

Particle Measurement Technology Co.

4882 McGrath Street ♦ Suite 260 ♦ Ventura, CA 93003-7721 USA
TEL: (805) 644-8884 ♦ FAX: (805) 644-8655 ♦ Email: pmtcompany@sbcglobal.net

February 21, 2012

Dynamo Aviation
16760 Schoenborn St.
North Hills, CA 91343

REPORT OF ENVIRONMENTAL CONDITIONS IN CLEANROOMS TESTED FEBRUARY 14, 2012

Environmental measurements have been made of the cleanroom areas for the purpose of establishing compliance with ISO Standard 14644-1, "Cleanrooms and Associated Controlled Environments" and applicable portions of DOD MIL-STD-1330D (SH). This report presents results of measurements for airborne particle counts, supply airflow velocities, and mass airflow taken 2/14/12 in accordance with applicable test standards, recommended practices, and methods currently in effect.

By issuing this report, Particle Measurement Technology Co. assumes full responsibility for the accuracy of the test data and reported results. All measurements and recorded data were made or supervised by Dean Hancock, Senior Analyst. This test report and original test data on file shall remain proprietary to Dynamo Aviation, North Hills, California.

Any questions or comments concerning this test project may be directed to the attention of Dean Hancock, Project Supervisor, Particle Measurement Technology Co. Thank you.

GENERAL TEST PARAMETERS

PARTICULATE MEASUREMENTS: Airborne particle measurements were taken at random locations consistent with requirements of the standards for testing. The sampling probe was oriented in such a way as to sample the air approaching the work locations. The air sampling rate was one liter of air per minute, then was calculated in accordance with the ISO Standard 14644-1 to obtain the statistical number of particles per cubic foot of air and ultimately the statistical number of particles per cubic meter of air. Particles were counted in the size range of those equal to or greater than 0.5 micron in size using a Bio-Test APC Analyzer employing the Light Scattering Principle of Operation.

AIRFLOW MEASUREMENTS: Airflow velocity measurements were made of the ceiling mounted HEPA filters in each room at a distance approximately 6 inches from the face of each filter. A minimum of one airflow reading per square foot of filter area was recorded and all were averaged for each filter. The average airflow velocity of each HEPA filter was then converted to mass airflow using the basis relationship which describes the flow of air:

$$\text{WHERE } Q = AV$$

Q = VOLUME OF AIR IN CUBIC FEET PER MINUTE.

A = CROSS SECTIONAL AREA THROUGH WHICH
THE AIR FLOWS EXPRESSED IN SQUARE FEET.

V = AVE. AIRFLOW VELOCITY IN FEET PER MINUTE.

The volume of air supplied by the HEPA filters in each room is used to calculate the theoretical number of supplied air changes per hour. The instrument used to measure airflow velocity is a Kurz Model 444 Air Velocity Meter which measures airflow in standard feet per minute using the hot wire principle of operation.

**MAIN CLEANROOM
PARTICLE COUNTS 2/14/12**

PARTICLES EQUAL TO OR GREATER THAN 0.5 MICRONS PER CUBIC METER OF AIR.

<u>LOCATION</u>	<u>0.5 MICRONS</u>	<u>LOCATION</u>	<u>0.5 MICRONS</u>
#1	196350	#5	164150
#2	105350	#6	80150
#3	82250	#7	130305
#4	71400	#8	146650

	<u>0.5 MICRONS</u>
MEAN OF AVERAGES	122076
STANDARD DEVIATION	40919
STANDARD ERROR	14467
95% CONFIDENCE LIMIT	152891

**MAIN CLEANROOM
AIRFLOW TESTS 2/14/12**

AIRFLOW MEASUREMENTS OF EACH FILTER CONVERTED TO MASS FLOW (CFM)

<u>FILTER</u>	<u>FLOW (CFM)</u>
#A	478

TOTAL AIR SUPPLIED **478 CFM**
TOTAL ROOM VOLUME **902 FT³**
ROOM AIR CHANGES PER HOUR = 32

**ASSEMBLY CLEANROOM
PARTICLE COUNTS 2/14/12**

PARTICLES EQUAL TO OR GREATER THAN 0.5 MICRONS PER CUBIC METER OF AIR.

<u>LOCATION</u>	<u>0.5 MICRONS</u>	<u>LOCATION</u>	<u>0.5 MICRONS</u>
#1	113050	#5	110600
#2	100800	#6	80850
#3	103145	#7	99645
#4	95550	#8	110600

	<u>0.5 MICRONS</u>
MEAN OF AVERAGES	101780
STANDARD DEVIATION	5933
STANDARD ERROR	2098
95% CONFIDENCE LIMIT	106248

**ASSEMBLY CLEANROOM
AIRFLOW TESTS 2/14/12**

AIRFLOW MEASUREMENTS OF EACH FILTER CONVERTED TO MASS FLOW (CFM)

<u>FILTER</u>	<u>FLOW (CFM)</u>
#A	499

TOTAL AIR SUPPLIED	499 CFM
TOTAL ROOM VOLUME	1155 FT³
ROOM AIR CHANGES PER HOUR =	26

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CERTIFICATION OF ENVIRONMENTAL COMPLIANCE

Environmental testing has been completed at Dynamo Aviation of North Hills, CA in accordance with the requirements set forth in ISO 14644-1, applicable portions of DOD MIL-STD-1330D (SH), and other applicable standards currently in effect, in order to establish both general and specific compliance to design and operating specifications. Particle Measurement Technology Co. hereby certifies that on 2/14/12 the facilities listed met or exceeded the requirements for the classifications shown.

MAIN CLEANROOM	“OPERATIONAL” ISO CLASS 7 (at 0.5um)
ASSEMBLY CLEANROOM	“OPERATIONAL” ISO CLASS 7 (at 0.5um)

By issuing this Certification of Environmental Compliance, Particle Measurement Technology Co. accepts full responsibility for the accuracy of the testing and reported results. Original data is maintained on file and is proprietary to Dynamo Aviation.

By: *Dean Hancock* (esig2012)
Dean Hancock, Test Supervisor

Test Date: 2-14-12