

# Underwriters Laboratories (UL LLC) Safety Certification (Manufacturing Factory) Report



Model: JMR20XXYZZ, where XX can be 24 (9-36) or 48 (18-75) for input voltage, Y can be S (single) or D (dual) for number of outputs, ZZ can be 05, 12, or 15 for output voltage

Device Description: Component DC-to-DC Converter for use in medical equipment

Applicant: XP Power LLC  
15641 Red Hill Ave, Suite 100  
Tustin, CA 92780 USA

Manufacturer: Same as Applicant

Manufacturing Facility(ies): 9 Keji 2nd Rd Technology Industrial Park  
Tainan 709031 Taiwan

Report No.: E321744-D1027-1/A1/C0(M)

Report (Re)Issue Date: 2023-05-25; 2023-08-22 (1/A1/C0)

Base Standard(s): AAMI ES60601-1:2005,ES60601-1:2005/AMD1 1:2012 , ES60601-1:2005/AMD2:2021, CAN/CSA-C22.2 No. 60601-1:08, CAN/CSA-C22.2 No. 60601-1:14 (including amendment 1) and Amendment 2:2022

Additional Standards: EN 60601-1: 2006+A2:2021

Report Types: This report consists of the following report types:  
[ Yes ] US Certification (UL Recognition)  
[ Yes ] CAN Certification (cUL Recognition)

This report covers the Safety evaluation of the referenced model(s) according to the standard(s) specified above.

This is the Manufacturing Factory report only, which is used as part of the factory FUS inspections.

## Table of Contents

<b>APPENDIX A: Enclosures</b> .....	1
Diagrams - (001) Transformer Spec .....	2
Marking Label - (001) JMR20 Labels .....	5
Miscellaneous - (001) Enclosure drawing .....	6
Miscellaneous - (002) Model differences .....	8
Miscellaneous - (003) Letter of Assurance .....	9
Photographs - (001) Overview 1 .....	10
Photographs - (002) Overview 2 .....	11
Photographs - (003) PWB view 3 .....	12
Photographs - (004) PWB view 4 .....	13
Schematics + PWB - (001) JMR20-DDH (JMR2024D05, JMR2024D12, JMR2024D15, JMR2048D05, JMR2048D12, JMR2048D15) .....	14
Schematics + PWB - (002) JMR20-DSH (JMR2024S12, JMR2024S15, JMR2048S12, JMR2048S15) .....	17
Schematics + PWB - (003) JMR20-DSL (JMR2024S05, JMR2048S05) .....	20
Schematics + PWB - (004) JMR20-IFS+IFD (All models) .....	23
<b>APPENDIX C: Follow-Up Service Documentation (Page Section: C)</b> .....	1
Follow-Up Service Procedure .....	1
UL Authorization Page .....	2
UL Appendix: .....	5
GENERIC INSPECTION INSTRUCTIONS .....	5
INSTRUCTIONS AND DUTIES FOR UL REPRESENTATIVE .....	6
INSTRUCTIONS FOR FOLLOW-UP TESTS AT UL .....	13
RESPONSIBILITIES AND REQUIREMENTS FOR MANUFACTURER .....	14
GENERAL TERMINOLOGY .....	19
GENERAL PRODUCT CONSTRUCTION REQUIREMENTS .....	20
UL CERTIFICATION MARK .....	28
Description .....	29
Markings and instructions .....	33
Special Instructions to UL Representative .....	33
Production-Line Testing Requirements .....	33
TABLE: List of Critical Components .....	34

## APPENDIX A: Enclosures

All Enclosures associated with this report are shown below.

### Enclosures

<u>Supplement - (ID)</u>	<u>Description</u>
Diagrams - (001)	Transformer Spec
Marking Label - (001)	JMR20 Labels
Miscellaneous - (001)	Enclosure drawing
Miscellaneous - (002)	Model differences
Miscellaneous - (003)	Letter of Assurance
Photographs - (001)	Overview 1
Photographs - (002)	Overview 2
Photographs - (003)	PWB view 3
Photographs - (004)	PWB view 4
Schematics + PWB - (001)	JMR20-DDH (JMR2024D05, JMR2024D12, JMR2024D15, JMR2048D05, JMR2048D12, JMR2048D15)
Schematics + PWB - (002)	JMR20-DSH (JMR2024S12, JMR2024S15, JMR2048S12, JMR2048S15)
Schematics + PWB - (003)	JMR20-DSL (JMR2024S05, JMR2048S05)
Schematics + PWB - (004)	JMR20-IFS+IFD (All models)



Diagrams - (001) Transformer Spec

Part:	JMWZ04009	07	0.15001	JARI SHINO WIRE CO., LTD. 09999-3 JL.S170007 7A VA ELECTRIC WIRE & CABLE C03170 TYP:0110 TYP:0210 JL.S00001 SUNAK HANJUK LIMITED 09999-3 JL.S230001 SUN PROCELA (MALAYSIA) 09999-3 P100 JL.S140010 T&I (THAILAND) 09999-3 JL.S00000	47	0.15001	JARI SHINO WIRE CO., LTD. 09999-3 JL.S170007 7A VA ELECTRIC WIRE & CABLE C03170 TYP:0110 TYP:0210 JL.S00001 SUNAK HANJUK LIMITED 09999-3 JL.S230001 SUN PROCELA (MALAYSIA) 09999-3 P100 JL.S140010 T&I (THAILAND) 09999-3 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000			
Part:	JMWZ04010 JMWZ04011 JMWZ04012	07	0.15001	JARI SHINO WIRE CO., LTD. 09999-3 JL.S170007 7A VA ELECTRIC WIRE & CABLE C03170 TYP:0110 TYP:0210 JL.S00001 SUNAK HANJUK LIMITED 09999-3 JL.S230001 SUN PROCELA (MALAYSIA) 09999-3 P100 JL.S140010 T&I (THAILAND) 09999-3 JL.S00000	47	0.15001	JARI SHINO WIRE CO., LTD. 09999-3 JL.S170007 7A VA ELECTRIC WIRE & CABLE C03170 TYP:0110 TYP:0210 JL.S00001 SUNAK HANJUK LIMITED 09999-3 JL.S230001 SUN PROCELA (MALAYSIA) 09999-3 P100 JL.S140010 T&I (THAILAND) 09999-3 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000			
Part:	JMWZ04009	07	0.15001	JARI SHINO WIRE CO., LTD. 09999-3 JL.S170007 7A VA ELECTRIC WIRE & CABLE C03170 TYP:0110 TYP:0210 JL.S00001 SUNAK HANJUK LIMITED 09999-3 JL.S230001 SUN PROCELA (MALAYSIA) 09999-3 P100 JL.S140010 T&I (THAILAND) 09999-3 JL.S00000	47	0.15001	JARI SHINO WIRE CO., LTD. 09999-3 JL.S170007 7A VA ELECTRIC WIRE & CABLE C03170 TYP:0110 TYP:0210 JL.S00001 SUNAK HANJUK LIMITED 09999-3 JL.S230001 SUN PROCELA (MALAYSIA) 09999-3 P100 JL.S140010 T&I (THAILAND) 09999-3 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000	07	0.00000	SPRAT LORLON INDUSTRIAL CO.LTD TYP:0110 TYP:0210 JL.S00000

Diagrams - (001) Transformer Spec

<p>Part</p> <p>JMR204500</p>	<p>07</p> <p>0.15mm</p> <p>JANG SHING WIRE CO., LTD.                  0700002                  JLE114001                  TA YA ELECTRIC WIRE &amp; CABLE CO. LTD.                  T9904110                  T9904110                  T9904110                  JLS0401                  Sanku Holdings Limited                  JLS0401                  JLS214001                  ELEKTRONIKA BINAUTAMA                  0700                  JLE14010                  Ta-Ya (Taiwan)                  JLS0401                  JLS05000</p>	<p>47</p> <p>0.15mm</p> <p>JANG SHING WIRE CO., LTD.                  0700002                  JLE114001                  TA YA ELECTRIC WIRE &amp; CABLE CO. LTD.                  T9904110                  T9904110                  T9904110                  JLS0401                  Sanku Holdings Limited                  JLS0401                  JLS214001                  ELEKTRONIKA BINAUTAMA                  0700                  JLE14010                  Ta-Ya (Taiwan)                  JLS0401                  JLS05000</p>	<p>07</p> <p>0.15mm</p> <p>080411001000                  INDUSTRIAL DOCS TO:                  T9904110000                  JLS217000</p>	<p>07</p> <p>0.15mm</p> <p>080411001000                  INDUSTRIAL DOCS TO:                  T9904110000                  JLS217000</p>
<p>Part</p> <p>JMR204501</p> <p>JMR204502</p> <p>JMR204503</p> <p>JMR204504</p>	<p>07</p> <p>0.15mm</p> <p>JANG SHING WIRE CO., LTD.                  0700002                  JLE114001                  TA YA ELECTRIC WIRE &amp; CABLE CO. LTD.                  T9904110                  T9904110                  T9904110                  JLS0401                  Sanku Holdings Limited                  JLS0401                  JLS214001                  ELEKTRONIKA BINAUTAMA                  0700                  JLE14010                  Ta-Ya (Taiwan)                  JLS0401                  JLS05000</p>	<p>47</p> <p>0.15mm</p> <p>JANG SHING WIRE CO., LTD.                  0700002                  JLE114001                  TA YA ELECTRIC WIRE &amp; CABLE CO. LTD.                  T9904110                  T9904110                  T9904110                  JLS0401                  Sanku Holdings Limited                  JLS0401                  JLS214001                  ELEKTRONIKA BINAUTAMA                  0700                  JLE14010                  Ta-Ya (Taiwan)                  JLS0401                  JLS05000</p>	<p>47</p> <p>0.15mm</p> <p>080411001000                  INDUSTRIAL DOCS TO:                  T9904110000                  JLS217000</p>	<p>47</p> <p>0.15mm</p> <p>080411001000                  INDUSTRIAL DOCS TO:                  T9904110000                  JLS217000</p>

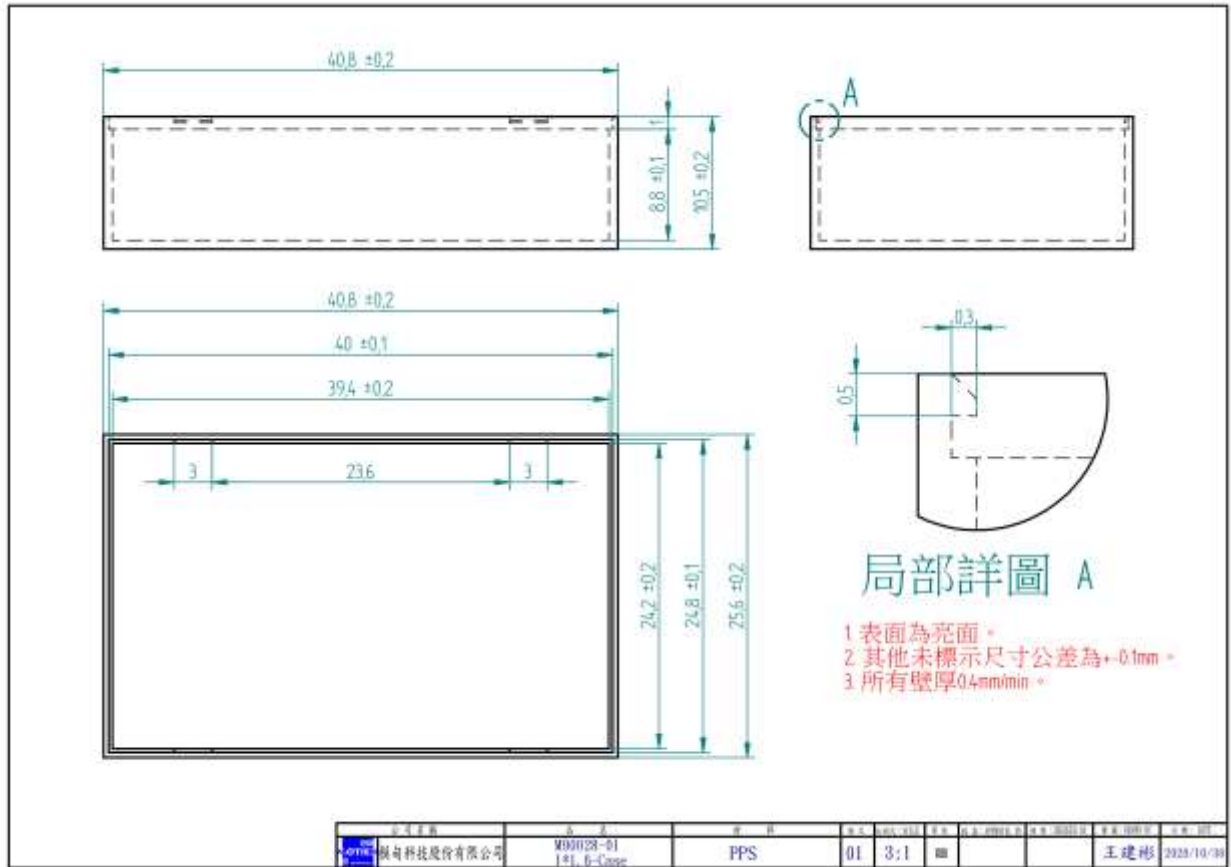
**Marking Label - (001) JMR20 Labels**

Marking Label - (001) JMR20 Labels



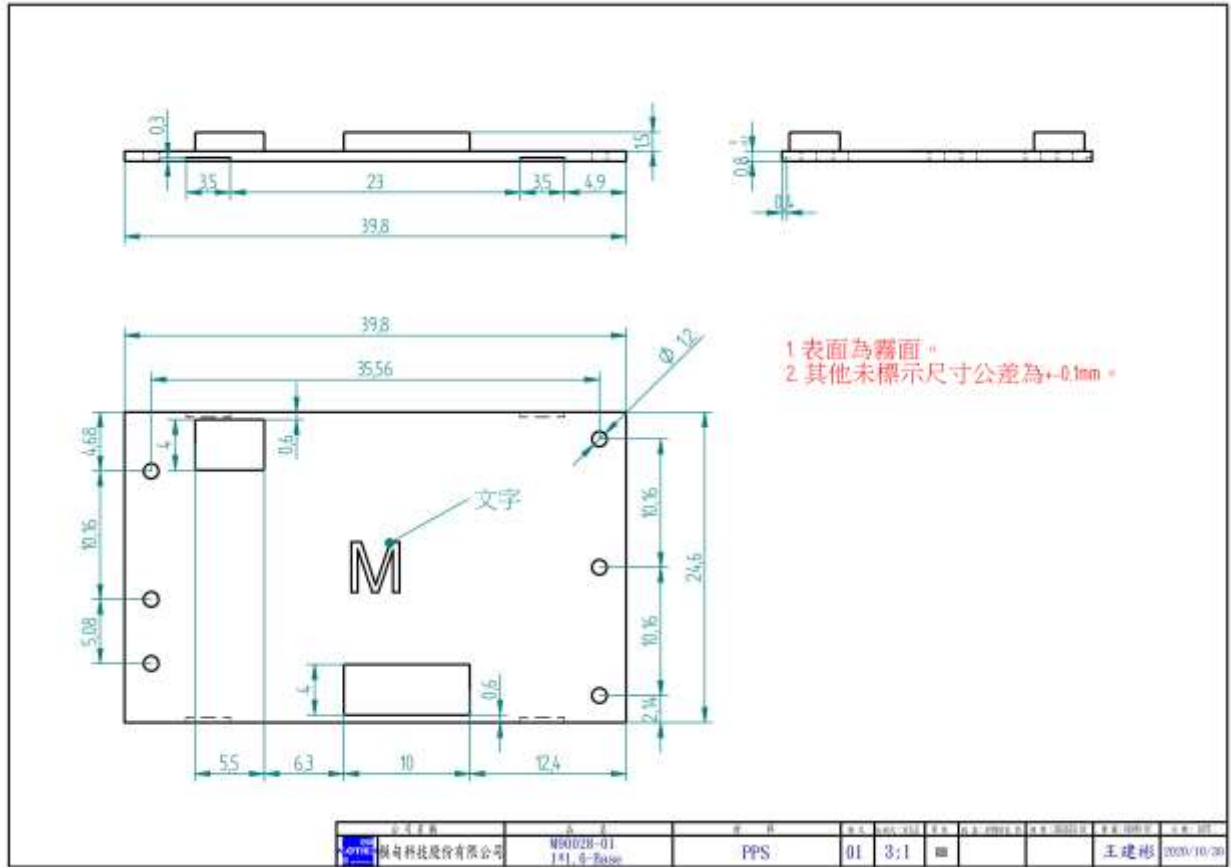
Miscellaneous - (001) Enclosure drawing

Miscellaneous - (001) Enclosure drawing





Miscellaneous - (001) Enclosure drawing



1 表面為霧面。  
2 其他未標示尺寸公差為 $\pm 0.1\text{mm}$ 。

**Miscellaneous - (002) Model differences**Miscellaneous - (002) Model differences

Model	Input voltage rating	Output rating	Transformer type	Main Board Layout type
JMR2024S05	9-36Vdc	5Vdc/4000mA	A (See Transformer specs )	DSL PWB
JMR2024S12		12Vdc/1670mA	C (See Transformer specs )	DSH PWB
JMR2024S15		15Vdc/1330mA	C (See Transformer specs )	DSH PWB
JMR2024D05		±5Vdc/±2000mA	B (See Transformer specs )	DDH PWB
JMR2024D12		±12Vdc/±833mA	C (See Transformer specs )	DDH PWB
JMR2024D15		±15Vdc/±667mA	C (See Transformer specs )	DDH PWB
JMR2048S05		18-75Vdc	5Vdc/4000mA	D (See Transformer specs )
JMR2048S12	12Vdc/1670mA		E(See Transformer specs )	DSH PWB
JMR2048S15	15Vdc/1330mA		E(See Transformer specs )	DSH PWB
JMR2048D05	±5Vdc/±2000mA		F(See Transformer specs )	DDH PWB
JMR2048D12	±12Vdc/±833mA		E(See Transformer specs )	DDH PWB
JMR2048D15	±15Vdc/±667mA		E(See Transformer specs )	DDH PWB

**Miscellaneous - (003) Letter of Assurance**Miscellaneous - (003) Letter of AssurancePOWERING THE WORLD'S CRITICAL SYSTEMS

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XP Power LLC, 15641 Red Hill Ave, Ste 100, Tustin, CA 92780 USA  
Tel: (714) 597-7100 Fax: (714) 597-7143 Website: www.xppower.com

UL LLC

Subject: Letter of Assurance

Dear UL,

This Document confirms that XP Power LLC was advised that the following items need to be provided to the Recognized National Certification Body along with the CB Test Report and CB Test Certificate.

Markings and Safety Instructions – Safety instructions and markings in the language for the countries listed in the attached report will be provided at the time the CB is submitted to the Recognized National Certification Body.

Power Supply Cords and Plugs – All power cords and plug assemblies will be certified and suitable for use in the particular countries when provided with the product. The Recognized National Certification Body may require certification.

EMC Test Report – Where specified in the National Difference, an EMC Test Report or Declaration of Conformity will accompany this product when sent to the Recognized National Certification Body who requires EMC testing.

Batteries – Upon shipment of products to Switzerland, the requirements of the most up-to-date Swiss Ordinance Annex 2.15, Batteries of SR 814.81 will be met including provision of the necessary markings, documents, and annual reports relative to disposal of the batteries to the Swiss Authorities.

Multiple Factory Locations – the sample(s) submitted for evaluation is (are) representative of the products from each factory. The factory (ies) are as noted in this CB Test Report.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Ron Nabong', written over a horizontal line.

Ron Nabong  
Compliance Engineer  
XP Power LLC

**Photographs - (001) Overview 1**

Photographs - (001) Overview 1



**Photographs - (002) Overview 2**

Photographs - (002) Overview 2



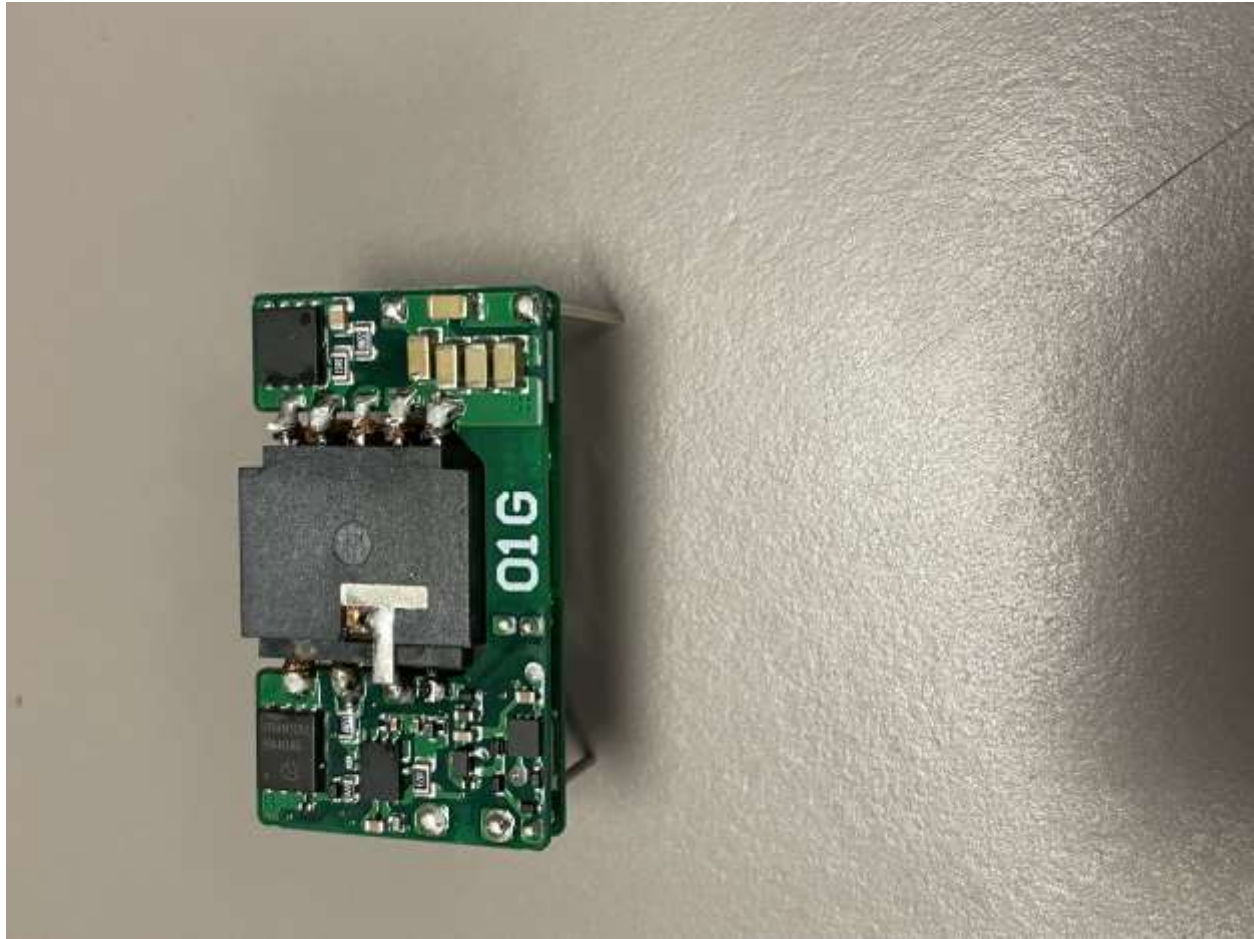
**Photographs - (003) PWB view 3**

Photographs - (003) PWB view 3



**Photographs - (004) PWB view 4**

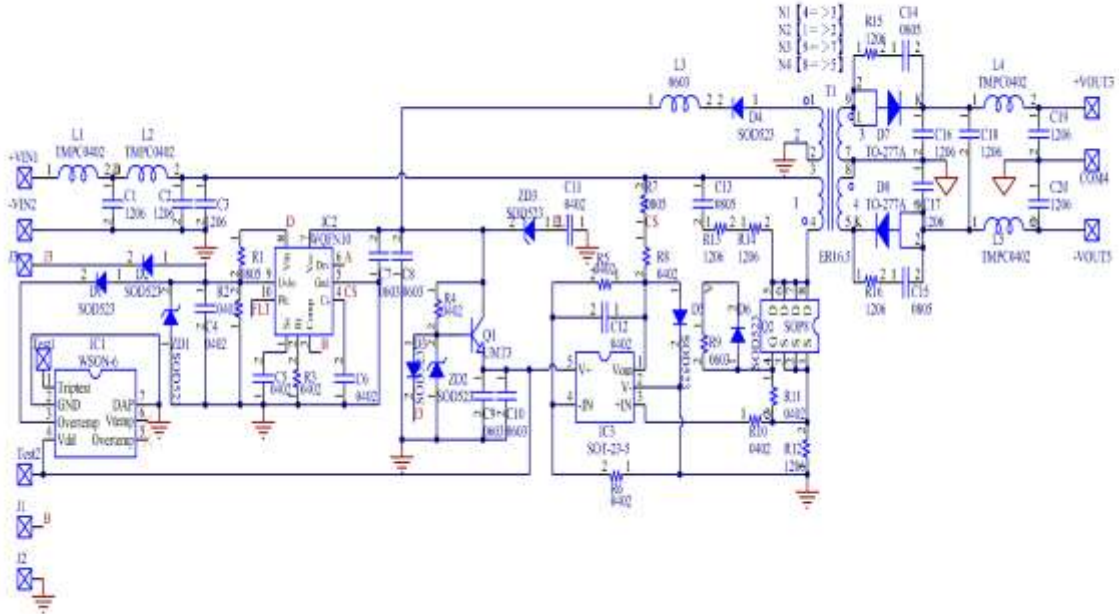
Photographs - (004) PWB view 4



**Schematics + PWB - (001) JMR20-DDH (JMR2024D05, JMR2024D12, JMR2024D15, JMR2048D05, JMR2048D12, JMR2048D15)**

Schematics + PWB - (001) JMR20-DDH (JMR2024D05, JMR2024D12, JMR2024D15, JMR2048D05, JMR2048D12, JMR2048D15)

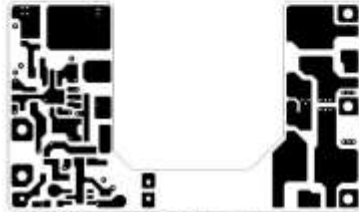
JMR20 Series-DDH [PCB: 0.8 mm / 4Layer / 2oz] [PCB: 38.6 mm x 23.0 mm]



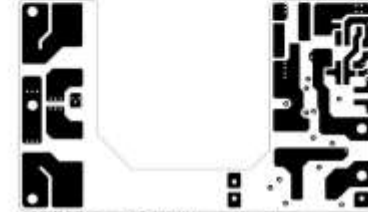


Schematics + PWB - (001) JMR20-DDH (JMR2024D05, JMR2024D12, JMR2024D15, JMR2048D05, JMR2048D12, JMR2048D15)

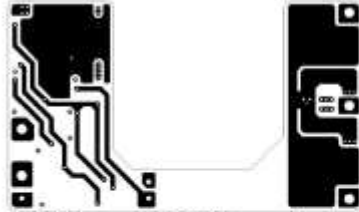
JMR20 Series -DDH Top Layer



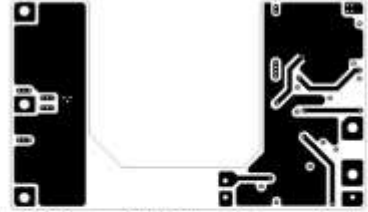
JMR20 Series -DDH Bottom Layer



JMR20 Series -DDH Top Inner Layer



JMR20 Series -DDH Bottom Inner Layer



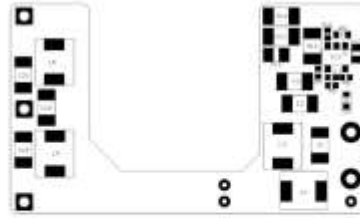
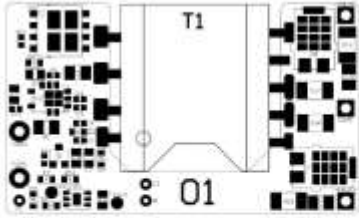
JMR20 Series -DDH Top Silkscreen Overlay



JMR20 Series -DDH Bottom Silkscreen Overlay



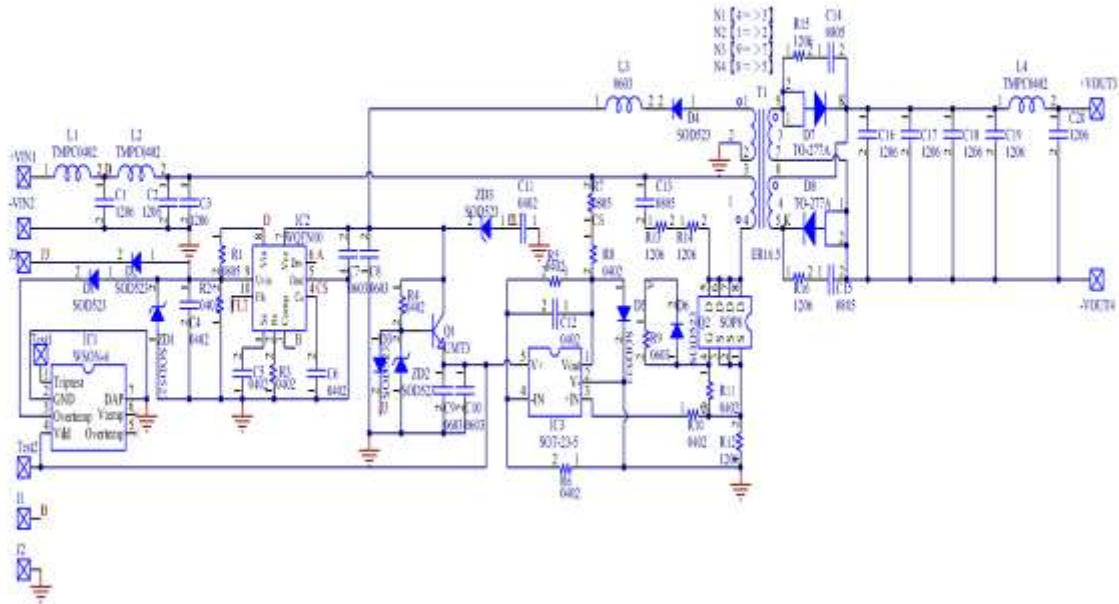
Schematics + PWB - (001) JMR20-DDH (JMR2024D05, JMR2024D12, JMR2024D15, JMR2048D05, JMR2048D12, JMR2048D15)



### Schematics + PWB - (002) JMR20-DSH (JMR2024S12, JMR2024S15, JMR2048S12, JMR2048S15)

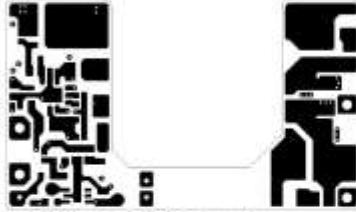
Schematics + PWB - (002) JMR20-DSH (JMR2024S12, JMR2024S15, JMR2048S12, JMR2048S15)

JMR20 Series-DSH [PCB: 0.8 mm / 4Layer / 2oz] [PCB: 38.6 mm × 23.0mm]



Schematics + PWB - (002) JMR20-DSH (JMR2024S12, JMR2024S15, JMR2048S12, JMR2048S15)

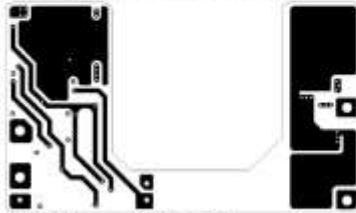
JMR20 Series -DSH Top Layer



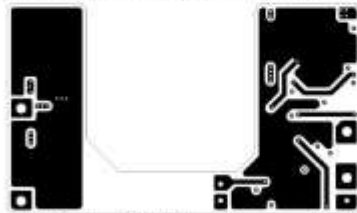
JMR20 Series -DSH Bottom Layer



JMR20 Series -DSH Top Inner Layer



JMR20 Series -DSH Bottom Inner Layer



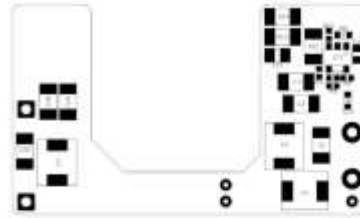
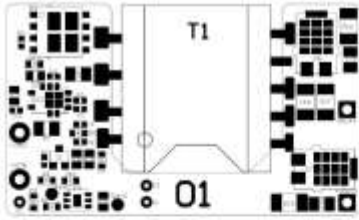
JMR20 Series -DSH Top Silkscreen Overlay



JMR20 Series -DSH Bottom Silkscreen Overlay



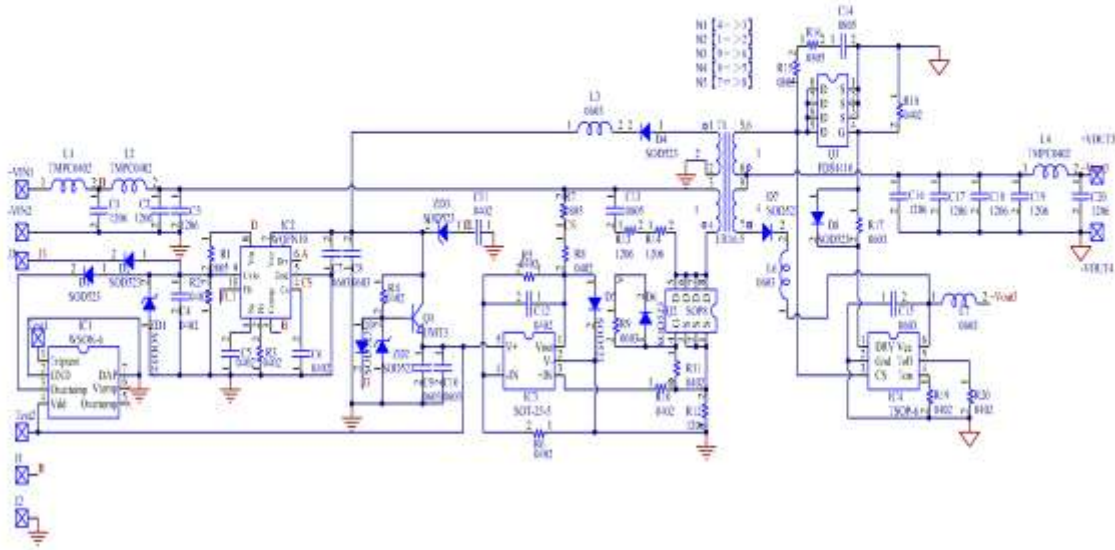
Schematics + PWB - (002) JMR20-DSH (JMR2024S12, JMR2024S15, JMR2048S12, JMR2048S15)



### Schematics + PWB - (003) JMR20-DSL (JMR2024S05, JMR2048S05)

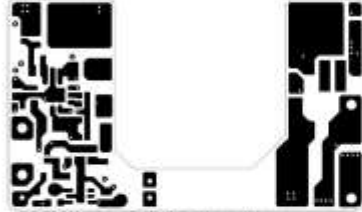
Schematics + PWB - (003) JMR20-DSL (JMR2024S05, JMR2048S05)

JMR20 Series-DSL [PCB: 0.8mm / 4Layer / 2oz] [PCB: 38.6 mm × 23.0mm]

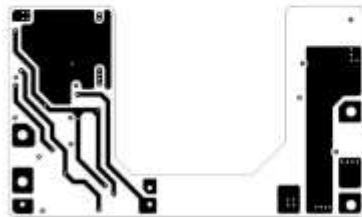


Schematics + PWB - (003) JMR20-DSL (JMR2024S05, JMR2048S05)

JMR20 Series -DSL Top Layer

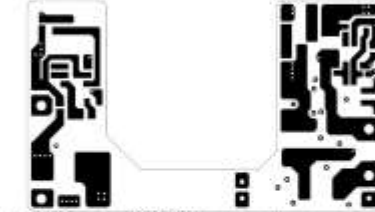


JMR20 Series -DSL Top Inner Layer

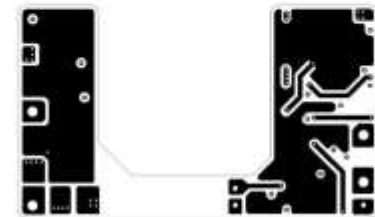


JMR20 Series -DSL Top Silkscreen Overlay

JMR20 Series -DSL Bottom Layer

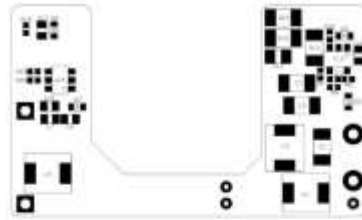
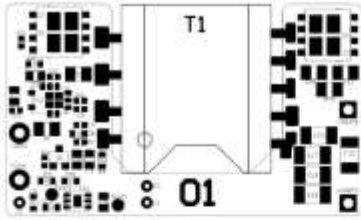


JMR20 Series -DSL Bottom Inner Layer



JMR20 Series -DSL Bottom Silkscreen Overlay

Schematics + PWB - (003) JMR20-DSL (JMR2024S05, JMR2048S05)

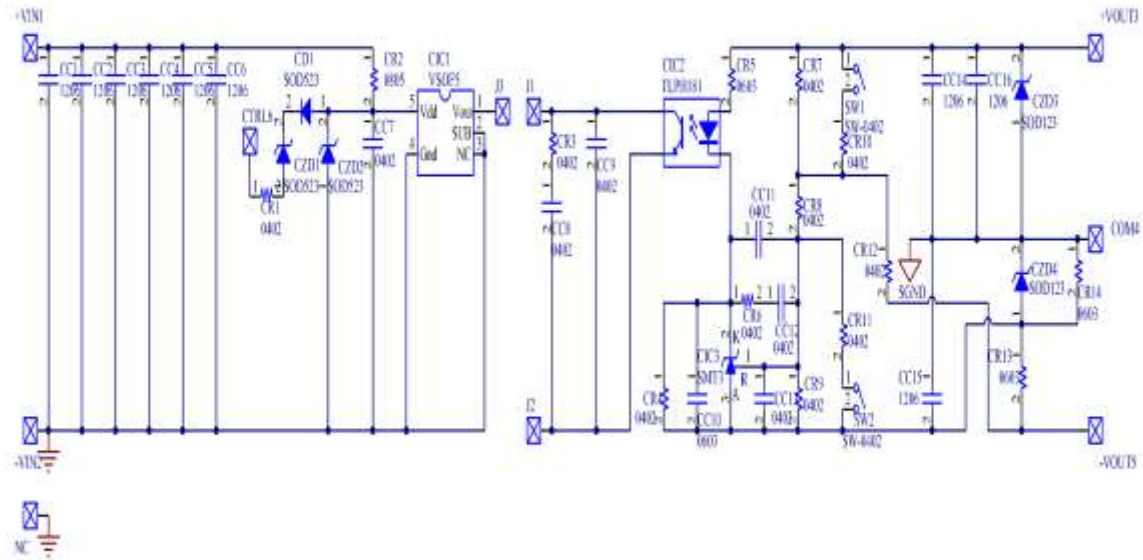




**Schematics + PWB - (004) JMR20-IFS+IFD (All models)**

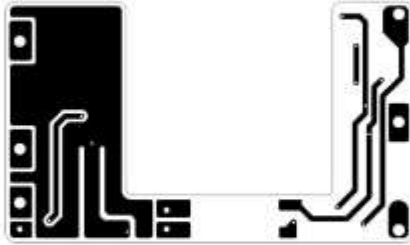
Schematics + PWB - (004) JMR20-IFS+IFD (All models)

JMR20 Series-IFS+IFD 【PCB: 0.8mm / 2Layer / 2oz】 【PCB: 38.2 mm × 22.7mm】



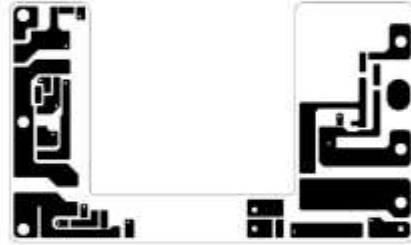
Schematics + PWB - (004) JMR20-IFS+IFD (All models)

JMR20 Series - IFS+IFD Top Layer



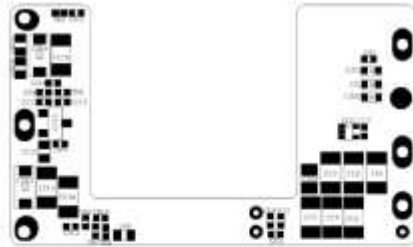
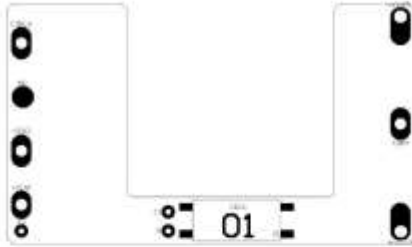
JMR20 Series - IFS+IFD Top Silkscreen Overlay

JMR20 Series - IFS+IFD Bottom Layer



JMR20 Series - IFS+IFD Bottom Silkscreen Overlay

Schematics + PWB - (004) JMR20-IFS+IFD (All models)



-----END OF APPENDIX A-----

## APPENDIX C: Follow-Up Service Documentation

### Follow-Up Service Procedure

**It is important to keep UL Procedures and Test Reports up-to-date as new or revised pages are received. Correct maintenance will decrease the amount of time the UL Representative spends when visiting your facility.**

UL LLC offers MyHome @UL, a dedicated website providing secure access to online tools and databases that can help simplify your compliance activities. You can customize your personal MyHome @UL page to include the content needed most, including timely information about certification updates and links to other Web sites you visit regularly. Visit <http://my.home.ul.com/> to sign up today!

PAGES (in content order)	FUNCTION	HOW TO UPDATE
<b>Authorization Page</b>	Displays the Product Category, the type of Follow-Up Service (Type R=Reexamination / Type L=Label), the File Number and the Volume Number associated with each Applicant's, Manufacturer's and Listee's company name and address.	Replace existing page by matching the UL File Number and Volume Number. Discard the older page (refer to "Issued" or "Revised" date).
<b>Addendum to Authorization Page*</b>	Lists the additional names and addresses of manufacturing locations, when multiple locations exist	Replace existing page by matching the UL File Number and Volume Number. Discard the older page (refer to "Issued" or "Revised" date).
<b>Listing Mark Data (LMD), Classification Mark Data (CMD) or Recognized Component Mark Data (RCMD) Pages* #</b>	Used only for products covered under Type R Service. Displays the correct LMD, CMD, or RCMD Mark, the Control Number for Listed and Classified categories and additional information regarding minimum size, application, procurement, and any other optional markings, in addition to the UL Mark.	Replace existing page by matching the UL File Number and Volume Number. Discard the older page (refer to "Issued" or "Revised" date).
<b>Multiple Listing (ML) Correlation Sheet*</b>	Correlates product model numbers between those products made by a Manufacturer for the Basic Applicant and those supplied to another company, the Multiple Listee.	Replace, add or delete page(s) with most current "Issued" or "Revised" date.
<b>Index*</b>	Catalogs the contents of the Procedure by some logical means, i.e. Section Number, Report Reference Number, or Issue Date.	Replace present page by matching the UL File Number, Volume Number, Page Number and most current "Revised" date.
<b>Appendices* # (App.)</b>	Contains instructions for the Manufacturer and UL Representative concerning specific responsibilities and required periodic tests. May also outline tests to be conducted on samples to be forwarded to UL's facilities.	Replace present page by matching the UL File Number, Volume Number, Appendix letter (eg. App. A), Page Number and most current "Revised" date.
	Standardized Appendix Pages are the same for all manufacturers within a particular product category.	Replace present page by matching the Appendix letter (eg. App. A), Page Number and most current "Revised" date.
<b>Follow-Up Inspection Instructions (FUII) Pages*</b>	Contains information similar to that in the Appendices. FUII Pages are issued as part of the Procedure when a UL Standard is used in conjunction with the Procedure, and are the same for all manufacturers within a particular category.	Replace present pages by matching the Page Number and most current "Issued" or "Revised" date.
<b>Section General* # (Sec. Gen.)</b>	Contains description, requirements, identifications and/or specifications that are common to all products covered by the entire volume and supplements the information provided in the Description Section.	Replace present page by matching the UL File Number, Volume Number, Page Number and most current "Revised" date.
<b>Description, or Section (Sec.)*</b>	Contains the specific description of one or more products or systems. This includes written text supplemented by photographs, drawings, etc., as necessary, to define features that affect compliance with the applicable requirements.	Replace present page by matching the UL File Number, Volume Number, Section Number, Page Number and most current "Issued" date.

\* The above page(s) may not appear in all UL Follow-Up Service Procedures; UL's Conformity Assessment Services staff determines their inclusion.

# These pages are combined in the **Generic Inspection Instructions** for International Style Reports, identified, as example by Vol. X1, X2, etc.

**PLEASE NOTIFY YOUR LOCAL UL OFFICE OF ANY CHANGES IN CONTACT NAME, COMPANY NAME OR ADDRESS, SO THIS MATERIAL AND IMPORTANT INFORMATION CONTINUES TO BE DELIVERED TO YOUR FACILITY WITHOUT INTERRUPTION.**

**UL Authorization Page**

UL File Number:E321744  
2023-08-22 (1/A1/C0)

Volume: D1

Issue Date: 2023-05-25;

**FOLLOW-UP SERVICE PROCEDURE**

(TYPE R)

**PRODUCT CATEGORY NAME**  
(QQHM2 / QQHM8)

Manufacturer: SEE ADDENDUM FOR MANUFACTURING LOCATIONS

Applicant: 75701 (Party Site)  
100565-739 XP Power LLC  
15641 Red Hill Ave, Suite 100  
Tustin, CA 92780 USA

Listee/Classified/  
Recognized Co.: Same as Applicant (unless specified differently below)  
Same as Applicant

This Follow-Up Service Procedure authorizes the above Manufacturer(s) to use the marking specified by UL LLC, or any authorized licensee of UL LLC, including the UL Contracting Party, only on products when constructed, tested and found to be in compliance with the requirements of this Follow-Up Service Procedure and in accordance with the terms of the applicable service agreement with UL Contracting Party. The UL Contracting Party for Follow-Up Services is listed on addendum to this Follow-Up Service Procedure ("UL Contracting Party"). UL Contracting Party and UL LLC are referred to jointly herein as "UL."

UL further defines responsibilities, duties and requirements for both Manufacturers and UL representatives in the document titled, "UL Mark Surveillance Requirements" that can be located at the following web-site: <http://www.ul.com/fus>. Manufacturers without Internet access may obtain the current version of this document from their local UL customer service representative or UL field representative. For assistance, or to obtain a paper copy of this document or the Follow-Up Service Terms referenced below, please contact UL's Customer Service at <http://ul.com/aboutul/locations/>, select a location and enter your request, or call the number listed for that location.

The Applicant, the specified Manufacturer(s) and any Listee/Classified/Recognized Company in this Follow-Up Service Procedure must agree to receive Follow-Up Services from UL Contracting Party. If your applicable service agreement is a Global Services Agreement ("GSA"), the Applicant, the specified Manufacturer(s) and any Listee/Classified/Recognized Company will be bound to a Service Agreement for Follow-Up Services upon the earliest by any Subscriber of use of the prescribed UL Mark, acceptance of the factory inspection, or payment of the Follow-Up Service fees which will incorporate such GSA, this Follow-Up Service Procedure and the Follow-Up Service Terms which can be accessed by clicking here: <http://services.ul.com/fus-service-termshttp://www.ul.com/contracts/Terms-After-12-31-2011>. In all other events, Follow-Up Services will be governed by and incorporate the terms of your applicable service agreement and this Follow-Up Service Procedure.

It is the responsibility of the Listee/Classified/Recognized Company to make sure that only the products meeting the aforementioned requirements bear the authorized Marks of UL LLC, or any authorized licensee of UL LLC.

This Follow-Up Service Procedure contains information for the use of the above Manufacturer(s) and representatives of UL and is not to be used for any other purpose. It is provided to the Manufacturer with the understanding that it will be returned upon request and is not to be copied in whole or in part.

This Follow-Up Service Procedure, and any subsequent revisions, is the property of UL and is not transferable. This Follow-Up Service Procedure contains confidential information for use only by the above named Manufacturer(s) and representatives of UL and is not to be used for any other purpose. It is provided to the Subscribers with the understanding that it is not to be copied, either wholly or in part unless specifically allowed, and that it will be returned to UL, upon request.

Capitalized terms used but not defined herein have the meanings set forth in the GSA and the applicable Service Terms or any other applicable UL service agreement.

UL shall not incur any obligation or liability for any loss, expense or damages, including incidental, consequential or punitive damages arising out of or in connection with the use or reliance upon this Follow-Up Service Procedure to anyone other than the above Manufacturer(s) as provided in the agreement between UL LLC or an authorized licensee of UL LLC, including UL Contracting Party, and the Manufacturer(s).

UL LLC has signed below solely in its capacity as the accredited entity to indicate that this Follow-Up Service Procedure is in compliance with the accreditation requirements.

Bruce A. Mahrenholz  
Director  
Conformity Assessment Programs (CPO)  
UL LLC

**Addendum to Authorization Page**

LOCATION

Manufacturing Factory(ies)  
Information:

Motien Technology Co LTD  
9 Keji 2nd Rd Technology Industrial Park  
Tainan 709031 Taiwan  
Party Site: 27782  
Subscriber No: 125645001  
Factory ID: None  
UL Contracting Party: UL GmbH

**UL Appendix:****GENERIC INSPECTION INSTRUCTIONS**

Product Category	Product Category CCN
Power Supplies, Medical and Dental - Component	QQHM

These instructions consist of the following Parts:

Part	Description
AA	Instructions and Responsibilities for UL Representative
AB	Instructions for Follow-Up Tests at UL
AC	Responsibilities and Requirements for Manufacturer
AD	General Terminology
AE	General Product Construction Requirements
AF	UL Certification Marks



**PART AA****INSTRUCTIONS AND DUTIES FOR UL REPRESENTATIVE**

AA1.0	<b>UL REPRESENTATIVE'S DUTIES</b>
AA1.1	<p>The UL Representative's duties include, but are not limited to:</p> <ul style="list-style-type: none"> <li>A. Examining the construction of production intended to bear the UL Mark or Marking to determine compliance with the description of the product and any other requirements expressed in this Procedure.</li> <li>B. Where so specified in each Test Report, forwarding samples to UL for Follow-Up tests.</li> <li>C. Where so specified by Part AC, inspecting the test records and facilities of the manufacturer to ensure that: <ul style="list-style-type: none"> <li>1. The proper number of samples are undergoing the required tests, and</li> <li>2. The required tests are being performed correctly, and</li> <li>3. The proper information is being recorded and is up-to-date, and</li> <li>4. The instruments being used for the tests have been calibrated at the prescribed interval and are in good working order.</li> </ul> </li> </ul>
AA2.0	<b>PROCEDURE IN CASE OF NONCONFORMANCE</b>
AA2.1	<p>Report to the manufacturer and UL LLC by means of a Variation Notice (VN) if:</p> <ul style="list-style-type: none"> <li>A. Variations in construction are found, or</li> <li>B. The manufacturer's method and/or frequency of testing is not as described, or</li> <li>C. The test records maintained by the manufacturer are not as described, or</li> <li>D. The manufacturer's inspection program is not being performed as described, or</li> <li>E. Nonconforming test results are witnessed during tests conducted specifically for the UL Representative.</li> </ul>
AA2.2	<p>Explain to the manufacturer that a VN is a means of communication with the manufacturer and applicant and forms a record of those items where nonconformance to the Procedure has been found.</p>
AA2.3	<p>When a product does not conform with the Procedure, require that the manufacturer:</p> <ul style="list-style-type: none"> <li>A. Remove any markings referencing UL from the product, or obliterate these markings where the marking is imprinted, die-stamped, molded, etc., or</li> <li>B. Suitably modify all products that do not comply with the Procedure, or</li> <li>C. Hold shipment pending further instructions from UL LLC</li> <li>D. Demonstrate that one of the conditions shown below exist and be able to provide any of the referenced information or documentation. Under the following conditions, variations from Procedure described constructions shall be noted on a Variation Notice, however, the manufacturer is not required to remove UL markings, rework the product or hold shipment. <ul style="list-style-type: none"> <li>1. A part is called out as Listed and the manufacturer or part number is not as described and the alternate part being used is Listed and all other attributes for the part are met.</li> <li>2. A part is called out as a Recognized Component (R/C) and the manufacturer or part number is not as described and the alternate part being used is Recognized under the described category and all other attributes for the part are met.</li> <li>3. Internal wiring is identified by UL Style Number and the manufacturer is using (R/C) Appliance Wiring Material (AWM) with Style Numbers not referenced in the Procedure description. The manufacturer must be able to provide documentation that the voltage and temperature ratings of the alternate Style Number are equal to or greater than the ratings of the Style Numbers specified in the Procedure. AWM with Style Numbers not</li> </ul> </li> </ul>

	specified in the Procedure must be rated VW-1.
AA2.4	It is the manufacturer's responsibility to forward a copy of the Variation Notice to the Applicant.
AA2.5	If the manufacturer or Applicant question the rejection of the product, the material may be held at the point of inspection, typically at the factory, pending an appeal. The manufacturer has the right to appeal a decision with which they disagree. Provide the name of the UL engineer to whom the appeal is to be made. To resolve issues involving variations in construction, the manufacturer and Applicant may also be offered the option of contacting their New Work assignment engineer. Held shipment appeals involving Follow-Up Services issues (e.g. -improper labeling, etc.) should be directed to an appropriate staff member designated by the Reviewing Office for the product category. Should UL grant temporary authorization for the continued use of the UL Mark, such temporary authorization shall only be for the time needed to review and/or process the Procedure revisions, or as otherwise specified to cover a particular lot or production run. The manufacturer shall satisfy the UL Representative that all marks referencing UL are removed from the rejected material. Those marks referencing UL not destroyed during their removal from the product shall be turned over to the UL Representative for destruction.

AA3.0	<b>EXAMINATIONS TO BE WITNESSED BY UL REPRESENTATIVE</b>
AA3.1	<b>Inspection of Printed Wiring Boards and Printed Wiring Board Assemblies</b>
AA3.1.1	The UL Representative shall determine that the printed wiring board is as specified in the Procedure.
AA3.1.2	If the soldering operation is performed at the Original Equipment Manufacturer's factory (OEM) and the soldering temperature and dwell time are given in the Procedure, the temperature and dwell time shall also be checked to determine that they do not exceed the limits specified.
AA3.1.3	The UL Representative shall determine that the printed wiring board is as specified in the Procedure. The UL Representative then shall make a visual inspection of the printed wiring board assemblies for any mechanical damage or evidence of exposure to excessive temperatures that may have occurred during the soldering operation. The base material and the conductors shall be examined for nonconforming features as indicated below: <ul style="list-style-type: none"> <li>A. Conductors, Terminal Pads, and Tabs <ul style="list-style-type: none"> <li>1. Reduction in cross-section, such as scratches, nicks, pin holes, tearing.</li> <li>2. Loosening or lifting of printed wiring conductor, pad, or tab from the base material.</li> <li>3. Sections missing or damaged.</li> <li>4. Blistering</li> <li>5. Breaks</li> </ul> </li> <li>B. Base Material <ul style="list-style-type: none"> <li>1. Warping</li> <li>2. Cracking</li> <li>3. Charring, blistering, or other heat damage due to solder process</li> <li>4. Delamination</li> </ul> </li> </ul>
AA3.1.4	Samples shall be selected at random as shown in Table AA1 in accordance with the size of the incoming lot. The lot is to be rejected in accordance with the fifth column of the table.
AA3.1.5	With respect to printed wiring boards using Surface Mounted Technology (SMT), if the SMT assembly process is done at temperatures and times below the soldering limits, the UL Representative will accept the boards. If the assembly process is conducted on-site with temperatures/times in excess of soldering limits or if the process is conducted off-site and the temperatures/times cannot be verified, a visual inspection will be conducted by the UL Representative in accordance with the guidelines shown above. If any instructions for SMT components are specified in the Procedure, then these SMT instructions are superseded.

TABLE AA1  
PRINTED WIRING BOARD SAMPLE SELECTION

Size of incoming lot# for each type##	Initial number of samples taken	Number of nonconforming samples requiring additional samples	Additional number of samples to retest lot	Cumulative number of nonconforming samples to reject lot
1 - 500	8	1	13	2
501 – 3200	13	1	20	2
3201 - 35000	20	1	32	2
Above 35000	32	1	50	2

## Notes:

# A lot is considered to comprise all printed wiring board assemblies of the same type at the manufacturer's factory at the time of the UL Representative's visit, which have not been previously checked by the UL Representative.

## A type is considered a printed wiring board assembly meeting all the following:

1. Same vendor who mounts and solders the components.
2. Same board manufacturer and type or catalog number.
3. Same size
4. Same pattern
5. Same components

AA4.0	<b>SAMPLE SELECTION FOR TESTS CONDUCTED AT MANUFACTURER AND UL</b>
AA4.1	<b>Standard Follow-Up Tests for Plastic Enclosures and Parts</b>
AA4.1.1	Each Test Report indicates the plastics enclosures or parts that may require Follow-Up Service testing. The UL Representative shall consult Table AA2 to determine which tests are required.
AA4.1.2	With respect to Table AA2, Access to Molding Operation shall be determined in accordance with the following:
	A. UL is considered to have access to the plastic molding operation if the molding takes place in the end-product assembly location and the operation complies with the requirements below.
	B. The UL Representative shall have free, unannounced, and immediate access to the factory and the storage facility during all business hours of the factory or storage facility. The UL Representative shall also have access to the records required below.
	C. The manufacturer shall mark each enclosure, cartons containing enclosures, or a tag accompanying the enclosure in a manner such that the UL Representative can trace the origin of each enclosure to a specific batch.
	D. The manufacturer shall keep records for each batch of plastic enclosures molded, in accordance with the below requirements.
	E. The records shall be thorough, so that the UL Representative may determine the composition of the enclosure. The records shall be maintained for at least six months from the date of production, and shall be accurate. All of the following items are to be covered:
	1. The records shall indicate the base material. The manufacturer may not blend resins. <i>Exception: The manufacturer may blend resins provided it is specifically stated in the Procedure.</i>
	2. The records shall include the amount of regrind used. Thermoplastic regrind shall not exceed 25 percent by weight. UL does not authorize the use of thermoset regrind. <i>Exception: Thermoplastic regrind may exceed 25 percent provided it is specifically stated in the Procedure and does not exceed the percent stated in the Procedure.</i>
	3. The composition of the enclosures shall not include recycled plastics, color concentrates, flame retardants, or mold release lubricants. <i>Exception: One or more of the elements indicated in 3) may be included, provided the Procedure specifically acknowledges its use.</i>
AA4.1.3	Where testing is required, samples are to be selected no less than once per year in accordance with each Test Report. All samples are to be handled in accordance with the requirements of this section.
AA4.1.4	Enclosure samples shall be chosen in a manner such that each enclosure material in use by the manufacturer is represented by tests no less than once over a two-year period. Enclosure materials that are used infrequently (i.e. less than once in a two year period) shall be selected whenever they are used.

TABLE AA2  
FOLLOW-UP TESTING FOR PLASTIC ENCLOSURES AND PARTS

Enclosure plastic	Molding location		
	Recognized Component molder or evaluated component molder other than Recognized <sup>d</sup>	Not evaluated molding	
		UL has access to molding operation <sup>a</sup>	UL does not have access to molding operation <sup>a</sup>
1. Recognized Component plastic	No impact test required	Reserved (no requirement)	Reserved (no requirement)
2. Unlisted Component plastic <sup>c</sup>	Annual Impact test required	Annual Impact test required	Impact test required at twice annually
<p><sup>a</sup>Access to molding operation means the molding takes place in the end-product assembly location and the manufacturer follows the requirements in Access to Molding Operation in AA3.</p> <p><sup>b</sup>The manufacturer may elect to perform an impact test in place of the ID Tests. If the manufacturer does not elect to perform the impact test, samples are to be selected for the ID tests. See Instructions for Sample Selection, AA4.</p> <p><sup>c</sup>The reference to Unlisted component plastic is in regard to a component plastic used in a Listed or Recognized product which is separately investigated in accordance with applicable requirements for the end-use product, and for which no coverage has been requested or established.</p> <p><sup>d</sup>The reference to evaluated component molder other than Recognized is in regard to a molder of plastic fabricated parts which has been authorized by UL to mold plastic for the end-use product, but for which no Recognition has been established.</p>			

AA4.1.5	<b>Impact Test at Manufacturer</b>
AA4.1.5.1	Where indicated in Table AA2, the UL Representative shall conduct the Impact Test as part of the product inspection at the manufacturer's facility and shall determine if the manufacturer records the test data in compliance with the requirements of this document  <i>Exception: As noted in Table AA2 footnote (d), the Impact Test shall be conducted at UL if the manufacturer does not have the ability to conduct the test.</i>
AA4.1.5.2	Each enclosure sample fabricated with the material specified in the Test Report shall be subjected to a single impact. The impact shall be directed onto the surface most likely to demonstrate a nonconformance when the Basis of Acceptability of AA4.1.5.3 is applied. The impact is to be produced by dropping a steel sphere 2 inches (50.8 mm) in diameter and weighing 1.18 pounds (0.536 kg mass) a height of 50.85 in. (129.2 cm). For surfaces other than the top of an enclosure the steel sphere is to be suspended by a cord and swung as a pendulum, dropping through the 50.85 in. (129.2 cm) vertical distance before striking the surface
AA4.1.5.3	Each sample shall withstand the impact of AA4.1.5.2 without being affected to the extent that: A. Uninsulated, live parts are accessible to contact, or B. The mechanical performance of the product is adversely affected so as to create a risk of injury to persons, or C. A condition is produced that can cause a risk of electric shock.
AA4.1.5.4	To determine compliance with AA4.1.5.3 (A), the UL Representative shall apply the articulate probe to verify that the probe cannot contact an uninsulated, live part. It is the manufacturer's responsibility to order and purchase the probe through UL's Corporate Standards Department, at the Northbrook Office.
AA4.1.5.5	To determine compliance with AA4.1.5.3 (B), the UL Representative shall give consideration to the functioning of safety devices and constructional features (such as thermostats, overload protective devices and strain relief). Cracking or denting of the enclosure shall not result in the exposure of moving parts that could cause a risk of injury to persons.
AA4.1.5.6	To determine compliance with AA4.1.5.3 (C), the product shall be subjected to a Dielectric Voltage-Withstand Test as described in AC2.3 without dielectric breakdown.
AA4.1.5.7	If the Impact Test sample produces any one of the conditions specified in AA4.1.5.3, the test is to be repeated on three previously untested samples from the same lot. The results are considered acceptable if all three samples comply with the requirements. If a nonconformance occurs on any one of the additional samples, then the lot shall be considered rejected.
AA4.1.6	<b>ID and Flammability Tests</b>
AA4.1.6.1	Samples selected in accordance with Table AA2 shall be tagged with all the following information, and the manufacturer shall forward them to the Reviewing Office: A. Material B. Manufacturer C. Model number D. Follow-Up Test(s) required E. Test parameters (if any)
AA4.2	<b>Standard Follow-Up Tests for Plastic Enclosures and Parts (Abnormal Operation, Mold Stress Relief Distortion and HB Flammability)</b>
AA4.2.1	Where specified by a Test Report, samples are to be collected once per year for these tests. All samples shall be tagged with all the following information, and the manufacturer shall forward them to the Reviewing Office: A. Material B. Manufacturer C. Model number

	D. Follow-Up Test(s) required
	E. Test parameters (if any)

**PART AB****INSTRUCTIONS FOR FOLLOW-UP TESTS AT UL**

AB1.0	<b>GENERAL</b>
AB1.1	The samples forwarded by the UL Representative shall be subjected to the tests indicated on the sample tags in accordance with any indicated test specifics (e.g. oven temperature).
AB1.2	Unless otherwise notes, all references are to the Generic Inspection Instructions.
AB1.3	<b>Abnormal Operation Test</b>
AB1.3.1	The sample shall be operated under the condition of abnormal operation indicated in the Test Report. During the test, the equipment is to rest on white tissue paper on a softwood surface and operate continuously until the ultimate results have been determined. In most cases, continuous operation for seven hours will be necessary in order to make sure that the ultimate results have been determined.
AB1.3.2	There shall be no ignition of the enclosure material, exposure of live parts, emission of flame or molten metal (except as noted below), nor glowing or flaming of the combustible material upon which the equipment is placed. Warping, shrinkage, expansion or cracking of the thermoplastic material is acceptable.  Emission of flame or molten metal that occurs through regular openings provided as a part of the enclosure design and construction (not openings which occur as a result of the performance of this test) are acceptable.

**TABLE AB1**  
**TEST PARAMETERS**

Test	Method	Basis for Acceptability
Impact	AA4.1.5.2	AA4.1.5.3 – AA4.1.5.7
Identification		
Qualitative Infrared Analysis (IR)	UL 746A	Compare to original spectrum in Test Report
Differential Scanning Calorimetry (DSC)	UL 746A	Compare to original thermogram in Test Report
Thermogravimetry (TGA)	UL 746A	Compare to original thermogram in Test Report
Flammability		
3/4 Inch Flame	UL 746C	UL 746C
5 Inch Flame	UL 746C	UL 746C
Mold Stress-Relief Distortion	UL746C	UL746C
HB Flammability	UL746C	UL746C
Abnormal Operation	AB1.3.1	AB1.3.2



**PART AC****RESPONSIBILITIES AND REQUIREMENTS FOR MANUFACTURER**

AC1.0	<b>MANUFACTURER'S RESPONSIBILITIES (INCLUDING BUT NOT LIMITED TO)</b>
AC1.1	<u>Control of UL Mark</u> - Restrict the use of markings that reference UL (either directly or by use of the name, an abbreviation of it, or the UL symbol or Classification Mark, or indirectly by means of agreed-upon markings that are understood to indicate acceptance by UL) to those products that are found by the manufacturer's own inspection to comply with the Procedure description. Such restrictions apply to packaging, brochures or other means of advertising that reference UL. Use of such markings is further limited by the agreements that have been executed by the subscriber and UL. Markings shall be confined to the locations authorized in these Generic Inspection Instructions or in individual Test Reports.
AC1.2	<u>Access to Factory</u> - During hours in which the factory is in operation, provide the UL Representative with free access to any portion of the premises where the product or components thereof are being fabricated, processed, finished or stored, and to the test area assigned for the UL Representative's use. The UL Representative shall be permitted to inspect and subject to prescribed tests, prior to shipment, any product bearing or intended to bear markings referencing UL.
AC1.3	<u>Production-Line Tests</u> - Conduct the tests detailed in Part AC2.0.
AC1.4	<u>Required Records</u> - Maintain records of test performance. The records shall include the model or catalog designation of the product, the date of production, the tests performed, number of units tested, test results and action taken on rejections. Records for test performance shall be retained for six (6) months and shall be readily available for review by the UL Representative.  <u>Exception</u> - Records of test results need not be maintained for 100% Production-Line Tests.
AC1.5	<u>Test Equipment and Personnel</u> - Provide, at a convenient location, all required test equipment and facilities and any required personnel for conducting all tests that are to be performed at the factory. These shall be available when needed so that the inspection work can proceed without undue delay.
AC1.6	<u>Test Equipment Calibration</u> - Determine that the test equipment is functioning properly daily, and have it calibrated at least annually, or whenever it has been subject to abuse (such as being dropped or struck with an object) or its accuracy is questionable. The test equipment and instruments shall be calibrated either by the manufacturer or by an outside laboratory. In either case, it shall be calibrated by comparison with a standard that is traceable to the applicable U.S. or foreign National Standard. A letter from the outside laboratory or from an off-site manufacturer's calibration lab stating that their lab standards are directly traceable to their country's National Standard and outlining their traceability pathway is considered adequate proof of traceability. For in-house calibrations, the Standard (weight and gauge blocks, etc.) used shall be calibrated every three years, or whenever the Standard has been subject to some form of abuse that may affect the Standard's fitness for use. The Standard shall be stored to protect it from damage or deterioration per the Standard manufacturer's recommendations. Records of the calibration of the test equipment and Standard(s) shall be maintained until the next required calibration is completed and recorded, and shall be readily available for review by the UL Representative.
AC1.7	<u>Samples for Follow-Up Testing at UL</u> - If Part AA4.0 specifies that samples are required to be forwarded to UL for Follow-Up Testing, the manufacturer shall forward the samples selected by the UL Representative, to the specified UL Testing Laboratory, within five working days of the UL Representative's inspection visit. Packaging and shipment of the samples are the responsibility of the manufacturer.
AC1.8	<u>Substitution of Non-Specified Plastic Materials</u> - Non-specified plastic materials may not be substituted for Procedure described materials unless a minimum flammability rating at a minimum thickness is described. Before a non-specified plastic material can be used, current UL certification documentation must be checked to ensure that the plastic material has a flammability rating as

	<p>specified at the thickness specified. Acceptable UL certification documentation includes: (a) the current edition of the Recognized Component Directory or Supplement; (b) the UL Online Certification Directory (<a href="http://www.ul.com/database">http://www.ul.com/database</a>); a copy of the plastic material company's Recognition Report; or d) a copy of the Recognition Card. The Component Recognition Report or Recognition Card may be used only if it is issued after the latest publication of the Recognized Component Directory.</p> <p>It is the responsibility of the manufacturer to provide the UL Representative with the above documentation.</p> <p>NOTE: The above does not apply to materials for which the specific manufacturer and type designation of the plastic is specified in the individual Test Reports (i.e. Enclosures).</p>
AC1.9	<p><u>Substitution of Non-Specified PWBs</u> – Non-specified printed wiring boards may not be substituted for Procedure described materials unless a minimum flammability rating or maximum operating temperature is described. Before a non-specified printed wiring board can be used, current UL certification documentation must be checked to ensure that the printed wiring board meets the specified flammability rating, operating temperature rating, solder and dwell times, and direct support requirements. Acceptable UL certification documentation includes: (a) the current edition of the Recognized Component Directory or Supplement; (b) the UL Online Certification Directory (<a href="http://www.ul.com/database">http://www.ul.com/database</a>); (c) a copy of the printed wiring board company's Recognition Report; or (d) a copy of the Recognition Card. The Component Recognition Report or Recognition Card may be used only if it is issued after the latest publication of the Recognized Component Directory.</p> <p>It is the responsibility of the manufacturer to provide the UL Representative with the above documentation.</p> <p>NOTE: The above does not apply to materials for which the specific manufacturer and type designation of the plastic is specified in the individual Test Reports (i.e. Enclosures).</p>
AC1.10	<p><u>Articulate Probe</u> - If the need for an articulate probe is identified in AA4.1.5, it is the manufacturer's responsibility to purchase the probe, and make it available for the UL Representative's use. The probe may be ordered through UL's Corporate Standards Department, at the Northbrook Office.</p>

AC2.0	<b>REQUIREMENTS FOR PRODUCTION-LINE TESTS</b>
AC2.1	The following Production-Line Tests shall be conducted on the products covered by this Procedure. During production, the test equipment shall be checked for proper operation at least once during each shift. When the tests are not performed concurrently, it is preferred that the Grounding Continuity Test be performed before either Dielectric Voltage-Withstand Test.
AC2.2	<b>Production-Line Grounding Continuity Test</b>
AC2.2.1	<p><u>General</u> - Except as may be noted under "Exceptions" in each Test Report, the manufacturer shall subject 100 percent of production of all of the following products to a routine Production-Line Grounding Continuity Test as described in section AC2.2.3:</p> <p>A. Products that are provided with a grounding type power supply cord, or  B. Fixed products that are for permanent connection to the branch circuit.</p> <p>Exception: This test is not required for permanent connection to the branch circuit by fixed wiring if the design does not employ bonding jumpers or grounding wiring to remote units.</p>
AC2.2.2	<u>Test Equipment</u> - Any suitable continuity-indicating device (such as an ohmmeter, a battery and buzzer combination, or the like) may be used to determine compliance with the Grounding Continuity Test requirements.
AC2.2.3	<u>Method</u> - Continuity shall be determined between the grounding conductor of the attachment plug cap, and/or the designated main grounding point, and accessible dead-metal parts of the product, using the test equipment indicated above.
AC2.2.4	<u>Basis for Acceptability</u> - There shall be grounding continuity between the parts specified.
AC2.3	<b>Production-Line Dielectric Voltage-Withstand Test</b>
AC2.3.1	<u>General</u> - Except as may be noted under "Exceptions" in each Test Report, the manufacturer shall subject 100 percent of production of all products to a routine Production-Line Dielectric Voltage-Withstand Test as described in section AC2.3.3.
AC2.3.2	<p><u>Test Equipment</u> - The test equipment shall include a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually operated reset device to restore the equipment after electrical breakdown or an automatic feature that rejects any unacceptable unit. If an ac test potential is applied, the test equipment shall also include a transformer having an essentially sinusoidal output.</p> <p>If the output of the test-equipment transformer is less than 500 volt-amperes, the equipment shall include a voltmeter in the output circuit to indicate the test potential directly.</p> <p>If the output of the test-equipment transformer is 500 volt-amperes or more, the test potential may be indicated (1) by a voltmeter in the primary circuit or in a tertiary-winding circuit, (2) by a selector switch marked to indicate the test potential, or (3), in the case of equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manually operated reset switch has been reset following a dielectric breakdown.</p> <p>Test equipment other than that described above may be used when it can be shown that UL has previously confirmed in writing that the equipment complies with the above requirements and is deemed suitable for use for this test.</p>
AC2.3.3	<p><u>Method</u> - Each product shall withstand without electrical breakdown, as a routine production-line test, the application of an ac potential at a frequency within the range of 40-70 Hz or DC potential between the primary wiring, including connected components, and accessible dead metal parts that are likely to become energized.</p> <p>The test potential and duration shall be in accordance with Table AC1. The manufacturer's test conditions may be higher than those shown in Table AC1 when necessary to comply with other international product safety certifications.</p>

	<p>The product may be in a heated or unheated condition for the test.</p> <p>The test shall be conducted when the product is complete (fully assembled), and it is not intended that the product be unwired, modified, or disassembled for the test, unless otherwise permitted below:</p> <ul style="list-style-type: none"><li>A. A part, such as a snap cover or a friction-fit knob, that would interfere with conducting the test need not be in place.</li><li>B. The test may be conducted before final assembly if the test parameters represent that for the completed product.</li></ul> <p>During the test, the primary switch is to be in the on position, both sides of the primary circuit of the product are to be connected together and to one terminal of the test equipment, and the second test-equipment terminal is to be connected to accessible dead metal.</p> <p>Electromagnetic interference filter capacitors connected to the primary circuit shall not be disconnected during the test.</p>
AC2.3.4	<p><u>Basis for Acceptability</u> - All products shall withstand the applied potential without an indication of electrical breakdown.</p>

**TABLE AC1**  
**DIELECTRIC VOLTAGE-WITHSTAND TEST CONDITIONS**

Appliance Rating and Form	Test Potential (V rms)	Test Potential (V dc)	Time	Test Potential (V rms)	Test Potential (V dc)	Time
105 - 130 Volts with or without a motor rated ½ horsepower and not applied to or contacted by persons in normal use	1000	1400	1 min	1200	1700	1 sec
105 - 130 Volts and applied to or contacted by persons in the intended use or with a motor rated more than ½ horsepower	$1000 + 2*U^a$	$1414 + 2.828*U^a$	1 min	$1200 + 2.4*U^a$	$1700 + 3.4*U^a$	1 sec
210 - 600 Volts	$1000 + 2*U^b$	$1414 + 2.828*U^b$	1 min	$1200 + 2.4*U^b$	$1700 + 3.4*U^b$	1 sec
<sup>a</sup> - Maximum marked voltage but not less than 120 volts <sup>b</sup> - Maximum marked voltage but not less than 240 volts						

AC2.4	<b>Production-Line Patient Circuit Dielectric Voltage-Withstand Test</b>
AC2.4.1	<u>General</u> - Except as may be noted under "Exceptions" in each Test Report, the manufacturer shall subject 100 percent of production of the specified products to a routine Patient Circuit Production-Line Dielectric Voltage-Withstand Test as described in section AC2.3.3.
AC2.4.2	<u>Test Equipment</u> - The equipment shall be as specified in AC2.3.2.
AC2.4.3	<u>Method</u> - The test method shall be as specified in AC2.3.3 except: A. The potential shall be applied between the primary wiring and the applied part (patient connection). B. The test potential and duration shall be in accordance with Table AC2.
AC2.4.4	<u>Basis for Acceptability</u> - All products shall withstand the applied potential without an indication of electrical breakdown.

**TABLE AC2**  
**PATIENT CIRCUIT DIELECTRIC VOLTAGE-WITHSTAND TEST CONDITIONS**

Appliance Rating and Form	Test Potential (V rms)	Test Potential (V dc)	Time	Test Potential (V rms)	Test Potential (V dc)	Time
Any	2500	3500	1 min	3000	4250	1 sec

**PART AD****GENERAL TERMINOLOGY**

AD1.0	<b>ABBREVIATIONS / DEFINITIONS</b>	
AD1.1	KAM	Known Agency Mark (Refer to Table AE3)
AD1.2	LP	Limited Power- A circuit with maximum available power of 15 or less
AD1.3	PWB	Printed wiring board
AD1.4	PRI	Primary (mains)
AD1.5	SEC	Secondary

## PART AE

## GENERAL PRODUCT CONSTRUCTION REQUIREMENTS

AE1.0	<b>CONSTRUCTION DETAILS</b>
AE1.1	Unless otherwise described or supplemented in individual Test Reports, the following requirements apply to all equipment included in this Procedure. It is the manufacturer's responsibility to assure the compliance of production with these requirements.
AE1.1.1	<u>Accessories Parts and Accessories</u> - Such items packaged with the product shall be specifically described in a Test Report.
AE1.1.2	<u>Adapters</u> – Three or two wire grounding type adapters shall not be furnished with the product unless specifically authorized by a Test Report.
AE1.1.3	<u>Attachment Plugs</u> - When a Test Report describes the power supply cord as being brazed, welded or both crimped and soldered to the plug, and the production line cannot be reviewed, the UL Representative will be required to cut open a sample of the attachment plug for confirmation.
AE1.1.4	<u>Bonding</u> - Except where specifically noted in a Test Report, bonding of internal dead-metal parts to the enclosure for grounding purposes shall be accomplished by a positive means such as clamping, riveting, bolting or screwed connection. The bonding connection shall reliably penetrate any nonconductive coatings such as paint or vitreous enamel.
AE1.1.5	<u>Casualty Considerations</u> - Except as described, or as necessary for normal operation of the equipment, there shall be no sharp edges, burrs, points, or spikes inside or outside the device that may cause injury during use or during cleaning operations.
AE1.1.6	<u>Connectors</u> - Connectors shall be applied so as to ensure that all bare strands are contained and insulated.
AE1.1.7	<p><u>Grounding</u> - The following guidelines shall be observed:</p> <p>A. <u>Non-Detachable Cord Connected Appliance</u> - The equipment-grounding conductor of the flexible cord:</p> <ol style="list-style-type: none"> <li>1. Shall be connected to the grounding member of the attachment-plug cap.</li> </ol> <p>Note: The grounding member of the attachment-plug shall be fixed in position with respect to the cap.</p> <ol style="list-style-type: none"> <li>2. Shall be conductively connected to all dead-metal parts of the product that are specified in the description as being connected to the grounding conductor. The grounding-conductor shall be connected by either (1) a screw or other reliable means which serves no other purpose and which is not liable to be removed during any servicing operation, or (2) a threaded grounding stud on which a closed ring connector secured to the ground conductor is the first conductor mounted and secured by a nut and split ring lockwasher. Solder alone shall not be used for securing this conductor.</li> </ol> <p>Note: The screw or stud and nut shall: (1) be provided with a means to penetrate nonconductive coatings, such as paint or enamel; (2) be of a corrosion-resistant metal or shall be protected against corrosion; and (3) be marked on or adjacent with a grounding symbol or the IEC417 Grounding Symbol 5019 “⊕”. The installation instructions shall identify the meaning of the symbol.</p>

	<p>B. <u>Detachable Cord Connected Appliance</u> - Polarization shall be maintained through the load fitting of the cord (appliance coupler) and the mating connector (appliance inlet) on the product. The load fitting shall be a three wire ANSI configuration.</p> <p>Exception: The load fitting need not be an ANSI configuration provided it is wired as follows (the description applies when viewing the face of the connector on the product, with the center contact down):</p> <ol style="list-style-type: none"> <li>1. The right contact shall be connected to the grounded conductor (neutral) of the cord.</li> <li>2. The center contact shall be connected to the grounding conductor of the cord.</li> </ol> <p>C. <u>Permanently-Connected Products</u> - In a permanently connected product (1) all exposed metal parts, and (2) all dead-metal parts within the enclosure, which are specified in the description as being connected (see “Bonding”) to the grounding conductor, shall be conductively connected to:</p> <ol style="list-style-type: none"> <li>1. The point of the enclosure at which the metal raceway of the power supply circuit will be connected, and</li> <li>2. The equipment-grounding field-wiring terminal or lead.</li> </ol> <p>The equipment-grounding terminal or grounding lead shall be connected to the frame or enclosure by a positive means, such as by a bolted or screwed connection. The grounding connection shall reliably penetrate nonconductive coatings, such as paint or vitreous enamel. The grounding point shall be so located that it is unlikely that the grounding means will be removed during normal servicing.</p> <p>A wire-binding screw intended for the connection of an equipment-grounding conductor shall be identified by the protective earth symbol. The head shall be either hexagonal shaped or slotted, or both. A pressure wire connector intended for connection of an equipment grounding conductor shall be identified by the protective earth symbol “⊕”.</p> <p>The wire-binding screw or pressure wire connector shall be so located that it is unlikely to be removed during normal servicing of the unit.</p> <p>D. <u>Grounding Terminal</u>:- The grounding conductor shall be the first conductor terminated on a grounding terminal and secured by a separate nut. Other grounding conductors may be secured to this terminal if they are secured on top of the first nut by a second nut.</p>
AE1.1.8	<p><u>Indicators</u> - Indicator lights shall be clearly visible to the equipment operator.</p>
AE1.1.9	<p><u>Internal Plastic Parts</u> - For each type of plastic material the manufacturer shall review the Recognized Component Directory and Supplement or UL Online Certification Directory (<a href="http://www.ul.com/database">http://www.ul.com/database</a>) in order to insure that the plastic material in question meets all the material characteristics specified (i.e. flammability rating, Relative Thermal Index (RTI), and color) at the thickness specified. Alternatively, a copy of the Plastic Manufacturer’s Component Recognition Report or Recognition Card may be used as a traceability pathway only if these materials were issued after the latest publication of the Recognized Component Directory.</p>
AE1.1.10	<p><u>Internal Wiring</u> - Conductors shall be routed away or protected from sharp edges and moving parts. Exception: LC that are reliably separated from PRI and SEC circuits need not be Recognized AWM.</p>
AE1.1.11	<p><u>Lampholder Connections</u> - All screw shells of lampholders shall be connected to the same conductor of the supply circuit.</p>
AE1.1.12	<p><u>Loose Strands</u> - Ends of stranded conductors shall have all strands contained to prevent contacting of, or reduction of spacing to, other live parts and dead metal. This can be accomplished by:</p> <ol style="list-style-type: none"> <li>A. Tinning</li> <li>B. Inserting properly into suitable wire connectors.</li> </ol>



	<p>C. Crimped connectors and/or eyelets with the crimp containing all strands</p> <p>D. Solder lugs.</p>
AE1.1.13	<u>Markings</u> - Required information shall be legibly marked on the product, in the manner and minimum height specified.
AE1.1.14	<u>Multiple Voltage</u> - Cord-connected multiple voltage products shall be provided with an attachment plug that is suitable for the voltage for which the product is set.
AE1.1.15	<p><u>Polarity</u> - An appliance intended for permanent connection to the source of supply and having an identified terminal or lead; and an appliance employing a power supply cord with a polarized attachment plug cap (excluding 250 volt, 2-pole and 250 volt, 3-pole, 3-phase), utilizing the components indicated, shall have the components wired as follows:</p> <p>A. <u>Lampholders and Receptacles</u> - The screw shell or identified terminal or lead of a lampholder and the identified terminal or lead of a receptacle, shall be connected to the identified grounded conductor or terminal within the product.</p> <p>B. <u>Switches (Single Pole)</u> - Unless otherwise specified in the Procedure, a manual single pole switch, and an automatic control with a marked "off" position, shall not be connected to the identified grounded conductor.</p>
AE1.1.16	<p><u>Power Supply Cords</u></p> <p>A. <u>Non-Detachable Power Supply Cord</u> – A non-detachable power supply cord as described in each Test Report <u>must</u> be provided and shipped with the unit in <u>all</u> cases. The power supply cord and any alternatives must be described in each Test Report. <u>Each conductor of a non-detachable power supply cord shall have only one color, except the conductor identified by a combination of green and yellow.</u></p> <p>B. <u>Detachable Power Supply Cord</u> – The detachable power supply cord as described in each Test Report may or may not be shipped with the unit. Follow the guidelines in Table AE1 to apply the alternatives under each of the situations described in the notes to Table AE1. Table AE1 also includes alternative detachable power supply cords that may be shipped with units intended for use outside the USA.</p>
AE1.1.17	<p><u>Printed Wiring Boards (PWBs)</u> - PWBs shall show no burning, bubbling or other visible evidence of damage to their conductors or substrate material as a result of the fabrication process.</p> <p>With respect to PWBs using Surface Mounted Technology (SMT), it is acceptable if the SMT assembly process is done at temperatures and times below the soldering limits. If the SMT assembly process is conducted on-site with temperatures/times in excess of soldering limits or if the process is conducted off-site and the temperatures/times cannot be verified, a visual inspection shall be conducted by the UL Representative.</p> <p>The PWBs shall be inspected by the manufacturer for mechanical damage or evidence of exposure to excessive temperatures that may have occurred during the soldering operation. If any nonconforming features (defined below) are found after visual inspection, the manufacturer shall reject the lot (as defined in Table AA1). Otherwise, the use of PWBs may continue without any interruption.</p> <p>The base material and the conductors shall be examined for nonconforming features as indicated below.</p> <p>A. Conductors, Terminal Pads, and Tabs</p> <ol style="list-style-type: none"> <li>1. Reduction in cross-section, such as scratches, nicks, pin holes, tearing.</li> <li>2. Loosening or lifting of printed wiring conductor, pad, or tab from the base material.</li> <li>3. Sections missing or damaged.</li> <li>4. Blistering</li> </ol>

	<p>5. Breaks</p> <p>B. Base Material</p> <ol style="list-style-type: none"> <li>1. Warping</li> <li>2. Cracking</li> <li>3. Charring, blistering, or other heat damage due to solder process</li> <li>4. Delamination</li> </ol>
AE1.1.18	<p><u>Protection of Wiring</u> - All wire and wire insulation in the product shall be protected from damage. This is commonly achieved by securement, segregation, and routing to keep the wire away from parts or assemblies which can damage the wire or insulation. Internal wiring that might make contact with metal parts shall be protected from sharp metal edges. This can be accomplished by rounding or deburring the metal, using a Recognized Component bushing, or through other construction features described in the Test Report.</p> <p>If the wiring is located where it may be in proximity to combustible material, it shall be protected by the method(s) described in the individual Test Report.</p> <p>Conductors shall be examined for evidence of damage. Faulty practices which can cause damage to conductors and/or insulation include:</p> <ol style="list-style-type: none"> <li>A. Improper application of crimped connectors, including but not limited to, use of crimping tool and dies not recommended by the manufacturer of the connector.</li> <li>B. Improper insulation removal.</li> <li>C. Overheating of conductor insulation because of routing or contact with hot surfaces during or after installation.</li> <li>D. Use of wire in which the insulation has been cut, cracked, crushed, abraded, etc.</li> </ol> <p>Constructions which may cause damage to conductors and/or insulation include:</p> <ol style="list-style-type: none"> <li>A. Moving parts such as rotating or reciprocating cams, shafts, and the like, as well as removable or sliding covers, hinged doors.</li> <li>B. Sharp edges and corners (including screw threads, burrs, points, stamped metal edges).</li> <li>C. Heat sources (including lamps, heating elements, etc.).</li> <li>D. Assemblies that clamp or squeeze wire insulation, unless described in the Test Report.</li> </ol>

AE1.1.19	<p><u>Securement of Parts</u> - Screws or other fastenings used to mount or support small, fragile, insulating parts shall not be tight enough to cause cracking or breaking of these parts. Uninsulated live parts, components which support live parts, and dead metal parts, that are normally intended to remain stationary, shall be prevented from rotating or shifting if movement will result in twisting or stress of internal wiring or connections, or spacings being reduced below that specified in the Test Report. Similar parts that are normally intended to move or rotate shall be prevented from excessive movement if such movement will result in twisting or stress of internal wiring or connections, or spacings being reduced below that specified in the Test Report.</p> <p>A switch, lampholder, attachment plug receptacle, motor attachment plug cap, or other components subject to handling by the user shall be mounted securely and prevented from rotating.</p> <p>Exception: Based on engineering considerations certain constructions of securely mounted push button or plunger type switches, and lampholders of the type in which the lamp cannot be replaced (such as a neon pilot or indicator light in which the lamp is sealed in a non-removable jewel) may be excluded from the above. These constructions are described in the Procedure. However, in no case will nonconforming spacings be allowed.</p> <p>Some means commonly used to prevent rotation are:</p> <ul style="list-style-type: none"> <li>A. Lock washer.</li> <li>B. Matched keying of the component and its mounting.</li> <li>C. Two or more fasteners (screws, rivets, pins, etc.).</li> <li>D. Strap, clip, or pin fitted into an adjacent part.</li> <li>E. Physical barrier (molded boss, side of enclosure, adjacent component, etc.) that bears against the component.</li> </ul>
AE1.1.20	<p><u>Solder Connections</u> - All solder connections shall be made mechanically secure before soldering. Some typical examples of mechanical securement are:</p> <ul style="list-style-type: none"> <li>A. Twisting wire around a solder post that has a change in dimension or restriction so unsoldered wire will not slip off post.</li> <li>B. Inserting wire through an opening, and bending over the free end.</li> </ul>
AE1.1.21	<p><u>Strain Relief</u> - Strain Relief methods such as tying the supply cord into a knot or tying the ends of the cord with string shall not be used.</p>
AE1.1.22	<p><u>Usage Markings</u> - There shall be no marking in the instruction manual, or on the carton or package that is, or could be construed to be, in conflict with or an extension of the use covered in the Test Report.</p>



















TABLE AE1  
DETACHABLE POWER SUPPLY CORD REQUIREMENTS

Detachable Power Supply Cord	
Provided	Not Provided
A or B	(C and D) or (C and E)
A. The power supply cord should be as described in the Test Report.	
B. The detachable power supply cord is either: <ol style="list-style-type: none"> <li>1. Certified by one of the agencies listed in Table AE3; or</li> <li>2. Comprised of cordage marked with an agency marking per Table AE3 or marked per Table AE4. The fittings are to be marked with at least one of the agencies listed in Table AE3.</li> </ol> Units provided with detachable power supply cords, which are certified by one of the agencies listed in Table AE3 or AE4, shall be considered to be intended for use outside of the USA.	
C. A marking must be provided adjacent to the appliance coupler or at an equivalent location either to inform the user on proper selection of the power supply cord or to see the instruction manual for this information. This marking may be in the form of a tag, nonpermanent label, or product insert that is provided on or packaged with the product so that the marking is visible at the time of installation.	
D. The marking (tag, label, or product insert) or instruction manual must contain complete instructions concerning selection of the power supply cord. It shall include either Option 1, 2, or 3 as follows: <ol style="list-style-type: none"> <li>1. Reference to a power supply cord must be as a UL Listed detachable power supply cord consisting of the specific configuration of appliance coupler, the cord type, and the electrical rating of the power supply cord as described in each Test Report. Refer to Table AE2 for equivalent cord types.</li> <li>2. Reference to a power supply cord may be made to a Listed field installed accessory kit containing a suitable Listed power supply cord. Authorization for use of a Listed field installed accessory kit must be included in the individual Test Reports.</li> <li>3. Reference to a power supply cord may be made to a cord that is not Listed and not intended for use in the United States or Canada. In this case, the manufacturer is to supply the UL Representative with information to verify that the referenced cord is certified or similarly appropriate for use in the destination country.</li> </ol>	
E. The reference to the power supply cord (see Note C) shall include instruction for selection of the proper power supply cord as described in Note B above.	

TABLE AE2  
EQUIVALENT CORDS

Basis Cord Type	Equivalent Types
SP-2	SPE-2, SPT-2
SP-3	SPE-3, SPT-3
SV	SVE, SVO, SVOO, SVT, SVTO, SVTOO
SJ	SJE, SJO, SJOO, SJT, SJTO, SJTOO
S	SE, SO, SOO, ST, STO, STOO

**TABLE AE3  
CERTIFICATION MARKINGS**

Country	Cert. Agency	Mark	Country	Cert. Agency	Mark
Argentina	IRAM		Ireland	NSAI	
Australia	SAA		Italy	IMQ	
Austria	OVE		Japan	JET, JQA	
Belgium	CEBEC		Netherlands	KEMA	
Canada	CSA		Norway	NEMKO	
China	CCC		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA	
Germany	VDE			BSI	

**TABLE AE4**  
**HAR FLEXIBLE CORDS**  
**APPROVAL ORGANIZATIONS AND CORDAGE HARMONIZATION MARKING METHODS**

Approval Organization	Printed or Embossed Harmonization Marking (May be Located On Jacket or Insulation of Internal Wiring)		Alternative Marking Utilizing Black-Red Yellow Thread (Length of color Section, mm)		
Comite Electrotechnique Belge (CEBEC)	CEBEC	<HAR>	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V. Prufstelle	<VDE>	<HAR>	30	10	10
Union technique de l'Electricite (UTE)	UTE	<HAR>	30	10	30
Instituto Italiano del Marchio di Qualita (IMQ)	IEMMEQU	<HAR>	10	30	50
British Approvals Service for Electric Cables (BASEC)	BASEC	<HAR>	10	10	30
N.V. KEMA	KEMA-KEUR	<HAR>	10	30	30
SEMKO AB Svenska Elektriska materielkontrollanstalter	SEMKO	<HAR>	10	10	50
Österreichischer Verband für Elektrotechnik (ÖVE)	<ÖVE>	<HAR>	30	10	50
Danmarks Elektriske Materialkontroll (DEMKO)	<DEMKO>	<HAR>	30	10	30
National Standards Authority of Ireland (NSAI)	<NSAI>	<HAR>	30	30	50
Norges Elektriske Materielkontroll (NEMKO)	NEMKO	<HAR>	10	10	70
Asociacion Electrotecnica Y Electronica Espanola (AEE)	<UNED>	<HAR>	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	<HAR>	30	30	70
Instituto Portages da Qualidade (IPQ)	np	<HAR>	10	10	90
Schweizerischer Elektro Technischer Verein (SEV)	SEV	<HAR>	10	30	90
Elektriska Inspektoratet	SETI	<HAR>	10	30	90




**PART AF**  
**UL CERTIFICATION MARK**

<i>Product Category:</i>	Power Supplies, Medical and Dental - Component
<i>Product Category CCN:</i>	QQHM2 / QQHM8
<i>Product Identity:</i>	Not Applicable for this Standard/CCN.

**UL Recognition Mark:**

AF1.1	Products Recognized under UL's Component Recognition Service are identified by marking elements consisting of:
AF1.1.1	The Recognized Company's identification specified in this document.
AF1.1.2	A catalog, model or other applicable product designation specified in the descriptive sections of this document.
AF1.1.3	The UL Recognized Component Mark shown below.
AF1.2	Only those components, which actually bear the Marking, should be considered as being covered under the Recognition Program. The UL Listing or Classification Mark is not authorized for use on or in connection with Recognized Components.
AF2.3	For products (such as implantable devices) where use of the Classification Mark is not feasible, the complete Classification Mark will appear on the carton or on the smallest unit container in which the product is packaged. The product's accompanying documents will contain the complete Classification Mark as described above.

**Recognized Component Mark**

AF2.2	Recognized only to United States safety requirements:  
AF2.3	Recognized only to Canadian safety requirements:  
AF2.4	Recognized to both U.S. and Canadian safety requirements:  
AF2.5	Minimum size of the Recognized Component Mark is not specified as long as it is legible. Minimum height of the registered symbol ® shall be 3/64 inch but may be omitted if it is out of proportion to the Recognized Component Mark or not legible to the naked eye.
AF2.6	The manufacturer may reproduce the Mark electronically. Any decision regarding the acceptability of the manufacturer's Mark reproduction will be made at the Reviewing Office.

**Description****UL TEST REPORT AND PROCEDURE**

<b>Standard:</b>	AAMI ES60601-1:2005,ES60601-1:2005/AMD1 1:2012 , ES60601-1:2005/AMD2:2021, CAN/CSA-C22.2 No. 60601-1:08, CAN/CSA-C22.2 No. 60601-1:14 (including amendment 1) and Amendment 2:2022
<b>Certification Type:</b>	Component Recognition
<b>CCN:</b>	QQHM2 / QQHM8
<b>Complementary CCNs:</b>	
<b>Product:</b>	Component DC-to-DC Converter for use in medical equipment
<b>Model:</b>	JMR20XXYZZ, where XX can be 24 (9-36) or 48 (18-75) for input voltage, Y can be S (single) or D (dual) for number of outputs, ZZ can be 05, 12, or 15 for output voltage
<b>Rating:</b>	JMR2024S05: Input: 9-36Vdc, 2680 mA; Output: 5Vdc, 4000mA  JMR2024S12: Input: 9-36Vdc, 2630 mA; Output: 12Vdc, 1670mA  JMR2024S15: Input: 9-36Vdc, 2584 mA; Output: 15Vdc, 1330mA  JMR2024D05: Input: 9-36Vdc, 2726 mA; Output: $\pm 5$ Vdc, $\pm 2000$ mA  JMR2024D12: Input: 9-36Vdc, 2600 mA; Output: $\pm 12$ Vdc, $\pm 833$ mA  JMR2024D15: Input: 9-36Vdc, 2615 mA; Output: $\pm 15$ Vdc, $\pm 667$ mA  JMR2048S05: Input: 18-75Vdc, 1330 mA; Output: 5VDC, 4A  JMR2048S12: Input: 18- 75Vdc, 1300 mA; Output:12Vdc, 1670mA  JMR2048S15: Input: 18- 75Vdc, 1292 mA; Output: 15Vdc, 1330mA  JMR2048D05: Input: 18- 75Vdc, 1355 mA; Output: $\pm 5$ Vdc, $\pm 2000$ mA  JMR2048D12: Input: 18- 75Vdc, 1292 mA; Output: $\pm 12$ Vdc, $\pm 833$ mA  JMR2048D15: Input: 18- 75Vdc, 1300 mA; Output: $\pm 15$ Vdc, $\pm 667$ mA
<b>Applicant Name and Address:</b>	XP Power LLC 15641 Red Hill Ave, Suite 100 Tustin, CA 92780, USA

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability as applicable.

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.



Prepared by: Longjie Zhang, Project  
Handler

Reviewed by: David V. Alma, Reviewer

### Supporting Documentation

The following documents located at the beginning of this Procedure supplement the requirements of this Test Report:

- A. Authorization - The Authorization page may include additional Factory Identification Code markings.
- B. Generic Inspection Instructions -
  - i. **Part AC** details important information which may be applicable to products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of this Test Report.
  - ii. **Part AE** details any requirements which may be applicable to all products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of each Test Report.
  - iii. **Part AF** details the requirements for the UL Certification Mark which is not controlled by the technical standard used to investigate these products. Products are permitted to bear only the Certification Mark(s) corresponding to the countries for which it is certified, as indicated in each Test Report.

### Product Description

Component DC-DC converter for use in medical power supplies  
Refer to the Report Modifications page for any modifications made to this report.

### Model Differences

All models are similar except for model designation, input rating, output rating, schematic, PWB layout, and Transformer (T1).  
See attached Model Difference for details.

### Additional Information

A review of IEC 60601-1:2005/AMD1: 2012 testing, methodologies, and equipment has determined it is equivalent to IEC 60601-1:2005/AMD1:2012/AMD2:2020 for tests conducted.

The following test were selected as representative of the test program applicable to model covered by this CBTR: Temperature Test, Humidity Conditioning, Dielectric Voltage Withstand

Those test have been witnessed for models selected as representative of the product family covered by this report and of the applicable test program.

### Technical Considerations

- The product was investigated to the following additional standards: EN 60601-1: 2006+A2:2021
- The following additional investigations were conducted: None
- The product was not investigated to the following standards or clauses: Biocompatibility, EMC, Usability
- The following accessories were investigated for use with the product: None
- None

### Engineering Conditions of Acceptability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- Technical Considerations:
  1. Scope of Power Supply evaluation defers the following clauses to be determined as part of the end product investigation:
    - All clauses related to Risk Management
    - Clause 4.3 (Essential Performance)
    - Clause 7.2 (Marking on the outside of ME EQUIPMENT or ME EQUIPMENT parts)
    - Clause 7.5 (Safety Signs),
    - Clause 7.9 (Accompanying Documents),

- Clause 8.7 (LEAKAGE CURRENTS and PATIENT AUXILIARY CURRENTS),
- Clause 9 (Mechanical Hazard),
- Clause 10 (Radiation),
- Clause 11.6 (Overflow, spillage, leakage, ingress of water or particulate matter, cleaning, disinfection, sterilization and compatibility with substances used with the ME EQUIPMENT)
- Clause 11.8 (Interruption of the power supply/ SUPPLY MAINS to ME EQUIPMENT)
- Clause 14 (PEMS),
- Clause 15.3 (Mechanical Strength),
- Clause 16 (ME Systems)
- All clauses related Usability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

1. The power supply terminals and/or connectors are: Suitable for factory wiring only
2. The output circuits have not been evaluated for direct patient connections.
3. The power supply has been evaluated for use up to a max altitude 5000 meters, Multiplication factor 1.29 used for MOPP air clearances
4. The power supply provides the following Means of Protection:
  - 2 [MOPP] based upon a working voltage of 250Vrms/354Vpk between Primary and Secondary for Models JMR2024S05, JMR2024S12, JMR2024S15, JMR2024D05, JMR2024D12, JMR2024D15
  - 2 [MOPP] based upon a working voltage of 250Vrms/354Vpk between Primary and Secondary for Models JMR2048S05, JMR2048S12, JMR2048S15, JMR2048D05, JMR2048D12, JMR2048D15
5. The dielectric strength test was conducted based on the peak working voltages and means of protection above.
6. Marking legibility (CI 7.1.2) and durability (CI 7.1.3) have not been evaluated.
7. Printed Wiring Board(s) in the power supply are rated a minimum of 130 Degrees C and a minimum flame rating of V-1
8. Transformer T1 employs a Class F Insulation System.
9. The investigated Pollution Degree is: 2
10. Manufacturer's specified maximum operating ambient: 55C
11. Overcurrent releases of adequate breaking capacity must be employed in the end product
12. Testing was conducted with external fuses rated 125Vdc/4A for models input rated 9-36Vdc, 125Vdc/2A fuse for model input rated 18-75Vdc. If different fusing is provided in the end-product, additional testing shall be considered.
13. The power supply was subjected to an elevated humidity test at 30°C, 93%RH for 48h
14. The unit is a DC/DC converter intended to be powered by an isolated regulated secondary DC source and has not been evaluated for connection to SUPPLY MAINS; suitable MAINS separation shall be provided during final installation
15. Temperature, Leakage Current, Protective Earthing Dielectric Voltage Withstand and Interruption of the Power Supply tests should be considered as part of the end product evaluation
16. The following end-product enclosures are required: Electrical / Fire
17. Proper cleaning requirements shall be evaluated within the end-product application
18. Interruption of power supply shall be evaluated in end-product application
19. Usability shall be evaluated in end-product application
20. The Risk Management Requirements were not addressed



**TABLE: List of Critical Components**

8.10	<b>TABLE: List of critical components</b>				
Component/ Part No.	Manufacturer/ Trademark	Type No./model No./	Technical data	Standard No. <sup>1</sup>	Required Mark(s) & Certificates of Conformity
Enclosure	TORAY INDUSTRIES INC	A504X90	Rated V0, 130°C; min. thickness 0.28 mm	UL 94, UL 746C	UL - QMFZ2 E41797
PCB	Interchangeable	Interchangeable	Rated min V-1, min 130C	UL 758	UL - ZPMV2
Optocoupler (CIC2) -	Everlight Electronics Co Ltd	EL1018V	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 110C	UL 1577, IEC 60747-5-5:2007/AMD1:2013	UL - FPQU2 E214129
Optocoupler (CIC2) - alternate	CT Micro International Corp	CT1018-W	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 125C	UL 1577, EN 60747-5-5:2011+A1:2015	UL - FPQU2 E364000
Optocoupler (CIC2) - alternate	COSMO Electronics Corp	KT1018	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 115C	UL 1577, EN 60747-5-5:2011+A1:2015	UL - FPQU2 E169586
Optocoupler (CIC2) - alternate	LITE-ON Optoelectronics	LTV-1008	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 110C	UL 1577, IEC 60747-5-5:2007/AMD1:2013	UL - FPQU2 E113898
Optocoupler (CIC2) - alternate	Fairchild Semiconductor Corp	FODM1008	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 110C	UL 1577, EN 60747-5-5:2011+A1:2015	UL - FPQU2 E90700
Optocoupler (CIC2) - alternate	RENESAS ELECTRONICS CORPORATION	PS2381-1	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 115C	UL 1577, IEC 60747-5-5:2020	UL - FPQU2 E72422
Optocoupler (CIC2) - alternate	Vishay Semiconductor GmbH	TCLT1018 or VOL617A	Double protection Isolate 5000Vrms, DTI 0.4 mm min. 110C	UL 1577, EN 60747-5-5:2011+A1:2015	UL - FPQU2 E76222
Transformer (T1)	Motien Technology Co Ltd	See Enclosure "Transformer Specs"	-	-	-
Transformer (T1)- insulation system	Motien Technology Co Ltd	MT-155-G	Rated 155 (Class F insulation system), See enclosure Diagram for constructions and components	UL 1446	UL - OBJY2 E487974
Transformer (T1) - Core	Encore Electronics Technology Co., Ltd	NP7	overall dimensions approx.16.5mm by 11mm by 3.4mm	Evaluated in this application	Evaluated in this application
Transformer (T1) – Core - alternate	Interchangeable	Interchangeable	overall dimensions approx.16.5mm by 11mm by 3.4mm	-	-
Transformer (T1) - Bobbin -	Celanese International Corp.	7130	V-0, 130C, min 0.25mm thick	UL94	UL - QFMZ2 E344082
Tape	3M COMPANY	1205	155 degrees C	UL 510A	UL - OANZ2 E17385
Tape (Alternate)	3M COMPANY	1218	180 degrees C	UL 510A	UL - OANZ2 E17385
Tape (alternate)	3M COMPANY	92	180 degrees C	UL 510A	UL - OANZ2 E17385
Tape (alternate)	Symbio INC	KA170	200 degrees C	UL 510A	UL - OANZ2 E50292
Tape (alternate)	Symbio INC	KA180	200 degrees C	UL 510A	UL - OANZ2 E50292
Tape (Alternate)	3M COMPANY	PIA220	180 degrees C	UL 510A	UL - OANZ2 E17385

Transformer (T1) Primary wire	Jung-Shing Wire Co., Ltd	SFBW-2	155 degrees C	UL 1446	UL - OBMW2 E174837
Transformer (T1) Primary wire - Alternate	Jung-Shing Wire Co., Ltd	SFBY-2	155 degrees C	UL 1446	UL - OBMW2 E174837
Transformer (T1) Primary wire - Alternate	TA YA ELECTRIC WIRE & CABLE CO.LTD.	TYPY-F155	155 degrees C	UL 1446	UL - OBMW2 E84201
Transformer (T1) Primary wire - Alternate	TA YA ELECTRIC WIRE & CABLE CO.LTD.	TYA1-U155	155 degrees C	UL 1446	UL - OBMW2 E84201
Transformer (T1) Primary wire - Alternate	Suntek Holdings Limited	UEW155	155 degrees C	UL 1446	UL - OBMW2 E234867
Transformer (T1) Primary wire - Alternate	ELEKTRISOLA (MALAYSIA) SDN BHD	P155	155 degrees C	UL 1446	UL - OBMW2 E143312
Transformer (T1) Primary wire - Alternate	ELEKTRISOLA (MALAYSIA) SDN BHD	P155P	155 degrees C	UL 1446	UL - OBMW2 E143312
Transformer (T1) Primary wire - Alternate	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWF	155 degrees C	UL 1446	UL - OBMW2 E85640
Transformer (T1) Primary wire	Interchangeable	Interchangeable	Min 155 degrees C	UL 1446	UL - OBMW2
Transformer (T1) Secondary wire	GREAT LEOFロン INDUSTRIAL CO LTD	TRW(F)-M-(H), triple insulated wire used	Triple insulated wire, 155 degrees C	UL 2353	UL - OBT2 E211989
-	-	-	-	-	-
Potting Compound - (not relied upon for isolation)	MOMENTIVE PERFORMANCE MATERIALS(NAN TONG) CO LTD	TSE3331	Min V-1,min 105 °C	UL 94, UL 746C	UL – QMFZ2 E320603
Potting Compound - alternate (not relied upon for isolation)	MOMENTIVE PERFORMANCE MATERIALS	TSE3331	Min V-1,min 105 °C	UL 94, UL 746C	UL – QMFZ2 E36952
Potting Compound - alternate (not relied upon for isolation)	MOMENTIVE PERFORMANCE MATERIALS JAPAN L L C	TSE3331	Min V-1,min 150 °C	UL 94, UL 746C	UL – QMFZ2 E56745
Potting Compound - alternate (not relied upon for isolation)	Interchangeable	Interchangeable	Min V-1, min 105°C	UL 94, UL 746C	UL – QMFZ2
MOSFET (Q2)	Infineon	BSC098N10NS5	OptiMOS power transistor, Drain- source 100-200V max, rated 150°C max.	Evaluated in this application	Evaluated in this application
MOSFET (Q2)	Interchangeable	Interchangeable	OptiMOS power transistor, Drain- source 100-200V max, rated 150°C max.	Evaluated in this application	Evaluated in this application
Temperature sensor (IC1)	Texas Instruments	LM26LV	Operating ambient: - 40C to 150C	Evaluated in this application and didn't operate during normal and/or abnormal tests	Evaluated in this application

Supplementary information:

The Test Laboratory has verified the component information.

- 1) Anything specified within brackets "( )" is for reference purposes only and can be used to specify the UL Product Category CCN(s)/File Number if the component includes an UL Certification. This can be useful for the UL Follow-Up Service Inspection associated with the UL Mark; however if in brackets, should not be a required element of the UL Inspection.

----- END OF APPENDIX C -----