

after each measurement;

- (d) Laboratory Calibration of the Air Blast sensor shall be carried out once per year, and;
- (e) if the measuring device is battery powered the battery condition shall be within the range for proper operation during measurements and the battery condition shall be checked after the device has been allowed to warm up and stabilize and after each measurement.

Particle Velocity

A-6. The Particle Velocity meter shall meet the following standards:

- (a) the geophone shall include three transducers that have their axes of maximum sensitivity mutually orthogonal;
- (b) the response of each transducer in the plane normal to its axis of maximum sensitivity shall be less than 10% of its response along its axis of maximum sensitivity;
- (c) the output of each transducer shall indicate the peak axial velocity along its axis of maximum sensitivity in the frequency range of 5-200 Hz over a range of peak particle velocity of 2.5-100 mm/s with a tolerance of $\pm 10\%$, and;
- (d) the continuous recording option available on some portable Particle Velocity meters shall not be used for monitoring blast-generated vibrations.

A-7. The placement and mounting of the geophone used for measurement of Particle Velocity shall meet the following standards:

- (a) the geophone shall be affixed according to the manufacturer's recommendations for the conditions at the measurement location;
- (b) geophone placement shall ensure that the data obtained adequately represents the vibration levels received at the structure, the geophone shall be placed on or in the ground on the side of the structure towards the blast hole and the geophone shall be placed no more than 10 % of the distance between the blast hole and the structure and no more than 3 metres from the structure;
- (c) where access to the structure is not possible the geophone shall be placed between the blast hole and the structure;
- (d) the geophone shall be nearly level in accordance with the manufacturer's recommendations;

- (e) the longitudinal transducer should be pointing directly at the blast hole;
- (f) the geophone should be located on or in soil with a density greater than or equal to the geophone density;
- (g) the geophone shall be Buried, Spiked to the Ground, Sandbagged or Anchored unless the Particle Velocity is expected to exceed the values in Table 2 in which case the geophone shall be Buried or Anchored;

Table 2

Particle Velocity Requiring Geophone Burial or Anchoring

<u>Frequency, Hz</u>	<u>Particle Velocity - mm/s</u>
20	19
30	15
50	10
100	5
200	3

- (h) if the geophone cannot be Buried, Spiked to the Ground or Anchored due to frozen ground or other conditions, the geophone shall be attached to the foundation of the structure within 300 mm of ground level.

A-8. The calibration of the Particle Velocity meter and the measurement of Particle Velocity shall meet the following standards:

- (a) the trigger level shall be programmed low enough to trigger the unit from blast vibrations, high enough to minimize the occurrence of false events and slightly above the expected background vibrations at the location of the geophone;
- (b) Field Calibration shall be carried out immediately before and after each measurement;
- (c) Laboratory Calibration of the Particle Velocity meter shall be carried out once a year, and;
- (d) Field and Laboratory Calibration shall be carried out to an accuracy of $\pm 5\%$.

Reporting

A-9. (1) The Air Blast and Particle Velocity monitoring reports shall be submitted to the Inspector at least once per week.

- (2) The Air Blast and Particle Velocity monitoring reports shall include at least the following:
 - (a) Blasting Permit number;
 - (b) Blaster and the Blaster's employer;
 - (c) date and time of each blast;
 - (d) locations of Particle Velocity meters and distances, accurate to within 5 percent, from each blast hole;
 - (e) blast design details including total charge and Charge Weight per Delay;
 - (f) source used by the Qualified Monitor to obtain the blast design details;
 - (g) the Particle Velocity reported shall be the maximum of the longitudinal, transverse or vertical component of vibration along with the associated frequency;
 - (h) the Particle Velocity reported shall be the velocity which is the greatest percentage of the allowable limit at the associated frequency;
 - (i) the Particle Velocity shall be reported to the nearest mm/second and as the percentage of the allowable Particle Velocity at the associated frequency; and;
 - (j) the maximum Air Blast shall be reported to the nearest decibel on the linear weighting scale.

Records

- A-10. (1) The Air Blast and Particle Velocity monitoring records shall be maintained by the Qualified Monitor for two years and submitted to the Inspector upon request.
- (2) The Air Blast and Particle Velocity monitoring record shall include at least the following for the project:
 - (a) Blasting Permit number;
 - (b) Blaster and the Blaster's employer;
 - (c) evidence of the most recent Laboratory Calibration of the Air Blast sensor and the Particle Velocity meter;
 - (3) The Air Blast and Particle Velocity monitoring record shall include at least the

following for each blast:

- (a) a plot of the Particle Velocity wave form and a plot of the Air Blast wave form;
- (b) plots of Particle Velocity values versus frequency for each vibration cycle together with the specified velocity limits detailed in Table 2 of this Appendix;
- (c) the orientation and mounting details of the vibration transducers;
- (d) a description of the Air Blast sensor and Particle Velocity meter;
- (e) proof of Field Calibration for the Air Blast sensor and the Particle Velocity meter;
- (f) a plan, to scale, of the blasting site and surrounding area showing locations of shots and locations of Particle Velocity and Air Blast monitoring stations, and;
- (g) meteorological conditions at the time of firing of each blast, including temperature, wind speed and direction.

Appendix "B"
Certificate of Compliance for Blast Monitoring Reports

Halifax Regional Municipality

**Certificate of Compliance
for
Blast Monitoring Reports**

Project: _____

Blasting Permit No. _____

I certify that the Blast Monitoring Reports referenced below comply in all respects with By-law B-600, Respecting Blasting, and for greater clarity that:

- (i) all Blasts have been monitored and recorded in accordance with the By-law, and;
- (ii) no results exceed the limits for Air Blast and Particle Velocity as stipulated in the By-law.

<List of Reports>

Signature of Qualified Monitor

Date

