



Battery-Powered Spreading Rescue Tools for Vehicle Extrication

Market Survey Report

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FOREWORD

The National Urban Security Technology Laboratory (NUSTL) is a federal laboratory within the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T). Located in New York City, NUSTL is the only national laboratory focused exclusively on supporting the capabilities of federal, state, local, tribal, and territorial responders to address the homeland security mission. The laboratory assists responders with the use of technology to prevent, protect against, mitigate, respond to, and recover from homeland security threats and incidents. NUSTL provides expertise on a wide range of subject areas, including chemical, biological, radiological, nuclear, and explosive detection, personal protective equipment, and tools for emergency response and recovery.

NUSTL manages the System Assessment and Validation for Emergency Responders (SAVER) program, which provides information on commercially available equipment to assist response organizations in equipment selection and procurement. SAVER knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: “What equipment is available?” and “How does it perform?” The SAVER program works with responders to conduct objective, practitioner-relevant, operationally-oriented assessments and validations of commercially available emergency response equipment. Having the right tools provides a safer work environment for responders and a safer community for those they serve.

NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, and coordinating with other organizations to leverage appropriate subject matter expertise. In conjunction with DAGER Technology, NUSTL conducted a market survey of commercially available battery-powered spreading rescue tools for vehicle extrication. This equipment falls under the AEL reference number 03SR-02-TPHY titled “Tools, Power.”

SAVER reports are available at www.dhs.gov/science-and-technology/saver-documents-library.

Visit the NUSTL website at www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory or contact the lab at NUSTL@hq.dhs.gov.



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EXECUTIVE SUMMARY

Emergency responders use battery-powered rescue tools to access persons trapped within vehicles. Opening or removing areas of a damaged vehicle from around an injured person could prevent further injury caused when removing them from the vehicle.

Between March 2022 and July 2022, the Systems Assessment and Validation for Emergency Responders (SAVER) program conducted a market survey of commercially available battery-powered spreading rescue tools or “spreaders.” This market survey report is based on information gathered from manufacturer and vendor websites, additional internet research, industry publications and a government-issued request for information that was posted on the System of Award Management website at <https://sam.gov/opp/aa6e7232803445b8b51e105545a476ff/view>. The survey identified 17 spreaders from five manufacturers, ranging in price from \$11,400 to \$15,116.

Each manufacturer offers models that differ based upon spreading distance, spreading force and size. Spreading distances typically range from approximately 20 inches to 32 inches. Included products weigh from 38.1 lb. to 56.6 lb. Generally, as the spreading distance increases, the spreader becomes larger, weighs more and has greater spreading and pulling forces, as defined by National Fire Protection Association’s (NFPA) “Standard on Rescue Tools,” NFPA 1936. Seven of the spreaders are powered by readily available commercial-off-the-shelf (COTS) batteries, while ten spreaders use a proprietary battery, which in some cases support enhanced capabilities such as underwater use. Additionally, features such as the capability of in-house maintenance, ingress protection rating and training offerings may also be of interest to responder agencies.

The purpose of this report is to provide emergency responders with information that will guide their agencies in making operational and procurement decisions. Each agency should consider overall capabilities, technical specifications and limitations of battery-powered spreaders for vehicle extraction in relation to their specific operational needs when making equipment selections.

Performance of these products and information included in this report has not been independently verified by the SAVER program.

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1.0 INTRODUCTION

Emergency responders use battery-powered spreading, cutting and spreading/cutting combination tools for extraction of persons trapped within vehicles. To minimize any further harm, responders use these tools to open or remove areas of a damaged vehicle from around the injured person, rather than removing the victim from the vehicle.

Between March 2022 and July 2022, the System Assessment and Validation for Emergency Responders (SAVER) program conducted a market survey of portable battery-powered spreading, cutting and spreading/cutting combination tools for vehicle extrication. This market survey report focuses solely on battery-powered spreading rescue tools, covering 17 different models. Additional reports on cutting and combination rescue tools will be published at www.dhs.gov/science-and-technology/science-and-technology-directorate/saver/st-battery-powered-rescue-tools-vehicle-extrication. This report is based on information gathered from manufacturer and vendor websites, internet research, industry publications and a government-issued that was posted on the System of Award Management website at <https://sam.gov/opp/aa6e7232803445b8b51e105545a476ff/view>. The U.S. Department of Homeland Security (DHS) Science and Technology Directorate's (S&T's) Technology Scouting Group also contributed to the market research used in the development of this report.

Products included in this report meet the following criteria:

- Single-person portable
- Battery-powered
- Self-contained
- Compliant with the National Fire Protection Association's "Standard on Rescue Tools," NFPA 1936 [1]

Due diligence was performed to develop a report that is representative of products in the marketplace.

2.0 BATTERY-POWERED VEHICLE EXTRICATION TOOLS OVERVIEW

Emergency personnel responding to automobile accidents often encounter trapped or injured individuals needing immediate medical care and extrication. Inclement weather, inaccessible locations, harsh terrain, and unpredictable environmental conditions often hinder the deployment of patient care and extrication equipment. In some situations, rescue personnel must carry equipment to crash sites including hard to reach off-road locations, steep embankments, marshy wetlands or submerged areas. Battery-powered rescue tools for vehicle extrication are more portable than tethered systems and eliminate the need to transport support equipment, such as hydraulic pumps, air compressors and generators. This can increase the speed with which responders can arrive on the scene.

Once on the scene, first responders often find a damaged vehicle body structure surrounding the victim(s) that prevents full access. In these rescue operations, the primary goal in victim extrication is to quickly open or remove the damaged vehicle from around the injured victim, which minimizes the potential for inflicting further physical harm while removing the victim from the vehicle. Battery-powered vehicle extrication tools can provide responders with the ability to maneuver around the vehicle with their equipment and coordinate rescue operations quickly and efficiently.

2.1 Background

Modern rescue tools have their genesis in American stock car racing. George Hurst, a racing equipment manufacturer, observed race crews taking over an hour to extricate a driver from their vehicle following an accident. The crews used slow-cutting circular saws that created sparks, a less than ideal situation in a potentially fuel-soaked area. In 1961, Hurst filed a patent for a hydraulically powered spreading tool to enable track rescue crews to quickly spread apart roll cages to extricate drivers. [1] The original extrication system, the Hurst Rescue Tool hydraulic spreader, was produced in 1971 and following its successful integration into motorsports, became a resource for emergency services. [2]

Early extrication systems relied on gasoline-powered hydraulic pumps large enough to fill the bed of a pickup truck. These pumps were connected to a handheld spreader unit via two hydraulic hoses. Since their initial design, systems have become smaller and stronger. The introduction of the lithium-ion battery enabled manufacturers to produce self-contained, portable, handheld vehicle extrication tools with onboard electrohydraulic pumps. These battery-enabled systems are capable of many of the tasks that formerly required using tools with separate power units.

2.2 Current Technologies

Spreaders, cutters and spreader/cutter combination tools used in vehicle extrication operations have traditionally relied on tethered lines attached to hydraulic pumps to pressurize the hydraulic fluid going to the tool. Battery-powered extrication tools are self-contained hydraulic systems that electrically power an internal high-pressure pump and pistons to control the flow of hydraulic fluid through input and output valves and chambers. These systems typically use a synthetic fluid known as phosphate-ester, which is non-flammable and electrically non-conductive [1]. Battery-powered tools have the advantage of being self-contained, eliminating tangling and tripping hazards from hydraulic hoses or electrical cords. These self-contained systems allowing rescue personnel to operate independently and to use multiple tools (such as spreaders and cutters) simultaneously, providing faster rescue operations.

Battery-powered tools also enable first responders to access tighter spaces, reduce tripping hazards and provide more flexibility to quickly remove mangled metal from around a trapped victim.

Battery-powered rescue tools are somewhat larger and heavier than traditional, tethered rescue tools because they include the power supply and hydraulic unit within one handheld system. Additionally, the run times for the battery-powered tools are limited by the battery used to power the system and incidents may require the use of replacement batteries. Other capabilities listed in the manufacturer-provided specifications (e.g., spreading distance, spreading forces, pulling forces and travel distance) of battery-powered rescue tools match those of traditional hydraulic rescue tools.

2.2.1 Battery-Powered Spreaders

Battery-powered spreaders, which are the focus of this report, are used to create access in tight, damaged spaces like car doors, dashboards, and firewalls. First responders apply force to wedge the narrow tips of the spreader tool into a tight area, then open the tips to separate and expand the damaged vehicle's metal. Spreaders can be used like a scissor jack to lift the side of some vehicles and can support some non-hydraulic ram systems by using the spreading tips to extend the ram's extension poles. Spreaders can also be used with chains to perform heavy lifting and pulling functions as described in more detail in Section 2.3.3.

2.3 Key Components

Battery-powered spreaders require a power source, external operating components (e.g., on/off switch, variable speed control, hand grip) and various arm attachments. Some manufacturers offer advanced features, such as temperature monitoring or the ability to operate under water. These are detailed below.

2.3.1 Power Options

Like other battery-powered rescue tools, spreaders are typically powered by a removable, rechargeable, lithium-ion battery pack inserted directly into the body of the tool. Some spreaders use proprietary manufacturer batteries, while others use commercial battery packs common to construction tools like drills and circular saws. Proprietary batteries may have advantages in certain features such as the ability to be charged while installed on the tool. Conversely, agencies may see advantages to construction tool batteries, including ready availability, relatively lower cost compared to proprietary batteries, and shared use with the agency's other tools such as drills, impact wrenches, reciprocating saws or metal shears.

Some manufacturers offer flexible options for powering the tools, including external battery packs with increased amp-hour capacities versus on-tool batteries. External battery packs, however, require a corded connection to the tool and require the user to wear the battery pack using a shoulder strap. Some manufacturers offer the ability to supply backup power to the tools using an alternating current (AC) connection, enabling rescuers to continue to work even if all batteries have been expended.

2.3.2 External Operating Components

Battery-powered spreaders commonly have a cylindrically shaped main body, an on/off switch, variable speed control lever, hand grip, and various spreader arm attachments as shown in Figure 2-1. The tools typically have a protective cover that protects both the motor from debris and the operator from moving parts. Some systems have a fixed hand grip, while others have rotating or adjustable hand grips that adjust to improve leverage.



Figure 2-1 Genesis S49-SL3 EFORCE spreading tool with external components labeled

Image Credit: Genesis Rescue Systems

Many spreaders include indicators that monitor the power supply and hydraulic fluid reservoir. Some advanced models also have load indicators that show the pressure range the tool is operating under and the amount of remaining capacity. Temperature-sensing and heat-protection mechanisms that protect sensitive electronic components and automatically adjust the speed to protect the motor from burning out are also available on some tools. Additionally, some systems are designed to operate in unique environments, such as under water.

2.3.3 Spreader Arms and Tips

Many spreaders have a quick-release capability to replace spreader arms in the field or to exchange various size spreader arms and tips. Manufacturers offer a variety of tips with different geometrical shapes and gripping surfaces. First responders can then choose the correct tips based on their need. While each manufacturer may refer to their tip attachments by different names, all tips operate under the same concept: tip attachments expand the length of the spreader arm to increase the opening width of the spreader and provide better/additional gripping contact. Figure 2-2 shows an example product with quick release buttons as well as several tips used in spreading operations. The Gator Tip is a starting tip that when closed completely can wedge into very tight spaces. After achieving a wider opening, operators can switch out the Gator Tip for the extended reach tips (ERT), which allow for even wider spreading capability. The other tips provide different angles of attack.



Figure 2-2 AMKUS iS280 showing quick tip release mechanism and Extended Reach Tip (ERT)

Image Credit: AMKUS

Manufacturers also make chain-mounting attachments for spreaders to pull metal and to lift or hoist objects using chains. The pulling method is used as an alternative to spreading or cutting individual car components, such as dashboards, steering columns, and firewalls. The chains attach to the opened spreader arms with a quick release tip. When the spreader arms close, the chains are pulled together, creating a pulling action. Figure 2-3 shows the AMKUS iS280 Spreader with the Pulling Chain Package offered.



Figure 2-3 AMKUS iS320 spreader and chain package has quick release push button tips

Image Credit: AMKUS

2.4 Applications

Today's vehicles have engineered crash-deflection zones or points that improve passenger safety by helping absorb impact and direct the crash away from the passenger area. Rescue crews that understand vehicle anatomy and collision crash points can perform timely vehicle extrication as a coordinated team effort. First responders using a spreader can effectively spread, squeeze, and pull damaged metal to clear a path to the victim or provide an opening in the vehicle for the use of additional tools. First responders using a cutter can cut through vehicle components to remove sections of the vehicle or provide relief cuts for displacement of components. First responders working together simultaneously on different areas of the vehicle can quickly gain access to a trapped or injured victim. For example, one team can work on cutting off the roof while another works to spread open the driver's side door or pull away the steering column.

The focus of this report is on spreaders used for vehicle extrication. However, these tools are also used for industrial accidents, search and rescue operations in collapsed structures, trench rescue, tactical breaching and anywhere else there is a need for power spreading.

2.5 Additional Considerations

Battery-powered spreaders are available with various capabilities. Additional features and greater capabilities typically translate to increased weight and cost. Agencies considering purchasing battery-powered spreaders should refer to their normal vehicle extrication workload and balance their equipment needs with their operational requirements. Basic selection considerations include the weight, dimensions (length, width, height) and ergonomic design of the tool, which will impact the personnel operating the equipment.

Other factors to consider include the following:

- Ease of use
- Portability (i.e., ease of dismounting, carrying, and maneuvering in off-road environments)
- Replacement batteries (proprietary or commercially available)

- NFPA certification
- Specialized tool training requirements
- Cleaning and decontamination procedures
- Spreader tip replacement procedures
- Warranty agreements
- Maintenance requirements

Agencies may also request a list of authorized service centers and determine if loaner equipment is available during long-term equipment repairs.

2.6 Emerging Technologies

Some manufacturers have begun using Electronic Direct Drive (EDD) technology to replace hydraulics in battery-powered rescue equipment. The EDD technology converts lithium battery power to output force and relies on a gearbox and motor.¹ By not using hydraulics, operators no longer risk contamination of hydraulic fluid from dust, dirt, debris, or moisture, which can damage hydraulic systems. While none of the products in this market survey employ EDD, it is currently commercially available in some cutting and combination cutting/spreading tools from PowerHawk² and RESQTEC³.

2.7 Standards/Certification Programs

The National Fire Protection Association (NFPA) 1936, “Standard on Rescue Tools,” 2020 Edition [1] describes the design, performance, testing, and compliance standards for vehicle extrication tools.


NFPA 1936 includes mandatory design criteria, including safety systems, the use of non-combustible hydraulic fluids, manual control designs, labeling, and many other features intended to improve performance and prevent injury to the operator or persons being rescued.

To assist responders in selecting equipment appropriate for their intended tasks, NFPA 1936 established requirements on the testing of rescue tools in order for them to be advertised as NFPA-compliant. This testing must be conducted by an Occupational Safety and Health Administration (OSHA)-approved, third-party laboratory. Manufacturers are required to publish these results for each tool for which they wish to claim NFPA compliance. Users should be aware that while NFPA results are third-party tested, manufacturers may still advertise “maximum” force claims for their tools, which may be engineering calculations that cannot be realistically achieved due to other limiting factors. This report quotes NFPA highest or low spreading or pulling force as measured in third-party testing, not the manufacturer’s claimed maximum force specification.

¹ Accompanying a graphic that compares hydraulics with EDD, text on the RESQTEC website explains: “Fewer steps means greater efficiency. High-energy consuming components (a hydraulic pump, fluid, valves, seals & tubing) all reduce the battery’s runtime, as they use precious battery energy. Eliminating these steps greatly boosts the system’s efficiency.” RESQTEC, “EDD Technology,” [Online]. Available: [rescue.resqtec.com/edd-technology-2/](https://www.rescue.resqtec.com/edd-technology-2/). [Accessed 28 March 2022].

²Power Hawk Technologies, Inc., “P-16 Rescue System,” [Online]. Available: www.powerhawk.com/p16-rescue-system. [Accessed 06 July 2022].

³RESQTEC, “EDD Technology,” 2018. [Online]. Available: www.rescue.resqtec.com/edd-technology-2/. [Accessed 28 March 2022].



The NFPA 1936 standardized tests applicable to battery-powered spreaders include the spreader opening and travel distance, lowest spreading force (LSF), highest spreading force (HSF), highest pulling force (HPF), lowest pulling force (LPF), and the product's operating noise level in decibels measured at 4 meters.

NFPA 1937, "Standard for the Selection, Care, and Maintenance of Rescue Tools," 2021 Edition [4] provides best practices for agencies to use in procurement, inspection, operations, ongoing maintenance, and recordkeeping. Prior to purchasing battery-powered rescue tools, agencies should review the selection section of NFPA 1937, particularly as it relates to conducting a risk assessment of the potential hazards anticipated, operating restrictions, usage frequency, service requirements, and environmental factors specific to their jurisdiction.

3.0 SPREADERS

This section provides product information on 17 battery-powered spreaders. General characteristics and specifications are provided in Table 3-1. The tools are listed alphabetically by manufacturer in the specifications table and in the tool descriptions. The SAVER program obtained the product information presented in this report directly from manufacturers, vendors, and their websites, from March to July 2022. In some cases, manufacturers do not have or publish all available specifications on their tools. It is highly recommended to request and obtain the most current specifications from the vendor or manufacturer when requesting a quote. The information in Section 3.0 has not been independently verified by the SAVER program.

Below are definitions of the product information in Table 3-1, listed in column order.

Weight: Weight in pounds of the tool in a ready-to-use configuration including the battery.

Dimensions: Overall dimensions (in length, width and height given in inches) of the tool in a ready-to-use configuration.

NFPA Highest Spreading Force: The highest spreading force (measured in pound-force (lbf) using a test fixture with a calibrated force-measuring device) as recorded at ten equidistant points along the spreader arms when they are spread to 95% of their opening.

NFPA Lowest Spreading Force: The lowest spreading force (measured in lbf using a test fixture with a calibrated force-measuring device) as recorded at ten equidistant points along the spreader arms when they are closed and calculated at the tips where the tool has the least amount of spreading force.

NFPA Travel Distance: The linear measurement difference (given in inches) at the spreader tips between the fully closed and fully open positions when there is no load on the tool.

NFPA Highest Pulling Force: The highest pulling force (HFP) is recorded at ten equidistant test points along the spreader arms using a test fixture equipped with a calibrated force-measuring device.

NFPA Lowest Pulling Force: The lowest pulling force (LFP) is recorded at ten equidistant test points along the spreader arms using a test fixture equipped with a calibrated force-measuring device.

Pulling Distance: How far (in inches) a spreader tool can pull an item using manufacturer-recommended chain attachment accessories as measured from the fully open position to in the fully closed position. (This is a manufacturer specification only as it is not defined by NFPA 1936.)

Power Supply: The source of power for the tool unit; for all products in this market survey, a removeable/replaceable battery is specifically identified for each product in Table 3-1

COTS Power Supply: This indicates whether the power supply is available as a commercial-off-the-shelf (COTS) battery designated with “Yes” proprietary device available only from the spreader manufacturer and those that use a proprietary battery from the cutter manufacturer are designated with a “No”.

IP Rating: The Ingress Protection (IP) rating identifies the level of protection an electrical enclosure provides against environmental conditions to include solids and liquids. The first digit indicates the protection level against solids and the second digit indicates the protection level against liquids. For example, in an IP54 rating, the “5” means that the tool is dust-protected (but not dust tight), and the “4” means that the tool can withstand water splashing from any direction. Appendix A describes the ratings in full. For products where IP rating information was not available “--” is indicated in the table.

MSRP: The manufacturer suggested retail price (MSRP) in U.S. dollars, which includes whatever comes standard with the rescue tool. Sometimes batteries, chargers and other accessories are not included in the base price and must be purchased separately.

Table 3-1 Battery-Powered Spreader Specifications and Features

Spreader Manufacturer and Model	Weight (lb)	Dimensions (L x W x H) (in.)	NFPA Highest Spreading Force (lbf)	NFPA Lowest Spreading Force (lbf)	NFPA Travel Distance (in.)	NFPA Highest Pulling Force (lbf)	NFPA Lowest Pulling Force (lbf)	Pulling Distance (in.)	Power Supply	COTS Power Supply	IP Rating	MSRP
AMKUS Rescue ION iS240	50.8	31.2 x 11.1 x 9.6	13,620	7,410	24.5	10,350	5,850	–	DeWalt FLEXVOLT 60V	Yes	–	\$11,400
AMKUS Rescue ION iS280	52.8	32.9 x 11.1 x 9.6	12,720	6,610	28	9,590	4,960	–	DeWalt FLEXVOLT 60V	Yes	–	\$11,930
AMKUS Rescue ION iS281	56.3	35.9 x 11.1 x 11.6	16,430	11,850	28.2	12,860	9,200	–	DeWalt FLEXVOLT 60V	Yes	–	\$12,500
AMKUS Rescue ION iS320	56.6	38.1 x 11.1 x 11.6	15,100	10,530	31.9	11,500	7,580	–	DeWalt FLEXVOLT 60V	Yes	–	\$12,600
Genesis S44-SL3	38.1	34.5 x 9.4 x 9.5	11,700	9,225	24.0	9,450	4,725	15.3	Milwaukee M28 Lithium-Ion	Yes	IP54	\$12,800
Genesis S49-SL3	45.6	38.7 x 11.1 x 9.5	17,100	11,475	28.9	12,150	6,750	22	Milwaukee M28 Lithium-Ion	Yes	IP54	\$12,910
Genesis S54-SL3	46.1	40.0 x 11.1 x 9.5	15,300	10,350	31.7	11,700	5,850	24.3	Milwaukee M28 Lithium-Ion	Yes	IP54	\$13,210
Holmatro PSP40CL	33.5	31.9 x 10.6 x 10.9	11,915	8,768	20.1	10,791	6,070	15.5	28V Lithium-Ion	No	IP57	\$12,890
Holmatro PSP40	42.8	37.6 x 10.6 x 10.9	15,557	8,790	28.5	11,623	6,070	24.1	28V Lithium-Ion	No	IP57	\$12,890

Spreader Manufacturer and Model	Weight (lb)	Dimensions (L x W x H) (in.)	NFPA Highest Spreading Force (lbf)	NFPA Lowest Spreading Force (lbf)	NFPA Travel Distance (in.)	NFPA Highest Pulling Force (lbf)	NFPA Lowest Pulling Force (lbf)	Pulling Distance (in.)	Power Supply	COTS Power Supply	IP Rating	MSRP
Holmatro PSP50	46.3	38 x 10.7 x 10.7	20,907	11,240	28.5	15,062	7,419	24	28V Lithium-Ion	No	IP57	\$14,340
Holmatro PSP60	55.1	41.4 x 12.6 x 10.8	25,179	13,489	32.3	17,760	8,543	27.6	28V Lithium-Ion	No	IP57	\$15,116
HURST SP333 E2	40.7	35.6 x 10.0 x 11.2	14,162	8,768	23.6	9,667	5,171	17.3	HURST EXL eDRAULIC 5 Ampere hours (Ah) battery	No	IP54	\$12,565
HURST SP555 E2	46.7	39.4 x 10.4 x 11.0	16,186	11,016	28.7	10,341	6,925	22.4	HURST EXL eDRAULIC 5 Ah battery	No	IP54	\$13,085
HURST SP777 E2	54.6	42.5 x 12.2 x 11.2	19,110	13,260	32	11,016	6,744	25.8	HURST EXL eDRAULIC 5 Ah battery	No	IP54	\$13,605
HURST SP333 E3	40.1	32.4 x 10.1 x 10.0	14,162	8,768	23.6	9,667	5,171	17.3	HURST 5 Ah or 9 Ah	No	IP58	\$13,664
HURST SP555 E3	46.2	36.3 x 10.4 x 10.0	16,186	11,016	28.7	10,341	6,295	22.4	HURST 5 Ah or 9 Ah	No	IP58	\$14,176
HURST SP777 E3	54.2	39.3 x 12.2 x 10.0	19,110	13,260	32	11,016	6,744	25.8	HURST 5 Ah or 9 Ah	No	IP58	\$14,688
Note: “—” indicates no data is available												

3.1 AMKUS Rescue Systems

The AMKUS Rescue Tools ION series spreaders are constructed of an aluminum alloy. The cylindrically shaped housing contains an electric direct current (DC) motor, hydraulic pump, and electronics used to drive mechanical linkages that open or close the arms to spread, squeeze, or pull objects. AMKUS carries four models of ION battery-powered rescue spreaders: the ION iS240, the ION iS280, the ION iS281, and the ION iS320.

Each ION series spreader operates on a COTS 60V DeWalt FLEXVOLT lithium-ion battery. The battery mounts to the top of the tool. A rotary-wheel control valve actuator controls the motor and hydraulic pump and has three operating positions: open, off (neutral) and close. The control valve actuator is equipped with a “deadman” safety feature, stopping the unit when the operator releases pressure from the actuator.

The startup time for each AMKUS ION series spreader is instant. The average run time is 45 minutes. The ION series spreaders have 360-degree, lockable, rotating handles. Each spreader comes standard with AMKUS “Gator Tip” pattern tips, as shown in Figure 3-1, which are designed to reduce slippage and have beveled edges to limit sheet metal from ripping during operations. The tips can be installed and removed via a push-button release.

The AMKUS ION series spreaders are NFPA 1936-compliant. Data on ingress protection (IP) ratings, operating temperatures, or operating noise levels for the AMKUS tools was not available. Each tool has an AMKUS warranty that covers defects in material and workmanship for 10 years from the date of manufacture for the original owner. Information on maintenance was not available.

The MSRP for each spreader in this series is listed under the individual tool descriptions. The MSRP does not include the required batteries, battery chargers. Extended reach tips, and the quick adjust chain package are available for purchase separately.

3.1.1 AMKUS Rescue Systems ION iS240 Spreader

The AMKUS ION iS240, as shown in Figure 3-2, weighs 50.8 lb and measures 31.2 x 11.1 x 9.6 inches. The tool uses a single-stage pump and has a spreading distance of 24.5 in. with the standard Gator Tips. The spreading distance can extend to 32 in. using optional extended reach tips. The tool’s highest spreading force is 13,620 lbf and lowest spreading force is 7,410 lbf. The tool’s highest pulling force is 10,350 lbf and lowest pulling force is 5,850 lbf. The AMKUS ION iS240 has an optional handle with built-in, dual LED lights. The LED lights have three levels of intensity and are powered separately using CR123 batteries. The LED lights also have a battery-saving feature that automatically shuts them off after 15 minutes of inactivity. The AMKUS ION iS240 has an MSRP of \$11,400.



Figure 3-1 Gator Tips

Image Credit: AMKUS Rescue Systems



Figure 3-2 ION iS240 Spreader

Image Credit: AMKUS Rescue Systems

3.1.2 AMKUS Rescue Systems ION iS280 Spreader

The AMKUS ION iS280, as shown in Figure 3-3, weighs 52.8 lb and measures 32.9 x 11.1 x 9.6 inches. The tool uses a single-stage pump and has a spreading distance of 28 in. with the standard tips. The spreading distance can extend to 36 in. with the optional extended reach tips. The tool's highest spreading force is 12,720 lbf and lowest spreading force is 6,610 lbf. The tool's highest pulling force is 9,590 lbf and lowest pulling force is 4,960 lbf. The AMKUS iS280 has an optional handle with built-in, dual LED lights. The LED lights have three levels of intensity and are powered separately using CR123 batteries. The LED lights have a battery-saving feature that automatically shuts them off after 15 minutes of inactivity. The AMKUS ION iS280 has an MSRP of \$11,930.



Figure 3-3 ION iS280 Spreader

Image Credit: AMKUS Rescue Systems

3.1.3 AMKUS Rescue Systems ION iS281 Spreader

The AMKUS ION iS281, as shown in Figure 3-4, weighs 56.3 lb. and measures 35.9 x 11.1 x 11.6 inches. The tool uses a four-stage pump and has a spreading distance of 28.2 in. with the standard tips. The spreading distance can extend to 35.4 in. with the optional extended reach tips. The tool's highest spreading force is 16,430 lbf and lowest spreading force is 11,850 lbf. The tool's highest pulling force is 12,860 lbf and lowest pulling force is 9,200 lbf. The AMKUS ION iS281 has LED lights built into the tool's handle. The LED lights have three levels of intensity and are powered separately using CR123 batteries. The LED lights have a battery-saving feature that automatically shuts them off after 15 minutes of inactivity. The AMKUS ION iS281 has an MSRP of \$12,500.



Figure 3-4 ION iS281 Spreader

Image Credit: AMKUS Rescue Systems

3.1.4 AMKUS Rescue Systems ION iS320 Spreader

The AMKUS ION iS320, as shown in Figure 3-5, weighs 56.6 lb. and measures 38.1 x 11.1 x 11.6 inches. The tool uses a four-stage pump and has a spreading distance of 31.9 inches with the standard tips. The spreading distance can extend to 39.1 in. with the optional extended reach tips. The tool's highest spreading force is 15,100 lbf and lowest spreading force is 10,530 lbf. The tool's highest pulling force is 11,500 lbf and lowest pulling force is 7,580 lbf. The AMKUS ION iS320 has LED lights built into the tool's handle. The LED lights have three levels of intensity and are powered separately using CR123 batteries. The LED lights have a battery-saving feature that automatically shuts them off after 15 minutes of inactivity. The AMKUS ION iS281 has an MSRP of \$12,600.



Figure 3-5 ION iS320 Spreader

Image Credit: AMKUS Rescue Systems

3.2 Genesis Rescue Systems

The Genesis Rescue Systems EFORCE series of battery-powered extrication tools are constructed of anodized aluminum and tool steel housing. Each tool contains an electric DC motor, piston-driven high-pressure hydraulic pump, and electronics used to drive mechanical linkages that open or close the arms to spread, squeeze, or pull objects. The Genesis EFORCE spreader tips are secured on the arms with collar studs and can be replaced or installed by pressing a spring-loaded ball. The battery mounts on the rear of the control handle using sliding rails. The Genesis EFORCE series has three models of battery-powered spreaders: S44-SL3, S49-SL3, and S54-SL3.

Genesis Rescue Systems uses a commercial-off-the-shelf Milwaukee 28V battery. The Milwaukee batteries have an estimated run time of 20–25 minutes and charge in less than an hour. A push-button indicator shows remaining charge left in the battery. Milwaukee batteries also have overload protection to prevent damage to the tool in heavy-duty situations and discharge protection to prevent cell damage. Milwaukee batteries have a 3-year warranty.

The Genesis Rescue Systems EFORCE battery-powered tools are activated using the on/off switch on top of the control handle. Each tool has a startup time of about 1–2 seconds. Operating functions using the rocker lever are located below the control handle. The rocker lever controls the opening and closing of the spreader arms and run as long as the rocker level is actuated.

The Genesis EFORCE battery-powered tools are NFPA 1936-compliant. They have an operating temperature range between -4°F and $+132^{\circ}\text{F}$. The Genesis EFORCE systems have an ingress protection rating of IP54 (i.e., protected against dust and splashes); they should not be operated in submerged conditions. Genesis Rescue Systems does not test their tools for noise output, so noise output data is not available. Each Genesis EFORCE has a tool lifetime (estimated at 10 years) manufacturer's defect warranty with no extended warranties. Genesis offers in-service training, which is included with the purchase of the tools. Annual service for Genesis tools is recommended. Maintenance can be performed by a local Genesis vendor or in-house by Genesis trained personnel.

The MSRP for each spreader is listed under the individual tool descriptions. The MSRP for the tool does not include the required batteries and chargers. Accessories, such as chain kits and connect heads, Brute Tips, RIT Tips, and Genesis E-Pack E28 Power Bank are available for purchase separately.

3.2.1 Genesis Rescue Systems S44-SL3 EFORCE

The Genesis S44-SL3 EFORCE, as shown in Figure 3-6, weighs 38.1 lb. and measures 34.5 x 9.4 x 9.5 inches. It has a spreading width of 24.0 inches. The tool's highest spreading force is 11,700 lbf and lowest spreading force is 9,225 lbf. It has a pulling distance of 15.3 inches. Its highest pulling force is 9,450 lbf and lowest pulling force is 4,725 lbf. The Genesis S44-SL3 has an MSRP of \$12,800.



Figure 3-6 S44-SL3 EFORCE

Image Credit: Genesis Rescue Systems

3.2.2 Genesis Rescue Systems S49-SL3 EFORCE

The Genesis S49-SL3 EFORCE, as shown in Figure 3-7, weighs 45.6 lb. and measures 38.7 x 11.1 x 9.5 inches. It has a spreading width of 28.9 in. The tool's highest spreading force is 17,100 lbf and lowest spreading force is 11,475 lbf. It has a pulling distance of 22 in. Its highest pulling force is 12,150 lbf and lowest pulling force is 6,750 lbf. The Genesis S49-SL3 has an MSRP of \$12,910.



Figure 3-7 S49-SL3 EFORCE

Image Credit: Genesis Rescue Systems

3.2.3 Genesis Rescue Systems S54-SL3 EFORCE

The Genesis S54-SL3 EFORCE, as shown in Figure 3-8, weighs 46.1 lb. and measures 40.1 x 11.1 x 9.5 inches. It has a spreading width of 31.7 inches. The tool's highest spreading force is 15,300 lbf and lowest spreading force is 10,350 lbf. It has a pulling distance of 24.3 inches. Its highest pulling force is 11,700 lbf and lowest pulling force is 5,850 lbf. The Genesis S54-SL3 has an MSRP of \$13,210.



Figure 3-8 S54-SL3 EFORCE

Image Credit: Genesis Rescue Systems

3.3 Holmatro Rescue Systems

The Holmatro Pentheon series of spreading tools have grip tips that are pointed on both sides to bite into the material being spread. Holmatro Pentheon rescue tools are based on an integrated hydraulic-pump that allows for stepless speed maximization. The motor and pump are controlled by an electrical and mechanical (mechatronic) system designed to deliver the maximum oil flow over the full pressure range. The mechatronic system replaces the changeover valves in traditional multi-pump systems. The electric motor and the hydraulic pump share the same shaft allowing for a smaller tool. Holmatro carries four models of Pentheon battery-powered rescue spreaders: the PSP40CL, the PSP40, the PSP50, and the PSP60.

Holmatro Pentheon Spreaders use a proprietary 28.8V, a semi-circular shaped battery that fits around the tool. Holmatro batteries operate for approximately 60 minutes and take about 60 minutes to recharge. LED indicators on the tool, battery, and charger provide information on the battery temperature, state of charge, and state of health. They have a reserve power feature that generates enough power to remove the tool from a spread without "hot swapping" the battery. Using a daisy chained power cord, the battery can be charged while on the spreader (when it is not being operated) via a magnetic connection from the charger. Additionally, when plugged into the charger a spare battery and the battery on the tool can charge concurrently; in that case, the battery on the tool is prioritized.



Figure 3-9 Holmatro's integrated motor and pump design

Image Credit: Holmatro

Holmatro spreaders can operate in low- and high-speed modes using the centrally positioned control handle at the back of the tool. Operators can manipulate the control handle from any position along the 360° carrying handle at the front of the tool. The carrying handle has built-in LED lights that are powered by the main battery. At maximum pressure, the maximum force indicator LED illuminates, accompanied by an audible warning. Holmatro Pentheon spreaders use an auto start/stop and “deadman” feature to preserve battery life. The spreader turns off when not being used and stops at maximum pressure to save energy.

The Holmatro Pentheon series spreaders are NFPA 1936-compliant. They operate at temperatures from -4°F to 131°F and have an ingress protection rating of IP57. The battery packs have an ingress protection rating of IP67. The Holmatro Pentheon spreaders can operate while completely submerged in fresh or salt water at a maximum depth of 3.28 feet for 60 minutes. The battery pack can be changed while the tool is submerged.

Annual maintenance by a Holmatro Certified Technician is recommended. Holmatro offers a training program for agencies so that they can conduct in-house maintenance. Each tool has a lifetime Holmatro warranty that covers defects in material and workmanship for the original owner. The electronic circuit boards inside the tools are warrantied for one year and the batteries are warrantied for two years.

The MSRP for each spreader, which includes two batteries and a charger, is listed within the below descriptions of the individual tools. Optional accessories include an extra battery for \$734 and a 24 VDC battery charger for \$494. Other optional accessories are a daisy chain power cord, on-tool charging cord, tool diagnostics cord, battery diagnostics tool, mains power connector, pulling attachments set spreaders, pulling chain set and tips spreading set.

3.3.1 Holmatro Pentheon PSP40CL Spreader

The Holmatro Pentheon PSP40CL Spreader, as shown in Figure 3-10, is the compact and light (CL) version of the PSP40 spreader. The PSP40CL is 9 lb. lighter and nearly 6 inches shorter than the PSP40. The PSP40CL weighs 33.5 lb. and measures 31.9 x 10.6 x 10.9 inches. The tool uses a five-stage pump and has a spreading distance of 20.1 inches. The PSP40CL's highest spreading force is 11,915 lbf and lowest spreading force is 8,768 lbf. The PSP40CL has a pulling distance of 15.5 in. with a highest pulling force of 10,791 lbf and lowest pulling force of 6,070 lbf. The tool has an operating noise level of 70 dBA at 13 feet. The Holmatro Pentheon PSP40CL has an MSRP of \$12,890.



Figure 3-10 PSP40CL Spreader

Image Credit: Holmatro

3.3.2 Holmatro Pentheon PSP40 Spreader

The Holmatro Pentheon PSP40 Spreader, as shown in Figure 3-11, weighs 42.8 lb. and measures 37.6 inches long, 10.6 inches wide, and 10.9 inches high. The tool uses a five-stage pump and has a spreading distance of 28.5 inches. The PSP40's highest spreading force is 15,557 lbf. and lowest spreading force is 8,790 lbf. The tool has a pulling distance of 24.1 inches. Its highest pulling force is 11,623 lbf. and lowest pulling force is 6,070 lbf. The tool has an operating noise level of 67 dBA at 13 feet. The Holmatro Pentheon PSP40 has an MSRP of \$12,890.



Figure 3-11 PSP40 Spreader

Image Credit: Holmatro

3.3.3 Holmatro Pentheon PSP50 Spreader

The Holmatro Pentheon PSP50 Spreader, as shown in Figure 3-12, is a larger and stronger version of the PSP40 spreader. The PSP50 weighs 46.3 lb. (3.5 lb. heavier than the PSP40) and measures 38 x 10.7 x 10.7 inches. The tool uses a five-stage pump and has a spreading distance of 28.5 inches. The PSP50's highest spreading force is 20,907 lbf and lowest spreading force is 11,240 lbf. The PSP50 has a pulling distance of 24 inches. Its highest pulling force is 15,062 lbf and lowest pulling force is 7,419 lbf. The tool has an operating noise level of 70 dBA at 13 feet. The Holmatro Pentheon PSP50 has an MSRP of \$14,340.



Figure 3-12 PSP50 Spreader

Image Credit: Holmatro

3.3.4 Holmatro Pentheon PSP60 Spreader

The Holmatro Pentheon PSP60 Spreader, as shown in Figure 3-13, is a larger and stronger version of the PSP40 and PSP50 spreaders. The PSP60 weighs 55.1 lb. (almost 9 lb. heavier than the PSP50) and measures 41.4 inches long, 12.6 inches wide, and 10.8 inches high. The tool uses a five-stage pump and has a spreading distance of 32.3 inches. The PSP60's highest spreading force is 25,179 lbf and lowest spreading force is 13,489 lbf. The PSP60 has a pulling distance of 27.6 inches. Its highest pulling force is 17,760 lbf and lowest pulling force is 8,543 lbf. The tool has an operating noise level of 70 dBA at 13 feet. The Holmatro Pentheon PSP60 has an MSRP of \$15,116.



Figure 3-13 PSP60 Spreader

Image Credit: Holmatro

3.4 HURST Jaws of Life

The HURST Jaws of Life battery-powered rescue spreaders are constructed of an anti-corrosive aluminum alloy. The cylindrically shaped housing contains an electric brushless DC motor, a hydraulic pump, and electronics used to drive mechanical linkages that open or close the arms to spread, squeeze, or pull objects. A star-grip control valve actuator controls the motor and hydraulic pump and is equipped with a “deadman” safety feature, which stops the unit when the operator releases pressure from the actuator. Each tool features two LED work lights. HURST Jaws of Life carries two lines of battery-powered rescue spreaders: E2 eDRAULIC, and E3. Within each line of rescue tools are three sizes of spreaders, SP333, SP555, and SP777, providing a total of six spreader variants available from HURST.

Each HURST Jaws of Life spreader operates on a proprietary HURST battery that differs between HURST spreader lines as detailed below. HURST batteries operate for roughly 50 minutes and take approximately two hours to recharge. Each battery mounts to the rear of the tool.

Each spreader comes standard with HURST “shark tooth” pattern tips (featuring four rows of shark-like teeth), which are designed to reduce slippage and have sharp points to limit sheet metal from ripping during operations. The tips can be installed and removed via a push-button release. The HURST spreaders have a fixed rear handle that sits forward of the battery and a crossbar-style handle at the base of the spreader jaws to provide a 180-degree grip from either side of the tool. All HURST rescue spreaders have an operating temperature range of -22°F to $+140^{\circ}\text{F}$.

All HURST spreaders are NFPA 1936-compliant. Each HURST tool has a warranty that covers defects in material and workmanship for three years from the date of manufacture for the original owner. After three years, the tool is warranted for parts replacement only (no labor) for an additional seven years. HURST Jaws of Life provides training with the purchase of tools. HURST recommends annual maintenance of their rescue tools. Maintenance can be performed by local HURST dealers or HURST can train agencies to conduct their own annual maintenance.

The MSRP for each spreader is listed under the individual tool descriptions. All tools are delivered with two tool batteries and a charger for the batteries. HURST also produces 110V battery adapters that can be used to directly power the spreaders if 110V AC power is available. Additional batteries, chargers, extended reach tips, and the quick adjust chain package are sold separately.

3.4.1 HURST E2 eDRAULIC Series Spreaders

E2 series spreaders are IP54 rated, with dust protection and splash protection, but are not rated for underwater immersion. E2 series spreaders use proprietary HURST EXL eDRAULIC 5 Ah (Ampere hours) batteries, which also have an ingress protection rating of IP54.

3.4.1.1 HURST SP333 E2 eDRAULIC Spreader

The HURST SP333 E2 eDRAULIC, as shown in Figure 3-14, is the smallest and lightest rescue spreader in the E2 eDRAULIC line. The spreader weighs 38.1 lb. and measures 35.6 x 10 x 11.2 inches. The SP333 E2 has a spreading distance of 23.6 inches with standard tips. Its highest spreading force is 14,162 lbf and lowest spreading force is 8,768 lbf. The SP333 E2 eDRAULIC has a pulling distance of 17.3 in. with a highest pulling force of 9,667 lbf and lowest pulling force of 5,171 lbf. The tool has an operating noise level of 71 dBA. The HURST SP333 E2 eDRAULIC has an MSRP of \$12,565, which includes the spreader, two batteries, and a battery charger.



Figure 3-14 HURST SP333 E2

Image Credit: HURST Jaws of Life

3.4.1.2 HURST SP555 E2 eDRAULIC Spreader

The HURST SP555 E2 eDRAULIC, as shown in Figure 3-15, is the mid-range (in size and weight) spreader in the E2 eDRAULIC line. The spreader weighs 44.1 lb. and measures 39.4 x 10.4 x 11 inches. The spreader has a spreading distance of 28.7 in. with standard tips. Its highest spreading force is 16,186 lbf and lowest spreading force is 11,016 lbf. The SP555 E2 eDRAULIC spreader has a pulling distance of 22.4 in. with a highest pulling force of 10,341 lbf, and lowest pulling force of 6,925 lbf. The tool has an operating noise level of 71 dBA. The HURST SP555 E2 eDRAULIC has an MSRP of \$13,085, which includes the spreader, two batteries, and a battery charger.



Figure 3-15 HURST SP555 E2

Image Credit: HURST Jaws of Life

3.4.1.3 HURST SP777 E2 eDRAULIC Spreader

The HURST SP777 E2 eDRAULIC, as shown in Figure 3-16, is the largest spreader in the E2 eDRAULIC line. The spreader weighs 52 lb. and measures 45.2 x 12.2 x 11.2 inches. The spreader has a spreading distance of 32 in. with standard tips. Its highest spreading force is 19,110 lbf and lowest spreading force is 13,260 lbf. The SP777 E2 eDRAULIC spreader has a pulling distance of 25.8 in. with a highest pulling force of 11,016 lbf and lowest pulling force of 6,744 lbf. The tool has an operating noise level of 71 dBA. The HURST SP777 E2 eDRAULIC has an MSRP of \$13,605, which includes the spreader, two batteries, and a battery charger.



Figure 3-16 HURST SP777 E2

Image Credit: HURST Jaws of Life

3.4.2 HURST E3 Series Spreaders

The E3 series tools include a turbo function that allows the spreader arms to move at faster speeds when the tool is working at low pressure levels. The HURST pulling chain package and spreader stability plate for lifting can be applied through the HURST E3 spreading tips.

E3 series spreaders also can operate while submerged in both fresh water and saltwater at a maximum depth of 11 feet for 60 minutes using the HURST Jaws of Life 9 Ah battery. A specially designed saltwater bag for the battery must be used for saltwater submersion. The E3 series has a control panel with indicator lights for battery level, for working tool pressure load, for the tool's Turbo function, to show when a saltwater-compatible battery is installed, to warn the operator of the electronics' temperature, and an illuminated direction indicator to show the direction in which the star grip control is activated.

The E3 series of spreaders has a wireless connection option that is sold as the "E3 Connect" series. E3 Connect spreaders have identical base capabilities as the E3 series but includes an additional Wi-Fi connectivity function. This function enables the tool to wirelessly transmit usage data to HURST's secure cloud servers to facilitate maintenance scheduling, automatically maintain agency usage logs, and conduct detailed error logging.

3.4.2.1 HURST SP333 E3 Spreader

The HURST SP333 E3, as shown in Figure 3-17, is the smallest and lightest rescue spreader in the E3 line. The spreader weighs 37.5 lb. and measures 32.4 x 10.1 x 10.0 inches. The spreader has a spreading distance of 23.6 in. with standard tips. Its highest spreading force is 14,162 lbf and lowest spreading force of 8,768 lbf. The SP333 E3 spreader has a pulling distance of 17.3 in. with a highest pulling force of 9,667 lbf and lowest pulling force of 5,171 lbf. The tool has an operating noise level of 73 dBA. The HURST SP333 E3 has an MSRP of \$13,664, which includes the spreader, two batteries, and a battery charger.



Figure 3-17 HURST SP333 E3

Image Credit: HURST Jaws of Life

3.4.2.2 HURST SP555 E3 Spreader

The HURST SP555 E3, as shown in Figure 3-18, is the mid-range (in size and weight) spreader in the E3 line. The spreader weighs 43.9 lb. and measures 36.3 x 10.4 x 10.0 inches. The spreader has a spreading distance of 28.7 in. with standard tips. Its highest spreading force is 16,186 lbf and lowest spreading force is 11,016 lbf. The SP555 E3 spreader has a pulling distance of 22.4 in. with a highest pulling force of 10,341 lbf, and lowest pulling force of 6,925 lbf. The tool has an operating noise level of 67 dBA. The HURST SP555 E3 has an MSRP of \$14,176, which includes the spreader, two batteries, and a battery charger.



Figure 3-18 HURST SP555 E3

Image Credit: HURST Jaws of Life

3.4.2.3 HURST SP777 E3 Spreader

The HURST SP777 E3, as shown in Figure 3-19, is the largest spreader in the E3 line. The spreader weighs 51.6 lb. and measures 39.3 x 12.2 x 10.0 inches. The spreader has a spreading distance of 32 in. with standard tips. Its highest spreading force is 19,110 lbf and lowest spreading force is 13,260 lbf. The SP777 E3 spreader has a pulling distance of 25.8 in. with a highest pulling force of 11,016 lbf and lowest pulling force of 6,744 lbf. The tool has an operating noise level of 69 dBA. The HURST SP777 E3 has an MSRP of \$14,688, which includes the spreader, two batteries, and a battery charger.



Figure 3-19 HURST SP777 E3

Image Credit: HURST Jaws of Life

4.0 MANUFACTURER AND VENDOR CONTACT INFORMATION

In the United States, most battery-powered rescue tools are sold through dealers based upon location. Manufacturers' websites usually provide links to locate vendors. Additional information on the spreaders included in this market survey report can be obtained from the manufacturers listed in Table 4-1.

Table 4-1 Manufacturer and Vendor Contact Information

Manufacturer	Address	Phone Number	E-mail or Web Form	Website
AMKUS	4201 Montdale Dr. Valparaiso, IN 46383	(800) 592-6587	amkus.com/support	www.amkus.com
Genesis	2780 Culver Ave. Kettering, OH 45429	(937) 293-6240	genesrescue.com/dealer-locator/	www.genesrescue.com
Holmatro	505 McCormick Dr. Glen Burnie, MD 21061	(410) 768-9662	info@holmatro.com	www.holmatro.com
Hurst	711 N. Post Rd. Shelby, NC 28150	(800) 537-2659	contacthurst@idexcorp.com	www.JawsofLife.com

5.0 CONCLUSIONS

Advancements in batteries, tool design and performance have greatly improved the capabilities and effectiveness of battery-powered rescue tools. The portability and ease of deployment of battery-powered rescue tools have improved responder access to hard-to-reach areas, decreased setup times and sped up the response to trapped victims.

This market survey report provides information on 17 battery-powered rescue spreaders, all of which are single-person portable, battery-powered, self-contained and NFPA 1936 compliant. Their prices range from \$11,400 to \$15,116. These tools vary in size, weight, features and performance. Each manufacturer offers a range of models that differ based upon spreading distance, spreading force and size. Spreading distances typically range from approximately 20 inches to 32 inches. Typically, as the spreading distances increase, the spreaders become larger, weigh more and have greater spreading and pulling forces, as defined by National Fire Protection Association performance specifications. Product weights range from 38.1 lb. to 56.6 lb. Seven of the spreaders are powered by commercial-off-the-shelf (COTS) batteries which may be more readily available, while ten spreaders use a proprietary battery that may offer other capabilities such as the ability to be charged while installed on the tool. Additionally, features such as the capability of in-house maintenance, ingress protection rating and training offerings may also be of interest to responder agencies.

Emergency responder agencies should carefully research the overall capabilities and limitations of battery-powered spreaders for vehicle extrication in relation to their agency's operational needs when making procurement or acquisition decisions.

APPENDIX A. INGRESS PROTECTION LEVELS (IP CODE)

This section provides information on the levels of ingress protection as specified by the 2-digit designations in the IEC 60529 standard [5]. Table A-1 provides levels of solid ingress protection (first digit). Table A-2 provides levels of liquid ingress protection (second digit).

Appendix Table A-1 Levels of Solid Ingress Protection per First Digit of IP Code

Digit	Object Size Effective Against	General Description
0	No Protection	No protection against contact and ingress of solids
1	> 50 mm	Large surfaces, e.g., back of hand, but no protection against deliberate contact with body part
2	> 12.5 mm	Prevents entry of fingers and similarly sized objects
3	> 2.5 mm	Prevents entry of tools, thick wires, etc.
4	> 1 mm	Prevents entry of most wires, screws, large ants, etc.
5	Dust Protected	Dust ingress not entirely prevented but does not enter in sufficient quantity to interfere with satisfactory operation of equipment
6	Dust Tight	No ingress of dust

Appendix Table A-2 Levels of Liquid Ingress Protection per Second Digit of IP Code

Digit	Water Exposure Protection	General Description
0	No Protection	No protection
1	Vertically dripping water	Vertically dripping water has no harmful effects
2	Dripping water, enclosure tilted up to 15 degrees	Vertically dripping water has no harmful effects when enclosure is tilted at an angle up to 15 degrees of normal vertical position
3	Spraying water	Water sprayed at angles up to sixty degrees from the vertical position has no harmful effects
4	Splashing water	Water splashed against the enclosure from any direction has no harmful effect
5	Water jets	Water projected by a nozzle (6.3 mm) against enclosure from any direction has no harmful effects
6	Powerful water jets	Water projected in powerful jets against the enclosure from any direction has no harmful effects
7	Temporary immersion in water	Ingress of water in harmful quantity is not possible when the enclosure is temporarily immersed in water under standard conditions or pressure and time
8	Continuous immersion in water	The equipment is suitable for continuous immersion in water under conditions more severe than for numeral 7

6.0 REFERENCES

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