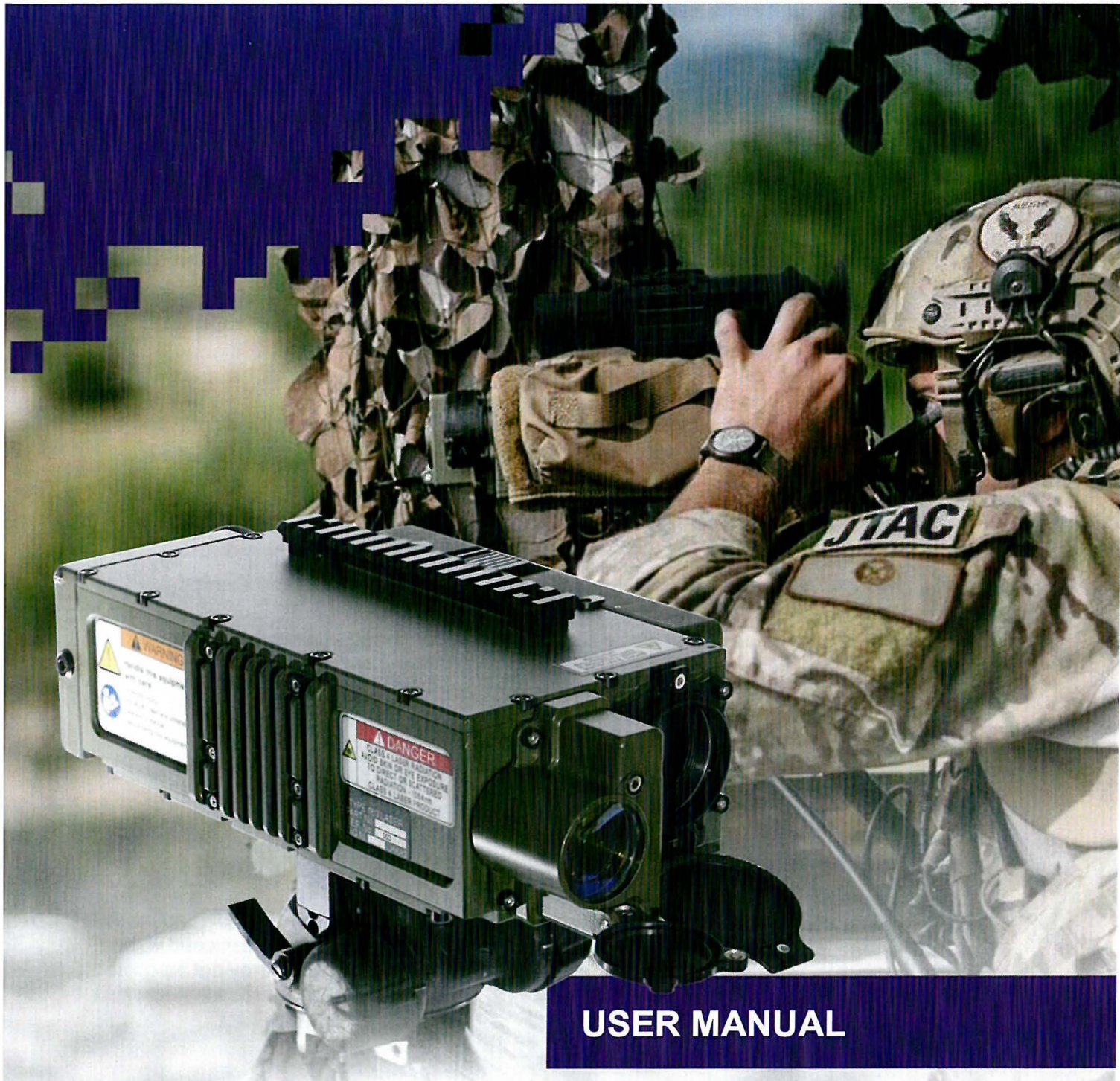

USER MANUAL

TYPE 163 LASER TARGET DESIGNATOR WITH LASER RANGEFINDER

LEONARDO

AP50083789

Type 163 User Manual

Document Number: AP50083789

Issue 9 May 2021

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SAFETY PRECAUTIONS

Figure 1: Type 163 Laser

During laser firing this equipment emits Class 4 Laser Radiation.

Prior to fitting the battery pack or the power adaptor to the Type 163 Laser, or switching power on, visually inspect all optics for any signs of damage. If there are

any signs of damage, the laser MUST NOT be used and immediately returned to Leonardo for investigation/repair.

It is recommended that the operator DOES NOT fit the battery pack or power adaptor to the laser, or switch power on, until the laser has been secured to the tripod and aimed at a target, and all tripod adjustments have been locked. ALWAYS switch power off and remove the battery pack or power adaptor before removing the laser from the tripod.

All users are responsible for wearing the appropriate eyewear during laser firing. The eyewear used must have AT LEAST the levels of protection detailed in Figure 2, in accordance with 'BS EN 207:2017, Personal eye protection equipment. Filters and eye-protectors against laser radiation (laser eye protectors)':

Laser protective eyewear with the following minimum performance is required for operation of the Type 163 laser in accordance with BS EN 207:2017.

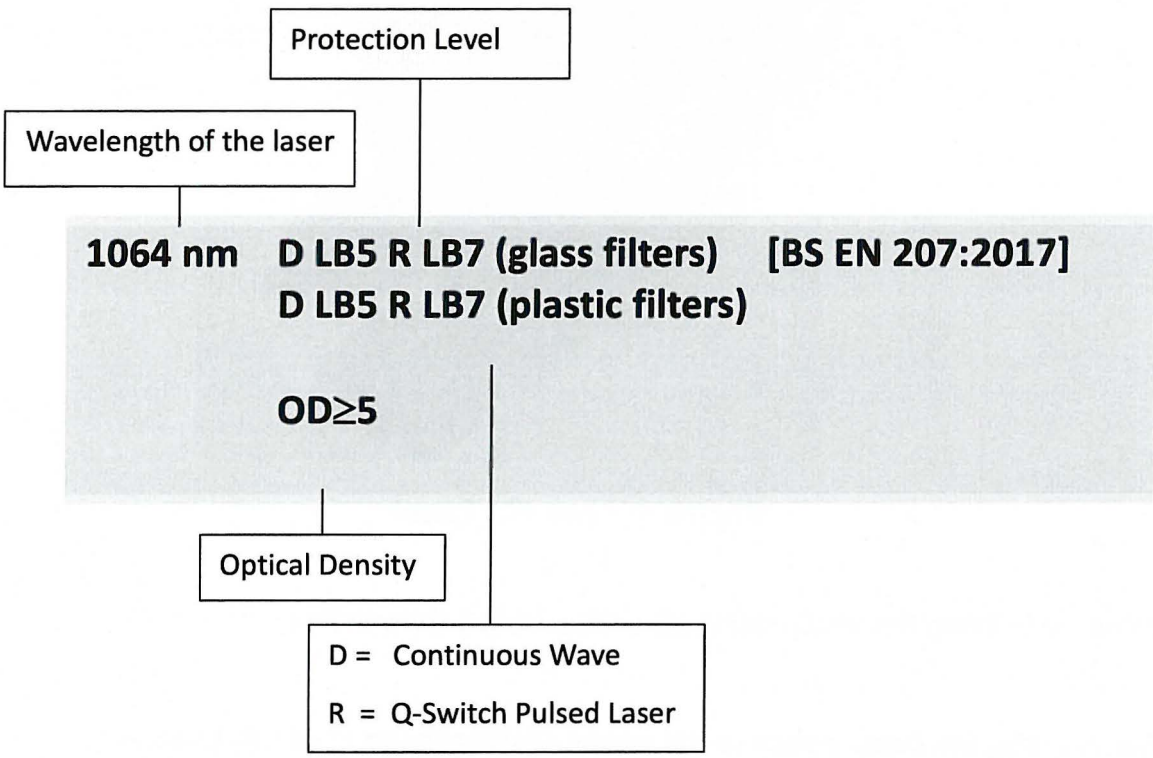


Figure 2: Laser Protective Eyewear Requirement

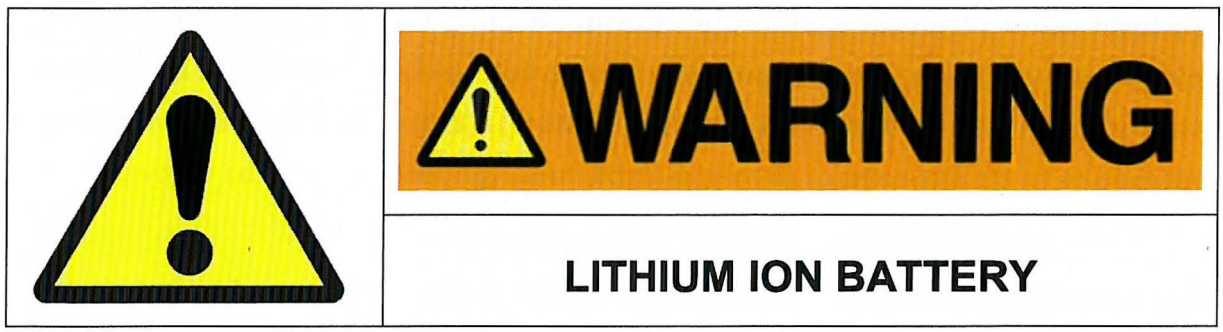
The laser utilises high energy density capacitor components that contain sulphuric acid. Damage to the unit may expose the user to sulphuric acid and must be handled in accordance with the Material Safety Data Sheet (MSDS) in Section 7.1. Should the unit require to be disposed of then applicable local guidelines are to be followed.

The laser utilises components that contain Gallium Arsenide and must be handled in accordance with the MSDS in Section 7.3. Should the unit require to be disposed of then applicable local guidelines are to be followed.

The laser utilises components that contain Lead and must be handled in accordance with the MSDS in Section 7.4. Should the unit require to be disposed of then applicable local guidelines are to be followed.

The laser has the ability to provide range data out over a serial link on the external comms port. Note that azimuth and elevation data from the MMI is pre-populated in order to display in a compatible format. These values should be discounted and the information should not be used as a part of a firing solution.

For more information regarding the safety aspects of the Type 163 Laser, refer to the Leonardo Laser Safety Paper, Document No. AP50106836 and BS EN 60825-1:2014, 'Safety of laser products: Equipment classification and requirements'.



This equipment employs a Lithium Ion battery.

HAZARDOUS COMPONENTS: Lithium Ion Battery Electrolyte contains Organic Solvents and Lithium Salt which will irritate skin, is flammable and toxic. Do not incinerate, puncture or crush batteries. If gas or liquid is leaking from the battery do not handle. Secure the area and maximise the ventilation around the battery. Leave in this condition until the battery has fully vented and cooled down to the ambient temperature. Once the battery has stopped leaking liquid and gas seal it in a heavy-duty polythene bag. Transport only after consultation with Leonardo. Handle using safety glasses with side shields, rubber gloves and coat.

DANGER FROM EXPLODING BATTERIES: Batteries may explode and/or release explosive or poisonous gasses due to cell venting if overcharged. The batteries must only be charged with the Type 163 Power Adaptor.

TOXIC HAZARD: In the event of puncturing or leakage of the electrolyte, actions should be carried out in accordance with the MSDS in Section 7. The Type 163 Battery Pack must not be tampered with in any way.

Batteries should be handled stored and disposed of in accordance with procedures for handling Lithium Batteries.

Batteries in an unserviceable or unknown condition must not be used and must be handled and disposed of in accordance with local procedures.

The Type 163 Battery Pack must not be connected or charged in locations where lead acid batteries are being charged; where vehicles are being refuelled, or where explosive gases are present.

DANGER FROM ELECTRIC SHOCK: A minor electric shock may be felt if the output terminals are touched when the battery pack or user is wet.

No servicing or repairs are to be carried out on the Type 163 Battery Pack.

Do not short circuit the external terminals.

If the covers are removed high Voltages are present within the Type 163 Laser; additionally there is a capacitor that stores high energy. These covers should not be removed as no servicing or repairs are to be carried out on the Type 163 Laser.

WARNING

HOT SURFACES

The Type 163 Laser is cooled by natural convection only and consequently during periods of laser firing the heatsink can get hot to the touch. Care should be taken to avoid touching the fins of the heatsink when the laser is firing and after the laser has been firing.

Figure 3: Position of Heatsink

ESD sensitive components are contained within this assembly. Appropriate handling precautions to be taken during maintenance.

LIST OF CONTENTS

1 Introduction

The Type 163 Laser is a lightweight laser designator which comprises: the Laser Transmitter Unit, (LTU) a Laser Range Receiver (LRR), a Man-Machine Interface (MMI) and a remote Arm/Fire cable. The Type 163 Laser is powered by either a detachable special to type battery or a Power Adaptor (connected to a suitable power source) mounted on the side of the Laser. The Man Machine Interface, which is attached to the rear of the laser, provides all control functionality and provides power control to the laser through the on/off switch. The remote Arm/Fire cable allows the laser to be Armed and Fired without requiring the operator to touch the laser when it is aligned to a target.

To achieve the lightweight feature of the Type 163 Laser the LTU chassis is manufactured from Magnesium Alloy ZW3. This does not present any additional hazards, except for situations where the chassis is machined, or damaged in such a way that cuttings present a potential fire hazard where an appropriate fire extinguisher should be used.

The laser designator is a diode-pumped Nd:YAG type, emitting radiation at a wavelength of 1064 nm. The athermal design has been demonstrated to provide a broad operating temperature range in a compact package.

The equipment is to be operated with an ambient temperature range of -30°C to +50°C.

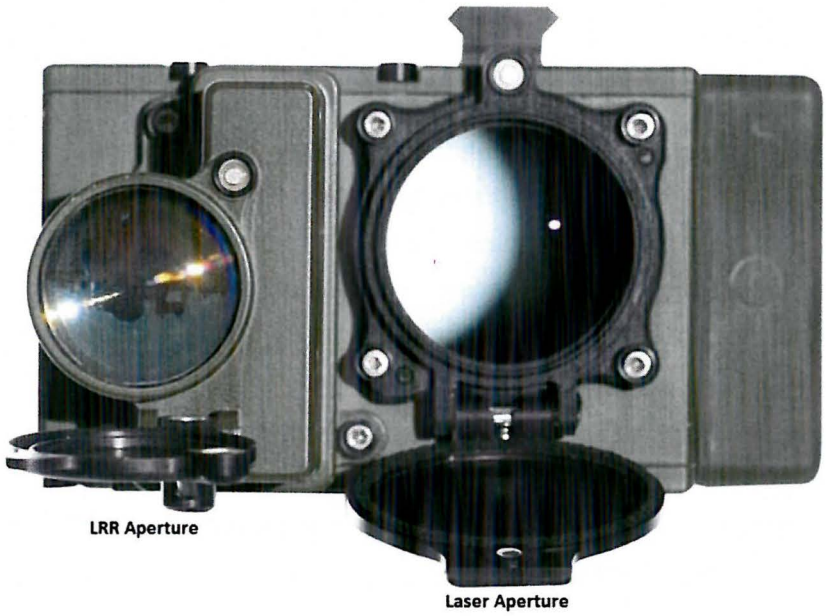


Figure 4: Laser and LRR Apertures

Note that the LRR may not be fitted

Figure 5: Direct View Optic (DVO), Man-Machine Interface (MMI) and Remote Arm/Fire Port

1.1 Abbreviations

AEL	Accessible Emission Limit
DVO	Direct View Optics
ENOHD	Extended Nominal Ocular Hazard Distance
ESD	Electrostatic Discharge
LED	Light Emitting Diode
LTU	Laser Transmitter Unit
LRR	Laser Range Receiver
MMI	Man-Machine Interface
MSDS	Material Safety Data Sheet
Nd:YAG	Neodymium-doped Yttrium Aluminium Garnet
NOHD	Nominal Ocular Hazard Distance
OD	Optical Density
PDM	Product Data Management
PRI	Pulse Repetition Interval
STANAG	Standardization Agreement (NATO)
UNC	Unified Coarse Thread

SI units in accordance with IEEE/ASTM SI 10-2002 are not included in the list of abbreviations

2 Equipment Description

2.1 Item Summary

The Type 163 Laser Equipment, as a minimum, consists of the items listed in Table 1. Optional accessories are listed in Table 2.

Table 1: Type 163 Equipment Item List

Item No.	Description	Part Number
1	Type 163 Laser	AP50073004 or AP50073008 or AP50073009
2	Remote Arm / Fire cable	AP50070924 or AP50105400
3	Battery	AP50073028
4	Power Adaptor	AP50059095
5	Mains Power Adaptor	AP50075328
6	Type 163 with LRR User Manual	AP50083789
7	Type 163 Laser Safety Paper	AP50106836

Table 2: Type 163 Optional Accessories List

Item No.	Description	Part Number
1	Type 163 Hard Carry Case	DB2822
2	Field Carry Pouch	DB2859
3	Type 163 Tripod Pouch	DB2860
4	Tripod, Lightweight	G0075656
5	Quick Release Adaptor	G0059923
6	Type 163 BA5590 Battery Adapter	AP50105936
7	Beam Dump Assembly	AP50159803

Figure 6: Type 163 Equipment and Accessories (Beam Dump Not Shown)

2.2 Type 163 Laser

The Type 163 Laser key characteristics are summarised in Table 3.

Table 3: Type 163 Laser - Key Characteristics

Wavelength	1064 ± 2nm
Output Energy	≥ 70 mJ
Beam Divergence	≤ 0.3 mRad
PRF Coding	STANAG 3733
Output Pulse Duration	18 ± 7 ns
Average Power Consumption	≤ 50 W (≤ 10 W when not firing)
System Controls	Provided by plug-in MMI Panel
Weight (LTU and MMI)	1.90 kg
Operating Temperature Range	-30°C to +50°C
Battery Operating Temperature Range	-10°C to +50°C
Mechanical Interfaces	¼" 20 UNC tripod interface
Laser to DVO reticule co-boresight	≤ 0.250 mRad
DVO Field of View	2 ° nom
DVO Image Resolution	≥ 12 cyc/mRad
NOHD	22.9 km
ENOHD	164.6 km

The laser aperture is located on the front surface of the Type 163 laser, and is clearly identified in Figure 4. The lens cap should be fitted over the laser aperture when the laser is not in use.

The Type 163 laser is equipped with an integrated aiming sight, referred to as a direct view optic, whose viewing port is located on the rear wall of the laser, as shown in Figure 5. The viewing port is fitted with a rubber eye cup.

The Type 163 laser incorporates internal safety features which prevent emission from the viewing port of any laser radiation in excess of the Accessible Emission Limit (AEL) for Class 1M defined in BS EN 60825-1:2014, 'Safety of laser products: Equipment classification and requirements'. However this

does not affect the safety precautions which must be taken when operating the laser, as stated in SAFETY PRECAUTIONS, Page iv and in Section 4 (System Operation) of this user manual.

2.3 Man Machine Interface

The MMI provides a means of controlling power to the laser.

The MMI allows selection and reporting of the operational mode.

The MMI allows selection and reporting of STANAG 3733 codes or pre-set code selection. .

When the Laser is firing, the MMI reports the Laser Range information. This information is displayed in a cyclical format with the laser code: the laser code is displayed with the Mode for 1 second, then the First Range for 1 second, then the Last Range for 1 second with this sequence repeating as long as valid range information is received.

The MMI has the ability to vary the brightness of the display.

The MMI has the ability to provide range data out over a serial link on the external comms port. Note that azimuth and elevation data from the MMI is pre-populated in order to display in a compatible format. These values should be discounted and the information should not be used as a part of a firing solution.

Figure 7: Man Machine Interface

2.4 Remote Arm/Fire Cable

The Remote Arm/Fire cable comprises of a turn and push rotary switch which provides the same functionality as the equivalent buttons on the MMI. When the remote Arm/Fire Cable is connected to the MMI, either the MMI buttons or the rotary switch on the remote Arm/Fire cable can be used to control the arming and firing of the laser. However, Leonardo recommends that in order to avoid disturbing the laser aim-point, the rotary switch on the Remote Arm/Fire cable is used to control the arming and firing of the laser.

The LED indicates the Arm / Fire status of the laser. The LED is on permanently when the laser is armed and flashes at 1 Hz when the laser is firing.

The Remote Arm/Fire Cable interfaces to the MMI by a 2-metre cable with a circular keyed connector.

Figure 8: Remote Arm/Fire Cable

2.5 Battery

The battery must be recharged using the power adaptor. The normal charge time for a fully discharged battery is 1 hour to 90% and 1.5 hours to fully charge at 25°C.

The following storage conditions apply to the battery:

- In the discharged state the battery can be stored for 6 weeks.
- The battery can be stored for 12 months if storage commences with the battery in the fully charged condition.
- To maximise their performance, it is recommended that the batteries are stored in an ambient temperature of 25+/-5°C.
- The batteries can be recharged up to 300 times before performance becomes degraded.

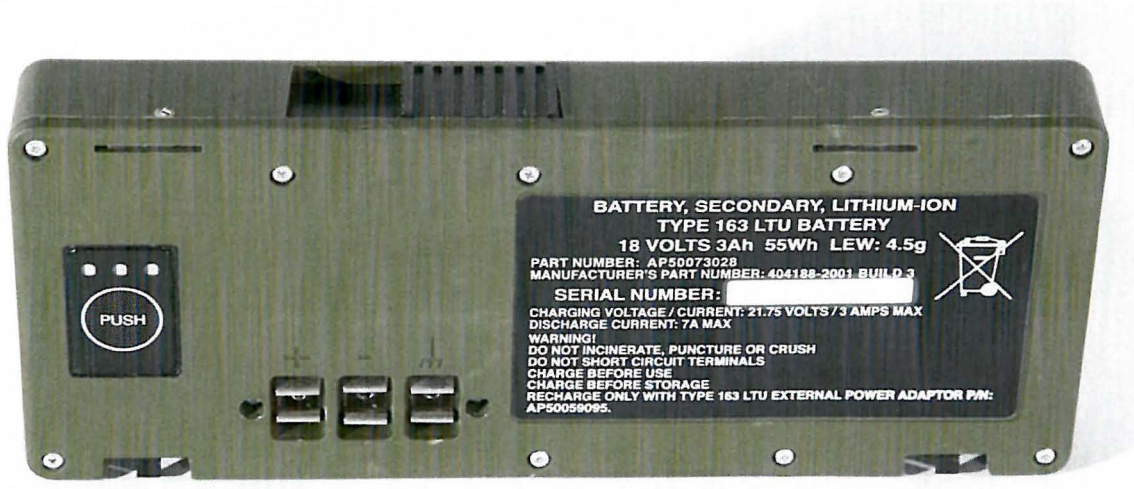


Figure 9: Lithium-Ion Battery

2.6 Power Adaptor

The LTU can be powered, or the battery recharged, when connected to a suitable power source, for example:

- The supplied Mains Power Adaptor
- A MIL-STD-1275D compliant power source, capable of providing 95W
- A DC source (using an optional adaptor cable) capable of providing 95W over an input voltage range of 10.8V → 32V

Figure 10: Power Adaptor

2.7 Tripod

The Type 163 Laser has an optional tripod, which allows fine adjustment and gives greater stability when in operation.

Figure 11: Type 163 Tripod

2.8 Tripod Interface

The Type 163 Laser has a ¼" 20 UNC tripod interface and this is to be used if the laser is attached to a tripod. When fitting to the laser, ensure that orientation is as noted below, where the arrow indicates the direction of the laser aperture.

Figure 12: Tripod Interface

2.9 Picatinny Rail (MIL-STD-1913)

The Type 163 Laser has a picatinny rail mounted on the top to enable accessories to be mounted. The maximum weight of accessories fitted to the picatinny rail should not exceed 1kg.

Figure 13: Type 163 Picatinny Rail

2.10 BA5590 Battery Adaptor

The Type 163 Laser can be supplied with an optional BA5590 Adaptor, if it is supplied, the BA5590 Battery Adaptor can be used to power the LTU when connected to a BA5590 battery.

Figure 14: BA5590 Battery Adaptor

2.11 Beam Dump

The Type 163 Laser can be supplied with an optional Beam Dump. When fitted to the laser aperture, the beam dump absorbs energy at 1064nm and dissipates any heat generated, allowing the laser to be fired in a training environment where a firing range is not available.

CORRECT FITMENT OF THIS ITEM IS SAFETY CRITICAL WHEN IN USE. REFER TO SECTION 3.5 FOR FITTING INSTRUCTIONS.

Figure 15: Type 163 Beam Dump

3 Equipment Set-up

3.1 Battery Pack Installation & Removal

The Type 163 Battery Pack is stowed separately, and should only be fitted when the equipment has been set up in preparation to fire.

NOTE: Do NOT hold the battery pack to lift the laser. The battery pack may disengage, causing the laser to be dropped.

Before using the battery pack carry out the following pre-use inspections:

- Check the battery pack case is not damaged
- Check the battery terminals are not damaged
- Check the securing latches are not damaged
- Check the membrane panel and press to test switch are not damaged.

The battery pack functionality and capacity should be checked before use by operating the press to test switch. If the battery pack functionality is suspect, it should not be used.

The battery capacity indications are as follows:

- Red LED ON – Battery Capacity <25%. Do not use, charge battery prior to use.
- Orange LED ON – Battery Capacity >25% and <75%. Battery can be used but this has limited capacity.
- Green LED ON – Battery Capacity >75%. The battery is in the fully charged state.

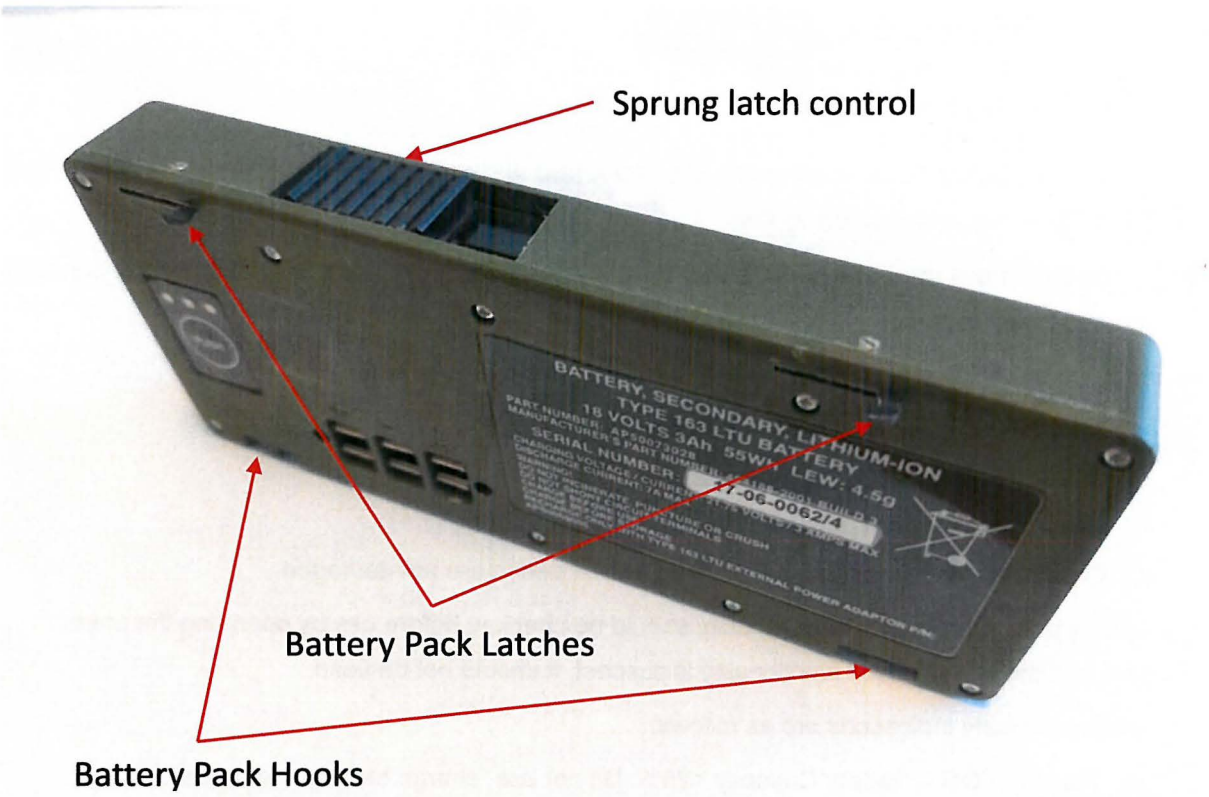


Figure 16: Battery Pack Hooks, Latches and Sprung Latch Control

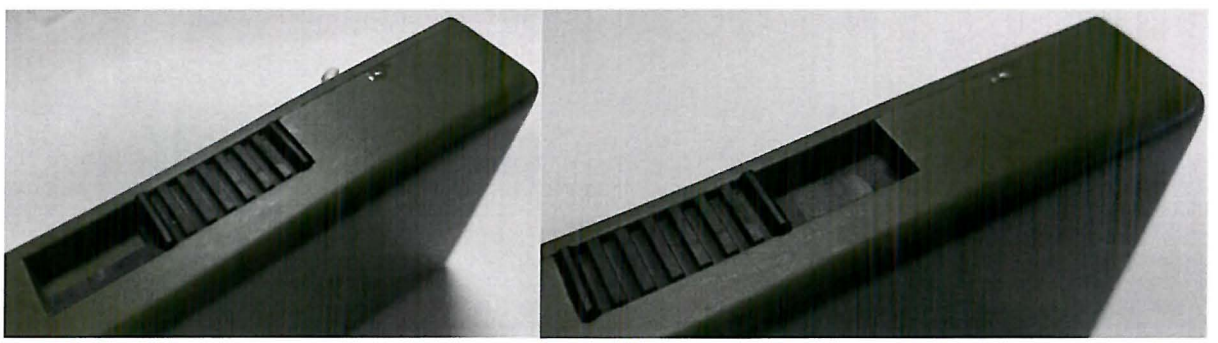


Figure 17: Showing the Sprung Latch Control's position when the Latches are fully open (left hand view) and when stowed (right hand view)

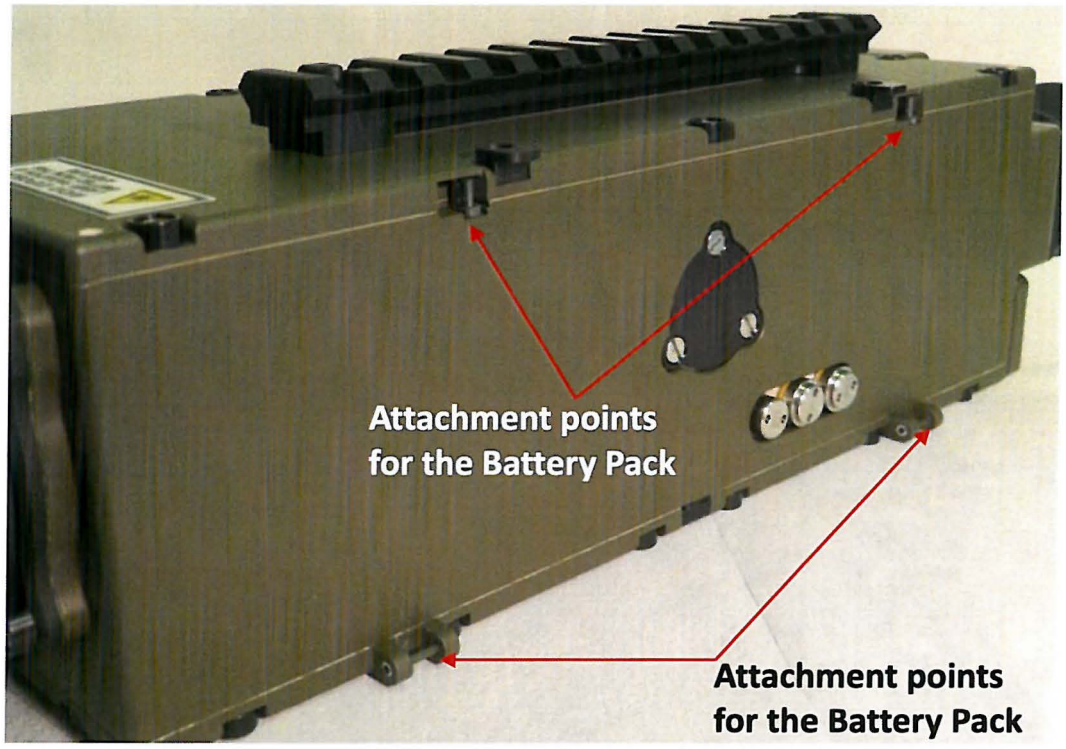


Figure 18: Laser Battery Pack attachment points

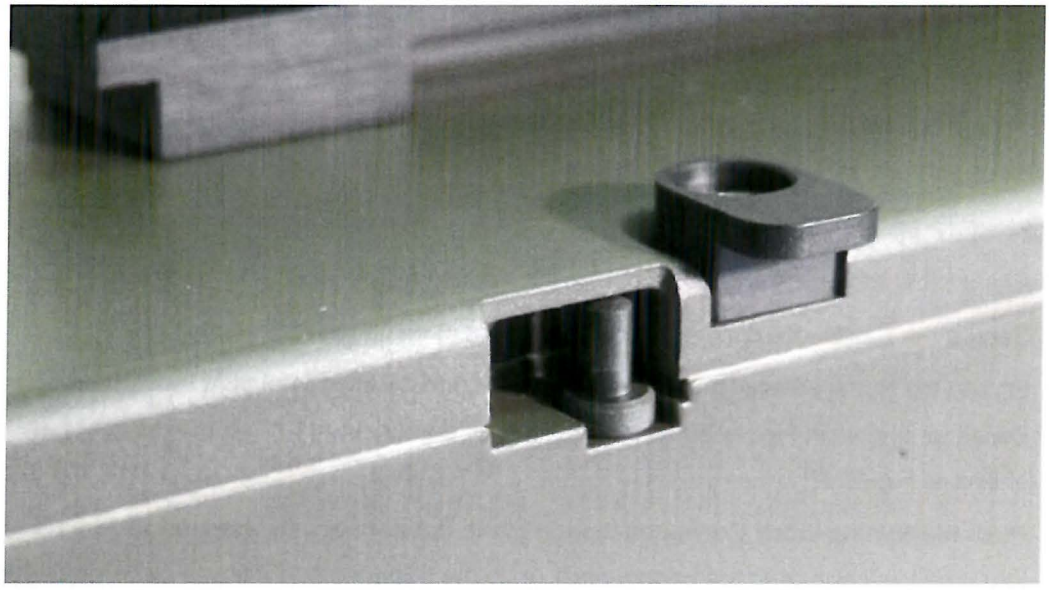


Figure 19: Laser Battery Pack Latch aperture

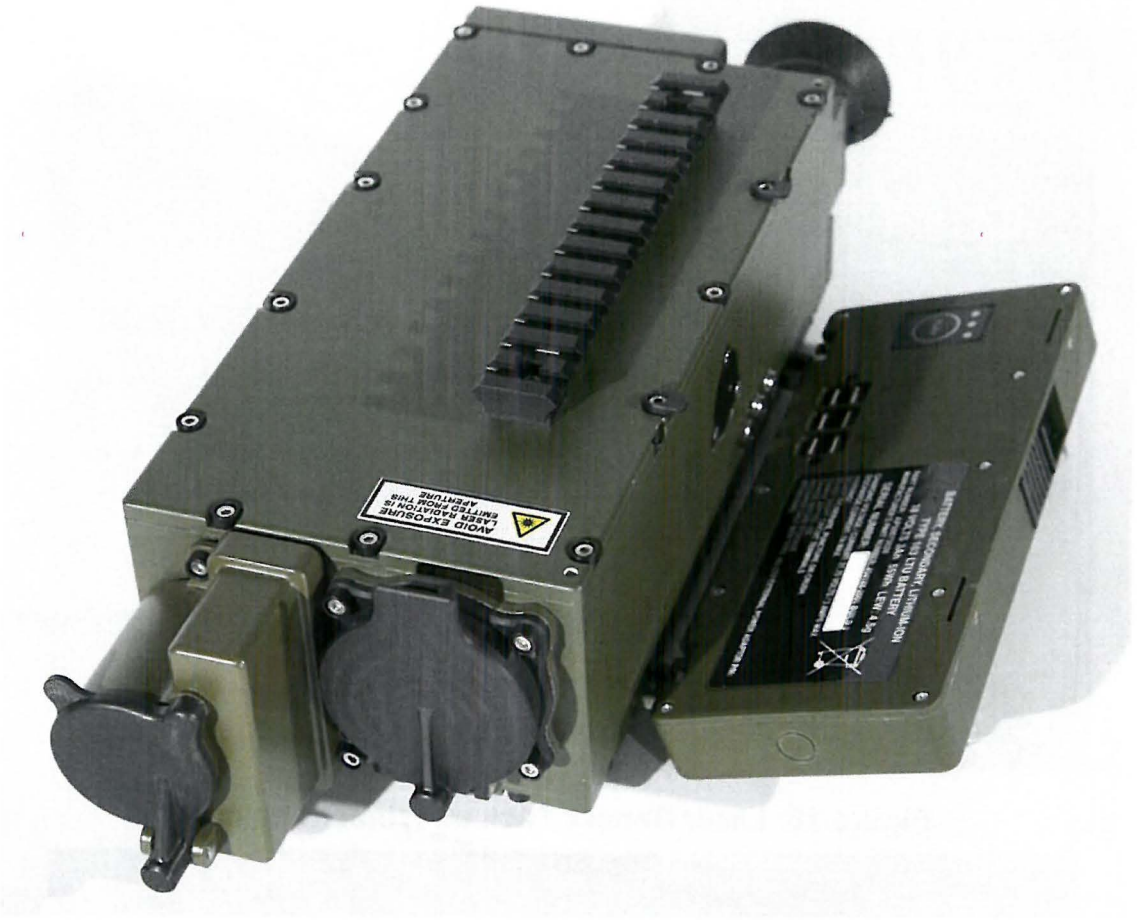


Figure 20: Showing the Battery Pack Hooks engaged first

To fit the battery:

1. Ensure that the power switch on the MMI is set to the OFF position.
2. Secure the Laser with one hand, to prevent it from being moved.
3. Locate the Battery Pack Hooks, as shown in Figure 16 into the pins at the bottom of the Laser, as shown in Figure 18. The Battery Pack and Laser at this point should appear as shown in Figure 20.
4. Push the Sprung Latch Control on the top of the Battery Pack forward, as shown in Figure 17 left hand view and offer the battery pack up to the Laser so that the gap between the battery and the laser is reduced. Ensure that the Latches enter the latch apertures, as shown on Figure 19, on the laser chassis. The Battery Pack and Laser at this point should appear as shown in Figure 21.

5. Release the Sprung Latch Control on top of the battery pack and ensure that the battery is fully engaged onto the laser.

Figure 21: Sprung Latch Control Position to allow removal of Battery Pack

To remove the battery pack:

1. Ensure that the power switch on the MMI is set to the OFF position, and the laser aperture lens cap is closed.
2. Secure the laser with one hand, to prevent it from being moved.
3. Release the spring mechanism on top of the battery pack by pushing it forward, as shown on Figure 21 and rotate the battery away from the laser.
4. Lift the battery pack hooks away from the pins in order to disengage it.

3.2 Power Adaptor Installation & Removal

The power adaptor attaches to the laser in the same way as the battery pack, follow the instructions for battery pack installation & removal.

3.3 Connection & Disconnection of Remote Arm/Fire Cable

NOTE: The connector on the remote Arm/Fire cable must be handled with care.

The Remote Arm/Fire cable should be stowed separately, and should only fitted to the MMI when the equipment has been set up in preparation to fire.

Remove the dust cover from the MMI connector, see Figure 7.

Ensure that the MMI connector and Remote Arm/Fire cable connector are clean and free from damage before attempting fit.

Align the Remote Arm/Fire cable connector to the locating cut out on the MMI connector and gently push it in to engage.

To disconnect, hold the Remote Arm/Fire cable connector and carefully pull it away from the MMI connector.

Fit the MMI connector dust cover when the Remote Arm/Fire cable is not in use, see Figure 7.

3.4 Connection & Disconnection of BA5590 Battery Adapter

The BA5590 Battery Adapter should be attached to the laser prior to attaching the cable to the BA5590.

The BA5590 battery adapter is attached to, and removed from, the laser in the same way as the battery pack as detailed in section 3.1.The cable can be removed from the adapter by gently pulling it from the adapter. When removing the cable it must be gently pulled in-line with the axis of the connector. Any twisting or angular pull may damage the connector.

The connectors are keyed and, therefore when re-connecting the cable to the adapter, the red dots on the cable and adapter must be aligned, see Figure 22. Once the red dots are aligned the cable connector can be gently pushed (along the axis of the connector) into the connector in the adapter. Any misalignment of the connectors when fitting together may damage the connector.

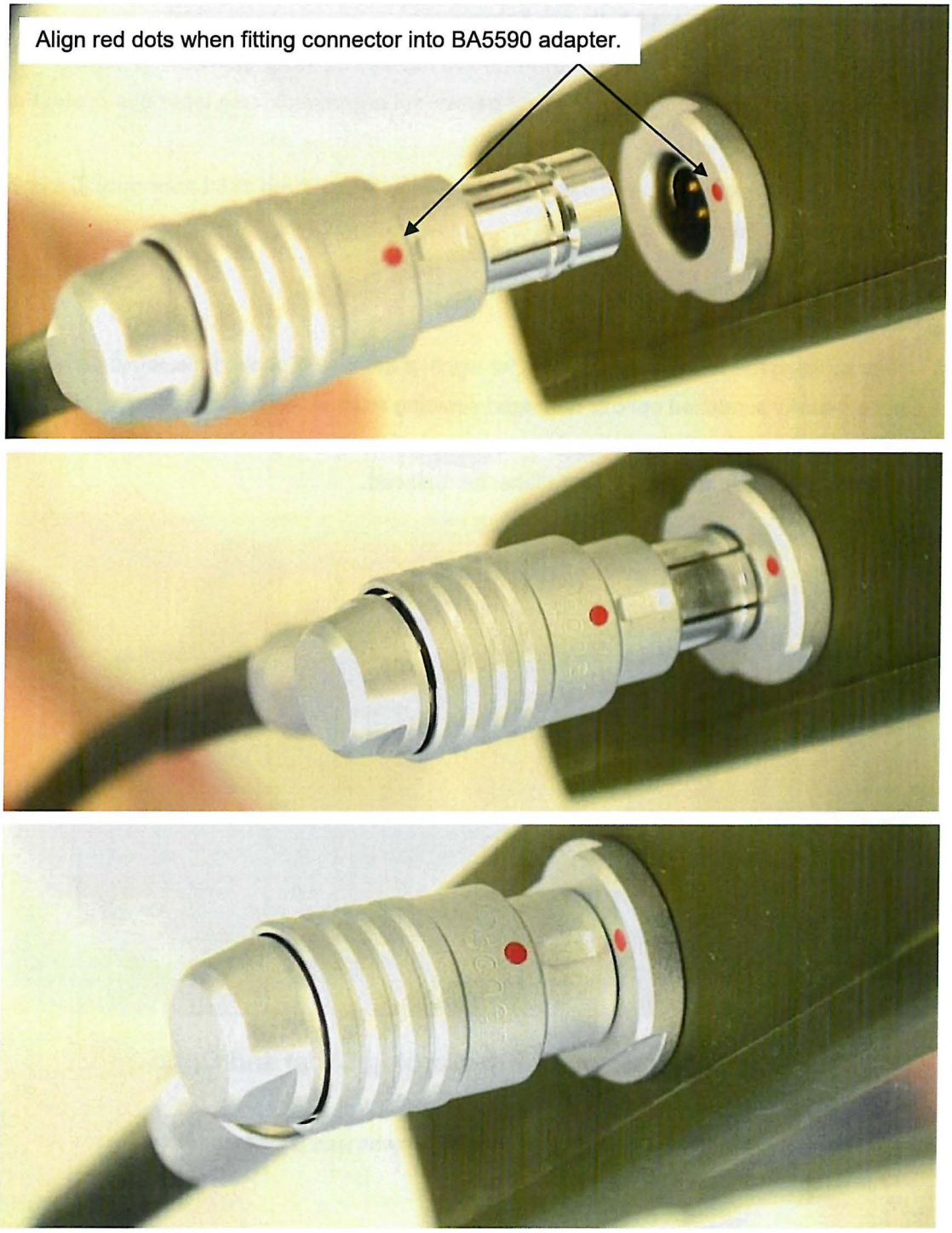


Figure 22: Showing cable assembly into BA5590 battery adapter

3.5 Attachment of Type 163 Beam Dump

Use of the Type 163 Beam Dump is not intended to replace existing operational safety measures and it is highly recommended that personnel continue to use laser eye protection when firing the laser.

The Type 163 Beam Dump has been designed for use with the Type 163 Laser only. Do not attempt to use with other equipment.

The following instructions are safety critical.

Fitting instructions:

1. Prior to fitting the beam dump, inspect for signs of damage. For example, loose optic, cracked optic, heavily scratched optic or damaged securing strap. If there is any doubt over the serviceability of the beam dump, do not proceed. If the warning label advice becomes illegible, it is recommended that the label be replaced.

Figure 23: Beam Dump Warning Label and Optic

2. Open Type 163 Laser aperture flip cover.
3. Ensure that the laser aperture mating surface is clean and undamaged.

4. Offer beam dump up to the laser aperture in a 1 o'clock position, as shown in Figure 24, ensuring that the beam dump fits over the ridged aperture window.

Figure 24: Offer Up Beam Dump

5. Rotate in an anti-clockwise motion, as shown in Figure 25, to engage with the magnet feature on the laser aperture, ensuring that the beam dump remains flush to the window.

Figure 25: Beam Dump Rotated Into Position

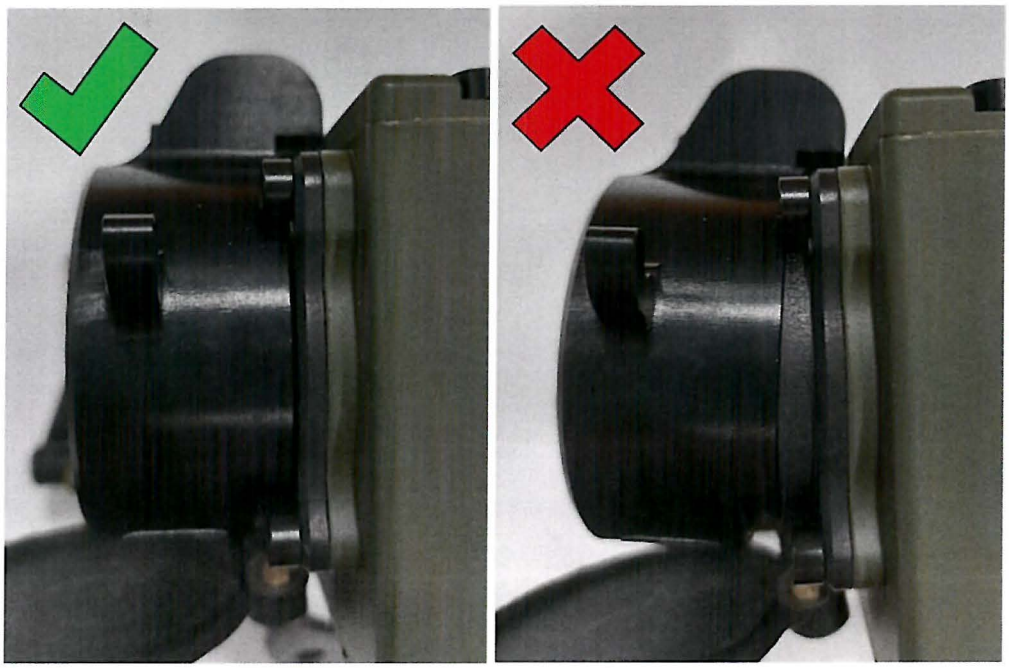


Figure 26: Flush Fit and Poor Fit Examples

6. Feed the beam dump strap down the left hand side of the aperture and behind the aperture window at the base.

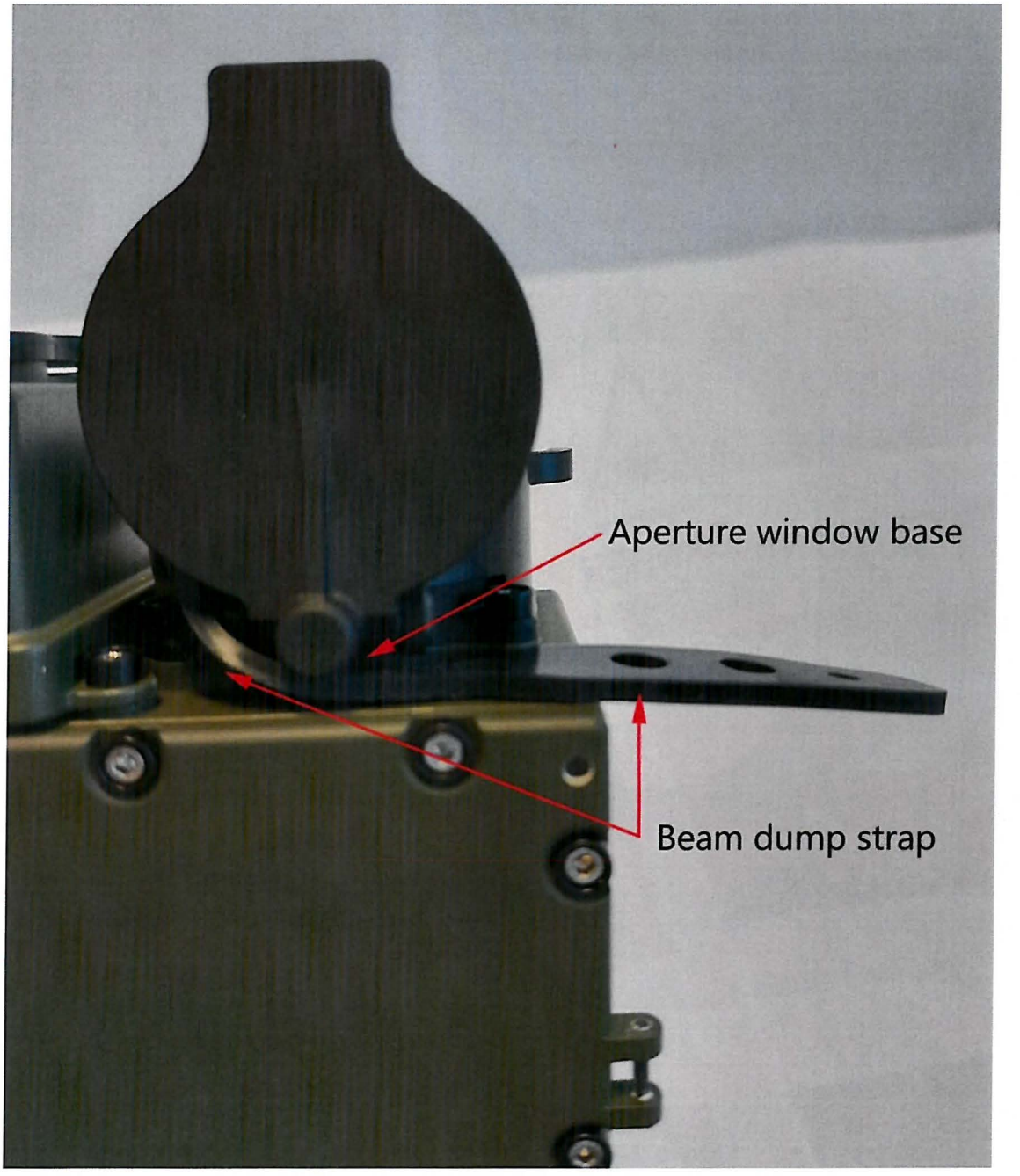


Figure 27: Beam Dump Strap Routing

7. Loop the beam dump strap over the hook feature to secure the beam dump in position. Typically the first larger hole should be used, as shown in Figure 28. An additional large hole is available to allow for stretching of the strap over time. A small hole at the end of the strap is provided for the convenience of the user.

Figure 28: Secure Beam Dump Strap

8. Gently check that the beam dump is securely fitted and ensure that it is fitted flush to the laser aperture and undamaged. If there is any doubt, do not proceed.

4 System Operation

(1) DO NOT fit the battery pack or power adaptor to the LTU, or switch power on, until the LTU has been secured to the tripod and aimed at a target, and all tripod adjustments have been locked. ALWAYS switch power off and remove the battery pack before removing the LTU from the tripod.

(2) LASER DESIGNATOR FIRING – WHEN THE LASER IS FIRED, Class 4 laser radiation IS emitted from the laser aperture. Eye protection rated for OD ≥ 5 at 1064 nm MUST be worn while operating the laser.

(3) Unintentional or Anomalous Laser Output – There are no external safety interlocks in the Type 163 Laser firing chain. Beyond the correct switch position and sequencing as outlined in these procedures, there are no physical interlocks preventing laser firing.

(4) Laser System Output Faults – In the event of an output fault, there will be no hazard if the hazard distances and the appropriate safety precautions are observed. However, there is no audible alert if any output fault occurs in the Type 163 Laser. If any fault is suspected during operation, the system should be powered down and sent for repair/investigation.

Figure 29: The Type 163 Laser

4.1 Stop Laser Firing

To stop the laser firing at any time, switch the power switch to the OFF position.

Replace the laser aperture lens cap.

Remove the battery pack from the laser.

4.2 Initial Setup

1. Set up the tripod in a clear area, and check that it is stable and that all controls are locked.
2. Visually inspect the laser to confirm that no physical damage is evident. Ensure that the DVO is inspected, if there is any damage to the DVO then the laser should not be used and the unit returned to Leonardo for repair.
3. Install the laser on the tripod.
4. Ensure that the laser aperture is directed at the target. See Figure 30, DVO View, and Figure 31, DVO Reticule guide.

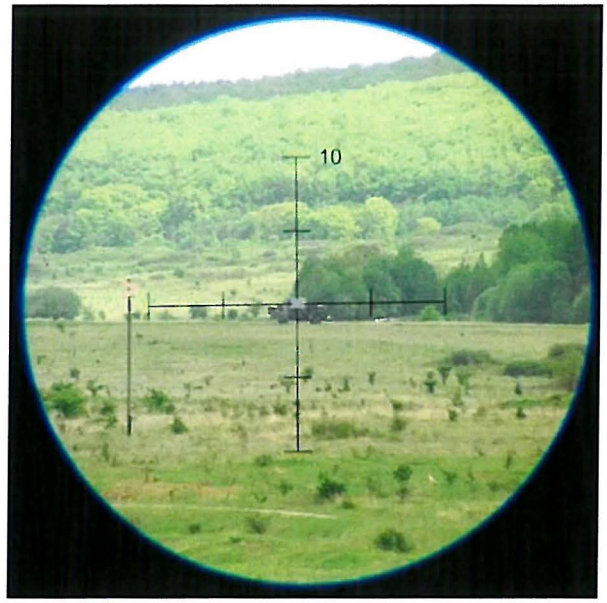


Figure 30: DVO View

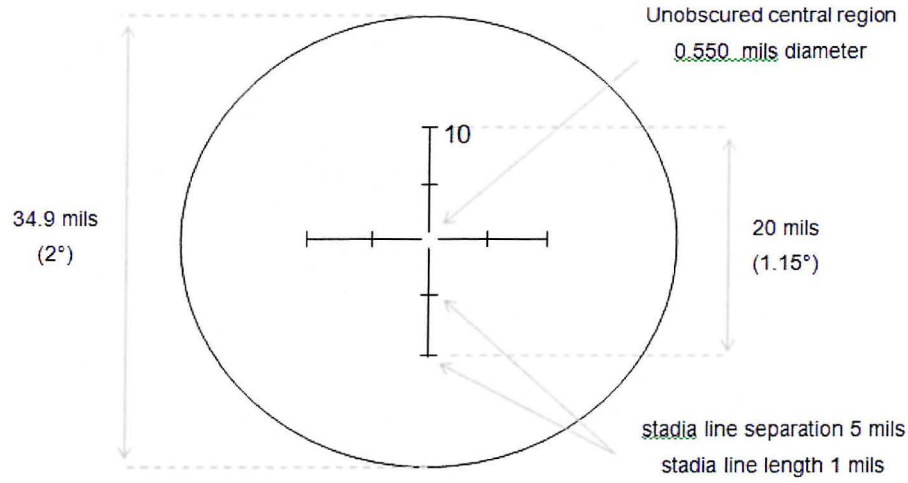


Figure 31: DVO Reticule Guide

5. Ensure that the MMI power switch is in the OFF position.
6. Connect the Remote Arm/Fire cable, ensuring that the switch is in the DISARM position.
7. Install the battery pack or the power adaptor onto the laser. If the power adaptor is fitted connect to a suitable power source.

4.3 Power On

4.3.1 Power on – AP50073004 Variant

1. Set the MMI power switch to the ON position.
2. The first digit of the LED display will display an "S" to indicate Standby mode. The last selected Laser code will be displayed on digits 2 to 5 of the LED display.

Figure 32: Standby Mode Indicator

4.3.2 Power on – AP50073008 and AP50073009 Variants

1. Set the MMI power switch to the ON position and momentarily depress the right arrow key.
2. The first digit of the LED display will display an "S" to indicate Standby mode. The last selected Laser code will be displayed on digits 2 to 5 of the LED display.

4.4 Laser Code Selection

4.4.1 To select one of the five pre-set codes

1. Ensure that the laser is in Standby Mode - the first digit of the LED display will display an "S".
2. Press the Up cursor. This will cause the first digit of the LED display to display "1" and the corresponding Laser code.
3. To select this code press the Right cursor, this will cause the first digit of the LED display to display "S" indicating the coded is selected.
4. To select another code press the Up cursor until the selected code is displayed and then press the Right cursor to select this code. Note that the first digit of the LED display will display the pre-set code number until it is selected, once selected (pressing of the Right cursor) the first digit of the LED display shall change to "S".

4.4.2 To adjust existing laser code

1. Ensure that the laser is in Standby Mode - the first digit of the LED display will display an "S".
2. Press the Right cursor twice. This will cause digit 3 to flash (note that digit 2 is fixed at '1').
3. Use the Up or Down cursor to change the digit 3 value.
4. Press the Right cursor to select digit 4. This will cause digit 4 to flash.
5. Use the Up or Down cursor to change the digit 4 value.

6. Press the Right cursor to select digit 5. This will cause digit 5 to flash.
7. Use the Up or Down cursor to change the digit 5 value.
8. Press the Right cursor to complete Laser code selection, and verify that no digits remain flashing.
9. Confirm code displayed is as intended.

4.4.3 To change the Pre-set codes

1. Ensure that the laser is in Standby Mode - the first digit of the LED display will display an "S".
2. Press and hold the Down cursor for five seconds.
3. This will select code 1 and cause all digits to flash, with digit 1 displaying 1 and digits 2 to 4 displaying the existing pre-set code.
4. Press the Right cursor to select this code for adjustment or press the Up Cursor to select another code.
5. Once the code for changing has been selected press the Right cursor.
6. This will cause digit 2 to flash and all other digits are now solid.
7. Press Up or Down cursor to adjust the digit.
8. When required number is displayed press the Right cursor to select.
9. This will cause digit 3 to flash and all other digits are now solid.
10. Press Up or Down cursor to adjust the digit.
11. When required number is displayed press the Right cursor to select.
12. This will cause digit 4 to flash and all other digits are now solid.
13. When required number is displayed press the Right cursor to select.
14. This will cause digit 5 to flash and all other digits are now solid.
15. Press Up or Down cursor to adjust the digit.
16. When required number is displayed press the Right cursor to select.
17. Preset code has now been changed.

4.5 Display Brightness Adjustment

1. Ensure that the laser is in Standby Mode - the first digit of the LED display will display an "S".
2. Press and hold the Right cursor for two seconds.
3. "-BRGT" will be shown on the LED display. Press Up or Down until the desired brightness is achieved.

Figure 33: Display Brightness Indicator

4. Press Right again and the LED display will return to showing "S" and the selected laser code.

4.6 Arming or Disarming the Laser Designator

1. Verify that the laser sightline is still aimed precisely at the target.
2. Ensure that the laser is in Standby Mode - the first digit of the LED display will display an "S".
3. Verify that the displayed laser code is as required.
4. On the Remote Arm/Fire cable turn the rotary switch clockwise to ARM, or using the MMI press the ARM/DISARM button to ARM.
5. At this point the first digit of the MMI LED display should change to an "A" to indicate ARMED mode and the LED on the Remote Arm / Fire cable should illuminate.
6. To revert to STANDBY mode at any time, switch the ARM/DISARM to DISARM. If armed on the remote, DISARM on the remote. If armed on the MMI, DISARM on the MMI.

Figure 34: ARMED Mode Indicator

4.7 Firing the Laser Designator

WARNING: WHEN THE LASER IS FIRED, Class 4 Laser Radiation IS emitted from the Laser Aperture. Eye protection rated for OD ≥ 5 at 1064 nm MUST be worn while operating the laser.

WARNING: DO NOT FIRE THE LASER WITH THE LASER APERTURE LENS CAP FITTED.

Note: The LRR function provides confirmation that the selected target is the correct one when the first range displayed matches the known range to target (derived by other means). On occasion, the first range may be less than the known range to target which may be indicative of other objects impinging on the beam between the laser and the target.

The user should also pay attention to the last return. This can provide information about how the laser beam is placed on the selected target. A longer range than the known range to target may be indicative of overspill caused by the laser beam positioned near to the edge of the target.

The user should follow their training should either of these events be observed.

WARNING: Very rapid single FIRE/STOP switch or button depressions, or multiple rapid depressions, may result in the laser firing continuously, even when the FIRE/STOP switch or button is disengaged. If this occurs, press FIRE/STOP button on either the remote or MMI to cease firing.

Type 163 Lasers that have been upgraded in accordance with mod kit AP50181159, as denoted by mod strike #1 shown in Figure 35, are not affected. The mod label is located on the laser's battery mating face.

Figure 35: Mod Strike-Off Label, Denoting Embodiment of Mod Strike #1

Ensure that the Laser Aperture lens cap is opened.

1. Ensure that the first digit of the LED Display is "A". If it is "S", repeat the steps in section 5.6 to Arm the Laser.
2. On the Remote Arm/Fire cable ensure that the LED is illuminated.
3. On the Remote Arm/Fire cable, press and hold the FIRE/STOP Fire button. If using handheld, on the MMI, press and hold the FIRE/STOP Fire button on the MMI.
4. At this point the first digit of the MMI LED display should change to an "F" to indicate FIRE mode.

Figure 36: FIRE Mode Indicator

5. The display will change at 1 Hz to report; Mode and Laser Code, ⌐ First Range and ¬ Last Range. The display will continue repeating this sequence whilst a valid range return is received.

Figure 37: First Range Indicator and Range Reading

Figure 38: Last Range Indicator and Range Reading

6. If using the Remote Arm/Fire cable, ensure that the LED is flashing.
7. To stop firing, release the FIRE/STOP Fire button on Remote or MMI. At this point the first digit of the LED Display will change to an "A" to indicate ARMED mode.

WARNING: Very rapid single FIRE/STOP switch or button depressions, or multiple rapid depressions, may result in the laser firing continuously, even when the FIRE/STOP switch or button is disengaged. If this occurs, press FIRE/STOP button on either the remote or MMI to cease firing.

4.8 System Shutdown

1. Set the MMI Power switch to the OFF position.
2. Close the Laser Aperture flip cover.
3. Remove and stow the Battery Pack or Power Adaptor and cable.
4. Disconnect and stow the Remote Arm/Fire cable.
5. Remove the Laser from the tripod, and stow it.

5 System Failures and Maintenance

The Type 163 Laser contains no user serviceable parts.

If a failure occurs which prevents operation of the system, the system should be returned immediately to Leonardo for investigation.

Note that the error messages will cycle with the laser information at 1 Hz. However, when the laser is firing and a valid range return is received the error messages will be displayed in addition to the cycled range information in section 4.7.

5.1 Error Messages

When an error message is present the 1st digit of the MMI will display "-"

Figure 39: Example Error Messages Showing Error Indicator "-"

5.1.1 BATT

If the LED Display shows BATT alternating with the laser code, the battery pack is discharged and needs to be replaced.

Figure 40: Battery Error Message

5.1.2 ENRG

If the LED Display shows ENRG alternating with the laser code, the output energy is below the specified output. The laser will continue to operate but at the earliest opportunity the power should be recycled and the right arrow key momentarily depressed to confirm or clear the fault.

If the fault persists, return the system to Leonardo for investigation.

Figure 41: Output Energy Error Message

5.1.3 TEMP

If the LED Display shows TEMP alternating with the laser code, there is an over temperature. The laser shall continue to operate but at the earliest opportunity the power should be removed and the laser allowed to cool.

If the fault persists, return the system to Leonardo for investigation.

Figure 42: Over Temperature Error Message

5.1.4 BITE

If the LED Display shows BITE alternating with the laser code there is a built in test error. The laser shall continue to operate but at the earliest opportunity the power should be recycled and the right arrow key momentarily depressed to confirm or clear the fault.

If the fault persists, return the system to Leonardo for investigation.

Figure 43: Built In Test Equipment Error Message

5.1.5 LASE

If the LED Display shows constant LASE there is a fault in the laser.

Recycle power on the unit and momentarily depress the right arrow key to confirm or clear the fault. If the fault persists, return the system to Leonardo for investigation.

Figure 44: Laser Fault Error Message

5.1.6 COMM

If the LED Display shows COMM there is a fault in the laser.

Note: This error message may be displayed if the right arrow button has been depressed for too long during the power on sequence.

Recycle power on the unit and momentarily depress the right arrow key to confirm or clear the fault. If the fault persists, return the system to Leonardo for investigation.

Figure 45: Comms Error Message

5.1.7 MMIE

If the LED Display shows MMIE there is a fault with the MMI.

Recycle power on the unit and momentarily depress the right arrow key to confirm or clear the fault. If the fault persists, return the system to Leonardo for investigation.

Figure 46: Man Machine Interface Error Message

5.1.8 LRR

If the LED Display shows LRR there is a fault with the Laser Range Receiver.

Recycle power on the unit to confirm or clear the fault. If the fault persists, return the system to Leonardo for Investigation.

Figure 47: Laser Range Receiver Error Message

5.2 Battery Storage

The following storage conditions apply to the Type 163 Laser Battery Pack:

- In the discharged state, the battery can be stored for 6 weeks.
- The battery can be stored for 1 year if storage commences with the battery in the fully charged condition.

Storage for longer than these times will result in the battery becoming unserviceable. Refer to section 6.2 for charging instructions.

Note: Discharged batteries must not be left on the Laser or Power Adaptor as this will cause the battery to become unserviceable.

5.3 DVO Eyecup Removal and Fit

Removal of the DVO eyecup can be achieved by gently pulling it away from the DVO window.

Fit of the DVO eyecup can be carried out as follows:

1. Insert the eyecup plug into the eyecup to help rigidize it.
2. Offer the eyecup up to DVO window.
3. Push the eyecup onto the DVO window, whilst gently twisting in small clockwise and anti-clockwise movements until the eyecup has fully engaged.

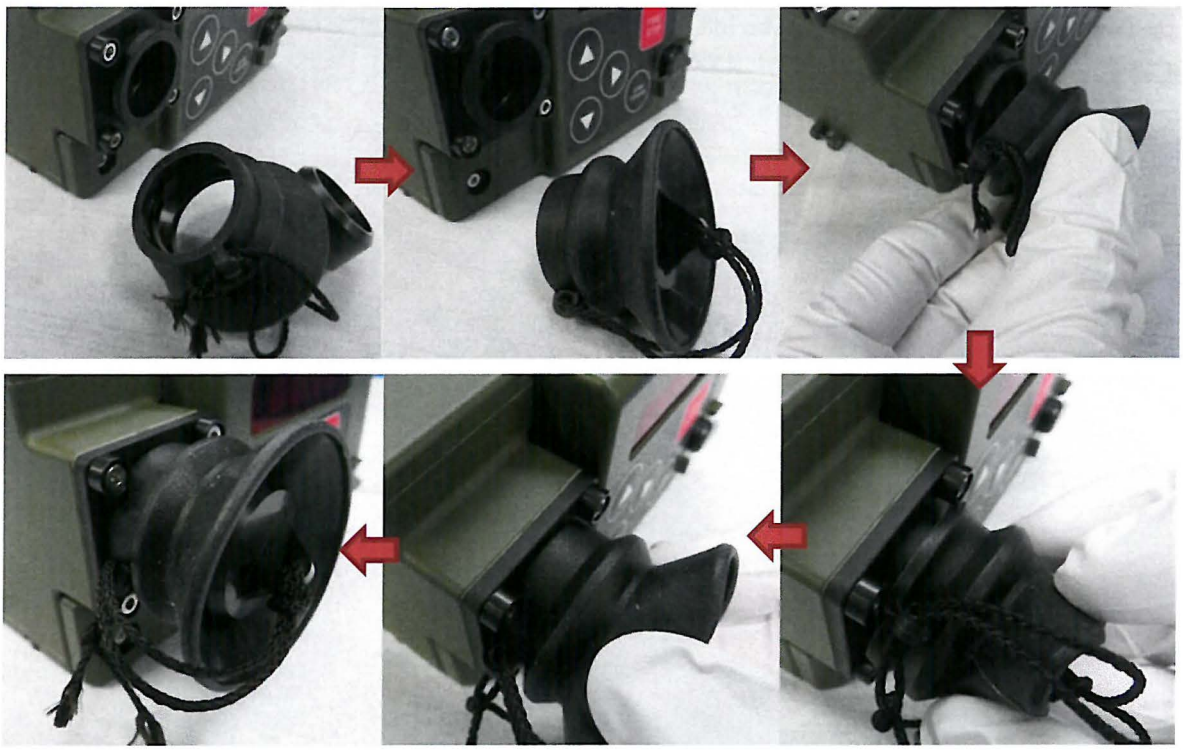


Figure 48: Type 163 Eyecup Fit

5.4 MMI Replacement

The Type 163 Laser supports replacement of the MMI, if required. This should be performed in a workshop environment.

The MMI can be removed and replaced as follows:

1. Remove 2.5mm hexagonal headed screws, and cup washers, in two locations as shown below in Figure 49. Retain screws and washers.
2. Gently pull the MMI away from the laser and put to one side.
3. Inspect the replacement MMI. Do not attempt to fit the replacement MMI if there are any signs of damage.
4. Offer the MMI connector up to the connector on the laser and gently press the MMI into place to mate the two parts.
5. Re-insert screws and washers and torque to 0.57 Nm.

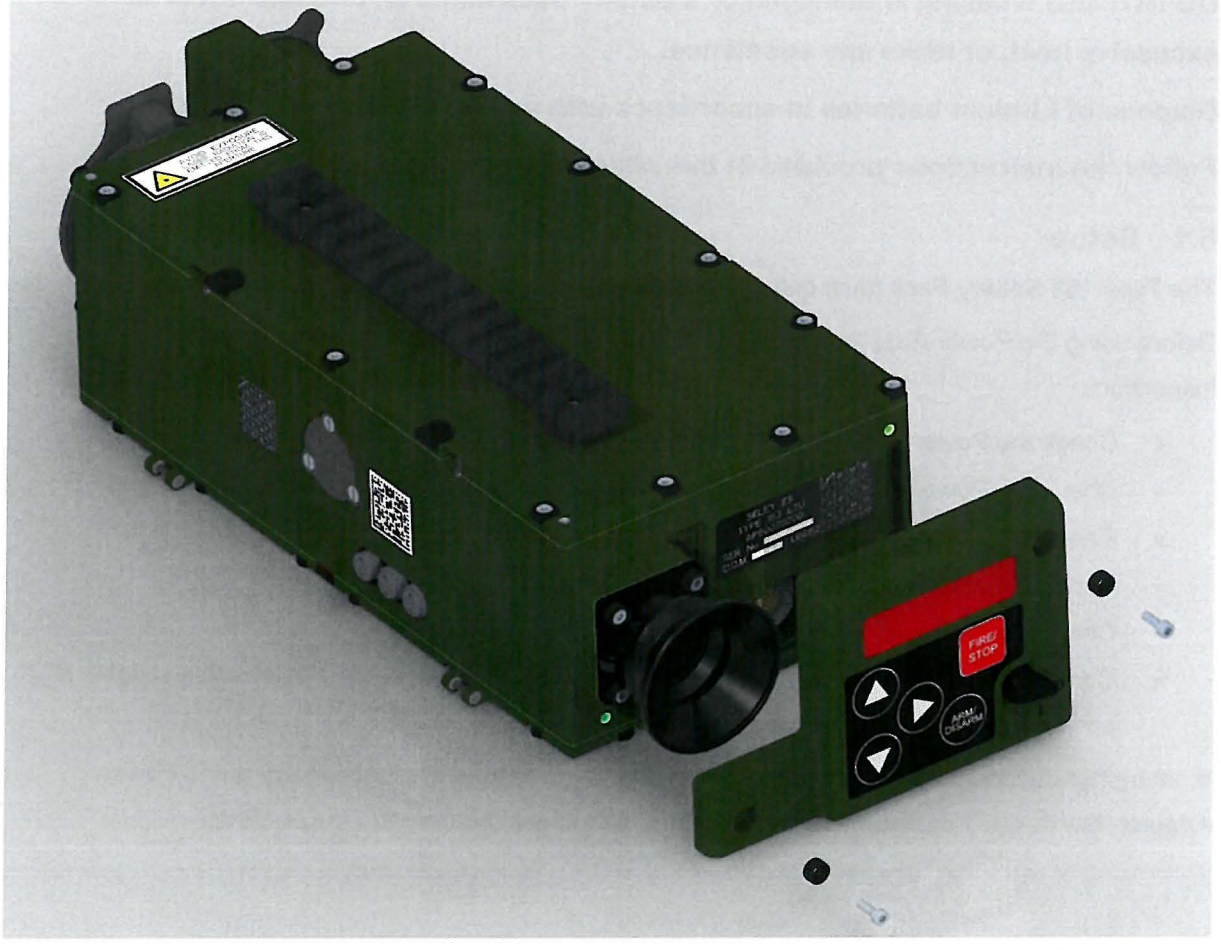
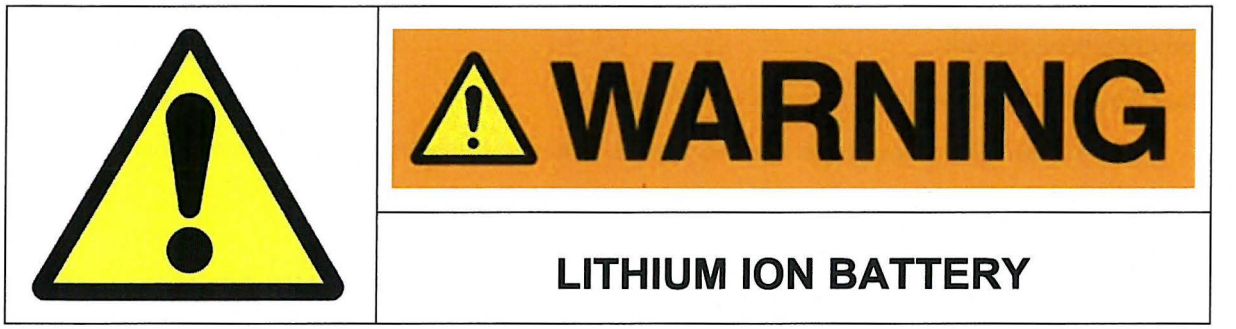


Figure 49: MMI Replacement

6 Battery Charging Procedure



This equipment employs a Lithium-ion battery.

DO NOT short circuit, puncture, deform, incinerate or expose to temperatures above 60°C.

DO NOT use if casing is damaged or if battery pack emits an unusual odour or excessive heat, or leaks any substance.

Dispose of Lithium batteries in accordance with applicable local regulations.

Follow the instructions provided in this charging procedure.

6.1 Setup

The Type 163 Battery Pack must only be charged with the Type 163 Power Adaptor.

Before using the Power Adaptor to charge the battery pack, carry out the following pre-use inspections:

- Check the Power Adaptor enclosure is not damaged.
- Check the Power Adaptor spring contacts and charge terminals and are not damaged
- Check the securing latches and mechanism are not damaged
- Check the mode selection flap is not damaged
- Check the battery is not damaged
- Connect the Power Adaptor to the supplied Mains Power Adaptor or alternative suitable DC power source

If, after physical checks are complete, there is any doubt around the functionality of the Power Adaptor, the Power Adaptor should not be used, and should be returned to Leonardo.

6.2 Charging

Ensure the Power Adaptor is un-powered.

The Power Adaptor Mode Selection flap should be opened and the Battery Pack offered up to the Power Adaptor, ensuring that the hooks on the battery pack engage with the Power Adaptor hinges. The latch retraction mechanism should now be operated to release the latches. The Battery Pack can now be mounted on the Power Adaptor. The latch retraction mechanism can now be released to lock the latches on to the Power Adaptor.

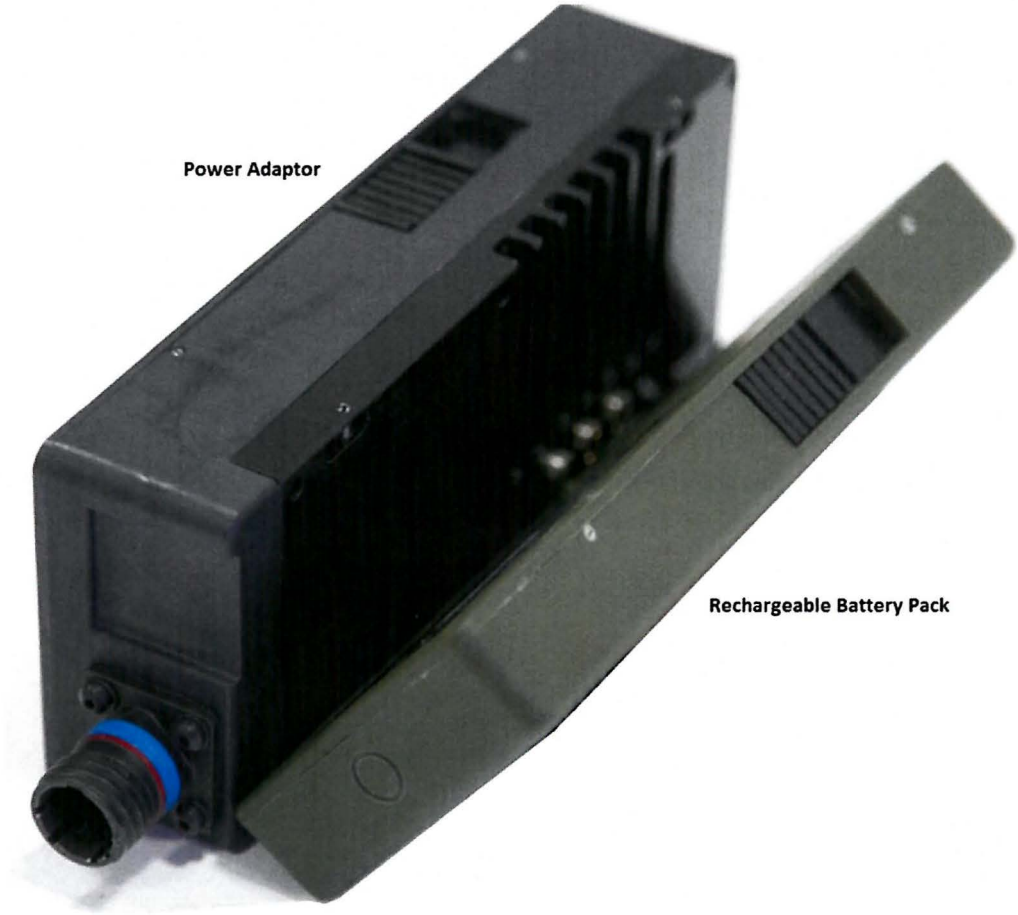


Figure 50: Battery Pack Connection To Power Adaptor For Charging

On switching on the DC Input supply to the Power Adaptor, power will be available within 15 seconds and charging indicated by the LED on the Power Adaptor illuminating yellow. On completion of charge, the LED will illuminate Green.

The normal charge time for a fully discharged battery is 1 hour to 90% and 1.5 hours to fully charge at 25°C.

After the battery has charged, switch off the DC Input supply to the Power Adaptor prior to removal of the Battery Pack. To remove the Battery from the Power Adaptor, operate the latch retraction mechanism to release the latches and unhook the battery pack from the Power Adaptor. The mode selection flap will automatically close.

A Fault or Over-Temperature on the Power Adaptor will be indicated by the LED on the Power Adaptor illuminating red.

Note: The Power Adaptor will get hot to the touch whilst the battery is charging and the Power Adaptor will remain hot once the battery is charged if the DC Input Supply is not removed. Care should be taken to avoid touching the fins of the Power Adaptor heatsink during, or shortly after battery charging.

7 Material Safety Data Sheets

7.1 Sulphuric Acid used in Evans Capacitors

SAFETY DATA SHEET

EVANS CAPACITOR COMPANY, 72 BOYD AVENUE, EAST PROVIDENCE, RI 02914 401-435-3555
Manufacturers of High Energy Density Capacitors

Evans Capacitor Company
72 Boyd Avenue
East Providence, RI 02914
ATTN: David Evans

Telephone Number

401-435-3555

Date Prepared: March 13, 2017

PRODUCT IDENTIFICATION ***Hybrid*** Capacitor tantalum electrolytic capacitor

I. HAZARDOUS INGREDIENTS

Component	CAS #	OSHA PEL ppm	ACGIH TLV ppm	Other Limits Recommended	Max. %
Sulfuric acid	7664-93-9	1 mg/m^3	1 mg/m^3		5
Tantalum	7440-25-7	5 mg/m^3	5 mg/m^3		91
Ruthenium Oxide	32740-79-7	Not hazardous			2
Stainless Steel		Not hazardous			1
Borosilicate Glass		Not hazardous			1
Other					<1

II. PHYSICAL DATA

Maximum Operating Temperature, see product literature. Specific Gravity 16

III. FIRE AND EXPLOSION DATA

Capacitors can burst and leak electrolyte if subjected to excessive voltage, reverse voltage or excessive temperature. See product literature for operating instructions.

IV. HEALTH HAZARD DATA

Electrocution Risk. Avoid personal contact with high-voltages which may be present on charged capacitors. Electrolyte contains sulfuric acid. Exposure to electrolyte is not possible unless case or seal is compromised. Avoid conditions which can burst case (see Section III). Sulfuric acid can cause serious burns to all tissues contacted. Sulfuric Acid Exceedingly dangerous to the eyes. Protect skin and eyes from contact with sulfuric acid. Overexposure from inhalation may lead to pulmonary edema. Long exposures are claimed to lead to respiratory infections, emphysema, and digestive disturbances.

Emergency First Aid Flush exposed skin and eyes immediately with cold water. Seek physician, especially if eyes are exposed.

V. SPECIAL INSTRUCTIONS

Avoid exposure to finely divided tantalum. Normal exposure to tantalum metal is not hazardous. Do not cut, drill, puncture, grind, or machine case. Do not incinerate.

7.2 Lithium Ion Battery

MATERIAL SAFETY DATA SHEET

ICR18650M26 Lithium-Ion Battery

LG CHEMICAL LIMITED

1. Chemical Product and Company Identification

Product Identification

ICR18650 Lithium-Ion Battery

Model	Wh (nominal)
M26	9.4

Manufacturer

LG Chemical Limited
Twin Tower
Youido-Dong, Youngdeungpo-Ku
Seoul, Korea

Emergency Telephone Number

82-2-3773-6671

2. Composition Information

Hazardous Ingredients	%	CAS Number
Metal Oxide (proprietary)	20-50	182442-95-1
Styrene-Butadiene-Rubber	<1	9003-55-8
Polyvinylidene Fluoride (PVDF)	<5	24937-79-9
Aluminum Foil	2-10	7429-90-5
Copper Foil	2-10	7440-50-8
Carbon	10-30	7440-44-0
Electrolyte(proprietary)	10-20	21324-40-3
Stainless steel, Nickel and inert materials	Remainder	N/A

3. Hazards Identification

Primary routes of entry

Skin contact : NO
Skin absorption : NO

Emergency Overview

May explode in a fire, which could release hydrogen fluoride gas.
Use extinguishing media suitable for materials burning in fire.

Eye contact : NO
Inhalation : NO
Ingestion : NO

Symptoms of exposure

Skin contact
No effect under routine handling and use.

Skin absorption
No effect under routine handling and use.

Eye contact
No effect under routine handling and use.
Inhalation
No effect under routine handling and use.

Reported as carcinogen
Not applicable

4. First Aid Measures

Inhalation

Not a health hazard.

Eye contact
Not a health hazard.

Skin contact
Not a health hazard.

Ingestion
If swallowed, obtain medical attention immediately.

IF EXPOSURE TO INTERNAL MATERIALS WITHIN CELL DUE TO DAMAGED OUTER CASING, THE FOLLOWING ACTIONS ARE RECOMMENDED :

Inhalation
Leave area immediately and seek medical attention.

Eye contact
Rinse eyes with water for 15 minutes and seek medical attention.

Skin contact
Wash area thoroughly with soap and water and seek medical attention.

Ingestion
Drink milk/water and induce vomiting; seek medical attention.

5. Fire Fighting Measures

General Hazard
Cell is not flammable but internal organic material will burn if the cell is incinerated. Combustion products include, but are not limited to hydrogen fluoride, carbon monoxide and carbon dioxide.

Extinguishing Media
Use extinguishing media suitable for the materials that are burning.

Special Firefighting Instructions
If possible, remove cell(s) from fire fighting area. If heated above 125°C, cell(s) may explode/vent.

Firefighting Equipment
Use NIOSH/MSHA approved full-face self-contained breathing apparatus (SCBA) with full protective gear.

6. Accidental Release Measures

On Land
Place material into suitable containers and call local fire/police department.

In Water
If possible, remove from water and call local fire/police department.

7. Handling and Storage

Handling
No special protective clothing required for handling individual cells.

Storage
Store in a cool, dry place.

8. Exposure Controls / Personal Protection

Engineering controls

Keep away from heat and open flame. Store in a cool dry place.

Personal Protection

Respirator

Not required during normal operations. SCBA required in the event of a fire.

Eye/face protection

Not required beyond safety practices of employer.

Gloves

Not required for handling of cells.

Foot protection

Steel toed shoes recommended for large container handling.

9. Physical and Chemical Properties

State	Solid
Odor	N/A
PH	N/A
Vapor pressure	N/A
Vapor density	N/A
Boiling point	N/A
Solubility in water	Insoluble
Specific gravity	N/A
Density	N/A

10. Stability and Reactivity

Reactivity
None

Incompatibilities
None during normal operation. Avoid exposure to heat, open flame, and corrosives.

Hazardous Decomposition Products
None during normal operating conditions. If cells are opened, hydrogen fluoride and carbon monoxide may be released.

Conditions To Avoid
Avoid exposure to heat and open flame. Do not puncture, crush or incinerate.

11. Toxicological Information

This product does not elicit toxicological properties during routine handling and use.

Sensitization	Teratogenicity	Reproductive toxicity	Acute toxicity
NO	NO	NO	NO

If the cells are opened through misuse or damage, discard immediately. Internal components of cell are irritants and sensitizers.

12. Ecological Information

Some materials within the cell are bioaccumulative. Under normal conditions, these materials are contained and pose no risk to persons or the surrounding environment.

13. Disposal Considerations

California regulated debris

RCRA Waste Code : Non-regulated

Dispose of according to all federal, state, and local regulations.

14. Transport Information

Lithium batteries are classified in Class 9 – Miscellaneous dangerous goods as:
• UN 3480, Lithium ion batteries
• UN 3481, Lithium ion batteries contained in equipment; or
• UN 3481, Lithium ion batteries packed with equipment.

With regard to transport of the product, the following regulations are cited and considered:

- The International Civil Aviation Organization (ICAO) Technical Instructions,
- The International Air Transport Association (IATA) Dangerous Goods Regulations
- The International Maritime Dangerous Goods (IMDG) Code,
- US Hazardous Materials Regulations 49 CFR(Code of Federal Regulations) Sections 173-185 Lithium batteries and cells,
- The UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria 38.3 Lithium batteries,

If those lithium-ion batteries are packed with or contained in an equipment, then it is the responsibility of the shipper to ensure that the consignment are packed in compliance to the latest edition of the IATA Dangerous Goods Regulations Section II of either Packing Instruction 966 or 967 in order for that consignment to be declared as NOT RESTRICTED (non-hazardous/non-Dangerous). If those lithium-ion batteries are packed with or contained in an equipment, UN No. is UN3481

Each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;

15. Regulatory Information

This product is not hazardous under the criteria of the Federal Occupational Safety and Health Administration(OSHA) Hazard Communication Standard.(29 CFR 1910.1200)

Hazardous ____✔____Non-hazardous

7.3 Gallium Arsenide

SAFETY DATA SHEET

GALLIUM ARSENIDE OPTICAL CRYSTAL

According to Regulation (EC) No.1907/2006 (REACH)

CRYSTRAN
UV - VISIBLE - IR SPECIALIST OPTICS

Revision 2015 : Issued 1st September 2015

1. IDENTIFICATION OF THE SUBSTANCE AND THE COMPANY

1.1. PRODUCT IDENTIFIERS:

Product Name: Gallium Arsenide Optical Crystal
Synonyms, Trade Names: GaAs

1.2. RELEVANT IDENTIFIED USES OF THE SUBSTANCE OR MIXTURE AND USES ADVISED AGAINST

Identified Uses: Optical Material for manufacture of Optical Components.

1.3. DETAILS OF THE SUPPLIER OF THE SAFETY DATA SHEET

Company: CRYSTRAN LTD, 1 Broom Road Business Park, Poole, Dorset UK BH12 4PA
☎ +44 1202 307650

1.4. EMERGENCY TELEPHONE NUMBER

Emergency Phone: ☎ +44 1202 307650 (Monday to Friday 08:30 to 17:00 GMT)
Emergency Action: In the event of a medical enquiry involving this product, please contact your doctor or local hospital accident and emergency department. The attending health professional will be able to contact the National Poisons Information Service.

2. HAZARDS IDENTIFICATION

2.1. CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

Class 6.1 Poison. Toxic by ingestion and inhalation with a danger of cumulative effects. Liberates highly toxic hydrogen selenide in contact with gastric juices. Dermatitis may result from prolonged contact. Particular care must be exercised when machining and creating dust or particles. Symptoms include garlic odour on breath. Dangerous for the environment.

2.2. LABEL ELEMENTS

Signal Word: Danger

H301	Toxic if swallowed
H331	Toxic if inhaled
H410	Very toxic to aquatic life with long lasting effects

Precautionary Statements:

P262	Do not breathe dust/fume/gas/mist/vapours/spray.
P264	Wash thoroughly after handling.
P270	Do not eat, drink or smoke when handling this product
P273	Avoid release to the environment.
P301+P310	IF SWALLOWED: Immediately call a poison centre or doctor. Rinse mouth.
P304+P312	IF INHALED: Call a poison centre or doctor/physician if you feel unwell.

2.3. OTHER HAZARDS

None

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1. SUBSTANCES

Component Name	CAS number	%	EC number (EINECS)	EU index	UN number
Gallium Arsenide	1303-00-0	100%	215-114-8	033-002-00-5	1557

4. FIRST AID MEASURES

4.1. DESCRIPTION OF FIRST AID MEASURES

GENERAL: Consult a doctor for specific advice.
EYES: Irrigate thoroughly with water for at least 15 minutes. Obtain medical attention.
SKIN: Wash thoroughly with soap and water. Dry area with clean towel. Remove contaminated clothing and wash clothing before re-use.
INHALATION: Remove to fresh air. Perform artificial respiration if breathing has stopped. When breathing is difficult, properly trained personnel may administer oxygen. Keep affected person warm and at rest. Obtain medical attention.
INGESTION: Do not induce vomiting. Wash out mouth thoroughly with water and give 2 cups of water to drink. Do not give carbonated drinks. Never give anything by mouth to an unconscious person. Obtain medical attention immediately.

4.2. MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 2.2 and to section 11.

4.3. INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No Data.

5. FIRE FIGHTING MEASURES

5.1. EXTINGUISHING MEDIA

This product does not burn.

5.2. SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

None known.

5.3. ADVICE FOR FIREFIGHTERS

None.

6. ACCIDENTAL RELEASE MEASURES

6.1. PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Wear suitable protective clothing & equipment as listed under Section 8. Avoid making dust.

6.2. ENVIRONMENTAL PRECAUTIONS

Prevent further leakage or spillage. Do not let product enter drains. Do not discharge to the environment.

6.3. METHODS AND MATERIALS FOR CONTAINMENT AND CLEANING UP

Take up and containerize for proper disposal. Containerize any cleaning materials used for proper disposal.

6.4. REFERENCE TO OTHER SECTIONS

Dispose as in Section 13.

SAFETY DATA SHEET

GALLIUM ARSENIDE OPTICAL CRYSTAL

According to Regulation (EC) No.1907/2006 (REACH)

CRYSTRAN UV / VISIBLE / IR SPECIALIST OPTICS

Revision 2015 : Issued 1st September 2015

7. HANDLING AND STORAGE

7.1. PRECAUTIONS FOR SAFE HANDLING:
Keep away from heat. Avoid contact with skin and eyes. Protect against physical damage. Avoid generating dust.

7.2. CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES
Keep away from foodstuffs. Keep away from acids and strong bases.

7.3. SPECIFIC END USES
Optical Material for Manufacture of Optical Components.

8. EXPOSURE CONTROL AND PERSONAL PROTECTION

8.1. CONTROL PARAMETERS
OCCUPATIONAL EXPOSURE LIMITS (OEL) = 0.1 mg/m^3 in 8 hour Time Weighted Average (TWA)

8.2. EXPOSURE CONTROLS
Protective gloves made of PVA are required. Use of a laboratory coat is suggested. Safety goggles or safety glasses with side shields are required if there is any possibility of chipping or dust creation. Respirators must be worn when the threshold limit is exceeded. Provide adequate general mechanical ventilation, and local exhaust ventilation. Wash hands immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE :	Grey-black metallic geometric shapes.	FLASH POINT:	Not Applicable
BOILING POINT (760mm Hg)	Not determined	FLAMMABILITY:	Not Applicable
MELTING POINT:	1238°C	EXPLOSIVE PROPERTIES:	Not Applicable
SPECIFIC GRAVITY:	5.31 g/mL	VAPOUR PRESSURE:	Not determined
SOLUBILITY IN WATER:	Insoluble	pH IN AQUEOUS SOLUTION:	Not determined

9.2. OTHER SAFETY INFORMATION
None

10. STABILITY AND REACTIVITY

10.1. REACTIVITY
Reacts with strong mineral acids and strong oxidising materials

10.2. CHEMICAL STABILITY
Stable under normal conditions of storage and use

10.3. POSSIBILITY OF HAZARDOUS REACTIONS
None known

10.4. CONDITIONS TO AVOID
Can react with oxidising agents. Avoid strong acids

10.5. INCOMPATIBLE MATERIALS
Strong Mineral Acids. Strong oxidising materials

10.6. HAZARDOUS DECOMPOSITION PRODUCTS
Contact with acids releases toxic gases. Arsine and oxides of arsenic can be formed

11. TOXICOLOGICAL INFORMATION

11.1. INFORMATION ON TOXICOLOGICAL EFFECTS
Toxic by ingestion and inhalation of dust, with a cumulative effect. Affects nervous system. Particular care must be exercised when machining and creating dust or particles. Inhalation of dust may irritate respiratory system.
TOXIC DOSE - LD50 > 4700 g/kg **CARCINOGENICITY:** No evidence of carcinogenic properties.
MUTAGENICITY/TERATOGENICITY: Refer to attached report. Particular care should be exercised when machining and creating dust or particles.

12. ECOLOGICAL INFORMATION

12.1. TOXICITY
Danger to drinking water. Poisonous to Fish

12.2. PERSISTENCE AND DEGRADABILITY
No Data

12.3. BIOACCUMULATIVE POTENTIAL
No Data

13. DISPOSAL CONSIDERATIONS

13.1. WASTE TREATMENT METHODS
Chemical residues are generally classified as special waste, and are covered by regulations which vary according to location. Contact your local waste disposal authority for advice, or pass to a chemical disposal company.

14. TRANSPORT INFORMATION

14.1. UN NUMBER: 1557

14.2. UN PROPER SHIPPING NAME:
Arsenic Compound, Solid, N.O.S. (Gallium Arsenide).

14.3. TRANSPORT HAZARD CLASS: 6.1

14.4. PACKING GROUP: II

14.5. ENVIRONMENTAL HAZARDS: Marine Pollutant

14.6. SPECIAL PRECAUTIONS FOR USER: None

14.7. TRANSPORT IN BULK MARPOL / IBC: No Data

15. REGULATORY INFORMATION

15.1. SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS / LEGISLATION SPECIFIC FOR THE SUBSTANCE OR MIXTURE
TSCA: Listed in the TSCA inventory
REACH: Refer to restrictions on the manufacture, placing on the market and use Annex XVII/19 EC/552/200 - 19. Arsenic Compounds.

16. OTHER INFORMATION

REVISION DATE: 1st September 2015 ©2015 Crystran Ltd.
The above information is believed to be correct but does not purport to be all inclusive and must be used only as a guide.

SAFETY DATA SHEET

GALLIUM ARSENIDE OPTICAL CRYSTAL

According to Regulation (EC) No.1907/2006 (REACH)

CRYSTRAN

Revision 2015 : Issued 1st September 2015

NTP Toxicology and Carcinogenesis Studies of Gallium Arsenide (CAS No. 1303-00-0) in F344/N Rats and B6C3F1 Mice (Inhalation Studies).

US National Toxicology Program Tech Rep Ser. 2000 Sep;492:1-306

Gallium arsenide is used primarily to make light- emitting diodes, lasers, laser windows, and photodetectors and in the photoelectronic transmission of data through optical fibers. Gallium arsenide was nominated for study because of its widespread use in the microelectronics industry, the potential for worker exposure, and the absence of chronic toxicity data. Male and female F344/N rats and B6C3F1 mice were exposed to gallium arsenide particles (greater than 98% pure; mass median aerodynamic diameter = 0.8 to 1.0 mg/m^3) by inhalation for 16 days, 14 weeks, or 2 years. Genetic toxicology studies were conducted in Salmonella typhimurium, and the frequency of micronuclei was determined in the peripheral blood of mice exposed to gallium arsenide for 14 weeks.

16-DAY STUDY IN RATS: Groups of five male and five female rats were exposed to particulate aerosols of gallium arsenide with a mass median aerodynamic diameter of approximately at concentrations of 0, 1, 10, 37, 75, or 150 mg/m^3 by inhalation, 6 hours per day, 5 days per week, for 16 days. All rats survived to the end of the study. The final mean body weights of all exposed groups of males and females were similar to those of the chamber controls. Compared to chamber controls, the liver and lung weights of males exposed to 1 mg/m^3 or greater and females exposed to 10 mg/m^3 or greater were increased; the thymus weights of all exposed groups of males were decreased. Gallium arsenide particles were visible in the alveolar spaces and, to a lesser extent, within alveolar macrophages of exposed rats. Moderate proteinosis (surfactant mixed with small amounts of fibrin) and minimal histiocytic cellular infiltrate were observed in the alveoli of exposed males and females. Epithelial hyperplasia and squamous metaplasia of the larynx were observed primarily in males exposed to 150 mg/m^3.

16-DAY STUDY IN MICE: Groups of five male and four or five female mice were exposed to particulate aerosols of gallium arsenide with a mass median aerodynamic diameter of approximately 1 &mgr;m at concentrations of 0, 1, 10, 37, 75, or 150 mg/m^3 by inhalation, 6 hours per day, 5 days per week, for 16 days. The final mean body weights were similar among exposed and chamber control groups. Compared to chamber controls, the lung weights of males and females exposed to 10 mg/m^3 or greater were increased. Gallium ar senide particles were visible in alveolar spaces and macrophages in some mice exposed to 150 mg/m^3. Moderate proteinosis, mild epithelial hyperplasia, and histiocytic infiltration of the lung were observed in males and females exposed to 10 mg/m^3 or greater. In the larynx, mild squamous metaplasia was seen in mice exposed to 10 mg/m^3 or greater, and mild chronic inflammation occurred in mice exposed to 75 or 150 mg/m^3.

14-WEEK STUDY IN RATS: Groups of 10 male and 10 female rats were exposed by inhalation to gallium arsenide particulate at concentrations of 0, 0.1, 1, 10, 37, or 75 mg/m^3, 6 hours per day, 5 days per week, for 14 weeks. All rats survived until the end of the study. The final mean body weight and body weight gain of males exposed to 75 mg/m^3 were significantly less than those of the chamber controls. Hematology and clinical chemistry results indicated that exposure to gallium arsenide induced a microcytic responsive anemia with an erythrocytosis and increased zinc protoporphyrin/heme ratios in exposed groups of rats. There were also increases in platelet and neutrophil counts, a transient decrease in leukocyte counts, and increases in the serum activities of alanine aminotransferase and sorbitol dehydrogenase. These changes were of greater magnitude in male rats. The lung weights of all exposed groups of rats were increased, while testis, cauda epididymis, and epididymis weights of males exposed to 37 or 75 mg/m^3 were generally less than those of chamber controls. Total spermatid heads and spermatid counts were significantly decreased in males exposed to 75 mg/m^3, while epididymal spermatozoa motility was significantly reduced in males ees exposed to 10 mg/m^3 or greater. Gallium arsenide particles were visible in alveolar spaces and macrophages in the lungs of exposed rats. Minimal to marked proteinosis and minimal histiocytic cellular infiltration of the alveoli were observed in all exposed groups; minimal squamous metaplasia in the larynx and lymphoid cell hyperplasia of the mediastinal lymph node were observed in some males and females exposed to 37 or 75 mg/m^3. Exposure-related increases in the incidences of plasma cell hyperplasia of the mandibular lymph node, testicular atrophy, epididymal hypospermia, bone marrow hyperplasia (males), and hemosiderosis in the liver were observed in the 37 and 75 mg/m^3 groups.

14-WEEK STUDY IN MICE: Groups of 10 male and 10 female mice were exposed by inhalation to gallium arsenide particulate at concentrations of 0, 0.1, 1, 10, 37, or 75 mg/m^3, 6 hours per day, 5 days per week, for 14 weeks. One female mouse exposed to 75 mg/m^3 died before the end of the study. Final mean body weights and body weight gains of males in the 75 mg/m^3 group were significantly less than the chamber controls. Hematology and clinical chemistry results indicated that exposure to gallium arsenide

SAFETY DATA SHEET

GALLIUM ARSENIDE OPTICAL CRYSTAL

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affected the circulating erythroid mass and induced a microcytic responsive anemia with an erythrocytosis and increased zinc protoporphyrin/heme ratios in male and female mice. There were also increases in platelet and neutrophil counts. Compared to the chamber controls, the lung weights of males exposed to 1 mg/m^3 or greater and females exposed to 10 mg/m^3 or greater were increased. Testis, cauda epididymis, and epididymis weights, total spermatid heads, spermatid counts, and concentration and motility of epididymal spermatozoa were generally decreased. Gallium arsenide particles were visible in alveolar spaces and macrophages in the lungs of mice exposed to 1 mg/m^3 or greater. Mild to marked proteinosis, histiocytic infiltration, and epithelial hyperplasia were observed in the alveoli of males and females exposed to 1 mg/m^3 or greater. Minimal to mild suppurative inflammation and granuloma in the lung and squamous metaplasia in the larynx were present in males and females exposed to 10 mg/m^3 or greater. Min imal hyperplasia was observed in the tracheobronchial lymph node of males exposed to 10 mg/m^3 or greater and females exposed to 37 or 75 mg/m^3. Exposure- related increases in the incidences of testicular atrophy, epididymal hypospermia, hematopoietic cell proliferation of the spleen, and hemosiderosis of the liver and spleen were observed in groups of male and female mice exposed to 10 mg/m^3 or greater.

2-YEAR STUDY IN RATS: Groups of 50 male and 50 female rats were exposed by inhalation to gallium arsenide particulate at concentrations of 0, 0.01, 0.1, or 1.0 mg/m^3, 6 hours per day, 5 days per week, for 105 weeks. Survival and Body Weights: Survival of exposed male and female rats was similar to the chamber controls. Mean body weights of males exposed to 1.0 mg/m^3 were generally less than those of the chamber controls throughout the study; females exposed to 1.0 mg/m^3 had slightly lower mean body weights during the second year. Pathology Findings: Compared to the chamber controls, the incidences of alveolar/bronchiolar neoplasms were significantly increased in females exposed to 1.0 mg/m^3 and exceeded the historical control ranges. Exposure-related nonneoplastic lesions in the lungs of male and female rats included atypical hyperplasia, alveolar epithelial hyperplasia, chronic active inflammation, proteinosis, and alveolar epithelial metaplasia. In the larynx of males exposed to 1.0 mg/m^3, the incidences of hyperplasia, chronic active inflammation, squamous metaplasia, and hyperplasia of the epiglottis were significantly increased. The incidences of benign pheochromocytoma of the adrenal medulla occurred with a positive trend in female rats, and the incidence was significantly increased in the 1.0 mg/m^3 group and exceeded the historical control range. The incidence of mononuclear cell leukemia was significantly increased in females exposed to 1.0 mg/m^3 and exceeded the historical control range.

2-YEAR STUDY IN MICE: Groups of 50 male and 50 female mice were exposed by inhalation to gallium arsenide particulate at concentrations of 0, 0.1, 0.5, or 1.0 mg/m^3, 6 hours per day, 5 days per week, for 105 (males) or 106 (females) weeks. Survival and Body Weights: Survival of male and female mice was similar to the chamber controls. Mean body weights of exposed groups of males were similar to those of the chamber controls throughout the study; mean body weights of exposed groups of females were greater than those of the chamber controls from week 13 until the end of the study. Pathology Findings: Exposure-related nonneoplastic lesions in the lung of all groups of exposed mice included suppurative focal inflammation, chronic focal inflammation, histiocyte cellular infiltration, alveolar epithelial hyperplasia, and proteinosis. Increased incidences of minimal lymphoid hyperplasia of the tracheobronchial lymph node occurred in mice exposed to 1.0 mg/m^3 and in 0.5 mg/m^{3}mg/m^3 males.

GENETIC TOXICOLOGY: Gallium arsenide was not mutagenic in several strains of Salmonella typhimurium, with or without S9 metabolic activation enzymes, and no increase in the frequency of micronucleated erythrocytes was observed in peripheral blood of male or female mice exposed to gallium arsenide by inhalation for 14 weeks.

CONCLUSIONS: Under the conditions of these 2-year inhalation studies, there was no evidence of carcinogenic activity of gallium arsenide in male F344/N rats exposed to 0.01, 0.1, or 1.0 mg/m^3. There was clear evidence of carcinogenic activity in female F344/N rats based on increased incidences of benign and malignant neoplasms in the lung. Increased incidences of benign neoplasms of the adrenal medulla and increased incidences of mononuclear cell leukemia were also considered to be exposure related. There was no evidence of carcinogenic activity in male or female B6C3F1 mice exposed to 0.1, 0.5, or 1.0 mg/m^3. Exposure to gallium arsenide caused a spectrum of nonneoplastic lesions in the lung of rats and mice, the larynx of male rats and hyperplasia of the tracheobronchial lymph node in mice.

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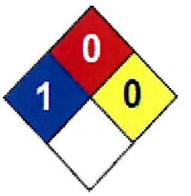
7.4 Lead

ScienceLab.com
Chemicals & Laboratory Equipment



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 05/21/2013 12:00 PM

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