

# Hyde GUARDIAN™

## Ballast Water Treatment System



### THE TYPE APPROVED SOLUTION

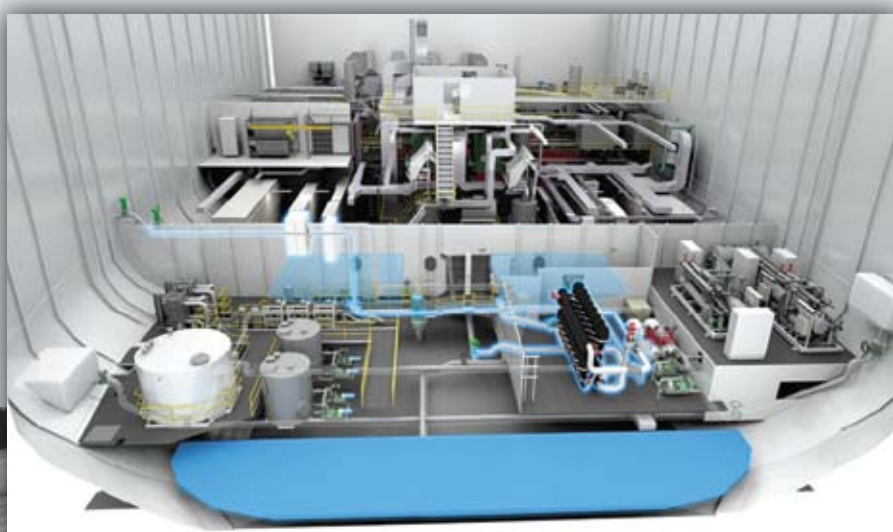
The Hyde GUARDIAN™ Ballast Water Treatment System is the simple and cost effective solution which exceeds international ballast water discharge requirements. Lloyd's Register and MCA Type Approval, April 2009.

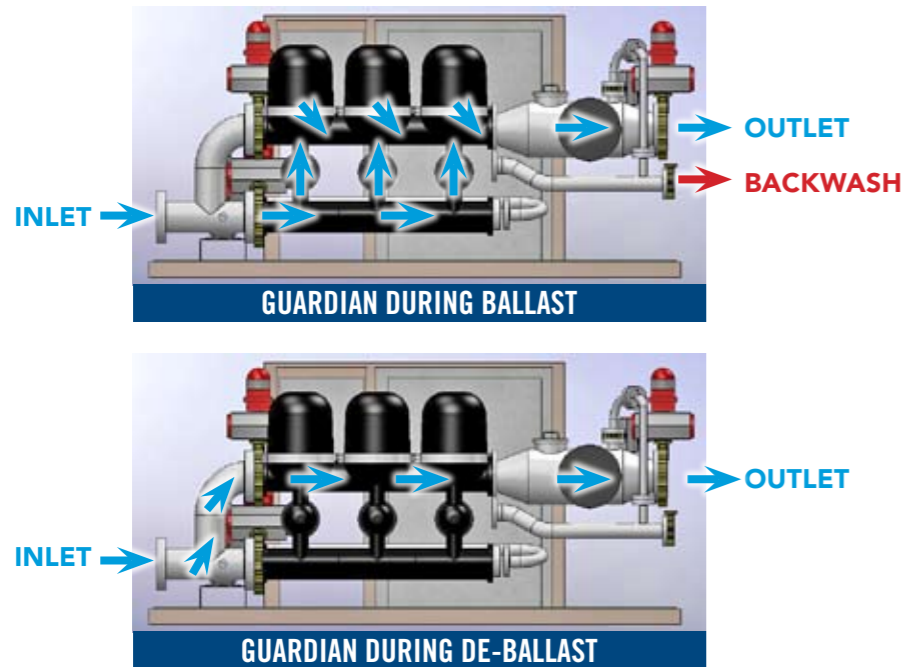
The GUARDIAN features a two-stage process; an efficient depth filter to remove sediment and larger organisms, and a powerful UV

disinfection unit to kill or inactivate smaller plankton, bacteria and other pathogens.

In designing the GUARDIAN system, Hyde selected the most robust and reliable components available. Our filter and UV technology has been proven in thousands of challenging water and wastewater treatment applications, ensuring the highest performance for this essential shipboard operation.

The Hyde GUARDIAN is integrated into the ship's ballast system so that treatment occurs automatically, with minimal effect on crew compliment or vessel operations. Simple and straightforward.





### SMALL SPACE AND EASE OF INSTALLATION

The flexible, modular design of the GUARDIAN allows it to be installed in even the most crowded machinery spaces. The filtration system can be delivered in small modules to be configured in a variety of shapes to fit available space. The Hyde GUARDIAN system is designed for minimum pressure drop, allowing use of existing ballast pumps. The modest energy consumption of the UV system in most cases allows installation of the system without major upgrades to the electrical generating and distribution system. Interface with the existing ballast system is simple and many installations are completed without requiring drydock and even while the vessel is in commercial operation.



### ECONOMY

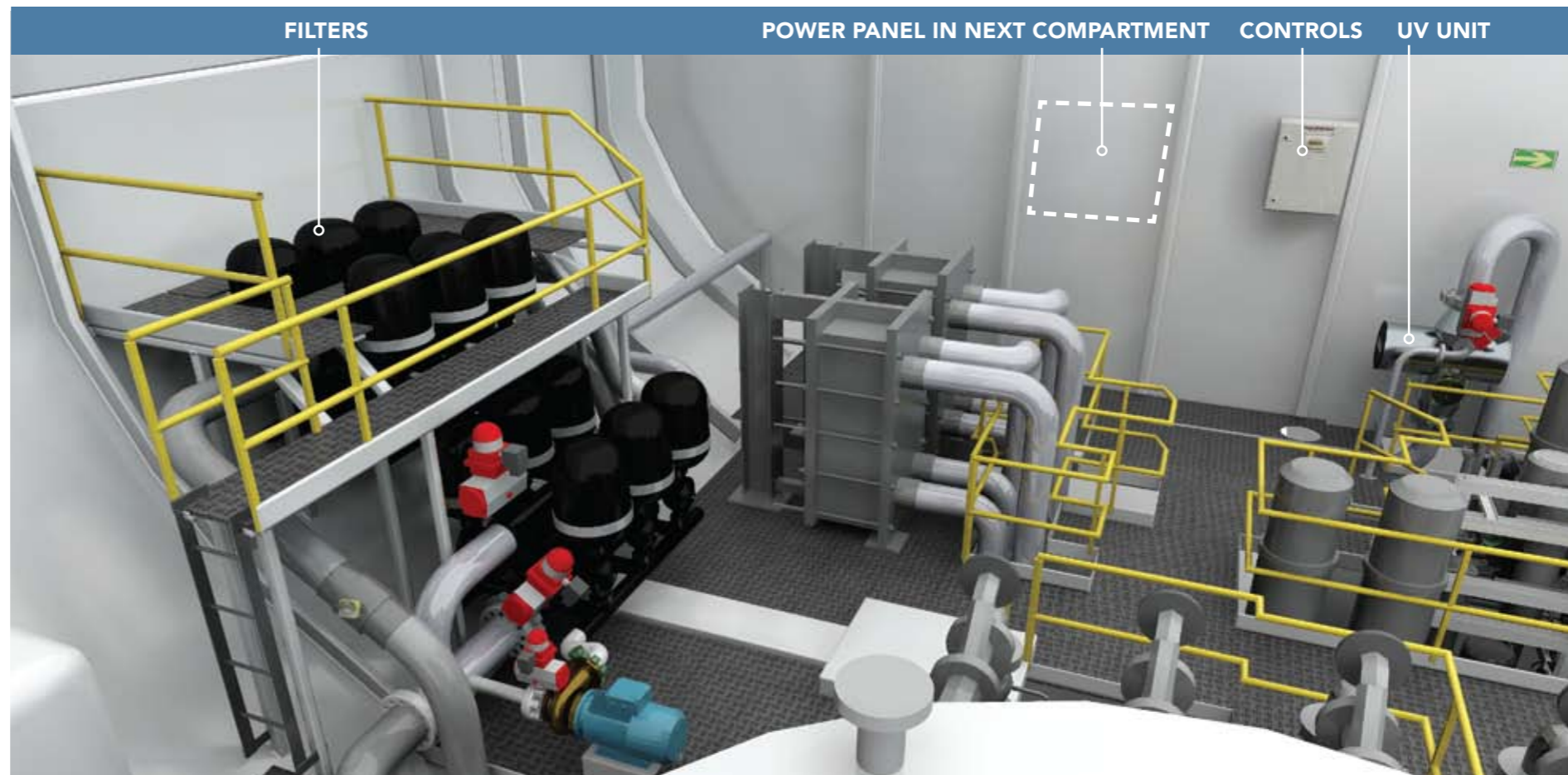
The affordable Hyde GUARDIAN system has a low installation cost, low operating cost and extremely low consumables cost over the life of the vessel. The low pressure drop of the system ensures minimal effect on vessel ballasting rates and turn-around time. The resulting low total cost of ownership ensures that Hyde GUARDIAN owners achieve compliance while gaining a competitive edge in their core business.

### SYSTEM OPERATION

The Hyde GUARDIAN system is fully integrated into the ship's control and automation system. During ballasting, water is processed through both the filter and UV stages as it is pumped from seachest to the ballast tanks. All solids and organisms captured by the filters are discharged during backflushing to the location they entered. During de-ballasting, the filter is bypassed and water flows only through the UV system before discharging overboard. Hyde GUARDIAN system and ballast operation data are automatically logged by the system and water sampling ports are installed in accordance with IMO G2 Guidelines.

## Hyde GUARDIAN™

STANDARD MODEL	CAPACITY M3/H (GPM)	POWER (KW) NOMINAL/MAXIMUM
HG60	60 (264)	10/15
HG150	150 (660)	10/15
HG250	250 (1100)	18/25
HG300	300 (1320)	24/34
HG350	350 (1540)	36/50
HG450	450 (1980)	36/51
HG500	500 (2200)	36/52
HG600	600 (2640)	36/53
HG700	700 (3080)	53/75
HG800	800 (3520)	53/75
HG900	900 (3960)	53/75
HG1000	1000 (4400)	78/114
HG1250	1250 (5500)	78/114
HG1350	1350 (5940)	78/114
HG1500	1500 (6600)	106/150
<b>CUSTOM MODELS</b>		
HG1600	1600 (7040)	106/150
HG1800	1800 (7920)	106/150
HG2000	2000 (8800)	156/228
HG2500	2500 (11000)	156/228
HG3000	3000 (13200)	234/342
HG4000	4000 (17600)	312/456
HG5000	5000 (22000)	312/456
HG6000	6000 (26400)	424/600





Ballast water is a particularly challenging filtration application due to the constantly changing biological and sediment loading, the corrosive nature of seawater, and the high flow required compared to power and space available. After years of testing different filter technologies for ballast water treatment, Hyde selected a unique stacked-disk filtration system as the standard for the Hyde GUARDIAN. This technology combines performance and efficiency of a depth filter with reliable automatic backflushing capability superior to that of a barrier filter.

Other important benefits include corrosion-

free materials of construction, low pressure drop, ability to handle heavy sediment loading, low maintenance requirements, and modular design that allows flexibility to install in existing machinery spaces.

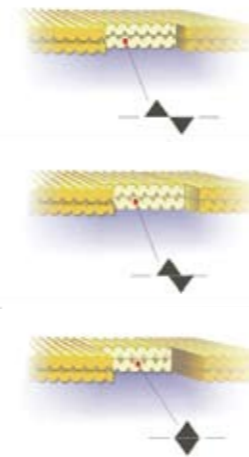
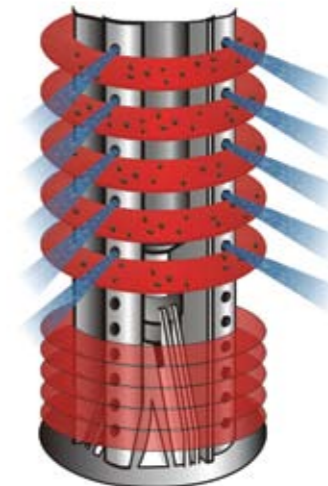
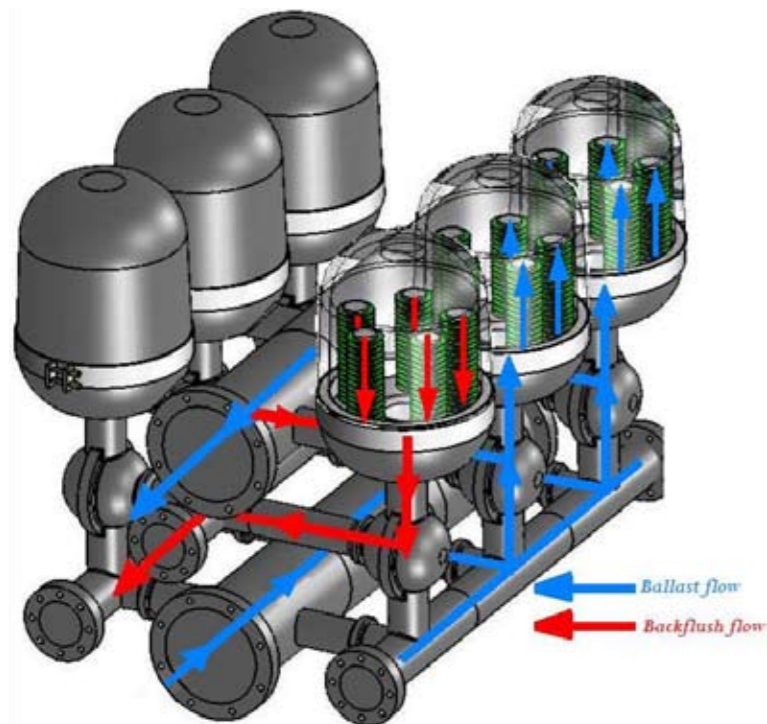
**FILTRATION**

The automatic backflushing filter ensures reliable removal of solids and larger organisms. The filter contains several modules of "stacked-disk" filter elements that capture and store large amounts of solids. The filter is designed to automatically backflush itself at the end of each ballasting operation and, when necessary, clean one module at a time using filtered water from the remaining modules. This allows for continuous ballast flow and immediate discharge of the filtered material back into the ballast water source.

**THE STACKED-DISK FILTER DESIGN**

Thin nylon disks are diagonally grooved on both sides to a specific micron size. These disks are stacked and compressed on special spines to create filter elements. The grooves on top of each disk run opposite to the grooves below, forming a statistically significant series of valleys and traps for solids. As water flows from the outside of each element to the core, the intersections of the grooves form dozens of stopping points in each flow path, thus creating an efficient depth filter to capture solids.

The stacked-disk elements are enclosed in a corrosion and pressure resistant housing module with a number of modules assembled in the system to provide the desired capacity.



What makes this filter design so special is how it is cleaned. During filtration the disks are tightly compressed together by spring and differential pressure. When a preset pressure differential is reached, a patented backflushing process quickly and efficiently cleans the entire module, while creating a small total backflush volume.

The first step in the backwash cycle is to activate the 3-way valve, which closes the inlet and opens the drain. By removing the differential pressure in the system, the spine piston rises up releasing the compression on the disks. Tangential jets of clean water are pumped at high pressure in the opposite direction through nozzles at the center of the spine. The disks spin free and clear, loosening the trapped solids. Solids are quickly and efficiently flushed out through the drain and immediately overboard. As this water contains only organisms that were recently picked

up, they are simply being returned to the environment from which they came.

Each module, with five to eight stacked disk elements, is completely cleaned in 10 to 20 seconds. The backflush process is repeated with each module until the entire filtration system is clean. This automatic backwashing ensures that the system operates reliably and with minimal reduction of ballast water flow.

**SIZING**

The filter systems used in the different Hyde GUARDIAN systems are sized to provide an efficient filtration of the total required ballast water flow. The chart below shows the maximum allowable flow for each filter module size in the Hyde GUARDIAN range.

When sizing and choosing the correct filter system for each customer, the filtration capacity selected is always at least one unit higher than the required ballast water flow rate.

FILTER MODULE SIZE	3"	4"	6"
Max Flow /per module (m3/hr)	10	50	80
Number of spines	1	5	8
Flow rate / spine	10	10	10

**FILTER COMPARISON**

PARAMETERS	GUARDIAN™ DISK (DEPTH) FILTER	HYDRO CYCLONE	SCREEN FILTER
Filtration Large Sediment	<b>Excellent</b>	Fair	Fair
Filtration Large Organisms	<b>Excellent</b>	Poor	Fair
Back-Flush Volume	<b>Excellent</b>	Poor	Fair
Energy Conservation	<b>Excellent</b>	Poor	Fair
High Sediment Loading	<b>Excellent</b>	Fair	Poor
Pressure Drop	<b>Excellent</b> (<1 bar)	Poor (2.5-5.0 bar)	Fair (>2.0 bar)

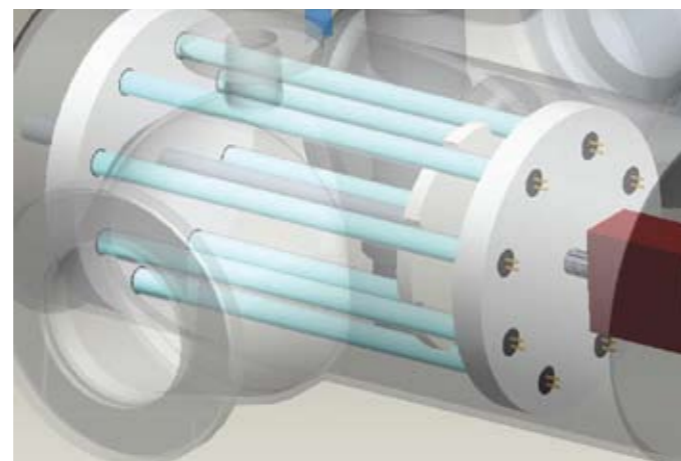


The Hyde GUARDIAN uses a high intensity ultraviolet (UV) treatment as a means of disinfection. The UV chamber is carefully designed for minimum pressure drop, maximum retention time, and compatibility with the marine operating environment.

UV dosage is a combination of lamp power, UV transmission, distance from the lamp sleeves, and exposure time. The flow velocity through the UV chamber is optimized to be within the range of 0.5 m/s to 3.0 m/s.

The advantages of using UV rather than chemical disinfection include:

- UV runs automatically with very little operator attention
- UV does not contribute to corrosion like chemical oxidants
- UV does not require transportation, storage or handling of hazardous material
- UV requires minimal space for chemical storage equipment and contact chamber
- UV has no danger of overdosing
- Organisms cannot build resistance against UV
- UV does not require dilution or deactivation
- UV has no known toxic or significant nontoxic by-products
- UV is 100% safe without side effects

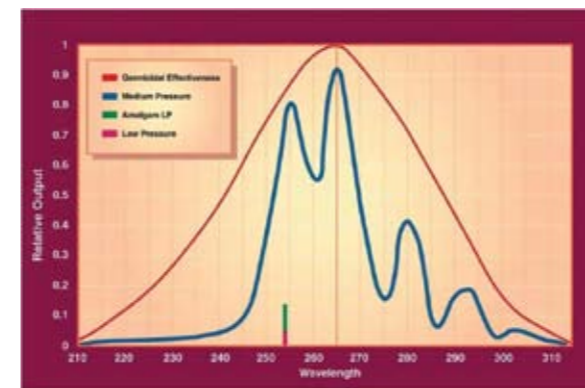


### UV LIGHT

Ultraviolet light is the part of the electromagnetic spectrum just below the visible portion and it can be further broken down into four smaller bands:

- UV-A 315nm-400nm
- UV-B 280nm-315nm
- UV-C 200nm-280nm
- UV-Vac 10nm-200nm

The portion that is known as germicidal is the region of UV-C from 240-280nm, with a peak at 264nm. UV-C light deactivates or damages the DNA of organisms, killing them or making them unable to reproduce.



UV light is produced using mercury vapor lamps. There are two basic types of UV lamp technology. The first is called a low pressure lamp. It excites the mercury molecules to a relatively low level resulting in a monochromatic output at 254nm. The medium pressure lamps that the Hyde GUARDIAN utilizes produce a polychromatic output across the entire spectrum of the germicidal curve. The relative germicidal effectiveness is shown on the diagram at right. The UV lamps used in the Hyde GUARDIAN have an expected service life of 8000 hours, which is far superior to other lamp types.

### TREATMENT CHAMBER

The Hyde GUARDIAN UV system includes a specific number and size of UV lamps depending on the total ballast water flow to be treated. These lamps are housed in high quality quartz sleeves, which pass through the corrosion resistant treatment chamber. The system employs an automatic wiping mechanism to keep deposits from accumulating on the sleeves. In addition there is a temperature sensor to monitor water temperature, a UV sensor to measure the relative intensity of the UV lamps, a drain, and air relief valves. For routine checks, maintenance and replacement of the quartz sleeves and wipers, the chamber has an inspection and access hatch.

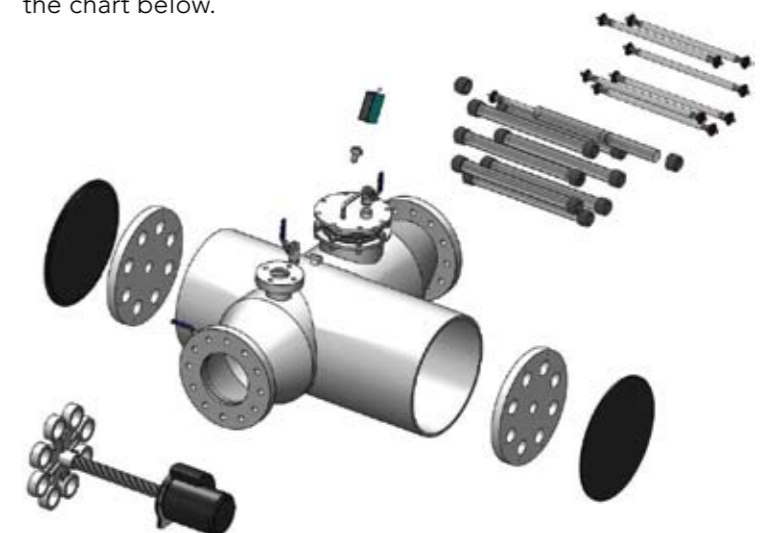
Model No.	160620	160635	160835	161235	201235	201836	201850
Max Flow (m3/hr)	153	255	331	488	694	1033	1488
No. of lamp	6	6	8	12	12	18	18
Type of lamp	B2035	B3535	B3535	B3535	B3550	B3550	B5050
Lamp Power (W)	1500 to 2240	2650 to 3750	2650 to 3750	2650 to 3750	2650 to 3750	2650 to 3750	3900 to 5700
Max Power (kW)*	15	25	34	50	52	78	114

\* Maximum power is typically only drawn when the system is in the highest power level, during the last ¼ of the lamp's life or when UV transmission is low due to exceptionally poor ballast water quality.



### SIZING

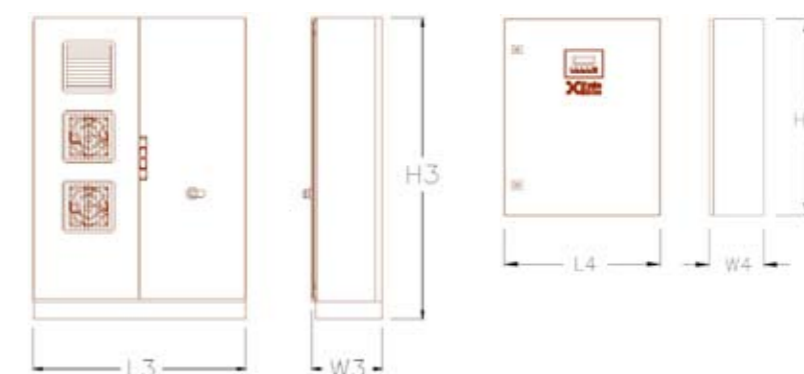
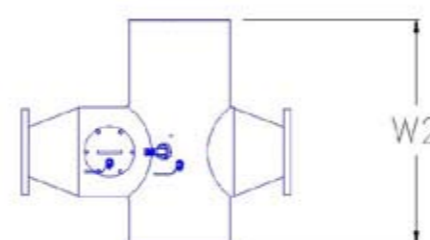
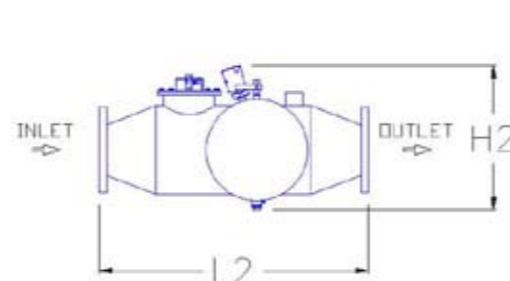
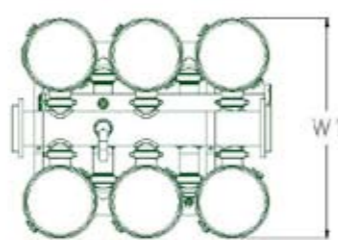
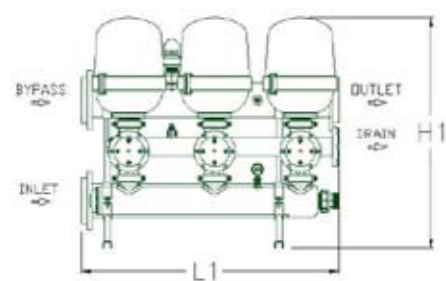
The UV treatment system in each Hyde GUARDIAN model is sized to provide a minimum average dose, at maximum rated ballast flow, at the end of the lamp life. Sizing is according to the chart below.



## MAIN COMPONENTS WEIGHTS AND DIMENSIONS<sup>1</sup>

Hyde GUARDIAN™	Filter	UV	FILTER			UV			POWER PANEL				CONTROL CABINET			TOTAL WEIGHT kg	SKID			
			L1	W1	H1	L2	W2	H2	L3	W3	H3	Qty	L4	W4	H4		L5	W5	H5	kg
60	3" x 8	080620	1100	900	1290	800	800	500	800	400	1200	1	600	210	760	441	2100	1500	150	550
150	4" x 4	160620	1000	1100	1250	1100	900	600	1200	400	1700	1	600	210	760	832	2300	2000	150	600
250	4" x 6	160635	1500	1100	1250	1100	900	600	1200	400	1700	1	600	210	760	968	2800	2000	150	700
300	4" x 8	160835	2000	1100	1250	1100	900	600	1200	400	1700	1	600	210	760	1150	3300	2000	200	950
350	4" x 8	161235	2000	1100	1250	1100	900	600	1200	400	1700	1	760	210	760	1250	3300	2000	200	950
450	4" x 10	161235	2500	1100	1250	1100	900	600	1200	400	1700	1	760	210	760	1386	3800	2000	200	1100
500	4" x 12	201235	3000	1100	1250	1300	1100	800	1200	400	1700	1	760	210	760	1673	4500	2000	200	1400
600	6" x 8	201235	2700	1900	1900	1300	1100	800	1200	400	1700	1	760	210	760	2036	3	3	3	3
700	6" x 10	201835	3300	1900	1900	1300	1100	800	1200	400	1700	2	800	300	1000	2850	3	3	3	3
800	6" x 12	201835	3900	1900	1900	1300	1100	800	1200	400	1700	2	800	300	1000	3145	3	3	3	3
900	6" x 12	201835	3900	1900	1900	1300	1100	800	1200	400	1700	2	800	300	1000	3145	3	3	3	3
1000	6" x 14	201850	4500	2100	2100	1300	1100	800	1200	400	1700	3	800	300	1000	3941	3	3	3	3
1250	6" x 16	201850	5200	2100	2100	1300	1100	800	1200	400	1700	3	800	300	1000	4236	3	3	3	3
1350	6" x 18	201850	5800	2100	2100	1300	1100	800	1200	400	1700	3	800	300	1000	4532	3	3	3	3
1500	6" x 20	201835 x 2	6500	2100	2100	1300	1100	800	1200	400	1700	4	800	400	1700	5700	3	3	3	3
1600 (HG800x2)	6" x 24	201835 x 2	2	2	2	1300	1100	800	1200	400	1700	4	800	400	1700	6291	3	3	3	3
2000 (HG1000x2)	6" x 28	201850 x 2	2	2	2	1300	1100	800	1200	400	1700	6	800	400	1700	7882	3	3	3	3
2500 (HG1250x2)	6" x 32	201850 x 2	2	2	2	1300	1100	800	1200	400	1700	6	800	400	1700	8473	3	3	3	3
3000 (HG1000x3)	6" x 42	201850 x 3	2	2	2	1300	1100	800	1200	400	1700	9	1200	400	1700	11800	3	3	3	3
4000 (HG1350x3)	6" x 56	201850 x 3	2	2	2	1300	1100	800	1200	400	1700	9	1200	400	1700	13868	3	3	3	3
5000 (HG1250x4)	6" x 64	201850 x 4	2	2	2	1300	1100	800	1200	400	1700	12	1200	400	1700	16850	3	3	3	3
6000 (HG1250x5)	6" x 80	201850 x 5	2	2	2	1300	1100	800	1200	400	1700	15	1200	400	1700	21014	3	3	3	3

1 - For reference only, technical specifications are subject to change without notice.  
 2 - Consult factory  
 3 - Skid mounting is not an option due to size of system



# Hyde GUARDIAN™



## THE HYDE GUARDIAN™ ADVANTAGE

## COMPARE FOR YOURSELF

ECONOMY		
Total Cost of Operation - Low	<input checked="" type="checkbox"/>	
Power Consumption – Low	<input checked="" type="checkbox"/>	
Pressure Drop – Low	<input checked="" type="checkbox"/>	
Consumables – Low	<input checked="" type="checkbox"/>	
Moving Parts – Few	<input checked="" type="checkbox"/>	
Existing Ballast Pump Compatible	<input checked="" type="checkbox"/>	
Footprint - Small, Modular	<input checked="" type="checkbox"/>	
EFFICIENCY		
IMO Type Approved	<input checked="" type="checkbox"/>	
Meets Future Higher Standards	<input checked="" type="checkbox"/>	
Filter System – High Efficiency Disk	<input checked="" type="checkbox"/>	
Sediment Removal	<input checked="" type="checkbox"/>	
Ballast Water UV Treated	<input checked="" type="checkbox"/>	
De-ballast Water UV Treated	<input checked="" type="checkbox"/>	
Backflush – Automatic at Site	<input checked="" type="checkbox"/>	
ENVIRONMENT		
Chemicals or Active Substances	<input checked="" type="checkbox"/>	
Chemical/Active Substance Storage	<input checked="" type="checkbox"/>	
Hazardous for Crew	<input checked="" type="checkbox"/>	
Special Training for Crew	<input checked="" type="checkbox"/>	
Added Risk of Corrosion	<input checked="" type="checkbox"/>	

LEAVE NOTHING BUT YOUR WAKE.



HONEST SOLUTIONS. HONEST EQUIPMENT

a LAMOR group company

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