



**Homeland
Security**

Science and Technology

Summary

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T), the SAVER Program conducts objective operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

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Non-sparking Tool Kits

(AEL reference number 030E-04-KTTL)

In order to provide emergency responders with information on currently available non-sparking tool (NST) kit capabilities, limitations, and usability, the Center for Domestic Preparedness conducted a comparative assessment of NST kits for the SAVER Program in January 2009. Detailed findings are provided in the complete Assessment Report on Non-sparking Tool Kits, which is available by request at <https://www.rkb.us/saver>.

Background

Non-sparking hand tools were developed and introduced in the early 1900s. These tools were created to help reduce sparks that might ignite combustible products. They are intended for use in areas where a high risk of fire or explosion exists, such as the presence of flammable or combustible gases or vapors, liquids, dusts, or residues in hazardous environments. As a precaution, many companies use non-sparking hand tools to reduce the risk of fire or explosion, even when no mandatory requirements exist. Additionally, these tools have a non-magnetic property that makes them ideal for use on equipment with strong magnetic fields. It is imperative for anyone who works in potential volatile environments to be equipped with the proper tools in order to provide safety to the public and themselves and to protect the response area.

Assessment

A focus group of eight emergency response practitioners with firefighting and hazardous materials (HAZMAT) backgrounds met in October 2008. The purpose of the focus group was to identify equipment selection criteria, evaluation criteria, and assessment scenarios. Based on focus group recommendations and market survey research, three preconfigured NSTs were ordered from different vendors along with additional tools needed to keep the tool kits as comparable as possible. A fourth kit was assembled from individual tools purchased from a single vendor. The following NST kits were included in the assessment:

- Newmatic Sound Systems MCTB17 17-piece tool box
- AMPCO Safety Tools M-51 17-piece HAZMAT kit
- NGK Berylco Safety Tools HAZMAT 16-piece bucket
- CS Unitec 18-piece assorted tools.

Eight emergency response practitioners served as assessment evaluators during simulated HAZMAT operations. The evaluators were divided into four groups of two to assess the NST kits. Each donned a Lion™ Class 2 ensemble and carried the tool kits to four outdoor assessment areas. Each team started at a different assessment area and rotated through the activities until each team had performed the activities in all four designated areas.

Area 1 required evaluators to use bung wrenches to open and drain a 55-gallon drum. The evaluators also used an assortment of other tools in the kit to plug small holes in the drum to mitigate any additional leakage.

Area 2 contained a drain pipe that was cracked and leaking contaminated waste (simulated). The evaluators placed pipe patches on two fractured pipes emitting potentially hazardous effluent. Evaluators also used the available tools and clamp kit to temporarily repair the leaks.

Area 3 required evaluators to remove and replace a stuck valve assembly that was leaking methane gas (simulated). Area 4 contained a leaking pipe union, which evaluators had to remove and cap.

Assessment Results

Evaluators rated the tool kits based on the evaluation criteria established by the NST kits focus group. Each original criterion was assigned to one of the five SAVER categories, and each SAVER category was assigned a weighting factor to indicate its impact on the total composite score. The SAVER category and composite scores are shown in table 1. Higher scores indicate better performance. To view how each NST scored against the individual evaluation criteria assigned to the SAVER Program categories, see table 2 (on page 7).

The following paragraphs provide a brief summary of the evaluator comments and feedback on each tool kit and present the NSTs from the highest to lowest composite score. For the purposes of this SAVER Summary, the category scores are normalized and rounded to the nearest whole number. The complete assessment report includes a breakdown of evaluator comments by individual criterion.

Newmatic

Evaluators agreed that most of the tools in the kit were strong enough to complete the assessment tasks without damage. The pipe and adjustable or

SAVER Program Category Definitions

Affordability: This category groups criteria related to life-cycle costs of a piece of equipment or system.

Capability: This category groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more responder-relevant tasks.

Deployability: This category groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use.

Maintainability: This category groups criteria related to the maintenance and restoration of a piece of equipment or system to operational conditions by responders.

Usability: This category groups criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

“crescent” wrenches were especially sturdy and held the desired adjustment settings well during the assessment activities. Evaluators especially liked the ergonomic rubber grips on the pliers and screwdrivers, which made them very easy to use while wearing gloves. They noted that the Newmatic tools were the lightest of the assessed tools, and they were well-balanced and easy to manipulate with one hand. The tool handles were long enough to provide adequate leverage and to allow the use of two hands when needed. Evaluators considered the double-end box wrenches especially useful. The Newmatic tool box was light, compact, and easy to carry. Evaluators said that the removable tray helped organize the tools

Table 1. NST Kits Assessment Results¹

NST Kit	Composite Score	Affordability (10% Weighting)	Capability (20% Weighting)	Deployability (20% Weighting)	Maintainability (10% Weighting)	Usability (40% Weighting)
Newmatic	77	72	68	83	73	81
AMPCO	75	74	67	82	73	77
NGK Berylco	73	68	66	78	68	77
CS Unitec	72	72	78	64	64	76

Note:

¹ Scores contained in the assessment report may be displayed differently. For the purposes of the SAVER Summary, all SAVER category scores are normalized using a 100-point scale and rounded to the nearest whole number.

	 Pros <ul style="list-style-type: none"> • Enclosed pipe wrench adjustment ring • Double-end box wrenches • Tool box • Easy to access tools • Easy to account for tools • Good handle grips on pliers and screwdrivers • Brush handle shape • Strong brush bristles
	 Cons <ul style="list-style-type: none"> • Only one pipe wrench • Channel lock handle design • Weak channel lock adjustment • No wire cutters • Flathead screwdriver durability • Philips screwdriver large tip • Small crescent wrench only • Flimsy pry bar/scrapper • No warranty information • No decontamination information
Newmatic	Composite Assessment Score: 77

and make smaller tools easier to reach without risking damage to gloves. They commented that the Newmatic tool box was the most compact storage/carrying case assessed, and they agreed that the tool box would be easier to securely store on a response vehicle than the bucket-style cases. A set of tin shears and a bung wrench from the same vendor were added to this kit.

Evaluators reported that the screwdriver tips, deck scraper, and pry bar were easily damaged during use. They also noted that the groove joint pliers or “channel locks” handles were awkwardly shaped, difficult to use, and repeatedly slipped during use. The nut on the channel locks gradually loosened, requiring the evaluators to periodically tighten the nut to limit damage to the grooves. Evaluators agreed that the kit needed at least one extra screwdriver of each type and a pair of wire cutters. They commented that the toolbox could easily accommodate these and a few more small tools.

AMPCO

Evaluators considered all of the AMPCO tools to be strong enough for emergency response applications, with the exception of the small crescent wrench and putty knife. They were especially pleased with the large adjustment ring on the pipe wrench and the smooth operation of the channel lock adjustment. The pipe and crescent wrench adjustments were strong, held the desired settings well, and did not slip during use. Evaluators reported that the screwdriver tips were

	 Pros <ul style="list-style-type: none"> • Rugged yet lightweight pipe wrench • Pipe wrench adjustment • Strong channel locks • Warranty • Strong screwdriver tips • Rubber handle grip on hammer • Good information provided on Web site • Brush handle shape • Strong brush bristles • Bung wrench fits vent plus for 55-gallon drums
	 Cons <ul style="list-style-type: none"> • Only one pipe wrench • Bucket-style case • Locking lid • Strength of small crescent wrench's moveable jaw • Rubber handle grips on pliers slips off easily • Tool bucket divider • No wire cutters • Handle grip made flat scrapper difficult to pick up
AMPCO	Composite Assessment Score: 75

strong and did not bend or deform during use. They stated that all of the tools were easy to manipulate with gloved hands, except for the tin snips. The tool handles were long enough to provide good leverage and to allow the use of two hands for additional force. Evaluators were especially pleased with the rubber grip on the hammer. They also noted that the shape of the screwdriver handles provided a good solid grip and prevented the handle from slipping in gloved hands. The tools were light enough to be easily controlled with one hand, even when used overhead. Evaluators easily carried the kit with one hand using the bucket handle, and they noted that this bucket also had additional handles on each side that can be used to lift or carry a bucket with both hands. The AMPCO bucket's large yellow label was easy to see and identify. Evaluators pointed out that the AMPCO bung wrench was the only bung wrench that would fit the vent plug on the 55-gallon drums. No tools were added to supplement the AMPCO kit.

While none of the tool handles or shafts flexed during use, the moveable jaw on the small crescent wrench broke and the putty knife handle loosened with each use. Evaluators noted that the smooth rubber grips worked well when dry, but became a little slippery when wet. The rubber grips slipped off of the handles during use and came off even more easily after repeated use. They noted that longer tools had to be

carefully placed in the bucket in order to get the lid to close, and the locking lid on the storage/carry bucket was difficult to open while wearing gloves. The bucket divider insert provided little help organizing the tools and made it even more difficult to reach the desired tools. All of the teams chose to remove the divider prior to using the kit in the assessment rotations. Evaluators suggested that additional screwdriver sizes and a set of box end wrenches similar to those in the Newmatic kit could be easily added to the kit.

NGK Berylco

Evaluators agreed that most of the NGK Berylco tools were strong enough to complete the assessment tasks without damage with the exception of the crate opener, the brush, and the tin snips. They noted that the tool handles and shafts did not flex or loosen during use. The pipe and crescent wrenches were strong and maintained their selected settings during the assessment activities. Evaluators saw little to no damage on the teeth or jaws. The tools were easy to manipulate with gloved hands, and the tool handles were large enough that both hands could be used when needed. A female evaluator commented that she often needs to use two hands when using NST kits, and she experienced no difficulty using both hands with these tools. Evaluators noted that the length and shape of most of the tools and tool handles provided good leverage during use. While some evaluators considered these tools heavier than other non-sparking tools, they agreed that these tools were still light and

easy to manipulate. An NGK Berylco bung wrench was added to the preconfigured 16-piece kit.

Evaluators reported the crate opener was damaged after several hits with a hammer, and the brush bristles began to fall out during use. They also noted that the bolt holding the tin snips together snapped when the snips were used to widen an opening on a 55-gallon drum. The channel locks repeatedly slipped settings, and the rubber handle grips repeatedly slipped off during use. Evaluators commented that the kit seemed heavier than the other assessed kits, yet it was light enough to be easily carried by one evaluator. The storage/carry bucket provided by the manufacturer was difficult to open and close while wearing gloves and evaluators agreed that it was difficult to quickly access the desired tool with all of the tools in the bucket. Evaluators commented that the kit would benefit from additional sizes of screwdrivers and a set of open-end or ratchet wrenches as additional components. Evaluators agreed that the bucket would easily accommodate the extra tools, but noted that the extra tools would make it more difficult to find a specific tool in the bucket.

CS Unitec

Individual components comparable to those in the other kits were ordered to comprise this kit. A 5-gallon bucket similar to those provided with the AMPCO and NGK Berylco kits was provided for use during assessment activities.

Evaluators reported that most of the CS Unitec tools were strong enough to complete the assessment tasks without damage. The pipe and crescent wrenches maintained their selected settings, and the wrench adjustment components (e.g., teeth, nut, and jaws) were not easily worn, damaged, or broken. Evaluators commented that the pipe wrench adjustment was very easy to adjust while wearing gloves. They also noted that the movement of the jaws was very controlled, which aided in adjusting the wrench size correctly the first time. The pipe wrench, crescent wrenches, and channel locks were easy for evaluators to adjust while wearing gloves. The tools were easily manipulated with gloved hands, especially the tools with molded rubber grips. The tool handles were large enough for responders to use both hands, if necessary, and the length and shape of the tool handles provided good leverage during use. Evaluators were especially pleased with the non-slip texture of the rubber handle grips on many of the tools. They agreed that most tools were light enough to be easily manipulated even

	 Pros	<ul style="list-style-type: none"> • Rugged pipe wrench • Pipe wrench adjustment • Strength of wrench adjustment components • Length of pry bar • Strong wire cutters and needle nose pliers • Size of screwdriver tips
	 Cons	<ul style="list-style-type: none"> • Only one pipe wrench • Bucket-style case • Locking lid • Slippery handle grips • Rubber handle grips on the pliers slipped off easily • Brush bristles not secure • Channel lock up • Flat handle made flat scraper difficult to pick up
NGK Berylco		Composite Assessment Score: 73

	 Pros	<ul style="list-style-type: none"> • Rubber handle grips on pliers • Rubber handle grip on hammer • Heavy duty pliers/cutters • Pliers also worked well as cutters • Good pipe wrench • Tools ordered separately and can be customized • Good information provided in catalog and on Web site • Warranty
	 Cons	<ul style="list-style-type: none"> • Only one pipe wrench • Inadequate shears • Heavy bung wrench • Flathead screwdriver easily damaged • Screwdriver selection • Sharp edges on scraper • Handle grip on scraper • Small size of smaller wrench
CS Unitec	Composite Assessment Score: 72	

when working overhead and balanced enough to use with one hand.

Evaluators reported that the crate opener broke and the flathead screwdriver became deformed during use. The channel lock grooves also began to show slight wear after repeated use. Evaluators noted that the kit included a good selection of tools, but lacked enough screwdriver sizes. They also noted that a small set of box-end wrenches would be a useful addition. Evaluators commented that they would not choose a bucket-style case for the CS Unitec tools since the case was not provided with the tools.

Conclusion

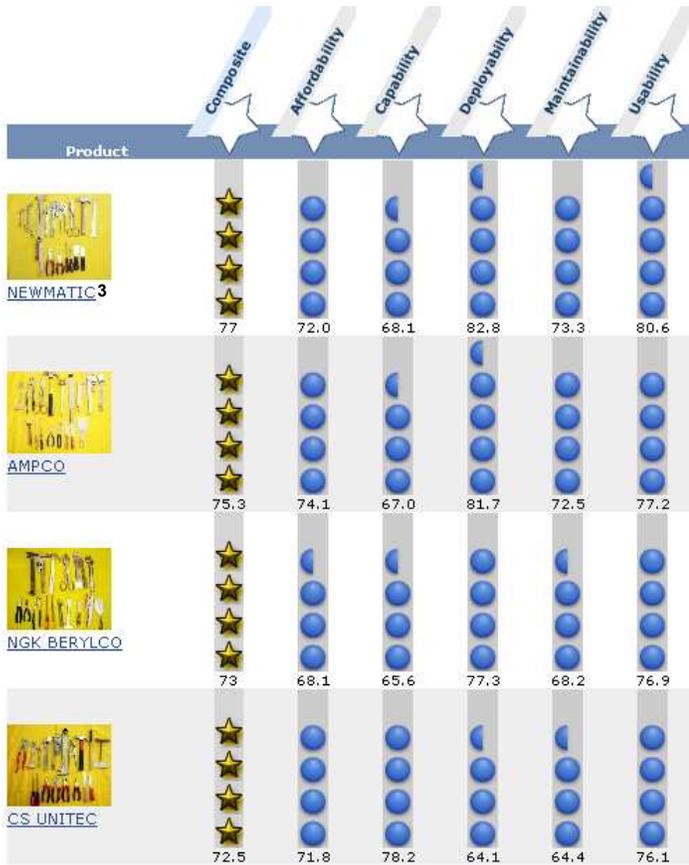
The assessment helped achieve the overall goal of evaluating the effectiveness of NST kits used by emergency responders in HAZMAT incidents. Evaluators agreed that all of the assessed kits would meet the basic NST needs of most departments. However, evaluators indicated that all of the assessed kits lacked tools they considered to be essential.

Analysis of the evaluators' comments indicates that jurisdictions should carefully identify the specific tools needed by their responders before selecting a preconfigured kit or assembling one of their own. Evaluators identified a number of preferences that should be taken into account when purchasing a preconfigured kit or assembling a customized kit:

- Two pipe wrenches are essential kit components. Evaluators repeatedly

- commented that most tasks requiring the use of a pipe wrench require two pipe wrenches.
- Two different sizes of Phillips and flat-tip screwdrivers are essential kit components. Each assessed kit only had one size of each type screwdriver, and evaluators repeatedly found them to be either too large or too small for the small variety of screw heads they encountered during the assessment.
- Permanently-affixed molded rubber handles are preferable over "slip-on" rubber grips. Evaluators consistently praised the secure and strong grip provided by the Newmatic and CS Unitec molded handles. They consistently encountered problems keeping the AMPCO and NGK Berylco grips on the pliers.
- The addition of a set of double-end wrenches is worth the storage space. Evaluators considered the small set of wrenches included in the Newmatic kit to be one of its strongest advantages. They noted that the wrenches work much better in tight places than the small crescent wrenches and do not round off the corners of nuts and bolts as easily.
- Buckets may not provide the best storage/carry cases. Evaluators expressed a strong preference for the Newmatic tool box over the bucket-style cases. They commented that the buckets were nice for carrying a few selected tools down range, but they found it too difficult to find a desired tool when all of the tools were in a bucket.

QuickLook Snapshot²



Notes:

² The SAVER QuickLook, available on the SAVER Web site, allows users to select the SAVER categories that are most important to their department and view results according to their specific needs.

³ Scores contained in the assessment report may be displayed differently. For purposes of the QuickLook, all SAVER category scores are normalized using a 100-point scale.

All reports in this series as well as reports on other technologies are available by request at

<https://www.rkb.us/saver>.

Table 2. SAVER Category and Criteria Scores

KEY					
Least Favorable		Most Favorable			
					
		Newmatic	AMPCO	NGK Berylco	CS Unitec
Assessment Criteria					
Affordability					
Useful kit configuration					
Replaceable tools cost					
Warranty					
Capability					
Tool strength					
Wrench adjustment strength					
Non-sparking limitations					
Independent certification/testing					
Chemical resistance					
Non-conductivity					
Deployability					
Easy to carry					
Easy vehicle storage					
Clearly identifiable case					
Maintainability					
Required maintenance					
Storage requirements					
Easy to clean					
Ease of decon					
Reusability					
Usability					
Ergonomic design					
Weight					
Tool accessibility					
Dexterity					
Flexibility of use					
Non-slip feature					
Tool visibility					