

# RIVAL AVIATION



AVIATION GROUND POWER PRODUCTS AND SERVICES



www.rivval.com



CoolSpool Ramp Carts p12

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# services

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# GPUs

## DC PORTABLE GPUS

12V 24V 28V

ALL RIVVAL PORTABLE GPUS ARE CLEARED FOR AIR TRANSPORTATION

THE RANGE IS DESIGNED TO COVER ALL TYPES OF GROUND AND FLIGHT OPERATIONS

### SELECTING THE CORRECT GPU

Selecting the correct model of GPU for starting turbines and with sufficient power for pre-flight checks is essential for good turbine starting performance and long product life.

The following checklist will assist in the correct GPU selection. RIVVAL's technical support department will be pleased to offer advice.

- **Is the pack for emergency use only?**  
A GPU with minimum capacity may be sufficient.
- **Will the pack be carried on board?**  
Beware of reducing weight at the cost of performance.
- **Will the GPU be used for programming/pre-flight checks before spool-up?**  
Allow additional amp/hr capacity to ensure a cool start.
- **Will the GPU be used as the main ramp/hangar GPU on multiple operations?**  
Extend GPU life with extra amp/hr capacity. Consider Coolspool ramp cart range on page 12 for better long-term value.
- **Is the GPU required for regular compressor washing?**  
Expect premature battery replacement if using a small pack – we strongly recommend the Coolspool battery cart range (see page 12).



Coolspool 17: MD500 pre-flight and turbine start

- **Will the GPU be used for regular avionics or maintenance work?**  
Batteries are not designed for the continuous powering of avionics. Consider a GPU with internal power supply or Coolspool cart or power supply connected in parallel.
- **What are the aircraft or FADEC upper/lower voltage limits? (Coolspool carts only)**  
Select correct Coolspool cart with 26 or 28 volt nominal output (see p. 12).
- **Is continuous power required for maintenance or training?**  
Use a GPU with internal power supply or use power supply in parallel to prevent premature battery replacement.
- **How many engine starts are required before the GPU can be re-charged?**  
Remember: starts require amp/hr capacity to maintain volts. More starts require more amp/hr capacity and more weight and therefore larger size. Consider twin packs or Coolspool cart.
- **Is engine free turbine or shaft turbine/turboprop?**  
Longer spool-up times of shaft turbines will require more amp/hr capacity.

#### Disclaimer

The information and data within this brochure regarding pack size, performance and engine models is given in good faith as a guide only. The company accepts no responsibility for errors and omissions.

Selecting any portable GPU is not an exact science. It is a compromise between weight, size, necessary performance, recharge time, battery life and price. It should be noted that the life of the GPU is dependent on the level of discharge each time the GPU is used. The deeper the discharge, then the sooner will be the time when batteries need replacing. Where possible it is always preferable and more cost effective to buy a GPU with the maximum amp/hr capacity.

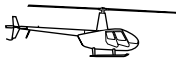
# RP05500/1



**Typical power plant:\*** Arrius, Rolls-Royce 250, PT6A-27. Continental and Lycoming piston. 24V diesel to ten litres (600 cu in), 12V diesel to 3 litres (180 cu in)



Small fixed wing GA piston aircraft



Small turbine and piston helicopters



Small turboprop and all piston aircraft



Free turbine helicopters: police, SAR, Hems, Executive

A tough, budget-priced, dual voltage GPU designed for the private operator and general aviation, it uses the same top-quality, high-discharge batteries as in other Powervamp packs. Ideal for smaller turbine helicopter operators, all piston aircraft or where the starting of 24 volt trucks and plant and 12 volt automobiles is a useful feature. The deep drawn polyethylene case allows the pack to sit in flooded sites up to 200mm (8in) deep without water ingress.

The 12 volt outlet provides a CCA of 470 amps and a peak amp figure of 925. The 25.4 volt DC outlet will deliver up to 850 amps with power control by removable key and 1000 amp switch.

This pack is supplied with 2m (6ft) output lead with rubber Nato plug and 2m (6ft) output lead with 1000 amp cast brass, braided and fully insulated, 'Vulture beak' colour-coded alligator clips. It is cleared for air transportation with key removed.

## SPECIFICATION

Peak amps (max short circuit current)	1800		
5 sec pulse amps	925		
Cell capacity 12 volt	29 amp/hrs		
Cell capacity 24 volt	29 amp/hrs		
Recharge time from 50%	5 hours		
Height	Width	Depth	Weight (without trolley)
570mm (22in)	180mm (7in)	158mm (6in)	21kg (46lbs)
Case	Polyethylene impact resistant moulded case		

## FEATURES

- 4 amp 110/230V 50/60Hz external charger
- 3 coloured LEDs indicate when pack is on charge and battery charge status
- 2-metre (6ft) lead and rubber 3-pin Nato plug
- Separate 2-metre (6ft) colour-coded lead with 1000 amp cast brass and braided, fully insulated, alligator clamps for connection directly to aircraft or vehicle battery terminals.
- Auto-selecting 110/220V AC internal emergency mini charger system (time to recharge from full discharge 16 hours)

## OPTIONS

- For a faster recharge: 10 amp 110/220 volt 50/60Hz external charger  
Charge time from full discharge: 2.5 hours
- Single trolley for ramp or vehicle compound use

\*This information is given in good faith. See disclaimer, page 2

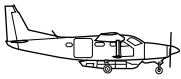
# RP05500/2



**Typical power plant:\* PT6A-27, TFE 331, Arriel, Williams FJ33, GE H80**



GPU 1500: Chinook line maintenance



**Small turboprop (Cessna Caravan series, Pilatus PC-12, PC-7, PC-9, Socata TBM 850) and all piston aircraft**



**Free turbine helicopters: police, SAR, Hems, Executive (e.g. Agusta 109, Dauphin, A-star/Ecureuil, BK117, S76, AS 350, EC 120B, EC 130B, EC 135, EC 145)**

In continuous production for more than 17 years, and in military use worldwide, this latest version of the 1500 GPU uses a tough, corrosion resistant, all stainless steel case with flush sides and full-length handle to prevent snagging in confined spaces. A heavy-duty pull-on/push-off isolator/emergency 'power kill' knob with 'on condition' replaceable silver-plated copper contacts ensures maximum power transfer with minimum voltage drop. The GPU is ideal for carrying on board and for emergency power and turbine starting. Improved, updated and fitted with auto-selecting integral modular mini charging system for remote charging and maximum cell recharge. Suitable for starting all on-board APUs and medium size free turbines.

## SPECIFICATION

Peak amps (max short circuit current)	1556		
Cell capacity	26 amp/hrs		
Cell configuration	series		
Standing volts (off charge)	25.6 volts nominal		
Ambient temperature range	-30°C to +40°C (-22°F to +104°F)		
Height	Length	Width	Weight
450mm (18in)	340mm (13in)	110mm (4in)	23.5kg (52lbs)
Case	All-welded antimagnetic stainless steel case with screw-retained rear cover. Pack sits on 2 x transverse welded 'u' section feet with cut-outs to suit optional lightweight trolley		
Nato stock number	NCAGE: KD628 NSN: 2990-99-930-3147		

## FEATURES

- Flush smooth sides and rectangular shape ensures easy stowage and handling without snagging in confined space
- Solid state digital voltmeter
- Heavy-duty push/pull on/off contactor with safety 'R' clip and replaceable 'on condition' contacts
- Flush-mounted polarized output port
- Fitted with unique input port designed for use with optional mains-powered 28V DC switch mode ramp/shop RIVAL power supply
- Accessory plug
- Controls located on pack top, protected by full-length stainless steel handle and reinforced angled side buttresses
- 2-metre (6ft) heavy-duty double-insulated 50mm sq leads with heavy-duty rubber Nato plug
- Twin 110/220V 50/60Hz 3-stage integral charging modules with charge indicator LEDs
- All-welded stainless steel case with removable screwed back panel

## OPTIONS

- For a faster recharge:  
4 amp 110/120 volt 50/60Hz external charger. Charge time from full discharge: 16 hours  
10 amp 110/220 volt 50/60Hz external charger. Charge time from full discharge: 2.5 hours
- Padded protective jacket
- Single trolley
- 2-metre (6ft) lead with 1000 amp cast brass, braided, fully insulated and colour coded wide jaw 'Vulture beak' alligator clips for plant and vehicle starting

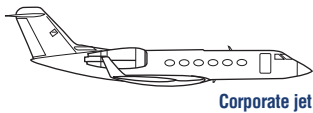
\*This information is given in good faith. See disclaimer, page 2

# RP05500/3

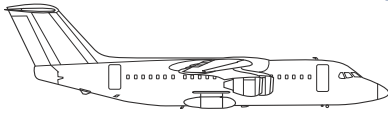


GPU 3000T: PT6-67A start PZL Skytruck

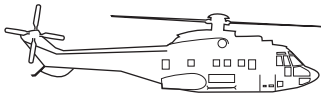
**Typical power plant:\* TPE 331, Makila, PT6-67, Arriel, LF 507, PW 305A, PW 308**



Corporate jet



Regional airliners  
(e.g. BAe 146)



20-seat helicopters with shaft turbines  
(e.g. Cougar and EC225)

Hand-portable GPUs, as their name suggests, cannot be excessively large or heavy. Situations exist where additional amp/hr capacity and performance is required while retaining the essential benefit of 'portability'. The solution – pioneered by Powervamp 19 years ago and now adopted throughout the industry – was to connect two units in parallel. The GPU 3000T (twin) comprises two GPU 1500 units connected by heavy-duty parallel lead (yoke) doubling the capacity from 26 to 52 amp/hrs.

Designed for turbine starting on large helicopters and corporate jets, the GPU 3000T (twin) is easy to use and transport by air. Individual GPU weight is low and packs can be easily stowed on board a vehicle or aircraft. The GPUs are cleared for air transportation with their safety locking isolator.

Repeatedly proven in combat zones and favoured by special forces helicopter units since its introduction in 1995, thousands of these units are in use worldwide. With more than 130 sets with the Republic of Korea army, 50 sets with French forces and multiple sets with other military and civil operators, the GPU 1500 and GPU 3000T are probably the most popular and well-proven medium-size portable GPUs in the world.

## SPECIFICATION

### Individual GPU data as for 1500 pack

Peak amps (max short circuit current)	3000		
Combined cell capacity	52 amp/hrs (packs connected in parallel)		
Overall dimensions: packs including trolley:			
Height	Length	Width	Weight
1000mm (39in)	450mm (18in)	440mm (17½in)	61kg (137lbs)
Nato stock number	NSN 2990-99-789-1831		

## FEATURES

- Solid state digital voltmeter
- Heavy-duty push/pull on/off contactor with safety 'R' clip and replaceable 'on condition' contacts
- Flush-mounted polarized output port
- Fitted with unique input port designed for use with optional mains-powered 28V DC switch mode ramp/shop RIVVAL power supply
- Accessory plug
- Controls located on pack top, protected by full-length stainless steel handle and reinforced angled side buttresses
- 2-metre (6ft) heavy-duty double-insulated 50mm sq leads with heavy-duty rubber Nato plug
- Twin 110/220V 50/60Hz 3-stage integral charging modules with charge indicator LEDs
- All-welded case with removable screwed back panel
- Double trolley
- Heavy-duty parallel yoke

## OPTIONS

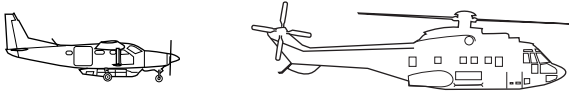
- Second 2-metre (6ft) lead with rubber Nato plug to allow packs to be deployed separately
- 10 amp 110/230v 50/60Hz fast charger with parallel connection lead to charge both packs simultaneously
- Padded transportation/protective jackets for each pack – sold individually
- 2-metre (6ft) lead with 1000 amp cast brass, braided, fully insulated and colour-coded wide jaw 'hawk beak' alligator clips for starting 24 volt plant and vehicles

\*This information is given in good faith. See disclaimer, page 2

# RP05500/4



**Typical power plant:\* TFE 331, PT6-27, Arriel**



**Small turboprop, free turbine engines**

The 1500/40 was originally developed for the Brazilian air force in 2001 in response to the need to replace their existing portable GPUs. Specification required a hand-portable GPU, able to start medium-size helicopters and air force PT6 turbine EMB110 Bandeirante aircraft.

The GPU incorporates an internal 40 amp continuous 28 volt DC output using split 20 amp power supplies for redundancy. The modular design allows easy swap out and field servicing. Input voltage is selectable 110/230 volts 50/60Hz. Packs can be paralleled to double continuous output and amp/hr capacity (model 3000/80).

With Brazil operating more than 100 units, Canadian forces more than 60 units and with multiple units in operation with many armed forces and civil operators, the 1500/40 is recognised worldwide for its versatility and performance. Thousands of 1500/40 GPUs power the helicopters of SAR, HEMS, off-shore operators and the airborne law enforcement helicopters.



GPU 1500/40: Swearingen Metroliner with Garrett TPE331 turbines, Trinidad

## SPECIFICATIONS

Nominal voltage	25.4V
Output voltage	28V (when mains input connected)
Cell capacity	29 amp/hrs
Peak amps (max short circuit current)	1540A
Output amps (max)	40A
Re-charge time (40 amp internal power supply) from 50% discharge	20 minutes
On-board charger	2 x 20A internal power supplies
AC input requirements	100–132V or 200–264V 45–400Hz (selectable input voltage)
Continuous amps (max)	30A
Efficiency	82%
Operating temperature range	-25°C to +50°C (-13°F to +122°F)
Cooling	Fan assisted
Displays	Digital voltmeter Power supply output status LEDs

Height	Length	Width	Weight
300mm (12in)	400mm (16in)	135mm (5in)	26kg (57lbs)
NATO stock number		2990-99-6117404	

## FEATURES

- 40 amp 28.5V DC continuous output (with mains input)
- Power supply LED output monitor – for load monitoring and diagnostic aid
- Solid state DC voltage display – auto mains activated with ‘push to view’ button with timed auto shut down when disconnected from mains)
- 40 amp continuous output with mains power. Split 20 amp independent power modules for redundancy backup
- 10 amp accessory socket. GPU can be re-charged via accessory port or any 24/28V DC vehicle/aircraft power source
- Can be recharged from aircraft 28 volt DC bus
- 1500/40 can be instantly coupled to a second 1500/40 GPU to double amp/hr capacity and double continuous power (model 3000/80)

## SUPPLIED WITH

- Padded protective jacket
- Mains power cord
- 2m (6ft) double insulated heavy-duty output cable with rubber Nato plug
- Set of socket keys for disassembly
- Instruction and parts manual

## OPTIONS

- Single trolley

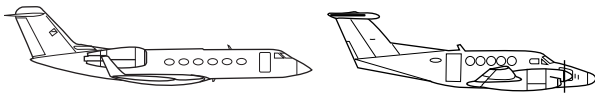
\*This information is given in good faith. See disclaimer, page 2



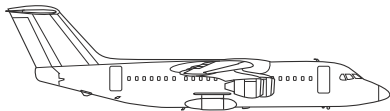
# RP05500/5



**Typical power plant:\* TPE 331, PT6-67, Makila, TFE 731, LF 507, CF 34, PW 120, PW 308**



Shaft turbines, medium turboprop, executive jets



The 3000/80 comprises 2 x 1500/40 GPUs connected in parallel. This twin pack is for starting larger helicopters and business jets where larger turbines or turboprop aircraft require higher instant amperage and longer start cycles.

The 3000/80 delivers more performance while still enabling the operator to handle and stow the units due to the lower individual pack weight. The integral power supplies make the units ideal for maintenance and lengthy pre-flight checks

Larger DC business jets and helicopters generally have higher continuous power requirements during ground ops. The 3000/80 will deliver 80 amps continuous power when connected to mains power.



GPU 3000/80: military application



GPU 3000/80: Bandeirante, Brazil

## SPECIFICATIONS

Output voltage	28V		
Cell capacity	58 amp/hrs		
Short circuit current	3120A		
Practical operational peak amps	1500		
Output amps (max)	80A		
Recommended max cont	70A		
Re-charge time (using 80 amps from internal power supplies) from 50% depth of discharge	20 minutes		
On-board charger	4 x 20 amp internal power supplies		
AC input requirements	100–132V or 200–264V 45–400Hz (select input voltage)		
Continuous amps (max)	60A		
Efficiency	82%		
Operating temperature range	-25°C to +50°C (-13°F to +122°F)		
Cooling	Fan assisted		
Displays	Digital voltmeter power supply output status LEDs		
Height	Length	Width	Weight (inc trolley)
1006mm (37in)	430mm (17in)	500mm (20in)	61kg (134lbs)
NATO stock number			

## FEATURES

- 80 amp 28.5V DC integral power supply
- Twin 'side by side' power packs with 'quick de-couple' connector
- Twin solid state voltage displays – mains activated. Cross checks power cell voltage
- Twin 28V DC accessory ports
- Tough, balanced ramp cart with storage for cable and Nato plug
- The 3000/80 model can be de-coupled to allow each 1500/40 unit to operate independently (requires additional lead and Nato plug)
- Can be recharged via an aircraft 115V 400Hz bus

## SUPPLIED WITH

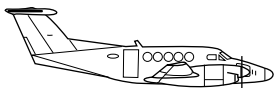
- Padded protective jacket
- Mains power cord
- 2m (6ft) double insulated heavy-duty output cable with rubber Nato plug
- Set of socket keys for disassembly
- Instruction and parts manual

\*This information is given in good faith. See disclaimer, page 2

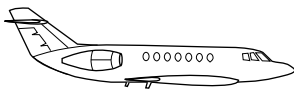
# RP05500/6



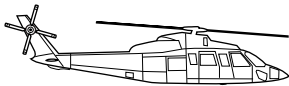
**Typical power plant:\* TPE 331, Arrius, ALF 502**



Corporate turbo prop



Corporate jets



10-16-seat helicopters with shaft turbines

Standard equipment with the British military and carried on board all frigates for turbine starting on all Lynx helicopters, the GPU 2000 pack has been proven in service for over 15 years.

Designed as a larger, more powerful pack than the GPU1500, where the starting of larger turbines with longer start cycles demands more amp/hr capacity, the GPU 2000 is a high performance pack designed for tough daily operations in harsh or remote environments.

Like other RIVAL GPUs it can also be coupled in parallel to double its capacity. A simple parallel yoke will instantly connect two GPU 2000 units to become the GPU 4000T (twin). The GPU has the same heavy-duty pull on/push off isolator as the GPU1500, with replaceable 'on condition' silver-plated contacts for maximum power transfer.

It is used also by logging companies and as an emergency starting pack on ALF 502 turbofans/BAe 146s. Ideal for off-shore operators needing to start a variety of heavier turbines, the pack is designed for rapid deployment and tough handling in extreme environments. There are no protrusions, keys or aperture covers to bend, break, lose or snag when handling or stowing. In use with US and British forces for many years, the GPU 2000 is unequalled in its clean lines, tough all stainless steel case, and 37 amp/hr capacity.

## SPECIFICATION

Peak amps (short circuit current)	2000 amps		
Battery capacity	38 amp/hr (2 x 13V 37.5 amp/hr cells in series)		
Standing volts (off charge)	25.6 volts		
Ambient temperature range	-40°C to +40°C (optional +50°C) (-40°F to +104°F (optional +122°F))		
Case	Non-magnetic stainless steel with M3 screw-retained rear panel for easy service		
Accessory socket	Top-mounted ABS 4-pin plug with screw cap – fuse protected		
Isolator	Push/pull contactor with security 'R' clip and replaceable contacts		
Output socket	Flush polarised plug		
	Auxiliary end-mounted power port designed to accept optional 28V DC continuous power supply or optional fast charger		
Height	Length	Width	Weight
450mm (18in)	440mm (17in)	110mm (4in)	32kg (70lbs)
Nato stock number	NCAGE: KD628 NSN: 2995-99-230-9194		

## SUPPLIED WITH

- 2-metre (6ft) double insulated leads – low temperature flexible and heavy-duty rubber Nato plug
- Twin 110/220V 50/60Hz 3-stage integral charging modules with charge indicator LEDs
- Mains input cable
- Fitted with neoprene anti-slip shock-absorbent feet
- Internal mini charger 110/240V input

## OPTIONS

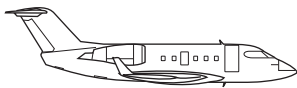
- 4 amp or 10 amp 24V rapid charger, 110/240V 50/60Hz mains input
- Heavy-duty trolley
- 24V work lamp
- Rapid recharge unit
- Padded jacket with cable stowage

\*This information is given in good faith. See disclaimer, page 2

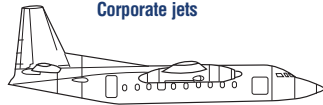
# RP05500/7



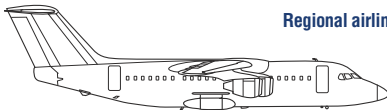
**Typical power plant:\* ALF 502, TPE 331, TFE 331, TFE 731, PW Twin Pack, Makila, PW120, PW305A**



Corporate jets



Regional airliners



30-seat helicopters with shaft turbines

These recently upgraded GPU 2000 packs joined in parallel provide the combination of a hand-portable module with the extra amp/hr capacity to start heavier turbines.

With the same push/pull isolator with replaceable contacts and mini 110/220 volt internal chargers, these packs are designed for everyday use and to be serviced and operated in the field in very harsh environments.

## SPECIFICATION

### Individual GPU data as for 2000 pack

Combined cell capacity 74 amp/hrs (packs connected in parallel)

Peak amps 4000

Overall dimensions: packs including trolley:

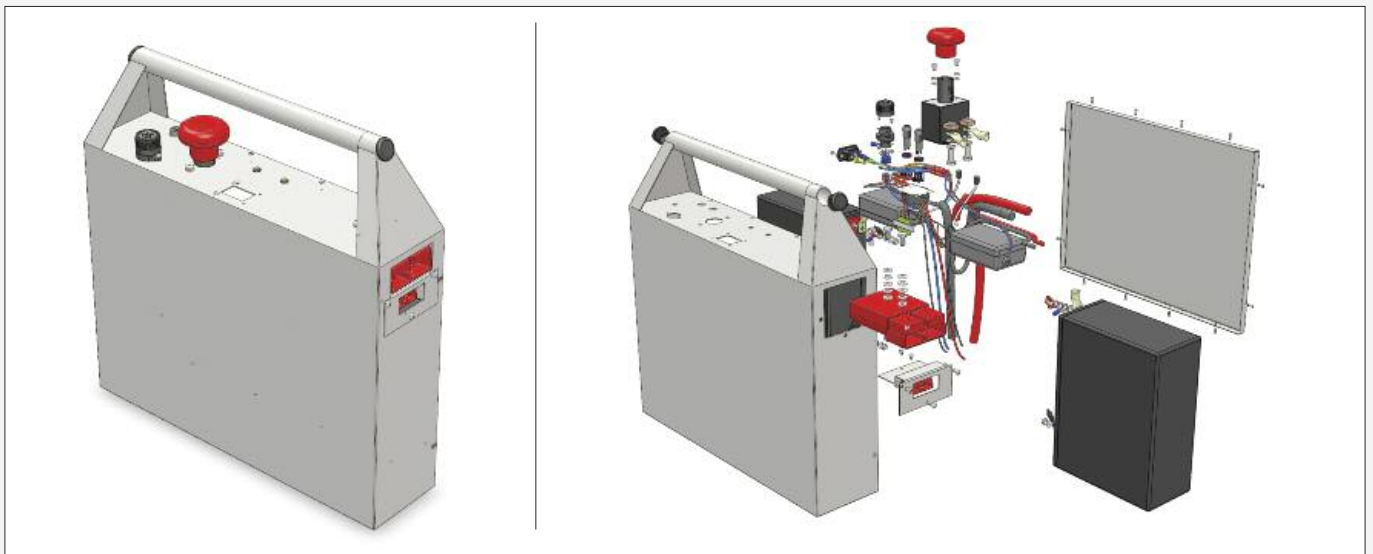
Height	Length	Width	Weight
1000mm (39in)	450mm (15in)	460mm (18in)	85kg (191lbs)

## FEATURES

- Supplied as standard with GPU parallel connecting yoke and trolley with 200mm (8in) diameter rubber wheels and frame of 30mm diameter yellow powder-coated tubular steel. Pack locates forward of wheels
- Fitted with neoprene anti-slip shock-absorbent feet
- Internal mini charger, 110/240V 50/60Hz mains input

## OPTIONS

- 28V DC 40 or 80 amp switch-mode power supply
- 4 amp or 10 amp 24V rapid charger, 110/240V 50/60Hz mains input
- Single trolley
- Woven nylon padded jacket for transportation/pack protection
- Bolt-on trolley shelf to accept 40 or 80 amp power supply unit



*Designed for tough field use side by side as a GPU400T, this twin pack delivers immense power*

\*This information is given in good faith. See disclaimer, page 2

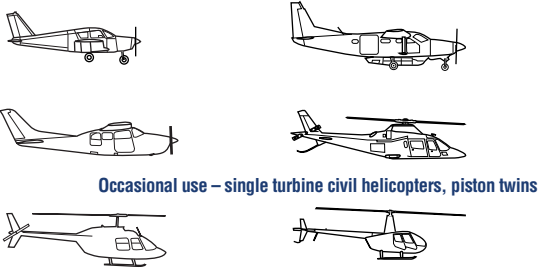
# RP05500/8

## HIGH PERFORMANCE 26 AND 28 VOLT GPUs



Coolspool 17: EC130 preflight and start

**Typical power plant:\* Arrius 2F, Rolls-Royce 250**



Occasional use – single turbine civil helicopters, piston twins

The advanced RIVAL Coolspool 17 is a state-of-the-art portable mini GPU designed as a lightweight emergency starting GPU for piston aircraft and light/medium turbine helicopters. The Coolspool 17 has power, performance and features that far exceed any other comparable mini GPU.

With a nominal voltage of 26–28 volts (for Eclipse-type aircraft) or 28–30 volts DC (for aircraft with a higher upper voltage limit – typically for single turbine helicopters), spool-up performance of this 17 amp/hr pack is more than 12% faster than a similar capacity 24V unit, with minimum weight penalty. Faster spool-ups mean cooler starts, aiding engine life. The Coolspool 17 has its own built-in mini charger. Connecting a 110/220V power cord to the unit will automatically activate the integral 3-stage charger. A 3-colour LED indicates charging status and a solid state digital voltmeter, with push-to-view button and timed auto shutdown, accurately displays output voltage.

The alloy case keeps weight to the minimum while the slim-line design and protective jacket allow the GPU to fit under seats or in any confined space. For continuous 28 volt power for avionics work, maintenance, training or troubleshooting, or for fast charging, the GPU has an accessory port for connection to a power supply or powerful charger.

The Coolspool is cleared for air transportation when protected from short circuit by its special padded protective jacket. It is designed to work alongside Powervamp's 30 amp mini DC power supply. When operating in parallel, the two units offer a unique lightweight combination of performance and versatility.

## SPECIFICATION

Output voltage	29–30V DC Optional lower voltage model: 26–28V		
Capacity amp/hr	17A		
Peak amps	1800A		
5 sec pulse	680A		
Pulse watts	18,920W		
Recharge from 80% DOD (internal charger)	8 hrs approx		
Charger type	Mini 3-stage fully-automatic dual 110/220V 50/60 Hz auto selecting capacity of 1.9 amps		
Case	All alloy welded with screw back and lie-flat handle		
Finish	Powder-coated yellow		
Height	Length	Width	Weight
250mm (10in)	370mm (14in)	95mm (4in)	18kg (40lbs)

## FEATURES

- Solid state digital voltmeter (push-button operated) with 2-minute auto-shutdown
- Internal self-contained mini charger with multi-colour LED charge status display
- S50 auxiliary/accessory port
- Padded jacket for GPU/aircraft protection
- Safe for air transportation
- 2-metre (6ft) mains input cord
- 2-metre (6ft) output cable with heavy-duty rubber Nato plug

## OPTIONS

- 1000 amp cast brass colour-coded and braided alligator clips with 2-metre (6ft) leads
- 30 amp fast charger/combined power supply

## ALSO AVAILABLE

Coolspool 29	with 3-stage mini charger
Coolspool 130 (battery cart)	with integral 28V power supply
Coolspool 260 (battery cart)	with integral 28V power supply
Coolspool 410 (battery cart)	with separate charger
Coolspool 580 (battery cart)	with separate charger

\*This information is given in good faith. See disclaimer, page 2

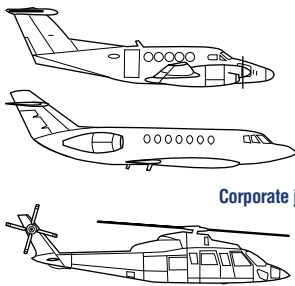
# RP05500/9

# RP05500/10



Coolspool 58: AW139 preflight and start

**Typical power plant:\* TPE 331, PT6-67, Arrius**



Corporate jets

10-16-seat helicopters with shaft turbines

The 28 volt (nominal) 29 amp/hr RIVAL Coolspool 29 portable GPU was developed for larger turbine aircraft and helicopters where portability requirements limit weight and size, but the need to maintain voltage above minimum FADEC limits during the start cycle is critical. This requirement demands that the GPU voltage is at the top of the FADEC upper limit before starter engagement.

When compared to a 24 volt GPU of the same capacity, the Coolspool 29 typically delivers a stunning 30% increase in performance (watts) for the same amperage. With an off-charge voltage of 30 volts, the GPU delivers faster spool-ups, cooler starts and a faster, more positive systems response, which benefits turbine life and system reliability.

Many modern voltage-critical aircraft require the higher 'standing voltage' of the Coolspool 29 to reduce the effect of heavy inrush currents during starting and the momentary voltage collapse below tight FADEC limits. The Coolspool range enables the powering of many aircraft systems that previously could only be activated with the generator on line. The pre-flighting and cycling of systems where aircraft are configured for rapid deployment with role equipment already on line, are examples where the higher Coolspool voltage can prevent the appearance of undesirable/spurious EFIS messages on start-up.

The Coolspool 29 has a built-in mini charger. Connecting any 110/220 volt power cord into the GPU will automatically activate the integral 3-stage charger. A 3-colour LED indicates charging status and a solid-state digital voltmeter, with push-to-view button and timed auto shutdown, accurately displays voltage.

\*This information is given in good faith. See disclaimer, page 2

## SPECIFICATION

	RP05500/9 - Coolspool 29	RP05500/10 - Coolspool 58		
Capacity amp/hr	29	58		
Short circuit current (approx)	1800 amps	2400 amps		
Standing voltage (off charge)	29 volts (nominal)	28		
Re-charge voltage	32-33 volts	32-33 volts		
Charge time with internal mini charger (from 50% depth of discharge )	7 hours	7 hours		
Internal charger	Mini 3-stage fully-automatic dual 110/220V 50/60 Hz auto selecting capacity of 1.9 amps			
Re-charge time using optional 1 x 30 amp charger from 80% discharge	1 hour	Optional 1 x 30amp charger and yoke, from 80% discharge: 2 hours		
Case	Powder-coated light alloy with neoprene shock-absorbing feet			
Safety	Spring-loaded sliding cover protects output socket			
	Height	Length	Width	Weight
Coolspool 29	300mm (12in)	400mm (16in)	135mm (5in)	30kgs (66lbs)
Coolspool 58	300mm (12in)	400mm (16in)	270mm (11in)	60kg (132lbs)

## FEATURES

- Solid state digital voltmeter with push-to-view button and watchdog timer for cell protection
- Internal self-contained mini charger with multi-colour LED charge status display
- Stainless steel sliding safety cover
- Safe for air transportation
- Operates in any position (inverted NOT recommended)
- Padded jacket for GPU/aircraft protection
- Neoprene anti-shock/anti-slip feet
- Can be ganged together to double output to create Coolspool 58
- 10 amp accessory socket for work lamp/solder iron etc
- 2-metre (6ft) mains input cord
- 2-metre (6ft) heavy-duty double insulated output cable with rubber Nato plug

## OPTIONS

- Lightweight or heavyweight trolley
- 24/28 volt work lamp
- Rapid external charger: 10 amps or 80 amps
- 1000 amp cast brass colour-coded and braided alligator clips with 2-metre (6ft) leads

# COOLSPool™

## DC BATTERY CARTS

### HEAVY DUTY DC BATTERY CARTS 26V–28V

130 TO 580 AMP/HOUR CAPACITY  
26 AND 28 VOLT OPTIONS

ULTRA HIGH DISCHARGE RAMP CARTS  
ENVIRONMENT-FRIENDLY POWER

- NO NOISE
- NO POLLUTION
- NO MAINTENANCE

MINIMUM OPERATING COST

RAPID RETURN ON INVESTMENT

RIVVAL's 28 volt DC Coolspool ramp carts are designed to replace diesel GPUs or fixed and semi-mobile transformer rectifier units (TRUs).

Where no mains power is present or noise curfews prohibit use of diesel GPUs, they are a highly efficient, low cost power source – operating at a fraction of the cost of a diesel GPU, yet able to deliver the same power and turbine starting output. These large, new generation, powerful, heavy-duty battery carts provide a combination of instant high amperage with pure DC wave form and full mobility, low initial investment and extremely low operating costs. Their zero noise and zero carbon footprint are important environmental considerations.

With the price of diesel increasing and stricter legislation on noise and CO2 emissions, the advanced technology Coolspool battery cart range is the way forward for regional and feeder airlines' FBOs and ground handling agents under pressure to reduce direct operating costs.

RIVVAL's large 28 volt Coolspool battery cart GPUs are increasingly being used to provide the smooth 28 volt DC power required for pre-flight checks, avionics programming or maintenance. They are ideal for crew training, aircraft turnround/cabin cleaning at remote airport stands (where power can be required for anything from a few minutes to several hours) or where noise curfews or the lack of any electrical supply prohibit any other method of powering the aircraft's DC systems.



*Coolspool 410: Revenue service – line ops,  
Jetstream 41, Allied Signal TPE331*

*Coolspool 410:  
Delta feeder,  
Saab 340, Fort  
Lauderdale*



*Coolspool 260: cold  
weather line ops,  
Jetstream 31,  
Iceland*





Coolspool 130 Specials: ongoing military contract

Unlike a diesel GPU, Coolspool battery carts are simply connected to a charger at the end of the day. Annual savings in fuel and maintenance are typically between \$40,000 and \$300,000 dollars compared with a diesel GPU running daily. There are no diesel costs, no exhaust, no noise, no pollution – and no maintenance.

Direct cost comparisons between a diesel GPU and a Coolspool show savings enabling many operators to amortise the Coolspool GPU in less than 6 months while benefiting from the favourable public and corporate publicity of using environment-friendly equipment.

The modular design of the advanced technology battery pack allows rapid swap-out if necessary. Batteries are sealed, maintenance-free and cleared for air transportation. Able to be used by personnel with the minimum of technical knowledge, Coolspool GPUs are easy to operate and repair.

The Coolspool battery cart range is perfect for remote operations, ramp/hangar duty or regular line operations. Unlike diesel GPUs which need regular maintenance, the Coolspool carts need only a single or 3-phase mains connection for their charger – depending on charge time.

For operators with multiple DC aircraft movements requiring several Coolspool carts, Powervamp supplies a remote multi-charge station which allows several battery carts to be simultaneously re-charged. Because the special cells have no memory effect, carts not in use can be recharged at any time.

## GENERAL SPECIFICATION

The Coolspool battery cart range is supplied to the following specification:

Amp/hr capacity	From 130 amp/hr to 580 amp/hr (see data sheet for specific battery characteristics based on user requirements)
Nominal voltage	28.5 volts
Optional nominal cart voltage	26 volts (for use on aircraft maximum upper voltage limit below 30 volts)
Max starting current (peak amps)	from 1200 to 6000 amps – capped at 2500 amps via cable resistance
Cell type	High power, high performance sealed, starved electrolyte or VRLA gas recombining lead-acid cells connected in series to deliver 28V. All cleared for air transportation
Leads	4-metre (13ft) heavy-duty double-insulated 75mm (3in) section output cable with heavy-duty rubber Nato plug
Charging	80 amp single phase internal/external charger or 240 amp 3-phase external charger

## FEATURES\*

\*Features vary according to model

### Simple controls

- Heavy-duty push/pull (emergency) isolator switch

### Full monitoring

- Digital voltmeter for GPU output voltage display
- Charge ammeter indicating charger output
- LED counter with start monitoring and interlock protection circuit (patent applied for)

### All-weather operation

- Cold weather protection/anti-cold soak insulation

### Rough terrain chassis

- Elastomeric rear suspension
- Bolt-on replaceable front axle assembly
- Bolt-on side protection bars
- Bolt-on mudguards
- Removable rear control panel module

### General

- Paint finish – powder-coat yellow
- Replaceable alloy corrosion-proof panels
- Spare wheel (side mounted)
- Foot operated parking brake
- Fire extinguisher (supplied only if shipped by road due to air transport regulations)
- 12 months warranty against faulty parts or labour (batteries are on a proportional warranty based on usage over time)

## RANGE OPTIONS

Model	Height	Dimensions*		Weight	Integral power supply	Capacity (amp/hrs)	Output cable lengths
		Length	Width				
Coolspool 580	950mm (37in)	1500mm (59in)	820mm (32in)	560kg (1,234lbs)	External	580	4m (13ft) standard
Coolspool 410	950mm (37in)	1500mm (59in)	820mm (32in)	477kg (1,051lbs)	External	350	4m (13ft) standard
Coolspool 260	710mm (28in)	1060mm (42in)	720mm (28½in)	270kg (594lbs)	80 amps	260	4m (13ft) standard
Coolspool 130	710mm (28in)	1060mm (42in)	720mm (28½in)	157kg (346lbs)	80 amps	130	4m (13ft) standard

\*Allow an extra 100mm (3.9in) for handle during transportation

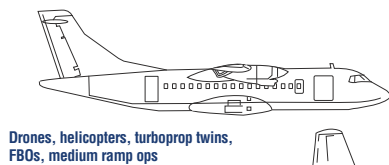
# RP05500/11 -130

# RP05500/12 - 260



**Typical power plant:\* PT6A-27, Makila, TPE 731, GE T700, AE3007, CF34**

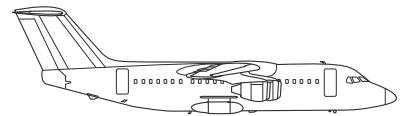
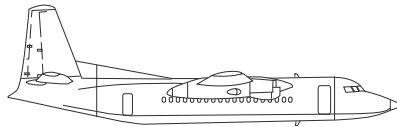
**Typical power plant:\* PT6C-67, Makila, TPE 731, ALF 502, HTF7000, RR Tay**



Drones, helicopters, turboprop twins, FBOs, medium ramp ops



FBOs, multiple heli-ops requiring heavy comp washes, training, civil and military. Ramp ops – large single shaft and 8-14 seat commuters, limited despatch or regional aircraft



## SPECIFICATIONS

28V DC Battery Cart	CoolSpool 130	CoolSpool 260	Coolspool 410	Coolspool 580
Peak amps (max starting current)	2000 amps	2500 amps	3500 amps	2800 amps
Amp hours	130 amp/hr	260 amp/hr	410 amp/hr	580 amp/hr
Max. power supply output	80	80	Separate charge	Separate charge
Continuous rating (recommended)	60	60	n/a	n/a
AC input voltage @ 220V	8 amps	16 amps	DC input from separate charger.	
AC input voltage @ 110V	16 amps	32 amps	Options: 80 amps 1-phase; 240 amps 3-phase	
Dimensions Length	1060mm (42in)	1060mm (42in)	1630mm (64in)	1500mm (59in)
Height	720mm (28½in)	720mm (28½in)	920mm (36in)	820mm (32in)
Width	710mm (28in)	710mm (28in)	750mm (29½in)	950mm (37in)
Weight	157kg (346lbs)	270kg (594lbs)	477kg (1,051lbs)	560kg (1,234lbs)
Batteries – 28V	4 x 6V, 1 x 4V	8 x 6V, 2 x 4V	14 x 2V	14 x 2V
26V	3 x 6V, 2 x 4V	6 x 6V, 2 x 4V	13 x 2V	13 x 2V
Control panel:	Digital voltmeter, digital ammeter, On/Off power knob			
Charge input plug: CS130, CS260	Single phase 16 amps @240 volts mains input	Single phase	S350 polarised DC accepts single- or 3-phase charger	
ON/OFF emergency isolator:	Heavy-duty double pole push/pull switch with red mushroom knob			
Accessory socket:	28V DC accessory socket, fused @ 10 amps, suitable for worklight, DC			
Power cells:	5 x 130 amp/hr series connected starved electrolyte gas recombining cells. Cells cleared for air transportation Correctly protected in accordance with ICAO regulations			
Tyres:	4 x 260mm (10.5in) pneumatic		4 x 400mm (16in) pneumatic	
Integral power supply charging system:	110/220V AC selectable single-phase switch mode powersupply/charger. Regulated to 31.2 volts DC. Units comprise 2 x 20 amp TEFC independent switch-mode modules paralleled for reliability. Short circuit protected, current overload protection			
NCAGE:	KD628			



Coolspool 260: First flight of the day, 90 amps for 45 minutes. 1850 amps starting peak

\*This information is given in good faith. See disclaimer, page 2



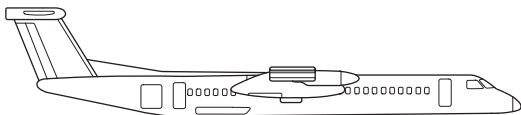
# RP05500/13 - 410 RP05500/14 - 580



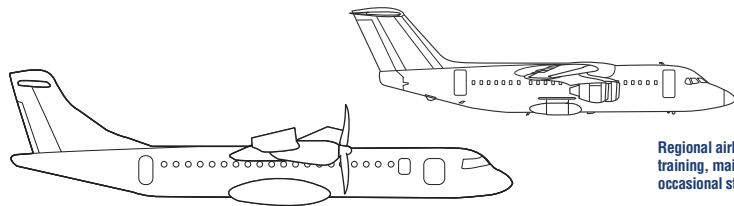
**Typical power plant:**\* PT6C-67, TPE 331-12, RR Dart 356, RR AE3007A, PW121, PW127, PW150A, ALF 502, CF34B, BR710



**Typical power plant:**\* Ramp services, training, maintenance, fault-finding, cabin cleaning, occasional turbine start



All regular line ops, 30-80 seat airline DC turboprops, Mil transports. Regional airports, FBOs, pre-flight and start



Regional airlines - all DC aircraft, training, maintenance, cleaning, occasional starts

## UNITS SUPPLIED AS STANDARD WITH

- Spare wheel
- Foam fire extinguisher (road shipment only)
- 4-metre (13ft) double insulated DC output cable
- Nato plug
- Frame manufactured from steel hollow section, finished in powder-coat yellow, side panels all alloy replaceable

## OPTIONS

- 4-cable 70 mm (3in) section 4-metre (13ft) double-insulated output cable (for minimum voltage drop under very heavy load)

Coolspool 410: preflight and start, Q400



Coolspool 580: Q400 - supplying power during heavy maintenance

\*This information is given in good faith. See disclaimer, page 2

# POWER SUPPLIES

## DC LIGHTWEIGHT PORTABLE POWER SUPPLIES 12V 28V



Electronic flight decks, once the sacred ground of the large corporate and wide body, are now common to every type and size of aircraft. Remaining ahead of the curve with the faster speeds of the VLJs requires private and corporate pilots to be proficient in the use of their EFIS. Practice and the need to update software are two reasons why all aircraft operators should own a reliable and compact power supply, able to be used for training, fault finding or software updates.

Powervamp's first 28 volt 40 amp power supply was produced in 1995 as a solution to the problem of training police observers on FLIR systems. Until then, training involved expensive helicopter flying hours or powering a FLIR system with battery GPUs with limited power duration.

Powervamp, with its range of power supplies from 30 to 600 amps, manufactures units for all types of aircraft from the Cessna 175 to the largest of DC aircraft such as the ATR, Embraer 145, Q400 and Saab 340.

Confirmation of Powervamp's quality and performance has been endorsed by some of the world's largest manufacturers of private, business and corporate jets who have selected Powervamp power supplies as their branded product supplied to customers for software updates and a source of DC power at remote locations. Other manufacturers too have selected Powervamp power supplies as the chosen unit for their service support teams. In every case, quality, reliability and product support are key.

### SELECTING THE CORRECT POWER SUPPLY

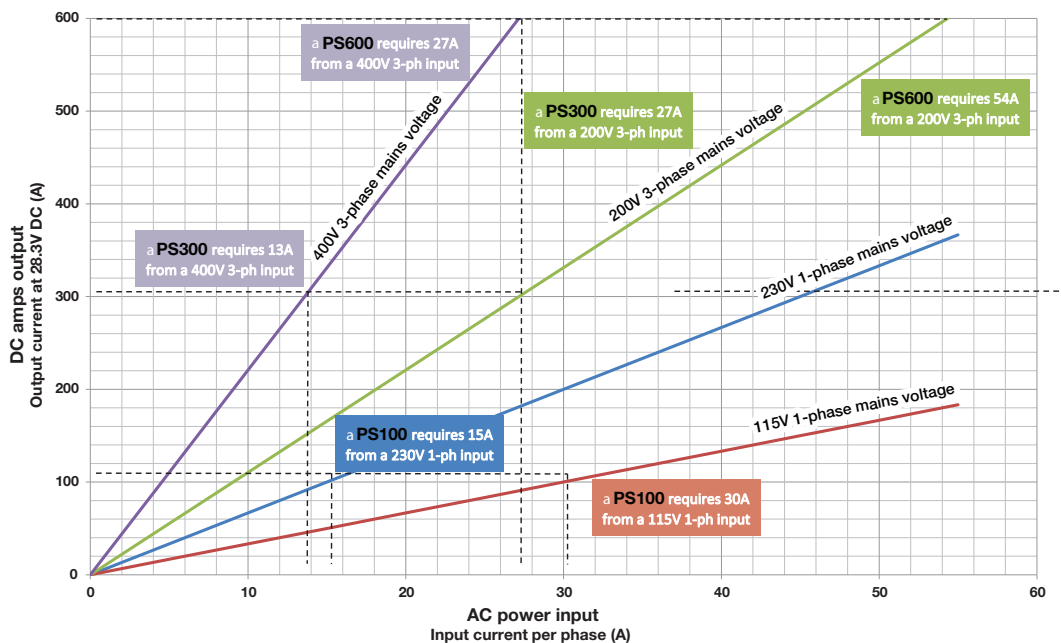
When deciding on the size of power supply, operators should consider the following.

While weight, size and cost are criteria for decision making, where aircraft loads may fluctuate, Powervamp strongly recommends a power supply with a digital voltmeter. Power demand fluctuating close to or above overload will trigger a progressive automatic voltage shutdown which can cause radio static and possible data loss. A digital voltmeter will visually alert the operator to the situation.

All Powervamp power supplies are fitted with accurate digital voltmeters. The larger units are fitted with digital ammeters to give pilots and engineers an instant reading of the load as each system is powered up.

The graph below shows the single-phase and 3-phase input amps at various voltages required for a specific DC output. Operators should be aware of possible power output limitations at 110 volts where the mains C/B rating may be insufficient to allow maximum DC output. In this situation, the anticipated output load will need to be checked against the input amperage, which must be less than the circuit breaker rating.

### MAINS POWER INPUT REQUIRED TO DELIVER MAXIMUM OUTPUT FOR EACH POWER SUPPLY



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## POWER SUPPLIES

Power Supply	Output voltage (V)	Maximum current (A)	Input voltage required (V)
PS30	28	30	110/230 1-ph
PS50	28	50	110/230 1-ph
PS100	28	100	110/230 1-ph
PS300	28	300	230/400 3-ph
PS400	28	400	230/400 3-ph
PS600	28	600	230/400 3-ph

## COMBINED POWER SUPPLIES/CHARGERS

Combined Power Supply/Charger	Dual Output Voltages (V)		Maximum current (A)	Suitable for charging	Input voltage required (V)
PS30C	28	31.5	30	24V/26V batteries	110/230 1-ph
PS50C	28	31.5	50	24V/26V batteries	110/230 1-ph
PS80C	31.5	33.6	80	26/28V batteries	230 1-ph
PS100C	28	31.5	100	24/26V batteries	110/230 1-ph
PS240C	31.5	33.6	240	26/28V batteries	230/400 3-ph
PS300C	28	31.5	300	24V/26V batteries	230/400 3-ph

# PS30C and PS50C

RIVAL's PS30C and PS50C miniature power supplies are lightweight combination charger/power supplies able to deliver 30 or 50 amps depending on model, at a pre-set voltage between 28.4 and 31.5 volts (for 28 volt Coolspool charging) as selected by the operator. Power supplies can be connected directly to the aircraft's external ground power receptacle or to any of Powervamp's portable battery GPUs.

The PS30C/PS50C are designed for operators of smaller helicopters and VLJs needing to download data or programme avionics in any location where size and weight are important.

The automatic 120/240 volt 50/60Hz input allows international use. A solid state voltmeter displays the output voltage selected by the mode switch. Coloured LEDs confirm mode selection. A green and red LED indicates amperage below or above current limit protection.

Unique to the PS30C/PS50C are two pre-set voltages enabling the power supplies to charge both 24 and 28 volt portable GPUs or operate in parallel with them. Specification includes forced ventilated with thermal protection and current overload/short circuit and reverse polarity protection.

A quick-release polarised 50 amp continuously rated connector allows instant connect/disconnect of the 2-metre (6ft) special double insulated 16mm (1/2in) section output cable fitted with Lexan Nato plug.

The PS30C / PS50C design allows units to be ganged in parallel to a second power supply to double output or to operate in parallel with any Coolspool 17, 29 or 58 GPU as a continuous power source or charger.

A single voltage unit (28.5V) is also available in this range (PS30/PS50).



## SPECIFICATIONS

**Use: Designed for the smaller helicopter, VLJ or use with CoolSpool 17, 29, and 58 GPUs or as a DC power source**

Max output	30 amps (PS30C); 50 amps (PS50C)		
Output volts	28.5, 31.7 (selectable)		
Input volts	Auto. 120/240 single-ph. 50/60Hz		
Max input current	120V 9 amps; 240V 4.4 amps		
Input frequency range	45–400Hz		
Efficiency	90%		
Cooling	Single fan, forced air		
IP Rating	IP54		

	Height	Length	Width	Weight
PS30C	150mm (6in)	325mm (13in)	95mm (4in)	3kgs (7lbs)
PS50C	155mm (6in)	350mm (14in)	140mm (5in)	6kgs (13lbs)

## FEATURES

- Mains input voltage selector
- Digital voltmeter
- Mains on/off switch
- Current limit LED
- Power output status LED
- Padded protective jacket
- 2-metre (6ft) detachable output cable with fitted Lexan Nato plug



# PS100 and PS100C



2 x PS100 in parallel delivering up to 200 amps

**PS100** Able to provide 100 amps of continuous power, Powervamp's standard PS100 is a 28V power supply designed to power flight decks of larger corporate/business aircraft using any AC single phase 110/230 volts 50/60 Hz input. It is supplied as the factory-approved product by one of the largest business aircraft manufacturers in the US.

**PS100C** The PS100C version has two pre-set voltages: 28.5V for lead acid battery charging and continuous avionics operation; and 31.5V for charging Coolspool GPU 17, 29, 58. Where only single-phase power is available it is also used to charge the larger Coolspool battery carts.

Delivering smooth, stabilised continuous DC power, the PS100 is compact and lightweight, allowing it to be stowed in any baggage hold.

Individual LEDs confirm DC output status and a digital ammeter and voltmeter accurately display output volts and amps so operators can monitor the current draw of avionics, pre-flight loads, invertors, cabin lighting and other systems. An on-off C/B is used to switch power.

Any PS100C or derivative can be paralleled to double or even triple the combined output and this design concept allows individual units to be easily handled, stowed and transported.

Each power supply is fitted with padded protective jacket and a 2-metre (6ft) 50mm (2in) double insulated output cable fitted with heavy-duty rubber Nato plug.

A single voltage unit (28.5V) PS100 is also available in this range.

## SPECIFICATION

**Designed to power large helicopters, full-size corporate jets and for ramp/hangar use, avionics shop and exhibition use**

Max output	100 amps		
Output volts (PS100C)	28.5, 31.7 (selectable)		
Output volts (PS100)	28.5		
Input volts	Auto. 120/240 single ph. 50/60 Hz		
Max input current	120V 36 amps; 240V 18 amps		
Input frequency range	45–400Hz		
Efficiency	90%		
Cooling	triple fan, forced air		
IP Rating	IP65 with protective cover		
Case	powder-coated alloy with neoprene anti-slip feet		
Height	Length	Width	Weight
300mm (15in)	400mm (16in)	135mm (5in)	12.5kgs (28lbs)

## FEATURES

- DC output voltage selector (PS100C only)
- Digital voltmeter
- Digital ammeter
- Mains on/off circuit breaker
- 2 x paralleled 50 amp micro-power supply modules for redundancy
- 2 x PCB output status LEDs
- Fuse protected 28V accessory socket
- Padded protective jacket
- 2-metre (6ft) detachable heavy-duty output cable with heavy-duty rubber Nato plug

## OPTIONS

- Bandolier option. With the larger business aircraft flying internationally, Powervamp offers PS100 and PS100C users its unique optional 'Universal connector bandolier'. This selection of international plugs, neatly housed in a webbing bandolier, allows the user to instantly select and connect the correct input plug without the need to obtain and wire local plugs.

# RP05500/19 - PS300, RP05500/20 - PS400 and RP05500/21 - PS600



These 300, 400 and 600 amp power supplies are compact, high performance, 28 volt ramp or hangar power supplies, delivering continuous power for air conditioning, air show ground power or general maintenance.

The low profile design allow the units to fit underneath fuselages, and small castor wheels and a sturdy protection frame make them ideal for tough hangar use.

Because each unit uses power supply modules connected in parallel, field servicing is simple. Modules can be rapidly removed and replaced and the failure of one module will have a minimum impact on output amps.

## SPECIFICATION

Rated power	8.4kW		
Max continuous current	PS300: 300 amps PS400: 400 amps PS600: 600 amps		
Peak current	400 amps		
AC input requirements	200–440V 3-phase 32A 50/60Hz		
Displays	Digital volts/amps		
Protection	Short circuit, current limit		
Height	Length	Width	Weight
370mm (15in)	410mm (16in)	400mm (15½in)	28kg (62lbs)



*Individual modules in parallel provide redundant operation and simple swapout/service exchange*

# PORTABLE FUELLING/DE-FUELLING

## RP05500/24 - Portapump

24/28 VOLT

PORTABLE FUELLING/DE-FUELLING PUMP  
FOR AIRCRAFT AND VEHICLES

SUITABLE ONLY FOR JET A1 AND DIESEL

The Portapump unit is a rugged, all-weather fuel pump designed for the rapid fuelling or defuelling of all types of aircraft or vehicles using jet A1 or diesel with a flash point above 37°C. The Portapump is designed to be easily transported by aircraft, helicopter or vehicle.

Able to be carried by one man, the Portapump uses a powerful 24–28 volt DC motor direct coupled to a high-speed pump with phosphor bronze sliding vanes. The power source can be any 24/28 volt supply such as a portable GPU, vehicle battery or aircraft DC bus.

Alternatively a 110/220 volt domestic mains supply can be used with a DC voltage converter.

The pump and filter assembly is housed within a stainless steel tubular space frame. All pipework and fittings are alloy or stainless steel with 'Cam-loc' quick release fittings to give rapid connect/disconnect of inlet and outlet hoses

The Portapump will filter contaminated fuel to 3 microns solids, and 2 parts per million water. Fuel drums or containers that would otherwise require a settling period after transport to allow fuel/water separation can be pumped immediately. Fuel drained from aircraft, vehicles or plant that would otherwise be discarded can safely be re-used once passed through the Portapump.

Controls comprise three warning LEDs to alert the operator to the status of the system. When fuel flow is shut off at the nozzle by the operator, a 'back pressure' switch automatically switches off the pump, leaving the system in 'standby' mode, indicated by a red warning LED.

Opening the fuel delivery nozzle causes pressure to drop and the pump to restart, confirmed by green LED. A warning amber LED indicates when the pump is receiving DC power, waiting for the nozzle to be opened to instantly continue fuel delivery. A resettable circuit breaker and internal thermistor protect the pump motor against overload and overheating.

Pump rotation is protected by an audible alarm that sounds if the 28 volt DC input is connected incorrectly. An inlet non-return valve prevents drain-back (siphoning) and maintains the back pressure to allow activation of the pressure-operated switch that shuts off the pump motor.

A non-return valve and coarse filter are mounted in a unique detachable cartridge which can be removed for inspection without tools.

Filter status is indicated by the differential pressure gauge mounted on the stainless steel control panel. Normal pumping is indicated by a reading of approximately 5 PSI on the gauge. Progressive filter blocking is indicated by a gradual rise in differential pressure. At approximately 15 PSI the coalescer filter cartridge should be removed and replaced if necessary. A drain tap is fitted to allow any collected water to be removed daily.



### SPECIFICATION

Aviation/military standard equipment

Case construction	All-welded stainless steel tubular open space frame		
Height	Width	Depth	Weight
490mm (19in)	360mm (14in)	330mm (13in)	27.5kg (61lbs) without hoses and power lead
Power requirement	24–28 volt DC, 14 amps peak. Power lead – 3 metres (10ft) of 4mm (0.16in) twin-core – connects to pump with polarized quick release plug		
Switching	On/Off switch, guarded by a 15A pop-out circuit breaker		
Filter warning	Indicated by three warning LEDs – Green, Yellow, Red		
Static bonding	1000 amp cast brass alligator clips with 5 metres stainless steel bonding wire. Clips to any part of the space frame		
Pump	Positive displacement sliding vane pump, giving 100 litres (26.4 gallons) per minute nominal at 1.5 metres (4.9ft) head approx		
Pump motor	24V DC – motor 340 watts		
Filter performance	Aviation fuel filter system gives clean, filtered fuel to 5 micron filtration with 98% efficiency and water separation to less than 2 parts per million		
Filter capacity	Holds 1.1 litres (2.3 pints) of water. Removes up to 0.64kg (1.4lbs) of impurities		
Hose (Suction side)	Supplied on suction side with 3 metres (10ft) of 1¼ inch hose, fitted to a 865mm (34in) 2-piece aluminium standpipe for use with standard 200 litre (45 gallon) drums		
Hose (Delivery side)	3 metres (10ft) of 1¼ inch pump to nozzle. Delivery nozzle full-flow type with pump automatic cut-off via back pressure operated switch		
Couplings	Quick-release 1¼ inch camlock type with protective blanking covers to prevent the ingress of contaminants or residual fuel spillage		
Protection	Padded protective transport jacket and hose stowage bag		
Nato stock number	NCAGE: KD628 NSN: 2910-99-297-691		

### OPTIONAL EXTRAS

- Digital fuel flow meter on output line
- 110/220 volt 50/60Hz to 24–28 volt DC waterproof power converter
- 12 volt pump motor (factory fitted)
- 24 volt Powervamp Power Pack/portable GPU
- Trolley for ramp operations

# TOOLKITS

## Aviation toolkits — airframe and power plant



**Toolkit model PVFC 2021:**  
Integrated in six layers. The two different inlay colours indicate lost tools on the spot making tool control easy. Tools are inch/metric, specialised for helicopters. Tool case trolley made of synthetic resin, black, watertight, impact-resistant, with pressure equalizing valve.



**Toolkit model PVFC 2018:**  
Integrated in five layers

Powervamp's A and P aviation tool kits were developed jointly by Powervamp and a major MRO power plant and air frame contractor in conjunction with FCS.

Tools are individually nested in stacking trays, housed within secure synthetic resin cases for easy transport. Shadow cut outs for each tool ensure any missing tool is instantly noticed. Each toolkit comprises between 3 and 6 trays holding between 75 and 200 tools, depending on kit composition.

Depending on the level of electro/hydraulic/mechanical work to be undertaken, different tools sets and kit sizes are available. All kits are supplied in secure cases or back packs, allowing A and P mechanics and other service personnel to carry them on assignment or AOG deployment as checked baggage.

Manufactured by Bahco of Sweden, long established and recognised internationally for their very high quality, the tools are made from specially formulated dropped forged steel, providing exceptional tensile strength with the durability that comes from accurate heat treating and annealing. Screwdrivers and bladed tools are made from Bahco formulated steel, tempered and ground for precision and long blade life.

Tools are guaranteed for life.



### Aviation Toolkit Model PVFC 2018 (5 layers) (Tools shown may differ depending on toolkit model)

Toolbox Trolley EXPLORER (empty )	Screwdriver for slotted head screws 2mm
Foam inlay socket key 1/4", 3/8" (empty)	Screwdriver for slotted head screws 0mm
13 x various Double hexagon socket, inch 1/4"	Screwdriver for slotted head screws 5.5x100mm
10 x various Double hexagon socket long series, inch 1/4"	Screwdriver for slotted head screws 6.5x125mm
20 x various Double hexagon socket, inch	Screwdriver for slotted head screws 8x175mm
Reversible ratchet	Screwdriver for Phillips PH head screws 60mm
Sliding T-handle	Screwdriver for Phillips PH head screw 75mm
Spinner handles with bi-material handle	Screwdriver for Phillips PH head screw 100mm
Extension bar 50mm	Screwdriver
Extension bar 150mm	Screwdriver for Phillips PH head screws PH 1-2
Extension bar 355mm	Double offset screwdriver for slotted head screws
Universal joint 1/4"	Pocket lamp LED
Adaptor, bit holder 1/4"	Bit set for slotted, Phillips PH, Torx, hexagon & Torq-set head screws
Adaptor, bit holder 3/8"	Screwdriver for Torq-Set screws
Adaptor, bit holder 3/8"	Measuring tape 3m, mm/inch
Speeder 435mm	Ruler, steel 300mm
Knob, Speeder	Mirror 2 1/4"
Reversible ratchet	Flexible pick-up tool
Extension bar 75mm	Magnetic pick-up tool
Extension bar 125mm	Foam inlay pliers (empty)
Extension bar 250mm	Scissor industrial strength
Adaptor 3/8"	ERGO side cutting pliers 160mm
Adaptor 1/4"	Connector pliers 240mm
Universal joint 3/8" 52mm	ERGO Combination pliers 160mm
Adaptor 3/8"	ERGO Snipe nose pliers, offset 200mm
Adaptor 1/2" 37mm	ERGO Snipe nose pliers 200mm
Ratchet Bitholder 1/4"-8mm	Wire twisting pliers 205mm
Foam inlay spanner (empty)	ERGO Slip joint pliers
12 x various Combination spanner, offset, inch	Foam inlay hammer (empty)
3 x various Ratcheting box spanner, inch	German hammer-DIN1041/ 300g
Liliput double open-end spanner, inch 3/16"	Superflex plastic hammer 300g
Liliput double open-end spanner, inch 7/32"	4 x various Drift punches 150mm
Wrench, chrome-plated 6"	Combination cotter pin extractor and spreader
Drift punches 150mm x 4 various	
Combination cotter pin extractor and spreader	
Nut pliers	
PUK-Saw	
Scribing iron bent 250 mm	
File sets, 3pcs., round-flat-square	
Foam inlay screwdriver (empty)	

**Model PVFC 2011**  
backpack toolkit.  
Kits can be designed to  
suit specific aircraft,  
engines or repair  
functions



# TRUs and CONVERTERS

## 28V TRANSFORMER RECTIFIER UNITS

## 115V 400HZ AC SOLID STATE FREQUENCY CONVERTERS

### SELECTING THE CORRECT TRU

Transformer rectifier units (TRUs) delivering 600 amps continuous power – with the ability to briefly produce up to 1800 amps for engine starting – require a mains input of at least 63 amps (44Kw @ 400V) to accommodate the overload without tripping the supply circuit breaker. If there is insufficient power, upgrading the mains supply to handle the inrush current can be prohibitively expensive.

For operators requiring a mains powered TRU, Powervamp offers two models: model TRU 600/2000 and model TRU 600/1800 Combi:

#### Option 1: TRU 600/2000

**If sufficient power is available**, Powervamp's conventional TRU 600/2000 delivers 600 amps continuous power and 2000 peak amps directly from the 3-phase mains.

#### Option 2: TRU 600/1800 Combi

**In locations where insufficient mains power is available**, Powervamp offers its TRU 600/1800 Combi (combination model). This high-efficiency unit utilises ultra-high-discharge batteries to deliver the peak amperage, with advanced switch-mode power supply modules ganged in parallel to provide the continuous amperage. The result is a lighter-weight, compact and highly efficient DC ground power unit suitable for daily ramp or hangar operations on the largest of DC aircraft.

Because batteries supply the peak amperage, with the 600/1800 Combi there is no need to overload the incoming supply and the 600/1800 Combi can be supplied from a more common 32A (22Kw @ 400V) supply. This combination of technology reduces power consumption with the added benefit of providing exceptionally stable DC power via the internal switch mode power supplies.

The 600/1800 Combi is a modular design allowing different power supplies to be installed. If the customer requires less continuous amps, the GPU can be supplied with a reduced continuous output thereby reducing the cost of the unit without affecting peak amp starting performance.

### RP05500/26 - TRU 600/1800 Combi



### RP05500/25 - TRU 600/2000



The Powervamp TRU600/2000 is an advanced transformer rectifier unit delivering 28.5V at 600A continuous and 2000A peak for engine starting. Regulation is achieved using additional thyristor control BEFORE the transformer, to achieve a clean output with less ripple than traditional TRUs. The TRU600/2000 is capable of worldwide operation as standard from the factory.

The TRU600/2000 is supplied in the same compact frame as the DC power carts, making the unit highly manoeuvrable. Controls are mounted at the rear of the unit, protected by a sturdy bumper. Side panels are replaceable and an optional top-mounted frame houses the output cable.

### SPECIFICATION

	TRU 600/2000	TRU 600/1800 Combi		
<b>INPUT: Voltage</b>	3-phase 200–480V	3-phase 200-440V		
Frequency	50/60Hz	50/60Hz		
Rectification	6 pulse	Switch mode individual units		
Line current	30A @ 400V	30A		
Efficiency	90%	90%		
<b>OUTPUT: Voltage</b>	28.5V (adjustable)	28.5V		
Current	600A (2000A peak)	600A (1800A peak)		
Output voltage	21–31V	28–30V		
Voltage regulation	<0.5%	<0.5%		
Voltage ripple	<1%	<1%		
Case	Alloy panels, steel frame			
	Height	Length	Width	Weight
600/200	710mm (28in)	1060mm (42in)	720mm (28in)	220kg (485lbs)
600/1800 Combi	650mm (26in)	550mm (22in)	550mm (22in)	60kg (132lbs)
Output cable	4-metre (13ft) double-insulated 70mm sq			

### FEATURES

- Output current regulation 1%
- Solid state design
- Powder baked wheeled cart with alloy panels
- 200mm (8in) dia. pneumatic tyres, spare wheel, cable stowage

- Ammeter, voltmeter, on/off AC and DC
- Indicator lights

### OPTIONS

- Input cable 3-phase price per metre
- Cable stowage frame
- 600/2000 TRU can be supplied in a fixed case for internal/external plinth mounting





One of a batch of 90 kVA converters installed at Bristol airport

# 400Hz static frequency converters

Powervamp converters stand alongside those of the world's leading manufacturers in quality and performance, with a superb reputation when it comes to product reliability, support and service. Unlike converters derived from 50/60Hz systems, Powervamp units are designed from conception to operate continuously at the demanding 400Hz frequency.

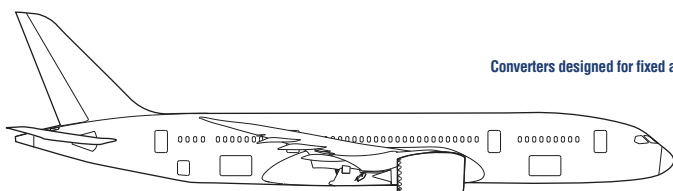
Powervamp converter reliability starts with Powervamp's software design team and full in-house manufacturing with intensive quality control – from initial design to finished product. The full range of converters, from 30 to 90kVA, is supported worldwide by the company's Technical Services Department and team of skilled graduate engineers, covering technical issues from power requirement and architects' drawings to installation and service contracts.

Housed in IP65 cabinets as standard, Powervamp converters use forced airflow with oversized heat sinking to maintain a stable temperature of the power electronics, crucial to the maintaining of continuous output at maximum load. Integral input and output EMC filters guarantee minimum distortion from the mains supply. Top wave form quality ensures compliance with the tight sine wave demands of modern aircraft.

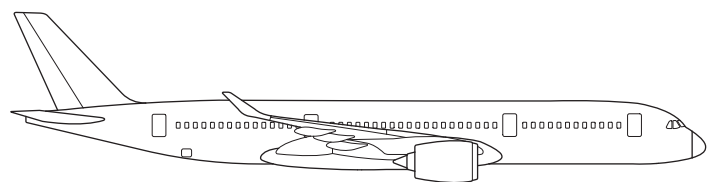
Where operators require both AC and DC power, Powervamp offers a separate stand-alone module which gives operators the flexibility to move the DC unit to different aircraft stands. For hangar installation, an integral unit is available.

A PFC rectifier converts three-phase into DC, with the PWM (Pulse-Width Modulation) inverter switching the DC back to AC at 115/200V 400Hz. The output transformer provides galvanic isolation between the input and the output. The 28V DC module can be directly coupled to the GPU 400Hz output through an adaptor plate thereby minimising investment costs.

Powervamp converters utilise electronic rectifiers with power factor correction to ensure that current drawn from the mains is perfectly in phase with the voltage (0.99pF @ full load), giving high efficiency compared to non PF corrected systems. Converters are designed for continuous operation at full load with the microprocessor controlled PWM IGBT inverter sized to accept high overload. Components and designs are sized for 100,000 hours MTBF.



Converters designed for fixed and mobile units for major airlines, airports, MROs and airshows





Powervamp's 90 kVA converter delivering top-quality stabilised power to the flightdeck of a Boeing 747-8  
Photo © Powervamp 2011

90 kVA showing MABS ethernet connection (see page 26)

## SPECIFICATION

### INPUT

Mains supply voltage	400V AC +/- 10% 3-phases
Mains supply frequency	50 or 60Hz +/- 5%
Power factor	0.99pF @ full load
Input protection	MCB to BS EN60898
Fusegear	gR to IEC 60269-1 and -4, DIN VDE 0636-23 DC Over-voltage
Protections	Mains low Input surge
Technology	Full wave controlled thyristor/diode bridge with IGBT power factor correction

### OUTPUT

Voltage	115/200V AC 3-ph
Voltage regulation	Static +/- 1%, Dynamic +/- 6%
Voltage waveform	Sinusoidal
Frequency	400Hz +/- 0.1%
Distortion (THD)	<3% into linear load
Load power factor	0.3 lag to 0.3 lead
Crest factor	3:1
Overload (kVA)	120% continuous, 121% for 2 min, 160% for 5 sec Electronic overload/short circuit Over-temperature
Protections	Inverter over/under voltage Low voltage shutdown
Technology	High frequency, pulse width modulated IGBT with isolation transformer

### Dimensions (basic unit)

	Height	Length	Width	Weight
PVC20	1000mm (39in)	800mm (32in)	550mm (22in)	350kg (772lbs)
PVC40	1000mm (39in)	800mm (32in)	550mm (22in)	450kg (992lbs)
PVC60	1400mm (55in)	1100mm (43in)	800mm (32in)	600kg (1,322lbs)
PVC90	1400mm (55in)	1100mm (43in)	800mm (32in)	700kg (1,543lbs)

## FEATURES

- 115/200V 400Hz aircraft GPU
- Large range of 400Hz power: from 20kVA up to 90kVA
- Optional 28V DC external module available – up to 600A continuous and 2000A peak for more versatility
- Worldwide input voltage 200–480V
- High quality sine wave output and reliability
- Galvanic isolation with grounded neutral
- Both civil and military aircraft interlocks
- High-quality steel/aluminium enclosure to handle all-weather conditions
- Cable entry at the rear with removable gland plates to allow simple installation
- Castors for easy positioning
- Protection against DC over-voltage, input mains low and main surges
- Removable panel and hinge for easy access and service
- Full datasheet and instructions available upon request

## OPTIONS:

- Heavy-duty 4-wheel ramp trolley with cable stowage and tow hitch



40 kVA fixed  
hangar power

# Extendable Cable Carrier System

The Powervamp Extendable Cable Carrier is designed to facilitate the rapid connection of external aircraft power from a fixed electrical distribution point to an aircraft parked within the envelope of the cable carrier's extended length and side to side arc of travel.

The extendable carrier maximises cable life by preventing abrasion damage typically caused by ground contact. Safety is aided because cables are clear of the ground and protected by the modular alloy extruded sections. A heavy-duty galvanised steel stowage cage mounted on 4 castor wheels stores the free cable and protects AC and DC aircraft plugs from damage.

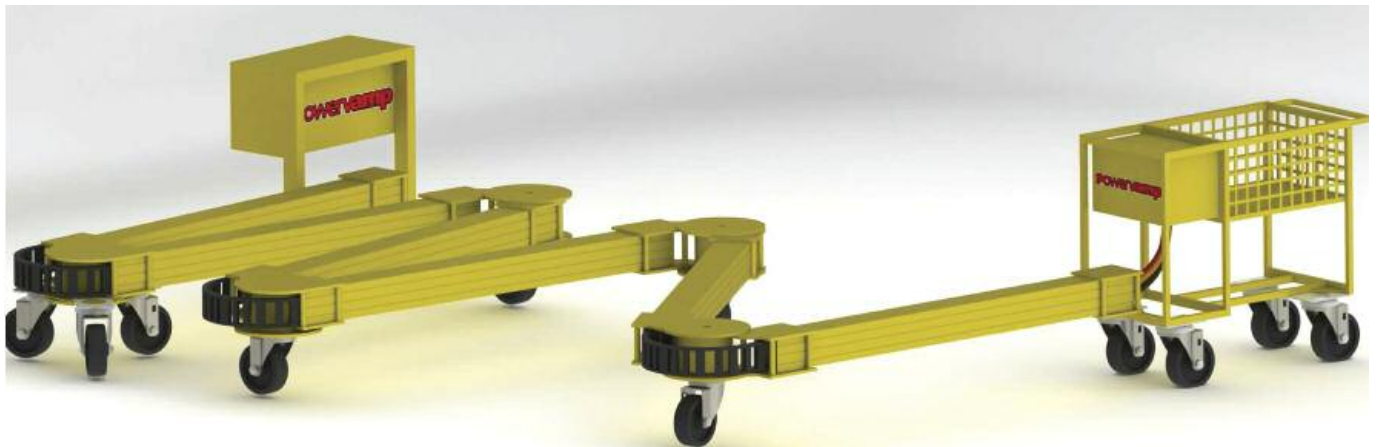
Each extruded alloy channel section has an alloy pivot plate to which are bolted nylon wheels. Heavy-duty IGUS chain protects and guides the cable, maintaining the correct bend radius and cable tension. Modular design allows carrier length to be tailored to aircraft stands and to cover a wide variety of aircraft types and parking positions within the stand area. Adjustable buffers on each extension cushion each section as the unit is returned to its stowed position after use.

Units can be left- or right-hand biased. Carrier length can be from 12 to 30 metres (39 to 98ft) in set increments (see specification).

Unless otherwise specified, the Powervamp extendable cable carrier is painted in powder coat yellow and is supplied as standard with a fixed stanchion/junction box unit with connections to accept the fixed electrical ground power output. An 'I' beam stanchion with shock absorber located at the opposite end of the extendable cable carrier's stowed position ensures correct parking with no over travel.

## SPECIFICATION

Dimensions	
Common	150mm (6in) wide x 150mm (6in) high
Extended length	12, 15, 20, 25, 30 metres (39, 49, 65.5, 82, 98ft)
Arm length	3 metres (10ft) and 5 metres (17ft)
Construction material	Extruded alloy
Pivot arrangement	Alloy base plate, centre shaft with pre-loaded bearings and polymer wearing surfaces with IGUS chain cable and radius protection. All non ferrous fittings
Skates	Flexell castors, high density nylon – 200mm (8in) diameter
Cable stowage cage	Mild steel, galvanised, painted powder-coat yellow with twin aircraft plug holsters
Base station	Lockable galvanised steel cabinet with heavy duty terminal bloc, isolator, earth point and grommet holes fixed to twin 'I' beams each with base plate and 4 x 20mm (¾in) securing holes
Max. extension angle to the vertical	20°



*Powervamp extendable cable carrier: options 12–30m (39–98ft), designed for use with all converters and FEGP installations*



# MABS™

## AIRPORT MONITORING AND BILLING SYSTEM FOR FIXED ELECTRICAL GROUND POWER INSTALLATIONS



Power hook-up to the aircraft will automatically be recorded by time and/or power usage for billing purposes  
Photo © Powervamp 2011

Already either in use by, or raising huge interest at, major international airports, Powervamp's new 'MABS' interface package brings the real-time interfacing of solid state frequency converters and power usage to airport logistics software allowing the billing of ground power by time and kilowatt. Although developed for Powervamp's own converters, the system is designed to be adapted to other makes of converter.

Building on its international reputation for single source solutions as part of its growing market in 400Hz and 28 volt DC ground power, Powervamp developed its converter software interface package for its converters. 'MABS', an acronym for 'monitoring and billing system', is designed for airports and ramp service providers under increasing pressure to maximise revenue and accurately apportion costs against each airline and aircraft using fixed electrical ground power (FEGP).

MABS enables airports to generate revenue based on the aircraft connection time to Powervamp's 400Hz converters.

This can be attractive where airport operators seek to recover the cost of their capital investment in FEGP. For the airline and airport operator it records accurately the on/off ground power connection.

While other companies have attempted to produce a similar system to Powervamp's MABS, key to the success of the Powervamp system is its simplicity which is critical for accuracy and reliability.

Any ramp input data function is time consuming and proven to be prone to input error thus invalidating the data and creating subsequent billing issues. Powervamp's MABS operates seamlessly in the background, monitoring the usage of the FEGP and reconciling the data with an airport's logistics software, such as the popular 'Manageair' system. Powervamp's MABS system connects the FEGP with the airport IT network via an ethernet connection, eliminating the need for installation of a proprietary network.

Up to 255 individual FEGPs can be connected in a single system. The monitoring software is installed on a server within the terminal building which stores the usage data in an SQL database in a format reconciled with the airport logistics software. Powervamp would normally liaise directly with the logistics software provider.

In addition to the normal billing data, Powervamp's MABS incorporates an automatic error reporting facility, instantly alerting the reporting centre should a specific FEGP unit develop a fault, thereby ensuring aircraft can be diverted to a serviceable stand on arrival.



# MINI DIESEL GPUs

RUN ON DIESEL OR JET A1



Multi-purpose unit – classified role

## RP05500/32 - Scammer™ 150

115V 400HZ / 28 VOLT DC

110V 60HZ / 28 VOLT DC

230V 50HZ / 28 VOLT DC

SCAMMER — SELF-CONTAINED, AIR-MOBILE, MODULAR, EMISSION RESTRICTED— GPU

### Typical power plant\*:

PT6C-67, ALF 502, TPE331,  
TFE 731, AE3007A

(Assumes SCAMMER batteries  
fully charged)

**Pre-flights:** All DC business jets, small  
commuters, Jetstream, Hawker  
Beechcraft etc.

**Air-con:** up to 150 amps continuous,  
peak to 2000 amps, short term 200–3000  
amps until voltage limit warning

**Turbine starting:** All DC business jets,  
Jetstream, BAe 146, Saab 340, ERJ 145



### 28.5 volts diesel GPU (115/200V 400Hz AC power optional)

The SCAMMER was first developed in 1995 for the UK military in response to the need for a low cost self contained GPU able to produce both continuous DC power for pre-flight/avionics use and short-term high power for turbine starting.

In various configurations and in series production over 17 years, with sales to several armed forces, the latest version of this mini diesel GPU has been adapted for civil use and is now available for FBOs, regional airlines, and operators requiring versatile remote power at a fraction of the cost of a conventional diesel GPU.

The Powervamp SCAMMER – self-contained, air mobile, modular, emission-restricted – GPU comprises a small high-efficiency single cylinder diesel engine able to run on diesel or jet A1 fuel, direct coupled to a generator. Depending on specification, this provides continuous AC or DC power and very high amperage for starting turbines or powering aircraft systems for short duration by using either internal batteries or demountable portable DC power packs. A 115 volt 400Hz SCAMMER is available to power 400Hz aircraft systems.

For versatility, the output may be switched between 28 volt DC power and 110 or 230 volt 50/60Hz domestic voltage depending on customer spec, allowing the GPU to be used as a conventional gen-set.

In enclosed spaces such as maintenance shops or hangars, the diesel engine can be shut down and the unit powered directly from any 110/220V mains supply to provide 28V DC power without discharging the batteries.

Modular battery packs are an option, instantly delivering peak loads up to 2000 amps for the starting of large turbine powered DC regional aircraft. These optional packs may be used independently for maximum equipment utilisation and flyaway capability.

The SCAMMER can be disassembled for easy transport by road or air and supplied in a variety of configurations, and equipped with modular power supplies of up to 150 amps continuous output.

\*This information is given in good faith. See disclaimer, page 2



SCAMMER providing power for MRO operator



Military units for remote ops

## SPECIFICATION

### DC output

Rated power	Up to 4.3kW
Voltage	28.3V / 29.5V / 31.6V +/- 1%
Permanent current	Up to 150A continuous
Inrush current (batteries)	Up to 3000A peak amps

### AC output

110V/230V 50/60Hz mains power available

Height	Length	Width	Weight
757–997mm* (30–39in*)	985–1999mm* (39–79in*)	610–930mm* (24–37in*)	185–350kg* (408–772lbs*)

\* dependent on configuration

Operating temperatures	-10°C to +50°C (+14°F to +122°F)
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Option	Cold starting aid
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Run time	Typically 13 hours @ 75% load
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110V 60Hz panel with 4 x 110V outlets. Panel layout will vary according to model and user requirements

## FEATURES — BASIC UNIT WITHOUT FRONT/REAR AXLES

- Range of modular outputs available to suit individual starting requirements, up to 3000 peak amps
- Support 24/26V and 28.5V DC systems
- Up to 150 amps continuous at 28.5V DC
- Additional 110V/230V 50/60Hz power outlets for general ramp use
- Optional 115/200V 400Hz AC alternator for 400Hz avionics use
- Shore power capability for silent, clean aircraft maintenance supply within hangar
- Removable battery modules for use independently or as fly-away GPUs when required (see Options)
- Easy to manoeuvre and transport between operational bases
- Simple to service and maintain
- Modular designs to suit operator requirements
- Full datasheet available upon request

## UNIT SUPPLIED AS STANDARD WITH

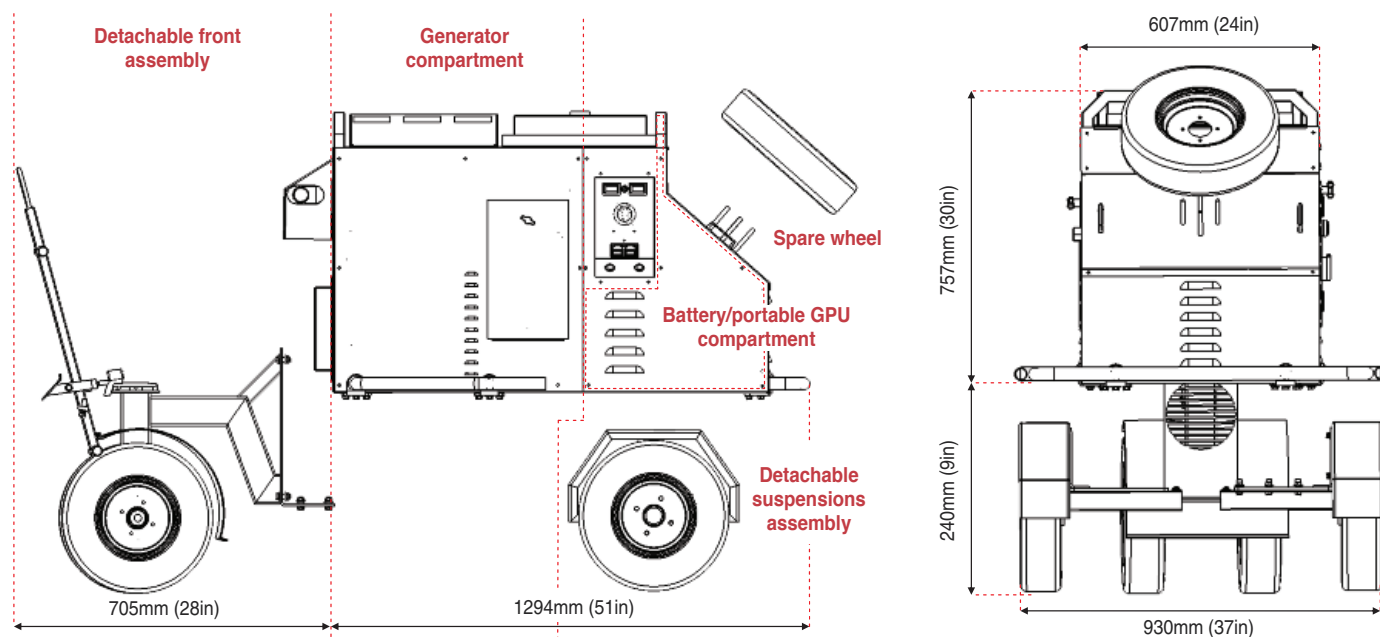
- 130 amp/hr high discharge VRSLA batteries
- 4-metre (13ft) double insulated DC output cable with heavy-duty rubber nato plug and 'yoke' cable if paralleled GPUs
- Frame manufactured from steel channel and square hollow section, finished as standard in yellow powder-coat paint. Alloy side panels and non-ferrous/stainless steel fittings
- Alloy 23-litre (6 gallon) fuel tank with purge drain tap for air transportation
- Toolkit for service and maintenance
- Spare wheel
- Fire extinguisher (only supplied when shipped by surface transport)

## OPTIONS

- Bolt-on twin front wheel, tow bar and rear wheel assembly to enable SCAMMER to be towed at up to 20kph (12mph).
- 2 x GPU 1500/40 24 volt demountable portable GPUs (see GPU 3000/80 spec) includes paralleling yoke
- 2 x GPU 2000 37 amp/hr demountable GPUs (see GPU 4000 spec) includes paralleling yoke
- 2 x Coolspace 29, 28 volt, 29 amp/hr demountable GPUs (see Coolspace 58 spec) includes paralleling yoke
- Padded protective jackets for demountable packs
- Extra output lead to allow individual pack use



For maximum versatility the SCAMMER is modular in design. Users wishing to operate the SCAMMER directly from the back of a vehicle, service van or baggage cart can order the unit without front/rear axles, suspension and wheels, while specifying the type of battery system they require.



- Detachable front wheel assembly through 8 x M10 bolts
- Combined "T" and tow bar for easy manoeuvrability

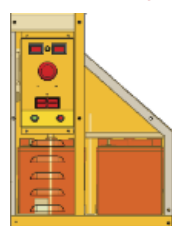
- 5kW 110V/230V AC or optional 5.6kW 115/200V AC 400Hz generator
- 4.5kW 28V DC power supply
- Up to 150 amp continuous

- Standard spec: 30 amp/hr high discharge VRSLA batteries option
- Option 1: Portable 24V 2 x GPU 2000 option
- Option 2: Portable 24V 2 x GPU 1500/40 option
- Option 3: Portable 28V 2 x GPU Coolspool 29 option

Overall weight varies between 185kg and 350kg (408lbs and 772lbs) depending on frame, generator and batteries options

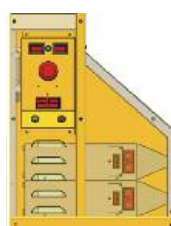
#### BATTERY/PORTABLE GPU COMPARTMENT

##### Standard factory fit



24, 26 or 28V 130 amp/hr VRSLA batteries

##### Alternative installations



GPU 4000T



GPU 3000/80

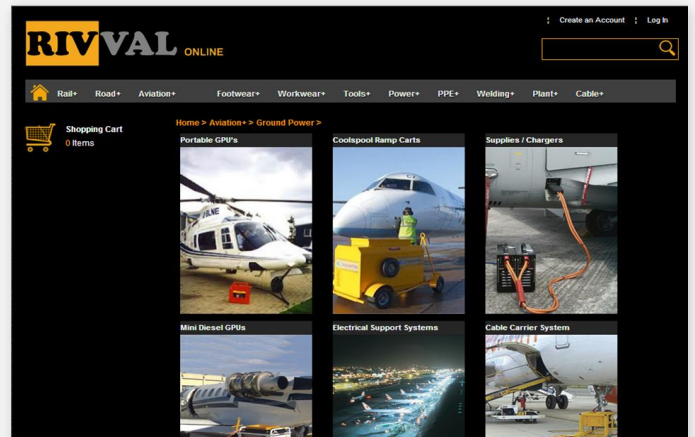
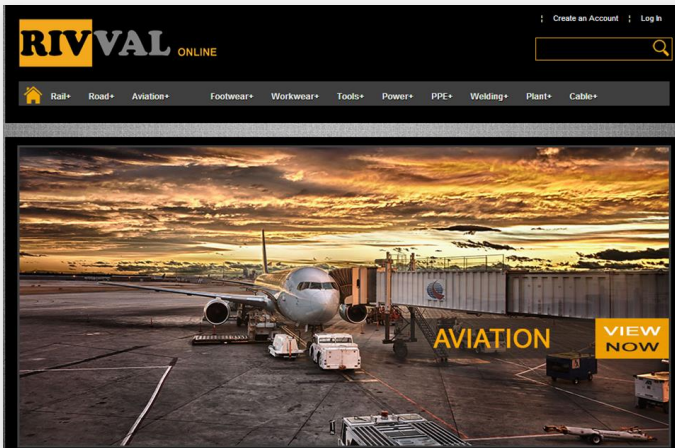


GPU Coolspool 58

# Aviation formulas: US-Imperial-Metric conversions

Length (distance)			
inches	x 25.4 =	millimetres	x 0.0394 = inches
feet	x 0.305 =	metres	x 3.281 = feet
miles	x 1.609 =	kilometres	x 0.621 = miles
Volume (capacity)			
cubic inches (cu in)	x 16.387 =	cubic centimetres	x 0.061 = cubic inches
imperial pints	x 0.568 =	litres	x 1.76 = imperial pints
imperial quarts	x 1.137 =	litres	x 0.88 = imperial quarts
imperial quarts	x 1.201 =	US quarts	x 0.833 = imperial quarts
US quarts	x 0.946 =	litres	x 1.057 = US quarts
imperial gallons	x 4.546 =	litres	x 0.22 = imperial gallons
imperial gallons	x 1.201 =	US gallons	x 0.833 = imperial gallons
US gallons	x 3.785 =	litres	x 0.264 = US gallons
Mass (weight)			
ounces	x 28.35 =	grams	x 0.035 = ounces
pounds	x 0.454 =	kilograms	x 2.205 = pounds
Force			
ounces-force	x 0.278 =	newtons	x 3.6 = ounces-force
pounds-force	x 4.448 =	newtons	x 0.225 = pounds-force
newtons	x 0.1 =	kilograms-force	x 9.81 = newtons
Pressure			
pounds-force per square inch	x 0.070 =	kilograms-force per square centimetre	x 14.223 = pounds-force per square inch
pounds-force per square inch	x 0.068 =	atmospheres	x 14.696 = pounds-force per square inch
pounds-force per square inch	x 0.069 =	bars	x 14.5 = pounds-force per square inch
pounds-force per square inch	x 6.895 =	kilopascals	x 0.145 = pounds-force per square inch

kilopascals	x 0.01 =	kilograms-force per square centimetre	x 98.1 = kilopascals
millibar	x 100 =	pascals	x 0.01 = millibar
millibar	x 0.0145 =	pounds-force per square inch	x 68.947 = millibar
millibar	x 0.75 =	millimetres of mercury	x 1.333 = millibar
millibar	x 0.401 =	inches of water	x 2.491 = millibar
millimetres of mercury	x 0.535 =	inches of water	x 1.868 = millimetres of mercury
inches of water	x 0.036 =	pounds-force per square inch	x 27.68 = inches of water
Torque (moment of force)			
pounds-force inches	x 1.157 =	kilograms-force centimetre	x 0.868 = pounds-force inches
pounds-force inches	x 0.113 =	newton metres	x 8.85 = pounds-force inches
pounds-force inches	x 0.083 =	pounds-force feet	x 12 = pounds-force inches
pounds-force feet	x 0.138 =	kilograms-force metres	x 7.233 = pounds-force feet
pounds-force feet	x 1.356 =	newton metres	x 0.738 = pounds-force feet
newton metres	x 0.102 =	kilograms-force metres	x 9.804 = newton metres
Power			
horsepower	x 745.7 =	watts	x 0.0013 = horsepower
Velocity (speed)			
miles per hour	x 1.609 =	kilometres per hour	x 0.621 = miles per hour
Fuel consumption			
miles per gallon, imperial	x 0.354 =	kilometres per litre	x 2.825 = miles per gallon, imperial
miles per gallon, US	x 0.425 =	kilometres per litre	x 2.352 = miles per gallon, US
Temperature			
degrees Fahrenheit (F) = (C x 1.8) + 32      degrees Celsius (degrees centigrade, C) = (F - 32) x 0.56			
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