

Nd:YAG LASER WELDER

LW500A/600A

OPERATION MANUAL



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Revision Record

Revision	EO	Date	Basis of Revision
A	19390	8/02	Production Release
B	42505	09/13	Updates & Corrections
C	42506	11/13	Corrections plus update to Miyachi America name and logo.
D	43483	12/14	Updated to Amada Miyachi America name and logo.
E	43879	11/15	Updated to Amada Miyachi America format.
F	44679	09/17	See ECO for description

This manual covers the following models:

Miyachi Unitek Models		Amada Miyachi Models	
220VAC Version	400VAC Version	220VAC Version	400VAC Version
LW500A	LW500AE	ML-2651B	ML-2651B-CE
LW600A	LW600AE	ML-2650B	ML-2650B-CE

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CONTACT US

Thank you for purchasing a Miyachi Unitek Pulsed Nd:YAG Laser. Upon receipt of the laser, please thoroughly inspect it for shipping damage *before* you install it. If there is any damage, contact the shipping company immediately to file a claim, and notify us at:

Amada Miyachi America
1820 South Myrtle Avenue
P. O. Box 5033
Monrovia, California 91016
Phone: (626) 303-5676
FAX: (626) 358-8048
E-mail: info@amadamiyachi.com

The contents of this manual are subject to change without notice. If you have any questions, or find any errors or omissions in this manual, please contact us.

Amada Miyachi America is not responsible for any losses or injury due to the improper use of this product.

It is our intent to strive for quality in workmanship and materials with every Laser Welder we manufacture. It is important that you read and understand this manual before attempting installation or operation.

CDRH COMPLIANCE STATEMENT

The Miyachi Unitek LW500A(E)/LW600A(E) and Amada Miyachi ML-2651B(-CE)/ML-2650B(-CE) Nd:YAG Lasers are certified to be fully compliant with all applicable standards and regulations as set forth by the United States of America's Health and Human Services (HHS), Food and Drug Administration (FDA), Center for Devices and Radiological Health (CDRH), title 21 Code of Federal Regulations (CFR) sections 1002, 1010, and 1040 for Class IV laser devices.

Reference CDRH Accession number is available upon request.

SAFETY PRECAUTIONS

Before using this equipment, read the **Safety Precautions** carefully to understand the correct usage of the equipment.

- These precautions are given for safe use of the Laser and for prevention of injury to operators or others.
- Be sure to read each of the instructions, as they are all important for safe operation.
- The meaning of the words and symbols are as follows:



	<p>These symbols denote PROHIBITION. They are warnings about actions that should <i>not</i> be performed because they can damage the equipment and will void the warranty.</p>
	<p>These symbols denote actions which operators <i>must</i> take.</p>
	<p>Each symbol with a triangle denotes that the contents gives notice of DANGER, WARNING, or CAUTION to the operator.</p>

DANGER

	<p>DO NOT TOUCH THE INSIDE OF THE LASER UNNECESSARILY. High voltages are present inside the equipment cabinet. Do <i>not</i> touch the inside of the Laser unnecessarily with the power turned ON.</p>
	<p>NEVER DISASSEMBLE, REPAIR, OR MODIFY THE LASER. These actions can cause electric shock and fire. Do <i>not</i> do anything other than the maintenance described in the Operator Manual.</p>
	<p>DO NOT LOOK AT OR TOUCH THE LASER BEAM. Both direct laser beams and reflected laser beams are <i>highly dangerous</i>. If the beam enters the eye directly, it can cause blindness.</p>



WARNING



Wear protective glasses.

Be sure to wear protective glasses while using the laser. Even with eye protection, you may lose your sight if you look directly at the laser beam.



Do not expose your skin to the laser beam.

Your skin may be severely burned.



Do not touch any processed part during, or immediately after processing.

Welded parts are **very hot**.



Use only specified cables.

A cable with insufficient capacity or loose connections can cause electric shock or fire.



Do not use a damaged power cable, connecting cables, or plugs.

Do not step on, twist, or tense any power cable. The power cable and connecting cables may be damaged which can cause electric shock, short circuit, or fire. If any part needs to be repaired or replaced, consult Amada Miyachi America or your distributor.



Stop operation if any trouble occurs.

If you detect a burning smell, abnormal sounds, abnormal heat, smoke, etc. from the Laser, turn the power OFF **immediately** to prevent fire or electric shock. Contact Amada Miyachi America or your distributor for help.



Ground the Laser.

If the Laser is not grounded, you may get an electric shock when there is trouble or if electricity leaks through the protective insulation.



Use a stopper plug.

Laser beams are dangerous to the human body. Prevent accidental leakage of the laser beam by using a stopper (a heat-resistant, laser beam absorbing material).



People with pacemakers *MUST* stay away from the Laser.

When the Laser is operating, it generates a magnetic field, which adversely affects pacemakers. People who use a pacemaker must **not** approach the Laser, or walk around the laser shop while the Laser is operating, **unless** their medical doctor has deemed it safe to do so.



CAUTION



Keep water and water containers away from the Laser.

Water spilled on the Laser can cause a short circuit, electrical shock, or fire.



Use proper tools (wire strippers, pressure wire connectors, etc.) for terminations of the connecting cables.

Do not nick the wire conductor. Doing so can cause a short circuit, electric shock, or fire.



Install the Laser on a firm, level surface.

Injury may result if the Laser falls over or drops from an uneven surface.



Keep combustible matter away from the Laser.

Laser spatter can ignite combustible materials. If you cannot remove all combustible materials, cover them with a non-combustible material.



NEVER apply the laser beam to combustible materials.

To avoid the risk of fire, never apply the laser to flammable or combustible materials.



When operating the Laser, do not cover it with a blanket, cloth, etc.

Heat generated by the operating Laser may ignite a blanket or cover.



Do NOT use the Laser for purposes other than processing metal.

Use of the Laser on other materials, or in a manner other than specified may cause fire or electrical shock.



Wear protective gear when operating the Laser.

Wear protective gear such as protective gloves, long-sleeved jacket, leather apron, etc. so that Laser spatter will not burn the skin.



Keep a fire extinguisher nearby.

Make sure there is a fire extinguisher in or near the Laser shop in case of fire.



Regularly inspect and maintain the Laser.

Regular inspection and maintenance is essential for safe operation and long life of the Laser. If you see **any** damage, make necessary repairs before operating the Laser.

General Precautions

This Operator's Manual describes the Operation and Maintenance of the LW500A(E) / 600A(E) and ML-2651B(-CE) / 2650B(-CE) Nd:YAG Laser Welders, and provides instructions relating to its SAFE use. Procedures described in this manual *must* be performed as detailed by *qualified* and *trained* personnel.

- *Before* attempting to use the laser, please read this instruction manual *and* the Laser Safety Manual (Amada Miyachi America Part Number 990-502) thoroughly for safety reasons and to effectively take advantage of the full capabilities of the Laser Welder.
- *After* reading this manual, retain it for future reference when any questions arise regarding the proper and SAFE operation of the Nd:YAG Laser Welder.

Installation Precautions

- Install the Laser securely on a firm and level surface.
- **LW500A/600A and ML-2651B/2650B Models:** Connect to an A.C. Service of three-phase, 220/220/240 VAC +10%/-15%, 100A, 50/60 Hz.
NOTE: Depending on the manufacturing date, the 240VAC option may not be available.
- **LW500AE/600AE and ML-2651B-CE/2650B-CE Extended Voltage Models:** Connect to an A.C. Service of three-phase, 380/400 VAC \pm 10%, 60A, 50/60 Hz (for 400VAC models).
- Be sure to apply good grounding to the laser.
- This manual does not cover adjustments made prior to start-up, as such adjustments are performed by our engineers after the Laser is installed. For space requirements and power supplies, see *Appendix A, Technical Specifications*.
- Use the Laser in a place where the ambient temperature is between 41-95°F (5-35°C) and humidity is 85% (non-condensing) or less and where there are no sudden temperature fluctuations.
- Do *not* use the Laser in the following places:
 - Where there is considerable dirt, dust, mist, chemicals, fumes, moisture, or near a high-frequency noise source.
 - Where the Laser may be subjected to vibration or impact.
 - Where moisture may be condensed on the surface of the Laser.
 - Where there is a high concentration of CO₂, NO_x (nitrogen oxides) or SO_x (sulfur oxides).
(Air containing more than 0.1% CO₂ may shorten the life of the ion-exchange resin).
- If the outside of the Laser is stained, wipe it with a dry or slightly moistened cloth. If it is badly stained, use a neutral detergent or alcohol to clean it. Do *not* use paint thinner, acetone, benzene, etc. which can discolor or deform the parts.
- Do *not* put screws, coins, etc. in the Laser, since they can cause a malfunction.
- Operate the switches and buttons carefully by hand. If they are operated roughly or with the tip of a screwdriver, a pen, etc. they can cause a malfunction.

Installation Precautions (Continued)

- Operate the switches and buttons one at a time. If two or more of them are operated simultaneously, the Laser may develop trouble.
- The outer panels and the covers are electrically connected to the main unit by connecting ground cables. When the panels, covers and connecting cables are removed and installed again, make sure that all these ground cables are put back into place correctly. Also, make sure that the cables do not block the optical path of the oscillator or get caught between the outer panel and the frame.

Operation Precautions

When operating or servicing the Laser Welder unit, always wear Protective Goggles having an optical density of at least 7⁺ at a wavelength of 1064 nanometers for the operation of the LW500A(E)/600A(E) and ML-2651B(-CE)/2650B(-CE) Nd:YAG Laser Welders.

Appoint a Laser Safety Officer (LSO). The LSO must provide personnel with sufficient training so that they can operate, maintain and service the Laser Welder safely. The LSO must take charge of the key to the Key Switch to ensure that *only* qualified and authorized personnel operate the Laser Welder.

Establish and control a dedicated Laser Operation Area. The LSO must isolate the Laser Operation Area from other work areas and display signs warning that the Laser Operation Area is off-limits to unauthorized personnel.

Maintenance/Service Precautions

- Do *not* modify the Laser Welder without prior written approval from Amada Miyachi America.
- *Before* performing any maintenance on the Laser, read *Chapter 5, Maintenance* thoroughly. Use the appropriate tools for terminating the connecting cables, being careful not to nick the wire conductors.
- Procedures other than those described in this manual or not performed as prescribed in this manual, may expose personnel to electrical and/or laser radiation hazards.

Cold Weather Precautions

- Rapid temperature changes may cause dew condensation on the end faces of the Nd:YAG rod and on other optical surfaces. This will attract dust and can cause damage to the optical surfaces. If this occurs, see *Chapter 5, Maintenance* for corrective action.
- If the temperature drops below 32°F (0°C), the water inside the Laser's cooling system can freeze, thus damaging the unit. Take special care to keep the ambient temperature above 32°F (0°C). If the temperature is likely to drop below 32°F (0°C), drain the water in accordance to the procedure described in *Chapter 5, Maintenance*.

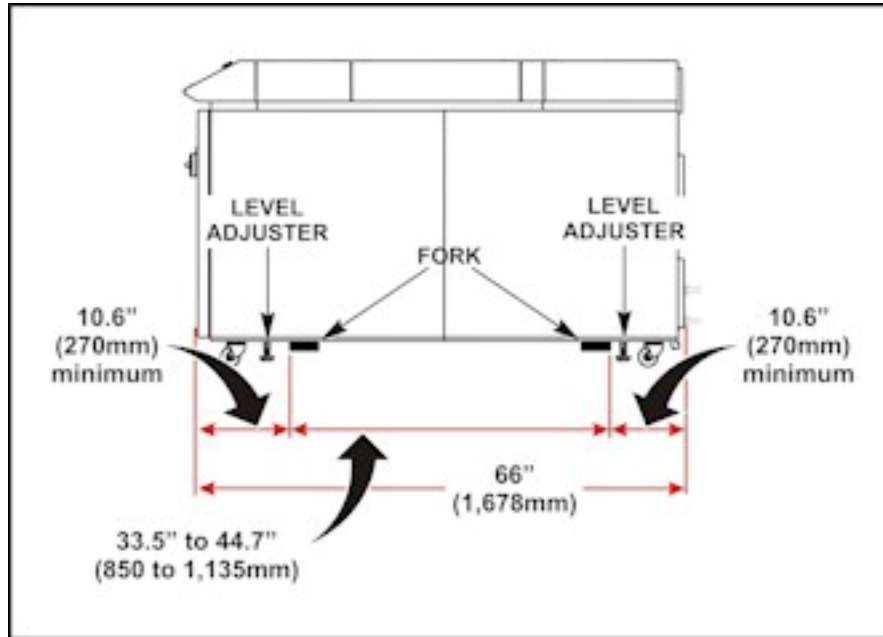
Transporting Precautions

When transporting the Laser, observe the following precautions to prevent an accident to the worker and damage to the Laser.

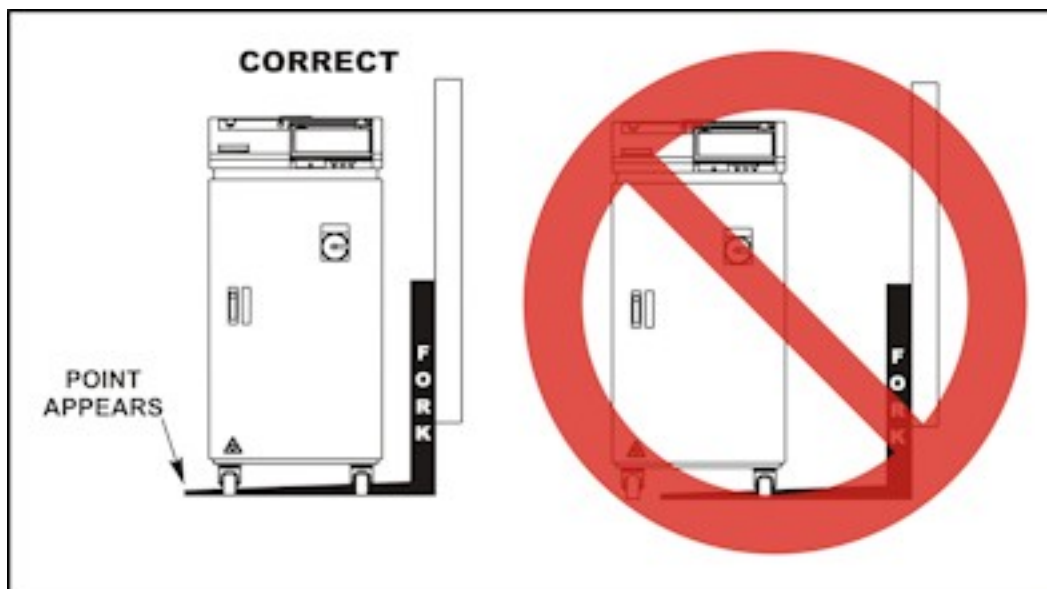
- Package the Laser securely.
- The worker must wear a helmet, safety shoes and gloves for safety. (Leather gloves are recommended.)
- When transporting the Laser, use a lift truck, crane, belt, etc., with a capacity of at least 1500 pounds (682 kg) of allowable load.
- Retract the level adjuster fully when transporting the Laser.

Lift Truck/Forklift Precautions

- As shown below, adjust the distance between the lift truck forks to at least 33.5" (850mm). Verify that the fork does *not* hit the level adjuster.
- When transporting, belt the Laser to the lift truck and keep it horizontal.

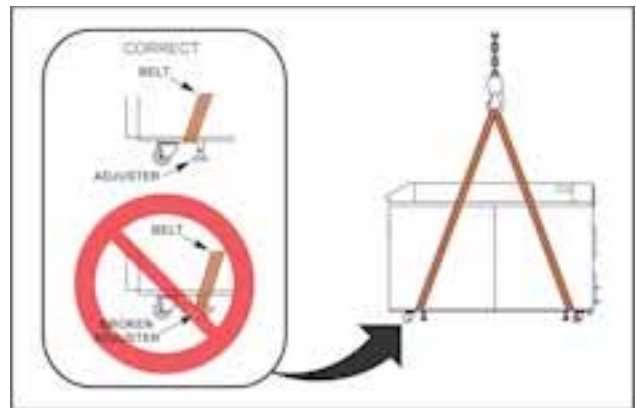
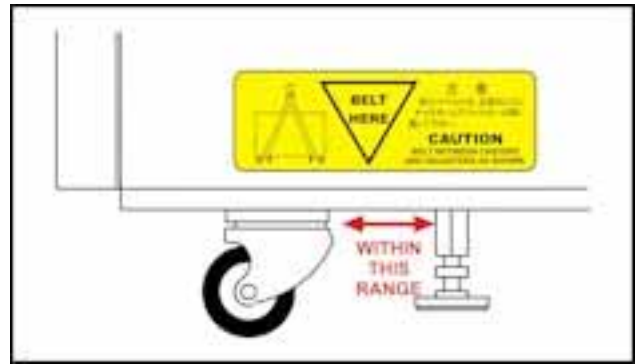


When using a fork lift, insert the forks fully until the points appear from under the Laser.



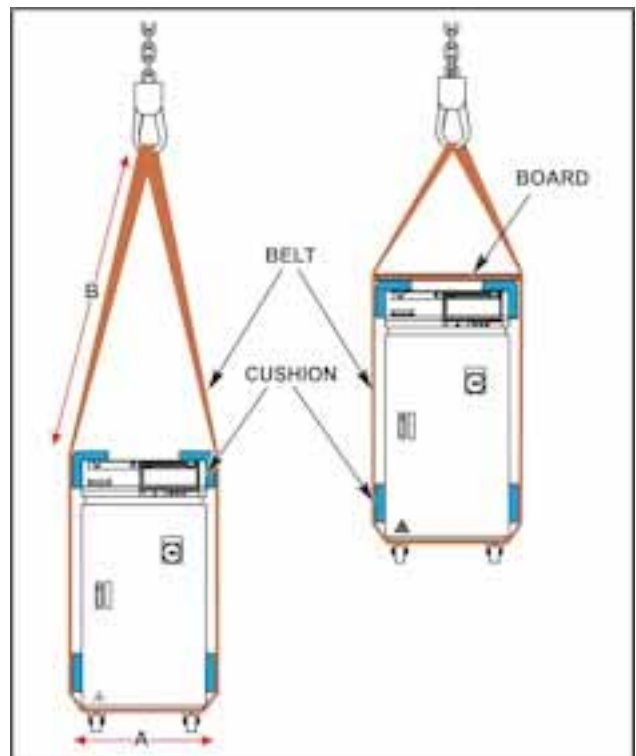
Crane Precautions

- When lifting the Laser, belt it between the caster and level adjuster as shown in the **BELT HERE** label.
- Use two belts.
- During transportation, keep the Laser horizontal.
- To prevent damaging the level adjusters, make sure that the lifting belt is *not* interfering with the level adjuster.



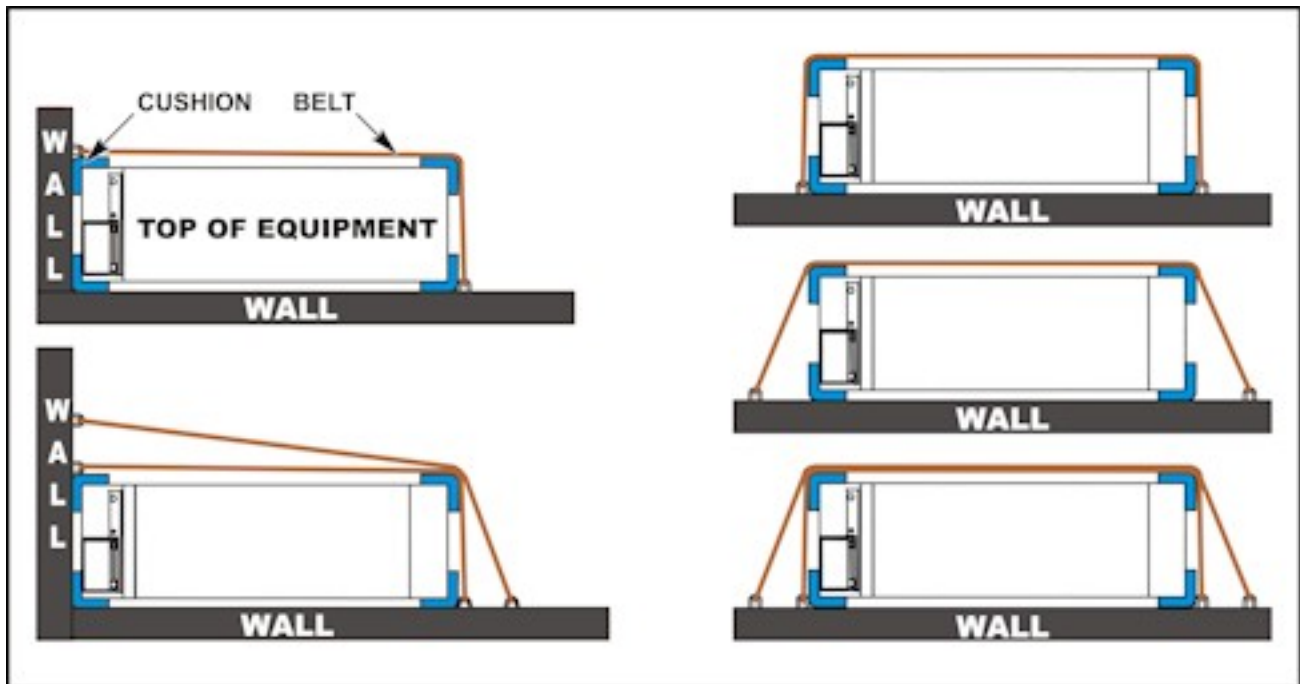
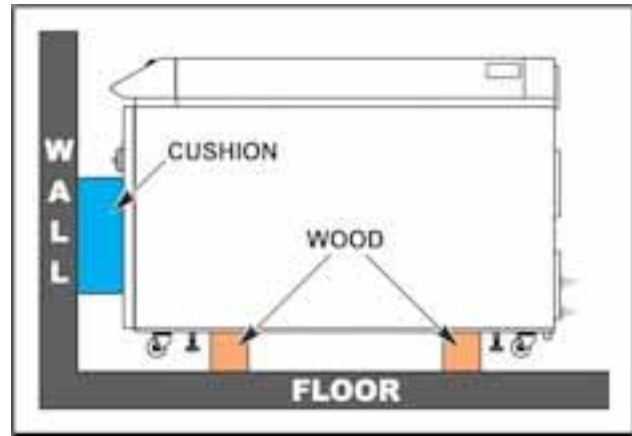
Using Cushions

- When lifting with a belt, properly cushion the Laser.
- When craning the Laser, use cushions (blanket, sponge, or rubber) between the Laser and belts to prevent damaging the Laser. Keep the Laser stable.
- Verify that the distance (**B**) between the top corner of the Laser and the crane hook is at least 1.5 times the Laser width (**A**) [including the protective cushions].
- When the belt is not long enough as shown, insert a board (plywood, laminated board, or angle board) on the Laser to prevent damage to the top surface of the Laser.
- Do *not* belt the front door, as it may become deformed and will not open/close properly.



Shipping Precautions

- Fix the Laser firmly using belts, cushions, etc., to prevent an accidental fall or damage due to vibration.
- Retract the level adjuster fully when freighting the Laser.
- Insert a board and thick cushion between the front door and wall to provide enough clearance between the wall and the upper front panel of the Laser.
- Insert wood between the bottom of the Laser and floor to balance the Laser.
- Belt and fix the laser using at least two planes of floor and wall. Be sure to use cushions between the Laser and the belt(s) to prevent damaging the laser.



LIMITED WARRANTY

1. (a) Subject to the exceptions and upon the conditions set forth herein, Seller warrants to Buyer that for a period of one (1) year from the date of shipment (“**Warranty Period**”), that such Goods will be free from material defects in material and workmanship.

(b) Notwithstanding the foregoing and anything herein to the contrary, the warranty set forth in this Section 1 shall be superseded and replaced in its entirety with the warranty set forth on **Exhibit A** hereto if the Goods being purchased are specialty products, which include, without limitation, laser products, fiber markers, custom systems, workstations, Seller-installed products, non-catalogue products and other custom-made items (each a “**Specialty Products.**”

(c) **EXCEPT FOR THE WARRANTY SET FORTH IN SECTION 1(A), SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.**

(d) Products manufactured by a third party and third party software (“**Third Party Product**”) may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in Section 1(a). For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer’s sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party’s warranty.

(e) Seller shall not be liable for a breach of the warranty set forth in Section 1(a) unless: (i) Buyer gives written notice of the defect, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods; (iii) Buyer (if requested to do so by Seller) returns such Goods (prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016 or to such other location as designated in writing by Seller) to Seller pursuant to Seller’s RMA procedures and Buyer obtains a RMA number from Seller prior to returning such Goods for the examination to take place; and (iii) Seller reasonably verifies Buyer’s claim that the Goods are defective and that the defect developed under normal and proper use.

(f) Seller shall not be liable for a breach of the warranty set forth in Section 1(a) if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller’s oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller’s own service personnel, or an authorized representative’s personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

(g) All expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

(h) Subject to Section 1(e) and Section 1(f) above, with respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: (i) repair or replace such Goods (or the defective part) or (ii) credit or refund the price of such Goods at the pro rata contract rate, provided that, if Seller so requests, Buyer shall, at Buyer's expense, return such Goods to Seller.

(i) THE REMEDIES SET FORTH IN SECTION 1(H) SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN SECTION 1(A). Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

Exhibit A
Warranty for “Specialty Products”

Limited Warranty

EXCEPT FOR THE WARRANTY SET FORTH BELOW IN THIS EXHIBIT A, SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

Warranty Period: The Warranty Period for Specialty Products is for one (1) year, and the Warranty Period for laser welders and laser markers is two (2) years (unlimited hours), and the Warranty Period for the laser pump diodes or modules is two (2) years or 10,000 clock hours, whichever occurs first (as applicable, the “**Warranty Period**”). The Warranty Period begins as follows: (i) on orders for Goods purchased directly by Buyer, upon installation at Buyer’s site or thirty (30) days after the date of shipment, whichever occurs first; or (ii) on equipment purchased by a Buyer that is an OEM or systems integrators, upon installation at the end user’s site or six (6) months after the date of shipment, whichever occurs first.

Acceptance Tests: Acceptance Tests (when required) shall be conducted at Amada Miyachi America, Inc., Monrovia, CA, USA (the “**Testing Site**”) unless otherwise mutually agreed in writing prior to issuance or acceptance of the Acknowledgement. Acceptance Tests shall consist of a final visual inspection and a functional test of all laser, workstation, enclosure, motion and accessory hardware. Acceptance Tests shall include electrical, mechanical, optical, beam delivery, and software items deliverable under the terms of the Acknowledgement. Terms and conditions for Additional Acceptance Tests either at Seller’s or Buyer’s facility shall be mutually agreed in writing prior to issuance or acceptance of the Acknowledgement.

Performance Warranty: The system is warranted to pass the identical performance criteria at Buyer’s site as demonstrated during final Acceptance Testing at the Testing Site during the Warranty Period, as provided in the Acknowledgement. Seller explicitly disclaims any responsibility for the process results of the laser processing (welding, marking, drilling, cutting, etc.) operations.

Exclusions: Seller makes no warranty, express or implied, with respect to the design or operation of any system in which any Seller’s product sold hereunder is a component.

Limitations: The limited warranty set forth on this Exhibit A does not cover loss, damage, or defects resulting from transportation to Buyer’s facility, improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the equipment, or improper site preparation and maintenance. This warranty also does not cover damage from misuse, accident, fire or other casualties of failures caused by modifications to any part of the equipment or unauthorized entry to those portions of the laser which are stated. Furthermore, Seller shall not be liable for a breach of the warranty set forth in this Exhibit A if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller’s oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller’s own service personnel, or an authorized representative’s personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

Seller further warrants that all Services performed by Seller's employees will be performed in a good and workmanlike manner. Seller's sole liability under the foregoing warranty is limited to the obligation to re-perform, at Seller's cost, any such Services not so performed, within a reasonable amount of time following receipt of written notice from Buyer of such breach, provided that Buyer must inform Seller of any such breach within ten (10) days of the date of performance of such Services.

Seller shall not be liable for a breach of the warranty set forth in this Exhibit A unless: (i) Buyer gives written notice of the defect or non-compliance covered by the warranty, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect or non-compliance and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods and (a) Buyer returns such Goods to Seller's place of business at Buyer's cost (prepaid and insured); or (b) in the case of custom systems, Seller dispatches a field service provider to Buyer's location at Buyer's expense, for the examination to take place there; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective or non-compliant and the defect or non-compliance developed under normal and proper use.

All consumable, optical fibers, and expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

No warranty made hereunder shall extend to any product whose serial number is altered, defaced, or removed.

Remedies: With respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: repair such Goods (or the defective part). **THE REMEDIES SET FORTH IN THE FOREGOING SENTENCE SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN THIS EXHIBIT A.** Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

Products manufactured by a third party and third party software ("**Third Party Product**") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in this Exhibit A. For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer's sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party's warranty.

