General Information or Other (PAR) Event # 46401

Rep Org:	CURTISS WRIGHT FLOW CONTROL CO.	**Notification Date / Time:**	11/08/2010 13:48 (EST)
Supplier:	QUALTECH NP	**Event Date / Time:**	09/16/2010 (EST)
		Last Modification:	11/08/2010
Region:	3	**Docket #:**	
City:	CINCINNATI	**Agreement State:**	Yes
County:		**License #:**	
State:	OH		
NRC Notified by:	KURT MITCHELL	**Notifications:**	ANN MARIE STONE R3DO
HQ Ops Officer:	JOHN KNOKE		KATHLEEN O'DONOHUE R2DO
Emergency Class:	NON EMERGENCY		PART 21 GROUP
10 CFR Section:			
21.21	UNSPECIFIED PARAGRAPH		

PART 21 REPORT - UPS MOTHERBOARD FAILED PRE-SERVICE INSPECTION

The information below is a summary of a report received via facsimile from QualTech NP dated November 8, 2010.

"This letter provides notification per regulation 10 CFR Part21 concerning the discovery through testing and evaluation of (4) four UPS System motherboards that reported to have failed pre-service inspection prior to installation into a UPS system at Southern Nuclear- Farley Station Unit 1 TDAFWP UPS 'B' Section. Trentec (now known as QualTech NP) provided these safety related motherboards for installation on a UPS system manufactured by (OEM) Dependable Power System.

"The (4) four questionable motherboards were returned to QualTech NP for testing and evaluation to determine operability of their safety function including fit, form and function for use within the UPS System. Southern Nuclear Condition Report, CR2010109013, states 'Motherboard (DPS 20050061, SN 354, Trentec Tag # 7T55201 SN01) with different valued resistors and or different locations than original motherboard...'

"QualTech NP developed a new dedication plan (DPS2010.0 Rev.1) to evaluate the returned motherboards for fit, form and function. The plan involves visual inspection verification - QualTech NP compared the returned boards to DPS BOM lists to identify any differences; and functional performance verification - the functionality of the items were verified by performance testing as factory Go/No Go board tests using a UPS system to the parameters defined in the existing referenced dedication plans.

"Visual inspection of the motherboards found one resistor installed in the wrong location. Performance testing of motherboards found the resistor installed in the wrong location affected the safety function of the UPS system.

"The motherboard with the resistor installed in the wrong location failed to operate during performance testing. The

IE19
NRR

General Information or Other (PAR) Event # 46401

motherboard was reworked by original equipment manufacturer (OEM) who removed the resistor in question and re-installed it in the correct location. The repaired motherboard was performance tested and found acceptable for safety function for use within the UPS system.

"QualTech NP has reviewed its customer project / PO files and has determined the dedicated UPS system (2) and these motherboards with Date Code 2007 have only been provided to Southern Nuclear-Farley Station Unit 1 & 2 (total quantity- 4). Southern Nuclear- Farley Station Unit 1 & 2 has two (2) motherboards in service. QualTech NP has addressed the dedication and testing of motherboards by the developing a new dedication plan (DPS2010.0 Rev. 1). Southern Nuclear has reviewed and approved this new plan.

"QualTech NP's conclusion is that the resistor in the wrong location on the motherboard caused the UPS system not to operate during performance testing and established the equipment would not perform its intended safety function. After rework, relocation of the resistor, and retesting the UPS system became operable and was performing its safety related function. QualTech NP has completed testing, evaluation, and repair of motherboards, no further action is required."

****

FAX

CURTISS WRIGHT Flow Control Company
QualTech NP

☒ Urgent ☐ Please Reply

Fax To:	**U.S. Nuclear Regulatory Commission**	Date Sent:	11/8/2010
Attention:	**Operation Center**	From:	Kurt Mitchell, General Manager
Company:		Company:	QualTech NP
Phone:	301-816-5151	Phone:	513-528-7900
Number Pages:		Fax:	513-528-9292
cc:			

Subject: Part 21 Reportable Condition Notification UPS System Mother Board (PC 1 & 11)

Reference: Manufacture, Dependable Power Systems (DPS), PN 20050061 (Date Code 2007)

Thank You.

QualTech NP
4600 East Tech Drive • Cincinnati, OH 45245
Phone: 513.528.7900 • Fax: 513.528.9292
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CURTISS WRIGHT Flow Control Company
QualTech NP

November 8, 2010

Via Facsimile
U.S. Nuclear Regulatory Commission
Operation Center
Fac. 301-816-5151

Via Regular Mail
NRC's Document Control Desk
U.S. Regulatory Commission
Washington, DC 20555-0001

Subject: Part 21 Reportable Condition Notification – UPS System Mother Board (PC 1 & 11)

Reference: Manufacture, Dependable Power System (DPS), PN 20050061 (Date Code 2007)

Dear Sir,

This letter provides notification per regulation 10CFRPart21concerning the discovery through testing and evaluation of (4) four UPS System motherboards that reported to have failed pre-service inspection prior to installation into a UPS system at Southern Nuclear – Farley Station Unit 1 TDAFWP UPS "B" Section. Trentec (now known as QualTech NP) provided these safety related motherboards for installation on a UPS system manufactured by (OEM) Dependable Power System.

Background:
The (4) four questionable motherboards were returned to QualTech NP for testing and evaluation to determine operability of their safety function including fit, form and function for use within the UPS System. Southern Nuclear Condition Report, CR2010109013, states "Motherboard (DPS 20050061, SN 354, Trentec Tag # 7T55201 SN01) with different valued resistors and or different locations than original motherboard…"

QualTech NP developed a new dedication plan (DPS2010.0 Rev. 1) to evaluate the returned motherboards for fit, form and function. The plan involves visual inspection verification – QualTech NP compared the returned boards to DPS BOM lists to identify any differences; and functional performance verification – the functionality of the items were verified by performance testing as factory Go/No Go board tests using a UPS system to the parameters defined in the existing referenced dedication plans.

Observation during Evaluation:
Visual inspection of the motherboards found one resistor installed in the wrong location. Performance testing of motherboards found the resistor installed in the wrong location affected the safety function of the UPS system.

The motherboard with the resistor installed in the wrong location failed to operate during performance testing. The motherboard was reworked by original equipment manufacturer (OEM) who removed the resistor in question and re-installed it in the correct location. The repaired motherboard was performance tested and found acceptable for safety function for use within the UPS system.

Extent of Condition:
QualTech NP has reviewed its customer project / PO files and has determined the dedicated UPS system (2) and these this motherboards with Date Code 2007 have only been provided to Southern Nuclear-Farley Station Unit 1 & 2 (total quantity- 4). Southern Nuclear – Farley Station Unit 1 &2 has two (2) motherboards in service. QualTech NP has addressed the dedication and testing of motherboards by the developing a new dedication plan (DPS2010.0 Rev. 1). Southern Nuclear has reviewed and approved this new plan.

Conclusion & preventative Action:
QualTech NP's conclusion is that the resistor in the wrong location on the motherboard caused the UPS system not to operate during performance testing and established the equipment would not perform its intended safety function.. After rework, relocation of the resistor, and retesting the UPS system became operable and was performing its safety related function. QualTech NP has completed testing, evaluation, and repair of motherboards, no further action is required.

Regards,

KMitchell

Kurt Mitchell
General Manager

Attached:

QualTech NP 10CFR Part 21 Report
QualTech NP Evaluation Report

10 CFR 21 Report
Dependable Power System (DPS) Motherboard Failures for use in the Turbine Driven Auxiliary Feedwater Pump Uninterruptible Power Supply

The following 10 CFR 21 written report is provided by QualTech NP, Business unit of Curtiss Wright Flow Control Corporation for Joseph M. Farley Nuclear Plant (Farley). The contents are in accordance with 10 CFR 21.21(d)(4).

(i) Name and address of the individual or individuals informing the Commission.

Mr. Kurt Mitchell
General Manager
4600 East Tech Drive
Cincinnati, OH 45245

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

The basic component containing the defect is a Dependable Power System (DPS) Motherboard (PN 20050061, DPS SN 354, Trentec Tag # 7T55201 SN01. Date Code 2007.) Trentec commercially dedicated the motherboard for use in safety related applications. The associated Trentec part number is 7T20701 with a 2007 manufacturing date..

(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

QualTech NP, Business Unit of Curtiss Wright Flow Control Corporation
4600 East Tech Drive
Cincinnati, OH 45245

(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

Resistor R43 installed in wrong location (R42). The defective motherboards reported to have failed pre-service visual inspection prior to installation into a UPS system at Southern Nuclear – Farley Station Unit 1 TDAFWP UPS "B" Section.

The Auxiliary Feedwater (AFW) system for each unit consists of two motor driven pumps and one turbine driven pump. The TDAFWP UPS for each unit has an A and B section for system redundancy, with one motherboard used in each section. The motherboards currently installed in the Farley 1 TDAFWP UPS B section and Farley 2 TDAFWP UPS B section do not have the suspect date code. (total of two).

The use of a defective motherboard for scheduled component replacement for the UPS would cause a start-up delay. Together with a single failure of one of the motor driven AFW pumps would leave the remaining motor driven AFW pump to ensure the reactor coolant system was properly cooled via the steam generators during emergency condition.

However, two of the three AFW pumps are required to satisfy the flow demand for the most limiting associated design basis accidents and transients, i.e., feedwater line break, main steam line break, and loss of main feedwater. Accordingly, the flow demand is needed to mitigate the consequences of these events which can result in over-

10 CFR 21 Report
Dependable Power System (DPS) Motherboard Failures for use in the Turbine Driven Auxiliary Feedwater Pump Uninterruptible Power Supply

pressurization of the reactor coolant pressure boundary, and to prevent uncovering the reactor core and potential radiological releases. Additionally, credit for operation of the TDAFWP is needed for coping with a station blackout event during which the TDAFWP is the only source of AFW.

(v) The date on which the information of such defect or failure to comply was obtained.

The motherboard defect information was obtained September 16, 2010

Southern, Farley Nuclear plant notified QualTech NP, 7/27/2010, that there could be a problem with the motherboards for use in the UPS system. Note, no failures of boards have occurred in service but questions were identified during pre-service inspection at Plant Farley. The motherboards were received at QualTech NP, September 15, 2010 for testing and evaluation. Southern Nuclear approved the test/dedication plan for the re-inspection and evaluation of the subject board on September 16, 2010.

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for, being supplied for, or may be supplied for, manufactured, or being manufactured for one or more facilities or activities subject to the regulations in this part.

The Dependable Power System (DPS) Motherboard (PN 20050061, DPS SN 354, Trentec Tag # 7T55201 SN01. Date Code 2007.) was for a quantity of one (1) each, shipped 11/7/2007 after repair services were performed including replacement of R43.

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

Corrective action is complete. The motherboard has been repaired and tested. The dedication plan has been revised by QualTech NP and approved by Southern Nuclear.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

Ensure procurement of replacement components are in accordance with QualTech NP dedication plan (DPS2010.0 Rev. 1)

(ix) In the case of an early site permit, the entities to whom an early site permit was transferred.

Not applicable.

QualTech NP
Report No.: DPS2010.0
Revision: 1

EVALUATION REPORT
FOR VARIOUS
DEPENDABLE POWER SYSTEMS, INC.
UPS CIRCUIT CARDS

CURTISS WRIGHT Flow Control Company
QualTech NP
4600 EAST TECH DRIVE
CINCINNATI, OHIO 45245
(513) 528-7900

This report (numbered above) is exclusively prepared to support the qualification of items listed herein, or items referenced in certification documents issued only by QualTech NP referencing this report number.

This plan may not be used for any other purpose or by any other organization except QualTech NP or their authorized agents.

REVIEWS AND APPROVALS

PREPARED BY:

Mike Wooldridge — Date 10/8/10
Product Manager

INDEPENDENT DESIGN /APPROVED BY:

Michael Bell, — Date 10/8/10
Operations Test Manager

RECORD OF REVISION

Revision Number	Issue Date	Prepared By	Reviewed By	Pages Revised and Description
0	09/24/10	MJW	MWB	Original Issue
1	10/8/10	MJW	MWB	Pages 4, 7, & 8

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Total Pages: 23

1.0 SCOPE

The purpose of this dedication report is to confirm that the requirements and procedure for performing re-inspection & re-testing activities on the items listed in Section 3.0 with results reported. This report is structured to address the Farley condition reports on select circuit boards supplied by QualTech NP (formerly Trentec) as safety related items & to report on the inspected boards returned under the QualTech NP return authorization program.

Additional testing and inspections may be required in some cases beyond what is presented in the` plan. Future dedications of this equipment will be based upon the QualTech plan noted in Section 2.0 as well as the original dedication plans referenced in table 3.1.

2.0 APPLICABLE DOCUMENTS, CODES, AND STANDARDS

All testing and inspection was conducted to meet the requirements of the following documents, codes, and standards:

10 CFR Part 21, "Reporting of Defects and Noncompliance".

10 CFR Part 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"

ASME NQA-1, "Quality Assurance Requirements for Nuclear Facility Applications"

ANSI/ASME N45.2-1977 "Quality Assurance Program Requirements for Nuclear Facilities"

NP-5652 (NCIG-07) Guidelines for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications

QualTech NP procedure QAP-8.06, current revision, "Dedication and Supply of Commercial Grade Items Having Safety Related Applications"

Qualification Report 3L001.0 Rev.1

Return Authorizations:	Orig. APC PO
RA7T552-1	QP070972/002
RAT8236-1	QP080390/001
RAT8589-1	QP081107
RAT8626-1	QP081176

Farley Condition Reports CR2010110041, CR2010110060, CR2010109013 (provided as reference only, reports were not provided to QualTech NP)

QualTech NP Test Plan DPS2010-1 Rev. 0

3.0 INTRODUCTION

The subject Southern Nuclear purchase orders (reference section 2.0) required dedication and the supply of Dependable Power Systems (DPS) parts listed in Table 3.1. After delivery to Plant Farley, this equipment was returned to QualTech NP for the investigation of possible design or fabrication errors. R1

Three Condition Reports were generated by Southern Nuclear against the QualTech NP supplied equipment. They are summarized as follows: R1

CR2010109013 Motherboard (DPS 20050061) – different valued resistors &/or different locations than original motherboard; discussed between Farley & DPS

CR2010110041 Rectifier/Charger Control Board (DPS 20010004) – R52 was a different value, R104 was added to the board; IC1, IC13, IC16, & IC17 had one pin soldered that was previously cut off

CR2010110060 Evaluation of CR2010110041 for Part 21 Reportability

Of these three reports, only two identified discrepancies & only one of these two was specific to the findings. However, based upon the concerns for design control by the manufacturer, QualTech NP is treating all circuit boards consistently with additional verification activities outlined in the QualTech NP Test Plan DPS2010-1 Rev. 0 (see Section 2.0) for both the current returned items under the referenced RAs and for all future sales as clarified herein.

The email dated 7/27/2010, from John Avery, Contracts Agent, is the formal notification from Southern, Farley Nuclear plant that there is a problem with the circuit boards used in the UPS system. Note that no failures of boards have occurred in service due to manufacturing defects or workmanship. The problems were identified during pre-service inspection at Plant Farley. R1

On July 27, 2010, George Kenney (QualTech NP Cincinnati QA Manager) had a conversation with John Avery and Floyd Vanderian, AFW System Engineer, to discuss problems with circuit boards reported during a sales meeting and by CR 2010109013. The first problem with the boards was noted over two (2) years ago. There was no CR created, nor was Trentec informed of the problem. CR 2010109013 was written within the month but not formally reported to Trentec/QualTech until July 27, 2010. During the conversation Southern could not identify any problems in writing found on the circuit boards.

Floyd Vanderian, informed John Avery and George Kenney that they, Southern, to address the problems with the boards, bypassed Trentec and went directly to the suppler of the UPS. Southern at the time could not identify what action was taken by the manufacture.

According to Bill Speth of DPS (OEM), he discovered that the defective motherboard was manufactured incorrectly (board manufactured in 2007) while at Floyd Vanderian's desk at Farley (April 2010 per Bill Speth), prior to intended installation.

3.1 Description of Equipment

Table 3.1 provides descriptions of the customer returned parts that were re-tested per the original test methodology and then installed in QualTech's qualification specimen to verify operability in a UPS system.

TABLE 3.1

Item#	Dependable Power Systems Inc. Part Number, Description, DPS SN, & Trentec Tag Number	Dedication Plan for functional testing
1 (Qty 3)	DPS PN 20010002 Rectifier Control Board, 130V (PC 5 & 15) DPS SN 10451 Trentec Tag # T823610F SN01 DPS SN 10471 Trentec Tag # T862601F SN01 DPS SN 10472 Trentec Tag # T863601F SN02	4L004EL-1 R2

Item#	Dependable Power Systems Inc. Part Number, Description, DPS SN, & Trentec Tag Number	Dedication Plan for functional testing
2 (Qty 5)	DPS PN 20010004 Rectifier/Charger Control Board, 48V (PC 1 & 11 daughter board) DPS SN 10452 Trentec Tag # T823610B SN01 DPS SN 10469 Trentec Tag # T862601B SN01 DPS SN 10470 Trentec Tag # T862601B SN02 DPS SN 10464 Trentec Tag # T858906 SN01 DPS SN 10465 Trentec Tag # T858906 SN02	4L004EL-1 R2
3 (Qty 3)	DPS PN 20020004 Inverter Control Board, 48V (PC 1 & 11 daughter board) DPS SN 20427 Trentec Tag # T823610C SN01 DPS SN 20439 Trentec Tag # T862601C SN01 DPS SN 20440 Trentec Tag # T862601C SN02	4L004EL-1 R2
4 (Qty 3)	DPS PN 20030001 Static Switch Control Board, 120V 1Phase (PC 1 & 11 daughter board) DPS SN 30418 Trentec Tag # T823610D SN01 DPS SN 30432 Trentec Tag # T862601D SN01 DPS SN 30433 Trentec Tag # T862601D SN02	4L004EL-1 R2
5 (Qty 3)	DPS PN 20040014 Alarm & Meter Board, 48V 1Phase (PC 2 & 12) DPS SN 40352 Trentec Tag # T823610G SN01 DPS SN 40367 Trentec Tag # T862601G SN01 DPS SN 40368 Trentec Tag # T862601G SN02	T8236EL-1 R0
6 (Qty 4)	DPS PN 20050061 Mother Board (PC 1 & 11) DPS SN 400 Trentec Tag # T823610A SN01 DPS SN 411 Trentec Tag # T862601A SN01 DPS SN 412 Trentec Tag # T862601A SN02 DPS SN 354 Trentec Tag # 7T55201 SN01	7L002EL-1 R1
7 (Qty 3)	DPS PN 20060000 Static Switch Gate Board (PC 1 & 11 daughter board) Note: no DPS SN Trentec Tag # T823610E SN01 Trentec Tag # T862601E SN01 Trentec Tag # T862601E SN02	4L004EL-1 R2

4.0 TEST SEQUENCE

After the returned boards were received at QualTech NP, the following sequence of activities occurred:

A cursory inspection was performed prior to testing with the following results:

1. Rectifier / Charger Board, PN 20010004, Trentec Tag # T823610B SN 01, DPS SN 10452 was received with shipping/handling damage. SW1 was replaced by Bill Speth of DPS with QualTech NP witnessing, prior to proceeding. (Toggle switch stroke worked only in one direction & could not be fully moved to opposite position.)

2. Alarm / Meter Board PN 20040014, Trentec Tag # T823610G SN 01, DPS SN 40352 was received with shipping/handling damage. SW7 was found to be defective. (Push Button Switch was non-functional, cover rotated 90 degrees from top to side.) This switch will be replaced upon receipt of replacement part.
3. Mother Board PN 20050061 Trentec Tag # 7T55201SN 01, DPS SN 354 had R43 mis-installed into R42 location. In this mis-configured condition, R43 would prevent the SCR from gating thus if installed would not have permitted the UPS section to operate. Note: per Bill Speth of DPS, who found the error while at APC, this board was not taken to the UPS for installation as it was discovered while at the APC engineer's desk. The resistor was removed & re-installed in the proper R43 location by Bill Speth prior to proceeding.

Functional Performance Verification – The functionality of the items were verified by performance testing as factory Go/No Go board tests to the parameters defined in the existing referenced dedication plans in table 3.1. These were "bench" type tests performed by Bill Speth using DPS test fixtures and performed by Bill Speth with QualTech NP witnessing. All boards (except Tag # T823610G SN 01) were tested and all passed the functional tests.

Note: Motherboards have tin plated connectors. In all cases, the motherboards, prior to installation & successful testing, had an eraser (or equivalent) applied to the sides of the connector pins nearest the PCB edge to remove any possible oxidation prior to insertion. Failure to do so can result in unexpected intermittent connectivity with indeterminate operating results. DPS recommends using the pink/red eraser at the end of a pencil or the larger pink/red hand held eraser.

Other than Tag # T823610G SN 01, all boards were then tested within the qualification Test Sample UPS system to further confirm fit and complete electrical operability. In all cases the tested boards performed properly and met their respective fit, form, & functions with the UPS system functioning normally.

Inspection verification – QualTech NP compared the returned boards to DPS BOM lists to identify any differences. Any differences in the BOMs and the boards were identified and either documented as BOM documentation errors or were justified. Due to time constraints and high confidence from successful testing within the operating Qualification Test Sample UPS, QualTech NP limited this activity to one of the most densely populated PCBs, the Alarm Meter Board, the board previously having only a resistance test, the Mother Board, and a Rectifier/ Charger board with the following findings:

Review of Alarm/Meter Board PN 20040014, DPS S/N 40367 Trentec Tag # T86201G SN 01:

1. Missing IC15 (4020 Ripple Counter) – Missing so that horn doesn't go off per APC's request
2. Missing C88 (0.01uF 100V Capacitor) – redundant noise suppression Substituted IC20 (drawing calls for OP07, used TL071ACP) – different mfr but equivalent Added D34 (1N4004) – not required but no impact on fit, form, and function
3. Not on BOM list but quantity shown in BOM is correct (LED 22, 23, & 25)
4. R35A labeled on PCB as R42A – silk screen error
5. BOM's DE4 (1K 1% 1/4W resistor) – BOM typo (Qty of 3 accounted for with R20, R64, & R67)
6. BOM's ZD5 (1N4744A 15V 1W Zener Diode) should be ZD6 (ZD5 also called out as 5W on next line in BOM, the 5W part is correct) – BOM typo
7. SW6 has different settings than qualification sample (Side A) - PCB dependent setting
   a. TS-A, 1 to 5 set as On, Off, Off, Off, On
   b. SN 40367 set as On, On, On, On, Off
8. SW10 has different settings than qualification sample (Side A) location 1 of sw10 is not used on this design therefore it can be in either position with no effect
   a. TS-A, 1 to 5 set as Off, Off, Off, Off, On
   b. SN 40367 set as On, Off, Off, Off, On

Each of the above had no impact on fit, form or function.

Review of Motherboard PN 20050061, DPS SN 354, Trentec Tag # 7T55201 SN01:

- R43 was mis-installed into R42, corrected by Bill Speth of DPS

Motherboards have several resistors that work within a range of values (thus can change from time to time without impacting operability).

1. R41 can be any nominal resistor between 200 ohms & 1000 ohms
2. R30 – R32, & R38 can be any value from a jumper to 10 ohms and any wattage up to 2W. The purpose of these resistors are to fail when another component fails, saving the clad on the PCB. Jumpers & larger wattage resistors could permit PCB's copper clad to fuse as a secondary failure but does not affect operability. This scenario of the manufacturer's approved variance is valid for this range of resistor values anywhere in the system.
3. R43 can be any equivalent nominal resistor between 45 & 55 ohms with 1/2W equivalent rating.

Each of the above had no impact on fit, form or function.

Review of Rectifier/Charger Board PN 20010004, DSP SN 10452, Trentec Tag # T823610B SN01:

1. Q1 per BOM is TIP126 transistor but part is TPP126 - different mfr
2. R37, R41, & R42 per BOM are 0.1 ohm 2W resistors, parts are 0.01Ohm 2W resistors - same as motherboard (jumper to 10 ohms range is acceptable per the manufacturer)
3. R52 is not on BOM - added when application is for single phase only, BOM error
4. R109 per BOM is 470K, installed 590K - value determined during testing
5. TP1 test terminal is missing - BOM error, no longer installed
6. Opto-Isolators/Couplers, IC's 1 & 2 require pin 6, in place. IC 18 required pin 6 to be removed when using the hot standby option. This is no longer required due to APC no longer wanting units used in Hot Standby. To conserve battery life, APC is using the units in cold standby mode. For all other applications of these ICs the pin 6 may be removed but is not required to be removed.

Each of the above had no impact on fit, form or function.

In all PCBs and pertaining to all resistors: parallel equivalent values with at least the equivalent wattage shown are acceptable without notation on drawings or the BOM. Tighter tolerances are always acceptable.

5.0 SUMMARY

What was referred to in the APC emails as "poor quality" is commonly referred to in the industry as "manufacturing deviations" and as "revisions to the design" or "alternative components". In all cases, the provided service parts are not provided as "identical" but as "equivalent". This methodology of substituting electrically equivalent sub-components is common practice for a commercial manufacturer and to be expected. Documented design justification of sub-components is generally not a requirement even in the Nuclear Industry unless said changes impact the safety function (ie alternative manufacturer of a relay that could potentially change the seismic full operability levels). For example, alternative brands of semiconductors, resistors values within the manufacturer's accepted ranges of values or wattages, resistor values selected by test results, etc. are all acceptable when GSTERI E-95002 defines these parts as seismically insensitive. In addition, similar components were seismically qualified elsewhere on the same or other PCBs within the qualification sample, & qualification sample was fully operable using these boards with these different sub-components. R1 R1

Thus it is QualTech NP's conclusion that evidence of operability within the parent component (the qualification sample or equivalent) is sufficient evidence of fit, form, & function which meets the requirements of dedicated commercial grade items that are intended for use in safety related applications. R1

QualTech NP thus met the quality and technical requirements of the original POs for these printed circuit boards. RI

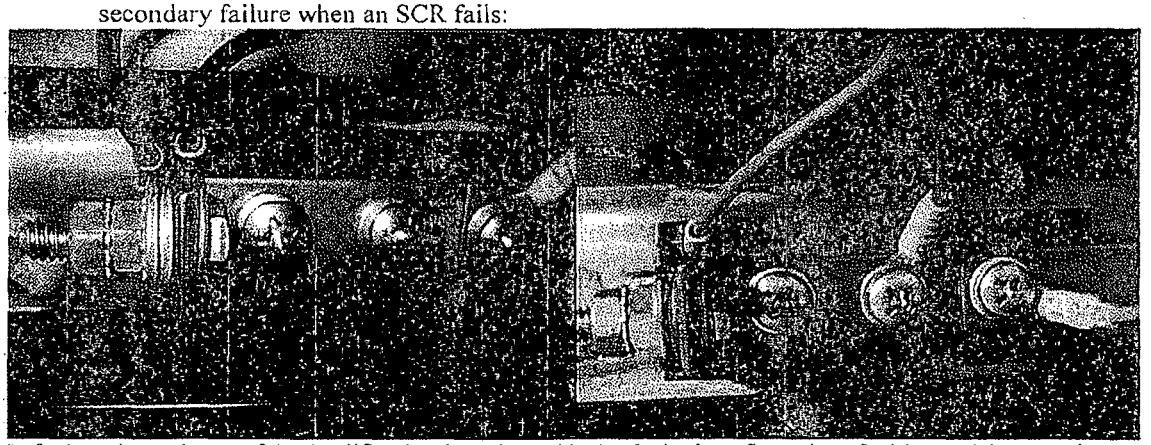
QualTech NP concludes that the sole finding of one resistor mis-located in one motherboard merits a Part 21 reportable event even though the defective PCB was not installed at the plant. (Note: Even if the board had been installed, the section of the unit would not start as the SCR's gate would not function. Since the unit must be operating at all times when the plant is operating, the defective board would never have allowed the section (1/2 of the redundant unit) to return to operability. Regardless, the supply of a defective component which prohibits the host from performing its Safety Function justifies a Part 21.) To prevent recurrence, the motherboards will be functionally tested in a working DPS UPS prior to upgrading to Safety Related. The issue was also addressed via QualTech NP Non-Conformance Report 10-78 regarding contract 7T552 which will be provided to Farley separate from this document. RI RI

After testing all other returned spare part boards (including other motherboards), all functioned properly when installed in the qualification sample. RI

QualTech NP has also identified through communication with Farley personnel & DPS that the B section of UPS in Farley Unit 1 has seen ambient temperatures which apparently exceeded the service temperature for which the unit was designed (50C external ambient conditions & 55C internally). About a year ago (July 2009), the exhaust fan/blower for the room in which it is installed failed resulting in an extended over-temperature condition. The high heat conditions were significant enough during the replacement of the fan/blower that time limits have now been set for personnel time in the room. QualTech NP understands that the UPS was operating during this time period and that specific operating half of the redundant UPS failed shortly thereafter. For this unit to be restored to a reliable operable condition, all temperature sensitive sub-components need replaced at the same time to preclude temperature stressed components from failing and damaging, as a secondary failure, components recently replaced. RI

This room is continually operating at an ambient condition near the maximum rated condition which will effectively provide real time accelerated aging of the components. QualTech NP and the manufacturer, DPS, strongly recommend the following changes:

1. Change the feed wire as shown in the photos below to preclude damaging a motherboard as a secondary failure when an SCR fails:



Left photo is section A of the Qualification Sample and is the desired configuration of wiring. Right photo is section B of the Qualification Sample and is the wiring configuration that can damage the mother board as a secondary failure. Both attachments were qualified.

2. The manufacturer recommends use of faster SCRs (faster turn off times) to allow higher operating temp, turn off times increase with temp, so faster turn off times give more margin & makes the commutating capacitor cover a wider operating temperature range (DPS PN 61461601 to replace PN 61231601 inverter SCRs 4, 5, 14, & 15).

3. Either move the UPS system(s) to a cooler area or lower the ambient temperatures to 80F or less as the "normal" temperature. As a rule of thumb, every 5C/9F temperature increase during "normal" conditions will effectively "halve" the life of the product. During a recent QualTech NP visit to the installation site, an ambient temperature of 106F (41C) was recorded with 113F (45C) at the exhaust fans of the UPS. Using QualTech NP's copy of System 1000 material database system, the Design Life for these aluminum capacitors, at 113F continuously, becomes 2.1 years (with a safety factor of 4). The units will operate at these temperatures but the expected replacement time for temperature sensitive components (such as aluminum electrolytic capacitors) will be greatly reduced.

4. To improve the cooling of the system using the exhaust fans installed. Manufacturer strongly recommends sealing off the open vent at the top of the unit which allows the air flow to short cycle. All air should be pulled through the base of the UPS, by the components and out the top. With the top vent open, air can flow from the room, into the vent at the top, into the fan, & back into the room without doing any cooling of the system. Note that the temperature inside of the UPS is likely much higher than the 113F read at the exhaust of the fans since the fans are cooling air from the unit by mixing that air with the room air prior to exhausting it.

QualTech NP considers fit, form, & function as being satisfied by the functional test results, even when parts change from the original designs.

QualTech will return the PCBs with a C of C for the tested items, stating that the earlier dedication is still valid for all PCBs except those repaired. The repaired PCBs were re-dedicated to the degree required to provide equivalent replacement items for use in the QualTech provided UPS systems.

Future sales of these boards will provide the option of having QualTech NP perform a sub-component by sub-component configuration check of the board against each board's BOM. This would result in documenting BOM errors and/or justification of differences on each board, if this level of documentation is desired by Farley.

ATTACHMENT A

DATA SHEETS FOR VERIFICATION ACTIVITIES

Note: No precision measurements were taken thus no calibrated equipment identification is required.

Return Authorizations: Orig. APC PO
RA7T552-1 QP070972/002
RAT8236-1 QP080390/001
RAT8589-1 QP081107
RAT8626-1 QP081176

Test Sheet Reviewed By: [signature] 9/24/10
Name/Date
Customer Witness (Sign): N/A
Name/Date
Customer Witness (Printed): No one came

DPS Parts: PPS S/N		T8236EL SNs	T8626EL SNs	T8589EL SNs	7T552EL SNs	Description	QualTech NP SN	Dedication Plan to be used for functional testing only (except at QualTech NP facility)	Testing performed by Bill Speth of DPS: Passed DPS Functional Test (Y/N)	Date	Customer Witness (Y/N)	QualTech NP Witness Initials	Passed Test in Qualification Sample (Y/N)	Date	Customer Witness (Y/N)	QualTech NP Witness Initials
10457 1	20010002	01				PCS,15: 130V Rectifier Control Bd	T823610F S/N 01	4L004EL-1 R2	Y	9/15/10	N/A	[initials]	Y	9/17/10	N	[initials]
10471 2	20010002		01				T862601F S/N 01	4L004EL-1 R2	Y	9/15/10	N	[initials]	Y	9/17/10	N	[initials]
10472 3	20010002		02				T862601F S/N 02	4L004EL-1 R2	Y	9/15/10	N	[initials]	Y	9/17/10	N	[initials]
10452 1	20010004	01				PC1,11 Daughter Bd:48V Rectifier/Charger Control Bd	T823610B S/N 01	4L004EL-1 R2	① Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
10469 2	20010004		01				T862601B S/N 01	4L004EL-1 R2	Y	9/15/10	N	[initials]	Y	9/17/10	N	[initials]
10470 3	20010004		02				T862601B S/N 02	4L004EL-1 R2	Y	9/15/10	N	[initials]	Y	9/17/10	N	[initials]
10464 4	20010004			01			T858906 S/N 01	4L004EL-1 R2	Y	9/15/10	N	[initials]	Y	9/17/10	N	[initials]
10465 5	20010004			02			T858906 S/N 02	4L004EL-1 R2	Y	9/15/10	N	[initials]	Y	9/17/10	N	[initials]
20427 1	20020004	01				PC1,11 Daughter Bd: 48VDC Inverter Control Bd	T823610C S/N 01	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
20439 2	20020004		01				T862601C S/N 01	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
20440 3	20020004		02				T862601C S/N 02	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
30418 1	20030001	01				PC1,11 Daughter Bd: 1PH 120V Static Sw Control Bd	T823610D S/N 01	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
30432 2	20030001		01				T862601D S/N 01	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
30433 3	20030001		02				T862601D S/N 02	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
40352 1	20040014	01				PC2,12: Alarm & Meter Bd 1PH, 48VDC	T823610G S/N 01	T8236EL-1 R0	③		N				N	
40367 2	20040014		01				T862601G S/N 01	T8236EL-1 R0	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
40368 3	20040014		02				T862601G S/N 02	T8236EL-1 R0	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
400 1	20050061	01				PC1,11 Mother Bd	T823610A S/N 01	7L002EL-1 R1	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
411 2	20050061		01				T862601A S/N 01	7L002EL-1 R1	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
412 3	20050061		02				T862601A S/N 02	7L002EL-1 R1	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
354 4	20050061				01		7T55201 S/N 01	7L002EL-1 R1	② Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
None 1	20060000	01				PC1,11 Daughter Bd: Static Switch Gate Bd	T823610E S/N 01	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
None 2	20060000		01				T862601E S/N 01	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]
None 3	20060000		02				T862601E S/N 02	4L004EL-1 R2	Y	9/16/10	N	[initials]	Y	9/17/10	N	[initials]

* Not Tested Because of damage. Once Repaired, to be Tested Later [initials] 9/23/10

① Rec'd with Switch Damage. SW1 Replaced by Bill Speth of DPS. Testing occurred after SW1 was Replaced.
② Rec'd with Push Button Damaged.
③ R43 was mis-installed into R42; installation corrected by Bill Speth of DPS; R42 empty, R43 has Correct Resistance

WITNESSED : [initials] = [signature] 9/17/10
REVIEWED : [signature] 9/24/10

711

DPS PN 20010004 Rectifier / Charger Control Board 48V
SN 10452, T823610B SN01
Received with damages SW1 toggle switch, replaced by Bill Speth of DPS

Review of Rectifier/Charger Board:
1. Q1 per BOM is TIP126 transistor but part is TPP126 - different mft
2. R37, R41, & R42 per BOM are 0.1 ohm 2W resistors, parts are 0.01Ohm 2W resistors - same as motherboard (jumper to 10 ohms is OK)
3. R52 is not on BOM - added when application is for single phase only, BOM error
4. R109 per BOM is 470K, installed 590K - value determined during testing
5. TP1 test terminal is missing - BOM error, no longer installed
6. IC's 1 & 2 require pin 6, in place, IC 18 required pin 6 to be removed when using hot standby. This is no longer required due to APC no longer wanting units used in Hot Standby. To conserve battery life, APC is using the units in cold standby mode. For all other applicationd of these ICs the pin 6 may be removed but is not required to be removed.

BOM

C1	(104J100V) 0.1uF, 100v dipped ceramic	D1	(1N4004) 1A 400V	IC1	4N32 (Opto Coupler)	Q1	TIP126 80V PNP Transistor (part says TPP126	R1	O W Br gold = 390 5% 1/4W	SW1	Toggle Sw
C2	(104J100V) 0.1uF, 100v dipped ceramic	D2	(1N4004) 1A 400V	IC2	4N32 (Opto Coupler)	Q2	2N3904 (40V NPN transistor)	R2	Br Bl R Gold = 1K, 5%, 2W		
C3	(104J100V) 0.1uF, 100v dipped ceramic	D3	(1N4004) 1A 400V	IC3	empty	Q3	TIP121 80V PNP Transistor	R3	Br Bl R Gold = 1K, 5%, 2W	TP1	Test Terminals empty
C4	(1.0K100H) 1.0uF 100V	D4	(1N4004) 1A 400V	IC4	4020 (Ripple Counter)	Q4	TIP121 80V PNP Transistor	R4	O W Br gold = 390 5% 1/4W	TP2	Test Terminals
C5	(104J100V) 0.1uF, 100v dipped ceramic	D5	(1N4004) 1A 400V	IC5	4020 (Ripple Counter)	Q5	TIP121 80V PNP Transistor	R5	Br Bl R Gold = 1K, 5%, 2W	TP3	Test Terminals
C6	(104J100V) 0.1uF, 100v dipped ceramic	D6	(1N4004) 1A 400V	IC6	4020 (Ripple Counter)	Q6	2N3904 (40V NPN transistor)	R6	O W Br gold = 390 5% 1/4W	TP4	Test Terminals
C7	(104J100V) 0.1uF, 100v dipped ceramic	D7	(1N4004) 1A 400V	IC7	4093 (Quad NAND)	Q7	2N3904 (40V NPN transistor)	R7	R R Br gold = 220 5% 2W	TP5	Test Terminals
C8	(104J100V) 0.1uF, 100v dipped ceramic	D8	(1N4004) 1A 400V	IC8	4001 (Quad NOR gate)	Q8	2N3904 (40V NPN transistor)	R8	R R Br gold = 220 5% 2W	TP6	Test Terminals
C9	(104J100V) 0.1uF, 100v dipped ceramic	D9	(1N4004) 1A 400V	IC9	7812 (12V regulator)	Q9	2N3906 (40V PNP Transistor)	R9	R R Br gold = 220 5% 2W	TP7	Test Terminals
C10	(104J100V) 0.1uF, 100v dipped ceramic	D10	(1N4004) 1A 400V	IC10	4093 (Quad NAND)			R10	R R Br gold = 220 5% 2W		
C11	1000uF 50V radial electrolytic 105C	D11	(1N4004) 1A 400V	IC11	40106 (Hex Inverter)			R11	R R Br gold = 220 5% 2W	ZD1	IN4734A 5.6V 1W Zener
C12	(104J100V) 0.1uF, 100v dipped ceramic	D12	(1N4004) 1A 400V	IC12	40106 (Hex Inverter)			R12	R R Br gold = 220 5% 2W	ZD2	IN4734A 5.6V 1W Zener
C13	(104J100V) 0.1uF, 100v dipped ceramic	D13	(1N4004) 1A 400V	IC13	4N32 (Opto Coupler)			R13	R R Br gold = 220 5% 2W	ZD3	IN4734A 5.6V 1W Zener
14	(104J100V) 0.1uF, 100v dipped ceramic	D14	(1N4004) 1A 400V	IC14	4046 (Phase Lock Loop)			R14	R R Br gold = 220 5% 2W	ZD4	IN4734A 5.6V 1W Zener
C15	(104J100V) 0.1uF, 100v dipped ceramic	D15	(1N4004) 1A 400V	IC15	339 (Quad Comparitor)			R15	R R Br gold = 220 5% 2W	ZD5	IN4734A 5.6V 1W Zener
C16	(104J100V) 0.1uF, 100v dipped ceramic	D16	(1N4004) 1A 400V	IC16	4N32 (Opto Coupler)			R16	R R Br gold = 220 5% 2W	ZD5	IN4734A 5.6V 1W Zener
C17	(104J100V) 0.1uF, 100v dipped ceramic	D17	(1N4004) 1A 400V	IC17	4N32 (Opto Coupler)			R17	R R Br gold = 220 5% 2W	ZD6	IN4734A 5.6V 1W Zener
C18	(104J100V) 0.1uF, 100v dipped ceramic	D18	(1N4004) 1A 400V	IC18	4N32 (Opto Coupler)			R18	R R Br gold = 220 5% 2W	ZD7	IN4734A 5.6V 1W Zener
C19	330uF 25V/35V radial electrolytic 85C	D19	(1N4004) 1A 400V	IC19	723 (Regulator)			R19	Br Bl O gold = 10k 5% 1/4w	ZD8	1N5364A (or B) 33V 5W Zener
C20	(104J100V) 0.1uF, 100v dipped ceramic	D20	(1N4004) 1A 400V					R20	R R R gold = 2.2K 5% 1/4W	ZD9	IN4734A 5.6V 1W Zener
C21	(.01K 100H) 0.01uF 63V Axial	D21	(1N4004) 1A 400V					R21	Br Bl O gold = 10k 5% 1/4w	ZD10	IN4734A 5.6V 1W Zener
C22	(.01K 100H) 0.01uF 63V Axial	D22	(1N4004) 1A 400V	J1	(2) 15 pin female connector with blocking key @17			R22	Br Bl O gold = 10k 5% 1/4w	ZD11	IN4734A 5.6V 1W Zener
C23	(.01K 100H) 0.01uF 63V Axial	D23	(1N4004) 1A 400V					R23	Br Gn Bl gold = 15 5% 2W	ZD12	IN4744A 15V 1W Zener
C24	(104J100V) 0.1uF, 100v dipped ceramic	D24	(1N4004) 1A 400V					R24	Br Gn Bl gold = 15 5% 2W	ZD13	empty
C25	(104J100V) 0.1uF, 100v dipped ceramic	D25	(1N4004) 1A 400V	LED1	RED			R25	Y V Y gold = 470k 5% 1/4w	ZD14	IN4734A 5.6V 1W Zener
C26	(104J100V) 0.1uF, 100v dipped ceramic	D26	(1N4004) 1A 400V	LED2	RED			R26	Br Bl O gold = 10k 5% 1/4w		
C27	(104J100V) 0.1uF, 100v dipped ceramic	D27	(1N4004) 1A 400V					R27	Y V Y gold = 470k 5% 1/4w		
C28	47uF 25V-50V radial electrolytic 85C (or	D28	(1N4004) 1A 400V					R28	(1N4004) 1A 400V		
C29	2.2uF 50V radial electrolytic 85C	D29	(1N4004) 1A 400V					R29	Y V Y gold = 470k 5% 1/4w		
C30	(104J100V) 0.1uF, 100v dipped ceramic	D29A	(1N4004) 1A 400V					R30	Br Bl O gold = 10k 5% 1/4w		
C31	(K1G 331J) 330pF 63V	D30	(1N4004) 1A 400V					R31	Y V R gold = 4.7K 5% 1/4W		
C32	(104J100V) 0.1uF, 100v dipped ceramic	D31	(1N4004) 1A 400V					R32	Br Bl O gold = 10k 5% 1/4w		
C33	(1.0K100H) 1.0uF 100V	D32	(1N4004) 1A 400V					R33	Y V R gold = 4.7K 5% 1/4W		
C34	(1.0K100H) 1.0uF 100V	D33	(1N4004) 1A 400V					R34	Br Bl O gold = 10k 5% 1/4w		
C35	(.01K 100H) 0.01uF 63V Axial							R35	Y V R gold = 4.7K 5% 1/4W		
C36	(102K 200:A:) 0.001uF 100V							R36	Br Bl O gold = 10k 5% 1/4w		
C37	(104J100V) 0.1uF, 100v dipped ceramic							R37	Br Bl Gld gold = 0.1 5% 2W or Br Br Gld = 1 5% 2W Part has Br Bl Silv gold = 0.01 5% 2W		
C38	(104J100V) 0.1uF, 100v dipped ceramic							R38	Br Bl Br Gold = 100, 5%, 1/4W		

P12

DPS PN 20010004 Rectifier / Charger Control Board 48V

C39 (104J100V) 0.1uF, 100v dipped ceramic
C40 (1.0K100H) 1.0uF 100V
C41 (1.0K100H) 1.0uF 100V
C42 (104J100V) 0.1uF, 100v dipped ceramic
C43 (104J100V) 0.1uF, 100v dipped ceramic
C44 (104J100V) 0.1uF, 100v dipped ceramic
C45 (104J100V) 0.1uF, 100v dipped ceramic
C46 10uF 25V/50V 85C radial electrolytic
C47 (104J100V) 0.1uF, 100v dipped ceramic
C48 (104J100V) 0.1uF, 100v dipped ceramic
C49 47uF 25V-50V radial electrolytic 85C (or higher ie 105C)
C50 2.2uF 50V radial electrolytic 85C

R39 Br Bl Br Gold = 100, 5%, 1/4W
R40 Br Bl Br Gold = 100, 5%, 1/4W
R41 Br Bl Gld gold = 0.1 5% 2W or Br Br Gld = 1 5% 2W Part has Br Bl Silv gold = 0.01 5% 2W
R42 Br Bl Gld gold = 0.1 5% 2W or Br Br Gld = 1 5% 2W Part has Br Bl Silv gold = 0.01 5% 2W
R43 Br Bl Grn gold = 1M 5% 1/4w
R44 Br Bl Grn gold = 1M 5% 1/4w
R45 Br Bl O gold = 10k 5% 1/4w
R46 Br Bl O gold = 10k 5% 1/4w
R47 Br Bl Y gold = 100K 5% 1/4w
R48 Br Bl O gold = 10k 5% 1/4w
R49 Br Bl O gold = 10k 5% 1/4w
R50 Br Bl O gold = 10k 5% 1/4w
R51 Br Bl Y gold = 100K 5% 1/4w
R52 MISSING Part has Br Bl Gld gold = 0.1 5% 1/4W
R53 Br Bl O gold = 10k 5% 1/4w
R54 Br Bl Y gold = 100K 5% 1/4w
R55 Bl Bl Bl gold = 1 5% 1/4W
R56 Bl Bl Bl gold = 1 5% 1/4W
R57 Bl Bl Bl gold = 1 5% 1/4W
R58 Y V R gold = 4.7K 5% 1/4W
R59 Y V R gold = 4.7K 5% 1/4W
R60 Y V R gold = 4.7K 5% 1/4W
R61 Y R R Br brown = 4.22k 1% 1/4W
R62 Y R R Br brown = 4.22k 1% 1/4W
R63 Y R R Br brown = 4.22k 1% 1/4W
R64 Br Bl Grn gold = 1M 5% 1/4w
R64A R R Grn gold = 2.2M 5% 1/4W
R65 Br Bl R Gold = 1K, 5%, 1/4W
R66 Y V O gold = 47K 5% 1/4W
R67 R V Y gold = 270K 5% 1/4W
R68 Br Bl Y gold = 100K 5% 1/4w
R69 Y V O gold = 47K 5% 1/4W
R70 Y V O gold = 47K 5% 1/4W
R71 Br Bl Blu gold = 10M 5% 1/4w
R72 Br Bl O gold = 10k 5% 1/4w
R73 Y V R gold = 4.7K 5% 1/4W
R74 empty
R75 500K multiturn side adj potentiometer
R76 Blu Y W R brown = 64.9K 1% 1/4W
R77 100K multiturn side adj potentiometer
R78 50K multiturn side adj potentiometer
R79 20K multiturn side adj potentiometer
R80 20K multiturn side adj potentiometer
R81 Y V Y gold = 470k 5% 1/4w
R82 1M multiturn Top adj potentiometer
R83 1M multiturn Top adj potentiometer
R84 Br Bl Y gold = 100K 5% 1/4w

P3

DPS PN 20010004 Rectifier / Charger Control Board 48V

R84A R Br Bl O brown = 210K 1% 1/4W
R85 Y V O gold = 47K 5% 1/4W
R86 Br Bl Grn gold = 1M 5% 1/4w
R87 V Br Grn R brown = 71.5K 1% 1/4W
R88 Br Bl Blu gold = 10M 5% 1/4w
R89 R V Y gold = 270K 5% 1/4W
R90 Br Bl Grn gold = 1M 5% 1/4w
R91 Br Bl O gold = 10k 5% 1/4w
R92 R R Grn gold = 2.2M 5% 1/4W
R93 Y V O gold = 47K 5% 1/4W
R94 Y V O gold = 47K 5% 1/4W
R95 Y V R gold = 4.7K 5% 1/4W
R96 Y V R gold = 4.7K 5% 1/4W
R97 Br Bl O gold = 10k 5% 1/4w
R98 Br Bl R Gold = 1K, 5%, 1/4W
R99 Br Bl Blu gold = 10M 5% 1/4w
R100 Y Bl R R brown = 40.2k 1% 1/4w
R101 Gy Y Gr R brown = 84.5K 1% 1/4W
R102 Y Bl R R brown = 40.2k 1% 1/4w
R103 Br Bl Bl O brown = 100K 1% 1/4W
R104 W Bl W R brown = 90.9K 1% 1/4W
R105 Bl Bl Gr Bl brown = 665 1% 1/4W
R106 V Br Grn R brown = 71.5K 1% 1/4W
R107 Br Bl Bl Br brown = 1K 1% 1/4W
R108 Br Bl Bl O brown = 100K 1% 1/4W
R109 Y V Y gold = 470k 5% 1/4W Installed Gn W Bl O brown = 590K 1% 1/4W
R110 R V O gold = 27k 5% 1/4w
R111 R V O gold = 27k 5% 1/4w
R112 Y V O gold = 47K 5% 1/4W
R113 Br Bl Bl R brown = 10K 1% 1/4W
R114 empty
R115 Y V O gold = 47K 5% 1/4W
R116 empty

DPS PN 20040014 Alarm & Meter Board (Front Panel Display Bd)

424 components inserted

Blank PCB - 20040000 CLAD Rev 3 (last 2 digits changed by white ink to PCB Assy no. 20040(
T862601G SN 01 DPS SN 40367

1. Review of Alarm/Meter Board DPS S/N 40367 T86201G SN 01:
   a. Missing IC15 (4020 Ripple Counter) – Missing so that horn doesn't go off per APC's request
   b. Missing C88 (0.01uF 100V Capacitor) – redundant noise suppression
   c. Substituted IC20 (drawing calls for OP07, used TL071ACP) – different mfr but equivalent
   d. Added D34 (1N4004) – shouldn't be here but a "don't care"
   e. Not on BOM list but quantity shown is correct (LED 22, 23, & 25)
   f. R35A labeled on PCB as R42A
   g. BOM's DE4 (1K 1% 1/4W resistor) – can't locate – BOM typo (Qty of 3 accounted for)
   h. BOM's ZD5 (1N4744A 15V 1W Zener Diode) should be ZD6 (ZD5 also called out as 5W on next line in BOM, the 5W part is correct) – BOM typ
   i. SW6 has different settings than qualification sample (Side A) - PCB dependent setting
      TS-A, 1 to 5 set as On, Off, Off, Off, On
      SN 40367 set as On, On, On, On, Off
   j. SW10 has different settings than qualification sample (Side A) location 1 of sw10 is not used on this design (don't care)
      TS-A, 1 to 5 set as Off, Off, Off, Off, On
      SN 40367 set as On, Off, Off, Off, On

BOM

C1	(101J100V)	100pf, 100v ceramic disc	D1	(1N4004) 1A 400V	IC1 ICL 7107CPL (3 1/2 DVM)	J1	7 pin connector (9 pos)	LED1	yellow	Q1	2N7000 (MOS Transistor)
C2	(104J100V)	0.1uF, 100v dipped ceramic	D2	(1N4004) 1A 400V	IC2 AD 536AJH (TRMS TO DC V)	J2	3pin, space, 5 pin connector (9 pos)	LED2	yellow	Q2	2N7000 (MOS Transistor)
C3	(104J100V)	0.1uF, 100v dipped ceramic	D3	(1N4004) 1A 400V	IC3 ICL 7107CPL (3 1/2 DVM)	J3	8 pin connector (9 pos)	LED3	green	Q3	empty
C4	(104J100V)	0.1uF, 100v dipped ceramic	D4	(1N4004) 1A 400V	IC4 LM2907N (Freq. to Volt)	J4	9 pin connector	LED4	empty	Q4	empty
C5	(.22K250H)	0.22uF 100V	D5	(1N4004) 1A 400V	IC5 79L05 (-5V regulator)	J5	9 pin connector	LED5	empty	Q5	empty
C6	(.047K100H)	0.047uF 100V	D6	(1N4004) 1A 400V	IC6 7805 (+5V regulator)	J6	12 pin connector	LED6	empty	Q6	2N7000 (MOS Transistor)
C7	(104J100V)	0.1uF, 100v dipped ceramic	D7	(1N4004) 1A 400V	IC7 4013 (Dual Flip Flop)	J7	9 pin connector	LED7	empty	Q7	2N7000 (MOS Transistor)
C8	4.7uF 25V/50V	radial electrolytic 85C	D8	(1N4004) 1A 400V	IC8 4016 (Quad Switch)	J8	9 pin connector	LED8	empty	Q8	2N3906 (40V PNP Transistor)
C9	(104J100V)	0.1uF, 100v dipped ceramic	D9	(1N4004) 1A 400V	IC9 AD 536AJH (TRMS TO DC V)			LED9	empty	Q9	2N7000 (MOS Transistor)
C10	(104J100V)	0.1uF, 100v dipped ceramic	D10	empty	IC10 4016 (Quad Switch)	JP1	A-B	LED10	red	Q10	2N7000 (MOS Transistor)
C11	(104J100V)	0.1uF, 100v dipped ceramic	D11	empty	IC11 4017 (Decade counter/divider)	JP2	empty	LED11	red	Q11	2N7000 (MOS Transistor)
C12	(1.0K100H)	1.0uF 100V	D12	empty	IC12 empty	JP3	empty	LED12	yellow	Q12	2N3906 (40V PNP Transistor)
C13	(101J100V)	100pf, 100v ceramic disc	D13	empty	IC13 empty			LED13	yellow	Q13	2N7000 (MOS Transistor)
C14	(104J100V)	0.1uF, 100v dipped ceramic	D14	empty	IC14 ICL 7107CPL (3 1/2 DVM)			LED14	green	Q14	2N3904 (40V NPN transistor)
C15	(104J100V)	0.1uF, 100v dipped ceramic	D15	empty	IC15 4020 (Ripple Counter)		MISSING	LED15	red	Q15	2N7000 (MOS Transistor)
C16	(104J100V)	0.1uF, 100v dipped ceramic	D16	(1N4004) 1A 400V	IC16 4001 (Quad NOR gate)			LED16	green	Q16	2N3904 (40V NPN transistor)
C17	(.22K250H)	0.22uF 100V	D17	(1N4004) 1A 400V	IC17 4020 (Ripple Counter)			LED17	green	Q17	2N3904 (40V NPN transistor)
C18	(.047K100H)	0.047uF 100V	D18	(1N4004) 1A 400V	IC18 4093 (Quad NAND)			LED18	red	Q18	2N3904 (40V NPN transistor)
C19	(103J)	0.01uF 63V Axial	D19	(1N4004) 1A 400V	IC19 7812 (12V regulator)			LED19	red	Q19	2N3904 (40V NPN transistor)
C20	(104J100V)	0.1uF, 100v dipped ceramic	D20	(1N4004) 1A 400V	IC20 OP07 (Op Amp) - SUBSTITUTED TL071ACP			LED20	red	Q20	2N7000 (MOS Transistor)
C21	(104J100V)	0.1uF, 100v dipped ceramic	D21	(1N4004) 1A 400V	IC21 40106 (Hex Inverter)			LED21	red	Q21	2N3904 (40V NPN transistor)
C22	(1.0K100H)	1.0uF 100V	D22	(1N4004) 1A 400V	IC22 40106 (Hex Inverter)			LED22	[redacted]	Q22	2N7000 (MOS Transistor)
C23	47uF 25V-50V	radial electrolytic 85C	D22A	(1N4004) 1A 400V	IC23 4N32 (Opto Coupler)		[redacted] NOT ON BOM	LED23	[redacted]	Q23	empty
C24	330uF 25V/35V	radial electrolytic 85C	D23	(1N4004) 1A 400V	IC24 LM339N (Quad Comparator)			LED24	yellow	Q24	2N7000 (MOS Transistor)
C25	330uF 25V/35V	radial electrolytic 85C	D24	(1N4004) 1A 400V				LED25	[redacted]	Q25	2N7000 (MOS Transistor)
C26	1000uF 50V	radial electrolytic 105C	D25	(1N4004) 1A 400V				LED26	red	Q26	2N7000 (MOS Transistor)
C27	(104J100V)	0.1uF, 100v dipped ceramic	D26	(1N4004) 1A 400V				LED27	red		
C28	(104J100V)	0.1uF, 100v dipped ceramic	D27	(1N4004) 1A 400V							
C29	(104J100V)	0.1uF, 100v dipped ceramic	D28	(1N4004) 1A 400V							
C30	(104J100V)	0.1uF, 100v dipped ceramic	D29	(1N4004) 1A 400V							
C31	(104J100V)	0.1uF, 100v dipped ceramic	D30	(1N4004) 1A 400V							
C32	(104J100V)	0.1uF, 100v dipped ceramic	D31	(1N4004) 1A 400V							

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C33	(1.0K100H) 1.0uF 100V	D32	(1N4004) 1A 400V
C34	(104J100V) 0.1uF, 100v dipped ceramic	D33	(1N4004) 1A 400V
C35	(104J100V) 0.1uF, 100v dipped ceramic	D34	*1N4004 shouldn't be there*
C36	4.7uF 25V/50V radial electrolytic 85C	D35	(1N4004) 1A 400V
C37	(101J100V) 100pf, 100v ceramic disc	D36	(1N4004) 1A 400V
C38	(104J100V) 0.1uF, 100v dipped ceramic	D37	(1N4004) 1A 400V
C39	(.047K100H) 0.047uF 100V	D38	(1N4004) 1A 400V
C40	(.22K250H) 0.22uF 100V	D39	(1N4004) 1A 400V
C41	(104J100V) 0.1uF, 100v dipped ceramic	D40	(1N4004) 1A 400V
C42	(104J100V) 0.1uF, 100v dipped ceramic	D41	(1N4004) 1A 400V
C42A	(102K 200:A:) 0.001uF 100V	D42	(1N4004) 1A 400V
C43	(104J100V) 0.1uF, 100v dipped ceramic	D43	(1N4004) 1A 400V
C44	(104J100V) 0.1uF, 100v dipped ceramic	D44	(1N4004) 1A 400V
C45	empty	D45	(1N4004) 1A 400V
C46	empty	D45A	(1N4004) 1A 400V
C47	empty	D46	(1N4004) 1A 400V
C48	empty	D47	(1N4004) 1A 400V
C49	empty	D48	(1N4004) 1A 400V
C50	empty	D49	(1N4004) 1A 400V
C51	(0.01K100H) 0.01uF 100V	D50	(1N4004) 1A 400V
C52	(104J100V) 0.1uF, 100v dipped ceramic	D51	(1N4004) 1A 400V
C53	(104J100V) 0.1uF, 100v dipped ceramic	D52	(1N4004) 1A 400V
C54	(104J100V) 0.1uF, 100v dipped ceramic	D53	(1N4004) 1A 400V
C55	(104J100V) 0.1uF, 100v dipped ceramic	D54	(1N4004) 1A 400V
C55A	(104J100V) 0.1uF, 100v dipped ceramic	D55	(1N4004) 1A 400V
C56	(104J100V) 0.1uF, 100v dipped ceramic	D56	(1N4004) 1A 400V
C57	(104J100V) 0.1uF, 100v dipped ceramic	D57	(1N4004) 1A 400V
C58	(104J100V) 0.1uF, 100v dipped ceramic	D58	(1N4004) 1A 400V
C59	(0.01K100H) 0.01uF 100V	D59	(1N4004) 1A 400V
C60	(104J100V) 0.1uF, 100v dipped ceramic	D60	(1N4004) 1A 400V
C61	(104J100V) 0.1uF, 100v dipped ceramic	D61	(1N4004) 1A 400V
C62	330uF 25V/35V radial electrolytic 85C	D62	(1N4004) 1A 400V
C63	1000uF 50V radial electrolytic 105C	D63	(1N4004) 1A 400V
C64	(1.0K100H) 1.0uF 100V	D64	(1N4004) 1A 400V
C65	(104J100V) 0.1uF, 100v dipped ceramic	D65	(1N4004) 1A 400V
C66	(104J100V) 0.1uF, 100v dipped ceramic	D66	(1N4004) 1A 400V
C67	(104J100V) 0.1uF, 100v dipped ceramic	D67	(1N4004) 1A 400V
C68	(104J100V) 0.1uF, 100v dipped ceramic	D68	empty
C69	(104J100V) 0.1uF, 100v dipped ceramic	D69	(1N4004) 1A 400V
C70	(104J100V) 0.1uF, 100v dipped ceramic	D70	(1N4004) 1A 400V
C71	jumper wire	D71	(1N4004) 1A 400V
C72	(104J100V) 0.1uF, 100v dipped ceramic	D72	(1N4004) 1A 400V
C73	(104J100V) 0.1uF, 100v dipped ceramic	D73	(1N4004) 1A 400V
C74	(104J100V) 0.1uF, 100v dipped ceramic	D74	(1N4004) 1A 400V
C75	(0.01K100H) 0.01uF 100V	D75	(1N4004) 1A 400V
C76	(104J100V) 0.1uF, 100v dipped ceramic	D76	(1N4004) 1A 400V
C77	(104J100V) 0.1uF, 100v dipped ceramic	D77	(1N4004) 1A 400V
C78	(104J100V) 0.1uF, 100v dipped ceramic	D78	(1N4004) 1A 400V

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C79	(0.01K100H) 0.01uF 100V	D79	(1N4004) 1A 400V	
C80	(104J100V) 0.1uF, 100v dipped ceramic	D80	(1N4004) 1A 400V	
C81	(104J100V) 0.1uF, 100v dipped ceramic			
C82	(104J100V) 0.1uF, 100v dipped ceramic			
C83	(104J100V) 0.1uF, 100v dipped ceramic	Display 1	7 Seg LED, 2 Digits	
C84	(104J100V) 0.1uF, 100v dipped ceramic	Display 1A	7 Seg LED, 2 Digits	
C85	(104J100V) 0.1uF, 100v dipped ceramic	Display 2	7 Seg LED, 2 Digits	
C86	(104J100V) 0.1uF, 100v dipped ceramic	Display 2A	7 Seg LED, 2 Digits	
C87	(104K400H) 0.1uF 400V	Display 3	7 Seg LED, 2 Digits	
C88	(0.01K100H) 0.01uF 100V	Display 3A	7 Seg LED, 2 Digits	MISSING
C89	(104J100V) 0.1uF, 100v dipped ceramic			
C90	10uF 25V/50V 85C radial electrolytic	Horn	Horn	
C91	(104J100V) 0.1uF, 100v dipped ceramic			
C92	(104J100V) 0.1uF, 100v dipped ceramic			
C93	(104J100V) 0.1uF, 100v dipped ceramic			
C94	(104J100V) 0.1uF, 100v dipped ceramic			
C95	(104J100V) 0.1uF, 100v dipped ceramic			
C96	(104J100V) 0.1uF, 100v dipped ceramic			

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Resistor (none are high temp or fuse link types)

R1	Br R Y gold = 120K 5% 1/4w	RL1	P&B PN T7CS5D-12, 12VAC/DC	TP1	Test Terminals	ZD1	IN4734A 5.6V 1W Zener
R2	Y V Y gold = 470k 5% 1/4w		COIL, 12A, 120VDC SPDT contacts	TP2	Test Terminals	ZD2	IN4734A 5.6V 1W Zener
R3	Br Bl Grn gold = 1M 5% 1/4w	RL2	empty	TP3	Test Terminals	ZD3	IN4734A 5.6V 1W Zener
R4	Br R Y gold = 120K 5% 1/4w	SW1	1 to 5, On,Off,Off,Off,On	TP4	Test Terminals	ZD4	IN4744A 15V 1W Zener
R5	Y Bl R R brown = 40.2k 1% 1/4w	SW2	PB	TP5	Test Terminals	ZD5	IN5364A (or B) 33V 5W Zener
R6	Y V Y gold = 470k 5% 1/4w	SW3	empty	TP6	Test Terminals	ZD5A	IN4744A 15V 1W Zener
R7	200K multiturn pot (top adjust)	SW4	empty			ZD6	IN4744A 15V 1W Zener
R8	O O R O brown = 332k 1% 1/4w	SW5	1 to 5, On,Off,Off,On,On	TS1	5 pos Terminal strip		
R9	Y V Bl gold = 47 5% 1/4w	SW6	1 to 5, On, Off, Off, Off, On	TSW1	Airpax 67L055 (thermal sw 55C NC)		
R10	Br Bl Bl Br brown = 1k 1% 1/4W	SW7	PB	SN 40367 set to On			
R11	Y Bl R Br brown = 4.02K 1% 1/4w	SW8	PB				
R12	R V O gold = 27k 5% 1/4w	SW9	PB				
R13	Br Bl O gold = 10k 5% 1/4w	SW10	1 to 5, Off, Off, Off, Off, On	SN 40367 set to Off, Off, Off, Off, On			
R14	Br Bl Bl gold = 10 5% 1/2w	SW11	1 to 5, Off, On, On, Off, Off				
R15	Br Bl Gld gold = 0.1 5% 2W or Br Br Gld gold = .11 5% 2W	SW12	PB				
R16	Br Bl Gld gold = 0.1 5% 2W or Br Br Gld gold = .11 5% 2W						
R17	Gy Gy V Br Br = 8.87K 1% 1/4w						
R18	Y Bl R R brown = 40.2k 1% 1/4w						
R19	2K potentiometer (multiturn, top Adjustment)						
R20	Br Bl R Gold = 1K, 5%, 1/4W						
R21	Br Bl Bl Br brown = 1k 1% 1/4W						
R22	Gy Gy V Br Br = 8.87K 1% 1/4w						
R23	O W Br gold = 390 5% 1/4W						
R24	Br Bl Bl Br brown = 1k 1% 1/4W						
R25	Gy Gy V Br Br = 8.87K 1% 1/4w						
R26	2K potentiometer (multiturn, top Adjustment)						
R27	Br Bl Grn gold = 1M 5% 1/4w						
R28	Y V O gold = 47K 5% 1/4W						
R28A	Y V Y gold = 470k 5% 1/4w						
R29	Br R Y gold = 120K 5% 1/4w						
R30	Y V Y gold = 470k 5% 1/4w						
R31	Y V O gold = 47K 5% 1/4W						
R32	Br Bl Bl Br brown = 1k 1% 1/4W						
R33	50K (multiturn, top Adj.)						
R34	Br Bl Bl Br brown = 1k 1% 1/4W						
R35	50K (multiturn, top Adj.)						
R35A	Y V O gold = 47K 5% 1/4W						
R36	empty						
R37	empty						
R38	empty						
R39	empty						
R40	empty						
R41	empty						
R42	empty						
R43	empty						
R44	empty						
R45	empty						

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R46	empty
R47	O W Br gold = 390 5% 1/4W
R48	O W Br gold = 390 5% 1/4W
R49	Br Bl O gold = 10k 5% 1/4w
R50	Br Bl O gold = 10k 5% 1/4w
R51	R R Gld gold = 2.2 5% 2W
R52	R R Gld gold = 2.2 5% 2W
R53	Br Bl Grn gold = 1M 5% 1/4w
R54	Y WW B brown = 4.99K 1% 1/4W
R55	Y Bl R Br brown = 4.02K 1% 1/4W
R56	R Bl Bl R brown = 20K 1% 1/4W
R57	Gr Bl Blu Br brown = 8.06K 1% 1/4W
R58	Blu Bl Y Br brown = 6.04K 1% 1/4 W
R59	R R Br gold = 220 5% 1/4W
R60	Br Bl Grn gold = 1M 5% 1/4w
R61	R V O gold = 27k 5% 1/4w
R62	Br Bl O gold = 10k 5% 1/4w
R63	R R Grn gold = 2.2M 5% 1/4W
R64	Br Bl R Gold = 1K, 5%, 1/4W
R65	Y V O gold = 47K 5% 1/4W
R66	Br Bl O gold = 10k 5% 1/4w
R67	Br Bl R Gold = 1K, 5%, 1/4W
R68	O W Br gold = 390 5% 1/4W
R69	Gy Gy V Br Br = 8.87K 1% 1/4w
R70	Y Bl R R brown = 40.2k 1% 1/4w
R71	2K potentiometer (multiturn, top Adjustment)
R72	200 multiturn potentiometer (Top Adj)
R73	W Bl W Bl brown = 909 1% 1/4W
R74	Br Bl Bl Br brown = 1k 1% 1/4W
R75	empty
R76	Br Bl Grn gold = 1M 5% 1/4w
R77	Y V R gold = 4.7K 5% 1/4W
R78	Br Bl O gold = 10k 5% 1/4w
R79	O W Br gold = 390 5% 1/4W
R80	O W Br gold = 390 5% 1/4W
R81	Y V O gold = 47K 5% 1/4W
R82	Y V O gold = 47K 5% 1/4W
R83	Br Bl Grn gold = 1M 5% 1/4w
R84	Y V O gold = 47K 5% 1/4W
R85	Br Bl Grn gold = 1M 5% 1/4w
R86	O W Br gold = 390 5% 1/4W
R87	Y V R gold = 4.7K 5% 1/4W
R88	O W Br gold = 390 5% 1/4W
R89	O W Br gold = 390 5% 1/4W
R90	Y V O gold = 47K 5% 1/4W
R91	Y V O gold = 47K 5% 1/4W
R92	Y V R gold = 4.7K 5% 1/4W
R93	Y V O gold = 47K 5% 1/4W

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R94 Br Bl Grn gold = 1M 5% 1/4w
R95 Br Bl O gold = 10k 5% 1/4w
R96 Y V O gold = 47K 5% 1/4W
R97 Y V O gold = 47K 5% 1/4W
R98 Y V O gold = 47K 5% 1/4W
R99 O W Br gold = 390 5% 1/4W
R100 O W Br gold = 390 5% 1/4W
R101 O W Br gold = 390 5% 1/4W
R102 R V Y gold = 270K 5% 1/4W
R103 empty
R104 Br Bl Grn gold = 1M 5% 1/4w
R105 Br Bl Grn gold = 1M 5% 1/4w
R106 Br Bl Grn gold = 1M 5% 1/4w
R107 Br Bl Grn gold = 1M 5% 1/4w
R108 Br Bl Grn gold = 1M 5% 1/4w
R109 Br Bl Grn gold = 1M 5% 1/4w
R110 Y V R gold = 4.7K 5% 1/4W
R111 Y V R gold = 4.7K 5% 1/4W
R112 O W Br gold = 390 5% 1/4W
R113 O W Br gold = 390 5% 1/4W
R114 Y V R gold = 4.7K 5% 1/4W
R114A Y V Y gold = 470k 5% 1/4w
R115 Y V R gold = 4.7K 5% 1/4W
R116 empty
R117 Y V Y gold = 470k 5% 1/4w
R118 empty
R119 Y V O gold = 47K 5% 1/4W
R120 empty
R121 Br Bl Grn gold = 1M 5% 1/4w
R122 Y V O gold = 47K 5% 1/4W
R123 Gy Gy V Br Br = 8.87K 1% 1/4w
R124 5K Multiturn Potentiometer (top adj)
R125 Br Bl Bl Br brown = 1k 1% 1/4W
R126 W Bl W Br brown = 9.09K 1% 1/4W
R127 R V O gold = 27k 5% 1/4w
R128 Br Bl Grn gold = 1M 5% 1/4w
R129 Br Bl Grn gold = 1M 5% 1/4w
R130 Y V R gold = 4.7K 5% 1/4W
R131 empty
R132 Br Bl Grn gold = 1M 5% 1/4w
R133 Br Bl Grn gold = 1M 5% 1/4w
R134 Br Bl Grn gold = 1M 5% 1/4w
R135 Br Bl Grn gold = 1M 5% 1/4w
R136 Br Bl Grn gold = 1M 5% 1/4w
R137 R R R gold = 2.2K 5% 2W
R138 R R R gold = 2.2K 5% 2W
R139 W Bl W R brown = 90.9K 1% 1/4W
R140 Gy Gy V O brown = 887K 1% 1/4W

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R141	Br O Bl R brown = 13K 1% 1/4W	
R142	Br O Bl R brown = 13K 1% 1/4W	
R142A	R V O gold = 27k 5% 1/4w	R142A (non-std holes near sw & R145)
R143	Gy Gy V O brown = 887K 1% 1/4W	
R144	W Bl W R brown = 90.9K 1% 1/4W	
R145	O W Br gold = 390 5% 1/4W	
R146	Y V Bl gold = 47 5% 1/4w	
R147	Y V O gold = 47K 5% 1/4W	
R148	Br Bl Grn gold = 1M 5% 1/4w	
R149	Y V O gold = 47K 5% 1/4W	
R150	O W Br gold = 390 5% 1/4W	
R151	O W Br gold = 390 5% 1/4W	
R152	Y Bl R R brown = 40.2k 1% 1/4w	
R153	Br O V O brown = 137K 1% 1/4W	
R154	O Y Bl O brown = 340K 1% 1/4W	
R155	W Bl W R brown = 90.9K 1% 1/4W	
R156	Br O V O brown = 137K 1% 1/4W	
DE4	1K 5% 1/4W	- can't find

DPS PN 20050061 Motherboard
Dedicated 7T55201 SN01 DPS SN 354

R43 was located into R42, was corrected by Bill Speth of DPS

Review of motherboard

1. JP12 called TP12 in BOM - BOM typo
2. R12 per BOM is 220 Ohm Resistor but installed 100 ohm - R15 will adjust out and difference
3. R30-R32 & R38 can be any value from a jumper to 10 ohms and any wattage up to 2W - The purpose of these resistors are to fail when another component fails, saving the clad on the motherboard. Jumpers & larger wattage resistors could permit motherboards clad to fuse as a secondary failure but does not affect operability.
4. R40 is shown as R46 on BOM (R46 on PCB is empty) - BOM typo
5. R41 per BOM is 1K but had 200 Ohm resistor installed - Per Bill Speth, R41 can be any nominal resistor between 200 & 1000 ohms.
6. R43 per BOM should be 47 ohm but had (2) 100 ohms in parallel - Per Bill Spteh, R43 can have any equivalent nominal resistor between 45 & 55 ohms with 1/2W equivalent rating.

BOM

Jumpers	C1		D1		FU1	IC1	
A	Y	C2 empty	D2	empty	FU2	N/A	
B	Y	C3 (104J100V) 0.1uF, 100v	D3	(1N4004)	FU3	N/A	
C	Y	C4 (104J100V) 0.1uF, 100v	D4	(1N4004)	FU4	RED LED (LED1 in BOM)	
D	Y	C5 empty	D5	(1N4004)	FU5	empty	
E	Y	C6 (104J100V) 0.1uF, 100v	D6	empty			
F	Y		D7	(1N4004) 1A 400V			
G	Y		D8	empty			
H	Y		D9	(1N4004) 1A 400V			
I	N/A		D10	empty			
J	Y		D11	empty			
K	Y		D12	empty			
L	Y		D13	empty			
M	Y						
N	Y						
COM	LOOP	A (near com) = LOOP					
P	Y						
Q	Y						
R	Y						
S	Y						
T	Y						
U	Y						
V	Y						
W	Y						
X	Y						
Y	Y						
Z	Y						

J1	9=4 space 4	JP1	Y	PC1 30=(2)15
J2	9=3 space 4 space	JP2	1-3,2-4	PC2 30=(2) 15
J3	9	JP3	1-3,2-4	PC3 30=(2)15
J4	12=6 space 5	JP4	1-3,2-4	PC4 15
J5	9=space 7 space	JP5	empty	PC5 empty
J6	12=3 space 8	JP6	Y	PC6 empty
J7	12	JP7	Y	
J8	N/A	JP8	Y	
J9	9=space 8	JP9	(CUT 2-3),1-3,2-4	
J10	9=2 space 2 space 3	JP10	empty	
J11	12=3 space 8	JP11	B-F	
J12	9=space 3 space 4	JP12	(CUT 1-2), 1-3, 2-4	
J13	9=2 space 5 space			
J14	12=3 space 2 space 2 space 2			
J15	empty	JP12 called TP12 in BOM		
J16	empty			

T1	empty
T2	DPC-20-500 115/230V TO 10/10V, 10VA (0.5A per secondary coil, dual coil)
T3	DPC-20-500 115/230V TO 10/10V, 10VA (0.5A per secondary coil, dual coil)
T4	DPC-20-500 115/230V TO 10/10V, 10VA (0.5A per secondary coil, dual coil)
T5	DPC-20-06, 115/230V to 10/10V 1.2VA (0.06A per secondary coil, dual coil)
T6	DPC-20-06, 115/230V to 10/10V 1.2VA (0.06A per secondary coil, dual coil)
T7	empty
T8	empty
T9	DPC-20-06, 115/230V to 10/10V 1.2VA (0.06A per secondary coil, dual coil)
T10	DPC-20-06, 115/230V to 10/10V 1.2VA (0.06A per secondary coil, dual coil)
T11	DPC-20-500 115/230V TO 10/10V, 10VA (0.5A per secondary coil, dual coil)
T12	DPC-20-500 115/230V TO 10/10V, 10VA (0.5A per secondary coil, dual coil)
T13	empty
T14	empty

R1	empty	
R2	empty	
R3	Y V R gold = 4.7K 5% 1/4W	
R4	Y V R gold = 4.7K 5% 1/4W	
R5	R R Gld gold = 2.2 5% 1/4W	
R6	200 multiturn potentiometer (Top Ad	
R7	Br Bl Bl Bl brown = 100 1% 1/4W	
R8	Y V R gold = 4.7K 5% 1/4W	
R9	R R Grn gold = 2.2M 5% 1/4W	
R10	empty	
R11	empty	
R12	R R Br gold =220 5% 1/4W	
R13	empty	
R14	empty	
R15	200 multiturn potentiometer (Top Adj)	
R16	empty	
R17	empty	
R18	empty	
R19	R R R gold = 2.2k 5% 2W	
R20	empty	
R21	empty	
R22	empty	
R23	empty	
R24	R R R gold = 2.2k 5% 2W	
R25	empty	
R26	empty	
R27	empty	
R28	empty	
R29	empty	
R30	1 5% 2W	Br Bl Gld gold = 0.1 5% 2W
R31	1 5% 2W	Br Bl Gld gold = 0.1 5% 2W
R32	1 5% 2W	Br Bl Gld gold = 0.1 5% 2W
R33	Blu Gy R gold = 6.8k 5% 2W	
R34	Blu Gy R gold = 6.8k 5% 2W	
R35	N/A	
R36	empty	
R37	empty	
R38	Br Bl Bl gold = 10 5% 2W	

RL1 PN also verified against qualification sample

RL1	**P&B PN KHAU-17D11-48, 12VAC/DC COIL, 12A, 120VDC SPDT contacts**
RL2	empty
RL3	empty
RL4	empty
RL5	empty
RL6	empty

P22

DPS PN 20050061 Motherboard

R39	empty	
R40	R R Gld gold = 2.2 5% 1/4W	shown as R46 in BOM
R41	1K 5% 2W	R R Br gold = 220 5% 2W
R42	empty	
R43	47 5% 1/2W	(2) Br Bl Br gold = 100 5% 1/4W (2
R44	empty	in parallel is 50, 5% 1/2W)
R45	Br Bl Bl Bl brown = 100 1% 1/4W	
R46	empty	
R47	R R Gld gold = 2.2 5% 1/4W	
R48	empty	
R49	2K potentiometer (multiturn, top Adjustment)	
R50	W Bl W Bl brown = 909 1% 1/4W	
R51	R R R gold = 2.2k 5% 1/4W	
R52	R R R gold = 2.2k 5% 1/4W	
R53	200 multiturn potentiometer (Top Adj)	
R54	empty	
R55	empty	
R56	empty	
R57	empty	
R58	empty	
R59	empty	
R60	Br Bl Silver gold = 0.01 5% 2W	
R61	Br Bl Silver gold = 0.01 5% 2W	
R62	empty	
R63	R R Gld gold = 2.2 5% 1/4W	
R64	R R Gld gold = 2.2 5% 1/4W	
R65	empty	
R66	R R Gld gold = 2.2 5% 1/4W	
R67	empty	
R68	empty	
R69	empty	