

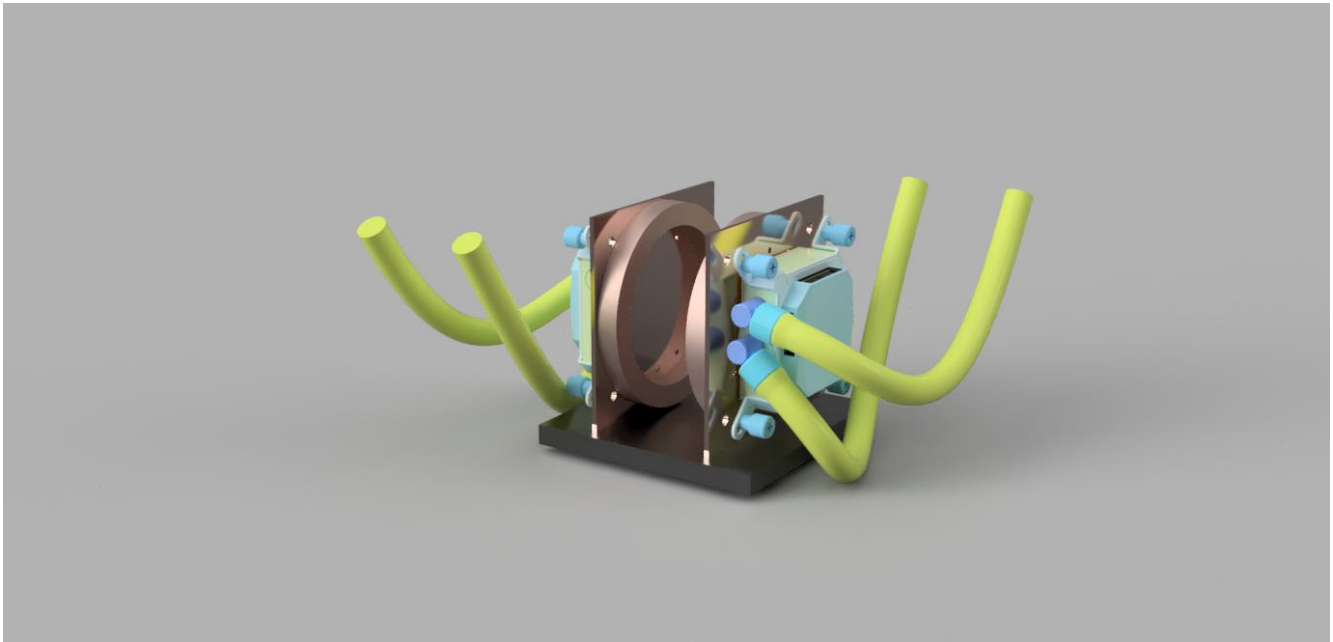


Woodruff Scientific Inc

4000 Aurora Ave N,
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(206) 905 9477 8am to 5pm Pacific
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Model number(s): HH-WC_S

Descriptive name: Small Water-Cooled Helmholtz Coil set for use in air



Features:

- Helmholtz coil pair mounted on Copper form and baseplate
- Designed to be used in air
- Custom sizing and materials based on customer specifications (5cm radius shown)
- Custom harnessing
- Demountable assembly allows for repositioning of coils (variable distances)
- Can be angled 90 degrees on baseplate.
- Water Cooled, 300W per coil

Operational ratings:

Temperature: $\leq 150\text{C}$ (set by polyimide coating on wires)
Field strength: $\leq 10\text{ T}$ (set by fuse limit in wire)



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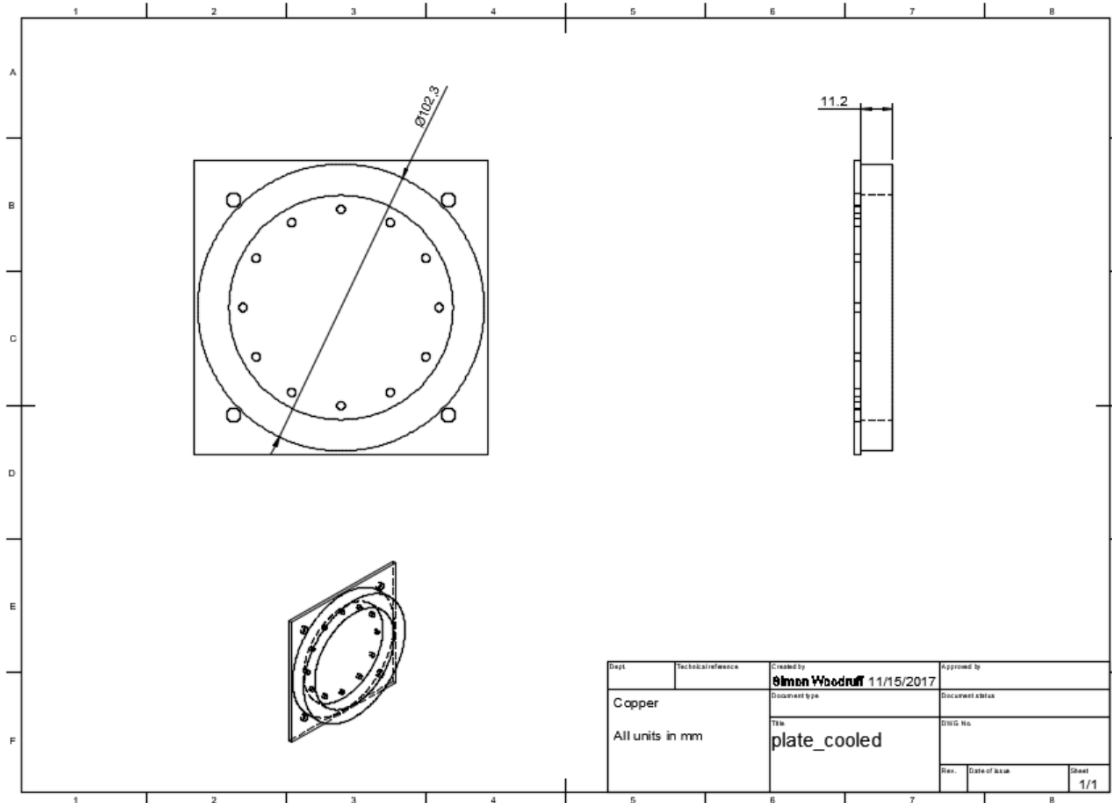
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Options:

- Orientations: Parallel / Anti-parallel
 Usual orientation for the HH configuration is parallel, but coils can be connected anti-parallel to provide a field null between them.
- Electronics: Static / time-varying
 Power supplies can be provided to program waveforms of almost arbitrary functions, from continuous operation to low duty-cycle operations. Computer control can be provided as well as thermal monitoring.

Engineering drawing:





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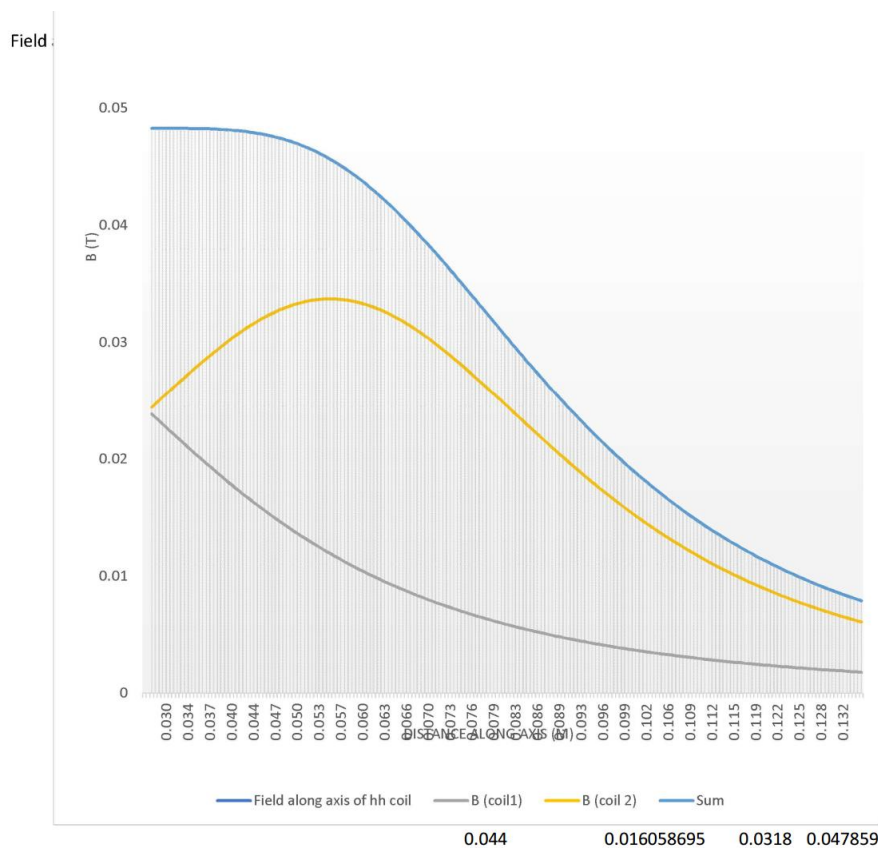
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Customization:

In addition to the options listed previously, the air HH coil can be customized in many different ways. For example, if the application is for pulsed operation with timescales short relative to the resistive diffusion time through the coil form, then an insulating break can be provided in the coil form itself. Other customizations can include form materials selection, wire selection, harnessing, shroud, orientation (two axis systems), water cooling, and so forth.





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HH Coil Calculations

Constants

Specific heat capacity of Cu	S_Cu	0.385	J/g/C
Density of copper	rho_Cu	8.6	g/cm^3
Permeability of free space	mu0	1.26E-06	

Input

Maximum current	Im	9	A	Constraint: 10A
Internal Diameter	ID	9	cm	
Turns per coil	n	340		
On time	tau	60	s	
Gauge of wire	AWG	18		
Aperture width between coils	D_aperture	2.50	cm	Constraint: 18mm

Output

Internal Radius	IR	0.045	m	
Maximum field in coil	Bmax	0.0505	T	
Maximum field in coil	Bmax	505.1838	Gauss	Constraint: 500G
Radius of wire	r_wire	0.0512	cm	
Winding pack dimensions (square)	d_pack	1.89	cm	
# of turns per layer	n_turns_layer	18.44	340.00	
OD of coil	OD	12.77	cm	
Distance between edge of turns	D_turns	2.61	cm	
Thickness of form and cooling channel	D_form	0.06	cm	
Average radius of coil	r_ave	0.054	m	
Length of wire, for two coils	l_wire	233	m	
Volume of wire, for two coils	v_wire	191	cm^3	
Mass of wire, for two coils	m_wire	1645	g	
Resistance of copper wire, total	R_wire	4.9	Ohms	
Voltage required to drive coil in series	V	44	Volts	Constraint: 55V
Energy for heating wire	Im^2.R_wire.tau	23669	J	
Change in temperature in time tau	dT	37.4	C	
Instantaneous Power	P_wire	394	W	
Max on time, without cooling	tau_max	3	Minutes	