



Ætrium-4 Double-Deck

Data Sheet 4/2022

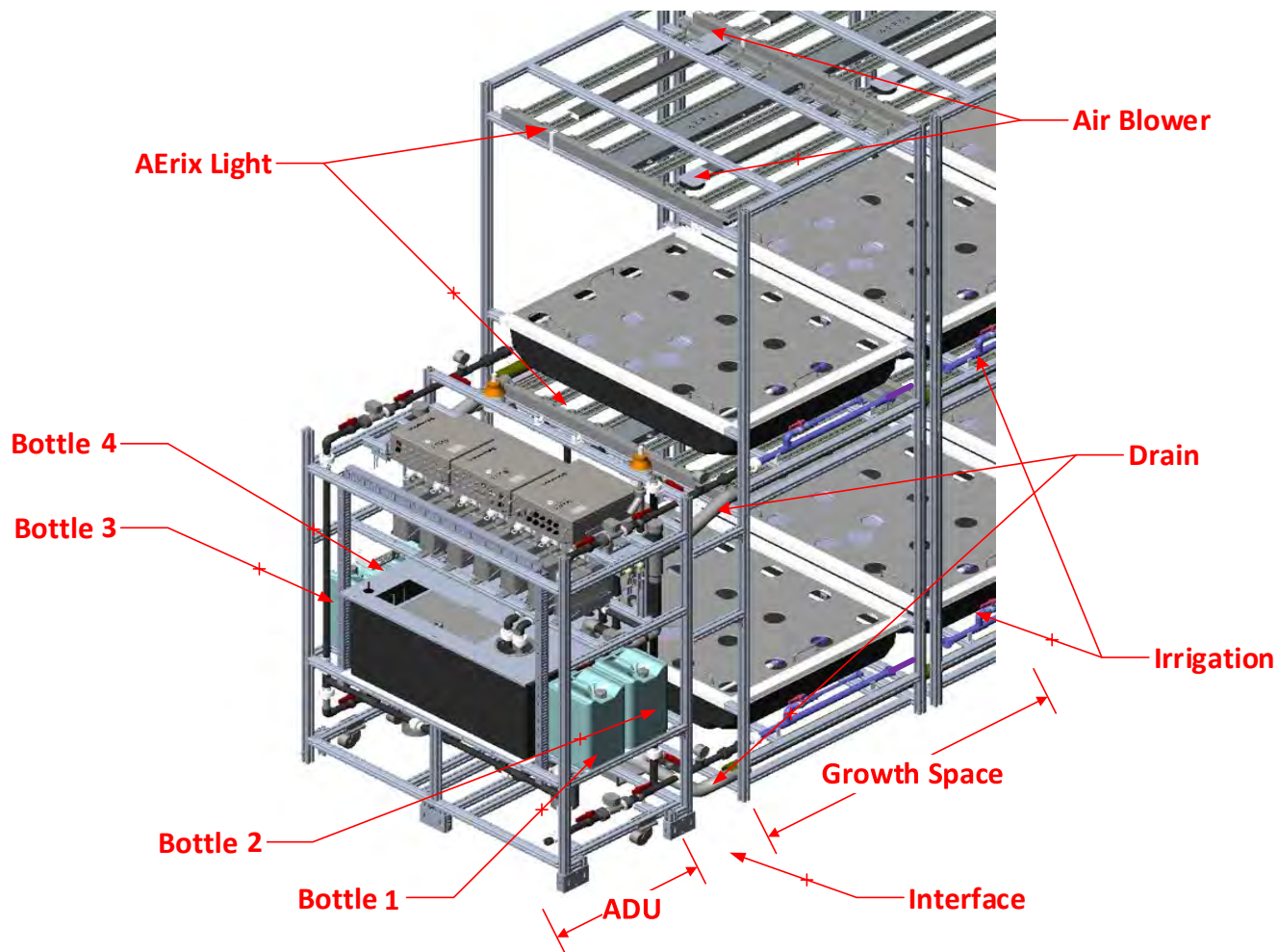
The Ætrium-4 Double Deck

The Ætrium-4 Double-Deck (A4DD) is a vertical blooming product that is part of the Ætrium System. After cloning and vegging in an Ætrium-2.1 the 12" (30cm) tall fully vegged plants can get transplanted into the A4DD to complete their blooming cycle.

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 in two levels. Each grow tub can support up to 20 plants. Each tub is illuminated by one Ærix LED light.



Power Distribution Unit (PDU)

The PDU links the Atrium Dosing Unit (ADU) either wirelessly via an Access Point or via an ethernet connection to the server that runs the GGM. 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.

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 GGM the Dosing Module adds a grower determined 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 heat exchanger loop so that user supplied chilled water 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. Manual Valves can be used to shut off water to certain parts of the Growth Space during servicing.

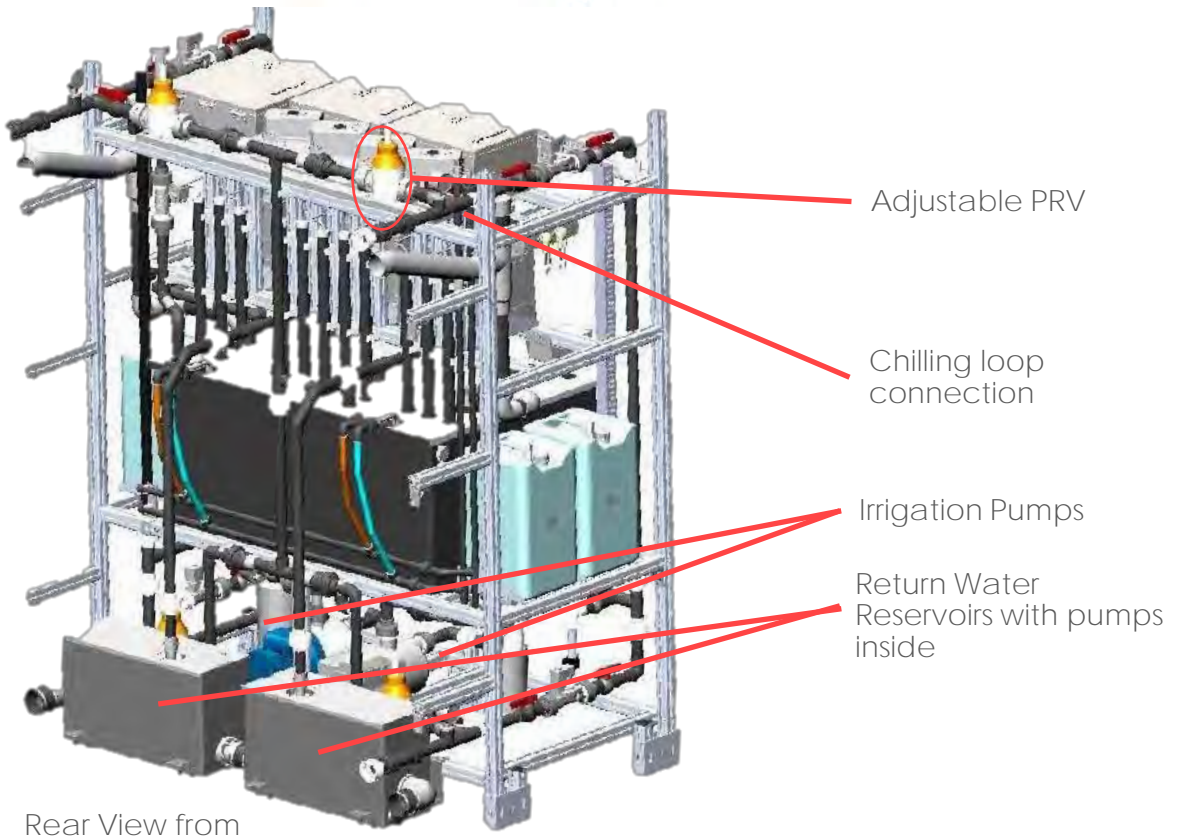
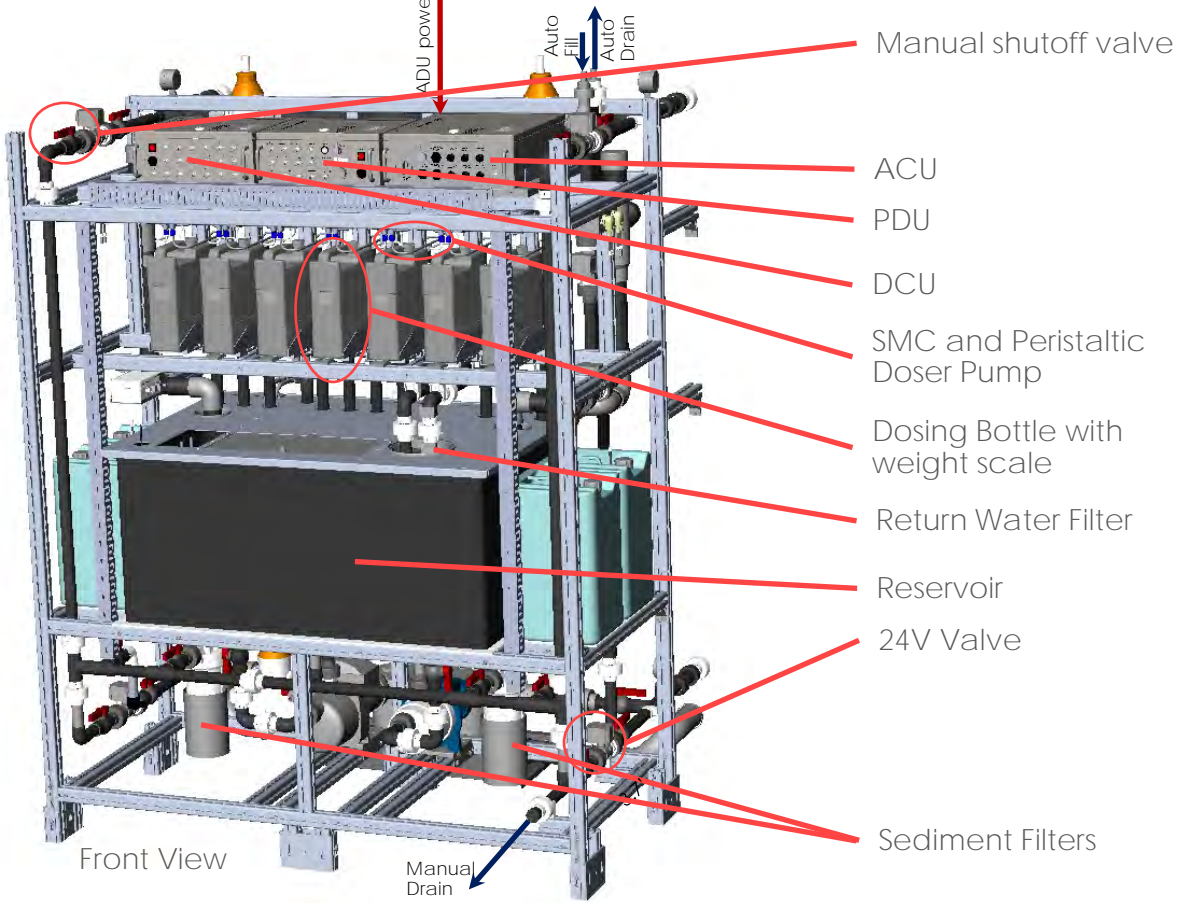
Sensors

The Water Pressure Sensors (WTP), the Water Sensing Module (WSE), and the Atrium System Detector (ASD) provide accurate feedback to the GGM on water pressure, level, pH, water temperature, electrical conductivity, air temperature, relative humidity, CO₂ 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.

AEtrium-4 Double Deck ADU Components



AEtrium-4 Double-Deck Datasheet

Specifications subject to change without notice

A4DD ADU Specifications

Description	Min	Typical	Max
ADU input voltage	208 V _{AC}	–	240 V _{AC}
ADU input frequency	47 Hz	–	63 Hz
ADU power draw	–	15A	–
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		
CE Certificate Number	8227170919		

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) ¹	Range: 2–20,000 µS/cm
Supplied water (EC)	<250µS/cm ¹
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	2
# 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	
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	
Input 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	316 Stainless Steel
Coil Length	37.4' (11400mm)
Coil Diameter	1/2" (12.7mm)
Coil Connection Hose Barb	5/8" OD (16mm OD)
Chilled water supply	<45°F (7°C)
Flow rate	2.6-3.2 gal/min (10-12 lpm)
Connection Hose Barb (uses 5/8" garden hose)	5/8" OD (16mm OD)
Heat Generated	5,340 BTU/hr for a 16 tub 6,675 BTU/hr for a 20 tub 8,010 BTU/hr for a 24 tub
Dosing Bottle capacity	7x 1.06 gal (4 L) 4x 5 gal (20 L)
Maximum pH up solution	30% potassium hydroxide (KOH) or equivalent
Maximum pH down solution	10% nitric acid (HNO ₃) or equivalent
# 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)

1. It is highly recommended that one do a complete analysis of the supplied water prior to commencing cultivation. One may need to condition the water to reduce the conductivity of it for best cultivation results.

A4DD Shared Specs

Description	Min	Typ	Max
Recommended Ceiling Height	14' (4267mm)	16' (4877mm)	Unlimited
Offset from walls (back & sides)	36" (914mm)	48" (1219mm)	Unlimited
Front offset (required for assembly)	64" (1626mm)		
Floor Slope	Floor must not be more than ¼" out of level over 10'		
Maximum number of carriages per room			4 ⁵
Airflow	35 CFM across canopy per grow tray (0.99 m3/min)		
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 on both levels		46.5" (1180mm)	
Top tray height off of ground		91.6" (2327mm)	
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		

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 ⁶)	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)	35' 9" x 5' 3" x 12' (11-0-7 mm x 1570 mm x 3653 mm)		
Ideal room size for 4x24 tub A4DDs (L x W)	44' 1" x 27' (13,437 x 8687mm)	45' 1" x 29' 2" (13,741 x 8890 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 ⁶)	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)	43' 3" x 5' 3" x 12' (13177 mm x 1570 mm x 3652 mm)		
Ideal room size for 4x24 tub A4DDs (L x W)	51' 7" x 27' (15,723 x 8687mm)	52' 7" x 29' 2" (16,027 x 8890 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 ⁶)	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)	50' 8" x 5.25' x 12' (15447 mm x 1570 mm x 3652 mm)		
Ideal room size for 4x24 tub A4DDs (L x W)	59' x 27' (17,983 x 8687mm)	60' x 29' 2" (18,288 x 8890 mm)	
A4DD dry weight		5070 lbs (2300 kg)	

- @ 100% light intensity with all fans running
- ADU @ 208 V_{AC}, Return Water Pump @ 120 V_{AC}
- 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
- Average Photosynthetically Active Photon Flux Density (PPFD) over each grow tub at 100% intensity
- We limit rooms to no more than 4 A4DD's wide to allow for proper air flow across the canopy
- Dependent on the crop, density, cultural practices, and environmental conditions

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

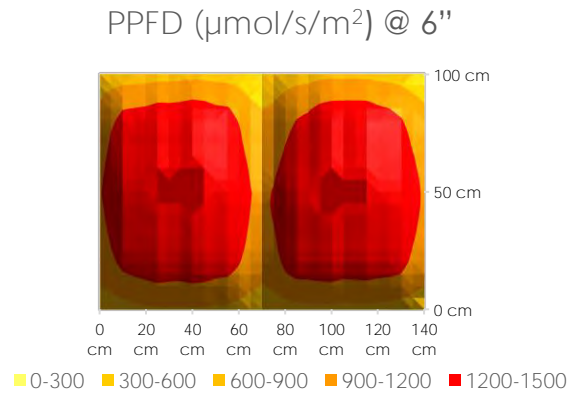
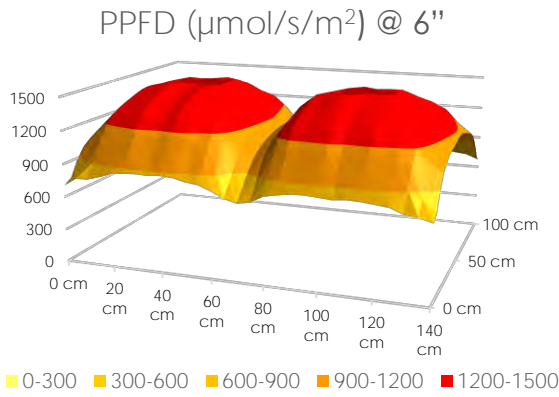
Description	Value
Avg. grouped PPF at 12" ^{1, 2}	1,130 μmol/s/m ²
Avg. grouped PPF at 20" ^{1, 2}	950 μmol/s/m ²
Avg. single PPF at 6" ^{1, 3}	800 μmol/s/m ²
Avg. single PPF at 12" ^{1, 3}	530 μmol/s/m ²
Light Uniformity at 20" ^{1, 4}	0.87
Light Variation (CV) at 20" ^{1, 5}	4%
Comm. Interface	AES 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)



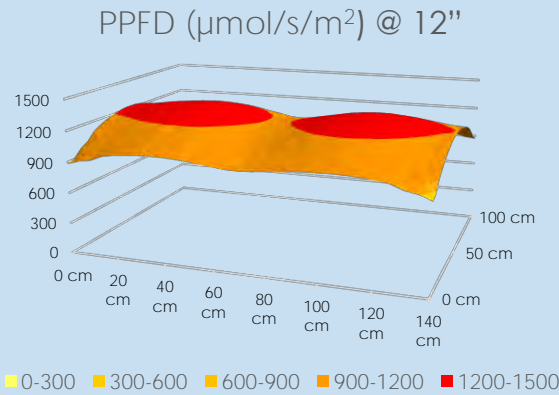
1. At 100% light intensity
2. Average Photosynthetically Active Photon Flux Density (PPFD) over the AEtrium-4 grow tray (40"x50") in a typical large-scale cultivation setup, measured with adjacent grow lights of the same type
3. Average Photosynthetically Active Photon Flux Density (PPFD) over the AEtrium-4 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 PPF 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

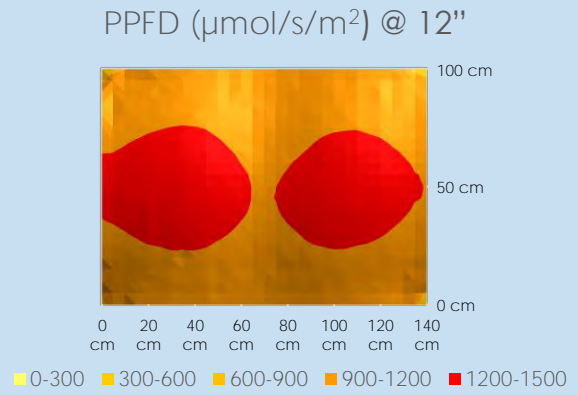
Measured at 100% light intensity with grow light centrally mounted at pre-determined height above a 40"x50" grow area, with adjacent illuminated grow areas (typical large scale cultivation).



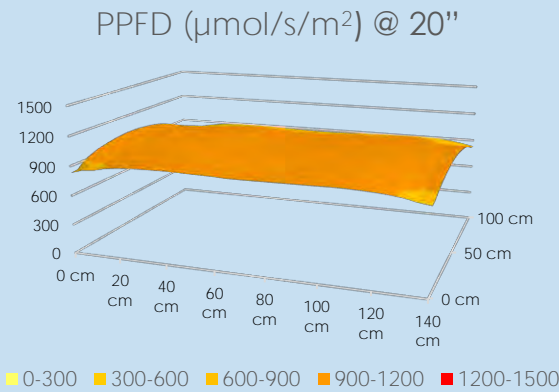
RECOMMENDED INSTALLATION HEIGHT



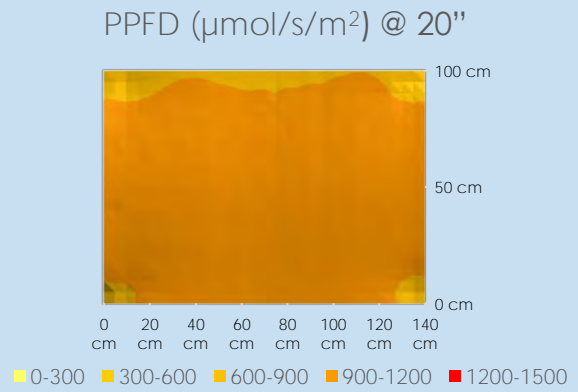
RECOMMENDED INSTALLATION HEIGHT



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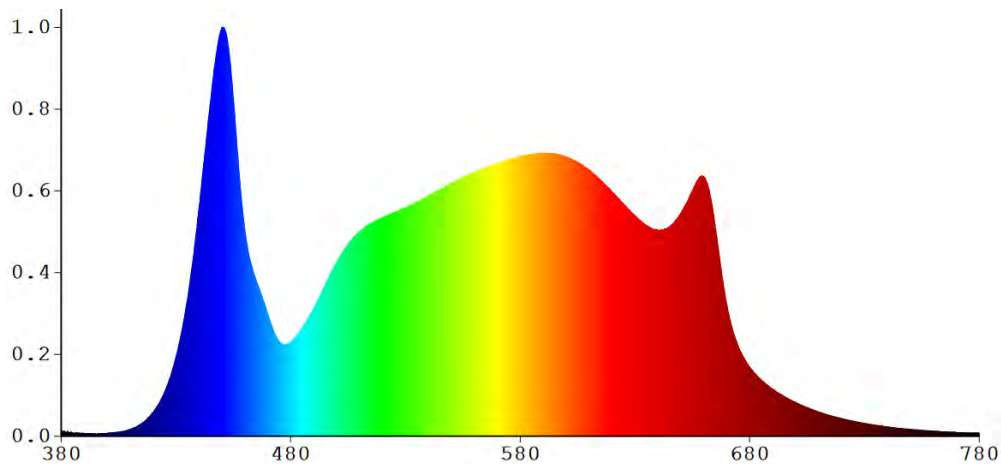


1. Average Photosynthetically Active Photon Flux Density (PPFD)

Light Intensity Characterization ¹

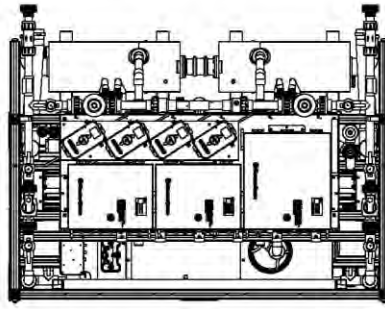
Guardian™ Setting ²	Wattage	Heat Output	Light Output (PPF)	Efficacy	Light Intensity ³ (PPFD, large grow)	Light Intensity ⁴ (PPFD, eval. grow)
0%	10 W	34 BTU/h	0 μmol/s	NA	0 μmol/s/m ²	0 μmol/s/m ²
20%	110 W	375 BTU/h	268 μmol/s	2.44 μmol/J	195 μmol/s/m ²	135 μmol/s/m ²
30%	183 W	624 BTU/h	456 μmol/s	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

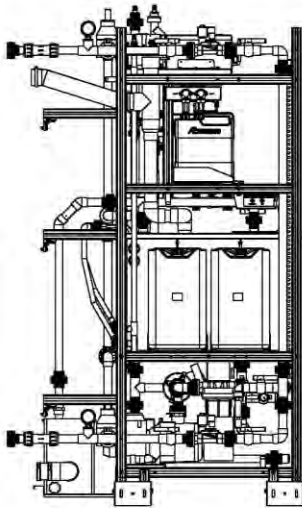


1. Tested at 230V/50Hz
2. Light Intensity Setting in the GGM
3. Average Photosynthetically Active Photon Flux Density (PPFD) over the plant canopy in the AEtrium-4 grow tray (40"x50") in a typical large-scale cultivation setup, measured at 12" mounting height over the canopy level with adjacent grow 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

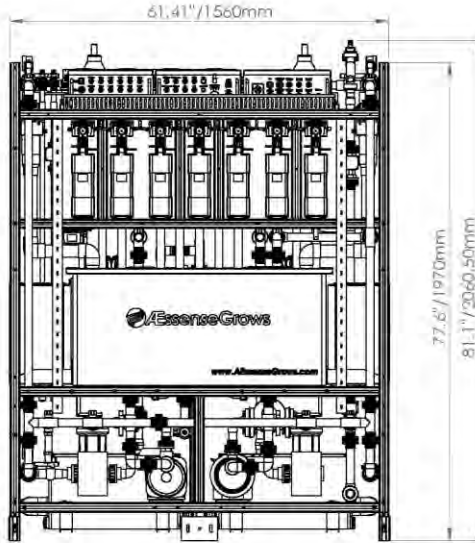
A4DD ADU Mechanical Design



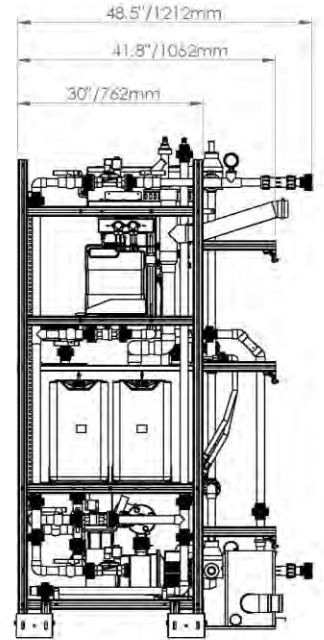
Top view



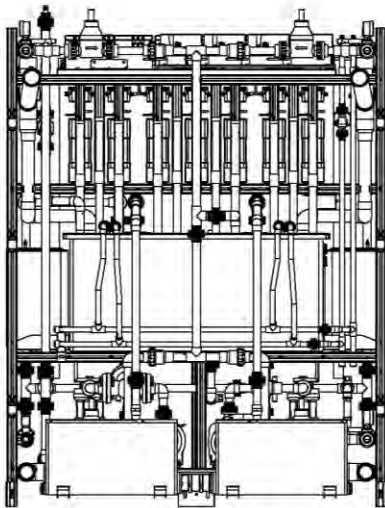
Left view



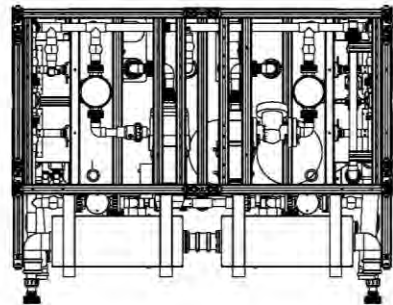
Front view



Right view



Rear view

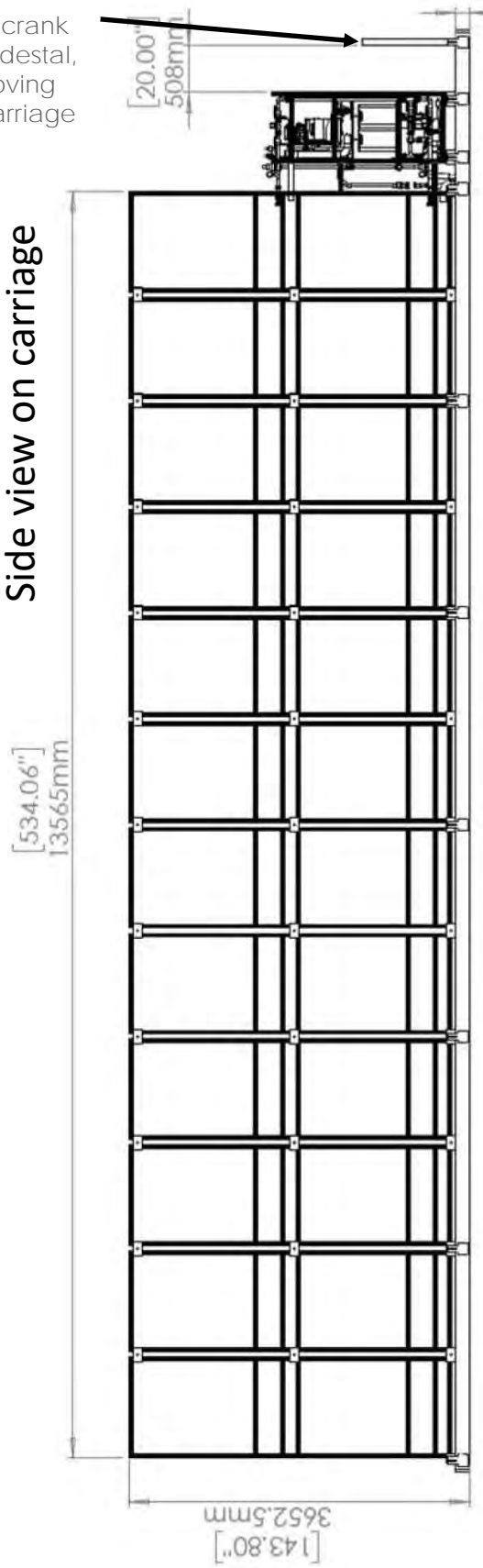


Bottom view

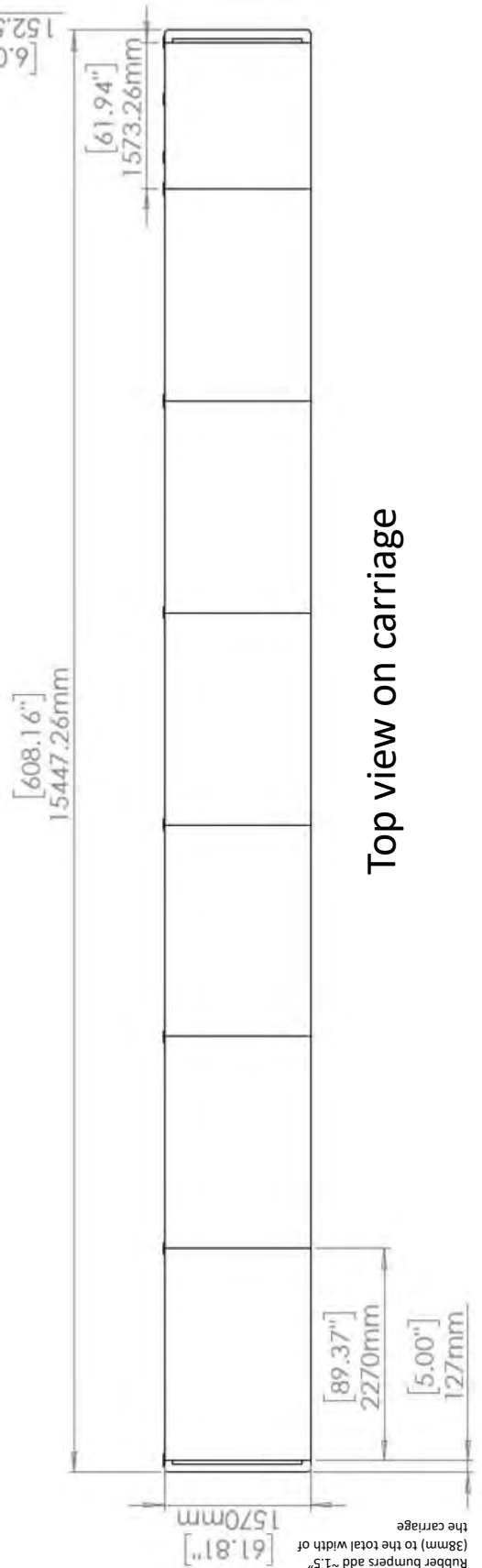
24-Tub AEtrium-4 Double-Deck Mechanical Design

Hand crank on pedestal, for moving the carriage

Side view on carriage



Top view on carriage

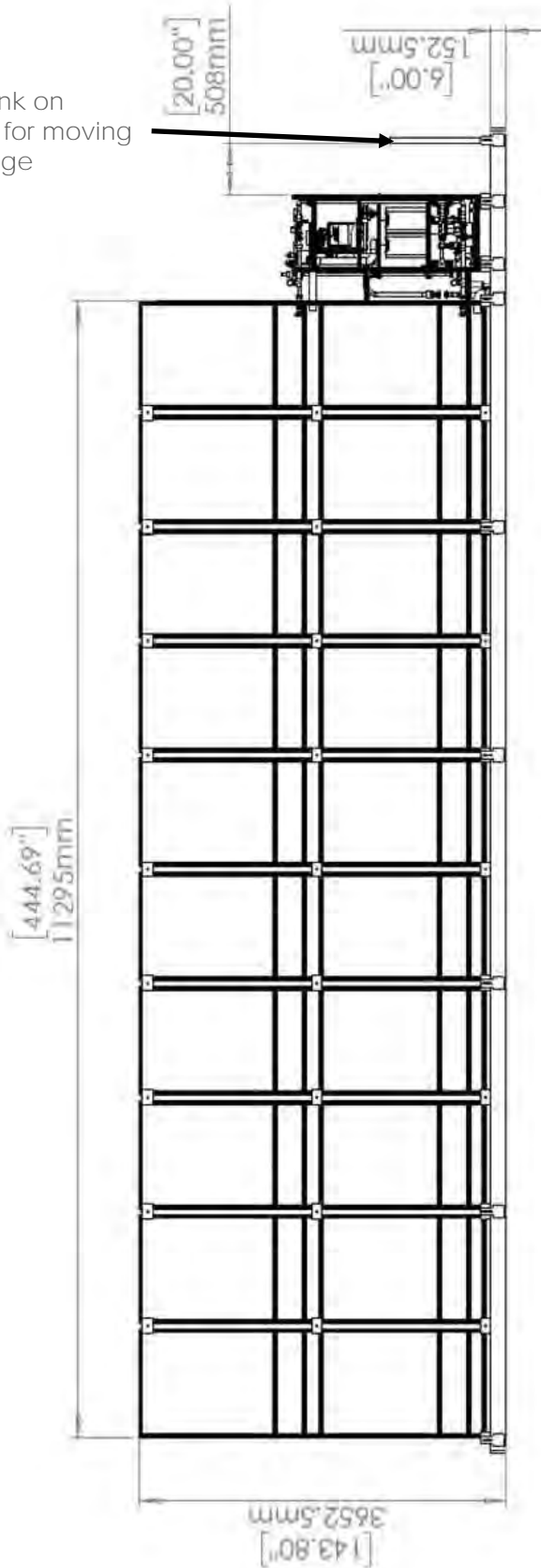


Rubber bumpers add ~1.5" (38mm) to the total width of the carriage

20-Tub Atrium-4 Double-Deck Mechanical Design

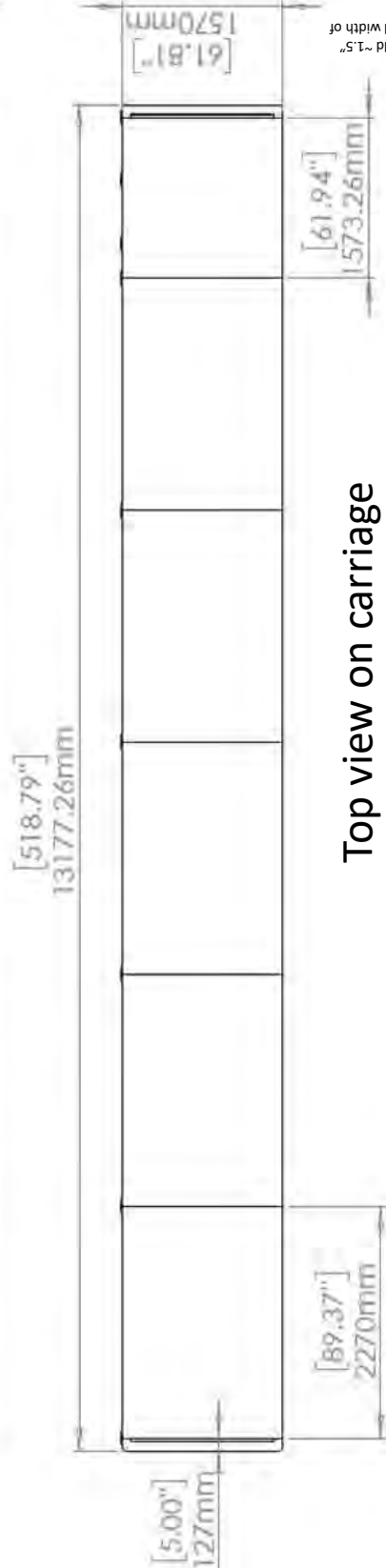
Hand crank on pedestal, for moving the carriage

Side view on carriage



Rubber bumpers add ~1.5" (38mm) to the total width of the carriage

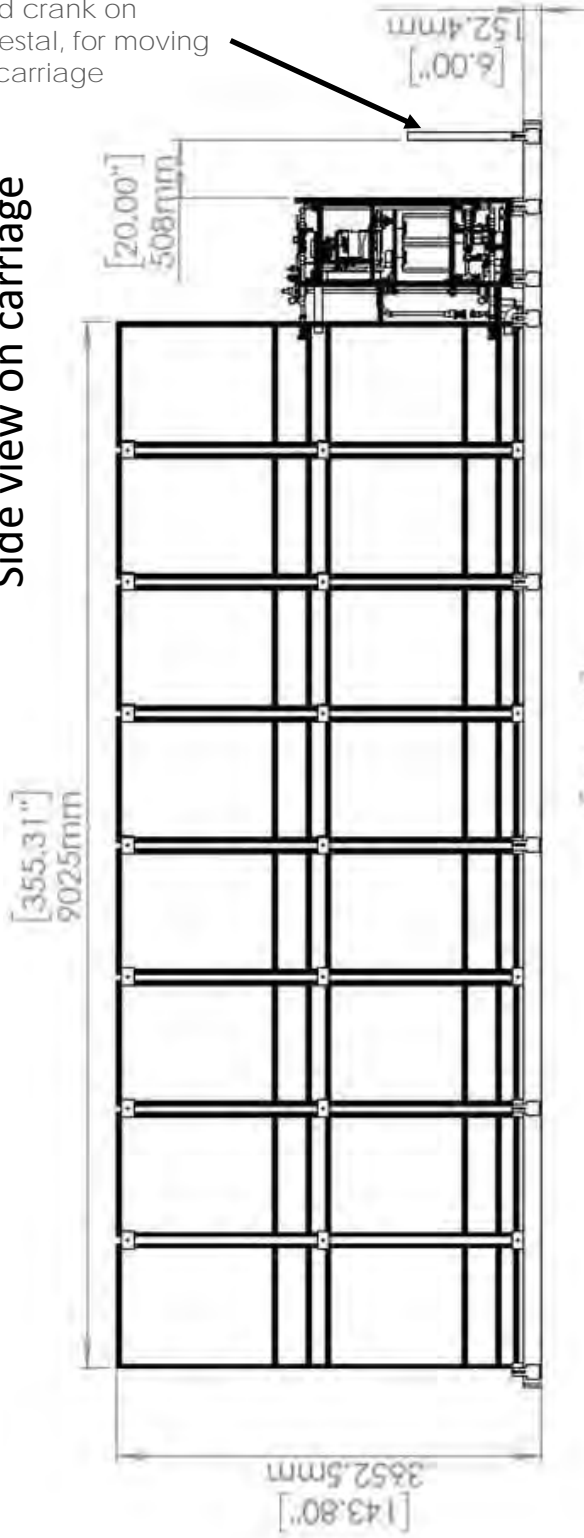
Top view on carriage



16-Tub Atrium-4 Double-Deck Mechanical Design

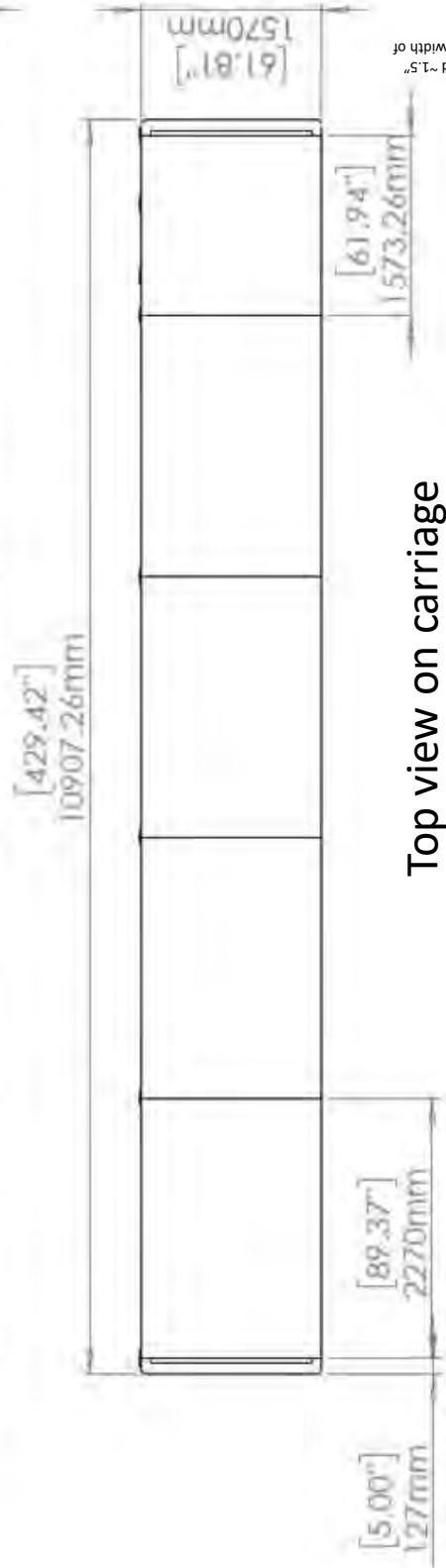
Hand crank on pedestal, for moving the carriage

Side view on carriage



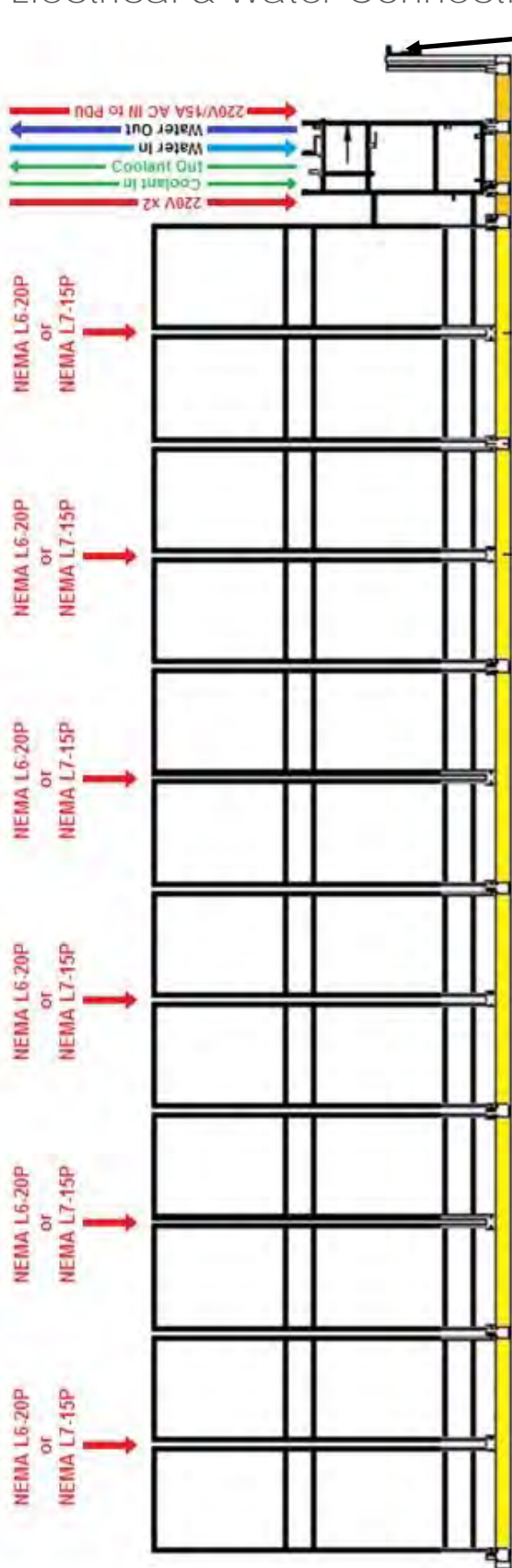
Rubber bumpers add ~1.5" (38mm) to the total width of the carriage

Top view on carriage



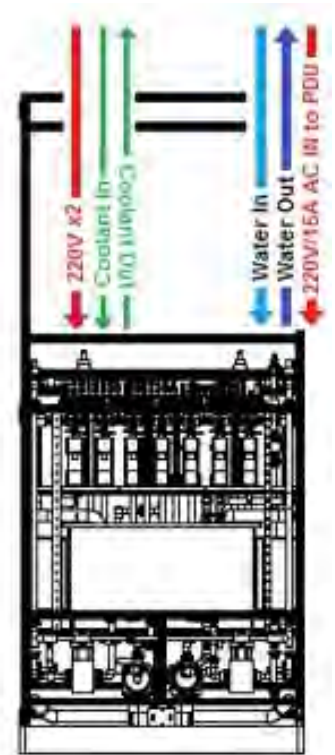
4DD Electrical & Water Connections

Side view of 4DD connections



Hand crank on pedestal, for moving the carriage

- PDU – 208V/60Hz/20A (NEMA L6-20P)
- Every 4 tub/AErix
 - 208V/60Hz/20A (NEMA L6-20P)
 - or 277V/60Hz/15A (NEMA L7-15P)
- Flexible piping required for water autofill and water drain (customer supplied)
- Flexible piping required for coolant (insulated, customer supplied)
- Flexible piping should allow for at least 36" (1m) of side to side movement

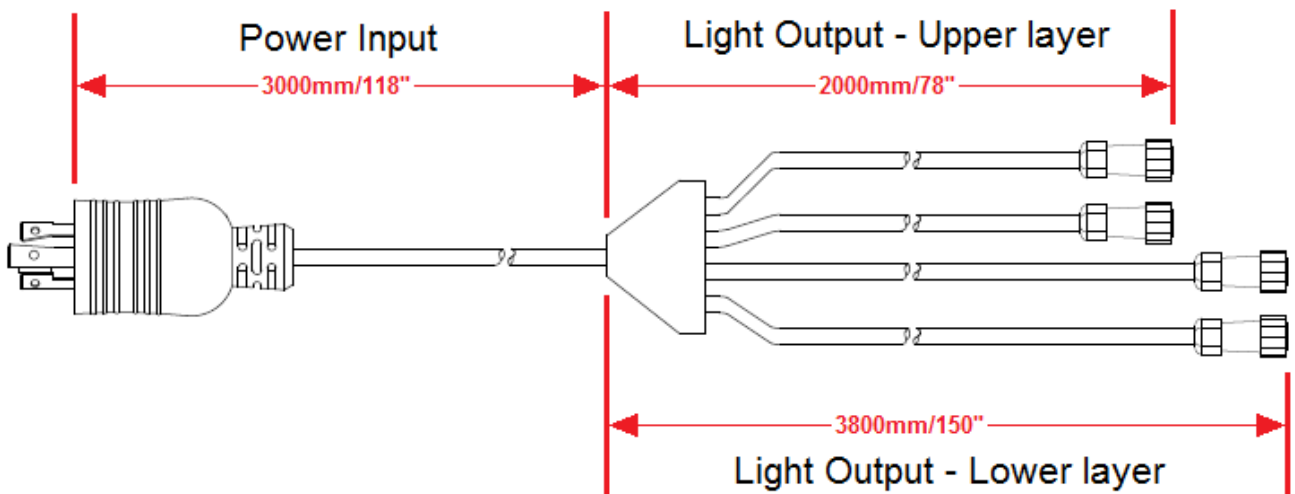


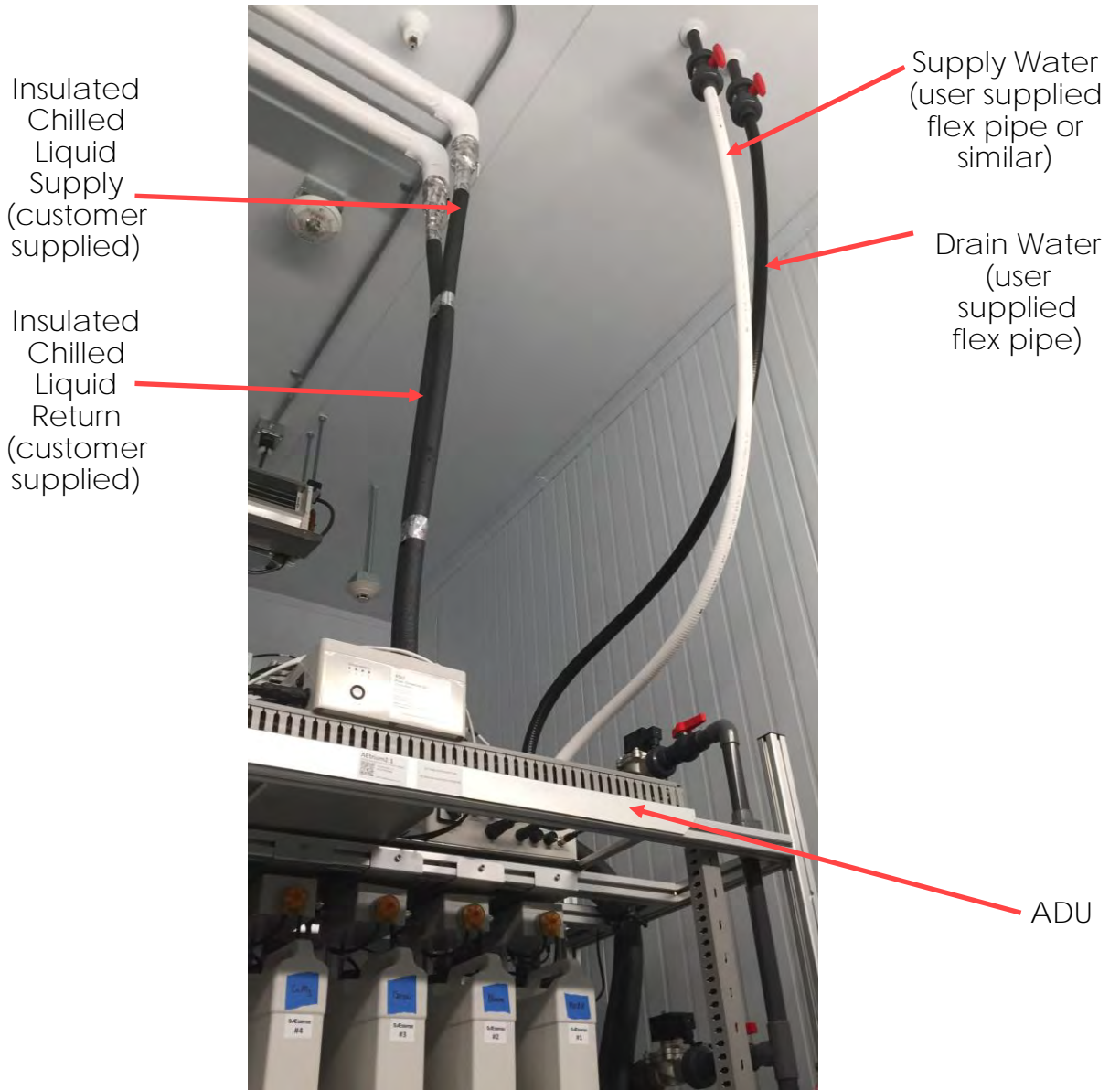
End view towards ADU hand crank and pedestal removed for clarity

1-to-4 Power Cable for Lights

- Power Input side (see drawing below) of 1-to-4 power cable is the flexible portion that moves while carriage is moving. The rest of 1-to-4 power cable are fixed on A4DD frame and connected to lights.
- Power Input cord is 3000mm (118"), so it limits the horizontal range A4DD could move once ceiling height is decided (see table). Note that 16' ceiling height is recommended.

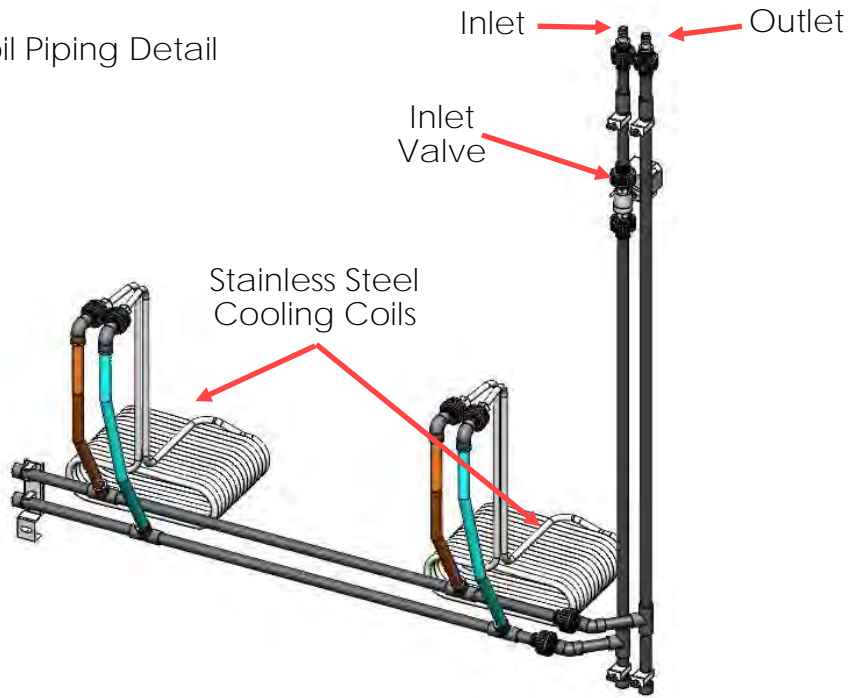
Ceiling Height	Horizontal range
15'	225"
16'	215"
17'	203"
18'	187"
19'	166"
20'	137"



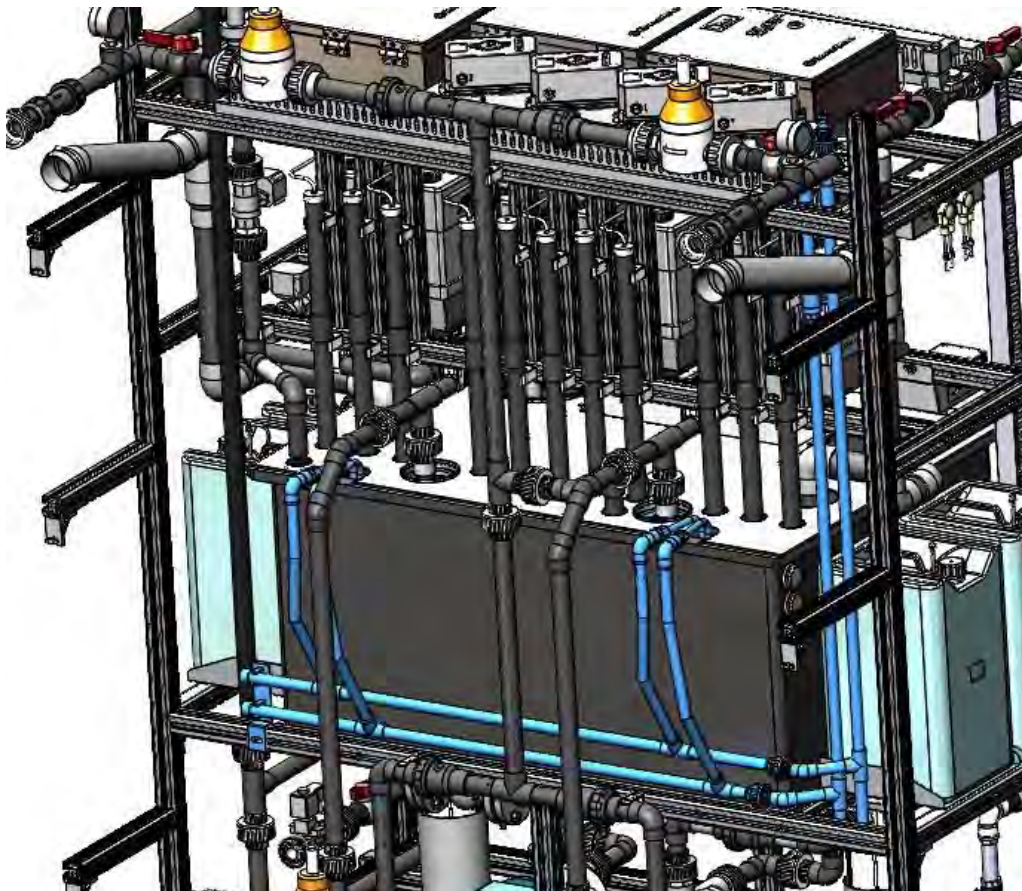


- Flexible lines allow the A4DD rows to move
- Lines should be long enough to allow carriage to move at least 36" (914mm)

Cooling Coil Piping Detail



Rear View of ADU and Reservoir
(cooling coil pipes in blue)



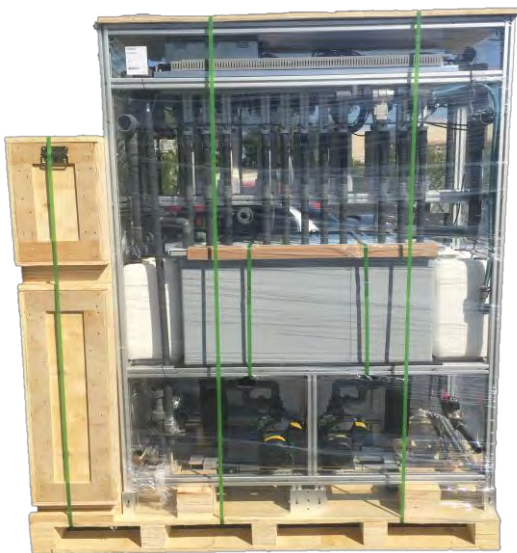
Typical Ætrium-4 Double-Deck Shipping Configuration

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 12 for 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

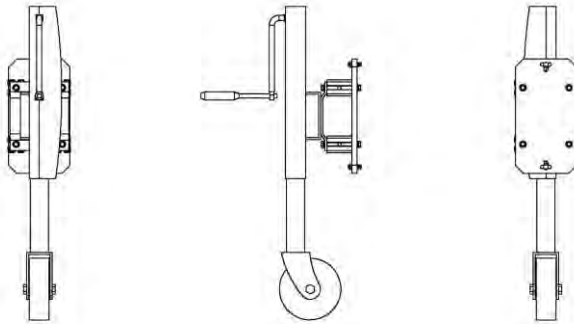
Emergency Box

Should the ADU suffer a complete failure, the emergency box allows one to fertigate the multiple levels automatically for two minutes each (period is not changeable). Disconnect the fertigation solenoids from the ADU and hook them up to the emergency box to allow fertigation to take place until the ADU is repaired. The same emergency box can be used on both the AEtrium-2.1 and AEtrium-4 Double-Deck. One recommended per facility.



Assembly Jacks

To help with assembly of the AEtrium-4 Double Deck it is recommended to purchase one set of assembly jacks (PN 310-10205-01 quantity of four required). They temporarily bolt to the segments of the A4DD allowing them to lift up and to easily roll them over the carriage in places where assembly with a forklift would be too cramped.



A 2996 Scott Blvd.
Santa Clara, CA 95054

P 1.800.369.8673

O 1.650.564.3058

E info@aessensegrows.com

