



DALT55 Digital Altimeter Instrument

INSTRUCTION SUPPLEMENT BARFIELD M/N DALT55

*Doc. P/N: 61-101-02184_02186
Revision E
June 25, 2015*

BARFIELD, INC.

Manual applicable for DALT55 P/Ns:

101-02184

101-02186

DALT55 is Designed to be used with Barfield
Pitot-Static Test Sets (1811 Series) and other
Ground Support Test Equipment.

Not for aircraft installation.

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CONTACT INFORMATION

Users are requested to notify the manufacturer of any discrepancy, omission, or error found in this manual. Inquiries should include specific questions and reference the publication title, number, chapter, page, figure, paragraph, and effective date.

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REVISION RECORD

REV.	ECO #	REV. DATE	DESCRIPTION OF CHANGE
A	-	May/20/11	First Issue. New Manual to be use for both part numbers 101-02184 & 101-02186. For P/N 101-02184 this document revision supersedes document number 61-101-02184-RevE
B	260-00950	Jan/10/13	Revision to update battery part number.
C	260-01017	Jul/1/14	Updated to add SDS as Appendix B
D	260-01046	Oct/ 24/ 14	Updated Barfield logos
E	260-01111	Jun/25/15	Updated Appendix B with the new release of the SDS



LIST OF APPROVED REPAIR FACILITIES

The manufacturer of this equipment does not recommend the user to attempt any maintenance or repair. In case of malfunction, contact the manufacturer, to obtain the list of approved repair facilities worldwide, ensuring that this equipment will be serviced using proper procedures and certified instruments. A Return Maintenance Authorization (RMA) number will be assigned during this call, to keep track of the shipment and the service.

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RECERTIFICATION

Barfield Digital Airspeed Instruments, P/Ns 101-02184 and 101-02186, have a one-year recertification requirement. Qualified technicians in a shop equipped with the necessary tooling, facilities, and Barfield-approved procedures must perform the maintenance required by these units.

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Form 7.5.3-13
Dated 09/01/2014, Rev. 1



AIRFRANCE
INDUSTRIES



LIST OF ACRONYMS / TERMS USED

CCW.....	Counterclockwise
CW	Clockwise
EEPROM.....	Electrically Erasable Programmable Read-Only Memory
EPR.....	Engine Pressure Ratio
FS.....	Full Scale
Ft.	Feet
F/W.....	Firmware
InHg.....	Inches of mercury
Km/hr.....	Kilometers per hour
Kts.....	Knots
LCD	Liquid Crystal Display
Mb	Millibar
Mb abs	Millibar absolute
MPH	Miles per hour
P/N	Part Number
Ps.....	Static Pressure
PSI	Pounds per Square Inch
PSID.....	Pounds per Square Inch Differential
Pt.....	Pitot Pressure
S/N	Serial Number

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1. GENERAL INFORMATION

1.1 Purpose

Electronic pressure sensors are far more stable, damage-resistant and more widely available than analog instruments. The DALT55 is designed as a digital, retrofit replacement for the current analog altimeter instrument found in the 1811 Pitot-Static Test Set series and equivalent testers. The fit, form and size of the DALT55 allows for easy installation into the test set.

1.2 Description

Data on the DALT55 shows on a graphic liquid crystal display (LCD). The display is backlit with an auto-shutdown timer for battery life protection. A battery pack supplies the power for the instrument. A keypad is used for access to, and movement through, the menu functions shown on the display. Additional keys on the keypad allow adjustment of the display contrast. The icons also serve as an indication of the battery power level and show the two-instrument state.

1.3 Features

The DALT55 calculates and displays such aeronautical data as altitude, vertical speed, differential or Pitot* pressure, and engine pressure ratio* (EPR). It may perform an automatic static leak test or a calibration procedure.

NOTE: * Feature is available when DALT55 and DAS650 are connected as part of instrument configuration.

Units of measurements for the DALT55 are user-determined and selectable. Units for aeronautical data can be expressed in feet, feet per minute (English), in meters and meters/minute. Units for static pressure data are available in inHg abs, mb abs or psia. The user may also choose between the Aeronautical or Pressure display.

The DALT55 allows the user to retrieve maintenance information such as instrument serial number (S/N), manufacturer part number (P/N), configuration of single or dual instruments, time, date and password setting and enabling automatic power off.

2. DIGITAL ALTIMETER SPECIFICATIONS – (P/N 101-02184)

The DALT55 specifications meet the requirements described in Federal Aviation Regulation Part 43 Appendix-E, which defines the requirements for accuracy of an aircraft’s altimeter and as such is reference for the accuracy of Pitot-Static testers.

Note: **Do not** use these specifications to certify the accuracy of **RVSM** qualified aircraft instruments.

DALT55 (P/N 101-02184)			
RANGE	-1500 to 55,000 ft		
ACCURACY	0.025% Typical FS over complete operating temperature range. Specific accuracies at certain altitudes are:		
	Altitude		Altitude
	-1,500 Ft	± 7 Ft	30,000 Ft
	0 Ft	± 7 Ft	40,000 Ft
	10,000 Ft	± 10 Ft	50,000 Ft
	20,000 Ft	± 14 Ft	55,000 Ft
<p><i>Note: When displaying altitude in Ft: Feet or M: Meters, the pressure altitude calculation is based on a baro set of 29.921 inHg = 1013.2 mb.</i></p> <p><i>Note: The Baro Set value cannot be changed, it is set at 29.921 inHg.</i></p>			
STABILITY	0.05% FS (Typical) over 12 months. <i>Note: This tolerance represents the typical stability over a 12 month period. If tighter tolerances are required, the calibration interval should be reduced or establish proof of stability.</i>		
PRESSURE RANGE	3.425 inHg to 32 inHg absolute		
ROC	VSI (Vertical Speed Displayed) ± 50 Ft/min (VSI > 150 Ft/min) ± 10 M/Min (VSI > 40 M/min) Note: Displays “0” below 100 Ft/min & 30 M/min		
LEAK TEST MODE	Measures Leak Rate After 1 minute of stabilization and the minimum of 1 minute Leak Test Interval, the Leak Test accuracy: ± 3 Ft/min ± 1 M/min		
TEMPERATURE RANGE:	OPERATING: -10° C to 50° C (-4° F to 122° F) STORAGE: -30° C to 60° C (-22° F to 140° F)		

DIGITAL ALTIMETER SPECIFICATIONS – (P/N 101-02186)

The DALT55 specifications meet the requirements described in Federal Aviation Regulation Part 43 Appendix-E, which defines the requirements for accuracy of an aircraft's altimeter and as such is reference for the accuracy of Pitot-Static testers.

Note: **Do not** use these specifications to certify the accuracy of **RVSM** qualified aircraft instruments.

DALT55 (P/N 101-02186)																					
ALTITUDE RANGE	-1,500 to 55,000 ft																				
ACCURACY	<p>0.020% FS Typical, 0.040% FS (Max) over complete operating temperature range. Specific accuracies at certain altitudes are:</p> <table border="1"> <thead> <tr> <th>Altitude</th> <th></th> <th>Altitude</th> <th></th> </tr> </thead> <tbody> <tr> <td>-1,500 Ft</td> <td>± 7 Ft</td> <td>30,000 Ft</td> <td>± 20 Ft</td> </tr> <tr> <td>0 Ft</td> <td>± 7 Ft</td> <td>40,000 Ft</td> <td>± 30 Ft</td> </tr> <tr> <td>10,000 Ft</td> <td>± 10 Ft</td> <td>50,000 Ft</td> <td>± 48 Ft</td> </tr> <tr> <td>20,000 Ft</td> <td>± 14 Ft</td> <td>55,000 Ft</td> <td>± 62 Ft</td> </tr> </tbody> </table> <p>Note: When displaying altitude in Ft: Feet or M: Meters, the pressure altitude calculation is based on a baro set of 29.921 inHg = 1013.2 mb. Note: The Baro Set value cannot be changed, it is set at 29.921 inHg.</p>	Altitude		Altitude		-1,500 Ft	± 7 Ft	30,000 Ft	± 20 Ft	0 Ft	± 7 Ft	40,000 Ft	± 30 Ft	10,000 Ft	± 10 Ft	50,000 Ft	± 48 Ft	20,000 Ft	± 14 Ft	55,000 Ft	± 62 Ft
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TEMPERATURE RANGE:	<p>OPERATING: -10° C to 50° C (-4° F to 122° F)</p> <p>STORAGE: -30° C to 60° C (-22° F to 140° F)</p>																				

<p>POWER: DALT55 / DAS650</p> <p>Operating Voltage: Current Consumption</p> <p>Battery Life:</p> <p>With Rechargeable BP4000 NiMH, P/N 137-00009</p> <p>With Rechargeable BP4015 NiMH, P/N 137-00030</p>	<p>4.0 to 5.5 VDC 100mA to 200mA (Depends on input voltage and the backlight ON/OFF)</p> <p>30 Hrs, single instrument 15 Hrs, Two instrument configuration (DALT55 & DAS650)</p> <p>30 Hrs, single instrument 15 Hrs, Two instrument configuration (DALT55 & DAS650)</p> <p>Note: BP4000 & BP4015 have same capacity, 4.8V / 4,000 mAh</p>
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Accessories for the DALT55 / DAS650 Instruments	
Retrofit Kit (Order as PN: 102-02111)	Kit, Generic Rechargeable NiMH Battery Pack. Use for retrofit old analog instrument units with digital instruments
BP4015 (Order as PN: 137-00030) See Appendix B for MSDS reference	Rechargeable NiMH 4.8 VDC @ 4,000 mAh. Compatible with SC3000 charger & ECP1200 embedded charger/power supply. Note: BP4015 replaces BP4010 and BP4000, same capacity. Refer to SIL 88-102-02111.
SC3000 (Order as PN: 137-00021)	Smart charger, fully charges a depleted BP4015 in less than 2 hrs. Not compatible with BP4000. Universal input (100-240 V, 50-60 Hz)

3. INSPECTION

All test sets must be recalibrated in precise time periods for their readings to remain valid.

The **DALT55** has a one-year recalibration period, for more details see the note in the Stability specification (page 2). During the last 30 days before the expiration of this period, a message displays at the end of the initialization sequence to remind the user that the instrument must be sent for recalibration to a Barfield Inc. approved facility.

4. INSTRUMENT DESCRIPTION

4.1 General

The **DALT55** is equipped with an easy-to-use menu-driven LCD display (Figure 1) that assists the technician during setup and testing. Each menu gives a set of user options that are selected using cursor (arrow) keys.

4.2 Function Keys

The four (4) function keys have a fixed purpose at all times. These keys are the power ON/OFF, “+” contrast display increase, “-“ contrast display decrease, and the display backlight ON/OFF.

4.3 Soft Keys

The three (3) “soft-keys” are programmable and multi-functional. The function of these keys depends on the software programming of the particular key. Each key has various functions depending on the displayed menu.

FUNCTION KEYS

Key (s)	Location	Function
ON/OFF	Top, right of display	Powers on instrument
Backlight	Right of display	Illuminates display
“+” and “-“	Left of display	Contrast adjustment
Soft (multi-functional)	Bottom of display	Access menus and control instrument

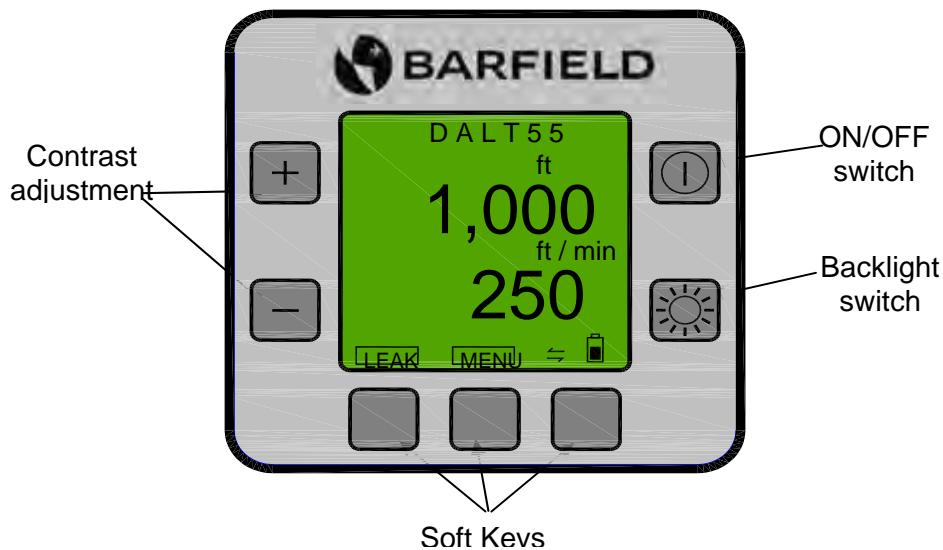


FIGURE 1 FUNCTION AND SOFT KEYS

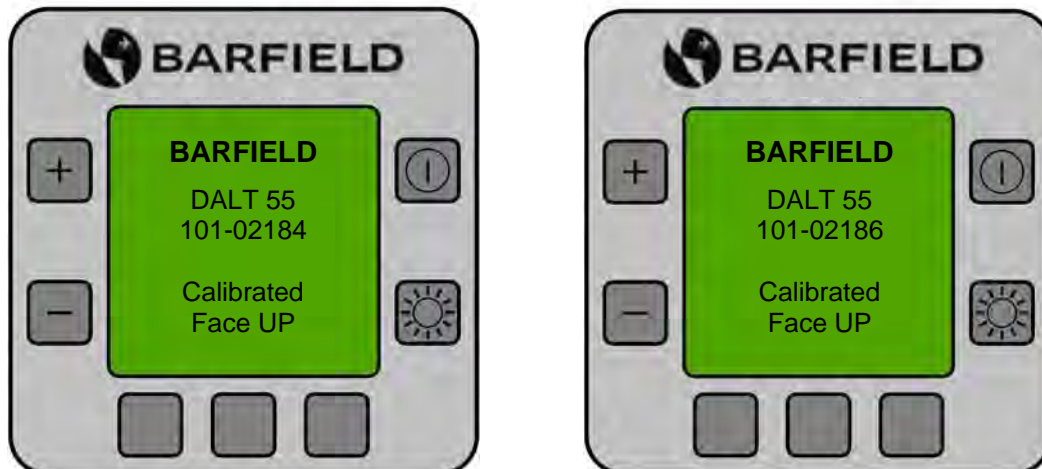


FIGURE 2 POWER ON IDENTIFICATION

5. OPERATION

5.1 Powering On (Initialization)

After pressing the ON/OFF switch, the unit will display the initialization screen with company name and equipment description. A second screen will display the part number and calibration orientation (Figure 2). The unit will then display a message indicating if the power automatic off feature is disabled or enabled (if the auto-off is enabled, the instrument also shows the amount of time until the unit shuts off). (Note: The manufacturer's default setting is disabled.) The instrument then begins a series of initial value calculations for altitude and, if applicable, establishes the link between two instruments. Also, the date of last calibration is read.* If no errors are detected during power up, the instrument enters normal mode and the Aeronautical display appears.

NOTE: There is a delay of several seconds before start-up sequence appears and the unit initializes. For two-instrument operations, turn on **DALT55** at the same time as **DAS650**. (A message appears showing the link is successful. If DAS650 is not on, the instrument displays a message that reminds the user to do so.)

* If the current date is within 30 days of the one-year anniversary of the last calibration date, a message tells the user when the next annual recalibration is due. However, if the current date is after the annual recalibration due date, the message tells the user "recalibration period exceeded".

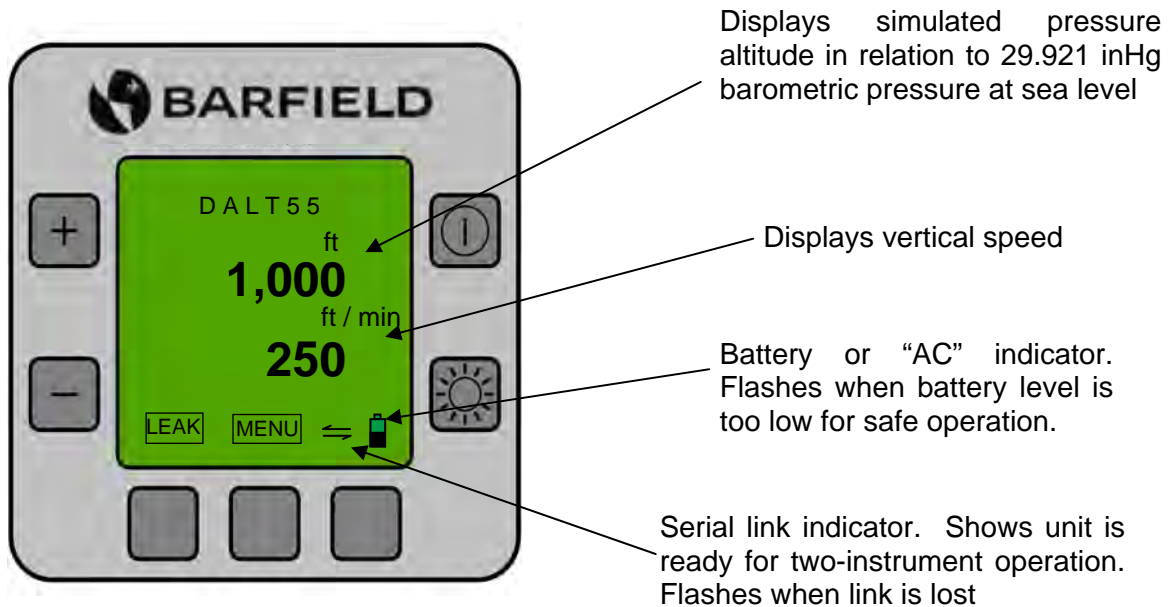


FIGURE 3 AERONAUTICAL DISPLAY

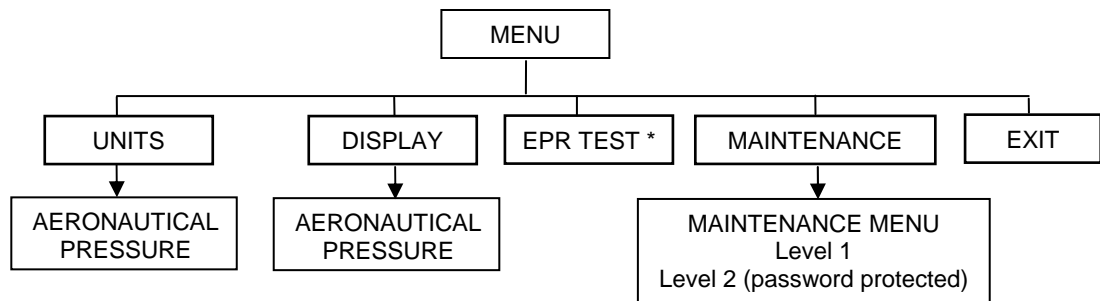
5.2 Start-up Procedure

- a. Press **ON/OFF** switch to turn on instrument.
- b. When initialization finishes, the Aeronautical display appears and shows the altitude and vertical speed.

5.3 Main Menu

Several menus allow user to access the various functions of the instrument. Primary functions of the tester are available by scrolling (using arrow keys) to the desired selection. Selecting EXIT returns the user to the previously displayed screen. (Refer to Chart 1, Main Menu)

- a. From the Aeronautical display, open the main menu by pressing **MENU** key (located at bottom of display). Press the **SEL** key to accept selection.



* accessible only in two-instrument configuration.

CHART 1 MAIN MENU

- b. Main menu options include: Units, Display, EPR Test, Maintenance, and Exit.

1) UNITS

The **DALT55** may be changed and configured to display several units of measurement.

- After selecting AERONAUTICAL, press **CHANGE** (located bottom left corner on display). Use the arrow keys to select ft & ft/min or m & m/min (metric) as desired. Press **SAVE** to store.
- After selecting PRESSURE, press **CHANGE**. Use the arrow keys to select inHg abs, mbar abs or psia units settings. Press **SAVE** to store.

2) DISPLAY

The DISPLAY option in the main menu allows selection of two types of active display:

- **Aeronautical** display shows simulated altitude and vertical speed.
- **Pressure** display shows static (Ps) pressure.

3) EPR TEST (Engine Pressure Ratio)

Note: EPR is only available if DAS650 and DAL55 are connected. Using the Maintenance menu in Level 1, both instruments must also be configured for the two-instrument configuration.

Selecting EPR allows user to view instrument's calculated Pt, Ps and EPR readings.

4) MAINTENANCE

Two submenus are available for maintenance functions such as calibration, configuring unit for two-instrument link and enabling and setting the automatic power off timer.

- **LEVEL 1** submenu contains tester general information (See Chart 2).

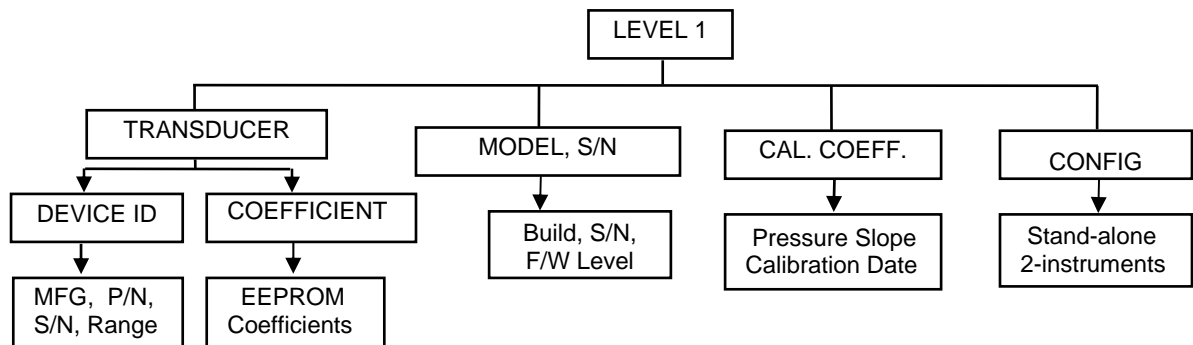


CHART 2 LEVEL 1 SUBMENU

(a) Transducer

- Device ID: displays the transducer's manufacturer, P/N, S/N and range.
- Coefficients: displays the four (K00-K03) temperature compensation coefficients stored in the transducer's EEPROM.

(b) Model, S/N

Displays tester's range, firmware version, build, S/N.

(c) Cal Coeffs.

Displays linearization coefficients:

- Offset pressure (inHg)
- Slope linearization
- Date last calibration was performed

(d) Config.

This option allows user to configure instrument, selecting:

- Stand-alone: **DALT55** is not communicating with **DAS650**.
- Two-instrument: **DALT55** is communicating with **DAS650**.

Note: In the two-instrument configuration, the serial link indicator shows at bottom of Aeronautical, Pressure, Leak Test and EPR Test displays. The indicator flashes when link is not functional.

Press **CHANGE**; then **SAVE** to change configuration.

- **Level 2** maintenance submenu is password-protected. User accesses calibration procedure, sets date/time and changes password and enables automatic power off.

NOTE: The initial default password is “111”.

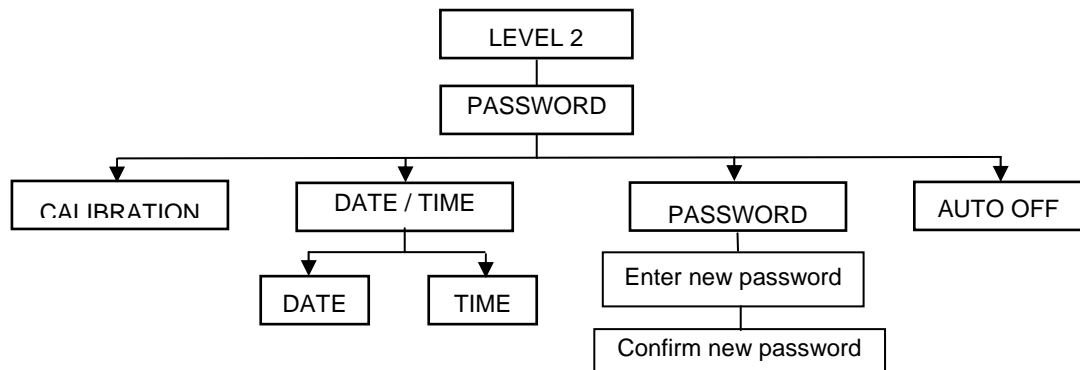


CHART 3 LEVEL 2 MAINTENANCE SUBMENU

(a) Calibration

User may perform calibration and change the units system for calibration by pressing the **UNITS** key. Continue pressing **UNITS** key to “scroll” to m (meters), inHg, mbar, Psi, or ft screens. Press **ENTER** to store.

(b) Date / Time

To set date or time, use the up / down arrow keys to increase / decrease selection.)

CHANGE (Set) DATE as MM / DD / YY

CHANGE (Set) TIME as hr / min.

(c) Password

To change the password:

- Enter new password (###).
- Re-enter new password to confirm.

NOTE: Once the user is in the password screen, the unit will not allow exiting from the screen until a password is entered and saved.

(d) Auto-Off

The feature *factory setting* is “disabled”. To change the setting, use the up / down arrows to select AUTO-OFF. Press **CHANGE** key. Press **MENU** to save.

When auto-off is enabled and there are 60 seconds left before the unit shuts off, the display shows a “countdown” screen. Pressing the keys below the arrows restarts the 30-minute timer and the countdown screen disappears.

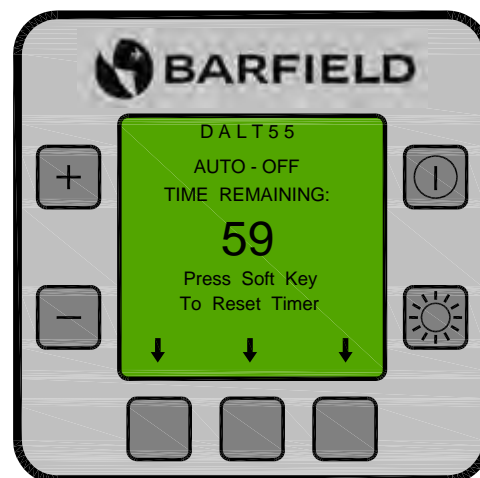


FIGURE 3 AUTO OFF COUNTDOWN DISPLAY

NOTE: Pressing any key at any time during the unit's operation will also reset the “clock” to another 30-minute time period.

6. STATIC LEAK TEST

NOTE: Press **CANCEL** to exit leak test at any time during procedure and to return to Aeronautical display.

6.1 STATIC PRETEST

NOTE: For more specific information regarding the control valves and ports, refer to the Test Set Operations Manual.

To verify the Leak Rate of the test set and hoses do the following:

- Connect the static hose to the static port of the test set.
- Ensure the aircraft end of the hose is capped (sealed).
- Close the STATIC and PITOT vent valves.
- Open the CROSSBLEED control valve.
- Slowly open the STATIC control valve to create an altitude of approximately 20,000 ft.
- When the desired altitude is reached, close the STATIC control valve.
- To go to the Leak Test display, press the **LEAK** key on the Aeronautical display. The Leak Test display appears. To change the duration of the Leak Test, press the **ADJ** key and using the keys below the arrows, increase (or decrease) the time from 1 to 30 minutes.

CAUTION: Do not press **START** until ready to do Leak Test. When the key is pressed, a display immediately appears with a 60-second countdown timer allowing time for stabilization of the static pressure. The actual leak test measurement begins when the timer completes the 60-second stabilization.

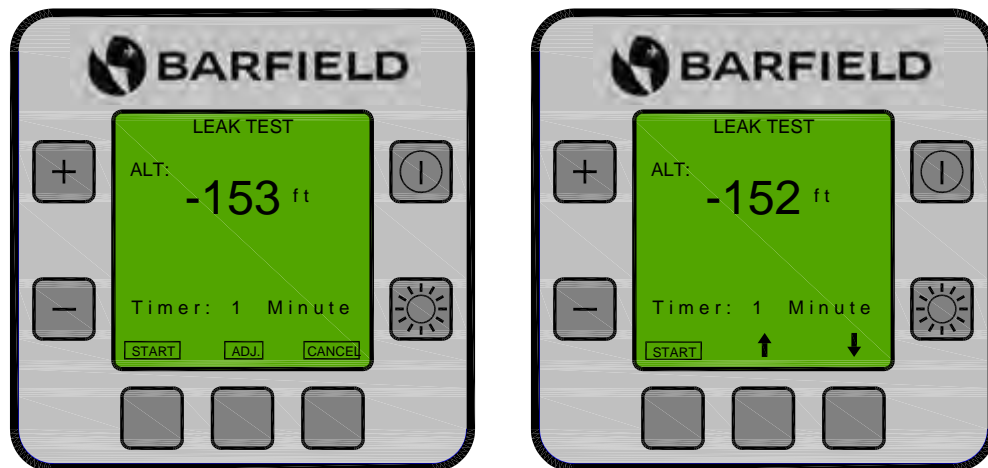


FIGURE 4 LEAK TEST TIMER DISPLAYS

- h. During the stabilization period, verify the altitude on the display.
NOTE: A rapid decrease in altitude (more than 100 ft/min) indicates presence of a leak. Stop Leak Test. (To discontinue the test, press **CANCEL** and skip to step m.)
- i. After the 60-second stabilization time, the Static Leak Test screen shows the start of the actual leak test.
- j. Allow the Leak Test time to reach approximately *2.00 min* or more.

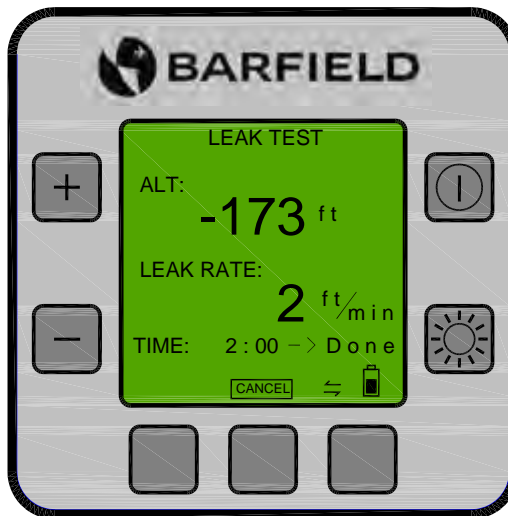


FIGURE 5 LEAK TEST TIMER DISPLAYS

- k. Record the leak rate of the tester and hoses.
- l. Deduct recorded rate from the aircraft leak rate.
NOTE: The test set must have a leak rate of **50 ft/min** or less.
- m. If the leak rate is more than 50 ft/min, remove the hoses from the test set and repeat the Static Leak test.
NOTE: Repeating the procedure isolates the test set from the hoses. If the test set passes the procedure, the leak is located in the static hose or connector. To correct the problem, repair or replace the hoses or connectors. A repeated failure of the test set means that the leak is contained within the test set and test set should be sent to the manufacturer for repair.
- n. Slowly open the PITOT VENT valve to return static system to ambient pressure.
- o. Remove the cap from the aircraft end of the static hose.

6.2 STATIC LEAK TEST

a. STATIC SYSTEM

- 1) Using specified aircraft plumbing diagram, connect the Static hose to aircraft pitot system.

CAUTION: Ensure connections between test set and aircraft are secure. A sudden break or leak may cause severe instrument damage.

b. SETUP

- 1) Press **ON/OFF** switch to power ON the **DALT55**.
- 2) If using a two-instrument configuration, also power ON the **DAS650**. Wait for initialization to complete (indicated when Aeronautical display appears).

c. STATIC SYSTEM TEST

- 1) Close STATIC and PITOT vent valves.
- 2) Ensure the CROSSBLEED control valve is fully OPEN.
- 3) Slowly open STATIC control valve and set desired test altitude (*normally 20,000 ft*). Close STATIC control valve fully.
- 4) Perform Static Leak test following instructions for Test Set Leak Test (section 6.1).

6.3 EPR TEST (ENGINE PRESSURE RATIO)

NOTE: This test may only be performed with DAS650 Airspeed / Mach. Verify a two-instrument configuration has been set in "CONFIG." option. (Maintenance Menu, 5.3.b.4)

- a. Connect PITOT PORT (red band) to PT7 (HI) port of the EPR transmitter to be tested.
- b. Connect STATIC PORT (blue band) to the PT2 (LO) port of the EPR transmitter to be tested.
- c. From the Main Menu, select EPR TEST (Main Menu, 5.3). EPR Test display appears.

NOTE: The EPR function of the **DALT55** allows display of the EPR ratio PT7/PT2, also PT2 and PT7 pressures individually. Units of measure available for the PT2 and PT7 pressure display are: inHg, mbar and PSIA. To change the unit system, refer to Changing Units Displayed section.

- d. Set the respective static (PT2) and Pitot (PT7) pressure combination to achieve desired EPR ratio.

APPENDIX A

INSTALLATION INSTRUCTIONS FOR:

Digital Instruments.....	Section 1
Rechargeable Battery Pack.....	Section 2
Alkaline Battery Pack.....	Section 3

APPENDIX B

Safety Data Sheet (SDS) for Chemical Products

Section 1: DIGITAL INSTRUMENTS

(MOUNTING, ASSEMBLING, INSTALLATION)

1. Remove front panel from test set.
2. Remove the analog instrument(s) from panel.
3. Drill captive nuts on altimeter and airspeed mounting holes to remove threads with drill bit #28.

NOTE: Do not drill the captive nuts on the VSI instrument hole.

4. Mount Digital Instruments with 4 each, 4-40 self-locking nuts, provided.

NOTE: Digital Instruments are designed to fit into existing analog instrument holes. All plumbing connections can be performed at this time.

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Section 2: RECHARGEABLE BATTERY PACK

(MOUNTING, ASSEMBLING, INSTALLATION)

VSI (center) instrument hole installation:

NOTE: For Barfield Test Sets with 3 instruments, the battery pack base can be mounted in the VSI (center) instrument hole.

1. Mount battery pack base (Item 1, Figure 1) using the 4 (each), 6-32 x 7/8" L Phillips head screws provided (Item 4, Figure 1).

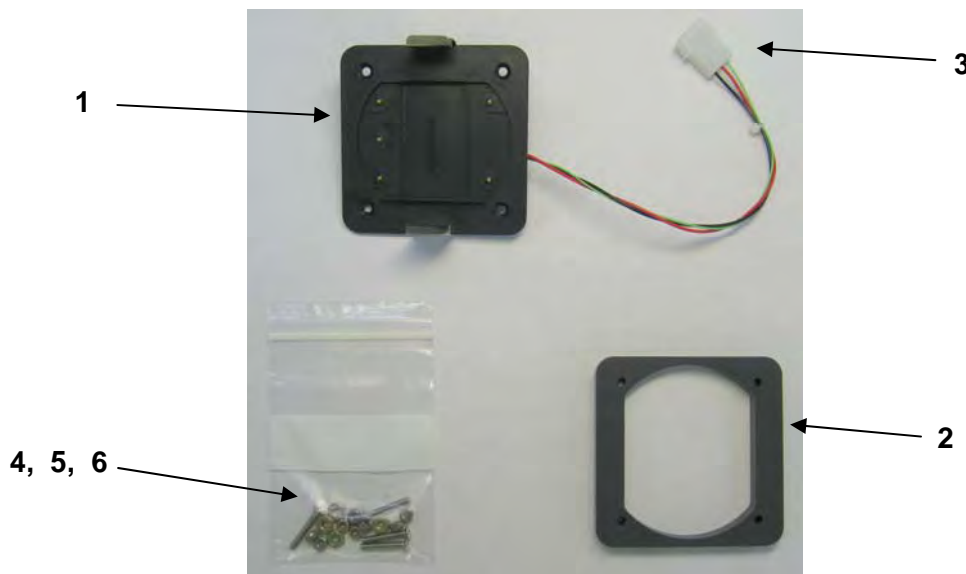


FIGURE 1

Flat panel installation:

NOTE: If mounting the battery pack base to a location other than an instrument hole, the spacer (Item 2, Figure 1) will be necessary. Using the spacer as a drill guide for the proper hole location, drill four (4) 5/32" diameter holes. Use the spacer as the reference for wires to feed through and drill a 3/16" diameter hole in the approximate center of the spacer.

CAUTION: Use care drilling. Damage may result to existing hardware and components behind the panel.

2. Feed battery pack base harness leads (Item 3, Figure 1). If required, disassemble the connector (Item 3, Figure 1) attached (as supplied) to feed wires through the 3/16" diameter center hole. Re-attach the connector (refer to Figure 2).

CAUTION: Use care when locating the base. Battery pack must not interfere with top covers, miscellaneous items, storage compartments, etc.

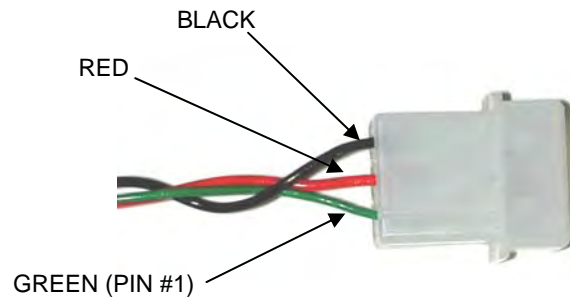


FIGURE 2

3. Connect the wire harness (Item 1, Figure 3) to digital instrument(s) and battery pack base harness (Item 2, Figure 3).

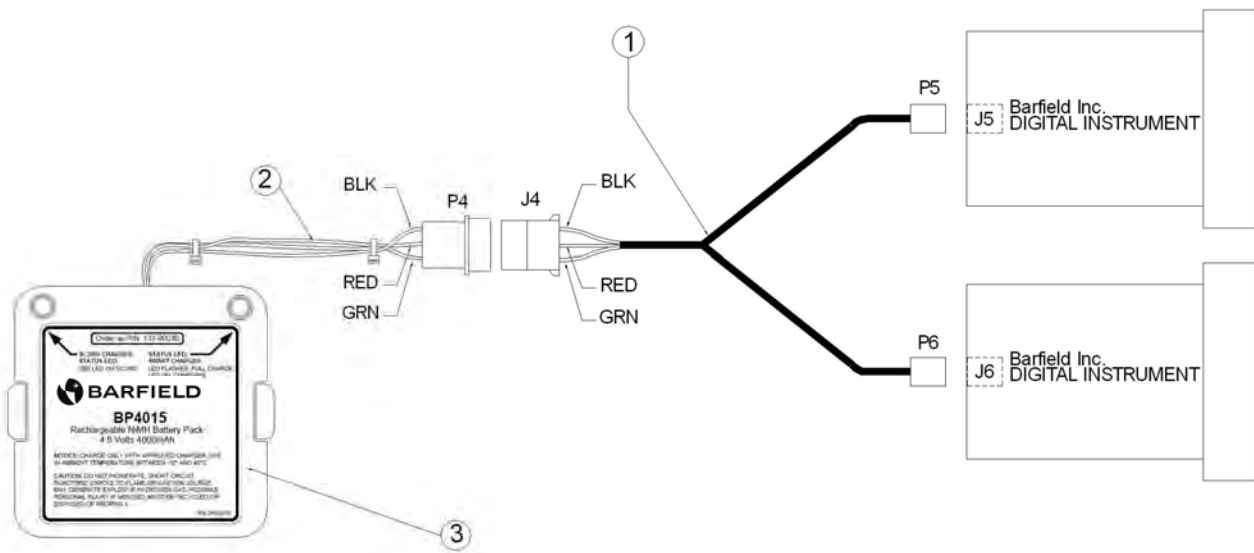


FIGURE 3

4. Reattach panel to test set. Insert rechargeable battery pack (Item 3, Figure 3) and snap onto mounting base. Ensure Battery pack is inserted properly into base.

Section 3: ALKALINE BATTERY PACK

(MOUNTING, ASSEMBLING, INSTALLATION)

1. Mount battery pack base (Item 1, Figure 4) on test set panel with the 4 (each), 6-32 x ½ L flat head screws and 4 (each) 6-32 self-locking nuts provided.

NOTE: For Barfield Test Sets, battery pack base mounts in the same location as the correction cards. Remove the clear polycarbonate cover and correction cards from the panel.

2. Using the attached drill template for proper hole location (refer to Figure 6), drill base mounting holes (C holes) and harness feed through A & B holes.

CAUTION: Use care when drilling. Damage may result to existing hardware and components behind the panel.

3. Feed battery pack base harness leads (Item 2, Figure 5), without the connector (Item 3, Figure 5) attached (as supplied) through center holes (A & B). Re-attach connector.
4. Connect wire harness (Item 4, Figure 5) to digital instrument(s) and battery pack base harness. (Refer to Figure 5.)
5. Re-attach panel to test set.
6. Insert alkaline batteries into battery pack (Item 5, Figure 5) and snap onto mounting base.

NOTE: Battery pack is keyed for proper insertion into base.

CAUTION: Use care when locating the mounting base. Battery pack must not interfere with top covers, miscellaneous items, storage compartments etc.

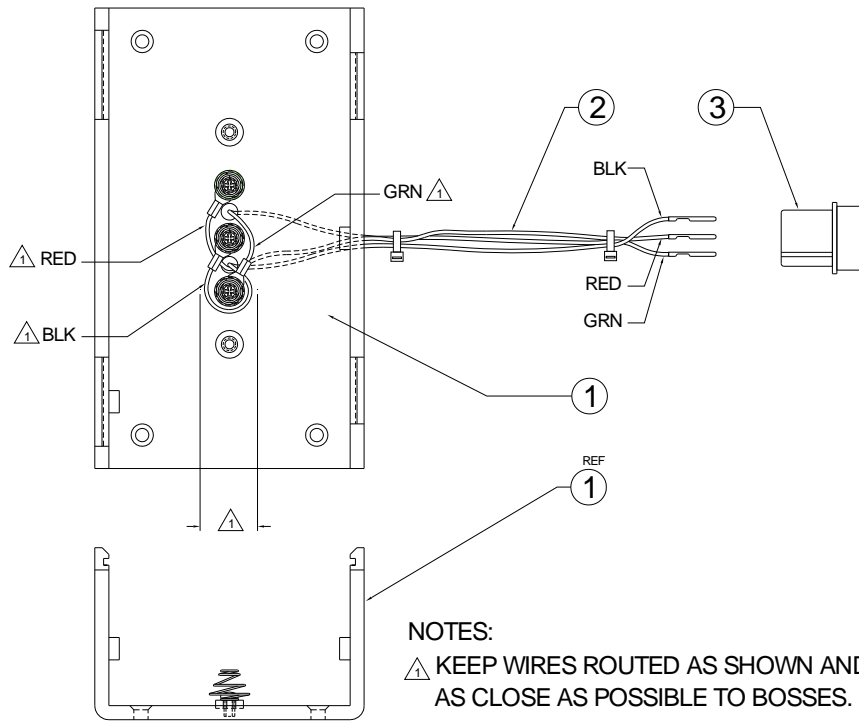


FIGURE 4

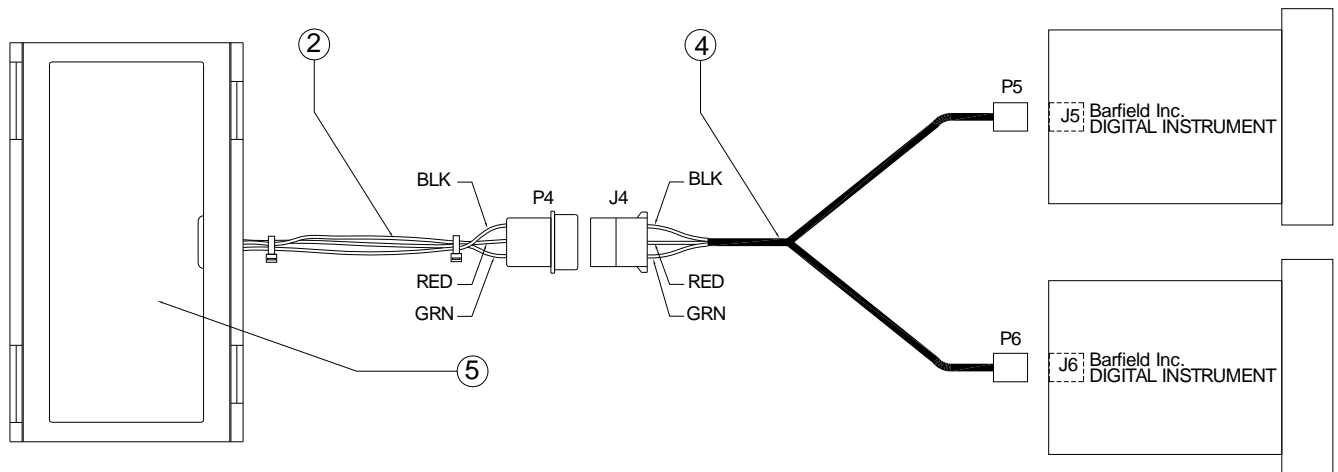


FIGURE 5

APPENDIX A: INSTALLATION INSTRUCTIONS

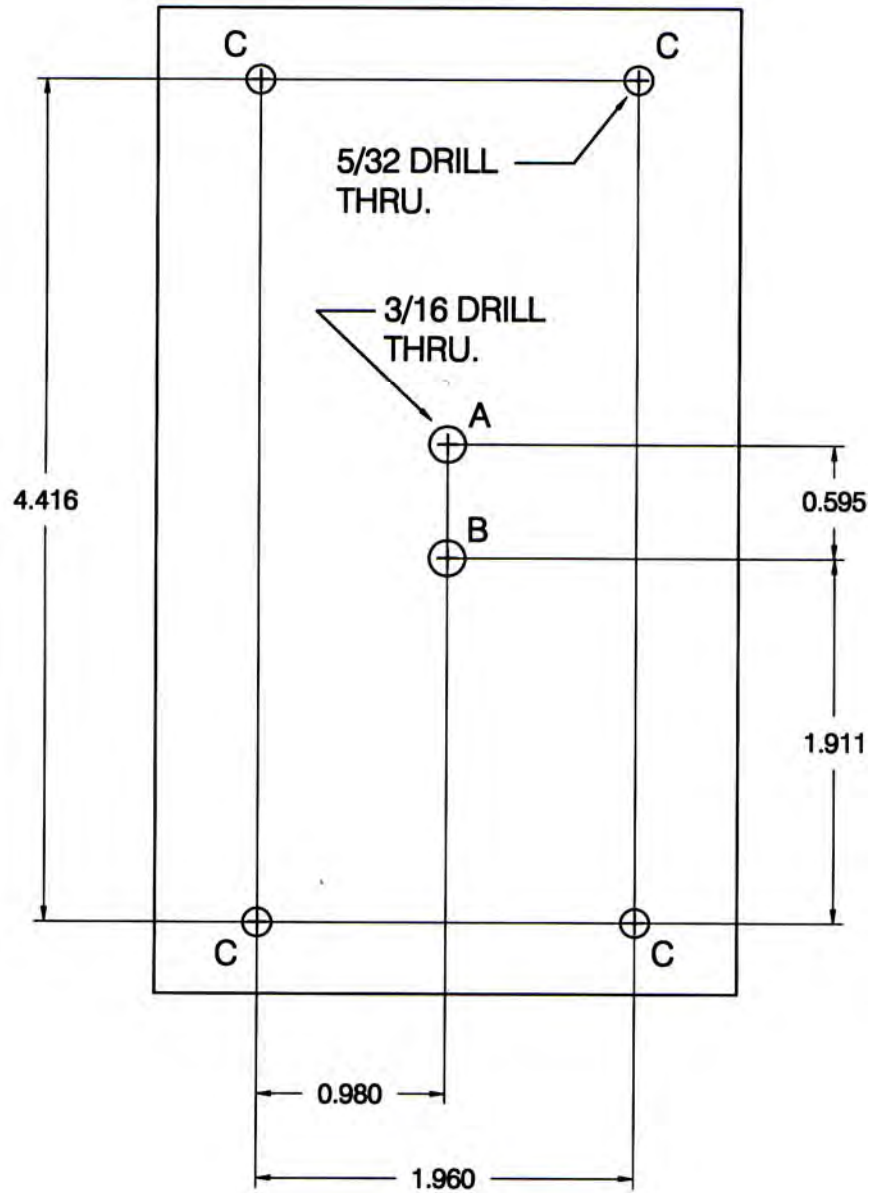


FIGURE 6

Safety data sheet for chemical products (SDS)

1. PRODUCT AND COMPANY IDENTIFICATION

- Product name : Nickel-Metal Hydride Battery
- Supplier's Name : FDK CORPORATION
- Supplier's Address : Hamagomu Bldg., 5-36-11 Shimbashi, Minato-ku, Tokyo 105-8677, JAPAN
- Telephone number : +81-3-3434-1271

- Manufacturer's Name : FDK CORPORATION TAKASAKI-PLANT
- Manufacturer's Address : 307-2 Koyagi-machi, Takasaki City, Gunma 370-0071, Japan
- Telephone number : +81-27-361-7575

2. HAZARDS IDENTIFICATION

- Most important hazard and effects
 For the battery cell, chemical materials are stored in a hermetically sealed metal case, designed to withstand temperatures and pressures encountered during normal use. As a result, during normal use, there is no physical danger of ignition or explosion and chemical danger of hazardous materials' leakage.
 However, if exposed to a fire, added mechanical shocks, decomposed, added electric stress by misuse, the gas release vent will be operated. The battery cell case will be breached at the extreme. Hazardous materials may be released.

Moreover, if heated strongly by the surrounding fire, acrid or harmful fume may be emitted.

Human health effects:

- Inhalation: The electrolyte inhalation affects the respiratory tract membrane and the lungs. Fume may cause a cough, chest pain and dyspnea. Bronchitis and pneumonia may occur. Possibly could be carcinogen.
- Skin contact: The electrolyte skin contact affects the skin seriously and may cause dermatitis.
- Eye contact: The electrolyte leaked from the battery cell is strong alkali. When it goes into an eye, the cornea may be affected and it may lead to blindness.
- Ingestion: The electrolyte ingestion irritates the mouth and the throat seriously results in vomiting, nausea, hematemesis, stomach pains and diarrhea.

Environmental effects:

Since a battery cell remains in the environment, do not throw out it into the environment.

- Specific hazards :
 As previously described.

3. COMPOSITION / INFORMATION ON INGREDIENTS

- Substance or preparation : Preparation
- Information about the chemical nature of product :

Common chemical name / General name	CAS number	Concentration / Concentration range	Classification and hazard labeling
Hydrogen Absorbing Alloy	7440-02-0(Ni) 7440-48-4(Co) 7439-96-5(Mn) 7429-90-5(Al)	20-40%	specific hazard
Nickel-Cobalt-Zinc oxide	7440-02-0(Ni) 7440-48-4(Co) 7440-86-6(Zn)	15-25%	acute toxicity specific hazard
Nickel	7440-02-0	5-15%	specific hazard
Iron	7439-89-6	20-40%	
Carbon Black	1333-86-4	0-1%	specific hazard
Potassium Hydroxide	1310-58-3	0-15%	acute toxicity corrosivity irritant property
Sodium Hydroxide	1310-73-2		
Lithium Hydroxide	1310-65-2		

4.FIRST-AID MEASURES

Internal cell materials of an opened battery cell

- Inhalation :
Cover the victim in a blanket, move to the place of fresh air and keep quiet. Seek medical attention immediately. When dyspnea (breathing difficulty) or asphyxia (breath-hold), give artificial respiration immediately.
- Skin contact :
Remove contaminated clothes and shoes immediately. Wash the adherence or contact region with soap and plenty of water. Seek medical attention immediately.
- Eye contact :
Immediately flush eyes with water continuously for at least 15 minutes. Seek medical attention immediately.

A battery cell and internal cell materials of an opened battery cell

- Ingestion :
Do not induce vomiting. Seek medical attention immediately.

5.FIRE-FIGHTING MEASURE

Although a battery cell is not flammability, in case of fire, move it to the safe place quickly.

The following measures are taken when it cannot be moved.

- Suitable extinguishing media: Dry sand, chemical powder fire extinguishing medium.
- Specific hazards: Acrid or harmful fume is emitted during fire.
- Special protective equipment for firefighters : Protective equipment written in Section 8.

6.ACCIDENTAL RELEASE MEASURES

Internal cell materials, such as electrolyte leaked from battery cell, are carefully dealt with according to the followings.

- Personal precautions :
Forbid unauthorized person to enter. Remove leaked materials with protective equipment written in Section 8.
- Environmental precautions: Do not throw out into the environment.
- Method of recovery and neutralization :
Dilute the leaked electrolyte with water and neutralize with diluted sulfuric acid. The leaked solid is moved to a container. The leaked place is fully flushed with water.

7.HANDLING AND STORAGE

- Handling
Technical measures
Prevention of user exposure: Not necessary under normal use.
Prevention of fire and explosion: Not necessary under normal use.
Precaution for safe handling: Do not damage or remove the external tube.
Specific safe handling advice: Never throw out cells in a fire or expose to high temperatures. Do not soak cells in water and seawater. Do not expose to strong oxidizers. Do not give a strong mechanical shock or throw down. Never disassemble, modify or deform. Do not connect the positive terminal to the negative terminal with electrically conductive material. In the case of charging, use only dedicated charger or charge according to the conditions specified by FDK.
- Storage
Technical measures
Storage conditions (suitable to be avoided): Avoid direct sunlight, high temperature, high humidity.
Store in cool place (temperature: -20 ~ 30 degree C, humidity: from 40 to 80%).
Incompatible products: Conductive materials, water, seawater, strong oxidizers and strong acids
Packing material (recommended, not suitable): Insulative and tear-proof materials are recommended.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

- Engineering measures :
No engineering measure is necessary during normal use. In case of internal cell materials' leakage, the information below will be useful.
- Control parameters

Common chemical name / General name	ACGIH(2011)	
	TLV-TWA	BEI
Nickel, Nickel Compounds	(As Ni) Metal : 1.5mg/m ³ Soluble compounds : 0.1mg/m ³ Insoluble compounds : 0.2mg/m ³	-
Cobalt Compounds	(As Co) 0.02mg/m ³	In urine : 15 micro g/l In blood : 1 micro g/l
Manganese Compounds	(As Mn) 0.2mg/m ³	-
Aluminum Compounds	(As Al) 1mg/m ³ (Flammable powder)	-
Zinc oxide	2mg/m ³	-
Carbon Black	3mg/m ³	-
Potassium Hydroxide	-	-
Sodium Hydroxide	-	-
Lithium Hydroxide	-	-

ACGIH: American Conference of Governmental Industrial Hygienists, Inc.
TLV-TWA: Threshold Limit Value-time weighted average concentration
BEI: Biological Exposure Indices

- Personal protective equipment
Respiratory protection: Protective mask
Hand protection: Protective gloves
Eye protection: Protective glasses designed to protect against liquid splashes
Skin and body protection: Working clothes with long sleeve and long trousers

9. PHYSICAL AND CHEMICAL PROPERTIES

- Appearance
Physical state: Solid
Form: Cylindrical and Prismatic
Color: Metallic color (without tube/label)
Odour: No odour
- pH : NA
- Specific temperatures/temperature ranges at which changes in physical state occur :
There is no useful information for the product as a mixture.
- Flash point : NA
- Explosion properties : NA
- Density : around 1.5 ~ 6.0g/cm³
- Solubility ,with indication of the solvent(s) : Insoluble in water

10. STABILITY AND REACTIVITY

- Stability : Stable under normal use
- Hazardous reactions occurring under specific conditions
By misuse of a battery cell or the like, oxygen or hydrogen accumulates in the cell and the internal pressure rises. These gases may be emitted through the gas release vent. When fire is near, these gases may take fire.
When a battery cell is heated strongly by the surrounding fire, acrid or harmful fume may be emitted.
- Conditions to avoid : Direct sunlight, high temperature and high humidity
- Materials to avoid : Conductive materials, water, seawater, strong oxidizers and strong acids
- Hazardous decomposition products: Acrid or harmful fume is emitted during fire.

11. TOXICOLOGICAL INFORMATION

There is no data available on the product itself. The information of the internal cell materials is as follows.

Nickel, Nickel Compounds

- Acute toxicity:
 - oral GHS: out of Category.
 - skin Unknown.
 - inhalation (gas) GHS: exempt from a classification.
 - inhalation (steam) Unknown.
 - inhalation (mist) Unknown.
- Skin corrosivity : Unknown.
- Serious damage and irritant property for eyes: Unknown.
- Respiratory or skin sensitization:
 - Respiratory sensitization: GHS: Category 1
The allergy, asthma or breathing difficulties might be caused when inhaling.
 - Skin sensitization: GHS: Category 1
The allergic skin reaction might be caused.
- Germline mutagenicity:
 - GHS: It is not possible to classify it due to data deficiency.
- Carcinogenicity :
 - GHS: Category 2
 - ACGIH: (Metal) A5 – Not suspected as a human carcinogen
 - ACGIH: (water-soluble compounds) A4 – Not classified as a human carcinogen obviously
 - ACGIH: (Insoluble compounds) A1 – Confirmed human carcinogen
 - NIOSH: Potential occupational carcinogen
 - NTP: Reasonably anticipated to be human carcinogen
 - IARC: (Metal) Group 2B Possibly carcinogenic to human
 - IARC: (Compounds) Group 1 carcinogenic to human
- Reproduction Toxicity :
 - GHS: It is not possible to classify it due to data deficiency.
- Certain target organ/ Systemic toxicity (single exposure):
 - GHS: Category 1(respiratory organ and kidney).
 - The disorder of the respiratory organ and the kidney is caused.
- Certain target organ/ Systemic toxicity (repeated exposure):
 - GHS: Category 1(respiratory organ).
 - The disorder of the respiratory organ is caused by long-term or repeated exposure.

Cobalt Compounds

- Acute toxicity:
 - oral GHS: out of Category.
 - skin Unknown.
 - inhalation (gas) GHS: exempt from a classification.
 - inhalation (steam) Unknown.
 - inhalation (mist) GHS: It is not possible to classify it due to data deficiency.
- Skin corrosivity : Unknown.
- Serious damage and irritant property for eyes: Unknown.
- Respiratory or skin sensitization:
 - Respiratory sensitization: GHS: Category 1
The allergy, asthma or breathing difficulties might be caused when inhaling.
 - Skin sensitization: GHS: Category 1
The allergic skin reaction might be caused.
- Germline mutagenicity: Unknown.
- Carcinogenicity :
 - GHS: Category 2
 - ACGIH: A3 –Confirmed animal carcinogen but relevance to human carcinogen is unknown.
 - IARC: Group 2B Possibly carcinogenic to human.
 - The cancer might be caused.

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- Reproduction Toxicity :
GHS: Category 2.
The adverse effect on reproductive competence or the fetus might occur.
- Certain target organ/ Systemic toxicity (single exposure):
GHS: Category 3(respiratory tract irritating properties).
The respiratory organ might be stimulated.
- Certain target organ/ Systemic toxicity (repeated exposure):
GHS: Category 1(respiratory organ).
The disorder of the respiratory organ is caused by long-term or repeated exposure.

Manganese compounds

- Acute toxicity:
 - oral GHS: out of Category.
 - skin Unknown.
 - inhalation (gas) GHS: exempt from a classification.
 - inhalation (steam, mist) Unknown.
- Skin corrosivity : GHS: Category 3. Slight skin stimulation.
- Serious damage and irritant property for eyes: GHS: Category 2B. eye stimulation.
- Respiratory or skin sensitization:
 - Respiratory sensitization: Unknown.
 - Skin sensitization: Unknown.
- Germline mutagenicity : GHS: It is not possible to classify.
- Carcinogenicity : GHS: out of Category.
- Reproduction Toxicity : GHS: Category 1B.
The adverse effect on reproductive competence or the fetus might occur.
- Certain target organ/ Systemic toxicity (single exposure):
GHS: Category 1(respiratory organ).
The disorder of the respiratory organ is caused.
- Certain target organ/ Systemic toxicity (repeated exposure):
GHS: Category 1(respiratory organ, nerve).
The disorder of the respiratory organ and nerve system is caused by long-term or repeated inhalation exposure.

Aluminum Compounds

- Acute toxicity:
 - oral, skin, inhalation(steam, dust) Unknown.
- Skin corrosivity : Unknown.
- Serious damage and irritant property for eyes: Unknown.
- Respiratory or skin sensitization:
 - Respiratory sensitization: Unknown.
 - Skin sensitization: Unknown.
- Germline mutagenicity : Unknown.
- Carcinogenicity : Unknown.
- Reproduction Toxicity : Unknown.
- Certain target organ/ Systemic toxicity (single exposure): Unknown.
- Certain target organ/ Systemic toxicity (repeated exposure):
GHS: Category 1 and 2.
The disorder of the pulmonary is caused by long-term or repeated inhalation exposure.(Category 1)
The disorder of the nerve system by long-term or repeated oral exposure might be caused.
(Category 2)

Zinc oxide

- Acute toxicity:
 - oral rat LD₅₀ > 5000mg/kg
 - inhalation (dust, mist) rat LC₅₀ > 5.7mg/l The harmful might be caused when inhaling.
- Skin corrosivity : GHS: out of Category.
- Serious damage and irritant property for eyes: GHS: out of Category

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- Respiratory or skin sensitization:
 - Respiratory sensitization: Unknown.
 - Skin sensitization: GHS: out of Category.
- Germline mutagenicity : Unknown.
- Carcinogenicity : GHS: out of Category.
- Reproduction Toxicity : GHS: out of Category.
- Certain target organ/ Systemic toxicity (single exposure):
 - GHS: Category 1.
 - The disorder of the whole body
- Certain target organ/ Systemic toxicity (repeated exposure):
 - GHS: Category 1.
 - The disorder of the pulmonary is caused by long-term or repeated inhalation exposure.

Carbon Black

- Acute toxicity:
 - oral rat LD₅₀ >15400 mg/kg
 - skin Unknown.
 - inhalation (dust) Unknown.
- Skin corrosivity : Unknown.
- Serious damage and irritant property for eyes: Unknown.
- Respiratory or skin sensitization:
 - Respiratory sensitization: Unknown.
 - Skin sensitization: Unknown.
- Germline mutagenicity : Unknown.
- Carcinogenicity :
 - GHS: Category 2
 - ACGIH: A3 –Confirmed animal carcinogen but relevance to human carcinogen is unknown.
 - IARC: Group 2B Possibly carcinogenic to human.
 - The cancer might be caused.
- Reproduction Toxicity : Unknown.
- Certain target organ/ Systemic toxicity (single exposure): Unknown.
- Certain target organ/ Systemic toxicity (repeated exposure):
 - GHS: Category 1
 - The disorder of the pulmonary is caused by long-term or repeated inhalation exposure.

Potassium Hydroxide

- Acute toxicity:
 - oral GHS: Category 3. Harmful if swallowed.
 - skin GHS: It is not possible to classify.
 - inhalation (steam) GHS: It is not possible to classify.
 - inhalation (dust) GHS: It is not possible to classify.
- Skin corrosivity : GHS: Category 1B.
 - Serious chemical wound of the skin and damage of eyes is caused.
- Serious damage and irritant property for eyes: GHS: Category 1.
- Respiratory or skin sensitization:
 - Respiratory sensitization: GHS: It is not possible to classify.
 - Skin sensitization: GHS: out of Category.
- Germline mutagenicity : GHS: out of Category.
- Carcinogenicity : GHS: It is not possible to classify.
- Reproduction Toxicity : GHS: It is not possible to classify.
- Certain target organ/ Systemic toxicity (single exposure):
 - GHS: Category 1.
 - The disorder of the respiratory system is caused.
- Certain target organ/ Systemic toxicity (repeated exposure)
 - GHS: It is not possible to classify.

Sodium Hydroxide

- Acute toxicity:
 - oral GHS: It is not possible to classify.
 - skin GHS: It is not possible to classify.
 - inhalation (gas) GHS: out of Category.
 - inhalation (steam) Unknown.
 - inhalation (dust) Unknown.
- Skin corrosivity : GHS: Category 1.
Serious chemical wound of the skin and damage of eyes is caused.
- Serious damage and irritant property for eyes: GHS: Category 1. Serious damage of eyes is caused.
- Respiratory or skin sensitization:
 - Respiratory sensitization: GHS: It is not possible to classify.
 - Skin sensitization: GHS: out of Category.
- Germline mutagenicity : GHS: out of Category
- Carcinogenicity : GHS: It is not possible to classify.
- Reproduction Toxicity : GHS: It is not possible to classify.
- Certain target organ/ Systemic toxicity (single exposure):
GHS: Category 1(respiratory system).
The disorder of the respiratory organ is caused.
- Certain target organ/ Systemic toxicity (repeated exposure):
GHS: It is not possible to classify.

Lithium Hydroxide

- Acute toxicity:
 - oral GHS: Category 3. Harmful if swallowed.
 - skin Unknown.
 - inhalation (steam) Unknown.
 - inhalation (dust) GHS: Category 3. Harmful if inhaled.
- Skin corrosivity : GHS: Category 1.
Serious chemical wound of the skin and damage of eyes is caused.
- Serious damage and irritant property for eyes: GHS: Category 1.
- Respiratory or skin sensitization:
 - Respiratory sensitization: GHS: It is not possible to classify.
 - Skin sensitization: GHS: It is not possible to classify.
- Germline mutagenicity : Unknown.
- Carcinogenicity : Unknown.
- Reproduction Toxicity : Unknown.
- Certain target organ/ Systemic toxicity (single exposure):
GHS: Category 1.
The disorder of the respiratory system is caused by inhalation exposure.
- Certain target organ/ Systemic toxicity (repeated exposure):
GHS: Category 1&2.
The disorder of the respiratory system is caused by long-term or repeated inhalation exposure. The disorder of the liver and the hematopoietic system by long-term or repeated oral exposure might be caused.

12.ECOLOGICAL INFORMATION

- Persistence/degradability :
Since a battery cell and the internal materials remain in the environment, do not bury or throw out into the environment.

13.DISPOSAL CONSIDERATIONS

- Recommended methods for safe and environmentally preferred disposal :
Product (waste from residues)
Do not throw out a used battery cell. Recycle it through the recycling company.

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Contaminated packaging

Neither a container nor packing is contaminated during normal use. When internal materials leaked from a battery cell contaminates them, dispose them as industrial wastes subject to special control.

14. TRANSPORT INFORMATION

This battery does not require the following items.

- TECHNICAL INSTRUCTIONS FOR THE SAFE TRANSPORT OF DANGEROUS GOODS BY AIR(ICA0)
- IATA Dangerous Goods Regulations - 56th Edition Effective 1st January 2015 (IATA)
- code of federal regulations (U.S.DOT)

This battery requires the following items.

- INTERNATIONAL MARITIME DANGEROUS GOODS CODE(IMO)

From the 1st January 2012, Nickel-Metal Hydride Batteries is classed as Dangerous Goods, Class 9 in accordance with United Nations Recommendations on the Transport of Dangerous Goods and will have the following UN Number:

UN No.	Proper Shipping Name	Class or division	Packing group	Special provisions
3496	BATTERIES, NICKEL-METAL HYDRIDE	9	-	117 963

Instructions and contents of Special Provisions (117 and 963) for this UN number include:

- Specifying it is only regulated when transported by sea,
- Ni-MH button cells are not subject to the provisions of this code.
- Ni-MH cells or batteries packed with or contained in equipment are not subject to the provisions of this code.
- All other Ni-MH cells or batteries shall be securely packed and protected from short circuit. They are not subject to other provisions of this code provided they are loaded in a cargo transport unit in a total quantity of less than 100 Kg gross mass.

When loaded in a cargo transport unit in a total quantity of 100 Kg gross mass or more, only subject to:

- Provided dangerous goods transportation information by a) Consignor and b) Shipper.
- Stowage and segregation provisions: as prescribed in Chapter 3 of IMDG Code: "away from" sources of heat as minimum horizontal separation of 3 metres.

Prior to transportation, confirmation that there is no leakage and no spillage from a container is necessary. Cargo must be handle without falling, dropping or breakage. Care must be taken to prevent the collapse of cargo piles or saturation by rain. Containers must be handled carefully. Packaging is constructed to prevent short-circuiting and/or electric shock. The product is handled as Non-Dangerous Goods by based on IATA(Special Provision A199) for air shipment.

15. REGULATORY INFORMATION

- Regulations specifically applicable to the product :
 - Wastes Management and Public Cleaning Law (Japan)
 - Law for Promotion Effective Utilization of Resources (Japan)
 - Commission Directive 2006/66/EU (EU)

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16. OTHER INFORMATION

- The information contained in this Safety data sheet is based on the present state of knowledge and current legislation.
 - This safety data sheet provides guidance on health, safety and environmental aspects of the product and should not be construed as any guarantee of technical performance or suitability for particular applications.
-

• Reference

Chemical substances information: Japan Advanced Information center of Safety and Health
International Chemical Safety Cards (ICSCs):
International Occupational Safety and Health Information Center (CIS)
2011 TLVs and BEIs : American Conference of Governmental Industrial Hygienists (ACGIH)
NIOSH CARCINOGEN LIST: National Institute for Occupational Safety and Health (NIOSH)
The Ninth Report on Carcinogen: National Toxicology Program (NTP)
IARC Monographs Program on the Evaluation of Carcinogenic Risks to Humans:
International Agency for Research on Cancer (IARC)
Globally Harmonized System of Classification and Labelling of Chemicals(GHS)
National Institute of Technology and Evaluation(NITE)

First edition Dec. 1, 2003

Latest edition Jan. 1, 2015

Prepared and approved by

• FDK CORPORATION TAKASAKI-PLANT
Engineering Department