COOLER TEST SPECIFICATION

OCTOBER 2003

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PART 1 - Introduction

1. Scope

1.1 This specification applies to standard test procedures for equipment, commonly known as remote coolers of 50 lbs/23 kg or more ice-bank weight, that are used for:

a) cooling draught beverages from storage temperature to serving temperature, and

b) providing a source of attemperating fluid (usually water) for cooling the insulated beverage lines between the storage area (beer cellar) and the serving area (bar).

1.2 The remote coolers are designed to provide the cooling for the loads in both 1.1(a) and (b) above, and are characterised by having some cold storage capability by provision of an ice-bank. Depending on the circumstances of any particular installation, the units may also in practice supply the cooling for only one of the loads.

1.3 Tests for both air- and liquid-cooled condensing units are specified. The remote coolers are of a maximum duty of nominal 1½ h.p. compressor capacity, exclusive of any ancillary equipment power requirement, and designed for d-o-l. starting on a 230/50/1 electrical supply.

1.4 It is the aim of the tests to produce benchmark results when the remote coolers are operated under standardised conditions. As such, the test results are to be certified, and to be available to the remote cooler manufacturer for publication.

1.5 The results of any tests undertaken for purposes other than to produce benchmark results, do not lie within the scope of this specification.

2 References

2.1 F.B.I. Harmonization Document Number : 001, “Product Type: Pre-made Python Loom”, issued 22-06-95 (see also Premier type 000014, Issue 3, 16.04..99).

3 Definitions

“*product*” means, in the context of testing the cooling capacity of the remote cooler, water drawn off through the product lines to emulate the drawing-off of beer.

"*cool drinks capacity*" means the capacity of the remote cooler for cooling drinks as determined by the tests of section 11.

"*specific capacity power*" means the power consumed in cooling one thousand pints of product, expressed in kWh/1000pts.

4 Witness of Testing

4.1 A qualified witness, competent in the field, shall certify the results of any tests, undertaken to produce benchmark figures in compliance with this specification (see §1.4).

4.2 In the case of a manufacturer having current accreditation to an appropriate part of recognised international quality standard (e.g. BS EN ISO 9000:2000 series, or equivalent quality management system), the qualified witness may be in the employment of the manufacturer. Certification shall be in compliance of the quality management system. The certificate shall bear the signature of two company representatives. (Appropriate company representatives will be: - the person conducting the tests, and either a qualified auditor from the QA department or a responsible member of the senior management of the company.)

4.3 In all other cases, the qualified witness should be independent, and appointed for the express purpose of acting as witness and certifying the results of the tests, as and when deemed necessary.

4.4 With the agreement of the qualified witness, the tests may be undertaken on the premises of the manufacturer if the testing facilities are considered by the qualified witness to be suitable for the purposes of the tests. This requirement shall include the suitability of all measuring equipment used.

4.5 The appointed qualified witness may agree to tests, other than benchmark tests, being conducted on the same cooler at the same time as the benchmark tests, provided that it his/her considered opinion that:

a) the performance of the extra tests does not interfere with the timely conduct of the benchmark tests;

b) any additional instrumentation required for the sole purpose of the extra tests will neither interfere with, nor affect the outcome of, the benchmark tests; and

c) the extra tests do not require any zeroing, recalibration, re-positioning, or other adjustments to the instrumentation used in the execution of the benchmark testing.

5 Remote cooler design

5.1 Any design of ice-bank type of remote cooler may be tested according to this specification.

5.2 The responsibility for the design of the class of remote cooler (from which the sample remote cooler to be tested is drawn), lies solely with the manufacturer of the cooler.

5.3 Any sample remote cooler selected for test shall be complete with all guards, interlocks and safety devices, as if ready for commercial installation. It shall be typical of the particular production model, and type (if applicable), of remote cooler of which it is intended to be representative, complete as specified in all respects, and without any special additional parts or extra ancillary equipment. The only exceptions to this requirement shall be any connections of measuring equipment required for monitoring the tests, and any removals necessary for the judicious completion of the tests. (The qualified witness shall agree any additions or removals; the sole basis of any objection shall be that any departure from standard may, or would, cause undue or unnecessary interference with the results of the test.) The sample chosen shall be new and shall not have been run other than for the essential production test programme normally employed in the manufacture of coolers of the same class. All parts shall be new, with no recycled parts employed. The oil and refrigerant charges shall be typical for the class, both as to type and quantity.

6 General conditions for tests

6.1 All specified tests are independent of any TEWI calculations.

6.2 All integral remote coolers shall be tested at ambient air temperatures of 24ºC and 35ºC.

6.3 To emulate cellar conditions, all liquid-cooled remote cooler base units will remain in a room with a controlled air temperature of 12.5ºC ± 0.5ºC. The liquid/air heat exchanger (the heat "dump") will be subjected to ambient air temperatures of 0ºC, 24°C and 40°C, during separate tests at each of the three ambient conditions. Each ambient temperatures (other than in simulated beer cellars) shall be controlled to within ± 1°C of the set temperature during each individual test.

The controlled ambient temperature test room shall contain the test 'python' and the liquid draw-off dispensers (simulating a bar) for all the tests of both integral and split system models of remote cooler. Integral air-cooled units shall also be placed in the controlled ambient test room for all tests, but the split system, liquid cooled, base unit should be in a room controlled at the specified cellar temperature (12.5º ± 0.5º C). [Dispense liquid simulating the draught beverage may also be in a cellar temperature controlled room.] The heat "dump" for a split system cooler shall be mounted in the ambient temperature controlled room.

6.4 The air within any temperature controlled test room shall be circulated by fan, but air velocities should be minimal and not exceed that required for maintaining ambient air temperatures at any point in the room within the range permitted by the tolerances in §6.3.

6.5 The relative humidity of the air within the test rooms shall be 50% ± 5%, it being monitored and recorded throughout any individual test.

6.6 Electrical supply to all equipment tested shall be from a voltage-controlled source and be a 230/50/1 supply.

6.7 The remote cooler for test shall be selected according to §5. In particular:

a) the water recirculation pump shall be as specified as the “standard type” for the class of cooler;

b) the cooler shall be fitted with 8 standard “long coils”, the standard “long coil” being that normally specified by the particular manufacturer for the class of cooler;

c) in addition to the long coils, four coil stations will be blanked (if the model has been designed to take 14 cooling coils) and two stations will each be fitted with one 1kW heater, generally formed in the same configuration as the standard long coil;

d) if appropriate, the lid of the ice-bank bath may be left off to facilitate the rapid emptying of water required to allow weighing of the ice-bank.

The configuration of the coil arrangement is shown in figs. 6.1 and 6.2. The positions at which the various entities are monitored are shown in figs. 6.3 and 6.4. (All figures are collected in Appendix A1.)

6.8 The accuracy of all instruments used for definitive measurement should be recorded, along with the calibration certificate number and the name of the calibrating laboratory.

7 Tests overview

7.1 Initial Ice-bank Pull-down Test:

The purpose of this test is to give the weight of the ice-bank achieved by the time the compressor first cuts out after the cooler is first switched on, without the operation of any attached “python” lines.

7.2 Initial Pull-down Time:

The “initial ice-bank pull-down test” gives the time taken to build the initial ice bank.

7.3 Ice-bank Availability Test:

A measured fixed external load is applied to the python water recirculation circuit in place of the python itself. A further fixed measured load is applied to the product-coil cooling bath. With no drinks dispensed, this test measures the maximum proportion of the ice-bank available for required cooling load.

This test will indicate when limiting heat transfer processes and/or water mixing mechanisms render the remaining ice-bank unable to fulfil its intended purpose. The test is conducted with the refrigeration equipment isolated.

7.4 Cool Drinks Capacity / System Recovery /Ice-bank Stability:

Starting with a full ice-bank, the number of drinks dispensed at the rate of 6 pints/minute whilst maintaining a dispensed drink temperature of less than 6.1º C gives the cool drinks capacity of the cooler.

On the event of the dispensed temperature rising above a temperature of 6.1ºC on two consecutive drinks, the drinks pull test will stop, and the cooler will be allowed to recover to the full ice-bank to give a total power consumption for a typical dispense profile. (Recovery time and Finished ice-bank weight to be recorded). The system is then left to run for 24 hours with only the python load applied. The ice-bank weight should be recorded at the first compressor cycle ON after the specified 24 hours as well as the subsequent cycle OFF.

7.5 Specific Capacity Power:

By measuring the total power used during the "cool drinks capacity" test, the specific capacity power can be determined in terms of kWh/1000 pints.

7.6 Calorific Test:

This test identifies the cooler's ability to maintain the standard dispense temperature profile under extreme conditions, i.e. once the ice-bank has been completely melted. The temperature of the water inlet to the recirculating pump should be held stable at 1.5º C. The data recorded is the heat input to the water from the heaters and the total power used by the unit in one hour. The electrical power input by the heaters during the test is expressed as kWh, and is also converted into terms of the equivalent number of cooled drinks served.

PART 2 – Integral, Air-Cooled, Ice-bank Coolers

8 General arrangement of test apparatus - air-cooled models.

8.1 The remote cooler, the test python, and the draw-off arrangement (bar) shall be all installed in the ambient controlled test room, which should be capable of automatically maintaining temperatures of either 24°C or 35°C (depending on the ambient at which the test is being conducted) throughout the period of the test. The ambient temperature shall be controlled to within ± 1°C of the set temperature. The storage of "product" and the means of supply to the remote cooler shall be installed in an area outside of the ambient controlled test room. Providing that the temperature of the "product" can be controlled within its specified limits (12.5ºC ± 0.5ºC) for the duration of the tests, the area itself need not be temperature controlled (i.e. a separate temperature controlled room or enclosure).

8.2 The remote cooler under test shall be connected to a test 'python' (14 + 2) conforming to standard FBI specification "F.B.I. Harmonization Document Number : 001". The python shall be of 30m length, with 14 product lines and two water recirculating lines, arranged in a vertical helix of slowly rising coils of one metre diameter supported on support stands. The lowest (start) point of the bottom horizontal coil shall be 280 mm above the floor, with each coil in the helix being separated from adjacent coils by a minimum of 100 mm. The number of turns in the helix will be determined by the length of python required to connect to the remote cooler at one end and the dispense points at the other. The diameter of the helix may also vary according to the precise layout of the apparatus. (See fig. 8.1, Appendix 1.) The helix should be in front of the remote cooler and on the centre-line of it, with a clear space of 1 metre between them, and with a clear space of 0.5 m. between the helix and any wall.

8.3 One end of the python will be connected to the remote cooler under test. Connections shall be made to eight product coils in the cooler, and the cold water circulate and return lines. At the other end of the python, the two water cooling lines shall be connected together to form a cold water recirculation loop through the python, and the eight product lines (connected to cooling coils in the cooler) shall be connected to eight dispense taps. (The taps shall be of the solenoid valve type, so that dispense cycle can be readily controlled.) At (or close to) the tap, there shall be provided half-pint meters of the turbine type, so that a known quantity of "product" will be dispensed on each actuation of any meter. The six product lines within the python which are unconnected for the purposes of the test, shall be connected to the "product" supply along with the test lines, and at the bar end be connected to any convenient dispense taps. At the start of any test, all dispense lines in the python shall be filled with "product", leaving no unfilled lines during the test. The insulating envelope of the python shall be sealed at the ends to prevent heat and moisture ingress. The length of the uncooled ? " o.d. product lines (between the python and the bar valves) is to be 600mm with 10mm thick insulation.

8.4 The remote cooler shall be installed as generally recommended in the manufacturer's normal instructions. In particular, it should be standing with the back of the unit adjacent to a wall, but at a distance from it in conformance to the manufacturer's recommended air gap.

8.5 The “product” connected to the dispense lines shall be kept at a temperature of 12.5°C ± 0.5°C throughout the test. (The “product” shall be stored in a room different from the test room containing the cooler.) For the 35º C ambient test, the product temperature shall also be 12.5°C.

8.6 The “product” shall be supplied to the remote cooler by means that do not increase its temperature by any significant amount. The supply line(s) may be insulated to prevent “product” temperature pickup from the ambient of the test room.

8.7 The remote cooler shall be connected to the controlled voltage supply. All parts that are normal, specified component parts of the remote cooler shall be coupled together on one electrical supply branch so that the total power supplied to the remote cooler can be measured independently of other measurements. The two 1 kW-heaters (which have been installed instead of product coils) shall be connected to the controlled voltage supply via a further voltage adjustment control means and voltage and power measurement devices. The external heat exchanger heater required for the ice-bank availability test, shall be similarly independently monitored.

9 Initial pull-down ice-bank test - air-cooled models.

9.1 Essential instruments are timing means, weigh scales and thermocouple.

9.2 The python remains disconnected for this test, the product cooling coils remaining empty of product. Before commencing the test, the apparatus needs preparing in accordance with the following procedure.

9.3 Bring the test room to the desired ambient temperature.

9.4 Weigh the dry remote cooler (i.e. empty of water in the bath).

9.5 Fill the unit to be tested to the recommended level with water at 20° C. Weigh the remote cooler (filled with water).

9.6 Link the flow and return of the python recirculation pump with 1m of 15mm OD x 10mm ID tubing, insulated with 6mm x 15mm Class 0 Armaflex. Apply power to the recirculating pump, and throttle the flow to 7 litres/min.

9.7 Start any water-bath agitator or pump.

9.8 Check that the water temperature in the bath is 20º C, and the test room temperature is at the desired ambient temperature.

9.9 Start the refrigeration unit and timer simultaneously.

9.10 Run the system until the ice-bank is fully established and the unit cuts out on the ice-bank thermostat. Stop the timer if it is not stopped automatically. Record the time.

9.11 Empty the remote cooler of water, and weigh the remote cooler and ice-bank . The calculations required to produce the results are given in § A2.2 (Appendix 2).

9.12 The ice-bank weight will be identified as the "initial pull-down ice-bank weight" and the time between switch-on and cut-off of the unit will be identified as the "initial pull-down time".

10 Ice-bank availability test - air-cooled models.

10.1 Essential instruments are timing means, kWhr meters, weigh scales and thermocouple. The instrumentation required for this test is shown in Fig. 6.3. To prepare for this test, an insulated heat exchange unit capable of supplying a known load of 0.5 kW to the python recirculating water is connected to the cooler (in place of the python). **Safety Note: Proper protection against over-pressure, over-temperature and electric shock <u>must</u> be included on the external heat exchange unit.** The heat input to the external heat exchanger shall be supplied (and monitored) through a kWhr meter.

10.2 The external water recirculation pump motor and any water-bath agitator motor present are to be supplied with electric power through a separate kWhr meter.

10.3 Adjust the heating load to give a total of 1.5 kW to the two internal water-bath heaters (750W for each heater). These heaters shall also be monitored through a separate kWhr meter.

10.4 If this test is started from scratch, repeat procedures according to paragraphs 9.3, 9.4 and 9.5. If this test is performed immediately after the ice-bank pull-down test in section 9, return the cold water to the cooler after the final weighing. It will be necessary to ensure that the ambient temperature of the test is being maintained at the stated value.

10.5 Ensure all heat loads are switched off. Switch on the external water recirculating pump and prime the external heat exchanger. The rate of water recirculation through the external heat exchanger shall be adjusted to a maximum of 7 litres/minute. If this water recirculation rate is not achievable, adjust the water recirculation rate to the maximum possible. Note the water recirculation rate. If necessary, top-up the water bath to the recommended operating level.

10.6 With all heater loads remaining switched off, switch on any water-bath agitator. Switch on the compressor and refrigeration system. Run the unit until the compressor switches off on the ice-bank control.

10.7 Immediately the compressor switches off, weigh the remote cooler and its ice-bank, returning the cold water, emptied for the weighing, back to the water-bath immediately after the weighing. Electrically isolate the compressor to prevent it automatically switching on via the ice-bank control during the remainder of the test. If the internal and/or external water agitators and pumps have been switched off for the weighing of the ice-bank, ensure that they are switched on again as soon as the water is returned to the water-bath.

10.8 Note the readings of all kWhr meters. Keeping the compressor electrically isolated, switch on the external 0.5 kW heat-exchanger load and the two water-bath heaters. Start the timer at the same time as all the heat loads are applied.

10.9 The temperature of the external recirculation water at the inlet to the recirculation pump should be noted and recorded once stabilised.

10.10 When the recirculation pump inlet water temperature reaches 2.5°C, all heating loads should be switched off, the pump and any agitator motor turned off. Weigh the unit's remaining ice-bank (by empty/refill process), record the time, and a note made of all kWhr meter readings. After returning the water to the water-bath, re-apply the heating loads and switch-on the circulation and agitator motors.

10.11 When all the ice of the ice-bank has melted, turn off all electrical supplies, empty the water and weigh the unit. Return the water removed for the weighing to the water-bath.

10.12 The calculation to determine the percentage of useful ice is given in Appendix 2, § A2.3. For each ambient temperature test, the result will be presented as a single percentage figure, as specified in Appendix 2.

11 Cool drinks capacity test - air-cooled models.

11.1 Repeat the test preparation procedure of sections 8 and 9, where appropriate. The measurements required are as indicated in Figure 6.4, Appendix 1.

11.2 Connect the python to the external water recirculation system. Ensure the python is fully primed, and the water recirculation rate is adjusted to 7 litres/minute or the maximum available. Fully prime each dispense line. Run the unit in the specified ambient for a minimum period of 12 hours to ensure all temperatures are correctly established. During the 12 hours "soak" period, no dispense operations should be performed.

11.3 Start the test when the compressor has just "cycled off" with a full, stabilised ice-bank.

11.4 Draw "product" at the rate of 6 pints/minute, at a dispense rate of 15 seconds/pint, using a sequence controller to achieve dispense consistency. Use the dispense sequence: line 1, line 5, line 2, line 6, line 4, line 8. (Lines numbered left to right when looking at the remote cooler from the front.) Measure the dispense temperature with a thermocouple supported in the dispense stream at a distance not greater than 50mm from the end of the tap nozzle. The dispense nozzle should not be fitted with any device (sparkler, creamer, etc) for creating or controlling the head normally required when dispensing beer. The measured dispense is normally in half-pint units, the pint being achieved by dispensing two half-pints consecutively. The temperature of the dispense will be taken as that achieved at the time the second half-pint has commenced. The dispensed water need not be collected, but the number of dispenses should be counted.

Note: For high ambient or product temperature tests, the initial dispense temperature may exceed the stated limit. If this is the case, note the temperatures and number of drinks, but continue the test provided that the product dispensed temperature falls below the specified limit.

11.5 Continue the test until the observed dispense temperature measured where and when specified in 11.4 (above) exceeds 6.1° C on two consecutive dispenses, whether or not from the same tap.

11.6 When the dispense temperature specified is breached, allow the cooler to recover until the ice-bank is fully rebuilt and the unit cuts out on the ice-bank control (cycles OFF). Time and record the recovery. On the cut out, drain the water bath and save the water. Weigh and record the ice-bank weight; refill the water bath with the saved water and allow the cooler to run for a minimum of 12 hours.

11.7 After the minimum 12 hours run time has elapsed, the ice-bank is again weighed at the first compressor cycle ON (after the elapsed time) - the 12hr minimum ice-bank weight - and also after the subsequent cycle OFF – the 12hr ice-bank weight. Record all weighings.

11.8 The total number of dispenses of drinks (in terms of pints dispensed) with a dispense temperature at or below 6.1° C shall be known as the "cool drinks capacity", and the power consumption of the remote cooler, in terms of kWhr/1000 pints, shall be known as the "specific capacity power". The calculations are shown in § A2.4, Appendix 2.

12 Calorific test.

12.1 Essential instruments are stopwatch, kWhr meter and thermocouples.

12.2 The python remains disconnected for this test, the product cooling coils remaining empty of product. Before commencing the test, the apparatus needs preparing in accordance with the following procedure.

12.3 Bring the test room to the desired ambient temperature.

12.4 Fill the unit to be tested to the recommended level with water at 0° C.

12.5 Link the flow and return of the python recirculation pump with 1m of 15mm OD x 10mm ID tubing, insulated with 15mm bore x 6mm thick Class 0 Armaflex foam insulation. Apply power to the recirculating pump, and throttle the flow to 7 litres/min or maximum available.

12.6 Start any water-bath agitator or pump.

12.7 Check that the water temperature in the bath is less than 1º C, and the test room temperature is at the desired ambient temperature.

12.8 Start the refrigeration unit.

12.9 Apply a controllable electrical supply to the heaters in the water bath. Adjust the voltage to the heaters, using a controllable voltage supply, until the water temperature rises to 1.5ºC at the entrance to the water recirculating pump, and remains stable.

12.10 Start the timer and note the reading on the kWhr meter on the electrical supply to the heaters. Run the cooler for 1 hour. Continue to monitor the water bath temperature and adjust the heat input if necessary to maintain the water at the entrance to the recirculating pump at 1.5ºC.

12.11 The measured heat input into the water-bath over one hour is the available cooling capacity for the cooler. The recorded kWhr can be converted into pints/hour by using the calculation in §A2.5 (Appendix 2).

PART 3 – 2-Part Split Glycol Cooled, Ice-bank Coolers.

13 General arrangement of test apparatus - liquid-cooled models.

13.1 The remote cooler base unit and the “product” supply arrangements shall be in a temperature controlled area, the temperature being maintained at 12.5° C ± 0.5° C for the duration of the tests. The python, dispense arrangement and the liquid-air heat exchanger for the remote cooler shall be installed in a further ambient controlled test room (at 0ºC, 24° C, and 40° C).

13.2 The remote cooler under test shall be connected to a test python (14 + 2), generally as described in section 8.2, except that the python helix and the remote cooler will be in separate temperature controlled areas.

13.3 The remote cooler base unit shall be installed as generally recommended in the manufacturer's normal instructions. It should be standing in a temperature controlled room with the back of the unit adjacent to a wall, but at a distance from it in conformance to the manufacturer's recommended air gap. The associated liquid/air heat exchanger (normally mounted on an exterior wall of the building) shall be installed in the controlled ambient temperature room, along with the python helix. The liquid/air heat exchanger shall be installed in the room in a manner in accordance with as many of the manufacturer's normal recommended installation instructions as is possible within the confines of the test facilities. The airflow off the heat exchanger shall not interfere with the ambient conditions of the python helix. If the test room size is such as to create potential interference between the liquid/air heat exchanger and the dispense python, each item shall be in its own individual temperature controlled environment. The secondary liquid coolant shall flow between the refrigerant condenser in the remote cooler base unit and the liquid/air heat exchanger through 20 m of 15 mm “Cobracoil”, or equivalent plastic tubing, of which 2 m shall be in the “cold” room and the remaining 18 m shall be in the “hot” room, generally as in Fig 13.1 (Appendix 1).

13.4 The “product” shall be supplied to the remote cooler base unit by means that do not increase its temperature. The supply line(s) may be insulated to prevent “product” temperature pickup.

13.5 The remote cooler shall be connected to the controlled voltage supply. All parts which are normal, specified component parts of the remote cooler (including the liquid/air heat exchanger) shall be coupled together on one electrical supply branch so that the total power supplied to the remote cooler can be measured independently of other measurements. The two 1 kW-heaters (which have been installed instead of product coils) shall be connected to the controlled voltage supply via a further voltage control means and voltage and power measurement devices.

13.6 The piping connecting the remote cooler with the liquid/air heat exchanger, should be installed in the recommended manner, and filled with the recommended strength of glycol/water mixture.

14 Pull-down ice-bank test – liquid-cooled model.

14.1 The procedure for this Test follows the procedures laid out in sections §9.1 to §9.12.

14.2 Ensure that the water/glycol mixtures in the recirculation system are of the correct strength and correctly filled.

15 Ice-bank availability test – liquid-cooled models.

TEST NOT REQUIRED. Values given will be those derived in the tests on the Air-Cooled Coolers.

16 Cool drinks capacity test - liquid cooled models.

TEST NOT REQUIRED. Values given will be those derived in the tests on the Air-Cooled Coolers

PART 4 – Certification

17 Results of Tests.

17.1 Results obtained with these tests will be subject to some fluctuation. Because the results obtained depend on the precise temperatures prevailing at the time of the tests (and the necessary tolerances required in the controlled temperatures, measurement of weights etc.), there is a potential for a variance of some 10% from the actual performance achieved.

17.2 Persons signing the Certificate of Performance Benchmarks shall have no responsibility whatsoever for any results of tests witnessed, other than as a witness to the event, that the results were achieved, measurements were recorded accurately and the calculations contain no errors.

17.3 The manufacturer may attend any benchmark testing involving his/her products. The manufacturer may abandon testing at any point during any sequence of tests, up to and including the issue of the Certificate.

17.4 Any data generated during any benchmark tests, or other tests carried out in conjunction with benchmark tests, remain the sole property of the manufacturer.

17.5 All data generated during testing, including abandoned tests, will remain confidential to the manufacturer. No person involved in the testing of coolers, or witnessing the tests, or acting as a signatory to the Certificate, will disclose to any other person any such data without the express permission of the manufacturer in writing.

17.6 Any data recorded during the tests, which is additional to that required to complete tests according to this specification, may be used for any purposes required by the manufacturer. Even if any additional data is used to perform calculations to confirm the results presented in the Certificate, neither the data nor any calculations which make use of it constitute any part of the Certificate, and do not require any authentication by the qualified witness other than that required for the purposes of §17.2.

18 Certificate.

18.1 Part of the certification process must include verification that the sample remote cooler to be tested is representative of its class by comparing the sample with its specification and manufacturing drawings, to the extent that it is possible so to do without dismantling or disconnecting any component parts or assemblies.

18.2 At completion of the bench-mark tests, a certificate of the results will be prepared and signed by the appropriate persons (see §4.3). A pro-forma certificate is presented in Appendix 3.

APPENDICES

APPENDIX 1

FIGURES

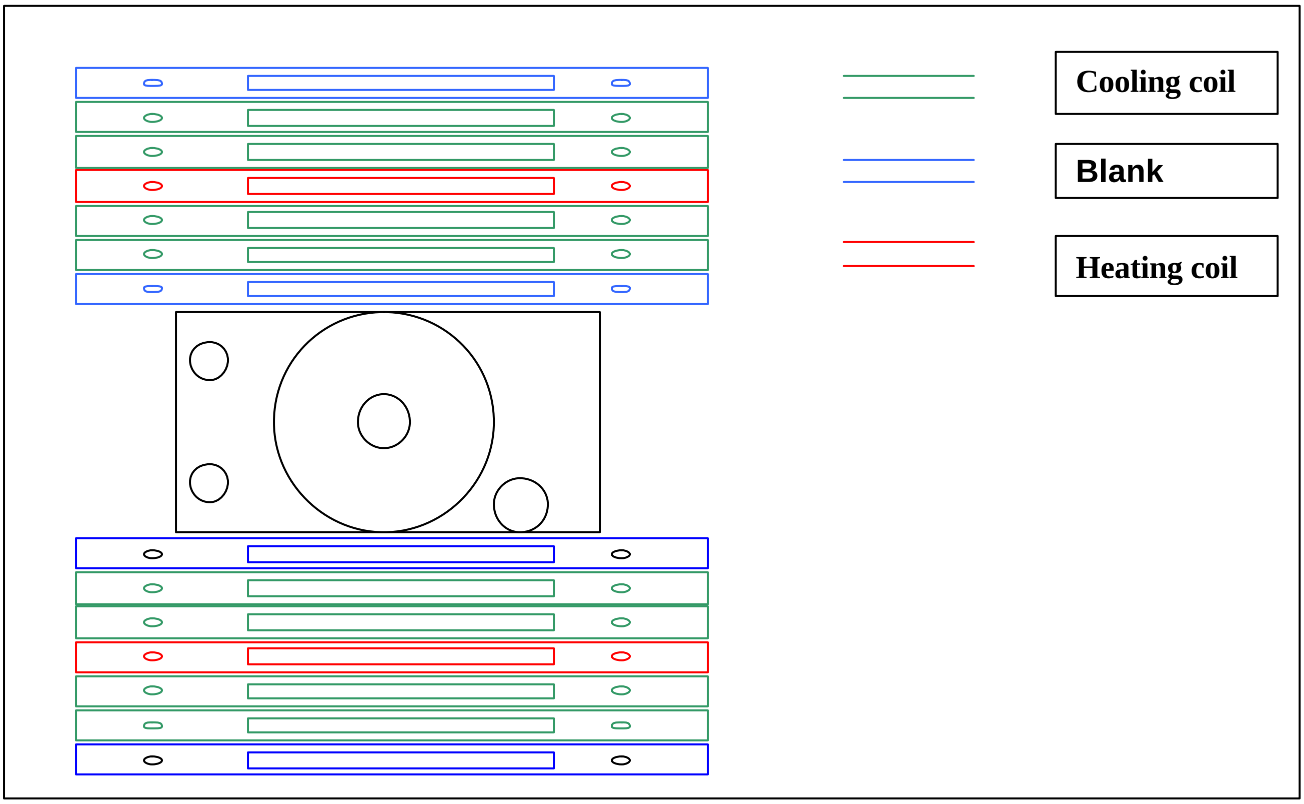


Figure 6.1 : Arrangement of the cooler lid showing positions of cooling coils, blanks and heating coils.

APPENDIX 1

FIGURES

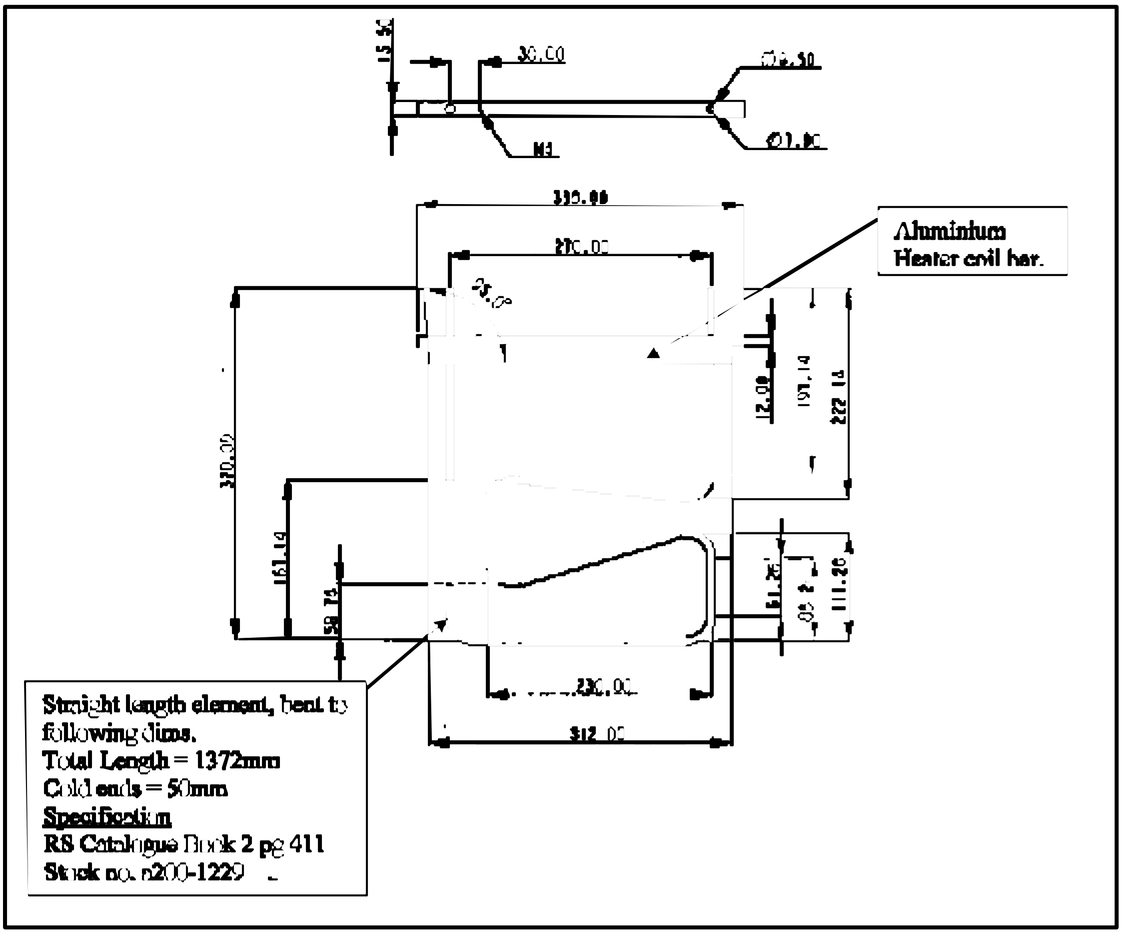
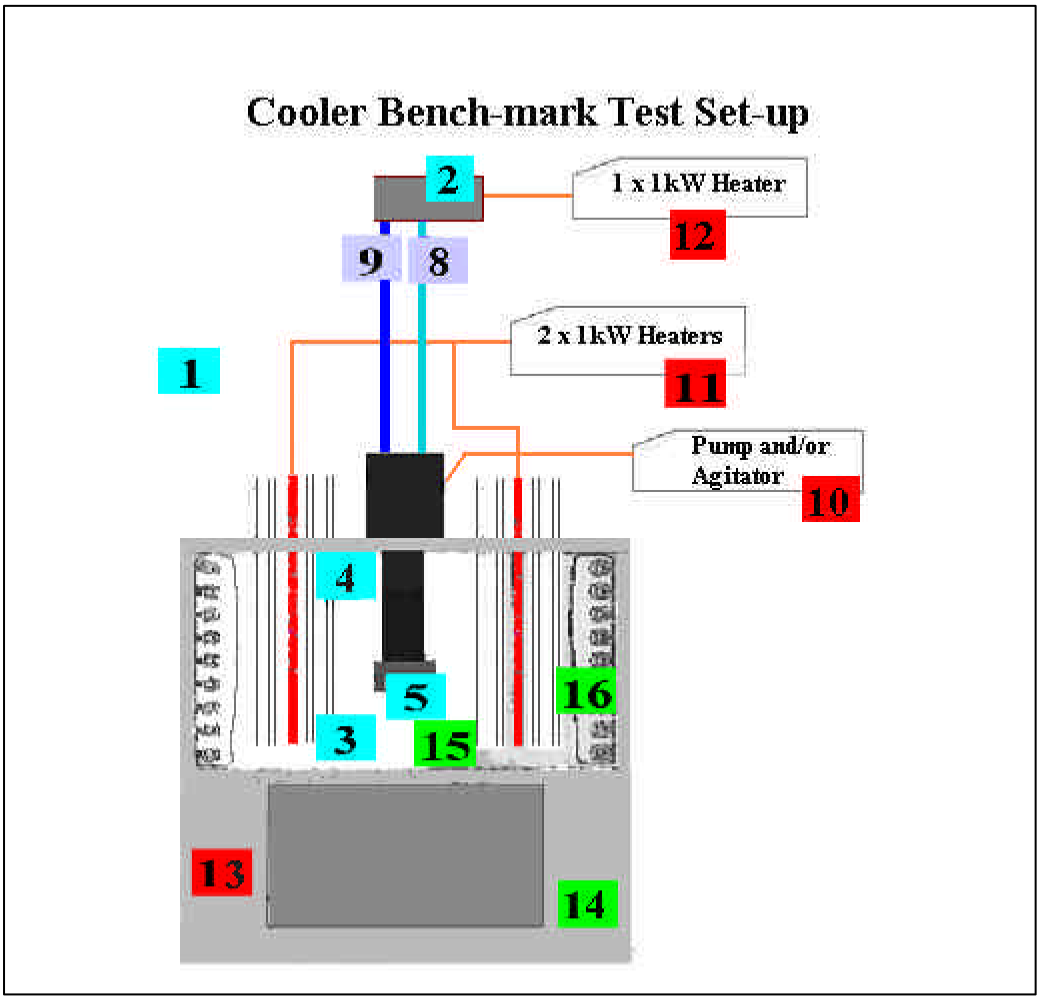


FIGURE 6.2 : Dimensions and Configuration for the Heating Elements in Remote Coolers.

APPENDIX 1

FIGURES

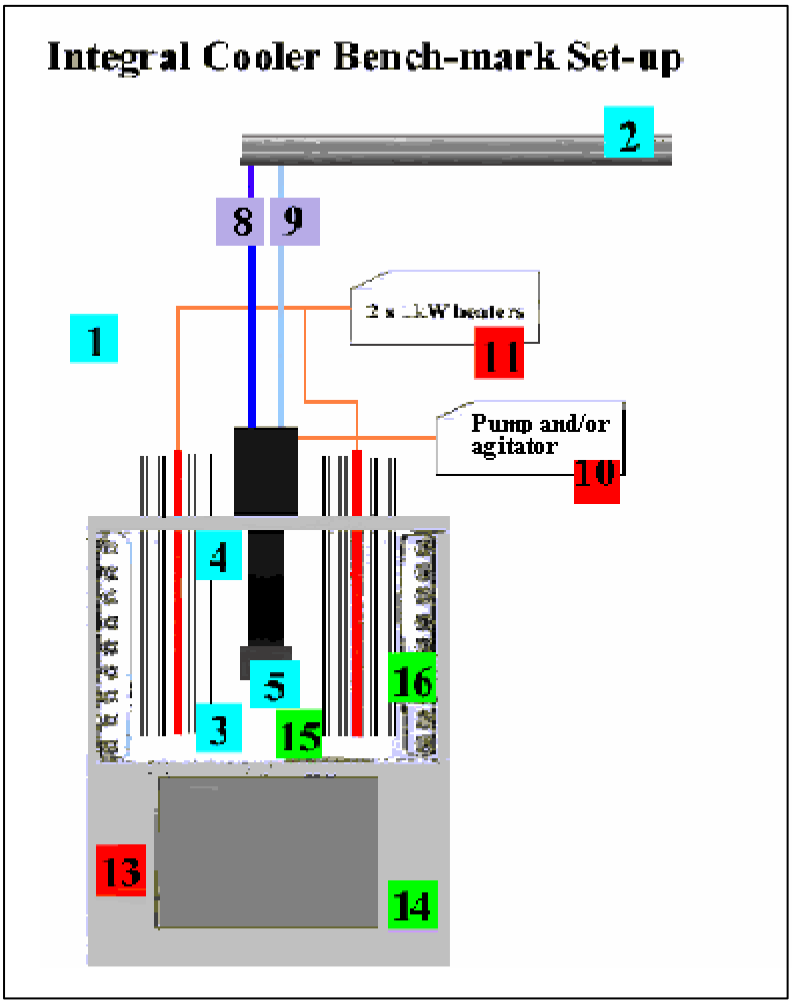


DATA LOG POINTS	*Applied load:*	*Operational variables:*
Temperatures: **1.Cellar ambient** **2. Heater ambient** **3. Coil bottom** **4. Coil top** **5. Pump inlet** *Flow rates:* **8. Pump pressure** **9. Recirculation flow Rate**	**10. Pump & Agitator, Watts** **11. Water Bath Heaters, Watts** **12. Python Heaters, Watts** **13. Compressor power consumption, Watts**	**14.Compressor run time** **15. Water bath capacity** **16.** **weight**

FIGURE 6.3 : Position of data monitoring points during Ice-bank Availability Test

APPENDIX 1

FIGURES



Data Log Points

Temperatures:
1. Cellar ambient
2. Python ambient
3. Coil bottom
4. Coil top
5. Pump inlet

Flow rates:
8. Pump pressure
9. Recirculation flow rate

Applied load:
10. Pump and agitator, Watts
11. Heaters, Watts
14. Refrigeration power, Watts

Operational variables:
13. Compressor run time
15. Water bath capacity
16. weight

FIGURE 6.4: Position of data monitoring points during Cool Drinks Capacity Test

APPENDIX 1

FIGURES

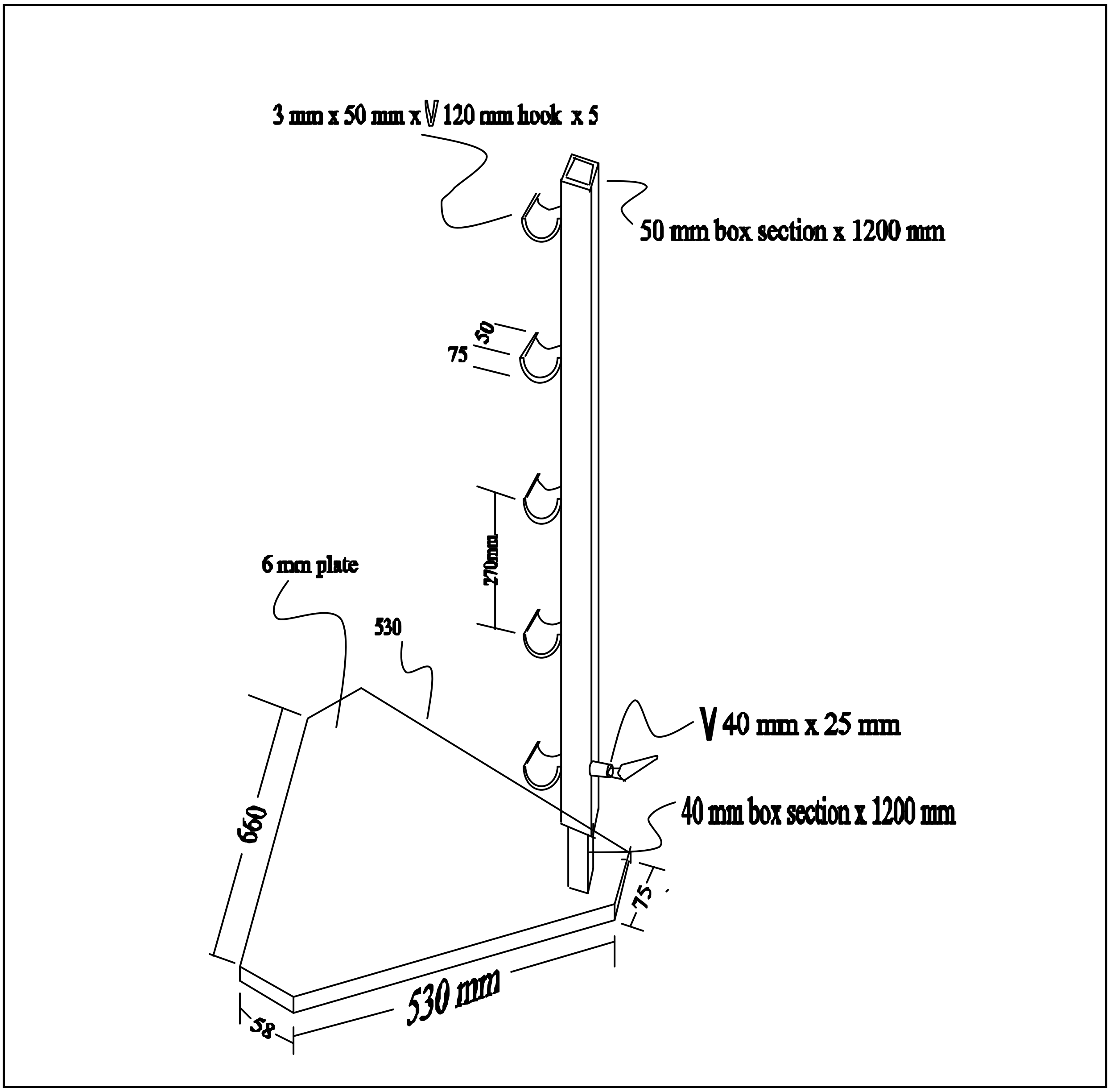


FIGURE 8.1 : Stand for supporting python – 3 off required

APPENDIX 1

FIGURES

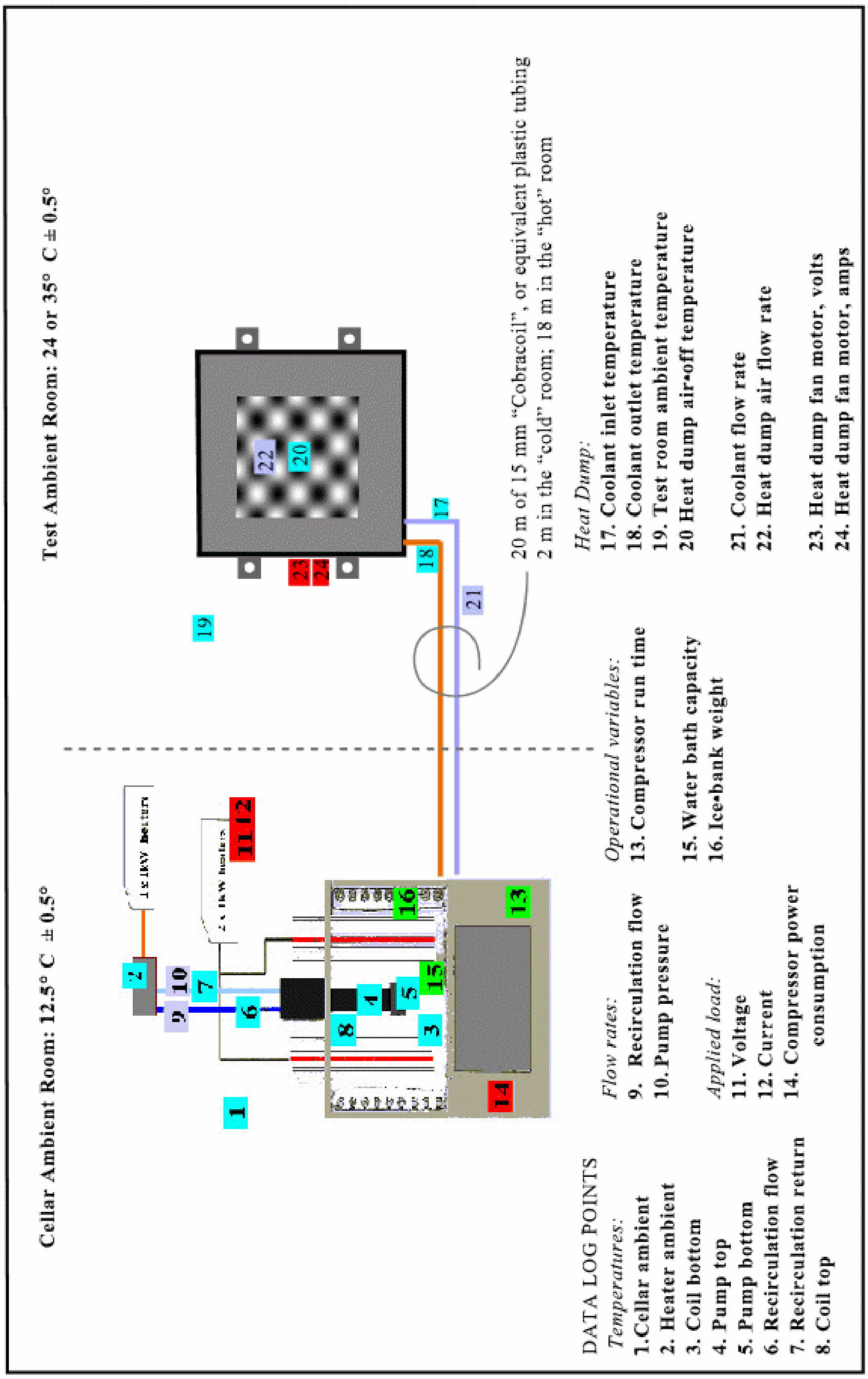


FIGURE 13.1 : Position of data monitoring points during Ice•bank Availability Test

APPENDIX 2

CALCULATIONS

A2.1 Symbols.

Symbols once defined retain their definition throughout this standard.

A2.2 Pull-down Ice-bank **test.**

w_{11} = weight of cooler base unit, Kg

w_{12} = weight of cooler base unit and water (at 20º C), Kg

w_{13} = weight of cooler base unit and ice-bank, at time t_1, Kg

t_0 = time the base refrigeration unit switched on

t_1 = time the base refrigeration unit cuts-out

water capacity of the cooler = $(w_{12} – w_{11})$ kg

initial pull-down ice-bank weight = $(w_{13} – w_{11})$ kg

initial pull-down time = $(t_1 - t_0)$ mins

Note: The initial pull-down time is expressed in minutes. Any odd seconds should be accounted for by rounding-up the result of the calculation to the next whole number of minutes (even if there is only 1 second).

APPENDIX 2

CALCULATIONS

A2.3 Ice-bank **availability test.**

w_{21} = weight of cooler base and ice-bank at start of ice-bank availability test (at cut-out of ice-bank thermostat), kg

w_{22} = weight of cooler base and ice-bank when temperature at inlet of external recirculation pump exceeds 1.6°C, kg

w_{23} = weight of cooler base when ice-bank completely melted, kg

useful weight of ice = $(w_{21} - w_{22})$ kg

total weight of ice = $(w_{21} - w_{23})$ kg

percentage of ice availability = $\frac{(w_{21} - w_{22})}{(w_{21} - w_{23})} \times 100$

The accuracy of this result can be confirmed by using the electrical measurements made during the test in an alternative calculation.

stability (see §11.7) = $\frac{\textbf{12hr ice-bank weight}}{\textbf{Initial ice-bank pull-down weight}}$ **x 100 %**

Minimum ice-bank (see §11.7) = $\frac{\textbf{12 hrs minimum ice-bank weight}}{\textbf{Initial ice-bank pull-down weight}}$ **x 100%**

APPENDIX 2

CALCULATIONS

A2.4 Cooled drink capacity test.

n = number of cooled drinks served, pints

W_1 = total power consumed during the test, kWhr

Cooled drink capacity = **n pints**

Specific capacity power = $$\frac{W_1}{n} \times 1000 \text{ kWhr/1000 pint}$$

A2.5 Calorific Test.

W_2 = power consumed by heaters over 1 hour run (kWhr)

= kWhr at end of run – kWhr at start of run.

n_2 = number of pints per hour

number of pints per hour = $$\frac{\text{power consumed}}{\text{weight of } n_2 \times \text{temperature range} \times \text{specific heat}} \times \text{const.}$$

Assuming cooling range is 6º C (i.e. from 12º C to 6º C);

specific heat is 4186.8 J/kg, ºC;

weight of 1 pint is 0.567kg.

Refrigerating system capacity = **W_2 kWhr**

n_2 = **$W_2 \times 253$ pints/hr**

APPENDIX 3

PRO-FORMA CERTIFICATE

REMOTE COOLER BENCHMARK TESTS IN ACCORDANCE WITH BFBi-C001
AIR COOLED CONDENSER MODELS

I,………………......being the independent witness for the tests of the remote cooler,
Model………………………………., Type……………………………….,
Manufactured by ……………………………………….
of ………………………………………...
…………………………………………
……………………………………….,

Certify that I have witnessed tests conducted during _________/____ in accordance with the Cooler Test Specification BFBi-C001 drawn up by BFBi Members in co-operation with the Technical Committee of the Five Brewers Initiative, and confirm that the results achieved during the tests were as recorded below. In the case of self-certification, a signature is also required from the manufacturer's QA Auditor.

Signed ………………..………………Position…………………………. date ………………….

Signed ………………..………………Position…………………………. date ………………….

	Stabilised voltage applied: **V**		
	ambient temperature	**24ºC**	**35ºC**
1	**Initial Pull-down test:**		
?	Initial pull-down weight	Kgs.	Kgs
?	Initial pull-down time	mins	mins.
2	**Ice-bank availability test:**		
?	Percentage ice availability	%	
?	Ice-bank stability	%	
?	Minimum ice-bank	%	
3	**Cool drinks capacity test:**	**12.5º C product**	**12.5º C product**
?	Cooled drink capacity	pints	pints
?	Specific capacity power	kWh/1000 pint	kWh/1000pint
4	**Calorific capacity test:**		
?	Refrigerating system capacity	kWh	kWh
?	Drinks capacity	pints/hr	pints/hr