

# Development of a New Flight Vent for the LOLA Laser Cavity

W. Lawrence Ramsey, NASA,GSFC

301-286-9187, [w.l.ramsey@nasa.gov](mailto:w.l.ramsey@nasa.gov)

Glenn Rosecrans, SGT,GSFC

301-286-2790, [grosecrans@sgt-inc.com](mailto:grosecrans@sgt-inc.com)

# Introduction

- The Lunar Orbiting Laser Altimeter (LOLA) will fly on the Lunar Reconnaissance Orbiter (LRO).
- The laser is based upon the one in the Mercury Laser Altimeter (MLA).
- LOLA will fly two lasers instead one in laser cavity.
- The MLA laser has a six year flight to station.

# Problem Definition

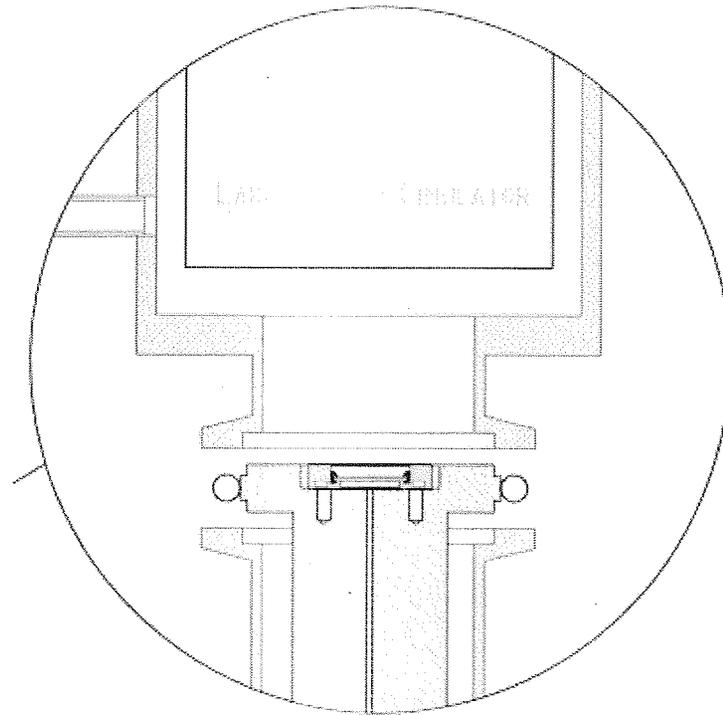
- Lasers can fire in air with O<sub>2</sub> present.
- During testing and on orbit, LOLA will fire in vacuum.
- The laser cavity must be sealed against molecular and particulate contaminants.
- Mission to Moon will start with 60 days of launch.

## Problem cont'd

- During development of mission requirements, a decision was made to re-evaluate the vent system.
- MLA system consisted of a  $.5\mu$  sintered stainless steel filter, and a tiny vent tube.
- System was designed to slow the flow of contaminants into laser cavity in the event of loss of purge air.
- Models of the flow through the vent indicated that it would take weeks to ambient and raises the possibility that cross contamination between lasers exists.

# Drawing of MLA Filter

---



# Proposed Solutions

- To prevent cross contamination, put a fence between lasers.
- Clean the parts and reduce outgassing more than MLA.
- Prevent known “bad” laser materials from being used.
- Increase venting rate, add more vents, and change locations.

# Solutions Chosen

- Convened expert panel.
- Eliminated changes in Be housing.
- Redesign metal filter vent hole.
- Clean NVR to A/3 instead of A/2.
- Use and RGA to ensure that bad compounds are gone - Principally: Silicones and Toluene.

# Design of New Vent - Outgassing

- Insert graph of MLA venting showing long slow outgassing

# Outgassing Cont'd

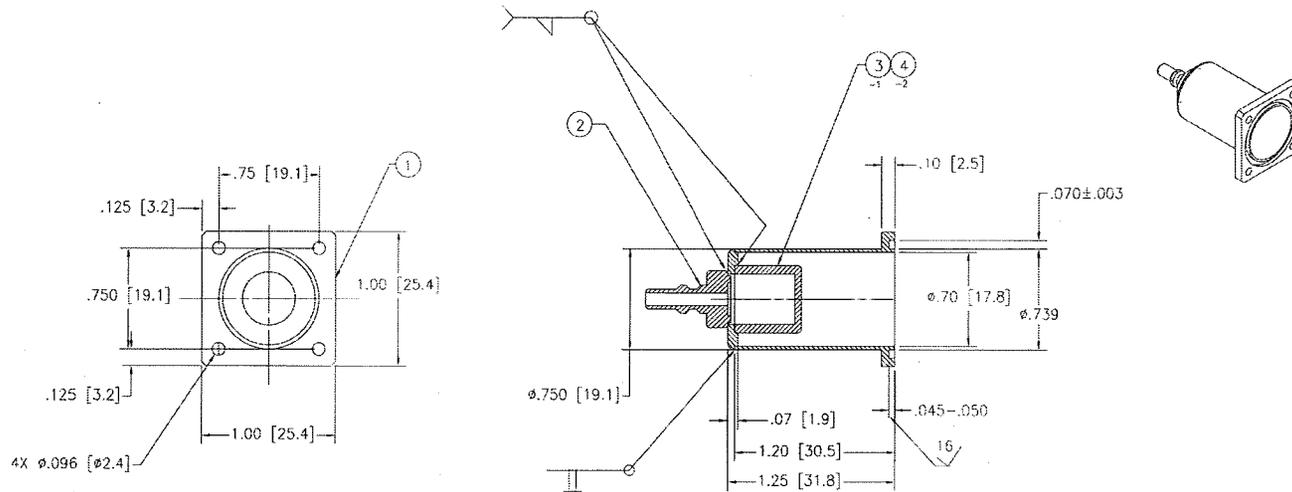
- Insert Graph of proposed changes.

# New Mott design

NOTES: UNLESS OTHERWISE SPECIFIED

SOURCE OF SUPPLY:  
MOTT CORPORATION  
84 SPRING LANE  
FARMINGTON, CT 06032  
800-289-6688

REVISION				
SYM	ZONE	DESCRIPTION	DATE	APPROVAL
A		REDESIGNED: TWO PIECE FILTER CAP		
B		REDESIGN FOR FLIGHT CONFIGURATION		



ITEM NO.	REQ'D	QUANTITY	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC.
4	1		1260-500-375-500-10	FILTER CUP, 1 MICRON MEDIA		SEE NOTE 1
3	1		1260-500-375-500-50	FILTER CUP, .50 MICRON MEDIA		SEE NOTE 1
2	1	1	GC2079306	FITTING, MODIFIED		GRES
1	1	1	-	BAR/ROD		GRES 316
-	-	-	-	WELDMENT		

ITEM NO.		REQ'D	QUANTITY	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC.
-2		-1					

UNLESS OTHERWISE SPECIFIED-DIMENSIONS ARE IN INCHES  
TOLERANCES:  
.XX .XXX  
±.01 ±.005 ±.1 FRACTIONS 63 ± 1/16

REMOVE ALL BURRS AND SHARP EDGES R. CHD OR CHAMFER MAX

FLIGHT HARDWARE/POST FAB HARDNESS TEST REQ'D  
 HARDNESS TEST NOT REQUIRED  
 TEST HARDNESS PER ASTM E-18, LOCATION OPTIONAL  
 TEST HARDNESS PER ASTM E-18 WHERE INDICATED ON FIELD OF DRAWING THUS: □

NO NON-DESTRUCTIVE EXAMINATION (NDE) REQ'D  
 NDE REQUIRED PER S-311-009 CODE

DESIGNER: MAMAKUS  
 DRAWN: MAMAKUS  
 CHECKED: CUZEK  
 APPROVED: RAMSLEY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
 Goddard Space Flight Center GREENBELT, MARYLAND  
 DRAWING INTERPRETED PER GSFC-X673-64-1

TITLE: FILTER ASSEMBLY WELDMENT LOLA

GC 2079305

REV B

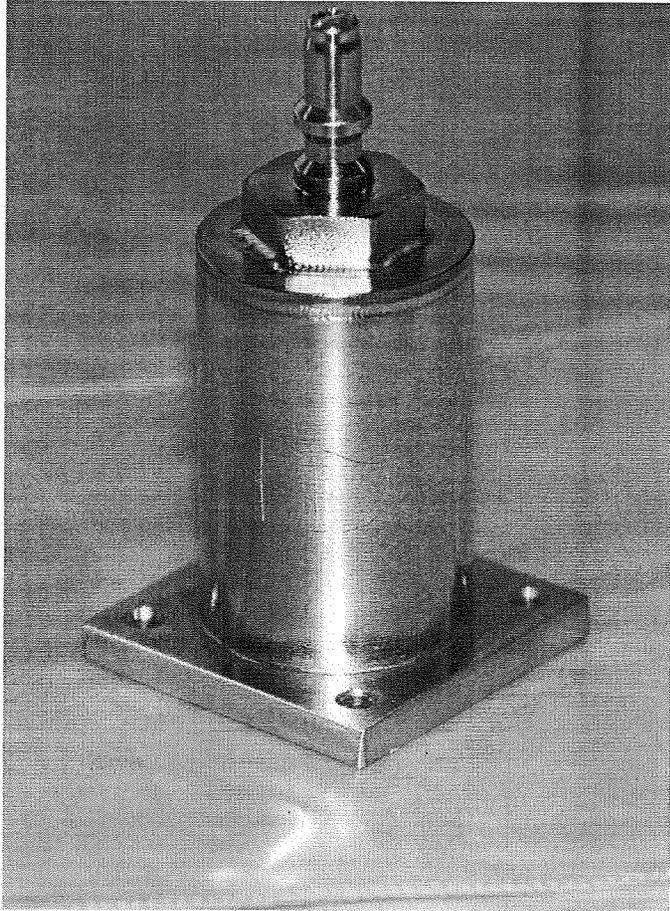
CODE: 544 SCALE: 2/1 WF SH: 01

PRELIMINARY RELEASE  
FOR ENGINEERING  
INFORMATION ONLY

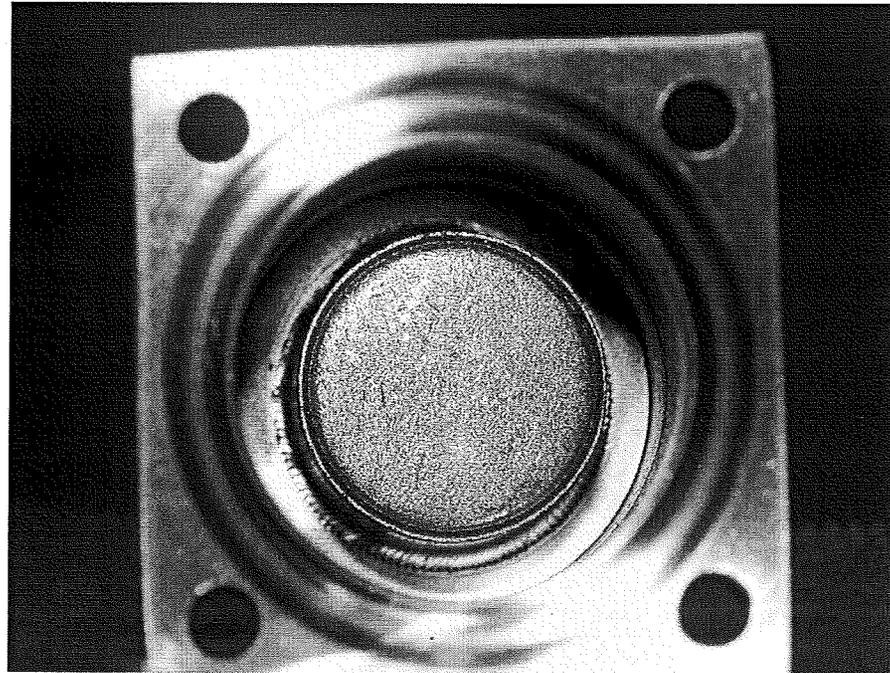
THIS DRAWING WAS PRODUCED USING  
SOFTWARE: AutoCAD VERSION: 2002  
FILE NAME: 2079305B

GC2079305

# New design Cont'd.



Flight filter profile

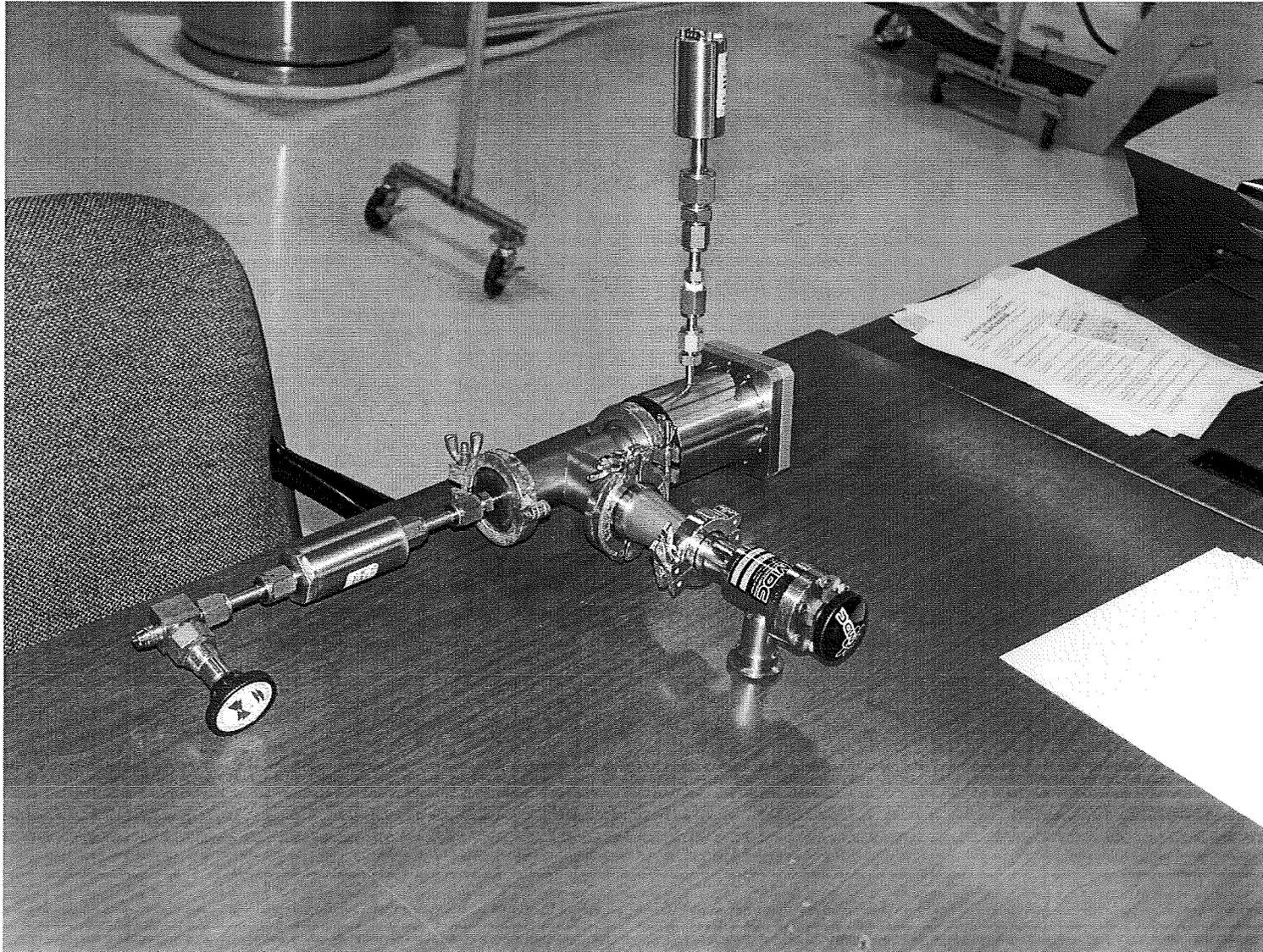


Filter base showing Mott  
Sintered metal filter cup and  
“O” ring cavity.

# Testing New Design

- Compare outgassing rates to tests performed during MLA.
- Since MLA filters arrived clean no cleaning was necessary. Came direct from sintering furnace.
- New filters undergo machining and welding.
- Test of workmanship and cleaning technique.

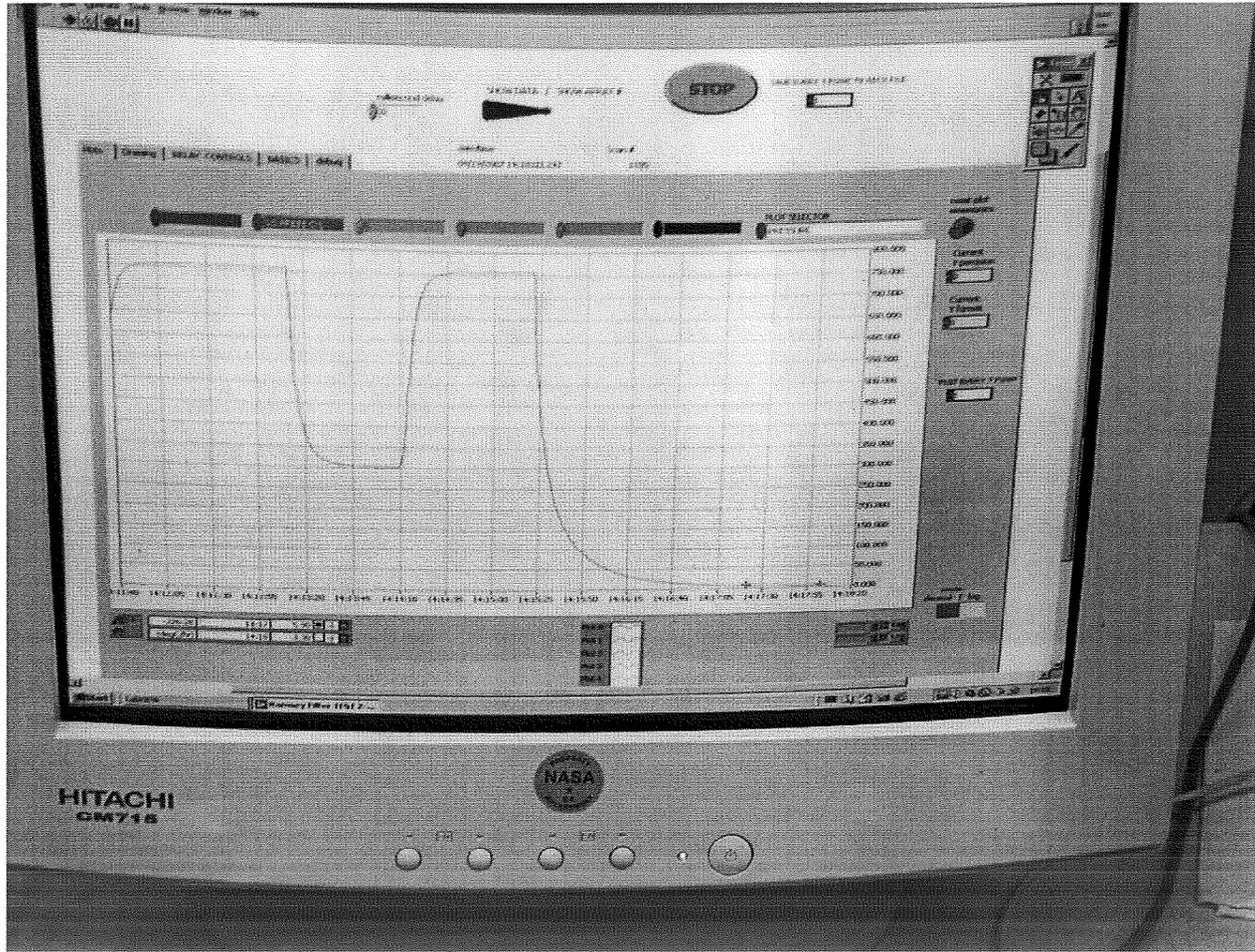
# Test Setup



# Test Setup

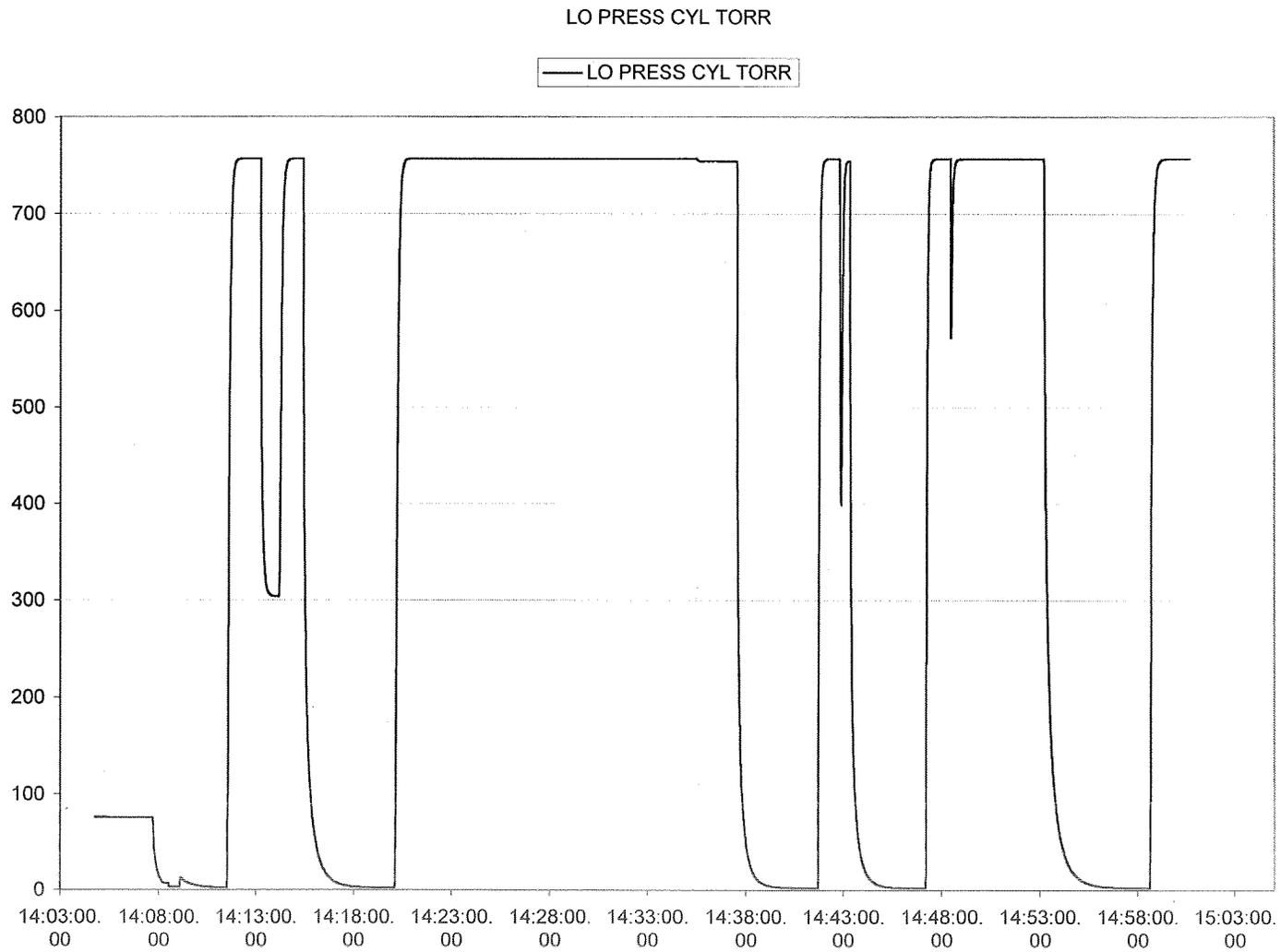


# Test Setup



Insert video of test.

# Test Results EM Before Cleaning



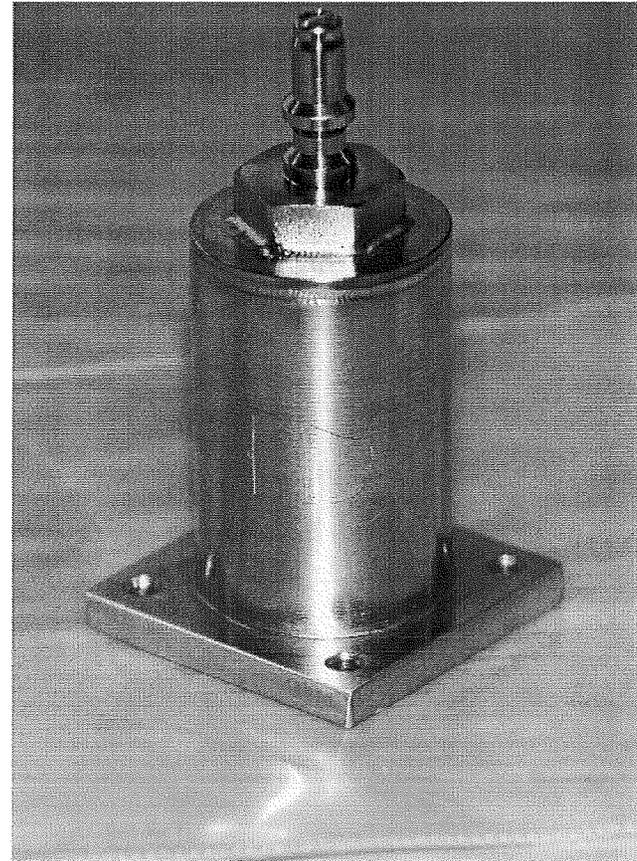
# Part Cleaning

- Begin with 2% Simple Green in DI water @ 40C in ultrasonic cleaner.
- Follow with just DI. Then rinse with Isopropyl Alcohol (IPA) Dry w/N<sub>2</sub>.
- Place part in 50:50 solution of IPA and Acetone @40C and ultrasonic cleaner.
- Rinse w/hexane take NVR sample and dry w/ N<sub>2</sub>.
- Place in oven at 550C for 1 hour.

# Test results after Cleaning

# Photo of Clean Part

- Comes out a cool blue.
- No visible ash.
- No visible damage.



# Ready for LOLA

