U.S. Army Aberdeen Test Center

*ATEC PROJECT NO. 2013-XX-ATC-BEB-XXXXX*

# *Draft Detailed Test Plan*

# *Preproduction Qualification Test (PPQT)*

# *Bridge Erection Boat (BEB)*

## *June 2012*


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**Prepared for:**
**U.S. Army TACOM Life Cycle Management Command**
**Warren, MI 48397-5000**

**U.S. Army Developmental Test Command**
**Aberdeen Proving Ground, MD 21005-5055**

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## SECTION 1. INTRODUCTION

### 1.1 SYSTEM DESCRIPTION

Figure 1-1. Bridge Erection Boat (BEB).

The BEB will be water jet (or pump jet) propelled aluminum workboat specifically designed to operate in shallow water environments and environmental conditions detailed in the Purchase Description (PD) (app E, ref 2). The BEB operates with twin marine engines having a heavy duty rating of xxx brake horsepower (bhp) at xxxx revolutions per minute (rpm). The engines will meet all requirements using Jet propellant (JP)-8 as the primary fuel. The primary function of the BEB is to provide propulsion and maneuvering thrust to the ribbon bridge bays to support tactical float bridge and rafting operations of the Multi-Role Bridge Company (MRBC) worldwide. The BEB will be designed for excellent stability and safety during operational maneuvers and provide for safe personnel movement between ribbon bridge bays and the BEB. The BEB shall be capable of operating in high particulate matter environments, such as sand in the air, and silt in fresh, brackish, and sea water. All functions will be performed by no more than a two-person crew. A secondary mission requires the BEB support diving missions, transporting troops, and towing another BEB.

## 1.2 SUMMARY

On xx xxxx, xxxx the U.S. Army Developmental Test Command (DTC) authorized the U.S. Army Aberdeen Test Center (ATC), Aberdeen Proving Ground (APG), Maryland, to plan, conduct, and report the Preproduction Qualification Test (PPQT) of the Bridge Erection Boat (BEB) in support of the U.S. Army TACOM Life Cycle Management Command (TACOM LCMC). This was done through the establishment of a U.S. Army Test and Evaluation Command (ATEC) project (ref 1).

Testing will be performed at ATC from xxx through xxx xxxx. ATC will provide the facilities, instrumentation, and personnel required to perform testing. The overall test control will be the responsibility of the ATC test officer. Engineers and technicians will perform all field and laboratory testing.

TACOM LCMC will provide test support equipment. Items and quantity, TBD.

Vendor will provide boats for testing as determined by TACOM LCMC. Vendor field service representatives (FSRs) will be responsible for new equipment training (NET) and all unscheduled and scheduled maintenance and repairs for the boats.

A summary of the test objectives is presented in Table 1-1. Additional objectives may be added upon completion of final draft test plan.

TABLE 1-1. TEST OBJECTIVES

| SUBTEST | OBJECTIVE |
|---|---|
| Initial Inspection (para 2.1) | To determine if the BEB and subsystems are in good condition and ready for testing. |
| System Configuration (para 2.2) | To document the configuration of the BEB and its components. |
| Physical Characteristics and Rollover Threshold (para 2.3) | To measure the physical dimensions and determine the weight and center of gravity (CG) measurements of the BEB and BEB in transport mode, and determine the rollover threshold of the BEB and BEB in transport mode. |
| Compatibility (para 2.4) | To determine if the BEB is compatible with the heavy expanded mobility tactical truck (HEMTT) load-handling system (LHS) and the prime mover. |
| Human Factors Engineering (HFE) and Safety (para 2.5) | To determine if human engineering design of the BEB is satisfactory. |
| | To determine if there are any safety or health hazards associated with the operation and maintenance of the BEB, and, if so, are they controlled to an acceptable level. |
| Performance (para 2.6) | To determine the performance characteristics of the BEB. |

TABLE 1-1 (Cont)

| SUBTEST | OBJECTIVE |
|---|---|
| High Temperature (para 2.7) | To obtain the necessary data to help evaluate the effects of high- and low-temperature conditions on the material safety, integrity, and performance of the BEB. |
| Low Temperature (para 2.8) | |
| Reliability and Maintainability (para 2.9) | To determine the reliability of the BEB. |
| Transportability (para 2.10) | To determine if the lift and tie-down provisions on the BEB meet the requirements in MIL-STD-209K and MIL-STD-913A (ref 3 and 4). |
| | To determine if the BEB can be safely transported by highway and marine. CH-47D and CH-53E helicopters, and C-130 aircraft. |
| | To determine if the BEB can withstand the effects of rail impact without damage or performance degradation. |
| Electromagnetic Environmental Effects (E3) (para 2.11) | The BEB shall be electromagnetically compatible among all subsystems, equipment within the system and with Electromagnetic Environmental Effects (E3) external to the BEB. Compliance to MIL-STD-464 and MIL-STD-1310 to the extent delineated in the PD. |
| Chemical, Biological and Radiological Contamination Survivability (CBRCS) (para 2.12) | To determine if the BEB can be decontaminated to a level that prevents residual exposure to personnel and if the BEB can withstand the processes associated with decontamination. |
| Whole Body Vibration (para 2.13) | To assess the ride quality of the BEB. |
| Corrosion (para 2.14) | To determine if the BEB is constructed with components and materials resistant to corrosion. |
| Final Inspection (para 2.15) | To inspect the BEB and subsystems for any damages that may have occurred during testing. |

Unless otherwise specified in Appendix A, the criteria were taken from the PD.





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## SECTION 2. SUBTESTS

### 2.1 INITIAL INSPECTION

#### 2.1.1 Objectives

The objectives of this test are:

a. To determine if the BEBs are in fully operational and safe condition and to identify and correct any defects or shipping damages prior to testing.

b. To record all major component serial and model numbers and other pertinent data.

c. To assign test item identification numbers (TIINs).

#### 2.1.2 Criteria Compliance and Analysis

TABLE 2.1-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 1 - Serviceable Condition | If the BEB is complete, undamaged, and ready for testing, the criterion will be met. |
| 2 - Out of Water Operation | If the engines, without any configuration changes, operate with the BEB clear of the water, at idle speed, in neutral gear, and without external water hookup for at least 10 min without overheating, the criterion will be met. |
| 3 - Hull | If no stiffeners terminate on the shell plate, doubler plates are used for structural applications, and all installed equipment is adequately secured in accordance with International Organization for Standardization (ISO) 12215-6 (ref 5), the criterion will be met. Doubler plates for wear applications must be approved by the Government. |
| 4 - Ground Supported | If the BEB remains stable and level when placed on the ground, the criterion will be met. |
| 5 - Hull Drainage | If a provision to drain/remove water entrapped in the hull when the BEB is in the level transport mode or when it is stored on level ground, and if the plugs, if used, are attached with a permanent tether/lanyard, the criterion will be met. |
| 6 - Anodes | If sacrificial anodes are provided and they are replaceable using common tools, the criterion will be met. |
| 7 - Rub Rail(s) | If a replaceable rub rail is mounted around the entire hull on the outermost projection, the rub rail is made of synthetic or rubber material, commercially available marine grade, replaceable using tools available in a general mechanic's tool kit, and the rub rail does not tear or detach when impacting a pier or floating bays from any angle at 3 kt, the criterion will be met. |

TABLE 2.1-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 8 - Dive Platform | If a dive platform capable of supporting two Soldiers is provided, the platform extends farther aft than any other appendages of the BEB when deployed, a means is provided for personnel boarding, the dive platform is stowable if required to reduce rear overhang during transport, and the platform can be stowed using common hand tools (threshold) or without tools (objective), the criterion will be met. |
| 9 - Push Knees | If the bow is fitted with push knees, the push knee interface surface is covered with marine-grade synthetic or rubber material, and the surface is replaceable using common hand tools, the criterion will be met. |
| 10 - Tie-Offs | If the BEB has at least three tie-offs on each side (forward, approximately amidship, and aft), the tie-off locations facilitate line attachment to support conventional and longitudinal rafting, and the tie-offs are sized to accept a minimum 1-in. diameter line, the criterion will be met. |
| 11 - Capstan | If the BEB is equipped with a multispeed, self-tailing capstan that can handle one line (threshold) or two lines (objective), and the capstan is located astern to provide for snugging and pulling in lines, has a drum diameter of at least 6 in., and has a rated capacity at least equal to the BEB forward bollard pull, the capstan has a removable locking handle, and the capstan foundation's ultimate strength is at least three times the BEB's forward bollard pull, the criterion will be met. |
| 12 - Anchor Fairlead | If fairleads (e.g., open chock) or other means are provided for guiding the anchor line off the bow and stern on centerline, the criterion will be met. |
| 13 - Personnel Safety Aids | If the BEB is equipped with grab rails, handholds, footholds, or other means to allow safe personnel movement, including moving between the BEB and bays, during all operations, the criterion will be met. |
| 14 - Crew Station | If the sides of the crew station structure are designed to accept flat appliqué panels, the criterion will be met. |
| 15 - Operator's Seat/Backrest | If the operator's station has one vertically adjustable and stowable padded seat/backrest, the criterion will be met. |
| 16 - Heater | If the crew station contains a marine heater with a blower capable of 10,000 Btu/hr, the criterion will be met. |
| 17 - Mast(s) | If a mast is provided to facilitate navigation and communication, the mast can be stowed, the stowed mast does not interfere with BEB operations and maintenance, and the mast can be stowed using no more than common hand tools (threshold) or without tools (objective), the criterion will be met. |
| 18 - Crew Station Bimini Top | If a removable, lightweight, collapsible marine-grade crew station bimini top is provided to protect the two-person crew from overhead sun and rain, the top can be installed and removed without tools, and the BEB has storage space for the top (objective), the criterion will be met. |
| 19 - Crew Station Enclosure | If the BEB has a removable, lightweight, collapsible marine-grade crew station enclosure (from the bimini top down to the operator's station or deck), the enclosure can be installed and removed without tools, and the BEB has storage space for the enclosure (objective), the criterion will be met. The enclosure may be combined with or attached to the bimini top. The type of material used for the enclosure will be verified by contractor certification. |
| 20 - Boat Cover | If a marine-grade boat cover, with hull attachments as needed, is provided to protect recessed areas from snow and rain water collection, and the BEB has storage space for the cover (objective), the criterion will be met. The type of material used for the boat covers will be verified by contractor certification. |

TABLE 2.1-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 21 - Rifle Stowage | If stowage for at least two weapons (both either M16A2 rifles with and without M203 grenade launcher or M4A2 rifles with and without optics) is provided near the crew station, and the mounts are designed to hold the weapons with the barrels pointed up and away from the operator's station and secure against loss, including if the boat capsizes, the criterion will be met. |
| 22 - Storage Compartments | If the storage compartments are protected from weather elements, are permanently mounted, and have covers that can be latched and locked using a padlock with a 3/8-in. shank; the covers incorporate a weathertight seal and have a positive-locking, hold-open device (threshold); and 2 $ft^3$ weathertight space is provided for extra personal gear to be brought onboard by Soldiers (objective), the criterion will be met. |
| 23 - Fuel | If the engines meet all performance requirements while operating on JP-8 fuels (MIL-DTL-83133G) (ref 6), the criterion will be met. Fuel lubricity filters are permitted; all other fuel lubricity additive devices and fuel lubricity additives that have to be manually administered are not acceptable (threshold); operate without lubricity additives (objective). |
| 24 - Emissions Technologies | The vendor will verify the Environmental Protection Agency (EPA) tier level of the engine. |
| 25 - Ignition | If a keyless ignition for the engines is provided at the operator's station, the criterion will be met. |
| 26 - Shut Down | If primary and emergency shutdown methods are provided for the engines, and the emergency method is a manually operated control, the criterion will be met. |
| 27 - Automatic Engine Shut Down Override | If the engines incorporate an automatic shutdown feature, an alarm and engine shutdown override control is provided at the operator's station, and the operator is provided with a means to override the shutdown, the criterion will be met. |
| 28- Hour Meter | If an accessible, readable hour meter is attached to each engine, the criterion will be met. |
| 29 - Exhaust System | If each engine has an independent exhaust system, and the water drains from the exhaust system to the outside of the BEB after shutdown to prevent damage from freezing, the criterion will be met. |
| 30 - Engine Cooling | If each engine has an independent cooling system, and if the engine is a liquid- cooled, closed-loop coolant system, the criterion will be met. |
| 31 - Raw Water Cooling | If the raw-water cooling system, if used, has the capability of being flushed, duplex strainers or self-cleaning strainers are used for raw water fed to heat exchangers, the non-self-cleaning strainers are readily accessible without having to lift a main engine hatch, and the water drains from the exhaust system to the outside of the BEB after shutdown to prevent damage from freezing, the criterion will be met. |
| 32 - Water Jets | If two water jets with linked steering and independent reversing controls are provided, the portions of the water jets requiring inspection as part of preventive maintenance checks and services (PMCS) are readily accessible, and the water jets are protected from damage, the criterion will be met. Pump jets are permitted. |
| 33 - Fire Protection | If a fixed fire extinguishing system is provided in each main engine space, and the system meets the requirements in 46 Code of Federal Regulations (CFR) 25 (ref 7), as verified by vendor certification, the criterion will be met. |

TABLE 2.1-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 34 - Actuation | If the fire extinguishing system is designed to automatically discharge, the criterion will be met. Actual testing will not be performed. |
| 35 - Alarm | If an audible alarm with a mute function is provided for when the fire system senses a fire, as verified by vendor certification, the criterion will be met. |
| 36 - Extinguishing Agent | If the extinguishing agent is carbon dioxide ($CO_2$) (CAS 124-38-9), pentafluoroethane (HFC-125) (CAS 354-33-6), heptafluoropropane (HFC-227ea) (FM-200) (CAS 43-18-90), sodium bicarbonate (baking soda) (CAS 144-55-8)), or an agent approved by the Procuring Contracting Officer (PCO), the criterion will be met. If the engine's combustion air is obtained from the engine space, the extinguishing agent must be $CO_2$. |
| 37 - Engine Space Confinement | If the engine's combustion air is obtained from the engine space, the criterion will be met if any forced ventilation or natural ventilation vents are dampened to prevent additional air from feeding a fire. |
| 38 - Fuel System | If each engine has an independent fuel system, except for a common fuel tank, the system allows each engine to be isolated, shutoff valves are positioned to preclude excess spillage when removing components or performing service operations, a fuel-water separator is provided and accessible and maintainable without removing any other equipment, and the empty fuel system can be primed from the fuel tank without using the starter, the criterion will be met. |
| 39 - Fuel Tank | If the fuel system accommodates safe, efficient fueling operations using a minimum 2-in. diameter refueling nozzle with a flow rate of at least 20 gal./min, an operator on the deck can perform all refueling operations while wearing gloves, the fuel overflow can be contained in an area or device designed to contain at least 8 fl oz, and a means is provided to sound the tank, the criterion will be met. |
| 40 - Electrical Systems | If the BEB employs a 24-volts direct current (VDC) electrical system with isolated negative grounds and neutrals (not a floating ground) to control corrosion and prevent electrolysis; all grounds and neutrals, using insulated conductors, come to common busses separate from the engine; open areas in the console and unused wire terminations are capped to provide protection from weather conditions; engine alternators, starters, sensors, and electronic control modules do not use the case of the component or the engine block as a negative return path to the batteries, the criterion will be met. Use of drive components as part of the 24-VDC return is unacceptable. |
| 41 - Alternator | If the BEB is fitted with an alternator, and the vendor supplies an alternator load analysis to satisfy the electrical load requirement, the criterion will be met. |
| 42 - Batteries | If all batteries are identical and in accordance with the specified requirements, the batteries are listed in the federal supply system and have a national stock number (NSN), at least two banks of batteries, one for each engine, are provided, a means to temporarily parallel the engine-starting battery banks for emergency engine starting are provided, the batteries are easily accessible by a crew member on the deck, the batteries are accessible without using tools, and all batteries are in battery boxes, the criterion will be met. |
| 43 - Battery Cables | If the battery cables have reusable insulated terminal covers on the positive lead, positive cable terminals are identified with a red sleeve labeled +, and negative cable terminals are identified with a black sleeve labeled -, the criterion will be met. Wing nut-type fasteners to connect battery cables to the battery terminals are not acceptable. |

TABLE 2.1-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 44 - Battery Disconnect Master Switch | If a master switch is provided near the battery compartment (threshold) (near the operator's console (objective)), and the master switch disconnects all power from each battery bank except for the single channel ground/airborne radio system (SINCGARS) radio and bilge pumps, the criterion will be met. |
| 45 - Connection Boxes | If the connection boxes and other electrical enclosures, including cable entry sealing devices into each connection box, are watertight, the criterion will be met. |
| 46 - North Atlantic Treaty Organization (NATO) Slave Receptacle | If a type-I receptacle, in accordance with NATO Standardization Agreement (STANAG) 4074 (ref 8), is provided to allow starting of each engine and charging of the batteries from an external power source; the receptacle provides a back feed power source from the BEB electrical system for charging and slaving other 24-VDC equipment; the receptacle is near the battery enclosure, accessible to personnel standing on the deck, and accessible without using tools; the receptacle is isolated from the hull to prevent it from inadvertently using the hull as a negative return path to batteries; the receptacle is labeled SLAVE 24 VOLTS DC with 1-in. black lettering; and the receptacle has a disconnect switch to isolate the receptacle when not in use, the criterion will be met. |
| 47 - 24- to 12-VDC Converter | If a 12-VDC supply is required to power onboard equipment, the criterion will be met if the 12-VDC supply is via a 24- to 12-VDC converter as opposed to drawing power from a single battery, and the converter uses an isolated ground to prevent a negative polarity return path through the hull. |
| 48 - Circuit Breaker Panel | If the vendor supplies certifications to verify that the electrical devices and cables in each circuit are protected by appropriately sized circuit breakers; circuit breakers are marine grade; separate panels are used if both 24- and 12-VDC components are used; each panel has at least three spare 15-A breakers (threshold) (three 20-A spare breakers (objective)); spare circuits are allocated as part of the total BEB electrical load and are labeled with individual label-plates as Spare, the criterion will be met. Fuses are not to be used unless integral with the component. |
| 49 - Searchlight | If a marine grade service 24-VDC searchlight (Hella Marine 8502 (national stock number (NSN) 6220-12-304-6240) or equivalent) is supplied, the searchlight has the capability of elevation and depression adjustment with a $360^{o}$ rotation, is in a location where it can be turned forward or aft for navigational purposes, is equipped with a one-hand control operable from either the operator's position or the deckhand's position within the cab (threshold) (from both the operator's and deckhand's positions within the cab using multiple mounting locations (objective)), can be removed from the mounting and hand-held to shine over the side of the BEB; and a dedicated 24-VDC searchlight electrical receptacle capable of accepting the mating plug on the searchlight power cord is installed on the operator's console, the criterion will be met. |
| 50 - Inspection Light | If a removable hand-held inspection 24-VDC light is provided for inspecting the battery, engine, transmission, and propulsion unit compartments, and dedicated 24-VDC electrical receptacle(s) and/or the cord length is provided such that the light can be moved to illuminate the compartments as well as the BEB waterline, the criterion will be met. |
| 51 - Lighting | If a variable-lighted operator's control console, instrument panel(s), and magnetic compass are provided, the lighting is controlled by an electronic dimmer switch on the operator's console, and the range of the lighting is variable from full-off to full-on intensity, the criterion will be met. |

TABLE 2.1-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 52 - Instrument Panel(s) | If the instrument panel is in and viewable from the operator's station, the criterion will be met. |
| 53 - Fuel Level Gauge | If the fuel tank has a graduated tank-level indicator on the operator's console, the criterion will be met. |
| 54 - Gauges | If the specified analog-display style gauges are provided for each engine, the gauges indicate normal operating range and high and low limits, as applicable, and the gauges include red/yellow/green color-markings for operating limits (objective), the criterion will be met. |
| 55 - Malfunction Indicators | If an audible alarm with a mute function and a visual indicator is provided to indicate the specified adverse conditions, the criterion will be met. |
| 56 - Horn | If the BEB has a horn conforming to 33 CFR 86.05, which will be verified by vendor certification, the criterion will be met. |
| 57 - Navigation Lights | If vendor certification verifies that the BEB has a marine-grade, long-life light emitting diode (LED) navigation light system with the mast erected, as required by Collision Regulations (COLREGS) 72 (ref 9) for International and Inland Navigation rules for power-driven vessels when pushing, the criterion will be met. The navigation light requirements will be verified through contractor certification. |
| 58 - Communications-Electronics Complement | If the specified items (table 2.1.1, items 59 through 63) are located in and viewable from within the operator's station, the criterion will be met. The sensors and displays may be combined. |
| 59 - SINCGARS Radio Capability | If the BEB has the capability to accommodate one AN/VRC-90 SINCGARS radio system; has a 24-VDC NATO power source, one two-shelf rack using a mounting base (MT-6352/MT-6353), a vehicle adapter assembly (VAA) (AM-7239), a 50-watt power amplifier (PA) (AM-7238), a SINCGARS antenna base, a two-piece fiberglass antenna (AS-3900) with attaching wrench, and a speaker (LS-671); all mounting, wire harnesses, antenna and transducers necessary for the equipment to be fully operational are installed and ready to accept the hardware control boxes; and the SINCGARS operation is not affected when the battery disconnect switch is turned off, the criterion will be met. |
| 60 - Global Positioning System (GPS) | If the BEB is equipped with a marine-grade GPS, and the GPS is wired to the BEB batteries and capable of displaying the position of the BEB in real time, the criterion will be met. |
| 61 - Infrared Strobe | If the BEB, at the uppermost point, can accommodate a LED infrared (IR) strobe light system, the criterion will be met. |
| 62 - Compass | If the BEB has a marine-grade lighted magnetic compass, the criterion will be met. |
| 63 - Depth Sounder | If a depth sounder with picture-representative (side or 3-D) imaging of underwater objects and bottom contour is provided, the depth sounder displays the water depth below the keel in real time to a minimum 1-ft depth, the depth sounder displays speed (water velocity) and water temperature, the depth sounder is integral to or interfaced with the GPS so as to allow depth information to be displayed on the GPS screen (threshold), the display unit can be removed without using tools, and storage space is provided for the display unit (objective), the criterion will be met. |

TABLE 2.1-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 64 - Bilge Drainage System | If at least three fixed, powered bilge pumps capable of discharging at least 10 gal./min each as installed are provided, the pumps are automatically and manually actuated, at least two pumps are in each bilge compartment, and a control and operation indicator for each pump is on the operator's console, the criterion will be met. |
| 67 - Appliqué Panel Support Structure | If the BEB includes permanent mounting provisions to accept appliqué panels and accommodates add-on replaceable flat appliqué panels up to 1-1/2 in. and weighing up to 12.5 $lb/ft^2$, the panels match the configuration of the operator's station and provide 100-percent coverage from the deck up to 48 in. for the front and sides (no protection is required behind the operator), and the panels on the sides extend a minimum of 12 in. from the rear of the operator, the criterion will be met. |
| 68 - Treatment and Painting | If the vender provides certification that the paint conforms to the color, gloss, and spectral reflectance requirements, the criterion will be met. Components not visible or exposed during normal operation may be unpainted. |
| 69 - Electronic | If the diagnostic connectors are equipped with a cover that prevents entrance of moisture and contaminants, the BEB features either a single data bus network as specified by Society of Automotive Engineers (SAE) J1939, J1708 (ref 10 and 11), or a multiple data bus network in accordance with J1939, which defines the interface between J1708 and J1939; the BEB data bus has built in sensors that provide fault isolation capability sufficient to identify failures of major components of each system monitored by the data bus; is compatible with current U.S. Army standard unit level test equipment, and the diagnostic connectors are easily accessible, hard mounted, and environmentally protected, the criterion will be met. |
| 70 - Item Unique Identification (IUID) Marking | If the vendor certification verifies that the IUID satisfies the requirements in MIL-STD-130N (ref 12), and the marking is permanent and in an easily identified area, the criterion will be met. |



### 2.1.3 Test Procedures and Data Required

a. Test Operations Procedure (TOP) 2-2-505 (ref 13) will be used as a general guide during testing.

b. Inspection. Upon arrival at ATC, the BEBs will be visually inspected to determine if any damages occurred during shipment. Components and assemblies will not be disassembled for inspection unless required to make repairs.

c. TIIN. All major component model and serial numbers and other pertinent data will be recorded. Each BEB will be assigned a TIIN, which will consist of the last three numbers of the hull serial number. The TIIN will be stenciled on the port and starboard sides of each BEB.

d. Inventory. The test support package (TSP), if provided, components of end item (COEI), and basic issue items (BII) provided with each BEB will be inventoried. The BII for each BEB will be installed in accordance with the Technical Manual (TM).

e. Functional Check. The BEB components will be functionally checked in accordance with the PMCS section in the TM. Any defects or damages will be corrected prior to testing.

f. Initial Service - Fluids, Fuel, and Lubricants.

(1) All fluid levels will be checked. The engine coolant level will be checked, and if necessary, adjusted. The ethylene glycol solution will be tested to determine if the coolant/antifreeze protection is in accordance with the TM. The lubricant fluid levels (engines, transmission, propulsion unit, hydraulic reservoirs, and steering) for each BEB will be verified in accordance with the TM.

(2) The fuel system for each BEB will be serviced. The fuel tanks will be drained, the fuel filters will be removed, and the fuel tanks will be filled with JP-8. New fuel filters from the TSP will be prefilled with JP-8 fuel and installed. Using a black permanent marker, the service date will be written on the filter after installation.

(3) Each BEB will be serviced with the proper lubricants prior to test operations. Samples will be taken before removing existing lubricants.

g. The BEB will be inspected to determine if:

(1) Tie-offs. At least three tie-offs are provided on each side (forward, approximately amidships, and aft), the tie-off locations facilitate line attachment to support conventional and longitudinal rafting, and the tie-offs are sized to accept a minimum 1-in. diameter line.

(2) Capstan. A multi-speed, self-tailing capstan that can handle one or two lines is provided, the capstan is located astern to provide for snugging and pulling in lines, and the capstan has a drum diameter of at least 6 in. with a rated capacity of at least the BEB forward bollard pull.

(3) Anchor fairlead. Fairleads (e.g., open chock) or other means are provided for guiding the anchor line off the bow and stern on centerline.

(4) Personnel safety aids. Grab rails, handholds, footholds, or other means are provided to allow safe personnel movement.

(5) Crew station. The sides of the crew station are designed to accept flat appliqué panels.

(6) Operator's seat/backrest. The operator's station has one vertically adjustable and stowable padded seat/backrest.

(7) Heater. A marine heater with a blower capable of 10,000 Btu/hr is provided in the crew station. The specifications (data plate) for the marine heater and blower will be checked; no testing will be performed to check the Btu/hr.

(8) Mast. A mast is provided to facilitate navigation and communication, the mast can be stowed, the stowed mast does not interfere with BEB operations and maintenance, and the mast can be stowed using common hand tools or without tools.

(9) Crew station bimini top. A removable, lightweight, collapsible marine-grade crew station bimini top is provided to protect the two-person crew from overhead sun and rain, personnel can install and remove the top without tools, and storage space is provided for the top.

(10) Crew station enclosure. A removable, lightweight, collapsible marine-grade crew station enclosure (from the bimini top down to the operator's station or deck) is provided, the enclosure can be installed and removed without using tools, and storage space is provided for the enclosure. The type of material used for the enclosure will be verified by contractor certification.

(11) Boat cover. A marine-grade boat cover with hull attachments, as needed, is provided to protect recessed areas from snow and rain water collection, and storage space is provided for the cover. The type of material used for the boat cover will be verified by contractor certification.

(12) Rifle stowage. Stowage for at least two M16A2 rifles with and without M203 grenade launcher or two M4A2 rifles with and without optics is provided near the crew station, and the mounts are designed to hold the weapons with the barrels pointed up and away from the operator's station and secure against loss, including if the boat capsizes. Simulated M16s will be used throughout testing, if required, to demonstate the durability of the bracket, if the bracket is not already fielded.

(13) Storage compartments. The storage compartments are permanently mounted, have covers that can be latched and locked using a padlock with a 3/8-in. shank, and are protected from weather elements; the covers incorporate a weathertight seal and have a positive-locking, hold-open device; and 2 $ft^3$ weathertight space is provided for extra personal gear to be brought onboard by Soldiers. The doors will be closed as in normal operation without any additional measures taken to improve sealing.

(14) Ignition. A keyless ignition is provided at the operator's station for the engines.

(15) Water jets. Two water jets (pump jets allowable) with linked steering and independent reversing controls are provided, the portions of the water jets requiring inspection as part of PMCS are readily accessible, and the water jets are protected from damage.

(16) Electrical systems. The BEB employs a 24-VDC electrical system with isolated negative grounds and neutrals (not a floating ground) to control corrosion and prevent electrolysis; all grounds and neutrals (using insulated conductors) come to common busses separate from the engine; open areas in the console and unused wire terminations are capped to provide protection from weather conditions; engine alternators, starters, sensors, and electronic control modules use the case of the component or the engine block as a negative return path to the batteries. Use of drive components as part of the 24 VDC return is unacceptable.

(17) Alternator. An alternator is provided.

(18) Searchlight. A marine-grade service 24-VDC searchlight (Hella Marine 8502 (NSN 6220-12-304-6240) or equivalent) is supplied, the searchlight has the capability of elevation and depression adjustment with a $360^o$ rotation, the searchlight is in a location that it can be turned forward or aft for navigational purposes, the searchlight is equipped with a one-hand control operable from either the operator's position or the deckhand's position within the cab (threshold), from both the operator's and deckhand's position within the cab using multiple mounting locations (objective), the searchlight can be removed from the mounting and moved to shine hand-held over the side of the BEB, and a dedicated 24-VDC searchlight electrical receptacle capable of accepting the mating plug on the searchlight power cord is installed on the operator's console. The type of searchlight and specifications will be verified through contractor certification.

(19) Inspection light. A removable hand-held inspection 24-VDC light(s) is provided for inspecting the battery, engine, transmission and propulsion unit compartments, and dedicated 24-VDC electrical receptacle(s) and/or the cord length is provided such that the light can be moved to illuminate the compartments as well as the BEB waterline. The type of inspection light and specifications will be verified through contractor certification.

(20) Lighting. A variable-lighted operator's control console, instrument panel(s), and magnetic compass are provided, the lighting is controlled by an electronic dimmer switch at the operator's console, and the lighting range is variable from full-off to full-on intensity.

(21) Instrument panels. The instrument panel is in and viewable from the operator's station.

(22) Fuel level gauge. A graduated tank-level indicator for the fuel tank is provided on the operator's console.

(23) Gauges. The specified analog-display style gauges indicating normal operating range and high and low limits, as applicable, are provided for each engine, and the gauges include red/yellow/green color markings for operating limits.

(24) Malfunction indicators. An audible alarm with a mute function is provided, and visual indicators are provided to indicate the following adverse conditions:

(a) Engine low oil pressure.

(b) Engine high coolant temperature.

(c) Low fuel.

(d) Flooding (bilge pump automatic activation).

(e) Fire sensing or system discharge.

(f) Loss of exhaust water cooling supply, if applicable.

(25) Horn. The BEB has a horn. The audible requirements in 33 CFR 86.05 (ref 14) for vessels between 12 and 20 m will be verified through contractor certification.

(26) Navigation lights. The BEB has a marine-grade, long-life LED navigation light system with the mast erected, as required by COLREGS 72 for International and Inland Navigation rules for power-driven vessels when pushing. The navigation lights will be verified by vendor certification. The navigation lights will be tested with the mast in the full upright position.

(27) Communications-electronics complement. The specified items (para 2.1.3g(28) through (42)) are located in and viewable from within the operator's station. The sensors and displays may be combined.

(28) SINCGARS radio capability. The BEB can accommodate one AN/VRC-90 SINCGARS radio system; the BEB has a 24-VDC NATO power source, one two-shelf rack using a mounting base (MT-6352/MT-6353), a VAA (AM-7239), a 50-watt PA (AM-7238), a SINCGARS antenna base, a two-piece fiberglass antenna (AS-3900) with attaching wrench,

and a speaker (LS-671); and the SINCGARS operation is affected when the battery disconnect switch is turned off. The specified equipment will be inspected for proper installation and connected to a government-furnished SINCGARS radio to verify operation.

(29) GPS. The BEB is equipped with a marine-grade GPS, and the GPS is wired to the BEB batteries and capable of displaying the position of the BEB in real time. The GPS voltage (12 or 24 VDC) will be verified.

(30) IR strobe. The BEB, at the uppermost point, can accommodate a LED IR strobe light system.

(31) Compass. The BEB has a marine-grade lighted magnetic compass.

(32) Depth sounder. A depth sounder with picture-representative (side or 3-D) imaging of underwater objects and bottom contour is provided, the depth sounder displays the water depth below the keel in real time to a minimum 1-ft depth, the depth sounder displays speed (water velocity) and water temperature, the depth sounder is integral to or interfaced with the GPS so as to allow depth information to be displayed on the GPS screen (threshold), the display unit can be removed without using tools, and storage space is provided for the display unit.

(33) Bilge drainage system. At least three fixed, powered bilge pumps, each capable of discharging at least 10 gal./min as installed, are provided, the pumps are automatically and manually actuated, at least two pumps are in each bilge compartment, and a control and operation indicator for each pump is on the operator's console. The contractor will provide certification for the bilge pumps.

(34) Appliqué panel support structure. The BEB includes permanent mounting provisions to accept appliqué panels and accommodates add-on replaceable flat appliqué panels up to 1-1/2 in. and weighing up to 12.5 $lb/ft^2$, the panels match the configuration of the operator's station and provide 100-percent coverage from the deck up to 48 in. for the front and sides (no protection is required behind the operator), and the panels on the sides extend a minimum of 12 in. from the rear of the operator. Personnel will remove and install the panels.

(35) Treatment and painting. All external surfaces suitable for painting except those that reach 400 $^{o}F$ are treated with chemical agent resistant coating (CARC). Components not visible or exposed during normal operation may be unpainted. The contractor will provide certification that the paint conforms to the color, gloss, and spectral reflectance requirements.

(36) IUID marking. The vendor will provide certification that all items exceeding $5000 in cost have IUID markings and satisfy the requirements in MIL-STD-130N. ATC personnel will inspect the IUIDs to determine if the markings are permanent and easily accessible and identifiable.

h. Out of Water Operation. It will be determined if the engines, without configuration changes, can operate clear of the water, at idle speed, with the transmission and water jets in neutral gear, and without external water hookup for 10 min without overheating. Sensors will be used to monitor the engine temperature.

i. Hull. The hull will be inspected to determine if any stiffeners terminate on the shell plate, if doubler plates are used for structural applications, and if all installed equipment is adequately secured in accordance with ISO 12215-6.

j. Ground Supported. The BEB will be placed on a flat, hard surface for 1 hr to determine if it is stable and level when on the ground. After 1 hr, the BEB will be inspected for damages.

k. Hull Drainage. The hull will be inspected to determine if it is equipped with a provision to drain/remove entrapped water. The functionality of the provision will be tested with the BEB in the level transport mode and with the BEB stored on level ground. If plugs are used, they will be inspected to determine if they are permanently attached with a tether/lanyard.

l. Anodes. Personnel will attempt to remove and reinstall the sacrificial anodes, if provided, using common tools.

m. Rub Rail. The hull will be inspected to determine if a replaceable rub rail is mounted around the entire hull on the outermost projection, and if the rub rail is made of commercially available, marine-grade synthetic or rubber material. Personnel will attempt to replace the rub rail using tools available in a general mechanic's tool kit. An ATC operator will be used to test boarding operations with the BEB in no less than 10 ft of water.

n. Dive Platform. The dive platform will be inspected to determine if it can support two Soldiers, if it extends farther aft than any other appendages of the BEB when deployed, if it is stowable to reduce rear overhang during transport, and if a means is provided for personnel boarding. Personnel will attempt to stow the platform using common hand tools and without the use of tools.

o. Push Knees. The bow will be inspected to determine if it is fitted with push knees, and if the push knee interface surface is covered with marine-grade synthetic or rubber material. Personnel will attempt to replace the interface surface using common hand tools.

p. Engines. The engines will be inspected to determine if:

(1) Fuel. The engines meet all performance requirements while operating on JP-8 fuel (MIL-DTL-83133).

(2) Emissions technologies. The vendor will provide EPA tier level engine certification documentation.

(3) Shut down. Primary and emergency shutdown methods are provided for the engines and the emergency method is a manually operated control.

(4) Automatic engine shut down override. The engines incorporate an automatic shutdown feature, and if so, is an alarm and engine shutdown override control provided at the operator's station, and is a means provided for the operator to override the shutdown.

(5) Hour meter. An accessible, readable hour meter is attached to each engine.

(6) Exhaust system. Each engine has an independent exhaust system and the water drains from the exhaust system to the outside of the BEB after shutdown to prevent damage from freezing.

(7) Engine cooling. Each engine has an independent cooling system, and if the engine is a liquid cooled, closed-loop coolant system.

q. Raw Water Cooling. The raw water cooling system, if applicable, will be checked to determine if it can be flushed, if duplex strainers or self-cleaning strainers are used for raw water fed to heat exchangers, if the non-self-cleaning strainers are readily accessible without having to lift a main engine hatch, and if the water drains from the exhaust system to the outside of the BEB after shutdown to prevent damage from freezing.

r. Fire Extinguishing System.

(1) Fire protection. Each main engine space will be inspected to determine if a fixed fire extinguishing system is provided. The vendor will provide certification that the system meets the requirements in 46 CFR 25.

(2) Actuation. The fire extinguishing system will be inspected to determine if it is designed to automatically discharge; actual testing will not be performed.

(3) Alarm. The system will be inspected to determine if an audible alarm with a mute function is provided for when the fire system senses a fire. The audible alarm will not be tested.

(4) Extinguishing agent. The extinguishing agent will be checked to determine if it is one of the approved agents or otherwise approved by the PCO.

s. Engine Space Confinement. The system will be checked to determine if the engine's combustion air is obtained from the engine space. If so, any forced ventilation or natural ventilation vents will be dampened to prevent additional air from feeding a fire.

t. Fuel System.

(1) Each engine will be inspected to determine if an independent fuel system (except for a common fuel tank) is provided, if the system allows each engine to be isolated, if shutoff valves are positioned to preclude excess spillage when removing components or performing service operations, if a fuel-water separator is provided and accessible and maintainable without removing any other equipment, and if the empty fuel system can be primed from the fuel tank without using the starter.

(2) The fuel supply will be shut off, the engine will be operated at idle until its fuel supply is exhausted, the tank will be drained and filled with JP-8, the fuel lines will be opened, and the empty fuel system will be primed. The engine will be started and allowed to idle for 2 min.

u. Fuel Tank.

(1) The fuel system will be inspected to determine if it accommodates safe, efficient fueling operations using a minimum 2-in. diameter refueling nozzle with a flow rate of at least 20 gal./min, if the fuel overflow is contained in an area or device designed to contain at least 8 fl oz, and if a means is provided to sound the tank.

(2) An operator on the deck will perform all refueling operations while wearing gloves.

v. Battery.

(1) Batteries. The batteries will be inspected to determine if:

(a) They are identical and in accordance with the specified requirements.

(b) They are listed in the federal supply system and have a NSN.

(c) At least two banks, one for each engine, are provided.

(d) A means is provided to temporarily parallel the engine-starting battery banks for emergency engine starting.

(e) The batteries are in battery boxes.

A crew member on the deck will check the batteries for accessibility without tools.

(2) Battery cables. The battery cables will be inspected to determine if they have reusable insulated terminal covers on the positive lead, if the positive cable terminals are identified with a red sleeve labeled + and the negative cable terminals are identified with a black sleeve labeled -, and if wing nut-type fasteners are used to connect the battery cables to the battery terminals.

(3) Battery disconnect master switch. An inspection will be performed to determine if a master switch is located near the battery compartment or near the operator's console, and if the master switch disconnects all power from each of the battery banks except for the SINCGARS radio and bilge pumps.

w. Electrical.

(1) Connection boxes. The connection boxes and other electrical enclosures, including cable entry sealing devices into each connection box, will be inspected to determine if they are watertight. The boxes will be inspected for watertightness after system operations, after natural rain storms, and during the final inspection.

(2) NATO slave receptacle. An inspection will be performed to determine if a type-I receptacle, in accordance with NATO STANAG 4074, is provided to allow for starting each engine and charging of the batteries from an external power source; if the receptacle provides a back feed power source from the BEB electrical system for charging and slaving other 24-VDC equipment, is near the battery enclosure, is accessible to personnel standing on the deck and accessible without using tools, and isolated from the hull to prevent it from inadvertently using the hull as a negative return path to batteries; if the receptacle is labeled SLAVE 24 VOLTS DC with 1-in. black lettering; and if the receptacle has a disconnect switch to isolate the receptacle when not in use.

(3) 24- to 12-VDC converter. If a 12-VDC supply is required to power onboard equipment, an inspection will be performed to determine if the 12-VDC supply is via a 24- to 12-VDC converter as opposed to drawing power from a single battery and if the converter uses an isolated ground to prevent a negative polarity return path through the hull.

(4) Circuit breaker panel. The circuit breaker panel will be inspected to determine if electrical devices and cables in each circuit are protected by appropriately sized circuit breakers. The vendor will provide certification that each breaker complies with the design, performance, and installation requirements in Institute of Electrical and Electronics Engineers Standards Association (IEEE SA 45 (ref 15)); the circuit breakers are marine grade; if separate panels are used when both 24- and 12-VDC components are used; if each panel has at least three spare 15-A breakers; if spare circuits are allocated as part of the total BEB electrical load and labeled with individual label plates as Spare.

(5) Electronic.

(a) Diagnostic connectors. The diagnostic connectors will be inspected to determine if they are equipped with a cover that prevents entrance of moisture and contaminants and if they are easily accessible, hard mounted, and environmentally protected.

(b) Data bus network. The BEB will be inspected to determine if it features either a single data bus network as specified in SAE J1939, J1708, or a multiple data bus network in accordance with J1939, which defines the interface between J1708 and J1939.

(c) Data bus. The BEB data bus will be inspected for built-in sensors that provide fault isolation capability sufficient to identify failures of major components of each system monitored by the data bus.

x. The following data will be recorded:

| |
|---|
| TIINs |
| Major component serial and model numbers |
| Defects or damages |
| Visual inspection results |
| Physical configuration inspection and test results |
| Test item photographs |





(Page 2.1-16 Blank)

## 2.2 SYSTEM CONFIGURATION

### 2.2.1 Objectives

The objectives of this test are:

a. To perform a mechanical inspection, check lubricant requirements, and perform any initial services.

b. To baseline the engine fuel system(s) for operation with JP-8 fuel.

c. To verify the provision and functionality of physical configuration items listed in the PD

### 2.2.2 Criteria and Data Analysis

TABLE 2.2-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| TBD | TBD |
| TBD | TBD |

### 2.2.3 Test Procedures and Data Required

a. TOPs 1-2-504, 2-2-801, and 2-2-800 and SAE J2180 (ref 16 through 19) will be used as general guides during testing.

a. TBD

x. The following data will be recorded:

| |
|---|
| TSP, COEI, and BII inventory lists |
| Lubricant samples and chemical analysis |
| Initial service results |
| Modifications, adjustments, or repairs |
| Functional check results |
| System configuration and test results |
| Photographs |

## 2.3 PHYSICAL CHARACTERISTICS AND ROLLOVER THRESHOLD

### 2.3.1 Objectives

The objectives of this test are:

a. To measure the physical dimensions (length, width, height, etc.) of the BEB and the BEB in transport configuration.

b. To determine the weight and CG measurements of the BEB and the BEB in transport configuration.

c. To determine the rollover threshold of the BEB and BEB in transport configuration. /BAP/PLST combinations.

### 2.3.2 Criteria and Data Analysis

TABLE 2.3-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 71 - Highway Transport | If the maximum overall height of the BEB, prepared for transport, does not exceed 157-1/2 in., and the maximum weight of the BEB in transport configuration does not exceed the 24,000-lb LHS capability of the CBT, the criterion will be met. |
| 72 - External air transport (EAT) | If the BEB system does not exceed 16,644 lb (objective), the criterion will be met. |

### 2.3.3 Test Procedures and Data Required

a. TOPs 1-2-504, 2-2-801, and 2-2-800 and SAE J2180 (ref 16 through 19) will be used as general guides during testing.

b. Physical Dimensions. Physical dimensions of the BEB and the BEB in transport configuration, positioned on a hard, level surface, will be measured using steel tapes, levels, and plumb bobs.

c. Weight. The BEB will be fueled to capacity. The weight of the BEB and the BEB in transport configuration will be determined using a calibrated platform scale (accuracy ±0.5 percent of reading).

d. CG. CG measurements of the BEB and the BEB in transport configuration will be determined using cranes, scales, load cells, and plumb bobs. The longitudinal and vertical CG measurements will be determined using the weight reaction method, and the lateral CG measurement will be determined using the suspension method.

e. Static Stability. The static rollover threshold of the BEB/BAP/CBT and BEB/BAP/PLST combinations will be determined using the ATC Tilt Table Test Facility. The combination will be secured to the tilt table with restraining provisions to prevent an actual rollover or downhill wheel slippage. The provisions will be installed with sufficient slack, which will allow observation of the onset and partial progression of this event. The combination will be tilted about its roll axis in progressive increments until the uphill tires lift off the platform or until a load shift occurs.

f. The following data will be recorded:

| |
|---|
| Physical dimensions |
| Weight |
| CG measurements |
| CBT and PLST tire pressures |
| Rollover threshold |
| Photographs and videos |

## 2.4 COMPATIBILITY

### 2.4.1 Objective

The objective of this test is to determine if any compatibility issues exist.

### 2.4.2 Criteria and Data Analysis

TABLE 2.4-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 9 - Push Knees | If the bow is fitted with push knees that interface with the standard ribbon bridge (SRB) and IRB bays for maneuvering operations, the criterion will be met. |
| 69 - Electronic | If the BEB is compatible with current U.S. Army standard unit level test equipment (maintenance support device (MSD)) with the auxiliary MSD-internal combustion engine (ICE) test hardware and the diagnostic connectors and circuits are compatible with current standard Army test equipment, the criterion will be met. |
| 73 - BAP | If use of the BAP is proposed as the interface equipment between the BEB and the CBT, the criterion will be met if any modification to the BAP can be installed or removed using only onboard tools and BII, and the contractor provides all components required to prepare the BAP for interface with the BEB as a kit. Permanent changes to the BAP which would alter the capability to handle existing loads are not permitted. |
| 74 - Multirole Bridge Company (MRBC) Transport System | The CBT with the BEB system shall be capable of towing a loaded PLST (e.g., IRB/BAP or dry support bridge (DSB)/M1077 flatracks) with the draw bar in the extended position and the extended drawbar/light bar (NSN 2540-01-460-5784) installed without restricting the turning diameter of the CBT/PLST combination. |
| 75 - Transload | If the BEB system can be transferred from the CBT to the PLST and from the PLST to the CBT, the criterion will be met. |

### 2.4.3 Test Procedures and Data Required

a. Push Knees. The push knees will interface with the SRB and the IRB during maneuvering operations. Operations will be observed for interface problems. Maneuvering with the SRB bays will not be conducted. Static push knee compatibility with a floating SRB will be demonstrated.

b. Electronic. The BEB will be inspected to determine if it compatible with current U.S. Army standard unit-level test equipment (MSD) with the auxiliary MSD-ICE test hardware and the diagnostic connectors and if circuits are compatible with current standard Army test equipment. The BEB will be connected to U.S. Army unit-level test, measurement, and diagnostic equipment (TMDE). A nondestructive fault will be inserted and diagnosed to determine functionality of the network and sensors.

c. BAP. Any modifications to the BAP will be installed and removed using only on-board tools and BII. The BEB will be transported, launched, and retrieved using the BAP. The BEB will be visually inspected for interference, compatibility issues, and damages during operations.

d. MRBC Transport System. The PLST loaded with an IRB and BAP will be towed by a CBT loaded with a BEB/BAP to determine if any interference problems exist. The combination will be driven in the forward direction while turning in minimum turning diameter circles (clockwise and counterclockwise). The combination will be operated on the longitudinal slopes in the ascending and descending directions to determine if any potential interference exists between the rear of the CBT payload and the front of the PLST payload as the combination transitions through the approach and departure angles of the slopes. Longitudinal testing will begin on the 10-percent longitudinal slope and will be accomplished in increasing grade up to and including 40 percent. The combination will be visually inspected for interference problems. The rollover threshold results will be used to determine if dynamic side slope testing is required.

e. Transload. Transloading will be performed on a hard, level surface. The BEB will be transferred from the CBT to the PLST and from the PLST to the CBT.

f. The following data will be recorded:

| |
|---|
| Compatibility issues |
| Defects or damages |
| Push knee compatibility test events and results |
| TMDE fault diagnostic results |
| BAP launch/retrieve interface results |
| MRBC transport test results |
| Photographs and videos |

## 2.5 HUMAN FACTORS ENGINEERING (HFE) AND SAFETY

### 2.5.1 Objective

The objective of this test is to assess the human factors and safety characteristics of the BEB.

### 2.5.2 Criteria and Data Analysis

TABLE 2.5-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 13 - Personnel Safety Aids | If grab rails, handholds, footholds or other means are provided to allow safe personnel movement during all operations, including moving between BEBs and bays, the criterion will be met. |
| 14 - Crew Station | If the crew station provides all-around visibility, there is room for two Soldiers in the crew station, and all BEB controls are located in the crew station and designed for a single operator, the criterion will be met. |
| 15 - Operator's Seat/Backrest | If the seat supports the operator wearing full Soldier gear with body armor, the criterion will be met. |
| 19 - Crew Station Enclosure | If the enclosure is designed to provide maximum field-of-view (FOV) with transparencies (threshold), with peel-away clear adhesive sheets on transparencies (objective), the criterion will be met. |
| 20 - Boat Cover | If the two-person crew can install the boat cover within 15 min and remove the boat cover within 15 min, the criterion will be met. |
| 21 - Rifle Stowage | If the weapons can be stowed within 10 sec and retrieved within 10 sec without tools, the criterion will be met. |
| 29 - Exhaust System | If the exhaust outlet is located in an area that minimizes noise and fume impact on the crew station, the criterion will be met. |
| 77 - Throwable Flotation | If storage space or mounting provisions are provided for the throwable flotation and deployment of the flotation can be accomplished within 10 sec, the criterion will be met. |
| 78 - Line Cutting Device | If mounts are provided to stow the line cutting device safely and securely and the device can be accessed by hand without tools within 10 sec, the criterion will be met. |
| 79 - HFE and Safety | If HFE principles and design standards are applied in accordance with the specified requirements and belts, filters, lubrication fittings, oil sampling valves on machinery can be easily inspected and replaced without removing any components, the criterion will be met. |
| 80 - Human Factors Range | If 5th percentile female through 95th percentile male, as defined in ASTM F1166 (ref 21), section 9, dressed in IBA and in mission-oriented protective posture (MOPP) gloves can operate and maintain the BEB, perform repairs, and conduct procedures, the criterion will be met. |
| 81 - Noise Limit | If the steady-state noise level on the deck with the engine compartment hatch closed does not exceed 85 dB(A) in accordance with MIL-STD-1474D (ref 22) compensated with single-level hearing protection (threshold), without hearing protection (objective) , the criterion will be met. |
| 82 - Hatch Securing | If hinged machinery hatches can be secured in the open position, the criterion will be met. |

TABLE 2.5-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 83 - Identification and Marking | If all attachments or components removed or disassembled for shipment are visually match-marked for proper reassembly, the criterion will be met. |
| 84 - Launch, Retrieve Performance | If the BEB can be launched by the CBT within 5 min (3 min objective) and retrieved by the CBT within 5 min (3 min objective), the criterion will be met. |

### 2.5.3 Test Procedures and Data Required

a. Test participants' anthropometrics data will be recorded to determine the percentile ranking on appropriately selected dimensions. The 5th percentile female and 95th percentile male values from MIL-STD-1472F (ref 23), Tables XIII, XVII, and XIX will be used for comparative purposes. The following measurements will be recorded:

(1) Stature.

(2) Standing shoulder height.

(3) Functional reach.

(4) Palm length.

(5) Hand breadth.

(6) Hand thickness.

(7) Overhead reach height.

(8) Weight.



b. Controls, Displays, and Labeling. All controls, displays, and labeling will be observed with respect to HFE design practices in accordance with MIL-STD-1472F. Maintenance access openings and workspaces will be observed with respect to the operator or maintainer's ability to perform required maintenance tasks while wearing MOPP gloves and while wearing cold weather gloves. The Operator's Manual will be reviewed to determine if all of the appropriate instructions are included.

c. Personnel Safety Aids. The BEB will be inspected to determine if grab rails, handholds, footholds or other means are provided to allow safe personnel movement during all operations, including moving between BEBs and bays. The provisions will be evaluated for safety and functionality.

d. Crew Station. While standing at the operator's console, the BEB operator will look around to determine if all-around visibility ($360^{o}$ view of the horizon) is provided. The operator will be permitted to move his head slightly to see past the Bimini top poles. An inspection will be

performed to determine if there is room in the crew station for two Soldiers and if all BEB controls are located in the crew station and designed for a single operator. The operator's ability to use the controls will be observed during the following operations:

| | DESCRIPTION |
|---|---|
| Line handling | Moving lines |
| | All knots and lashings |
| | Securing bays with rope |
| | Securing rafts (conventional and longitudinal) with rope |
| | Securing bridges with rope |
| BEB operations | Launch and retrieve operations |
| | Maneuvering operations with and without bay attached |
| | Securing bays launched from the CBT |
| | Rafting (conventional and longitudinal) |
| PMCS | Includes access to all areas: engine hatches, jet cover, etc. |
| Access/egress | While on a CBT |
| | While beached |
| | While tied off to a bay |
| | While tied off to rafts and bridges |

e. Operator's Seat/Backrest. An inspection will be performed to determine if the seat/backrest supports the operator wearing full Soldier gear with body armor. Full Soldier gear includes the following:

| |
|---|
| PFD |
| Body armor with modular lightweight load-carrying equipment (MOLLE) |
| Ammunition pouches |
| Canteen/Camel Pak (personal hydration system) |
| Gas mask |
| Helmet |
| Complete uniform, including cold weather gear |

f. Crew Station Enclosure. The crew station enclosure will be inspected to determine if it provides maximum FOV with transparencies and with peel-away clear adhesive sheets on transparencies.

g. Boat Cover. Timed trials will be performed to determine if personnel can install the boat cover within 15 min and remove the boat cover within 15 min.

h. Rifle Stowage. Timed trials will be performed to determine if personnel can stow the weapons within 10 sec and retrieve the weapons within 10 sec without using tools for either process.

i. Throwable Flotation. If storage space or mounting provisions are provided for the throwable flotation and deployment of the flotation can be accomplished within 10 sec.

j. Line Cutting Device. Timed trials will be performed to determine if personnel can access the line-cutting device from its mount, if provided, by hand within 10 sec.

k. Exhaust System. The exhaust outlet will be inspected to determine if it is located in an area that the noise and fume impact on the crew station are minimized.

l. HFE and Safety. The BEB will be inspected to determine if HFE principles and design standards are applied in accordance with the specified requirements and if belts, filters, lubrication fittings, and oil sampling valves on machinery can be easily inspected and replaced without removing any components.

m. Human Factors Range. If 5th percentile female through 95th percentile male, as defined in ASTM F1166, section 9, dressed in body armor and in MOPP gloves can operate and maintain the BEB, perform repairs, and conduct procedures.

n. Noise Limit. Steady-state noise levels will be recorded at the operator's station (ear level), stern deck winch, and the engine compartment hatch. Testing will be performed while the BEB is idling, patrolling, and conducting simulated rafting. Noise levels during patrolling and simulated rafting will be recorded with the engine speed at idle, mid-range, and full throttle. The engine compartment hatch will be closed during noise testing.

o. Hatch Securing. Hinged machinery hatches will be inspected to determine if they can be secured in the open position.

p. Identification and Marking. All attachments and components that were removed or disassembled for shipment will be inspected to determine if they are visually match-marked for proper reassembly.

q Launch and Retrieve. Timed trials will be performed to determine if the BEB can be launched by the CBT within 5 min and retrieved by the CBT within 5 min. Time commences after the BEB is prepared for launch or retrieval and the CBT is in position to launch or retrieve with the water level at the middle of the rear wheel hub. For launch, time ceases when the BEB is completely free and clear. For retrieval, time commences when the first part of the BEB hull is over the CBT structure and ceases when the BEB is secured and the CBT begins movement out of the water.

r. The following data will be recorded:

| |
|---|
| Anthropometrics data |
| Inspection results |
| Performance times |
| Noise levels |
| Safety issues |
| Photographs and videos |

## 2.6 PERFORMANCE

### 2.6.1 Objective

The objective of this test is to assess the performance characteristics and determine the integrity of the BEB.

### 2.6.2 Criteria and Data Analysis

TABLE 2.6-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 3 - Hull | If the hull integrity (including all appendages) is maintained (no hull rupture/penetration or broken welds) during all operations without ice in the water including ground contact against a hard mud bottom at 8 kt and any part of the BEB that contacts the ground during beaching, loading, unloading, launching, and recovery operations is protected or reinforced as required to withstand the contact, the criterion will be met. |
| 7 - Rub Rail(s) | If the rub rail does not tear or detach when impacting a pier or floating bay from any angle at 3 kt, the criterion will be met. |
| 9 - Push Knees | If the push knees withstand the force of a fully loaded BEB impacting stationary bays at 3 kt with all push knees contacting simultaneously and withstand a 45$^{o}$ impact with stationary floating bays at 2 kt, the criterion will be met. |
| 10 - Tie-Offs | If the static bollard capacity is three times the maximum calculated load of the BEB or three times the maximum calculated load from bay handling and towing and the tie-off locations facilitate line attachment to support conventional and longitudinal rafting, the criterion will be met. |
| 18 - Crew Station Bimini Top | If the crew station bimini top withstands a wind load of the BEB's maximum speed heading into a 25-kt wind, the criterion will be met. |
| 31 - Raw Water Cooling | If the keel coolers, if used, are capable of being flushed while underway without having to access the engine compartment, the criterion will be met. |
| 32 - Water Jets | If the reversing and neutral controls for the water jets are independently-power assisted and allow the operator to change from ahead to astern operation without changing the throttle setting and the water jets can be back flushed or have other means to clear the water jet inlet grill, the criterion will be met. |
| 39 - Fuel Tank | If the low fuel alarm sounds while the BEB is operating with less than 10 percent of fuel remaining, a means is provided for sounding the tank, and the BEB has enough fuel capacity for 9 hr of operation at 45-percent rated engine power, the criterion will be met. |
| 40 - Electrical Systems | If the BEB employs a 24-VDC electrical system with isolated negative grounds and neutrals (not a 'floating' ground) to prevent electrolysis; all grounds and neutrals come to common busses separate from the engine using insulated conductors; open areas in the console and unused wire terminations are capped to protect from exposure to weather conditions; engine alternators, starters, sensors and electronic control modules do not use the case of the component or the engine block as a negative return path to the batteries, the criterion will be met. The vendor will certify the electrical system for proper wiring size and grounding type. |

TABLE 2.6-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 41 - Alternator | If the alternator and pulley are sized so that adequate power for electrical loads is available (contractor load analysis), the amperage output from each alternator is capable of providing power to operate the BEB without restriction, the system is wired and sized such that either alternator can charge either bank of batteries, and the alternators are replaceable without having to remove the engine, or having to disconnect any fuel or hydraulic line (objective), the criterion will be met. |
| 63 - Depth Sounder | If the sensor is not damaged during BEB operations and can supply the specified data requirements, the criterion will be met. |
| 84 - Launch, Retrieve Performance | If the BEB can be launched or retrieved from the CBT within 5 min (threshold), 3 min (objective) within the following launch site requirements: up to 20-percent ($11^{o}$) slope, 8-percent ($5^{o}$) side-to-side slope, water depth of at least 48 in. where the boat enters the water, current of up to 5 ft/s, and if any water taken onboard during launch or retrieval can be drained from the operators' spaces (no standing water), but not into machinery spaces, the criterion will be met. |
| 85 - Launch, Retrieve Personnel | If two people in the BEB (threshold) (one person in the BEB (objective)) can launch and retrieve the BEB from the CBT, the criterion will be met. |
| 86 - Rafting | If two BEBs are able to push a seven-bay raft (two ramps and five interior) with up to military load classification (MLC) 140 (two MLC-70 ton tracked vehicles or equivalent) for both conventional (see 6.4.3) and longitudinal rafting (see 6.4.4), in a water depth greater than 6 ft, the criterion will be met. |
| 87 - Navigational Draft | If the BEB, at full-load condition in freshwater, has a navigational draft of no more than 30-in. (threshold) (24-in. (objective)), the criterion will be met. |
| 88 - Shallow Water Operation | The BEB is capable of operating at full power for 30 min in 4 ft of water with a soft bottom at a relative water velocity of 6 ft/s without overheating, the criterion will be met. |
| 89 - BEB Speed | If the BEB, at full-load condition in greater than 23 ft of water, can achieve a forward steady-state speed of at least 16 kt, and the BEB, at full-load condition in calm water, can safely back at 4 kt without water flooding the craft, the criterion will be met. |
| 90 - Unloaded Bay Maneuverability | If the BEB can maneuver one to four bays (ramp and interior bay combinations) forward, reverse, and sideways in a relative water speed of up to 5 ft/s,, the criterion will be met. |
| 92 - Payload | If the BEB, at full-load condition, maintains safety and stability while transporting a 1000-lb payload, the BEB has multiple tie-down points to secure various sized payloads in the cargo area, and the cargo area is sized to accommodate both IRB and SRB rafting brackets (no more than two at a time), the criterion will be met. |
| 93 - Anchor and Line | If the anchor and line are capable of holding the BEB stationary, the criterion will be met. |
| 94 - Mechanical Systems | If the propulsion systems operate independently of and in tandem with each other and allow for independent forward/reverse/neutral operating, the criterion will be met. |
| 95 - Petroleum, Oils, and Lubricants (POL) Leakage | If there is no fluid leakage in the fuel, hydraulic, or cooling systems, the criterion will be met. |

TABLE 2.6-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 96 - Propulsion | If the propulsion provides the thrust to meet performance requirements, without exceeding the component manufacturer's recommended installation requirements, durability and horsepower rating, the criterion will be met. |

### 2.6.3 Test Procedures and Data Required

a. Prior to each shift of operation, a PMCS will be performed to ensure that all the fluids are filled to their appropriate levels, all functions are properly working, and that no degradation has occurred to the BEB. The BEB will be periodically inspected throughout performance testing and after retrieval from the water.

b. Engine hours, fuel consumption, and test incidents will be recorded in Test Incident Reports (TIRs), which will be completed in accordance with Army Regulation (AR) 73-1 (ref 24).

c. Hull.

(1) The BEB traveling at 8 kt will be run aground against a hard mud/sand bottom to determine the integrity of the hull. The hull will be inspected immediately after running the BEB aground.

(2) After contact with the ground during beaching, loading, unloading, launching, and retrieval operations, the hull will be inspected to determine if it is protected or reinforced as required to withstand the contact. The BEB will remain in the water for four to five days during performance. Hull inspection will be conducted when the BEB is retrieved for a weekend break.

d. Rub Rails. During rafting and reliability test operations, the BEB traveling at 3 kt will be impacted against a floating IRB interior bay from different angles to determine if the rub rails tear or detach.

e. Push Knees. During rafting, the fully loaded BEB traveling at 3 kt will be impacted against a stationary IRB interior bay with all push knees contacting simultaneously. The push knees will also be tested to withstand a 2-kt impact at a $45^{o}$ angle against an IRB interior bay. The push knees will be inspected after the impacts, and the results will be recorded.

f. Tie-Offs. The BEB will be positioned in the Underwater Explosion (UNDEX) Test Facility Harbor, and a line with a load cell will be secured between the boat and bulkhead. The BEB at various rpms through wide-open throttle will pull against the line to the bollard pull capacity. During conventional and longitudinal rafting, the tie-off locations will be observed to determine if they facilitate line attachment.

g. Crew Station Bimini Top. The BEB with the crew station bimini top installed will be positioned with BEB bow facing the wind machine. The wind machine will be adjusted to the maximum speed of the BEB plus 25 kt. The BEB will be subjected to wind for 30 min. Testing will be continuously observed to determine if the top can withstand the effects of wind. The bimini top and hardware will be physically inspected after the test, and any damage or degradation will be recorded.

h. Raw Water Cooling.

(1) Flushing keel coolers. During operations, personnel will attempt to flush the keel coolers without having to access the engine compartment. Flushing the keel coolers will be performed in accordance with the NET or the TM.

(2) Draining. The BEB will be removed from the water and inspected to determine if sufficient water drains to prevent freezing. This will also be verified during low temperature testing (para 2.7).

i. Water Jets. The water jets will be tested during operations in accordance with NET or the TM.

(1) Reversing control. The operator will attempt to change from ahead to astern operation without changing the throttle setting.

(2) Water jet back flush. Personnel will attempt to back flush the water jets.

j. Fuel Tank.

(1) Operation. The BEB fuel tank will be filled to capacity, and the usable fuel capacity will be determined. The BEB, at 45-percent rated engine power, will maneuver two IRB interior bays for 2 hr. The fuel tank will be refilled, and the fuel consumption rate will be calculated.

(2) Low fuel alarm. During operations, the operator will monitor the fuel level and low fuel alarm to determine if the alarm sounds when the BEB is operating with less than 10 percent (approximately) of fuel remaining.

k. Electrical Systems. The electrical system will be monitored during performance testing. Any incidents will be recorded.

l. Alternator. The alternator load analysis for the electrical system will be verified by contractor certification. While performing daily PMCS, the alternator belt will be inspected for wear and alignment. The alternator amperage will be monitored during operations.

m. Depth Sounder. The depth sounder will be inspected for functionality during BEB operations.

n. Launch and Retrieve Performance.

(1) The BEB will be launched and retrieved at least five times and the duration to accomplish these tasks will be recorded and averaged. The time will commence after the BEB is prepared for launch or retrieval and the CBT is in position to launch or retrieve with the water level at the middle of the rear wheel hub. For launch, the time will cease when the BEB is completely free and clear. For retrieval, time commences when the first part of the BEB hull is over the CBT structure and ceases when the BEB is secured and the CBT begins movement out of the water. The BEB will be able to be launched and retrieved from the CBT within the launch site requirements: up to 20 percent ($11^{o}$) slope, 8 percent ($5^{o}$) side-to-side slope, water depth of at least 48 in. where the boat enters the water, current of up to 5 ft/s. Any water taken onboard during launch or retrieval will be monitored to determine if it drains from the operators' spaces (no standing water), but not into machinery spaces.

(2) The following data will be recorded:

| |
|---|
| BEB and CBT identification |
| Site configuration |
| Launch and retrieve times |
| Photographs and video |

o. Launch, Retrieve Personnel. Launch and retrieve operations will be observed to determine if they can be performed by one or two people.

p. Rafting.

(1) Two BEBs will push a seven-bay IRB raft (two ramp bays and five interior bays) loaded to MLC 140 (two 70-ton M1 Abrams tanks) in both conventional and longitudinal rafting configurations, in a water depth of greater than 6 ft. Testing will be accomplished in calm water conditions in the Bush River. The raft will be instrumented with wave staffs and a calibrated GPS to record relative water velocity and position.

(2) The following data will be recorded:

| |
|---|
| Raft freeboard |
| Current velocity relative to land |
| Water depth |
| Raft velocity relative to land |
| BEB engine speed |
| Wind speed and direction |

q. Navigational Draft. Each side of the BEB hull, fore and aft, will be marked vertically in 1-in. increments. Navigational draft will be determined with the BEB in freshwater at full-load condition (combat ready). Full-load conditions is defined as the BII, fuel tanks filled to 95-percent capacity, and two crew members with personal gear and weapons (368 lb each). A simulated weight may be used to represent the crew members and their weapons. The navigation draft will be measured.

r. Shallow Water Operation. To determine if the BEB will overheat in shallow water, the BEB at full power will maneuver two IRB interior bays in 4 ft of water for 30 min. The riverbed will be soft sand/mud.

s. BEB Speed. The BEB in full-load condition and at full power will be operated in >23 ft of water to determine if a forward steady-state speed of at least 16 kt can be achieved. The BEB will then be operated in reverse at 4 kt in calm water to determine if the BEB can be safely backed without water flooding the craft (entering the cockpit). A GPS will be used to verify the BEB speed. The BEB forward and reverse steady-state speeds, the speed that water enters the craft at less than 4 kt, and any safety issues will be recorded.

t. Unloaded Bay Maneuverability. The BEB will maneuver IRB interior and ramp bays in the forward, reverse, and sideways directions. The BEB will maneuver up to and including four IRB bays simultaneously.

u. Payload.

(1) The BEB will be inspected to determine if multiple tie-down points are provided to secure various-sized payloads in the cargo area, if the cargo area is sized to accommodate IRB and SRB rafting brackets (no more than two at a time), and if the cargo area is located on engine hatches or in areas that may require emergency access.

(2) A 1000-lb payload (fig. 2.5-1) will be added to the fully loaded BEB to determine if safety and stability can be maintained. The distribution of the payload will be located in one 12-$ft^2$ rectangular area. The payload will have a CG of 24 in. above the cargo area surface. A series of maneuvers will be accomplished, and the results will be recorded.

v. Anchor and Line. The capability of the anchor and line to hold the BEB stationary will be determined throughout operations. The anchor and line rated strength will be verified by contractor certification.

w. Mechanical Systems. The propulsion systems will be tested during the rafting and bollard tests. Each propulsion system will be operated independently and in tandem. Each system will be checked to determine if it allows for independent forward/reverse/neutral operating.

x. POL Leakage. Leakage of the fuel, hydraulic, and cooling systems is not permitted; any leakage will be immediately reported to the manufacturer's representative for resolution and documented in a TIR. All external leaks on components such as the engine, gearboxes, and pump drive will be classified in accordance with SAE J1176.

y. Propulsion. The contractor will provide supplier certifications showing that the engine and water jet components of the propulsion system are designed, assembled, and operated within the installation, durability, and horsepower requirements of the manufacturers.

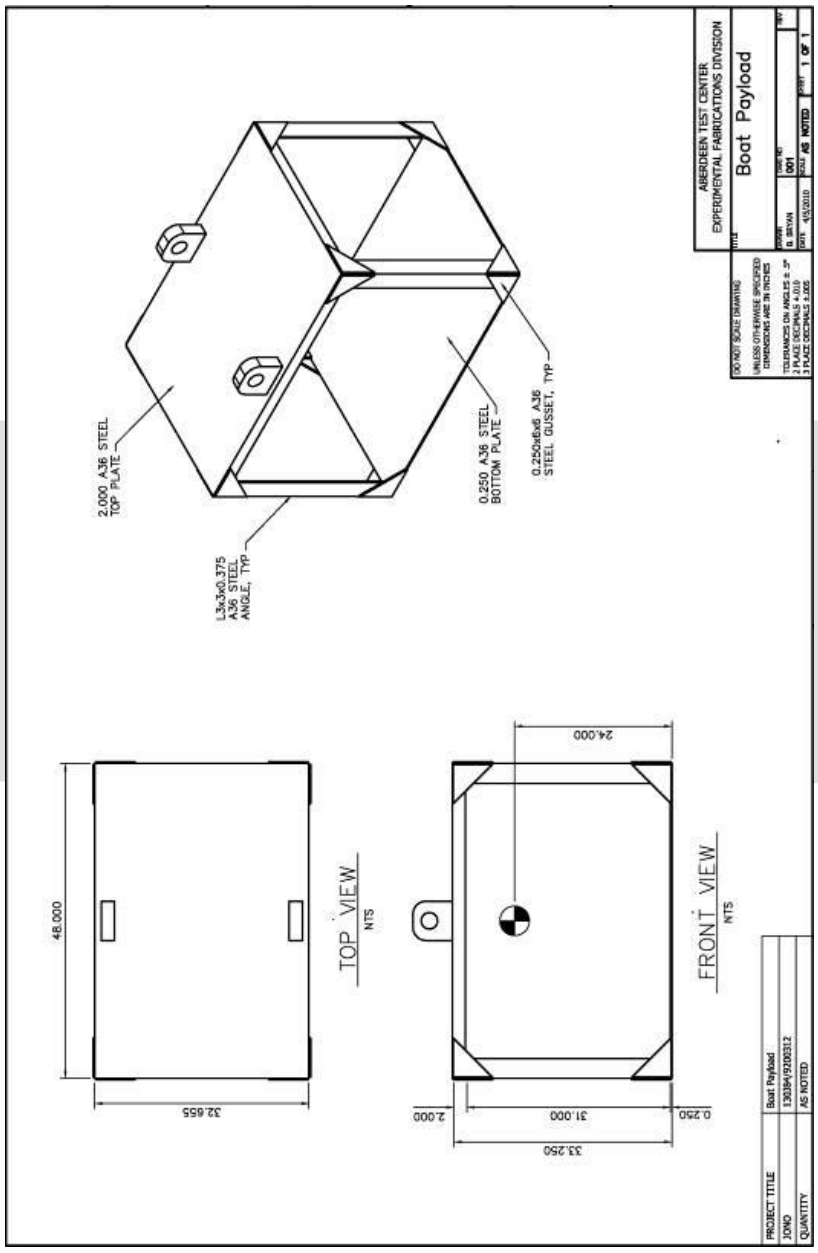


Figure 2.5-1 BEB 1000-lb payload with 24-in. CG.



(Page 2.6-8 Blank)

## 2.7 HIGH TEMPERATURE

### 2.7.1 Objective

The objective of this test is to determine the effects of high temperature storage and operating conditions on the BEB.

### 2.7.2 Criteria and Data Analysis

TABLE 2.7-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 40 - Electrical System(s) | If the BEB control gauges, circuit breakers, switches, and displays allow for safe operation in high temperature conditions, the criterion will be met. |
| 97 - Ambient Conditions | If the BEB withstands the effects of storage at 160 $^{o}$F and operation at 120 $^{o}$F without damage or performance degradation, the criterion will be met. |

### 2.7.3 Test Procedures and Data Required

a. MIL-STD-810G, Test Method 501.5 (ref 25), Procedures I (Storage) and II (Operation), will be used as a general guide during testing, which will be performed in a climatic chamber.

b. The BEB will be positioned in the climatic chamber at standard ambient conditions and instrumented with thermocouples in the fluid reservoirs (fuel, engine oil, and coolant).

c. The BEB will be subjected to an operational checkout. The control gauges, circuit breakers, switches, and displays will be checked for proper function.

d. Storage.

(1) The BEB will be placed in its storage configuration and prepared in accordance with the TM.

(2) The chamber will be adjusted from standard ambient to 160 $^{o}$F at a rate not to exceed 5 $^{o}$F per minute.

(3) The BEB will be stabilized at 160 $^{o}$F. Stabilization is attained when the temperature of the functional part(s) of the test item considered to have the longest thermal lag reaches a temperature that is within the temperature tolerance of the air surrounding the test item.

(4) This condition will be maintained for at least 2 hr.

(5) The BEB will be visually inspected. All fluid reservoirs will be inspected to determine if sufficient volume for expansion was provided. Any damage or performance degradation will be recorded.

e. Operation.

(1) The chamber will be lowered to 120 $^{o}$F and maintained until the BEB is stabilized at 120$^{o}$F for at least 2 hr. The data sample rate will be adjusted to one sample per min.

(2) The BEB will be visually inspected, engine starts will be performed. The engines will be operated at idle. The control gauges, circuit breakers, switches, and displays will be functionally checked. Engine operations will not exceed 10 min. Any damage or performance degradation will be recorded.

f. The following data will be recorded:

| |
|---|
| BEB pretest preparation |
| Test facilities and instrumentation |
| Deviations from test procedures (if applicable) |
| Test duration |
| Test item configuration |
| Locations of thermocouples |
| Stabilization times |
| Temperatures versus time conditions for each thermocouple |
| Inspection results |
| Operational test results |

## 2.8 LOW TEMPERATURE

### 2.8.1 Objective

The objective of this test is to determine the effects of low temperature storage and operating conditions on the BEB.

### 2.8.2 Criteria and Data Analysis

TABLE 2.8-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 40 - Electrical System(s) | If the BEB control gauges, circuit breakers, switches, and displays allow for safe operation in low temperature conditions, the criterion will be met. |
| 42 - Batteries | If the cranking performance for each starting bank ensures the engines can be started at -25 $^{o}$F without preparatory charging of the batteries, the criterion will be met. |
| 97 - Ambient Conditions | If the BEB withstands the effects of storage at -50 $^{o}$F and operation at -25 $^{o}$F without damage or performance degradation, the criterion will be met |

### 2.8.3 Test Procedures and Data Required

a. MIL-STD-810G, Test Method 502.5, Procedures I (Storage) and II (Operation), will be used as a general guide during testing, which will be performed in a climatic chamber.

b. The BEB will be drained of all standing water (i.e., bilge, raw water cooling system, etc.).

c. The BEB will be positioned in the climatic chamber at standard ambient conditions and instrumented with thermocouples in the fluid reservoirs (fuel, engine, and coolant). The batteries and starters will be equipped with transducers to measure battery voltage and starter current. The BEB will be prepared for low temperature storage and operation in accordance with the TM.

d. The BEB will be subjected to an operational checkout. The control gauges, circuit breakers, switches, and displays will be checked for proper function.

e. Storage.

(1) The BEB will be placed in its storage configuration.

(2) The chamber will be adjusted from standard ambient to -50 $^{o}$F at a rate not to exceed 5 $^{o}$F per minute.

(3) The BEB will be stabilized at -50 $^{o}$F. Stabilization is attained when the temperature of the functional part(s) of the test item considered to have the longest thermal lag reaches a temperature that is within the temperature tolerance of the air surrounding the test item.

(4) This condition will be maintained for at least 2 hr.

(5) The BEB will be visually inspected. Any damage or performance degradation will be recorded.

f. Operation.

(1) The chamber will be raised to -25 $^{o}$F and maintained until the BEB is stabilized at -25$^{o}$F for at least 2 hr. The plug-in accessories will be energized when the chamber air reaches -25 $^{o}$F. Upon energizing the accessories, the data sample rate will be adjusted to one sample per min.

(2) After stabilization, the BEB will be visually inspected, and an engine start attempt will be performed. The engines will be operated at idle. The control gauges, circuit breakers, switches, and displays will be functionally checked. Engine operations will not exceed 10 min. Any damage or performance degradation will be recorded.

g. The following data will be recorded:

| |
|---|
| BEB pretest preparation |
| Test facilities and instrumentation |
| Deviations from test procedures (if applicable) |
| Test duration |
| Test item configuration |
| Locations of thermocouples |
| Stabilization times |
| Temperatures versus time conditions for each thermocouple |
| Battery voltage |
| Starter current |
| Inspection results |
| Operational test results |

## 2.9 RELIABILITY AND MAINTAINABILITY

### 2.9.1 Objective

The objective of this test is to determine if the BEB satisfies the reliability and maintainability requirements in the PD.

### 2.9.2 Criteria and Data Analysis

TABLE 2.9-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 76 - PFD | If three self-inflating PFDs approved by USCG or 46 CFR 160.076 approved type-V, special-use inflatable PFDs are provided, and the PFDs are Army green, camouflage, or black when not inflated, the criterion will be met. |
| 77 - Throwable Flotation | If a USCG-approved, type-IV PFD (ring or horseshoe buoy), in accordance with 46 CFR 160.050 (ref 26), and storage space or mounting provisions for the PFD are provided, the criterion will be met. |
| 78 - Line Cutting Device | If a manual hand-held device is provided for cutting through mooring lines in emergency conditions, and mounts are provided to stow the device safely and securely, the criterion will be met. |
| 93 - Anchor and Line | If an anchor and at least 100 ft of line are provided, the criterion will be met. The type of anchor line and line strength will be verified by the contractor. |
| 95 - POL Leakage | If the POL external leakage for components such as the engine, gearboxes, and pump drive does not exceed Class 2 for dust-free conditions or Class 2D for dusty conditions in accordance with SAE J1176 (ref 27), and no fluid leakage is present in the fuel, hydraulic, and cooling systems, the criterion will be met. |
| 98 - BII | If the minimum BII (PFDs; throwable flotation device; anchor and line; mooring, towing, and steering lines; hand tools; hand pump; first aid kit; line-cutting device; document pouch; mats; headsets; digital range finder; and hand-portable fire extinguisher) is provided with each BEB, and all BII can be adequately stowed, the criterion will be met. |
| 99 - Mooring, Towing, and Steering Lines | If at least six double-braided polyester lines with a 5/8-in. minimum diameter are provided, the lines are at least 50 ft long and have an eye splice on one end and are sized for the tie-offs on the BEB or IRB, whichever is greater, the minimum line breaking strength of the lines is at least three times the forward static bollard pull or the maximum static load required in service, whichever is greater, the criterion will be met. The type of line used and its rated strength will be verified through contractor certification. |
| 100 - Hand Tools | If all tools (at a minimum, 8-in. adjustable wrench, No. 2 Phillips screwdriver, and a 1/4-in. flat tip screwdriver) required for PMCS and a tool bag to hold the hand tools are provided, the criterion will be met. |
| 101 - Hand Pump | If a marine-grade, self-priming, manually operated, portable hand pump is provided for dewatering, the criterion will be met. |
| 102 - First Aid Kit | If a two-person first aid kit is provided, and the kit is protected against the weather and can be stowed in the operator's station, the criterion will be met. |
| 103 - Document Pouch | If a waterproof, ultraviolet (UV)-resistant document pouch, large enough to hold an 8-1/2- by 11- by 1-in. three-ring binder and an Operator's Manual, is provided, the criterion will be met. |

TABLE 2.9-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 104 - Mat(s) | If anti-fatigue, self-draining, marine-quality mats are provided and secured in the crew station, and the mats can be removed using common tools, the criterion will be met. The mat type and characteristics will be verified through contractor certification. |
| 105 - Headsets | If stowage space is provided in the crew station for two communication headsets, the criterion will be met. |
| 106 - Digital Range Finder | If one battery-powered, digital eye-safe laser range finder (ESLRF) capable of determining the straight-line distance between the operator and the shore from 66 to 2000 ft (threshold) (40 to 2000 ft (objective)) is provided, the ESLRF provides elevation in degrees (threshold) (percentage (objective)) and compass bearing readings, and the ESLRF provides electronic output or storage (objective), the criterion will be met. |
| 107 - Hand Portable Fire Extinguisher | If a type-B, size I, hand-portable fire extinguisher is provided, and the extinguisher can be accessed from the crew station, the criterion will be met. The type and size of the fire extinguisher will be verified through contractor certification. |
| 108 - Lubricants and Fluids | If all fluids and lubricants are compatible and in accordance with the specified requirements, unless approved by the PCO, the criterion will be met. |
| 109 - Lubrication Fittings | If lubrication fittings are provided for all moving parts that require lubrication, and the fittings are in protected locations, accessible using a grease gun with a 10-in. flexible extension, and accessible without removing or adjusting accessories or parts, the criterion will be met. Remote or extended lubrication fittings can be used. |
| 110 - Propulsion | If the vendor has certifications showing that the propulsion system provides the thrust to meet performance requirements without exceeding the component manufacturer's recommended installation requirements, durability and horsepower rating, the criterion will be met. |
| 111 - Oil Change System | If each engine employs an oil change system, and the engine oil can be drained into portable containers using only common mechanics hand tools with the BEB in or out of the water, the criterion will be met. |
| 112 - Oil Filters | If the oil filters can be replaced using common mechanics hand tools, and no other equipment has to be disconnected or removed to replace the oil filters, the criterion will be met. |
| 113 - Oil Sampling Valves | If an engine oil sampling valve, allowing an in-stream sample to be taken before the engine oil filter, is provided on each engine, the valve is manually operated and closes automatically when released, and the valve discharge port is covered with a captive chain cap, the criterion will be met. |
| 114 - Reliability | If the BEB achieves reliability of 275 hr mean time between hardware system aborts (MTBHSA) and 143 hr mean time between hardware essential function failures (MTBEFF) (objective), the criterion will be met. |
| 115 - Maintenance Ratio (MR) | If the BEB operates continuously without maintenance for at least 9 hr and the maintenance man hour per operating hour (MMH/OH) ratio does not exceed 0.136, allocated as MMH/OH ratio of 0.10 for field-level maintenance and MMH/OH ratio of 0.036 for sustainment-level maintenance, the criterion will be met. |

TABLE 2.9-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 116 - Maintainability, Supportability | If special tools not contained in the tool sets are provided (threshold) and the tools required for BEB maintenance are provided in the following tool sets (objective), the criterion will be met:<br><br>-Army general mechanics tool kit, automotive (NSN 5180-00-177-7033)<br>-General mechanics (NSN 5180-01-454-3787)<br>-Common No. 1 organizational maintenance (NSN 4910-01-754-0654)<br>-Common No. 2 (NSN 4910-00-754-0650)<br>-Supplemental No. 1 (NSN 4910-00-754-0653)<br>-Forward repair system (NSN 4940-01-463-7940) |
| 117 - At Platform Diagnostic Capabilities | If the BEB has at-platform diagnostics or embedded diagnostics in accordance with the specifications in the PD, and when practical, the BEB has the diagnostic ability to identify major system line replaceable unit (LRU) failures (e.g., check engine lights, blinking/flashing lights etc.), the criterion will be met. |



### 2.9.3 Test Procedures and Data Required

a. Prior to each shift of operation, the ATC crew members will perform scheduled PMCS on each BEB to ensure that all the fluids are filled to their appropriate levels, all functions are properly working, and that no degradation has occurred to the BEB.

b. The BEB will be inspected to determine if:

(1) PFD. Three USCG-approved self-inflating PFDs or 46 CFR 160.076-approved, type-V, special-use inflatable PFDs are provided, and the PFDs are Army green, camouflage, or black when not inflated. The types and sizes of the PFDs will be verified through contractor certification.

(2) Throwable flotation. A USCG-approved, type-IV PFD (ring or horseshoe buoy) in accordance with 46 CFR 160.050 is provided, and storage space or mounting provisions are provided for the PFD. The PFD type will be verified through contractor certification.

(3) Line cutting device. A manual hand-held device is provided for cutting through mooring lines in emergency conditions, and mounts are provided to stow the device safely and securely.

(4) Anchor and line. An anchor and at least 100 ft of line are provided. The type of anchor and line strength will be verified through contractor certification.

(5) Mooring, towing, and steering lines. At least six double-braided polyester lines with a 5/8-in. minimum diameter are provided, and the lines are at least 50 ft long, have an eye splice on one end and are sized for the tie-offs on the BEB or IRB, whichever is greater, and the minimum line breaking strength is at least three times the forward static bollard pull or the maximum static load required in service, whichever is greater. The type of line used and its rated strength will be verified through contractor certification.

(6) Hand tools. All tools (at a minimum, 8-in. adjustable wrench, No. 2 Phillips screwdriver, and a 1/4-in. flat tip screwdriver) required for PMCS and a tool bag to hold the hand tools are provided.

(7) Hand pump. A marine-grade, self-priming, manually operated, portable hand pump is provided for dewatering.

(8) First aid kit. A two-person first aid kit is provided, and the kit is protected against the weather and can be stowed in the operator's station.

(9) Document pouch. A waterproof, UV-resistant document pouch, large enough to hold an 8-1/2- by 11- by 1-in. three-ring binder and an Operator's Manual, and storage for the pouch are provided.

(10) Mats. An anti-fatigue, self-draining marine-quality mat or mats are provided and secured in the crew station, and the mat or mats can be removed using common tools. The mat type and characteristics will be verified through contractor certification.

(11) Headset stowage. Stowage space is provided in the crew station for two communication headsets.

(12) Digital range finder. One battery-powered, digital ESLRF capable of determining the straight-line distance between the operator and the shore from 66 to 2000 ft (40 to 2000 ft (objective)) is provided, the ESLRF provides elevation in degrees or percentage and compass bearing readings, the ESLRF provides electronic output or storage (objective), and storage for the finder is provided.

(13) Hand portable fire extinguisher. One type-B, size-I hand-portable fire extinguisher is provided, the extinguisher can be accessed from the crew station, and a mounting provision is provided for the extinguisher. The type and size of the fire extinguisher will be verified through contractor certification.

c. POL Leakage. POL external leakages for components such as the engine, gearboxes, and pump drive will be classified in accordance with SAE J1176. Leakage rates will be checked to determine whether they exceed Class 2 for dust-free conditions or Class 2D for dusty conditions.

d. BII. The BII will be inspected to determine If the following items have been provided with each BEB. The BII will be stowed for the fit test and remain stowed throughout testing.

(1) PFDs.

(2) Throwable flotation device.

(3) Anchor and line.

(4) Mooring, towing, and steering lines.

(5) Hand tools.

(6) Hand pump.

(7) First aid kit.

(8) Line-cutting device.

(9) Document pouch.

(10) Mats.

(11) Headsets.

(12) Digital range finder.

(13) Hand-portable fire extinguisher.

e. Fluids, Lubricants, and Fittings.

(1) Lubricants and fluids. All fluids and lubricants will be checked to determine conformance with the specified requirements.

(2) Lubrication fittings. All moving parts that require lubrication will be checked for the presence of a lubrication fitting. It will be determined if the fittings are located in protected locations, accessible by a grease gun with a 10-in. flexible extension, and accessible without removing or adjusting accessories or parts, and if remote or extended lubrication fittings can be used.

f. Propulsion. Vendor-provided certifications will be checked to determine if the propulsion system provides the thrust to meet performance requirements without exceeding the component manufacturer's recommended installation requirements, durability and horsepower rating.

g. Oil.

(1) Oil change system. Each engine will be checked to determine if an oil change system is employed, and if the engine oil can be drained into portable containers using only common mechanic's hand tools with the BEB in or out of the water.

(2) Oil filters. It will be determined if the oil filters can be replaced using common mechanic's hand tools, and if any other equipment needs to be disconnected or removed to replace the oil filters.

(3) Oil sampling valves. Each engine will be inspected to determine if an engine oil sampling valve, allowing an in-stream sample to be taken before the engine oil filter, is provided, if the valve is manually operated and closes automatically when released, and if the valve discharge port is covered with a captive chain cap.

h. Reliability. Five BEBs will each undergo 400 hr of reliability testing in accordance with the operational duty cycle simulation (table 2.8-2). The BEBs will be operating on JP-8 fuel. Two empty IRB interior bays will be attached to each BEB when simulating anchoring, bridge building/retrieval, and rafting. The MTBHSA and MTBEFF are defined in the Failure Definition/Scoring Criteria (FD/SC) (ref 28).

TABLE 2.9-2. OPERATIONAL DUTY CYCLE SIMULATION

| STEP NO. | DESCRIPTION |
|---|---|
| 1 | Simulate rafting - full throttle for 37 min; two-bay conventional-configuration (alternate: two-bay longitudinal configuration) |
| 2 | Simulate bridge building/retrieval - run eight varied-throttle cycles<br><br>One varied-throttle cycle = 5 min full throttle<br>30 sec idle<br>30 sec full throttle<br>30 sec idle |
| 3 | Simulate anchoring - half throttle for 11 min |
| 4 | Disconnect bays from BEB |
| 5 | Simulate patrol - full throttle for 25 min |
| 6 | Reconnect bays to BEB |
| 7 | Simulate rafting - full throttle for 42 min |
| 8 | Simulate bridging building/retrieval - run seven varied-throttle cycles |
| 9 | Simulate anchoring - half throttle for 14 min |
| 10 | Disconnect bays from BEB |
| 11 | Simulate patrol - full throttle for 42 min |
| 12 | Reconnect bays to BEB |
| 13 | Shut down engine in accordance with commercial off-the-shelf (COTS) manuals. Conduct immediate restart on each engine using proper procedures. |
| 14 | Shut down engines for 5 min, or longer as necessary if refueling. After the engine-off period, restart. |

i. MR. The MR will be calculated using the total cumulative maintenance man-hours divided by the operating hours (engine hour meter). Maintenance induced errors, crew errors, and operator/inspection times will be excluded.

j. Maintainability/Supportability. The following tool sets will be checked to determine if the tools required for BEB maintenance are provided. Any special tools required for BEB maintenance and whether or not they are provided with the BEB will be recorded.

(1) Army general mechanics tool kit, automotive, (NSN 5180-00-177-7033).

(2) General mechanics (NSN 5180-01-454-3787).

(3) Common No. 1 organizational maintenance (NSN 4910-01-754-0654).

(4) Common No. 2 (NSN 4910-00-754-0650).

(5) Supplemental No. 1 (NSN 4910-00-754-0653).

(6) Forward repair system (NSN 4940-01-463-7940).

k. At Platform Diagnostic Capabilities. Faults will not be induced during testing. However, if faults occur, the BEB at-platform diagnostics or embedded diagnostics will be checked to determine conformance with the specifications in the PD.

l. The following data will be recorded:

| |
|---|
| Engine hours |
| Fuel consumption |
| Duty cycles performed |
| Maintenance performed |
| Diagnostic actions |
| TIRs |
| Service, part, and mission forms |
| Photographs |





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## 2.10 TRANSPORTABILITY

### 2.10.1 Objectives

The objectives of this test are:

a. To determine if the BEB meets the requirements for configuration, function, and structural integrity as required for safe lifting during inter-modal transportation by assets of the Defense Transportation System (DTS).

b. To develop appropriate and satisfactory rigging procedures for connection of the test load to transporting aircraft by the end user.

c. To determine if the test load can be safely transported and delivered as a stable, externally suspended load by helicopter.

d. To determine if the BEB can withstand the effects of rail impact without damage or performance degradation.

### 2.10.2 Criteria and Data Analysis

TABLE 2.10-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 63 - Depth Sounder | If the sensor (transom-mounted transducer) is not damaged during BEB transport, the criterion will be met. |
| 71 - Highway Transport | If the BEB in transport configuration is highway transportable in accordance with MIL-STD-1366E (ref 29), and the BEB/BAP can withstand the shock and vibration encountered in ground transportation without damage or degradation (threshold), the criterion will be met. |
| 72- External Air Transport (EAT) | If the BEB meets the requirements in MIL-STD-209K and MIL-STD-913A for external helicopter transport and the BEB alone and the BEB in transport configuration are capable of dual point lift from a CH-47 helicopter (threshold) (CH-53 helicopter (objective)), the criterion will be met. |
| 119 - Transportation | If the BEB and the BEB in transport configuration is capable of being transported worldwide by rail, marine, highway, and air modes, the criterion will be met.<br><br>Guidance on transportability criteria to include load distribution and maximum dimensions is provided in MIL-STD-1366E, MIL-HDBK-1791, and Transportation Engineering Agency (TEA) Pamphlet 70-1 (ref 30 and 31). |
| 120 - Disassembly for Transport | If the BEB can be disassembled or reassembled by two Soldiers within 30 min using no more than onboard tools and BII, if disassembly is required to meet any of the transportation requirements, the criterion will be met.<br><br>Appliqué panel removal is not included in the time requirement. |

TABLE 2.10-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 121 - Rail Transport | If the BEB in transport configuration can be transported by rail in the Continental United States (CONUS) and NATO countries, the BEB in transport configuration can withstand shock loads resulting from rail impact testing without failure, the BEB in transport configuration meets the dimensional requirements of the Association of American Railroads (AAR) outline diagram for single loads, without end overhang, on open-top cars when loaded on a 51-in. high railcar, and the BEB in transport configuration meets the dimensional requirements of the NATO envelope-M equipment gauge diagram when mounted on a 51.4-in. high railcar, the criterion will be met.<br><br>These diagrams apply to standard gauge rail lines in CONUS and NATO countries, the criterion will be met. |
| 122 - Marine Transport | If the BEB in transport configuration, with or without the CBT or PLST, can be transported on commercial and military watercraft, the criterion will be met. |
| 123 - Air Transport | If the BEB in transport configuration can be transported in C-130 aircraft (objective), the criterion will be met. |
| 124 - Tie-Down Provisions | If the tie-down provisions conform to MIL-STD-209K, the BEB has four tie-down provisions to permit attachment to the floor or deck of the transportation system, and all provisions are labeled LIFT or LIFT/TIE-DOWN in not less than 1-in. high letters, the criterion will be met.<br><br>The tie-down provisions on the BAP are not sufficient to secure the weight of the BEB. The weight to be used when calculating the required strength of the tie-down devices will include the BEB in transport configuration at full load condition. Tie-down provisions may also be used as lifting provisions when such provisions meet the requirements. |
| 125 - Slinging/ Lifting Provisions | If the BEB has slinging provisions conforming to MIL-STD-209K and MIL-STD-913A for EAT, the BEB in transport configuration is capable of a single-point lift for loading with a crane, and all provisions are labeled LIFT or LIFT/TIE-DOWN in not less than 1-in. high letters, the criterion will be met.<br><br>The use of spreader bars is not permitted. Slinging provisions may also be used as tie-down provisions when such provisions meet the requirements, the criterion will be met. |
| 126 - BEB Transportability Data Plate(s) | If each BEB has a transportability data plate that shows a silhouette of the BEB in the transport configuration and lists the item name and model/mark number, item serial number, NSN, contractor, contract number, date manufactured, shipping weight, maximum height and width, CG, and CG location and capacity of the slinging and tie-down provisions, and the plate is permanently attached/affixed to the BEB in accordance with MIL-HDBK-1223 and A-A-50271 (ref 32 and 33), composition C, type I style I for identification plates and type III (style not applicable) for all others in a viewable position from a person on the ground, the criterion will be met. |

### 2.10.3 Test Procedures and Data Required

a. Transportability Data Plate. The transportability data plate will be inspected to determine if it contains the required information, if the plate is permanently attached/affixed to the BEB, and if the plate can be viewed by a person on the ground.

b. Lift and Tie-Down.

(1) The tie-down and slinging/lift provisions will be inspected to determine if they are properly labeled. The conformance of the BEB slinging and tie-down provisions with MIL-STD-1366E, MIL-STD-913A and MIL-STD-209K, paragraph 5.1 will be examined. TOP 1-2-500 (ref 34) will be used as a general guide during testing. Test methodologies and applied test loads will be consistent with the guidance from the Military Surface Deployment and Distribution Command - Transportation Engineering Agency (SDDCTEA). Physical characteristics data (para 2.3) will be employed for this effort. The weight, CG measurements, dimensions, lift/tie-down provision locations, and placement factors with drawings or images of the system will be provided to SDDCTEA for use in developing the slinging and tie-down requirements and in determining the correct loads to be applied during testing.

(2) The number, types, locations, arrangement, principle dimensions, clearances, and any labeling of the BEB slinging and tie-down provisions will be compared to the requirements in MIL-STD-209K, paragraph 5 and Figures 1 through 15.

(3) Load cells and transducer indicators will be used to monitor applied forces during static pull tests. Air bags, bottle jacks, floor jacks, hydraulic cylinders, cranes, and/or a mobile field dynamometer will be used to apply the required forces. The orientation of the shackles used to connect the load cell/test instrumentation to the provisions will be examined to ensure that bending loads in the shackle are kept to a minimum. After releasing the load, the provisions and adjacent structural members will be examined for any type of deformation, including measurement of relevant dimensions and separation of the provisions for comparison with pretest measurements.

(4) Tie-down provisions. The BEB in transport configuration will be positioned on the bedplate at the ATC Lift and Tie-Down Facility and will undergo tie-down provision strength testing.

(a) The method/means of securement will be recorded. The tie-down provisions will be tested for the load requirements listed in Table 2.9-2.

TABLE 2.10-2. LOAD REQUIREMENTS FOR TIE-DOWN PROVISIONS

| DESIGN LOAD LIMIT | AXIS | DIRECTION OF LOAD |
|---|---|---|
| 4.0 times gross weight | Longitudinal | Fore and aft |
| 2.0 times gross weight | Vertical | Downward |
| 1.5 times gross weight | Lateral | Left and right |

Note: Table derived from MIL-STD-209K, Table I.

(b) The loads will be applied statically and independently. The directional load will be distributed among the provisions that would effectively resist the motion along that axis. For example, if two provisions are used to restrain the BEB longitudinally, the load will be shared proportionately. If the provisions are not located symmetrically about the CG measurements of

the BEB, the proportionate share of the load will be calculated in accordance with

MIL-STD-209K. The highest load share will be applied to the respective provision for at least 6 sec. The load applied, provision tested, and rigging configuration will be recorded. The provisions and their supporting hardware will be visually inspected after each load trial. If deemed necessary, the supporting hardware will undergo nondestructive test (NDT) methods (magnetic-particle inspection, dye penetrant, X-ray, etc.).

(5) Lifting provisions. Because the BEB has a helicopter sling loading (HSL) requirement in addition to the normal crane slinging requirements, the BEB lifting provisions must satisfy the requirements in MIL-STD-209K and MIL-STD-913A. The BEB mounted on a cradle will be used to test the BEB and/or cradle lift provisions (as specified on the transportation data plate) for crane lift. The BEB alone will undergo HSL static and lift provision testing. The BEB will be positioned on the bedplate at the ATC Lift and Tie-Down Facility and will undergo provision strength testing.

(a) The lift provisions will be tested for crane lift in accordance with MIL-STD-209K.

(b) The lift provisions will be tested to a design limit load of not less than the lift point load factor times the static load (gross weight of the item). Each load application will be performed for at least 90 sec. The load factor is identified in Table 2.10-3.

TABLE 2.10-3. HELICOPTER MATERIEL LIFT POINT LOAD FACTOR

| HSLWT/ MPFA,[a] lb/ft$^2$ | EATWT, lb | LOAD FACTOR |
|---|---|---|
| ≤45 | <5,000 | 5.9 |
| ≤45 | 5,000 to 15,000 | 5.6 |
| ≤45 | 15,001 to 36,000 | 3.2 - [0.000038 x (HSLWT - 15,000] + 2.4 |
| >45 but <60 | <5,000 | 3.5 + [0.16 x (60 - HSLWT/MPFA))] |
| >45 but <60 | 5,000 to 15,000 | 3.2 + [0.16 x (60 - HSLWT/MPFA))] |
| >45 but <60 | 15,001 to 36,000 | 3.2 - [0.000038 x (HSLWT - 15,000)] + [0.16 x (60 - HSLWT/MPFA))] |
| ≥60 | <5,000 | 3.5 |
| ≥60 | 5,000 to 15,000 | 3.2 |
| ≥60 | 15,001 to 35,000 | 3.2 - [0.000038 x (HSLWT - 15,000] |

EATWT = EAT weight.
HSLWT = HSL weight.
MPFA = Maximum projected frontal area.

Notes: The MPFA for a single-point load is the maximum area projected on a vertical plane. The side of the BEB would serve as the MPFA.
This table was derived from MIL-STD-209K, Table A-1.

(6) The following data will be recorded:

| |
|---|
| Load at apex |
| Sling lengths and corresponding link counts |
| Sling angles |
| Individual sling loads |
| Problems encountered |
| Type, location, orientation, number, principle dimensions, function(s), rating, manufacturer's part number, range of motion, and marking of each provision |
| Type of sling used to suspend load |
| Types, numbers, and applications of any sling set accessories used to suspend load: chain extensions, coupling links, additional sling apexes, etc. |
| Type of suspension: single- or dual-point |
| Link count for each sling leg |
| Any special equipment required to suspend load: spreader bars, insulation, etc. |
| Length of rigging applied for lift |
| Type and range of load cell |
| Description of load application apparatus |
| Type and range of hydraulic cylinder used for applying loads |
| Applied loading as function of time |
| Duration of each applied load |
| Photographs of the test configurations and any deformation experienced |

c. HSL.

(1) Test operations supportive of HSL certification will be performed in two stages in accordance with MIL-STD-913A. The first stage is a series of engineering exercises performed by the test agency to ascertain if the test load can be rigged and suspended by a military standard sling set as a stable and structurally integral load (prerequisites to a flight demonstration). The second stage consists of lifting, flying, and delivering the test load to a landing zone by military helicopter to determine its flightworthiness. The test agency will coordinate all testing and data with the certifying agency (U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC)) for HSL.

(2) The number, types, locations, arrangement, and any labeling of the test load lifting provisions will be compared to the requirements in MIL-STD-209K, Figure 3 for such fittings.

(3) Static lift. The ability of the test load to be rigged as a stable load for HSL will be determined.

(a) FMs 10-450-4 and 10-450-5 (ref 35 and 36) will be consulted to determine if the rigging for an existing configuration can be used. If none is applicable, the appropriate link count will be achieved by trial-and-error. Link count increments of 5 will be employed except where chain ends are secured at a link count of 3, consistent with prevailing field practice and as directed by NSRDEC.

(b) The test load will be rigged in the single- and/or dual-point HSL lift configuration by standard military sling set of capacity consistent with the test load gross weight suspended with a crane. Sets currently used are the Army 10,000- and 25,000-lb capacity and U.S. Marine Corps (USMC) 15,000-lb capacity multi-leg and 40,000-lb capacity sling sets.

(c) Static load stability and attitude of the suspended load will be checked and sling adjustments will made as necessary to achieve a nominal flight attitude of 3 to $5^{o}$ front down. The inclination of the test load will be measured relative to horizontal as suspended during HSL.

(d) The link counts required to achieve the requisite flight attitude of the test load, without contact between the fabric sections of the slings and suspended load, will be recorded. The link count corresponds to the specific link from the free end of the chain that is inserted in the connection point at the grab hook. The location of any sling contact with the suspended load will be marked as reference for proof load testing. Proof load testing will be warranted for clearances less than 1 in., at the discretion of NSRDEC.

(4) Proof load, HSL. This test will be performed to validate the structural integrity of the slinging provisions if lifting provisions were not previously certified for the gross shipping weight (GSW) of the test load, interference of the test load structure with rigging, proximity of rigging to the test load of less than 1 in., or specifically required by NSRDEC. If proof loading is required, an applied loading, representative of the worst-case experienced during HSL, will be applied for not less than 90 sec through the sling apex to the lifting provisions of the test load while it is suspended at approximately the flight attitude achieved during the static lift test.

(a) An applied loading, representative of the worst-case experienced during HSL, will be applied for not less than 90 sec through the sling apex to all four lifting provisions of the test load for single-point lift. The legs of the chain sling used to apply the load will be adjusted to match the respective lengths of the military standard sling set legs at the link counts employed during the static lift, resulting in a comparable item inclination during simultaneous loading of its provisions.

(b) The primary structural members of the load will be restrained at a limited number of points of symmetry about its CG to induce an approximation of the bending moments generated by the net of weight distribution of the load, prevent unrealistic stress concentrations throughout the structure of the load, and avoid static indeterminacy of the restraints. The restraints will be secured to load blocks constrained between multiple rails embedded in a level concrete bed plate.

(c) Determination of applied loads. The total apex loading for HSL will be calculated as the product of the materiel lift point load factor (MLPLF) and the HSLWT of the test load. The MLPLF is a function of the HSLWT and the MPFA-to-HSLWT ratio, MIL-STD-209K, Appendix A, Table A-1. The MPFA of the test load will be derived as the product of the overall height and diagonal projection of length of the suspended load.

(5) Flight demonstration, HSL, load stability. The test load will be rigged, lifted, flown through a series of prescribed maneuvers, and returned to a landing site by an appropriate rotary winged or vertical/short takeoff and landing (V/STOL) aircraft in accordance with the requirements for a flight demonstration derived from MIL-STD-913A. This will be done to observe load stability and ability to resist the dynamic effects of EAT. It is not an assessment of the aircraft. Specific methodologies, materials, and personnel skills used for general

preparation and rigging the item for flight will be consistent with guidance presented in FM 10-450-3 (ref 37). The ATC Transportability Unit Leader will provide oversight to ensure consistency of field operations. The flight demonstration will be observed by a NSRDEC representative.

(a) Facilities. The flight demonstration will be conducted at Phillips Army Airfield (PAAF), which will provide for airspace coordination and control, facilities for participating pilot briefings/debriefings, a common landing and delivery zone at which staging and load connect/disconnect will be performed, emergency services, and a UH-1 chase aircraft and crew. Restricted airspace over ATC-controlled ranges through which a designated flight plan with discrete waypoints has been established for Department of Defense (DOD) helicopters and V/STOL.

(b) Preoperational review.

All test participants will be briefed prior to and debriefed after completion of the flight demonstration. At a minimum, the briefing will encompass a description of the operation and its objectives, the nature of the test load, key elements of the ATC risk assessment and DTC Safety Release for the flight demonstration, essential cautions and warnings, the flight plan and rules/limitations for flight over ATC ranges, the roles of each participant group, emergency procedures, and communications requirements. The debriefing will include a discussion with the transporting and chase aircraft flight crews of load and aircraft flight characteristics and any lessons learned.

Prior to flight operations, the crews of the transporting and chase aircraft will review the normal and emergency procedures for transporting external loads, including aborting the operation; maximum permissible fleet (cone) angle; maximum allowable airspeed, angle of bank, and rate of descent; and conditions for emergency jettison of the load.

(c) Rigging. After deployment of the test load at PAAF and preparation to prevent equipment loss or damage in accordance with the general directions and procedures in FM 10-50-3, the BEB will be rigged for the first of any appropriate HSL lift configurations with a military standard sling set appropriate to the HSLWT of the test load and the type of transporting aircraft. Three Army school-certified civilian rigging inspectors will serve as the hookup and receiving teams of a ground crew, performing as signalman, apex fitting handler, and a static-discharge wand handler. Prior to flight operations, the crew chief of the transporting aircraft will inspect the item preparation, sling sets, and rigging process and the ATC ground crew will record the results of their sling set inspections on a Sling Load Inspection Record (Department of the Army (DA) Form 7382-R). The same area will be used as the supported and receiving unit landing sites.

(d) Load connection to transporting aircraft.

The hookup team will take positions to direct the aircraft approach and prepare for hookup of the load while standing beside or on top of the load. As the transporting aircraft hovers over the vehicle, it will be grounded at the center cargo hook by the static-discharge wand handler. This connection will be maintained until the sling apex fitting or pendant is attached to the center cargo hook for single-point lift. The ground crew will guide the sling legs to prevent their entanglement with the load as the aircraft maneuvers to remove slack. The ground crew will then evacuate the vicinity of the load to its right side, allowing the left side for emergency landing of the aircraft if required, and signal clear for the aircrew.

Minor sling misalignment or interference will be remedied by a rigger approaching the load and realigning the sling leg. If the riggers actions do not remedy the situation within 10 to 15 sec, the rigger(s) will clear the load to the right side of the aircraft. After the riggers clear the load, the aircraft will be instructed to release the cargo hook. Following release, the aircraft will clear the hook-up area while the load is rerigged and prepared for a second connection attempt.

(e) Flight operations.

Flight operations will be conducted in accordance with the procedures and limitations in the CH-47D Operator's Manual and Aircrew Training Manual, the Multiservice Flight Data Collection Sheet (MSFDCS) maneuver requirements, and during visual meteorological conditions (VMC). The PAAF chase helicopter will maintain constant communication with the transporting aircraft and serve as the communication liaison between it and all other ATC participants and the PAAF tower.

After liftoff of the test load, hover in ground effect (HIGE) and out of ground effect (HOGE) (70 and 100 ft, respectively) above ground level (AGL), transition to forward flight, a series of flying maneuvers, and transition to hover will be accomplished in accordance with the MSFDCS. The transporting helicopter aircrew will provide their experienced assessment of the flight characteristics of the suspended load and aircraft response on a five-point scale on the MSFDCS.

Forward flight will be initiated at 10 knots indicated air speed (KIAS), or as low as practical, and will increase in 10-KIAS increments until sway of the load to the aircraft's cone angle limitation or load instability is imminent. Aerodynamic behavior of the test load will be constantly monitored by the crew chief of the test aircraft and personnel onboard the ATC UH-1C chase helicopter and reported to lifting helicopter pilots for immediate corrective actions. If the load becomes unstable, the transporting aircraft will be slowed to a speed at which load stability is achieved; with a right or left level turn to correct longitudinal oscillation, and level deceleration to correct lateral oscillation. The same approach will be taken for climbing/ descending and turning maneuvers, which will be performed in gradual fashion while maintaining close observation of load stability.

The suspended load will then be delivered to the landing zone and the aircraft moved sufficiently to the side of the test load to release the sling without its apex striking the test load. Ground personnel will not approach the load until the aircraft has released the load and has departed to the preassigned landing area or until the aircraft has departed to initiate a succeeding flight test.

(6) Data acquisition (DAQ) and instrumentation.

(a) Static lift. A digital level (resolution to $0.1^{o}$) will be used to measure the inclinations. Standard mensurative devices such as tape measures and calipers will be used to determine dimensions. The rigging equipment and configurations used will be recorded manually in a logbook. A photographic record will be maintained of the rigging configurations and suspended load.

(b) Proof load.

Loadings will be applied through a Baltimore Hydraulics 36,000- or 86,000-lb capacity hydraulic cylinder placed in line between the sling apex and crane. This will provide finer control of the forces than would be available by action of the crane winch alone. An Enerpack GPER3340B 10,000-psi capacity hydraulic pump will be used to control the motion of the cylinder while the pump operator monitors the resultant loading as measured by the load cell connected to the sling apex.

Applied loadings will be measured using strain-gage based load cells of 10,000- through 100,000-lbf ranges (accuracy $\pm$1 percent of the reading). Load cell output will be monitored using a 16-bit multifunction DAQ system in conjunction with a Signal Conditioning Extensions for Instrumentation (SCXI) universal strain gage input module. The text file output will be imported into Microsoft Excel for analysis and plotting.

(c) Flight demonstration. No specific measurements of test load response will be taken during this test. The aircrew of the transporting helicopter will rely entirely on aircraft instrumentation and direct observation to control and characterize the dynamics and safety of the flight. The aircrew of the transporting helicopter will provide their experienced assessment of the flight characteristics of the suspended load and aircraft response on a five-point scale on a MSFDCS derived from MIL-STD-913A on which they will rate, provide comments, notate flight limitations, and document relevant information regarding the aircraft, rigging, and ambient atmospheric conditions. A videographer in a UH-1C chase helicopter from PAAF will record the flight event through the video function of a forward-looking infrared (FLIR) camera.

(7) Inspections. The test load will be visually inspected for any deformation or damage to or in the vicinity of the lifting provisions and associated structure in line with the applied proof loadings. Relevant dimensions and separation of the provisions will be measured before and after the applied loadings for comparison. The test load will be visually inspected for any deformation or damage to the test item or loss of materiel after completion of the flight demonstration.

(8) The following data will be recorded.

| |
|---|
| Load at apex |
| Sling lengths and corresponding link counts |
| Sling angles |
| Individual sling loads |
| Problems encountered |
| Type, location, orientation, number, principle dimensions, function(s), rating, manufacturer's part number, range of motion, and marking of each provision |
| Type of sling used to suspend load |
| Types, numbers, and applications of any sling set accessories used to suspend load: chain extensions, coupling links, additional sling apexes, etc. |
| Type of suspension: single- or dual-point |
| Link count for each sling leg |
| Any special equipment required to suspend load: spreader bars, insulation, etc. |
| Length of rigging applied for lift |
| Type and range of load cell |
| Description of load application apparatus |

| |
|---|
| Type and range of hydraulic cylinder used for applying loads |
| Applied loading as function of time |
| Duration of each applied load |
| Type and serial number of helicopter |
| List of steps, materials, personnel, and time(s) required to prepare load for helicopter lift |
| Maximum allowable airspeed, angle of bank, and rate of descent |
| Completed MSFDCS for each flight test |
| Any damage, permanent deformation, including approximate measurement thereof, or other discrepancy resulting from loading or flight |
| Photographs and videos |

d. Rail Impact.

(1) MIL-STD-810G, Test Method 526, will be used as a general guide during testing, which will be conducted at the ATC Rail Impact Test Facility.

(2) Before testing, the BEB in transport configuration will be visually inspected and functionally checked. Any damages that might compromise the results of testing will be repaired.

(3) The BEB in transport configuration will be loaded onto a 140-ton DODX steel deck railroad flatcar equipped with a cushioned draft gear. The BEB in transport configuration will be secured in accordance with TEA Pamphlet 55-19 (ref 38).

(4) The flatcar with the BEB in transport configuration will be impacted against one stationary, 100-ton flatcar (buffer car). Steel plates will be loaded and secured to the buffer car with steel bracing, essentially making it a single mass body weighing at least 250,000 lb.

(5) The stationary flatcar will be positioned with the air and hand brakes set. Testing will be conducted on a straight, flat section of track. A shuttlewagon will be used to set the flatcar in motion at the desired speed. A calibrated noncontact fifth wheel attached to the shuttlewagon will be used as a speed indicator for the shuttlewagon operator.

(6) Actual impact speeds will be measured using an electronic timer that starts and stops with microswitches actuated by contact with the wheels of the moving flatcar. The microswitches will be placed 1.5 m (5 ft) apart, and the stop switch will be within 2.1 m (7 ft) of the point of impact. The speeds and orientations of the rail impacts are presented in Table 2.9-3. The speeds as well as other physical quantities will be measured in U.S. Customary System units and then converted to International System (SI) units. No adjustments to the loading or securing mechanisms or reconditioning of the bracing or items that are secured are allowed after test initiation.

(7) The BEB in transport configuration will be visually inspected after each impact and functionally checked after testing.

TABLE 2.10-3. RAIL IMPACT SPEEDS AND ORIENTATIONS

| IMPACT NO. | NOMINAL SPEED | | ORIENTATION |
|---|---|---|---|
| | km/hr | mph | |
| 1 | 6 | 4 | Forward |
| 2 | 10 | 6 | Forward |
| 3 | 13 | 8 | Forward |
| 4 | 13 | 8 | Reverse |

(8) The following data will be recorded:

| |
|---|
| Rail tie-down configuration (number, size, location and type of lashing |
| Load shifts or damages as a result of testing |
| Actual impact speeds |
| Visual inspections and functional check results |
| Photographs |
| Video of each impact |

e. Marine Transport. Physical characteristics data will be forwarded to SDDCTEA. Based on the data, SDDCTEA will perform a paper study to determine if the BEB is marine transportable.

f. C-130 Aircraft.

(1) MIL-HDBK-1791 and MIL-STD 1366E will be used as general guides during testing. Specific test methodologies are consistent with the guidance promulgated by the Air Transportability Test Loading Agency (ATTLA). A loadmaster from the U.S. Army C-130 Aviation Support Activity will serve as the subject matter expert (SME) for this exercise and supervise the roll-on/roll-off (RO/RO) loading operations. An ATTLA representative will be onsite to witness testing and inspect the BEB for certification.

(2) The BEB in transport configuration will be examined to determine if it is appropriately equipped with provisions for restraint in a C-130 aircraft.

(3) The BEB in transport configuration loaded on a 463L pallet train will be loaded with a K-loader. Tie-down patterns will be established and recorded. The BEB in transport configuration will then be offloaded and any anomalies will be recorded.

(4) The following data will be recorded:

| |
|---|
| C-130 airframe identification |
| Loadmaster and ATTLA representative identification |
| Inspection results |
| Time to configure BEB for RO/RO |
| Loading configuration |
| Time to load/unload |
| Safety incidents and/or health hazards |
| Clearance measurements |
| Photographs and video |

## 2.11 ELECTROMAGNETIC ENVIRONMENT EFFECTS (E3)

### 2.11.1 Objective

The objectives of this test are:

a. To determine if the BEB could maintain operational requirements during a simulated near-strike lightning (NSL) strike in accordance with MIL-STD-464C (ref 40).

b. To determine if the BEB undergoes any malfunction or degradation of performance when exposed to a simulated high-altitude electromagnetic pulse (HEMP) environment.

c. To determine the survivability of the BEB when subjected to personnel electrostatic discharge (PESD) and helicopter electrostatic discharge (HESD) as specified in MIL-STD-464C and Test Operations Procedure (TOP) 1-2-511 (ref 41).

d. To determine if the BEB is compatible when other subsystems are individually or collectively operated or activated as specified for electromagnetic compatibility (EMC) in MIL-STD-464C. Prior to EMC testing, voltage standing wave ratio (VSWR) and forward power measurements will be obtained from each radio to determine if the installation and operation of the radio is correct.

e. To determine the hazards of electromagnetic radiation to ordnance (HERO) and to verify that the BEB will not cause any onboard ordnances to detonate.

f. To determine the hazards of electromagnetic radiation to personnel (HERP) associated with the BEB and to provide recommendations to prevent needless personnel exposure to radiation levels in excess of permissible exposure limits (PELs) in accordance with MIL-STD-464C and Department of Defense Instruction (DODI) 6055.11 (ref 42).

g. To determine the hazards of electromagnetic radiation to fuel (HERF) and to verify that the system will not cause fuels to ignite.

### 2.11.2 Criterion and Data Analysis

TABLE 2.11-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 127 - NSL | If the BEB performs all mission-essential functions when exposed to an NSL environment, the criterion will be met. |
| 128 - HEMP | If the BEB survives exposure to HEMP in accordance with MIL-STD-2169B (ref 43), the criterion will be met. |
| 129 - PESD | If the BEB remains safe and reliable when subjected to PESD and HESD, the criteria will be met. |
| 129 - HESD | |
| 130 - EMC | If the BEB complies with the requirements in MIL-STD-464C, paragraph 5.2, the criterion will be met. |

**Comment [tdg1]:** Usually HEMP testing is in accordance with MIL-STD-2169B or do you want it to state "MIL-STD-464" as stated in your requirements??

TABLE 2.11-1 (Cont)

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 131 - HERO | If the BEB does not require precautionary measures to prevent detonating ordnances, the criterion will be met. |
| 132 - Radiation Hazard (RADHAZ) | If there are no HERP of the BEB, the criterion will be met. |
| 133 - HERF | If the BEB does not cause fuels to ignite by radiated electromagnetic environments (EMEs), including onboard emitters and external EME, the criterion will be met. |

**2.11.3 Test Procedures and Data Required**

a. MIL-STD-464C, TOP 1-2-511, DODI 6055.11, and MIL-STD-2169B will be used as general guides during testing, which will be conducted at the Electromagnetic Interference Test Facility (EMITF), Test Areas A or B. The shielded enclosures consist of filtered electrical power that is divided into separate phases for the BEB and the test equipment to achieve isolation and reduce conducted noise.

(1) EMITF Test Area A has a shielded enclosure (28.7 by 18.3 by 8.5 m (94 by 60 by 28 ft)) and a control room. Within the test enclosure are anechoic panels as required by MIL-STD-461F (ref 44), paragraph 4.3.2.1, that surround all four sides of the BEB. The panels consist of blocks of radio frequency (RF) absorber material manufactured by Cuming and fastened by contact cement to 1.2-m (4-ft) wide by 30-m (10-ft) high plywood sheets on casters. The chamber floor consists of a metal ground plane embedded beneath 15.2 cm (6.0 in.) of concrete. The electrical distribution includes 120/208 volts alternating current (VAC) at 60 Hz, 277/480 VAC at 60 Hz, 120/208 VAC at 400 Hz, and 28-volts direct current (VDC) variable prime power.

(2) EMITF Test Area B has a shielded enclosure (18.3 by 18.3 by 6.1 m (60 by 60 by 20 ft)) and a control room. Within the test enclosure are anechoic panels as required by MIL-STD-461F, paragraph 4.3.2.1, that consist of blocks of RF absorber material manufactured by ETS-Lindgren and fastened by contact cement to the walls and ceiling. The chamber floor consists of a metal ground plane embedded beneath 20.3 cm (8.0 in.) of concrete. The electrical distribution includes 120/208 VAC at 60 Hz, 120/240 VAC at 60 Hz, 277/480 VAC at 60 Hz, 120/208 VAC at 400 Hz, 28-VDC variable prime power.

(3) The EMITF is a full-time participant in the Army Metrology Calibration Program through the Test, Measurement, and Diagnostic Equipment (TMDE) laboratory. All calibrations are traceable to the National Institute of Standards and Technology (NIST). Test instrumentation accuracy is within the tolerances of $\pm$2 percent for frequency and $\pm$2 dB for amplitude in accordance with MIL-STD-461F.

b. NSL. This phase of testing will be conducted using two test setups. The E-Field simulator is a Marx stack capable of generating 2.5 MV. An open-air spark gap of approximately 1.0 m (3.3 ft) (will be used to simulate fields generated by NSL). The H-Field simulator will be made up of a group of Marx generators designed to generate the waveforms and amplitudes specified in MIL-STD-464C. The 50-kA moderate-threat portable lightning simulator will be used for this test. The simulator will be composed of six Marx stages, with each stage having a dedicated high voltage switch. The simulator produces Waveform A in MIL-STD-464C even when connected to inductive loads. Each simulator will be set up to drive a plate wide enough to cover the entire test object.

The BEB will be set up in an operational configuration starting in the power off mode. It will be positioned in a controlled area and placed in the field map volume of the NSL simulators in increasingly harsh EME to monitor the NSL effects on the BEB. ATC personnel will perform a functional check on each subsystem after exposure to the EME. The BEB will be exposed to a peak electric field intensity of 150 kV/m with a 3.5 by 1011 V/m/s rate-of-rise and a peak magnetic field of 1100 A/m with a 2.2 by 109 A/m/s rate-of-rise.

The following data will be recorded for NSL testing:

| |
|---|
| Test equipment and calibration data |
| Serial/model numbers of data acquisition (DAQ) instrumentation |
| Description, serial numbers, and dimensions of each BEB test unit |
| Description of system checks used to baseline the BEB and to determine its operating capabilities |
| Results of testing |
| TIRs |
| Photographs |

c. HEMP.

(1) The HEMP simulator is located at the Patuxent River Naval Air Station (NAS) HEMP Facility. The pulser has a rise time of 1 to 4 nanoseconds (ns) and a peak output voltage of 5 MV. Operating at a normal charge of 4 MV, the antenna radiates a peak electric field in excess of 50 kV/m, 3.0 m (9.8 ft) above the ground directly beneath the pulser. The pulser is contained in a low-pressure, gas-tight, fiberglass enclosure that is approximately 5.0 m (16.4 ft) long and 3.0 m (9.8 ft) in diameter. A command and control van contains instrumentation necessary to operate and monitor the pulser and serves as coordination point for site safety.

(2) The BEB will be positioned directly beneath the horizontally polarized dipole (HPD) simulator in both the parallel and perpendicular positions. During power-on and power-off configurations, the BEB will be exposed to an electric field intensity of 50, 75, and 100 percent of the required test level, as defined in MIL-STD-2169B, for a minimum of three pulses at each level. Test personnel will operate the BEB while it is exposed to a simulated HEMP environment and will record any upsets or failures during or after power-off and power-on testing. If anomalies should occur during the test, testing will be halted until the impact can be assessed.

(3) The following data will be recorded for HEMP testing:

| |
|---|
| Test equipment and calibration data |
| Serial numbers and dimensions of each test unit |
| Checks (audible signal) used to baseline the test unit and to determine its operating capabilities |
| Serial/model numbers of DAQ instrumentation |
| Results of testing |
| TIRs |
| Photographs |

d. Electrostatic Discharge (ESD).

(1) PESD. The BEB will be positioned in the EMITF shielded enclosure, configured for normal operations, and photographed. The BEB will be tested with the ESS-2000 Electrostatic Simulator and Discharge Gun, model No. TC-8150, with 500-pF capacitance and 500-Ω resistance. Each subsystem component identified by ATC personnel will be tested (power on) at ±4, ±8, ±12, ±16, ±20, and ±25-kV PESD requirement. All operator-accessible locations and exposed surfaces subject to operator adjustments or maintenance activities during operation will be tested. Each test location will receive three positive and three negative pulses at each voltage level, which will be stepped up to ±25-kV maximum discharge. If a problem occurs at a level less than the maximum, the level will be recorded, and testing for that test location will be stopped. The BEB will be functionally checked prior to and after each series of voltages.

The following data will be recorded for PESD testing:

| |
|---|
| BEB system functional check |
| Test equipment and calibration data |
| BEB system operation condition, control setting, terminations, and monitoring equipment used |
| BEB operating data |
| Test locations |
| Voltages tested at each location |
| Results of testing |
| TIRs |
| Photographs |

(2) HESD. The Naval Surface Warfare Center (NSWC) will perform HESD testing. HESD testing will be conducted in accordance with DODI 6055.11. A 300-kV ESD test will be conducted on the Hangar 144 Ramp to evaluate BEB basic response to an ESD. The test article will be tested with all systems powered down and in the transport configuration. System checks will be performed before and after each test level. The ESD simulator will be placed alongside the test article with the electrodes placed 2.54 cm (1 in.) from the hoist points. Both positive and negative polarity 300-kV pulses will be introduced on the BEB simulating a natural ESD, which occurs during normal operations.

The following data will be recorded for HESD testing:

| |
|---|
| BEB system functional check |
| Test equipment and calibration data |
| BEB system operating data |
| Test locations |
| Voltages tested at each location |
| Results of testing |
| TIRs |
| Photographs |

e. EMC.

(1) The BEB will be positioned outside the EMITF shielded enclosure and photographed. Prior to EMC testing, VSWR and forward power measurements will be obtained from each radio to determine if the installation and operation of the radio is correct.

(2) After obtaining the VSWR of each radio, a compatibility test matrix will be developed to determine if the components of the BEB are a source of EMI (culprit), a recipient of EMI (victim), or both a culprit and a victim. To attain this information, ATC personnel will energize the first victim and check for normal operation. Then ATC personnel will energize, operate, and de-energize each culprit individually while monitoring the victim for malfunctions or degradation of performance. This procedure will be repeated with all vehicle components until all culprits are tested against all victims. Then all culprits and victims will be energized simultaneously and monitored for any indications of compatibility problems.

(3) The following data will be recorded for EMC testing:

| |
|---|
| Test vehicle description and all pertinent test information |
| EMC matrix of a component breakdown listing all potential culprits and victims |
| Any system malfunction or performance degradation |
| System functional checkout |
| Results of testing |
| TIRs |
| Photographs |

f. HERO. HERO testing will be performed by the NSWC and provided to the EMITF at ATC. HERO susceptible distances and HERO unsafe/unreliable distances will be calculated using DOD 6055.11 and Naval Sea Systems Command (NAVSEA) OP 3565, Volumes 2 and 3 (ref 45 and 46). Various distances will be calculated depending on the specific HERO frequency bands. HERO measurements will be used to determine applicable safe separation distances for RF emitters installed onboard any BEB platform. Field strengths must be measured at specific locations on top of and around the vehicle.

Prior to testing, all radiating equipment installed in the BEB will be surveyed, and output powers will be verified. A calibrated antenna will be set up 6 m (20 ft) from the vehicle. Field strength will be measured with a NARDA probe using Institute of Electrical and Electronics Engineers Standard (IEEE-STD)-1309-2005 (ref 47) measurement methodology. One spatial

field point will be accomplished for each occupational area. Maximum power will be measured and recorded for all measurements. Test personnel will use measurements data to determine personnel exposure hotspots in multiple configurations, personnel exposures at occupational areas inside the cabin, and personnel exposures in the cupola/outer hatch areas.

The following data will be recorded for HERO testing:

| |
|---|
| System baseline functional checkout |
| Description of the BEB and all pertinent test information |
| System functional checkout data during HERO testing |
| Results of testing |

g. HERP. The NSWC will perform HERP testing. HERP testing will be conducted in accordance with DODI 6055.11 to evaluate the exposure potential to personnel associated with the various antennas installed on the BEB. Prior to testing, proper transmitter operations will be verified. A calibrated antenna will be set up 6 m (20 ft) from the vehicle. Power density and field strength will be measured in and around the BEB from each transmitter to determine if the RF levels from the transmitter emissions cause a hazardous condition for personnel. Each radio will be measured in, around, and on the roof of the BEB with the transceiver transmitting at the highest power level possible (measurements are in milliwatts per square centimeter ($mW/cm^2$)). Test personnel will use measurements data to determine personnel exposure hotspots in multiple configurations, personnel exposures at occupational areas inside and around the shelter areas.

The following data will be recorded for HERP testing:

| |
|---|
| Test equipment and calibration data |
| BEB operation condition, control setting, terminations, and monitoring equipment used |
| BEB operating data |
| Locations of measurements |
| Results of evaluation of exposure limits |
| Power density and field strength measurements |
| System functional checkout during HERP testing |
| Results of testing |

h. HERF. The NSWC will perform HERF testing. HERF analysis applies to fuels with low vaporization rates and does not require measurement. Based on fuel rates and RF calculations, safe separation distances will be provided in accordance with NAVSEA OP 3565, Volume 1 (ref 48).

The following data will be recorded for HERF testing:

| |
|---|
| System baseline functional checkout |
| Description of the BEB and all pertinent test information |
| System functional checkout data during HERF testing |
| Results of testing |

## 2.12 CHEMICAL, BIOLOGICAL AND RADIOLOGICAL CONTAMINATION SURVIVABILITY (CBRCS)

### 2.12.1 Objective

The objective of this test is to provide the necessary data to help evaluate the BEB's ability to withstand exposure to chemical, biological, radiological and nuclear (CBRN) agents and the decontamination process which must reduce the agents to negligible levels.

### 2.12.2 Criterion and Data Analysis

TABLE 2.12-1. CRITERION AND DATA ANALYSIS

| CRITERION APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 127 - CBRN Contamination | If the BEB materials, particularly those used externally, are resistant to CBRN agents and decontamination agents, the BEB can operate in a CBRN environment while contaminated for 72 hr, and the BEB is capable of being decontaminated to negligible risk levels with minimum replacement of exposed components, the criterion will be met. |

### 2.12.3 Test Procedures and Data Required

West Desert Test Center (WDTC), Dugway Proving Ground (DPG), Utah, will perform a paper study to assess the CBRCS of the BEBs. The study results will be reported under separate cover.

## 2.13 WHOLE BODY VIBRATION

### 2.13.1 Objective

The objective of this test is to measure the BEB ride quality for all operator positions as a function of water operations and BEB speed.

### 2.13.2 Criterion and Data Analysis

TABLE 2.13-1. CRITERION AND DATA ANALYSIS

| CRITERION APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 128 - Whole Body Vibration | If the whole body vibration is below the health caution zone, as specified in ISO 2631-1 (ref 39), during calm water operations, the criterion will be met. |

### 2.13.3 Test Procedures and Data Required

a. ATC personnel will conduct the BEB operations.

b. The ride quality test will be conducted with the operator seated and standing.

c. The driver's seat and the floor at the driver' position will be instrumented with triaxial ride quality seat pads to measure acceleration input into the seated subjects (live). A longitudinal accelerometer will be attached to a rigid structure near the vertical back support of each seat. A vertical accelerometer will be placed near the occupant's feet. BEB speed will be measured using a GPS and will be recorded as part of the data stream and will be displayed (digitally) to the driver. Acceleration and speed data will be low-pass filtered at approximately 100 Hz (accelerometers) and 20 Hz (BEB speed) and will be digitized at a minimum sample rate of 400 samples/second.

d. Acceleration and speed data will be acquired as the BEB and the BEB in the fully loaded condition are operated at a constant speed (to be determined) for at least 1 min (when not limited by wave actions).

e. Following each data run, the crew will be polled to ensure that it is safe to proceed to the next test speed. If the crew agrees, and the absorbed power calculations have not exceeded the 6-W limit, the vehicle will traverse the test surface at the next higher test speed.

f. Acceleration data will be processed to provide an exposure time with respect to health [from ISO 2631-1, Annex B] and absorbed power value in each axis for each run.

h. The following data will be recorded:

| |
|---|
| Descriptions and specifications of all transducer locations |
| Load conditions and BEB speeds |
| Power spectral density (PSD) computation summary information |
| Sample time history plots |
| Sample PSD plots |
| Absorbed power as a function of water roughness |
| ISO 2631-1:1997 analysis to include $rms_w$ as a function of water roughness |
| Peak acceleration for the half-round obstacles low-pass filtered at 100 and 30 Hz |
| Photographs |

## 2.14 CORROSION

### 2.14.1 Objective

The objective of this test is to determine the physical condition of the BEB after testing.

### 2.14.2 Criteria and Data Analysis

TABLE 2.14-1. CRITERIA AND DATA ANALYSIS

| CRITERIA APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 6 - Anodes | If sacrificial anodes are provided to deter corrosion on the hull and underwater portions of the BEB machinery, the criterion will be met. |
| 43 - Oil Sampling Valves | If the oil sampling valves are made of material resistant to corrosion such that it will not contaminate the sample, the criterion will be met. |
| 64 - Battery Cables | If corrosion resistant bolts and nuts are used to connect the battery cables, the criterion will be met. |
| 129 - Corrosion Control | If the BEB is cleaned, treated, primed, and coated to preserve material integrity in the specified operating environments, only normal washing, scheduled maintenance (exclusive of paint touch up) and repair of damaged areas (not a result of intended use, deficiency in design, materials, manufacturing or normal wear) are necessary to maintain corrosion control, and the fit, form, or function of any component are not adversely affected due to corrosion, the criterion will be met. |
| 130 - Corrosion Minimized | If all attaching hardware does not induce corrosion, galvanic or otherwise, the equipment and material used in the construction of the BEB is corrosion protected/coated (threshold) or fabricated of noncorroding materials (objective), and direct contact of electrolytically dissimilar metals is isolated (threshold) (eliminated (objective)), the criterion will be met. |

### 2.14.3 Test Procedures and Data Required

a. The BEB will be inspected to determine if sacrificial anodes have been provided to deter corrosion on the hull and underwater portions of the BEB machinery.

b. The oil sampling valves will be inspected to determine if they are made of material resistant to corrosion.

c. The BEB will be inspected to determine if the paint has preserved material integrity.

d. After testing, the BEB exterior, storage compartments, and engine compartment will be visually inspected for any corrosion or degradation of material. Any corrosion or degradation of material will be recorded and photographed. Any corrosion will be rated in accordance with the TACOM LCMC Corrosion Rating System (app D).

e. The following data will be recorded:

| |
|---|
| Effects of corrosion |
| Photographs |

## 2.15 FINAL INSPECTION

### 2.15.1 Objective

The objective of this test is to establish and document the post-test condition of the BEBs and subsystems.

### 2.15.2 Criterion and Data Analysis

TABLE 2.15-1. CRITERION AND DATA ANALYSIS

| CRITERION APP A, ITEM NO. | REMARKS/ANALYSIS |
|---|---|
| 131 - Overall Assessment | If the BEBs are fully operational and in good condition following testing, the criterion will be met. |

### 2.15.3 Test Procedures and Data Required

a. TOP 2-2-505 will be used as a general guide during testing.

b. The BEBs and subsystems will be inspected to determine post-test conditions. Special attention will be paid to areas of repair and damaged areas where repair was deferred.

c. A bollard pull will be performed.

d. All test instrumentation will be removed from the BEBs.

e. Any damages or defects not previously noted during testing will be recorded.

f. The following data will be recorded:

| |
|---|
| Complete inventory list |
| Bollard pull results |
| Any abnormal wear, deformation, or damaged components not previously recorded |
| Photographs |



(Page 2.13-2 Blank)

| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 1 | Test Agency devised, DTC approved | Serviceable Condition. The BEB system shall be complete, undamaged, and ready for testing. | 2.1 | |
| 2 | Para 3.3.8 | Out of Water Operation. The engines, without any configuration changes, shall operate with the BEB clear of the water, at idle speed, in neutral gear, without external water hookup, for at least 10 minutes without overheating. | 2.1 | |
| 3 | Para 3.4.1 | Hull. Hull integrity (including all appendages) shall be maintained (no hull rupture/penetration or broken welds) during all operations without ice in the water including ground contact against a hard mud bottom at 8 knots. Any part of the BEB that contacts the ground during beaching, loading, unloading, launching, and recovery operations shall be protected or reinforced as required to withstand the contact. In accordance with ISO 12215-6, no stiffeners shall terminate on shell plate, and doubler plates are not allowed for structural applications. Doubler plates for wear applications must be approved by the Government. All installed equipment shall be adequately secured. | 2.1, 2.6 | |
| 4 | Para 3.4.1.1 | Ground Supported. The BEB shall remain stable and level when placed on the ground. Stabilizing equipment that is integral to the BEB is allowable. | 2.1 | |
| 5 | Para 3.4.1.3 | Hull Drainage. The BEB shall have means to drain/remove water entrapped in the hull when the BEB is in level transport mode and when stored on level ground. Plugs, if used, shall be attached with a permanent tether/lanyard. | 2.1 | |

[a]Unless otherwise specified, the criteria will be taken from the Purchase Description (PD) for the Boat, Bridge Erection, 23 August 2010.

| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 6 | Para 3.4.1.7 | Anodes. Sacrificial anodes shall be provided to deter corrosion on the hull and underwater portions of the BEB machinery. Anodes shall be replaceable with common tools. | 2.1, 2.13 | |
| 7 | Para 3.4.1.8 | Rub Rail(s). Replaceable rub rail(s) shall be mounted around the entire hull on the outer-most projection. The rub rail shall be synthetic or rubber material, commercially available marine grade. The rub rail shall be replaceable using tools available in a general mechanic's tool kit. The rub rail shall not tear or detach when impacting a pier or floating bay(s) from any angle at 3 knots. | 2.1, 2.6 | |
| 8 | Para 3.4.1.9 | Dive Platform. A dive platform capable of supporting the two Soldier crew shall be provided and shall extend farther aft than any other appendages of the BEB when deployed. Means shall be provided for boarding of personnel. The platform shall be stowable if required to reduce rear overhang during transport. Stowing shall be accomplished with common hand tools (threshold), without tools (objective). | 2.1 | |
| 9 | Para 3.4.1.10 | Push Knees. The bow shall be fitted with push knees which interface with the SRB and IRB bays for maneuvering operations. The push knee interface surface shall be covered with marine grade synthetic or rubber material. The surface shall be replaceable with common hand tools. The push knees shall withstand the force of a fully loaded BEB impacting stationary bays at 3 knots with all push knees contacting simultaneously. The push knees shall also withstand a 45-degree impact with stationary floating bays at 2 knots. | 2.1, 2.4, 2.6 | |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 10 | Para 3.4.1.11 | Tie-Offs. The BEB shall have at least six tie-offs, three located on each side: forward, approximately amidships, and aft. Each tie-off and its mounting structure shall withstand the greater of three times the static bollard capacity of the BEB or three times the maximum calculated load from bay handling and towing. Tie-off locations shall facilitate line attachment to support conventional and longitudinal rafting. At a minimum, tie-offs shall be sized to accept one-inch diameter line. | 2.1, 2.6 | |
| 11 | Para 3.4.1.12 | Capstan. The BEB shall be equipped with a capstan located astern to provide for snugging and pulling in lines. The capstan shall be multi-speed, self-tailing, and shall handle one line (threshold), two lines (objective). The capstan shall have a drum diameter of at least six-inches with a rated capacity of at least the BEB's forward bollard pull. The capstan shall have a removable locking handle. The capstan foundation's ultimate strength shall be at least three times the BEB's forward bollard pull. | 2.1 | |
| 12 | Para 3.4.1.13 | Anchor Fairlead. Fairleads (e.g., open chock) or other means shall be provided for guiding the anchor line off the bow and stern on centerline. | 2.1 | |
| 13 | Para 3.4.1.14 | Personnel Safety Aids. Grabrails, handholds, footholds or other means shall be provided to allow safe personnel movement during all operations, including moving between BEBs and bays. | 2.1, 2.5 | |
| 14 | Para 3.4.1.15 | Crew Station. The crew station shall provide all-around visibility and space for two Soldiers. All BEB controls shall be located in the crew station and designed for a single operator. Sides of the crew station structure shall be designed to accept flat appliqué panels per PD 3.7.1. | 2.1, 2.5 | |

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|---|---|---|---|---|
| 15 | Para 3.4.1.16 | Operator's Seat/Backrest. One vertically adjustable and stowable padded seat/backrest shall be located in the operator's station. The seat shall support the operator wearing full Soldier gear with Individual Body Armor (IBA). | 2.1, 2.5 | |
| 16 | Para 3.4.1.17 | Heater. The crew station shall contain a marine heater with blower capable of 10,000 Btu/hour when the ambient air temperature is 28 $^{o}$F and the engines at normal operating temperature. | 2.1 | |
| 17 | Para 3.4.1.18 | Mast(s). Mast(s) shall be provided as required to facilitate navigation and communication. The masts shall be stowable. The mast(s) in the stowed position shall not interfere with BEB operations and maintenance. Stowing shall be accomplished by no more than common hand tools (threshold), without tools (objective). | 2.1 | |
| 18 | Para 3.4.1.19 | Crew Station Bimini Top. A removable, lightweight, collapsible marine-grade crew station bimini top shall be provided to protect the two person crew from overhead sun and rain. The top shall be installed and removed without tools. The top shall withstand a wind load of the BEB's maximum speed heading into a 25 knot wind. <u>The top shall be designed for at least a 4-year life</u>. Storage space shall be allocated on the BEB (objective). | 2.1, 2.6 | |
| 19 | Para 3.4.1.20 | Crew Station Enclosure. A removable, lightweight, collapsible marine-grade crew station enclosure shall be provided from the bimini top down to the operator's station or deck. The enclosure shall be installed and removed without tools. The enclosure shall be designed to provide maximum field of view with transparencies (threshold), | 2.1, 2.5 | The type of material used for the enclosure will be verified by contractor certification. |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
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| | | with peel-away clear adhesive sheets on transparencies (objective). The enclosure may be combined with or attached to the bimini top. The enclosure shall be designed for at least a 4-year life. Storage space shall be allocated on the BEB (objective). | | |
| 20 | Para 3.4.1.21 | Boat Cover. A marine-grade boat cover, with hull attachments as needed, shall be provided to protect recessed areas from snow and rain water collection. The boat cover shall be installed or removed by the 2-person crew within 15 minutes. The cover shall be designed for at least a 4-year life. Storage space shall be allocated on the BEB (objective). | 2.1, 2.5 | The type of material used for the boat cover will be verified by contractor certification. |
| 21 | Para 3.4.1.22 | Rifle Stowage. Stowage shall be provided near the crew station for at least two weapons, both of either M16A2 with and without M203 grenade launcher, or M4A2 rifle with and without optics. The mounts shall hold the weapons with the barrels pointed up and away from the operator's station and secure against loss, including if the boat capsizes. Stowage or retrieval of the weapons shall not exceed 10 seconds without tools. | 2.1, 2.5 | |
| 22 | Para 3.4.1.23 | Storage Compartments. Storage compartments shall be weather protected, be permanently mounted and have covers which are latching and lockable with a padlock of 3/8-inch shank. Covers shall incorporate a weather tight seal in accordance with ISO 12216 watertightness 4, and have a positive locking hold-open device (threshold). Two cubic feet of weather tight space is required for extra personal gear to be brought onboard by Soldiers (objective). | 2.1 | |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 23 | Para 3.4.2.4.4.1 | Fuel. The engines shall meet all performance requirements while operating on ULSD (ASTM D975) and JP-8 (MIL-DTL-83133) fuel. The engine shall not require any modifications (beyond normal maintenance items) when switching between fuels. Fuel lubricity filters are permitted; all other fuel lubricity additive devices and fuel lubricity additives that have to be manually administered are not acceptable (threshold); operate without lubricity additives (objective). | 2.1 | |
| 24 | Para 3.4.2.4.4.2 | Emissions Technologies. Pollution control technologies that are impacted by the sulfur level of the JP-8 fuel (up to 3000 ppm sulfur) either in effectiveness, maintenance or life expectancy shall not be used, e.g., Exhaust Gas Recirculation (EGR), Oxides of Nitrogen (NOx) traps, catalytic converters, etc. | 2.1 | The contractor will provide EPA tier level engine certification. |
| 25 | Para 3.4.2.4.4.3 | Ignition. The engines shall use keyless ignition at the operator's station. | 2.1 | |
| 26 | Para 3.4.2.4.4.4 | Shut Down. The engines shall have both primary and emergency shutdown methods. The emergency method shall be a manually operated control. | 2.1 | |
| 27 | Para 3.4.2.4.4.4.1 | Automatic Engine Shut Down Override. If the engines incorporate an automatic shut down feature, an alarm and engine shut down override control shall be provided at the operator's station. The operator shall be provided with the means to override the shut down. | 2.1 | |
| 28 | Para 3.4.2.4.4.5 | Hour Meter. Each engine shall have an accessible and readable hour meter attached. | 2.1 | |

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|---|---|---|---|---|
| 29 | Para 3.4.2.4.4.6 | Exhaust System. Each engine shall have an independent exhaust system. The exhaust outlet shall be located to minimize noise and fume impact on the crew station. After shut down water shall drain from the exhaust system to the outside of the BEB to prevent damage from freezing. | 2.1, 2.5 | |
| 30 | Para 3.4.2.4.4.7 | Engine Cooling. Each engine shall have an independent cooling system. If the engine is liquid cooled, it shall be a closed-loop coolant system. | 2.1 | |
| 31 | Para 3.4.2.4.4.8 | Raw Water Cooling. Raw-water cooling system, if used, shall have the capability of being flushed. Duplex strainers or self-cleaning strainers shall be used for raw-water fed to heat exchangers. Non-self-cleaning strainers shall be readily accessible without having to lift a main engine hatch. Keel coolers, if used, shall be capable of being flushed while underway without access to the engine compartment. After shut down water shall drain from the exhaust system to the outside of the BEB to prevent damage from freezing. | 2.1, 2.6 | |
| 32 | Para 3.4.2.4.5 | Water Jets. Two water jets (pump jets allowable) with linked steering and independent reversing controls shall be provided. Reversing and neutral controls for the water jets shall be independently-power assisted, allowing the operator to change from ahead to astern operation without changing throttle setting. The water jets shall be able to be back flushed, or have other means to clear the water jet inlet grill. Portions of the water jets requiring inspection as part of PMCS shall be readily accessible. The water jets shall be protected from damage. | 2.1, 2.6 | |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 33 | Para 3.4.2.4.6 | Fire Protection. A fixed fire extinguishing system shall be employed in the main engine space(s) and shall meet the following requirements for a commercial uninspected vessel in CFR Title 46, Part 25: | 2.1 | Underlined portion will be addressed by manufacturer certification. |
| 34 | Para 3.4.2.4.6.1 | Actuation. The fire extinguishing system shall automatically discharge upon sensing a fire via temperature (threshold), temperature and infra-red (objective), temperature and infra-red and particulate (objective). | 2.1 | Underlined portion will be addressed by manufacturer certification. |
| 35 | Para 3.4.2.4.6.2 | Alarm. An audible alarm shall indicate when the fire system senses a fire. The alarm shall be able to be muted. | 2.1 | The audible alarm will not be tested. |
| 36 | Para 3.4.2.4.6.3 | Extinguishing Agent. The extinguishing agent shall be one the following unless approved by the PCO:<br>• Carbon dioxide (CO2) (CAS 124-38-9)<br>• Pentafluoroethane (HFC-125) (CAS 354-33-6)<br>• Heptafluoropropane (HFC-227ea) (a.k.a. FM-200) (CAS 43-18-90)<br>• Sodium bicarbonate (baking soda) (CAS 144-55-8)<br>If the engine's combustion air is obtained from the engine space, the extinguishing agent shall be CO2. | 2.1 | |
| 37 | Para 3.4.2.4.6.4 | Engine Space Confinement. If the engine's combustion air is obtained from the engine space, any forced ventilation or natural ventilation vents shall be dampened to prevent additional air from feeding a fire. | 2.1 | |

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|---|---|---|---|---|
| 38 | Para 3.4.2.5 | Fuel System. Each engine shall have an independent fuel system with the exception of a common fuel tank. The system shall allow each engine to be isolated. Shutoff valves shall be positioned to preclude excess spillage when removing components or performing service operations. A fuel-water separator shall be provided, accessible and maintainable without removal of any other equipment. Priming the empty fuel system from the fuel tank shall be performed without use of the starter. | 2.1 | |
| 39 | Para 3.4.2.5.2 | Fuel Tank. The fuel system shall accommodate safe, efficient fueling operations using a refueling nozzle of minimum 2-inch diameter at a flow rate of at least 20 gallons per minute. One gloved operator on the deck shall perform all refueling operations without tools. Fuel overflow shall be contained in an area or device designed to contain at least 8 fluid ounces. <u>The fuel tank shall not contain explosive retardant material.</u> The low fuel alarm shall sound while the BEB is operating below 10% fuel remaining. A means shall be provided for sounding the tank. The BEB shall have enough fuel capacity for 9 hours of operation at 45% rated engine power. | 2.1, 2.6 | |
| 40 | Para 3.4.3 | Electrical Systems. The BEB shall employ a 24 volt direct current (VDC) electrical system with isolated negative grounds and neutrals (not a 'floating' ground) to control corrosion and prevent electrolysis. The control gauges, circuit breakers, switches, and displays shall allow for safe operation in all climatic conditions. All grounds and neutrals shall come to common busses separate from the engine using insulated conductors. Open areas in the console and unused wire terminations shall be capped to protect from exposure to weather conditions. Engine | 2.1, 2.6, 2.7, 2.8 | Normal test operations will be under ambient conditions. Chamber testing will be conducted in high and low temperature conditions. |

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|---|---|---|---|---|
| | | alternators, starters, sensors and electronic control modules shall not use the case of the component or the engine block as a negative return path to the batteries. Use of drive components as part of the 24 VDC return is unacceptable. | | |
| 41 | Para 3.4.3.2 | Alternator. Each engine shall be fitted with an alternator. The alternator and pulley shall be sized so that adequate power for electrical loads is available at engine idle without over speeding the alternator when the engine is at maximum RPM. The amperage output from each alternator shall be capable of providing power to operate the BEB without restriction. The system shall be wired and sized such that either alternator can charge either bank of batteries. Alternators shall be replaceable without having to remove the engine, or having to disconnect any fuel or hydraulic line (objective). | 2.1, 2.6 | The alternator load analysis for the electrical system will be verified by contractor certification. |
| 42 | Para 3.4.3.3 | Batteries. All batteries shall be identical, deep-cycle marine grade, absorbed glass-mat (AGM) type (e.g., Optima D34M Bluetop, National Stock Number [NSN] 6140-01-475-9355). Batteries selected shall be in the federal supply system (i.e., already have NSN assigned). At least two banks of batteries, one for each engine, shall be provided. A means to temporarily parallel the engine-starting battery banks for emergency engine starting shall be provided. The cranking performance for each starting bank shall ensure engines can be started at -25 oF without preparatory charging of the batteries. The batteries shall be easily accessible by a crewmember on the deck without the use of tools. All batteries shall be in battery boxes. | 2.1, 2.8 | |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 43 | Para 3.4.3.3.1 | Battery Cables. Battery cables shall be furnished with reusable insulated terminal covers on the positive lead, at a minimum. Positive and negative cable terminals shall be identified with a red sleeve labeled “+” and a black sleeve labeled “-”, respectively. Corrosion resistant bolts and nuts shall be used. Wing nut type fasteners to connect battery cables to the battery terminals are not acceptable. | 2.1, 2.13 | |
| 44 | Para 3.4.3.4 | Battery Disconnect Master Switch. A master switch, which disconnects all power from each of the battery banks with the exception of SINCGARS radio and bilge pumps, shall be provided near the battery compartment (threshold), near operator’s console (objective). | 2.1 | |
| 45 | Para 3.4.3.5.2 | Connection Boxes. Connection boxes and other electrical enclosures shall be water tight, including cable entry sealing devices into each connection box. | 2.1 | |
| 46 | Para 3.4.3.5.3 | NATO Slave Receptacle. A receptacle in accordance with NATO STANAG 4074, Type I shall be provided to allow for starting of each engine and charging of the batteries from an external power source. The receptacle shall also provide a back feed power source from the BEB electrical system for charging and slaving other 24 VDC equipment. The receptacle shall be installed near the battery enclosure and shall be accessible without tools to personnel standing on the deck. The NATO receptacle shall be isolated from the hull to prevent the receptacle from inadvertently using the hull as a negative return path to batteries. The receptacle shall be labeled "SLAVE 24 VOLTS DC" with one-inch black lettering. The receptacle shall have a disconnect switch to isolate the receptacle when not in use. | 2.1 | |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 47 | Para 3.4.3.6 | 24 VDC to 12 VDC Converter. If required to power onboard equipment, 12 VDC supply shall be via a 24 VDC to 12 VDC converter as opposed to drawing power from a single battery. The converter shall use an isolated ground to prevent a negative polarity return path through the hull. | 2.1 | |
| 48 | Para 3.4.3.7 | Circuit Breaker Panel. The electrical devices and cables in each circuit shall be protected by appropriately sized circuit breakers. Each circuit breaker shall comply with the design, performance, and installation requirements of IEEE-STD 45. Circuit breakers shall be marine grade. Separate panels shall be used if both 24 VDC and 12 VDC components are used. Each panel shall have no less than three spare 15 amp breakers (threshold), three 20 amp spare breakers (objective). Spare circuits shall be allocated as part of the total BEB electrical load, and shall be labeled with individual label-plates as "Spare". Fuses shall not be used unless integral with the component. | 2.1 | The circuit breaker sizing, grade, and performance will be verified by contractor certification. |
| 49 | Para 3.4.3.8 | Searchlight. A marine grade service 24 VDC searchlight (Hella Marine 8502 (NSN 6220-12-304-6240) or equivalent) shall be supplied. The searchlight shall have the capability of elevation and depression adjustment with a rotation of 360 degrees. The searchlight shall be placed in such a location that it may be turned forward or aft for navigational purposes. The searchlight shall be equipped with a one-hand control operable from either the operator's position or the deckhand's position within the cab (threshold), from both the operator's and deckhand's position within the cab using multiple mounting locations (objective). The searchlight shall have the capability of being removed from the mounting and moved to shine hand-held over the side of the BEB. | 2.1 | The type of searchlight and specifications will be verified by contractor certification. |

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|---|---|---|---|---|
| | | A dedicated 24 VDC searchlight electrical receptacle, capable of accepting the mating plug on the searchlight power cord, shall be installed on the operator's console. | | |
| 50 | Para 3.4.3.9 | Inspection Light. A removable hand-held inspection 24 VDC light(s) shall be provided to allow inspection of the battery, engine, transmission and propulsion unit compartments. Dedicated 24 VDC electrical receptacle(s) and/or the cord length shall be provided such that the light can be moved to illuminate the compartments as well as the BEB's waterline. | 2.1 | The type of inspection light and specifications will be verified through contractor certification. |
| 51 | Para 3.4.3.10 | Lighting. A variable-lighted operator's control console, instrument panel(s), and magnetic compass shall be provided, controlled from the operator's console by an electronic dimmer switch. The range of intensity shall be variable from full-off to full-on intensity. | 2.1 | |
| 52 | Para 3.4.3.11 | Instrument Panel(s). The instrument panel(s) shall be located in and viewable from the operator's station. | 2.1 | |
| 53 | Para 3.4.3.11.1 | Fuel Level Gauge. The fuel tank shall have a graduated tank-level indicator on operator's console. | 2.1 | |
| 54 | Para 3.4.3.11.2 | Gauges. The following analog-display style gauges shall be provided for each engine indicating normal operating range and high-and-low limits as applicable:<br>• Engine oil pressure<br>• Engine coolant temperature<br>• Engine RPM Tachometer<br>• Battery voltmeter<br>• Transmission oil pressure<br>• Single Steering position indicator | 2.1 | |

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|---|---|---|---|---|
| | | • Secondary Engine hour meter (objective)<br>• Gauges shall include red/yellow/green color-markings for operating limits (objective). | | |
| 55 | Para 3.4.3.11.3 | Malfunction Indicators. An audible alarm with a mute function, as well as visual indicator(s) shall be provided which indicates these adverse conditions:<br><br>• Engine low oil pressure<br>• Engine high coolant temperature<br>• Low fuel<br>• Flooding (bilge pump automatic activation)<br>• Fire sensing or system discharge<br>• Loss of exhaust water cooling supply, if applicable | 2.1 | |
| 56 | Para 3.4.3.12 | Horn. The horn shall comply with audible requirements of 33 CFR 86.05 for vessels between 12 and 20 meters. | 2.1 | The audible requirements will be verified through contractor certification. |
| 57 | Para 3.4.3.13 | Navigation Lights. The BEB shall have marine-grade long-life Light Emitting Diode (LED) navigation light system with the mast erected, as required by COLREGS 72 for International and Inland Navigation rules for power-driven vessels when pushing. | 2.1 | The navigation light requirements will be verified through contractor certification. |
| 58 | Para 3.4.4 | Communications-Electronics Complement. The items below shall be located in and viewable from within the operator's station. The sensors and displays may be combined. | 2.1 | |

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| 59 | Para 3.4.4.1 | SINCGARS Radio Capability. The BEB shall have the capability to accommodate one AN/VRC-90 SINCGARS radio system. At a minimum the BEB shall have:<br><br>• 24 VDC NATO power source<br>• One two-shelf rack using Mounting Base MT-6352/MT-6353<br>• Vehicle Adapter Assembly (VAA) AM-7239<br>• 50 watt Power Amplifier (PA)(AM-7238)<br>• SINCGARS antenna base<br>• Two-piece fiberglass antenna (AS-3900) with attaching wrench<br>• Speaker (LS-671)<br><br>All mounting, wire harnesses, antenna and transducers necessary for the equipment to be fully operational shall be installed and ready to accept the hardware control boxes. SINCGARS operation shall not be affected when the battery disconnect switch is turned off. | 2.1 | |
| 60 | Para 3.4.4.2 | Global Positioning System. The BEB shall be equipped with a marine grade Global Positioning System (GPS). The GPS shall be wired to the BEB batteries and capable of displaying the position of the BEB in real time. | 2.1 | |
| 61 | Para 3.4.4.3 | Infrared Strobe. The BEB shall have the capability to accommodate a LED Infrared (IR) strobe light system at the uppermost point on the BEB. | 2.1 | |
| 62 | Para 3.4.4.4 | Compass. The BEB shall have a marine-grade lighted magnetic compass. | 2.1 | |

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| 63 | Para 3.4.4.5 | Depth Sounder. A depth sounder with picture-representative (side or 3-D) imaging of underwater objects and bottom contour shall be provided. The depth sounder shall display the water depth below the keel in real time to a minimum 1-foot depth. The depth sounder shall display speed (water velocity) and water temperature. The sensor shall not be damaged during BEB operations or transport. The depth sounder shall be integral to or interfaced with the GPS so as to allow depth information to be displayed on the GPS screen (threshold). If the display unit is removable without the use of tools, storage space shall be provided for the display unit (objective). | 2.1, 2.6, 2.10 | |
| 64 | Para 3.4.5 | Bilge Drainage System. A minimum of three fixed, powered bilge pumps capable of discharging at least 10 gallons per minute each as installed shall be provided. The pumps shall be actuated both automatically and manually. At least two pumps shall be located in each bilge compartment. Control and an operation indicator for each pump shall be located on the operator's console. The bilge drainage system shall not entrap water which could freeze and cause damage. Bilge pump operation shall not be affected when the battery disconnect switch is turned off. | 2.1 | The contractor will provide certification for the bilge pumps. |
| 65 | Para 3.6.1 | Hazardous Materials Management. Asbestos, beryllium, radioactive materials, hexavalent chromium, (electroplating and coatings), cadmium (electroplating), mercury, or other highly toxic or carcinogenic hazardous materials (HAZMAT), as defined in 29 CFR 1910.1200, shall not be used to manufacture, assemble, maintain or sustain the BEB, without prior approval from the PCO. Dry film lubricants (torque tension modifiers) may be used to duplicate equivalent clamp loads due to the elimination of | 2.1 | Will be addressed by TARDEC |

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| | | hazardous material plating or finishing. Lead shall not be used without prior approval of the PCO. The use of lead solder may be approved for electrical components where a suitable alternative is not available. Lead-acid batteries may be used without approval from the PCO. | | |
| 66 | Para 3.6.2 | Airborne Concerns. Class I and Class II Ozone Depleting Substances (ODS) shall not be used. Volatile Organic Compounds (VOC) and Hazardous Air Pollutants (HAP) shall be minimized (threshold), eliminated (objective). | 2.1 | Will be addressed by TARDEC |
| 67 | Para 3.7.1 | Appliqué Panel Support Structure. The BEB shall include permanent mounting provisions to accept appliqué panels. The BEB shall accommodate add-on replaceable flat appliqué panels up to one and one-half inch thick weighing up to 12.5 pounds per square foot (psf). The panels shall match the configuration of the operator's station and provide 100% coverage from the deck up to 48-inches for the front and sides (no protection is required behind the operator). The panels on the sides shall extend a minimum of 12-inches from the rear of the operator. | 2.1 | |
| 68 | Para 3.8.2 | Treatment and Painting. All external surfaces suitable for painting except those that reach a temperature of 400° F shall be cleaned, treated and (Chemical Agent Resistant Coatings) CARC painted in accordance with MIL-DTL-53072. High temperature external surfaces such as exhaust ducts shall be painted with high temperature paint of limited reflectivity. Surfaces not suitable for painting shall be treated to or inherently provide a surface of limited reflectivity. Components not visible or exposed | 2.1 | The contractor will provide certification that the paint conforms to the color, gloss, and spectral reflectance requirements. |

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| | | during normal operation may be unpainted. The color of the primer, under the top coat, shall be of a darker color than the top coat color. The top coat color shall be 34094 green 383 conforming to FED-STD-595. | | |
| 69 | Para 3.9.1.1 | Electronic. The BEB must be compatible with current U.S. Army Standard Unit Level Test Equipment which is presently the MSD (Maintenance Support Device) with the auxiliary MSD-ICE (Internal Combustion Engine) test hardware. Diagnostic connectors and circuits must be compatible with current standard Army test equipment. Diagnostic connectors shall be easily accessible, hard mounted and environmentally protected. The diagnostic connectors shall be equipped with a cover, which shall prevent entrance of moisture and contaminants.<br><br>The BEB shall feature either a single data bus network as specified by SAE J1939, J1708, or a multiple data bus network in accordance with J1939, which defines the interface between J1708 and J1939. The BEB data bus shall have built in sensors that provide fault isolation capability sufficient to identify failures of major components of each system monitored by the data bus. Diagnostic outputs shall be transmitted to the vehicle mounted J1939 female 9 pin Deutsch Connector, which shall conform to SAE J1939/13 'Off-board Diagnostic Connector' dated July 1999. Software required to interface, retrieve, and interpret vehicle system's diagnostic data shall be provided to the government. Software shall be capable of displaying operator/driver informational data associated with each error code. | 2.1, 2.4 | |

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| 70 | Para 3.11.2 | Item Unique Identification Marking. Any assembly, subassembly, component, repairable, or serially managed part with a government acquisition cost of $5,000 or more, shall be marked with an Item Unique Identification Marking (IUID) in accordance with MIL-STD-130. The BEB hull does not need to be marked. Marking shall be permanent in nature and located in an area which is easily identified. | 2.1 | Will be addressed by the manufacturer |
| 71 | Para 3.5.4 | Highway Transport. The BEB System on the CBT or PLST shall be highway transportable per MIL-STD-1366. When prepared for transport the maximum overall height shall not exceed 157-1/2-inches (ref: NATO highway). Permits are allowable to accommodate the BEB width. The maximum weight of the BEB System shall not exceed the Load Handling System (LHS) capability of the CBT of 24,000 lb. The BEB System shall withstand shock and vibration encountered in ground transportation without damage or degradation (threshold). | 2.2, 2.10 | |
| 72 | Para 3.5.7 | External Air Transport. The BEB shall meet the requirements of MIL-STD-209 and MIL-STD-913 for external helicopter transport. The BEB alone, and BEB System, shall be capable of dual point lift from a CH-47 (threshold), CH-53 (objective). The BEB System weight shall not exceed 16,644 lb (objective). | 2.2, 2.10 | |
| 73 | Para 3.2.5 | IBC and BAP. If use of the IBC or BAP is proposed as the interface equipment between the BEB and the CBT, any modification to the IBC or BAP shall be installed or removed using only on-board tools and Basic Issue Items (BII). The contractor shall provide all components required to prepare the IBC or BAP for interface with the BEB as a kit. Permanent changes to the IBC or BAP which would alter the capability to handle existing loads are not permitted. | 2.4 | |

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| 74 | Para 3.5.4.1 | MRBC Transport System. The CBT with the BEB System shall be capable of towing a loaded PLST (e.g., IRB/BAP, SRB/BAP or DSB/M1077 flatracks) with the draw bar in the extended position and the extended drawbar/light bar (NSN 2540-01-460-5784) installed without restricting the turning diameter of the CBT/PLST combination. | 2.4 | |
| 75 | Para 3.5.4.2 | Transload. The BEB System shall be capable of being transloaded (transferred) from the CBT to and from the PLST (objective). | 2.4 | |
| 76 | Para 3.4.1.24.1 | Personal Flotation Device. Three self-inflating, USCG or 46 CFR 160.076 approved Type V-Special Use Inflatable Personal Flotation Device (PFD) shall be provided. When not inflated the PFDs shall be Army green, camouflage, or black in color. | 2.9 | The types and sizes of the PFDs will be verified by contractor certification. |
| 77 | Para 3.4.1.24.2 | Throwable Flotation. A USCG approved Type IV personal flotation device (ring or horseshoe buoy) per 46 CFR 160.050 shall be provided. Storage space or mounting provisions shall be provided and allow deployment within 10 seconds. | 2.5, 2.9 | The PFD type will be verified by contractor certification. |
| 78 | Para 3.4.1.24.8 | Line Cutting Device. The BEB shall be provided with a manual hand-held device for cutting through the mooring lines in emergency conditions. Mounts shall be provided to stow the device safely and securely, while allowing access by hand without tools within 10 seconds. | 2.5, 2.9 | |
| 79 | Para 3.10 | Human Factors Engineering and Safety. Human Factor Engineering (HFE) principles and design standards shall be applied in accordance with ASTM F1166 Sections 5.1.8, 5.1.9, 6.1.10, 15 (all sub paragraphs), 17.1.1, | 2.5 | |

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|---|---|---|---|---|
| | | 17.1.7.16, 17.1.10, 17.1.12, 17.2.7.1, 17.2.8, 17.2.9.2, 17.4.1, 17.7.1, 17.7.2, and 18.1 (all sub paragraphs). Belts, filters, lubrication fittings, oil sampling valves on machinery shall be readily inspectable and replaceable without component removal. | | |
| 80 | Para 3.10.1 | Human Factors Range. Operation, maintenance, and repair activities and procedures shall 5th percentile female to the 95th percentile male as defined in section 9 of ASTM F1166 and dressed in protective gear (i.e., Individual Body Armor (IBA) and in Mission-Oriented Protective Posture (MOPP) 4). | 2.5 | |
| 81 | Para 3.10.3 | Noise Limit. Steady-state noise on deck with the engine compartment hatch closed shall not exceed 85 dB(A) in accordance with MIL-STD-1474 compensated with single-level hearing protection (threshold), without hearing protection (objective). | 2.5 | |
| 82 | Para 3.10.4 | Hatch Securing. Hinged machinery hatches shall be capable of being secured in the open position. | 2.5 | |
| 83 | Para 3.11 | Identification and Marking. All attachments or components removed or disassembled for shipment shall be visually match-marked for proper re-assembly. | 2.5 | |
| 84 | Para 3.3.1 | Launch, Retrieve Performance. The BEB shall be launched or retrieved from the CBT within 5 minutes (threshold), 3 minutes (objective). Time commences after the BEB is prepared for launch or retrieval and the CBT is in position to launch or retrieve with the water level at the middle of the rear wheel hub. For launch, time ceases when the BEB is completely free and clear. For retrieval, | 2.5, 2.6 | |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| | | time commences when the first part of the BEB hull is over the CBT structure and ceases when the BEB is secured and the CBT begins movement out of the water. The BEB shall be able to be launched and retrieved from the CBT within the launch site requirements: up to 20% (11 degrees) slope, 8% (5 degrees) side-to-side slope, water depth of at least 48-inches where the boat enters the water, current of up to 5 fps. Any water taken onboard during launch or retrieval shall be drained from operator's spaces (no standing water), but not into machinery spaces. | | |
| 85 | Para 3.3.2 | Launch, Retrieve Personnel. Launching and Retrieving the BEB from the CBT shall not require more than two people in the BEB (threshold), one person (objective). | 2.6 | |
| 85a | Para 3.3.3 | Temporary Bridge Anchoring. BEBs shall be able to temporarily anchor the bridge during live vehicle crossings with up to Military Load Class (MLC) 100 wheeled and up to MLC 85 tracked, at a ratio of one BEB per six bays, in a wather depth greater than 6 feet, at a water velocities of up to 6 fps (threshold), 8 fps (objective). | 2.6 | |
| 86 | Para 3.3.4 | Rafting. Two BEBs shall be able to push a 7-bay raft (2 ramps and 5 interior) with up to MLC 140 (two MLC-70 ton tracked vehicles or equivalent) for both conventional (see 6.4.3) and longitudinal rafting (see 6.4.4), in a water depth greater than 6 feet, at a relative water speed of 6 fps (threshold), 8 fps (objective). For longitudinal rafting, use of IRB or SRB rafting brackets is required unless the BEB is equipped with appurtenances which function as rafting brackets. | 2.6 | |

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|---|---|---|---|---|
| 87 | Para 3.3.6 | Navigational Draft. The BEB shall have a navigational draft at Full Load condition of no more than 30-inches (threshold), 24-inches (objective) in fresh water. | 2.6 | |
| 88 | Para 3.3.7 | Shallow Water Operation. The BEB shall be capable of operating in 4 feet of water depth with a soft bottom at a relative water velocity of 6 feet per second, while at full power for 30 minutes without overheating. | 2.6 | |
| 89 | Para 3.3.10 | BEB Speed. The BEB shall achieve a forward steady state speed of at least 16 knots with Full Load in a water depth greater than 23 feet. The BEB shall be able to back safely at 4 knots without water flooding the craft in calm water and Full Load conditions. | 2.6 | |
| 90 | Para 3.3.11 | Unloaded Bay Maneuverability. To assemble rafts and bridges the BEB shall be capable of maneuvering from 1 to 4 bay-combinations of ramp and interior bays forward, reverse, and sideways <u>in a relative water speed of up to 5 fps.</u> | 2.6 | |
| 91 | Para 3.4.1.4 | Buoyancy. The BEB in Full Load condition shall be positively buoyant after flooding in accordance with Directive EU 94/25/EC (objective). Flotation material used for this requirement shall be protected from damage during BEB operation and maintenance. | 2.6 | The builder shall provide certification that the BEB is constructed with sufficient inherently buoyant material to keep the flooded boat afloat.<br><br>Flooding of the BEB hull will not be performed during testing. |

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|---|---|---|---|---|
| 92 | Para 3.4.1.6 | Payload. The BEB shall have the capability to transport 1000 lbs of payload in addition to the Full Load while maintaining safety and stability. Multiple tie-down points shall be provided to secure various sized payload in the cargo area. The cargo area shall be sized to accommodate both IRB and SRB rafting brackets (no more than two at a time). Payload shall be assumed to have a center of gravity 24-inches above the surface of the cargo area. Cargo area shall not be located on engine | 2.6 | |
| | | hatches or in areas that may require emergency access (threshold). The distribution of the payload weight shall be located in one rectangular area of 12 sq ft (objective). | | |
| 93 | Para 3.4.1.24.3 | Anchor and Line. The BEB shall be provided with an anchor and at least 100 feet of line capable of holding the BEB stationary in a current of 6 fps (threshold), 8 fps (objective), with up to 25 knot winds in hard sand. | 2.6, 2.9 | The type of anchor line and line strength will be verified by contractor certification. |
| 94 | Para 3.4.2 | Mechanical Systems. The propulsion systems shall operate independently of and in tandem with each other, and shall allow for independent forward/reverse/neutral operating. | 2.6 | |
| 95 | Para 3.4.2.3 | Petroleum, Oils, and Lubricants Leakage. The degree of petroleum, oils, and lubricants (POL) external leakage allowable on components such as engine, gearboxes, and pump drive shall not exceed class 2 of SAE J1176 for dust free conditions and class 2D of SAE J1176 for dusty conditions. No evidence of fluid leakage shall be permitted in fuel, hydraulic, or cooling systems. | 2.6, 2.9 | |

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<table>
<tr><th>ITEM</th><th>APPLICABLE SOURCE[a]</th><th>TEST CRITERIA</th><th>SUBTEST</th><th>REMARKS</th></tr>
<tr><td>96</td><td>Para 3.4.2.4</td><td>Propulsion. The propulsion system shall provide the thrust to meet performance requirements, without exceeding the component manufacturer's recommended installation requirements, durability and horsepower rating.</td><td>2.6</td><td>The contractor shall provide supplier certifications that show that the engine and water jet components of the propulsion system are designed, assembled, and operated within the installation, durability, and horsepower requirements of the manufacturers.</td></tr>
<tr><td>97</td><td>Para 3.3.9</td><td>Ambient Conditions. Normal operating and storage condition for the BEB shall be as follows:<br><table><tr><th rowspan="2">CONDITION</th><th colspan="2">TEMPERATURE, °F</th><th>SOLAR LOAD (RADIATION)</th><th>RELATIVE HUMIDITY</th></tr><tr><th>AIR</th><th>WATER</th></tr><tr><td>Engine start (note 1)</td><td>-25 to 0</td><td>NA</td><td>Negligible</td><td>Tending toward saturation</td></tr><tr><td>BEB operation, includes engine starts</td><td>0 to 120</td><td>20 to 95</td><td>Up to 104 W/ft$^2$ (1120 W/m$^2$)</td><td>95 % or above</td></tr><tr><td>Storage</td><td>-50 to 160</td><td>NA</td><td>Up to 104 W/ft$^2$</td><td>95% or above</td></tr></table><br>Note 1. Engine starting out of the water, without ether or similar starting aids (plug-in accessories are acceptable, i.e., block heater, dipstick heater, engine blanket(s) etc.).</td><td>2.7, 2.8</td><td></td></tr>
<tr><td>98</td><td>Para 3.4.1.24</td><td>Basic Issue Items. The following is the minimum basic issue items (BII) to be provided with each BEB. All BII shall be adequately stowed. The contractor shall propose items beyond this listing if required.</td><td>2.9</td><td></td></tr>
</table>

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| 99 | Para 3.4.1.24.4 | Mooring, Towing, and Steering Lines. The BEB shall be provided with at least six (6) lines. Lines shall be double-braided polyester, minimum diameter of 5/8-inch. The lines shall be at least 50 feet in length with an eye splice on one end, and shall be sized for the tie-offs on the BEB or IRB, whichever is greater. The minimum line breaking strength shall be at least three times the forward static bollard pull or the maximum static load required in service, whichever is greater. | 2.9 | The type of line used and its rated strength will be verified through contractor certification. |
| 100 | Para 3.4.1.24.5 | Hand Tools. The contractor shall provide all tools required for Preventive Maintenance Checks and Services (PMCS). At a minimum, these tools shall include an 8-inch adjustable wrench, #2 Phillips and 1/4-inch flat tip screwdrivers. A tool bag shall be provided to hold the hand tools. | 2.9 | |
| 101 | Para 3.4.1.24.6 | Hand Pump. A marine-grade, self-priming, manually-operated, portable hand pump shall be provided for dewatering. | 2.9 | |
| 102 | Para 3.4.1.24.7 | First Aid Kit. A two-person, weather protected first aid kit shall be provided and stowed in the operator's station. | 2.9 | |
| 103 | Para 3.4.1.24.9 | Document Pouch. The BEB shall have a waterproof and UV-resistant document pouch capable of holding a standard 8-1/2- by 11- by 1-inch three-ring binder and Operator's Manual. | 2.9 | |
| 104 | Para 3.4.1.24.10 | Mat(s). Anti-fatigue, self-draining, secured, marine quality mat(s) shall be provided in the crew station. The mat shall be capable of being removed by no more than common tools. | 2.9 | The mat type and characteristics will be verified through contractor certification. |

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| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 105 | Para 3.4.1.24.11 | Headsets. Stowage space shall be provided in the crew station for 2 communication headsets. | 2.9 | |
| 106 | Para 3.4.1.24.12 | Digital Range Finder. One battery powered, digital, eye-safe laser range finder shall be provided for determining the straight-line distance between the operator and the shore at a range between 66 feet (threshold), 40 feet (objective) to 2000 feet. In addition, | 2.9 | |
| | | the range finder shall provide elevation measurement in degrees (threshold), percentage (objective), and compass bearing readings. The range finder shall provide electronic output or storage (objective). | | |
| 107 | Para 3.4.1.24.13 | Hand Portable Fire Extinguisher. One type B size I hand portable fire extinguisher shall be installed for immediate access from the crew station. | 2.9 | |
| 108 | Para 3.4.2.1 | Lubricants and Fluids. All fluids and lubricants shall be compatible with the following unless approved by the PCO:<br>• Engine Oils: MIL-PRF-2104 (OE/HDO), MIL-PRF-46167 (OEA-30)<br>• Automotive Engine/Preservation Oils: MIL-PRF-21260 (PE)<br>• Antifreezes and Test Kit: A-A-52624<br>• Gear Lubricants: SAE J2360 (GO)<br>• Biodegradable Hydraulic Fluid (BHF): MIL-PRF-32073, on the Qualified Products List (QPL)<br>• Multi-purpose Grease: MIL-PRF-10924 (GAA)<br>• Fuel Biocide/Stabilizer Additive: MIL-S-53021<br>• Degreasing Solvents: MIL-PRF-680 | 2.9 | |

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| 109 | Para 3.4.2.2 | Lubrication Fittings. Means shall be provided for lubricating all moving parts that require lubrication. Fittings shall be located in a protected location and accessible by a grease gun with a 10-inch flexible extension. Fittings shall be accessible without removing or adjusting accessories or parts. Remote or extended lubrication fittings may be used. | 2.9 | |
| 110 | Para 3.4.2.4 | Propulsion. The propulsion system shall provide the thrust to meet performance requirements, without exceeding the component manufacturer's recommended installation requirements, durability and horsepower rating. | 2.9 | The contractor will provide supplier cerifications showing that the propulsion system engine and water jet components are designed, assembled, and operated within the installation, durability, and horsepower requirements of the manufacturers. |
| 111 | Para 3.4.2.4.1 | Oil Change System. Each engine shall employ an oil change system which permits removal of oil from the engines into a portable container using only common mechanics hand tools. This effort shall be accomplished with the BEB either in or out of the water. | 2.9 | |
| 112 | Para 3.4.2.4.2 | Oil Filters. Oil filters shall be changeable with common mechanics hand tools without having to remove or disconnect any other equipment. | 2.9 | |

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| 113 | Para 3.4.2.4.3 | Oil Sampling Valves. An engine oil sampling valve shall be provided on each engine, which allows an in-stream sample to be taken before the engine oil filter. The valve shall be manually operated and shall close automatically when released. It shall be made of material resistant to corrosion such that it will not contaminate the sample. The discharge port of the valve shall be covered with a captive chain cap conforming to MIL-V-81940/1B and SAE J514. | 2.9, 2.13 | |
| 114 | Para 3.3.12 | Reliability. The BEB shall achieve reliability of 275 hours Mean Time Between Hardware System Abort (MTBHSA) and 143 hours Mean Time Between Hardware Essential Function Failures (MTBEFF) (objective). | 2.9 | |
| 115 | Para 3.3.13 | Maintenance Ratio. The BEB shall operate continuously without maintenance for a minimum of 9 hours. The Maintenance Man Hour per Operating Hour (MMH/OH) ratio shall not exceed 0.136, allocated as MMH/OH ratio of 0.10 for field-level maintenance and MMH/OH ratio of 0.036 for sustainment-level maintenance. | 2.9 | |

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|---|---|---|---|---|
| 116 | Para 3.9 | Maintainability, Supportability. The tools required for BEB maintenance shall be found in the following tool sets (objective):<br><br>• Army General Mechanics Tool Kit, Automotive, (NSN 5180-00-177-7033)<br>• General Mechanics (NSN 5180-01-454-3787)<br>• Common #1 Organizational Maintenance (NSN 4910-01-754-0654)<br>• Common #2 (NSN 4910-00-754-0650)<br>• Supplemental #1 (NSN 4910-00-754-0653)<br>• Forward Repair System (NSN 4940-01-463-7940)<br><br>Special tools not contained in the tool sets shall be provided (threshold). | 2.9 | |
| 117 | Para 3.9.1 | At Platform Diagnostic Capabilities. The BEB shall have at-platform diagnostics in accordance with 3.9.1.1 or embedded diagnostics in accordance with 3.9.1.2 when Line Replacement Unit (LRU) fault isolation capability is | 2.9 | Will only be addressed if faults occur during testing. Faults will not be induced. |
| | | equivalent or greater than sections 3.9.1.1. In addition when practical, the BEB shall have the diagnostic ability to identify major system LRU failures (e.g., check engine lights, blinking/flashing lights etc.). | | |

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|---|---|---|---|---|
| 118 | Para 3.9.1.2 | Embedded Diagnostics. The BEB shall have an on-board display screen capable of retrieving and interpreting diagnostic error codes of major components of each system monitored by the data bus. The BEB shall feature either a single data bus network as specified by SAE J1939, J1708, or a multiple data bus network in accordance with J1939, which defines the interface between J1708 and J1939. The BEB data bus shall have built in sensors that provide fault isolation capability sufficient to identify failures of major components of each system monitored by the data bus. Software required to interface, retrieve, and interpret vehicle system's diagnostic data shall be provided to the government. Software will also be capable of displaying operator/driver informational data associated with each error code. Software will be capable of performing a self-test of its self. | 2.9 | Will be addressed by the vendor |
| 119 | Para 3.5 | Transportation. The BEB System shall be capable of being transported worldwide by rail, marine, highway and air modes. Guidance on transportability criteria to include load distribution and maximum dimensions is provided in MIL-STD-1366, MIL-HDBK-1791, and SDDCTEA Pamphlet 70-1. | 2.10 | |
| 120 | Para 3.5.1 | Disassembly for Transport. If disassembly is required to meet any of the transportation requirements, the BEB shall be disassembled or reassembled by two Soldiers within 30 minutes using no more than onboard tools and BII. Appliqué panel removal is not included in the time requirement. | 2.10 | |

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|---|---|---|---|---|
| 121 | Para 3.5.2 | Rail Transport. The BEB System shall be rail transportable in the Continental United States (CONUS) and NATO countries per MIL-STD-1366. The BEB shall be capable of withstanding shock loads resulting from rail impact testing in accordance with MIL-STD-810 without failure. When loaded on a 51-inch high rail car, the BEB System shall meet the dimensional requirements of the Association of American Railroads (AAR) Outline Diagram for Single Loads, Without End Overhang, on Open-Top Cars. When mounted on a 51.4-inch high railcar, the BEB System shall meet the dimensional requirements of NATO envelope-M equipment gauge diagram. These diagrams apply to standard gauge rail lines in CONUS and NATO countries. | 2.10 | |
| 122 | Para 3.5.3 | Marine Transport. The BEB System with or without the CBT or PLST shall be marine transportable on commercial and military watercraft per MIL-STD-1366. | 2.10 | Vendor certification required |
| 123 | Para 3.5.5 | Air Transport. <u>The BEB System shall be transportable on C-5 and C-17 aircraft per MIL-STD-1366 (threshold).</u> The BEB System shall be transportable on C-130 aircraft per MIL-STD-1366 (objective). | 2.10 | |

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| 124 | Para 3.5.6 | Tie-Down Provisions. The tie-down provisions shall conform to MIL-STD-209 Interface Standard for Lifting and tie-down provisions. The BEB shall have four tie-down provisions, to permit attachment to the floor or deck of the transportation system (the tie down provisions on the IBC and BAP are not sufficient to secure the weight of the BEB). The weight to be used when calculating the required strength of the tie-down devices shall include the BEB System at Full Load condition. Tie-down provisions may also be used as lifting provisions when such provisions meet the requirements. All provisions shall be labeled "LIFT" or "LIFT/TIE-DOWN" as applicable in not less than 1-inch high letters. | 2.10 | |
| 125 | Para 3.5.8 | Slinging/Lift Provisions. The BEB shall have slinging provisions conforming to MIL-STD-209. The BEB System shall be capable of a single-point lift for loading with a crane. The use of spreader bars is not permitted. Slinging provisions may also be used as tie-down provisions when such provisions meet the requirements. All provisions shall be labeled "LIFT" or "LIFT/TIE-DOWN" as applicable in not less than 1-inch high letters. | 2.10 | |
| 126 | Para 3.11.1 | BEB Transportability Data Plate(s). Each BEB shall be furnished with a transportability data plate(s), showing a silhouette of the BEB in its transport configuration indicating the item name and model/mark number, item serial number, NSN, contractor, contract number, date manufactured, shipping weight, maximum height and width, center of gravity, and the location and capacity of the slinging and tie-down provisions. The plate(s) shall be permanently attached and affixed on the BEB, per MIL-HDBK-1223 and A-A-50271, composition C Type I | 2.10 | |

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| | | Style I for identification plates and Type III (style not applicable) for all others in a viewable position from a person on the ground, and shall be fade and corrosion resistant. | | |
| 127 | Para 3.7.3 | Chemical, Biological, Radiological and Nuclear Contamination. BEB materials, particularly those used externally, shall be resistant to Chemical, Biological, Radiological and Nuclear (CBRN) agents and decontamination agents. The BEB shall be able to operate in a CBRN environment while contaminated for 72 hours. The BEB shall be capable of being decontaminated to negligible risk levels with minimum replacement of exposed components. | 2.12 | |
| 128 | Para 3.10.2 | Whole Body Vibration. Whole body vibration shall be below the health caution zone of ISO 2631-1 during calm water operations. | 2.13 | |
| 129 | Para 3.8 | Corrosion Control. The BEB shall be cleaned, treated, primed, and coated to preserve material integrity for operating over the 20-year service life. Operating environment includes fresh, brackish, and sea water immersion and spray; ground contact; gravel impingement during road transport; atmospheric contamination; airborne dust and dirt; and temperature extremes (-25 to +120 oF). Only normal washing, scheduled maintenance (exclusive of paint touch up) and repair of damaged areas (not a result of intended use, deficiency in design, materials, manufacturing or normal wear) shall be necessary to maintain corrosion control. The fit, form, or function of any component shall not be adversely affected due to corrosion throughout the in-service life. | 2.14 | |

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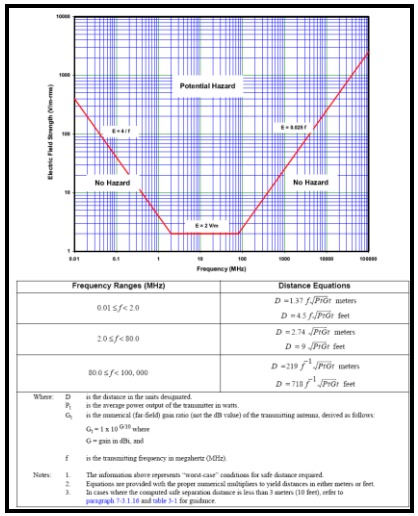
| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 130 | Para 3.8.1 | Corrosion Minimized. All attaching hardware shall not induce corrosion, galvanic or otherwise. Equipment and material used in the construction of the BEB system shall be corrosion protected/coated (threshold) or fabricated of non-corroding materials (objective). Direct contact of electrolytically dissimilar metals shall be isolated (threshold), eliminated (objective). | 2.14 | The contractor shall provide certification that dissimilar metal contact is isolated or eliminated. |
| 131 | Test Agency devised, DTC approved | Overall Assessment. The BEB shall be fully operational and in good condition following testing. | 2.15 | |
| 127 | Para 3.7.2.1 | NSL. The BEB shall survive a Near Strike Lightning (NSL) event at a distance of 10 m with the characteristics provided in MIL-STD-464 (using TABLE 2B: Electromagnetic fields from near strike lightning [close-to-ground]). Operation through a NSL event is not required. | 2.11 | |
| 128 | Para 3.7.2.2 | HEMP. The BEB shall survive a High-Altitude Electromagnetic Pulse (HEMP) environment in accordance with MIL-STD-464. Operation through a HEMP event is not required. The design shall conform to the requirements of MIL-STD-464, section 5.5. | 2.11 | |
| 129 | Para 3.7.2.3 | PESD and HESD. The BEB shall meet the requirements of Helicopter Electrostatic Discharge (HESD) and Personnel Electrostatic Discharge per MIL-STD-464, section 5.7. | 2.11 | |
| 130 | Para 3.7.2.4 | EMC. The BEB shall have ElectroMagnetic Compatibility (EMC) within itself and with its defined ElectroMagnetic Environment (EME). EMC describes compatibility with like platforms (such as other watercraft), friendly emitters, and hostile emitters, using reference for ground systems radiated interference and susceptibility characteristics as described in MIL-STD-464, Table 1D (External EME for ground systems). | 2.11 | |

[a]Unless otherwise specified, the criteria will be taken from the Purchase Description (PD) for the Boat, Bridge Erection, 23 August 2010.

| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 131 | NAVSEA OP 3565/ NAVAIR 16-1-529 Volume 2, para 2-2.1 | HERO. The maximum safe field strengths for the various frequency ranges for HERO susceptible, HERO unsafe, and HERO unreliable ordnance, shown on figures 2-1 and 2-2, when applied to the basic distance field strength equation, will determine the "worst-case" safe distance. The safe field strength/distance equations for HERO susceptible ordnance are derived from figure 2-1. The safe field strength/distance equations for HERO unsafe and HERO unreliable ordnance are derived from figure 2-2. | 2.11 | |



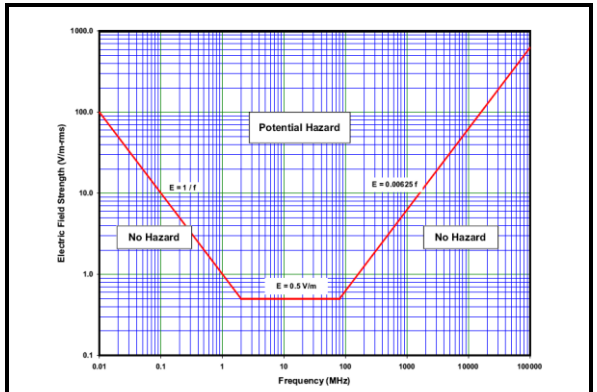

| Frequency Ranges (MHz) | Distance Equations |
|---|---|
| $0.01 \le f < 2.0$ | $D = 1.37\ f_c\sqrt{P_t G_t}$ meters<br>$D = 4.5\ f_c\sqrt{P_t G_t}$ feet |
| $2.0 \le f < 80.0$ | $D = 2.74\ \sqrt{P_t G_t}$ meters<br>$D = 9\ \sqrt{P_t G_t}$ feet |
| $80.0 \le f < 100,000$ | $D = 219\ f^{-1}\sqrt{P_t G_t}$ meters<br>$D = 718\ f^{-1}\sqrt{P_t G_t}$ feet |

Where: D is the distance in the units designated.
$P_t$ is the average power output of the transmitter in watts.
$G_t$ is the numerical (far-field) gain ratio (not the dB value) of the transmitting antenna, derived as follows:
$G_t = 1 \times 10^{G/10}$ where
G = gain in dBi, and
f is the transmitting frequency in megahertz (MHz).

Notes: 1. The information above represents "worst-case" conditions for safe distance required.
2. Equations are provided with the proper numerical multipliers to yield distances in either meters or feet.
3. In cases where the computed safe separation distance is less than 3 meters (10 feet), refer to paragraph 7-3.1.16 and table 3-1 for guidance.

Figure 2-1. Graph and equations for computing safe field strength/distance with HERO susceptible ordnance.

[a]Unless otherwise specified, the criteria will be taken from the Purchase Description (PD) for the Boat, Bridge Erection, 23 August 2010.

| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| | |  | | |

| Frequency Ranges (MHz) | Distance Equations |
|---|---|
| $0.01 \le f < 2.0$ | $D = 5.5\, f \sqrt{PtGt}$ meters<br>$D = 18\, f \sqrt{PtGt}$ feet |
| $2.0 \le f < 80.0$ | $D = 10.95\, \sqrt{PtGt}$ meters<br>$D = 36 \sqrt{PtGt}$ feet |
| $80.0 \le f < 100,000$ | $D = 876\, f^{-1} \sqrt{PtGt}$ meters<br>$D = 2,873 f^{-1} \sqrt{PtGt}$ feet |

Where:
- D is the distance in the units designated.
- $P_t$ is the average power output of the transmitter in watts.
- $G_t$ is the numerical (far-field) gain ratio (not the dB value) of the transmitting antenna, derived as follows:
  - $G_t = 1 \times 10^{G/10}$ where
  - G = gain in dBi, and
- f is the transmitting frequency in megahertz (MHz)

Notes:
1. The information above represents "worst-case" conditions for safe distance required.
2. Equations are provided with the proper numerical multipliers to yield distances in either meters or feet.
3. In cases where the computed safe separation distance is less than 3 meters (10 feet), refer to paragraph 7-3.1.16 and table 3-1 for guidance.

Figure 2-2. Graph and equations for computing safefield strength/distance for HERO unsafe and HERO unreliable ordnance.

[a]Unless otherwise specified, the criteria will be taken from the Purchase Description (PD) for the Boat, Bridge Erection, 23 August 2010.

| ITEM | APPLICABLE SOURCE[a] | TEST CRITERIA | SUBTEST | REMARKS |
|---|---|---|---|---|
| 132 | Para 3.7.2.5 | RADHAZ. SINCGARS antenna placement shall incorporate personnel safety standards for electromagnetic radiation hazard (RADHAZ) in accordance with MIL-STD-464 section 5.8.1, Hazards of Electromagnetic Radiation to Personnel (HERP). | 2.11 | |
| 133 | MIL-STD-464C, para 5.8.2 | HERF. Fuels shall not be inadvertently ignited by radiated EMEs. The EME includes onboard emitters and the external EME (see 5.3). Compliance shall be verified by test, analysis, inspection, or a combination thereof. | 2.11 | |

[a]Unless otherwise specified, the criteria will be taken from the Purchase Description (PD) for the Boat, Bridge Erection, 23 August 2010.

## APPENDIX B. TEST SCHEDULE

| TASK NAME | NO. OF DAYS |
|---|---|
| Initial inspection | 5 |
| System Configuration | 8 |
| Physical characteristics | 7 |
| Compatibility | 2 |
| HFE and safety | 3 |
| Performance | 5 |
| High temperature | 3 |
| Low temperature | 3 |
| Reliability | 80 |
| Transportability | 7 |
| Electromagnetic Environmental Effects | 14 |
| CBRCS (WDTC Assessment) | 60 |
| Corrosion | 2 |
| Whole body vibration | 2 |
| Final inspection | 3 |
| Test report | 75 |



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## APPENDIX C. INFORMAL COORDINATION

The following agencies have reviewed and concurred with this Test Plan:

Commander
U.S. Army Developmental Test Command
ATTN:TEDT-TMW (Mr. Joseph McKeever)
314 Longs Corner Road
Aberdeen Proving Ground, MD 21005-5055

Commander
U.S. Army TACOM Life Cycle Management Command
ATTN:SFAE-AMS-FP-E (Mr. Rand Ponting)
6501 East Eleven Mile Road
Warren, MI 48397-5000

Director
U.S. Army Evaluation Center
ATTN: TEAE-SET (Casey Fillinger)
4119 Susquehanna Boulevard
Aberdeen Proving Ground, MD 21005-3013



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# APPENDIX D. U.S. ARMY TACOM LIFE CYCLE MANAGEMENT COMMAND (TACOM LCMC) CORROSION RATING SYSTEM



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Adopted by:
U.S. Army TACOM Life Cycle Management Command (TACOM LCMC)

**Introduction**

The pictures contained within this document represent corrosive attack that may be present on vehicle and weapon system components. Although every effort has been made to accurately depict the various stages of corrosion, not all stages for all types of materials are represented by the enclosed pictures. These pictures are intended to be used as a guideline during inspections, not to depict all forms and stages of corrosion. The overall rating given to a component should be based upon the narrative description of each stage below.

This document is meant to be used only to monitor corrosion occurring on metallic components and to accurately report the severity of corrosion on that component. No effort is made by this document to determine what constitutes a corrosion failure. This should be done on a system-by-system or component-by-component basis by the program management office for that system.

**Stages of Corrosion**

The different stages of corrosion are described below. These are also highlighted in several of the pictures contained within this document. These figures are for informational purposes only and are not intended to be all-inclusive. The severity of corrosion should be determined by the narrative for the five stages of corrosion listed below.

Stage 0 - No visible signs of corrosion or corrosive attack. No presence of white, red, or black corrosive products. No presence of paint film blistering indicating corrosive attack. Discoloration of a coating system, other than caused by corrosion, is permissible.

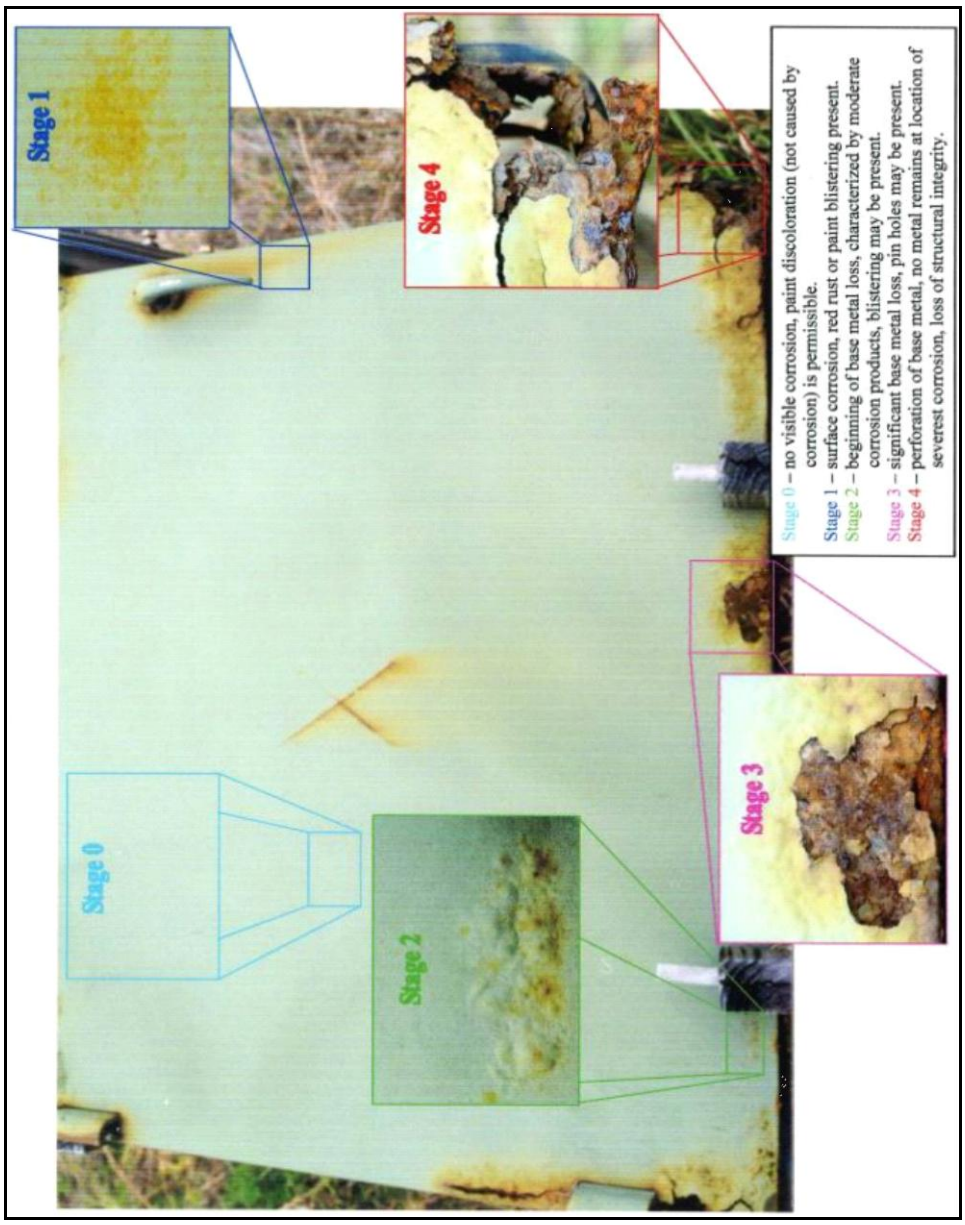
Stage 1 - General surface corrosion is present. White, red, and/or black corrosion products are present on the surface of the component being evaluated, but no significant attack is present. Minor blistering of the coating may have also occurred.

Stage 2 - Heavy corrosion products are present on the surface of the component. This is the beginning of base metal loss; however, no significant loss has yet occurred. Moderate white, red, and/or black corrosion products are present on the component surface. Severe blistering of the paint may have also occurred.

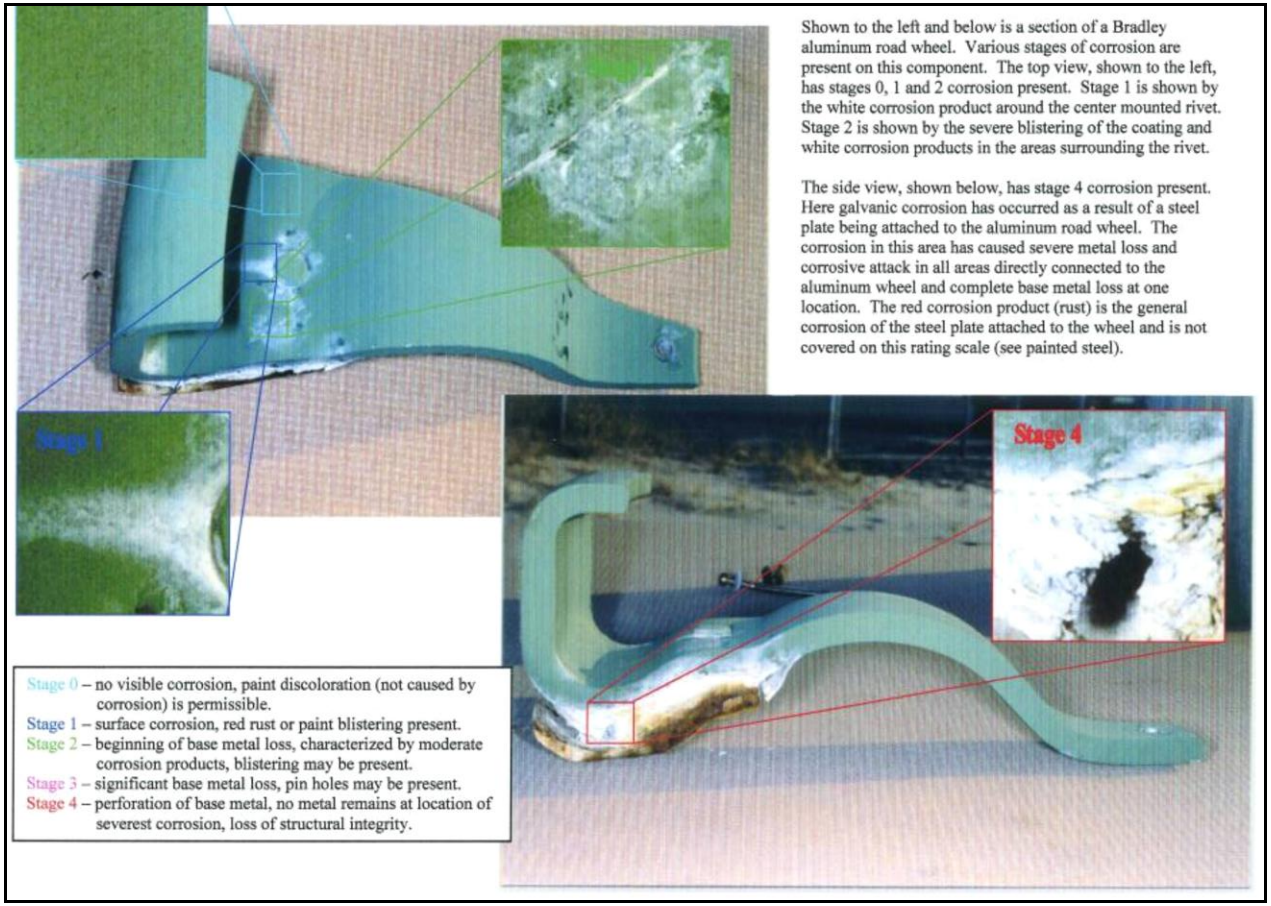
Stage 3 - Corrosive attack has resulted in significant base metal loss. Reduction in the cross-section thickness of the component has occurred. Voluminous white, red, and/or black corrosion products are present on the component. The structural integrity of the component may or may not be compromised. Pinholes, which may or may not penetrate through the base metal, may have developed.

Stage 4 - Perforation of the base metal has occurred. No metal remains at the point of the severest corrosive attack. The component has lost structural integrity.

Painted Steel



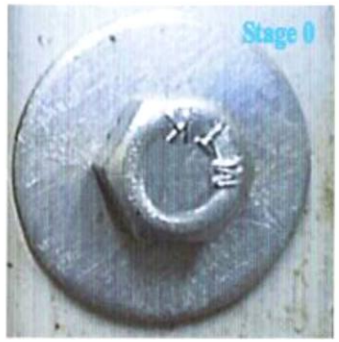

Shown to the left and below is a galvanized steel door painted with a MIL-Spec CARC coating system. Here the open seam area has signs of corrosion initiation. This is more easily seen on the close-up picture below. Here, and on other painted galvanized steel, stage 1 corrosion is shown by the white corrosion poducts of the galvanizing. Stages 0, 2, 3 and 4 are the same as for painted steel. Here stage 2 corrosion is observed at several areas along the seam as shown by red corrosion products (rust). No corrosion beyond stage 2 is observed on this component.
Stage 1
Stage 2
Stage 0 – no visible corrosion, paint discoloration (not caused by corrosion) is permissible.
Stage 1 – surface corrosion, red rust or paint blistering present.
Stage 2 – beginning of base metal loss, characterized by moderate corrosion products, blistering may be present.
Stage 3 – significant base metal loss, pin holes may be present.
Stage 4 – perforation of base metal, no metal remains at location of severest corrosion, loss of structural integrity.

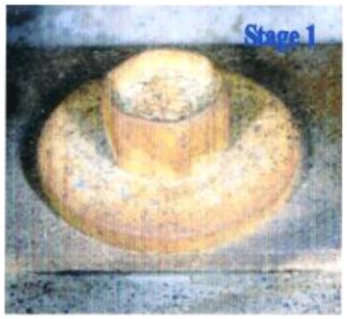



Shown to the left and below is a section of a Bradley aluminum road wheel. Various stages of corrosion are present on this component. The top view, shown to the left, has stages 0, 1 and 2 corrosion present. Stage 1 is shown by the white corrosion product around the center mounted rivet. Stage 2 is shown by the severe blistering of the coating and white corrosion products in the areas surrounding the rivet.

The side view, shown below, has stage 4 corrosion present. Here galvanic corrosion has occurred as a result of a steel plate being attached to the aluminum road wheel. The corrosion in this area has caused severe metal loss and corrosive attack in all areas directly connected to the aluminum wheel and complete base metal loss at one location. The red corrosion product (rust) is the general corrosion of the steel plate attached to the wheel and is not covered on this rating scale (see painted steel).

Stage 0 – no visible corrosion, paint discoloration (not caused by corrosion) is permissible.
Stage 1 – surface corrosion, red rust or paint blistering present.
Stage 2 – beginning of base metal loss, characterized by moderate corrosion products, blistering may be present.
Stage 3 – significant base metal loss, pin holes may be present.
Stage 4 – perforation of base metal, no metal remains at location of severest corrosion, loss of structural integrity.






Stage 0 – no visible corrosion, paint discoloration (not caused by corrosion) is permissible.
Stage 1 – surface corrosion, red rust or paint blistering present.
Stage 2 – beginning of base metal loss, characterized by moderate corrosion products, blistering may be present.
Stage 3 – significant base metal loss, pin holes may be present.
Stage 4 – perforation of base metal, no metal remains at location of severest corrosion, loss of structural integrity.

Small Aluminum Components

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## APPENDIX F. ABBREVIATIONS

| | |
|---|---|
| AAR | = Association of American Railroads |
| AGL | = above ground level |
| AGM | = absorbed glass-mat |
| APG | = Aberdeen Proving Ground |
| AR | = Army Regulation |
| ATC | = U.S. Army Aberdeen Test Center |
| ATEC | = U.S. Army Test and Evaluation Command |
| ATTLA | = Air Transportability Test Loading Agency |
| BAP | = bridge adaptor pallet |
| BEB | = bridge erection boat |
| BHF | = biodegradable hydraulic fluid |
| bhp | = brake horsepower |
| BII | = basic issue items |
| Btu | = British thermal unit |
| CARC | = chemical agent resistant coating |
| CBRCS | = chemical, biological and radiological contamination survivability |
| CBRN | = chemical, biological, radiological, and nuclear |
| CBT | = common bridge transporter |
| CFR | = Code of Federal Regulations |
| CG | = center of gravity |
| $CO_2$ | = carbon dioxide |
| COEI | = components of end item |
| COLREGS | = Collision Regulations |
| CONUS | = Continental United Status |
| COTS | = commercial off-the-shelf |
| DA | = Department of the Army |
| DAQ | = data acquisition |
| DOD | = Department of Defense |
| DODI | = Department of Defense Instruction |
| DPG | = Dugway Proving Ground |
| DSB | = dry support bridge |
| DTC | = U.S. Army Developmental Test Command |
| DTS | = Defense Transportation System |
| E3 | = electromagnetic environmental effects |
| EAT | = external air transport |
| EATWT | = EAT weight |
| EGR | = exhaust gas recirculation |
| EMC | = electromagnetic compatibility |
| EME | = electromagnetic environment |
| EMI | = electromagnetic interference |
| EMITF | = Electromagnetic Interference Test Facility |
| EPA | = Environmental Protection Agency |
| ESLRF | = eye-safe laser range finder |
| ESD | = electrostatic discharge |
| FD/SC | = Failure Definition/Scoring Criteria |
| FLIR | = forward-looking infrared |
| FM | = Field Manual |
| FOUO | = For Official Use Only |
| FOV | = field-of-view |



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FSR = field service representative
GPS = Global Positioning System
GSW = gross shipping weight
HAP = hazardous air pollutants
HAZMAT = hazardous materials
HEMTT = heavy expanded mobility tactical truck
HEMP = high-altitude electromagnetic pulse
HERF = hazards of electromagnetic radiation to fuel
HERO = hazards of electromagnetic radiation to ordnance
HERP = hazards of electromagnetic radiation to personnel
HESD = helicopter electrostatic discharge
HFE = human factors engineering
HIGE = hover in ground effect
HOGE = hover out of ground effect
HPD = horizontally polarized dipole
HSL = helicopter sling loading
HSLWT = HSL weight
IBA = individual body armor
IBC = improved boat cradle
ICE = internal combustion engine
IEEE-SA = Institute of Electrical and Electronics Engineers Standards Association
IEEE-STD = Institute of Electrical and Electronics Engineers Standard
IR = infrared
IRB = improved ribbon bridge
ISO = International Organization for Standardization
IUID = item unique identification
JP = jet propellant
KIAS = knots indicated air speed
LED = light emitting diode
LHS = load-handling system
LRU = line replaceable unit
MLC = military load classification
MLPLF = materiel lift point load factor
MMH/OH = maintenance man-hours per operating hours
MOLLE = modular lightweight load-carrying equipment
MOPP = mission-oriented protective posture
MPFA = maximum projected frontal area
MR = maintenance ratio
MRBC = Multirole Bridge Company
MSD = maintenance support device
MSFDCA = Multiservice Flight Data Collection Sheet
MTBEFF = mean time between essential function failures
MTBHSA = mean time between hardware system aborts
NAS = Naval Air Station
NAVSEA = Naval Sea Systems Command
NATO = North Atlantic Treaty Organization
NBC = nuclear, biological, chemical
NDI = nondevelopmental item
NDT = nondestructive test
NET = new equipment training
NIST = National Institute of Standards and Technology



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NOX = oxides of nitrogen
NSL = near-strike lightning
NSN = national stock number
NSRDEC = U.S. Army Natick Soldier Research, Development and Engineering Center
NSWC = Naval Surface Warfare Center
ODS = ozone depleting substances
OEA = Arctic engine oil
PA = power amplifier
PAAF = Phillips Army Airfield
PCO = Procuring Contracting Officer
PD = Purchase Description
PEL = permissible exposure limit
PESD = personnel electrostatic discharge
PFD = personal flotation device
PLST = palletized loading system trailer
PM = program manager
PMCS = preventive maintenance checks and services
POL = petroleum, oils, and lubricants
ppm = parts per million
PPQT = Preproduction Qualification Test
PSD = power spectral density
RO/RO = roll-on/roll-off
RADHAZ = radiation hazard
RF = radio frequency
rpm = revolutions per minute
SAE = Society of Automotive Engineers
SCXI = Signal Conditioning Extensions for Instrumentation
SDDCTEA = Surface Deployment and Distribution Command - Transportation Engineering Agency
SI = International System
SINCGARS = single channel ground/airborne radio system
SME = subject matter expert
SRB = standard ribbon bridge
SS = Swiftships Shipbuilders
STANAG = Standardization Agreement
TACOM LCMC = U.S. Army TACOM Life Cycle Management Command
TEA = Transportation Engineering Agency
TIIN = test item identification number
TM = Technical Manual
TMDE = test, measurement, and diagnostic equipment
TIR = Test Incident Report
TOP = Test Operations Procedure
TSP = test support package
ULSD = ultra-low sulfur diesel
UNDEX = underwater explosion
USCG = U.S. Coast Guard
USMC = U.S. Marine Corps
UV = ultraviolet
V/STOL = vertical/short takeoff and landing
VAA = vehicle adapter assembly



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| | |
|---|---|
| VAC | = volts alternating current |
| VDC | = volts direct current |
| VMC | = visual meteorological conditions |
| VOC | = volatile organic compounds |
| VSWR | = voltage standing wave ratio |
| WDTC | = West Desert Test Center |



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## APPENDIX G. DISTRIBUTION LIST

| Addressee | Test Plans | Final Reports |
|---|---|---|
| Director<br>U.S. Army Developmental Test Command<br>ATTN: TEDT-TMW (Mr. Joseph McKeever)<br>314 Longs Corner Road<br>Aberdeen Proving Ground, MD 21005-5055 | 1 | 1 |
| Commander<br>U.S. Army TACOM Life Cycle Management Command<br>ATTN: SFAE-AMS-FP-E (Mr. Rand Ponting)<br>6501 East Eleven Mile Road<br>Warren, MI 48397-5000 | 1 | 1 |
| Director<br>U.S. Army Evaluation Center<br>ATTN: TEAE-SET (CW5 Kenneth Bittner)<br>4119 Susquehanna Boulevard<br>Aberdeen Proving Ground, MD 21005-3013 | 1 | 1 |
| Commander<br>U.S. Army Aberdeen Test Center<br>ATTN: TEDT-AT-WFE (Mr. Charlie Jones)<br>(Ms. Marie Swearingen)<br>TEDT-AT-PO<br>400 Colleran Road<br>Aberdeen Proving Ground, MD 21005-5059 | 1<br>1<br>1 | 1<br>1<br>1 |

Secondary distribution is controlled by Commander, U.S. Army TACOM Life Cycle Management Command, ATTN: SFAE-AMS-FP-E.



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