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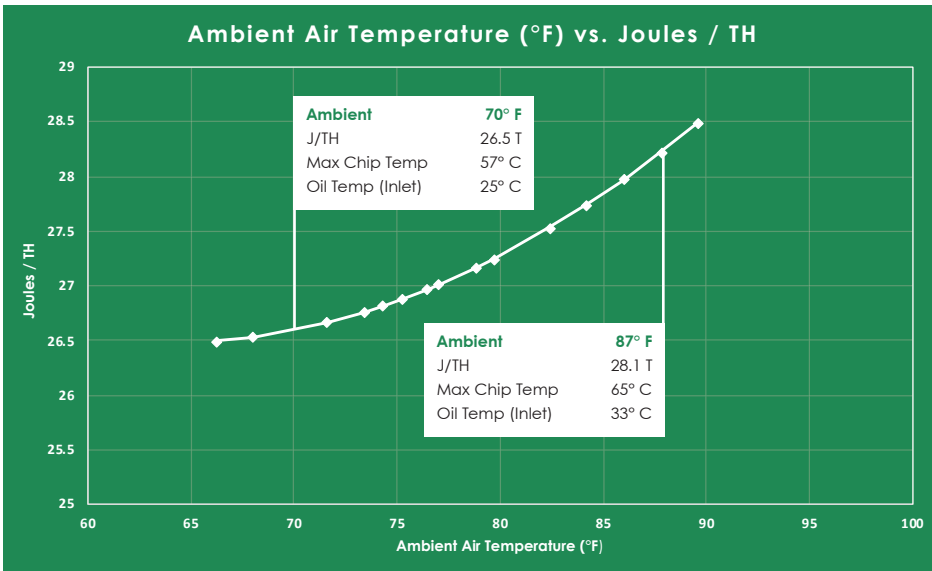
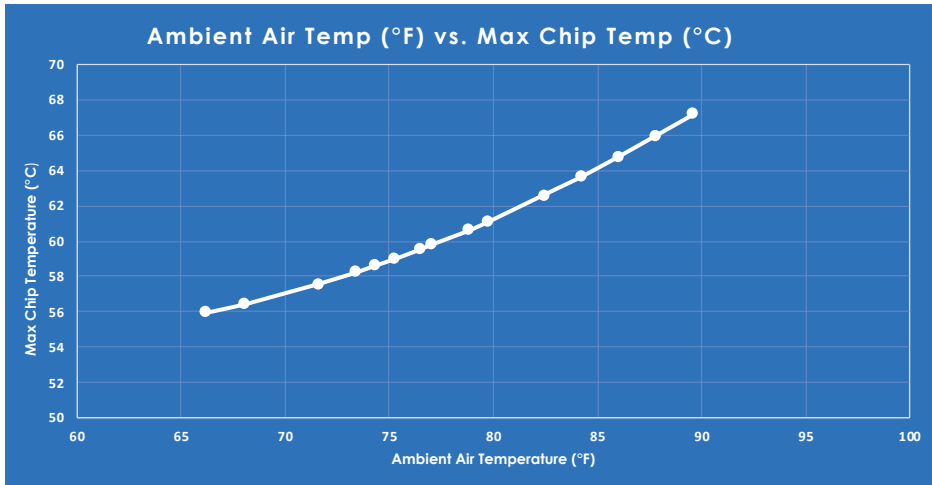
HAYDEN IMMERSION



HAYDEN

60 YEARS OF
INNOVATION

Engineered Immersion Cooling Systems



Testing Notes:

Our proprietary software monitoring system displays a test tank being cooled by a heat exchanger designed for **90F ambient at 125KW** load.

Despite the (intentionally) undersized heat exchanger, we are able to keep the maximum chip temperature below the critical | shutoff temperature far higher than the system design temperature; this system will outperform its design on hot days.

All miners in the test tank have maximum chip and board temperatures **within 2-3 degrees** of each other at all ambient temperatures, due to our well designed flow control system.

HASH	BOARD TEMP		CHIP TEMP		#	CHIP TEMP		BOARD TEMP		HASH
	INLET	OUTLET	INLET	OUTLET		OUTLET	INLET	OUTLET	INLET	
100T	45° 44°	53° 53°	60° 59°	68° 68°	1	66° 64°	59° 59°	51° 49°	44° 44°	101T
	45° 43°	52° 53°	60° 58°	67° 68°	2	65° 64°	59° 59°	50° 49°	44° 44°	
	46° 44°	52° 53°	61° 59°	67° 68°	3	65° 64°	59° 59°	50° 49°	44° 44°	
83T	43° 42°	52° 53°	58° 57°	67° 68°	1	66° 65°	58° 59°	51° 50°	43° 44°	103T
	43° 43°	53° 55°	58° 58°	68° 70°	2	65° 64°	59° 58°	50° 49°	44° 43°	
	43° 43°	53° 54°	58° 58°	68° 69°	3	65° 64°	59° 59°	50° 49°	44° 44°	
102T	44° 44°	52° 52°	59° 59°	67° 67°	1	67° 66°	56° 58°	52° 51°	41° 43°	106T
	45° 44°	51° 52°	60° 59°	66° 67°	2	66° 66°	57° 58°	51° 51°	42° 43°	
	44° 44°	51° 53°	59° 59°	66° 68°	3	67° 65°	57° 58°	52° 50°	42° 43°	
103T	44° 44°	52° 53°	59° 59°	67° 68°	1	67° 65°	59° 60°	52° 50°	44° 45°	102T
	45° 45°	52° 52°	60° 60°	67° 67°	2	66° 65°	60° 60°	51° 50°	45° 45°	
	45° 43°	53° 53°	60° 58°	68° 68°	3	66° 65°	59° 60°	51° 50°	44° 45°	
102T	45° 44°	52° 52°	60° 59°	67° 67°	1	67° 66°	60° 60°	52° 51°	45° 45°	101T
	46° 44°	52° 52°	61° 59°	67° 67°	2	66° 65°	59° 60°	51° 50°	44° 45°	
	45° 45°	52° 52°	60° 60°	67° 67°	3	66° 66°	60° 61°	51° 51°	45° 46°	
102T	44° 43°	51° 52°	59° 58°	66° 67°	1	67° 66°	60° 60°	52° 51°	45° 45°	104T
	45° 44°	51° 51°	60° 59°	66° 66°	2	67° 66°	60° 60°	52° 51°	45° 45°	
	45° 44°	51° 52°	60° 59°	66° 67°	3	67° 66°	60° 60°	52° 51°	45° 45°	
102T	45° 44°	52° 53°	60° 59°	67° 68°	1	66° 65°	58° 59°	51° 50°	43° 44°	102T
	46° 44°	51° 52°	61° 59°	66° 67°	2	66° 65°	59° 60°	51° 50°	44° 45°	
	46° 44°	52° 53°	61° 59°	67° 68°	3	66° 65°	59° 60°	51° 50°	44° 45°	
101T	44° 43°	50° 51°	59° 58°	65° 66°	1	66° 65°	59° 60°	51° 50°	44° 45°	101T
	45° 45°	50° 51°	60° 60°	65° 66°	2	66° 65°	59° 60°	51° 50°	44° 45°	
	45° 44°	51° 51°	60° 59°	66° 66°	3	66° 65°	59° 60°	51° 50°	44° 45°	
100T	44° 43°	51° 51°	59° 58°	66° 66°	1	67° 66°	59° 60°	52° 51°	44° 45°	96T
	45° 44°	52° 52°	60° 59°	67° 67°	2	67° 66°	60° 60°	52° 51°	45° 45°	
	45° 44°	51° 51°	60° 59°	66° 66°	3	67° 66°	60° 60°	52° 51°	45° 45°	
100T	45° 44°	51° 52°	60° 59°	66° 67°	1	67° 66°	59° 59°	52° 51°	44° 44°	104T
	45° 44°	51° 51°	60° 59°	66° 66°	2	66° 66°	59° 59°	51° 51°	44° 44°	
	46° 45°	52° 52°	61° 60°	67° 67°	3	67° 65°	59° 60°	52° 50°	44° 45°	
103T	45° 43°	51° 52°	60° 58°	66° 67°	1	67° 67°	58° 59°	52° 52°	44° 44°	100T



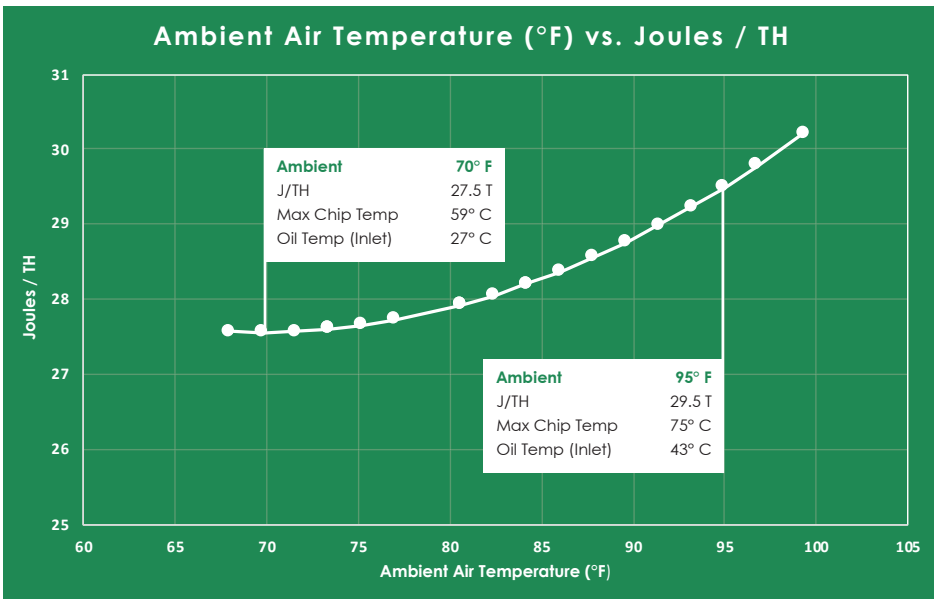
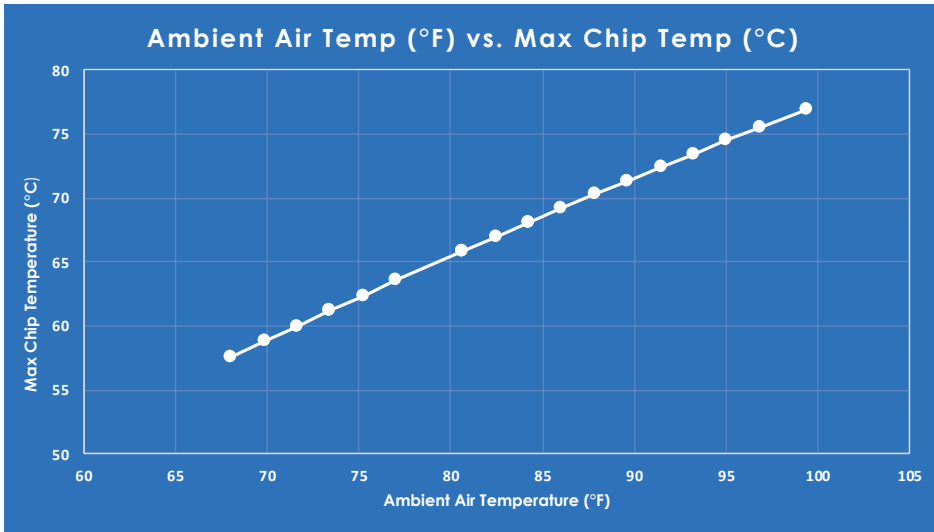
26 Antminer S19
Modular Tank Unit



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Heat Exchanger
Immersion Tank
Performance

125KW @ 90F with a 47°C Tank Inlet
26 S19 Series 96, 104, 110 Models
100TH Preset



Testing Notes:

Our proprietary software monitoring system displays a test tank being cooled by a heat exchanger designed for **90F ambient at 125KW** load.

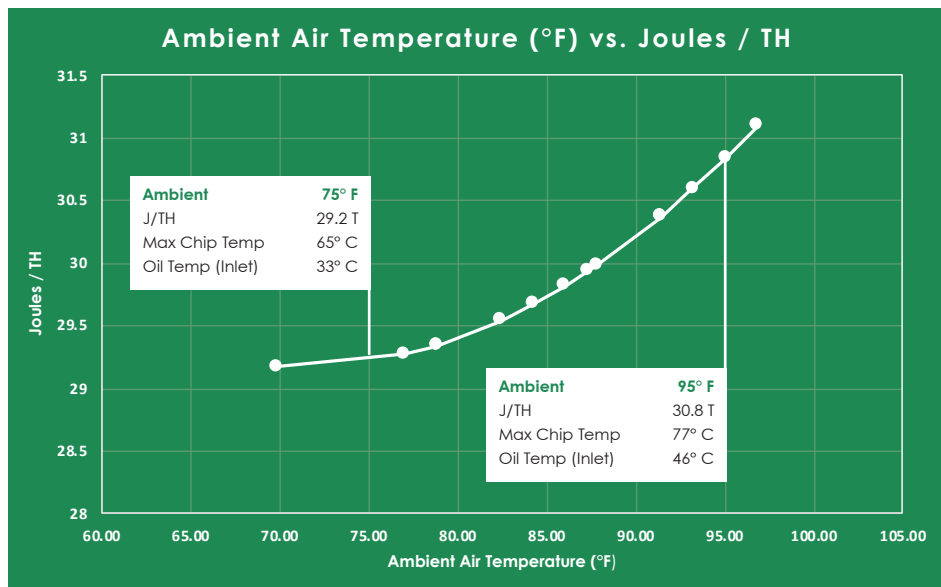
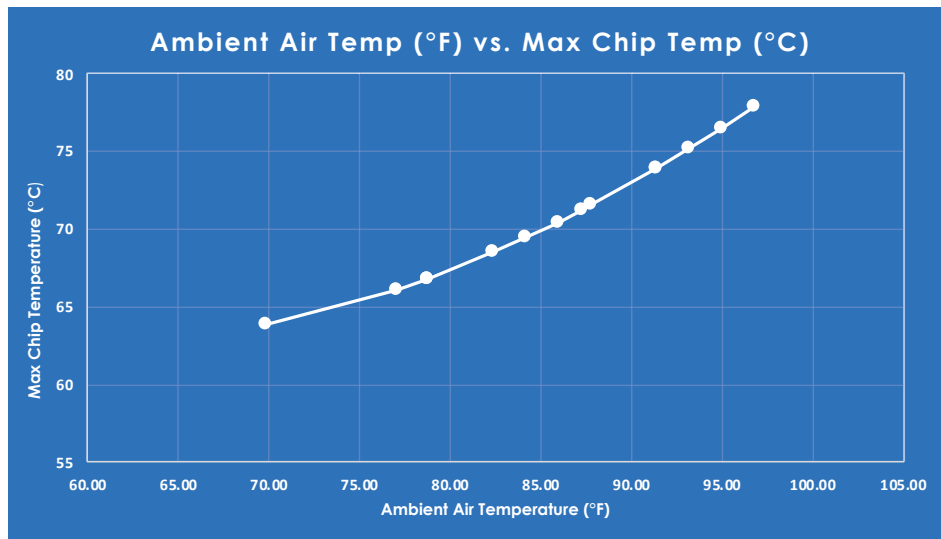
Despite the (intentionally) undersized heat exchanger, we are able to keep the maximum chip temperature below the critical | shutoff temperature far higher than the system design temperature; this system will outperform its design on hot days.

All miners in the test tank have maximum chip and board temperatures **within 2-3 degrees** of each other at all ambient temperatures, due to our well designed flow control system.

HASH	BOARD TEMP		CHIP TEMP		#	CHIP TEMP		BOARD TEMP		HASH
	INLET	OUTLET	INLET	OUTLET		OUTLET	INLET	OUTLET	INLET	
112 T	41° 40'	50° 51'	56° 55'	65° 66'	1	64° 63'	53° 54'	49° 48'	38° 39'	112 T
	41° 40'	51° 52'	56° 55'	66° 67'	2	65° 64'	54° 55'	50° 49'	39° 40'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	66° 64'	53° 54'	51° 49'	38° 39'	
113 T	43° 41'	52° 53'	58° 56'	67° 68'	1	64° 63'	53° 54'	49° 48'	38° 39'	110 T
	43° 42'	53° 55'	58° 57'	68° 70'	2	65° 64'	54° 55'	50° 49'	39° 40'	
	43° 42'	53° 54'	58° 57'	68° 69'	3	66° 64'	53° 54'	51° 49'	38° 39'	
111 T	41° 40'	50° 51'	56° 55'	65° 66'	1	65° 64'	54° 55'	50° 49'	39° 40'	110 T
	41° 40'	51° 52'	56° 55'	66° 67'	2	66° 65'	55° 56'	51° 50'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	67° 65'	54° 55'	52° 50'	39° 40'	
111 T	41° 40'	50° 51'	56° 55'	65° 66'	1	65° 64'	54° 55'	50° 49'	39° 40'	109 T
	41° 40'	51° 52'	56° 55'	66° 67'	2	66° 65'	55° 56'	51° 50'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	67° 65'	54° 55'	52° 50'	39° 40'	
111 T	41° 40'	50° 51'	56° 55'	65° 66'	1	66° 65'	55° 56'	51° 50'	40° 41'	112 T
	41° 40'	51° 52'	56° 55'	66° 67'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	68° 66'	56° 56'	53° 51'	41° 41'	
110 T	40° 39'	49° 50'	55° 54'	64° 65'	1	66° 65'	55° 56'	51° 50'	40° 41'	113 T
	41° 40'	50° 51'	56° 55'	65° 66'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	68° 66'	56° 56'	53° 51'	41° 41'	
112 T	41° 40'	50° 51'	56° 55'	65° 66'	1	65° 64'	54° 55'	50° 49'	39° 40'	110 T
	41° 40'	51° 52'	56° 55'	66° 67'	2	66° 65'	55° 56'	51° 50'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	67° 65'	54° 55'	52° 50'	39° 40'	
111 T	40° 39'	49° 50'	55° 54'	64° 65'	1	65° 64'	54° 55'	50° 49'	39° 40'	111 T
	41° 40'	50° 51'	56° 55'	65° 66'	2	66° 65'	55° 56'	51° 50'	40° 41'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	67° 65'	54° 55'	52° 50'	39° 40'	
110 T	40° 39'	49° 50'	55° 54'	64° 65'	1	65° 64'	54° 55'	50° 49'	39° 40'	108 T
	41° 40'	50° 51'	56° 55'	65° 66'	2	66° 65'	55° 56'	51° 50'	40° 41'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	67° 65'	54° 55'	52° 50'	39° 40'	
112 T	40° 39'	49° 50'	55° 54'	64° 65'	1	65° 64'	54° 55'	50° 49'	39° 40'	111 T
	41° 40'	50° 51'	56° 55'	65° 66'	2	66° 65'	55° 56'	51° 50'	40° 41'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	67° 65'	54° 55'	52° 50'	39° 40'	
111 T	40° 39'	49° 50'	55° 54'	64° 65'	1	66° 65'	55° 56'	51° 50'	40° 41'	112 T



26 Antminer S19
Modular Tank Unit



Testing Notes:

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HASH	BOARD TEMP					CHIP TEMP					CHIP TEMP					BOARD TEMP				HASH
	INLET	OUTLET	INLET	OUTLET		OUTLET	INLET	OUTLET	INLET		OUTLET	INLET	OUTLET	INLET		OUTLET	INLET	OUTLET	INLET	
118 T	42°	41°	51°	52°	57°	56°	66°	67°	1	65°	64°	54°	55°	50°	49°	39°	40°			122 T
	42°	41°	52°	54°	57°	56°	67°	69°	2	66°	65°	55°	56°	51°	50°	40°	41°			
	42°	42°	52°	53°	57°	57°	67°	68°	3	67°	65°	54°	55°	52°	50°	39°	40°			
118 T	43°	41°	52°	53°	58°	56°	67°	68°	1	65°	64°	54°	55°	50°	49°	39°	40°			121 T
	43°	42°	53°	55°	58°	57°	68°	70°	2	66°	65°	55°	56°	51°	50°	40°	41°			
	43°	42°	53°	54°	58°	57°	68°	69°	3	67°	65°	54°	55°	52°	50°	39°	40°			
120 T	43°	41°	52°	53°	58°	56°	67°	68°	1	66°	65°	55°	56°	51°	50°	40°	41°			121 T
	43°	42°	53°	55°	58°	57°	68°	70°	2	67°	66°	55°	56°	52°	51°	40°	41°			
	43°	42°	53°	54°	58°	57°	68°	69°	3	68°	66°	56°	56°	53°	51°	41°	41°			
117 T	42°	41°	51°	52°	57°	56°	66°	67°	1	66°	65°	55°	56°	51°	50°	40°	41°			120 T
	42°	41°	52°	54°	57°	56°	67°	69°	2	67°	66°	55°	56°	52°	51°	40°	41°			
	42°	42°	52°	53°	57°	57°	67°	68°	3	68°	66°	56°	56°	53°	51°	41°	41°			
120 T	42°	41°	51°	52°	57°	56°	66°	67°	1	67°	66°	56°	57°	52°	51°	41°	42°			119 T
	42°	41°	52°	54°	57°	56°	67°	69°	2	69°	67°	56°	57°	54°	52°	41°	42°			
	42°	42°	52°	53°	57°	57°	67°	68°	3	68°	67°	57°	57°	53°	52°	42°	42°			
120 T	41°	40°	50°	51°	56°	55°	65°	66°	1	67°	66°	56°	57°	52°	51°	41°	42°			122 T
	41°	40°	51°	52°	56°	55°	66°	67°	2	69°	67°	56°	57°	54°	52°	41°	42°			
	41°	41°	51°	53°	56°	56°	66°	68°	3	68°	67°	57°	57°	53°	52°	42°	42°			
122 T	42°	41°	51°	52°	57°	56°	66°	67°	1	66°	65°	55°	56°	51°	50°	40°	41°			120 T
	42°	41°	52°	54°	57°	56°	67°	69°	2	67°	66°	55°	56°	52°	51°	40°	41°			
	42°	42°	52°	53°	57°	57°	67°	68°	3	68°	66°	56°	56°	53°	51°	41°	41°			
118 T	41°	40°	50°	51°	56°	55°	65°	66°	1	66°	65°	55°	56°	51°	50°	40°	41°			121 T
	41°	40°	51°	52°	56°	55°	66°	67°	2	67°	66°	55°	56°	52°	51°	40°	41°			
	41°	41°	51°	53°	56°	56°	66°	68°	3	68°	66°	56°	56°	53°	51°	41°	41°			
119 T	41°	40°	50°	51°	56°	55°	65°	66°	1	67°	66°	56°	57°	52°	51°	41°	42°			121 T
	41°	40°	51°	52°	56°	55°	66°	67°	2	69°	67°	56°	57°	54°	52°	41°	42°			
	41°	41°	51°	53°	56°	56°	66°	68°	3	68°	67°	57°	57°	53°	52°	42°	42°			
118 T	42°	41°	51°	52°	57°	56°	66°	67°	1	67°	66°	56°	57°	52°	51°	41°	42°			122 T
	42°	41°	52°	54°	57°	56°	67°	69°	2	69°	67°	56°	57°	54°	52°	41°	42°			
	42°	42°	52°	53°	57°	57°	67°	68°	3	68°	67°	57°	57°	53°	52°	42°	42°			
120 T	41°	40°	50°	51°	56°	55°	65°	66°	1	67°	66°	56°	57°	52°	51°	41°	42°			121 T



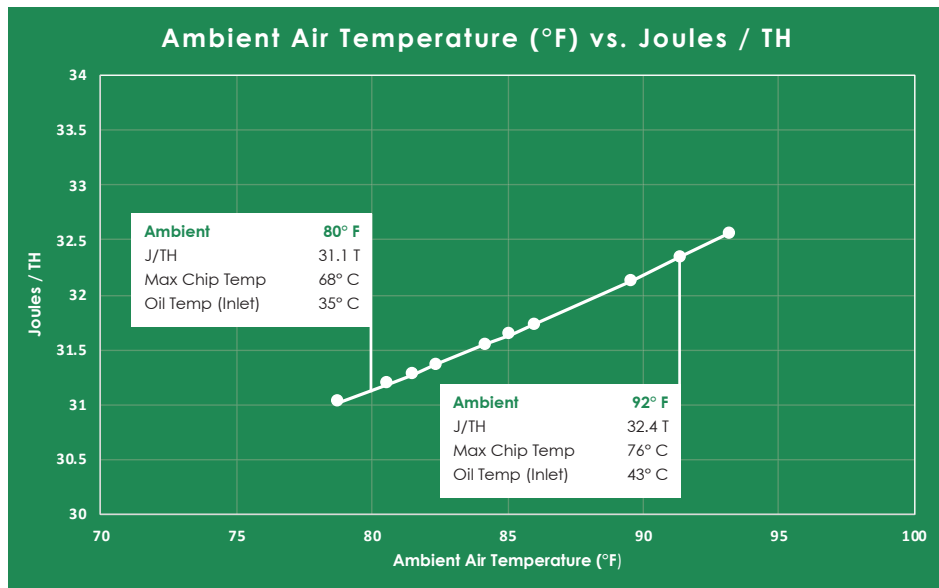
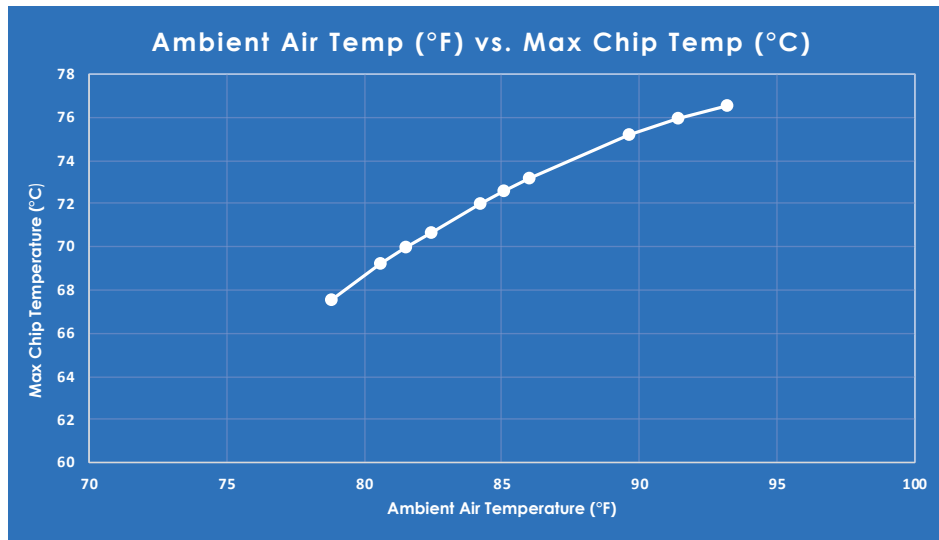
26 Antminer S19
Modular Tank Unit



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Heat Exchanger
Immersion Tank
Performance

125KW @ 90F with a 47°C Tank Inlet
26 S19 Series 96, 104, 110 Models
120TH Preset



Testing Notes:

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HASH	BOARD TEMP				CHIP TEMP	INLET	OUTLET	INLET	OUTLET	Φ	CHIP TEMP	INLET	OUTLET	BOARD TEMP	INLET	HASH
	INLET	OUTLET	INLET	OUTLET												
126T	43°	41°	52°	53°	58°	56°	67°	68°	1	66°	65°	55°	56°	51°	50°	130T
	43°	42°	53°	55°	58°	57°	68°	70°	2	67°	66°	55°	56°	52°	51°	
	43°	42°	53°	54°	58°	57°	68°	69°	3	68°	66°	56°	56°	53°	51°	
116T	43°	41°	52°	53°	58°	56°	67°	68°	1	66°	65°	55°	56°	51°	50°	129T
	43°	42°	53°	55°	58°	57°	68°	70°	2	67°	66°	55°	56°	52°	51°	
	43°	42°	53°	54°	58°	57°	68°	69°	3	68°	66°	56°	56°	53°	51°	
125T	43°	41°	52°	53°	58°	56°	67°	68°	1	67°	66°	56°	57°	52°	51°	133T
	43°	42°	53°	55°	58°	57°	68°	70°	2	69°	67°	56°	57°	54°	52°	
	43°	42°	53°	54°	58°	57°	68°	69°	3	68°	67°	57°	57°	53°	52°	
126T	43°	41°	52°	53°	58°	56°	67°	68°	1	67°	66°	56°	57°	52°	51°	119T
	43°	42°	53°	55°	58°	57°	68°	70°	2	69°	67°	56°	57°	54°	52°	
	43°	42°	53°	54°	58°	57°	68°	69°	3	68°	67°	57°	57°	53°	52°	
130T	43°	41°	52°	53°	58°	56°	67°	68°	1	68°	67°	56°	58°	53°	52°	129T
	43°	42°	53°	55°	58°	57°	68°	70°	2	70°	68°	57°	58°	55°	53°	
	43°	42°	53°	54°	58°	57°	68°	69°	3	69°	68°	57°	58°	54°	53°	
123T	42°	41°	51°	52°	57°	56°	66°	67°	1	68°	67°	56°	58°	53°	52°	131T
	42°	41°	52°	54°	57°	56°	67°	69°	2	70°	68°	57°	58°	55°	53°	
	42°	42°	52°	53°	57°	57°	67°	68°	3	69°	68°	57°	58°	54°	53°	
129T	43°	41°	52°	53°	58°	56°	67°	68°	1	67°	66°	56°	57°	52°	51°	126T
	43°	42°	53°	55°	58°	57°	68°	70°	2	69°	67°	56°	57°	54°	52°	
	43°	42°	53°	54°	58°	57°	68°	69°	3	68°	67°	57°	57°	53°	52°	
127T	42°	41°	51°	52°	57°	56°	66°	67°	1	67°	66°	56°	57°	52°	51°	132T
	42°	41°	52°	54°	57°	56°	67°	69°	2	69°	67°	56°	57°	54°	52°	
	42°	42°	52°	53°	57°	57°	67°	68°	3	68°	67°	57°	57°	53°	52°	
127T	42°	41°	51°	52°	57°	56°	66°	67°	1	68°	67°	56°	58°	53°	52°	122T
	42°	41°	52°	54°	57°	56°	67°	69°	2	70°	68°	57°	58°	55°	53°	
	42°	42°	52°	53°	57°	57°	67°	68°	3	69°	68°	57°	58°	54°	53°	
128T	42°	41°	51°	52°	57°	56°	66°	67°	1	68°	67°	56°	58°	53°	52°	132T
	42°	41°	52°	54°	57°	56°	67°	69°	2	70°	68°	57°	58°	55°	53°	
	42°	42°	52°	53°	57°	57°	67°	68°	3	69°	68°	57°	58°	54°	53°	
126T	42°	41°	51°	52°	57°	56°	66°	67°	1	68°	67°	56°	58°	53°	52°	141T
	42°	41°	52°	54°	57°	56°	67°	69°	2	70°	68°	57°	58°	55°	53°	
	42°	42°	52°	53°	57°	57°	67°	68°	3	69°	68°	57°	58°	54°	53°	



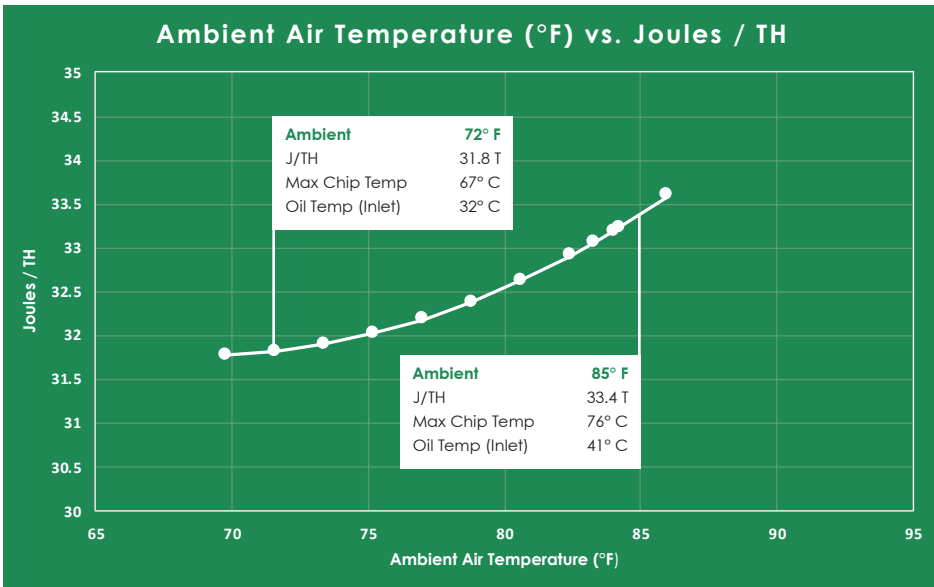
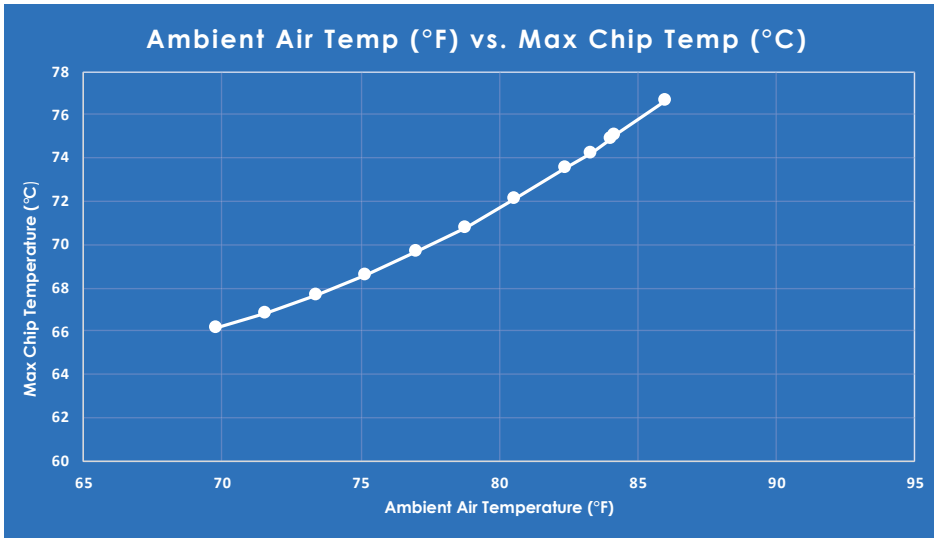
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Despite the (intentionally) undersized heat exchanger, we are able to keep the maximum chip temperature below the critical | shutoff temperature far higher than the system design temperature; this system will outperform its design on hot days.

All miners in the test tank have maximum chip and board temperatures **within 2-3 degrees** of each other at all ambient temperatures, due to our well designed flow control system.

HASH	BOARD TEMP		CHIP TEMP		FAN	CHIP TEMP		BOARD TEMP		HASH
	INLET	OUTLET	INLET	OUTLET		OUTLET	INLET	OUTLET	INLET	
135T	41° 40'	50° 51'	56° 55'	65° 66'	1	64° 63'	53° 54'	49° 48'	38° 39'	140T
	41° 40'	51° 52'	56° 55'	66° 67'	2	65° 64'	54° 55'	50° 49'	39° 40'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	66° 64'	53° 54'	51° 49'	38° 39'	
109T	43° 41'	52° 53'	58° 56'	67° 68'	1	64° 63'	53° 54'	49° 48'	38° 39'	140T
	43° 42'	53° 55'	58° 57'	68° 70'	2	65° 64'	54° 55'	50° 49'	39° 40'	
	43° 42'	53° 54'	58° 57'	68° 69'	3	66° 64'	53° 54'	51° 49'	38° 39'	
135T	41° 40'	50° 51'	56° 55'	65° 66'	1	66° 65'	55° 56'	51° 50'	40° 41'	140T
	41° 40'	51° 52'	56° 55'	66° 67'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	68° 66'	56° 56'	53° 51'	41° 41'	
135T	42° 41'	51° 52'	57° 56'	66° 67'	1	66° 65'	55° 56'	51° 50'	40° 41'	140T
	42° 41'	52° 54'	57° 56'	67° 69'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	42° 42'	52° 53'	57° 57'	67° 68'	3	68° 66'	56° 56'	53° 51'	41° 41'	
139T	41° 40'	50° 51'	56° 55'	65° 66'	1	66° 65'	55° 56'	51° 50'	40° 41'	139T
	41° 40'	51° 52'	56° 55'	66° 67'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	68° 66'	56° 56'	53° 51'	41° 41'	
133T	40° 39'	49° 50'	55° 54'	64° 65'	1	67° 66'	56° 57'	52° 51'	41° 42'	139T
	40° 40'	50° 51'	56° 55'	65° 66'	2	69° 67'	56° 57'	54° 52'	41° 42'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	68° 67'	57° 57'	53° 52'	42° 42'	
141T	41° 40'	50° 51'	56° 55'	65° 66'	1	66° 65'	55° 56'	51° 50'	40° 41'	135T
	41° 40'	51° 52'	56° 55'	66° 67'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	68° 66'	56° 56'	53° 51'	41° 41'	
136T	40° 39'	49° 50'	55° 54'	64° 65'	1	66° 65'	55° 56'	51° 50'	40° 41'	141T
	41° 40'	50° 51'	56° 55'	65° 66'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	68° 66'	56° 56'	53° 51'	41° 41'	
128T	40° 39'	49° 50'	55° 54'	64° 65'	1	66° 65'	55° 56'	51° 50'	40° 41'	133T
	41° 40'	50° 51'	56° 55'	65° 66'	2	67° 66'	55° 56'	52° 51'	40° 41'	
	40° 39'	50° 52'	55° 54'	65° 67'	3	68° 66'	56° 56'	53° 51'	41° 41'	
137T	41° 40'	50° 51'	56° 55'	65° 66'	1	67° 66'	56° 57'	52° 51'	41° 42'	140T
	41° 40'	51° 52'	56° 55'	66° 67'	2	69° 67'	56° 57'	54° 52'	41° 42'	
	41° 41'	51° 53'	56° 56'	66° 68'	3	68° 67'	57° 57'	53° 52'	42° 42'	
140T	41° 40'	50° 51'	56° 55'	65° 66'	1	67° 66'	56° 57'	52° 51'	41° 42'	140T



26 Antminer S19
Modular Tank Unit

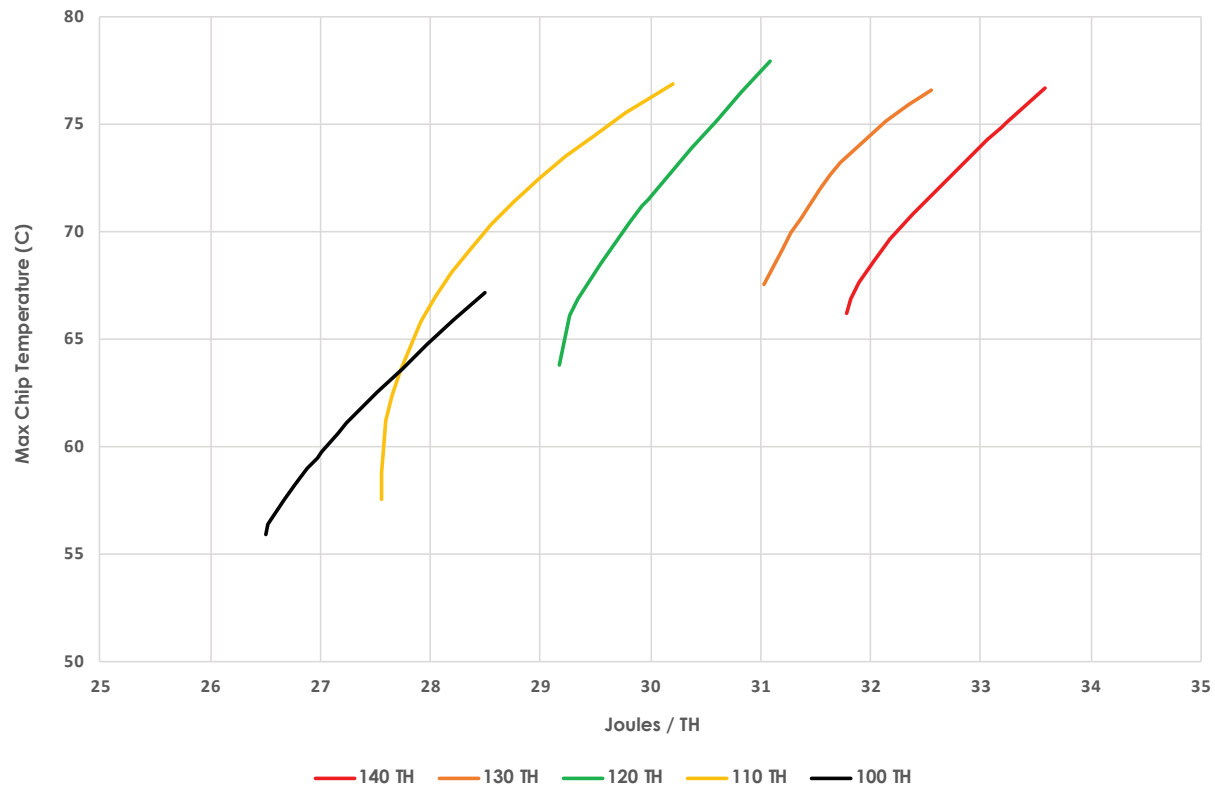


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Heat Exchanger
Immersion Tank
Performance

125KW @ 90F with a 47°C Tank Inlet
26 S19 Series 96, 104, 110 Models
140TH Preset

Max Chip Temperature (C) vs. Joules / TH



The energy efficiency of hashing in an immersion tank, measured in Joules / TH, varies based on the miner chip temperatures; higher chip temperatures generally mean lower efficiency (more power is required to hash at the same rate). We find that for the Antminer S19 series, above 75°C max chip temperatures, the hash rate is consistent, but efficiency goes down as temperature goes up. Below 75°C max chip temperatures, as the temperature gets colder, efficiency increases, but you start to lose hash rate at a given preset; up to 15% of the preset hash rate at the coldest temperatures.

There is an economic decision to be made as to the benefit of increased hash rates vs lower efficiency (higher J/TH) as well as higher efficiency (lower J/TH) vs. the increased capital cost of higher cooling capacity.

One thing to keep in mind is that efficiency is not a static number and will rise and fall with ambient temperatures and seasons. The worst efficiency will only be seen on the hottest parts of the hottest days. Most systems will be able to cool to quite low temperatures during the colder months and overnight.

This fact also stresses the importance of understanding the capabilities of your immersion equipment supplier's ability to provide properly sized heat exchangers. Even poorly designed systems may run quite well during the winter months, but start to overheat as daily ambient temperatures increase.



HAYDEN

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