APPLICATION		REVISIONS			
NEXT ASSY	USED ON	REV	DESCRIPTION	DATE	APPROVED
N/A	VARIOUS	-	INITIAL RELEASE	03/02/17	JT

SEAKR® ENGINEERING PROPRIETARY

Distribution Outside of SEAKR is prohibited without prior express written permission of Director of IRAD or Manager, Contracts

Non-Disclosure Statement
This document contains proprietary information developed by SEAKR Engineering, Inc.

The pages marked "SEAKR Engineering Proprietary" shall not be duplicated, used, or disclosed in whole or in part, for any reason other than their intended purpose. All proprietary rights pertaining to the information provided hereunder shall remain the sole property of SEAKR Engineering, Inc.

This Document contains SEAKR® Engineering Proprietary Information and may not be used in whole or in part except for the limited purpose for which it was furnished and in accordance with the Contract. Do not distribute, duplicate, or reproduce, in whole, or in part, without the written permission of SEAKR and this notice affixed to the document or any information from this document.

RELEASED
03/02/17 009

SOURCE CONTROL DRAWING

Printed copy is for REFERENCE ONLY

	CONTRACT NO. SEAKR			SEAKR ENGINEERING 6221 S. Racine Circle Centennial, CO 80111-6427		
	APPROVALS	DATE				
	DRAWN: C. Gehrig	02/26/17	SCD, EXTENSIVE SCREENING OF TWO-PHASE HEAT TRANSPORT SYSTEMS, SEAKR			
	CHECKED: K. Kingsford	03/02/17				
			SIZE A	CAGE CODE 0LB42	DRAWING NO. 10097	REV -
DO NOT SCALE DRAWING	ISSUED: J. Trevarton	03/27/17	SCALE		SHEET 1 of 8	

SEAKR Engineering, Inc.
6221 South Racine Circle,
Centennial, CO 80111-6427

Revision / Change Record

Rev	Document Date	Revision / Change Description	Pages Affected
-	03/02/17	Initial release	N/A

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

1 SCOPE

This specification establishes the requirements for the extended screening of two-phase heat transport systems that are to be used in either space flight applications, qualification testing, or engineering model applications. This specification covers the required testing criteria for each type of assembly. The requirements in this document shall be performed by the manufacturer supplying the assemblies or a SEAKR approved facility.

2 APPLICABLE DOCUMENTS

The following standards and documents for a part of this drawing are applied to the extent specified herein. In the event that there are discrepancies between the referenced documents and this document, the order of precedence shall be as follows:

a) SEAKR Purchase Order (PO)
b) This SCD
c) Other specifications or standards referenced herein

3 DEFINITIONS AND ACRONYMS

The following terms are specific to the present standard:

Failure

Degradation or any other phenomenon resulting in the inability to transfer the required power levels

Two-phase Heat Transport Systems

Hermetically closed system filled with a working fluid that transports thermal energy by a continuous evaporation/condensation process using latent heat of the working fluid

The following acronyms are used throughout this standard:

Abbreviation	Meaning
C	Celsius
EIDP	end item data package
EM	engineering model
MDP	maximum design pressure
SCD	source control drawing
PHL	parasitic heat loss
PN	part number

PO	purchase order
Q_{EVAP}	required power to be applied at the TP_{EVAP} as defined in Program Specific Document with the addition of PHL
Q_{MAX}	maximum power level required by Program Specific Document
SEWI	SEAKR Engineering work instruction
T_{BOUND}	required temperature to be maintained at the TP_{COND} as defined in Program Specific Document
TP_{COND}	test point on the condenser as defined in Program Specific Document
TP_{EVAP}	test point on the evaporator as defined in Program Specific Document
W	Watt

4 EXTENDED SCREENING TESTS

EM, Flight, and Qualification assemblies required to undergo the augmented screening defined herein shall follow the test flow specified in the appropriate section. The required extended screening shall be defined in a **Program Specific Document**.

4.1 HERMETIC TESTING REQUIREMENTS

Testing conditions and pass/fail criteria for the hermetic screening of two-phase heat transport systems are detailed in subsequent sections. EM, Flight, and Qualification assemblies required to undergo hermetic testing defined herein shall follow the test flow specified in Figure 1.

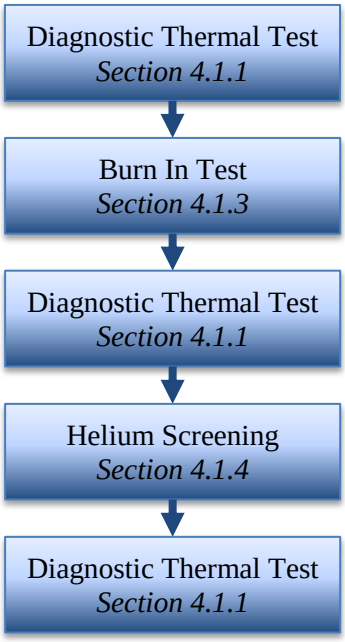

Figure 1: Test Flow - Hermetic Screening of EM, Flight, and Qualification Assemblies

Table 1: Specific Test Conditions and Tolerances

ID	Examination	Conditions and Tolerances	Quantity	Ref.
1	Diagnostic Thermal Performance	**Orientation**: Horizontal **T_{BOUND}**: 45°C **Temperature Tolerance:** ±2°C **Q_{EVAP}: Q_{MAX}** **Q_{EVAP} Tolerance:** ±5% **Duration:** N/A **Duration Tolerance:** N/A **Ambient Temperature**: Atmospheric **Ambient Pressure**: Atmospheric	100%	4.1.1
2	Burn In	**Orientation**: Any **T_{BOUND}**: N/A **Temperature Tolerance:** N/A **Q_{EVAP}:** N/A **Q_{EVAP} Tolerance:** N/A **Duration:** 60 hours **Duration Tolerance:** +12 hours/-0 hours **Ambient Temperature**: 150C ±2°C **Ambient Pressure**: Atmospheric	100%	4.1.3
3	Helium Screening	**Orientation**: Any **T_{BOUND}**: N/A **Temperature Tolerance:** N/A **Q_{EVAP}:** N/A **Q_{EVAP} Tolerance:** N/A **Duration:** 60 hours **Duration Tolerance:** +12 hours/-0 hours **Ambient Temperature**: 150°C ±2°C **Ambient Pressure**: Pressurized helium to 100 psi ±2 psi	100%	4.1.4

4.1.1 Diagnostic Thermal Performance Testing

All assemblies subjected to the diagnostic thermal performance testing are to be characterized by measurement of the thermal resistance exhibited by the device. This thermal resistance is to be measured from a test point on the surface interfacing with the power source (designated TP_{EVAP} in a **Program Specific Document**) to a test point on the surface of the condenser end of the assembly (designated TP_{COND} in a **Program Specific Document**). The evaporative heat sink, heat source, and temperature sensor shall be insulated against excess losses via radiation. Both TP_{EVAP} and TP_{COND} shall be recorded for each serialized unit.

The precision of the measurement and calculation of thermal resistance shall be assumed to yield usable values no greater than two decimal places. For example, a measurement and calculation yielding a resistance of 0.304 shall be rounded down to 0.30 and a thermal resistance determined to be 0.305 shall be rounded up to 0.31.

4.1.1.1 Test Conditions

For assemblies, thermal resistance testing will be carried out at ambient pressure. The condenser temperature, $TP_{CON,}$ will be maintained at T_{BOUND} as specified in Table 1. Measurements will be taken with the assembly axis in the horizontal orientation.

For tests conducted in air, as is the case with EM and Flight assemblies, parasitic heat loss (PHL) shall be determined experimentally and used as the basis for actual heater power application. Therefore, for Q_{EVAP} as specified in Table 1, the sum of the nominal power level and the PHL shall be applied to the heater. PHL need only be calculated on the first unit of each dash configuration. This value may be reused on subsequent test units, provided the test setup remains the same. The same fixtures for qualification and acceptance test shall be used and any deviation from this shall require SEAKR's approval.

Calculations associated with the pass/fail criteria shall be conducted using the Q_{MAX} as defined in a **Program Specific Document**.

4.1.1.2 Pass/Fail Criteria

All assemblies shall exhibit a thermal resistance less than or equal to the associated thermal performance requirements provided in the **Program Specific Document** for the HORIZONTAL (gravity neutral) condition. The vendor shall test Q_{MAX} power level listed in the **Program Specific Document.**

4.1.2 Warm Up Testing

A warm up test may be performed in lieu of a diagnostic thermal test with written SEAKR approval. This test shall be performed according to the vendor's best practice to ensure that the unit is still functioning as a heat pipe.

4.1.3 Burn In Testing

The Burn In Test shall be performed at a temperature of 150°C with the assembly in any orientation. The burn in test duration shall be a minimum of 60 hours at 1 atm.

4.1.4 Helium Screening

The Helium Screening shall be performed in a helium environment with an external pressure to the heat pipe of 100 psi. The test shall be conducted at 150°C for a minimum of 60 hours.

4.1.5 Pass/Fail Criteria and Required Documentation

Unit failures for any check in this screen shall be marked or otherwise identified. These units shall not be subjected to any further testing without SEAKR written approval.

An affirmation statement of successful hermetic screening shall be provided with the EIDP of the delivered units. Details of the screening described in this document shall not be provided in the EIDP of the end unit.