APPENDIX 1 - EXAMPLE OF APPLICATION FOR APPROVAL

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Ottawa, Ontario, Canada K1A 0G1

date: _____

Enclosed please find a cheque for the required Can$500 application fee, made out to the Receiver General for Canada. It is understood that the fee is a non-refundable credit that will be deducted from the total fees ultimately assessed for the testing of our company's diesel-related equipment as described below in order to obtain approval for use in mines in Canada and other confined work locations.

The equipment to be investigated is defined by the following information:

Approval required for: gassy coal mines _____ or non-gassy mines _____
Type of device or assembly: _____
Manufacturer: _____
Model number: _____
Serial number: _____
Other:

The enclosed promotional literature further defines the equipment, its function, and its performance. Also enclosed are the engine performance curves and specifications sheet.

This application is submitted by:

Company name: _____
Address: _____
Tel.: _____ Fax: _____ e-mail: _____
Liaison officer: _____

Submitted by:

Signature: _____
Name: _____
Position: _____

APPENDIX 2 - DOCUMENTATION FOR APPROVAL OF A DIESEL ENGINE FOR NON-COAL MINE USE IN CANADA

ENGINE
- manufacturer.....
- model .....
- serial number .....
- number of parts manual.....
- number of repair manual.....
- IDI or DI.....
- number of cylinders.....
- cylinder arrangement .....
- flywheel size
  - (see SAE J620 as guide).....
- engine flywheel housing flange no.
  - (see SAE J617 as guide).....
- engine displacement.....
- compression ratio.....

- rated horsepower .....
- rated speed .....
- torque at rated speed.....
- fuel consumption at rated power .....
- maximum governed speed .....
- peak torque .....
- speed at peak torque .....
- fuel consumption at peak torque .....
- starting speed .....
- idle speed.....
- type of engine cooling.....
- cooling system installed.....
- current generator installed?.....
- manuf'r, type and serial #.....
- air compressor installed?.....
- manuf'r, type and serial #.....

- v-angle .....
- bore .....
- stroke .....
- connecting rod length .....
- oscillating mass per cylinder.....
- moment of inertia - primary part.....
- moment of inertia - secondary part.....
- dynamic stiffness .....
- damping factor .....
- engine damping factor .....
- engine damper (if used).....
- type.....

FUEL INJECTION SYSTEM
- injection pump manufacturer.....
  - type .....
  - model number .....
  - serial number.....
- from injection pump manual:
  - fuel injection timing .....
  - timing adjustment means.....
  - max fuel rate adjustment .....
  - sealing pump adjustments.....

AIR CLEANER (dry type only)
- manufacturer.....
- model number .....
- serial number .....
- intake restriction clean filter .....

EXHAUST SYSTEM
- ex pipe diameter .....
- ex max back pressure.....

EXHAUST TREATMENT (if installed)
- manufacturer.....
- type.....
- model number .....
- serial number .....
- inlet/exit connection definition.....

OTHER
- maximum operating altitude.....
- crank case breather exit
  - directed away from air intake?.....

APPENDIX 3 - EXAMPLE ENGINE TEST OBSERVATION SHEET

- manufacturer
- engine model #
- cooling fan
- air filter
- exhaust treatment

Special Conditions:

test number

engine variables

speed	rpm
torque	lb/ft
power	bhp
fuel rate	lb/hr

air flow

Pbar	mm H_g
air temp	^oF
RH	%
measured air flow	lb/hr
engine displacement	in^3

exhaust gas analysis (dxg basis)

CO_2	%vol dry
O_2	%vol dry
CO	ppm
NO	ppm
NO_2	ppm
SO_2	ppm
HC	ppm

particulate analysis

dry exhaust gas flow	lb/hr
wet exhaust gas flow	lb/hr
DPM concentration	mg/m^3

ventilation

EQI	index
ventilation required	scfm dry air

intake/exhaust/engine variables

engine oil temp	^oF
intake air temp	^oF
exhaust gas temp	^oF
inlet restriction	"H_2O
exhaust pressure	"H_2O

APPENDIX 4 – ENGINE DYNAMOMETER HOOKUP REQUIREMENTS

To minimize the delay after the engine is received, flywheel drawings with accurate dimensions (diameter of an inset step; bolt circle, size, number, and location of bolt holes; location and height of the central boss, etc.) should be forwarded well in advance of the engine shipping date.

The Diesel Emissions Laboratory may request that the manufacturer supply a specified SAE flywheel bolt pattern required to mate to the selected coupling or have the manufacturer supply a suitable flywheel/coupling adaptor plate. At the request of the manufacturer, the Diesel Emissions Laboratory can arrange to have an appropriate flywheel adaptor fabricated through a local firm or Engineering and Technical Services (Natural Resources Canada) upon delivery of the engine.

Depending on the engine flywheel size and vibration damping requirement, the universal shaft and selected coupling can accommodate most flywheel configurations with an appropriate adaptor. All bolts connecting the shaft, viscous coupling, adapter plate and flywheels should be of minimum Grade 5 (SAE) or Grade 8.8 (ISO) and torqued to specification with a torque wrench.

Torsional Couplings

The Diesel Emissions Laboratory utilizes four torsionally flexible couplings in order to keep the main resonance speeds below the idling speed. The dynamometer drive shaft system is shown in Figure 1. Furthermore the couplings should provide a large damping capacity in order to keep vibrations at a minimum. The final determination of the suitable coupling demands carrying out provisionally a torsional vibration calculation based on previously requested engine data.

The four torsional couplings are designed for connection to universal joint shafts (UJS), which are insensitive to large bending angles of the UJS during normal operation (Figure 1). In general, the customer should use as a guide and provide a flywheel housing type that follows the SAE J617 Standard - Surface vehicle standard ® Engine flywheel housing and mating transmission housing flanges. This standard specifies the major dimensions and tolerances for Engine Flywheel Housings and the Mating Transmission Housing Flanges. The standard locates the crankshaft flange face or the transmission pilot bore (or pilot bearing bore) stop face in relation to the housing flange face. The four couplings are designed to work with a SAE J17 flywheel housing in limited configurations from SAE J617 No. 4 (361.5 mm), No. 3 (409.58 mm), No. 2 (447.68 mm), No. 1 (511.2 mm) and No. 0.5 (584.2 mm) nominal pilot dimension (A).

The four torsional couplings flanged face are designed against SAE J620 standard for flywheels with industrial engines with SAE J620 flange sizes No. 10 (314.3 mm), No. 11.5 (352.4 mm), No. 14 (466.7 mm) and No. 16 (517.5 mm) diameters. Typically but not limited to, each coupling can serve a certain engine power range as follows:

No. 10 (100 HP); No. 11.5 (100-250 HP); No. 14 (250 to 500 HP); and No. 16 (500-600 HP).

Upon review, the laboratory will determine what flywheel size is required for testing. Some engines may require a different flywheel housing size in order accommodate the best coupling with the appropriate flange size.

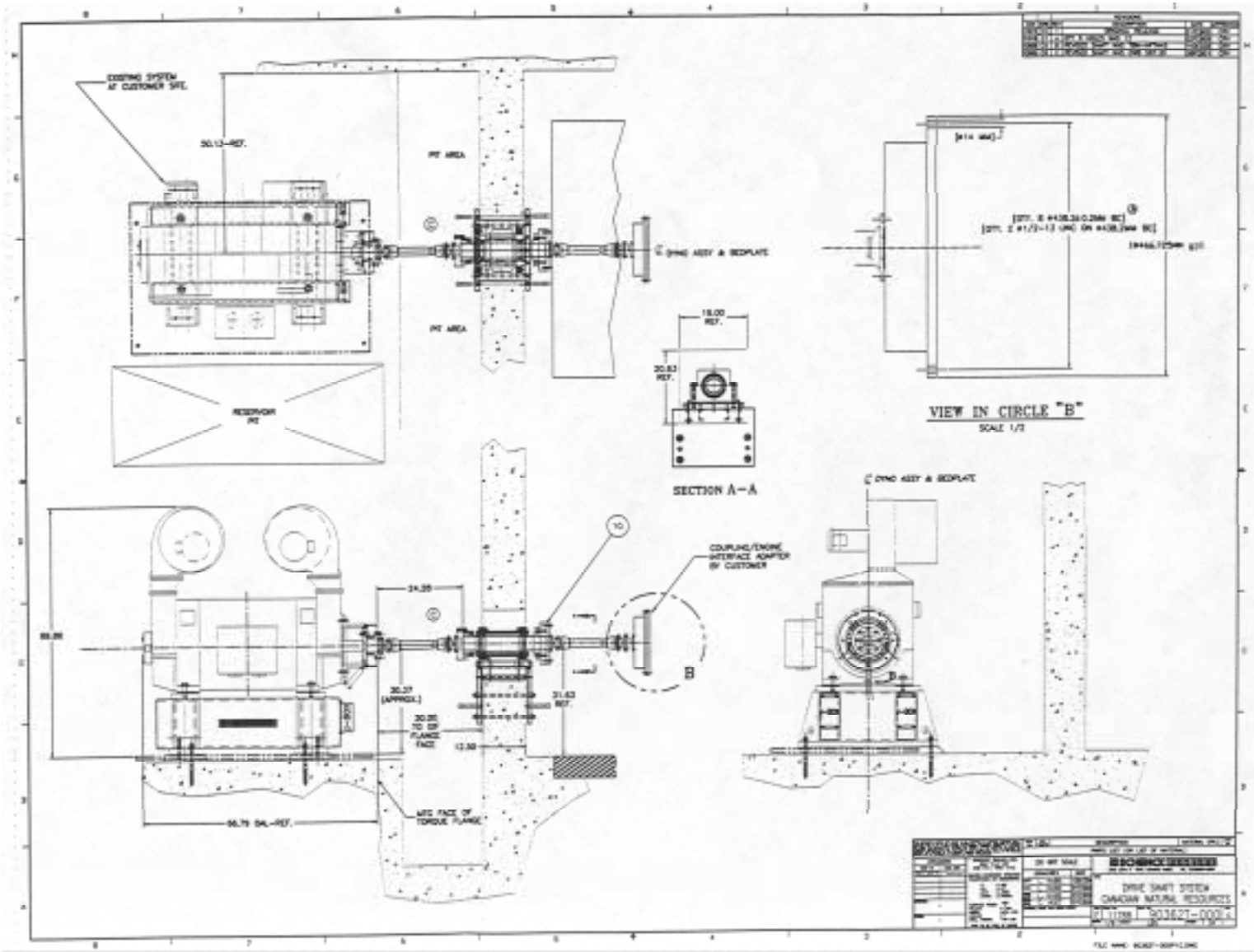

Figure 1. Drive Shaft System