ÆssenseGrows

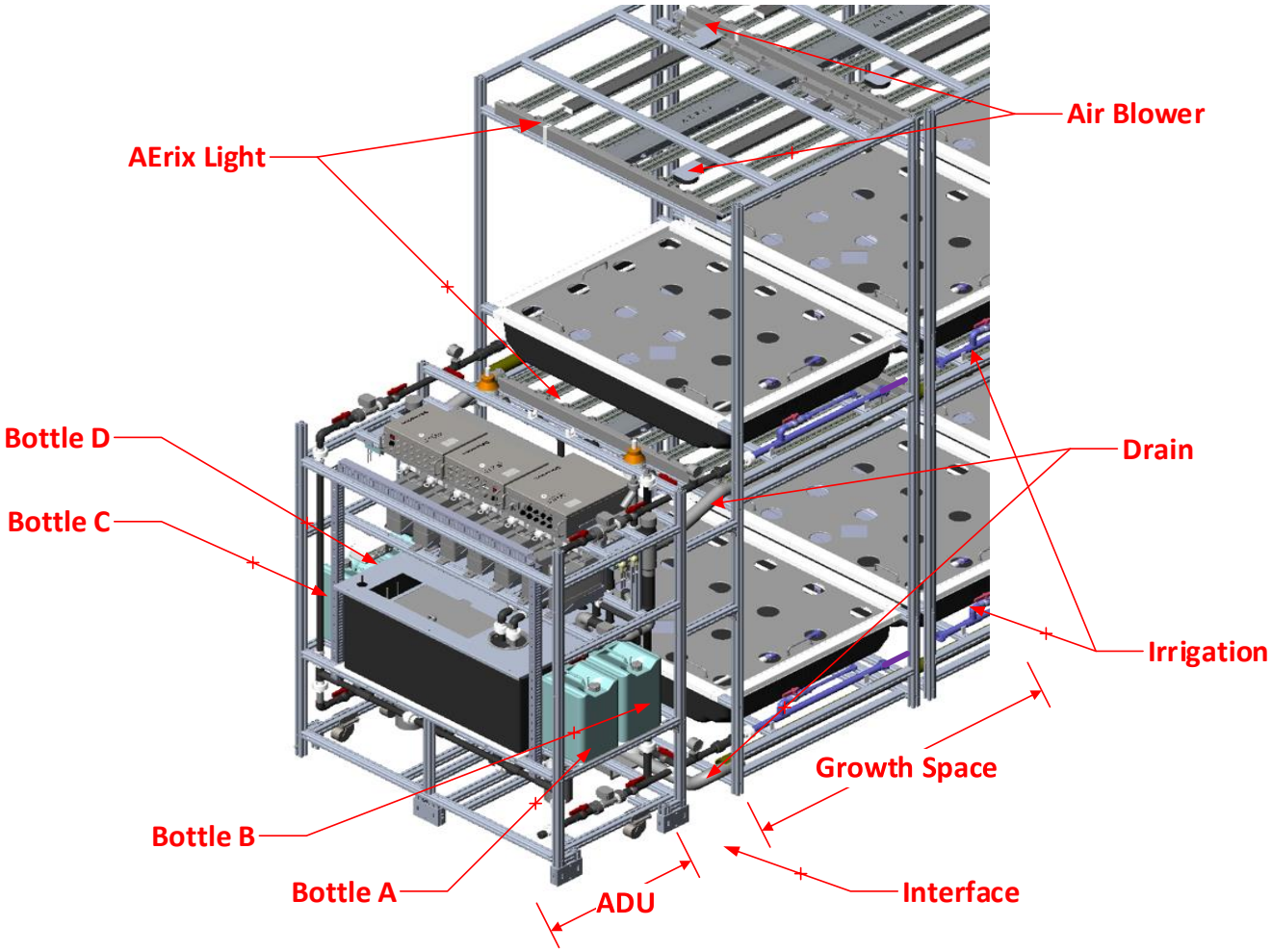
Ætrium-4 Double-Deck

Data Sheet 10/2019

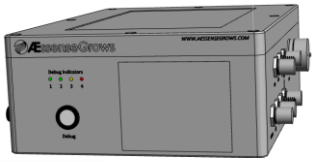
Ætrium-4 Double Deck Components

The Ætrium Dosing Unit (**ADU**) is the main engine of the Ætrium-4 Double-Deck. Using our Guardian Grow Manager (GGM) as its main interface, it controls all water, air, and electrical operations

Plants are cultivated in the **Growth Space**. This is where the grow tubs with the spray manifold system are located. The Growth Space can be configured to have 16, 20 or 24 tubs. Each grow tub can support up to 20 plants. Each tub is illuminated by one AErix LED light.

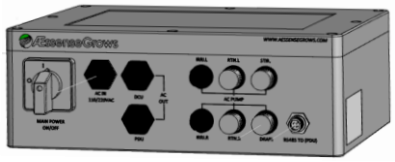


Power Distribution Unit (PDU)



The **PDU** links the AEtrium Dosing Unit (ADU) either wirelessly via an Access Point or via an ethernet connection to the server that runs the Guardian™ Grow Manager. It directly controls the Dosing Module, the ACU, the DCU, the WSE, the ASD, and the SPDUs in the Growth Space.

AC Relay Controller (ACU)



The **ACU** contains all AC relays that enable the Irrigation Pumps and Return Water Pump.

DC Relay Controller (DCU)

The **DCU** contains all DC relays that enable the 24V Valves.

Irrigation Pumps

The two Irrigation Pumps move water from the Reservoir through the pipes to the manifold spray heads in the Growth Space. They alternate their duty cycle and provide complete redundancy in case of failure. Each pump has a Sediment Filter attached to it. The pumps operate in an alternating manner.

Return Water Pump

The Return Water Pump moves water from the grow trays in the Growth Space back to the Reservoir.

Dosing Module

Driven by Guardian™ Grow Manager the Dosing Module adds a programmed ratio of fertilizer and amendments to the water in the Reservoir. It consists of Dosing Bottles and Peristaltic Doser Pumps controlled by Stepper Motor (doser) Controllers (**SMC**).

Reservoir

The Reservoir is the storage tank for nutrient rich water circulated through the Growth Space. To maintain optimal conditions of the nutrient solution to support healthy roots, a chiller is required to manage and control temperature. Each A4DD is supplied with a standard stainless steel loop so that user supplied chilled liquid can cool the reservoir. A solenoid controls the reservoir temperature to ideal temperatures driven by the Guardian Grow Manager.

Valves

The automatically controlled 24 VDC valves enable individual irrigation patterns for each layer in the Growth Space. The Pressure Relief Valves (**PRV**) are manually adjustable diaphragm valves for fine tuning pressure under the growth trays. The Manual Valves can be used to shut off water to certain parts of the Growth Space during servicing.

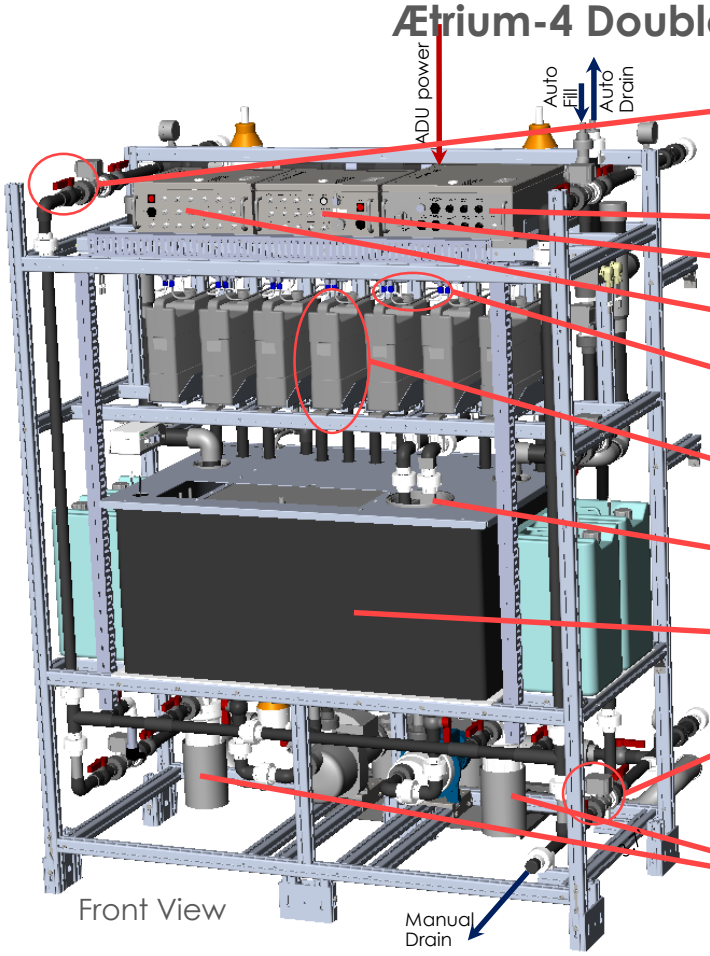
Sensors

The Water Pressure Sensors (**WTP**), the Water Sensing Module (**WSE**), and the AEtrium System Detector (**ASD**) provide accurate feedback to the Guardian™ Grow Manager on water pressure, level, pH, water temperature, electrical conductivity, air temperature, relative humidity, CO_2 level, and light intensity (ON/OFF).

Backup Power

In areas where one could suffer from loss of mains power it is highly recommended that the ADU be supplied with power from a backup source to assure that the plants continue to get fertigated. The control network, and its components, should also be on backup power.

Ætrium-4 Double Deck ADU Components



Front View

Manual shutoff valve

ACU

PDU

DCU

SMC and Peristaltic Doser Pump

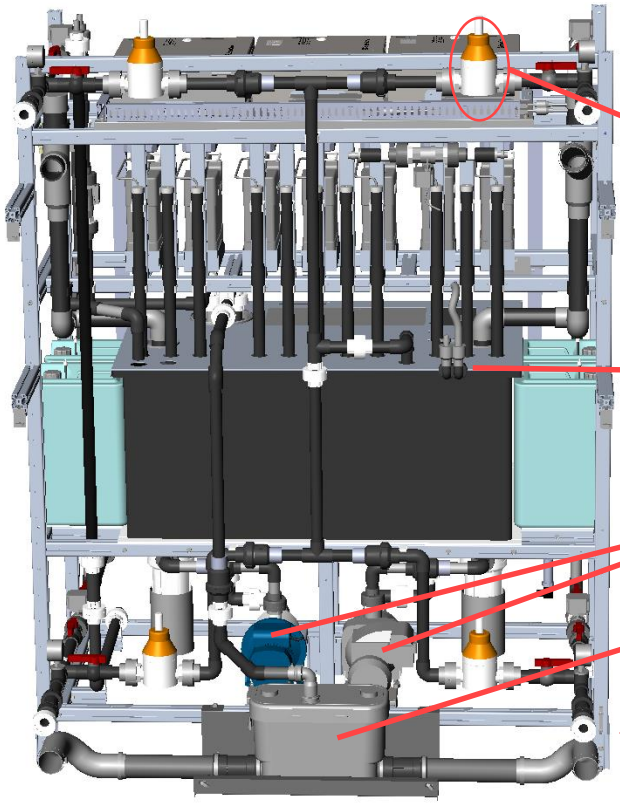
Dosing Bottle with weight scale

Return Water Filter

Reservoir

24V Valve

Sediment Filters



Rear View from Behind

Adjustable PRV

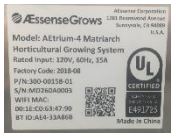
Chilling loop connection

Irrigation Pumps

Return Water Pump

A4DD ADU Specifications

Description	Min	Typical	Max
ADU input voltage	100 V_{AC}	–	240 V_{AC}
ADU input frequency	47 Hz	–	63 Hz
ADU power draw	–	1400W	–
Return Water Pump input voltage (US)	114 V_{AC}	–	126 V_{AC}
Return Water Pump Input frequency (US) [1]	–	60 Hz	–
Return Water Pump power draw (US)	–	500W	–
Operating temperature	34 °F (1 °C)	–	104 °F (40 °C)
Storage temperature	-22 °F (-30 °C)	–	176 °F (80 °C)
UL/CSA Certification		reference E491725	



Description	Value
Water temperature	Range: 32-122°F (0-50°C) Resolution: 1°F (0.1°C)
Water pH	Range: 0-14 pH Resolution: 0.01 pH
Water Electrical Conductivity (EC)	Range: 10 µS/cm – 30 mS/cm
Irrigation Pump max flow rate	15.8 gal/min (60 lpm)
# of Irrigation Pumps	2
Return Water Pump max flow rate	18 gal/min (68 lpm)
# of Return Water Pumps	1
# of Dosing Pumps	11
Sediment Filters (2)	
Material	Polypropylene frame 304 Stainless mesh
Size	80 mesh (0.18mm)
Sediment Filter dimensions (L x W x H)	7.1" x 7.1" x 32.3" (180 mm x 180 mm x 820 mm)
Return Water Filter	
Material:	Polypropylene frame Polyamide mesh
Size	60 mesh (0.25mm)

Description	Value
Automatic Drain pump: the ADU can automatically complete a change out of the fertigation solution	
Max. drain pumping height	14.7' (4.5 m)
Flow rate	1.7 gal/min (6.4 lpm)
Connection Hose Barb (uses 5/8" garden hose)	5/8" OD (16mm OD)
Automatic Water Fill: the ADU automatically senses water level and will add water using a provided solenoid when water levels slip below allowable levels	
Flow/pressure	30-50psi @2.2gpm (2-3bar, 8.3lpm)
Connection Hose Barb (uses 5/8" garden hose)	5/8" OD (16mm OD)
Reservoir Capacity	80 gal (302 L)
Reservoir Cooling Coil: included, user must supplied chilled liquid	
Coil Material	304 Stainless Steel
Coil Length	25' (7600mm)
Coil Diameter	10" (250mm)
Coil Connection Hose Barb	5/8" OD (16mm OD)
Dosing Bottle capacity	7x 1.06 gal (4 L) 4x 5 gal (20 L)
# of Dosing Bottles	11
# of 24V Valves	8
# of Pressure Relief Valves	4
# of Manual Valves	20
ADU dimensions (L x W x H)	41.9"x61.5"x81.8" (1062 mm x 1560 mm x 2077 mm)
ADU dry weight	574 lbs (260 kg)

A4DD Shared Specs

Description	Min	Typ	Max
Recommended Ceiling Height	14' (4267mm)	16' (4877mm)	Unlimited
Offset from walls (front back sides)	30" (762mm)	36" (914mm)	Unlimited
Grow tray dimensions (inner) (L x W)		51" x 38" (1300 mm x 970 mm)	
Grow tray dimensions (outer) (L x W)		56" x 43" (1420 mm x 1090 mm)	
Grow tray area		16.7 sqft (1.55 m^2)	
Max. plant count per tray		20	
Maximum grow height		48" (1219mm)	
Top tray height off of ground		91.5" (2324mm)	

Carriage:

- Carriage is included with all A4DD orders
- Carriage is moved manually with wheel at the doser end
- Carriage rides on low profile rails permanently attached on top of the floor
- Floor must not be more than ¼" out of level over 10'

16-Tub A4DD Specs

Description	Min	Typ	Max
Average daytime wattage [1,2]	–	11,200 W	11,680 W
Peak hourly heat output [1,2]	–	39,289 BTU/h	–
Total daily energy consumption [1,2,3]	–	180 kWh	190 kWh
Total daily heat generation [1,2,3]	–	379,000 BTU	–
Average daily water consumption (2-3 gal./day/tub)	32 gal. (121L)		48 gal. (182L)
Square Feet of Canopy		267 ft^2 (24.8M^2)	
# of AErix LED Lights		16	
A4DD dimensions on carriage (L x W x H)		429" x 63.4" x 144" (1-0-7 mm x 1570 mm x 3653 mm)	
A4DD dry weight		3571 lbs (1620 kg)	

20-Tub A4DD Specs

Description	Min	Typ	Max
Average daytime wattage [1,2]	–	14,000 W	14,600 W
Peak hourly heat output [1,2]	–	49,100 BTU/h	–
Total daily energy consumption [1,2,3]	–	224 kWh	234 kWh
Total daily heat generation [1,2,3]	–	630,000 BTU	–
Average daily water consumption (2-3 gal./day/tub)	40 gal. (151L)		60 gal. (227L)
Square Feet of Canopy		334 ft^2 (31 M^2)	
# of AErix LED Lights		20	
A4DD dimensions on carriage (L x W x H)		519" x 63.4" x 144" (13177 mm x 1570 mm x 3652 mm)	
A4DD dry weight		4321 lbs (1960 kg)	

24-Tub A4DD Specs

Description	Min	Typ	Max
Average daytime wattage [1,2]	–	16,800 W	17,520 W
Peak hourly heat output [1,2]	–	58,920 BTU/h	–
Total daily energy consumption [3,4]	–	270 kWh	280 kWh
Total daily heat generation [1,2,3]	–	942,720 BTU	–
Average daily water consumption (2-3 gal./day/tub)	48 gal. (181L)		72 gal. (273L)
Square Feet of Canopy		401 ft^2 (37 M^2)	
# of AErix LED Lights		24	
A4DD dimensions on carriage (L x W x H)		608" x 63.4" x 144" (15447 mm x 1570 mm x 3652 mm)	
A4DD dry weight		5070 lbs (2300 kg)	

1. @ 100% light intensity with all fans running
2. ADU @ 208 V_{AC}, Return Water Pump @ 120 V_{AC}
3. Both layers irrigated in a round robin manner without pause, fans on 24 hours, lights on 12 hours, lights off 12 hours, 208 V_{AC} input to ADU and SPDUs, 110 V_{AC} input to Return Water Pump
4. Average Photosynthetically Active Photon Flux Density (PPFD) over each grow tub at 100% intensity

AErix LBR003 Specifications

Description	Min	Max
Input Voltage	100 V_{AC}	277 V_{AC}
Input Frequency	50 Hz	60 Hz
AC Power Draw [1]	680 W	730 W
Heat Output [1]	2,320 BTU/h	2,455 BTU/h
Operating Temperature	-4 °F (-20 °C)	104 °F (40 °C)
Storage Temperature	-40 °F (-40 °C)	140 °F (60 °C)
Power factor	0.95	–
Dimming	0% / 20%	100%
PPF	0 µmol/s	1,550 µmol/s

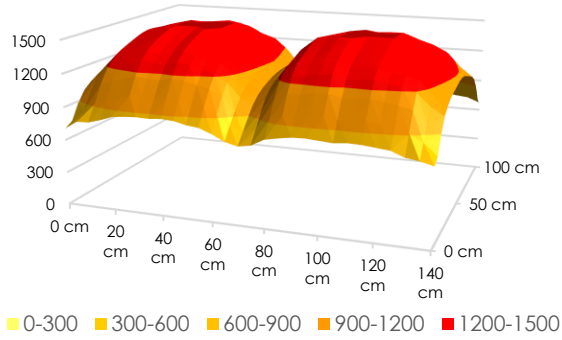
Description	Value
Avg. grouped PPFD at 12" [1, 2]	1,130 µmol/s/m^2
Avg. grouped PPFD at 20" [1, 2]	950 µmol/s/m^2
Avg. single PPFD at 6" [1, 3]	800 µmol/s/m^2
Avg. single PPFD at 12" [1, 3]	530 µmol/s/m^2
Light Uniformity at 20" [1, 4]	0.87
Light Variation (CV) at 20" [1, 5]	4%
Comm. Interface	AES Link [6]
Dimensions (L x W x H)	52" x 42" x 2.5" (1328 mm x 1083 mm x 64 mm)
Weight	46 lbs. (21 kg)
Ingress Protection	IP65
L70 Rating [7]	180,000 hrs.
L90 Rating [8]	58,000 hrs.
UL 1598 Location Rating	Damp
ETL Certification [9]	UL 1598, UL 8750, UL 8800 CSA C22.2 No. 250.0-08 CSA C22.2 No. 250.13-14 IEC 62471
Warranty	5-year standard
Package Dimensions (L x W x H)	55" x 18" x 9" (1400 mm x 460 mm x 230 mm)
Package Weight	56 lbs. (25.5 kg)

1. At 100% light intensity
2. Average Photosynthetically Active Photon Flux Density (PPFD) over the AEtrium-4 grow tray (40"x50") in a typical large-scale cultivation setup, measured with adjacent grow lights of the same type
3. Average Photosynthetically Active Photon Flux Density (PPFD) over the AEtrium-4 grow tray (40"x50") in a typical evaluation setup, measured with no adjacent grow lights, no reflective walls
4. Uniformity expressed as the ratio of the lowest PPFD value and the average over a 40"x50" grow tray (100% intensity, measured with adjacent lights of the same type)
5. Coefficient of Variation over a 40"x50" grow tray (100% intensity, measured with adjacent lights of the same type); lower values represent more uniform light
6. Wired communication protocol used in the AEtrium System
7. Hours of normal operation before 30% degradation in maximum light intensity
8. Hours of normal operation before 10% degradation in maximum light intensity
9. ETL Control Number: 5013160

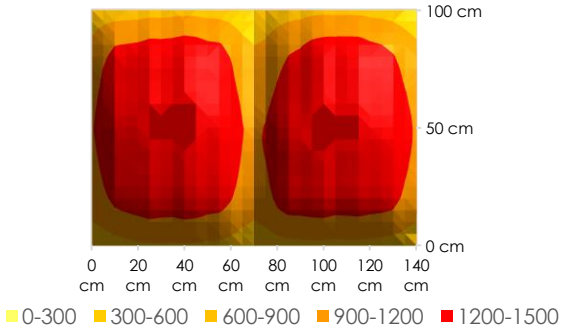
Grouped Photon Flux Distribution [1]

Measured at 100% light intensity with grow light centrally mounted at pre-determined height above a 40"x50" grow area, with adjacent illuminated grow areas (typical large scale cultivation).

PPFD (µmol/s/m²) @ 6"

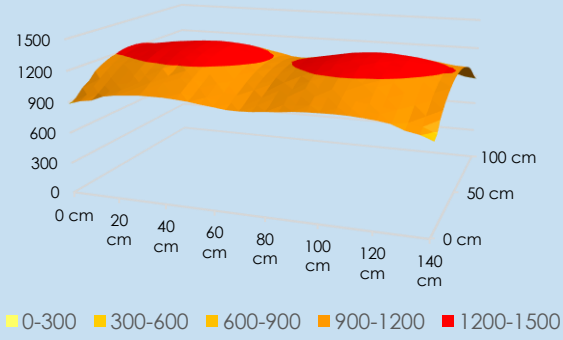


PPFD (µmol/s/m²) @ 6"



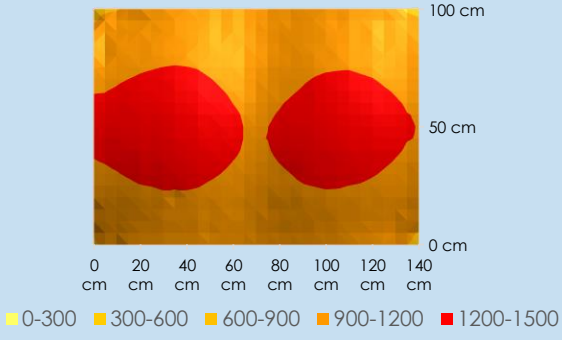
RECOMMENDED INSTALLATION HEIGHT

PPFD (µmol/s/m²) @ 12"



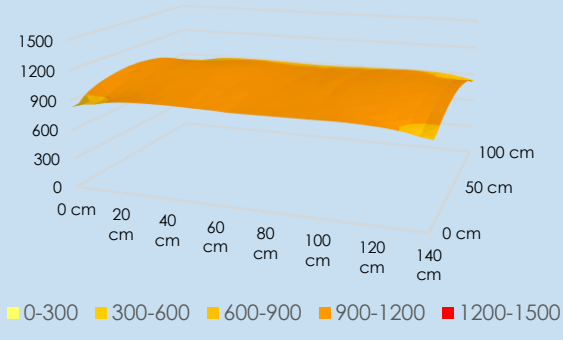
RECOMMENDED INSTALLATION HEIGHT

PPFD (µmol/s/m²) @ 12"



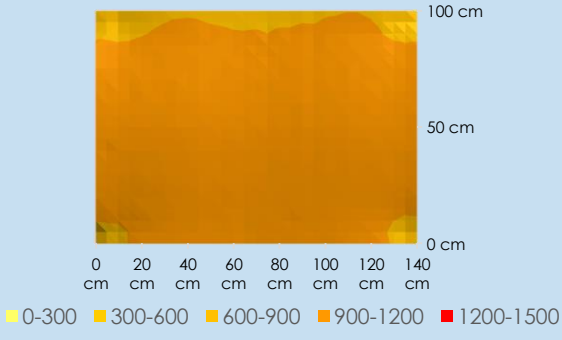
RECOMMENDED INSTALLATION HEIGHT

PPFD (µmol/s/m²) @ 20"



RECOMMENDED INSTALLATION HEIGHT

PPFD (µmol/s/m²) @ 20"

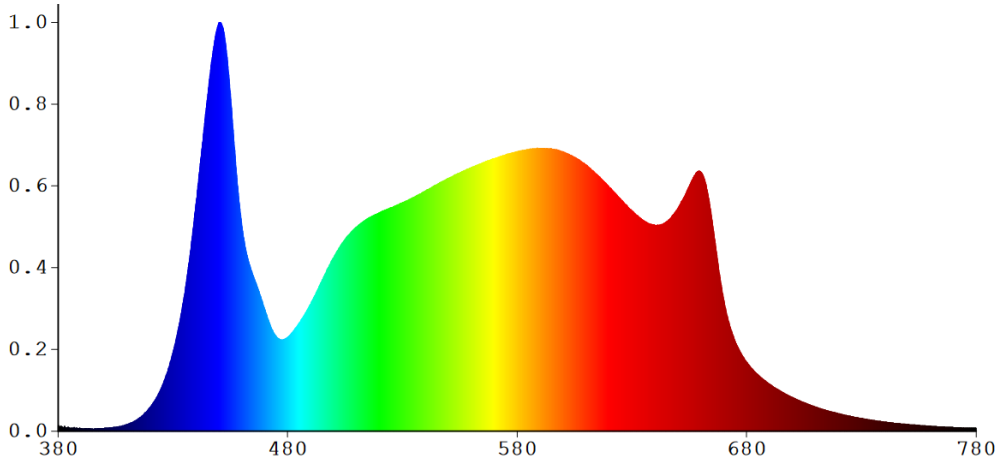


1. Average Photosynthetically Active Photon Flux Density (PPFD)

Light Intensity Characterization [1]

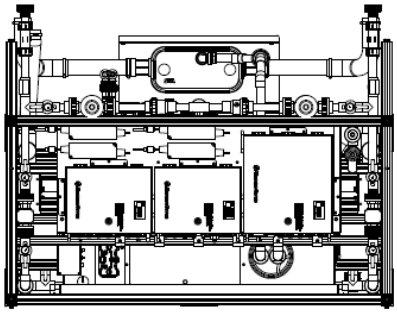
Guardian™ Setting [2]	Wattage	Heat Output	Light Output (PPF)	Efficacy	Light Intensity [3] (PPFD, large grow)	Light Intensity [4] (PPFD, eval. grow)
0%	10 W	34 BTU/h	0 µmol/s	NA	0 µmol/s/m^2	0 µmol/s/m^2
20%	110 W	375 BTU/h	268 µmol/s	2.44 µmol/J	195 µmol/s/m^2	135 µmol/s/m^2
30%	183 W	624 BTU/h	456 µmol/s	2.49 µmol/J	330 µmol/s/m^2	235 µmol/s/m^2
40%	254 W	866 BTU/h	629 µmol/s	2.48 µmol/J	455 µmol/s/m^2	320 µmol/s/m^2
50%	325 W	1,108 BTU/h	787 µmol/s	2.42 µmol/J	570 µmol/s/m^2	405 µmol/s/m^2
60%	395 W	1,347 BTU/h	941 µmol/s	2.38 µmol/J	685 µmol/s/m^2	485 µmol/s/m^2
70%	467 W	1,592 BTU/h	1,091 µmol/s	2.34 µmol/J	795 µmol/s/m^2	560 µmol/s/m^2
80%	543 W	1,851 BTU/h	1,245 µmol/s	2.29 µmol/J	905 µmol/s/m^2	640 µmol/s/m^2
90%	624 W	2,128 BTU/h	1,410 µmol/s	2.26 µmol/J	1,025 µmol/s/m^2	725 µmol/s/m^2
100%	691 W	2,355 BTU/h	1,550 µmol/s	2.24 µmol/J	1,130 µmol/s/m^2	800 µmol/s/m^2

Spectrum

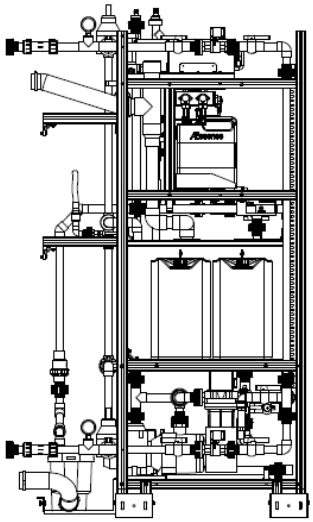


1. Tested at 230V/50Hz
2. Light Intensity Setting in the Guardian™ Grow Manager
3. Average Photosynthetically Active Photon Flux Density (PPFD) over the plant canopy in the AEtrium-4 grow tray (40"x50") in a typical large-scale cultivation setup, measured at 12" mounting height over the canopy level with adjacent grow lights of the same type
4. Average Photosynthetically Active Photon Flux Density (PPFD) over the plant canopy in the AEtrium-4 grow tray (40"x50") in a typical evaluation grow setup, measured at 6" mounting height over the canopy level with no adjacent grow lights or reflective walls

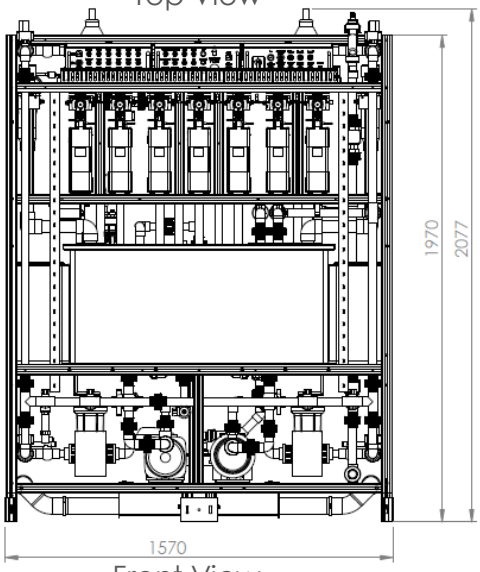
A4DD ADU Mechanical Design



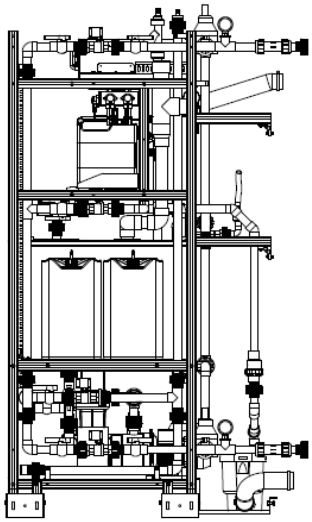
Top View



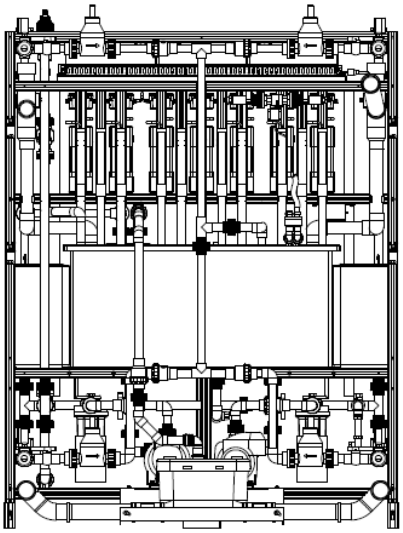
Left Side View



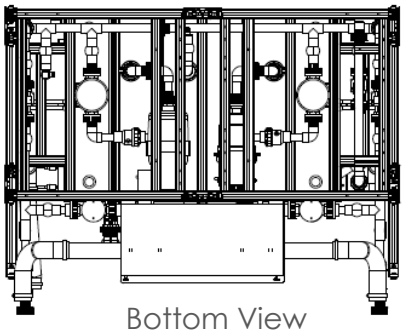
Front View



Right Side View

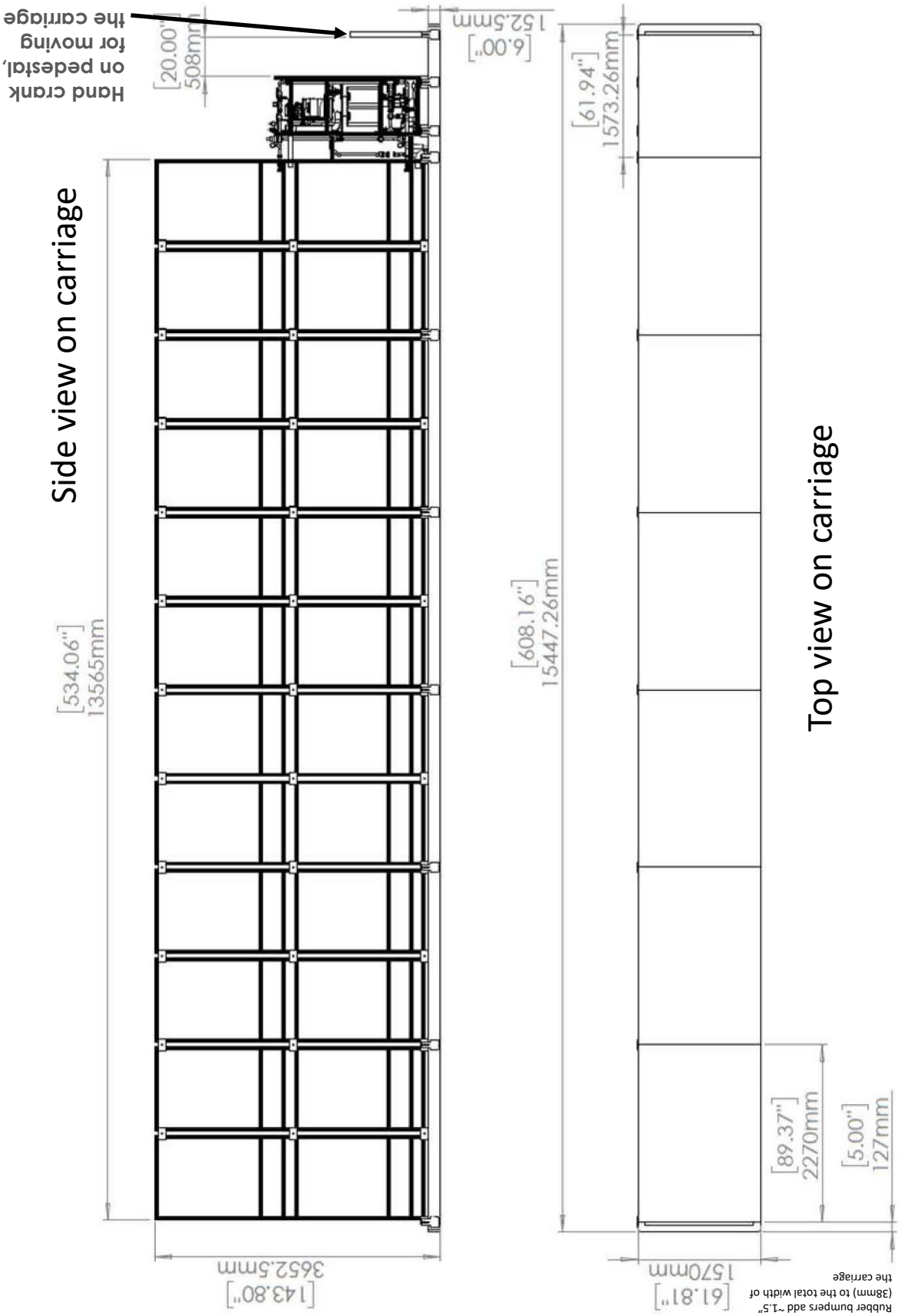


Rear View

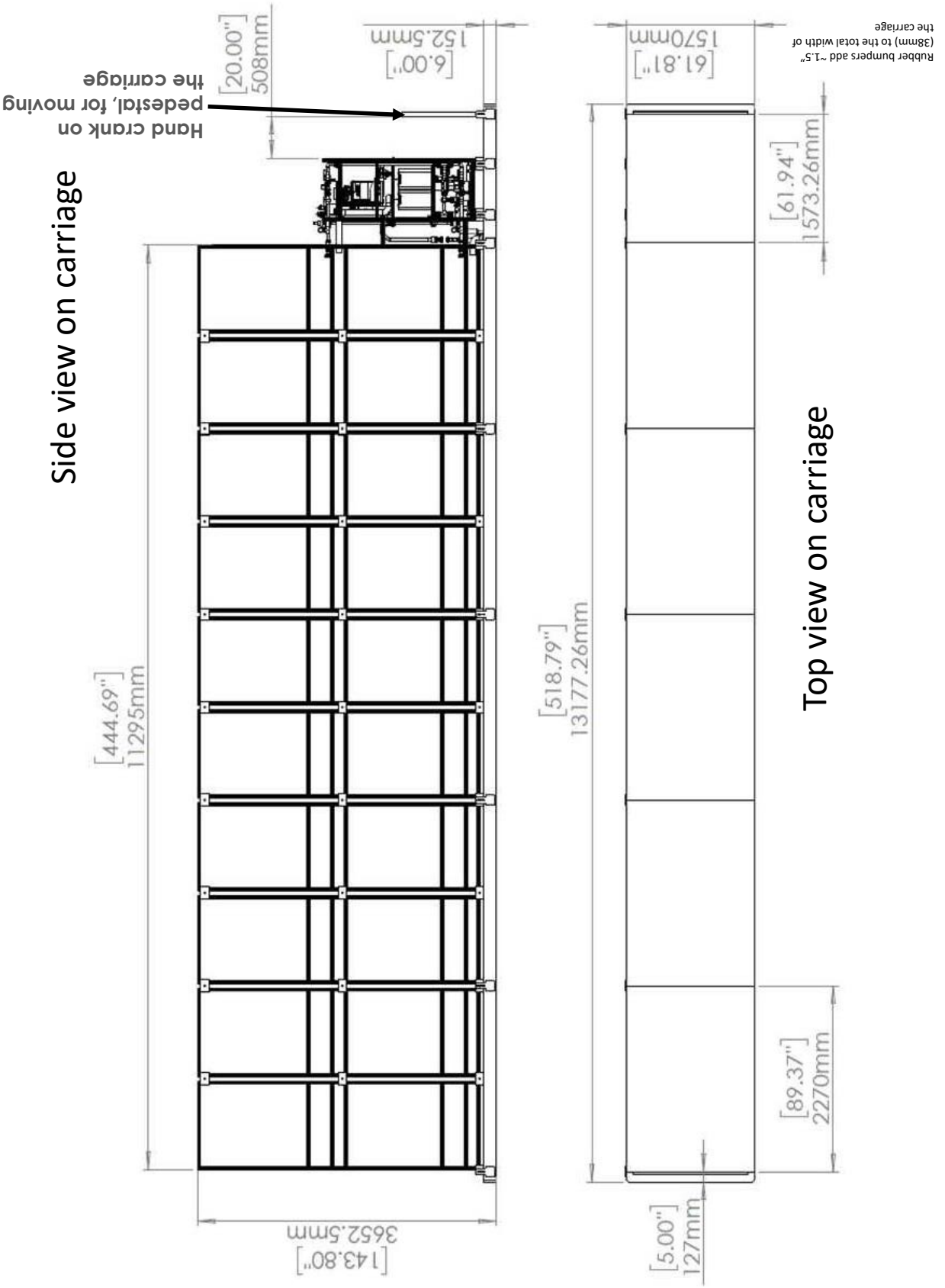


Bottom View

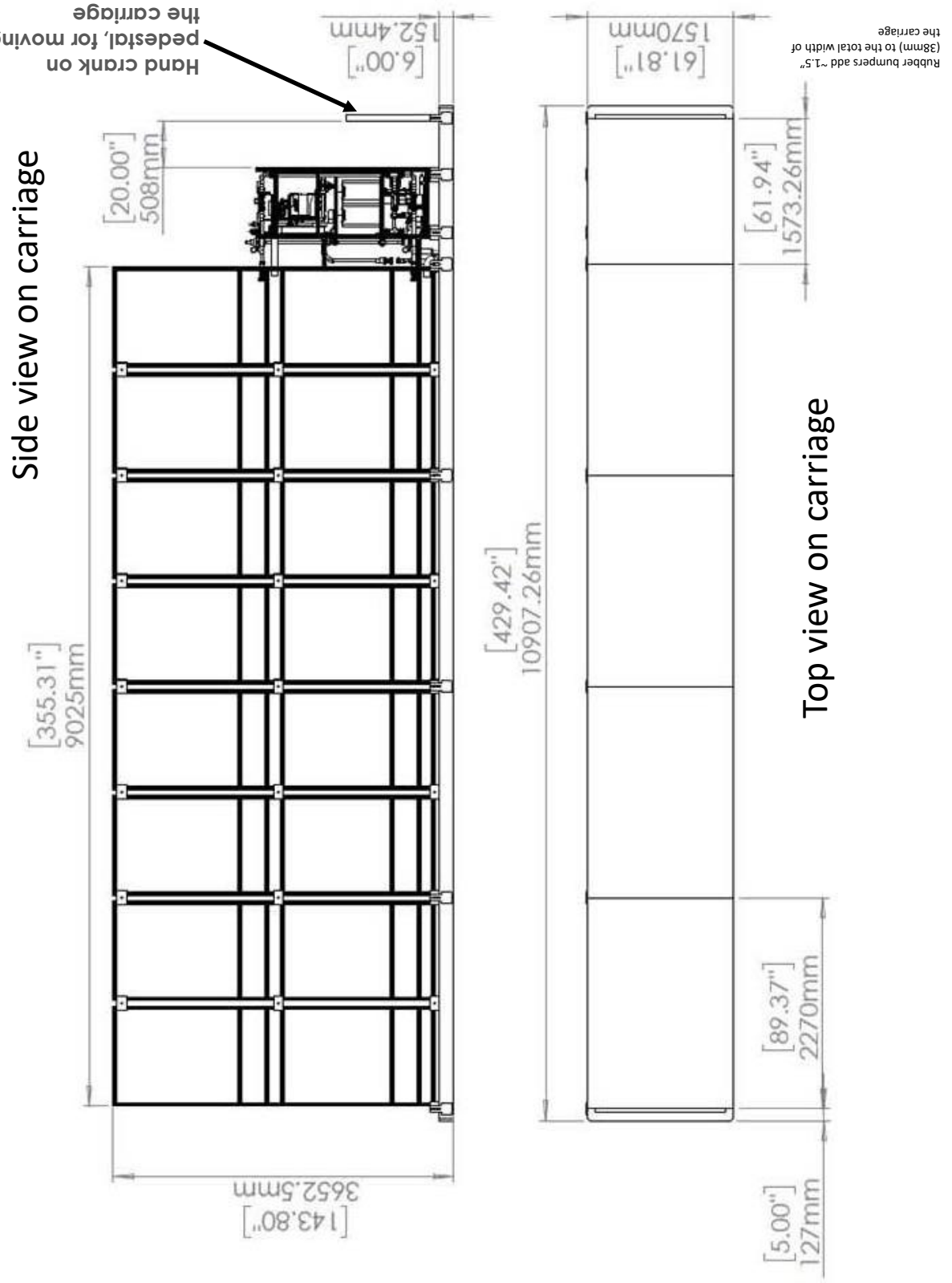
24-Tub *Ætrium-4 Double-Deck Mechanical Design*



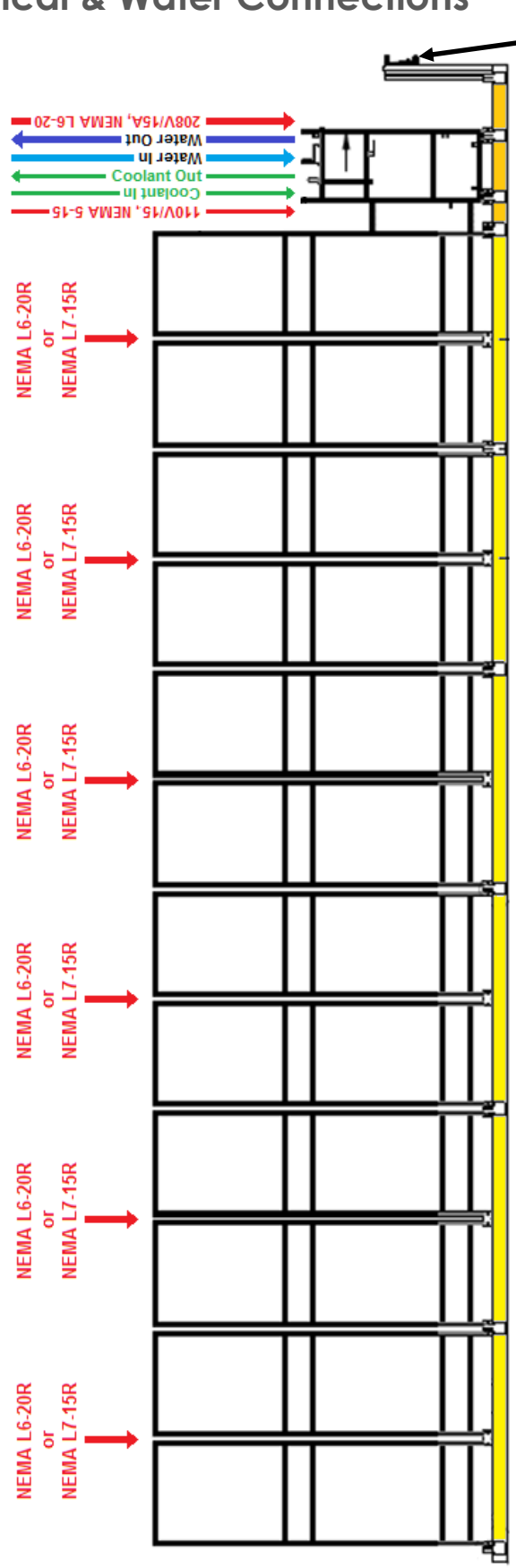
20-Tub Ætrium-4 Double-Deck Mechanical Design



16-Tub Ætrium-4 Double-Deck Mechanical Design

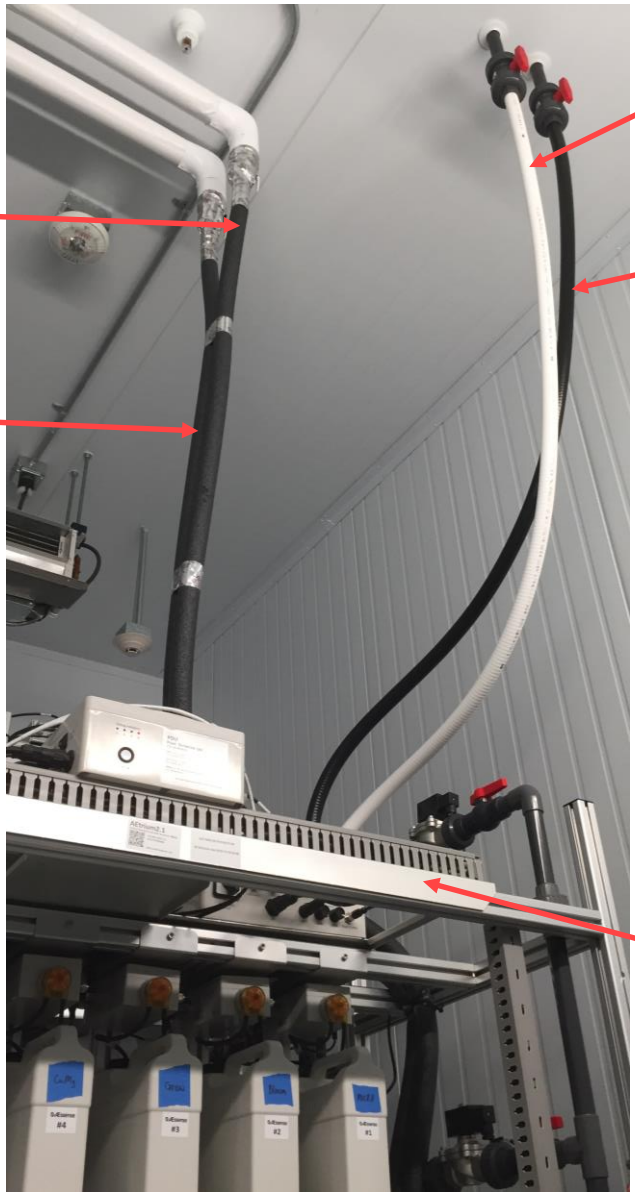


4DD Electrical & Water Connections



Side view on carriage

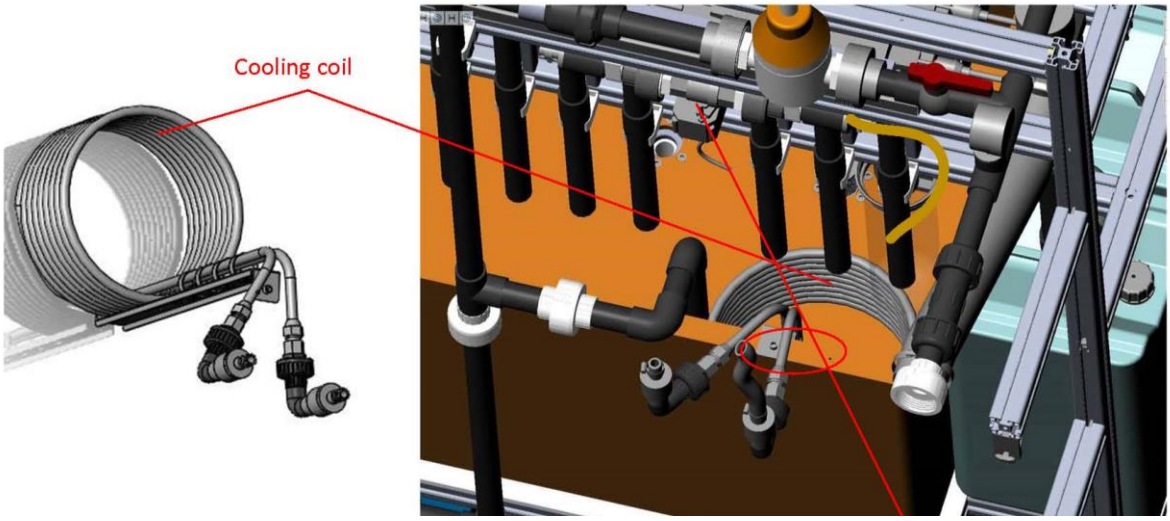
- PDU – 208V/60Hz/20A (NEMA L6-20P)
- Return Pump – 110V/60Hz/15A (NEMA 5-15P)
- Every 4 tub/Aerix
  - 208V/60Hz/20A (NEMA L6-20P)
  - or 277V/60Hz/15A (NEMA L7-15P)
- Flexible piping for water autofill and water drain
- Flexible piping for coolant
- Flexible piping should allow for at least 36" (1m) of side to side movement

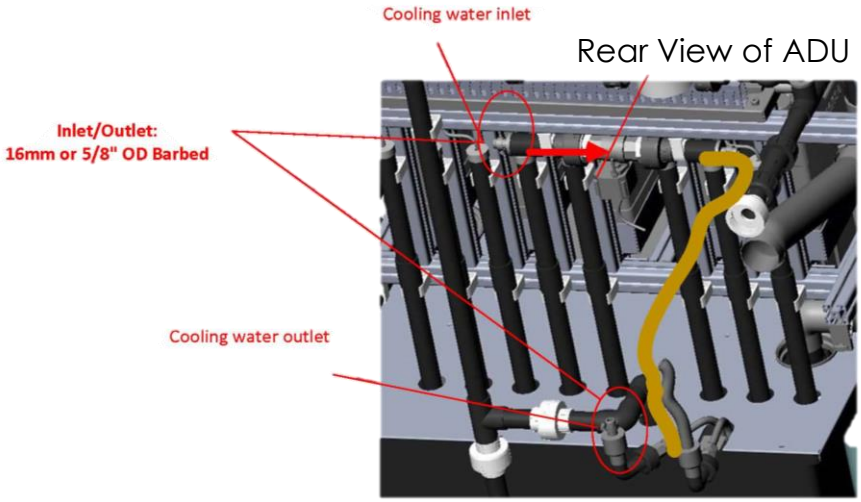


- Flexible lines allow the A4DD rows to move
- Lines should be long enough to allow carriage to move at least 36" (914mm)

Stainless Steel Cooling Coil installed in reservoir

Rear View of Reservoir





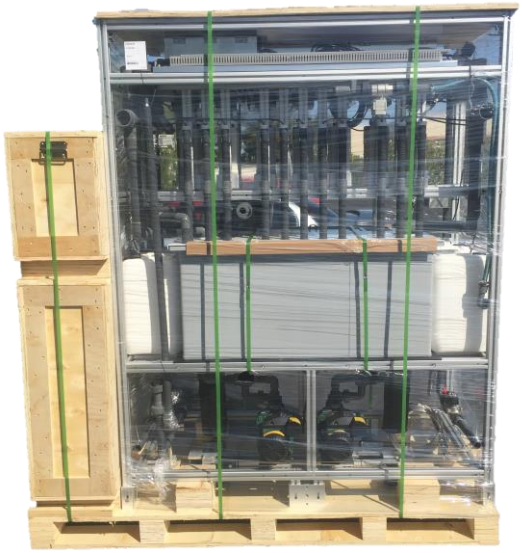
Typical Ætrium-4 Double-Deck Shipping Configuration

Major Ætrium-2.1 components	Dimensions (L x W x H)	Weight
ADU on pallet	77" x 33.5" x 84" (1950 x 850x 2130mm)	705 lbs (320 kg)
ADU off of pallet (shipping configuration)	61.5" x 31.25" x 77.5" (1560 x 794 x 1969mm)	
Growth Space Module (with top layer broken down) on pallet	62.251" x 43.31" x 100.1" (1580x 1100 x 2565mm)	492 lbs (223 kg)
Growth Space Module (with top layer broken down) off pallet	61.42" x 42.52" x 95.08" (1560 x 1080 x 2415mm)	

Ætrium-4 Double-Deck Shipping and installation

The ADU ships on a pallet and each of the Growth Space modules ship on a pallet. A 24 tub unit ships on 13 pallets, one for the ADU and 12for the grow space modules. It is recommended to unload the A4DD components from their pallets using a forklift. Once unloaded from the pallets the ADU and growth space modules are best moved using a forklift as they do not include casters (because they will be mounted on moving carriages).

- **Door size for installation:** Grow room doors are recommended to be a double door that is wide enough and tall enough to accommodate a forklift. Typically this represents a double door at least 6' (1829mm) wide by 8' (2438mm) tall.
- **Forklift Required:** A forklift will be required for assembly onto the carriage and for lifting up the second deck



ADU and piping accessories in crate on pallet

One Growth Space Module on pallet

Contact Information

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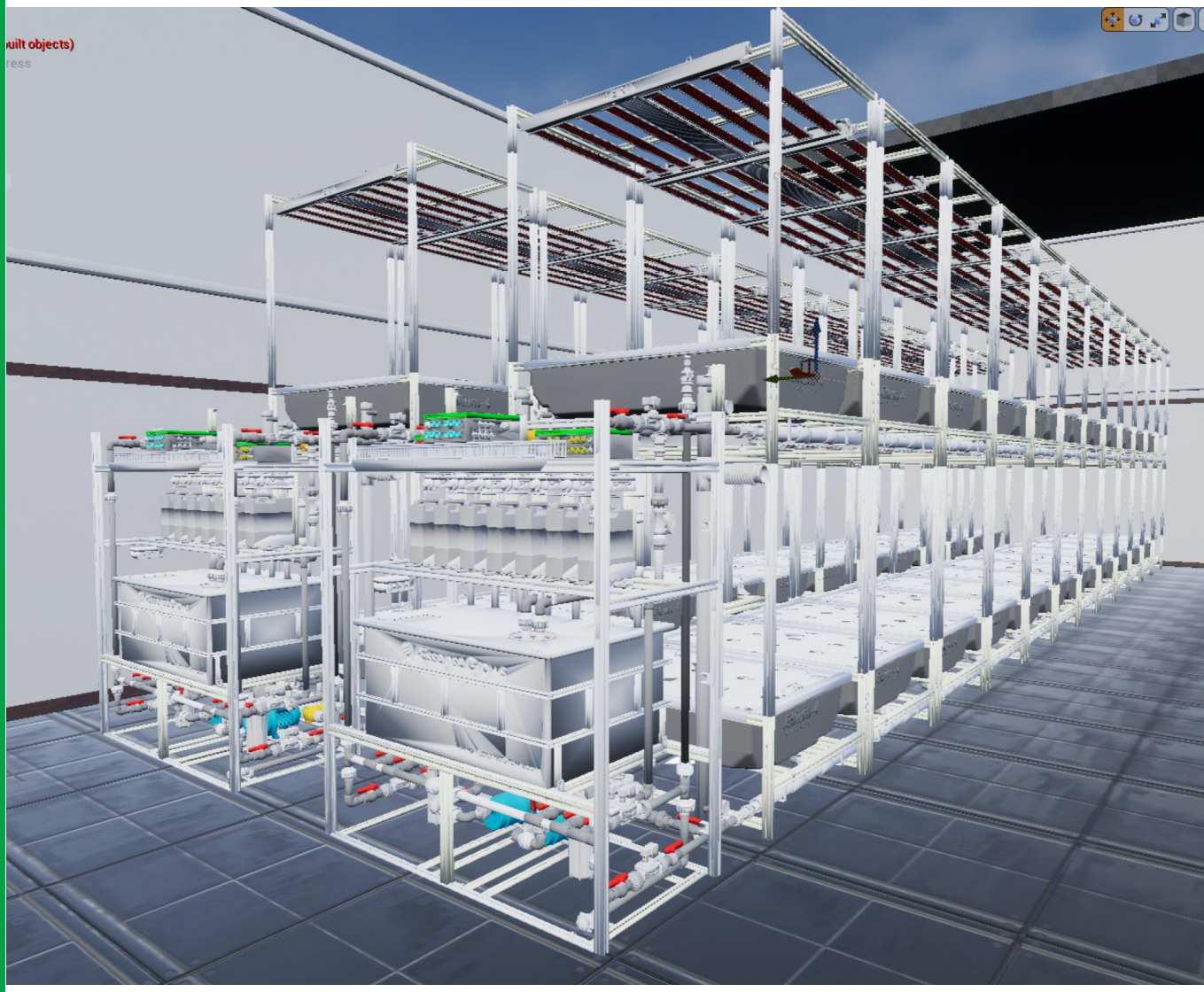

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