DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

MCHB-TS-ESW (40)

20 June 2003

EXECUTIVE SUMMARY
INFORMATION PAPER NO. IP 31-037
PREVENTIVE MEDICINE CONCERNS OF PERSONAL HYDRATION SYSTEMS

1. PURPOSE. To provide preventive medicine concerns and background information on personal hydration systems (PHSs) typically procured through General Services Administration (GSA), the Army and Air Force Exchange Service, and Military Clothing Sales Stores. This information paper makes recommendations for preventive medicine doctrine, policy, and training material. It also describes the integration of PHSs into the armed services.

2. CONCLUSIONS. Properly used and maintained, PHSs, containing potable water can help maximize performance, comfort, and health. Personal hydration systems can provide a readily available storage container of safe and clean drinking water for soldiers when hydration demand is warranted by conditions of diverse activity. There is insufficient data for the U.S Army Center for Health Promotion and Preventive Medicine (USACHPPM) to state with assurance that tested PHS reservoirs and protective mask assemblies will meet requirements for operating in Chemical, Biological, Radiological, and Nuclear (CBRN) environment. Only potable water should be used in PHSs. This conclusion is based on combat wound management principles where existing personal water supplies may be needed for wound management.

3. RECOMMENDATIONS. For proper maintenance of PHSs, follow the manufacturers' recommendations. Should the chemical resistant reservoir become contaminated or compromised by CBRN contaminants, USACHPPM recommends decontaminating the entire system in accordance with (IAW) policies for equipment decontamination. Upon successful decontamination of the over-pack material, Commanders must ensure that the reservoir and its delivery tube are properly discarded and not reused by the soldier. Personal hydration systems should be used in addition to issued canteens where operations in extreme climatic conditions prevail. Soldiers should ensure the reservoir and delivery tube are properly insulated and protected from chemical and environmental contaminants. Soldiers should wash the PHS as needed with mild soap and water using only treated water. Commanders should ensure that while participating in operations, sanitizing agents such as calcium hypochlorite are available to disinfect and purify water collected for use in PHSs. Commanders must ensure that soldiers do not use sports drink mixes in organizational hydration systems. Furthermore, Commanders should ensure that soldiers are issued new drinking tubes and bite valves with used organizational personal hydration systems. Failure to comply with these recommendations may increase the occurrence of disease within the command.

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Blackhawk® is a registered trademark of Blackhawk® Industries Inc., Norfolk, Virginia

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2. REFERENCES. Appendix A contains a list of references used in developing this paper.

3. BACKGROUND. With the military's transformation to lighter and less burdensome field gear the armed services began investigating PHSs as a practical alternative to the canteen. More than a decade ago cyclists and hikers began using hands-free hydration systems. Today, several companies have recognized the potential market of PHSs for all outdoor athletes and the military services. Though several companies manufacture skillfully designed systems, the brand most integrated with the armed services is the "CamelBak®," manufactured by the CamelBak® Company. These systems have competitively evolved with tougher plastics and laminates with more resilient reservoirs; larger filling ports; more durable materials; various filtration devices; and accessories for cleaning and sanitizing. A variety of other brands of PHSs have been developed by commercial vendors specifically for use in hot, cold, and chemical, biological, radiological, and nuclear (CBRN) environments. The CamelBak® has been incorporated into the design of the modular lightweight load-carrying equipment (MOLLE) backpack. Furthermore, in the latest version of Army Regulation (AR) 670-1 dated July 2002, it states that Commanders may authorize the use of camouflaged personal hydration systems in field environments, in high-heat areas, or on work details. Soldiers will not normally carry hydration systems in a garrison environment unless the commander has authorized it for one of the situations described above. Soldiers will not let the drinking tube hang from their mouths when the device is not in use.

4. FINDINGS AND DISCUSSION.

a. Systems Description.

(1) General.

(a) Most personal hydration systems hold between 70 and 100 ounces, have a delivery tube to the mouth, and a bite valve with a positive shut off.

The military advantage of a PHS is that it provides the soldier with the capability to drink safe water while road marching with a loaded rucksack. Some military systems are camouflaged with comfortable, thin shoulder straps that will not interfere with standard load-bearing equipment shoulder straps. The system is worn on the torso so as not to impede the soldier's movements when worn with load-bearing equipment and body armor in a combat environment. The system's bladder or reservoir usually has a dull, minimally reflective surface. The intended procedure within the military is to re-issue PHSs from one user to the next with a replacement reservoir and drinking tube. According to the MOLLE specifications, the system should not promote growth of mold or fungus when used or stored. As some companies are investigating the feasibility of developing nuclear, biological, chemical (NBC) systems, these bladders should be compatible with existing protective masks, and be resistant to radioactive particles and a host of chemical and biological agents. Ideally, the PHS should be 100% compatible with the MOLLE system.

(b) CamelBak's® next generation hydration system reservoir insulation is closed cell, and the 102-ounce wide-mouthed reservoir named the AeroForm, Omega Reservoir™. The manufacturer claims this reservoir is made of Food and Drug Administration-approved polyurethane, which is taste-free, odor-free, and ultraviolet stable. Its delivery tube has a neoprene cover to keep water cool (standard on all CamelBak® Maximum Gear PHSs for military use), and a "Hydrolock™" plastic valve (Figure 1) that can shut off water flow at the bite valve. As mentioned above, the PHS exterior is made of abrasion-resistant 1000D Cordura pack cloth. The shoulder straps and waist belt have Velcro strap retainers. The "Transformer™" is produced by Woodland Camo, and its cost is about $70 government price (Figure 3).

Figure 1. Hydrolock™ Valve

Figure 2. CamelBak® ThermoBak® 3-Liter

Figure 3. CamelBak® Transformer™

(2) Available Systems. CamelBak® produces military specification PHSs that are camouflaged, green, or black. They can range from the single, 1-liter reservoir to a large hydration pack that can carry two 3-liter reservoirs and additional equipment. CamelBak® and at least one other company market a chemical resistant reservoir (CRR), which is claimed to be compatible with an M40 series chemical protective mask. The CamelBak® type system offers a thermal control kit for use in extreme winter and summer conditions. It includes a "Big Bite" valve mouthpiece (Figure 4), a mouthpiece cover, a 46-inch delivery tube, and an insulated tube cover.

Figure 4. Personal Hydration System Bite Valve

b. Materials. Materials for PHSs can be divided into several categories. There are specific materials for PHSs used in hot/humid climates and other materials for cold climates. A separate and distinct system has been developed for chemical resistant reservoirs/packs intended by the manufacturer to withstand radioactive, biological, and chemical environments.

(1) The non-CRR is typically made of high-grade polyurethane. The bite valve is made of medical grade silicone and the delivery tube cover insulation is generally made of neoprene. The carrying pack can be insulated with closed cell foam throughout, which does not absorb moisture or perspiration. Some PHSs are equipped with breathable foam and mesh materials that disperse body heat, keeping the wearer cool. Others are made with ripstop nylon fabric, a 1000 denier Cordura nylon, or 1000D NyTaneon for added strength.

(2) Other newly designed PHSs have attachment systems to integrate with the MOLLE. Such a PHS is the CamelBak® "Transformer™" having dual side pockets that can carry ammunition magazines or other military equipment.

c. PHS Capabilities.

(1) Capacity. Personal hydration systems come in a variety of sizes equivalent to the current military issue canteens. They are available with reservoir volumes of 50 oz (1.5L), a 70 oz (2.0L) and a 100 oz (3.0L). Most reservoirs are fully insulated to help the water in them cool, and they have a large screw-on cap that permits easy ice insertion.

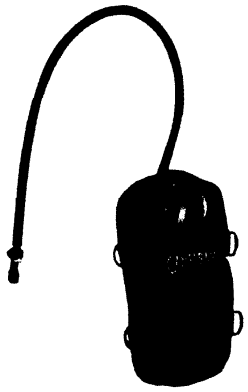

Figure 5. PakTeen™

(2) NBC Resistant Reservoirs. Currently there are initiatives on two fronts, the U.S. Army Soldier and Biological Chemical Command (SBCCOM) and the commercial industry, to provide adequate protection to allow the use of PHSs while in Military Oriented Protective Posture (MOPP) Level 4. This ability would provide soldiers with hands free, on-the-move hydration capability during operations in CBRN environments. The reservoir's ability as a barrier to NBC contamination has not been thoroughly tested by the Army. It could be assumed that a certain thickness of butyl polymer would probably prevent contamination from penetrating the reservoir, but the cap and connector to the reservoir would still be possible ports of entry for contamination.

(3) CamelBak® Specific Capabilities. CamelBak® also produces a PHS called the PakTeen™. This 50-ounce stand-alone PHS can integrate with a standard rucksack, load-bearing belt, and web harness, or can be stowed within the MOLLE system. According to CamelBak® , their CRR product has been tested for resistance to GB and HD chemical agents under SBCCOM, Chemical Analysis Team Lab Operating Procedures for Drink Bag Chemical Agent Testing (April 2000 protocol). CamelBak® further states that under those test conditions, their product "exceeds USACHPPM standard Technical Guide (TG) 230A for water quality," and that their product "has not been tested for any other agents or exposures." CamelBak® also

offers a protective mask adapter kit (Figure 6), which includes a valve and protective mask connector. The kit connects the CRR to the mask. It can also attach a mask to a regular reservoir for training purposes. CamelBak® appears to be tailoring their products towards military needs; however, there has been no official Army approval for their NBC items.

Figure 6. Protective Mask Adapter Kit (PMAK)

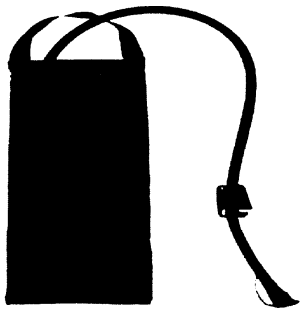

Figure 7. Chemical Resistant Reservoir (CRR)

d. Water Disinfection Procedures. All surface water supplies should be considered contaminated no matter how pristine the sources appear. Because of the difficulty with transporting large amounts of water, military personnel find it necessary to obtain drinking water from rivers, lakes, and other potentially contaminated supplies. Soldiers traveling overseas, especially to developing nations, are often faced with the lack of a microbiologically safe water supply. Listed below are the most common forms of water disinfection methods for use with PHSs. Iodine and boiling should be used for emergency water treatment only. Chlor-Floc® should not be used at any time with PHSs, as it is not compatible with the location of the drinking tubes placement on the reservoir. Calcium hypochlorite and chlorine bleach offer the greatest protection from harmful bacteria and should be used if reverse osmosis water purification unit-produced water is not available or chlorine levels needs to be maintained.

(1) Calcium Hypochlorite. Calcium Hypochlorite is the most common form of disinfectant used to disinfect field drinking water in the Army. To properly disinfect the water inside the PHS you must first produce a slurry in the same manner you would for a 1 or 2 quart canteen. To do so, dissolve 1 level teaspoon of 70% Calcium Hypochlorite placed inside a half canteen cup of water (1½ cups). Ensure that the contents are dissolved, and remove 0.3 ml or 4 drops of slurry for the 70-ounce reservoir and 0.5 ml or 7 drops of slurry for the 100-ounce reservoir. Mix the added solution in the reservoir water and let the water stand for 30 minutes before drinking it.

(2) Chlorine Bleach. Chlorine bleach can be used when other disinfectants are not available. For a 70-ounce reservoir, use 4 drops from a standard 10 mL dropper, or 6 drops for

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Chlor-Floc® is a registered trademark of Deatrick & Associates, Inc., Alexandria, Virginia

the 100-ounce reservoir. Mix the added bleach in the reservoir water and let it stand 30 minutes before drinking it.

(3) Iodine. Use 4 iodine tablets for 70 or 72-ounce water reservoirs, and 6 for 100 or 102-ounce reservoirs. Allow 30 minutes of contact time before consuming the water. If the water to be treated is cloudy or discolored, either double the dosage or utilize Chlor-Floc® in a separate container.

(4) Chlor-Floc®. Use 2 Chlor-Floc® tablets for the 70 or 72-ounce reservoir, or 3 tablets for 100 or 102-ounce reservoirs. Use a separate clean container and fill it with the amount of water desired to treat. Add the recommended number of tablets to the water and stir to dissolve the tablets completely (at least one minute). Wait 4 minutes. Stir for 10 more seconds. Wait 15 minutes. Pour water through the cloth filter provided with the kit into the reservoir of the PHS. The filter can be re-used for up to 24 hours if rinsed with treated water after use. Always filter through the same side of the cloth. Chlor-Floc® should not be used in the reservoir itself due to the location of the drinking tube at the bottom of the reservoir. This is where all the flocculent will settle, greatly affecting the quality of the water drawn into the straw during consumption.

(5) Boiling. When no other adequate means of disinfection are available, water should be boiled. Hold the desired amount of water at a rolling boil for 1 or 2 minutes. The command surgeon may prescribe longer boiling times in areas where certain heat-resistant organisms are prevalent or at high altitudes. The boiled water must be kept in a covered, uncontaminated container until it is put in the PHS reservoir.

e. Health Advantages. Heat stress is a problem for the military because of the type of clothing worn, the type of activities performed, and the environment where soldiers are deployed. By the time military personnel feel thirsty, they're already dehydrated. They should consume about 1 liter of fluids per hour when active in a warm, humid environment. Losing just 2% of one's body weight in water, about 3 pounds for a 150-pound person, is enough to start feeling the initial effects of dehydration, causing a decrease in energy and endurance. Through the use of a PHS, health professionals have shown that persons who continually sip water stay better hydrated when compared to inconsistent consumption. Similarly, manufacturers claim that persons using PHSs drink 46% more fluids than bottled water users under similar conditions.

f. Potential Health Threats.

(1) Pathogens. Water-Borne Diseases and Contaminants. In addition to the threat of casualties from inadequate water supplies, the potential threat from water-borne disease also exists.

(a) Water can serve as the vehicle for disease-causing infectious agents, biological and chemical contaminants, and excessive amounts of dissolved solids. In particular, a vast historical record exists of disabling gastrointestinal disease caused by bacteria and viruses contaminating water supplies during military operations. To combat this, leaders must ensure that soldiers are properly maintaining both personal hygiene and the cleanliness of their PHS.

(b) Potable water is a critical resource for forces in the field. The responsibilities for ensuring that water produced and provided to soldiers and civilians in field environments is safe are shared among Preventive Medicine, Corps of Engineers, and Quartermaster Corps personnel, and Unit Field Sanitation Teams under the direction of their unit commanders. However, mission requirements often isolate soldiers and patrols, making the water production point or water distribution network inaccessible. In these instances, obtaining drinking water in the field requires the utilization of available raw water sources, such as a stream, pond, lake, or well. Leaders should ensure soldiers are provided with training on the proper chlorination procedures described in this information paper and Technical Bulletin Medical (TB MED) 577.

(2) Health Threats. Personal hydration systems may do more harm than good if they are used in industrial areas where chemicals or hazardous materials are present. Soldiers could accidentally expose themselves to health hazards. While the devices are useful in extreme climatic conditions in the field, or on flight lines, PHSs can cause problems for those working in areas where painting, sanding, metal grinding, and mixing chemicals and pesticides occur, or wherever vapors or particles may be ingested. Since PHSs have rubber-like mouthpieces that have to be bitten open, there is a significant chance for transferring the chemicals to the mouth. Additionally, dusts can collect on the mouthpiece and chemical vapors can absorb into the rubber/silicone. Commanders and supervisors should only allow eating and drinking in designated areas to avoid ingesting harmful substances. By limiting these activities the amount of exposure to potentially dangerous chemicals can be limited.

g. Personal Hydration Systems Optional Accessories.

(1) Water Filtering Systems. The Blackhawk® HydraStorm™ is an in-line water filtration system. It is said to remove offensive tastes, odor, chlorine, silt, sand, and sediment. It is also supposed to be effective against microbiologic pathogens such as Cryptosporidium, Giardia, and other cysts and spores. The company also states that the filter guards against volatile organic compounds, polychlorinated biphenyls, agricultural synthetic organic compounds, detergents, and pesticides, such as DDT. The filter also reportedly removes dissolved solids, heavy metals, and Radon 222. For further information about hand held treatment devices or inline filter technologies refer to CHPPM Information Paper 31-032, Preventive Medicine Concerns of Hand Held Water Treatment Devices dated March 2003.

Figure 8. Blackhawk® HydraStorm™ In-Line Filter

(2) Insulated Delivery Tubes. The PHS delivery tubes can be insulated with a closed cell foam cover. The insulation helps in providing cool water in hot climates, and helps prevent the freezing of delivery tube fluid in cold climates. The tube insulation is offered in a variety of military specification colors. For further information on PHS accessories see Appendix B. of this information paper.

(3) Cleaning Kit. CamelBak® markets a "cleaning brush set" for keeping the delivery tube and reservoir clean and mildew-free. The kit includes two brushes, one for the delivery tube and one for the reservoir. The reservoir brush has a radial tip to prevent puncturing the reservoir. It is made of nylon to prevent mold and mildew. There is a flexible spring wire that cleans the delivery tube. These devices are simply designed, albeit effective for their intended use. For more information on cleaning procedure of PHSs see Appendix C. of this information paper.

Figure 9. Personal Hydration System Cleaning Kit

h. Device Component Concerns. The delivery tube bite valve is a potential source of contamination. The manufacturer claims that the "Bite Valve" is designed to be easily cleaned, even in the field. The directions for cleaning the bite valve instruct the user to pull the valve off of the tube end by grasping the rib at the valve's face and rolling it backwards, which exposes the core piece with the slit opening. Then the user pulls the core off of the ribbed post. This procedure allows the user to clean the valve parts with a cotton swab or toothbrush and some soapy water. To reassemble the delivery system, re-position the valve core on the center post of the valve body, and roll the outer sleeve forward again.

i. NBC Components/Compatibility.

(1) Effectiveness for NBC Agents. The PHS manufacturer CamelBak® has developed a CRR. According to CamelBak®, their unit was tested in accordance with USACHPPM TG 230A for nerve agents GB (Sarin, an anticholinesterase agent), and HD (the blister agent Mustard). CamelBak® has stated that under the test procedures set by SBCCOM requiring a 24-hour exposure to both GB and HD, the CRRs tested did not exceed the detection limits of 0.005 ug/ml for GB and 0.02 ug/ml for HD in laboratory tests. However, this has not been confirmed by an independent third party organization or in a government laboratory. The USACHPPM

does not endorse the use of TG 230A guidelines for water quality design criteria. TG 230A is to be used as a short-term environmental exposure guide for deployed forces.

(2) The CamelBak® CRR attaches directly to the standard protective mask fittings of the M17, M70, M40, and MCU2P masks. It can be integrated with any 70 or 100-ounce reservoir pocket. The reservoir's ability to resist NBC contamination has not been tested by the Army, or other Department of Defense organizations. The U.S. Army Natick Soldier Center is currently researching a variety of commercial materials for the development of a CRR.

j. Modular Lightweight Load-carrying Equipment. The MOLLE is designed to enhance the survivability and lethality of the 21st century Soldier. It is a replacement for the current All-purpose Lightweight Individual Carrying Equipment (ALICE) system and components of the Integrated Individual Fighting System including the Enhanced Tactical Load-Bearing Vest.

(1) The MOLLE system provides far more load carrying capabilities than the Vietnam-era ALICE and other fielded systems. The MOLLE system consists of the fighting load vest, the main rucksack, the sleep system carrier, the patrol pack, the frame, sustainment pockets, six foot lashing straps, hydration bladder, repair kit, and additional pockets. Five configurations are currently available: rifleman, medic/corpsman, pistol, squad automatic gunner, and grenadier.

(2) The load-bearing vest has a number of pockets that accommodate several load configurations and a padded belt. It features a PHS consisting of an internal water bag or reservoir/bladder, with a drinking delivery tube, similar to the drink-on-the-move hydration systems on the commercial market. The hydration pocket doubles as a pocket for a rear-body armor plate. This PHS is not for use in a chemical or biological agent-contaminated environment. However, efforts are ongoing to develop a mobile hydration system for all conditions.

5. SUMMARY. The concept and employment of PHSs for the soldier have demonstrated that the systems are viable hydration devices, and can effectively augment or replace the canteen under certain conditions. They are especially beneficial under extreme climatic conditions, and during high levels of exertion. Military personnel employ PHSs under a wide range of adverse conditions worldwide. Existing PHSs have been successfully integrated into modern load carrying equipment, and have been used in war theaters, such as Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom. There are a few manufacturers that produce in-line water filters for additional protection of drinking water. It should be noted that the manufacturer warrants positive removal of harmful bacteria and viruses; however, they have not been evaluated by USACHPPM. A two-stage process incorporating mechanical filtration with a hand held device, followed by chemical disinfection is recommended for emergency water purification. The CRR by CamelBak® requires further testing, as the data is currently inadequate to state with assurance that reservoirs and protective mask assemblies will meet requirements for operating in CBRN environments.

6. CONCLUSIONS. Properly used and maintained, PHSs containing potable water can help maximize performance, comfort, and health. Personal hydration systems can provide a readily available storage container of safe and clean drinking water for soldiers when hydration demand

is warranted by conditions of diverse activity. There is insufficient data for USACHPPM to state with assurance that tested PHS reservoirs and protective mask assemblies will meet requirements for operating in CBRN environments. Only potable water should be used in PHSs. This conclusion is based on combat wound management principles where existing personal water supplies may be needed for wound management.

7. **RECOMMENDATIONS**. For proper maintenance of PHSs, follow the manufacturers' recommendations. Should the chemical resistant reservoir become contaminated or compromised by CBRN contaminants, USACHPPM recommends decontaminating the entire system in accordance with policies for equipment decontamination. Upon successful decontamination of the over-pack material, Commanders must ensure that the reservoir and its delivery tube are properly discarded and not reused by the soldier. Personal hydration systems should be used in addition to issued canteens where operations in extreme climatic conditions prevail. Soldiers should ensure the reservoir and delivery tube are properly insulated and protected from chemical and environmental contaminants. Soldiers should wash the PHS as needed with mild soap and water using only treated water. Commanders should ensure that while participating in operations, sanitizing agents such as calcium hypochlorite are available to disinfect and purify water collected for use in PHSs. Commanders must ensure that soldiers do not use sports drink mixes in organizational hydration systems. Furthermore, Commanders should ensure that soldiers are issued new drinking tubes and bite valves with used organizational personal hydration systems. Failure to comply with these recommendations may increase the occurrence of disease within the command.

8. **ADDITIONAL ASSISTANCE.** For further assistance on this information paper or other field water issues contact the USACHPPM, 5158 Blackhawk Road, Building E-1675, ATTN: MCHB-TS-EWS, Aberdeen Proving Ground, Maryland 21010-5403, or telephonically at (410) 436-3919, or DSN 584-3919. You can also send messages or questions to the following e-mail address: Water.Supply@apg.amedd.army.mil

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APPENDIX A
REFERENCES

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APPENDIX B
PERSONAL HYDRATION SYSTEMS AND REPLACEMENT PARTS

2003 CamelBak Maximum Gear GSA Pricelist & Order Form

EFFECTIVE March 1, 2003

CamelBak Products, Inc. 1310 Redwood Way, Suite C, Petaluma, CA 94954 • TEL: 800-767-8725 • FAX: 707-665-3844 • www.camelbak.com

Sales Rep	Date	S.O. #	Ship Via
			☒ UPS Ground
	Ship Date	Customer #	☒ UPS 3-Day
			☐ UPS 2Day
	P.O. #		☐ UPS Ovnt
Contract Number: GS07F-9727H Cage Code: 063G3	"Other" Shipping Method		☐ FedEx Ovnt
military.sales@camelbak.com			☐ "OTHER"

Bill To:	Ship To:
Phone: FAX:	Phone: FAX:

SKU#	Product Name	Color	Price	Qty	Ext. Price
	MAXIMUM GEAR PRODUCTS				
20322	Sabre 70 oz.	Black	$21.00		$ -
71000	ThermoBak 2L 70 oz.	Black	$25.00		$ -
71050	ThermoBak 2L 70 oz.	Desert Camo	$26.00		$ -
20111	ThermoBak 3L 100 oz.	Black	$29.95		$ -
20121	ThermoBak 3L 100 oz.	Woodland Camo	$31.00		$ -
20131	ThermoBak 3L 100 oz.	OD Green	$29.95		$ -
20332	ThermoBak 3L 100 oz.	Desert Camo	$31.00		$ -
60065	Ambush Ω 100 oz.	Woodland Camo	$42.00		$ -
60066	Ambush Ω 100 oz.	Desert Camo	$42.00		$ -
72000	MULE-MG Ω 100 oz.	Black	$54.00		$ -
72050	MULE-MG Ω 100 oz.	Woodland Camo	$55.00		$ -
72150	MULE-MG Ω 100 oz.	Desert Camo	$55.00		$ -
73000	HAWG-MG Ω 100 oz.	Black	$64.00		$ -
73150	HAWG-MG Ω 100 oz.	Woodland Camo	$65.00		$ -
73100	HAWG-MG Ω 100 oz.	Desert Camo	$65.00		$ -
74000	MotherLode Ω 100 oz.	Black	$85.00		$ -
74050	MotherLode Ω 100 oz.	OD Green	$85.00		$ -
60072	MotherLode Ω 100 oz.	Desert Camo	$87.00		$ -
60062	BFM Ω 100 oz.	OD Green	$99.95		$ -
76000	Stealth Ω 72 oz.	Black	$35.00		$ -
20211	Viper Ω 102 oz.	Black	$45.00		$ -
20402	Viper Ω 102 oz.	Woodland Camo	$46.00		$ -
60078	Viper Ω 102 oz.	Desert Camo	$46.00		$ -
20362	Transformer Ω 102 oz.	Black	$70.00		$ -
20372	Transformer Ω 102 oz.	Woodland Camo	$71.00		$ -
20311	Storm 100 oz.	OD Green	$20.00		$ -
76050	PakTeen 50 oz.	Black	$20.00		$ -
	INDUSTRIAL SAFETY PRODUCTS				
30012	WaterPro Ω 50 oz	Gray/Black	$19.92		$ -
30022	WaterMaster Ω 70 oz.	Gray/Black	$24.67		$ -
30112	HotShot Ω 72oz.	OD Green	$24.96		$ -
30072	Hi-Viz Ω 70oz	Int'l Orange	$30.37		$ -
30082	Hi-Viz Ω 70oz	Lime Green	$30.37		$ -
30092	FR Watermaster Ω 70 oz.	Nomex-Navy	$39.87		$ -

Ω= Omega - Wide Mouth Reservoir

SKU#	Product Name	Price	Qty	Ext. Price
	REPLACEMENT RESERVOIRS			
90271	70oz. Omega - Ω - Gray	$ 14.00		$ -
90241	100oz. Omega - Ω- Gray	$ 15.00		$ -
90251	72oz. Omega Baffled - Ω- Gray	$ 15.00		$ -
90261	102oz. Omega Baffled - Ω- Gray	$ 16.00		$ -
90201	50oz. LongNeck- Gray	$ 11.50		$ -
90211	70oz. LongNeck- Gray	$ 12.00		$ -
90221	100oz. LongNeck- Gray	$ 12.50		$ -
	ACCESSORIES			
90051	Thermal control kit	$8.00		$ -
90041	Tubing extender kit	$3.50		$ -
90231	Powerbelt Sternum Strap 1"	$2.60		$ -
90071	Camelclip	$0.90		$ -
90021	Tube-Trap	$0.95		$ -
9040	Insulated Tube Cover - Black	$5.00		$ -
9042	Insulated Tube Cover - Tan	$5.00		$ -
90081	Cleaning Brush Set	$5.00		$ -
60061	Cleaning Tablets	$5.00		$ -
60083	Field Cleaning Kit	$8.50		$ -
90091	Reservoir Dryer	$4.50		$ -
9080	Bite Valve Cover	$4.00		$ -
90031	Tube Director	$5.00		$ -
90502	Big Bite Valve - Black HL*	$3.00		$ -
90512	Conversion Kit (HydroLock) HL*	$5.00		$ -
	SPECIALTY ITEMS			
77100	Chemical Resistant Reservoir HL*	$59.95		$ -
90522	Type-M Mask Adapter (M-40) HL*	$4.00		$ -
90532	Type-A Mask Adapter (Avon) HL*	$5.00		$ -

Shipping and Handling Additional
Prices FOB Origin
There is a $5 charge on orders under $100

Sub Total Right:	$ -
Sub Total Left:	$ -
Combined Sub Total:	$ -
ESTIMATED Shipping & Handling	
GRAND TOTAL	$ -

WATER VOLUME TABLE		
OUNCES	=	LITERS
50	=	1.5
70	=	2
100	=	3

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APPENDIX C
CLEANING AND STORAGE PROCEDURES FOR PERSONAL HYDRATION SYSTEMS

1. Cleaning the Reservoir and Pack. Under ideal conditions, manufacturers suggest the following basic steps for cleaning personal hydration systems:

a. Remove the reservoir (water bladder) from the cloth pack.

b. Clean the reservoir with mild soap and hot water by scrubbing the inside with a bottlebrush.

c. Air dry the reservoir, leaving the top opened.

d. To remove odors, fill the reservoir with water and add 2 teaspoons of baking soda. Let it sit overnight. Rinse thoroughly and air dry.

e. Disinfect the reservoir with water and 2 teaspoons of liquid bleach. Let it sit for 30 minutes. Rinse thoroughly and air dry. Run the water/bleach cleaning solution through the tube, and scrub it with a long pipe cleaner, a flexible wire covered with cloth, or one of the specially made brushes. Be careful not to puncture the tube.

f. If possible machine-wash the cloth pack in cold water with a mild detergent, and let it air dry. You may also hand wash the pack in a field environment.

g. To store the PHS, dry the pack thoroughly and completely before storing. This is the safest way to store the pack.

2. Cleaning the Reservoir Bite Valve. A primary source of potential contamination is the delivery tube bite valve. To properly clean the valve, pull the valve off of the tube end. Or, if you just want to clean debris out of the diaphragm core, the valve body may be left on the tube's end. Secondly, grasp the rib at the valve's face and roll it backwards. This exposes the core piece with the slit opening. Third, pull the core off of the ribbed post. Then clean the valve parts with a q-tip or toothbrush and some soapy water. Finish by rinsing thoroughly and re-positioning the valve core on the center post of the valve body. Then roll the outer sleeve forward again to complete the job.

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