PREMO Tank Testing Equipment Estabrook's Ezy 3 Locator Plus Upgrade kit

Designed and Manufactured
by
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ESTABROOK'S EZY 3 LOCATOR PLUS

UPGRADE KIT
FOR
ESTABROOK'S AND HORNER EZY 3 USERS

Introduction

The Estabrook's Ezy 3 Locator Plus detects leaks, (gas or liquid), by detecting and if necessary quantifying the sound generated by that leak.

The sound "profile" of a bubble will be different to that of gas leaking into the ullage space, or liquid leaking into the tank. The ability of the unit to discriminate between the sound "profiles" is one of the strengths of this equipment.

Testing using this method is:

Fast:	Test tanks in under one hour.
Definite:	See and hear the fault, no calculations to carry out.
Stable:	Not affected by temperature, product volume or vapour saturation.

Sound transmission

The detected sounds are transmitted readily through the tank contents. The signal travelling faster through the higher density liquid medium.

In a similar way, sound is conducted well from the liquid to the tank material and can even be detected from outside the tank by using the special seismic or vibrational cells with the Ezy 3 Locator Plus.

Easily discriminate between events in the tank and mechanical noises from outside.

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Bubbles

Bubbles exhibit two distinct components of their sound “profiles”; the first is caused by the bubble detaching from the surrounds of the hole, while, the second is the sound of the bubble breaking on the surface of the liquid.

The first sound is caused by the closure of the of the bubble surface. It gives the characteristic sound that most people associate with bubbles.

The second sound is the sound of the bubble surface breaking as the gas escapes into the gas space above the tank liquid. This sound can vary slightly from tank to tank depending on the surface and reflections from the tank walls, but is always of similar sound structure.

The sound profile of the bubble is easily discriminated from that of a liquid drop falling into the surface of the liquid from the tank top. The latter profile is similar to the second component of the bubble profile on its own.

Leaks

The hiss of a gas entering the ullage space of a tank is caused by the turbulence in the air flow generated by the pressure drop across the hole and the hole geometry. The pressure drop is a function of both the vacuum and the hole size.

Leaks detected through standard, (0.008"), inlet orifice showed a profile with a very different sound spectrum to that of the bubble. The sound that the operator hears is distinctly different from one type of leak to the other. It is not necessary for the printed spectrum to be viewed to determine which type of leak is taking place.

A similar sound “profile” is heard from liquid leaking in through a hole. The frequencies and amplitude are different due to the lower entrance velocities, but the “profile” is characteristically similar.

Liquid leaking into the tank under the liquid level can still be detected due to the excellent sound transmission through the liquid.

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Comments

a) The Ezy 3 Locator Plus system has extremely low background noise levels, (better than -70Db!)

b) The frequency response curve of this instrument allows it to discriminate easily between bubbles, leaks and mechanical vibration. There is no suppression or compression employed in the signal detection.

c) This instrument gives true "live" sound, reproducing a natural sound which is comfortable and easily recognisable for the operator. Surprisingly little practice results in easily identified leaks and leak types.

d) This instrument gives true zero output for "tight" tanks when set up correctly. This increases both the speed and accuracy of tank testing.

Graphical print outs

These graphical print outs were produced using the optional computer interface module and the PREMO2 software.

This module connects the Ezy 3 Locator Plus to any desktop or laptop computer. This gives real time visual tracking of the test.

At any time during the test, a printout can be made of the audio signal. At the end of the test a report can be automatically generated.

The software is user friendly, employing a simple point and click windows user interface. Drop down menus allow ready access to all the user functions. A fully featured on screen help menu is standard to guide new users through the software.

Minimum requirements are very basic, with the software capable of running on a 486 DX2 33 MHz machine. The software runs under Windows 3.1x, Win95 or Win98.

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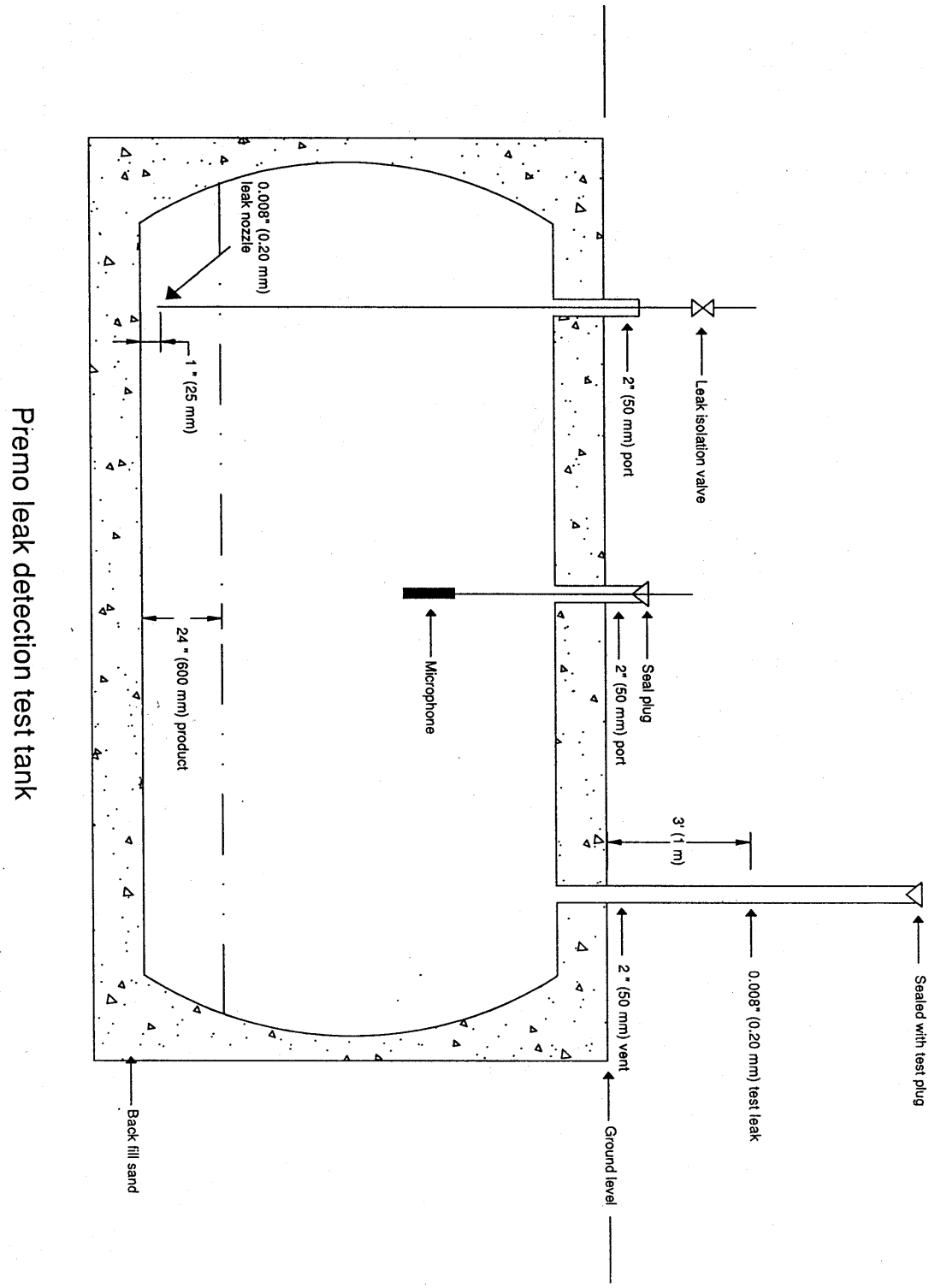

Premo leak detection test tank

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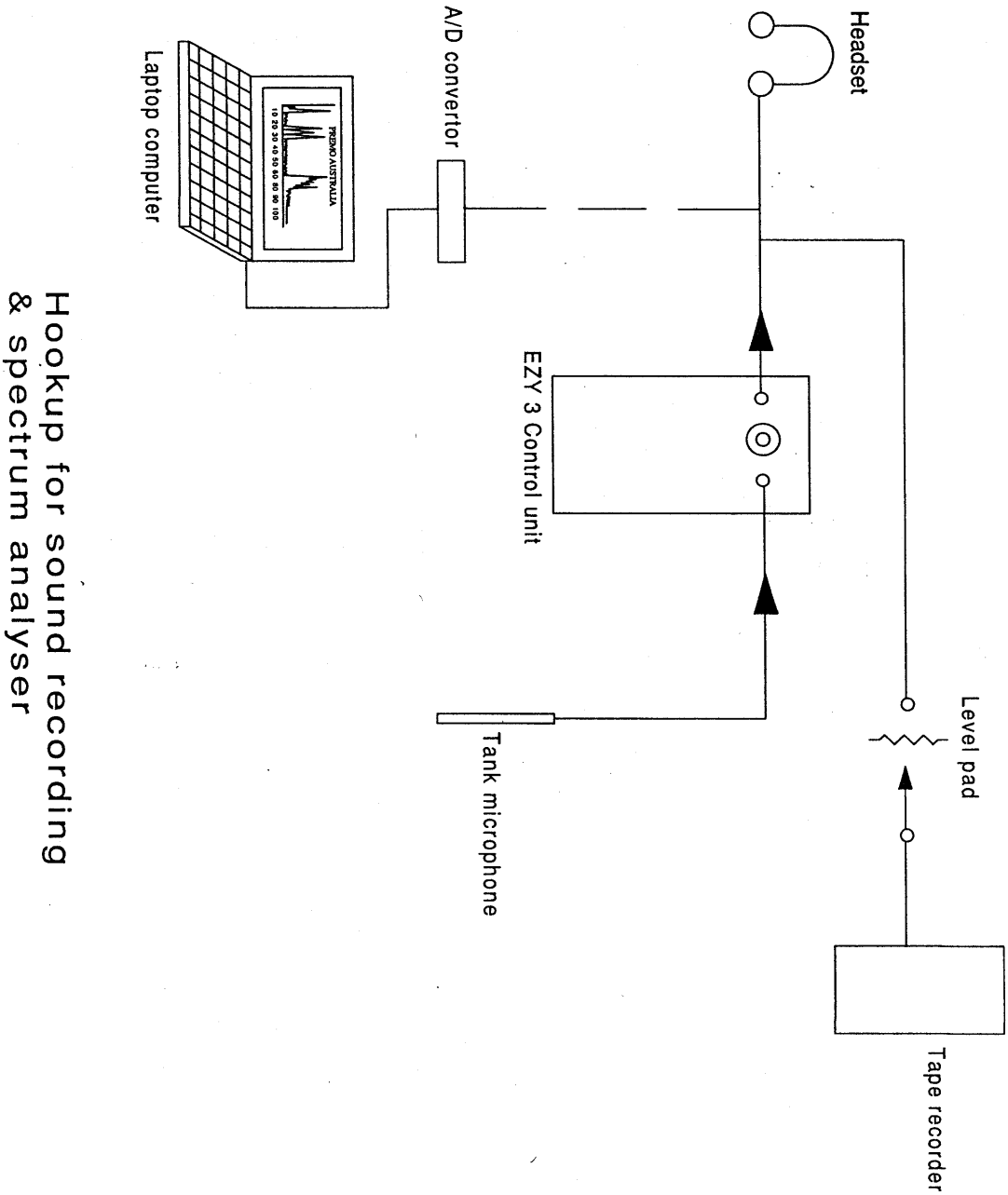

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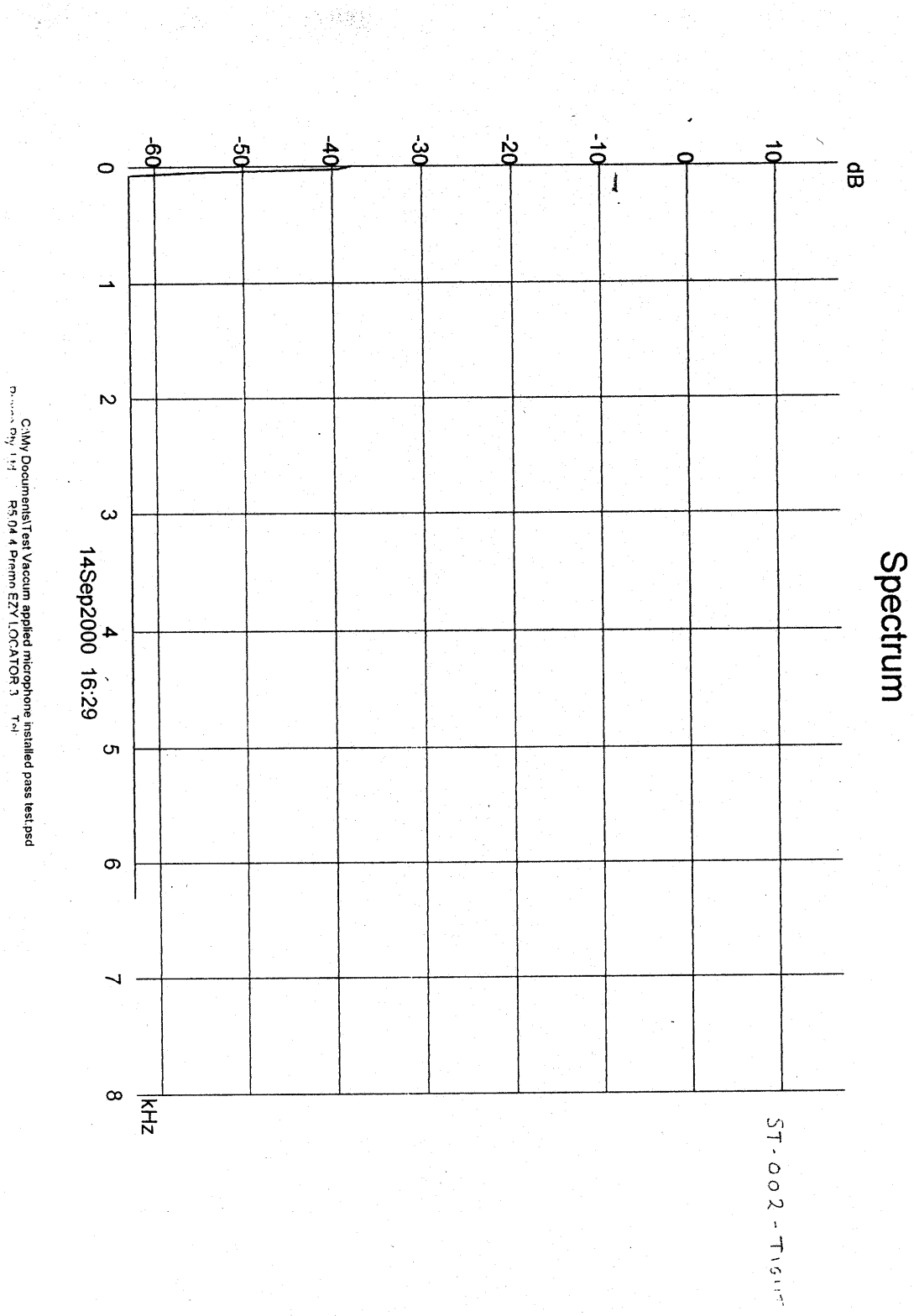
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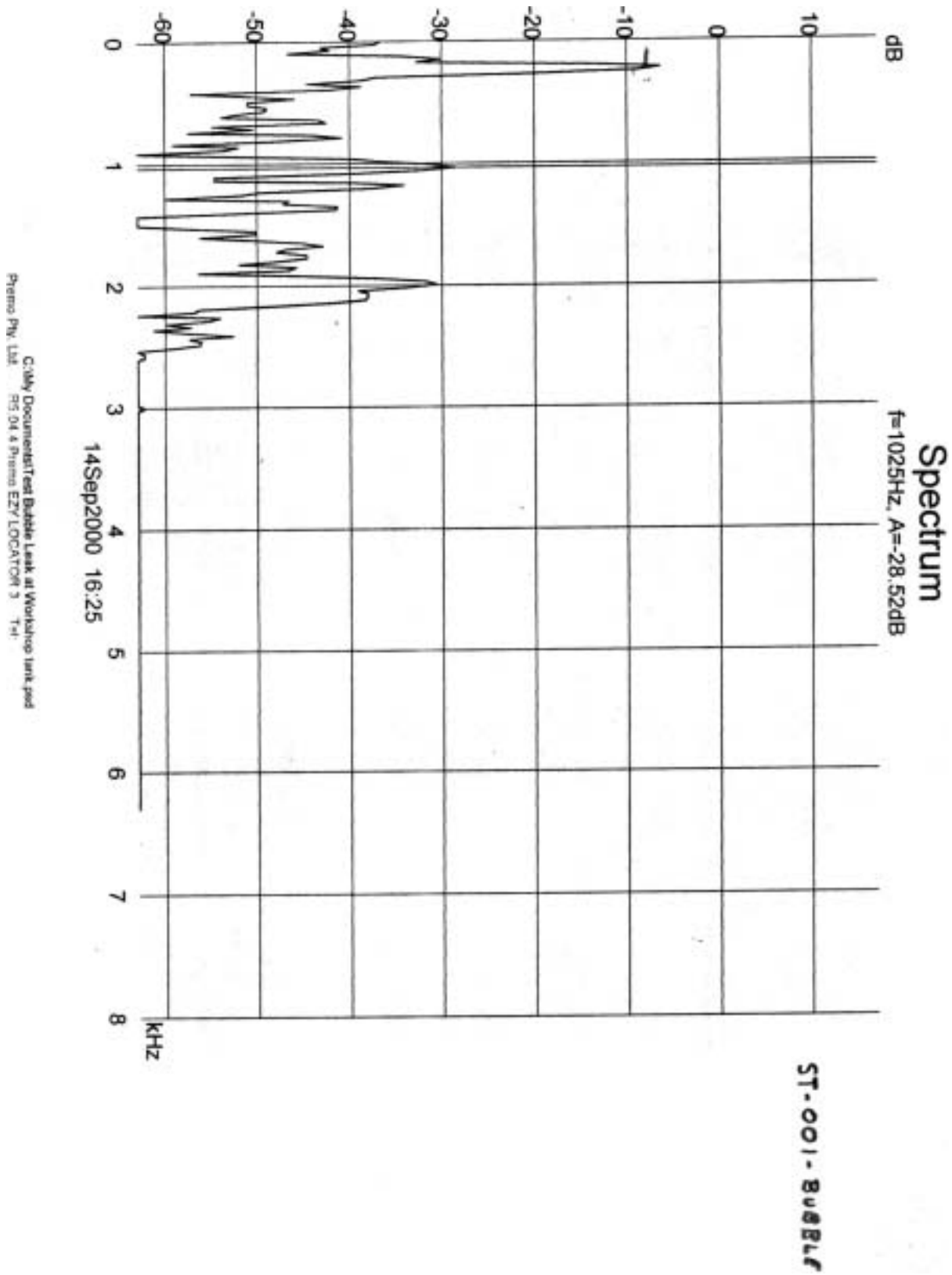
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8
kHz
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Premo Pty. Ltd. RS 04.4 Premo EZY LOCATOR 3 Tel:
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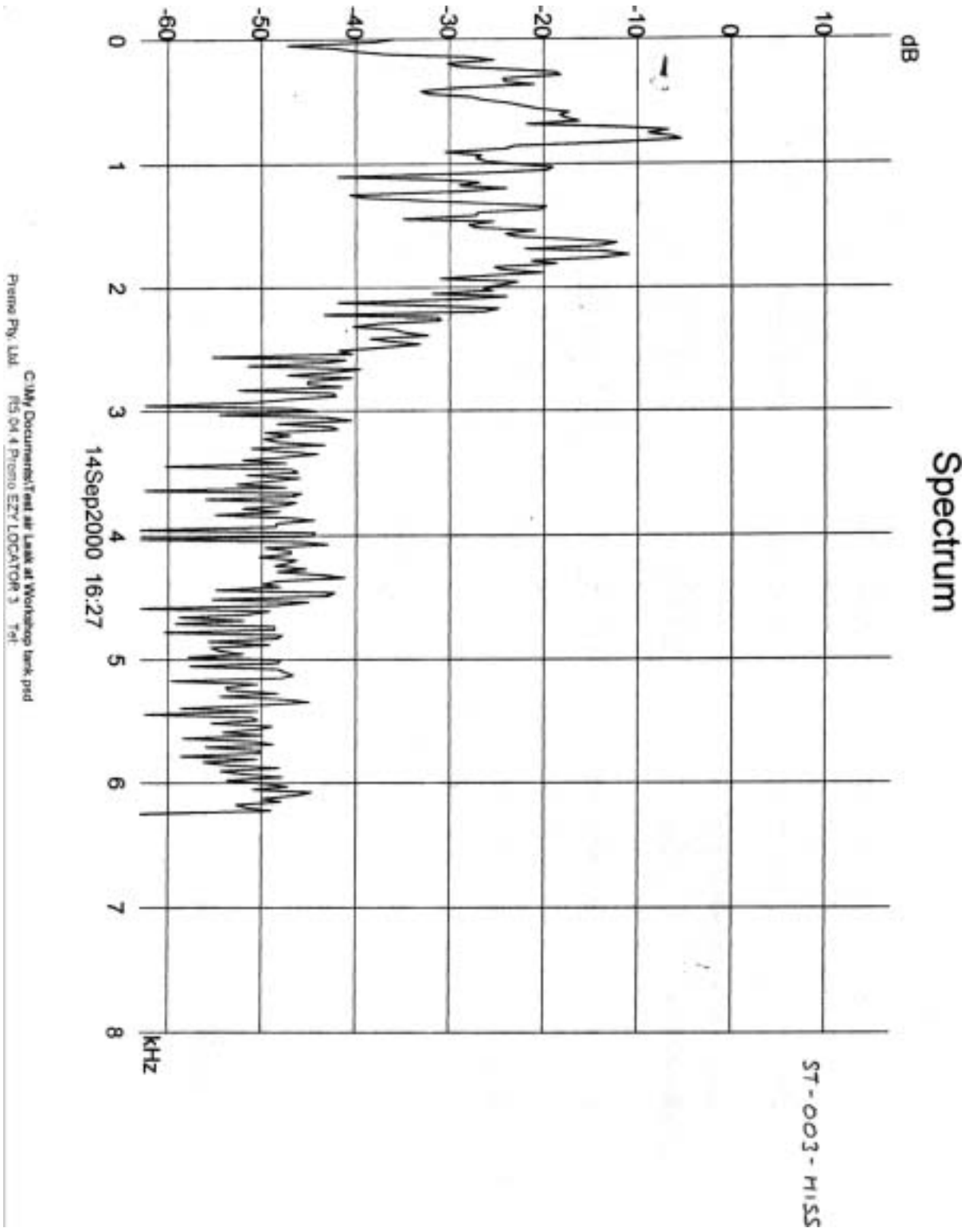

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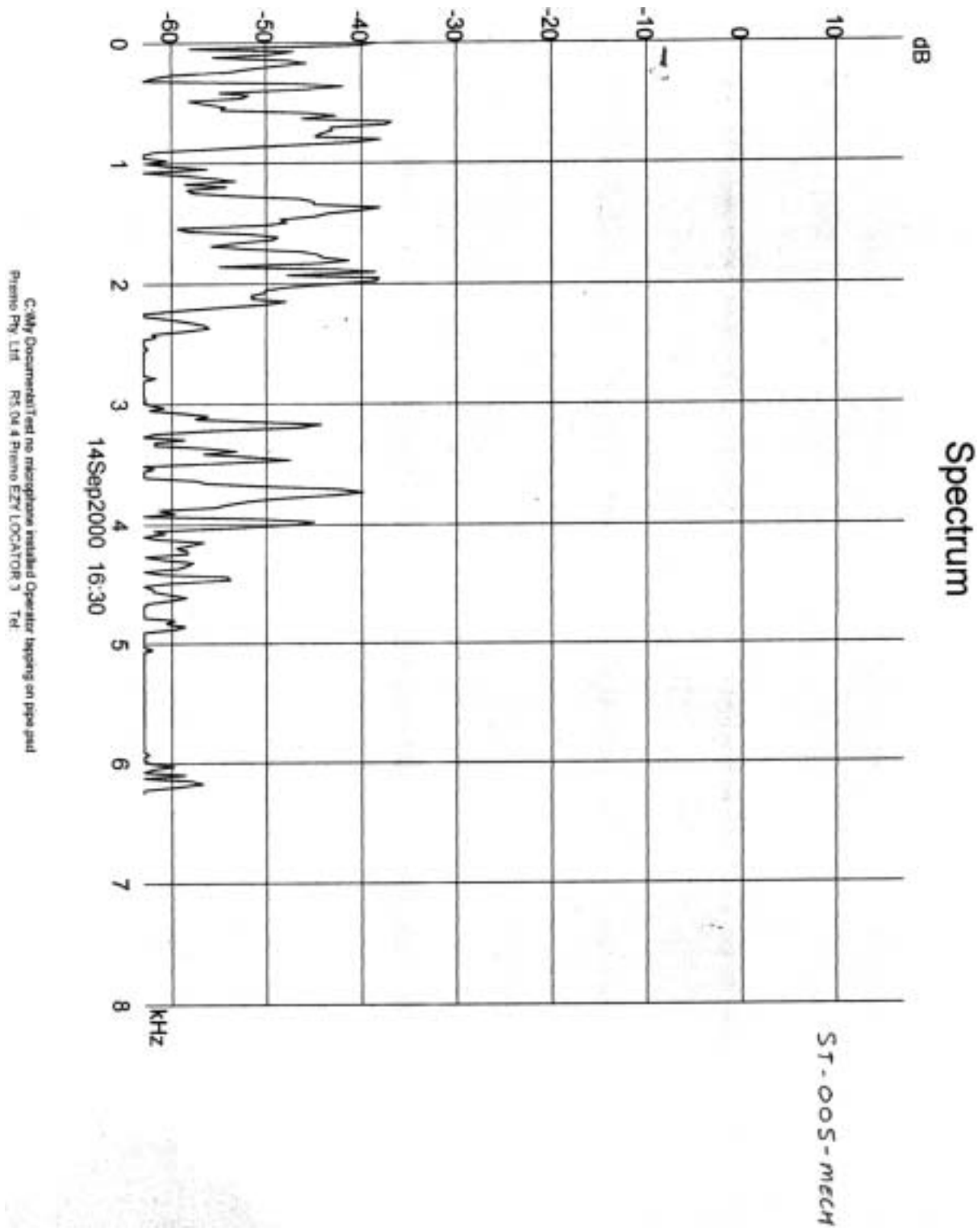

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PREMO TEST PROTOCOL

Introduction

PREMO Australia Pty. Ltd. has developed an acoustic testing system that allows the testing of large tanks when the product levels are anywhere from empty, to maximum capacity. This represents a convenience to tank owners since no fuel deliveries or "topping up" is required before testing.

This method can be used alone or in conjunction with other non-volumetric tests to improve both the speed and accuracy of leak detection.

The US Environmental Protection Agency requires that non-volumetric leak detectors meet specific performance levels. Testers who conduct annual tightness tests on UST's must be capable of detecting leaks of 0.1 gal / hr with a probability of detection of P_D >95% and a probability of false alarm of P_{FA} <5%.

The following test protocol is designed to demonstrate the ability of this equipment to meet or exceed the US EPA requirement.

Description of the PREMO system

The PREMO Acoustic Leak Detection System (PALDS), operates by creating a negative or positive pressure in the tank or piping, sufficient to overcome the head of liquid or external restrictive pressure.

A sensitive sonic or vibration detection module located either on or in the top of the tank or pipework detects the acoustic or vibratory signature of the leak. The leak can be in the ullage space or in the liquid.

This system can be used in conjunction with the PREMO water detection module, which gives extremely accurate measurement of water ingress if the leak is below the water table.

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Description of evaluation process

The evaluation process consists of connecting the PALD system to the test tank and performing a series of tests under “tight” and “Controlled leak” conditions.

“Tight” tests

1. The test tank is set up so that all inlet points are sealed and the Controlled leak rate is set to zero.

2. The tank is brought to the test vacuum as calculated from the standard pressure tables as indicated in appendix one.

3. The tank is allowed to equilibrate for sufficient time such that no firther changes in pressure occur over a ten minute period.

4. Acoustic and vibration levels are monitored over a ten minute period to ensure that no signal is being detected from the tank. Provision for external noise rejection is made as outlined in appendix two.

5. The tank is “tight” if no signal is detected over the test period at sensitivity up to the maximum detection level.

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"Controlled leak" tests

1. The test tank is set up so that all inlet points are sealed and the controlled leak rate is set to zero.

2. The tank is brought to the test vacuum as calculated from the standard pressure tables as indicated in appendix one.

3. The tank is allowed to equilibrate for sufficient time such that no firther changes in pressure occur over a ten minute period.

4. Acoustic and vibration levels are monitored over a ten minute period to ensure that no signal is being detected from the tank. Provision for external noise rejection is made as outlined in appendix two.

5. A controlled leak rate is introduced into the tank via the apparatus described in appendix three.

6. The acoustic and vibratory signatures are monitored and logged.

7. The detection threshold is plotted against the leak rate to indicate the minimum leak detection threshold.

8. The result is the average of three duplicate test runs.

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APPENDIX ONE

HORNER EZY - 3 PRESSURE SET UP CALCULATIONS FOR DETERMINING MAXIMUM PRESSURE REDUCTION FOR TEST.

APPENDIX TWO

External acoustic and vibration signals can adversley affect the test result. Stray signals can lead to inability to confirm the "tight" result, or false alarms in the "Controlled leak" mode.

To ensure the test results are valid, the acoustic and vibration profile of the tank must be checked before commencing the test run. To do this the following method is used.

1. The test tank is set up so that all inlet points except the tank vent system are sealed.

2. The tank is checked to ensure that it is at the same pressure as the outside atmosphere. If necessary allowance is made to ensure the temperature gradient between the tank and the outside environment remains stable.

3. The tank is allowed to equilibrate for sufficient time such that no firther changes in pressure occur over a ten minute period.

4. Acoustic and vibration levels are monitored over a ten minute period and any signal detected from the tank is logged

5. The result is the average of three duplicate test runs.

6. The signal levels are plotted, and if the source of the background can not be eliminated, this signal level is used to correct results from the full tank test.

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APPENDIX THREE

CONTROLLED LEAK APPARATUS

Description.

PREMO has designed and constructed an apparatus for producing a controlled leak at known, low and reproducible levels. This apparatus is used to determine the minimum leak detection threshold by calibrating the magnitude of the detectable leak.

The apparatus consists of a calibration chamber of known air volume that can be evacuated at constant pressure into the test tank. The flow of air from this chamber is controlled by a precision needle valve, and can be optionally followed on a precision micro-flowmeter.

Procedure.

1. The controlled leak apparatus is connected to the air introduction point on the test tank.

2. The air introduction point is one or all of the following points:

    I) A tube extending to the bottom of the tank to introduce a bubble into the bottom of the tank.

    II) A point designed to introduce the leak into the ullage space at the top of the tank.

    III) A point designed to introduce the leak into the vent system or other piping.

3. The calibration chamber is filled to the mark with air at atmospheric pressure and the inlet valve closed.

4. The feed valve to the air introduction point is opened and the needle valve adjusted to give a flow that empties the calibration chamber is approximately 15 minutes.

5. The exact time to empty the chamber is noted and the rate calculated.

At 15 minutes, the leak rate is 0.05 Us gal / hr. Other time intervals can be selected to determine the detection limit and response at various leak rates.