BUILDING SERVICES PLANNING REPORT

DELFONT MACKINTOSH THEATRES

SONDHEIM (AMBASSADORS) THEATRE PROJECT

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INDEX

1.0 INTRODUCTION

The application proposes a new dedicated theatrical transfer house to accommodate productions that have come to the end of their run in the subsidised sector. The proposed theatre will provide the opportunity for subsidised productions that would not otherwise have the opportunity to transfer to the West End.

It is currently very difficult for successful subsidised productions to transfer to the West End because the internal arrangement of most West End theatres differs substantially from more modern arrangements of the subsidised sector. The vast majority of West End theatres have traditional 'proscenium arch' stages whilst most originating theatres in the subsidised sector have more modern arrangements, such as thrust stages or are arranged 'in the round'. This means that a transfer has to be restaged, often at huge cost to the originating subsidised theatre and eroding the original artistic intention of the director, to the detriment of the audience experience.

There are currently no dedicated theatres in the West End to which productions arising in the subsidised theatre sector can transfer in the event of critical acclaim or audience demand. Typically, publically subsidised productions are pre-programmed in advance at the originating playhouses and run for a period of 6-8 weeks only. The proposed new theatre would provide an opportunity for successful subsidised shows to transfer to the West End for a further 8-16 weeks.

This increased run would provide the subsidised sector with an opportunity to increase revenue at a time of consistently squeezed funding pressures and cuts. It will also diversify the offer for theatre goers and open up a range of quality productions to be viewed as originally intended, enhancing the range and quality of productions and cementing London's status as a world cultural capital in theatre.

Such is the shortage of space in the West End that very many successful subsidised productions are simply never seen again after their original run. Others, due to the physical difficulties of restaging in a proscenium setting simply have no prospect of transfer at all, even if a space in the West End were available.

In order to create a modern and flexible internal arrangement, it is proposed that much of the building is demolished and rebuilt behind the retained West Street façade and the stucco return onto Tower Court. Historically significant elements of plasterwork are to be relocated within the new theatre.

The proposed theatre will then provide a much needed resource for the transfer of productions from the subsidised sector. In turn, the subsidised sector will be able to secure a longer run for critically acclaimed productions that would otherwise close for good, frustrating a large unmet demand from the audience. Thus, the cultural life of the West End will be enhanced along with the audience's opportunity to see good quality subsidised productions for a longer period of time. In their turn, the subsidised sector will realise the opportunity to increase their revenue in an environment of constantly reduced funding.

The proposals have attracted wide ranging support from within the industry. Nicholas Hytner (former Artistic Director of the National Theatre) summarised the situation as:

> *"Over recent years, a large number of the most successful and ambitious productions in the subsidised theatre sector have been unable to find a venue for further life, leaving a significant potential audience without an opportunity to see work it would like to see. Very often this work would not justify the risks involved in a transfer to a large West End theatre. Cameron Mackintosh's plans for his new 450 seat theatre would greatly increase the chances of a future life for successful productions form theatres like the Dorfman, the Almeida, the Royal Court and the Donmar as well as offering a suitable venue for regional transfers."*

Full details of the need for a dedicated transfer house and how the proposed theatre meets that need is set out in the Design and Access Statement and Planning and Heritage Statement that accompany this application.

2.0 BUILDING SERVICES SCHEME DESIGN

2.1 GENERAL

The proposed building services scheme design is detailed in the scheme design drawings and equipment schedules attached in the appendices to this report.

We have addressed specific Council Planning requirements in the sections below.

3.0 AIR QUALITY

3.1 AUDITORIUM AND FRONT OF HOUSE

The central plant serving the Auditorium and Front of House Areas will supply the recommended quantity of fresh air based on CIBSE and Technical Standards for Places of Entertainment published by The District Surveyors Association.

Motorised dampers will be provided to direct fresh air from the Auditorium to the Front of House areas during the intermission thus reducing the maximum capacity of the plant and minimising energy usage. The motorised dampers along with fan speed control measures will allow the central plant to operate at reduced capacity to allow efficient operation when the Stalls Bars is being used for independent functions.

Fresh air will be drawn into the plant at roof level where pollution is relatively light. The air will be filtered, and heated or cooled as required to maintain comfort conditions in the theatres.

Heating of the air will firstly be by heat reclaimed from the exhaust air stream, any additional heat requirement will be supplied by a low temperature hot water coil. The low temperature hot water will be heated by a high efficiency, low NOx, gas fired condensing boiler.

The supply air stream will be cooled by a chilled water coil in the air handling unit, chilled water will be produced by a packaged electrically driven air cooled water chiller.

The plant will be configured to allow recirculation of the air to suit public occupancy levels and will also operate at a reduced air volume when the theatres are not occupied by the public to conserve energy and to pre condition the air space prior to occupation.

3.2 REHEARSALS LEVEL

The plant serving the Rehearsals Level will supply the recommended quantity of fresh air based on CIBSE and Technical Standards for Places of Entertainment published by The District Surveyors Association.

Fresh air will be drawn into the plant at roof level where pollution is relatively light. The air will be filtered, and heated or cooled as required to maintain comfort conditions in the theatres.

Heating of the air will firstly be by heat reclaimed from the exhaust air stream, any additional heat requirement will be supplied by a low temperature hot water coil. The low temperature hot water will be heated by a high efficiency, low NOx, gas fired condensing boiler.

The supply air stream will be cooled by a chilled water coil in the air handling unit, chilled water will be produced by a packaged electrically driven air cooled water chiller.

The plant will be configured to allow recirculation of the air to suit public occupancy levels and to conserve energy and to pre condition the air space prior to occupation.

3.3 BASEMENT BACK OF HOUSE

The plant serving the Basement Back of House Levels will supply the recommended quantity of fresh air based on CIBSE and Technical Standards for Places of Entertainment published by The District Surveyors Association.

Fresh air will be drawn into the plant at roof level where pollution is relatively light. The air will be filtered, and heated or cooled as required to maintain comfort conditions in the theatres.

Heating of the air will be by low temperature hot water which is heated by a high efficiency, low NOx, gas fired condensing boiler.

The supply air stream will be cooled by a chilled water coil in the air handling unit, chilled water will be produced by a packaged electrically driven air cooled water chiller.

4.0 ENVIRONMENTAL IMPACT

4.1 ENERGY CONSUMPTION

The theatre operating company is committed to reducing carbon emissions for commercial and social reasons. There is currently a carbon levy on energy usage and in April 2010 the requirements of the Carbon Reduction Commitment started to be enforced.

The plant operating times will be controlled and the plant will only run at full capacity when the building is fully occupied.

The cooling system capacity will be precisely matched to the load and the plant will only run when required and maximum use will be made of free cooling by outside fresh air.

The gas consumed in heating the incoming air will be minimised because heat will be reclaimed from the exhaust air from the auditorium and rehearsal level. The heating will provided by a high efficiency, low NOx, gas fired condensing boiler to conserve energy and minimise emissions.

Speed controls will be provided for all plant to allow operation at reduced capacity to suit occupancy levels and to conserve energy.

4.2 DRAINAGE AND WATER POLLUTION

During the demolition of the existing building the existing chilled water and LTHW systems will be drained down and discharged into the Thames Water combined sewer. The new chilled water and LTHW systems will be closed systems and any discharge of treated water into the Thames Water sewer can therefore be minimised and controlled.

4.3 REFRIGERANT RECOVERY

During the demolition of the existing building several existing refrigerant systems will be removed. The refrigerant will be drained down and recovered from these systems and disposed of in accordance with the applicable regulations and standards.

5.0 VENTILATION

The ventilation systems will keep the auditoria slightly pressurised with respect to the outside air to prevent infiltration of unfiltered and untreated air into the space. Unfiltered air particularly from street level contains pollutant particulates and gases mainly from vehicle exhaust fumes. Allowing cold air into the theatre increases the winter heating load and allowing hot air to enter in the summer adds to the summer cooling load.

Air will be extracted from the top of the auditoria allowing hot contaminated air to rise using natural buoyancy forces.

The extract air from the top of the auditoria will be ducted to extract plant where the air will pass through heat exchangers to reclaim energy that will be transferred to the incoming fresh air stream. Reclaiming heat in this way will reduce the energy required in the winter by at least 45%. Under some summer conditions it will be possible to reclaim some of the cooling energy in the exhaust air stream.

After passing through the heat reclaim systems the exhaust air will be discharged to the atmosphere at roof level well away from the fresh air intake and from other buildings in the vicinity.

6.0 FIRE SAFETY

6.1 DRY RISER

A Dry Riser will be provided in the stair core located on West Street to aid fire fighting.

6.2 EMERGENCY STANDBY GENERATOR

An emergency standby generator wiil be provided on the roof. The generator will only be operated for essential testing, except when required to operate the lift and smoke extract fans in the event of a fire and concurrent loss of mains power.

The generator will be tested between the hours of 09:00 to 17:00, Monday to Friday and not at all on public holidays.

6.3 SMOKE EXTRACT

The Auditorium will be provided with mechanical smoke extract fans which will be sized to suit the fire load in the Auditorium in accordance with the Fire Strategy.

The smoke extract fans will extract via the general exhaust ductwork. The general extract ductwork will be provided with fail safe motorised fire/smoke dampers to provide additional smoke extract grilles inside the Auditorium as well as to bypass the Auditorium AHU and discharge directly to atmosphere. The smoke extract fans and ductwork will be fire rated to meet the applicable regulations and standards.

Make up air will be provided via open Auditorium escape doors at Ground Floor level.

The smoke extract fans will only be operated for essential testing and in the event of a fire.

The smoke extract fans will be tested between the hours of 09:00 to 17:00, Monday to Friday and not at all on public holidays.

APPENDIX A SCHEME DESIGN DRAWINGS

800x250 BOH
SUPPLY AIR RISER
FROM ABOVE

BOH DB

600mm WIDE LV POWER TO ABOVE
300mm WIDE FA/PA & SECURITY TO ABOVE
300mm WIDE COMMS/IT TO ABOVE
600mm WIDE STAGE SERVICES TO ABOVE

CWS, HWS F&R, LTHW F&R AND BASEMENT REFRIGERANT PIPES TO ABOVE

STALLS BAR DB

SVP, RWP, CWS AND HWS F&R TO ABOVE

BOH/STAGE SWITCHBOARD

MISCELLANEOUS DB's

LV MAIN SWITCHBOARD

600mm WIDE STAGE SERVICES CABLE LADDER TO ABOVE

HV MAIN SWITCHBOARD

SPRAGUE ROOM
+ 17.460

BAR
+ 17.460

8 PERSON DRESSING ROOM

4 PERSON DRESSING ROOM

1 PERSON DRESSING ROOM

11 PERSON DRESSING ROOM

ELECTRICAL SWITCHROOM

MEZZANINE
+ 19.030

+ 18.060

+ 19.249

FEMALE TOILET
+ 19.030

HV SWITCHROOM

DISABLED TOILET

MALE TOILET

Smoke Vent

4329 | 4200 | 4200 | 4059 | 2.8218° | 2.3°

5850 | 11 | 2775

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Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179

Title
LOWER BASEMENT
BUILDING SERVICES
PROPOSED LAYOUT

Drawn By	Drawn Date	Scale
BWS	05/02/2015	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10010	-

This drawing is not to be scaled
Verify all dimensions on site

600mm WIDE LV POWER TO ABOVE
300mm WIDE FA/PA & SECURITY TO ABOVE
300mm WIDE COMMS/IT TO ABOVE
600mm WIDE STAGE SERVICES TO ABOVE

SVP, RWP, CWS RISING & FALLING MAINS, GAS, HWS F&R AND LTHW F&R PIPES TO ABOVE

UNDER STAGE DB

800x250 BOH SUPPLY AIR RISER FROM ABOVE

4 OFF 600x450 SUPPLY AIR DUCTS FROM ABOVE

4 OFF 110Ø STAGE SERVICES CONDUITS FROM SOUND DESK AND DIRECTORS DESK FLOOR PATCH PANELS ABOVE

LTHW HEATING F&R TO ABOVE

150mm WIDE LV POWER TO ABOVE
150mm WIDE COMMS/IT TO ABOVE
150mm WIDE FA/PA & SECURITY TO ABOVE

SVP, RWP, CWS, HWS F&R AND FOH REFRIGERATION PIPES TO ABOVE

300x300 TOILET EXTRACT TO ABOVE

SVP AND RWP FROM ABOVE

150Ø VENTILATED PIPE IN PIPE GAS MAIN

700x300 BASEMENT TOILET EXTRACT TO ABOVE

SVP AND RWP FROM ABOVE

SVP, RWP, CWS AND HWS F&R TO ABOVE

600mm WIDE LV POWER FROM ABOVE

600mm WIDE STAGE SERVICES CABLE LADDER TO ABOVE

HV SWITCHROOM VENTILATION SUPPLY & EXTRACT DUCTS TO ABOVE

200Ø STEEL CONDUIT FOR HV CABLE RISER

BUILDERSWORK CONCRETE DUCT AT HIGH LEVEL

SPRAGUE ROOM
UNDERSTAGE
2 PERSON DRESSING ROOM
1 PERSON DRESSING ROOM
MEZZANINE + 19 .030
FEMALE TOILET + 19 .030
HV SWITCH ROOM
GAS METER ROOM
+ 21 .762
+ 20 .907
+ 20 .410
+ 19 .249
+ 20 .707
Smoke Vent

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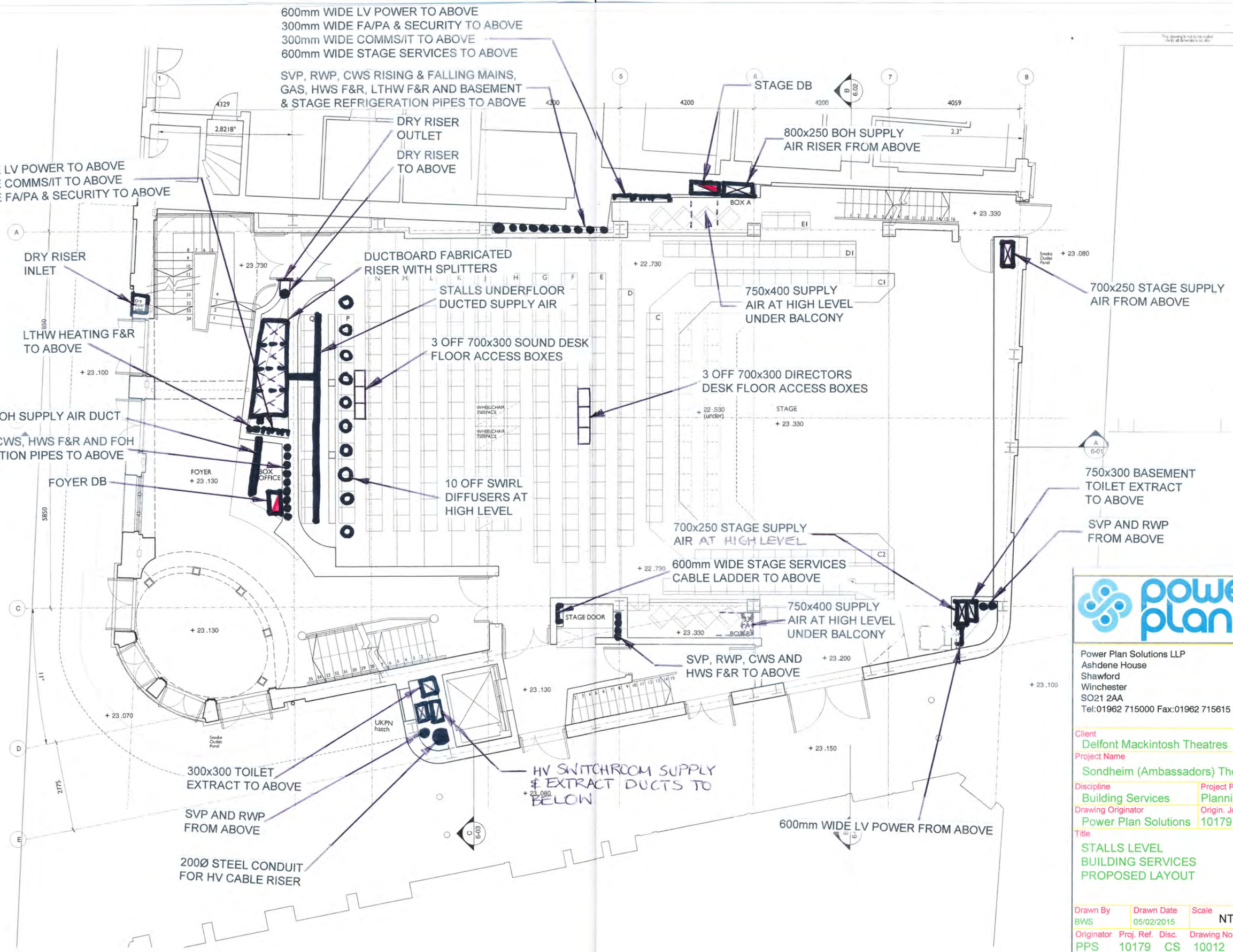
Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	UPPER BASEMENT BUILDING SERVICES PROPOSED LAYOUT

Drawn By	Drawn Date	Scale
BWS	05/02/2015	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10011	-



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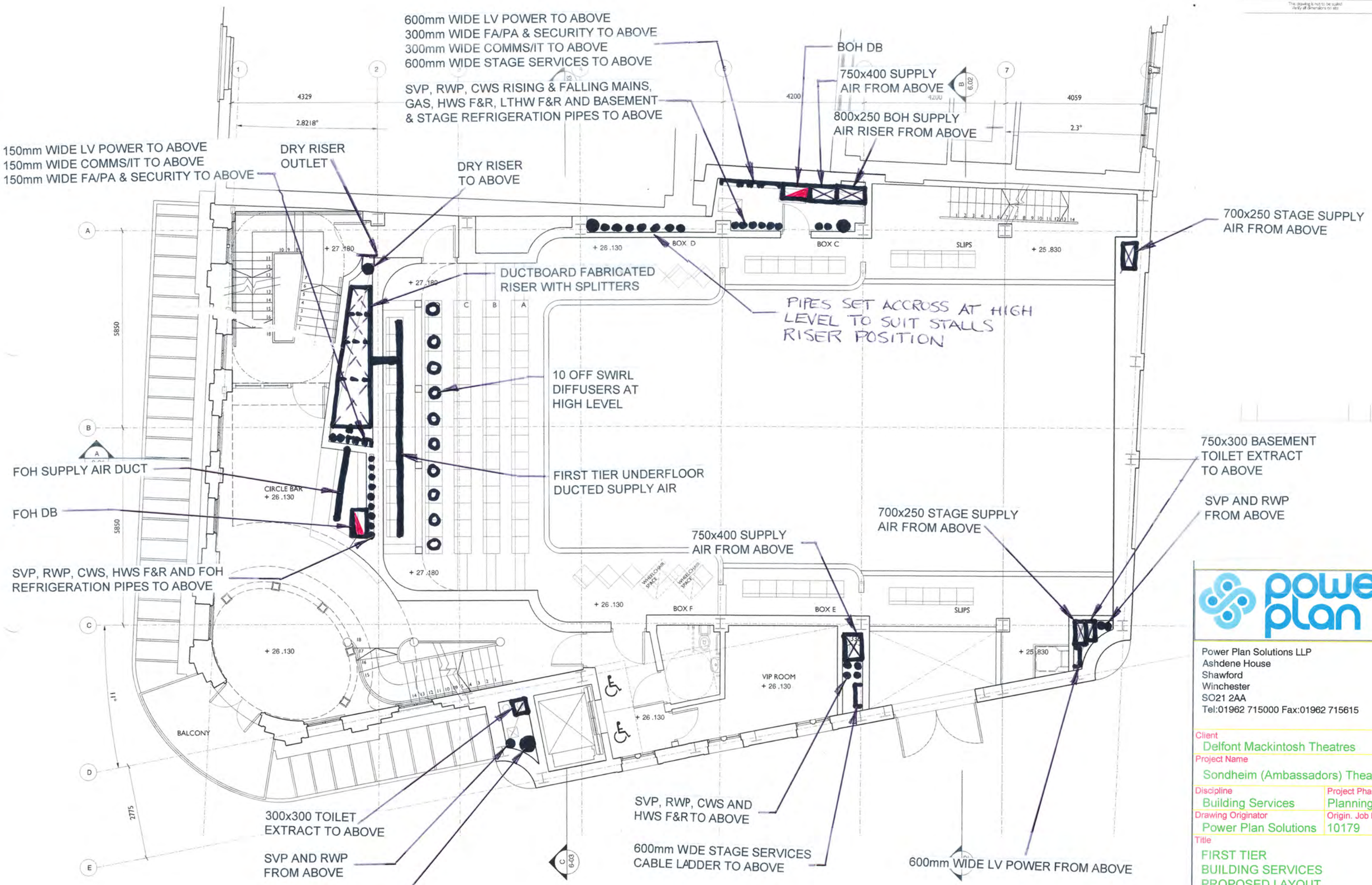
Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	STALLS LEVEL BUILDING SERVICES PROPOSED LAYOUT

Drawn By	Drawn Date	Scale
BWS	05/02/2015	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10012	-



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Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	FIRST TIER BUILDING SERVICES PROPOSED LAYOUT
Drawn By	BWS
Drawn Date	05/02/2015
Scale	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10013	-

600mm WIDE LV POWER TO ABOVE
300mm WIDE FA/PA & SECURITY TO ABOVE
300mm WIDE COMMS/IT TO ABOVE
600mm WIDE STAGE SERVICES TO ABOVE

SVP, RWP, CWS RISING & FALLING MAINS,
GAS, HWS F&R, LTHW F&R AND BASEMENT
& STAGE REFRIGERATION PIPES TO ABOVE

BOH DB

750x400 SUPPLY
AIR FROM ABOVE

800x250 BOH SUPPLY
AIR RISER FROM ABOVE

150mm WIDE LV POWER TO ABOVE
150mm WIDE COMMS/IT TO ABOVE
150mm WIDE FA/PA & SECURITY TO ABOVE

DRY RISER
OUTLET

DRY RISER
TO ABOVE

FOH DB

700x250 STAGE SUPPLY
AIR FROM ABOVE

DUCTBOARD FABRICATED
DUCT AT HIGH LEVEL AND
RISERS WITH SPLITTERS

1000x1100 SUPPLY AIR
DUCT FROM ABOVE

750x300 BASEMENT
TOILET EXTRACT
TO ABOVE

300x300 TOILET EXTRACT
AT HIGH LEVEL

750x400 SUPPLY
AIR FROM ABOVE

700x250 STAGE SUPPLY
AIR FROM ABOVE

SVP, RWP, CWS, HWS F&R AND FOH
REFRIGERATION PIPES TO ABOVE

300x300 TOILET
EXTRACT TO ABOVE

SVP AND RWP
FROM ABOVE

200Ø STEEL CONDUIT
FOR HV CABLE RISER

SVP, RWP, CWS AND
HWS F&R TO ABOVE

600mm WIDE STAGE SERVICES
CABLE LADDER TO ABOVE

600mm WIDE LV POWER FROM ABOVE

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Project Name
Sondheim (Ambassadors) Theatre

Discipline	Project Phase
Building Services	Planning
Drawing Originator	Origin. Job No.
Power Plan Solutions	10179

Title
SECOND TIER
BUILDING SERVICES
PROPOSED LAYOUT

Drawn By	Drawn Date	Scale
BWS	05/02/2015	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10014	-

600mm WIDE LV POWER TO ABOVE
300mm WIDE FA/PA & SECURITY TO ABOVE
300mm WIDE COMMS/IT TO ABOVE
600mm WIDE STAGE SERVICES TO ABOVE

SVP, RWP, CWS, HWS F&R AND FOH REFRIGERATION PIPES TO ABOVE

SVP, RWP, CWS RISING & FALLING MAINS, GAS, HWS F&R, LTHW F&R AND BASEMENT & STAGE REFRIGERATION PIPES TO ABOVE

BOH DB

750x400 SUPPLY AIR FROM ABOVE

800x250 BOH SUPPLY AIR RISER FROM ABOVE

DRY RISER OUTLET

DRY RISER TO ABOVE

700x250 STAGE SUPPLY AIR FROM ABOVE

150mm WIDE LV POWER TO ABOVE
150mm WIDE COMMS/IT TO ABOVE
150mm WIDE FA/PA & SECURITY TO ABOVE

900x800 EXTRACT AIR DUCT TO ABOVE

1000x1100 SUPPLY AIR DUCT TO BELOW

900x800 EXTRACT AIR DUCT TO ABOVE

750x300 BASEMENT TOILET EXTRACT TO ABOVE

SVP AND RWP FROM ABOVE

FOH DB

700x250 STAGE SUPPLY AIR FROM ABOVE

300x300 TOILET EXTRACT TO ABOVE

750x400 SUPPLY AIR FROM ABOVE

300x300 TOILET EXTRACT TO ABOVE

SVP AND RWP FROM ABOVE

SVP, RWP, CWS AND HWS F&R TO ABOVE

200Ø STEEL CONDUIT FOR HV CABLE RISER

600mm WIDE STAGE SERVICES CABLE LADDER TO ABOVE

600mm WIDE LV POWER FROM ABOVE

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Client: Delfont Mackintosh Theatres
Project Name: Sondheim (Ambassadors) Theatre
Discipline: Building Services | Project Phase: Planning
Drawing Originator: Power Plan Solutions | Origin. Job No.: 10179
Title: TECHNICAL GALLERY BUILDING SERVICES PROPOSED LAYOUT

Drawn By	Drawn Date	Scale
BWS	05/02/2015	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10015	-

600mm WIDE LV POWER TO ABOVE
300mm WIDE FA/PA & SECURITY TO ABOVE
300mm WIDE COMMS/IT TO ABOVE
600mm WIDE STAGE SERVICES TO ABOVE

REHEARSALS DB's

750x400 SUPPLY AIR FROM ABOVE

800x250 BOH SUPPLY AIR RISER FROM ABOVE

DRY RISER TO ABOVE

SVP, RWP, CWS RISING & FALLING MAINS, GAS, HWS F&R, LTHW F&R AND BASEMENT & STAGE REFRIGERATION PIPES TO ABOVE

SVP, RWP, CWS, HWS F&R AND FOH REFRIGERATION PIPES TO ABOVE

700x250 STAGE SUPPLY AIR FROM ABOVE

700x1400 SUPPLY AIR DUCT ABOVE STAIR TO TECHNICAL GALLERY LEVEL

1000x1100 SUPPLY AIR

900x800 EXTRACT AIR DUCT TO ABOVE

900x800 EXTRACT AIR DUCT TO ABOVE

SVP AND RWP FROM ABOVE

750x400 SUPPLY AIR FROM ABOVE

600mm WIDE STAGE SERVICES CABLE LADDER

TOILET EXTRACT FAN

150mm WIDE LV POWER TO ABOVE
150mm WIDE COMMS/IT TO ABOVE
150mm WIDE FA/PA & SECURITY TO ABOVE

REHEARSALS DB's

300x300 TOILET EXTRACT TO ABOVE

SVP AND RWP FROM ABOVE

200Ø STEEL CONDUIT FOR HV CABLE RISER

SVP, RWP, CWS AND HWS F&R TO ABOVE

700x250 STAGE SUPPLY AIR FROM ABOVE

600mm WIDE LV POWER FROM ABOVE

750x300 BASEMENT TOILET EXTRACT TO ABOVE

STORE
STORE
REHEARSAL ROOM 1
+ 35 .150
OFFICE
RECEPTION
+ 35 .150
+ 35 .150
BREAKOUT AREA
Smoke vent
4329
2.8218°
4200
4059
2.3°
5850
5850
2775

power plan

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Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	REHEARSAL SUITE BUILDING SERVICES PROPOSED LAYOUT

Drawn By	Drawn Date	Scale
BWS	05/02/2015	NTS

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10016	-

REHEARSALS AHU
1400Wx7900Lx3525H
6500kg

AUDITORIUM AHU
2250Wx7900Lx3525H
8500kg

BALCONY SUPPLY AIR
750x400

BASEMENT BOH SUPPLY AIR
700x350

TOP OF WATER TANK BALL
VALVE ENCLOSURE 3100H

DOMESTIC WATER STORAGE TANK
1824Wx2915Lx1275H
5300kg
WATER TANK ON TOP OF BASEMENT SUPPLY A
BALL VALVE HOUSING ON TOP OF WATER TANK
700Wx600Lx350HIGH

BASEMENT SUPPLY AHU
1100Wx5075Lx1175H
1500kg

STAGE SUPPLY AIR
700x250

FOH VRV OUTDOOR UNIT
800Wx1000Lx1750H
250kg

STANDBY GENERATOR
1126Wx3511Lx1681H
1900kg

AIR COOLED CONDENSERS (9 OFF)
350Wx3400Lx3300H
1200kg TOTAL WEIGHT

CHILLER
2253Wx2457Lx2297H
2300kg

BOH VRV OUTDOOR UNIT
800Wx1000Lx1750H
250kg

PACKAGED SUB STATION
2000Wx2300Lx2300H
3500kg

ROOF PLANTROOM MCP
450Wx1800Lx2100H
200kg

BASEMENT TOILET EXTRACT
750x300

STAGE SUPPLY AIR
700x250

CHW BUFFER VESSEL
1000DIA.x1800H
1400kg

ROOF PLANTROOM
2400H

LTHW PUMPS (3 OFF)
150kg EACH

BOILERS
680Wx700Lx2040H
500kg

AUDITORIUM SUPPLY
1100x1000

AUDITORIUM EXTRACT
900x800

SMOKE EXTRACT FAN
STACK 1470DIA.x4500H
800kg

SMOKE EXTRACT FAN
STACK 1470DIA.x4500H
800kg

REHEARSALS SUPPLY
750x650

REHEARSALS EXTRACT
750x650

HOT WATER CYLINDERS
700DIA.x1850H
1000kg EACH

AUDITORIUM EXTRACT
900x800

BALCONY SUPPLY AIR
750x400

Notes:

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Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	ROOF BUILDING SERVICES PROPOSED LAYOUT

Checked By	Checked Date	Drawn By	Drawn Date
BWS	06/02/2015	BWS	06/02/2015
Approved By	Approval Date	Scale	
BWS	06/02/2015	1:50	

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	CS	10017	-

150kvA LIFE SAFETY
EMERGENCY STANDBY
GEN. SET

CONTROL
PANEL

N/AUTO
MCCB's

PHASE
INDICATORS

N/O

N/C

PHASE
INDICATORS

M

GEN LV
SWITCHBOARD

LIFE SAFETY SUPPLIES

PFR CIRCUIT

HVAC PLANT

M

315A
TPN
ISOL.

WP 500kvA PACKAGED
SUB-STATION
1100/415V DYN11

PM870
CHECK METER

CM

PFR

PHASE
INDICATORS

400A
TPN

400A
TPN

ALLOW 20%
SPARE FUSES

ROOF

REHEARSAL ROOM 1 AND RECEPTION
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

REHEARSAL ROOM 2
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

REHEARSALS LEVEL
STAGE SERVICES POWER
DISTRIBUTION BOARD

M

250A
TPN
ISOL

REHEARSAL SUITE

COMMS
DISTRIBUTION BOARD

M

125A
SPN
ISOL

TECHNICAL GALLERY
STAGE SERVICES POWER
DISTRIBUTION BOARD

M

250A
TPN
ISOL

TECHNICAL ROOM
POWER SERVICES
DISTRIBUTION BOARD

M

250A
TPN
ISOL

TECHNICAL GALLERY
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
SPN
ISOL

TECHNICAL GALLERY

SECOND TIER, MALE AND FEMALE TOILETS
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

DIMMERS

M

250A
TPN
ISOL

SECOND TIER
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
SPN
ISOL

SECOND TIER

FIRST TIER, CIRCLE BAR AND VIP ROOM
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

FIRST TIER
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
SPN
ISOL

FIRST TIER

FOYER & FOH
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

CANOPY DISPLAY
EXTERNAL LIGHTING
DISTRIBUTION BOARD

M

125A
TPN
ISOL

STALLS AREA
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

STAGE AREA
STAGE SERVICES POWER
DISTRIBUTION BOARD

M

250A
TPN
ISOL

STAGE AREA
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

STALLS/GROUND FLOOR

UNDER STAGE
POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

UNDER STAGE
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

M

125A
TPN
ISOL

UPPER BASEMENT

125A TPN MCCB | 125A TPN MCCB | 125A TPN MCCB | 125A TPN MCCB | 125A TPN MCCB | 125A SPN MCCB | 125A TPN MCCB | 125A TPN MCCB

FOH SWITCHBOARD

* PROVIDE 15%
SPARE WAYS

CT

CM PM870

REF

SPD

PFC CT

PHASE
INDICATORS

400A
TPN
ISOL.

100A
TPN
MCCB

LIFT

M

SPRAGUE ROOM & TOILETS
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

125A
TPN
ISOL

M

DRESSING ROOMS & TOILETS
LIGHTING & SMALL POWER
DISTRIBUTION BOARD

125A TPN MCCB | 250A TPN MCCB | 125A SPN MCCB | 250A TPN MCCB | 250A TPN MCCB | 125A SPN MCCB | 250A TPN MCCB | 125A SPN MCCB | 125A SPN MCCB | 250A TPN MCCB | 125A TPN MCCB | 125A TPN MCCB | 125A TPN MCCB

STAGE & ROH SWITCHBOARD

* PROVIDE 15%
SPARE WAYS

MAIN
EARTH BAR

CT

CM PM870

REF

SPD

PFC CT

PHASE
INDICATORS

400A
TPN
ISOL.

UKPN'S MAIN
METER

M

CT

UKPN RING MAIN UNIT (RMU)
IN MV SWITCHROOM

UKPN INTAKE AT
LOWER BASEMENT LEVEL

LOWER BASEMENT

Notes:

REV	DATE	DESCRIPTION

Power Plan Solutions LLP
Ashdene House
Shawford
Winchester
SO21 2AA
Tel:01962 715000 Fax:01962 715615

Client
Delfont Mackintosh Theatres

Project Name
Sondheim (Ambassadors) Theatre

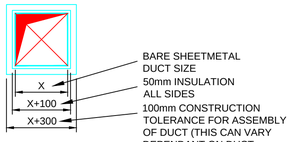
Discipline	Project Phase
Building Services	Planning
Drawing Originator	Origin. Job No.
Power Plan Solutions	10179

Title
ELECTRICAL SINGLE
LINE SCHEMATIC

Checked By	Checked Date	Drawn By	Drawn Date
BWS	05/02/2015	GAT	30/07/2014
Approved By	Approval Date	Scale	
BWS	05/02/2015	NTS	

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	SCH	10020	-

NOTE: ALL SIZES SHOWN ON THIS SCHEMATIC ARE BARE SHEETMETAL DUCT SIZES. PLEASE ADD RISER TOLERANCES AS SHOWN IN THE DETAIL



TYPICAL RISER SPACE ALLOWANCES DETAIL

AUDITORIUM AHU

BASEMENT BOH AHU

REHEARSALS SUITE AHU

SMOKE EXTRACT FANS

ROOF MOUNTED TOILET EXTRACT FAN

ROOF

ROOF MOUNTED TOILET EXTRACT FAN

TERRACE

350 l/s (4.1 m/s, 0.65 Pa/m) 300x300

300 l/s (2.6 m/s, 0.22 Pa/m) 500x250

CONTROL ROOM

DUCTBOARD FABRICATED RISER WITH SPLITTERS

350 l/s (4.1 m/s, 0.65 Pa/m) 300x300

750 l/s (4.3 m/s, 0.45 Pa/m) 800x250

REHEARSALS SUITE

750 l/s (4 m/s, 0.38Pa/m) 650x350

1450 l/s (4 m/s, 0.25 Pa/m) 750x550

2200 l/s (5 m/s, 0.33 Pa/m) 750x650

750 l/s (4 m/s, 0.38Pa/m) 650x350

1450 l/s (4 m/s, 0.25 Pa/m) 750x550

3400 l/s (5.3 m/s, 0.3 Pa/m) 900x800

3400 l/s (5.3 m/s, 0.3 Pa/m) 900x800

RISER MOUNTED TOILET EXTRACT FAN

TECHNICAL GALLERY

3400 l/s (3 m/s, 0.1 Pa/m) 1400x900

3400 l/s (3 m/s, 0.1 Pa/m) 1400x900

750 l/s (2.6m/s, 0.14 Pa/m) 900x350

FEMALE TOILET

600 l/s (2.7 m/s, 0.17 Pa/m) 700x350

SECOND TIER

BALCONY BOXES

600 l/s (2.7 m/s, 0.17 Pa/m) 700x350

600 l/s (2.7 m/s, 0.17 Pa/m) 700x350

CIRCLE BAR

600 l/s (2.7 m/s, 0.17 Pa/m) 700x350

FIRST TIER

BALCONY BOXES

600 l/s (2.7 m/s, 0.17 Pa/m) 700x350

600 l/s (2.7 m/s, 0.17 Pa/m) 700x350

750 l/s (4 m/s, 0.42 Pa/m) 700x300

STALLS

FOYER

750 l/s (2.8m/s, 0.16 Pa/m) 750x400

750 l/s (2.8m/s, 0.16 Pa/m) 750x400

STAGE

500 l/s (3.2m/s, 0.3 Pa/m) 700x250

500 l/s (3.2m/s, 0.3 Pa/m) 700x250

750 l/s (4 m/s, 0.42 Pa/m) 700x300

750 l/s (3m/s, 0.18 Pa/m) 600x450

750 l/s (3m/s, 0.18 Pa/m) 600x450

300 l/s (3.2 m/s, 0.38 Pa/m) 400x250

UPPER BASEMENT

750 l/s (3m/s, 0.18 Pa/m) 600x450

750 l/s (3m/s, 0.18 Pa/m) 600x450

300 l/s (3.2 m/s, 0.38 Pa/m) 400x250

STALLS BAR

LOWER BASEMENT

Notes:

power plan

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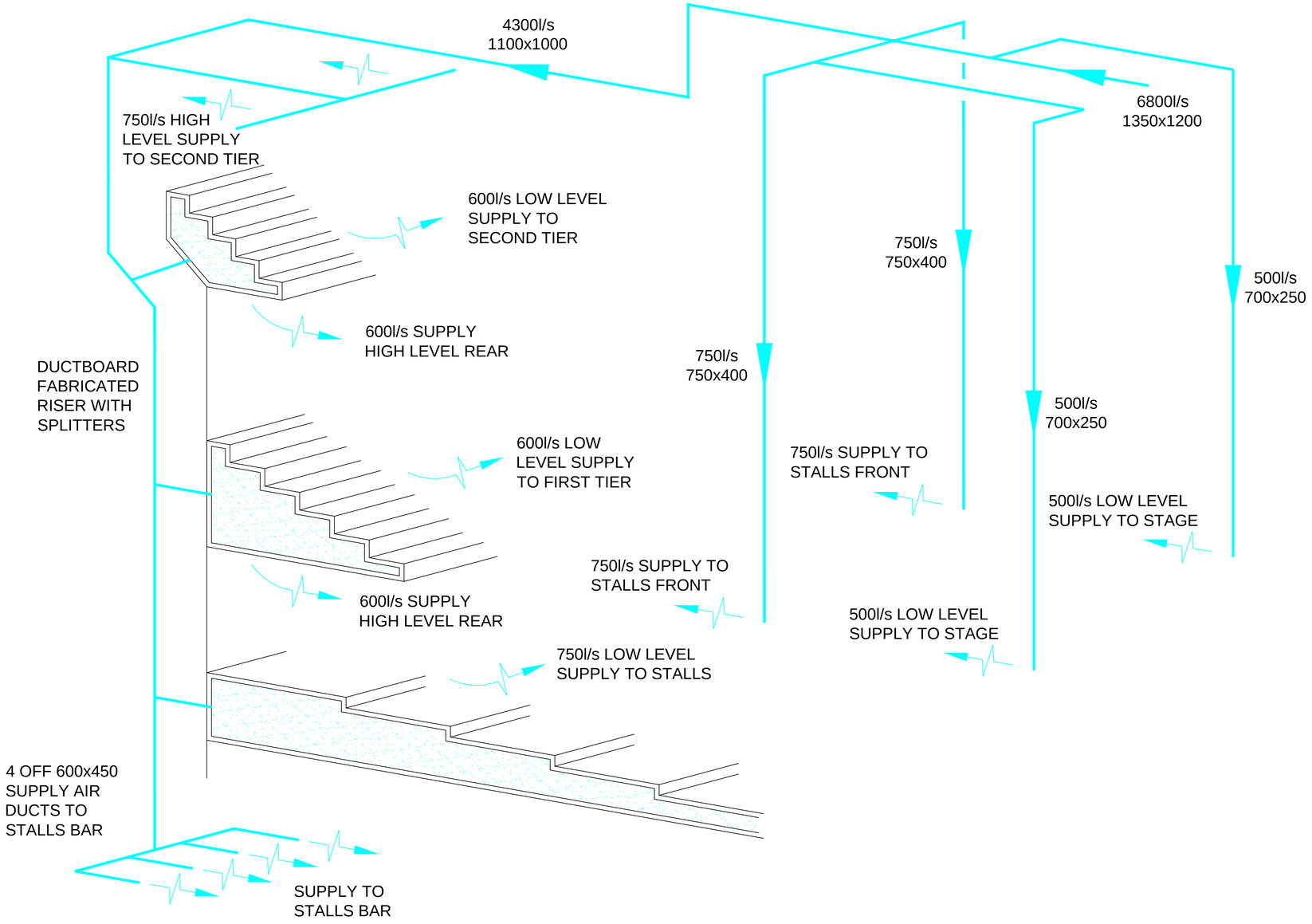
SO21 2AA
Tel:01962 715000 Fax:01962 715615

Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	AIR SCHEMATICS SHEET 1 OF 2 PROPOSED LAYOUT

Checked By	Checked Date	Drawn By	Drawn Date
BWS	05/02/2015	BWS	05/02/2015
Approved By	Approval Date	Scale	
BWS	05/02/2015	1:50	

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	SCH	10021	-



Notes:

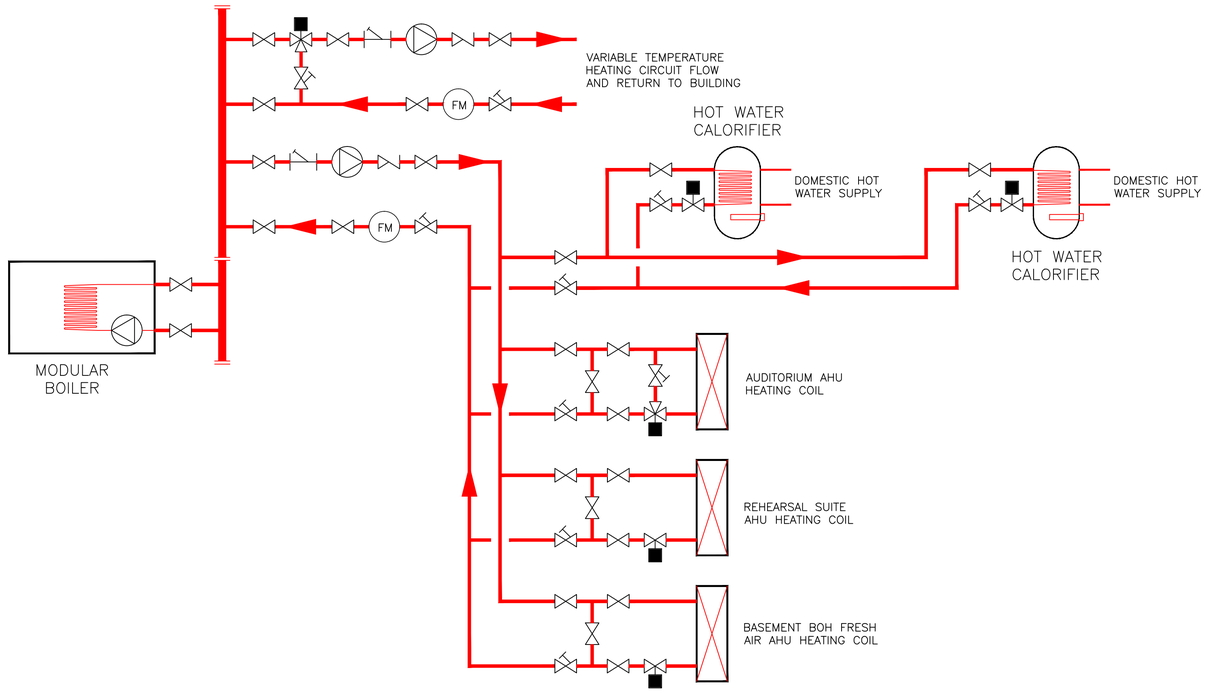
Power Plan Solutions LLP
Ashdene House
Shawford
Winchester
SO21 2AA
Tel:01962 715000 Fax:01962 715615

Client: Delfont Mackintosh Theatres
Project Name: Sondheim (Ambassadors) Theatre
Discipline: Building Services
Project Phase: Planning
Drawing Originator: Power Plan Solutions
Origin. Job No.: 10179
Title:
AIR SCHEMATICS
SHEET 2 OF 2
SUPPLY AIR ISOMETRIC

Checked By	Checked Date	Drawn By	Drawn Date
BWS	05/02/2015	BWS	05/02/2015

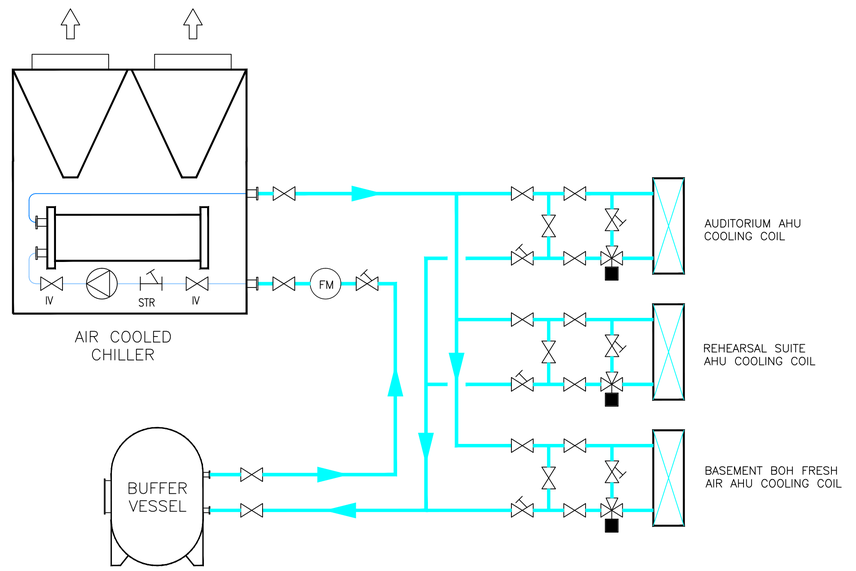
Approved By	Approval Date	Scale
BWS	05/02/2015	1:50

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	SCH	10022	-



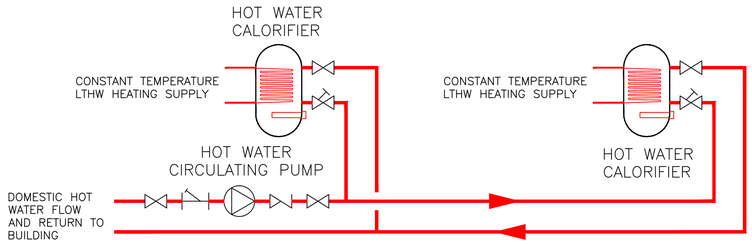
LTHW HEATING WATER SCHEMATIC

SCALE: NTS



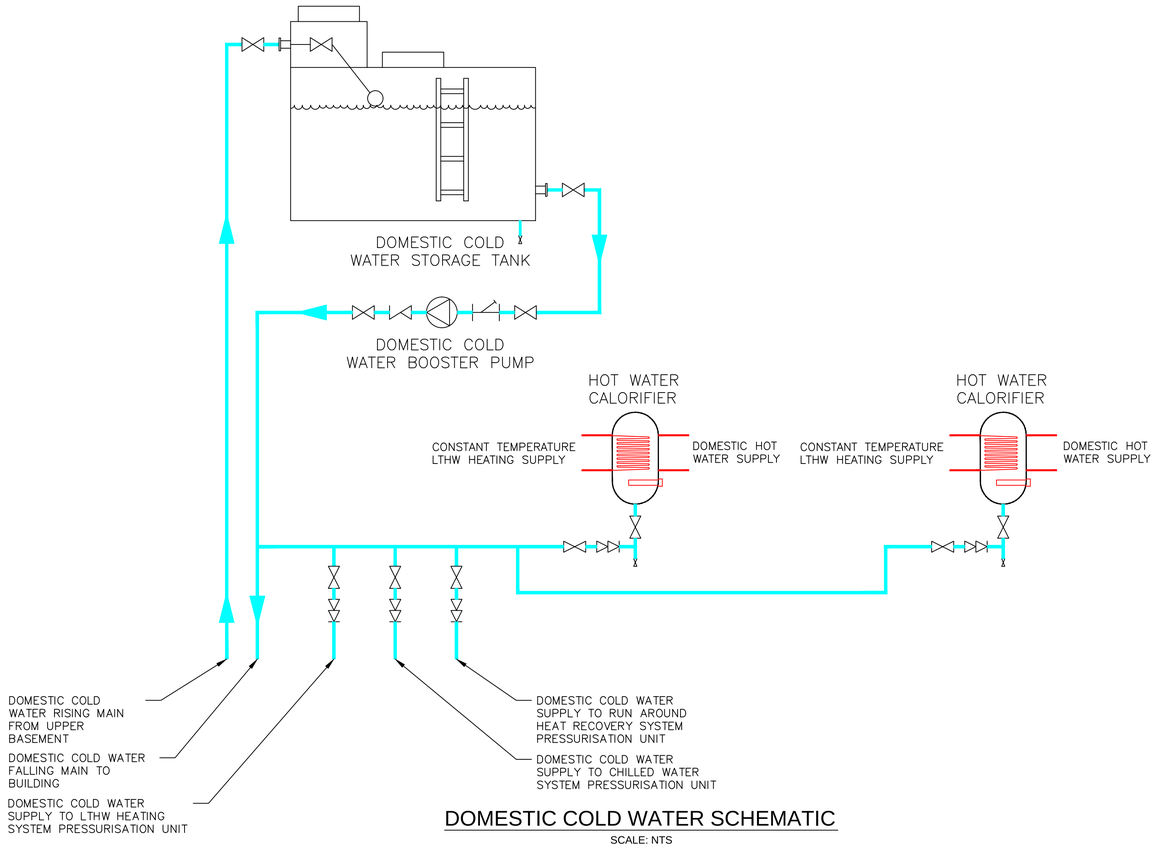
CHILLED WATER SCHEMATIC

SCALE: NTS



DOMESTIC HOT WATER SCHEMATIC

SCALE: NTS



DOMESTIC COLD WATER SCHEMATIC

SCALE: NTS

Notes:

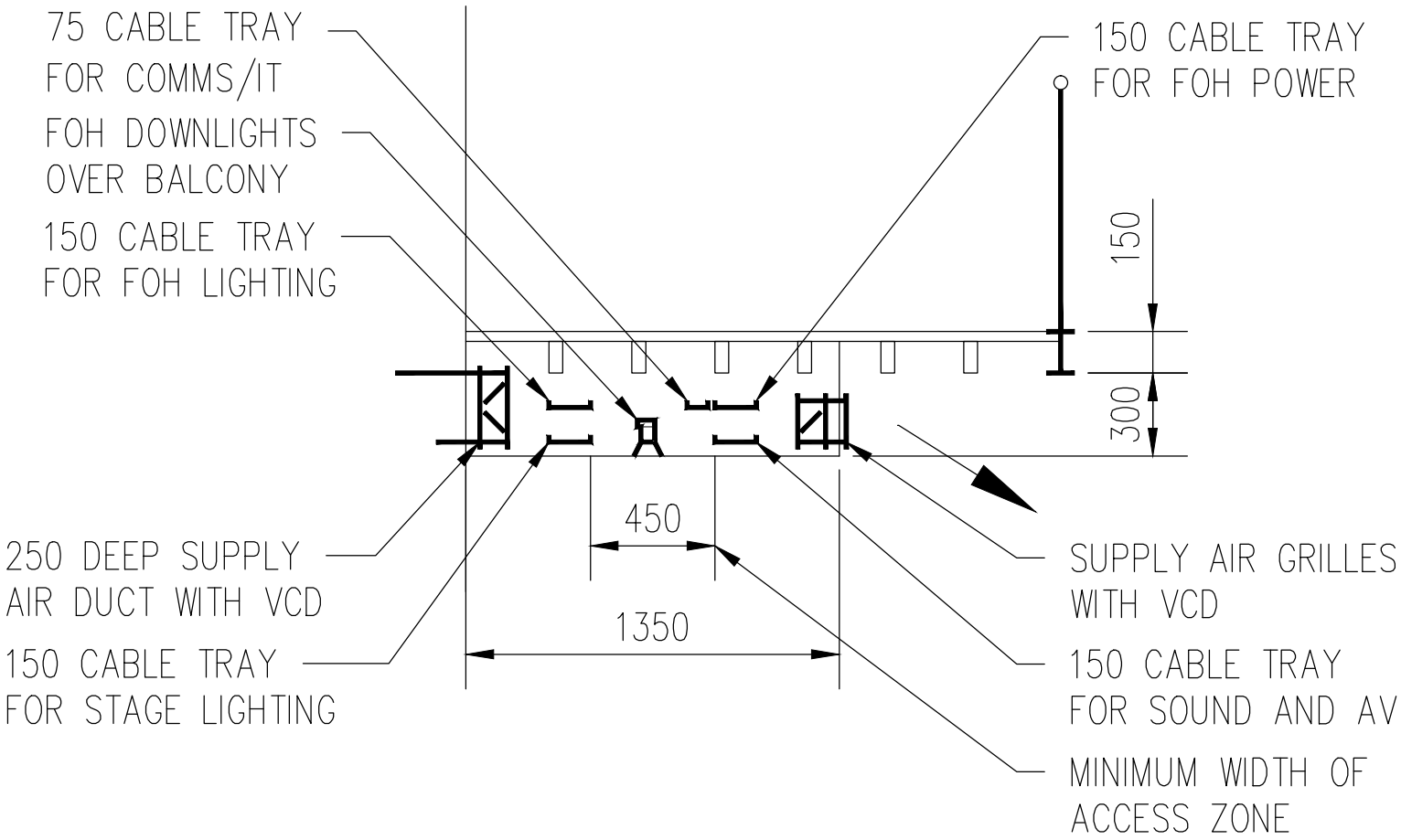
power plan

Power Plan Solutions LLP
Ashdene House
Shawford
Winchester
SO21 2AA
Tel:01962 715000 Fax:01962 715615

Client	Delfont Mackintosh Theatres
Project Name	Sondheim (Ambassadors) Theatre
Discipline	Building Services
Project Phase	Planning
Drawing Originator	Power Plan Solutions
Origin. Job No.	10179
Title	CHILLED WATER, LTHW HEATING WATER, DOMESTIC COLD WATER AND DOMESTIC HOT WATER SCHEMATICS

Checked By	Checked Date	Drawn By	Drawn Date
BWS	05/02/2015	BWS	05/02/2015
Approved By	Approval Date	Scale	
BWS	05/02/2015	NTS	

Originator	Proj. Ref.	Disc.	Drawing No.	Rev.
PPS	10179	SCH	10023	-



TYPICAL BALCONY SERVICES ZONE

APPENDIX B EQUIPMENT SCHEDULES

Sondheim (Ambasadors) Theatre Proposed Services Equipment Schedule

Equipment	Location	Duty	Dimensions			Weight (kg)
			Width (mm)	Length (mm)	Height (mm)	
Air Cooled Chiller	Roof	200 kW	2253	2457	2297	1850
CHW Buffer Vessel	Roof	1000 l	1000 dia.		1800	
CHW Pressurisation Unit	Roof	1.5 Bar	Aquatech Pressmain Micropack 'ETM' Series with 60 litre minimum expansion tank			
CHW Pumps	Roof	9.6 kg/s @ 250 kPa	Included in Chiller			
Auditorium AHU	Roof	6800 l/s @ 350 Pa external static	2850	8150	3500	7000
Rehearsals AHU	Roof	1500 l/s @ 350 Pa external static	1500	8150	2300	
Basement AHU	Roof	500 l/s @ 600 Pa external static	1200	6950	1200	
RA Pressurisation Unit	Roof	1.5 Bar	Aquatech Pressmain Micropack 'ETM' Series with 60 litre minimum expansion tank			
RA Pump	Roof	2.9 l/s @ 250 kPa	Twin Head Type Inline Duty/Standby Pump			
Boiler	Roof	240 kW	700	680	2040	350
LTHW Pressurisation Unit	Roof	1.5 Bar	Aquatech Pressmain Micropack 'ETM' Series with 200 litre minimum expansion tank			
VT LTHW Pump	Roof		Twin Head Type Inline Duty/Standby Pump			
CT LTHW Pump	Roof		Twin Head Type Inline Duty/Standby Pump			
HWS Calorifiers (2 off)	Roof	300 l storage with 30 kW recovery	700 dia.		1800	
HWS Circulation Pumps	Roof		Twin Head Type Inline Duty/Standby Pump			
Stalls Bar Toilet Extract Fan	Basement	400 l/s @ 250 Pa	Inline Axial Type mounted in riser at Technical Gallery Level			
Basement Toilet Extract Fan	Basement	700 l/s @ 250 Pa	Roof Mounted Duty/Standby Type			
Circle Bar Male Toilet Extract Fan	Second Floor	Ventilation via windows	Roof Mounted Duty/Standby Type			
Circle Bar Female Toilet Extract Fan	Second Floor	Ventilation via windows	Roof Mounted Duty/Standby Type			
Smoke Fans (2 off)	Roof	15000 l/s @ 600 Pa	1250 dia.		1010 fan only 3400 including shut off dampers and flexible connections	472 fan only
Water Storage Tank	Roof	5000 l	1824	2915	1275	5300
Basement VRV Outdoor Unit	Roof	35 kW	760	920	1750	245
FOH VRV Outdoor Unit	Roof	35 kW	800	1000	1750	245
IT Hub/Comms DX Outdoor Units (2 off)	Roof	10 kW	800	1000	1350	125
Dimmer DX Outdoor Units (3 off)	Roof	15 kW	350	1100	1350	125
Stage Cooling DX Outdoor Units (2 off)	Roof	10 kW	350	1100	1350	125
AV Rack DX Outdoor Units (3 off)	Roof	10 kW	350	1100	1350	125
Dry Riser	All Levels above ground in main stairs	N/A				
HV Switchgear	Basement	500 kVA	N/A			
Sub Station	Roof	500 kVA	1200	3900	2300	3500
Standby Generator	Roof	100 kVA	1200	3000	1700	1500
Standby Generator Change Over Panel	Roof	100 kVA	700	1800	2000	N/A
Electrical HV Switchboard	Basement		2000	600	1800	N/A
FOH Switchboard	Basement		2000	600	1800	N/A
ROH Switchboard	Basement		2000	600	1800	N/A
Stage Services Switchboard	Basement		2000	600	1800	N/A
Dimmer Racks (5 off)	Basement	To be comfirmed - Based on Sensor 3 racks	400	600	2200	N/A
AV Racks (3 off)	Basement	To be comfirmed - Based on Sensor 3 racks	400	600	2200	N/A
Comms Rack	Basement		800	1000	2200	N/A
IT Hub Rack	Basement		800	1000	1200	N/A

APPENDIX C EQUIPMENT NOISE DATA

AMBASSADORS THEATRE
NOISE DATA

Equipment	Location	Noise SWL (dB(A))							
		63	125	250	500	1000	2000	4000	8000
Air Cooled Chiller	Roof		94	91	91	87	83	76	
AHU Panel Insertion Losses	Roof	17	20	25	25	31	33	37	26
Auditorium AHU Extract Fan Discharge	Roof	98	92	89	88	85	81	76	68
Auditorium AHU Extract Fan Discharge 1200 mm Long Attenuator Insertion Loss	Roof	8	13	27	39	45	45	35	24
Auditorium AHU Supply Fan Discharge	Roof	98	92	89	88	85	81	76	68
Auditorium AHU Supply Fan Intake 1200 mm Long Attenuator Insertion Loss	Roof	8	13	27	39	45	45	35	24
AHU Panel Insertion Losses	Roof	17	20	25	25	31	33	37	26
Rehearsals AHU Extract Fan Discharge	Roof	95	90	88	83	78	72	68	60
Rehearsals AHU Extract Fan Discharge 1200 mm Long Attenuator Insertion Loss	Roof	8	13	27	39	45	45	35	24
Rehearsals AHU Supply Fan Discharge	Roof	95	90	88	83	78	72	68	60
Rehearsals AHU Supply Fan Intake 1200 mm Long Attenuator Insertion Loss	Roof	8	13	27	39	45	45	35	24
AHU Panel Insertion Losses	Roof	17	20	25	25	31	33	37	26
Basement AHU Supply Fan Discharge	Roof	90	89	84	82	80	78	71	60
Basement AHU Supply Fan Intake 1200 mm Long Attenuator Insertion Loss	Roof	8	13	27	39	45	45	35	24
Boiler	Roof	61							
Stalls Bar Toilet Extract Fan	Roof	78							
Basement Toilet Extract Fan	Roof	78							
Circle Bar Male Toilet Extract Fan	Roof	76							
Circle Bar Female Toilet Extract Fan	Roof	76							
Smoke Fans Inlet	Roof	113	106	108	105	104	102	99	96
Smoke Fans Outlet	Roof	115	108	109	105	104	102	98	97
Smoke Fans Break Out	Roof	105	85	81	78	77	73	77	74
Basement VRV Outdoor Unit	Roof	79							
FOH VRV Outdoor Unit	Roof	79							
IT Hub/Comms DX Outdoor Units (2 off)	Roof	SPL - 51 dB(A)							
Dimmer DX Outdoor Units (3 off)	Roof	SPL - 51 dB(A)							
Stage Cooling DX Outdoor Units (2 off)	Roof	SPL - 51 dB(A)							
AV Rack DX Outdoor Units (3 off)	Roof	SPL - 51 dB(A)							
Standby Generator	Roof	SPL - 83.9 dB(A) @ 1 m							

APPENDIX D PROPOSED EQUIPMENT MANUFACTURERS DETAILS

Carrier®

Air-Cooled Liquid Chillers with Integrated Hydronic Module

PRO-DIALOG

AQUASNAP®

EUROVENT CERTIFIED PERFORMANCE
www.eurovent-certification.com

www.eurovent-certification.com
www.certiflash.com

Model shown is with low-noise option

LLOYD'S REGISTER QUALITY ASSURANCE
ISO9001·ISO14001

Quality and Environment Management Systems Approval

30RB 162-802

Nominal cooling capacity 162-774 kW

The Aquasnap liquid chiller range features the latest technological innovations:
- ozone-friendly refrigerant R-410A
- scroll compressors
- low-noise fans made of a composite material
- auto-adaptive microprocessor control
- aluminium micro-channel heat exchangers (MCHE)

The Aquasnap can be equipped with an integrated hydronic module, limiting the installation to straight-forward operations like connection of the power supply and the chilled water supply and return piping.

Features

Quiet operation

- Compressors
  - Low-noise scroll compressors with low vibration level
  - The compressor assembly is installed on an independent chassis and supported by flexible anti-vibration mountings
  - Dynamic suction and discharge piping support, minimising vibration transmission (Carrier patent)
  - Acoustic compressor enclosure, reducing radiated noise emissions (option)
- Condenser section
  - Condenser coils in V-shape with an open angle, allowing quieter air flow across the coil
  - Low-noise 4th generation Flying Bird fans, made of a composite material (Carrier patent) are now even quieter and do not generate intrusive low-frequency noise
  - Rigid fan installation for reduced noise (Carrier patent)

Easy and fast installation

- Integrated hydronic module (option)
  - Centrifugal low or high-pressure water pump (as required), based on the pressure loss of the hydronic installation
  - Single or dual pump (as required) with operating time balancing and automatic changeover to the back-up pump if a fault develops
  - Water filter protecting the water pump against circulating debris
  - High-capacity membrane expansion tank ensures pressurisation of the water circuit
  - Thermal insulation and frost protection down to -20°C, using an electric resistance heater (see table of options)
  - Pressure gauge to check filter pollution and measure the system water flow rate (option)
  - Water flow control valve (option)

- Simplified electrical connections
  - A single power supply point without neutral (30RB 162-522)
  - Main disconnect switch with high trip capacity (see table of options)
  - 24 V control circuit without risk from a transformer included
- Fast commissioning
  - Systematic factory operation test before shipment
  - Quick-test function for step-by-step verification of the instruments, electrical components and motors

Economical operation

- Increased energy efficiency at part load
  - Eurovent energy efficiency class (in accordance with EN14511-3:2011) B to D
  - The refrigerant circuit includes several compressors connected in parallel. At part load, around 99% of the operating time, only the compressors that are absolutely necessary operate. At these conditions the compressors operating are even more energy efficient, as they use the total condenser and evaporator capacity.
  - The electronic expansion device (EXV) allows operation at a lower condensing pressure (EER optimisation).
  - Dynamic superheat management for better utilisation of the evaporator heat exchange surface
  - All-aluminium micro-channel condenser (MCHE), more efficient than a copper/aluminium coil
- Reduced maintenance costs
  - Maintenance-free scroll compressors
  - Fast diagnosis of possible incidents and their history via the Pro-Dialog Plus control
  - R-410A refrigerant is easier to use than other refrigerant blends

Environmental care

- Ozone-friendly R-410A refrigerant
  - Chlorine-free refrigerant of the HFC group with zero ozone depletion potential
  - Very efficient - gives an increased energy efficiency ratio (EER)
  - 40% reduction in the refrigerant charge through use of the micro-channel heat exchangers (MCHE)
- Leak-tight refrigerant circuit
  - Brazed refrigerant connections for increased leak-tightness
  - Reduction of leaks as no capillary tubes and flare connections are used
  - Verification of pressure transducers and temperature sensors without transferring refrigerant charge

Superior reliability

- State-of-the-art concept
  - Cooperation with specialist laboratories and use of limit simulation tools (finite element calculations) for the design of the critical components, e.g. motor supports, suction/discharge piping
  - Compressor control box installed on the cold side of the compressor (Carrier patent)
  - All-aluminium micro-channel heat exchanger (MCHE) offers 3.5 times higher corrosion resistance than a conventional coil. The all-aluminium construction eliminates the formation of galvanic currents between aluminium and copper that are responsible for the coil corrosion in saline or corrosive atmospheres.
- Auto-adaptive control
  - Control algorithm prevents excessive compressor cycling and permits reduction of the water quantity in the hydronic circuit (Carrier patent).
  - Automatic compressor unloading in case of abnormally high condensing pressure. If an anomaly occurs (e.g. fouled condenser coil, fan failure) Aquasnap continues to operate, but at reduced capacity.
- Exceptional endurance tests
  - Corrosion resistance tests in salt mist in the laboratory
  - Accelerated ageing test on components that are submitted to continuous operation: compressor piping, fan supports
  - Transport simulation test in the laboratory on a vibrating table. The test is based on a military standard and equivalent to 4000 km by truck.

Pro-Dialog Plus control

Pro-Dialog Plus combines intelligence with operating simpli-city. The control constantly monitors all machine para-meters and precisely manages the operation of compressors, expansion devices, fans and of the evaporator water pump for optimum energy efficiency.

- Energy management
  - Internal time schedule clock: permits chiller on/off control and operation at a second set point
  - Set point reset based on the outside air temperature or the return water temperature
  - Master/slave control of two chillers operating in parallel with operating time equalisation and automatic change-over in case of a unit fault.
  - Start/stop control based on the air temperature
- Ease-of-use
  - User interface with synoptic diagram for intuitive display of the principal operating parameters: number of compressors operating, suction/discharge pressure, compressor operating hours, set point, air temperature, entering/leaving water temperature
  - Ten menus for direct access to all machine commands, including fault history, allowing fast and complete chiller diagnostics

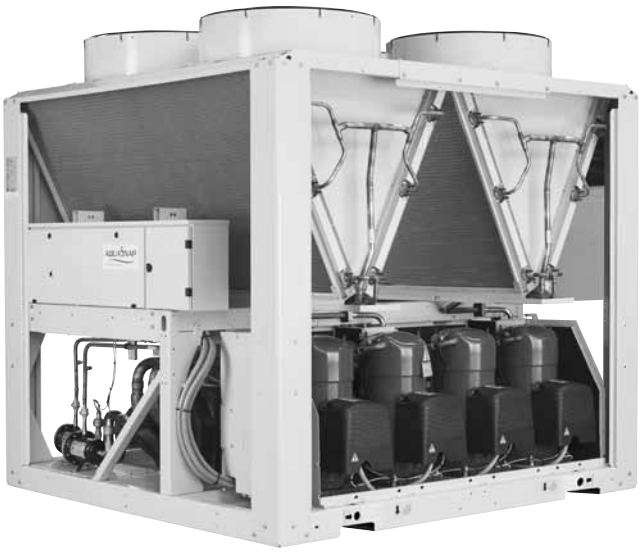
Pro-Dialog Plus operator interface

Remote management (standard)

A simple two-wire communication bus between the RS485 port of the Aquasnap and the Carrier Comfort Network offers multiple remote control, monitoring and diagnostic possibilities. Carrier offers a vast choice of control products, specially designed to control, manage and supervise the operation of an air conditioning system. Please consult your Carrier representative for more information on these products.

- Start/stop: opening of this contact will shut down the unit
- Dual set point: closing of this contact activates a second set point (example: unoccupied mode)
- Demand limit: closing of this contact limits the maximum chiller capacity to a predefined value
- User safety: this contact is connected in series with the water flow switch and can be used for any customer safety loop
- Heat reclaim (option): closing of this contact allows heat reclaim mode operation
- Water pump 1 and 2 control*: these outputs control the contactors of one or two evaporator water pumps
- Water pump on reversal*: these contacts are used to detect a water pump operation fault and automatically change over to the other pump
- Operation indication: this volt-free contact indicates that the chiller is operating (cooling load) or that it is ready to operate (no cooling load)
- Alert indication: this volt-free contact indicates the presence of a minor fault
- Alarm indication: this volt-free contact indicates the presence of a major fault that has led to the shut-down of one or two refrigerant circuits

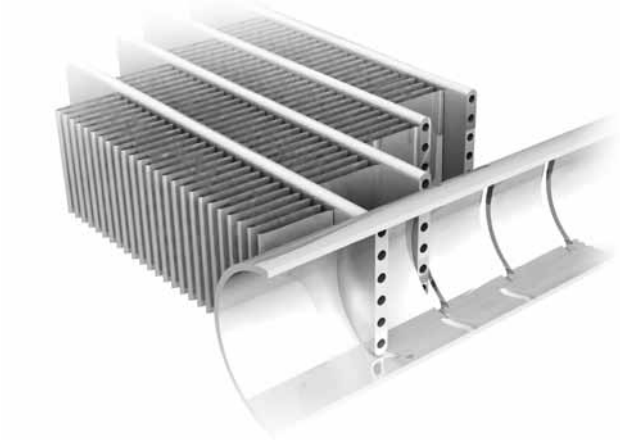
* contacts already supplied with the hydronic module option



Remote management (EMM option)

- Room temperature: permits set point reset based on the building indoor air temperature (with Carrier thermostat)
- Set point reset: ensures reset of the cooling set point based on a 4-20 mA or 0-5 V signal
- Demand limit: permits limitation of the maximum chiller demand based on a 4-20 mA or 0-5 V signal
- Demand limit 1 and 2: closing of these contacts limits the maximum chiller capacity to three predefined values
- User safety: this contact can be used for any customer safety loop, closing of the contact generates a specific alarm
- Ice storage end: when ice storage has finished, this input permits return to the second set point (unoccupied mode)
- Time schedule override: closing of this contact cancels the time schedule effects
- Out of service: this signal indicates that the chiller is completely out of service
- Chiller capacity: this analogue output (0-10 V) gives an immediate indication of the chiller capacity
- Compressor operation: this contact signals that one or several compressors are in operation

All aluminium micro-channel heat exchanger (MCHE)



Already utilised in the automobile and aeronautical industries for many years, the MCHE heat exchanger is entirely made of aluminium. This one-piece concept significantly increases its corrosion resistance by eliminating the galvanic currents that are created when two different metals (copper and aluminium) come into contact in traditional heat exchangers. Unlike traditional heat exchangers the MCHE heat exchanger can be used in moderate marine and urban environments.

From an energy efficiency point-of-view the MCHE heat exchanger is approximately 10% more efficient than a traditional coil and allows a 40% reduction in the amount of refrigerant used in the chiller. The low thickness of the MCHE reduces air pressure losses by 50% and makes it less susceptible to fouling (e.g. by sand) than a traditional coil. Cleaning of the MCHE heat exchanger is very fast using a high-pressure washer.

Options

Options	No.	Description	Advantages	For 30RB
Unit for low leaving water temperature	6B	Leaving water temperature of +3°C to -10°C.	All low-temperature applications: ice storage, cold stores, process cooling etc.	162-402
Unit for indoor installation with discharge ducts	12	Fans with available pressure	Ducted condenser air discharge, optimised condensing temperature control, based on the operating conditions and system characteristics	162-802
Low noise level	15	Sound absorbing compressor enclosure	Noise emission reduction	162-802
Very low noise level	15LS	Sound absorbing compressor enclosure and low-speed fans	Noise emission reduction	162-802
Grilles	23	Metallic grilles on all four unit faces (this option includes the supply of enclosure panels)	Improved aesthetics	162-802
Enclosure panels	23A	Side panels on each end of the coils	Improved aesthetics	162-802
Electronic starter	25	Electronic starter on each compressor	Reduced start-up current	162-522
Winter operation down to -20°C	28	Fan speed control via frequency converter	Stable unit operation when the air temperature is between 0°C and -20°C	162-802
Winter operation down to -10°C	28B	Twin-speed lead fan for each circuit	Stable unit operation when the air temperature is between 0°C and -10°C	162-802
Winter operation down to -10°C and very low noise level (options 28B + 15LS)	28C	Sound absorbing compressor enclosure and low- speed fans + twin-speed lead fan for each circuit	Noise emission reduction and stable unit operation when the air temperature is between 0°C and -10°C	162-802
Evaporator and water piping frost protection	41	Electric heater on the evaporator and the water inlet/outlet piping	Evaporator frost protection for air temperatures between 0°C and -20°C	162-802
Evaporator, water piping and hydronic module frost protection	42A	Electric heaters on the evaporator, the water inlet/outlet piping and hydronic module	Evaporator and hydronic module frost protection for air temperatures between 0°C and -20°C	162-522
Partial heat reclaim	49	Partial heat reclaim by desuperheating of the compressor discharge gas	Free high-temperature hot-water production simultaneously with chilled water production	162-802
Total heat reclaim	50	See heat reclaim option. Note: Unit equipped with coils with copper tubes and aluminium fins	Free hot water production simultaneously with chilled water production	262-522
Master/slave operation	58	Unit equipped with an additional field-installed leaving water temperature sensor, allowing master/slave operation of two chillers connected in parallel	Optimised operation of two chillers connected in parallel with operating time equalisation	162-802
Main disconnect switch without fuse (standard for sizes 162-262)	70	Factory-installed main electric disconnect switch in the control box	Ease-of-installation and compliance with local electrical regulations	302-802
Main disconnect switch with fuse	70D	Factory-installed main electric disconnect switch with fuse in the control box	Same advantage as main disconnect switch and reinforced anti-short circuit protection	302-802
Evaporator with aluminium jacket	88	Evaporator thermal insulation protection by aluminium sheets	Improved resistance to climatic aggression	162-802
Evaporator and hydronic module with aluminium jacket	88A	Evaporator and water piping thermal insulation protection by aluminium sheets	Improved resistance to climatic aggression	302-522
Suction valve	92	Shut-off valve on the compressor suction piping (discharge valve as standard)	Simplified maintenance	302-802
Compressor suction and discharge valves	92A	Shut-off valves on the common compressor suction and discharge piping	Simplified maintenance	162-262
High-pressure single-pump hydronic module	116B	Single high-pressure water pump, water filter, expansion tank, pressure gauge, water flow control valve. See hydronic module option.	Easy and fast installation	162-522
High-pressure dual-pump hydronic module	116C	Dual high-pressure water pump, water filter, expansion tank, pressure gauge, water flow control valve. See hydronic module option.	Easy and fast installation, operating safety	162-522
Low-pressure single-pump hydronic module	116F	Single low-pressure water pump, water filter, expansion tank, pressure gauge, water flow control valve. See hydronic module option.	Easy and fast installation	162-522
Low-pressure dual-pump hydronic module	116G	Dual low-pressure water pump, water filter, expansion tank, pressure gauge, water flow control valve. See hydronic module option.	Easy and fast installation, operating safety	162-522
High-pressure single-pump hydronic module	116M	Single high-pressure water pump, water filter, expansion tank, pressure ports. See hydronic module option.	Easy and fast installation	162-522
High-pressure dual-pump hydronic module	116N	Dual high-pressure water pump, water filter, expansion tank, pressure ports. See hydronic module option.	Easy and fast installation, operating safety	162-522
Low-pressure single-pump hydronic module	116P	Single low-pressure water pump, water filter, expansion tank, pressure ports. See hydronic module option.	Easy and fast installation	162-522
Low-pressure dual-pump hydronic module	116Q	Dual low-pressure water pump, water filter, expansion tank, pressure ports. See hydronic module option.	Easy and fast installation, operating safety	162-522
Direct-expansion free-cooling system	118A	See free-cooling option. Note: Unit equipped with coils with copper tubes and aluminium fins	Economic chilled-water production at low outside temperature	232-522
JBus gateway	148B	Two-directional communications board, complies with JBus protocol	Easy connection by communication bus to a building management system	162-802
Bacnet gateway	148C	Two-directional communications board, complies with Bacnet protocol	Easy connection by communication bus to a building management system	162-802
LonTalk gateway	148D	Two-directional communications board, complies with LonTalk protocol	Easy connection by communication bus to a building management system	162-802
Energy Management Module EMM	156	See controls manual	Easy wired connection to a building management system	162-802
Safety valve with three-way valve fitted	194	Three-way valve upstream of the safety valves (not compatible with BPHE version)	Safety valve inspection and replacement facilitated without refrigerant loss	162-802
Conformance with Australian regulations	200	Heat exchanger approved to Australian code	-	162-802
Unit storage above 48°C	241	Refrigerant charge stored in the condenser. Option not compatible with MCHE coils; Cu/Al coils are required to store the charge.	Unit transport by container only possible with this option	162-802
MCHE anti-corrosion protection	263	MCHE protection by the Carrier factory for applications in aggressive environments	The Super Enviro-Shield option was developed to increase the MCHE coil application range to severe environmental conditions.	162-802
Connection sleeve	266	Piping to be welded with Victaulic connection	Ease-of-installation	162-802
Shell-and- tube evaporator	280	Different heat exchanger type	Ensures compatibility with other options than those available with the standard unit (see Electronic Catalogue)	162-262
Power cable connection side extension	283	Side extension on the power control to allow a reduced cable bend radius	Use of thicker power cables	302-802

Units with fans with available pressure for indoor installation (option 12)

This option applies to 30RB units installed inside the building in a plant room. For this type of installation the hot air leaving the air-cooled condensers is discharged by the fans to the outside of the building, using a duct system.

30RB units equipped with fans with available pressure are designed to operate with air discharge ducts with maximum pressure drops of 200 Pa.

To compensate for these pressure drops 30RB units with option 12 are equipped with variable-speed fans with a maximum speed of 19 r/s, instead of 15.8 r/s and fixed-speed fans as for the standard units.

All fans in the same refrigerant circuit are controlled by a single-speed variator and therefore all run at the same speed.

The full-load or part-load speed is controlled by a patented algorithm that permanently optimises the condensing temperature to ensure the best unit energy efficiency (EER) whatever the operating conditions and pressure drops of the system ductwork.

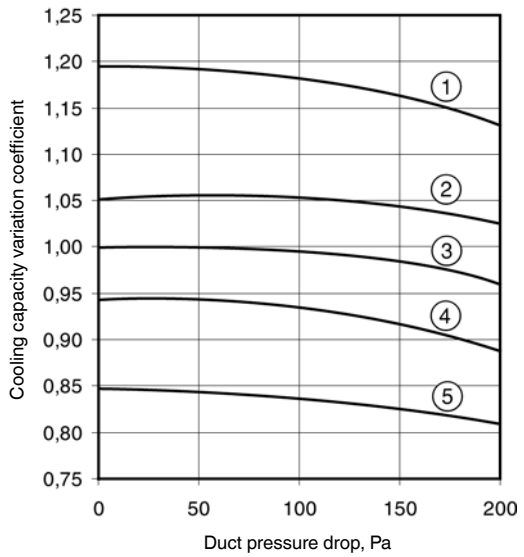
Each refrigerant circuit (A, B and C) must have a separate ducting system to prevent any air recycling between the condensers of the different refrigerant circuits.

In 30RB units with option 12 each fan is equipped with a factory-installed connection interface, allowing the connection to the ducting system for the specific circuit (A, B and C) for each fan. Please refer to the unit dimensional drawings for the exact dimensions of the connection interface.

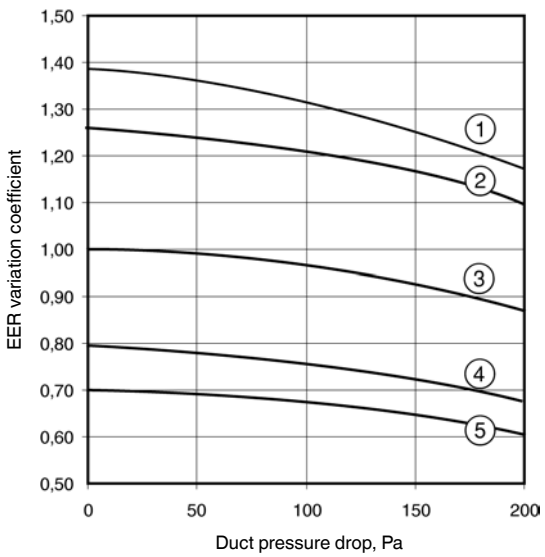
The unit cooling capacity and energy efficiency ratio (EER) vary depending on the duct pressure drops:
- between 0 and 100 Pa the unit cooling capacity is only slightly affected,
- between 100 and 200 Pa the unit cooling capacity falls considerably depending on the operating conditions (outdoor air temperature and water conditions).

Please refer to the curves below to evaluate the impact of the estimated duct system pressure drop for the installation and the impact of different full load operating conditions on the 30RB unit cooling capacity and EER.

Cooling capacity variations for operating conditions that differ from Eurovent conditions



EER variations for operating conditions that differ from Eurovent conditions



Operating conditions

Curve No.	Outside temperature, °C	Entering water temperature, °C	Leaving water temperature, °C	Load %
1	25	15	10	100
2	25	10	5	100
3 Eurovent	**35**	**12**	**7**	**100**
4	45	15	10	100
5	45	10	5	100

Nominal and maximum air flows per circuit

30RB	Nominal/maximum air flow, l/s		
	Circuit A	Circuit B	Circuit C
162-262	9030/11110	9030/11110	-
302-342	13540/16670	9030/11110	-
372-402	13540/16670	13540/16670	-
432-462	18060/22220	13540/16670	-
522	18060/22220	18060/22220	-
602	13540/16670	13540/16670	13540/16670
672	13540/16670	13540/16670	18060/22220
732	18060/22220	18060/22220	13540/16670
802	18060/22220	18060/22220	18060/22220

Sound power level at the discharge duct outlet for all circuits

30RB		162	182	202	232	262	302	342	372	402	432	462	522	602	672	732	802
Sound power level 10^{-12} W	dB(A)	93	93	93	93	93	94	94	95	95	95.5	95.5	96	96.5	97	97.5	98

Partial heat reclaim using desuperheaters (option 49)

This option permits the production of free hot water using heat reclaim by desuperheating the compressor discharge gases. The option is available for the whole 30RB range.

A plate heat exchanger is installed in series with the air condenser coils on the compressor discharge line of each circuit.

Physical data, 30RB units with partial heat reclaim

30RB - partial heat reclaim mode		162	182	202	232	262	302	342	372	402	432	462	522	602	672	732	802
Cooling capacity*	kW	163	181	197	227	271	298	332	367	397	424	454	506	609	660	714	778
Heating capacity*	kW	42	44	61	57	90	103	110	113	129	126	152	159	197	206	243	241
Unit power input*	kW	54	60	71	74	100	106	122	130	150	154	173	192	222	243	272	297
Energy efficiency ratio*	kW/kW	3.01	3.01	2.77	3.07	2.72	2.81	2.72	2.83	2.64	2.75	2.62	2.63	2.75	2.72	2.63	2.62
Operating weight**																	
Standard unit***	kg	1882	1974	2074	2092	2260	2853	3049	3092	3218	3755	3895	4063	5285	5484	6145	6315
Unit with options****	kg	2052	2154	2244	2282	2450	3083	3279	3342	3478	4045	4185	4373	5645	5833	6555	6745
Unit with options†	kg	2302	2404	2484	2522	2690	3393	3589	3692	3818	4395	4585	4795	-	-	-	-
Desuperheater in circuits A/B/C		Plate heat exchanger															
Water volume circuit A	l	1.75	1.75	1.75	3.75	3.75	5.5	5.5	5.5	5.5	7.5	7.5	7.5	5.5	5.5	7.5	7.5
Water volume circuit B	l	3.5	3.5	3.5	3.75	3.75	3.75	3.75	5.5	5.5	5.5	5.5	7.5	5.5	5.5	7.5	7.5
Water volume circuit C	l	-	-	-	-	-	-	-	-	-	-	-	-	5.5	5.7	5.5	7.5
Max. water-side operating pressure	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections		Cylindrical male gas thread															
Connection	in	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Outside diameter	mm	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3

* Nominal conditions: Evaporator entering and leaving water temperature = 12°C/7°C, desuperheater entering and leaving water temperature = 50°C/60°C, outside air temperature = 35°C. Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.
** Weights shown are a guideline only
*** Standard unit (with MCHE coils) and desuperheater option + option 280 (shell-and-tube heat exchanger)
**** Unit with option 15 (desuperheater)
† Unit with option 15 and desuperheater and hydronic module with high-pressure dual pump

Operating limits

Desuperheater		Minimum	Maximum
Entering water temperature at start-up	°C	25*	75
Leaving water temperature during operation	°C	30	80
Air condenser		**Minimum**	**Maximum**
Outside operating temperature	°C	0**	46

* The entering water temperature at start-up must not be lower than 25°C. For installations with a lower temperature a three-way valve is necessary.
** The minimum outside temperature is 0°C. With the winter operation option it is -20°C.

Total heat reclaim (option 50)

Suitable for heating, domestic hot water preparation, agriculture and food industry, industrial processes and other hot-water requirements.

With the total heat reclaim option it is possible to reduce the energy consumption bill considerably compared to conventional heating equipment such as fossil fuel boilers or electric water tanks.

Operating principle

If hot water production is required, the compressor discharge gases are directed towards the heat reclaim condenser. The refrigerant releases its heat to the hot water that leaves the condenser at a temperature of up to 55°C. In this way 100% of the heat rejected by the liquid chiller can be used to produce hot water. When the demand for heat is satisfied, the hot gas is again directed towards the air condenser where the heat is rejected to the outside air by the fans. Hot water temperature control is ensured by the chiller Pro-Dialog control that independently controls the reclaim operation of each refrigerant circuit.

Physical data, 30RB units with total heat reclaim

30RB – total heat reclaim mode		262*	262**	302**	342**	372**	402**	432**	462**	522**
Cooling capacity* **	kW	224	246	269	317	342	369	395	429	477
Heating capacity in heat reclaim mode***	kW	311	332	363	427	459	503	537	585	661
Total power input (unit)***	kW	91	91	99	116	124	141	150	165	194
Total energy efficiency ratio (EER/COP)	kW/kW	2.45/3.40	2.72/3.67	2.73/3.68	2.73/3.68	2.77/3.72	2.62/3.57	2.64/3.59	2.60/3.55	2.46/3.41
Operating weight** **										
Standard unit	kg	2340	2610	3200	3420	3480	3610	4290	4430	4620
Unit with option 15	kg	-	2800	3440	3660	3470	3870	4590	4730	4930
Refrigerant charge										
Circuit A	kg	15.4	27	40	41	41.5	42	50	51.5	51.5
Circuit B	kg	14.9	27	29	29	41.5	42	46	46	51.5
Heat reclaim condenser		Twin-circuit shell-and-tube condenser with finned copper tubes								
Water volume	l	22	22	22	22	22	22	46	46	46
Maximum water-side operating pressure	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections		Victaulic								
Diameter	in	3	3	3	3	3	3	4	4	4
Outside diameter	mm	88.9	88.9	88.9	88.9	88.9	88.9	114.3	114.3	114.3

* Standard MCHE coil
** Copper/aluminium coil
*** Nominal conditions: Entering and leaving water temperature: evaporator 12°C/7°C; heat reclaim condenser: 40°C/45°C; evaporator and heat reclaim condenser fouling factor = 0 m² K/kW. Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.
**** Weights are for guidance only

Operating limits

Heat reclaim condenser		Minimum	Maximum
Entering water temperature at start-up	°C	15*	55
Leaving water temperature during operation	°C	20	55
Condenser (air)		**Minimum**	**Maximum**
Outdoor ambient operating temperature	°C	0**	46
Available static pressure	Pa	0	0

* The water entering temperature at start-up must not fall below 15°C. For installations with a lower temperature an accessory 3-way valve must be installed.
** The minimum outside temperature for heat reclaim mode is 0°C in cooling mode and -20°C with the 'winter operation' option.

Hydronic module (option 116)

The hydronic module option saves a lot of installation time. The chiller is factory-equipped with the main components for the hydronic system: screen filter, water pump, expansion tank, safety valve and water flow control valve (option).

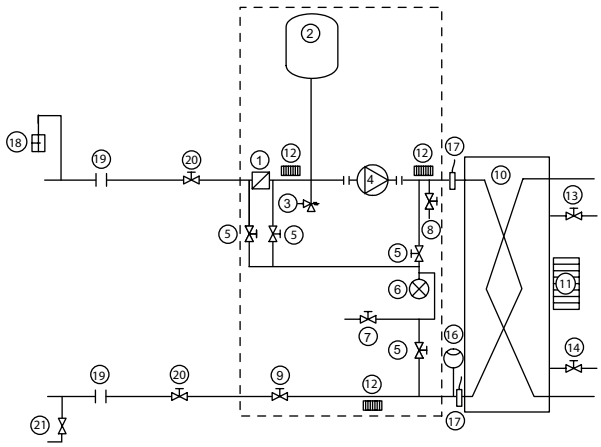
Several water pump types are available to suit any application: primary single or dual low-pressure pump or single or dual high-pressure pump (30RB 162-522).

An automatic pump start-up algorithm protects the heat exchanger and the hydronic module piping against frost down to -10°C outside temperature, if the evaporator frost protection option is installed. If necessary increased frost protection down to -20°C is possible by adding the heater option to the hydronic module piping (see options 41 and 42A).

The hydronic module option is integrated into the chiller without increasing its dimensions and saves the space normally used for the water pump.

Hydronic module

Typical hydronic circuit diagram



Legend

Components of unit and hydronic module
1 Victaulic screen filter
2 Expansion tank
3 Safety valve
4 Available pressure pump
5 Pressure tap valve
6 Pressure gauge to measure the component pressure loss (option)
7 System vent valve, pressure gauge
8 Drain valve
9 Water flow control valve (option)
10 Heat exchanger
11 Evaporator heater (option)
12 Hydronic module heater (option)
13 Air vent (evaporator)
14 Water purge (evaporator)
16 Flow switch
17 Water temperature sensor

System components
18 Air vent
19 Flexible connection
20 Shut-down valves
21 Charge valve

--- Hydronic module (units with hydronic module)

Notes:
With option 42A the unit hydronic module is protected against frost by electric heaters.
The unit evaporator must be protected against frost (anti-freeze solution or optional electric heater)

Electrical data, units with hydronic modules

The pumps that are factory-installed in these units have motors with efficiency class IE2. The additional electrical data required by regulation 640/2009 is given in the installation, operation and maintenance manual.

This regulation concerns the application of directive 2005/32/EC on the eco-design requirements for electric motors.

DX free-cooling system (option 118A)

The DX free-cooling option permits significant energy savings for all applications that require cooling in winter. In the free-cooling mode the compressors are stopped and only the fan and cooling micro-pump are running. The changeover from compressor cooling mode to free-cooling mode is automatically controlled by the Pro-Dialog control, based on the chiller heat load and the temperature difference between chilled water and ambient air.
Important: In order to optimise chiller performances, it is recommended to use the leaving water set point reset function.

Operating principle

When the chilled water-air temperature difference exceeds a threshold value, the Pro-Dialog control carries out a comparison between the instantaneous chiller cooling capacity and the available free-cooling capacity. If the operating conditions allow free-cooling operation, the compressors are stopped, a three-way valve on the suction piping connects the evaporator with the condenser, allowing the migration of the refrigerant vapours to the condenser. The refrigerant condenses in the condenser coils, and the cooling micro-pump transports the liquid to the evaporator. The cooling capacity in free-cooling mode is controlled by the opening of the electronic expansion valve (EXV).

Advantages of the DX free-cooling system

- Operation without glycol
  - Unlike traditional hydronic free-cooling systems that require the use of a glycol solution, the Aquasnap DX free-cooling chiller works with pure water. The evaporator is protected against frost down to -20°C by an electric resistance heater (option).
- Low water pressure losses
  - The Aquasnap DX free-cooling chiller does not include a three-way valve nor free-cooling coils connected in series with the evaporator. The Aquasnap free-cooling chiller has the same water pressure losses as a standard chiller.
- Weight and dimensions gain
  - The DX free-cooling option has little impact on the weight of the liquid chiller.
  - The Aquasnap free-cooling chiller has the same dimensions as a standard chiller.
- Increased energy efficiency
  - In free-cooling mode only the fans and the cooling micro-pump run. At an air-water temperature difference of 10 K for example the average chiller energy efficiency (EER) is 15 (kW/kW).
  - In the mechanical cooling mode chiller thermal and energy performances are not reduced by the use of a water-glycol solution.
  - As the pressure losses of the water circuit are low, the water pumps use less energy.

Physical data, 30RB units free-cooling system

30RB (compressor cooling mode)		232	262	302	342	372	402	432	462	522
Nominal cooling capacity*	kW	222	251	286	323	358	381	417	442	494
Unit power input*	kW	76	101	108	125	133	152	157	175	199
Operating weight**										
Unit with option 15	kg	2398	2580	3229	3429	3518	3658	4241	4381	4591
Unit with option 15 + dual pump hydronic module	kg	2638	2818	3539	3739	3868	3998	4591	4781	5011
Standard unit	kg	2208	2390	2999	3199	3268	3398	3951	4091	4281
Refrigerant charge		R-410A								
Circuit A	kg	29	29	42.5	44	45.5	46	55	57	57
Circuit B	kg	29	29	31	31	45.5	46	47	47	57

* Nominal conditions: evaporator leaving water temperature 12°C/7°C, outside air temperature 35°C, evaporator fouling factor = 0 m^2 K/kW.
Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.
** Weights are for guidance only

Cooling capacities

30RB 232-522 (free-cooling mode)

		Condenser entering air temperature, °C								
		0			-5			-10		
30RB	LWT °C	Qc kW	Unit kW	EER kW/kW	Qc kW	Unit kW	EER kW/kW	Qc kW	Unit kW	EER kW/kW
232	10	117	8	14.7	121	8	15.1	121	4	30.0
262		117	8	14.7	121	8	15.1	121	4	30.0
302		145	10	14.9	162	10	16.5	186	8	23.6
342		145	10	14.9	162	10	16.5	186	8	23.6
372		173	11	15.0	203	12	17.5	250	12	21.3
402		173	11	15.0	203	12	17.5	250	12	21.3
432		211	13	15.9	246	13	18.3	277	14	20.5
462		211	13	15.9	246	13	18.3	277	14	20.5
522		248	15	16.5	275	15	18.1	293	15	19.1

LWT - Leaving water temperature, °C
Qc - Cooling capacity, kW
Unit kW - Unit power input (compressors, fans, control)
EER - Energy efficiency, kW/kW

Operating limits

30RB - compressor cooling mode			
Evaporator water temperature	**°C**	**Minimum**	**Maximum**
Entering water at start-up		6.8	40
Entering water during operation		8.5	25
Leaving water during operation		5	15
Condenser air temperature	**°C**	**Minimum**	**Maximum**
Standard free-cooling unit		0	48
With winter operation option (No. 28)		-20	48

30RB - free-cooling mode			
Evaporator water temperature	**°C**	**Minimum**	**Maximum**
Entering water at start-up		6.8	40
Leaving water during operation		5	26
Condenser air temperature	**°C**	**Minimum**	**Maximum**
		-25	20

Physical data

30RB 162-262 “B” standard units (with plate heat exchanger)

30RB		162	182	202	232	262
Air conditioning application as per EN14511-3:2011*						
Nominal cooling capacity	kW	170	184	208	222	265
EER	kW/kW	2.95	2.96	2.86	3.00	2.67
Eurovent class, cooling		B	B	C	B	D
ESEER	kW/kW	3.71	3.53	3.82	3.87	3.69
Air conditioning application**						
Nominal cooling capacity	kW	171	185	209	223	266
EER	kW/kW	3.00	3.02	2.92	3.05	2.71
ESEER	kW/kW	3.87	3.70	4.00	4.06	3.90
Operating weight***						
Standard unit with option 15 and high-pressure dual-pump hydronic module option	kg	1561	1671	1770	1818	1993
Unit with option 15	kg	1385	1495	1594	1634	1809
Standard unit******	kg	1310	1420	1519	1539	1714
Sound levels						
Unit with option 15LS (very low noise level)						
Sound power level 10^{-12} W†	dB(A)	84	84	84	85	85
Sound pressure level at 10 m‡	dB(A)	52	52	52	53	53
Unit with option 15 (low noise level)						
Sound power level 10^{-12} W†	dB(A)	89	89	89	89	89
Sound pressure level at 10 m‡	dB(A)	57	57	57	57	57
Unit without option 15 and without hydronic module						
Sound power level 10^{-12} W†	dB(A)	91	91	91	91	91
Sound pressure level at 10 m‡	dB(A)	59	59	59	59	59
Dimensions						
Length x depth x height	mm	2457 x 2253 x 2297	2457 x 2253 x 2297	2457 x 2253 x 2297	2457 x 2253 x 2297	2457 x 2253 x 2297
Compressors		Hermetic scroll, 48.3 r/s				
Circuit A		1	1	1	2	2
Circuit B		2	2	2	2	2
No. of control stages		-	-	-	-	4
Refrigerant		R-410A				
Circuit A	kg	8.8	11.6	11.6	14	13.2
Circuit B	kg	13	13	12.9	13.5	12.9
Capacity control		Pro-Dialog Plus				
Minimum capacity	%	33	28	33	25	25
Condensers		All aluminium micro-channel heat exchanger (MCHE)				
Fans		Axial Flying Bird 4 with rotating shroud				
Quantity		3	4	4	4	4
Total air flow	l/s	13542	18056	18056	18056	18056
Speed	r/s	16	16	16	16	16
Evaporator		Twin-circuit plate heat exchanger				
Water volume	l	10.76	10.76	12.64	16.38	16.69
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000
Hydronic module (option)		Pump, Victaulic screen filter, safety valve, expansion tank, pressure gauge, water + air purge valves, flow control valve				
Pump		Centrifugal, monocell, low or high pressure (as required), 48.3 r/s, single or twinned dual pump (as required)				
Quantity		1	1	1	1	1
Expansion tank volume	l	50	50	50	50	50
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400
Water connections without hydronic module		Victaulic				
Diameter	inch	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
Outside tube diameter	mm	76	76	76	76	76
Water connections with hydronic module		Victaulic				
Diameter	inch	3	3	3	3	3
Outside tube diameter	mm	88.9	88.9	88.9	88.9	88.9
Chassis paint colour		Colour code: RAL7035				

* Eurovent-certified performances in accordance with standard EN14511-3:2011.
Cooling mode conditions: evaporator water entering/leaving temperature 12°C/7°C, outside air temperature 35°C, evaporator fouling factor 0 m² K/W

** Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.
Cooling mode conditions: evaporator water entering/leaving temperature 12°C/7°C, outside air temperature 35°C, evaporator fouling factor 0 m² K/W

*** Weight shown is a guideline only. To find out the unit refrigerant charge, please refer to the unit nameplate.

**** Standard unit: base unit without option 15 and hydronic module.

† In accordance with ISO 9614-1 and certified by Eurovent.

‡ For information, calculated from the sound power level Lw(A).

Physical data (continued)

30RB 162-262 “B” units with option 280 (shell-and-tube heat exchanger) and 30RB 302-802 units

30RB		162	182	202	232	262	302	342	372	402	432	462	522	602	672	732	802
Air conditioning application as per EN14511-3:2011*																	
Nominal cooling capacity	kW	162	181	197	227	270	297	331	366	395	422	452	503	607	657	712	774
EER	kW/kW	2.98	2.98	2.74	3.04	2.68	2.77	2.69	2.80	2.60	2.71	2.59	2.58	2.72	2.68	2.59	2.58
Eurovent class, cooling		B	B	C	B	D	C	D	C	D	C	D	D	C	D	D	D
ESEER	kW/kW	3.89	3.81	3.64	4.07	3.74	3.80	3.81	3.95	3.72	3.71	3.65	3.56	3.97	3.88	3.75	3.71
Air conditioning application**																	
Nominal cooling capacity	kW	163	181	197	227	271	298	332	367	397	424	454	506	609	660	714	778
EER	kW/kW	3.01	3.01	2.77	3.07	2.72	2.81	2.72	2.83	2.64	2.75	2.62	2.63	2.75	2.72	2.63	2.62
ESEER	kW/kW	3.99	3.91	3.74	4.22	3.87	3.96	3.95	4.11	3.89	3.86	3.81	3.74	4.11	4.03	3.91	3.88
Operating weight**																	
Standard unit with option 15 and high-pressure dual-pump hydronic module option	kg	1896	2006	2093	2118	2292	2911	3102	3258	3358	3720	3977	4183	-	-	-	-
Unit with option 15	kg	1720	1830	1917	1934	2108	2606	2797	2913	3013	3375	3582	3768	4828	5091	5597	5861
Standard unit***	kg	1645	1755	1842	1839	2013	2489	2680	2779	2879	3224	3431	3600	4627	4873	5362	5609
Sound levels																	
Unit with option 15LS (very low noise level)																	
Sound power level 10^{-12} W†	dB(A)	84	84	84	85	85	86	86	87	87	88	88	88	89	89	89	90
Sound pressure level at 10 m‡	dB(A)	52	52	52	53	53	54	54	55	55	55	55	56	56	57	57	57
Unit with option 15 (low noise level)																	
Sound power level 10^{-12} W†	dB(A)	89	89	89	89	89	90	90	91	91	92	92	92	93	93	94	94
Sound pressure level at 10 m‡	dB(A)	57	57	57	57	57	58	58	59	59	60	60	60	61	61	61	62
Unit without option 15 and without hydronic module																	
Sound power level 10^{-12} W†	dB(A)	91	91	91	91	91	92	92	93	93	94	94	94	95	95	96	96
Sound pressure level at 10 m‡	dB(A)	59	59	59	59	59	60	60	61	61	62	62	62	62	63	63	64
Dimensions																	
Length x depth	mm	2457 x 2253					3604 x 3353				4798 x 2253			5992 x 2253		7186 x 2253	
Height	mm	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297
Compressors		Hermetic scroll, 48.3 r/s															
Circuit A		1	1	1	2	2	3	3	3	3	4	4	4	3	3	4	4
Circuit B		2	2	2	2	2	2	2	3	3	3	3	4	3	3	4	4
Circuit C		-	-	-	-	-	-	-	-	-	-	-	-	3	4	3	4
No. of control stages		-	-	-	-	4	5	5	6	6	7	7	8	9	10	11	12
Refrigerant		R-410A															
Circuit A	kg	9.2	11	11	13.5	13.5	18.5	19.5	19.5	19	24.3	24.5	24.5	21.5	21.5	26	26
Circuit B	kg	12.8	12.8	12.8	13	13	13	14	19.5	20	21.5	21.5	25.5	22	21.5	28	28
Circuit C	kg	-	-	-	-	-	-	-	-	-	-	-	-	23.5	28	24	31
Capacity control		Pro-Dialog Plus															
Minimum capacity	%	33	28	33	25	25	18	20	15	17	13	14	13	11	10	9	8
Condensers		All aluminium micro-channel heat exchanger (MCHE)															
Fans		Axial Flying Bird 4 with rotating shroud															
Quantity		3	4	4	4	4	5	5	6	6	7	7	8	9	10	11	12
Total air flow	l/s	13542	18056	18056	18056	18056	22569	22569	27083	27083	31597	31597	36111	40623	45139	49653	54167
Speed	r/s	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Evaporator		Direct-expansion, dual-circuit shell-and-tube															
Water volume	l	110	110	110	110	110	110	125	125	125	113	113	113	284	284	284	284
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydronic module (option)		Pump, Victaulic screen filter, safety valve, expansion tank, pressure gauge, water + air purge valves, flow control valve															
Pump		Centrifugal, monocell, low or high pressure (as required), 48.3 r/s, single or twinned dual pump (as required)															
Quantity		1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-
Expansion tank volume	l	50	50	50	50	50	80	80	80	80	80	80	80	-	-	-	-
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400	-	-	-	-
Water connections without hydronic module		Victaulic															
Diameter	inch	3	3	3	3	3	4	4	4	4	6	6	6	6	6	6	6
Outside tube diameter	mm	88.9	88.9	88.9	88.9	88.9	114.3	114.3	114.3	114.3	168.3	168.3	168.3	168.3	168.3	168.3	168.3
Water connections with hydronic module		Victaulic															
Diameter	inch	3	3	3	3	3	4	4	4	4	5	5	5	-	-	-	-
Outside tube diameter	mm	88.9	88.9	88.9	88.9	88.9	114.3	114.3	114.3	114.3	139.7	139.7	139.7	-	-	-	-
Chassis paint colour		Colour code: RAL7035															

* Eurovent-certified performances in accordance with standard EN14511-3:2011.
Cooling mode conditions: evaporator water entering/leaving temperature 12°C/7°C, outside air temperature 35°C.
evaporator fouling factor 0 m² K/W

** Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.
Cooling mode conditions: evaporator water entering/leaving temperature 12°C/7°C, outside air temperature 35°C.
evaporator fouling factor 0 m² K/W

*** Weight shown is a guideline only. To find out the unit refrigerant charge, please refer to the unit nameplate.

**** Standard unit: base unit without option 15 and hydronic module.

† In accordance with ISO 9614-1 and certified by Eurovent.

‡ For information, calculated from the sound power level Lw(A).

Electrical data

30RB 162-262 “B” standard units and units with option 280 and 30RB 302-802 units

30RB (without hydronic module)		162	182	202	232	262	302	342	372	402	432	462	522	602	672	732	802
Power circuit																	
Nominal power supply	V-ph-Hz	400-3-50															
Voltage range	V	360-440															
Control circuit supply		24 V, via internal transformer															
Nominal unit current draw*																	
Circuits A + B (one supply)	A	101	113	129	135	167	185	209	227	251	269	293	334	251	251	334	334
Circuit C (separate supply)	A	-	-	-	-	-	-	-	-	-	-	-	-	125	167	125	167
Maximum unit power input**																	
Circuits A + B (one supply)	kW	76	85	98	102	127	140	159	172	191	204	223	255	191	191	255	255
Circuit C (separate supply)	kW	-	-	-	-	-	-	-	-	-	-	-	-	96	127	96	127
Cosine phi, unit at max. capacity**		0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Maximum unit current draw (Un-10%)***																	
Circuits A + B (one supply)	A	143	159	183	191	239	263	299	323	359	383	419	478	359	359	478	478
Circuit C (separate supply)	A	-	-	-	-	-	-	-	-	-	-	-	-	179	239	179	239
Maximum unit current draw (Un)****																	
Circuits A + B (one supply)	A	131	146	168	175	219	241	274	296	329	351	384	438	329	329	439	438
Circuit C (separate supply)	A	-	-	-	-	-	-	-	-	-	-	-	-	164	219	164	219
Maximum start-up current, standard unit (Un)†																	
Circuits A + B	A	304	353	375	348	426	448	481	502	535	557	590	645	535	535	645	645
Circuit C	A	-	-	-	-	-	-	-	-	-	-	-	-	371	426	371	426
Max. start-up current, unit with soft starter (Un)†																	
Circuits A + B	A	259	283	305	323	356	378	411	433	466	489	521	575	-	-	-	-
Circuit C	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Standardised Eurovent conditions: evaporator entering/leaving water temperature 12°C/7°C, outside air temperature 35°C.
** Power input, compressors and fans, at the unit operating limits (saturated suction temperature 10°C, saturated condensing temperature 65°C) and nominal voltage of 400 V (data given on the unit nameplate).
*** Maximum unit operating current at maximum unit power input and 360 V.
**** Maximum unit operating current at maximum unit power input and 400 V (values given on the unit nameplate).
† Maximum instantaneous start-up current at operating limit values (maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor).

Fan motor electrical data: current used in the tables below: Units at Eurovent conditions and motor ambient air temperature of 50°C at 400 V: 3.8 A, start-up current 20 A, power input 1.75 kW. These values are those given on the motor nameplate.

Short-circuit stability current (TN system)*

30RB		162	182	202	232	262	302	342	372	402	432	462	522	602	672	732	802
Unit without main disconnect (except for units 30RB 162 to 262, that are supplied with the disconnect switch installed as standard)																	
With fuses upstream - maximum fuse values assigned (gL/gG)																	
Circuits A and B	A	-	-	-	-	-	500	500	500	500	630/500	630/500	630/500	630/500	630/500	630/500	630/500
Circuit C	A	-	-	-	-	-	-	-	-	-	-	-	-	400	400	400	400
With fuses upstream - admissible rms current value (gL/gG)																	
Circuits A and B	kA	-	-	-	-	-	70	70	70	70	60/70	60/70	60/70	70	70	60/70	60/70
Circuit C	kA	-	-	-	-	-	-	-	-	-	-	-	-	60	60	60	60
Unit with optional main disconnect without fuse (standard for units 30RB 162 to 262, and option for units 30RB 302 to 802)																	
Short-time assigned current Icw (1s) rms value/peak Ipk*****																	
Circuits A and B	kA/kA	9/26	9/26	9/26	9/26	9/26	13/26	13/26	13/26	13/26	15/30	15/30	15/30	13/26	13/26	15/30	15/30
Circuit C	kA/kA	-	-	-	-	-	-	-	-	-	-	-	-	13/26	13/26	13/26	13/26
With fuses upstream - maximum fuse values assigned (gL/gG)																	
Circuits A and B	A	200	200	200/250	250/315†	250/315†	400	400	400	400	500	630	630	400	400	630	630
Circuit C	A	-	-	-	-	-	-	-	-	-	-	-	-	400	400	400	400
With fuses upstream - conditional short-circuit assigned current Icc/Icf††																	
Circuits A and B	kA	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Circuit C	kA	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50
Unit with optional main disconnect with fuses (not available for units 30RB 162 to 262, and option for units 30RB 302 to 802)																	
Short-circuit stability current Icc/Icf†† increased with fuses - maximum fuse values assigned (gL/gG)																	
Circuits A and B	kA	-	-	-	-	-	315	315	400	400	400	630	630	400	400	630	630
Circuit C	kA	-	-	-	-	-	-	-	-	-	-	-	-	250	250	250	250
Short-circuit stability current Icc/Icf†† increased with fuses - admissible rms current value (gL/gG)																	
Circuits A and B	kA	-	-	-	-	-	50	50	50	50	50	50	50	50	50	50	50
Circuit C	kA	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50

* Type of system earthing
** Icw: assigned short-time current
*** Ipk: assigned current, admissible peak
† For units with options 12 and 116 use the higher value.
†† Icc/Icf: assigned conditional short-circuit current

IT system: The short circuit current stability values given above for the TN system are also valid for IT for units 30RB 302 to 522. For units 30RB 162 to 262 and 30RB 602 to 802 modifications are required.

Electrical data notes for 30RB units:

- 30RB 162-522 units have a single power connection point at the main disconnect switch; 30RB 602-802 units have two connection points at the main disconnect switch.
- The control box includes the following standard features:
  - one main disconnect switch
  - Starter and motor protection devices for each compressor and the fan(s)
  - Control devices
- **Field connections:**
  All connections to the system and the electrical installations must be in full accordance with all applicable local codes.
- The Carrier 30RB units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60 204-1 (corresponds to IEC 60204-1) (machine safety - electrical machine components - part 1: general regulations) are specifically taken into account, when designing the electrical equipment.
- **Electrical reserves:**
  Circuit A has disconnect switches and branch sections, designed to supply the evaporator pump power input.

IMPORTANT:

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60204 is the best means of ensuring compliance with the Machines Directive § 1.5.1.
- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.

1. The operating environment for the 30RB units is specified below:
   a. Environment* - Environment as classified in EN 60721 (corresponds to IEC 60721):
      - outdoor installation*
      - ambient temperature range: -20°C to +48°C ± 1 K, class 4K3*
      - altitude: ≤ 2000 m (for hydronic kit see chapter 5.3 of the installation manual)
      - presence of hard solids, class 4S2 (no significant dust present)
      - presence of corrosive and polluting substances, class 4C2 (negligible)
      - vibration and shock, class 4M2

   b. Competence of personnel, class BA4* (trained personnel - IEC 60364)
2. Power supply frequency variation: ± 2 Hz.
3. The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
4. Overcurrent protection of the power supply conductors is not provided with the unit.
5. The factory-installed disconnect switch(es)/circuit breaker(s) is (are) of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
6, The units are designed for simplified connection on TN(s) networks (IEC 60364). For IT networks derived currents may interfere with network monitoring elements, and it is recommended to create an IT type divider for the system units that require this and/or a TN type divider for Carrier units. Please consult the appropriate local organisations to define the monitoring and protection elements and carry out the electrical installation.

   If short circuit currents above those given in the electrical data table are likely, modifications are required. Please contact your local Carrier representative.

   NOTE: If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local Carrier representative.

* The required protection level for this class is IP43B (according to reference document IEC 60529). All 30RB units are protected to IP44CW and fulfil this protection condition.

Part load performances

With the rapid increase in energy costs and the care about environmental impacts of electricity production, the power consumption of air conditioning equipment has become an important topic. The energy efficiency of a liquid chiller at full load is rarely representative of the actual performance of the units, as on average a chiller works less than 5% of the time at full load.

The heat load of a building depends on many factors, such as the outside air temperature, the exposure to the sun and the building occupancy.

Consequently it is preferable to use the average energy efficiency, calculated at several operating points that are representative for the unit utilisation.

IPLV (in accordance with AHRI 550/590)

The IPLV (integrated part load value) allows evaluation of the average energy efficiency based on four operating conditions defined by the AHRI (Air Conditioning, Heating and Refrigeration Institute). The IPLV is the average weighted value of the energy efficiency ratios (EER) at different operating conditions, weighted by the operating time.

ESEER (in accordance with EUROVENT)

The ESEER (European seasonal energy efficiency ratio) permits evaluation of the average energy efficiency at part load, based on four operating conditions defined by Eurovent. The ESEER is the average value of energy efficiency ratios (EER) at different operating conditions, weighted by the operating time.

IPLV (integrated part load value)

Load %	Air temperature °C	Energy efficiency	Operating time %
100	35	EER_1	1
75	26.7	EER_2	42
50	18.3	EER_3	45
25	12.8	EER_4	12
ESEER =	EER_1 x 1% + EER_2 x 42% + EER_3 x 45% + EER_4 x 12%		

ESEER (European seasonal energy efficiency ratio)

Load %	Air temperature °C	Energy efficiency	Operating time %
100	35	EER_1	3
75	30	EER_2	33
50	25	EER_3	41
25	20	EER_4	23
ESEER =	EER_1 x 3% + EER_2 x 33% + EER_3 x 41% + EER_4 x 23%		

Part load performances

30RB 162-262 “B” standard units (with plate heat exchanger)						
30RB		**162**	**182**	**202**	**232**	**262**
IPLV	kW/kW	4.33	4.16	4.50	4.47	4.27
ESEER	kW/kW	3.71	3.53	3.82	3.87	3.69

30RB 162-262 “B” units with option 280 (shell-and-tube heat exchanger) and 30RB 302-802 units																	
30RB		**162**	**182**	**202**	**232**	**262**	**302**	**342**	**372**	**402**	**432**	**462**	**522**	**602**	**672**	**732**	**802**
IPLV	kW/kW	4.42	4.31	4.13	4.69	4.26	4.40	4.25	4.63	4.32	4.33	4.27	4.19	4.56	4.49	4.39	4.34
ESEER	kW/kW	3.89	3.81	3.64	4.07	3.74	3.80	3.81	3.95	3.72	3.71	3.65	3.56	3.97	3.88	3.75	3.71

ESEER Calculations according to standard performances (in accordance with EN14511-3:2011) and certified by Eurovent.
IPLV Calculations according to standard performances (in accordance with AHRI 550-590).

Sound spectrum

30RB 162-262 "B" standard units									
		Octave bands, Hz						Sound power levels	
		125	250	500	1k	2k	4k		
162	dB	92	90	89	86	81	75	dB(A)	91
182	dB	92	90	89	86	81	75	dB(A)	91
202	dB	92	90	89	86	81	75	dB(A)	91
232	dB	93	90	90	86	82	75	dB(A)	91
262	dB	93	90	90	86	82	75	dB(A)	91

30RB 162-262 "B" units with option 280 and 30RB 302-802 units									
		Octave bands, Hz						Sound power levels	
		125	250	500	1k	2k	4k		
162	dB	92	90	89	86	81	75	dB(A)	91
182	dB	92	90	89	86	81	75	dB(A)	91
202	dB	92	90	89	86	81	75	dB(A)	91
232	dB	93	90	90	86	82	75	dB(A)	91
262	dB	93	90	90	86	82	75	dB(A)	91
302	dB	94	91	91	87	83	76	dB(A)	92
342	dB	94	91	91	87	83	76	dB(A)	92
372	dB	94	92	92	88	83	77	dB(A)	93
402	dB	94	92	92	88	83	77	dB(A)	93
432	dB	95	92	93	88	84	78	dB(A)	94
462	dB	96	93	93	89	85	78	dB(A)	94
522	dB	96	93	93	89	85	78	dB(A)	94
602	dB	96	94	94	90	85	79	dB(A)	95
672	dB	97	94	94	90	86	79	dB(A)	95
732	dB	97	94	95	90	86	80	dB(A)	96
802	dB	97	95	95	91	86	80	dB(A)	96

Operating limits

Evaporator water flow rate

30RB 162-262 “B” standard units (with plate heat exchanger)		
30RB	**Minimum flow rate, l/s**	**Maximum flow rate, l/s***
162	2.8	13.9
182	2.8	13.9
202	2.8	14.3
232	3.0	14.3
262	3.5	14.3

30RB 162-262 “B” with option 280 (shell-and-tube heat exchanger) and 30RB 302-802		
30RB	**Minimum flow rate, l/s**	**Maximum flow rate, l/s***
162	2.8	28.1
182	2.8	28.1
202	2.8	28.1
232	3.0	26.7
262	3.5	26.7
302	3.9	26.7
342	4.4	29.4
372	4.9	29.4
402	5.2	29.4
432	5.8	31.1
462	6.1	31.1
522	6.9	31.1
602	7.9	50.6
672	8.7	50.6
732	9.6	50.6
802	10.3	50.6

* The maximum flow rate corresponds to a pressure loss of 100 kPa (heat exchanger without hydronic module).

Unit operating limits

30RB 162-262 “B” standard units and units with option 280			
Evaporator		**Minimum**	**Maximum**
Entering water temperature at start-up	°C	8*	40
Leaving water temperature during operation	°C	5	15**
Condenser		**Minimum**	**Maximum**
Outdoor ambient operating temperature			
Standard unit	°C	0***/10†	48
Unit with options 28B, 28C (winter operation)	°C	-10	48
Unit with option 28 (winter operation)	°C	-20	48
Available static pressure			
Standard unit (outdoor installation)	Pa	0	0
Unit with option 12 (indoor installation)	Pa	0****	200

30RB 302-802 units			
Evaporator		**Minimum**	**Maximum**
Entering water temperature at start-up	°C	6,8*	40
Leaving water temperature during operation	°C	3,3	15**
Condenser		**Minimum**	**Maximum**
Outdoor ambient operating temperature			
Standard unit	°C	0***	48
Unit with options 28B, 28C (winter operation)	°C	-10	48
Unit with option 28 (winter operation)	°C	-20	48
Available static pressure			
Standard unit (outdoor installation)	Pa	0	0
Unit with option 12 (indoor installation)	Pa	0****	200

* For application requiring operation at less than 8 or 6.8°C respectively, contact Carrier for unit selection using the Carrier electronic catalog.

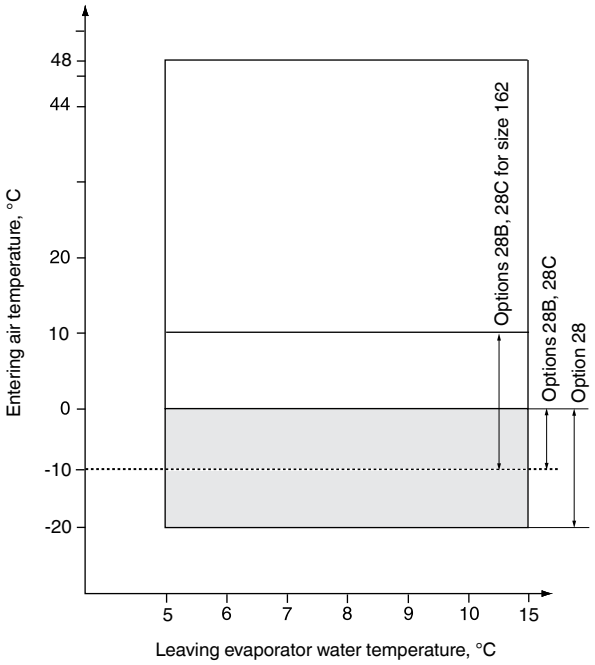
** For an application, requiring operation up to +15°C leaving water temperature, contact Carrier for the selection of the unit.

*** For operation from 0°C to -10°C the units must be equipped with options 28B, 28C “Winter operation”. For operation from 0°C to -20°C the units must be equipped with option 28 “Winter operation”. For both options the unit must either be equipped with the evaporator frost protection option (for units without hydronic module option) or the evaporator and hydronic module frost protection option (for units with hydronic module option) or the water loop must be protected against frost by the installer, using an anti-freeze solution.
Maximum outside temperature: For transport and storage of the 30RB units the minimum and maximum allowable temperatures are -20°C and +48°C. It is recommended that these temperatures are used for transport by container.

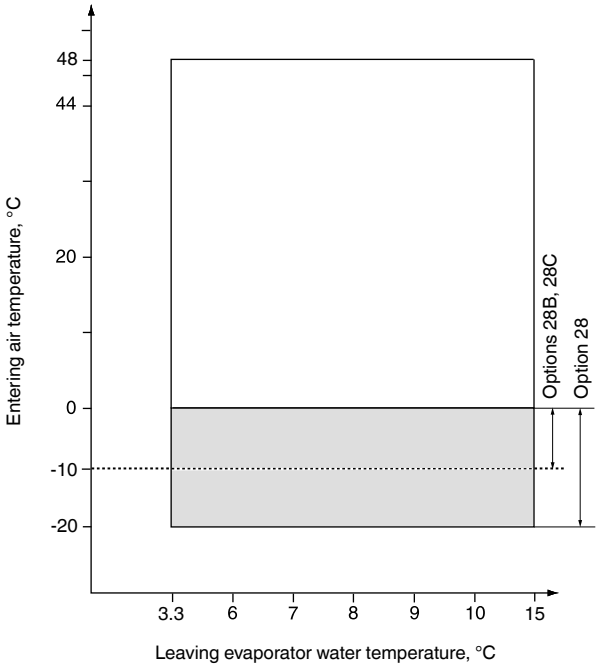
**** Unit with fans with available pressure up to 200 Pa.

† 30RB 162 units use options 28B, 28C for outside temperatures below 10°C.

Operating range - 30RB 162-262 “B” standard units and units with option 280



Operating range - 30RB 302-802



Notes:
Evaporator ΔT = 5 K
The evaporator is protected against frost down to -20°C.

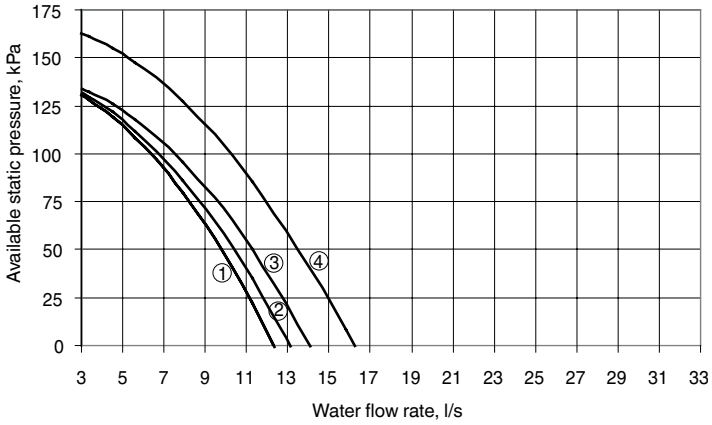
Legend:

Standard unit operating at full load.
Operating range, units equipped with options 28, 28B, 28C “Winter operation”.
Option 28 (with variable-speed lead fan for each circuit) allows operation down to -20°C outside temperature.
Options 28B, 28C (with two-speed lead fan for each circuit) allows operation down to -10°C outside temperature. In addition to options 28, 28B, 28C the unit must either be equipped with the evaporator frost protection option (for units without hydronic module option) or the evaporator and hydronic module frost protection option (for units with hydronic module option) or the water loop must be protected by the installer by adding a frost protection solution.

Available static system pressure

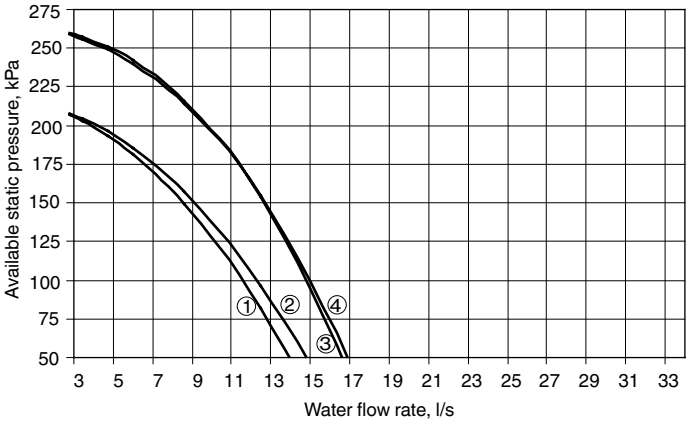
30RB 162-262 “B” standard units (with plate heat exchanger)

Low-pressure pump (hydronic module option)



Legend
1 30RB 162-182 "B"
2 30RB 202 "B"
3 30RB 232 "B"
4 30RB 262 "B"

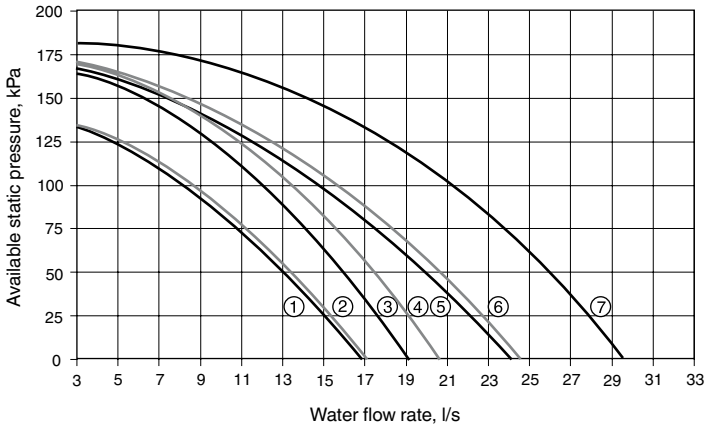
High-pressure pump (hydronic module option)



Legend
1 30RB 162-182 "B"
2 30RB 202 "B"
3 30RB 232 "B"
4 30RB 262 "B"

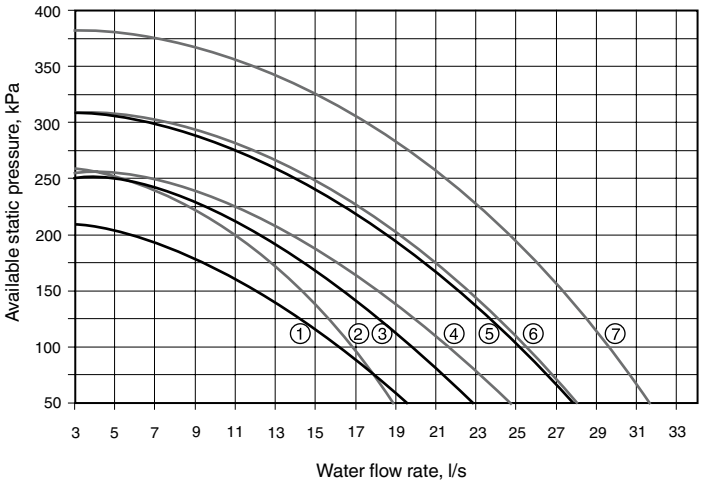
30RB 162-262 “B” units with option 280 (shell-and-tube heat exchanger) and 30RB 302-522 units

Low-pressure pump (hydronic module option)



Legend
1 30RB 162-202 "B"
2 30RB 232-262 "B"
3 30RB 302
4 30RB 342
5 30RB 372-402
6 30RB 432
7 30RB 462-522

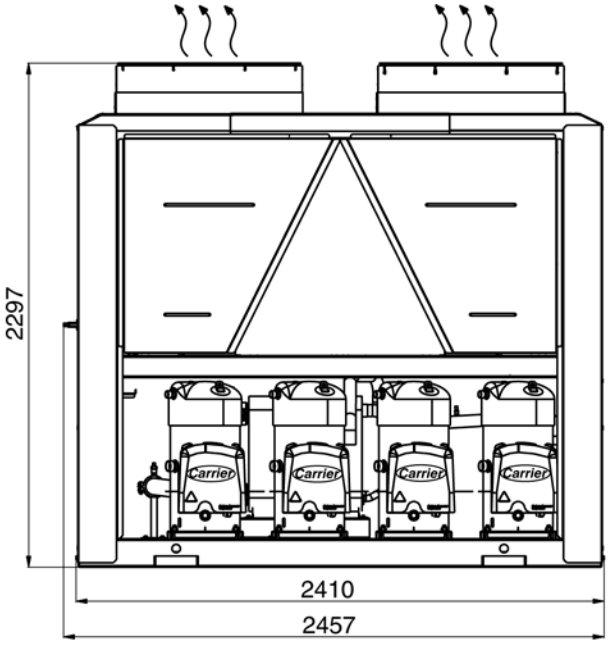
High-pressure pump (hydronic module option)

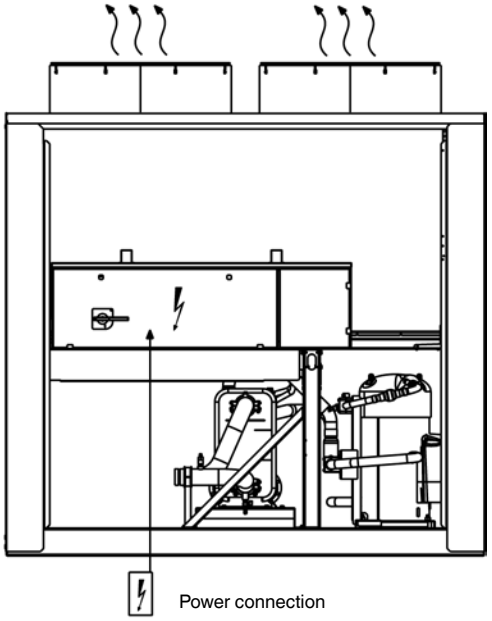


Legend
1 30RB 162-202 "B"
2 30RB 202-232 "B"
3 30RB 302
4 30RB 342
5 30RB 372-402
6 30RB 432
7 30RB 462-522

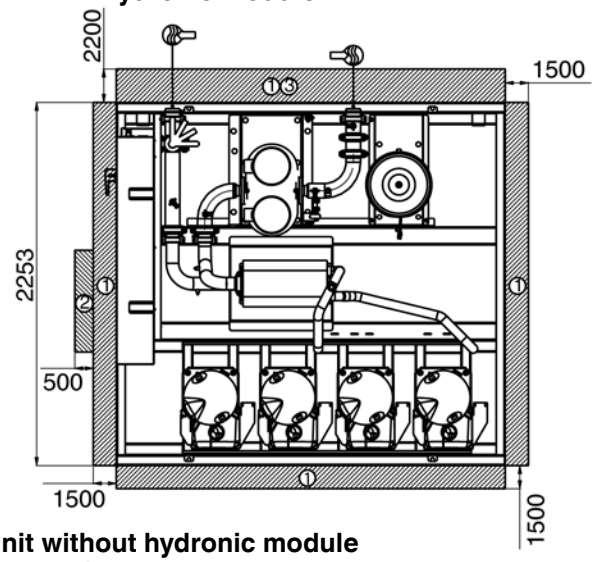
Dimensions/clearances

30RB 162-262 “B”, standard units (with plate heat exchanger)

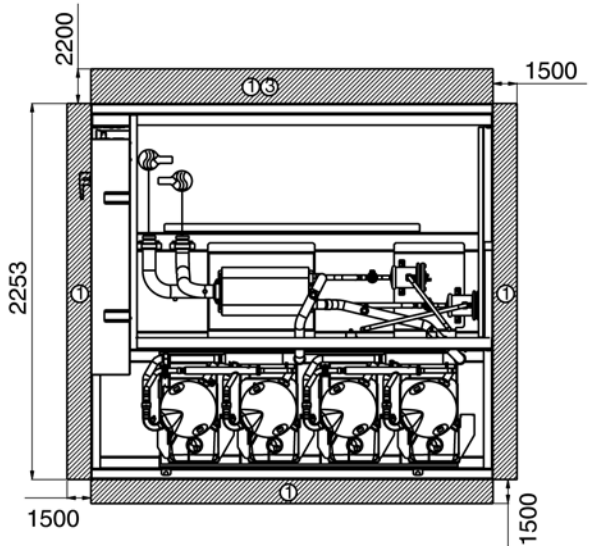




Unit with hydronic module



Unit without hydronic module



Legend:
All dimensions are in mm.

1. Clearances required for maintenance and air flow
2. Clearances recommended for evaporator tube removal
3. Clearances recommended for heat exchanger removal

Water inlet

Water outlet

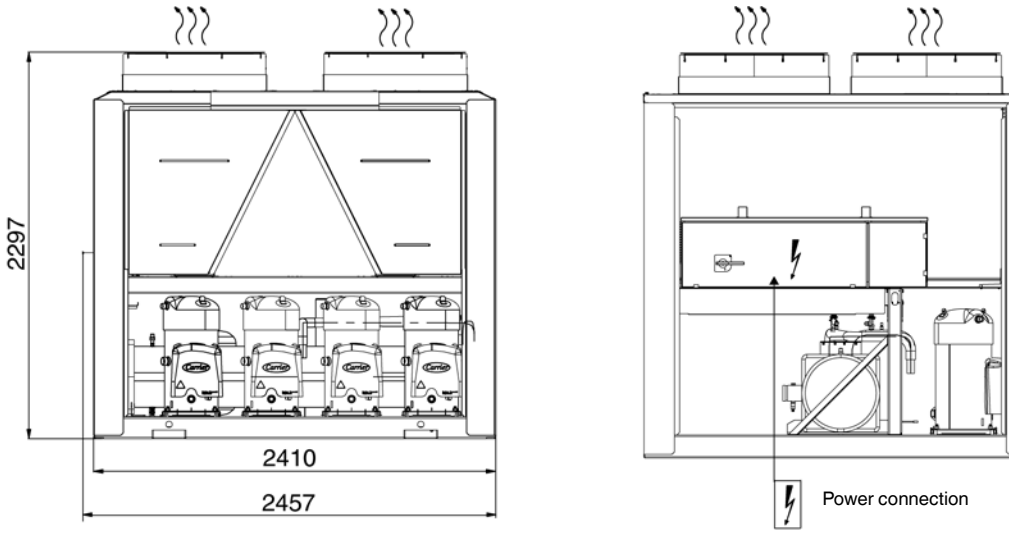
Air outlet, do not obstruct

NOTE: Drawings are not contractually binding. Before designing an installation, consult the certified dimensional drawings, available on request.

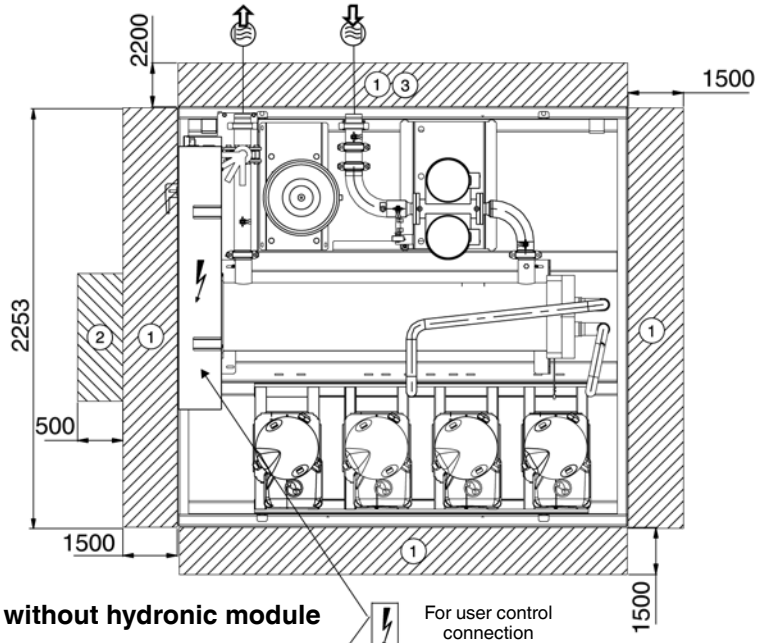
For the positioning of the fixing points, weight distribution points and centre of gravity coordinates please refer to the dimensional drawings.

Dimensions/clearances

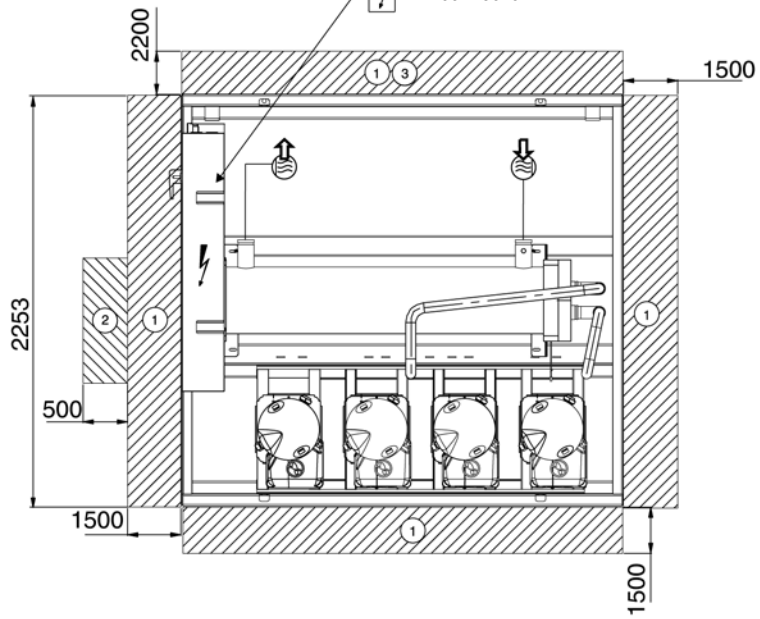
30RB 162-262 “B” with option 280 (shell-and-tube heat exchanger)



Unit with hydronic module



Unit without hydronic module



Legend:
All dimensions are in mm.

- ① Clearances required for maintenance and air flow
- ② Clearances recommended for evaporator tube removal
- ③ Clearances recommended for heat exchanger removal
- Water inlet
- Water outlet
- Air outlet, do not obstruct

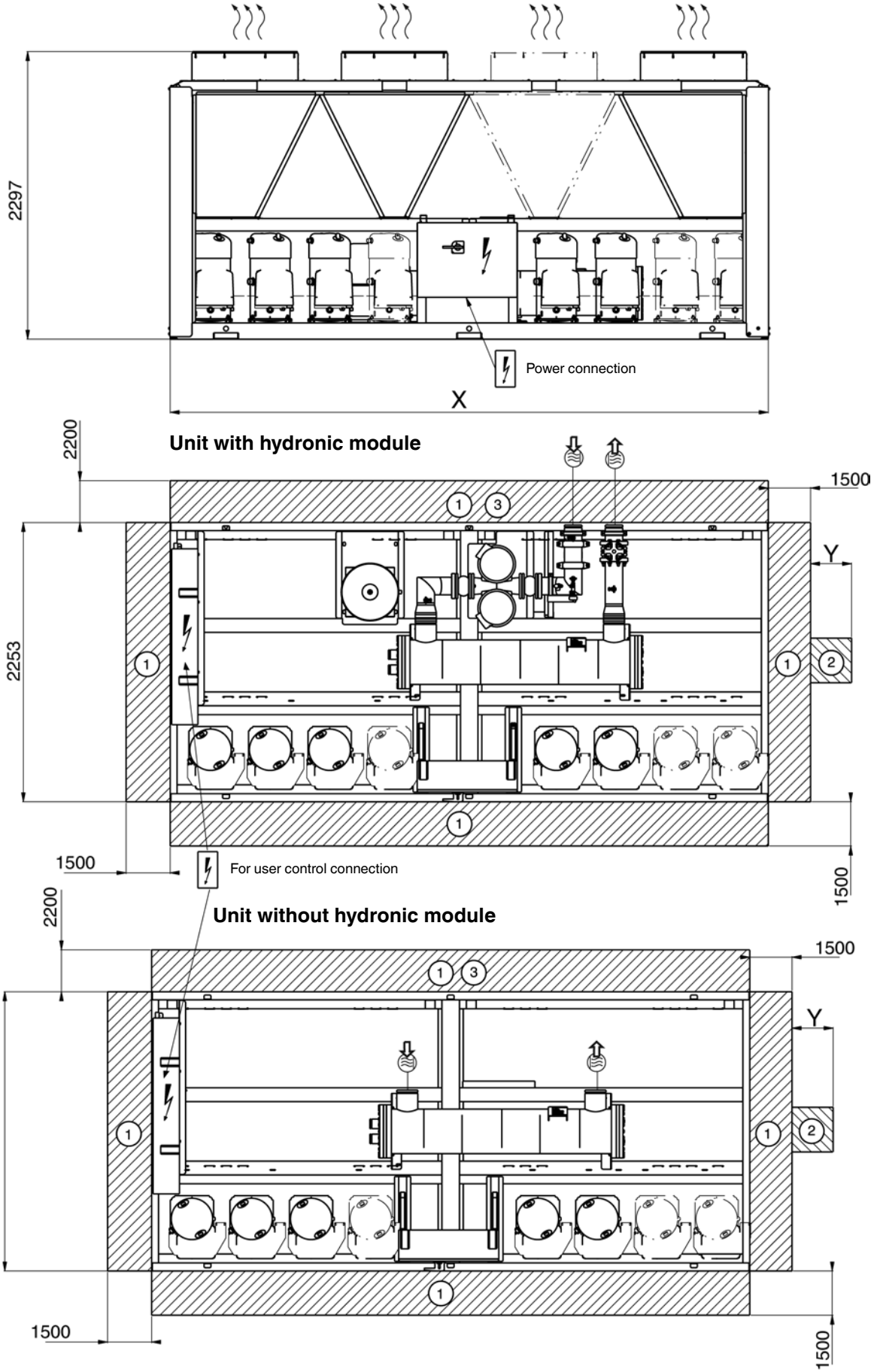
NOTE: Drawings are not contractually binding. Before designing an installation, consult the certified dimensional drawings, available on request.

For the positioning of the fixing points, weight distribution points and centre of gravity coordinates please refer to the dimensional drawings.

Dimensions/clearances

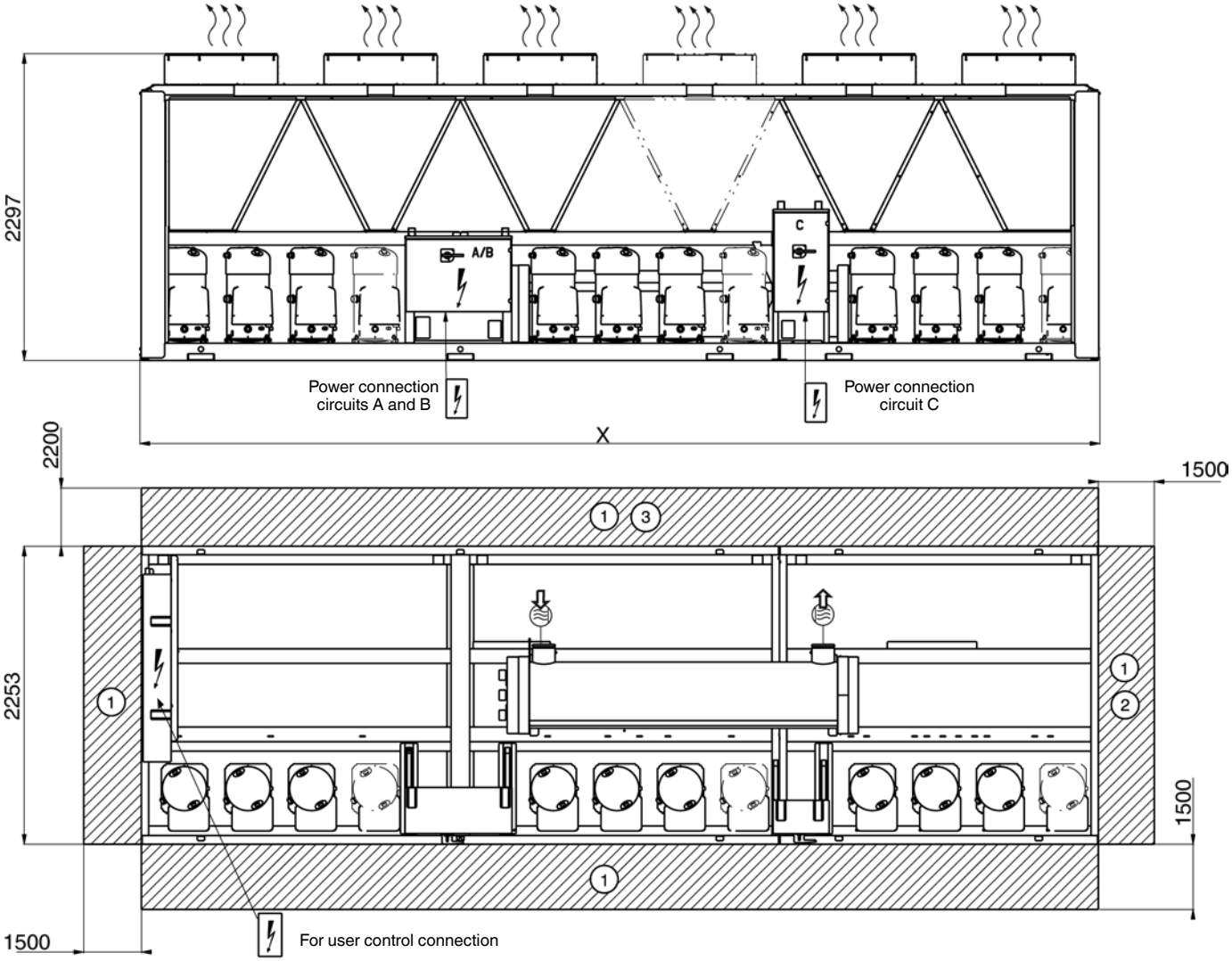
30RB	X	Y
302-402	3604	200
432-522	4798	0

30RB 302-522



Dimensions/clearances

30RB 602-802



30RB	X
602-672	5992
732-802	7186

Legend:
All dimensions are in mm.

1. Clearances required for maintenance and air flow
2. Clearances recommended for evaporator tube removal
3. Clearances recommended for heat exchanger removal

Water inlet

Water outlet

Air outlet, do not obstruct

NOTE: Drawings are not contractually binding. Before designing an installation, consult the certified dimensional drawings, available on request.

For the positioning of the fixing points, weight distribution points and centre of gravity coordinates please refer to the dimensional drawings.

Cooling capacities in accordance with EN14511-3 : 2011

30RB 162-262 “B” standard units (with plate heat exchanger)

		Condenser entering air temperature, °C																							
		20				25				30				35				40				46			
	LWT	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp
	°C	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa
162	5	187	4.29	8.5	51	179	3.75	8.1	47	170	3.26	7.7	43	160	2.80	7.2	39	149	2.37	6.7	34	134	1.90	6.1	28
182		197	4.15	9.2	59	187	3.63	8.8	54	177	3.16	8.3	49	166	2.72	7.8	44	154	2.31	7.2	38	139	1.86	6.5	32
202		234	4.13	11.0	67	222	3.63	10.4	61	209	3.17	9.8	55	196	2.74	9.2	49	183	2.36	8.6	43	166	1.95	7.8	37
232		243	4.32	11.4	60	232	3.79	10.9	55	221	3.30	10.4	50	208	2.83	9.8	45	193	2.40	9.1	40	173	1.92	8.1	33
262		302	3.92	13.8	78	286	3.44	13.1	71	269	3.00	12.3	64	251	2.59	11.5	56	234	2.23	10.7	50	213	1.83	9.7	42
162	7	198	4.46	9.0	56	189	3.92	8.6	51	180	3.41	8.2	47	170	2.94	7.7	42	158	2.49	7.2	37	142	2.01	6.5	31
182		215	4.44	10.1	68	205	3.91	9.6	63	194	3.41	9.1	57	182	2.94	8.6	51	169	2.50	7.9	45	150	2.00	7.1	36
202		247	4.27	11.6	73	235	3.77	11.0	67	222	3.29	10.4	61	207	2.85	9.7	54	192	2.44	9.0	47	174	2.01	8.2	39
232		255	4.44	12.0	64	245	3.93	11.5	60	233	3.44	11.0	55	221	2.98	10.4	50	205	2.53	9.7	44	185	2.04	8.7	37
262		319	4.01	14.6	85	302	3.53	13.8	77	284	3.08	13.0	69	264	2.66	12.1	61	243	2.27	11.1	53	220	1.87	10.1	44
162	10	214	4.69	9.7	63	204	4.12	9.3	58	194	3.60	8.8	53	183	3.11	8.3	48	171	2.67	7.8	42	155	2.16	7.0	35
182		235	4.65	11.1	78	224	4.13	10.6	72	214	3.64	10.1	66	202	3.18	9.5	60	189	2.75	8.9	54	171	2.23	8.0	45
202		268	4.46	12.6	83	254	3.95	12.0	76	240	3.46	11.3	69	225	3.01	10.6	61	209	2.59	9.8	54	186	2.11	8.8	44
232		272	4.58	12.8	71	261	4.06	12.3	66	249	3.57	11.7	61	236	3.11	11.1	55	222	2.69	10.5	50	202	2.19	9.5	42
262		343	4.14	15.8	95	325	3.65	14.9	86	306	3.19	14.0	77	284	2.76	13.0	68	261	2.36	11.9	59	231	1.92	10.6	48

Legend
LWT Leaving water temperature, °C
Qc Cooling capacity, kW
EER Energy efficiency ratio, kW/kW
q Evaporator water flow rate, l/s
Δp Evaporator pressure drop, kPa

Application data

Standard units, refrigerant: R-410A
Evaporator entering/leaving water temperature difference: 5 K
Evaporator fluid: chilled water
Fouling factor: 0.18 x 10^{-4} (m^2 K)/W

Performances in accordance with EN14511-3:2011.

Cooling capacities

30RB 162-262 “B” standard units (with plate heat exchanger)

		Condenser entering air temperature, °C)																							
		20				25				30				35				40				46			
	LWT	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp
	°C	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa
162	5	188	4.40	8.5	51	180	3.84	8.1	47	171	3.32	7.7	43	161	2.84	7.2	39	149	2.40	6.7	34	135	1.92	6.07	28.2
182		198	4.26	9.2	59	188	3.72	8.8	54	178	3.22	8.3	49	167	2.77	7.8	44	155	2.34	7.2	38	139	1.88	6.51	31.9
202		235	4.25	11.0	67	223	3.72	10.4	61	210	3.23	9.8	55	197	2.79	9.2	49	183	2.40	8.6	43	166	1.97	7.77	36.6
232		244	4.43	11.4	60	233	3.88	10.9	55	222	3.36	10.4	50	209	2.88	9.8	45	194	2.43	9.1	40	173	1.94	8.11	32.7
262		304	4.03	13.8	78	288	3.53	13.1	71	271	3.06	12.3	64	252	2.63	11.5	56	235	2.26	10.7	50	214	1.86	9.74	42.5
162	7	199	4.58	9.0	56	190	4.01	8.6	51	181	3.48	8.2	47	170	2.99	7.7	42	158	2.53	7.2	37	143	2.03	6.45	31.0
182		216	4.58	10.1	68	206	4.02	9.6	63	195	3.49	9.1	57	183	3.00	8.6	51	170	2.54	7.9	45	151	2.02	7.06	36.4
202		249	4.41	11.6	73	236	3.87	11.0	67	223	3.37	10.4	61	208	2.91	9.7	54	193	2.48	9.0	47	174	2.04	8.16	39.3
232		256	4.58	12.0	64	246	4.03	11.5	60	235	3.52	11.0	55	222	3.03	10.4	50	206	2.57	9.7	44	186	2.06	8.71	36.5
262		321	4.15	14.6	85	304	3.63	13.8	77	285	3.15	13.0	69	265	2.71	12.1	61	244	2.31	11.1	53	221	1.89	10.08	44.5
162	10	215	4.83	9.7	63	205	4.23	9.3	58	195	3.68	8.8	53	184	3.17	8.3	48	172	2.71	7.8	42	155	2.18	7.03	35.4
182		236	4.82	11.1	78	226	4.26	10.6	72	215	3.74	10.1	66	203	3.25	9.5	60	190	2.80	8.9	54	172	2.26	8.03	44.8
202		270	4.63	12.6	83	256	4.07	12.0	76	242	3.55	11.3	69	226	3.08	10.6	61	210	2.63	9.8	54	187	2.14	8.77	43.9
232		274	4.73	12.8	71	262	4.17	12.3	66	250	3.65	11.7	61	237	3.17	11.1	55	223	2.73	10.5	50	202	2.22	9.49	41.7
262		346	4.30	15.8	95	327	3.76	14.9	86	307	3.27	14.0	77	285	2.82	13.0	68	262	2.40	11.9	59	232	1.94	10.59	47.6

Legend
LWT Leaving water temperature, °C
Qc Cooling capacity, kW
EER Energy efficiency ratio, kW/kW
q Evaporator water flow rate, l/s
Δp Evaporator pressure drop, kPa

Application data

Standard units, refrigerant: R-410A
Evaporator entering/leaving water temperature difference: 5 K
Evaporator fluid: chilled water
Fouling factor: 0.18 x 10^{-4} (m^2 K)/W

Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.

Cooling capacities in accordance with EN14511-3 : 2011

30RB 162-262 “B” units with option 280 (shell-and-tube heat exchanger) and 30RB 302-802 units

		Condenser entering air temperature, °C																							
		20				25				30				35				40				46			
	LWT	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp
	°C	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa
162	5	176	4.31	8.3	21	168	3.76	7.9	19	160	3.25	7.5	18	150	2.78	7.0	17	139	2.34	6.5	15	125	1.87	5.8	13
182		193	4.18	9.0	23	184	3.67	8.6	22	174	3.20	8.1	20	164	2.76	7.7	19	152	2.34	7.1	17	137	1.89	6.4	15
202		213	3.89	10.1	28	203	3.42	9.7	26	193	2.99	9.2	24	182	2.59	8.7	22	170	2.22	8.1	20	154	1.82	7.3	18
232		251	4.44	11.8	34	240	3.90	11.2	32	228	3.39	10.7	30	215	2.92	10.1	27	199	2.47	9.3	25	179	1.98	8.4	21
262		296	3.88	13.7	42	282	3.41	13.1	40	268	2.97	12.4	37	252	2.57	11.6	34	234	2.20	10.8	30	213	1.81	9.8	27
302		324	4.00	15.2	49	309	3.51	14.5	46	293	3.06	13.7	43	276	2.64	12.9	39	256	2.25	12.0	35	232	1.83	10.9	31
342		361	3.88	16.9	42	344	3.41	16.1	39	327	2.97	15.3	35	307	2.57	14.4	32	286	2.20	13.4	28	259	1.80	12.1	24
372		397	4.02	18.4	48	379	3.53	17.6	45	360	3.08	16.7	41	338	2.66	15.7	37	314	2.27	14.6	33	283	1.84	13.2	27
402		430	3.75	20.2	56	411	3.30	19.3	52	390	2.87	18.3	48	367	2.49	17.2	43	342	2.13	16.0	38	311	1.74	14.6	32
432		459	3.89	21.5	54	439	3.43	20.6	50	417	2.99	19.6	45	394	2.59	18.4	41	367	2.22	17.2	36	334	1.81	15.6	30
462		489	3.71	22.9	61	467	3.26	21.9	56	445	2.85	20.8	51	419	2.48	19.6	46	390	2.13	18.3	40	355	1.74	16.6	33
522		546	3.69	26.1	77	522	3.26	24.9	71	497	2.85	23.7	65	468	2.48	22.3	58	437	2.13	20.8	51	398	1.75	19.0	43
602		665	3.93	30.9	45	635	3.45	29.5	41	603	3.02	28.0	38	568	2.61	26.4	34	529	2.24	24.6	30	481	1.84	22.4	25
672		719	3.87	33.7	53	686	3.40	32.2	48	652	2.97	30.5	44	614	2.57	28.8	39	573	2.21	26.8	35	522	1.82	24.4	29
732		778	3.73	36.5	61	743	3.29	34.8	56	706	2.88	33.1	51	664	2.50	31.1	46	620	2.15	29.0	40	564	1.77	26.4	34
802		846	3.70	39.2	70	807	3.27	37.4	64	767	2.86	35.6	58	722	2.48	33.5	52	673	2.13	31.2	46	613	1.75	28.4	38
162	7	189	4.57	8.9	23	180	3.98	8.5	21	171	3.45	8.0	20	161	2.96	7.6	18	149	2.50	7.0	16	134	2.00	6.3	14
182		210	4.44	9.8	26	200	3.91	9.4	24	190	3.42	8.9	23	179	2.96	8.4	21	166	2.51	7.8	19	149	2.03	7.0	16
202		228	4.05	10.8	30	217	3.58	10.4	28	207	3.13	9.8	26	195	2.72	9.3	24	181	2.33	8.6	22	165	1.91	7.8	19
232		262	4.56	12.3	36	251	4.01	11.8	34	238	3.50	11.2	31	225	3.02	10.6	29	210	2.58	9.9	26	190	2.08	8.9	23
262		314	4.00	14.5	45	299	3.52	13.8	42	284	3.08	13.1	39	267	2.67	12.4	36	249	2.29	11.5	33	227	1.88	10.5	29
302		342	4.12	16.0	52	327	3.62	15.3	49	311	3.17	14.6	46	293	2.75	13.7	42	273	2.36	12.8	38	248	1.92	11.6	33
342		383	3.99	18.0	46	366	3.52	17.2	42	348	3.08	16.3	39	327	2.67	15.3	35	304	2.29	14.3	31	276	1.88	13.0	26
372		424	4.19	19.7	53	405	3.68	18.8	49	384	3.21	17.8	45	361	2.78	16.8	41	336	2.37	15.6	36	304	1.93	14.1	30
402		457	3.88	21.5	62	437	3.42	20.5	57	415	2.98	19.5	52	390	2.58	18.3	47	364	2.22	17.1	42	331	1.82	15.5	36
432		482	4.00	22.6	59	462	3.53	21.7	54	441	3.10	20.7	50	417	2.69	19.6	45	390	2.31	18.3	40	356	1.90	16.7	33
462		521	3.83	24.5	68	498	3.38	23.4	62	474	2.96	22.2	57	446	2.57	21.0	51	417	2.21	19.5	45	380	1.82	17.8	38
522		579	3.81	27.7	85	553	3.36	26.4	78	527	2.95	25.2	72	497	2.57	23.7	64	465	2.21	22.2	57	424	1.83	20.3	48
602		708	4.05	33.0	50	676	3.57	31.5	46	641	3.12	29.8	42	602	2.70	28.0	37	562	2.32	26.1	33	511	1.91	23.8	27
672		760	3.98	35.7	58	727	3.51	34.1	53	691	3.07	32.4	48	651	2.67	30.5	43	608	2.29	28.5	38	555	1.89	26.0	32
732		828	3.86	38.9	68	790	3.40	37.1	62	749	2.97	35.2	56	705	2.58	33.1	50	657	2.22	30.8	44	599	1.83	28.1	37
802		900	3.83	41.8	77	859	3.37	39.9	71	814	2.95	37.8	64	766	2.56	35.6	57	715	2.21	33.2	51	651	1.82	30.2	43
162	10	206	4.86	9.7	25	196	4.27	9.2	23	186	3.70	8.7	22	175	3.18	8.2	20	163	2.69	7.6	18	147	2.17	6.9	16
182		231	4.74	10.9	30	221	4.19	10.4	28	211	3.67	9.9	26	199	3.18	9.3	24	185	2.73	8.7	22	168	2.24	7.9	19
202		250	4.29	11.9	34	239	3.79	11.4	32	227	3.32	10.8	29	215	2.90	10.2	27	201	2.50	9.6	25	182	2.05	8.7	22
232		282	4.77	13.3	39	270	4.19	12.7	37	256	3.66	12.1	34	242	3.17	11.4	32	225	2.71	10.6	29	204	2.21	9.6	25
262		341	4.17	15.8	50	326	3.67	15.1	47	309	3.21	14.3	44	291	2.79	13.5	40	271	2.40	12.6	36	247	1.98	11.4	32
302		377	4.35	17.7	59	360	3.83	16.9	55	342	3.35	16.1	51	322	2.90	15.1	47	300	2.49	14.1	43	273	2.05	12.8	37
342		421	4.16	19.8	53	402	3.67	18.9	49	381	3.22	17.9	45	358	2.80	16.8	40	333	2.41	15.7	36	303	1.99	14.2	30
372		467	4.42	21.8	62	446	3.89	20.8	57	423	3.40	19.7	52	398	2.95	18.5	47	370	2.52	17.2	42	334	2.06	15.6	35
402		500	4.05	23.5	71	478	3.57	22.5	65	454	3.13	21.4	60	427	2.72	20.1	54	398	2.34	18.7	48	362	1.93	17.0	41
432		526	4.19	24.7	68	505	3.71	23.7	63	482	3.25	22.7	58	455	2.83	21.4	52	426	2.44	20.0	46	389	2.01	18.3	39
462		571	4.00	26.9	79	547	3.54	25.7	73	520	3.10	24.5	67	489	2.70	23.0	59	455	2.32	21.4	52	415	1.92	19.5	44
522		632	3.97	30.3	99	605	3.51	29.0	91	575	3.08	27.6	83	541	2.69	25.9	74	504	2.31	24.1	65	460	1.92	22.0	55
602		776	4.23	36.2	58	740	3.73	34.5	53	703	3.26	32.7	48	659	2.84	30.7	43	613	2.44	28.6	38	557	2.01	25.9	32
672		826	4.15	38.8	66	790	3.66	37.1	61	751	3.21	35.3	56	708	2.79	33.2	50	661	2.41	31.1	44	604	1.99	28.4	37
732		909	4.04	42.8	79	868	3.57	40.8	73	824	3.12	38.7	66	773	2.71	36.3	59	719	2.33	33.8	51	654	1.92	30.7	43
802		989	4.01	46.1	91	944	3.54	44.0	83	896	3.10	41.7	76	841	2.70	39.1	67	782	2.32	36.3	59	711	1.91	33.0	49

Legend

LWT	Leaving water temperature, °C
Qc	Cooling capacity, kW
EER	Energy efficiency ratio, kW/kW
q	Evaporator water flow rate, l/s
Δp	Evaporator pressure drop, kPa

Application data

Standard units, refrigerant: R-410A
Evaporator entering/leaving water temperature difference: 5 K
Evaporator fluid: chilled water
Fouling factor: 0.18 x 10^{-4} (m^2 K)/W

Performances in accordance with EN14511-3:2011.

Cooling capacities

30RB 162-262 “B” units with option 280 (shell-and-tube heat exchanger) and 30RB 302-802 units

		Condenser entering air temperature, °C																							
		20				25				30				35				40				46			
	LWT	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp	Qc	EER	q	Δp
	°C	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa	kW	kW/kW	l/s	kPa
162	5	177	4.37	8.3	21	169	3.81	7.9	19	160	3.29	7.5	18	150	2.81	7.0	17	139	2.36	6.5	15	125	1.88	5.8	13
182		193	4.24	9.0	23	184	3.72	8.6	22	175	3.23	8.1	20	164	2.78	7.7	19	153	2.36	7.1	17	137	1.91	6.4	15
202		214	3.95	10.1	28	204	3.47	9.7	26	194	3.02	9.2	24	182	2.62	8.7	22	170	2.24	8.1	20	155	1.84	7.3	18
232		252	4.52	11.8	34	241	3.96	11.2	32	229	3.44	10.7	30	215	2.95	10.1	27	200	2.50	9.3	25	179	2.00	8.4	21
262		297	3.95	13.7	42	283	3.46	13.1	40	269	3.01	12.4	37	253	2.60	11.6	34	235	2.23	10.8	30	214	1.82	9.8	27
302		325	4.08	15.2	49	310	3.58	14.5	46	294	3.11	13.7	43	277	2.68	12.9	39	257	2.28	12.0	35	233	1.85	10.9	31
342		362	3.94	16.9	42	345	3.46	16.1	39	328	3.01	15.3	35	308	2.60	14.4	32	287	2.22	13.4	28	260	1.81	12.1	24
372		398	4.10	18.4	48	380	3.59	17.6	45	361	3.12	16.7	41	339	2.69	15.7	37	315	2.29	14.6	33	284	1.86	13.2	27
402		432	3.83	20.2	56	413	3.36	19.3	52	392	2.92	18.3	48	369	2.52	17.2	43	343	2.15	16.0	38	312	1.76	14.6	32
432		461	3.97	21.5	54	441	3.49	20.6	50	419	3.04	19.6	45	395	2.62	18.4	41	369	2.25	17.2	36	335	1.83	15.6	30
462		491	3.79	22.9	61	469	3.32	21.9	56	446	2.90	20.8	51	420	2.51	19.6	46	392	2.15	18.3	40	356	1.76	16.6	33
522		549	3.79	26.1	77	525	3.33	24.9	71	499	2.91	23.7	65	471	2.52	22.3	58	439	2.16	20.8	51	400	1.77	19.0	43
602		667	3.99	30.9	45	637	3.50	29.5	41	605	3.05	28.0	38	570	2.64	26.4	34	531	2.26	24.6	30	483	1.85	22.4	25
672		722	3.94	33.7	53	689	3.46	32.2	48	654	3.01	30.5	44	616	2.60	28.8	39	575	2.23	26.8	35	523	1.83	24.4	29
732		781	3.81	36.5	61	746	3.35	34.8	56	708	2.92	33.1	51	666	2.53	31.1	46	621	2.17	29.0	40	566	1.78	26.4	34
802		850	3.79	39.2	70	811	3.33	37.4	64	770	2.90	35.6	58	725	2.51	33.5	52	675	2.15	31.2	46	614	1.77	28.4	38
162	7	190	4.64	8.9	23	181	4.04	8.5	21	172	3.49	8.0	20	162	2.99	7.6	18	150	2.52	7.0	16	134	2.01	6.3	14
182		210	4.51	9.8	26	201	3.96	9.4	24	190	3.46	8.9	23	179	2.99	8.4	21	166	2.54	7.8	19	150	2.05	7.0	16
202		228	4.12	10.8	30	218	3.63	10.4	28	207	3.17	9.8	26	195	2.75	9.3	24	182	2.35	8.6	22	165	1.93	7.8	19
232		263	4.65	12.3	36	251	4.07	11.8	34	239	3.55	11.2	31	226	3.06	10.6	29	211	2.61	9.9	26	190	2.10	8.9	23
262		315	4.08	14.5	45	300	3.58	13.8	42	285	3.12	13.1	39	268	2.70	12.4	36	250	2.31	11.5	33	227	1.90	10.5	29
302		343	4.21	16.0	52	328	3.69	15.3	49	312	3.22	14.6	46	294	2.78	13.7	42	274	2.38	12.8	38	249	1.94	11.6	33
342		385	4.07	18.0	46	367	3.57	17.2	42	349	3.12	16.3	39	328	2.70	15.3	35	305	2.31	14.3	31	277	1.89	13.0	26
372		426	4.28	19.7	53	406	3.75	18.8	49	386	3.26	17.8	45	362	2.81	16.8	41	337	2.40	15.6	36	305	1.95	14.1	30
402		460	3.97	21.5	62	439	3.49	20.5	57	417	3.03	19.5	52	392	2.62	18.3	47	365	2.24	17.1	42	332	1.84	15.5	36
432		484	4.09	22.6	59	464	3.60	21.7	54	443	3.15	20.7	50	419	2.73	19.6	45	392	2.34	18.3	40	357	1.92	16.7	33
462		523	3.92	24.5	68	500	3.45	23.4	62	476	3.01	22.2	57	448	2.61	21.0	51	418	2.24	19.5	45	381	1.84	17.8	38
522		582	3.92	27.7	85	556	3.45	26.4	78	529	3.01	25.2	72	499	2.61	23.7	64	467	2.24	22.2	57	426	1.85	20.3	48
602		711	4.13	33.0	50	678	3.62	31.5	46	643	3.16	29.8	42	604	2.73	28.0	37	563	2.34	26.1	33	512	1.93	23.8	27
672		763	4.07	35.7	58	730	3.57	34.1	53	694	3.12	32.4	48	653	2.70	30.5	43	610	2.32	28.5	38	556	1.90	26.0	32
732		832	3.95	38.9	68	793	3.47	37.1	62	752	3.02	35.2	56	707	2.61	33.1	50	660	2.24	30.8	44	601	1.85	28.1	37
802		905	3.92	41.8	77	863	3.44	39.9	71	818	3.00	37.8	64	769	2.60	35.6	57	717	2.23	33.2	51	653	1.84	30.2	43
162	10	206	4.94	9.7	25	197	4.34	9.2	23	187	3.75	8.7	22	176	3.22	8.2	20	163	2.72	7.6	18	147	2.18	6.9	16
182		232	4.82	10.9	30	222	4.25	10.4	28	211	3.72	9.9	26	199	3.22	9.3	24	186	2.76	8.7	22	168	2.26	7.9	19
202		250	4.36	11.9	34	239	3.85	11.4	32	228	3.37	10.8	29	215	2.93	10.2	27	201	2.52	9.6	25	183	2.07	8.7	22
232		283	4.86	13.3	39	270	4.27	12.7	37	257	3.72	12.1	34	243	3.21	11.4	32	226	2.74	10.6	29	205	2.23	9.6	25
262		343	4.25	15.8	50	327	3.74	15.1	47	310	3.26	14.3	44	292	2.83	13.5	40	272	2.43	12.6	36	248	2.00	11.4	32
302		379	4.46	17.7	59	362	3.91	16.9	55	344	3.41	16.1	51	323	2.94	15.1	47	302	2.53	14.1	43	274	2.07	12.8	37
342		423	4.25	19.8	53	403	3.74	18.9	49	383	3.27	17.9	45	359	2.83	16.8	40	334	2.43	15.7	36	304	2.01	14.2	30
372		470	4.53	21.8	62	448	3.98	20.8	57	425	3.46	19.7	52	399	2.99	18.5	47	371	2.56	17.2	42	335	2.08	15.6	35
402		503	4.15	23.5	71	480	3.65	22.5	65	456	3.19	21.4	60	429	2.76	20.1	54	399	2.37	18.7	48	364	1.95	17.0	41
432		529	4.30	24.7	68	507	3.79	23.7	63	484	3.31	22.7	58	457	2.88	21.4	52	428	2.47	20.0	46	390	2.03	18.3	39
462		575	4.12	26.9	79	550	3.62	25.7	73	523	3.16	24.5	67	491	2.74	23.0	59	457	2.35	21.4	52	416	1.94	19.5	44
522		636	4.11	30.3	99	609	3.62	29.0	91	579	3.16	27.6	83	544	2.74	25.9	74	506	2.35	24.1	65	462	1.94	22.0	55
602		779	4.32	36.2	58	743	3.80	34.5	53	705	3.31	32.7	48	661	2.87	30.7	43	615	2.47	28.6	38	559	2.03	25.9	32
672		830	4.25	38.8	66	793	3.74	37.1	61	754	3.26	35.3	56	710	2.83	33.2	50	663	2.44	31.1	44	606	2.01	28.4	37
732		914	4.15	42.8	79	872	3.65	40.8	73	827	3.18	38.7	66	776	2.76	36.3	59	721	2.36	33.8	51	656	1.94	30.7	43
802		995	4.13	46.1	91	950	3.63	44.0	83	901	3.17	41.7	76	845	2.74	39.1	67	785	2.35	36.3	59	714	1.93	33.0	49

Legend

LWT	Leaving water temperature, °C
Qc	Cooling capacity, kW
EER	Energy efficiency ratio, kW/kW
q	Evaporator water flow rate, l/s
Δp	Evaporator pressure drop, kPa

Application data

Standard units, refrigerant: R-410A
Evaporator entering/leaving water temperature difference: 5 K
Evaporator fluid: chilled water
Fouling factor: 0.18 x 10^{-4} (m^2 K)/W

Gross performances, not in accordance with EN14511-3:2011. These performances do not take into account the correction for the proportional heating capacity and power input generated by the water pump to overcome the internal pressure drop in the heat exchanger.

Order No.13438-20, 10.2012. Supersedes order No. 13438-20, 05.2011.
Manufacturer reserves the right to change any product specifications without notice.

Manufactured by: Carrier SCS, Montluel, France.
Printed in the European Union.

Type: Roof mounted (external) full fresh air unit with run around coil heat recovery, filter sections, chilled water cooling coil, LTHW heating, supply fan and extract fan section (AHU 2) stacked on top of full fresh air unit with filter sections, chilled water cooling coil, LTHW heating coil, supply fan section (AHU 3). Packaged air handling unit with 50mm thick insulated panels, integral base frame, sloping roof and access to all maintainable components. All access sections (including the fan section) will be fitted with hinged doors, porthole style windows and internal bulkhead lights with factory wired switches on the outside of the AHU.

Units to be configured as shown below:

AHU No. 1 Details

Supply Air Volume – 6800 l/s
Extract Air Volume – 6800l/s
Maximum Height – 3500mm
Maximum Length – 8150mm

Section	Details	Comments
Opposed blade damper	Either integral to the ahu, or bolted on inlet flange	Damper actuator mounted and fitted in factory
Panel filter section	Basic EU3 standard	Walk in access to panel filter with open grid flooring. HRC coil is accessed for cleaning once panel filters have been removed.
Heat recovery coil	Run Around Coils Nominal selection **Supply Side** Summer EAT of 30°C db & 21°C wb Winter EAT of -4°C db saturated **Extract Side** Min. EAT of 20°C db & 15°C wb Max. EAT of 26°C db & 19°C wb Dependent on occupancy	Provide modulating face and bypass dampers for up to 100% by pass.
Bag Filter section	EU7 standard bags	Walk in access to bag filter with open grid flooring.
Cooling Coil Chilled water	EAT of 30°C db & 21°C wb LAT of 13°C db EWT of 7°C LWT of 12°C	Actual cooling coil duty to be confirmed, complete with CHW flowrate and pressure drop. 10fpi minimum fin spacing
Access section	600mm wide, hinged access door, porthole window, internal bulkhead light. Open grid flooring.	
Heater section	EAT of 5°C – adjust this to suit the run around coil leaving temperature LAT of 23°C Nominal duty of 145kW	LTHW Heating Coil Entering Water Temperature of 60°C

Supply Fan section	External static pressure of 350Pa, to include 250Pa on supply and 100Pa on intake. Fan will be inverter driven to modulate between 50-100% volume.	Double inlet BCA type fan. Belt drive motor to be within the fan section with guards etc. internal lighting, porthole windows on both sides. Internal bulkhead light(s). Standby idling motor required. Heavy duty slow running fan preferred for low noise application. Plumber block type bearings preferred.
Extract Fan section	External static pressure of 350Pa, to include 250Pa on supply and 100Pa on intake. Fan will be inverter driven to modulate between 50-100% volume.	Double inlet BCA type fan. Belt drive motor to be within the fan section with guards etc. internal lighting, porthole windows on both sides. Internal bulkhead light(s). Heavy duty slow running fan preferred for low noise application. Plumber block type bearings preferred.
Acoustic Treatment	Supply fan discharge – In Duct Supply Intake – 1200mm attenuator with side entry and weatherproof cowl Extract fan intake – In Duct Extract Discharge – 1200mm attenuator	

AHU No. 2 Details

Supply Air Volume – 1500 l/s
Extract Air Volume – 1500l/s
Maximum Height – 2300mm
Maximum Length – 8150mm

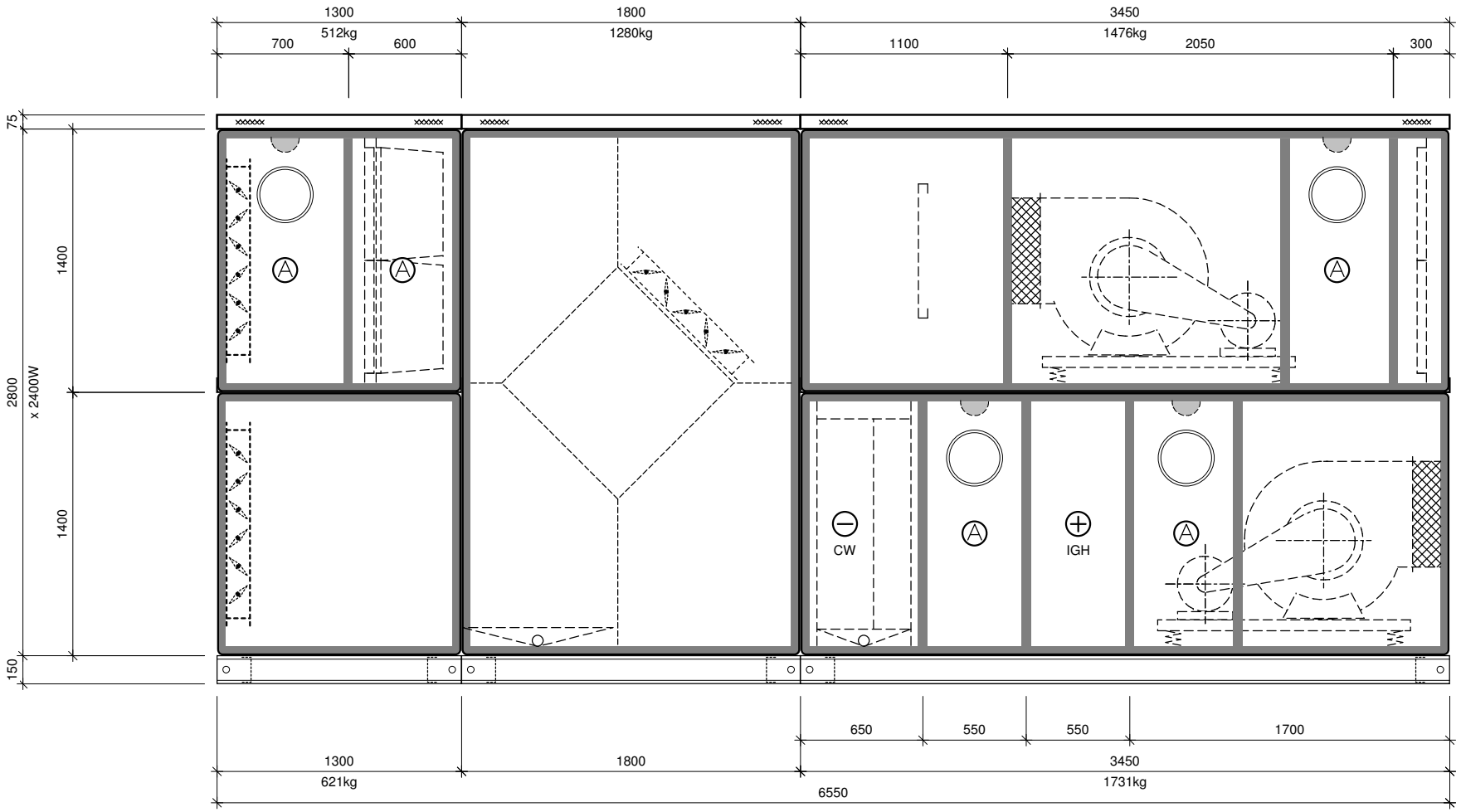
Section	Details	Comments
Opposed blade damper	Either integral to the ahu, or bolted on inlet flange	Damper actuator mounted and fitted in factory
Panel filter section	Basic EU3 standard	Walk in access to panel filter with open grid flooring. HRC coil is accessed for cleaning once panel filters have been removed.
Heat recovery coil	Run Around Coils Nominal selection **Supply Side** Summer EAT of 30°C db & 21°C wb Winter EAT of -4°C db saturated **Extract Side** Min. EAT of 20°C db & 15°C wb Max. EAT of 26°C db & 19°C wb Dependent on occupancy	Provide modulating face and bypass dampers for up to 100% by pass.
Bag Filter section	EU7 standard bags	Walk in access to bag filter with open grid flooring.
Cooling Coil Chilled water	EAT of 30°C db & 21°C wb LAT of 13°C db EWT of 7°C LWT of 12°C	Actual cooling coil duty to be confirmed, complete with CHW flowrate and pressure drop. 10fpi minimum fin spacing
Access section	600mm wide, hinged access door, porthole window, internal bulkhead light. Open grid flooring.	
Heater section	EAT of 5°C – adjust this to suit the run around coil leaving temperature LAT of 23°C Nominal duty of 32kW	LTHW Heating Coil Entering Water Temperature of 60°C
Supply Fan section	External static pressure of 350Pa, to include 250Pa on supply and 100Pa on intake. Fan will be inverter driven to modulate between 50-100% volume.	Double inlet BCA type fan. Belt drive motor to be within the fan section with guards etc. internal lighting, porthole windows on both sides. Internal bulkhead light(s). Standby idling motor required. Heavy duty slow running fan preferred for low noise application. Plumber block type bearings preferred.

Extract Fan section	External static pressure of 350Pa, to include 250Pa on supply and 100Pa on intake. Fan will be inverter driven to modulate between 50-100% volume.	Double inlet BCA type fan. Belt drive motor to be within the fan section with guards etc. internal lighting, porthole windows on both sides. Internal bulkhead light(s). Heavy duty slow running fan preferred for low noise application. Plumber block type bearings preferred.
Acoustic Treatment	Supply fan discharge – In Duct Supply Intake – 1200mm attenuator with side entry and weatherproof cowl Extract fan intake – In Duct Extract Discharge – 1200mm attenuator	

AHU No. 3 Details (Supply Only)

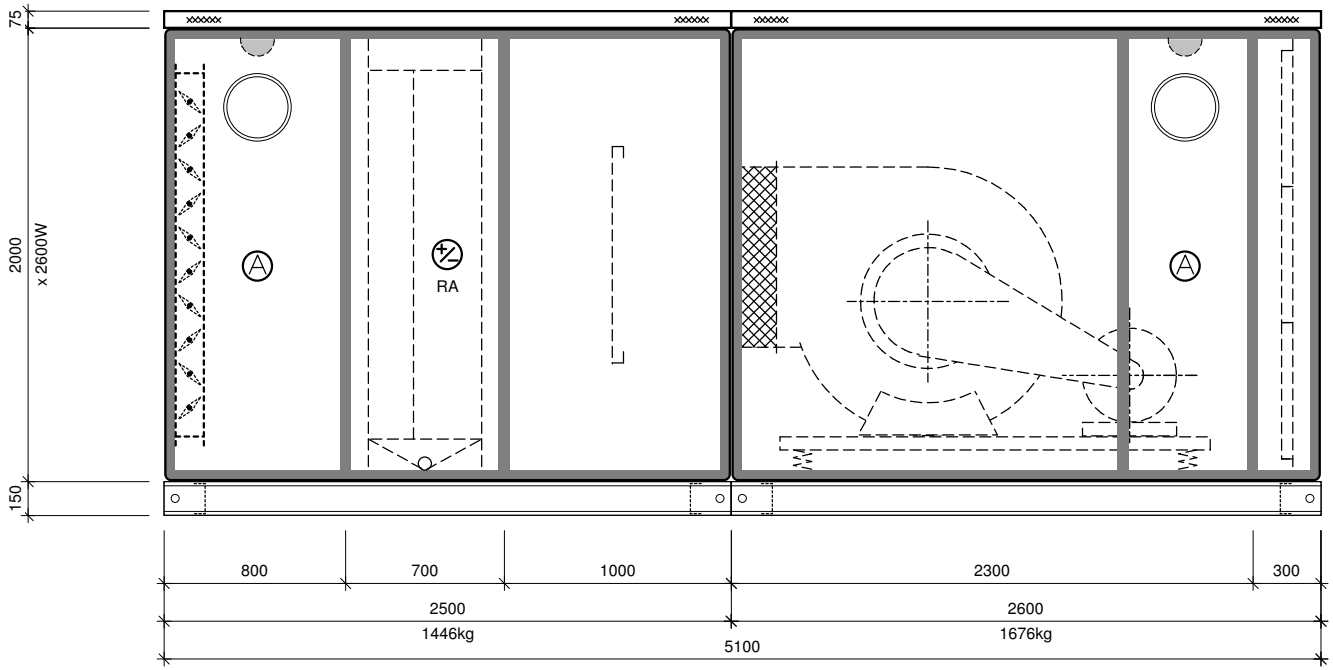
Supply Air Volume – 500 l/s
Maximum Height – 1200mm
Maximum Length – 6950mm

Section	Details	Comments
Opposed blade damper	Either integral to the ahu, or bolted on inlet flange	Damper actuator mounted and fitted in factory
Panel filter section	Basic EU3 standard	Walk in access to panel filter with open grid flooring. HRC coil is accessed for cleaning once panel filters have been removed.
Bag Filter section	EU7 standard bags	Walk in access to bag filter with open grid flooring.
Cooling Coil Chilled water	EAT of 30^{o}C db & 21^{o}C wb LAT of 13^{o}C db EWT of 7^{o}C LWT of 12^{o}C	Actual cooling coil duty to be confirmed, complete with CHW flowrate and pressure drop. 10fpi minimum fin spacing
Access section	600mm wide, hinged access door, porthole window, internal bulkhead light. Open grid flooring.	
Heater section	EAT of -4^{o}C LAT of 23^{o}C Nominal duty of 16kW	LTHW Heating Coil Entering Water Temperature of 60^{o}C
Supply Fan section	External static pressure of 600Pa, to include 500Pa on supply and 100Pa on intake. Fan will be inverter driven to modulate between 50-100% volume.	Double inlet BCA type fan. Belt drive motor to be within the fan section with guards etc. internal lighting, porthole windows on both sides. Internal bulkhead light(s). Standby idling motor required. Heavy duty slow running fan preferred for low noise application. Plumber block type bearings preferred.
Acoustic Treatment	Supply fan discharge – In Duct Supply Intake – 1200mm attenuator with side entry and weatherproof cowl	



Elevation

Dalair	Project Reference: **DMT New Theatre**	Date: **07/07/14**	Supply Volume & External Static: **5.4m³/s @ 600Pa**	Notes:	Drawing Scale: **1:33**
	Unit Reference: **Main Supply & Extract AHU**	Model Reference: **MA/11S**	Extract Volume & External Static: **5.4m³/s @ 600Pa**		Drawing Number: **E140750/1**



Elevation

Dalair	Project Reference: **DMT New Theatre**	Date: **07/07/14**	Supply Volume: **N/A**	Notes:	Drawing Scale: **1:33**
	Unit Reference: **Main Auditorium Extract AHU**	Model Reference: **MA/20**	Extract Volume & External Static: **10.m³/s @ 350Pa**		Drawing Number: **E140750/2**

QUOTATION

Daikin Airconditioning UK Ltd

Western Region, Maple House , Brotherswood Court,Great Park Road, Almondsbury, BS32 4QW
Tel: 0845 6419320 Fax: 0845 6419329 Email: bristolsales@daikin.co.uk

Power Plan Solutions
Ashdene House
Shawford
SO21 2AA
United Kingdom

Project Reference:	**Queens Theatre**
Project Location:	London
Your Account No:	22417
Quotation Number:	131233
Quotation Date:	13.08.2014
Valid to Date:	12.09.2014
External Sales Engineer:	Kevin Gregory
Tel. Number:	07747 844636
Email:	gregory.k@daikin.co.uk
Quote prepared by:	Mark Hutton
Email:	hutton.m@daikin.co.uk

Dear Brett Shepherd,

Thank you for your valued enquiry. We have pleasure in submitting our quotation for the supply of Daikin UK products and services as detailed below:

The equipment and services as detailed within this document have been based upon the information provided by you or information already in our possession. It is your responsibility to check the selections shown to ensure that they meet with your specific project requirements and that we have interpreted your requirements precisely and correctly.

Unit Ref.	Description	Quantity	Unit Price	Net Price Total GBP
Auditorium				**25,580.00**
RYMQ10T	VRV IV Condenser units - multi	1	4,963.00	4,963.00
RYMQ16T	VRV IV Condenser units - multi	2	8,183.00	16,366.00
EKEXV250	Expansion Valve Kit	4	132.00	528.00
KHRQ22M64T	2 Pipe R410A Refnet Joint, Twin Joint RY	1	38.00	38.00
KHRQ22M75T	2 Pipe R410A Refnet Joint	2	48.00	96.00
BRC1E52A	Premium Controller with energy features	4	76.00	304.00
EKEQMCB	Interface kit for VRV connection to DX C	4	557.00	2,228.00
RTD-20	Retail Economiser	4	226.00	904.00
BHFQ22P1517	3 condenser connection kit.	1	153.00	153.00
Auditorium/Rehearsal/Basement				**22,323.00**
RYMQ16T	VRV IV Condenser units - multi	1	8,183.00	8,183.00
RYMQ20T	VRV IV Condenser units - multi	1	10,028.00	10,028.00
EKEXV100	Expansion Valve Kit	1	78.00	78.00
EKEXV250	Expansion Valve Kit	3	132.00	396.00
KHRQ22M64T	2 Pipe R410A Refnet Joint, Twin Joint RY	2	38.00	76.00
KHRQ22M75T	2 Pipe R410A Refnet Joint	1	48.00	48.00

QUOTATION
Daikin Airconditioning UK Ltd

Unit Ref.	Description	Quantity	Unit Price	Net Price Total GBP
BRC1E52A	Premium Controller with energy features	4	76.00	304.00
EKEQMCB	Interface kit for VRV connection to DX C	4	557.00	2,228.00
RTD-20	Retail Economiser	4	226.00	904.00
BHFQ22P1007	2 condenser connection kit.	1	78.00	78.00
Ancilliary Areas				**27,998.00**
REYQ20T	VRV IV Heat Recovery 20HP	1	11,395.00	11,395.00
BS1Q10A	VRV IV Single BS Box 100 class	8	337.00	2,696.00
BS4Q14AV1	VRV IV 4 way Multi BS Box	2	1,550.00	3,100.00
FXAQ32P	Wall mounted VRV Fan Coil	12	469.00	5,628.00
FXAQ50P	Wall mounted VRV Fan Coil	2	507.00	1,014.00
FXHQ63A	Ceiling Mounted VRV Fan Coil Unit	2	1,004.00	2,008.00
KHRQ23M20T	3 Pipe R410A Refnet Joint	3	42.00	126.00
KHRQ23M29T9	3 Pipe R410A Refnet Joint	1	55.00	55.00
KHRQ23M64T	3 Pipe R410A Refnet Joint	5	58.00	290.00
BRC1E52A	Premium Controller with energy features	16	76.00	1,216.00
RTD-10	Extended control adaptor	2	210.00	420.00
UK.FB2	Fixing Box	2	25.00	50.00
Controls				**2,262.00**
DCM601A51	I-Touch Manager	1	2,262.00	2,262.00
IT/Hub/AV Rooms				**4,450.00**
FAQ71C	Sky Air Wall Mounted Fan Coil	2	723.00	1,446.00
BRC1E52A	Premium Controller with energy features	2	76.00	152.00
RTD-10	Extended control adaptor	2	210.00	420.00
UK.FB2	Fixing Box	2	25.00	50.00
RZQG71L8V1	CONDENSING UNIT- SEASONAL SMART 1PH	2	1,191.00	2,382.00
	TOTAL NET PRICE (excl. V.A.T.)			**82,613.00**

Did you know Daikin's heating range now includes under floor heating?
Did you know Daikin's Self-cleaning cassettes can save up to 30% on running costs?
Did you know Daikin's VRV®III-Q upgrade for r-22 systems offers up to 50% saving on replacing the entire system?
Did you know Daikin now does a range of water cooled turbocor chillers within our extensive range of chilled water products?
Did you know ZEAS is perfect for applications with fluctuating loads such as supermarkets and blast coolers?

V.A.T.:- Value added tax will be charged at the prevailing rate on the date of the invoice. Please note that all prices quotes are exclusive of Valued Added Tax.

Equipment Availability:- Daikin UK will supply most equipment from stock however, some items (such as but not limited to:- Chilled water products, Air handling, Rooftop Packaged and made to order units) may be subject to extended delivery times. Please call at time of order for dates available.

QUOTATION
Daikin Airconditioning UK Ltd

Delivery:- Unless otherwise mentioned, this project price includes one shipment to a UK Mainland site, on our standard vehicle, between the hours of 8.00am - 5.00pm, Monday - Friday. Should you require more than one delivery to site, out of hours delivery, a specific or specialist vehicle or timed delivery, then additional costs will be levied based on the individual project and location - please contact us for details.

Storage:- Should you not be able to accept delivery of some items immediately after manufacture (such as but not limited to; Chillers, Air Handling Units, Rooftop Packaged and made to order units) we can make arrangements to store the equipment. Storage with us would be at your risk and expense and any associated handling, subsequent delivery and storage charges would be passed on to you. Please do not hesitate to contact us for further information should you feel this may be a requirement of your project.

Commissioning:- Unless otherwise included, commissioning services will be charged separately.

Warranty:- The Daikin equipment offered is subject to the relevant warranty terms and conditions which are available on request.

Removal and Disposal of Redundant Equipment:- Unless otherwise mentioned, this item has not been included in our quotation. For a nominal fee, we are able to safely dispose of your old equipment in an environmentally responsible manner recycling up to 95% for further use.

Exclusions:- Prices are exclusive of the following items unless stated in the aforementioned.

Any installation or site requirement such as (but not limited to):
1) Un-loading, spreader bars, lifting gear etc.
2) Special vehicles, timed, weekend or out of hours delivery.
3) Storage.
4) Equipment handling and positioning on site.
5) All builders work, foundations or supports.
6) Water flow balancing or proving.
7) Fitting, wiring & commissioning of any loose items.
8) Pipework, valves, commissioning sets, controls etc.
9) Electrical services, inc power and controls wiring.
10) BMS wiring, configuration and interfacing.
11) Refrigerant & oil charge. (condenserless chillers)
12) Removal or disposal of redundant equipment.

We trust the foregoing information meets with your approval and requirements allowing you to proceed with Daikin UK. However, should you have any further queries then please do not hesitate to contact our sales department who will be pleased to assist you.

Assuring you of our close and careful attention at all times, we remain,
Yours sincerely

Mark Hutton
For Daikin Airconditioning UK Limited

PUMY-P140YKM Y SERIES 6HP OUTDOOR UNIT

R410A Heat Pump

The latest in Mitsubishi Electric Y Series technology incorporated within the new City Multi 6hp model allows up to 12 indoor units to be connected to a single outdoor unit, using the standard branch/header pipework system proven in the larger models. Utilising the latest Mitsubishi Electric Inverter technology, the system is fully controllable with all City Multi controllers or linked to third party BEMS.

Hover your mouse over the red icons below to view a description of each feature:

MODEL INFO

- A two core non-polar transmission line allows for simple installation of up to 12 indoor units
- Latest in inverter technology including a highly efficient DC Scroll Compressor, DC fan motor and Demand Control
- The condensing unit is extremely slimline which allows easy location and application of the system
- Anti-Corrosion blue and flat fin technology
- Improved pipe lengths and height difference
- Expanded operation range to -20°C in heating mode
- Connect stylish M Series Zen indoor units to the system via the LEV Interface (PAC-LV11)

OUTDOOR

Heating Capacity (kW) (nominal)	18
Cooling Capacity (kW) (nominal)	15.5
Heating Capacity (kW) (UK)	14.9
Cooling Capacity (kW) (UK)	14.3
Heating Power Input (kW) (nominal)	4.47
Cooling Power Input (kW) (nominal)	4.52
Heating Power Input (kW) (UK)	3.98
Cooling Power Input (kW) (UK)	3.03
COP / EER (nominal)	4.03 / 3.43
Max No. of Connectable Indoor Units	12
Max Connectable Capacity	130%
Airflow (m³/min)	110
Pipe Size Gas (mm [in])	15.88 (5/8)
Pipe Size Liquid (mm ([in])	9.52 (3/8)
Sound Pressure Level (dBA)	51
Weight (kg)	125
Dimensions (mm) Width x Depth x Height	1050 x 330+30 x 1338
Electrical Supply	380-415V, 50HZ
Phase	3
Starting Current (A)	5
Running Current (A) - Heating	6.79
Running Current (A) - Cooling	6.87
Guaranteed Operating Range (°C) - Heating	-20 ~ 15
Guaranteed Operating Range (°C) - Cooling	-5 ~ 46
Fuse Rating (BS88) - HRC (A)	16
Mains Cable No. Cores	4 + EARTH

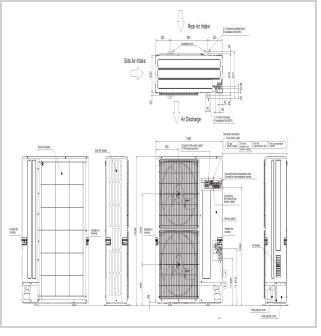
PIPING RESTRICTIONS

Total Piping Length (m)	300
Furthest Piping Length (m)	150
Furthest Piping Length After First Branch (m)	30
Between Indoor and Outdoor units - Height (m)	50
Between Indoor and Indoor units - Height (m)	15

DIMENSIONS

PUMY-P140YKM

[Click to enlarge/Print]



Fläkt Woods Limited
Technical Data Sheet
JM Aerofoil

Quotation Number	:	Fan Code	: HT125JM/50B/4/6/19
Project Name	:	Customer	:
Item Reference:	:	Date:	: Wednesday, July 30, 2014

Fan Code	HT125JM/50B/4/6/19
Fan Diameter / Size	1250 Size / mm
Blades	6
Fan Speed	1470 rpm
Velocity	12.4 m/s
Blade Angle	19°
Installation Type / Form of Running	D / B
Fan Casing	Long
Requested Duty	15m³/s @ 600 Pa (static)
Actual Emergency Duty	15.24m³/s @ 777 Pa (static)
Outlet Dynamic Pressure	92 Pa
Idling Loss*	153 Pa
Duty Shaft Power	24.16 kW
Max Shaft Power	25.15 kW
Total Efficiency	54.8 %
Motor Frame	180L
Motor Rating	26.40 kW [IE2]
Full Load Current	49.5 A
Starting Current	277.2 A
Motor Mounting	Pad
Electrical Supply	380-420 Volts 50 Hz 3 Phase
Start Type	DOL
Motor Winding	Standard
Enclosure	Standard All
ErP [FMEG] Rating	N 56 (ErP Compliant 2015)
ErP [FMEG] Target	N 55
Measurement Category	D (Total)
VSD	N
Fan + Motor Efficiency	56.7% (23.27 m³/s @ 571 Pa)
Motor Input Power (ErP)	23.45 kW
SFP value	1.72 W/(l/s) @ Requested Duty
Energy Consumption	52532 kWh (2000 h/year)
Running Cost / Year	£3677
Air Density	1.2 kg/m³ / 20 °C / 0 m / 50% RH
Smoke Venting	400°C for 2 Hours

Performance data has been derived from tests carried out in a Flakt Woods laboratory, in accordance with ISO 5801 and is specifically applicable for Ducted installations. When an electronic controller is incorporated, enhanced motor noise can occur - particularly when the operating speed is well below maximum. FWL therefore recommend using an auto transformer speed controller for noise sensitive applications.

Acoustic data has been derived from tests carried out in a Flakt Woods laboratory, in accordance with BS 848 Pt 2, 1985 / BS EN ISO 5136 under Ducted conditions. The single figure provided is the overall Inlet sound pressure level at the specified distance, under spherical, free field conditions. Breakout levels stated are estimated from induct sound power levels and are provided for guidance.

Acoustic figures for adjusted running speeds have been interpolated and are for reference only.

Terms and Conditions:This offer is made subject to the terms and conditions detailed on the accompanying letter.

Selection includes run / standby in series losses. Sound levels could be up to 5 dB higher than those stated, dependant on fan spacing.

	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3 m**
Inlet*	113	106	108	105	104	102	99	96	116	89
Outlet*	115	108	109	105	104	102	98	97	117	89
Breakout*	105	85	81	78	77	73	77	74	105	64

* Lw dB re 10^{-12} W ** dBA re $2x10^{-5}$ Pa

Description	Qty
Fan HT125JM/50B/4/6/19 Fan Accessories	2
Estimated Despatch : 11 Weeks	

Optional Controllers & Sensors

IDDXF54 - 3/3 - Inverter
[EA901027]

Optional Accessories

Mounting Feet

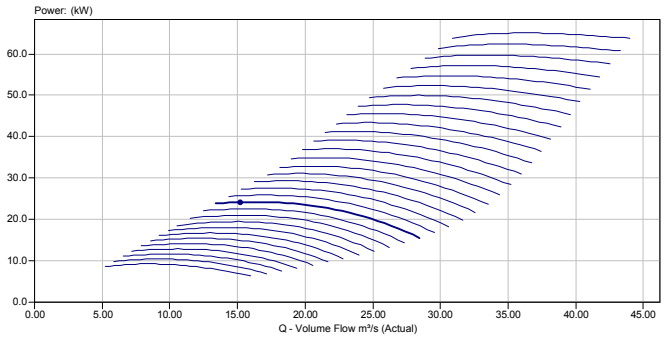
Flexible Connector

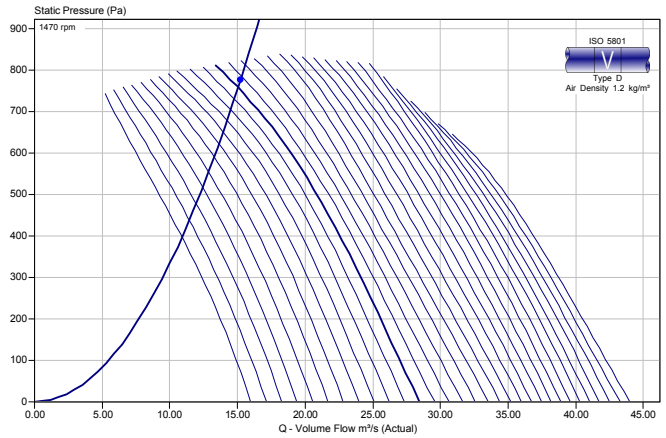
Matching Flange

Website:
, ,
Email: bshepherd@powerplan-solutions.com
Tel: Fax:

Quotation Number	:	Fan Code	: HT125JM/50B/4/6/19
Project Name	:	Customer	:
Item Reference:	:	Date:	: Wednesday, July 30, 2014

Fan Code	HT125JM/50B/4/6/19
Fan Diameter / Size	1250 Size / mm
Blades	6
Fan Speed	1470 rpm
Velocity	12.4 m/s
Blade Angle	19°
Installation Type / Form of Running	D / B
Fan Casing	Long
Requested Duty	15m³/s @ 600 Pa (static)
Actual Emergency Duty	15.24m³/s @ 777 Pa (static)
Outlet Dynamic Pressure	92 Pa
Idling Loss*	153 Pa
Duty Shaft Power	24.16 kW
Max Shaft Power	25.15 kW
Total Efficiency	54.8 %
Motor Frame	180L
Motor Rating	26.40 kW [IE2]
Full Load Current	49.5 A
Starting Current	277.2 A
Motor Mounting	Pad
Electrical Supply	380-420 Volts 50 Hz 3 Phase
Start Type	DOL
Motor Winding	Standard
Enclosure	Standard All
ErP [FMEG] Rating	N 56 (ErP Compliant 2015)
ErP [FMEG] Target	N 55
Measurement Category	D (Total)
VSD	N
Fan + Motor Efficiency	56.7% (23.27 m³/s @ 571 Pa)
Motor Input Power (ErP)	23.45 kW
SFP value	1.72 W/(l/s) @ Requested Duty
Energy Consumption	52532 kWh (2000 h/year)
Running Cost / Year	£3677
Air Density	1.2 kg/m³ / 20 °C / 0 m / 50% RH
Smoke Venting	400°C for 2 Hours





	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3 m**
Inlet*	113	106	108	105	104	102	99	96	116	89
Outlet*	115	108	109	105	104	102	98	97	117	89
Breakout*	105	85	81	78	77	73	77	74	105	64

* Lw dB re 10^{-12} W ** dBA re $2x10^{-5}$ Pa

Selection includes run / standby in series losses. Sound levels could be up to 5 dB higher than those stated, dependant on fan spacing.
Terms and Conditions: This offer is made subject to the terms and conditions detailed on the accompanying letter.

Description	Qty
Fan HT125JM/50B/4/6/19 Fan Accessories	2
Estimated Despatch : 11 Weeks	

Optional Controllers & Sensors

IDDXF54 - 3/3 - Inverter
[EA901027]

Optional Accessories

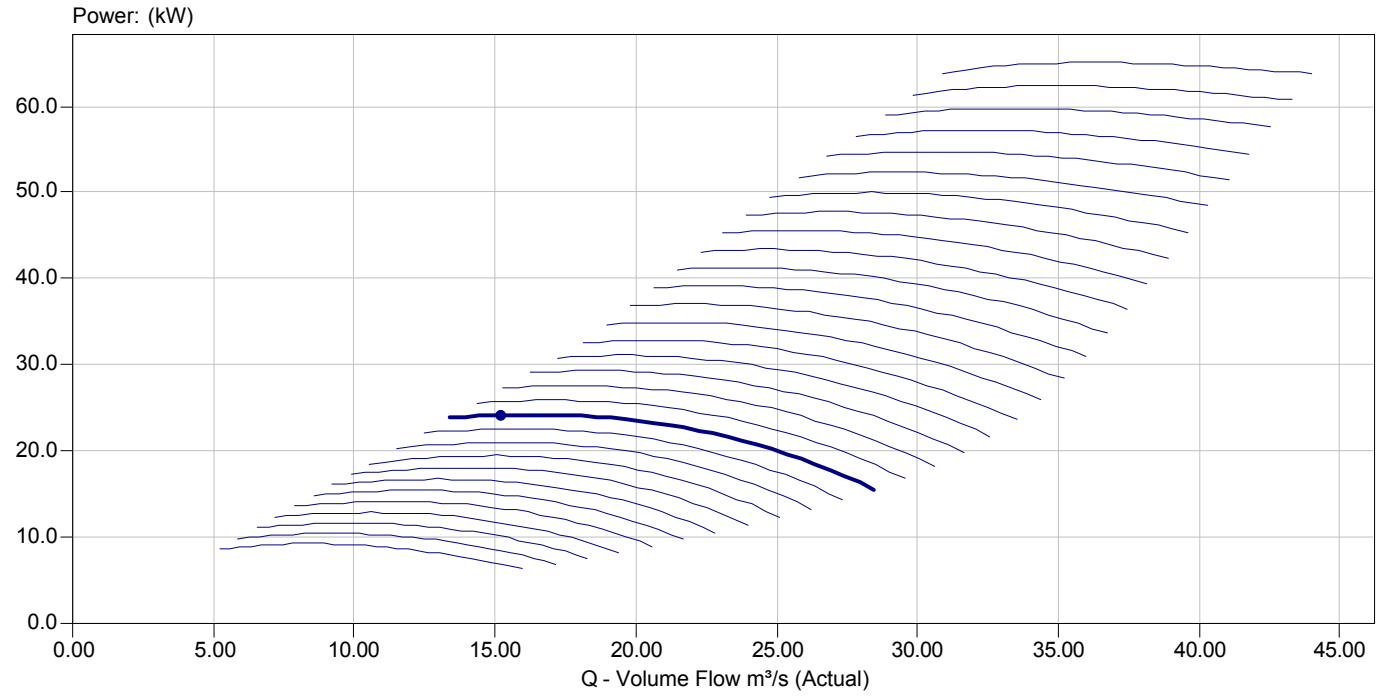
Mounting Feet

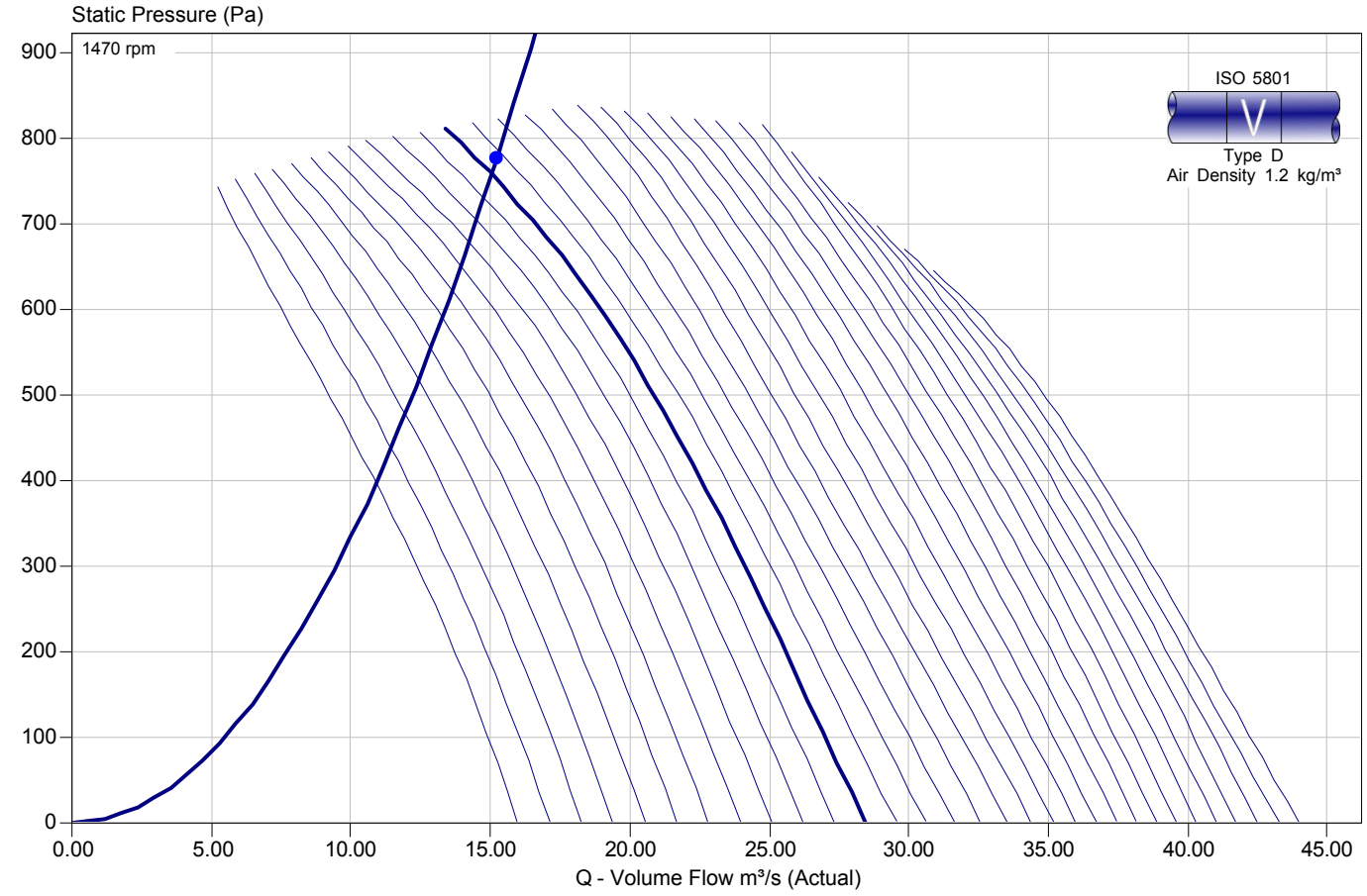
Flexible Connector

Matching Flange

Website:
, ,
Email: bshepherd@powerplan-solutions.com
Tel: Fax:

Quotation Number	:	Fan Code	: HT125JM/50B/4/6/19
Project Name	:	Customer	:
Item Reference:	:	Date:	: Wednesday, July 30, 2014



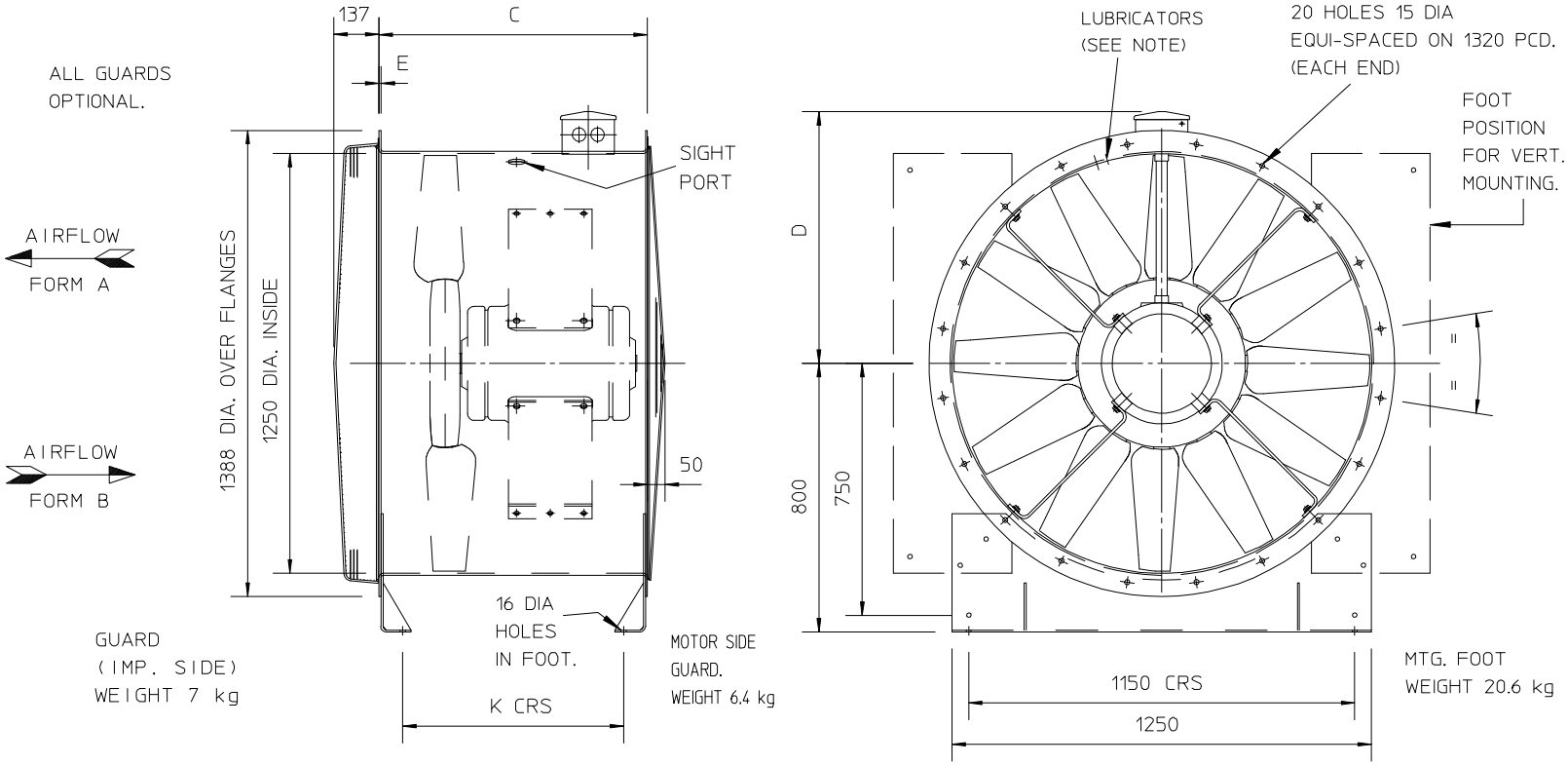


Quotation Number	:	Fan Code	: HT125JM/50B/4/6/19
Project Name	:	Customer	:
Item Reference:	:	Date:	: Wednesday, July 30, 2014

T/BOX WEG200/225/250 FRAMES

EXTERNAL LUBRICATORS
AVAILABLE ON WEG225/250
FRAMES ONLY. (STD TEMP)

C	800
D	755
E	6
K	658
Weight Fan Only	472



Notes : Dimensions shown in mm / Weight in kg

Reference:D276679

This drawing shows dimensions that should be used as a guide only and are subject to change. Certified drawings are available on request.

www.FGWilson.com

CAL / CALG Modular Acoustic Enclosure

32 – 125 kVA

The compact modular design of the 32 – 125 kVA CAL and CALG enclosures ensure optimum performance in the harshest of environments. Designed on modular principles, they have interchangeable components permitting on-site repair. Lift off doors and access panels provide optimal service and maintenance access.

Extremely durable and robust, the enclosures are designed to resist corrosion and handling damage with the ability to withstand rough handling common on many construction sites.

Developed through continuing research and development by our specialist engineers, all FG Wilson enclosures are fully weatherproof and incorporate internally mounted exhaust silencers.

The sound attenuated CAL and CALG enclosures reduce sound levels to comply with the stage II levels of the European Community Directive 2000/14/EC, effective from 3 January 2006 (F35-1 to F72-1).

Durable and Robust Construction

- High grade steel protected by powder coat paint (CAL)
- Galvanised steel protected by powder coat paint (CALG)
- Black finish stainless steel locks and hinges
- Zinc plated / stainless steel fasteners

Security and Safety

- Control panel viewing via large viewing window in lockable enclosure door
- Emergency stop push button mounted on enclosure exterior
- Cooling fan and battery charging alternator fully guarded
- Fuel fill and battery can only be reached via lockable access doors
- Fully enclosed exhaust silencing system for operator safety

Excellent Service and Maintenance Access

- Side hinged doors on both sides of the enclosure opening to 180°
- Side hinged doors lift off at 90°
- Removable front and rear access panels
- Lube oil and coolant drains

Transportability

- Lifting points on base frame facilitating handling from both sides

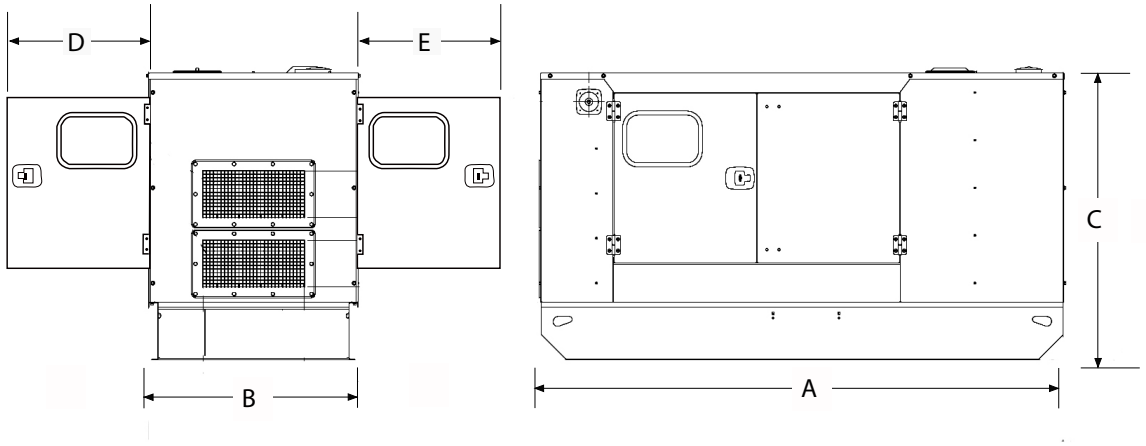
Sound Pressure Levels (dBA) (CAL)

50 Hz @ 1500 RPM

Generator Set Model		15m (50 ft)		7m (23 ft)		1m (3 ft)	
		75% Load	100% Load	75% Load	100% Load	75% Load	100% Load
3 Phase Models							
F35-1	Prime	61.8	61.8	67.6	67.8	79.9	80.2
	Standby	61.7	61.8	67.7	67.8	80.0	80.3
F50-1	Prime	61.2	61.3	67.2	67.3	79.4	79.5
	Standby	61.3	61.3	67.3	67.3	79.4	79.5
F72-1	Prime	61.6	61.5	67.6	67.5	80.5	80.4
	Standby	61.6	61.3	67.6	67.3	80.5	80.3
F94-1	Prime	65.0	65.6	71.0	71.6	82.5	83.1
	Standby	65.2	65.8	71.2	71.8	82.7	83.4
F125-1	Prime	65.2	65.4	71.2	71.4	83.4	83.8
	Standby	65.2	65.4	71.2	71.4	83.5	83.9

L

Dimensions and Weights (CAL)



Generator Set Model	A: mm (in)	B: mm (in)	C: mm (in)	D: mm (in)	E: mm (in)	Weight: kg (lb)	Fuel Tank Fillable Capacity: l (US gal)
3 Phase Models							
F35-1	2291 (90.2)	1026 (40.4)	1426 (56.1)	800 (31.5)	1000 (39.4)	914 (2015)	145 (38.3)
F50-1	2291 (90.2)	1126 (44.3)	1526 (60.0)	800 (31.5)	1000 (39.4)	1100 (2425)	188 (49.7)
F72-1	2291 (90.2)	1126 (44.3)	1526 (60.0)	800 (31.5)	1000 (39.4)	1180 (2602)	188 (49.7)
F94-1	2761 (108.7)	1126 (44.3)	1535 (60.4)	800 (31.5)	1000 (39.4)	1450 (3196.7)	212 (56.0)
F125-1	3511 (138.2)	1126 (44.3)	1681 (66.2)	1015 (40.0)	1000 (39.4)	1812 (3994.8)	289 (76.3)

Weight with lube oil and coolant, no fuel.

FG Wilson manufactures product in the following locations:

Northern Ireland • Brazil • China • India • USA

With headquarters in Northern Ireland, FG Wilson operates through a Global Dealer Network.
To contact your local Sales Office please visit the FG Wilson website at www.FGWilson.com.

FG Wilson is a trading name of Caterpillar (NI) Limited.

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Ref: Ambassadors Theatre - London WC2

Details

Page : 1 of 2
Date : 23-07-2014
Quote: DW-77799-298218

External Dimensions (LxWxH): **2915 x 1824 x 1275 mm**

Nominal Capacity: **5000 Litres (1100 Gallons)**

Description

A1S11 5000 Litres One Piece GRP Cold Water Storage Tank	**Price**	**Quantity**	**Total**
Tank with cover, screened vent + 50mm insulation:		1	
Insulated Base:		Price on Request	
Drip Tray:		Price on Request	
Horizontal Split:		Price on Request	
Reinforced Base:		1	
AB Airgap:		Price on Request	
Across Divider:		Price on Request	
Along Divider		Price on Request	
A Range Tank Delivery		1	
DW Ballvalve Housing 700x600x350 (Add 350mm to height of tank above)		1	
Connections see next page for details		**Price Included**	

Total Cost

£2,586

Comments:
Vat Extra.
Tank insulated on top and sides

Issued by : **Brett Bolton**
Terms net 30 days subject to approval of credit facilities. Note: This quote is valid for 90 days.

Dewey Waters Ltd, Heritage Works, Winterstoke Road, Weston-Super-Mare, BS24 9AN
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Page : 2 of 2
Date : 23-07-2014
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Ancillary Items and Connections Included per Tank

Code	Description	Quantity
825313	Inlet - 1 1/4" Equilibrium Ball Valve + 10" Copper Float	1
900146	Outlet - 2 1/2" PVC Tank Connector (Male) DW-OP	1
821201	Warning pipe - 3/4" Screened Overflow - R30E	1
900025	Overflow - 2 1/2" Screened Overflow Assembly + Internal Elbow (Type16)	1
900142	Drain - 1" PVC Tank Connector (Male) DW-OP	1

Connection holes are not fitted

Notes.

1. Dewey Waters Ltd. Conditions of Sale apply, which are available upon request.
2. Tank must be installed and maintained strictly in accordance with Dewey Waters Ltd Installation and Maintenance Instructions, copies of same are available upon request.
3. The Tanks are to be placed in position by others
4. Tank / Cistern to be fully supported over its entire base on a support suitably designed and installed by others, capable of supporting the tank and its contents without deflection.
5. Price does not include for offloading components.
6. Liquidated and or ascertained damages are not applicable to this contract.
7. Water Tanks are not to be placed above water sensitive areas unless there is adequate bunding.
8. Subcontract orders will not be accepted on values less than £10,000.
9. Tanks to be placed on a base certified by others.
10. It is the customers responsibility to ensure that external ladders quoted are suitable.
11. Guardrailing may be necessary to Satisfy Health and Safety Regulations. The type of railing required is dependant on the tank height, distance from good ground level, access etc. Please confirm which guardrail arrangement is required so that we can make the necessary inclusion.
12. Unless otherwise stated standard delivery Monday - Friday is included between the hours of 8.00am to 4.30pm. Out of hours, weekend or timed deliveries will incur an additional charge on application.
13. VAT Extra. This quotation does not constitute an offer.

Certificate No: 135 : ISO 9001

Issued by : **Brett Bolton**
Terms net 30 days subject to approval of credit facilities. Note: This quote is valid for 90 days.

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APPENDIX E ELECTRICAL SUPPLY REPORT

AMBASSADOR'S THEATRE – POWER SUPPLY REPORT

1.0 INTRODUCTION

In order to establish the power supply intake and space requirements from the Regional Electricity Company (REC), Power Plan Solutions (PPS) approached UK Power Networks (UKPN) for an 'unofficial' heads up regarding what they will require on the site and obtain an order of cost.

This information was urgently required in order to progress the RIBA Stage D design co-ordination exercise between PPS and Richard Bragg Architects. This document provides a brief summary of items discussed and UKPNs requirements.

2.0 ESTIMATED MAXIMUM DEMAND FOR THE NEW EXPANDED THEATRE

The following Preliminary Electrical Maximum Demand (MD) load breakdown load was issued to UKPN.

	Area m2	ltg	total	sm pwr	total	Total load
Basement	238	10	2380	3	714	3094
Ground floor stalls area, stage and front entrance	792	20	15840	5	3960	19800
Circle area	470	15	7050	5	2350	9400
Upper circle area	218	15	3270	5	1090	4360
Roof	200	10	2000	3	600	2600
Stage lighting power	All in					40000
AC power	All in					160000
Stage electrics	All in					95000
Lifts	All in					30000
Façade and canopy lighting	All in					17000
Total kVA	**1918**		**30540**		**8714**	**381254**
					Amps/ph	**550.1501**

3.0 INITIAL SPACE PLANNING DISCUSSIONS HELD WITH BRAGG ARCHITECTS

Initial discussions with the architect highlighted physical space restrictions on all floors including the roof. Therefore regarding UKPNs elements of work and prior to making any contact with UKPN, PPS advised that:

1. It was unlikely that UKPN would provide a new 550A 3-phase Low Voltage (LV) supply for the new extend theatre as LV supplies are only provided for users of 200A 3phase supplies and under.
2. A new sub-station will therefore be required by UKPN. Normally they wanted this room positioned on the ground or basement level close to the adjacent street.

3. UKPN were likely to approve a new substation on the roof so long as it's Customer-Owned and that a small Medium Voltage (MV) UKPN switchroom is provided on the ground or basement level close to the adjacent street. This is identical to what has recently been installed at the Gielgud theatre.

In terms of size, the roof 500kVA (551A 3-phase) packaged substation would be around 4100x4000mm in size. If a separate MW switchroom was required by UKPN, this would be approximately 3.5 x 3.5m in size.

4.0 UKPN's ADVICE

Graham Crane, Project Designer for UKPN has advised PPS that:

a) UKPN would not provide that level of power demand at low voltage (LV) as it would impact on the exiting LV local network.

Note:
Any other LV power supply to the theatre would still involve the construction of a new UKPN LV sub-station either within the theatre itself (most likely option and at ground level/basement only) or if available - in an adjacent site. This is NOT normal practise by UKPN and as such will need to be first approved by UKPN and in the very unlikely event that it was approved, the cost would be very high and not cost-effective.

b) UKPN confirmed they no longer provide more than one power supply per building therefore there was no way we could ask for say 3no 200A LV 3-phase supplies.
c) The existing LV supplies feeding the building at the moment would not be upgraded to provide the additional power supply availability required.
d) UKPN would accept a rooftop substation so long as a 3.5x3.5mm MV switchroom is provided at ground floor level adjacent to the street. UKPN would consider locating the MV switchroom at basement level provided it is adjacent to the street however this would be subject to UKPN's approval and requirements for access and maintenance.

5.0 BUDGET COST

UKPN has confirmed that the order of cost for the new MV ring and Ring main Unit to the site will be approximately £100,000. This includes all the external ground works, cabling and RNU. It does not include the substation and customer MV cabling from the MV switchroom to the substation.

6.0 CONCLUSION

As confirmed by UKPN a new customer owned 4x4m2 packaged substation will be required on the roof. A new 3.5x3.5m2 MV switchroom will be required on the ground floor or basement area ideally close to the junction between West Street and Tower Street.