Part Number(s): 000566-01

	Name	Part Number(s)	Qty	Sheet No.	Schematic No.
Item:	OSVU 28V Electromagnetic Compatibility Filter and Power Supply Unit	000549-02 000807-03	1		000810, 000638
Function:	OSVU 28V Electromagnetic Compatibility Filter and Power Supply Unit	The EMC Filter is a custom design. The filter consists of one stage of differential mode filtering and one of common mode filtering. The input power connector is an integral part of the filter enclosure. The Power Supply itself combines modules to produce a 270W supply which provides three voltages used by the OSVU electronics and external HMI components. 5V, +12V and -12V. The input of the unit PSU is protected by a 10A circuit breaker located on the OPP in the Orbiter.			

Failure Mode: Loss of single 5V power supply module, no output

	H/W	Func.	Screen Failures
Criticality:	3	2R	A

Mission Phase: Orbit

Cause(s):	OSVU 28V Electromagnetic Compatibility Filter and Power Supply Unit	Single 5V PSU module, no output.

Failure effect on unit/end item:

1. OSVU: No effect
2. Interfacing Subsystems: No effect.
3. Mission: No immediate effect. Subsequent failures of a 5V module will result in loss of this OSVU.
4. Crew/Vehicle: No effect.

Worst Case: No effect

Redundant Paths: Two remaining power modules
Standby OSVU in locker

Retention Rationale

Design: PSU Design:
A 28VDC input PSU and EMC Filter is installed in the OSVU and are located in a separately partitioned section of the SVS core unit. This separation provides EMC isolation between the power and digital/analog sections of the unit. Additional EMC considerations include single point ground, EMC filters on the OSVU air intake and air outlet, minimum screw spacing on panels, and OSVU bonding to the Orbiter R12 rack via the electroless nicke. plated surface on the rear of the front panel.

The input of the unit PSU is protected by a 10A circuit breaker located on the OPP in the Orbiter. All PSU outputs provide over-voltage, thermal and short circuit protection. A green LED located on the front of the unit in the OSVU configuration is powered from the 5V supply to indicate the presence of 5V power.

The power supply unit uses five (5) DC-DC converter modules from PICO Electronics to provide the output voltages shown below. Three 10A 5V modules are connected in parallel to provide 30A capability at 5V. The combined modules produce a 270W supply which provides three voltages used by the OSVU electronics and external HMI components.

5 V @ 30 A
-12 V @ 5.0 A
-12 V @ 5.0 A

Present SVS current requirements for the +5V supply is 13A, which leaves 17A for growth. These are industrial grade power modules designed to operate from -40C to +85C whereas the nominal operational supply temperature range is 30 to 45C. Given the above conditions these supply modules are not experiencing a great deal of stress and are unlikely to fail.

Prepared: 17Apr98 by Rice, Craig

Supersedes: N/A

The Max Load regulation for these modules when loading is between 50-100% is 1.25% or 62.5mV. The SVS will operate normally for +5V −250mV. Therefore, if one module stops contributing the remaining 2 modules will continue to provide sufficient power to operate SVS indefinitely.

Materials Processes and Parts and design verification.

The PSU was designed in accordance with SSP 30233, Space Station requirements for Materials and Processes and in accordance with SSP 50062, NASA/CSA Bilateral Safety and Mission Assurance Requirements, Paragraph 3.3.1 for Electrical, Electromechanical and Electromagnetic (EEE) Parts. (These requirements are the Canadian equivalent to NASA requirements - SSP 30312)

Test: Pico Electronics Inc. Pelham, NY, provides +5V modules in three module sets screened as follows:
Stabilization Bake: per MIL-STD-883 method 1008, 24 hours, TA=125C.
Temperature Cycle: per MIL-STD-883 method 1010, Condition B (-55C to 125C).
Burn In: per MIL-STD-883 method 1015, 160 Hours @85C (case temp).

Pico also provides Neptec with the documentation of the power sharing balance test for each module set shipped at -10C, 30C and 60C.
In addition as a result of CAR 97037 Pico will also provide the following:
1) All Linear Technology LT1105 parts received go through a reduced AQL sampling of 0.65 per MIL-STD-105D before being approved for Pico Component stock.
2) 100% screening of all IC's used for Neptec units go through a prescreening thermal shock test of 10 cycles from -60 to 145C, with a dwell time of 15 minutes, before assembly.
3)The top side marking are not removed on any Neptec module assembled and IC lot and date codes will appear on internal PICO lot Travelers.
4) Screening process has been modified to include each module being powered up and verified operational at -40C under full load.

Once installed in the PSU CCA Neptec verifies the balance and load driving characteristics of the modules in the PSU configuration on the bench as well as in a thermal chamber as outlined in ATP 001586-01

PSU ATP 001586-01 performs tests under the following headings
1. Continuity Tests
   All input power wires are connected in J1.
   Input power signals are isolated from each other and chassis.
   All output power wires are connected in J3.
   Output power signals are not shorted to their returns.
   Output power signals are isolated from each other and chassis.
   Sense signals are connected in J2.
   The input power signals are isolated from the output power signals.

2. Functional Tests, pre Conformal Coating

The purpose of this test is to confirm the integrity of the supply outputs and temperature sensor over minimum, nominal and maximum line voltage and loads. The tests are performed at room temperature. Output voltages, noise and ripple, and 5V module input currents are measured. The supply is powered up and down 10 times, whilst testing for 5V dips, and module power up within 2 seconds. The temperature sensor voltage is recorded.

3. Thermal Tests from +10C to +60C

This test confirms the operation of the supply, with line and load variation over temperature. The functions: +5V, −12V, +12V and 5V current share upper limit are tested over a temperature sequence of -10C and +60C. To improve accuracy and repeatability specified elapsed times are given to allow temperature stabilization. The oven is typically set colder than the temperature of the required test, due to the internal heat generation of the supply. Output voltages, noise and ripple, and 5V module input currents are measured. The supply is powered up and down 10 times, whilst testing for 5V dips, and module power up within 2 seconds. The temperature sensor voltage is recorded.

4. Functional Tests, post Conformal Coating

This test is similar to the test for Pre Conformal Coating. The purpose of this test is to confirm the integrity of all the supply outputs. The tests are performed at room temperature.

Once the PSU assembly is installed in a Unit, the Unit and PSU undergo the following tests.

CSVU ATP 0001103-01

1. Functional Test (0001104-01)

The OSVU Functional Test provides a comprehensive method for verifying the functionality and interfaces of the OSVU. The Functional Test is performed prior to, and after any major environmental tests (e.g., EM Thermal/Vibration, Flight Acceptance), as well as prior to delivery of the OSVU to the customer.
The Functional Test covers the following areas of functionality.
- power consumption;
- OSVU supply voltage check;
- initialization;
- user interfaces;
- video inputs;
- video outputs;
- target acquisition;
- target tracking;
- photosolution generation;
- calibration;
- MDM interface

2. Thermal Test (operational, in conjunction with Checkout Test)

During the operational thermal check, the OSVS is set up to track and generate a photosolution for a static target array coming from a high fidelity VCR source in the Test Rack. The OSVS must continue to operate normally throughout the operational thermal test. Acquired targets must not be lost and neither can the OSVS go from the RUN mode to the HALT mode.
The thermal cycle starts and ends at ambient temperature and consists of two hours at 40C followed by two hours at -5C followed by two hours at 40C. OSVU checkout test below is performed at each of the plateaus.
The total duration of the test will be approximately 9 hours.

Checkout test: This test verifies the basic ability of the OSVU to:
- power up;
- provide a navigable set of user interface windows;
- load a database;
- process a balanced video signal on Video in 1;
- generate tracking windows;
- acquire target dots on the input video signal;
- generate photosolutions for the acquired targets;
- generate a synthetic display with the calculated photosolutions;

3. Vibration Test (operational, in conjunction with Checkout Test)

The OSVS, excluding its commercial off-the-shelf (COTS) peripherals, must operate after exposure in each of the three axes to the random vibration, levels provided below:

Frequency(Hz)	Vibration Level(g2/Hz)
20	0.01
20 to 80	+3.00 dB/octave
80 to 350	0.04
350 to 2000	-3.00 dB/octave
2000	0.007

Composite = 6.1 Grms

The duration of the acceptance vibration is one minute per axis.

4. Burn-in Test

The OSVS Burn-in Acceptance Test consists of accumulating power-on operating time to detect material and workmanship defects that occur early in the components life. The burn-in time total is monitored over the course of the overall acceptance test, and sufficient time is left prior to the final functional test to operate the OSVS for the length of time necessary to achieve the minimum 50 hour burn-in requirement.

5. Functional Test (0001104-01)

In addition the design has been tested against the Orbiter Space Vision Unit (OSVU)Qualification Test (NDG001178-01)

EMC testing were performed David Florida Labs (DFL) and Aprel Labs, in accordance with test procedure NDG001111-01. Testing was

performed in the following order:
Radiated emissions, electric field (RE02), section 7.5.
Radiated emissions, AC magnetic field (RE04), section 7.4.
Conducted emissions, power leads (CE01, CE03), section 5.4.
Radiated susceptibility, electric field (RS03), section 6.5.
Radiated susceptibility, AC magnetic field (RS01), section 6.4.
Conducted susceptibility (CS01, CS02, CS06), section 4.
Conducted emissions, DC ripple and transient spikes (CE07), section 5.5.
Radiated susceptibility, lightning-induced, section 6.7.
Radiated emissions, DC magnetic field, section 7.6.
Radiated susceptibility, DC magnetic field, section 6.6.

Atmospheric Pressure & Humidity (Non-Operating and Operating)tests were performed at QETE, in accordance with test procedure NDG001109-01-01.00.

The operating and non-operating thermal tests were performed in the thermal test facility at Neptec, as per Thermal Qualification Test Procedure NDG001107-01.

Inspection: Units are manufactured under documented quality controls with workmanship in accordance to MIL-STD-2000. These controls are exercised throughout design procurement, planning, receiving, processing, fabrication, assembly, testing and shipping of the units. Mandatory inspection points are employed at various stages of fabrication, assembly, and test. Each PSU CCA and PSU Assembly is tracked through the assembly and test process using a unique shop traveler which is included as part of the OSVS End Item Data Package shipped with each system.

Incoming inspection verifies that all module sets received are as identified in the procurement document, that no physical damage has occurred to modules during shipment, that the receiving documents provide adequate traceability information and screening data to clearly identify the module sets.

After kitting an Audit is performed to verify all parts are correct and that the matched sets of modules are kitted to the same PSU. The assembly of the PSU is multi-stage with inspection points between each stage. An inspection for stage completion, cleanliness and workmanship standards is performed after the preliminary assembly stage and before installation of the power modules. A heat plate is used to raise the temperature of both the PCB and the modules in order to reduce the time required to solder the power pins. An inspection for PCB final stage completion, cleanliness and workmanship standards is then performed. These inspections include checks for correct board installation, proper connector contact mating, wire routing, strapping of wires as well as cleanliness and workmanship standards. After the Pre conformal coating test of the ATP is performed the PCB's are conformally coated. The inspection is repeated after conformal coating. A final inspection is performed after the Post conformal coating test of the ATP is performed and before the PSU enclosure is closed.

OMRSD Offline: NA

OMRSD Online Installation: NA

OMRSD Online Turnaround: None

Screen Failure: A: This fails the A screen because a failure of one of the three modules within the 5V power supply is undetectable. The redundant hardw items (two other modules) are connected in parallel and are not individually instrumented. The current requirements of the system for t is such that the system can function on two modules.

B: Pass

C: Pass

Crew Training: None

Crew Action: None

Operational Effect: None

Mission Constraints: None

Approvals:

Prepared: 17Apr98 by Rice, Craig

Supersedes: N/A

Functional Group	Name	Position	Telephone	Date Signed	Status
Engineer	Brule, Dave	Design Engineer	613-599-7602 EX	15May98	Signed
Reliability	Elgin, David	CSVS Systems Engineer	613-599-7603X2	21May98	Signed
Program Management Off	Darlington, Tom	Program Manager - CSVS	613-599-7603 EX	28May98	Signed
Customer, S & MA	Kokosz, Cheryl	SR & QA Jeeves User - NASA	281-244-1954	03Sep98	Signed
Subsystem Manager	Glenn, George	Customer - Subsystem Manager	(281) 483-1516	26Aug98	Signed
Technical Manager	Peck, John	NASA Program Manager	281-483-1264	25Sep98	Signed