



## DEPARTMENT OF THE NAVY

CRANE DIVISION  
NAVAL SURFACE WARFARE CENTER  
300 HIGHWAY 361  
CRANE INDIANA 47522-5001

IN REPLY REFER TO:

9223  
6095/2089  
11 Jun 02

From: Commander, Crane Division, Naval Surface Warfare Center  
To: Distribution

Subj: ACN 2/A TO NSTM 223; DIGITAL HYDROMETER

Ref: (a) NAVSEA S9086-G1-STM-010/Ch-223R3, Naval Ships'  
Technical Manual (NSTM) Chapter 223 Rev 3,  
31 December 2000, Submarine Storage Batteries Volume 1,  
Lead-Acid Batteries

1. This is Advance Change Notice (ACN) 2/A, NSWC Port Hueneme Control Number N00164-02-DR02, to reference (a), which is currently undergoing a major revision. The next revision of reference (a) will incorporate this ACN.

2. This ACN is intended for immediate use because it affects maintenance procedures. The use of the digital hydrometer for obtaining temperature-corrected specific gravity readings results in reduced man-hours for Ship's Force.

3. Replace paragraph 1.9.8 with the following:

223-1.9.8 Hydrometers. A hydrometer is a device for measuring the specific gravity of a liquid (paragraph 223-1.4.14). Digital hydrometers are self-contained, electronic units, which indicate a digital readout of temperature corrected specific gravity and electrolyte temperature. The floating hydrometer consists of a weighted bulb with a long stem. When the hydrometer floats in a liquid, the depth of immersion, over the range for which it is designed, decreases linearly with increasing specific gravity. The stem is graduated to show the specific gravity corresponding to each depth of immersion. (see Table 223-3 for hydrometers used with submarine batteries.)

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Replace Table 223-3 with the following:

**Table 223-3 Battery Test Kit**

Equipment	National Stock Number	Onboard Allowance						
1. Barrel, syringe, Type A	9L6630-00-290-0500	6						
2. Bulb, hydrometer (rubber)	9L6630-00-286-3868	4						
3. Gauge, electrolyte level (8 points/in or 1 point/3mm)	9G6680-00-246-1103	3						
4. Gloves, rubber, size 10	9D8415-00-266-8677	8						
5. Hose assembly	9C4720-00-230-6577	3						
6. Hydrometer, digital	9N6625-01-485-9637	2						
7. Hydrometer, graduate float (range 1.228 to 1.316)	1H6630-00-116-5599	10 or 6#						
8. Hydrometer, graduate float (range 1.200 to 1.280)	9L6630-00-580-3951	6 or 3#						
9. Hydrometer, graduate float (range 1.060 to 1.240)	1H6630-01-049-1009	4 or 2#						
10. Plug, bottom, hard	9L6630-00-291-8077	3						
11. Plug, top, soft	9L6630-00-291-8081	3						
12. Thermometer, dial, bimetallic	9G6685-00-802-9270	3						
13. Restrictor, fluid flow	9C4730-00-203-7626	24						
14. Teflon rod, 4.76 mm (3/16 in) diameter	9G9390-00-781-7851	2						
15. Flash arrester, ASB-49 and PDX-57 (type 1)**	9G6140-00-731-9144	2**						
16. Flash arrester, ASB-49 (type 2)**	9G6140-00-900-8252	2**						
17. Flash arrester, LLL-69 (Mod 3)	TBD	2						
18. Tube with collar (air supply tube)*	9GS140-01-214-3798	126*						
19. Battery record book	0116-LF-014-1100	1						
<p>** Either type 1 or type 2 flash arrester will be required but not both. # Lesser number required when digital hydrometer is used. * Depending on type of battery installed, this item is covered by the following Allowance Parts List (APL); [126 each for ASB-49 and LLL-69, 128 each for PDX-57]:</p> <table><tr><td>090660045</td><td>ASB-49</td></tr><tr><td>T090660036</td><td>PDX-57</td></tr><tr><td>090660046</td><td>LLL-69</td></tr></table>			090660045	ASB-49	T090660036	PDX-57	090660046	LLL-69
090660045	ASB-49							
T090660036	PDX-57							
090660046	LLL-69							

4. Replace paragraph 223-3.1.6.1 with the following:

223-3.1.6.1 Measurements. The specific gravity of the electrolyte is measured with a digital hydrometer or a floating hydrometer that is weighted at one end. Digital hydrometers automatically correct for the temperature of the electrolyte. With the floating hydrometer depth of immersion of the instrument depends upon the specific gravity of the liquid in which it floats. Floating hydrometer readings must be corrected for the temperature of electrolyte when the readings are to be used as a measure of the state of charge, since they depend upon three factors, of which only the first furnishes a direct measure of the state of charge. These factors are:

- a. the mass of sulfuric acid in the electrolyte.

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- b. the volume of electrolyte or height of electrolyte in the cell.
- c. the temperature of the electrolyte.

5. Replace paragraph 3.1.6.2 with the following:

223-3.1.6.2 Correction for Temperature. Hydrometers for Naval use are calibrated to read correctly when the electrolyte temperature is 26.7° C (80° F). To correct to this temperature, add 0.001 to the hydrometer reading for each 1.7° C (3° F) the electrolyte temperature exceeds 26.7° C (80° F) and subtract 0.001 from the hydrometer reading for each 1.7° C (3° F) the electrolyte temperature is below 26.7° C (80° F) as shown in Table 223-9. Temperature correction is performed automatically by digital hydrometers so digital hydrometer readings do not require temperature correction.

6. Replace paragraph 3.1.7 with the following:

223-3.1.7 Interpretation Of Corrected Specific Gravity. Digital hydrometers give readouts of the temperature-corrected specific gravity of the electrolyte above the plates. Float hydrometers give the uncorrected specific gravity of the electrolyte above the plates, and require temperature correction. If the electrolyte is not uniformly mixed, the specific gravity of the electrolyte above the plates does not represent the true state of charge or discharge.

7. Replace paragraph 5.1.2k. with the following:

- k. Check accuracy of reference hydrometer floats at intervals specified by PMS (paragraph 223-5.5.3). Accuracy of digital hydrometers should be checked annually (paragraph 233-5.5.3.3).

8. Replace paragraph 5.3.4 with the following:

223-5.3.4 Specific Gravity Measurements and Corrections. The specific gravity should be measured in accordance with paragraph 223-3.1.6.1. Working hydrometer floats that are used to take readings must also have their readings corrected for any reading inaccuracies identified during comparison of working hydrometer floats to reference hydrometer floats that are known to provide accurate readings. The accuracy of reference hydrometer floats is checked at intervals specified by PMS (paragraph 223-5.5.3) and the accuracy of working hydrometer floats in use is determined after each equalizing charge prior to taking cell readings (paragraph 223-5.3.4.7). Digital hydrometers automatically temperature correct specific gravity readings.

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9. Replace paragraph 5.3.4.5 with the following:

223-5.3.4.5 Use of Hydrometers. Hydrometers for submarine storage battery use shall be used for no other purpose except as described herein. All working hydrometers shall be flushed with fresh water after use (paragraph 223-5.5.3.3 for digital hydrometers) in order to prevent the accumulation of sticky substances inside the glass barrel. These substances gradually gather on the hydrometer float, causing the readings to be in error. NAVSEA has authorized the use of digital hydrometers for measuring specific gravity of potassium hydroxide (KOH) used in electrolytic oxygen generators (EOG). Ensure digital hydrometers are cleaned as specified by PMS after measuring KOH.

**WARNING**

**Do not allow sulfuric acid and potassium hydroxide to mix or come in contact with each other.**

11. Insert the following new paragraph:

223-5.5.3.3 Digital Hydrometer. NAVSEA has authorized the use of the Anton Paar DMA 35N digital hydrometer with custom function 80/60. The digital hydrometer indicates temperature-corrected specific gravity and temperature of the electrolyte. It can store readings for every cell in the battery and is provided with an infrared/RS 232 cable for downloading readings to a computer. Digital hydrometers should be flushed thoroughly with fresh water after use by drawing fresh water into and discharging water from the measuring cell using the built-in pump. A minimum of ten flushes should be used to ensure all sample solution is removed from the measuring cell. Digital hydrometers require annual calibration and do not require comparison with reference glass hydrometers.

12. This ACN does not authorize modification of existing government contracts, project orders, work requests, or allotments. Therefore, requests must be made to cognizant authority for authorization and funding as may be required to accomplish this ACN. Cognizant authorities are requested to authorize accomplishment of any required effort by this ACN.

13. Following incorporation of this change to printed copies of reference (a), record accomplishment by entering change data on the "Record of Changes" page. File a copy of this letter after the "Record of Changes" page in the printed manual.

14. File a copy of this letter with all CD-ROM versions of reference (a).

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15. NAVSEA 05Z has assigned NSWC Crane as In Service Engineering Agent (ISEA) for submarine batteries and duties that include the NSTM Chapter 223 maintenance responsibilities.

16. NSWC Crane point of contact is Mr. Dan Rea, Code 6095, telephone DSN 482-2817 or commercial 812-854-2817, e-mail Rea\_D@crane.navy.mil; or Mr. John Inman, Code 6095, telephone DSN 482-2161 or commercial 812-854-2161.

*RAAreen (acting)*  
JANNA L. FOXX  
By direction

Distribution:

COMNAVSYSKOM (05Z41, 92T228, 08K)  
COMSUBLANT (N4024)  
COMSUBPAC (N4512)  
GNB Industrial Power  
NAVSURFWARFARCENDIV NSDSA Port Hueneme (Code 5E31)  
MARF KAPL-KSO  
S8G KAPL-KSO  
MTS - 626  
MTS - 635  
SSN - 21 USS SEAWOLF  
SSN - 22 USS CONNECTICUT  
PCU - 23 USS JIMMY CARTER  
SSN - 683 USS PARCHE  
SSN - 688 USS LOS ANGELES  
SSN - 690 USS PHILADELPHIA  
SSN - 691 USS MEMPHIS  
SSN - 698 USS BREMERTON  
SSN - 699 USS JACKSONVILLE  
SSN - 700 USS DALLAS  
SSN - 701 USS LA JOLLA  
SSN - 705 USS CITY OF CORPUS CHRISTI  
SSN - 706 USS ALBUQUERQUE  
SSN - 707 USS PORTSMOUTH  
SSN - 708 USS MINNIAPOLIS-ST. PAUL  
SSN - 709 USS HYMAN G. RICKOVER  
SSN - 710 USS AUGUSTA  
SSN - 711 USS SAN FRANCISCO  
SSN - 713 USS HOUSTON  
SSN - 714 USS NORFOLK  
SSN - 715 USS BUFFALO  
SSN - 716 USS SALT LAKE CITY  
SSN - 717 USS OLYMPIA

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SSN - 718	USS HONOLULU
SSN - 719	USS PROVIDENCE
SSN - 720	USS PITTSBURGH
SSN - 721	USS CHICAGO
SSN - 722	USS KEY WEST
SSN - 723	USS OKLAHOMA CITY
SSN - 724	USS LOUISVILLE
SSN - 725	USS HELENA
SSN - 726	USS OHIO
SSN - 727	USS MICHIGAN
SSN - 728	USS FLORIDA
SSN - 729	USS GEORGIA
SSN - 730	USS HENRY M. JACKSON
SSN - 731	USS ALABAMA
SSN - 732	USS ALASKA
SSN - 733	USS NEVADA
SSN - 734	USS TENNESSEE
SSN - 735	USS PENNSYLVANIA
SSN - 736	USS WEST VIRGINIA
SSN - 737	USS KENTUCKY
SSN - 738	USS MARYLAND
SSN - 739	USS NEBRASKA
SSN - 740	USS RHODE ISLAND
SSN - 741	USS MAINE
SSN - 742	USS WYOMING
SSN - 743	USS LOUISIANA
SSN - 750	USS NEWPORT NEWS
SSN - 751	USS SAN JUAN
SSN - 752	USS PASADENA
SSN - 753	USS ALBANY
SSN - 754	USS TOPEKA
SSN - 755	USS MIAMI
SSN - 756	USS SCRANTON
SSN - 757	USS ALEXANDRIA
SSN - 758	USS ASHEVILLE
SSN - 759	USS JEFFERSON CITY
SSN - 760	USS ANNAPOLIS
SSN - 761	USS SPRINGFIELD
SSN - 762	USS COLUMBUS
SSN - 763	USS SANTA FE
SSN - 764	USS BOISE
SSN - 765	USS MONTPELIER
SSN - 766	USS CHARLOTTE
SSN - 767	USS HAMPTON
SSN - 768	USS HARTFORD
SSN - 769	USS TOLEDO
SSN - 770	USS TUCSON
SSN - 771	USS COLUMBIA

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SSN - 772 USS GREENEVILLE  
SSN - 773 USS CHEYENNE  
PCU - 774 USS VIRGINIA  
COMMANDER NORFOLK NSY, CODE 270  
COMMANDER PEARL HARBOR NSY, CODE 270  
COMMANDER PEARL HARBOR NSY, BLDG 394 BATTERY SHOP  
COMMANDER PORTSMOUTH NSY, CODE 270.2  
COMMANDER PORTSMOUTH NSY, 951 BATTERY SHOP  
COMMANDER PUGET SOUND NSY, CODE 215  
COMMANDER PUGET SOUND NSY, 951 BATTERY SHOP  
COMMANDER TRIDENT REFIT FACILITY BANGOR  
COMMANDER TRIDENT REFIT FACILITY KINGS BAY  
COMMANDER SUBMARINE SQUADRON ONE  
COMMANDER SUBMARINE SQUADRON TWO  
COMMANDER SUBMARINE GROUP TWO  
COMMANDER SUBMARINE SQUADRON THREE  
COMMANDER SUBMARINE SQUADRON FOUR  
COMMANDER SUBMARINE DEVELOPMENT SQUADRON FIVE  
COMMANDER SUBMARINE SQUADRON SIX  
COMMANDER SUBMARINE SQUADRON SEVEN  
COMMANDER SUBMARINE GROUP SEVEN  
COMMANDER SUBMARINE SQUADRON EIGHT  
COMMANDER SUBMARINE GROUP EIGHT  
COMMANDER SUBMARINE GROUP TEN  
COMMANDER SUBMARINE SQUADRON ELEVEN  
COMMANDER SUBMARINE DEVELOPMENT SQUADRON TWELVE  
COMMANDER SUBMARINE SQUADRON SIXTEEN  
COMMANDER SUBMARINE SQUADRON SEVENTEEN  
COMMANDER SUBMARINE SQUADRON TWENTY  
COMMANDER SUBMARINE SQUADRON TWENTY TWO  
COMMANDER SUBMARINE SUPPORT UNIT NORFOLK  
COMMANDER SUBMARINE SUPPORT UNIT GROTON  
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GENERAL DYNAMICS ELECTRIC BOAT DIVISION  
SUBMEPP (Code 1840)

Distribution (2):

Distribution made in accordance with Technical Data Management Information System (TDMIS) distribution list of 30 Apr 02.