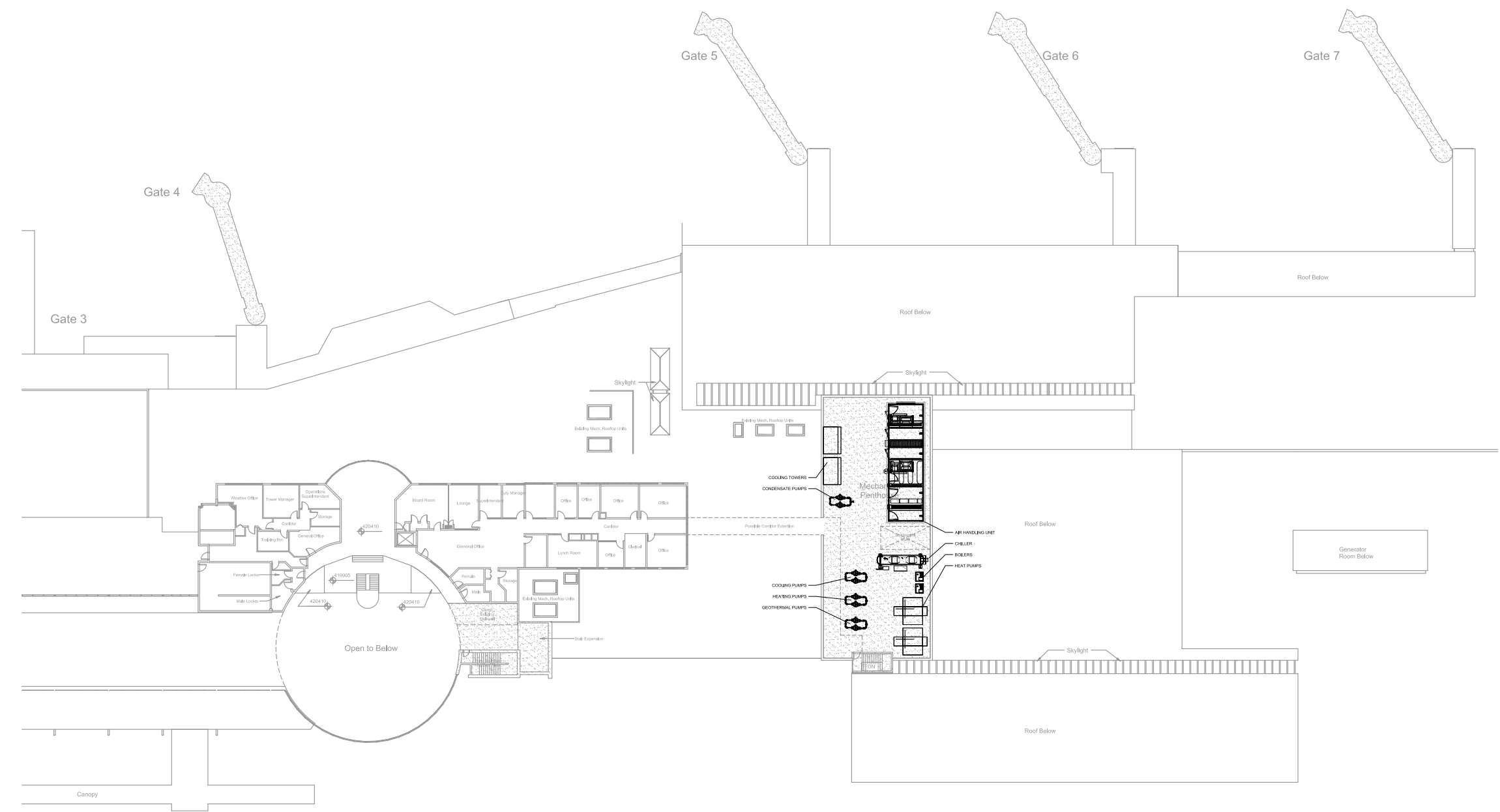
2 MAIN FLOOR - GENERATOR ROOM
1:200



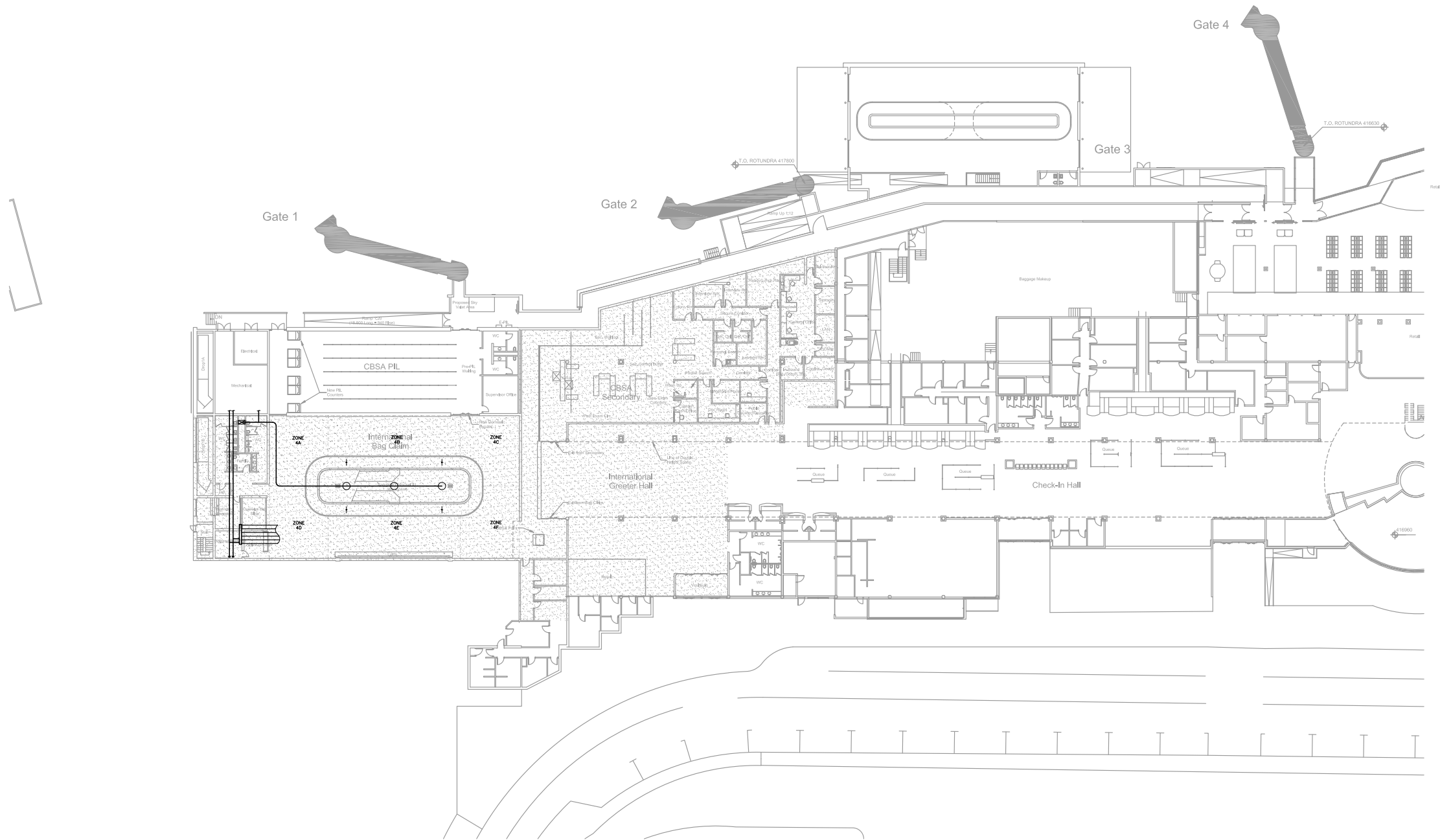
1 MAIN FLOOR VENTILATION PLAN
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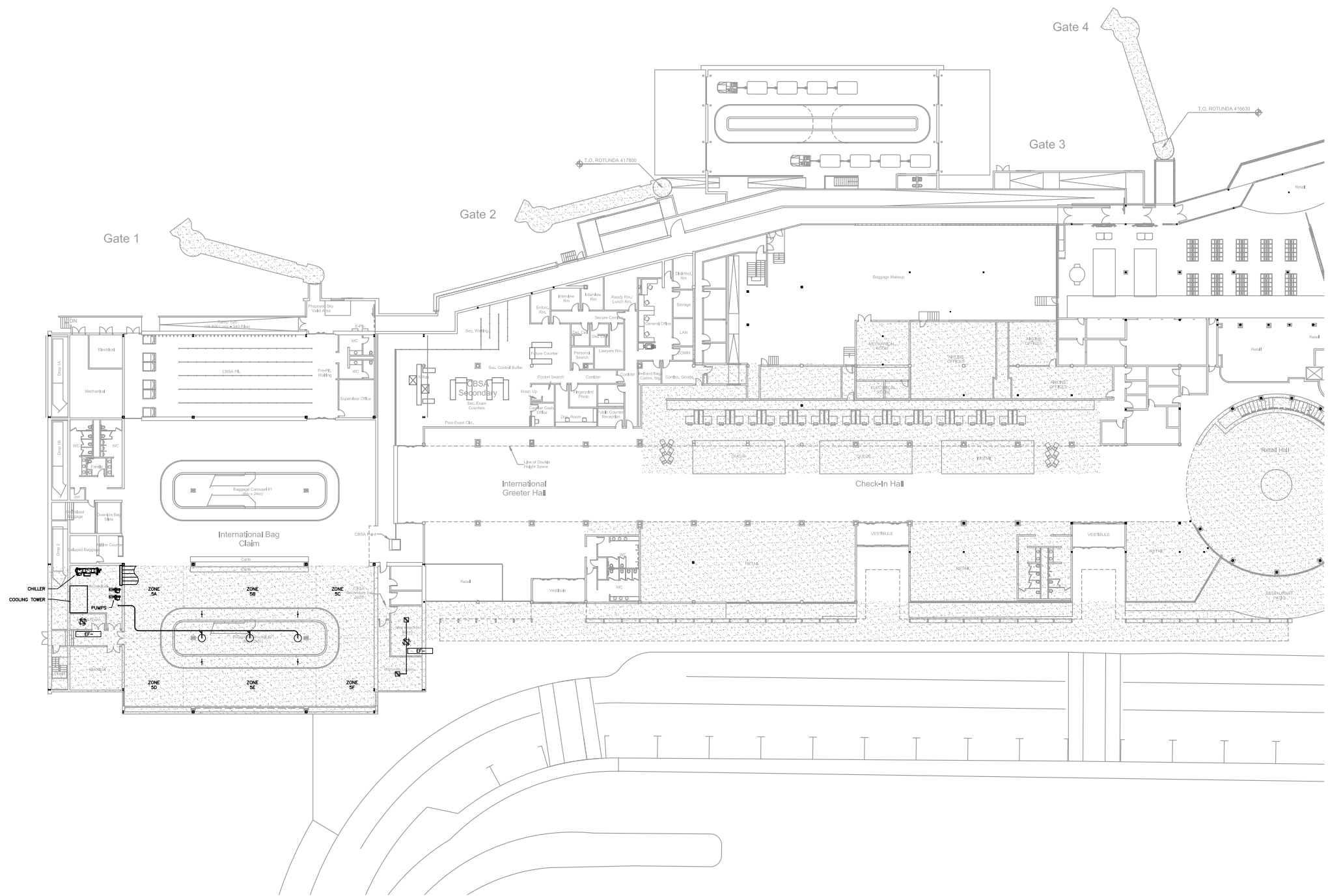
① MAIN FLOOR SOUTH - VENTILATION PLAN
1 : 200



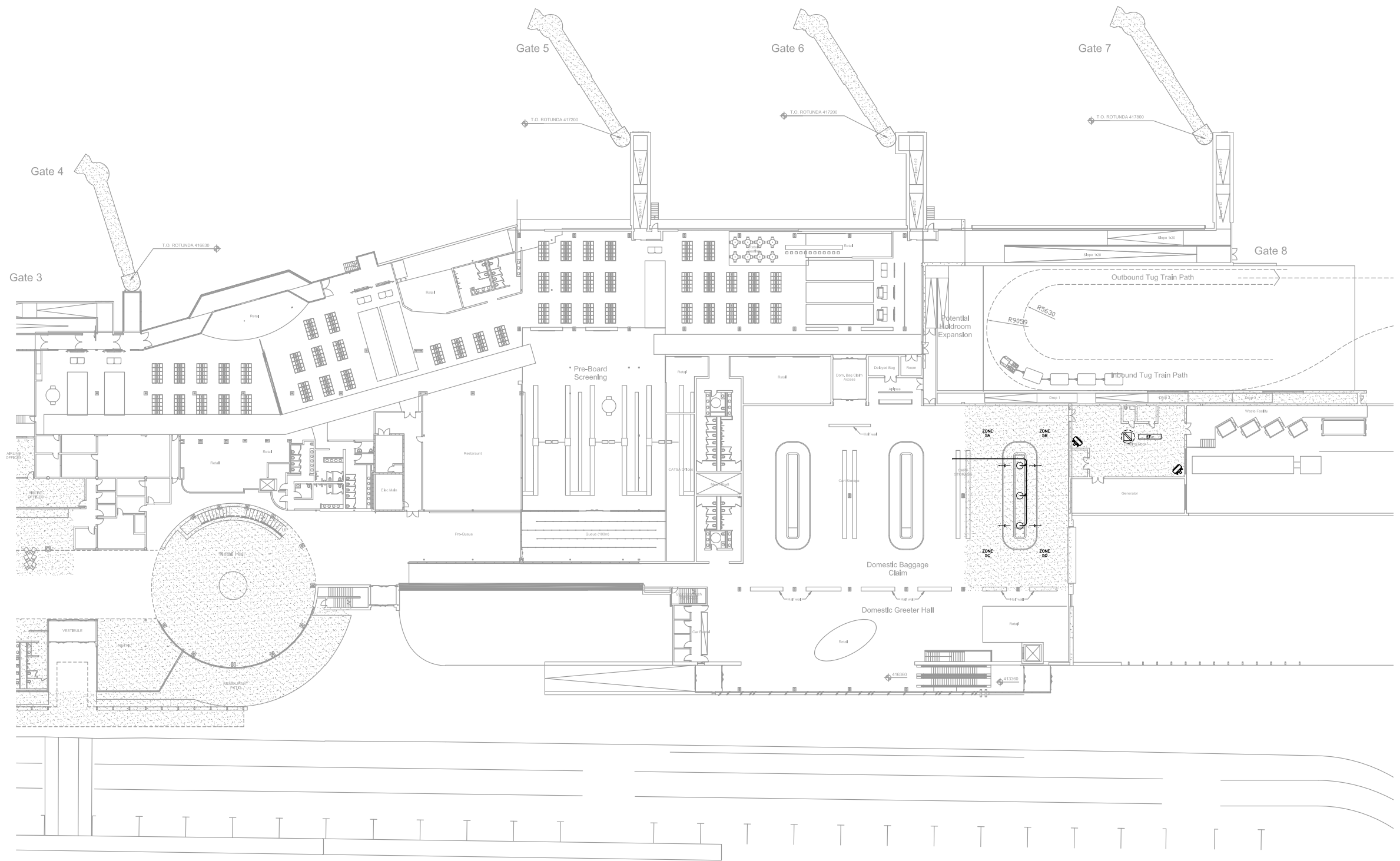
1 SECOND FLOOR SOUTH VENTILATION PLAN
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1 MAIN FLOOR NORTH - VENTILATION PLAN
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1 MAIN FLOOR NORTH - VENTILATION PLAN
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1 MAIN FLOOR SOUTH - VENTILATION PLAN
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9.0 ELECTRICAL SYSTEMS

► INTRODUCTION

This report outlines the early design strategies for power distribution, lighting, fire alarm, communication and security systems at the Kelowna Airport Terminal Building (ATB). The general design philosophy is to provide higher electricity system reliability, superior lighting, future proofing with an extensible data network, sustainability through “right-sizing” and a high degree of maintainability. Consistency in lighting design, lighting control, fire alarm safety and security will be achieved between new and renovated spaces. After review by the Kelowna Airport and the City of Kelowna, this report is intended to form the basis for the further development of the detailed design.

► PERFORMANCE CRITERIA

The design will use current technology while giving due consideration to safety, ease of maintenance, energy efficiency, and cost. The electrical design will utilize affordable sustainability criterion where they can be applied to lower the carbon footprint of the project, enhance maintainability and improve the experiences of both the traveling public and staff. The equipment, light fixtures, and other electrical components specified will be based on readily available, standardized products.

Codes and Regulations

- ◆ The design for the Kelowna Airport renovation and expansion will be in accordance with the British Columbia and National Building Codes. In addition, illumination level requirements for the interior will be comply with IESNA and IATA recommended practices.
- ◆ Security systems will be designed in accordance with CATSA, CBSA and Airport Authority requirements.
- ◆ Fire Alarm systems will be designed in accordance with the Building Code and will be verified to CAN/ULC-S537 (Verification of Fire Alarm Systems) standards.

► DESIGN CONDITIONS AND PHASING

Design Goals

The following design goals will be incorporated into electrical systems designs for the ATB:

- ◆ Provide emergency power to all ATB operations.
- ◆ Reduce energy consumption from lighting substantially. The amount of power savings that can be achieved have been documented in the Dialog Energy Audit report.
- ◆ Minimize electrical system disruptions and shutdowns. Airport operations must be maintained during air operations hours.
- ◆ Integrate the quality and sustainability of electrical options chosen for new construction into renovated areas. There should be no jarring changes in lighting, control, safety systems or power availability between similar functional areas in the ATB at the conclusion of the project. Lighting systems upgrades in areas not directly affected by construction as outlined in phases 1 - 4 will be under a separate contract.
- ◆ Improve the operational safety of the fire alarm system and ensure that the quality of devices, wiring and annunciation is uniformly high throughout the ATB. All older fire alarm systems will be replaced.

Phasing

The ATB expansion and renovation will be accomplished in 5 phases. The first 4 phases form the basis of design through to the year 2016. A fifth phase which would encompass planning through to 2025 is included in order to provide context.

Phasing diagrams, with notes, have been provided as sketches in an addendum with this electrical report. They immediately follow the report text.

From an electrical standpoint, key phasing milestones are as follows:

Phase 1

- ◆ All new, lower power lighting in new construction areas with new power, fire alarm and comms to suit the PIL requirements.
- ◆ Installation of a 1600 A cable bus from the new north electrical room to the south main electrical room. A temporary connection of the cable bus to the south main switchgear will be required.
- ◆ Undertake re-lamping, mock-ups and re-fixturing on north side of ATB to improve lighting efficiency. (Under separate contract)
- ◆ Stub out and cap a duct bank suitable for a 1600 A load from the new north electrical room to an area at least 2 meters north of the future ATB northern extents.
- ◆ Renovate lighting in domestic and international hold rooms.
- ◆ Upgrade fire alarm system with all new 2 stage, addressable system suitable for use on the full 2025 area of the ATB. Replace all old fire alarm wiring with new. Replace all analog devices with addressable devices.

Phase 2

- ◆ New 1500 KVA generator and transfer switch installed in dedicated structure.
- ◆ New 1500 KVA transformer installed to replace existing transformer
- ◆ New duct banks from new transformer to transfer switch and from transfer switch to south main electrical room
- ◆ Provide power and service to suit the new Baggage Facility from the north electrical room. Risks in building the Baggage Facility include unforeseen relocation or replacement costs for underground conduit and services that may be running through or adjacent to the new facility’s footprint. Provide new Fire Alarm devices as required.
- ◆ Provide new fixturing and control strategies for lighting in the main concourse area (under separate contract).

PHASE 3

- ◆ Expand the south main electrical room to allow for relocation of telecommunications services, improve equipment access and maintainability, make room for new gear. Make permanent connection to the 1600 A cable bus.
- ◆ Provide power, lighting, comms, fire alarm for the new ATB expansion.

PHASE 4

- ◆ All new, lower power lighting in new construction areas with new power, fire alarm and comms to suit the PIL requirements.

PHASE 5

- ◆ Abandon and relocate old northwest electrical room to north electrical room to make way for new retail space.
- ◆ Add second transformer at north end along with new emergency power to allow for bridge PCA and power pack improvements. Re-balance power loading of transformers in the system. Make improvements to allow for bi-directional power transfer in ATB.

► SYSTEMS

Utility Supply

The ATB is currently powered from a single 1000 KVA transformer. Distribution voltage is 600 V. Average peak demand in a month is approximately 750 KVA however it can peak in the 830 KVA range during hot months and be in the 600 KVA range in off-peak months. The actual operating demand of the ATB is in the 300-500 KVA range, depending on air-side operations intensity (ie: time of day) and the time of year.

The ATB main breaker is rated at 1200 A, while the main switchgear is 1600 A rated. By phase 2, we plan to replace the main breaker with a 100% rated, 1600 A unit. This will coincide with the installation of a new 1500 KVA transformer and generator.

Late phase 1 power demand will increase load by about 100 to 150 A. Some of this demand will be offset by energy saving measures for lighting and power usage in the existing ATB space. Demand at the new baggage hall will increase power use by the end of phase 2 but this will be offset by the increased capacity of the main service.

Emergency Power

The electrical systems will feature improvements to the emergency power capacity of the ATB. This will be achieved by way of an emergency generator upgrade. The goal of the upgrade is to ensure that most equipment or Utility supply failures will not cause a sustained interruption to any ATB operations. This would include; adversely affecting the processing of arriving or departing passengers, baggage flow or arrivals and departures of aircraft from the gates.

To effect a whole ATB back-up, a new 1500 KVA generator complete with transfer switch will be installed in a purpose built building during phase 2. By phase 5, the generator building will be incorporated into the ATB expansion at the south end of the building. As part of the emergency power upgrade, the existing, end-of-life 75 KW generator that supplies emergency power for the air field lighting will be removed from service. The 125 KW generator that provides emergency power to the ATB will be re-tasked to provide air field emergency power.

There is a cost and installation risk attendant with the upgrading of the emergency power system. CEC Rule 46-108(4) requires that conductors associated with life safety systems and exit signs shall be kept entirely independent of all other conductors. This is probably not the case at the ATB given the age of the building. We would seek an advance ruling from the electrical inspection authority in advance of construction on phase 2. If the Code rule is applied literally and no grandfathering of existing systems is allowed, considerable conduit re-work and re-wiring would be required along with a second transfer switch to fulfill the requirements of the Rule.

Power

Switchgear and Distribution

A key challenge of early expansion is to provide power to the phase 1 Primary Inspection Line (PIL) addition for CBSA. None of the existing electrical rooms have adequate permanent capacity or available space to power a new north end addition. We propose the installation of a 1600 A cable bus between a new north end electrical room and the south main electrical room. As well as providing a new power feed to the north end, this cable bus will serve as a power backbone between the newer, and much longer, ATB that will exist after phase 3.

The cable bus backbone can be used to route power during unusual emergency situations. For instance, in the event of generator maintenance or failure, a temporary truck-mounted generator could be situated on the north side of the ATB and back-feed the ATB through the north electrical room. By phase 5, this cable bus becomes a key pathway for bi-directional load-sharing and shifting. An additional transformer can be added to the ATB and load could then be added from new PCA and power pack units.

Sub-Distribution

All building wiring, unless noted otherwise, will be 98% conductivity copper with minimum 600 volt insulation. Branch circuit wiring will use #12 AWG as the minimum size conductor. Wiring for receptacles will have a dedicated neutral and ground wire. Lighting circuits may utilize shared ground and neutral wires. Shared neutrals shall be minimum #10 AWG. Ground wires shall be minimum #12 AWG.

All wiring will be installed in conduit or cable tray. Electrical metallic tubing (EMT) will be used for the majority of conduit in the building. Empty conduit will have pull cables installed to facilitate future cable installations. Where cable trays and conduit pass through floors and fire-rated walls, they will be sleeved and fire-stopped.

Typically, power utilization will be as follows:

Fluorescent Lighting	347 volts
HID Lighting	347 volts
Convenience receptacles	120 volts
Motorized loads up to and including .37 kW (½ hp)	120 volts
3 Phase motorized loads greater than .37 kW (½ hp)	600 volts

Duplex receptacles will be commercial, specification grade, complete with lamicaid nametags indicating the circuit and panel number. Where possible, data, voice and power receptacles will be housed in a single, multi-device housing.

Connections for Mechanical Equipment

Motor control centers (MCCs) will be provided for the majority of mechanical equipment, complete with starters (where not integral to the equipment). Small motors (½ hp and less) will generally operate on single-Phase 120-volt power, with larger motors operating on three-Phase, 600 V power. In cases of large motor loads not controlled with variable frequency drives (VFDs), power factor correction capacitors will be incorporated.

Starters in the MCC will generally be combination starters, complete with a molded case circuit breaker, a contactor with an adjustable overload relay and single-Phase protection, holding coil, LED pilot light, HOA switch, and two normally open and one normally closed auxiliary holding contacts. Where VFDs are specified the MCC will house a molded case circuit breaker for the device, along with overload protection. Variable frequency drives will be fitted with iron core reactors where larger motor size current harmonics could impact voltage bus stability.

Hand-wash and sanitary fixtures that utilize infra-red sensing will be hardwired.

Grounding

A complete building grounding and bonding network will be provided derived from Earth Ground Electrodes as per the CEC and the requirements of the local electrical inspection authority.

Copper ground busses mounted on insulated stand-offs will be provided in each electrical closet/room and beside all voice/data patch panel racks.

Pre-Conditioned Air and 400 Hz Power

Aircraft pre-conditioned air (PCS) and 400 Hz power are currently provided from portable diesel powered units on the apron. This strategy will continue through the 2016 expansion. Peak power needed to provide stand-by PCA and power to a full complement of aircraft at the gates from bridge attached units could be in the range of an additional 400-600 KW. This would require the installation of much larger transformer during the phase 2 build (with attendant replacement of the main switchgear) or the installation of a second transformer near the north electrical room sometime during phases 2 to 4.

Dialog believes that preparing now for the staging of an additional transformer after 2016 (ie: “phase 5”) provides the most cost effective solution for expansion of the electrical system. In effect, the Phase 1-4 expansion and renovation improves internal building power reliability and capacity, while Phase 5 provides additional power expansion to service future new external power requirements.

Lighting

Interior Lighting

Lighting Power Density Targets

All spaces within the ATB will be designed to meet or exceed ASHRAE 90.1. ASHRAE 90.1 compliance is a pre-requisite of the Building Code, however exceeding the ASHRAE targets will deliver significant energy and carbon emission savings.

The target lighting average power density (LPD) is approximately 0.9 watts per square foot. Areas requiring hire visual acuity will require significantly hire lighting power but these will be offset by lower power requirements in hallways and infrequently occupied areas. In general the LPD’s will be 0.6 w/ft2 for back of house or service locations, 0.6 w/ft2 for concourse areas, 0.9 w/ft2 for offices and lobbies, 1.2 w/ft2 for retail areas. The current lighting power density at the Kelowna ATB is 1.31 w/ft2; so the target LPD represents a 31.3% improvement in operational efficiency.

Lighting Strategies

Lighting strategies for typical areas of the ATB are described in the following sections. To provide an idea of the type of fixtures that can be used, a number of lighting fixture cut-sheets have been provided as an appendix to this report. Consider these fixtures as “suggested” or “typical” for the basis of design.

Mid to Lower Ceiling Lighting

Lighting in mid to lower ceiling areas will utilize suspended T5 fluorescent with Acrylic Lenses or recessed T5 troffer lighting depending on the ceiling treatment and height. T5’s represent a superior feature over basic T8 lighting. Suspended fixtures will help to provide a more amenable space by utilizing indirect/ direct lighting.

Daylight will be harvested using photocell devices to turn off as many luminaires in an area as possible. Photocells coupled with occupancy sensors will ensure that small space lighting is off while unoccupied.

Office and Administrative Areas

Offices, and Administrative Areas will use T5 fluorescent deep cell parabolic luminaires to control display glare. These spaces will be controlled by occupancy sensors to ensure energy conservation and by photocell where practical to harvest daylight. Illuminance levels for these spaces are targeted at 400 lux in agreement with IES levels. Provision to boost lighting levels in these spaces to 500 lux can be accommodated with the existing lighting concept.

High Bay Service Spaces

High Bay areas will use T5 High Output Fluorescent (T5HO) High Bay luminaires. These luminaires will feature clear polycarbonate sealed lenses to improve luminaire efficiency and mitigate lumen depreciation while protecting the lamps.

Central Corridors, Rotunda and Concourse Areas

The concourse and feature common areas will use T5 recessed and pendant fluorescent luminaires depending on ceiling treatments. Wall mounted linear fluorescent fixtures will be used along spaces where there is no ceiling to reduce the need for ceiling suspended high bay fixtures. Interior Light Poles may be provided in vaulted spaces to project light further into the space and provide indirect/direct lighting for aesthetic qualities. Lighting will be controlled to harvest available daylight where possible.

Exterior Lighting

Architectural details will be lit as is appropriate for the application and will be determined as the design progresses. Security lighting will be located as required in consultation with the Airport.

Exterior lighting should be controlled using a combination of daylight sensors and timers. Daylight sensors will keep the lighting off during day-lit hours, while the timers can be used to schedule lights to provide a decreased light level after normal working hours. The existing external lighting control system will be audited to determine its sufficiency. Should a new system be able to require greater efficiency and low payback period, we will recommend replacing it under separate contract as part of Operations and Maintenance Improvements.

There is currently no scope in this project for major roadway, apron or parking lot lighting upgrades. No consideration to additional external lighting beyond the immediate confines of the ATB has been considered for this report.

Emergency and Exit Lighting

Emergency lighting will be mounted in key locations to provide suitable egress lighting as per the Building Code. Exit lights will be provided as required to give exit guidance in accordance with CEC requirements. Emergency and exit lighting will be powered from the emergency generator and may also include battery packs in some areas depending on the safety requirements of the illuminated area.

Sustainable Energy Options

Solar and wind generation, were investigated for their current economics. Airport operations and prevailing wind conditions are not suitable for wind generation.

Solar energy, could be installed on site but not in an economical fashion. The Dialog energy model roadmap indicates that there are better, more economical options for reducing the carbon footprint and improving the energy efficiency of the ATB.

Fire Alarm

A new microprocessor-based, addressable, monitored, annunciated detection and fire alarm system will be installed. Annunciation for this system will be installed in the current west “main” entrance. Due to the size and strategic nature of the ATB a second annunciator should be installed for increased safety. The location of this annunciator is currently planned for an entrance to the building at the north end of the ATB.

Fire alarm initiating devices such as manual pull stations, smoke detectors and heat detectors will be located where required by Code. Signaling devices will be located throughout public, support, and service areas to give alarm signals at the decibel levels required by Code. Fire alarm sprinkler flow valves and tamper switches will be connected to the fire alarm system.

All smoke doors will close on alarm. All fans on air handling units will shut down and smoke dampers will close on alarm and the sprinkler system will be monitored.

Communications

A data /security network will be expanded in the building utilizing a CAT 6 cabling system. In addition, the existing voice network will be extended utilizing the same CAT 6 cabling. The network cabling will serve as a data network for IT equipment and can be used for the security network utilizing addressable digital security cameras. Optical fiber back-bones meeting the multimode requirements of the client Agencies and the Airport will be between communications rooms and where distance is a factor in delivering high speed data. In addition:

- A 300mm wide low voltage cable tray or basket tray system will run in corridors for use with the telephone, data and other low voltage wiring. All runs from the cable tray to zone boxes or devices will be in conduit, which will minimize mechanical damage. Cross-over points will be carefully controlled to comply with EIA/TIA standards.
- The system will be full Category 6 Cabling, outlet jacks, and terminations will be provided in accordance with EIA/TIA standards. Where older cable needs to be replaced, it will be replaced with CAT 6 cable.

Security

This system will interact with the Building Automation Systems, Lighting Controls and Fire Alarm in order to provide intrusion and lock-down protection. Additional interfaces to Agency based systems will be provided where required. It is the intent of this design to migrate new security cameras to a fully digital IP-based system. The current ATB camera system is a high quality analogue system however it will become more expensive to maintain over time and will not have the expansion flexibility of a digital system. A bridge will be required from the new digital cameras to be used in the new construction to the analogue systems’s back-end. This will allow the 2 systems to work as a single system.

The Airport has indicated a preference to continue utilizing Chubb security systems and components. This would maximize the investment in security devices that are currently installed in the ATB. Security design will include the Airport’s preferred vendor during the next phase of design (Design Development).

Commissioning

To ensure that all electrical systems are installed as designed and are fully operational at the time of operation, a comprehensive commissioning and start-up program will be part of the construction process. The program shall insure that the electrical systems are operational at the time of take-over and that maintenance staff is fully trained in its operation.

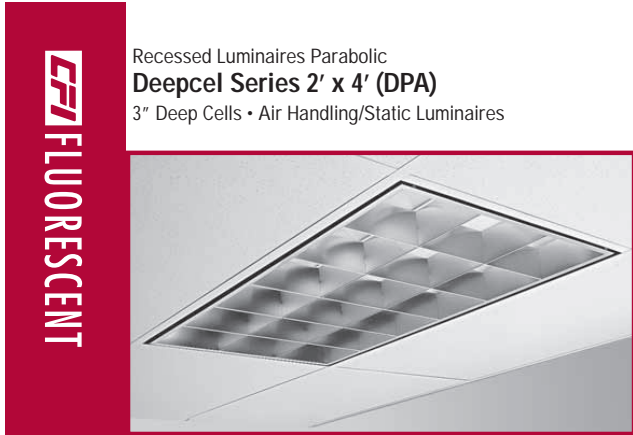
The commissioning process will include design analysis, installation monitoring, testing and correction of deficiencies for at the following systems:

- ◆ Electrical power and distribution, including a coordination study of the newly installed service
- ◆ Emergency lighting operation, light levels and battery packs
- ◆ Lighting and switching
- ◆ Voice and data testing to Cat 6 standards, and correction of deficiencies
- ◆ Fire Alarm Verification and Inspection
- ◆ Functional testing of security and card access systems
- ◆ Integrated systems testing involving mechanical and electrical system coordination

► **TYPICAL INTERIOR FIXTURE TYPES**

Drawing List

- ◆ Electrical Phase 1A Construction Sketch
- ◆ Electrical Phase 1B Construction Sketch
- ◆ Electrical Phase 2 Construction Sketch
- ◆ Electrical Phase 3 Construction Sketch
- ◆ Electrical Phase 4 Construction Sketch
- ◆ Electrical Phase 5 Construction Sketch



Recessed Luminaires Parabolic
Deepcel Series 2' x 4' (DPA)
3" Deep Cells • Air Handling/Static Luminaires

Lightolier Deepcel is the industry standard 3" parabolic louver troffer with features that offer value above the industry standard. Deepcel housings have a clean white interior without holes or bends. Black painted exteriors reduce heat build-up within the lamp/ballast compartment(s) for optimum lamp and ballast efficiency. 24 cell configuration meets IES RP-1 recommended (basic) criteria for VDT areas.

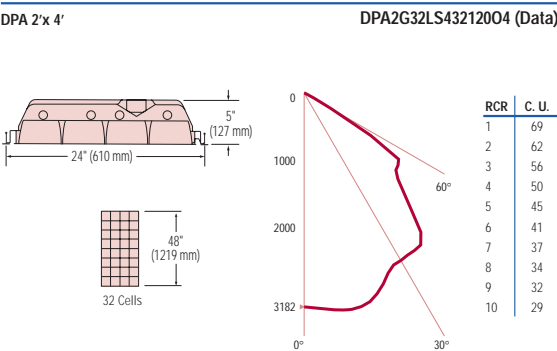
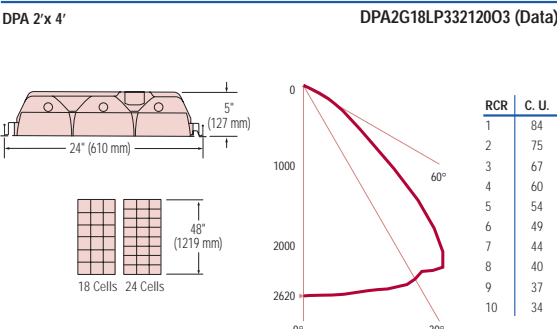
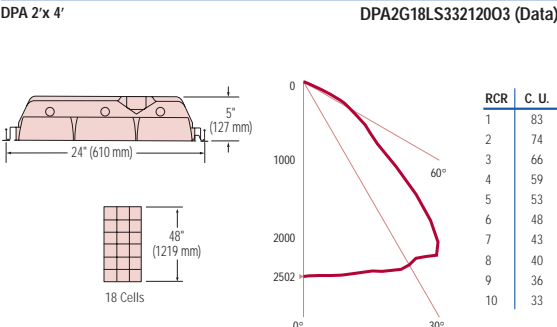
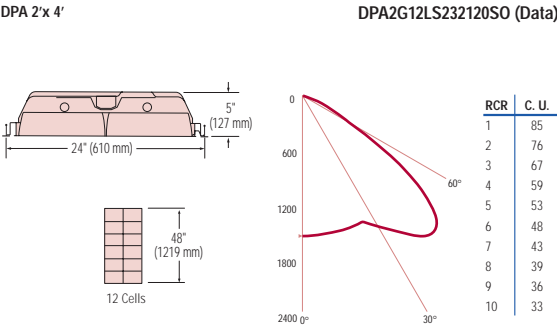
Features

- Only 5" deep.
- Vertical grain on louver eliminates reflected lamp image on cross baffle.
- Spring-loaded latches.
- Mitered aluminum louver flange.
- 3 lamp, 18 cell (77.7% efficient).
- 1.6 spacing to mounting height ratio.
- Snap-in ballast cover.
- Louver has polyethylene dust guard.
- Black exterior finish for cooler ballast operation.
- 24 cell louver configuration meets IES RP-1 recommended (basic) for VDT applications (3-T8 only).
- Built-in Hold-Down clip.
- 3" deep aluminum parabolic louver.
- Available in in T8, T5 and T5HO combinations.

Options pages 150-156

Ballast Specify voltage (120, 277 or 347) and add suffix, e.g. 120SO.
Magnetic Electronic PowerSpec Dimming
T8: **OC** T8: **SO** T8: **PS**
T5/T5HO: **PG**
3 LPB T5/T5HO: **PU** (not avail. in 347V)
4 LPB T5/T5HO: **PV**

LPB : Number of lamps per ballast.
Drywall Kit For plaster frames, order Cat. No.: **FK92X4** (2' x 4').
Radio Interference Filter 120, 277 or 347 volt, 50 or 60 Hz. Suffix: **R**.
Emergency Lighting System Suffix: **O** (e.g. DPA2G12LS232120SOO).
Emergency battery pack with charger.
(90 minutes at 15% of lumens for 1 lamp).
Louver Finish Low iridescence semi-specular is standard. Except **DPA** 24 cells : Low iridescence specular. Consult factoy for other finishes.
Air Pattern Control and Air Slot Closure For horizontal and vertical air supply and to balance return air. Suffix: **S**.
Static For static luminaires, replace **A** in the basic catalogue number by **S**.



FEATURES & SPECIFICATIONS

INTENDED USE
Specification premium, high performance, static T5 luminaires provide general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES
Designed specifically for use with high-efficiency T5 lamps, electronic ballasts and rotary sockets.

CONSTRUCTION
Smooth hemmed sides and smooth, inward formed end flanges for easy handling. Lighter weight fixture allows safe, easy installation.
Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder-painted, steel latches provide easy, secure door closure.
Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos used in this product.

US PATENTS: 6,210,025; 6,231,213; 6,213,625; 2,288,471.

FINISH
Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with highly reflective matte white enamel.

OPTICAL
A12 lens features reverse apex technology for superior lamp obscuration and improved visual comfort.

ELECTRICAL SYSTEM
Standard ballast is electronic programmed rapid start, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.
Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

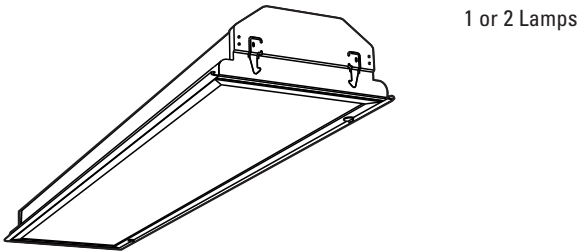
LISTING
Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

WARRANTY
Guaranteed for one year against mechanical defects in manufacture.
Specifications subject to change without notice.

Catalog Number	
Notes	Type A2

Specification Premium T5 Troffer

SP5 1'X4'



Specifications
Length: 48 (1218)
Width: 12 (305)
Depth: 4-1/2 (114)
Weight: 17 lbs (7.7 kg)
All dimensions are inches (millimeters) unless otherwise specified.

ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold)**.
Example: SP5 G 1 54T5HO A12 MVOLT GEB10PS

SP5	G	1	28T5	-	A12	347	GEB10PS	Options
Series	Trim type	Number of lamps	Lamp type	Door frame	Diffuser type	Voltage	Ballast	
SP5	G Grid F Overlapping flanged	1 2 3	28T5 28W T5 (46") 54T5HO 54W T5HO (46")¹	(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white	A12 RA125 A12125 A19	MVOLT² 120 277 347³ Others available.	GEB95 0.95 ballast factor⁴⁵ GEB10PS 1.00 ballast factor GEB95S 0.95 ballast factor, step dimming⁴⁵ GEB115 1.15 ballast factor⁴⁵ GEB115S 1.15 ballast factor, step dimming⁴⁵	EL14 Emergency battery pack⁵⁷ GLR Internal fast-blow fuse⁵ GMF Internal slow-blow fuse⁵ LP835 3500K LPM835P Premiere 3500K⁶ LP841 4100K PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires PWS1846 6' prewire, 3/8" dia., 18-gauge, 4 wires JP Palletized and stretch-wrapped without individual cartons CSA CSA Certified NOM NOM Certified

NOTES:
1 For T5HO applications use GEB10PS.
2 MVOLT (120-277 volts), 50-60HZ.
3 For 347, use GEB95S or GEB10PS.
4 Use with 2-lamp only.
5 Must specify voltage 120 or 277.
6 Use with 28T5 only.
7 Not available with 3-lamp configurations.



FEATURES & SPECIFICATIONS

INTENDED USE

Specification premium, high performance, static T5 luminaires provide general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES

Designed specifically for use with high-efficiency T5 lamps, electronic ballasts and rotary sockets.

CONSTRUCTION

Smooth hemmed sides and smooth, inward formed end flanges for easy handling. Lighter weight fixture allows safe, easy installation.

Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder-painted, steel latches provide easy, secure door closure.

Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

US PATENTS: 6,210,025; 6,231,213; 6,213,625; 2,288,471.

FINISH

Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with highly reflective matte white enamel.

OPTICAL

A12 lens features reverse apex technology for superior lamp obscuration and improved visual comfort.

ELECTRICAL SYSTEM

Standard ballast is electronic programmed rapid start, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING

Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

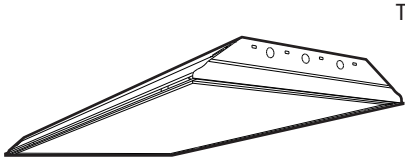
WARRANTY

Guaranteed for one year against mechanical defects in manufacture. Specifications subject to change without notice.

Catalog Number	
2SP5-G-3-28T5-A12-347-GEB10PS	
Notes	Type
	A3

Specification Premium T5 Troffer

SP5 2'X4'



T5 and T5HO Lamps
2, 3 or 4 Lamps

Specifications
Length: 48 (1218)
Width: 24 (609)
Depth: 3-11/16 (94)
Weight: 22 lbs (9.9 kg)

All dimensions are inches (millimeters).

ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold)**.
Example: 2SP5 G 2 28T5 A12 MVOLT GEB95

2SP5	G	3	28T5	-	A12	347	GEB10PS	
Series		Number of lamps		Door frame		Voltage	Ballast	Options
2SP5		2 3 4		(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white		MVOLT ² 120 277 347 ³ Others available.	GEB95 0.95 ballast factor^{4,5} GEB10PS 1.00 ballast factor GEB95S 0.95 ballast factor, step dimming ^{4,5} GEB115 1.15 ballast factor ^{4,5} GEB115S 1.15 ballast factor, step dimming ^{4,5} S5 0.95 ballast factor, SIMPLY5 system ^{5,6}	1/3 One three-lamp ballast (T5HO only) 1/4 One four-lamp ballast (T5HO only) EL14 Emergency battery pack^{7,9} GLR Internal fast-blow fuse⁷ GMF Internal slow-blow fuse⁷ LP835 3500K LPM835P Premiere 3500K ⁵ LP841 4100K PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires PWS1846 6' prewire, 3/8" dia., 18-gauge, 4 wires ⁸ JP Palletized and stretch-wrapped without individual cartons CSA CSA Certified NOM NOM Certified
Trim type		Lamp type						Diffuser type
G Grid F Overlapping flanged MT Modular fit in		28T5 28W T5 (46") 54T5HO 54W T5HO (46") ¹						A12 #12 pattern acrylic, reverse apex RA125 #12 pattern acrylic, .125" thick, reverse apex A12125 #12 pattern acrylic .125" thick A19 #19 pattern acrylic .156" thick

NOTES:
1 For T5HO applications, use GEB10PS.
2 MVOLT (120-277 volts), 50-60HZ.
3 For 347V, use GEB95S or GEB10PS.
4 Available with two- or four-lamp configurations only.
5 28T5 lamps only.
6 SIMPLY5 system includes 13' S5 RELOC wiring system. Specify voltage unless HW (hardwire) or PWS1836 is ordered. For two-lamp 28T5 only.
7 Must specify voltage: 120V or 277V.
8 Use with GEB95S or GEB115S.
9 Not available with three- or four-lamp 28T5 configurations.

Fluorescent

Sheet #: SP5-2x4

STAT-230



FEATURES & SPECIFICATIONS

INTENDED USE

Specification premium, high performance, static T5 luminaires provide general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES

Designed specifically for use with high-efficiency T5 lamps, electronic ballasts and rotary sockets.

CONSTRUCTION

Smooth hemmed sides and smooth, inward formed end flanges for easy handling. Lighter weight fixture allows safe, easy installation.

Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder-painted, steel latches provide easy, secure door closure.

Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

US PATENTS: 6,210,025; 6,231,213; 6,213,625; 2,288,471.

FINISH

Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with highly reflective matte white enamel.

OPTICAL

A12 lens features reverse apex technology for superior lamp obscuration and improved visual comfort.

ELECTRICAL SYSTEM

Standard ballast is electronic programmed rapid start, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING

Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

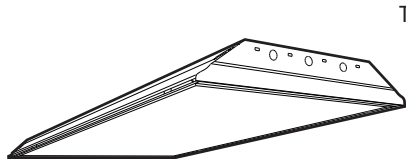
WARRANTY

Guaranteed for one year against mechanical defects in manufacture. Specifications subject to change without notice.

Catalog Number	
2SP5-G-2-28T5-A12-347-GEB10PS	
Notes	Type
	A4

Specification Premium T5 Troffer

SP5 2'X4'



T5 and T5HO Lamps
2, 3 or 4 Lamps

Specifications
Length: 48 (1218)
Width: 24 (609)
Depth: 3-11/16 (94)
Weight: 22 lbs (9.9 kg)

All dimensions are inches (millimeters).

ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold)**.
Example: 2SP5 G 2 28T5 A12 MVOLT GEB95

2SP5	G	2	28T5	-	A12	347	GEB10PS	
Series		Number of lamps		Door frame		Voltage	Ballast	Options
2SP5		2 3 4		(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white		MVOLT ² 120 277 347 ³ Others available.	GEB95 0.95 ballast factor^{4,5} GEB10PS 1.00 ballast factor GEB95S 0.95 ballast factor, step dimming ^{4,5} GEB115 1.15 ballast factor ^{4,5} GEB115S 1.15 ballast factor, step dimming ^{4,5} S5 0.95 ballast factor, SIMPLY5 system ^{5,6}	1/3 One three-lamp ballast (T5HO only) 1/4 One four-lamp ballast (T5HO only) EL14 Emergency battery pack^{7,9} GLR Internal fast-blow fuse⁷ GMF Internal slow-blow fuse⁷ LP835 3500K LPM835P Premiere 3500K ⁵ LP841 4100K PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires PWS1846 6' prewire, 3/8" dia., 18-gauge, 4 wires ⁸ JP Palletized and stretch-wrapped without individual cartons CSA CSA Certified NOM NOM Certified
Trim type		Lamp type						Diffuser type
G Grid F Overlapping flanged MT Modular fit in		28T5 28W T5 (46") 54T5HO 54W T5HO (46") ¹						A12 #12 pattern acrylic, reverse apex RA125 #12 pattern acrylic, .125" thick, reverse apex A12125 #12 pattern acrylic .125" thick A19 #19 pattern acrylic .156" thick

NOTES:
1 For T5HO applications, use GEB10PS.
2 MVOLT (120-277 volts), 50-60HZ.
3 For 347V, use GEB95S or GEB10PS.
4 Available with two- or four-lamp configurations only.
5 28T5 lamps only.
6 SIMPLY5 system includes 13' S5 RELOC wiring system. Specify voltage unless HW (hardwire) or PWS1836 is ordered. For two-lamp 28T5 only.
7 Must specify voltage: 120V or 277V.
8 Use with GEB95S or GEB115S.
9 Not available with three- or four-lamp 28T5 configurations.

Fluorescent

Sheet #: SP5-2x4

STAT-230



OPTION MATRIX

Catalogue Number & Lamp Designations	Ballast Options (choose one)				Radio Filter	Fuse	Emergency Options ³ (choose one)	
	Electronic		Dimming				Integral E ²	Remote ER
	120V-277V U	347V S3	120V D1	277V D2				
FV13 (1) CFQ13W/ G24q	●				●	●	●	
FV18 (1) CFQ18W/ G24q (1) CFM18W/ GX24q	●	●	●	●	●	●	●	
FV26/32/42 (1) CFQ26W/ G24q (1) CFM26W/ GX24q (1) CFM32W/ GX24q (1) CFM42W/ GX24q	●	●			●	●	●	
FV26 (1) CFQ26W/ G24q (1) CFM26W/ GX24q			●	●	●	●	●	
FV32 (1) CFM32W/ GX24q			●	●	●	●	●	
FV42 (1) CFM42W/ GX24q			●	●	●	●	●	

¹ FS2 fuse kits are field installed (see page 574 for details). For large projects, consult factory for information on factory installation.
² For use with emergency trim options only.
³ Emergency options are not available for use with sloped ceiling systems or remodel systems.

CAPRI® C1

8" Diameter Compact Fluorescent

TRIMS (For finishes see pages 578-579)

Catalogue #	Description
V83	Gold Reflector
V83SL	Gold Reflector, Self-lipped
V84	Black Reflector
V84SL	Black Reflector, Self-lipped
V85	Low Iridescent Reflector
V85SL	Low Iridescent Reflector, Self-lipped
V86	White Reflector
V86SL	White Reflector, Self-lipped
V87	Wheat Reflector
V87SL	Wheat Reflector, Self-lipped
V83E	Gold Reflector, Emergency
V84E	Black Reflector, Emergency
V85E	Low Iridescent Reflector, Emergency
V86E	White Reflector, Emergency
V87E	Wheat Reflector, Emergency
V85BE	Low Iridescent Refl., Black Baffle, Emerg.
V85WBE	Low Iridescent Refl., White Baffle, Emerg.
V85BC	Black Baffle, Clear lens Insert ♣
V85BF	Black Baffle, Fresnel lens Insert ♣
V85BP	Black Baffle, C73 Prismatic lens Insert ♣
V85B	Low Iridescent Reflector, Black Baffle
V85WB	Low Iridescent Reflector, White Baffle
V85WBC	White Baffle, Clear lens Insert ♣
V85WBF	White Baffle, Fresnel lens Insert ♣
V85WBP	White Baffle, C73 Prismatic lens Insert ♣
VW83	Gold Reflector, Single Wall Wash
VWD83	Gold Reflector, Double Wall Wash
VW85	Low Iridescent Refl., Single Wall Wash
VWD85	Low Iridescent Refl., Double Wall Wash
VW87	Wheat Reflector, Single Wall Wash
VWD87	Wheat Reflector, Double Wall Wash
V85C	Clear Cone, Clear lens Insert ♣
V85F	Clear Cone, Fresnel lens Insert ♣
V85P	Clear Cone, C73 Prismatic lens Insert ♣
V86C	White Splay, Clear lens Insert ♣
V86F	White Splay, Fresnel lens Insert ♣
V86P	White Splay, C73 Prismatic lens Insert ♣
V85SR10	Accommodates, 5° - 15° Slope
V85SR20	Accommodates, 16° - 25° Slope
V85SR30	Accommodates, 26° - 35° Slope
V85XB	Clear Low Iridescent Cross Baffle Reflector
V85SWR	Shower Trim ♣

To create a catalogue number

Start with the plaster frame

Choose an electrical system

Choose a 8" trim

CM8S

CM8S-FV26/32/42U

CM8S-FV26/32/42U-V85SR20-CH24⁴

⁴See page 573 for bar hanger options.



FEATURES & SPECIFICATIONS

INTENDED USE
Specification premium, high performance, static T5 luminaires provide general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES
Designed specifically for use with high-efficiency T5 lamps, electronic ballasts and rotary sockets.

CONSTRUCTION
Smooth hemmed sides and smooth, inward formed end flanges for easy handling. Lighter weight fixture allows safe, easy installation.

Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder-painted, steel latches provide easy, secure door closure.

Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

US PATENTS: 6,210,025; 6,231,213; 6,213,625; 2,288,471.

FINISH
Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with highly reflective matte white enamel.

OPTICAL
A12 lens features reverse apex technology for superior lamp obscuration and improved visual comfort.

ELECTRICAL SYSTEM
Standard ballast is electronic programmed rapid start, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

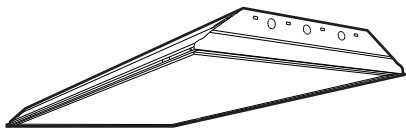
LISTING
Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

WARRANTY
Guaranteed for one year against mechanical defects in manufacture. Specifications subject to change without notice.

Catalog Number	2SP5-G-2-28T5-A19-347-GEB10PS
Notes	Type A8

Specification Premium T5 Troffer

SP5 2'X4'



T5 and T5HO Lamps
2, 3 or 4 Lamps

Specifications
Length: 48 (1218)
Width: 24 (609)
Depth: 3-11/16 (94)
Weight: 22 lbs (9.9 kg)
All dimensions are inches (millimeters).

ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold)**.
Example: 2SP5 G 2 28T5 A12 MVOLT GEB95

2SP5	G	2	28T5	-	A12	347	GEB10PS	
Series		Number of lamps		Door frame		Voltage	Ballast	Options
2SP5		2 3 4		(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white		MVOLT² 120 277 347 ³ Others available.	GEB95 0.95 ballast factor^{4,5} GEB10PS 1.00 ballast factor GEB95S 0.95 ballast factor, step dimming ^{4,5} GEB115 1.15 ballast factor ^{4,5} GEB115S 1.15 ballast factor, step dimming ^{4,5} S5 0.95 ballast factor, SIMPLY5 system ^{5,6}	1/3 One three-lamp ballast (T5HO only) 1/4 One four-lamp ballast (T5HO only) EL14 Emergency battery pack^{7,9} GLR Internal fast-blow fuse⁷ GMF Internal slow-blow fuse⁷ LP835 3500K LPM835P Premiere 3500K ⁵ LP841 4100K PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires PWS1846 6' prewire, 3/8" dia., 18-gauge, 4 wires ⁸ JP Palletized and stretch-wrapped without individual cartons CSA Certified NOM NOM Certified
Trim type		Lamp type					Diffuser type	
G Grid F Overlapping flanged MT Modular fit in		28T5 28WT5 (46") 54T5HO 54WT5HO (46")¹					A12 #12 pattern acrylic, reverse apex RA125 #12 pattern acrylic, .125" thick, reverse apex A12125 #12 pattern acrylic .125" thick A19 #19 pattern acrylic .156" thick	
NOTES: 1 For T5HO applications, use GEB10PS. 2 MVOLT (120-277 volts), 50-60HZ. 3 For 347V, use GEB95S or GEB10PS. 4 Available with two- or four-lamp configurations only. 5 28T5 lamps only. 6 SIMPLY5 system includes 13' S5 RELOC wiring system. Specify voltage unless HW (hardwire) or PWS1836 is ordered. For two-lamp 28T5 only. 7 Must specify voltage: 120V or 277V. 8 Use with GEB95S or GEB115S. 9 Not available with three- or four-lamp 28T5 configurations.								

♣ Denotes cUL wet location listing. Emergency trims are dry location listed only.



FEATURES & SPECIFICATIONS

INTENDED USE
Specification premium, high performance, static T5 luminaires provide general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES
Designed specifically for use with high-efficiency T5 lamps, electronic ballasts and rotary sockets.

CONSTRUCTION
Smooth hemmed sides and smooth, inward formed end flanges for easy handling. Lighter weight fixture allows safe, easy installation. Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder-painted, steel latches provide easy, secure door closure. Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

US PATENTS: 6,210,025; 6,231,213; 6,213,625; 2,288,471.

FINISH
Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with highly reflective matte white enamel.

OPTICAL
A12 lens features reverse apex technology for superior lamp obscuration and improved visual comfort.

ELECTRICAL SYSTEM
Standard ballast is electronic programmed rapid start, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

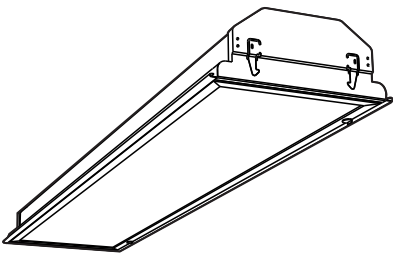
LISTING
Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

WARRANTY
Guaranteed for one year against mechanical defects in manufacture. Specifications subject to change without notice.

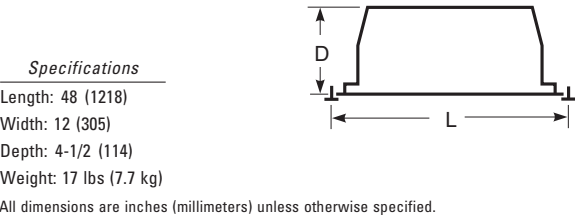
Catalog Number	SP5-G-1-28T5-A19-347-GEB10PS
Notes	Type A9

Specification Premium T5 Troffer

SP5 1'X4'



1 or 2 Lamps



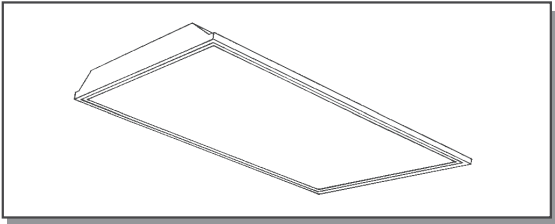
ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold)**.
Example: SP5 G 1 54T5HO A12 MVOLT GEB10PS

SP5	G	1	28T5	-	A12	347	GEB10PS	
Series SP5		Number of lamps 1 2 3		Door frame (blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white		Voltage MVOLT² 120 277 347 ³ Others available.	Ballast GEB95 0.95ballast factor^{4,6} GEB10PS 1.00ballast factor GEB95S 0.95 ballast factor, step dimming ^{4,6} GEB115 1.15ballast factor^{4,6} GEB115S 1.15 ballast factor, step dimming ^{4,6}	Options EL14 Emergency battery pack^{5,7} GLR Internal fast-blow fuse⁵ GMF Internal slow-blow fuse⁵ LP835 3500K LPM835P Premiere 3500K ⁶ LP841 4100K PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires PWS1846 6' prewire, 3/8" dia., 18-gauge, 4 wires JP Palletized and stretch-wrapped without individual cartons CSA CSA Certified NOM NOM Certified
Trim type G Grid F Overlapping flanged		Lamp type 28T5 28W T5 (46") 54T5HO 54W T5HO (46")¹			Diffuser type A12 #12 pattern acrylic, reverse apex RA125 #12 pattern acrylic, reverse apex 0.125" thick A12125 #12 pattern acrylic 0.125" thick A19 #19 pattern acrylic 0.156" thick			

NOTES:
1 For T5HO applications use GEB10PS.
2 MVOLT (120-277 volts), 50-60HZ.
3 For 347, use GEB95S or GEB10PS.
4 Use with 2-lamp only.
5 Must specify voltage 120 or 277.
6 Use with 28T5 only.
7 Not available with 3-lamp configurations.

2' x 4' TG



CONSTRUCTION/FINISH

- A quality low-profile troffer with specification features for NEMA "G" grid, or NEMA "F" flange ceiling types.
- 3" nominal housing depth, 3-3/16" maximum depth.
- Smooth rolled edges on all four sides for easy handling.
- Die-formed one piece housing includes stiffening embosses and provides increased rigidity.
- Housing is multi-stage phosphate treated for maximum corrosion resistance and finish coat is high reflectance baked white enamel.
- Lamp pin openings in housing ends for easier relamping (can be relamped without using openings).
- Integral baffling system to prevent light leaks.
- 2 sets of integral grid clips (wraparound and fold out) for maximum mounting flexibility.
- Integral wire hanger holes for independent wire suspension.
- Embosses with holes provided in housing end for screwing to T-bar if desired.
- On T8 models, a single lamp can be changed without disturbing other lamps or wireway cover.



2, 3, or 4 Lamp
T5 or T8
Prismatic Acrylic Lens

- 7/8" K.O.'s provided in each end cap for through wiring.
- Factory installed access plate in housing top includes 7/8" hole with rolled edge and 7/8" K.O.

ELECTRICAL

- Class P, HPF ballasts comply with © Federal Ballast Law (Public Law 100-357,1988).
- cUL certified.
- Self-contained fluorescent emergency power packs can be incorporated.
- Rotating ring locking lampholder is standard for secure and positive retention of lamps.

ENCLOSURES

- Full "C" channel door frames for improved lens support and reduced shipping damage.
- Flat steel door frame features smooth rolled edges inside and outside.
- All door frames have mitered corners.
- All door frames use T-hinges and can be hinged and latched from either side.
- Opposable spring loaded latches are standard for easy operation and consistent retention.

CATALOG NUMBER

2

WIDTH
2 - 2'

FIXTURE FAMILY
TG8 - TG8 Troffer, Grid
TF8 - TG8 Troffer, Flange

NO. OF LAMPS
(not included)
2
3
4

DOOR FRAME
(not included)
BLANK - Flat Steel
FA - Flat Alum.
RA - Regr. Alum.

DOOR FINISH
BLANK - White Door
B - Black Door

LENS
01 - Pattern 12 prismatic acrylic
12 - DB-12, .125" nominal
19 - DB-19, .156" nominal
21 - Pattern 12, .125" nominal
32 - 1/2" x 1/2" x 1/2" silver louver
36 - 1-1/2" x 1-1/2" x 1-1/2" silver louver

LAMP TYPE/WATTAGE
28 - 28wT5 (46")
32 - 32wT8 (48")
54HO - 54wT5HO (46")

VOLTAGE
120
277
347
UNV - Universal voltage, 120-277

OPTIONS
SI - Silverado Insert
1/2 - One 2-lamp ballast (electronic or non-standard)
1/3 - One 3-lamp ballast (electronic or non-standard)
1/21- 2-lamp & 1-lamp ballasts (electronic or non-standard)
1/4 - One 4-lamp ballast (electronic or non-standard)
1W - 1-way gasketing, between lens & door frame
2W - 2-way gasketing, 1W + gasketing between door frame & housing
3W - 3-way gasketing, 2W + gasketing for field installation between housing & ceiling
See section C1600-OA for other options.

Accessory:
FMA24 - 2' x 4' "F" mounting frame for NEMA

Job name:

Type:

C425.3-SR

189 Bullock Drive, Markham, Ontario L3P 1W4
Tel: 905-294-9570
Fax: 905-294-9811 or 1-800-268-0003
www.thomaslightingcanada.com

THOMAS LIGHTING CANADA
a Genlyte company

EDGE 4 A

1T5 and 2T5 RECESSED LINEAR DIRECT /Acrylic Lens

CONSTRUCTION Formed cold rolled steel housing. Highly reflective die-formed white painted steel reflector, .125" diffuse snap-in acrylic lens with matte finish, removable for lamp replacement.

ELECTRICAL Standard programmed start UL listed Class P, T5 electronic, Sound Rated A, thermally protected, high power factor ballasts less than 10% THD, Universal voltage (120/277) with 50/60Hz operation. Through wiring with quick connects standard. Standard single circuit. Integral battery packs with remote test switch are provided with 1B and 2B options. Each ballast provided with disconnects to meet luminaire disconnect code requirement.

MOUNTING Edge is designed to install into acoustical grid and inaccessible ceilings. Specify GXG, FLF, SFS, NFN for Individual, unjoinable units (individual units will fall on-grid). Specify GX, FL, SF, NF for continuous rows (Rows fall on-grid). Consult factory for detailed installation instructions.

FINISH Standard powder-coat textured white painted finish on exposed trim, consult factory for custom colors.

LABELS UL and cUL Listed, approved for dry/damp location unless otherwise noted.

LUMINAIRE SPECIFICATION						
E4A- 1T5__- __'- __'- __'- __'- __'- __'-						
HOUSING	LAMPS	LENGTH	MOUNTING ¹	VOLTAGE	CIRCUITING	FINISH OPTIONS
E4A- Edge 4 recessed with Acrylic Lens	Individual Units ² 2- 2' T5: 1 or 2-14W T5HO: 1 or 2-24W 3- 3' T5: 1 or 2-21W T5HO: 1 or 2-39W 4- 4' T5: 1 or 2-28W T5HO: 1 or 2-54W 6- 6' T5: 2 or 4-21W T5HO: 2 or 4-39W 8- 8' T5: 2 or 4-28W T5HO: 2 or 4-54W Continuous Runs ³ xx'- Specify nominal overall row length in 1' increments	120- 120 V 277- 277 V 347- 347 V ⁵ UNV- UNV ⁵ (120/277)	W- Matte White CC- Custom Color	1C- Single Circuit 2C- Dual Circuit ⁶ 1D- Single Circuit Dimming ⁶ 2D- Dual Circuit Dimming ⁶ 1B- Single Circuit with Battery Pack ^{6,12} 2B- Dual Circuit with Battery ^{6,12} 1E- Single Circuit with Emergency Circuit ⁶ 2E- Dual Circuit with Emergency Circuit ⁶	QS- Quick Ship ⁷ PM- Perimeter Mount ⁸ RC- Rotating Crossbar ⁹ M- MR16 Lamp ¹⁰ CP- Chicago Plenum CL- Illuminated Connector ¹¹	
INDIVIDUAL UNITS (CANNOT BE JOINED) ² Acoustical Grid Ceiling G1G- 1" Ceiling Grid G9G- 9/16" Ceiling Grid GSG- Screw Slot Ceiling Grid		CONTINUOUS RUNS (JOINABLE) ³ Acoustical Grid Ceiling G1- 1" Ceiling Grid G9- 9/16" Ceiling Grid GS- Screw Slot Ceiling Grid		Inaccessible Ceiling FL- Standard 1/2" Flange SF- Spackle Flange NF- Flangeless ⁴		

¹See below for mounting detail. Consult factory for regular edged tiles.

²Individual units cannot be joined. All end trims are factory installed and cannot be removed in the field. Individual fixtures designed to fall on-grid.

³Continuous runs are designed to fall on-grid with acoustical grid ceilings.

⁴NF and NFN are to be utilized for metal pan / millwork ceiling.

⁵347 volt and UNV not available with MR16 and battery packs.

⁶Some Edge configurations will not accommodate all electrical options. Consult factory.

⁷Includes 4 ft individual unjoinable units, G1G, FLF mounts, Universal voltage, std white finish, single and dual circuit.

⁸Available for acoustical grid ceilings. Wall rail painted white unless otherwise specified.

⁹1/2" to 5/8" drywall thickness. Available for standard 1/2" flange (FL).

¹⁰See back page for Layout and Ordering Information.

¹¹Add CL to all fixture types involved in the connector layout. See back page for additional information.

¹²Integral battery packs with remote test switch are provided with 1B and 2B options.

Individual Luminaires¹

Mounting Detail

PINNACLE ARCHITECTURAL LIGHTING™ 12655 East 42nd Avenue, Suite 50 Denver, Colorado 80239 Ph 303.322.5570 Fax 303.322.5568 www.pinnacle-ltg.com
Specifications and dimensions subject to change without notice. Specification sheets that appear on
pinnacle-ltg.com are the most recent version and supersede all other previous printed or electronic versions.
December 2009
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FEATURES & SPECIFICATIONS

INTENDED USE
Specification premium, high performance, static T5 luminaires provide general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES
Designed specifically for use with high-efficiency T5 lamps, electronic ballasts and rotary sockets.

CONSTRUCTION
Smooth hemmed sides and smooth, inward formed end flanges for easy handling. Lighter weight fixture allows safe, easy installation.

Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder-painted, steel latches provide easy, secure door closure.

Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

US PATENTS: 6,210,025; 6,231,213; 6,213,625; 2,288,471.

FINISH
Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with highly reflective matte white enamel.

OPTICAL
A12 lens features reverse apex technology for superior lamp obscuration and improved visual comfort.

ELECTRICAL SYSTEM
Standard ballast is electronic programmed rapid start, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING
Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

WARRANTY
Guaranteed for one year against mechanical defects in manufacture.
Specifications subject to change without notice.

ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold)**.
Example: 2SP5 G 2 28T5 A12 MVOLT GEB9S

2SP5	G	2	28T5	-	A12	347	GEB10PS	
Series		Number of lamps		Door frame		Voltage	Ballast	Options
2SP5		2 3 4		(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white		MVOLT² 120 277 347 ³ Others available.	GEB9S 0.95 ballast factor^{4,5} GEB10PS 1.00 ballast factor GEB95S 0.95 ballast factor, step dimming ^{4,5} GEB115 1.15 ballast factor ^{4,5} GEB115S 1.15 ballast factor, step dimming ^{4,5} S5 0.95 ballast factor, SIMPLY5 system ^{5,6}	1/3 One three-lamp ballast (T5HO only) 1/4 One four-lamp ballast (T5HO only) EL14 Emergency battery pack^{7,9} GLR Internal fast-blow fuse⁷ GMF Internal slow-blow fuse⁷ LP835 3500K LPM835P Premiere 3500K ⁵ LP841 4100K PWS1836 6' prewire, 3/8" dia., 18-gauge, 3 wires PWS1846 6' prewire, 3/8" dia., 18-gauge, 4 wires ⁸ JP Palletized and stretch-wrapped without individual cartons CSA CSA Certified NOM NOM Certified
Trim type		Lamp type					Diffuser type	
G Grid F Overlapping flanged MT Modular fit in		28T5 28WT5 (46") 54T5HO 54WT5HO (46") ¹					A12 #12 pattern acrylic, reverse apex RA125 #12 pattern acrylic, .125" thick, reverse apex A12125 #12 pattern acrylic .125" thick A19 #19 pattern acrylic .156" thick	

NOTES:
1 For T5HO applications, use GEB10PS.
2 MVOLT (120-277 volts), 50-60HZ.
3 For 347V, use GEB95S or GEB10PS.
4 Available with two- or four-lamp configurations only.
5 28T5 lamps only.
6 SIMPLY5 system includes 13' S5 RELOC wiring system. Specify voltage unless HW (hardwire) or PWS1836 is ordered. For two-lamp 28T5 only.
7 Must specify voltage: 120V or 277V.
8 Use with GEB95S or GEB115S.
9 Not available with three- or four-lamp 28T5 configurations.

Fluorescent


Sheet #: SP5-2x4 STAT-230


Verge™


Suspended


Direct/Indirect

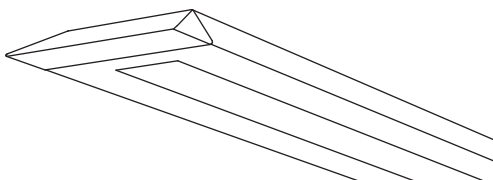
2 T5











Project Name

Spec Type

Notes


Order Guide

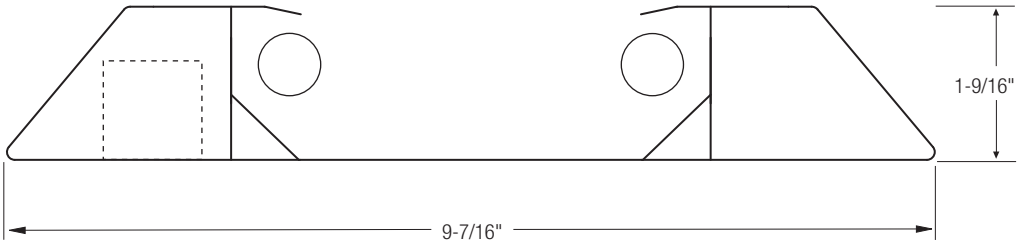
Some combinations of product options may not be available. Consult factory for assistance with your specification.

7606	F02	Q	G	-		-		-		-	
Product Series & Type	Lamping	Lower Optics	Upper Optics	Run Length	Wiring	Voltage	Ballast	Color & Finish			
Verge Direct/Indirect	2 T5	Q MesoOptics® Lens	N None G 80% Down Kit J 100% Down Kit	Enter the total run length in feet (4ft increments)	1 1 cct 2 2 cct 3 1 cct w/ Emergency cct 4 2 cct w/ Emergency cct 5 1 cct w/ Battery Pack 6 2 cct w/ Battery Pack 7 1 cct Dimming	1 120V 2 277V	E Standard Ballast Consult website for ballast manufacturer information	W Standard White C Factory Color X Custom Color Consult website for color and finish options			
						Mounting Hardware					
						Mount Type	Suspension Length				
						Consult separate mounting spec sheet for mount type options	Enter distance from ceiling to top of fixture in inches				

Upgrades & Accessories

Please indicate with check mark.

<input type="checkbox"/> Lamps Included	<input type="checkbox"/> Dust Cover
<input type="checkbox"/> Response Daylight (Integrated Controls) For details visit www.ledalite.com/response	



© 2009 Ledalite Phone: 604.888.6811 Fax: 800.665.5332 Web: www.ledalite.com

Filename 7606F02QG.pdf Rev 1.2

Ledalite is a Philips group brand

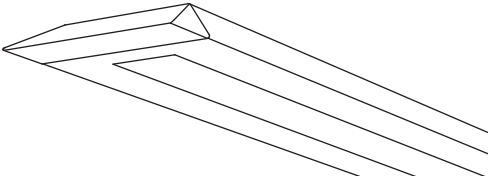
PHILIPS

104

Verge™



Suspended
Direct/Indirect
2 T5HO



Project Name

Spec Type

Notes

Order Guide

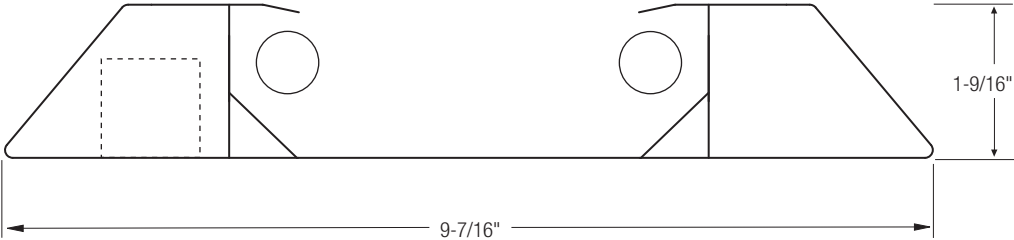
Some combinations of product options may not be available. Consult factory for assistance with your specification.

7606	H02	Q	G	-		-		-		-	
Product Series & Type Verge Direct/Indirect	Lamping 2 T5HO	Lower Optics Q MesoOptics® Lens	Upper Optics N None G 80% Down Kit J 100% Down Kit	Run Length <i>Enter the total run length in feet (4ft increments)</i>	Wiring 1 1 cct 2 2 cct 3 1 cct w/ Emergency cct 4 2 cct w/ Emergency cct 5 1 cct w/ Battery Pack 6 2 cct w/ Battery Pack 7 1 cct Dimming	Voltage 1 120V 2 277V 3 347V	Ballast E Standard Ballast Consult website for ballast manufacturer information	Color & Finish W Standard White C Factory Color X Custom Color Consult website for color and finish options			
						Mounting Hardware					
						Mount Type	Suspension Length				
						Consult separate mounting spec sheet for mount type options	<i>Enter distance from ceiling to top of fixture in inches</i>				


Upgrades & Accessories

Please indicate with check mark.

- ☐ Lamps Included
- ☐ Response Daylight (Integrated Controls)
For details visit www.ledalite.com/response



DAY-BRITE®
CLDW



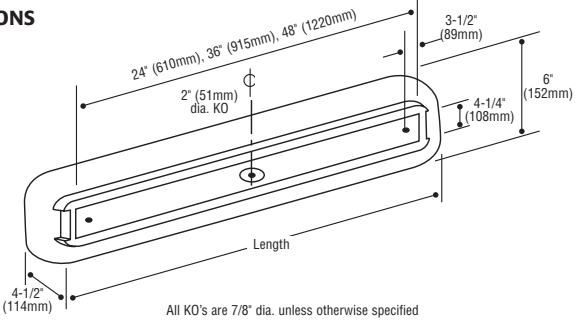
CLOUDLINE BRACKET

A functional and attractive wall luminaire.

DESIGN FEATURES

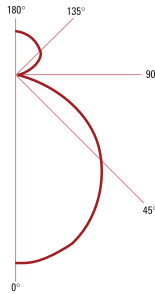
- These fixtures are primarily used for wall mounting; however they may also be surface mounted to ceilings.
- Housing is multi-stage phosphate treated for maximum corrosion resistance and finish coat is high reflectance baked white enamel.
- For individual mounting only.
- Lens is one piece smooth opal acrylic.
- Lens is retained by a thumb screw on each end.
- cUL certified.

DIMENSIONS



All KO's are 7/8" dia. unless otherwise specified

CLDW232A-120-1/2-EB -- IES File: D19743.IES



RF	20%	RC	80%	
RW	70	50	30	10
RCR				
0	77	77	77	77
1	68	64	61	57
2	61	55	50	45
3	56	48	42	37
4	51	42	36	31
5	46	37	31	26
6	43	33	27	22
7	39	30	24	20
8	37	27	21	17
9	34	25	19	15
10	32	23	17	14

SAMPLE CATALOGUE NUMBER: CLDW232-120-1/2-EB

FAMILY

CLDW – Cloudline Wall Bracket

LAMP TYPE/WATTAGE

14 – 14wT5 (22")
17 – 17wT8 (24")
20 – 20wT12 (24")
24HO – 24wT5HO (22")
21 – 21wT5 (34")
39HO – 39wT5HO (34")
25 – 25wT8 (36")
28 – 28wT5 (46")
32 – 32wT8 (48")
54HO – 54wT5HO (46")

NO. OF LAMPS

(not included)
1
2

VOLTAGE


120
277
347
UNV – Universal voltage, 120-277 volt (with T8 electronic ballast option only)

OPTIONS

See pages 145 to 149 for options information.

CLOUDLINE BRACKETS –PRODUCT AVAILABILITY				
Size	Family	Lamps/ Fixture	Lamp Type	
2'	1, 2	14, 17, 20, 24HO	26-3/4"(679)	
3'	1, 2	21, 25, 39HO	38-3/4"(984)	
4'	1, 2	28, 32, 54HO	50-3/4"(1289)	

DAY-BRITE®
CLDW



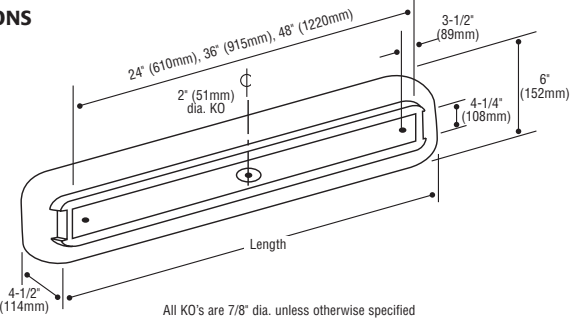
CLOUDLINE BRACKET

A functional and attractive wall luminaire.

DESIGN FEATURES

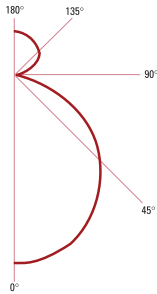
- These fixtures are primarily used for wall mounting; however they may also be surface mounted to ceilings.
- Housing is multi-stage phosphate treated for maximum corrosion resistance and finish coat is high reflectance baked white enamel.
- For individual mounting only.
- Lens is one piece smooth opal acrylic.
- Lens is retained by a thumb screw on each end.
- cUL certified.

DIMENSIONS



All KO's are 7/8" dia. unless otherwise specified

CLDW232A-120-1/2-EB -- IES File: D19743.IES



RF	20%	RC	80%	
RW	70	50	30	10
RCR				
0	77	77	77	77
1	68	64	61	57
2	61	55	50	45
3	56	48	42	37
4	51	42	36	31
5	46	37	31	26
6	43	33	27	22
7	39	30	24	20
8	37	27	21	17
9	34	25	19	15
10	32	23	17	14

SAMPLE CATALOGUE NUMBER: CLDW232-120-1/2-EB

FAMILY

CLDW – Cloudline Wall Bracket

LAMP TYPE/WATTAGE

14 – 14wT5 (22")
17 – 17wT8 (24")
20 – 20wT12 (24")
24HO – 24wT5HO (22")
21 – 21wT5 (34")
39HO – 39wT5HO (34")
25 – 25wT8 (36")
28 – 28wT5 (46")
32 – 32wT8 (48")
54HO – 54wT5HO (46")

NO. OF LAMPS

(not included)
1
2

VOLTAGE

120
277
347
UNV – Universal voltage, 120-277 volt (with T8 electronic ballast option only)

OPTIONS

See pages 145 to 149 for options information.

CLOUDLINE BRACKETS –PRODUCT AVAILABILITY				
Size	Family	Lamps/ Fixture	Lamp Type	
2'	1, 2	14, 17, 20, 24HO	26-3/4"(679)	
3'	1, 2	21, 25, 39HO	38-3/4"(984)	
4'	1, 2	28, 32, 54HO	50-3/4"(1289)	

COOPER LIGHTING - METALUX®

DESCRIPTION

The HB series is an outstanding solution for high mounting height industrial or retail applications. The HB optic has been optimized to provide maximum performance from either the T5 or T8 lamps. Optional uplight component is provided to enable excellent ceiling uniformity. HB's high lumen package allows the benefits of fluorescent to be applied at high mounting heights that were traditionally exclusive to H.I.D. The primary benefits include exceptional color rendering, high system efficacy, 95% lumen maintenance, long lamp life, instant on/instant re-strike, economical dimming, and uniform brightness control. Primary applications include "big box" retail, shopping malls, light industrial, gymnasiums, etc.

SPECIFICATION FEATURES

A ... Construction

Full bodied steel housing utilizes captive fasteners to protect optical assembly and assure structural integrity. The housing features an integral ballast channel that adds strength and provides numerous KO's for easy installation. Optional Top Access Plate allows service in electrical compartment without removal of lamps. Die formed internal reflectors are available in both high reflectance specular material or in painted after fabrication white enamel.

B ... Electrical

Class "P" ballasts are positively secured by mounting bolts. Roto-lock lampholders. Optional modular power receptacle meets UL2459 and NEC 410.73 and is

UL/cUL rated for make and break under load from outside the luminaire to speed maintenance. Thermally optimized for environments up to 149°F (65°C) when used with high temperature ballasts in open uplight configurations. UL/CUL listed. Suitable for damp locations.

C ... Finish

White enamel finish preceded by a multistage cleaning cycle, iron phosphate coating with rust inhibitor to protect against contaminants and oxidation.

D ... Downlight/Uplight Optics

Die formed reflectors are faceted with two optical distributions: medium and wide. Medium beam optical modules utilize 95% specular aluminum while the wide

distribution utilizes a high performance 95% reflective polyester powder coated finish. Gasketed door frame and lens assembly is optional for more demanding environments. Uplight option provided to enable ceiling uniformity.

Mounting

The HB series is suited for surface, suspension mounting with optional wire hook and chain set, stem or cable mounting. Top connector box mounting is also available.

Options

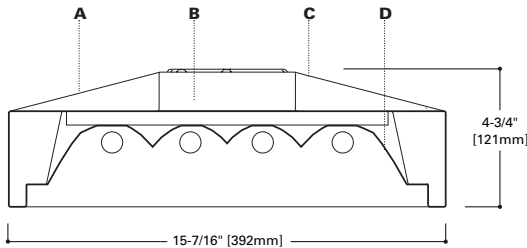
Integral Occupancy Sensor available and provides from 600 sq. ft. (MS) up to 1250 sq. ft. (MSO) of coverage in a maximum mounting height of 40'.

Catalog #		Type
Project		B5
Comments		Date
Prepared by		

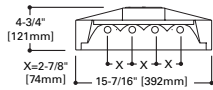


F-BAY
HB SERIES

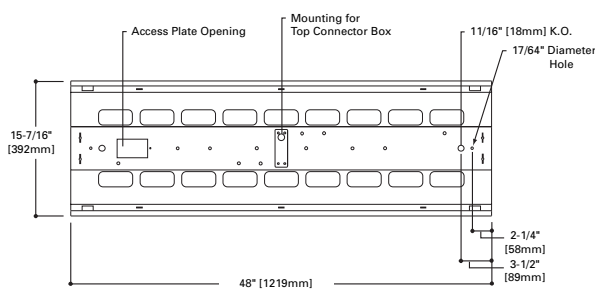
15" x 4' High-Bay
4 Lamp
HIGH-BAY INDUSTRIAL
LUMINAIRE



LAMP CONFIGURATIONS



DIMENSION TOP VIEW



ENERGY DATA

Input Watts:

EB Ballast

432 (109)

EB/Plus Ballast

432 (147)

ER Ballast

432 (112)

454 (229)

ER/Plus Ballast

432 (144)

Luminaire Efficacy Rating

LER = 66 (White)

LER = 70 (Specular)

Catalog Number: HB-454T5-UPL

Yearly Cost of 1000 Lumens,

3000 hrs. at .08 KWH = \$3.42

* Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements

** Consult Pre Sales Technical Support.

LAMPS CONTAIN MERCURY. DISPOSE ACCORDING TO LOCAL, STATE OR FEDERAL LAWS



COOPER LIGHTING - METALUX®

DESCRIPTION

The HB series is an outstanding solution for high mounting height industrial or retail applications. The HB optic has been optimized to provide maximum performance from either the T5 or T8 lamps. Optional uplight component is provided to enable excellent ceiling uniformity. HB's high lumen package allows the benefits of fluorescent to be applied at high mounting heights that were traditionally exclusive to H.I.D. The primary benefits include exceptional color rendering, high system efficacy, 95% lumen maintenance, long lamp life, instant on/instant re-strike, economical dimming, and uniform brightness control. Primary applications include "big box" retail, shopping malls, light industrial, gymnasiums, etc.

SPECIFICATION FEATURES

A ... Construction

Full bodied steel housing utilizes captive fasteners to protect optical assembly and assure structural integrity. The housing features an integral ballast channel that adds strength and provides numerous KO's for easy installation. Optional Top Access Plate allows service in electrical compartment without removal of lamps. Die formed internal reflectors are available in both high reflectance specular material or in painted after fabrication white enamel.

B ... Electrical

Class "P" ballasts are positively secured by mounting bolts. Roto-lock lampholders. Optional modular power receptacle meets UL2459 and NEC 410.73 and is

UL/cUL rated for make and break under load from outside the luminaire to speed maintenance. Thermally optimized for environments up to 149°F (65°C) when used with high temperature ballasts in open uplight configurations. UL/CUL listed. Suitable for damp locations.

C ... Finish

White enamel finish preceded by a multistage cleaning cycle, iron phosphate coating with rust inhibitor to protect against contaminants and oxidation.

D ... Downlight/Uplight Optics

Die formed reflectors are faceted with two optical distributions: medium and wide. Medium beam optical modules utilize 95% specular aluminum while the wide

distribution utilizes a high performance 95% reflective polyester powder coated finish. Gasketed door frame and lens assembly is optional for more demanding environments. Uplight option provided to enable ceiling uniformity.

Mounting

The HB series is suited for surface, suspension mounting with optional wire hook and chain set, stem or cable mounting. Top connector box mounting is also available.

Options

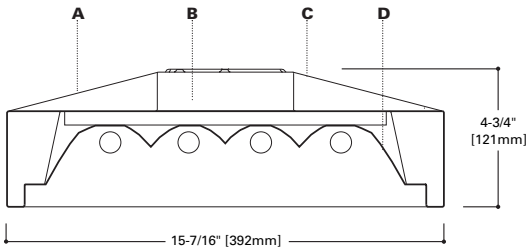
Integral Occupancy Sensor available and provides from 600 sq. ft. (MS) up to 1250 sq. ft. (MSO) of coverage in a maximum mounting height of 40'.

Catalog #		Type
Project		B6
Comments		Date
Prepared by		

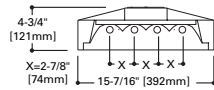


F-BAY
HB SERIES

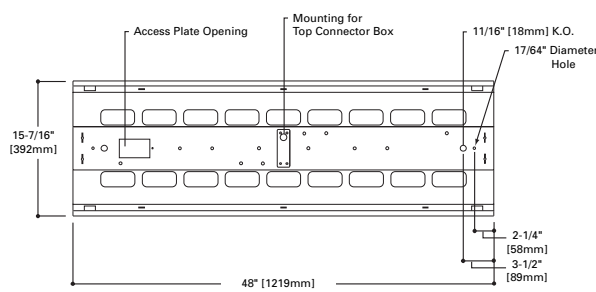
15" x 4' High-Bay
4 Lamp
HIGH-BAY INDUSTRIAL
LUMINAIRE



LAMP CONFIGURATIONS



DIMENSION TOP VIEW



ENERGY DATA

Input Watts:

EB Ballast

432 (109)

EB/Plus Ballast

432 (147)

ER Ballast

432 (112)

454 (229)

ER/Plus Ballast

432 (144)

Luminaire Efficacy Rating

LER = 66 (White)

LER = 70 (Specular)

Catalog Number: HB-454T5-UPL

Yearly Cost of 1000 Lumens,

3000 hrs. at .08 KWH = \$3.42

* Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements

** Consult Pre Sales Technical Support.

LAMPS CONTAIN MERCURY. DISPOSE ACCORDING TO LOCAL, STATE OR FEDERAL LAWS



METALUX®

DESCRIPTION

The HB series is an outstanding solution for high mounting height industrial or retail applications. The HB optic has been optimized to provide maximum performance from either the T5 or T8 lamps. Optional uplight component is provided to enable excellent ceiling uniformity. HB's high lumen package allows the benefits of fluorescent to be applied at high mounting heights that were traditionally exclusive to H.I.D. The primary benefits include exceptional color rendering, high system efficacy, 95% lumen maintenance, long lamp life, instant on/instant re-strike, economical dimming, and uniform brightness control. Primary applications include "big box" retail, shopping malls, light industrial, gymnasiums, etc.

SPECIFICATION FEATURES

A Construction

Full bodied steel housing utilizes captive fasteners to protect optical assembly and assure structural integrity. The housing features an integral ballast channel that adds strength and provides numerous KO's for easy installation. Center access plate location allows for easy access to ballast leads on all new and retrofit projects regardless of mounting type.

B Electrical

Class "P" ballasts are positively secured by mounting bolts. Roto-lock lampholders. Optional modular power receptacle meets UL2459 and NEC 410.73 and is UL/cUL rated for make and break under load from outside the luminaire to speed maintenance. UL/CUL listed. Suitable for damp locations. Thermally optimized for environments up to 149°F (65°C) when used with high temperature ballasts in an open uplight configuration.

C Finish

White enamel finish preceded by a multistage cleaning cycle, iron phosphate coating with rust inhibitor to protect against contaminants and oxidation.

D Downlight/Uplight Optics

Die formed reflectors are faceted with two optical distributions –medium and wide. Medium beam optical modules utilize 95% specular aluminum while the wide distribution utilizes a high performance 95% reflective polyester powder coated finish. Gasketed door frame & lens assembly is optional for more demanding environments. Uplight option provided to enable ceiling uniformity.

Mounting

The HB series is suited for surface, suspension mounting with optional wire hook and chain set or cable mounting.

Options

Integral Occupancy Sensor available and provides from 600 sq. ft. (MS) up to 1250 sq. ft. (MSO) of coverage in a maximum mounting height of 40'.



F-BAY HB SERIES

15" x 4' High-Bay
2 Lamp

HIGH-BAY INDUSTRIAL
LUMINAIRE



ENERGY DATA

Input Watts:

EB Ballast
232 (58)

EB/Plus Ballast
232 (73)

ER Ballast
232 (57)
254 (117)

ER/Plus Ballast
232 (74)

Luminaire Efficacy Rating

LER = 72

Catalog Number: HB-254T5-UPL

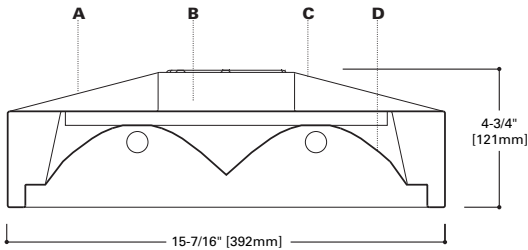
Yearly Cost of 1000 Lumens,
3000 hrs. at .08 KWH = \$3.33

* Reference the lamp/ballast data in the
Technical Section for specific lamp/ballast
requirements
** Consult Pre Sales Technical Support.

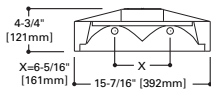
LAMPS CONTAIN MERCURY. DISPOSE ACCORDING
TO LOCAL, STATE OR FEDERAL LAWS



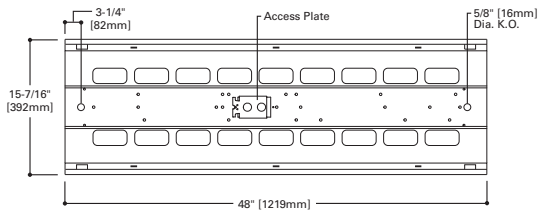
ADF030117



LAMP CONFIGURATIONS



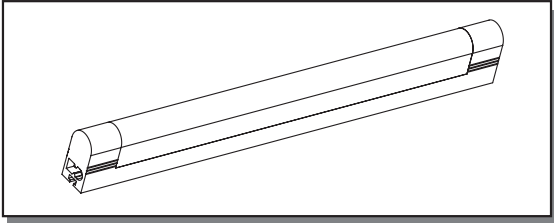
DIMENSION TOP VIEW



COOPER LIGHTING



MICRO UNDERCABINET



T5
14", 23", 36", or 48"
1 Lamp
An extremely small undercabinet
luminaire using T5 lamps

CONSTRUCTION/FINISH

- Lens removable without tools for easy maintenance and cleaning.
- Rocker switch standard.
- Low profile (only 7/8" deep) provides neat, trim appearance.
- Mounting brackets included for mounting parallel or perpendicular to the mounting surface.
- Up to three units can be "daisy-chained" together using the supplied connectors.

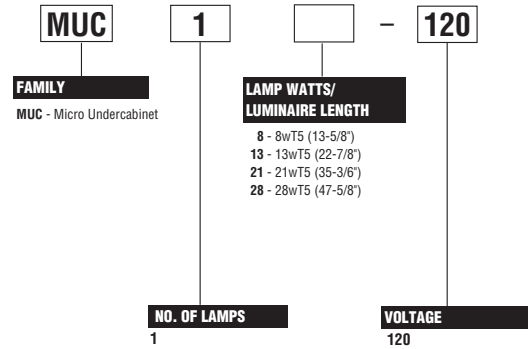
ELECTRICAL

- UL listed.
- Electronic ballast is standard.
- Lamp included.
- Power cord with standard wall plug included, no wiring necessary.
- Available in 120 volt only.

ENCLOSURE

- High impact lens.
- Lens easily removable without tools.
- Linear prisms in lens for glare control.

CATALOG NUMBER



JOB INFORMATION

1240-WU

Job Name: □

Type:

T5 STRIPS

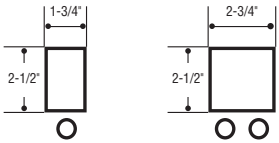
Uses latest technology T5 ballasts and lamps. Ideal for most fluorescent lighting applications including general illumination, cove lighting and display cases.

DESIGN FEATURES

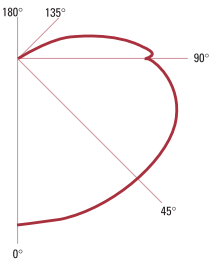
- Designed for ceiling mount, wall mount or chain hung.
- Highly reflective baked white enamel.
- Suitable for individual or continuous row mounting.
- Only 2-1/2" deep.
- Uses efficient T5 lamps or H.O. lamps for up to 70% more light output.
- CSA/CUL certified.



DIMENSIONS

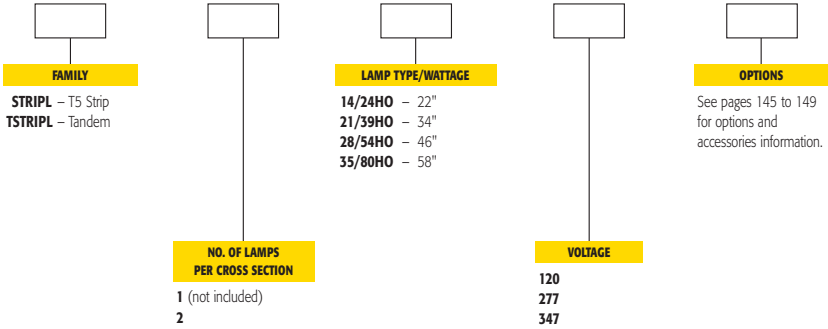


STRIPL148-120 -- IES File: C8493.IES



Coefficients of Utilization					
RF	20%	RC	80%		
RW	70	50	30	10	
RCR					
0	1.081	1.081	1.081	1.081	
1	95	89	84	79	
2	85	76	68	61	
3	77	65	57	50	
4	70	57	48	41	
5	63	50	41	34	
6	58	44	35	29	
7	53	40	31	25	
8	49	35	27	21	
9	45	32	24	18	
10	42	29	21	16	

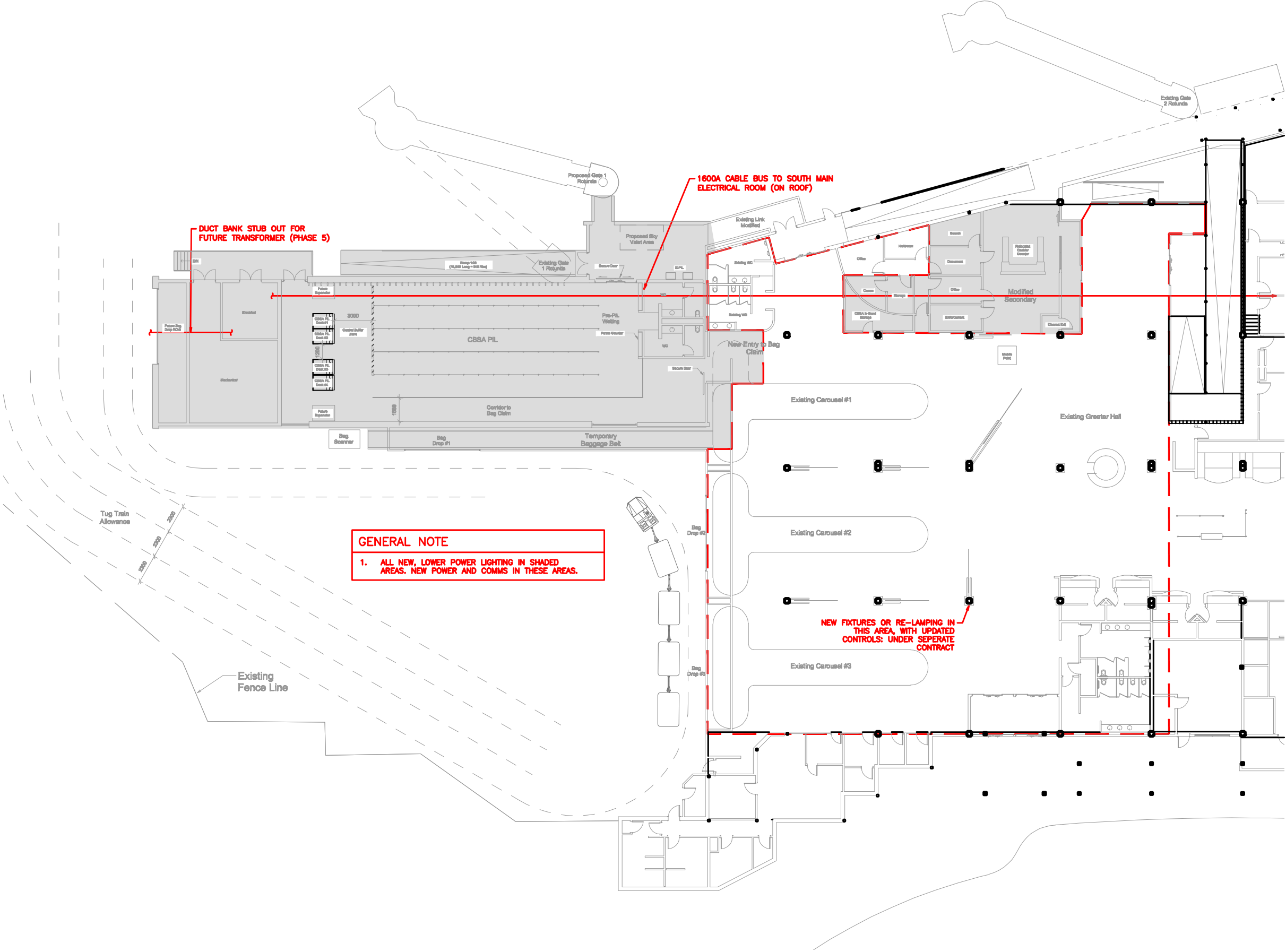
SAMPLE CATALOGUE NUMBER: STRIPL114-120

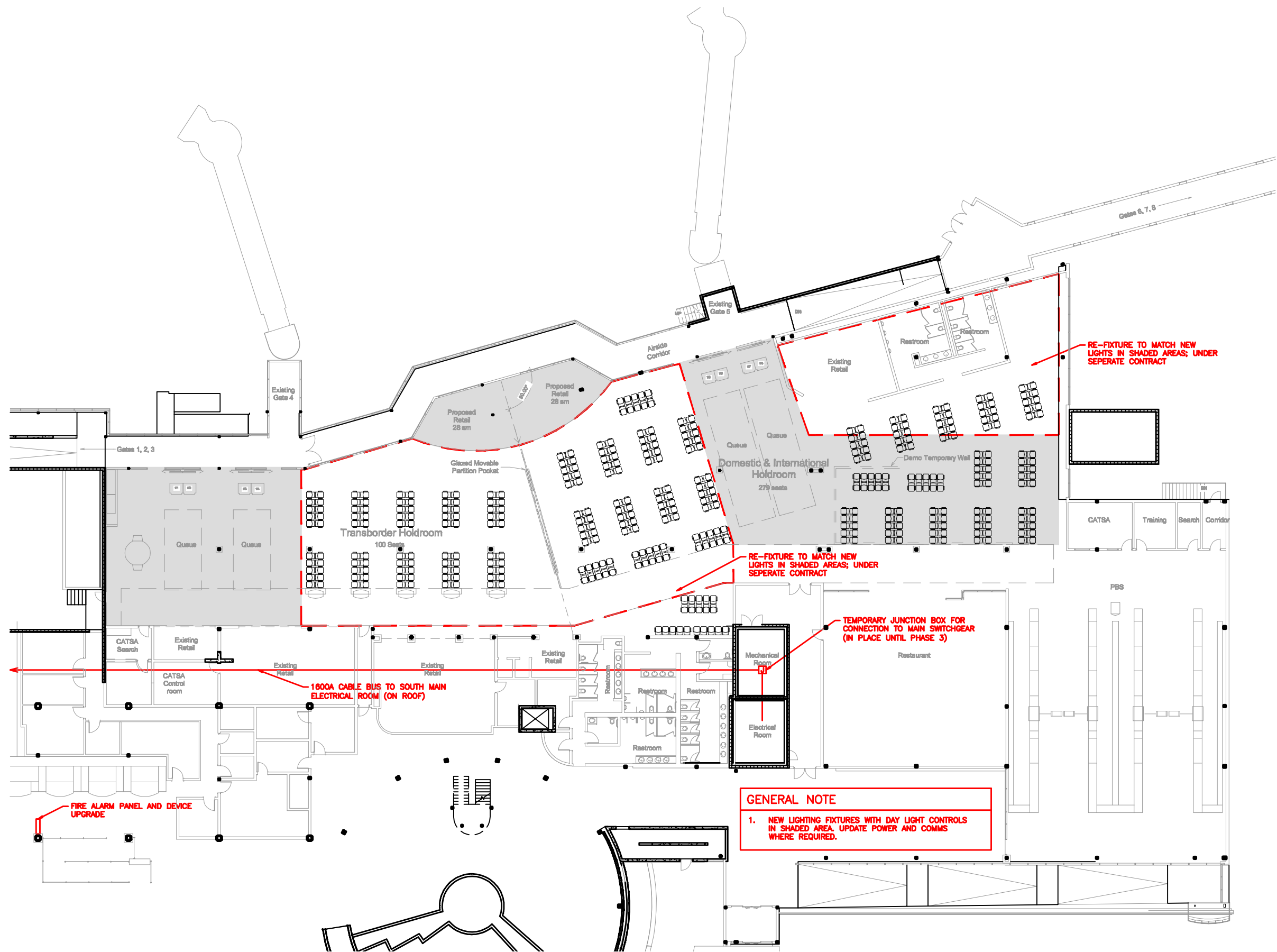


STANDARD STRIPLIGHT—PRODUCT AVAILABILITY

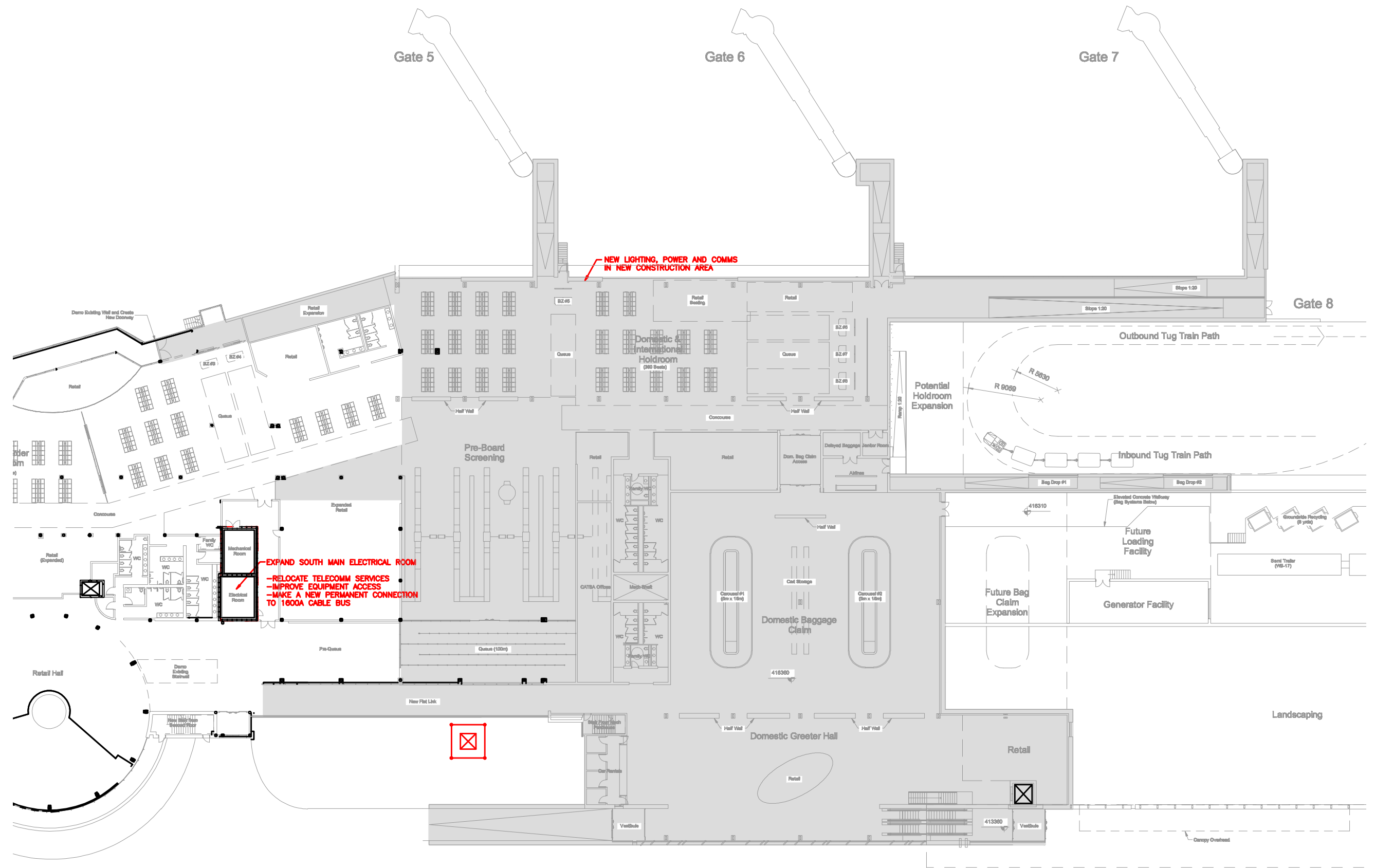
Size	Family	Lamps Cross-Sect	Lamps/ Fixture	Lamp Type	Length in. (mm)
22"	STRIPL	1 or 2	1/2	14/24HO	22 3/8"(570)
34"	STRIPL	1 or 2	1/2	21/39HO	34 1/4"(870)
46"	STRIPL	1 or 2	1/2	28/54HO	46"(1170)
58"	STRIPL	1 or 2	1/2	35/80HO	57 7/8"(1470)
92"	TSTRIPL	1 or 2	2/4	28/54HO	92"(2340)

- Accessories (ordered separately):**
- **WG-T5** – Strip-1LP (must specify length)
 - **WG-T5** – Strip-2LP (must specify length)



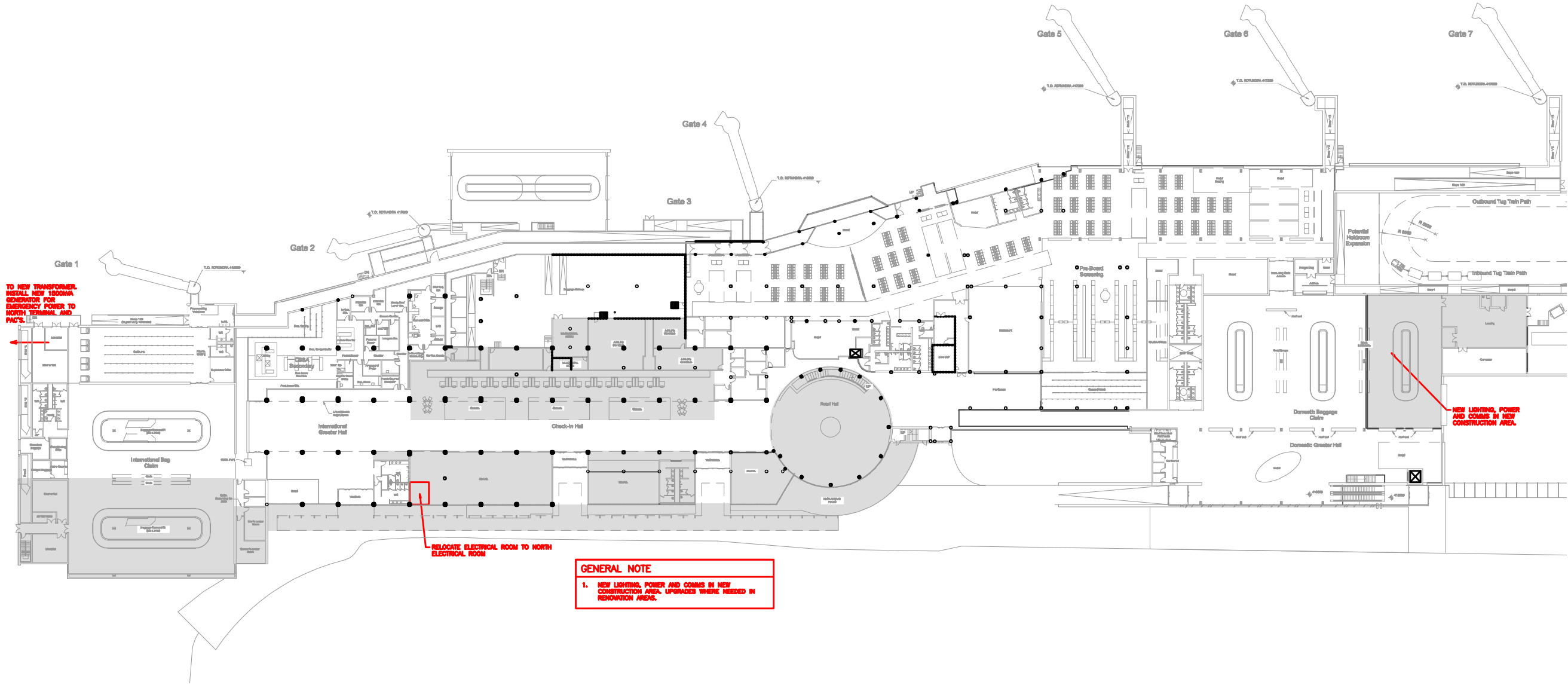








**NEW LIGHTING, POWER AND COMMS IN
NEW CONSTRUCTION AREA ONLY.
LIGHTING, POWER, COMMS UPGRADES
ONLY WHERE NEEDED IN RENOVATION
AREA**



10.0 ENVIRONMENT AND SUSTAINABLE DESIGN

► Executive Summary

The Kelowna Airport has identified energy efficiency as a priority for this project. As part of the City of Kelowna, the Airport needs to comply with the City’s climate change commitments and the design team was tasked with evaluating the greenhouse gas impact of the expansion. The design team also created several options to reduce airport green house gas emissions. An energy audit was performed at an early stage of the project to assess potential energy saving in the existing building. Data from this energy audit has been integrated into this document to show energy and green house gas savings associated with the recommended upgrades. The energy audit report can be found in the Appendix.

As part of an integrated design process, energy modeling is also being used to guide the design of the Kelowna Airport Expansion. Different types of analyses were performed: peak heating and cooling load, solar angles, glare, room temperature, and energy consumption. Outputs from those studies help the design team understand how to improve energy efficiency and sustainability. Important factors regarding energy efficiency can be analyzed in detail to provide energy cost savings necessary to support return on investment calculations.

The results from this integrated design process has been summarized in a tabular format presenting six options for the airport expansion ranging from building to Code to the incorporation of best design practices including a hybrid geothermal heating and cooling system. Due to the increased building area after the expansion, just building to current Building Code will increase the airport’s carbon footprint by 87%. The various upgrades and energy audit initiatives can reduce the airport carbon footprint substantially as shown in the table to the right. The addition of geothermal has a significant effect on reducing greenhouse gas emissions as it replaces natural gas consumption for heating with electricity consumption to drive the heat pumps. Electricity production in British Columbia is nearly entirely produced with green house gas neutral hydro electric power.

	V0	V1	V2A	V2B	V3	V4	V5	V6
	Existing ATB only	New Building Code compliant	Envelope upgrade and energy audit	V2a +triple glazing	Mech&Elec system Upgrade 1	Mech&Elec system Upgrade 2	V3 plus Geothermal	V4 plus Geothermal
Total CO2 (tCo2)*	502	939	794	786	558	464	247	220
% overall carbon change	0%	87%	58%	56%	11%	-8%	-51%	-56%

► BACKGROUND

British Columbia Climate Action Charter

Kelowna carbon reduction goals have been formalized through the British Columbia Climate Action Charter. The City of Kelowna Green Gas Emission Inventory explains the commitment of the city toward reducing carbon emission as follows:

“In 2001, Kelowna joined the Partners for Climate Protection Program. Municipal Council then endorsed the Kyoto Protocol in March of 2002 and adopted the Federation of Canadian Municipalities resolution towards the reduction of greenhouse gas emissions (GHG) in September of 2002. On September 21st, 2007 the City signed on to the Climate Action Charter (Appendix 1). In signing the Charter, the City committed to being carbon neutral in respect to City operations by 2012, as well as to measuring and reporting community greenhouse gas emissions and creating a complete, compact, more energy efficient community. In 2008, the provincial government adopted Bill 27 - Local Government (Green Communities Statutes Amendment Act. Bill 27 requires municipalities to identify a numeric target for greenhouse gas and to amend their Official Community Plans (OCP) to reflect this target by May 31st, 2010. Eager to show leadership on greenhouse gases, the Province committed to a very ambitious 33% reduction from 2007 levels, by 2020. The target set by the Province (for the Province as a whole) establishes a starting point for communities such as the City of Kelowna in setting municipal community emissions targets. It should be noted that, in addition to targeting a 33% reduction by 2020, the Province is also targeting an 80% reduction by 2050. This report focuses on what would be required to achieve the 2020 reductions. The Provincial targets, although not at this point legally imposed on local jurisdictions, cannot be achieved without the cooperation of communities such as Kelowna.

To achieve a 33% reduction of greenhouse gas emissions by 2020, a significant change will be required of all Kelowna residents and businesses including the corporation of the City of Kelowna. In the simplest terms, by 2020, each Kelowna resident will need to generate less than half the greenhouse gas emissions they generated in 2007. Achieving those reductions

Sustainability Goals and objectives

The design team is using Kelowna’s target for reducing carbon emission by 33% as a target for the airport. Several design options were developed to better understand what is required to meet the target. This report provides an estimate of the energy consumption and greenhouse gas emissions for different design options.

► ENERGY MODELING METHODOLOGY AND ASSUMPTIONS

Methodology

The IES Virtual Environment Software was used to test energy use, day lighting strategies, mechanical system options and to calculate energy consumption. IES software was selected for its ability to model the advanced systems that are being considered for the airport. IES has been identified as the “most comprehensive, most rigorous, and best integrated suite of tools for building energy design and analysis on the world market today.” (Cadalyst Labs Review)

IES VE calculates energy consumption on an hourly basis, based on a detailed set of inputs that include the following:

- ◆ 3D building information
- ◆ Type of glazing
- ◆ Type of building materials and construction
- ◆ Internal and external shading
- ◆ Shading from other buildings (or in our case, the surrounding mountains)
- ◆ Internal lighting types and schedules
- ◆ Heating and cooling loads and schedules
- ◆ Zone temperature set point and schedules
- ◆ Terminal equipment characteristics and performance
- ◆ Central system characteristics and performance
- ◆ Energy type (natural gas, electricity, etc.)

It is important to recognize that energy modeling is a tool best used to evaluate different design options as part of a design process. Building operations and occupant behaviour have a significant impact on actual energy consumption that is not effectively considered by the energy model. The existing building was modeled to take into account impact of the existing building on the new expansion, but energy simulation was not performed for the existing building. Real energy consumption was used instead for greater accuracy.

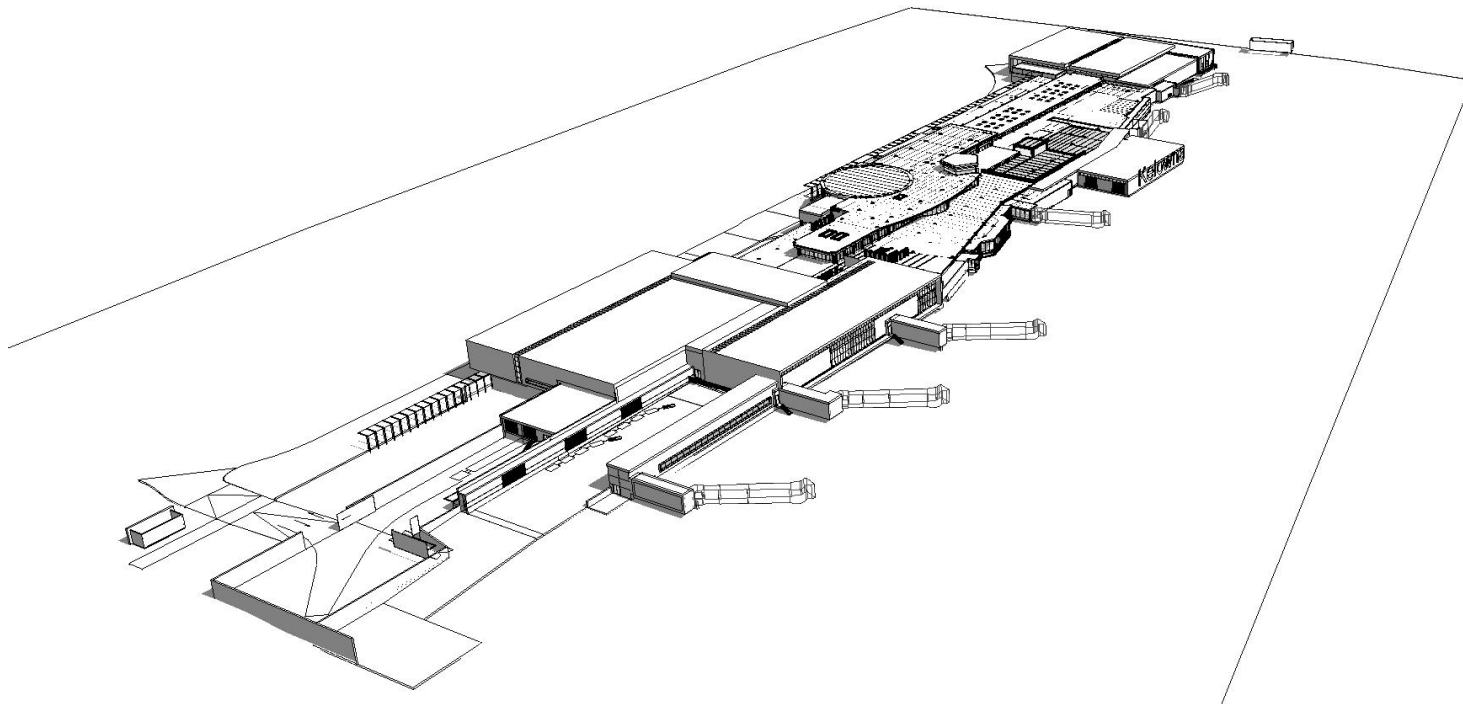


Figure 1 - 3D View of the Revit Model