

**NOT RELEASED
FOR REFERENCE ONLY**

**TEST PROCEDURE:
BENCH TESTING
FOR THE
OIL CHIP DETECTOR HOUSING
F1901-0001
APRIL 10, 2020**

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Note: Document approvals are captured electronically in the Honeywell Product Data Management (PDM) System. Technical approval for the content of this document is given by the individual(s) listed above or their delegates.

REVISION HISTORY

Rev	By	Approved	Date	Revision Summary
—				Initial issue.

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	Fahrenheit
N/A	Not Applicable
P/N	Part Number
OCDH	Oil Chip Detector Housing
PSC	Procurement Specification (document)
DAQ	Data Acquisition System
GPM	Gallons Per Minute
LBS.	Pounds
PSIG	Pounds Per Square Inch Gauge Pressure

1.0 INTRODUCTION

1.1 Purpose and Scope

This test procedure describes the process of verifying that the OCDH satisfies all original performance standards before being subject to a live engine test.

The design and test procedure were created by a Northern Arizona University senior design team for undergraduate degree fulfillment. The design, test procedure, and results should only be used for educational purposes.

1.2 Summary

The following document contains a list of testing procedures to be conducted on the OCDH. The tests will cover the required design assurance tests which include weight verification, burst pressure, and proof pressure. The tests will allow verification of the flow models. The test specimens will be provided by Team Honeywell at NAU for the purposes of testing. A list of required equipment is included within this test procedures. A list of approved liquids is included for use as the working fluid for the pressure and flow tests.

1.3 Applicable Documents

The following documents, of the exact issue shown below, form a part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document shall supersede. If more than one revision of a referenced document applies, the specific revision is noted in the text reference.

The PSC referenced by this document contains preliminary objectives and constraints for the OCDH, many of which have not changed since its introduction.

<u>Document Number</u>	<u>Document Name</u>
24-PSC-XXXXXXXX	Procurement Specification for the Oil Chip Detector Housing
14-CFR-Part 33	Airworthiness Standards: Aircraft Engines

2.0 DISCUSSION

2.1 Ambient Conditions

During testing, unless otherwise specified, functional test criteria will be based on the following range of ambient temperature, humidity and pressure:

Temperature: $77^{\circ} \pm 41^{\circ} \text{F}$

Relative Humidity: 80% or less
Barometric Pressure: site pressure

Whenever voltages are not specified for test conditions, they shall be assumed to be the nominal value. Where tests are specified at other than ambient conditions, the following test tolerances apply:

Temperature: $\pm 37.4^{\circ}\text{F}$

2.2 Recording of Testing

Complete test records shall be maintained throughout all testing. All anomalies encountered during the test shall be recorded. Pressure and flow testing will require a DAQ to keep record of the pressure and velocity within the OCDH.

2.3 Test Failures

Test failure will be determined if the OCDH experiences any leaks, deformations, or ruptures. Any leaks or ruptures will be recorded, and the testing specimen will be replaced with a new specimen. Deformations will be determined posttest by visual inspection of the OCDH. All test failures will be reported to Team Honeywell for reevaluation of the design.

2.4 Test Specimens

The test specimen for all procedures will be provided by team Honeywell at NAU. As only one test specimen will be completed, all the tests will be applied to the same unit. Reference Table 1 for the OCDH assembly item list.



Figure 1: Partially Completed OCDH

Table 1: Oil Chip Detector Assembly

Item	Description	Quantity
OCDH Body	Body, 304SST	1
OCDH Lid	Lid, 304SST	1
Gasket	Precut, Graphite/Nitrile composite	1
Screw	M10x50mm, SST socket cap screw	3

2.5 Test Location

All tests will be performed at the Honeywell San Tan Testing Facility in Gilbert, Arizona. The tests will be performed based upon the information provided in this testing document.

2.6 Test Sequence

Tests will be performed in the order as they appear below.

Table 2: Test Requirements

Test	Requirement Satisfied By	Comment
Weight	<1 lbs.	Allowance to 1.3 lbs.
Proof Pressure	12 hrs. flow at 50psig inlet	Leakage is a fail
Burst Pressure	1 hr. flow at 100psig inlet	Leakage or Rupture is a fail
Flow Test	≤4 ft/s at the sensor	<i>n</i> -samples to determine mean flow rate with 95% CI

2.7 Procedure Revisions

There has been no revision to date on the testing procedure document.

3.0 EQUIPMENT LIST

3.1 Design Assurance and Benchtop Test Equipment

Equipment listed below will be used for design assurance and benchtop testing regimes. The following arrangement has proven to be ideal for flow rate and pressure tests:

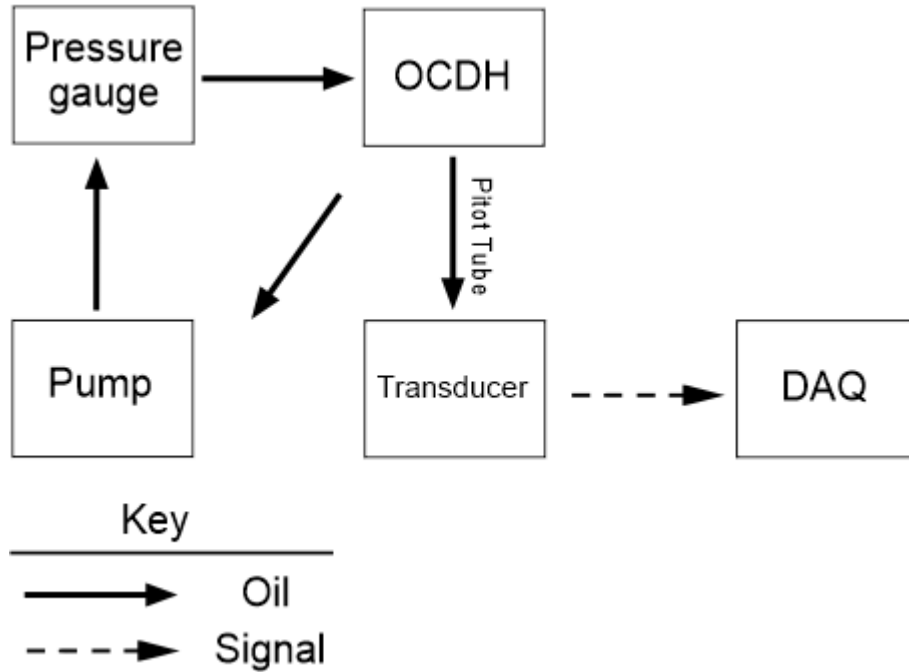


Figure 2: Layout of the capstone team’s test apparatus

Table 3: Equipment List

Qty	Description	Model, Product, or Part Number or Equivalent	Comment
1	Digital Scale (0.01lbs. Precision)	Mettler Toledo ICS465	Calibrated
1	Data Acquisition Module	National Instruments 9XXX Series	Calibrated
2	Pressure Transducer	Omega PX190	Calibrated
1	Oil pump		Capable of supplying 8-10gpm

3.2 Oil Types, working fluid

Tests for flow characteristics or experiments studying interactions involving the working fluid shall utilize working fluids from the list of Approved Lubricants in Table 3:

Table 4: Approved Lubricants

Type	MIL-Spec	Brand Name
1	MIL-PRF-7808	BP Turbo Oil 2389 Castrol 399 Brayco 880
2	MIL-PRF-23699	Mobil Jet Oil II BP Turbo Oil 2380 Castrol 5000 Aeroshell/Royco Turbine Oil 500 Aeroshell/Royco Turbine Oil 560 Mobil Jet Oil 254 BP Turbo Oil 2197 Exxon Turbo Oil 2197 Exxon Turbo Oil 2380

3.3 Qualification Testing

Qualification testing shall utilize equipment necessary to fulfill requirements by 14 CFR Part 33.

4.0 TESTING PROCEDURE

4.1 Weight Testing

Using a calibrated scale and a complete assembled oil chip detector housing:

1. Ensure scale is level
2. Tare scale

3. Ensure OCDH assembly is clean and free of debris and fluids
4. Weigh OCDH, record weight
5. Validate to specifications in Table 1 or PSC for Oil Chip Detector Housing (24-PSC-XXXXXXXX)

4.2 Proof Pressure

Using the flow apparatus:

1. Plug the pitot tube port
2. Using a gate valve between the OCDH return line and pump, dial up the pressure to 50psig and time for 12 hrs.

4.3 Burst Pressure

1. Plug the pitot tube port
2. Using a gate valve between the OCDH return line and pump, set the pressure to 100psig and time for 1 hrs.
3. Take data points using the DAQ and pressure transducers.
4. Findings will be reported and the OCDH will be given a pass or fail score.

4.4 Flow Testing

1. Assemble test apparatus, reference Figure 2
2. Connect DAQ to pressure transducer, open data logging software
3. Initiate fluid flow, calibrate pressure transducer
4. Initiate fluid flow consistent with parameters in PSC for Oil Chip Detector Housing (24-PSC-XXXXXXXX)
5. Data log key fluid flow characteristics
6. Characterize n samples for 95% CI, validate to specifications in Table 1 or PSC for Oil Chip Detector Housing (24-PSC-XXXXXXXX)