INSYNC SERVICES
PTY LTD

Mechanical Services

Concept Design Report

Opal Development

Site 68 - Sydney Olympic Park

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1 Executive Summary

1.1 Summary

This mechanical services Concept design report outlines the scope of works, design criteria, components and materials which shall be adopted by Insync Services Pty Ltd for completion of mechanical services design and documentation for the Site 68 residential development at Sydney Olympic Park.

The report shall form the basis for communication of design principles to the client, for review, comment and sign-off by the client such that the mechanical services design and documentation can be completed for the project.

The proposed Opal development at Site 68, Sydney Olympic Park, will be constructed on a site of triangular shape bounded by a new road to the north, the existing railway line to the west and Bennelong Parkway to the south and east.

The building has an effective height of more than 50m in accordance with the definition provided under the Building Code of Australia.

1.2 Mechanical Services

The mechanical services covered by this Concept design report include;

Mechanical Services	Design Codes	Proposed Compliance
Air Handling Systems	NCC, AS 1668.2	Deemed To Satisfy
Stair Pressurisation Systems	NCC, AS 1668.1	Deemed To Satisfy
Refrigerant Systems	NCC, AS 1677	Deemed To Satisfy
Carpark Ventilation Systems	NCC, AS 1668.2	Deemed To Satisfy

*NCC – National Construction Code which includes:

- Volume 1 – Building Code of Australia – Class 2 to Class 9 Buildings
- Volume 2 – Building Code of Australia – Class 1 and 10 Buildings
- Volume 3 – Plumbing Code of Australia

2 Introduction

2.1 Background

Ecove Group Pty Ltd has engaged Insync Services Pty Ltd to provide building services consultancy for the proposed Opal residential development at Site 68, Sydney Olympic Park. Specifically, Insync Services Pty Ltd have been engaged to provide engineering consultancy with regard to mechanical services.

2.2 Scope of Services

The mechanical services engineering elements considered within this report are as follows;

- Split Air Handling Systems
- Carpark Ventilation System
- Stair Pressurisation System
- Miscellaneous ventilation systems
- Miscellaneous Exhaust systems

2.3 Aims

The aim of this Concept Design report is to provide a detailed description of the mechanical services design proposals associated with development.

Specifically the report is intended to provide a summary of the following;

- Identification of services to be provided.
- Description of the codes to which they will be installed.
- Description of the basis for design.
- Description of the required performance.
- Description of the materials to be used.

2.4 Briefing Documents

The mechanical services engineering elements considered within this report have taken into account the following preliminary documentation and investigations;

- Preliminary architectural documentation prepared by Bates Smart Pty Ltd.
- Building Code of Australia

2.5 Associated Services

The associated services engineering elements to be considered in conjunction within this report are as follows;

- Fire Detection and Alarm Services as detailed by the Electrical Engineer.
- Emergency Communication and Warning Services as detailed by the Electrical Engineer.
- Fire Rated Construction as detailed by the Architect and Structural Engineer.
- Hydraulic Services as detailed by the Hydraulic Services Engineer
- Fire Services as detailed by the Fire Services Engineer

3 Summary of Requirements

3.1 Area Schedule

Preliminary load estimates within this report have been based upon the Schedule of Area detailed below;

Building Level	Floor Level	Building Area (m^2)
Basement Level 3	0.500	6516
Basement Level 2	3.500	6516
Basement Level 1	6.500	6516
Ground Level	10.700	750
Level 01	15.800	1083
Level 02	19.000	1083
Level 03	22.200	1083
Level 04	25.400	1080
Level 05	28.600	1080
Level 06	31.800	1080
Level 07	35.000	1080
Level 08	38.200	1080
Level 09	41.400	1080
Level 10	44.600	1083
Level 11	47.800	1083
Level 12	51.000	1083
Level 13	54.200	1083
Level 14	57.400	1083
Level 15	60.600	1083
Level 16	63.800	1072
Level 17	67.000	1072
Level 18	70.200	1072
Level 19	73.400	1072
Level 20	76.600	1072
Level 21	79.800	1072
Level 22	83.000	1072
Level 23	86.200	1072
Level 24	89.400	1072
Level 25	92.600	1076
Level 26	95.800	1076
Level 27	99.000	1076
Level 28	102.200	1076
Level 29	105.400	1076
Level 30	108.600	1076
Level 31	111.800	1076
Level 32	115.000	1076
Level 33	118.200	1076
Plant Level	121.400	598
Roof Level	125.600	
Totals		56455

3.2 Accommodation Schedule

Preliminary load estimates within this report have been based upon the Schedule of Accommodation detailed below;

Building Level	Studio	One Bed	Two Bed	Three Bed	Four Bed	Totals
Basement Level 3	0	0	0	0	0	**0**
Basement Level 2	0	0	0	0	0	**0**
Basement Level 1	0	0	0	0	0	**0**
Ground Level	0	0	0	0	0	**0**
Level 01	0	6	6	0	0	**12**
Level 02	0	6	6	0	0	**12**
Level 03	0	6	6	0	0	**12**
Level 04	0	6	6	0	0	**12**
Level 05	0	6	6	0	0	**12**
Level 06	0	6	6	0	0	**12**
Level 07	0	6	6	0	0	**12**
Level 08	0	6	6	0	0	**12**
Level 09	0	6	6	0	0	**12**
Level 10	0	6	6	0	0	**12**
Level 11	0	6	6	0	0	**12**
Level 12	0	6	6	0	0	**12**
Level 13	0	6	6	0	0	**12**
Level 14	0	6	6	0	0	**12**
Level 15	0	6	6	0	0	**12**
Level 16	0	7	4	1	0	**12**
Level 17	0	7	4	1	0	**12**
Level 18	0	7	4	1	0	**12**
Level 19	0	7	4	1	0	**12**
Level 20	0	7	4	1	0	**12**
Level 21	0	7	4	1	0	**12**
Level 22	0	7	4	1	0	**12**
Level 23	0	7	4	1	0	**12**
Level 24	0	7	4	1	0	**12**
Level 25	0	2	4	2	1	**9**
Level 26	0	2	4	2	1	**9**
Level 27	0	2	4	2	1	**9**
Level 28	0	2	4	2	1	**9**
Level 29	0	2	4	2	1	**9**
Level 30	0	2	4	2	1	**9**
Level 31	0	2	4	2	1	**9**
Level 32	0	2	4	2	1	**9**
Level 33	0	2	4	2	1	**9**
Plant Level	0	0	0	0	0	
Totals	**0**	**171**	**162**	**27**	**9**	**369**

4 Split Air Conditioning Systems

4.1 Split Units Generally

Specifically this section of the Concept Design report shall cover the following services:

- Split Air Conditioning Systems

4.2 System Design

The proposed Site 68 development will provide residential facilities in accordance with the Schedule of Accommodation as detailed herein.

Residential units have been designed to include multiple zones. Living areas and bedrooms are all zoned separately and each zone will have its own concealed individual indoor split air conditioning unit. Each residential unit will have a single outdoor condenser unit associated with it which will serve all indoor air conditioning units associated with that apartment.

All 1 and 2 bedroom apartments as well as 3 bedroom apartments below level 25, will have their respective condenser units situated on their individual balconies and each unit will be enclosed in an architectural designed partially louvered and/or perforated enclosure.

All 3 bedroom apartments on level 25 and above and all 4 bedroom apartments will have individual VRF condenser units located on the roof of the building, ensuring that these balconies are kept free of mechanical equipment.

4.3 Sizing

Indoor wall mounted units and associated condensers shall be sized with adequate capacity to maintain conditions in associated rooms/zones. In addition, ductwork where required shall be of adequate size to ensure velocities do not exceed that of the acoustic constraints for each zone as detailed by the acoustic consultant.

External condenser units will be sized to provide sufficient capacity for all internal zones taking into account day/night zoning.

Initial loads for apartments have been based on a nominal 120W/m2 as per AIRAH recommendations for preliminary sizing. Using this as a guide the apartment types are indicatively sized as follows:

Apartment Type	Total Load
1 Bed	4 KW
2 Bed	4 KW
3 Bed	10 KW
4 Bed	12 KW

4.4 Installation

The split unit system shall be thoroughly coordinated with all other services disciplines, structure and architecture to ensure the design not only meets the thermal load requirements but also achieves accessibility without compromising the design intent of the project.

Condensers shall be installed externally to the main building with adequate spatials to ensure accessibility and to ensure short circuiting of air does not occur.

4.5 Materials

Materials shall be constructed as follows;

Service	Location	Size	Material
Refrigerant Pipework	All	All	Phosphate deoxidized copper
Ductwork	All	All	Galvanised Sheet Steel
Flexible Ductwork	All	All	Zinc plated spring steel helix, with reinforced aluminium or foil laminate liner
Ductwork Insulation	All	All	Mineral wool, polyester or polyolefin foam

The above-nominated materials have been selected for the durability; cost effectiveness and intended purpose and are in line with current trade practice.

5 Carpark Supply and Exhaust System

5.1 Carpark Generally

Specifically this section of the Concept Design report shall cover the following services;

- Carpark Supply and Exhaust Systems

5.2 System Design

The proposed Site 68 development will provide residential and car parking facilities in accordance with the Schedule of Accommodation as detailed herein. Carpark ventilation will be provided in accordance with code requirements.

Supply air shall be introduced into the carpark via two supply air fans which will be located on the western side of level B1. The individual fan rooms shall house their respective fans and associated ductwork, allowing it to transition out into the carpark on B1 and also distribute air through risers that serve both B2 and B3, supplying sufficient air into the carpark for effective ventilation.

There will be two sets of intake louvres for the supply air and will be located external to the building and incorporated into the landscape design. Each set of louvres will supply air to a single fan room minimizing the need for multiple connections into each plant room. Plenums will be created beneath the surface of the ground and coordinated with landscaping and structure to provide the interface between the intake louvres and the associated fan rooms.

Exhaust air shall be introduced to the carpark via two exhaust air fans which will be located on the eastern side of level B1. The individual fan rooms shall house their respective fans and associated ductwork, allowing it to transition out into the carpark on B1 and distribute air through risers that serve both B2 and B3, exhausting sufficient air for effective ventilation of the carpark.

There will be two sets of exhaust louvres for the carpark exhaust air and will be located external to the building and incorporated into the landscape design. Each set of louvres will be a point of discharge to a single fan room minimizing the need for multiple connections into each plant room. Plenums will be created beneath the surface of the ground and risers above ground where required. These air paths will be coordinated with landscaping and structure to provide the interface between the exhaust louvres and the associated fan rooms.

Carpark exhaust that is located nearby to a footpath will need to be engineered to ensure it does not create a nuisance as per requirements in AS 1668.2.

Volume of carpark usage will be intermittent therefore CO monitoring shall be used to reduce the fan power where appropriate and hence the flow rate requirement for the carpark when it is not required. Reduced fan power will significantly reduce ongoing energy usage and running costs for the development.

5.3 Sizing

Carpark Supply and Exhaust Ductwork and associated fans shall be sized to provide adequate ventilation in the Carpark. In addition, ductwork shall be of adequate size to ensure velocities do not exceed that of the acoustic constraints for each zone and as detailed by the acoustic consultant.

We have based our Carpark Supply and Exhaust air flow estimates upon the following car spaces for the building;

Level	Car Spaces
B1	146
B2	142
B3	184

Calculations take into account the area of the carpark taken from the architectural drawings and the number of car spaces as detailed above. Using this information we have calculated the maximum requirement for supply and exhaust air for the three levels of carpark as per requirements set out in AS 1668.2 2012.

From this we have determined duct, riser, intake and outlet sizes as nominated on the mechanical services drawings.

5.4 Installation

The Carpark Exhaust system shall be thoroughly coordinated with all other services disciplines, structure and architecture to ensure the design not only meets the mechanical requirements but also achieves accessibility without compromising the design intent of the project.

5.5 Materials

Ductwork shall be constructed from materials as follows;

Service	Location	Size	Material
Ductwork	All	All	Galvanised Sheet Steel

The above-nominated materials have been selected for the durability; cost effectiveness and intended purpose and are in line with current trade practice.

6 General Exhaust Systems

6.1 Exhaust Systems Generally

Specifically this section of the Concept Design report shall cover the following services;

- Toilet and Laundry Exhaust Systems
- Kitchen Exhaust Systems
- Garbage Room Exhaust Systems
- Retail Kitchen Exhaust

6.2 System Design

General exhaust requirements will be provided in accordance with code requirements.

There are four types of general exhausts required for this development which are as follows:

- Toilet and Laundry Exhaust
- Kitchen Exhaust
- Garbage Room Exhaust
- Retail Kitchen Exhaust

Toilet and Laundry Exhaust

Toilet and laundry exhausts will use combined ductwork where possible to minimize the amount of ductwork in the building. Exhaust air for these rooms will be expelled locally to each apartment complete with a local fan. These rooms will be kept under negative pressure to ensure foul odours do not escape into adjacent areas of the associated apartment.

Kitchen Exhaust

Exhaust air from kitchens will be discharged locally to each apartment using the kitchen exhaust hood fan and appropriate filters and then expelled to the outside.

Garbage Room Exhaust

The garbage rooms on each level will be connected to a central exhaust air riser that will expel the air at roof level. These rooms will be kept under negative pressure to ensure foul odours do not escape into the lobby or adjacent apartments.

Retail Kitchen Exhaust

The retail areas of the new development are proposed to have a minimum of one cafe. Exhaust air from associated kitchen will be discharged at low level from the building incorporating associated filtration to comply with AS1668.2.

6.3 Sizing

Generally, all exhaust ductwork and associated fans shall be sized to provide adequate ventilation to the area they are associated with. In addition, ductwork shall be of adequate size to ensure velocities do not exceed that of the acoustic constraints for each zone and as detailed by the acoustic consultant.

Toilet and Laundry Exhaust

Allowances for Toilet and Laundry Exhaust air flow estimates are based upon minimum allowances as outlined in 1668.2. Higher flow rates may be required in order to reduce the steam where showers are located and should be designed accordingly.

Exhaust air for these rooms will be expelled locally to each apartment complete with a local fan.

Kitchen Exhaust

We have based our apartment Kitchen Exhaust air flow estimates upon the following allowances;

- 100 L/s per Kitchen

Exhaust air from kitchens will be expelled locally to each apartment using the kitchen exhaust hood fan and flow rates and associated ductwork sizes will be adjusted to suit.

Garbage Room Exhaust

We have based our Garbage Room Exhaust air flow estimates upon the following allowances;

- 5 L/s per m^2 of floor area

The garbage rooms on each level will be connected to a central exhaust air riser complete with a central fan that will discharge the air at roof level.

6.4 Installation

All exhaust systems shall be thoroughly coordinated with all other services disciplines, structure and architecture to ensure the design not only meets the mechanical requirements but also achieves accessibility without compromising the design intent of the project.

6.5 Materials

Ductwork shall be constructed from materials as follows;

Service	Location	Size	Material
Ductwork	All	All	Galvanised Sheet Steel (fire spray where required)

The above-nominated materials have been selected for the durability; cost effectiveness and intended purpose and are in line with current trade practice.

7 Stair Pressurisation System

7.1 Smoke Management Generally

Specifically this section of the Concept Design report shall cover the following services;

- Stair Pressurisation

7.2 System Design

The proposed Site 68 development will incorporate a stair pressurisation system that will serve the tower fire stairs.

Each stair shaft will be served by two stair pressurisation fans located at the top and bottom of each stair. The fans will be controlled via individual variable speed drives and associated pressure sensors to ensure that pressure within the stairwell does not exceed the allowable amount.

Relief air for the stair pressurisation system will be via relief air louvres located in the lobbies of each associated level. As the building is triangular in shape there will be three identical sets of louvres on each level to ensure that wind direction and associated pressure will not affect the system from relieving the required amount of air in the case of a fire.

7.3 Sizing

The Stair Pressurisation and associated relief systems will be based on AS1668.1 requirements and will ensure stack effect and possible leakage will be taken into account in detailed calculations.

The Stair Pressurisation System and associated equipment shall be sized with adequate capacity to meet the requirements of AS 1668.1 and in-line with the Fire Engineer's requirements. In addition, ductwork shall be sized to ensure that safe expulsion of air is achieved as appropriate.

7.4 Installation

The Stair Pressurisation System shall be comprehensively coordinated with all other services disciplines, structure and architecture to ensure the design not only meets the safety requirements of the project and the Fire Engineer's prerequisites but also the accessibility to associated maintainable equipment such as stair pressurisation fans and the like, as required.

7.5 Materials

Ductwork shall be constructed from materials as follows;

Service	Location	Size	Material
Ductwork	All	All	Galvanised Sheet Steel (fire spray as necessary)

The above-nominated materials have been selected for the durability; cost effectiveness and intended purpose and are in line with current trade practice.

8 Mechanical Services Opinion of Cost

Project:	Site 68 - Sydney Olympic Park
Project Number:	20140028
Revision:	P1
Date:	4/09/2014
Engineer:	Ilina Nanitsos

AREA SCHEDULE	TOTAL
Carpark	$2,023,321.50
Retail	$8,200.00
Residential	$8,009,065.35
SUB-TOTAL	$10,040,586.85
GST	$1,004,058.69
TOTAL	**$11,044,645.54**

NOTES:
1. Opinion of cost includes preliminaries, overhead & margin.

9 Spatial Requirements

9.1 Carpark Exhaust System:

Item	Description	Area	Configuration	Comments
1	Carpark Exhaust Fan Room	35m^2	3.5m x 10m (x2)	Plant room located at Basement level B1
2	Carpark Exhaust Outlet	40m2 F.A.		Above Ground
3	Carpark Supply Air Fan Room	35m^2	3.5m x 10m (x2)	Plant room located at Basement level B1
3	Carpark Supply Air Inlet	40m2 F.A.		Above Ground

9.2 Miscellaneous Systems:

Item	Description	Area	Configuration	Comments
1	Grease Arrestor Exhaust Riser	0.09m^2	0.3m x0.3m	Areas are 'clear' and all risers are fire rated.
2	Garbage Chute Room Exhaust Riser	0.2m^2	0.4m x 0.5m	Areas are 'clear' and all risers are fire rated.
3	Garbage Room Exhaust Riser	0.12m^2	0.4m x 0.3m	Areas are 'clear' and all risers are fire rated.

9.3 Tower Stair Pressurisation System:

Item	Description	Area	Configuration	Comments
1	Riser per stair	1.3m^2	700 x 1900mm	
2	Fan Room per stair (x2)	25 m^2 (x2)	2500 x 10000mm (x2)	
3	Intake Louvre (each)	7 m^2		Combined intake for both stairs. 1 at high level and 1 at low level. Figures indicate free area.
4	Relief air louvres per level	2m^2 (x3)		Figures indicate free area.

9.4 Split AC System:

Item	Description	Area	Configuration	Comments
1	Refrigerant Riser	0.8m^2	Varies	Areas are 'clear' and all risers are fire rated.
2	Condenser compound	150 m^2	Varies	Located on Roof.