Operating Instruction Manual

No. 442M

6200

Oxygen Bomb Calorimeter

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PREFACE

Scope

This manual contains instructions for installing and operating the Parr 6200 Calorimeter. For ease of use, the manual is divided into nine chapters.

Concept of Operation

Installation

Instrument Description

Program Installation & Control

Operating Instructions

Corrections & Final Reports

Reporting Instructions

File Management

Maintenance & Troubleshooting

Subsections of these chapters are identified in the Table of Contents.

To assure successful installation and operation, the user must study all instructions carefully before starting to use the calorimeter to obtain an understanding of the capabilities of the equipment and the safety precautions to be observed in the operation.

Customer Service:

Questions concerning the installation or operation of this instrument can be answered by the Parr Customer Service Department:
309-762-7716
800-872-7720
Fax: 309-762-9453
www.parrinst.com
parr@parrinst.com

Additional instructions concerning the installation and operation of various component parts and peripheral items used with the 6200 Calorimeter have been included and made a part of these instructions.

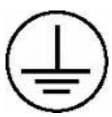
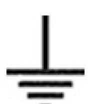
No.	Description
201M	Limited Warranty
483M	Introduction to Bomb Calorimetry
205M	1108 Oxygen Combustion Bomb
207M	Analytical Methods for Oxygen Bombs
230M	Safety Precautions

Additional instructions for the printer, cooler, and water handling systems are found in the respective package and should be made a part of this book.

Note:
The unit of heat used in this manual is the international calorie, which is equal to 4.1868 absolute joules.

PREFACE

Explanation of Symbols

I	On position
O	Off position
~	Alternating Current (AC)
	This **CAUTION** symbol may be present on the Product Instrumentation and literature. If present on the product, the user must consult the appropriate part of the accompanying product literature for more information.
	**ATTENTION**, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices.
	**Protective Earth (PE) terminal**. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**Chassis Ground**. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**Earth Ground**. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.

PREFACE

Safety Information

To avoid electrical shock, always:

1. Use a properly grounded electrical outlet of correct voltage and current handling capability.
2. Ensure that the equipment is connected to electrical service according to local national electrical codes. Failure to properly connect may create a fire or shock hazard.
3. For continued protection against possible hazard, replace fuses with same type and rating of fuse.
4. Disconnect from the power supply before maintenance or servicing.

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such material.
2. Refer servicing to qualified personnel.

Intended Usage

If the instrument is used in a manner not specified by Parr Instrument Company, the protection provided by the equipment may be impaired.

Cleaning & Maintenance

Periodic cleaning may be performed on the exterior surfaces of the instrument with a lightly dampened cloth containing mild soap solution. All power should be disconnected when cleaning the instrument.

There are no user serviceable parts inside the product other than what is specifically called out and discussed in this manual. Advanced troubleshooting instructions beyond the scope of this manual can be obtained by calling Parr Instrument Company in order to determine which part(s) may be replaced or serviced.

General Specifications

Electrical Ratings
120VAC, 6.0 Amps. 50/60 Hz
240VAC, 3.0 Amps, 50/60 Hz

Before connecting the calorimeter to an electrical outlet, the user must be certain that the electrical outlet has an earth ground connection and that the line, load and other characteristics of the installation do not exceed the following limits:

Voltage: Fluctuations in the line voltage should not exceed 10% of the rated nominal voltage shown on the data plate.

Frequency: Calorimeters can be operated from either a 50 or 60 Hertz power supply without affecting their operation or calibration.

Current: The total current drawn should not exceed the rating shown on the data plate on the calorimeter by more than 10 percent.

Environmental Conditions

Operating: 15ºC to 30ºC; maximum relative humidity of 80% non-condensing.

Installation Category II (overvoltage) in accordance with IEC 664.

Pollution degree 2 in accordance with IEC 664.

Altitude Limit: 2,000 meters.

Storage: -25ºC and 65ºC; 10% to 85% relative humidity.

Provisions for Lifting and Carrying

Before moving the instrument, disconnect all connections from the rear of the apparatus. Lift the instrument by grabbing underneath each corner.

PREFACE

Getting Started

These steps are offered to help the user become familiar with, install, operate and develop the full capabilities of the Parr 6200 Calorimeter.

1. Review the Concept of Operations, Chapter 1, to get an understanding of the overall capabilities of the calorimeter and microprocessor control.

2. Unpack and install the calorimeter in accordance with the Installation Instructions, Chapter 2. This simple, step-wise procedure will acquaint the user with the various parts of the calorimeter and make it easier to understand the operating instructions which follow.

3. Turn the power switch ON (located on the back). Turn to the Instrument Description, Chapter 3, to review the touch screen controls.

4. Review the Program Installation and Control, Chapter 4, to match the factory settings to the intended mode of operation. Any required changes can be made to the program parameters located in the Main Menu.

5. Review the Reporting Instructions, Chapter 7, to become familiar with the manner in which calorimetry corrections are entered. Also discussed are generating final reports, editing and clearing memory.

6. Turn to the Menu Operating Instructions, Appendix A, to review the menu functions used to modify the program contained in the 6200 Calorimeter. A review of the menus will provide a good idea of the capabilities and flexibility designed into this instrument.

7. Review the Calculations, Appendix B. This provides information about calculations performed by the 6200 Calorimeter.

8. Review Standardization, Appendix C. This will serve two important functions. First, it provides instructions on generating the energy equivalent factor required to calculate the heat of combustion of unknown samples. Secondly, it will give the user the opportunity to run tests on a material with a known heat of combustion to become familiar with the instrument and confirm that the instrument and operating procedures are producing results with acceptable precision. Most 6200 Calorimeters will have an energy equivalent of approximately 2400 calories per ºC. The runs for standardization and determinations are identical, except for the setting of the instrument to the standardization or determination mode.

9. Review the Communication Interfacing, Appendix D, for the correct installation of any peripherals connected to the 6200 Calorimeter.

10. After successful standardization, the 6200 Calorimeter should be ready for testing samples.

1 CONCEPT OF OPERATION

Overview

The 6200 Calorimeter has been designed to provide the user with:

- A **traditional design** calorimeter with removable oxygen bomb and bucket.
- A **moderately priced** calorimeter which uses real time temperature measurements to determine heat leaks using a controlled calorimeter jacket.
- A **high precision** calorimeter capable of exceeding the repeatability and reproducibility requirements of all international standard test methods.
- A **compact** calorimeter requiring minimum laboratory bench space.
- A modern intuitive **graphical user interface** for ease of operation and training.
- A calorimeter with up to date **digital hardware, software** and **communications** capabilities.
- A calorimeter that is **cost effective** and which can incorporate a user's current bombs, buckets, and accessories.

Removable Bomb

The Model 6200 calorimeter utilizes the Parr 1108 oxygen bomb. More than 20,000 of these reliable oxygen combustion bombs have been placed in service on a world wide basis. This bomb features an automatic inlet check valve and an adjustable needle valve for controlled release of residual gasses following combustion. They are intended for samples ranging from 0.6 to 1.2 grams with a maximum energy release of 8000 calories per charge.

The 1108 oxygen bomb is made of high-strength, high nickel stainless steel designed to resist the corrosive acids produced in routine fuel testing. An alternative 1108CL bomb is available, constructed of an alloy containing additional cobalt and molybdenum to resist the corrosive conditions produced when burning samples containing chlorinated compounds.

The Model 6200 can also be equipped with a variety of special purpose oxygen bombs for unusual samples and/or applications. The 1104 high strength oxygen bomb is designed for testing explosives and other potentially hazardous materials. The 1109/1109A semimicro oxygen bombs can be fitted along with its unique bucket to test samples ranging from 25 to 200 mg.

Removable Bucket

The A391DD removable bucket has been designed to hold the bomb, stirrer and thermistor with a minimum volume of water and to provide an effective circulating system which will bring the calorimeter to rapid thermal equilibrium both before and after firing.

Dynamic Operation

In its Dynamic Operating Mode, the calorimeter uses a sophisticated curve matching technique to compare the temperature rise with a known thermal curve to extrapolate the final temperature rise without actually waiting for it to develop. Repeated testing, and over 20 years of routine use in fuel laboratories, has demonstrated that this technique can cut the time required for a test by one-half without significantly affecting the precision of the calorimeter.

Full Microprocessor Based Process Control

The microprocessor controller in this calorimeter has been preprogrammed to automatically prompt the user for all required data and control input and to:

- **A.** Generate all temperature readings in the calorimeter.
- **B.** Monitor jacket as well as bucket temperature.
- **C.** Confirm equilibrium conditions.
- **D.** Fire the bomb.
- **E.** Confirm that ignition has occurred.
- **F.** Determine and apply all necessary heat leak corrections.
- **G.** Perform all curve matching and extrapolations required for dynamic operation.
- **H.** Terminate the test when it is complete.
- **I.** Monitor the conditions within the calorimeter and report to the user whenever a sensor or operating condition is out of normal ranges.

Full Microprocessor Based Data Acquisition and Handling

In addition to its process control functions, the microprocessor in the calorimeter has been preprogrammed to:

- **A.** Collect and store all required test data.
- **B.** Apply all required corrections for combustion characteristics.
- **C.** Compute and report the heat of combustion for the sample.

Flexible Programming

The fifth generation software built into this calorimeter and accessed through the screen menus permit the user to customize the operation of the calorimeter to meet a wide variety of operating conditions including:

- **A.** A large selection of printing options.
- **B.** Choice of accessories and peripheral equipment.
- **C.** Multiple options in regard to handling thermochemical corrections.
- **D.** Choice of ASTM or ISO correction procedures.
- **E.** A variety of memory management and reporting procedures.
- **F.** Complete freedom for reagent concentrations and calculations.
- **G.** Unlimited choice of reporting units.
- **H.** Automatic bomb usage monitoring and reporting.
- **I.** A choice of Equilibrium or Dynamic test methods.
- **J.** Automatic statistical treatment of calibration runs.
- **K.** Enhanced testing and trouble shooting procedure.

The 6200 Calorimeter is equipped with two RS232C connections for direct communication with its printer and an attached balance. It is also equipped with an Ethernet network connection for connections to laboratory computers.

2 INSTALLATION

The 6200 Calorimeter is completely assembled and given a thorough test before it is shipped from the factory. If the user follows these instructions, installation of the calorimeter should be completed with little or no difficulty. If the factory settings are not disturbed, only minor adjustments will be needed to adapt the calorimeter to operating conditions in the user's laboratory.

This apparatus is to be used indoors. It requires at least 4 square feet of workspace on a sturdy bench or table in a well-ventilated area with convenient access to an electric outlet, running water and a drain. The supply voltage must be within ± 10% of marked nominal voltage on the apparatus. The supply voltage receptacle must have an earth ground connection.

Filling the Jacket Reservoir

The water reservoir of the calorimeter must be filled with approximately 1.4 liters of water (distilled or de-ionized preferred). This must be done prior to turning on the heater and the pump. The reservoir is filled through the tank fill elbow on the back of the calorimeter. The tank is full once water stands in the horizontal run of the filling elbow.

Power Connection

Plug the power line into any grounded outlet providing proper voltage that matches the specification on the nameplate of the calorimeter. The calorimeter will draw approximately 300 watts of power. Grounding is very important not only as a safety measure, but also to ensure satisfactory controller performance. If there is any question about the reliability of the ground connection through the power cord, run a separate earth ground wire to the controller chassis.

Turn the power switch to the on position. After a short time, the Parr logo will appear on the LCD display followed by a running description of the instrument boot sequence. When the boot sequence is complete, the calorimeter Main Menu is displayed. Go to the Calorimeter Operation page and turn the heater and pump on. This begins circulating and heating the calorimeter jacket water. Add water to the filling elbow at the rear of the instrument as required in order to keep it full.

Jacket Cooling Water Connection

It becomes necessary to use the jacket cooling water connection only if the calorimeter operating room temperature exceeds 24 °C (75°F).

When required, an external water source is used to cool the jacket of the 6200 Calorimeter. This is done in either of the following ways:

1. Tap water is used for cooling and then run to a drain.
2. Cooling water is re-circulated to the calorimeter from a Parr water handling system.

The water that provides the cooling goes through a heat exchanger and does not mix with the water in the jacket and its reservoir. There is a very low cooling load and tap water up to a temperature of 27°C should be adequate.

Tap Water Cooling

Connect the tap water supply to the cold water inlet on the back of the calorimeter using either ¼" copper or nylon tubing (HJ0025TB035). A 196VB metering valve is provided with the calorimeter. This valve should be installed in this inlet line near the calorimeter. This valve is used to adjust the flow of water to the heat exchanger to compensate for differences in tap water temperatures and water line pressures. Once the calorimeter is operating at equilibrium, check the jacket temperature that is displayed on the operating page. If this temperature is cycling significantly, close down on the metering valve to reduce the flow of cooling water. If the jacket rises above its 30 °C set point, open this valve to increase the cooling. A flow rate of 100 ml / minute is generally all that is required.

Jacket Cooling Water Connection *Continued*

Connect the cooling water outlet on the back of the calorimeter to a drain using either nylon (HJ0025TB035) or copper ¼” tubing. A shut off valve in tap water supply line is also a good idea if the calorimeter will not be used for an extended period.

Cooling with the Water Handling System

If the calorimeter is to be operated with a Parr Water Handling System, connect the pump output to the cooling water inlet and connect the cooling water outlet to the return connection on the water handling system. With this installation it is neither necessary nor desirable to install the 196VB metering valve in the inlet line. It is a good idea to keep all water line runs as short as practical to avoid unwanted temperature changes in the water between the source and the calorimeter.

Oxygen Filling Connection

The 6200 Calorimeter is equipped with an automatic bomb oxygen filling system. This system consists of an oxygen pressure regulator with a relief valve that mounts on an oxygen tank and a controlled solenoid inside the calorimeter. To install the regulator on the oxygen supply tank, unscrew the protecting cap from the oxygen tank and inspect the threads on the tank outlet to be sure they are clean and in good condition. Place the ball end of the regulator in the outlet and draw up the union nut tightly, keeping the gages tilted slightly back from an upright position. Connect the regulator to the oxygen inlet fitting on the back of the calorimeter case. This hose should be routed so that it will not kink or come in contact with any hot surface. Connect the high-pressure nylon hose with the push on connector to the back of the calorimeter.

All connections should be checked for leaks. Any leaks detected must be corrected before proceeding. Instructions for operating the filling connection are in the Operating Instructions chapter.

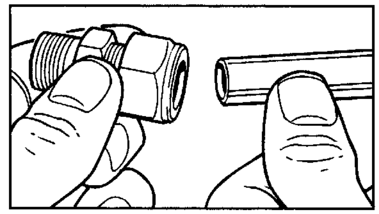
Adjust the pressure regulator to deliver 450 psi of O_2. Assemble the oxygen bomb without a charge and attach the filling hose to the bomb inlet valve. Press the O_2 fill key on the Calorimeter Operation page and observe the delivery pressure on the 0 – 600 psi gage while the oxygen is flowing into the bomb. Adjust the regulator, if needed, to bring the pressure to 450 psi. If there is any doubt about the setting, release the gas from the bomb and run a second check.

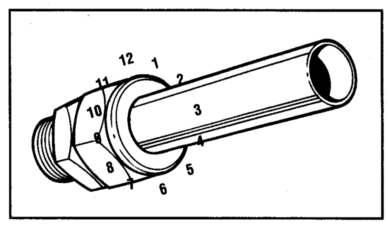
Printer and Balance Connections

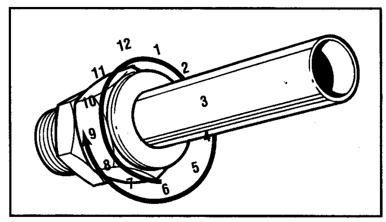
Connect the printer to the calorimeter at this time. The Parr 1757 Printer is configured and furnished with a cord to connect directly to the RS232C printer port on the back of the calorimeter.

The balance port connection, if used, should be made at this.

Swagelok Tube Fittings







When Swagelok Tube Fittings are used, the instructions for installation are:

1. Simply insert the tubing into the Swagelok Tube Fitting. Make sure that the tubing rests firmly on the shoulder of the fitting and that the nut is finger-tight.
2. Before tightening the Swagelok nut, scribe the nut at the 6 o'clock position.
3. While holding the fitting body steady with a back-up wrench, tighten the nut 1-1/4 turns. Watch the scribe mark, make one complete revolution and continue to the 9 o'clock position.
4. For 3/16" and 4mm or smaller tube fittings, tighten the Swagelok nut 3/4 turns from finger-tight.

Retightening Swagelok Tube Fittings

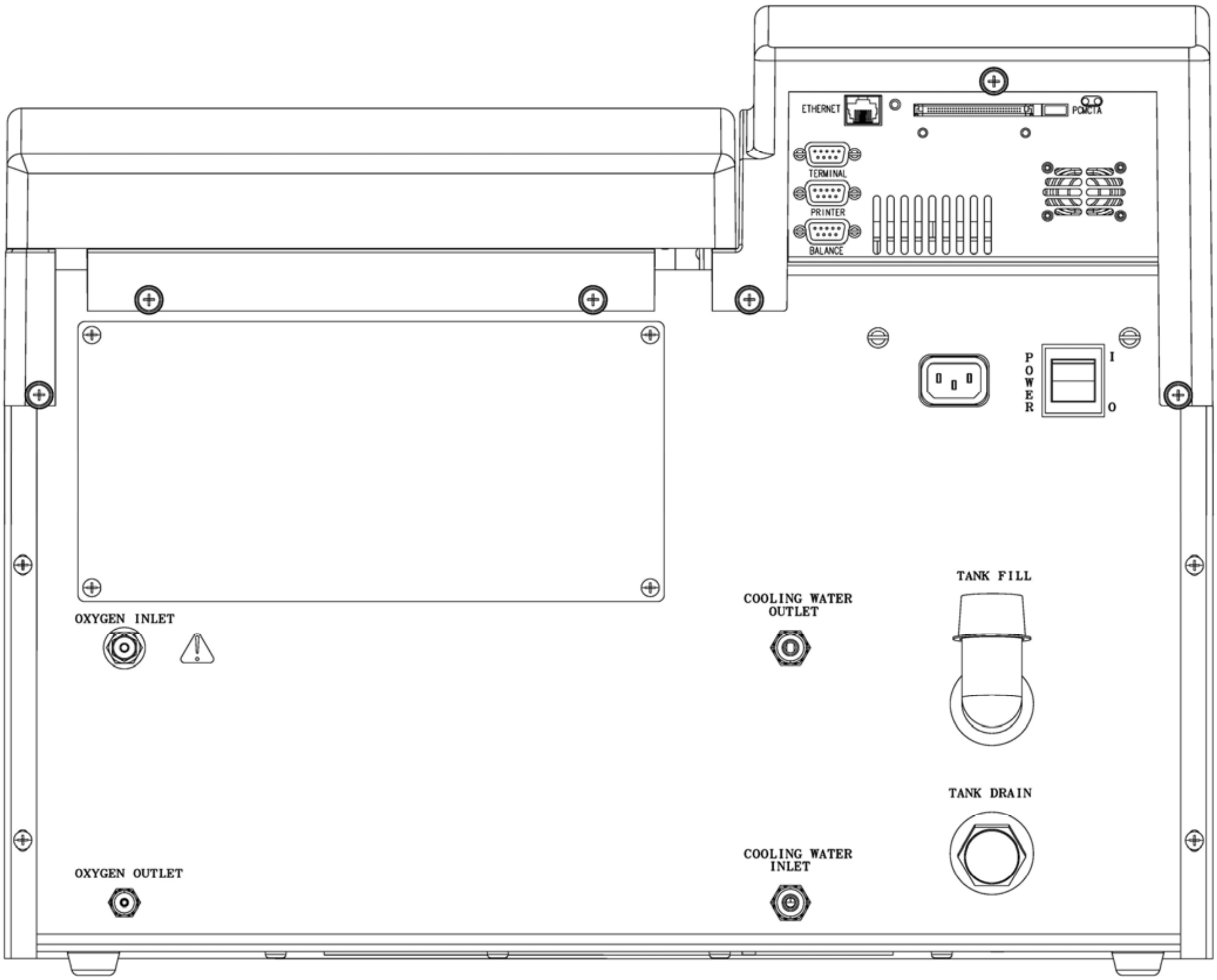
Swagelok tubing connections can be disconnected and retightened many times. The same reliable leak-proof seal can be obtained every time the connection is remade using the simple two-step procedure.

1. Insert the tubing with pre-swaged ferrules into the fitting body until the front ferrule seats.
2. Tighten the nut by hand. Rotate the nut to the original position with a wrench. An increase in resistance will be encountered at the original position. Then tighten slightly with a wrench. Smaller tube sizes (up to 3/16" or 4mm) take less tightening to reach the original position than larger tube sizes. The type of tubing and the wall thickness also has an effect on the amount of tightening required. Plastic tubing requires a minimal amount of additional tightening while heavy wall metal tubing may require somewhat more tightening. In general, the nut only needs to be tightened about 1/8 turn beyond finger tight where the ferrule seats in order to obtain a tight seal.

Over tightening the nut should be avoided.

Over tightening the nut causes distortion (flaring) of the lip of the tube fitting where the ferrule seats. This in turn causes the threaded portion of the body to deform. It becomes difficult to tighten the nut by hand during a subsequent re-tightening when the fitting body becomes distorted in this manner.

Figure 2-1
6200 Calorimeter Back Panel



6200 Calorimeter External Plumbing

Line 1 & 2 – Maximum length of 10 feet
 -¼” OD, Polyurethane (Part Number HJ0025TB035)

Line 3 - Maximum length of 25 feet
 - $^{1}/_{8}$” OD, Nylon (Part Number HX0012TB024)

Closed Loop Configurations
Figure 2-2

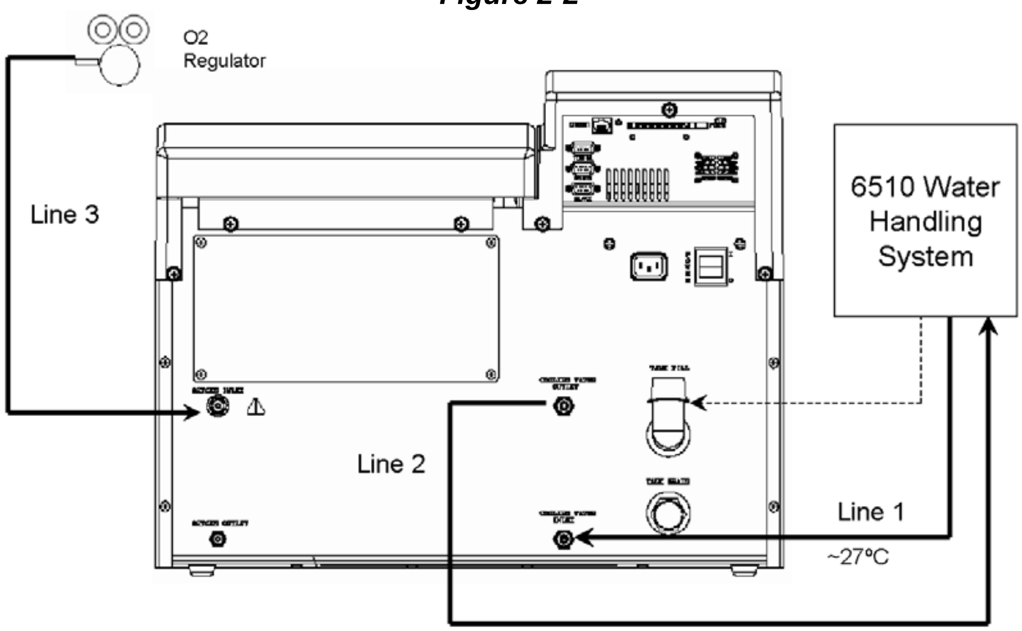
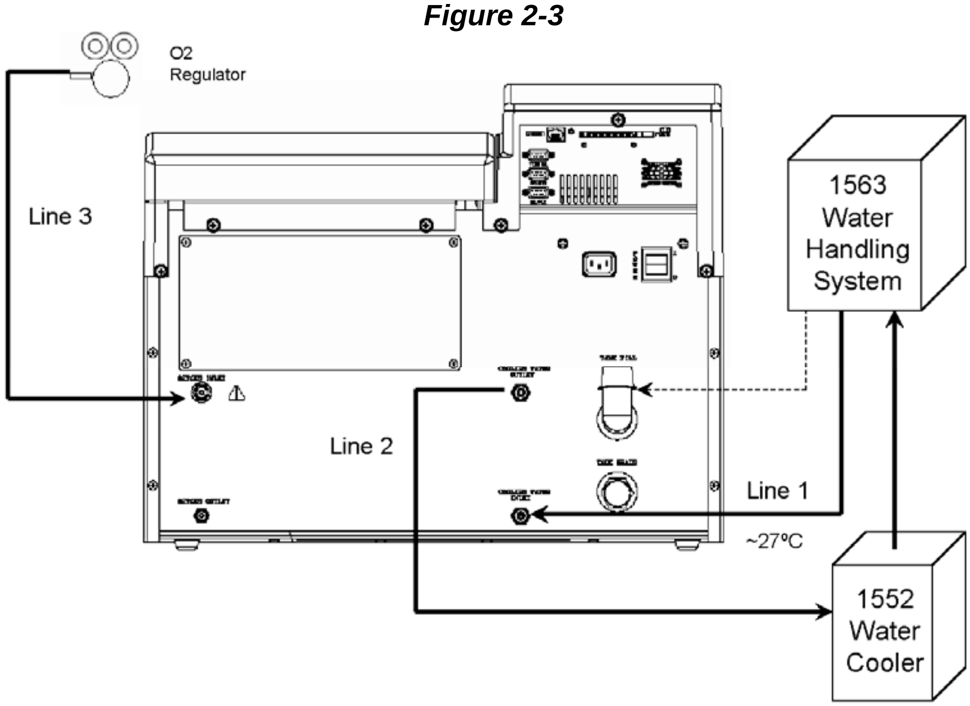


Figure 2-3



Open Loop Configurations
Figure 2-4

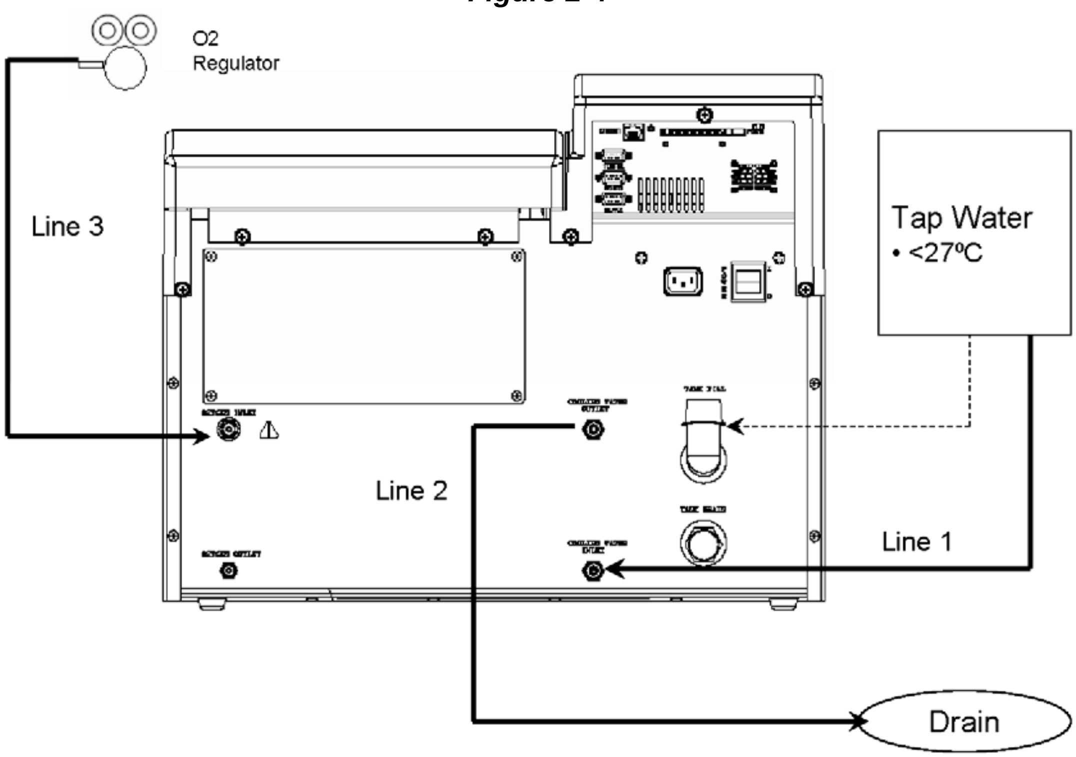
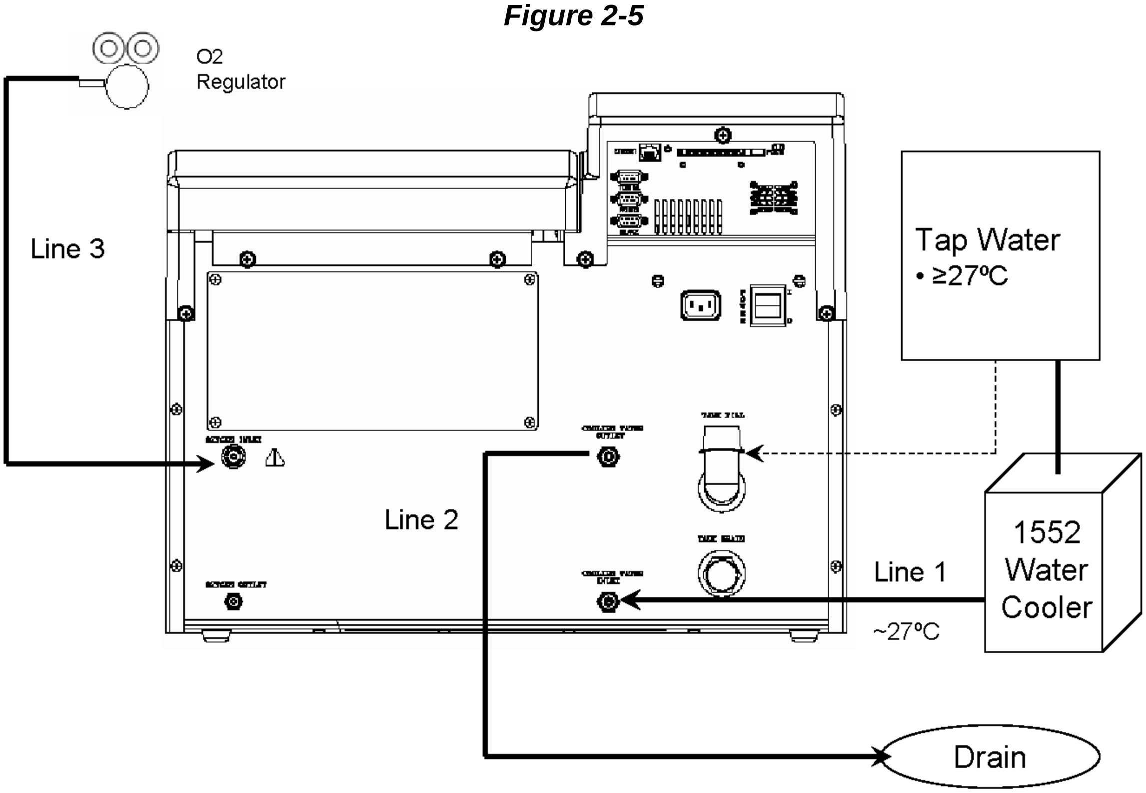


Figure 2-5



Standardizing the Calorimeter

The calorimeter must be accurately standardized prior to actually performing calorimetric tests on sample materials. Review Appendix C - Standardization, in order to become familiar with the general procedure and calculations. The user should configure the calorimeter at this time to accommodate the desired sample weight entry mode. The calorimeter can be placed into standardization mode on the Calorimeter Operation Page, with the operating mode key. If two bombs and buckets are being used with the calorimeter to maximize sample throughput, the calorimeter can be configured to prompt for a Bomb ID at the start of each test. The Bomb ID can also be selected on the Calorimeter Operations Page, using the Bomb key. All bomb and bucket combinations will need to be standardized separately. The end result of a standardization test is an energy equivalent value, or the amount of energy required to raise the temperature of the calorimeter one degree. Repeated standardization with any given bomb and bucket combination should yield an energy equivalent value with a range of 14 calories per degree, centered around the mean value for all tests using that bomb and bucket combination. The calorimeter is ready for testing samples after an energy equivalent value has been obtained.

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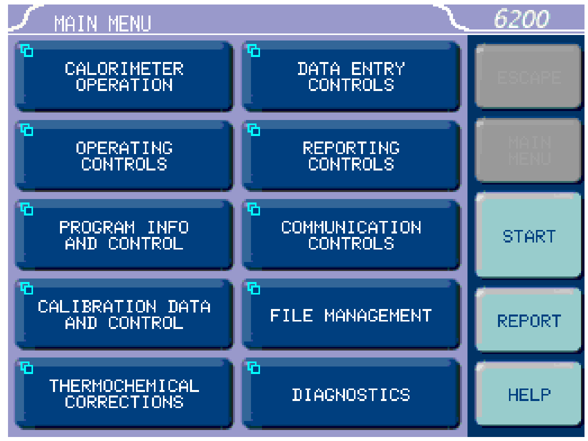
3 INSTRUMENT DESCRIPTION

Types of Controls

All calorimeter configurations and operations are handled by a menu-driven system operated from the bright touch screen display. The settings and controls are organized into nine main sections or pages which comprise the MAIN MENU.

Note:

Keys with a "double box" in the upper left hand corner lead to sub-menus.



Menu Keys

The controls that change the data field information in the menus will be one of the following:

1. **Toggles.** These data fields contain ON/OFF or YES/NO choices. Simply touching the key on the screen toggles the choice to the other option. The current setting is displayed in the lower right corner of the key.
2. **Option Selection.** These data fields contain a list of options. Touching the key on the screen steps the user through the available choices. The current setting is displayed in the lower right corner of the key.
3. **Value Entry Fields.** These data fields are used to enter data into the calorimeter. Touching the key on the screen brings up a sub menu with a key pad or similar screen for entering the required value. Some keys lead to multiple choices. Always clear the current value before entering a new value. Once entered the screen will revert to the previous menu and the new value will be displayed in the lower right corner of the key.
4. **Data Displays.** Most of these keys display values that have been calculated by the calorimeter and are informational only. Certain ones can be overridden by the user entering a desired value through a sub-menu. The value is displayed in the lower right corner of the key.

Note:

Some keys will respond with an opportunity for the user to confirm the specified action to minimize accidental disruptions to the program and/or stored data.

Control Keys

There are five control keys which always appear in the right column of the primary displays. These keys are unavailable when they are gray instead of white.

1. **Escape.** This key is used to go up one level in the menu structure.
2. **Main Menu.** This key is used to return to the main menu touch screen from anywhere in the menu structure.
3. **Start.** This key is used to start a calorimeter test.
4. **Report.** This key is used to access the test results stored in the calorimeter, to enter thermochemical corrections and to initiate report on the display, printer or attached computer
5. **Help.** This key is used to access help screens related to the menu currently displayed on the touch screen.

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4 PROGRAM INSTALLATION & CONTROL

Software Installation

The program in the 6200 Calorimeter can be extensively modified to tailor the unit to a wide variety of operating conditions, reporting units, laboratory techniques, available accessories and communication modes.

In addition, the calculations, thermochemical corrections and reporting modes can be modified to conform to a number of standard test methods and procedures.

Numerous provisions are included to permit the use of other reagent concentrations, techniques, combustion aids and short cuts appropriate for the user's work.

Note:
Changes to the program are made by use of the menu structure described in Appendix A of this manual. Any of these items can be individually entered at any time to revise the operating program.

Default Settings

Units are preprogrammed with default settings. See pages 4-3 and 4-4 for a listing of the factory default settings.

These default settings remain in effect until changed by the user. Should the user ever wish to return to the factory default settings, go to the Program Information and Control Menu, then to User/Factory Settings, and then touch Reload Factory Default Settings and YES.

Non-volatile memory is provided to retain any and all operator initiated program changes; even if power is interrupted or the unit is turned off. If the unit experiences an intentional or unintentional "Cold Restart", the controller will return to its default settings.

Revising Default Settings

The default parameters of the 6200 Calorimeter can be changed to guarantee that the 6200 Calorimeter, when cold restarted, will always be in the desired configuration before beginning a series of tests.

Users who wish to permanently revise their default settings may do so using the following procedure:

- Establish the operating parameters to be stored as the user default settings.
- Go to the Program Info and Control Menu, User/ Factory Settings, User Setup ID, and enter the desired User Setup ID.
- Select Save User Default Settings

To re-load the user default settings, go to the Program Info and Control Page, User/Factory Settings, Re-load User Default Settings, and YES.

4

Factory Default Settings

Figure 4- 1
6200 Factory Default Settings

Calorimeter Operation	
Operating Mode	Determination
Bomb Installed/EE	1/2400.0
Heater and Pump	OFF

Operating Controls	
Method of Operation	Dynamic
Reporting Units	Btu/lb
Use Spiking Correction	OFF
"OTHER" Multiplier	4.1868
Calibrate Touchscreen	
LCD Backlight Timeout(s)	1200 S
LCD Contrast	30%
Print Error Messages	ON
Language	English

Spike Controls	
Use Spiking	OFF
Heat of Combustion of Spike	6318.4
Use Fixed Spike	OFF
Weight of Fixed Spike	0.0
Prompt for Spike before Weight	OFF

Program Info and Control	
Date	XX/XX/XXXX
Time	XX:XX
Software and Hardware Info	
Settings Protect	OFF
User/Factory Settings	
Feature Key	
Bomb Type Select	
User Function Setup	
Cold Restart	

User / Factory Settings	
User Setup ID	00000001
Reload Factory Default Settings	
Reload User Default Settings	
Save User Default Settings	

Calibration Data & Control	
Calibration Run Limit	10
EE Max Std Deviation	0.0
Heat of Combustion of Standard	6318.4
Bomb Service Interval	500
Use Bomb	1

Bomb 1 Through 4	
EE Value	2400.0
Protected EE Value	OFF

Thermochemical Corrections Standardization	
Fixed Fuse Correction	ON 15.0
Fixed Acid Correction	ON 10.0
Fixed Sulfur Correction	ON 0.0

Determination	
Fixed Fuse Correction	ON 15.0
Fixed Acid Correction	ON 10.0
Fixed Sulfur Correction	OFF 0.0
Calculate Net Heat of Combustion	OFF

Calculation Factors	
Acid Value is Nitric Acid Only	ON
Acid Multiplier	0.0709
Sulfur Value is Percent	ON
Sulfur Multiplier	0.6238
Fuse Multiplier	1.0
Use Offset Correction (ISO)	OFF
Offset Value	0.0
Fixed Hydrogen	OFF 0.0
Hydrogen Multiplier	50.68
Dry Calculation	OFF

Data Entry Controls	
Prompt for Bomb ID	ON
Weight Entry Mode	Touch Screen
Acid Entry Mode	Touch Screen
Hydrogen Entry Mode	Touch Screen
Auto Sample ID Controls	ON
Sample Weight Warning above	2.0
Spike Weight Entry Mode	Touch Screen
Sulfur Entry Mode	Touch Screen
Moisture Entry Mode	Touch Screen
Auto Preweigh Controls	ON

Auto Sample ID Controls	
Automatic Sample ID	ON
Automatic Sample ID Increment	1
Automatic Sample ID Number	1

Auto Preweigh Controls	
Automatic Preweigh ID	ON
Automatic Preweigh ID Increment	1
Automatic Preweigh ID Number	1

Reporting Controls	
Report Width	40
Automatic Reporting	ON
Auto Report Destination	Printer
Individual Printed Reports	OFF
Edit Final Reports	OFF
Recalculate Final Reports	OFF
Use New EE Values in Recalculation	OFF

Communication Controls	
Printer Port (RS232)	
Balance Port (RS232)	
Network Interface	
Printer Destination	Local (RS232)
Bar Code Port (RS232)	
Network Data Devices	

Printer Port Communications	
Number of Data Bits	8
Parity	None
Number of Stop Bits	1
Handshaking	Xon/Xoff
Baud Rate	9600
Printer Type	Parr 1757

Balance Port Communications	
Balance Type	Custom
Customize Balance Settings	

Balance Port Settings	
Number of Data Bits	8
Parity	None
Number of Stop Bits	1
Handshaking	None
Baud Rate	9600
Data Characters from Balance	8
Data Precision	4
Transfer Timeout (seconds)	10
Balance Handler Strings	

Data Logger	
Data Logger	OFF
Data Log Interval	12s
Data Log Destination	Log File and Printer
Select Data Log Items	
Data Log Format	Text Format

5 OPERATING INSTRUCTIONS

Operating the 1108 Oxygen Bomb

Detailed Instructions for preparing the sample and charging the 1108 Oxygen Bomb are given in Operating Instructions No. 205M. Follow these instructions carefully, giving particular attention to the precautions to be observed in charging and handling the bomb.

Operating the Filling Connection

To fill the bomb, connect the hose to the bomb inlet valve and push the O2 button on the calorimeter control panel. The calorimeter will then fill the bomb to the preset pressure and release the residual pressure in the connecting hose at the end of the filling cycle. It will take approximately 60 seconds to fill the bomb. During this time a countdown timer on the O2 fill button will display the remaining fill time. Pushing the O2 key a second time will stop the flow of oxygen at any time. Once the display returns to its normal reading, the user can disconnect the coupling and proceed with the combustion test.

If the charging cycle should be started inadvertently, it can be stopped immediately by pushing the O2 fill key a second time. During extended periods of inactivity, overnight or longer, close the tank valve to prevent leakage. When changing oxygen tanks, close the tank valve and push the O2 FILL key to exhaust the system. Do not use oil or combustible lubricants on this filling system or on any devices handling oxygen under pressure. Keep all threads, fittings, and gaskets clean and in good condition. Replace the two 394HCJE O-rings in the slip connector if the connector fails to maintain a tight seal on the bomb inlet valve.

The recommended filling pressure is 450 psig (3 MPa or 30 bar). This pressure is prescribed by most of the standard bomb calorimetric test methods. Higher or lower filling pressures can be used, but the bomb must never be filled to more than 600 psig (40 atm).

Operating the Calorimeter

All operations required to standardize the 6200 Calorimeter, or test an unknown sample, should proceed step-wise in the following manner:

1. Turn on the calorimeter and activate the pump and heater using Calorimeter Operations. Allow at least 20 minutes for the calorimeter to warm up and the jacket temperature to stabilize. Once the jacket temperature comes within 0.5°C of 30°C and stays there for approximately 10 minutes, the calorimeter is ready to begin testing. The bomb parts should be wetted and then dried in the manner used at the conclusion of a test. This serves to wet all sealing parts as well as leaving the bomb with the same amount of residual water which will exist in all subsequent testing.

2. Prepare the sample weighing the material to 0.1 mg and charge the oxygen bomb as described in the section entitled, Operating the Filling Connection. Using an additional bomb and bucket can increase the throughput of the 6200 Calorimeter. With this arrangement, the calorimeter can operate almost continuously since the operator will be able to empty a bomb and recharge it while a run is in progress. A bomb and bucket for the next run will be ready to go into the calorimeter as soon as it is opened.

   Each bomb and bucket combination will have to be standardized separately and the proper energy equivalent for each set must be used when calculating the heat of combustion.

3. Fill the calorimeter bucket by first taring the dry bucket on a solution or trip balance; then add 2000 (+/- 0.5) grams of water. Distilled water is preferred, but demineralized or tap water containing less than 250 ppm of dissolved solids is satisfactory. The bucket water temperature should be approximately 3 to 5 °C below the jacket temperature. It is not necessary to use exactly 2000 grams, but the amount selected must be duplicated within +/- 0.5 gram for each run. Instead of weighing the bucket, it can be filled from an automatic pipet, or from any other volumetric device if the repeatability of the filling system is within +/- 0.5 ml.

   To speed and simplify the bucket filling process, and to conserve water and energy, Parr offers a closed circuit Water Handling System (No. 6510). This provides a water supply, cooled to the starting temperature and held in an automatic pipet ready for delivery in the exact amount needed to fill the bucket. Instructions for this automatic system are given in Operating Instruction No. 454M.

Operating the Calorimeter *Continued*

4. Set the bucket in the calorimeter. Attach the lifting handle (421A) to the two holes in the side of the screw cap and partially lower the bomb in the water. Handle the bomb carefully during this operation so that the sample will not be disturbed. Push the two ignition lead wires into the terminal sockets on the bomb head. Orient the wires away from the stirrer shaft so they do not become tangled in the stirring mechanism. Lower the bomb completely into water with its feet spanning the circular boss in the bottom of the bucket. Remove the lifting handle and shake any drops of water back into the bucket and check for gas bubbles.

5. Close the calorimeter cover. This lowers the stirrer and thermistor probe into the bucket.

6. Select determination or standardization as appropriate on the Calorimeter Operation menu by toggling the operating mode key. After pressing the start key, the calorimeter will now prompt the operator for Bomb ID number, sample ID number, sample weight and spike weight in accordance with the instructions set into the operating controls page.

7. The calorimeter will now take over and conduct the test. During the time it is establishing the initial equilibrium, it will display PREPERIOD on the status bar. Just before it fires the bomb, it will sound a series of short beeps to warn the user to move away from the calorimeter. Once the bomb has been fired, the status bar will display POSTPERIOD. The calorimeter will check to make certain that a temperature rise occurs and will then look for the final equilibrium conditions to be met. If it fails to meet either the initial or final equilibrium conditions, or if it fails to detect a temperature rise within the allotted time, the calorimeter will terminate the test and advise the user of the error.

8. At the conclusion of the test, the calorimeter will signal the user.

9. Open the cover and remove the bomb and bucket. Remove the bomb from the bucket and open the knurled valve knob on the bomb head to release the residual gas pressure before attempting to remove the cap. This release should proceed slowly over a period of not less than one minute to avoid entrainment losses. After all pressure has been released, unscrew the cap; lift the head out of the cylinder and examine the interior of the bomb for soot or other evidence of incomplete combustion. If such evidence is found, the test will have to be discarded. Otherwise, wash all interior surfaces of the bomb, including the head, with a jet of distilled water and collect the washings in a beaker.

10. Remove all unburned pieces of fuse wire from the bomb electrodes; straighten them and measure their combined length in centimeters. Subtract this length from the initial length of 10 centimeters and multiply this burned length by 2.3 calories per cm (for Parr 45C10 Fuse Wire) to obtain the fuse correction. The scale on the fuse wire card can be used to obtain this value directly.

11. Titrate the bomb washings with a standard sodium carbonate solution using methyl orange, red or purple indicator. A 0.0709N sodium carbonate solution is recommended for this titration to simplify the calculation. This is prepared by dissolving 3.76 grams of Na2CO3 in the water and diluting to one liter. NaOH or KOH solutions of the same normality may be used.

12. Analyze the bomb washings to determine the sulfur content of the sample if it exceeds 0.1%. Methods for determining sulfur are discussed in Operating Instructions No. 207M.

13. At the end of the testing period, turn OFF the calorimeter at the power switch.

Samples and Sample Holders

Particle Size and Moisture Content. Solid samples burn best in an oxygen bomb when reduced to 60 mesh, or smaller, and compressed into a pellet with a *2811 Parr Pellet Press*.

Large particles may not burn completely and small particles are easily swept out of the capsule by turbulent gases during rapid combustion.

Note*:*
Particle size is important because it influences the reaction rate. Compression into a pellet is recommended because the pressure developed during combustion can be reduced as much as 40% when compared to the combustion of the material in the powder form. In addition in giving controlled burn rates, the pelletizing of samples keeps the sample in the fuel capsule during combustion.

Materials, such as coal, burn well in the as-received or air-dry condition, **but do not burn completely dry samples**. A certain amount of moisture is desirable in order to control the burning rate. Moisture content up to 20% can be tolerated in many cases, but the optimum moisture is best determined by trial combustions.

If moisture is to be added to retard the combustion rate, drop water directly into a loose sample or onto a pellet after the sample has been weighed. Then let the sample stand for awhile to obtain uniform distribution.

Combustion Aids

Some samples may be difficult to ignite or they may burn so slowly that the particles become chilled below the ignition point before complete combustion is obtained. In such cases powdered benzoic acid, white oil or any other combustible material of known purity can be mixed with the sample. Ethylene glycol, butyl alcohol or decalin may also be used for this purpose.

Note:
It must be remembered, however, that a combustion aid adds to the total energy released in the bomb and the amount of sample may have to be reduced to compensate for the added charge.

Also, when benzoic acid is combusted for standardization runs or for combustion aid purposes, it should be in the form of a pellet to avoid possible damage to the bomb which might result from rapid combustion of the loose powder.

Oxygen Charging Pressure

The 6200 Calorimeter has been designed to operate with an oxygen filling pressure of 30 atm. Significant changes from this value are not recommended.

Combustion Capsules

Non-volatile samples to be tested in Parr oxygen bombs are weighed and burned in shallow capsules measuring approximately 1" diameter and 7/16" deep. These are available in stainless steel, fused silica and platinum alloyed with 3-1/2% rhodium.

Stainless steel capsules (43AS) are furnished with each calorimeter. When combusting samples that contain metal particles such as aluminum or magnesium, the non-metallic (fused silica) 43A3 Capsule is required. When superior corrosion resistance is needed, the Platinum Rhodium 43A5 Capsule is required.

The stainless steel capsules will acquire a dull gray finish after repeated use in an oxygen bomb due to the formation of a hard, protective oxide film. This dull finish not only protects the capsule, but it also promotes combustion and makes it easier to burn the last traces of the sample. Capsules should be monitored for wear. Do not use the capsule if the wall or base thickness is less than 0.025”.

New capsules are heated in a muffle furnace at 500ºC for 24 hours to develop this protective coating uniformly on all surfaces. This treatment should be repeated after a capsule has been polished with an abrasive to remove any ash or other surface deposits. Heating in a muffle is also a good way to destroy any traces of carbon or combustible matter which might remain in the capsule from a previous test.

Note:

After heating, place the capsules in a clean container and handle them only with forceps when they are removed to be weighed on an analytical balance.

Foodstuffs and Cellulosic Materials

Fibrous and fluffy materials generally require one of three modes of controlling the burn rate. Fibrous materials do not pelletize readily and generally require either moisture content of combustion aid such as mineral oil to retard the burn rate and avoid development of high pressures.

Partial drying may be necessary if the moisture content is too high to obtain ignition, but if the sample is heat sensitive and cannot be dried, a water soluble combustion aid such as ethylene glycol can be added to promote ignition.

Coarse Samples

In most cases it may be necessary to burn coarse samples without size reduction since grinding or drying may introduce unwanted changes. There is no objection to this if the coarse sample will ignite and burn completely. Whole wheat grains and coarse charcoal chunks are typical of materials which will burn satisfactorily without grinding and without additives or a special procedure.

Corrosive Samples

The 1108 Oxygen Bomb is made of a corrosion resistant alloy designed to withstand the corrosive mixture of sulfuric and nitric acids produced in normal fuel testing operations. Samples containing chlorine and particular samples containing more than 20 mg of chlorine samples with high sulfur contents will greatly accelerate corrosion of the bomb. An alternate 1108CL Bomb is available constructed of an alloy selected to specifically resist the corrosive effects of samples with high chlorine or chloride.

While no material will offer complete corrosion resistance to these samples, the 1108CL Bomb offers significantly enhanced corrosion resistance for this service.

Explosives and High Energy Fuels

The 1108 and 1108CL Bombs used in the 6200 Calorimeter have been designed to provide highly automated testing of routine samples. Materials which release large volumes of gas which detonate with explosive force or burn with unusually high energy levels, should not be tested with these bombs.

Rather, they should be tested in a model 1104 High Pressure Oxygen Bomb designed specifically for these types of samples.

Volatile Sample Holders

Volatile samples can be handled in a Parr 43A6 Platinum Capsule with a spun rim, or in a Parr 43AS Alloy Capsule which has a sturdy wall with a flat top rim. These holders can be sealed with a disc of plastic adhesive tape prepared by stretching tape across the top of the cup and trimming the excess with a sharp knife. The seal obtained after pressing this disc firmly against the rim of the cup with a flat blade will be adequate for most volatile samples. The tape used for this purpose should be free of chlorine and as low in sulfur as possible. Borden Mystic Tape, No. M-169-C or 3M Transparent Tape, No. 610, are recommended for this purpose. The 3M Transparent Tape can be ordered through Parr, Part No. 517A.

The weight of the tape disc must be determined separately and a correction applied for any elements in the tape which might interfere with the determination. This can be done by running a blank test with tape alone using a sample weighing 1.0 gram. The compensation for heat of tape may be done through the spike option; see Spike Controls, Heat of Combustion of Spike. The heat of combustion of the 517A tape is approximately 6300 cal/gram.

Note:

Tape should always be stored in a sealed container to minimize changes in its moisture and solvent content

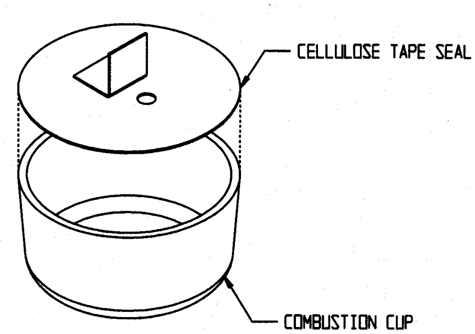

Figure 5-7 Combustion Capsule with Adhesive Tape Seal

Volatile Sample Holders *Continued*

Use the following procedure when filling and handling any of these tape-sealed sample holders:

- Weigh the empty cup or capsule; then cover the top with tape, trim with a knife and press the trimmed edge firmly against the metal rim. Also cut and attach a small flag to the disc (see Figure 5-7).
- Puncture the tape at a point below the flag, then re-weigh the empty cup with its tape cover.
- Add the sample with a hypodermic syringe; close the opening with the flag and re-weigh the filled cup.
- Set the cup in the capsule holder and arrange the auxiliary fuse so that it touches the center of the tape disc.
- Just before starting the test, prick the disc with a sharp needle to make a small opening which is needed to prevent collapse of the disc when pressure is applied.
- Fill the bomb with the usual oxygen charging pressure.
- The calorimeter will fire the bomb and complete the test in the usual manner.

Volatile samples are defined as one with an initial boiling point below 180ºC per ASTM D-2.

Low volatile samples with a high water content, such as urine or blood, can be burned in an open capsule by absorbing the liquid on filter paper pulp or by adding a combustion aid, such as ethylene glycol.

Poor Combustion

Because of the difference in combustion characteristics of the many different materials which may be burned in an oxygen bomb, it is difficult to give specific directions which will assure complete combustions for all samples.

The following fundamental conditions should be considered when burning samples:

- Some part of the sample must be heated to its ignition temperature to start the combustion and, in burning, it must liberate sufficient heat to support its own combustion regardless of the chilling effect of the adjacent metal parts.
- The combustion must produce sufficient turbulence within the bomb to bring oxygen into the fuel cup for burning the last traces of the sample.
- Loose or powdery condition of the sample which will permit unburned particles to be ejected during a violent combustion.
- The use of a sample containing coarse particles which will not burn readily. Coal particles which are too large to pass a 60 mesh screen may not burn completely.
- The use of a sample pellet which has been made too hard or too soft. Either condition can cause spalling and the ejection of unburned fragments.
- Insufficient space between the combustion cup and the bottom of the bomb. The bottom of the cup should always be at least one-half inch above the bottom of the bomb or above the liquid level in the bomb to prevent thermal quenching.
- Excessive moisture or non-combustible material in the sample. If the moisture, ash and other non combustible material in the sample amounts to approximately 20% or more of the charge, it may be difficult to obtain complete combustion. This condition can be remedied by adding a small amount of benzoic acid or other combustion aid.

6 CORRECTIONS & FINAL REPORTS

Entering Corrections and Obtaining the Final Report

Final reports for each test can be obtained whenever the operator is prepared to enter any required corrections for fuse, acid and sulfur.

When entering corrections, the user can choose either of two methods.

These are:

- Manual Entry
- Fixed Corrections

Program Installation and Control, Chapter 4, provides the default settings used to setup the method preferred by the user.

Refer to the Reporting Instructions, Chapter 7, for the steps necessary to initiate a report from the controller

Manual Entry

During the reporting process, the controller will prompt the user to enter the following values:

Fuse Correction Key in the Fuse Correction and press the ENTER key. The default setting for this value is to be entered in calories. This is explained in Appendix B, Page B-2.

Acid Correction Key in the Acid Correction and press the ENTER key. The default setting for this value is to be entered in milliliters of standard alkali required to titrate total acid or calories.

Sulfur Correction Key in the Sulfur Correction and press the ENTER key. The default setting for this value is to be entered as percent sulfur in the sample.

If fixed values for fuse, acid and sulfur are turned OFF on the Thermochemical Corrections Page, then the user must manually enter the values at the prompt.

If the Spiking Correction is used, a spiking correction must be entered before obtaining a Final Report.

If values for these corrections are not available, the operator can use the SKIP key to bypass any of the corrections, however, a Final Report will not be printed until an entry is made for fuse, acid and sulfur or spike if used.

After the last entry has been made, the calorimeter will automatically produce a Final Report.

Fixed Corrections

In many cases, fixed values for fuse and acid can be used without introducing a significant error since the corrections are both relatively small and constant.

Fixed sulfur corrections can also be used whenever a series of samples will be tested with a reasonably constant sulfur content.

Details for applying fixed corrections are found in Appendix B, Thermochemical Calculations.

Any value set-up as a fixed correction will be automatically applied and the controller will not prompt the user for this value.

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7 REPORTING INSTRUCTIONS

Report Option Selection

The 6200 Calorimeter can transmit its stored test data in either of two ways. The REPORT DESTINATION key on the Reporting Controls Page toggles the report destination between the display and an optional printer connected to the RS232C port of the calorimeter. This page also selects the type of reports that are generated automatically by the calorimeter.

Report Generation

There are two kinds of calorimeter reports: Preliminary and Final.

Preliminary Reports are generated at the conclusion of a test. They will not contain the thermochemical corrections for sulfur, fuse, or acid. They are intended to confirm to the operator that the results of the test fell within the expected range.

Final reports are generated once all of the thermochemical corrections have been entered into the file. If fixed corrections are used for all of the thermochemical corrections preliminary reports will automatically become final reports.

Thermochemical corrections are entered by using the following steps to select and edit preliminary reports.

Test results are stored as files using the sample ID number as the file name. A listing of the stored results is accessed by pressing the Report command key. The Report command key brings up a sub-menu on which the operator specifies:

Select From List This key displays the stored results specified with the following two keys.

Run Data Type This key enables the operator to display only determination runs, only standardization runs or all runs. (The choice of solution data type is not applicable to this calorimeter.)

Run Data Status This key enables the operator to display both preliminary and final reports, final reports only, preliminary reports only, preweighs only or all runs.

Prompt For Final Values When turned on, the controller will prompt the operator to enter any missing corrections for fuse, sulfur and acid in any selected preliminary reports. When turned off preliminary reports will be displayed as entered.

Report Generation *Continued*

The displayed files can be sorted by sample ID number, by type, by status or by date of test by simply touching the appropriate column.

Individual files can be chosen by highlighting them using the up and down arrow keys to move the cursor. Press the SELECT key to actually enter the selection. Once selected the highlight will turn from dark blue to light blue. A series of tests can be selected by scrolling through the list and selecting individual files.

The double up and down keys will jump the cursor to the top or bottom of the current display.

If a range of tests is to be selected, select the first test in the series, scroll the selection bar to the last test in the series and press EXTEND SEL to select the series.

The DESEL ALL key is used to cancel the current selection of files.
To bring the selected report or series of report to the display, press the DISPLAY key. To send the reports to the printer press the PRINT key.

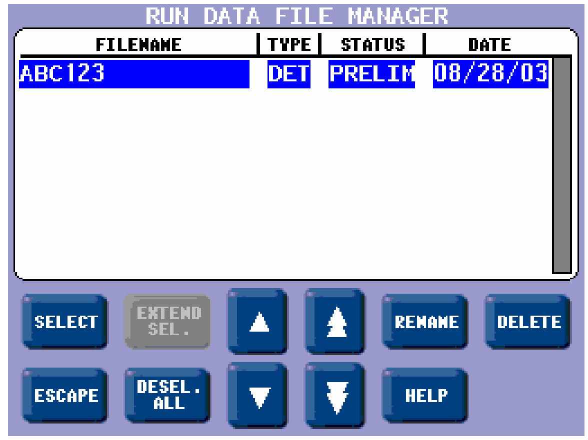
The EDIT key brings up a sub-menu which enables the operator to edit any of the data in the report or add thermochemical corrections to convert preliminary reports to final reports. Final reports can only be edited if EDIT FINAL REPORTS on the reporting control page is turned on.

Net Heat of Combustion

To have the Net Heat of Combustion print as part of preliminary and final reports, go to the Thermochemical Corrections Page and turn ON Calculate Net Heat of Combustion. During the reporting process, the controller will prompt for the hydrogen (H) value.

8 FILE MANAGEMENT

The 6200 Calorimeter will hold data for 1000 tests in its memory. These tests may be pre weights, preliminary or final reports for either standardization or determination runs. Once the memory of the controller is filled, the controller will not start a new analysis until the user clears some of the memory.



Clearing Memory

The FILE MANAGEMENT key on the main menu leads to the file management sub-menu. The RUN DATA FILE MANAGER key leads to a listing of the files.

- Single files can be deleted by highlighting the file and pressing the DELETE key. The controller will then ask the user to confirm that this file is to be deleted.
- A series of files can be deleted by selecting the first file in the series and then the last file in the series using the EXTEND SEL key and then pressing the DELETE key.

Removable Compact Flash Memory

The controller of the 6200 calorimeter can accept compact flash memory cards. These cards can be used to:

- Copy test file data for transfer to a computer
- Copy user settings for back up
- Reload user settings to the controller to restore or update the controller's operating system.

Compact flash memory cards are inserted into the slot on the back of the control section of the calorimeter. Keys are provided on the FILE MANAGEMENT sub-menu to initiate each of the above three actions.

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9 MAINTENANCE & TROUBLESHOOTING

Oxygen Bomb

Under normal usage the 1108 Parr Oxygen Bomb will give long service if handled with reasonable care. However, the user must remember these bombs are continually subjected to high temperatures and pressures that apply heavy stresses to the sealing mechanism. The mechanical condition of the bomb must therefore be watched carefully and any signs of weakness or deterioration should be replaced before they fail. It is recommended the 1108 Oxygen Combustion Bomb have O-rings and valve seats replaced after 6 months or 500 firings which ever comes first or at more frequent intervals if the bomb has been subject to heavy usage or if it shows any evidence of damage. Detailed information can be found in Bulletin 205M supplied as a part of this manual. This 1108 Oxygen Combustion Bomb is the only part of the calorimeter system that requires routine maintenance. All other problems will require diagnosis and parts replacement.

Jacket Temperature Troubleshooting

The jacket temperature is monitored with the use of a thermistor installed in the temperature control assembly. This assembly is heated by a heater cartridge, A1459DD. In the Diagnostics Menu, select Instrument Monitor. If the heater PID is ON and reading 100%, yet the jacket is at ambient temperature, check the following possible causes.

If the heater PID is OFF, the heater and pump must be turned on in the Calorimeter Operation screen to perform the troubleshooting steps.

WARNING: *Turn off the power to the calorimeter prior to attempting to reset the thermostat. The temperature control assembly can become very hot. Use caution when servicing this area of the calorimeter.*

If line voltage (115V or 230V) is present across the heater cartridge connection, check the resistance across the heater cartridge. Approximately 70 ohms will be seen with a 115V calorimeter. Approximately 140 ohms will be seen with a 230V calorimeter. If the resistance is not correct the heater may have failed.

If the voltage is not present, then examine the 2040E thermostat reset button. If the reset button extrudes this means that the temperature in the temperature control assembly has exceeded 75ºC. Confirm that water is flowing through the system, turn off the power and then reset the switch by depressing the button. If the thermostat continues to trip even though water is flowing through the system, refer to the error code “There Is A Problem With The Jacket Thermistor” for further troubleshooting.

If there is no voltage present, and the reset button on the thermostat is not tripped, refer to the error code “There Is A Problem With The Jacket Thermistor” for further troubleshooting. There may also be a problem with the calorimeter controller, A1279DD, and Parr service should be contacted.

Fuses

The replacement of protective fuses for the 6200 Calorimeter should be performed by qualified personnel.

All fuses except Parr part # 139E23 are located on the A1794E I/O board located inside the instrument. To gain access to the inside, first disconnect the power cord from the rear of the unit. Remove the two screws at the upper rear of the unit that secure the front cover. Pry up on the back lip of the cover and carefully hinge it forward. Make sure that the cables attached to the front portion of the cover do not become stretched or disconnected. Follow this procedure in reverse order to re-secure the front cover.

Note: Check the labels on the instrument for correct fuse rating.

Parr Part #	Description	Type	Ratings
139E23	Lines Protective Fuses	Fast-Acting	15 Amps, 250Vac
1641E2	Heater Fuse (F2)	Fast-Acting	2.5 Amps, 250Vac
1641E	Pump Fuse (F1)	Fast-Acting	1 Amp, 250VAC

6200 Calorimeter Error List

The calorimeter will run a number of diagnostic checks upon itself and will advise the operator if it detects any error conditions. Most of these errors and reports will be self-explanatory. The following list contains errors that are not necessarily self-evident and suggestions for correcting the error condition.

A Misfire Condition Has Been Detected This error will be generated in the event the total temperature rise fails to exceed 0.5 C after the first minute of the post-period.

A Preperiod Timeout Has Occurred. The calorimeter has failed to establish an acceptable initial temperature, prior to firing the bomb, within the time allowed. Possible causes for this error are listed below:

- A bomb leak.
- Poor bucket stirring.
- Metal to metal contact between the bucket and the jacket.
- Lid not tight or foam seal has deteriorated.
- Bucket temperature outside the acceptable range (3-5 deg C below the jacket setpoint).
- Jacket requires water

The Current Run Has Aborted Due To Timeout. The calorimeter has failed to establish an acceptable final temperature within the time allowed. Possible causes for this error are listed below:

- Poor jacket water circulation due to a kinked hose or insufficient water in the tank.
- A bomb leak.
- Poor bucket stirring.

There Is A Problem With The Bucket Thermistor. Possible electrical open.

- Check connection to board.
- Check quick disconnect.
- Replace probe.

There Is A Problem With The Jacket Thermistor. Possible electrical open or short. These errors will result if the temperature probe response is not within the expected range. Probe substitution can be useful in determining the cause of the problem (probe or electronics). The valid working range of the probe resistance is 1000 to 5000 ohms

6200 Calorimeter Error List ***Continued***

A / D Initialization Failed.
Shortly after power is applied to the calorimeter controller and the operating system has started, the CPU attempts to read the unique IO board calibration information from the IO board.
If the IO board is not connected to the CPU, or the information on the board is not valid, this error will be issued.

Bomb ID – Has Been Fired – Times Which Exceeds The Bomb Service Interval. The calorimeter controller keeps track of how many times the bomb has been fired. When this count exceeds a preset limit (usually 500) this message will be issued each time the bomb is used for a test. Perform bomb maintenance and reset counter on Calibration Data and Control page for appropriate bomb number.

You Have Exceeded The Run Data File Limit (1000 Files) - The memory set aside for test runs has been filled. Use the memory management techniques to clear out non-current tests.

Bomb EE Standard Deviation Warning. The relative standard deviation for the calibration runs in memory for the indicated bomb exceeds the preset limit.

The heater loop break limit has been detected. The heater will now be shutdown. This error means that the calorimeter is trying to heat the water in the unit for an extended period of time. The calorimeter suspects that there is a short and shuts the system down in order to “save” itself. This is a fairly normal occurrence if the lab temperature is very cool at night. It is acceptable practice to ignore the warning and re-start the unit. However, if this error occurs more than three times in a row, then it may be a true thermistor problem and the user should contact Parr Technical Service.

Sample Weight Warning.
The entered sample mass exceeds the value entered via the Sample Weight Warning Above key on the Data Entry Controls page. This warning threshold is normally 2 grams.

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APPENDIX A MENU OPERATING INSTRUCTIONS

The settings and controls are organized into nine main sections or pages which comprise the Main Menu.

This appendix describes all pages of the menu-based operating system of the 6200 Calorimeter.

Calorimeter Operation Menu

The calorimeter will normally be operated from the Calorimeter Operation Page, although tests can always be started from any menu page.

Operating Mode. Sets the operating mode by toggling between standardization and determination.

Bomb / EE. Used to identify the bomb presently installed in the calorimeter and its EE value.

Heater and Pump. The heater and pump must only be turned on after the calorimeter water tank is filled with water.

Note:

The heater and pump must be turned ON to bring jacket to the correct starting temperature before testing can commence.

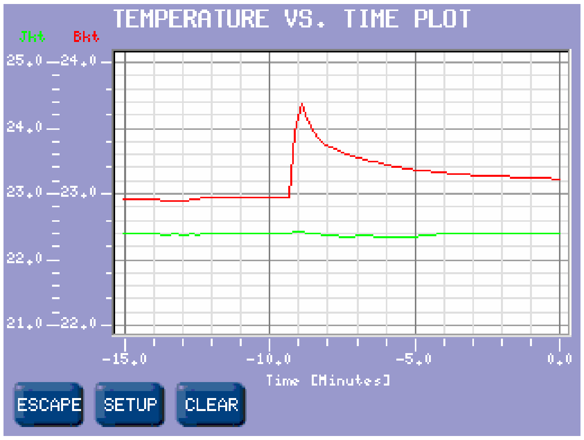
Temperature Graph. Press this key to view the Temperature vs. Time Plot Screen.

Start Preweigh. This key is used to start the sample preweigh process. The user is presented with or prompted for a sample ID. Next, the user is asked to key in the associated sample mass or alternatively the mass is retrieved from a connected balance.

O2 Fill. This key is used to activate the oxygen filling system used to fill the bomb. Pressing this same key while the bomb is filling will abort the process.

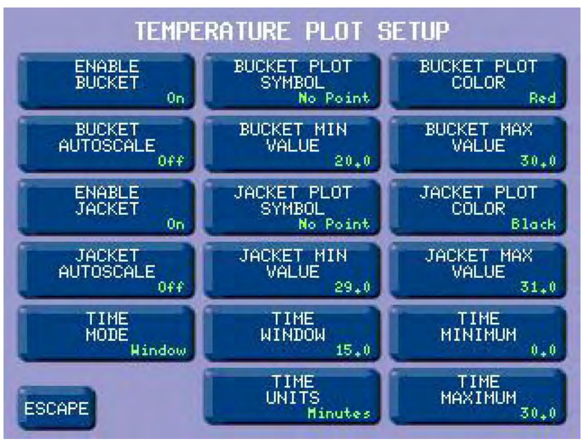
APPENDIX A

Temperature vs. Time Plot Screen



Setup. Press this key to access the Temperature Plot Setup Menu, which has many keys that permit the user to fully customize both the x (time) axis and the scaling of the y axis.

Temperature Plot Setup Menu



Enable Bucket. Toggles ON/OFF.

Bucket Autoscale. Toggles ON/OFF.

Enable Jacket. Toggles ON/OFF.

Jacket Autoscale. Toggles ON/OFF.

Time Mode. Toggles between Autoscale, Window, and Range.

Bucket Plot Symbol. Toggles between:

- No Point
- Small Dot
- Round
- Square
- Up Triangle
- Down Triangle
- Diamond

Bucket Min Value. Press this key to access its numeric dialog box to set a minimum bucket value.

Jacket Plot Symbol. Toggles between (same as Bucket Plot Symbol, above).

Jacket Min Value. Press this key to access its numeric dialog box to set a minimum jacket value.

Time Window. Sets the time scale for the X-axis.

APPENDIX A

Temperature Plot Setup Menu *Continued*

Time Units. Toggles between minutes and seconds.

Bucket Plot Color. Toggles between:

- Red
- Green
- Yellow
- Blue
- Magenta
- Cyan
- White
- Black

Bucket Max Value. Press this key to access its numeric dialog box to set a maximum bucket value.

Jacket Plot Color: (same as Bucket Plot Color, above).

Jacket Max Value. Press this key to access its numeric dialog box to set a maximum jacket value.

Time Minimum. Press this key to access its numeric dialog box to set the least amount of time for the run.

Time Maximum. Press this key to access its numeric dialog box to set the greatest amount of time for the run.

Operating Controls Menu

Method of Operation. Offers an operating mode of either dynamic or equilibrium. In most cases, the dynamic mode with its curve matching capability will save approximately 3-4 minutes per test and will produce the same operating precision as the slower equilibrium mode.

Reporting Units. Offers a choice of Btu/lb, cal/g, J/kg, or MJ/kg for the reporting units. A user selected set of reporting units may be selected by selecting "other".

Spiking Correction. Accesses sub-menu, Spiking Controls. Spiking is the material addition, such as benzoic acid or mineral oil, to samples which are difficult to burn in order to drive the combustion to completion.

Use Spiking. When set to ON, the calorimeter will prompt for the weight of the spike added and will compensate for the heat of combustion in the calculations.

Heat of Combustion of Spike. The heat of combustion of spike is entered on sub-menu keyboard in Cal/g.

Use Fixed Spike. When set to ON, a constant amount of spike is to be added to each test.

Note:

> *The precision of tests with fixed spikes can be no better than the repeatability of the spike weight.*

Weight of Fixed Spike. The weight of the fixed spike is entered on sub-menu keyboard.

Prompt for Spike before Weight. When set to ON, the calorimeter will prompt the user for the weight of the spike and the weight of the sample. Normally the calorimeter will prompt the user for the weight of the sample and then the weight of the spike.

Other Multiplier. This button allows the user to enter a final multiplier that is used when the reporting units are set as "other".

APPENDIX A

Operating Controls Menu *Continued*

Calibrate Touchscreen. This key prompts the user to touch the screen at predefined points in order to facilitate touchscreen calibration.

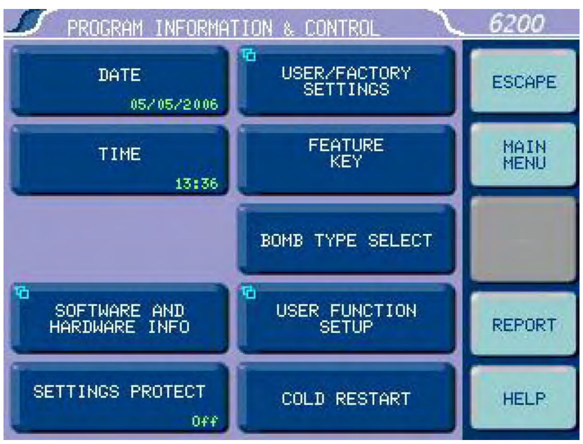
LCD Backlight Time-out. The unit is equipped with an automatic circuit to shut-off the backlight when it is not being used. The back light will shut-off if there is no keyboard activity for the number of seconds entered. Pressing any key will automatically turn the back lighting ON. A setting of 0 will keep the backlight ON at all times.

LCD Contrast. This key accesses a sub-menu with a slide control which adjusts the contrast on the LCD display for optimum viewing.

Print Error Messages. When turned ON, all error messages will be printed on the printer as well as displayed on the screen.

Language. Steps the calorimeter through the installed operating languages.

Program Information and Control Menu



Date. Displays current date and accesses sub-menu on which date is set in (YY/MM/DD) format.

Time. Displays current time and accesses sub-menu on which time is set in (HH:MM) format.

Software and Hardware Info. This screen displays important information such as the main software version, I/O board hardware and calibration information, CPU IO firmware revision, and Controller IP address assigned by the network DHCP server.

Settings Protect. Provides protection for the program options and settings on the menus. If this is turned ON, the user will be warned that enumeration keys are locked when a key is pressed. Enumeration Keys either toggle a value (ON / OFF) or select from a predefined list. This feature is used primarily to protect the instrument settings from accidental changes if one were to inadvertently touch or bump up against the touchscreen.

User/Factory Settings. This key leads to a sub-menu that allows the user to save or recall user defined instrument settings. Additionally, factory preinstalled settings supporting different bombs or special operating modes can also be recalled.

Reload Factory Default Settings. Used to erase all of the settings and restore the factory default settings.

Reload User Default Settings. Used to restore the user's setup should the program in the instrument be corrupted for any reason.

APPENDIX A

Program Information and Control Menu *Continued*

Save User Default Settings. Used to record the setup to the memory once the user has configured the instrument to their operating requirements.

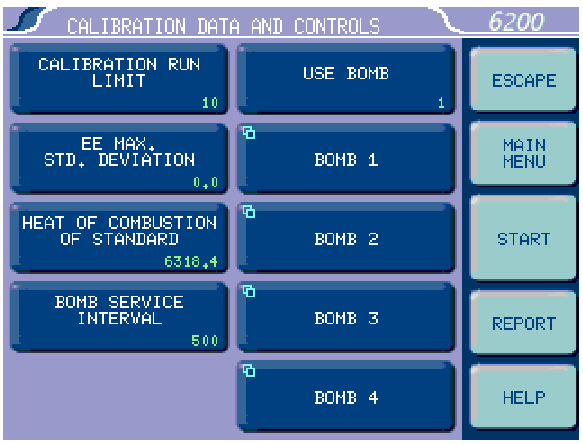
Note:
Keys which make global changes to the setup of the calorimeter contain a YES or NO response to make certain that the user wishes to proceed. This two step entry is intended to prevent inadvertent global program changes.

Bomb Type Select This key toggles through the different bomb models available for the calorimeter. When the user chooses a bomb, the instrument must be re-booted to load the correct version of the software.

User Function Setup This key leads to sub menus that support the configuration of five factory / user definable function keys. The function keys are accessible from the Diagnostics page.

Cold Restart. Returns the instrument to its last known state. Otherwise the instrument will return to the factory default settings.

Calibration Data and Controls Menu



Calibration Run Limit. Displays the maximum number of runs that will be included in determining the EE value of a bomb and bucket combination and accesses the sub-menu on which this limit is set. Most test methods suggest 10 tests. Tests in excess of the most recent ones used are still available but are not used in the calculation of the EE value. For example if 11 standardization tests have been run, the calorimeter will only use the most recent 10. The 11th is still stored in the memory and is available for view or printing.

APPENDIX A

Calibration and Data Controls Menu *Continued*

EE Max Std Deviation. Displays the maximum relative standard deviation in percent that will be permitted for any EE value calculated by the calorimeter and accesses the sub-menu on which this limit is set. If this value is exceeded, the user will be warned to take corrective action before proceeding with testing. This calorimeter is capable of achieving a value of 0.15 or better for 15 tests. A setting of zero disables this check.

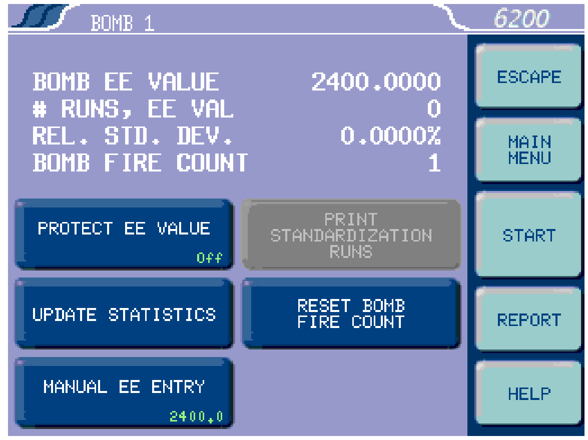
Heat of Combustion of Standard. Displays the heat of combustion in calories per gram for the material used to standardize the calorimeter and accesses the sub-menu on which this value is set. For benzoic acid, this value is 6318.4 calories per gram.

Bomb Service Interval. Displays the maximum number of times a bomb may be fired before it is flagged as due for service and accesses the sub-menu on which this limit is set. Parr recommends 500 firings for this service interval. This interval may be more frequent depending upon the nature of the sample.

Use Bomb. Displays the bomb number of the bomb currently installed in the calorimeter and toggles through the four possible bomb numbers.

Bomb 1. Leads to sub-menu, Bomb 1. Displays standardization information for bomb and bucket combinations with the respective EE values for each bomb being stored in the memory.

Note:
For rapid turn around between tests, user may wish to use two bomb assemblies in the calorimeter. Each bomb/bucket can be assigned a bomb number if the EE Values are significantly different. Set prompt for bomb ID to "ON"



Bomb 1

EE Value. Displays the calculated EE value for the corresponding Bomb 1.

Number of Runs. Displays how many runs have been used to determine the EE value.

Relative Standard Deviation. Displays the relative standard deviation for the series of tests used to determine the current EE value in percent of the EE value.

Bomb Firing Count. Displays the current bomb firing count or the number of times the bomb has been fired since it was last serviced. When this count matches the limit set by Bomb Service Interval, the user will be informed that the bomb is ready for service.

Protect EE Value. When set to ON, protects the EE values if the user does not wish to have the calorimeter automatically update its own EE value.

Update Statistics. This key will cause the EE Value for this calorimeter ID to be updated using all standardization runs currently in memory if the EE value is not protected.

Calibration and Data Controls Menu *Continued*

Print Standardization Runs. Will print all of the tests that have been incorporated into the calculated EE value. This will be helpful in evaluating a series of tests which fail to produce a satisfactory EE value and relative standard deviation.

Reset Bomb Fire Count. After bomb service, press this button to reset the fire count to zero

Bomb 2. Accesses sub-menu, Bomb 2. Provides the same controls as described for Bomb 1.

Bomb 3. Accesses sub-menu, Bomb 3. Provides the same controls as described for Bomb 1.

Bomb 4. Accesses sub-menu, Bomb 4. Provides the same controls as described for Bomb 1.

Thermo-chemical Corrections Menu

Standardization Correction

Fixed Fuse Correction. Displays both the ON / OFF of the fixed fuse corrections for standardization runs and the value of the correction. This key toggles the correction ON/OFF and accesses a sub-menu on which the value is set. An appropriate fixed fuse value is 15 calories.

Fixed Acid Correction. Displays both the ON/OFF of the fixed acid corrections for standardization runs and the value of the correction. This key toggles the correction ON/OFF and accesses a sub-menu on which the value is set.

Fixed Sulfur Correction. Displays both the ON/OFF of the fixed sulfur corrections for standardization runs and the value of the correction. This key toggles the correction ON/OFF and accesses a sub-menu on which the value is set. When benzoic acid is used as the calibrant, a fixed sulfur value of zero should be used.

Determination Correction

Fixed Fuse Correction. Displays both the ON/OFF of the fixed fuse corrections for determination runs and the value of the correction. This key toggles the correction ON/OFF and accesses a sub-menu on which the value is set.

Fixed Acid Correction. Displays both the ON/OFF of the fixed acid corrections for determination runs and the value of the correction. This key toggles the correction ON/OFF and accesses a sub-menu on which the value is set.

Fixed Sulfur Correction. Displays both the ON/OFF of the fixed sulfur corrections for determination runs and the value of the correction. This key toggles the correction ON/OFF and accesses a sub-menu on which the value is set.

Note:

When fixed corrections are turned ON, the value in the specified field will be used in both the preliminary and final reports. The calorimeter will not prompt for actual corrections. If all corrections are fixed, a preliminary report will not print, rather only a final report will be generated. If values for these corrections are entered into these lines, and the toggle is set to OFF, then the fixed value will be used in the preliminary report, but not in the final report.

APPENDIX A

Thermo-chemical Corrections Menu *Continued*

Calculation Factors. Accesses sub-menu, Calculation Factors which sets a number of options for the way the thermochemical corrections are applied.

Acid Value is Nitric Acid Only. When set to ON, the acid value is nitric acid only. When set to OFF, it represents both nitric and sulfuric acid.

Acid Multiplier. The multiplier is the normality of the sodium carbonate used to titrate for the acid correction. The default value of 0.0709 allows for direct entry of the acid correction in calories. If the bomb rinsings are titrated in order to determine the acid correction, this multiplier is the concentration of the base (equivalents/L) or normality used for titration. In this case, the acid correction is entered as milliliters of base used to titrate the bomb rinsings.

Sulfur Value is Percent. When set to ON, the sulfur value is being entered as weight percent sulfur. If another system is to be used, this must be turned OFF and the sulfur multiplier set accordingly.

Sulfur Multiplier. Values entered by the user to be used for the sulfur correction are multiplied by this value to get the product into units of milli-equivalents. The default number (0.6238) requires that the sulfur value be entered in weight percent.

Fuse Multiplier. The fuse corrections represent the number of calories liberated by the burning thread used to ignite the sample. If another measurement is used, the correction factor must be entered here.

Use Offset Correction (ISO). The thermochemical calculations used for treatment of nitric acid and sulfuric acid corrections in the ISO and B. S. methods require an offset correction to compensate for the back titration that is made. To use these calculations, set to ON and enter the appropriate value as the offset value.

Offset Value. Entry for the value when use offset correction is turned ON.

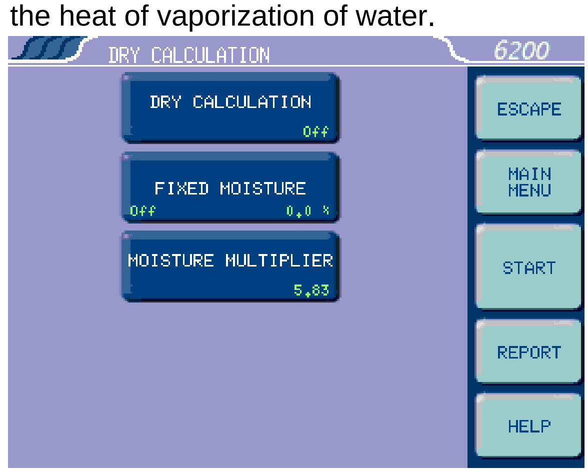
Fixed Hydrogen. On / Off and value entry.

Hydrogen Multiplier. This value is associated with the net heat of calculation. It is related to the heat of formation of water.

Dry Calculation. On / Off

Fixed Moisture. On / Off and value entry. Units are weight %.

Moisture Multiplier. This value is associated with the net heat calculation. It is related to the heat of vaporization of water.



APPENDIX A

Data Entry Controls Menu

Prompt for Bomb ID. In the ON position the controller will prompt for a Bomb ID(1-4) when a test is started.

Weight Entry Mode. This key steps through the options for entering sample weights either manually through the touch screen, network or through the balance port.

Acid Entry Mode. This key steps through the options for entering acid correction value either manually through the touch screen or automatically through the balance port.

Hydrogen Entry Mode. This key steps through the options for entering hydrogen content for calculating the net heat of combustion either manually through the touch screen or automatically through the balance port.

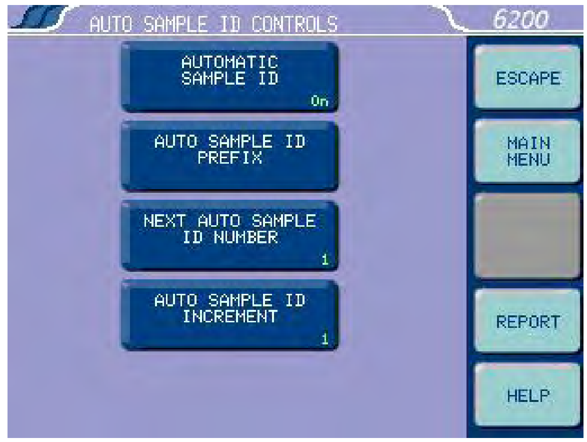
Automatic Sample ID Controls. Accesses sub-menu for controlling the automatic assignment of sample identification numbers.

Automatic Sample ID. When set to ON will automatically assign sample identification numbers in accordance with instructions set in the other two keys on this menu.

Auto Sample ID Prefix. An entry here will be used as a prefix for all sample IDs.

Auto Sample ID Increment. Establishes the increment between sample numbers.

Next Auto Sample ID Number. Establishes the initial sample number for a series of tests and then shows the next sample ID which will be assigned.



Sample Weight – Warning Above. This key displays and leads to a sub-menu used to set the maximum allowable sample weight (including spike) in grams. A warning will be given if sample weights above this value are entered.

Spike Weight Entry Mode. This key steps through the options for entering spike weights either manually through the touch screen, network or through the balance port.

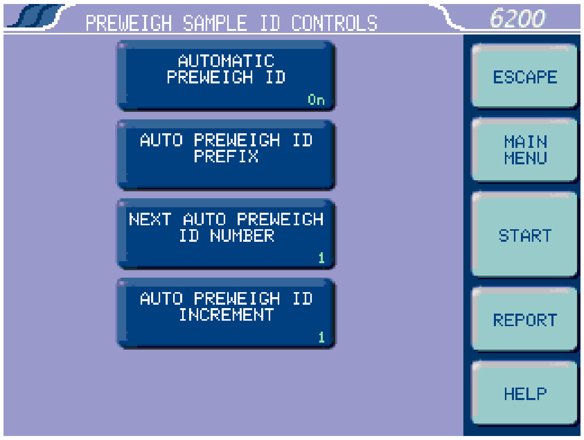
Sulfur Entry Mode. This key toggles steps through the options for entering sulfur correction value either manually through the touch screen or automatically through the balance port.

Moisture Entry Mode. This key steps through the options for entering the moisture percentage whether manually through the touch screen or automatically through the balance port.

APPENDIX A

Data Entry Controls Menu *Continued*

Auto Preweigh ID Controls. Accesses sub-menu, used to automatically assign Sample ID numbers when a series of samples are preweighed ahead of the time they are actually tested.



Automatic Preweigh ID. ON/OFF toggle for this feature.

Automatic Preweigh ID Prefix. An entry here will be used as a prefix for all pre-weigh sample IDs.

Next Automatic Preweigh ID Number. Shows the next Sample ID which will be assigned and is used to enter the beginning Sample ID of any series

Automatic Preweigh ID Increment. Establishes the increment between samples.

Reporting Controls Menu

Report Width. The column width of the printer being used can be set to 40 or 80 columns. Select 40 when the 1757 Printer is used.

Automatic Reporting. Preliminary reports will be generated at the conclusion of the test and final reports will be generated as soon as all of the thermochemical corrections are available when this automatic reporting feature is turned ON. When this is turned OFF, reports will only be generated through the Report menu.

Automatic Report Destination. Directs the reports to the Printer Port or the display.

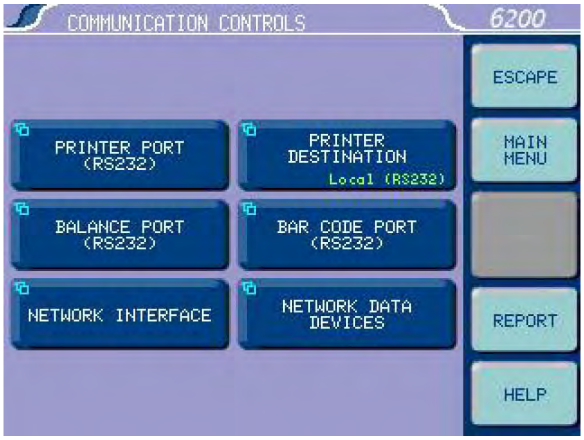
Individual Reports. When set to ON, will generate header information for each report printed. In the OFF position, only one header will be printed for a series of tests.

Edit Final Reports. When set to ON, enables the user to revise sample weight and thermochemical corrections.

Recalculate Final Reports. When set to ON, causes a recalculation of stored final reports using calibration data and menu settings currently in the calorimeter.

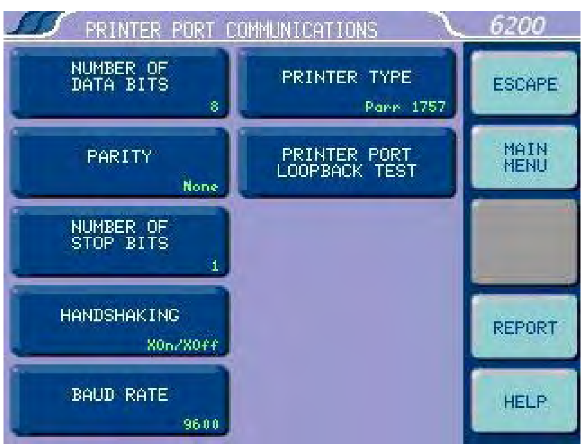
Use New EE Value in Recalculation. When set to ON, any recalculation made will use the most recent EE value in the calculations. In the OFF position, all calculations will be made using the EE value which was effective when the test was originally run.

Communication Controls Menu



Communication Controls. Accesses sub-menus which set the communications protocols for the printer and balances.

Printer Port (RS232). Accesses sub-menu, Printer Port Communications. Sets the communication parameters for the RS232 ports used for the printer port. Standard options for data bits, parity, stop bits, handshaking, baud rate and balance type are provided to match any devices that might be connected to these ports.



Note:

Default port settings for the 1757 Printer are 8, None, 1, XOn/XOff, 9600. Cable is A1816E2

Number of Data Bits. Standard options for data bits. Toggles between 7 and 8.

Parity. Standard options for parity. Choose from None, Odd or Even.

Number of Stop Bits. Standard options for stop bits. Toggles between 1 and 2.

Handshaking. Standard options for handshaking. Choose from Xon/Xoff, RTS/CTS and None.

Baud Rate. Standard options for baud rate. Choose from 19.2K, 9600, 4800, 2400, 1800, 1200, 600, 300, 150, 134.5, 110, and 75.

Printer Type. Toggles between a Parr 1757 and a generic printer. When set for the 1757 Printer, all of the features of this printer, such as bold printing, will be activated.

Note:

Serial Ports Pin-Out

9 Pin D	Description	Direction
2	Rx	<
3	Tx	>
4		
5	Ground	<>
6		
7	RTS	>
8	CTS	<

Both the terminal and balance port are female. The printer port uses a male connector.

Printer Port Loop Back Test. Used for factory testing of the printer port.

APPENDIX A

Communication Controls Menu *Continued*

Balance Port (RS232). Accesses sub-menu, Balance Port Communications.

Balance Type. This key toggles through the available balance templates.

Customize Balance Settings. This key leads to a submenu that allows the balance template and related port frame parameters to be altered as required.

The Customize Balance Settings sub-menu sets the communication parameters for the RS232 port used for the balance port. Standard options for data bits, parity, stop bits, handshaking, baud rate and balance type are provided to match any devices that might be connected to these ports.

Number of Data Bits. Standard options for data bits. Toggles between 7 and 8.

Parity. Standard options for parity. Choose from None, Odd or Even.

Number of Stop Bits. Standard options for stop bits. Toggles between 1 and 2.

Handshaking. Standard options for handshaking. Choose from Xon / Xoff, RTS/CTS and None.

Baud Rate. Standard options for baud rate. Choose from 19.2K , 9600, 4800, 2400, 1800, 1200, 600, 300, 150, 134.5, 110, and 75.

Data Characters from Balance. This setting is only used when the generic balance format is selected. This value determines the number of numeric data characters (0-9 . + -) to accept. Any additional characters after this value and before the string terminating <CR> are discarded.

Data Precision. This key allows the user to establish the number of digits to the right of the decimal point that are passed from the balance handler.

Transfer Timeout (seconds). This value determines how long the interface will wait before giving up on a weight transfer. The value is entered in seconds.

Balance Handler Strings. This key leads to a submenu that allows balance template to be customized for unique balances or needs.

Log Balance to Display. This button will direct the incoming data stream from the balance to a display buffer. This function can be used to determine the data format from an unknown balance type. The display buffer is 40 characters in length. The balance must be forced to issue at least 40 characters before the contents of the buffer are displayed.

Balance Port LoopBack Test. This key initiates a loopback test on the port. A special loopback plug is required in order to perform this test.

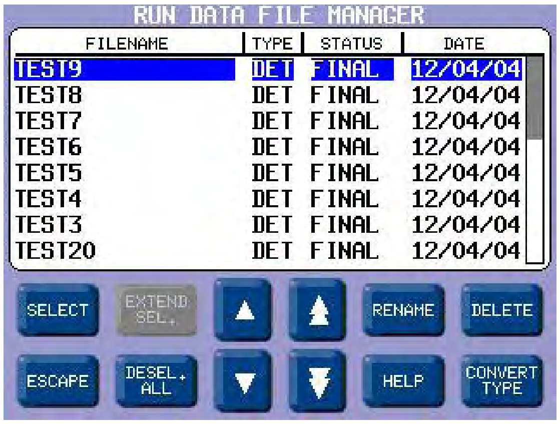
Parr offers the following communication cables:

25 pin D (male)		
A1837E	9-pin DP	25-pin DP S-T
A1838E	9-pin DP	25 pin DP-Null
9 pin D (male)		
A1892E	9-pin DP	9-pin DP S-T
A1893E	9-pin DP	9-pin DP Null

Further information on establishing communications for the Printer Port, Balance Port, Network Interface, Bar Code Port and other Network Data Devices can be found in Appendix D, Communication Interfaces, of this manual.

File Management Menu

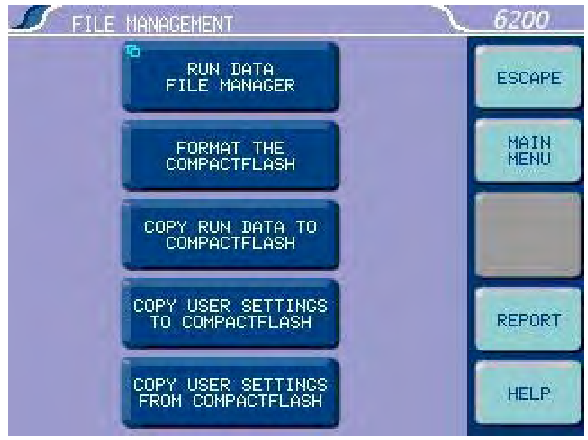
Run Data File Manager - This key activates the File Manager. The File Manager is used to delete or rename test report files. It is also used to convert file types.



See the Report Generation section in chapter 7.

Format the CompactFlash – This key provides access to a function that will format the user installed CF card in a manner that is compatible with the CPU Boot loader. Formatting the card this way is recommended prior to installing any program update files on the CF card.

Copy Run Data to CompactFlash - This key copies all test data to a Compact Flash (CF) card inserted into the rear of the calorimeter controller. This feature is used as a means of either archiving data or transferring it to a PC.



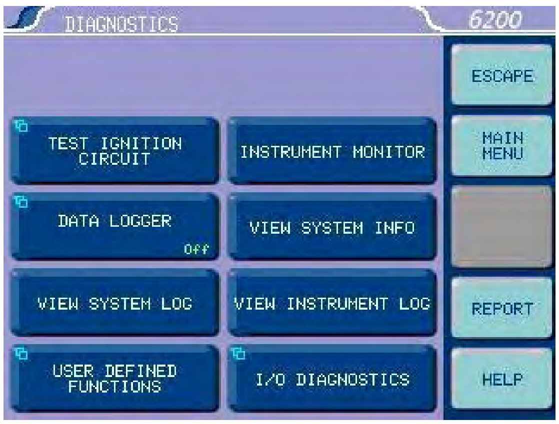
Copy User Settings to CompactFlash - This key copies all previously saved user setups to CF.

Copy User Settings From CompactFlash - This key copies all user setups previously saved to CF back to the calorimeter controller memory. This feature can be used to configure multiple calorimeters in an identical manner.

APPENDIX A

Diagnostics Menu

Allows the user to test many of the components and subsystems of the calorimeter. These capabilities must be used in conjunction with the Maintenance Instructions to obtain the maximum benefits from these capabilities.



Test Ignition Circuit – The key activates the ignition circuit. A volt meter can be placed across the lead wires to ensure that the actual firing charge is reaching these contacts.

Data Logger - This key displays and leads to sub-menus which control the data logging function of the calorimeter.

View System Log - This key is used to display the contents of /flash/log/messages. This file is used primarily to log application program debug messages.

User Defined Functions – This key leads to a sub-menu that offers five special purpose user / factory definable function keys.

Instrument Monitor – This screen provides a summary of the important instrument parameters. The monitor is used to detail the course of a test or to observe the heating / cooling performance of the calorimeter.

View System Info - This key accesses current program information and settings such as: Processes and their associated PIDs (proportional (P), the integral (I), and the derivative (D) controls), memory, mass storage, network.

View Instrument Log - This screen displays the contents of tmp/instlog. This file, among other things, is the logfile destination for the data logger.

I/O Diagnostics – This key accesses a sub-menu which allows the user to manipulate digital outputs for troubleshooting.

APPENDIX A

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APPENDIX B CALCULATIONS

Calculating the Heat of Combustion

The 6200 Calorimeter will automatically make all of the calculations necessary to produce a gross heat of combustion for the sample. However, it is important that the user understand these calculations to ensure the instrument is set up so the calculations match the procedures and the units are consistent throughout the process.

General Calculations

The calculation for the gross heat of combustion is done by:

$$H_c = \frac{WT - e_1 - e_2 - e_3}{m}$$

Where:

Hc = Gross heat of combustion.
T = Observed temperature rise.
W = Energy equivalent of the calorimeter being used.
e_1 = Heat produced by burning the nitrogen portion of the air trapped in the bomb to form nitric acid.
e_2 = The heat produced by the formation of sulfuric acid from the reaction of sulfur dioxide, water and oxygen.
e_3 = Heat produced by the heating wire and cotton thread.
m = Mass of the sample.

These calculations are made in calories, grams, and degrees Celsius, and then converted to other units if required.

Temperature Rise.
The 6200 Calorimeter produces a corrected temperature rise reading automatically. Corrections for heat leaks during the test are applied. (For a complete discussion of this process see Introduction to Bomb Calorimetry, Manual No. 483M).

Energy Equivalent.
The energy equivalent (represented by W in the above formula, or abbreviated as EE) is determined by standardizing the calorimeter as described in Appendix C - Standardization. It is an expression of the amount of energy required to raise the temperature of the calorimeter one degree. It is commonly expressed in calories per degree Celsius. Since it is directly related to the mass of the calorimeter, it will change whenever any of the components of the calorimeter (i.e. the bomb, bucket or amount of water) is changed.

APPENDIX B

Thermochemical Corrections

Nitric Acid Correction.

In the high pressure oxygen environment within the oxygen bomb, nitrogen that was present as part of the air trapped in the bomb is burned to nitric oxide which combines with water vapor to form nitric acid. All of this heat is artificial since it is not a result of the sample burning. The nitric acid correction removes this excess heat from the calculation.

Sulfur Correction.

In the oxygen rich atmosphere within the bomb, sulfur in the sample is oxidized to sulfur trioxide which combines with water vapor to form sulfuric acid. This liberates additional heat over the normal combustion process which converts sulfur to sulfur dioxide. The sulfur correction removes this excess heat from the calculation.

Fuse Correction.

The fuse correction applied by the calorimeter is calculated as:

e_3 = (fuse value)(fuse multiplier from calculation factors page)
= (entered value)(fuse multiplier from thermochemicals page)

"Fuse Value" is the number entered by the user and the value which appears in the test report.

Note:

Calculation Factors, - Fuse Multiplier is normally set to 1.0 so the entered value is in calories

Users may find it convenient to enter a fixed value for the fuse correction and avoid the need to determine this correction for each test. Fixed fuse corrections can be entered when Thermochemical Corrections, is set to ON. By default a fixed fuse correction of 15 calories is applied to all tests. Total errors of more than 5 calories will seldom occur when using a fixed fuse correction and the fuse wire supplied by Parr.

When using the 1108P bomb, there are two components to the fuse correction:

- The heat introduced by heating the wire used to ignite the cotton thread.
- The heat of combustion of the cotton thread used to ignite the sample.

The semi-permanent heating wire is heated by dissipating an electrical charge from a capacitor. Since this charge is controlled by the size of the capacitor and the charging voltage, and because the capacitor is fully discharged for each test, the energy released can be calculated. In the 6200 Calorimeter this is a fixed correction of 10 calories per test.

Cotton has a heat of combustion of 4000 calories per gram. The actual thread being used should be weighed to see how much is being burned. Ten centimeters of a fine thread will weigh approximately 0.003 grams which would release 12 calories as it burns. Heavier threads weigh up to 0.010 grams per 10 centimeters and increase this correction to 40 calories per test. The finer the thread, the smaller errors will be if the thread is not exactly ten centimeters in length. Polyester thread is not recommended for use in the bomb because it has a tendency to melt and fall away from the heating wire before it ignites.

Using the fine thread mentioned above, the fuse correction for the calorimeter would be the 10 calories from electrical heating plus 12 calories from the burning thread for a total of 22 calories per test. The thread supplied by Parr has a mass of approximately 1 milligram per centimeter. This results in a total fuse correction of 50 calories. This value should be changed from the default value of 15 calories in the Thermochemical Corrections menu.

APPENDIX B

ASTM and ISO Methods Differ

Current ASTM, ISO, and British Standard Methods differ on their treatment of the nitric and sulfuric acid thermochemical corrections. ASTM Methods call for titrating the bomb washings to determine the total acid present. This is assumed to be all nitric acid with a heat of combustion of -14.1 Kcal per mole. The amount of sulfur is then determined and converted to equivalents of sulfuric acid. The difference between the heat of formation of sulfuric acid (-72.2 Kcal per mole or -36.1 calories per milliequivalent) and nitric acid is then subtracted as the sulfur correction.

Most other test methods treat nitric and sulfuric acid corrections as entirely separate values instead of combined values. This eliminates the requirement for a total acid determination and permits the nitric acid correction to be handled in a variety of ways, including the assumption of a fixed nitric acid correction.

The 6200 Calorimeter can be set up to apply the acid correction by either the ASTM or ISO convention, as the user prefers. Care must be used to ensure the proper corrections are applied, and the calculations made are consistent with the procedure used.

Note*:*
Please review the following section on Acid and Sulfur Corrections. Different standard test methods use different values for the heat of formation of sulfuric acid. These differences are generally insignificant. The 6200 Calorimeter uses the most recent, published values for all thermochemical data.

Thermochemical Calculation Details

Traditionally, standard solutions and procedures have been established to simplify the calculations related to the thermochemical corrections. The 6200 Calorimeter has been programmed to permit the user to use standard solutions and units which are most convenient, since the microprocessor can easily apply any conversion factors required.

APPENDIX B

Acid and Sulfur Corrections

- **Total acid** is the amount of base required to titrate the bomb washings (milliliters).
- **Nitric acid** is that portion of the total acid in the bomb washings that result when the nitrogen in the air that is trapped in the bomb is burned at high pressure. Since this nitric acid does not result from the sample, and the combustion conditions are reasonably constant from test to test, the amount of nitric acid formed is also constant.
- **Acid multiplier** is multiplied by the user entered acid value to arrive at the number of milliequivalents of acid. This value is normally the concentration (normality) of the base in equivalents per liter (N).
- **Percent sulfur** is the concentration of sulfur in the sample (weight %).
- **Molecular weight of sulfur** is 32.06.
- **Equivalent weight of sulfur in H_2SO_4** is 16.03 (one half of the molecular weight).
- **Heat of formation of nitric acid** is 14.1 calories/milliequivalent.
- **Heat of formation of sulfuric acid** (from SO_2) is 36.1 calories / milliequivalent.
- **Sample mass** is the mass of sample burned in the bomb (grams).
- **Sulfur multiplier** is multiplied by the product of the user entered sulfur value and the sample mass to arrive at the number of milliequivalents of sulfuric acid in the bomb washings.

Example:

(Percent Sulfur) x (Sample Mass) x **10** = milligrams of sulfur

(milligrams of sulfur) / (**equivalent wt. of S in H_2SO_4**) = milliequivalents of H2SO4

Sulfur Multiplier is **then 10 / equivalent wt. of S in H_2SO_4** or 10/16.03 = **0.6238**

e_1 is the **nitric acid portion** of the total acid correction.

e_2 is the **sulfuric acid portion** of the total acid correction.

e_1 + **e_2** is the **total** bomb acid correction.

Calculation for **e_1** when entered acid value is **total acid**:

[((**total acid**) (acid mult))-(percent sulfur) (sample mass) (sulfur mult)] (heat of formation of HNO_3)

Total acid milliequivalents - milliequivalents of H_2SO_4 = milliequivalents of HNO_3. (milliequivalents of HNO_3) (heat of formation of HNO_3) = heat (in calories) due to HNO_3 produced.

Calculation for **e_1** when entered acid value is **nitric acid only**:

(**nitric acid**) (acid multiplier) (heat of formation of HNO_3).

Calculation of e_2 when entered sulfur value is % sulfur:

e_2 = (percent sulfur) (sample mass) (sulfur multiplier) (heat of formation of **H_2SO_4**).

APPENDIX B

Acid and Sulfur Corrections *Continued*

Users may find it convenient to enter a fixed value for the acid correction and avoid the need to determine this correction for each test. Use of a fixed value for the acid correction is highly recommended. Fixed acid corrections can be entered when Fixed Acid - Thermochemical Corrections, is set to ON. A correction of 10 calories is a good number for the fixed nitric acid value. For most work, it is recommended to set "Acid Value is Nitric Acid Only", in Calculation Factors to ON. Total errors of more than 3 calories will seldom occur when using fixed nitric acid corrections.

Fixed sulfur corrections can be entered if a series of samples contain a constant amount of sulfur. Fixed sulfur corrections can be entered when Fixed Sulfur - Thermochemical Corrections, is set to ON and then enter percent sulfur as indicated on this line. Any errors will be proportional to the difference between the actual and assumed value for sulfur.

For ordinary work where benzoic acid is used, for standardizing the calorimeter, the Fixed Sulfur Correction, for Standardizations should be ON applying a fixed value of 0.0 to all standardization tests. Benzoic acid contains no sulfur.

Please note that the values entered into the test report appear as entered in the report. Values for e_1, e_2 and e_3 are calculated and used as energy corrections in accordance with the formulas and settings given above. The formulas used above to arrive at e_1 or e_2 are not the same as the formulas used for e_1 and e_2 which appear in most ASTM bomb calorimetric procedures. However, the sum of e_1 and e_2, above, is equal to the sum of the ASTM treatment of e_1 and e_2.

Page	Line	Setting	Value
Thermochemical Corrections	Fixed Acid STD	Off	13
	Fixed Sulfur STD	Off	7
	Fixed Acid DET	Off	13
	Fixed Sulfur DET	Off	7
Calculation Factors	Acid is Nitric Only	On	
	Acid Multiplier		0.154
	Sulfur Value is Percent	Off	
	Sulfur Multiplier		0.1
	User Offset Correction	On	
	Offset Value		-43.5

Table B-1
Settings for ISO & BSI Methods

APPENDIX B

ASTM Treatment for Acid and Sulfur

In the ASTM treatment, the correction for acid formation assumes that all the acid titrated is nitric acid. Obviously, if sulfur is present in the sample, which in turn produces sulfuric acid, part of the correction for the sulfuric acid formed is already included in the ASTM nitric acid correction (e1). This is adjusted by a separate computation based upon the sulfur content of the sample. An additional correction of 1.37 Kcal must be applied for each gram of sulfur converted to sulfuric from sulfur dioxide. This is based upon the heat of formation of sulfuric acid, from sulfur dioxide, under bomb conditions, which is -72.2 Kcal per mole or -36.1 calories per milliequivalent. But remember, a correction of 14.1 calories per milliequivalent of sulfuric acid is already included in the ASTM nitric acid correction (e1). Therefore the additional correction which must be applied for sulfur will be the difference between 36.1 and 14.1 or 22.0 calories per milliequivalent (44.0 Kcal per mole). For convenience, this is expressed, in the ASTM e2 formula, as 13.7 calories (44.0/32.06) for each percentage point of sulfur per gram of sample.

ISO Calculations

Both the ISO 1928 and BSI 1016: Part 5 methods for testing the calorific value of coal and coke, deal with acid and sulfur corrections in a manner which is somewhat different than ASTM procedures. Provision has been made in the 6200 Controller for dealing with these different procedures.

The analysis of bomb washings in these methods call for a titration, first using 0.1N barium hydroxide (V2) followed by filtering, and a second titration using 0.1N HCL(V1) after 20 ml of a 0.1N sodium carbonate has been added to the filtrate. Table B-1 gives the settings which allows the results of the two titrations, V1 and V2, to be entered into the controller directly for the calculation of the total acid correction. V1 should be entered at the prompt for acid and V2 is entered at the prompt for sulfur.

The settings in Table B-1 assume that the same procedure is carried out for both standardization and determination.

The offset value is the product of -1, the Heat of Formation of Nitric Acid, the acid multiplier, and the 20 ml of 0.1 N sodium carbonate used in the analysis.

The formula used to get the total correction in calories is as follows: V1(Acid Multiplier)(Heat of Formation of Nitric Acid)V2(Sulfur Multiplier)(Heat of Formation of Sulfuric Acid)+offset value.

The values for fixed acid and sulfur, which are used in preliminary reports, will reflect a sulfur correction of 0, and a nitric acid correction of 10 calories.

APPENDIX B

Spiking Samples

It is sometimes necessary to add a spiking material to samples which are very small, have a low heat of combustion, or have a high moisture content to add sufficient heat to drive the combustion to completion. Benzoic acid is an excellent material for spiking for all of the same reasons it is a good standard material. White oil is also an excellent material, particularly for liquid samples. The 6200 Calorimeter can automatically compensate for the addition of spiking materials to these samples. The calculations are modified in these cases as follows:

$$H_c = \frac{WT - e_1 - e_2 - e_3 - (Hcs)(M_s)}{m}$$

where Hcs = Heat of combustion of the spiking material (cal/gm)

Ms = Mass of spiking material

This factor is added to the calculations when Spike Controls, Use Spiking is set to ON. Heat of Combustion of Spike is entered as calories per gram. The controller will prompt the user to enter the weight of spiking material. Fixed spikes can be used when, Use Fixed Spike is set to ON and entering the mass of the spike on - Weight of Fixed Spike.

Conversion to Other Moisture Bases

The calculations described above give the calorific value of the sample with moisture as it existed when the sample was weighed. For example, if an air-dried coal sample was tested, the results will be in terms of heat units per weight of air-dry sample. This can be converted to a moisture free or other basis by determining the moisture content of the air-dry sample and using conversion formulae published in ASTM Method D3180 and in other references on fuel technology.

Conversion to Net Heat of Combustion

The calorific value obtained in a bomb calorimeter test represents the gross heat of combustion for the sample. This is the heat produced when the sample burns, plus the heat given up when the newly formed water vapor condenses and cools to the temperature of the bomb. In nearly all industrial operations, this water vapor escapes as steam in the flue gases and the latent heat of vaporization, which it contains, is not available for useful work. The net heat of combustion obtained by subtracting the latent heat from the gross calorific value is therefore an important figure in power plant calculations. If the percentage of hydrogen H, in the sample is known, the net heat of combustion, Hnet Btu per pound can be calculated as follows:

H_{net} = 1.8Hc - 92.7H
(Solid fuels, ASTM D2015)

H_{net} = 1.8Hc - 91.23H
(Liquid fuels, ASTM D240)

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STANDARDIZATION — APPENDIX C

Standardizing the Calorimeter

The Energy Equivalent Factor.

The term "standardization", as used here, denotes the operation of the calorimeter on a standard sample from which the energy equivalent or effective heat capacity of the system can be determined. The energy equivalent, W or EE of the calorimeter, is the energy required to raise the temperature one degree, usually expressed as calories per degree Celsius. Standardization tests should be repeated after changing any parts of the calorimeter, and occasionally as a check on both the calorimeter and operating technique.

Standardization Procedure.

The procedure for a standardization test is exactly the same as for testing a fuel sample. Use a pellet of calorific grade benzoic acid weighing not less than 0.9 nor more than 1.1 grams. The corrected temperature rise, T, is determined from the observed test data and the bomb washings are titrated to determine the nitric acid correction. The energy equivalent is computed by substituting the following equation:

$$W = \frac{Hm + e_1 + e_2 + e_3}{T}$$

Where:

W = Energy equivalent of the calorimeter in calories per degree Celsius.
H = Heat of combustion of the standard benzoic acid sample in calories per gram.
m = Mass of the standard benzoic acid sample in grams.
T = Temperature rise in ºC.
e_1 = Correction for heat of formation of nitric acid in calories.
e_2 = Correction for sulfur which is usually 0.
e3 = Correction for heating wire and combustion of cotton thread.

.

Standard Materials

A bottle of 100 one-gram benzoic acid pellets (Part No. 3415) is furnished with each calorimeter for standardizing purposes. The Parr benzoic acid has been calibrated against NIST benzoic acid. Additional benzoic acid pellets can be obtained from Parr. For very high precision measurements, a primary standard benzoic acid powder can be purchased from the National Institute of Standards & Technology, Washington, D.C.

It is not common to have sulfur in standard materials, or to use spikes in standardizations, but the capabilities have been included in this calorimeter.

Users should take great care to ensure that the conditions during standardization runs and determinations are as identical as possible.

CAUTION:

BENZOIC ACID MUST ALWAYS BE COMPRESSED INTO A PELLET BEFORE IT IS BURNED IN AN OXYGEN BOMB TO AVOID POSSIBLE DAMAGE FROM RAPID COMBUSTION OF THE LOOSE POWDER. THIS IS BEST ACCOMPLISHED BY USING A PARR 2811 PELLET PRESS.

APPENDIX C

Automatic Statistical Calculations

The 6200 Calorimeter includes a provision for calculating and using a mean energy equivalent for each of up to 4 separate bomb and bucket combinations. ASTM procedures recommend that the energy equivalent be determined by averaging ten tests. The 6200 Calorimeter automatically determines and uses up to 10 tests in its memory and will update the EE Value as additional standardizations are run. Only Final Tests will be used in determining and updating EE values. These values, the number of tests, and the relative standard deviation for the tests used in determining the EE value are stored in the Calibration Data Page under the EE Value for each bomb.

The user can chose to turn off the automatic averaging and updating procedure and protect the EE Values by turning ON the protection feature for the appropriate bomb on the Calibration Data and Control Page using Protected EE Value.

Any outliers or other tests which should not be included in the average EE Value must be deleted from the memory using the memory management procedures (see Chapter 8). A list of all tests associated with any Cal ID can be printed from the Calibration Data Page using Print Standardization Runs.

The user can elect to have any number of stored standardization runs used in determining the EE value by entering this number on Calibration Data & Controls Page - Calibration Run Limit.

EE Max Std Deviation on this same page establishes the maximum allowable standard deviation for the EE Value before an error condition is reported. The default value is zero which turns off this limit. But the user should enter a value appropriate for the test being made.

Calorimeter control limits when benzoic acid is used as a test sample

Accepted heat of combustion taken as 26454 J/g.
Instrument precision 0.10% RSD.
Control limits based on 99% confidence (3 sigma) values. Values are in J/g.

NUMBER OF OBSERVATIONS IN A GROUP	UCL FOR THE RANGE (HIGH – LOW) WITHIN THE GROUP	UCL FOR THE RSD WITHIN THE GROUP	MAXIMUM PERMISSIBLE DEVIATION OF THE GROUP MEAN FROM THE ACCEPTED VALUE OR GRAND MEAN
1			79.4
2	97.5	0.2606	56.1
3	115.3	0.2276	45.8
4	124.3	0.2088	39.7
5	130.1	0.1964	35.5
6	134.3	0.1874	32.4
7	137.6	0.1806	30.0
8	140.4	0.1751	28.1
9	142.7	0.1707	26.5
10	144.7	0.1669	25.1
11	146.4	0.1637	23.9
12	147.9	0.1610	22.9
13	149.4	0.1585	22.0
14	150.7	0.1563	21.2
15	151.8	0.1544	20.5
16	153.0	0.1526	19.8
17	154.0	0.1511	19.2
18	154.9	0.1496	18.7
19	155.8	0.1483	18.2
20	156.7	0.1470	17.7
21	157.4	0.1459	17.3
22	158.2	0.1488	16.9
23	158.9	0.1438	16.5
24	159.5	0.1429	16.2
25	160.2	0.1420	15.9

APPENDIX D COMMUNICATION INTERFACES

Printer Port

RS232C Connections

The 6200 Calorimeter is also equipped with an RS232C port for connection to either a 40 or 80 column printer and/or a balance. Before making either of these connections the data transmission rate of the calorimeter and the printer or balance must be matched. Generally the baud rates on either device can be changed to achieve this match. Printer Port Communications for the 6200 Controller are on the Printer Port Communications Page.

The default parameters for the 6200 Calorimeter are set up for use with the Parr 1757 Printer. Table D-1 on page D-3 identifies and describes the pin-out for the RS232C port.

Balance Port

The 6200 Calorimeter supports input from multiple balance types indicated below. Additionally, a generic input driver is provided for communications with balances that do not conform to the supported protocols. A new feature supported by all balance input drivers is the ability to change the expected number of characters in the data field. The number of data characters indicated for each of the drivers, below, are default values. This feature virtually eliminates the need for balance input drivers to be re-written in the event the balance manufacturer elects to alter the output string of a balance when new models are introduced.

The format of an unknown balance can be determined by logging the balance output to the printer attached to the calorimeter. Those protocols which send a command string to the balance will do so while logging is active. In order for the logging to produce meaningful results, the cable connecting the balance to the balance input port of the calorimeter must be correctly wired or configured. In addition, the specifics of the data frame, such as the baud rate, # of data bits, parity, # of stop bits and handshaking (if used) must be the same for both the balance and the calorimeter.

Mettler 011/012 Balance Interface

Field	Length
ID	2
space	1
data	9
space	1
g	1
CR	1
LF	1

The ID field must contain “S_” to indicate a stable mass. The data field contains the current mass, right justified, with a decimal point. The balance should be configured to send continuously.

APPENDIX D

Sartorious Balance Interface

Field	Length
polarity	1
space	1
data	8
space	1
stability	2
CR	1
LF	1

The polarity field must contain either a "+" or a space. Leading zeros in the data field are blanked, except for the one to the left of the decimal point. The stability field must contain "g_" for the calorimeter to accept a mass. The balance should be configured to transmit data upon receipt of the following command string:

[ESC] P [CR] [LF]

Note:

The automatic data output option should not be used.

The calorimeter will send this command string once every few seconds after the ENTER key has been pressed during a mass entry sequence. The ENTER key should only be pressed when the mass reading is stable. However, unstable readings will be rejected and a warning will be issued. Acknowledging the warning will re-issue the command string to the balance on a periodic basis.

APPENDIX D

Generic Interface

Field	Length
data	9
CR	1

The data field should consist of 9 numeric characters (0 through 9, +, - and space) terminated with a carriage return (CR). Leading zeros may be blanked as spaces and are counted. Non-numeric characters are ignored and will reset the input buffer if the data field has not been filled. Any characters received after filling the data field and before the carriage return are ignored.

Table D-1
6200 Calorimeter Serial Ports Pin-Out

There are three RS-232 serial ports at the rear of the calorimeter. These ports are designated Terminal, Printer and Balance. The pin-out of these three ports are identical. The pin-out is illustrated in the following table.

9 pin D Connector Pin #	Description	Direction (6200 – External Device)
2	Received Data	←
3	Transmitted Data	→
4		
5	Signal Ground	← →
6		
7	Ready to Send (RTS)	→
8	Clear to Send (CTS)	←

Both the terminal and balance port are female. The printer port uses a male connector.

Note: Printers must be serial.

APPENDIX D

Test data files are named with the following convention.

Test type	Filename
Preliminary Standardization	<ID>.std.plim.csv
Final Standardization	<ID>.std.finl.csv
Preliminary Determination	<ID>.det.plim.csv
Final Determination	<ID>.det.finl.csv
Pre-weigh	<ID>.---.pwgh.csv

Table D-2
6200 Calorimeter Run Data Template

Field	Description
SampleID	Field will hold ID up to sixteen characters in length
Timestamp	MM/DD/YY HH:mm:ss
Mode	0 = determination, 1 = standardization
Method	0 = equilibrium, 1 = dynamic
State	0 = preweigh, 1 = preliminary, 2 = final
Units	0 = MJ/kg, 1 = Btu/lb, 2 = cal/g, 3 = J/kg, 4 = other
UnitMultIfOther	unit multiplier in effect at time of report
BombID	[1-4]
BombEE	bomb energy equivalent
SampleWt	sample weight
SpikeWt	spike weight
Fuse	fuse value
FuseFinal	fuse value is final
Acid	acid value
AcidFinal	acid value is final
Sulfur	sulfur value
SulfurFinal	sulfur value is final
Hydrogen	hydrogen value (net calc option)
HydrogenFinal	hydrogen value is final (net calc option)
Moisture	moisture value (dry calc option)
MoistureFinal	moisture value is final (dry calc option)
JacketTemp	jacket temperature
InitTemp	initial temperature
DeltaT	temperature rise
HOC	gross heat of combustion
NetHOC	dry net HOC (if both dry and net calc options enabled)
DryHOC	dry gross HOC (if dry calc option enabled)
DryNetHOC	dry net HOC (if both dry and net calc options enabled)

APPENDIX D

Ethernet Interface

Calorimeter test data can be transferred to an Ethernet network connected computer using the FTP File Transfer Protocol. First, you must know the IP address of the network-connected calorimeter. The network DHCP (Dynamic Host Configuration Protocol) server provides this address shortly after the calorimeter is turned on. The address can be seen on the “software and hardware info” page, under “program information and control”. See the example screenshot.

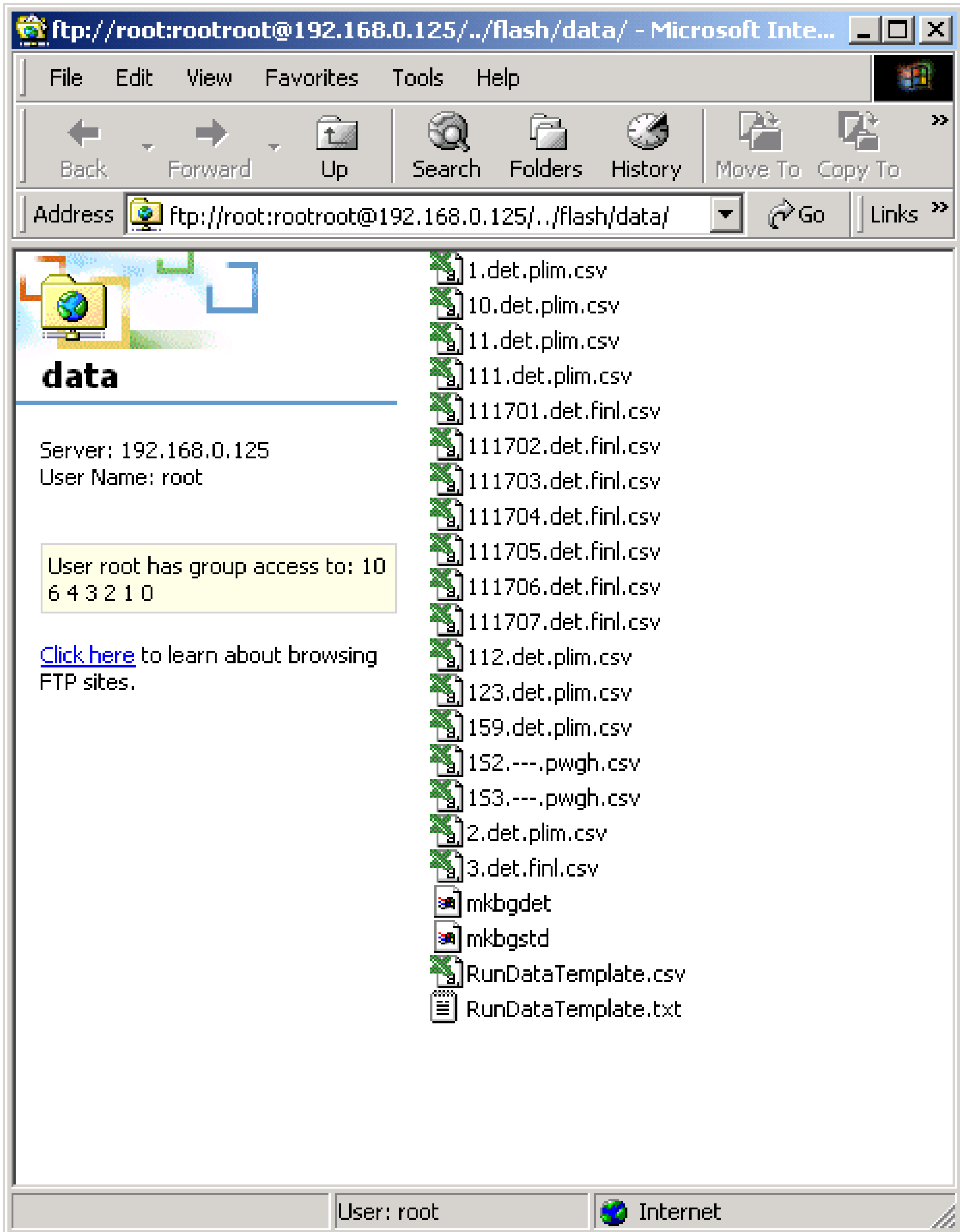
Users who don’t have a network infrastructure can create a simple network by connecting a router with DHCP server capability to the calorimeter using an ordinary CAT 5 network cable. The calorimeter should be connected to LAN side of the router. The PC in turn is also connected to the LAN side of the router using a similar CAT 5 cable. A D-Link 614+ router is recommended for this purpose. For this router, operated without a WAN connection, the primary DNS address of the router (WAN setup) must be set to the IP address of the router found on the LAN setup page. Other routers behave differently in the absence of a WAN connection. Providing an active upstream connection to the WAN port of most routers generally minimizes the use of any obscure setup configurations.

An FTP enabled web browser can be used to access stored test data. The URL is of the following form.

ftp://root:rootroot@192.168.0.125/../flash/data/

In this case, 192.168.0.125 is the IP address of the calorimeter.

The following screenshot illustrates the contents of the calorimeter data directory as presented by a web browser.



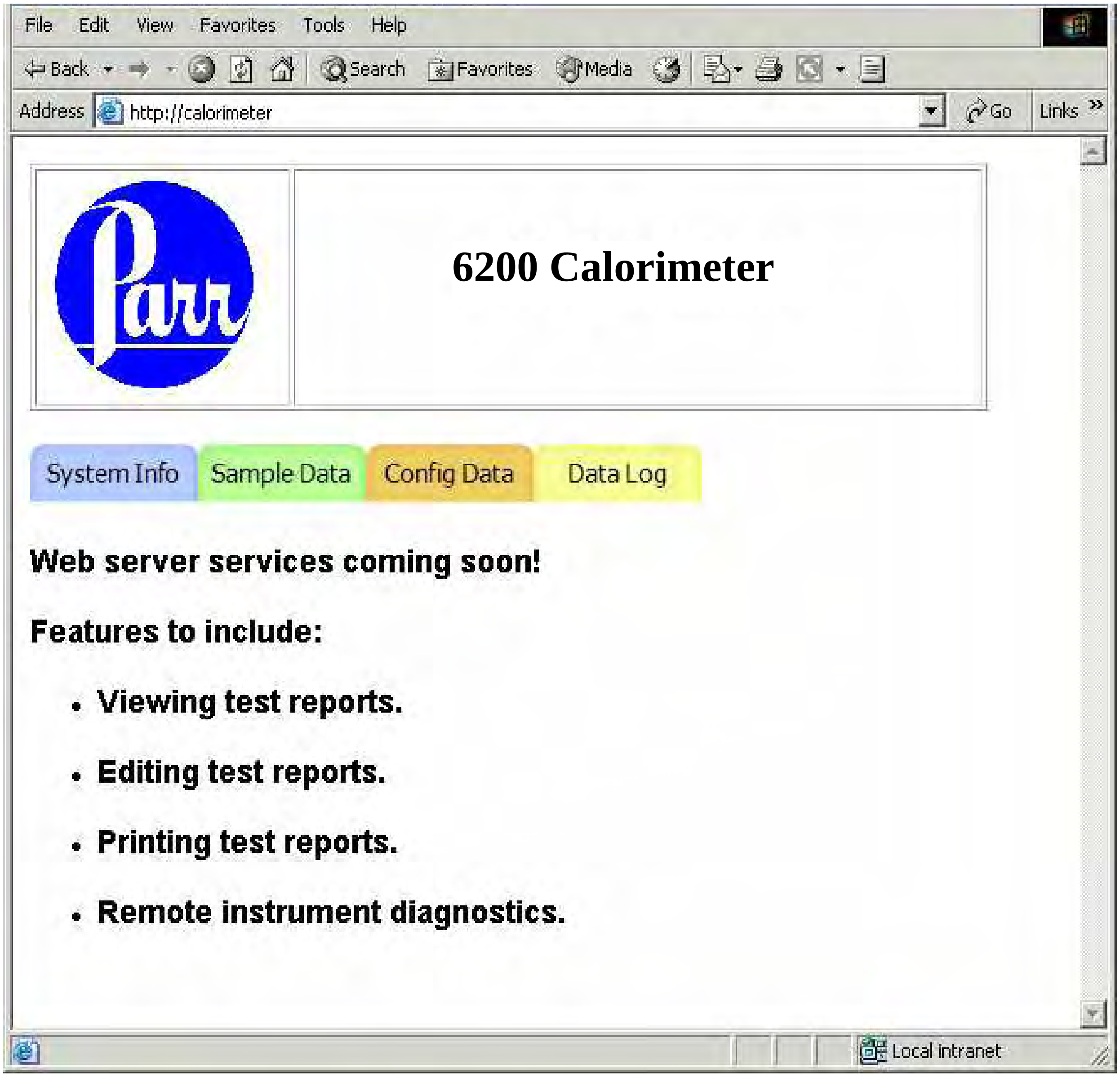
You can drag and drop or copy and paste test data files (with the csv suffix) from the web browser window to any convenient folder or directory on the PC.

APPENDIX D

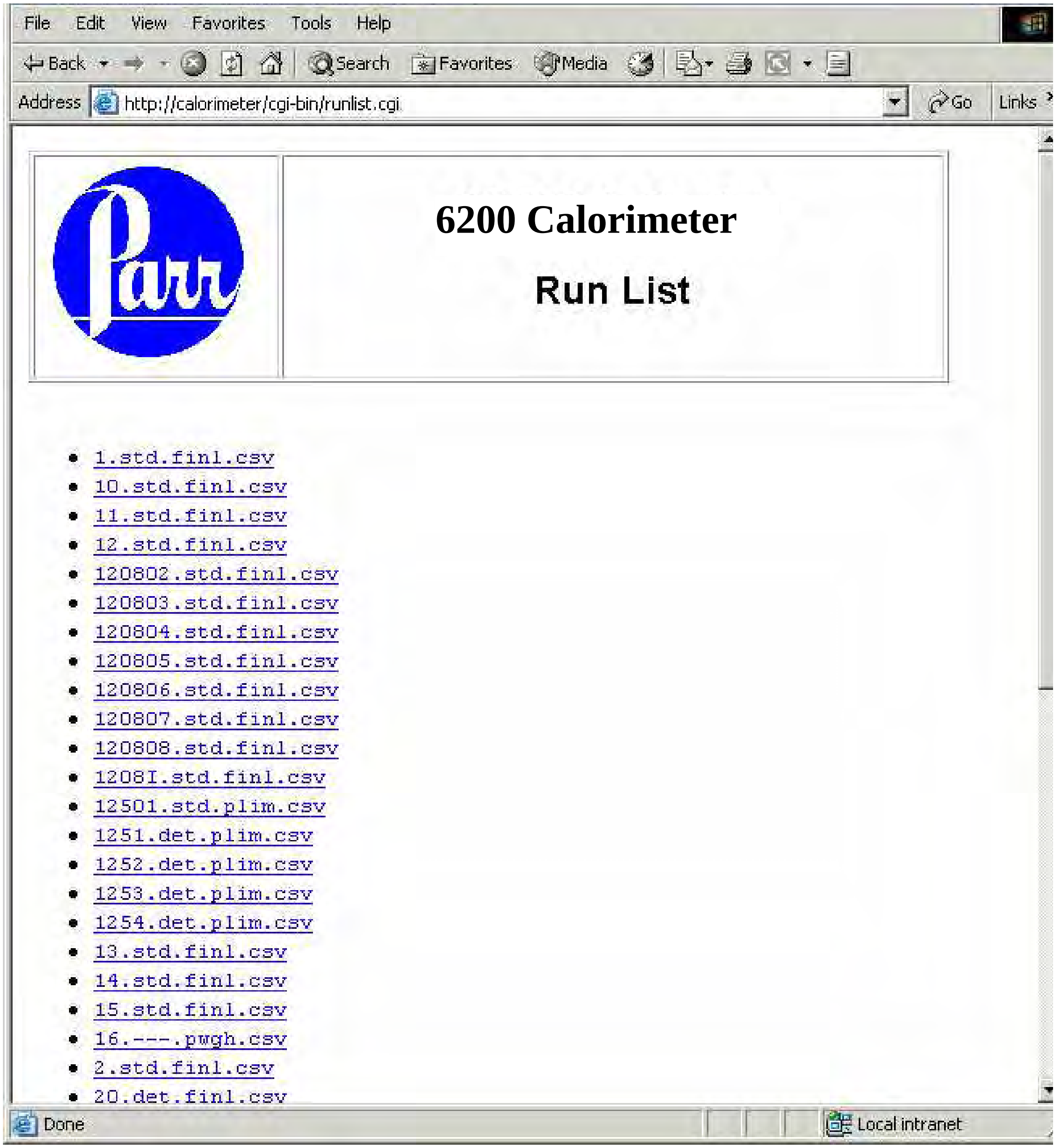
The calorimeter offers a web server service. Test reports can be viewed with a web browser using a URL of the following form.

http://192.168.0.125

Where 192.168.0.125 is the IP address of the calorimeter. The following screenshot illustrates the calorimeter home page.

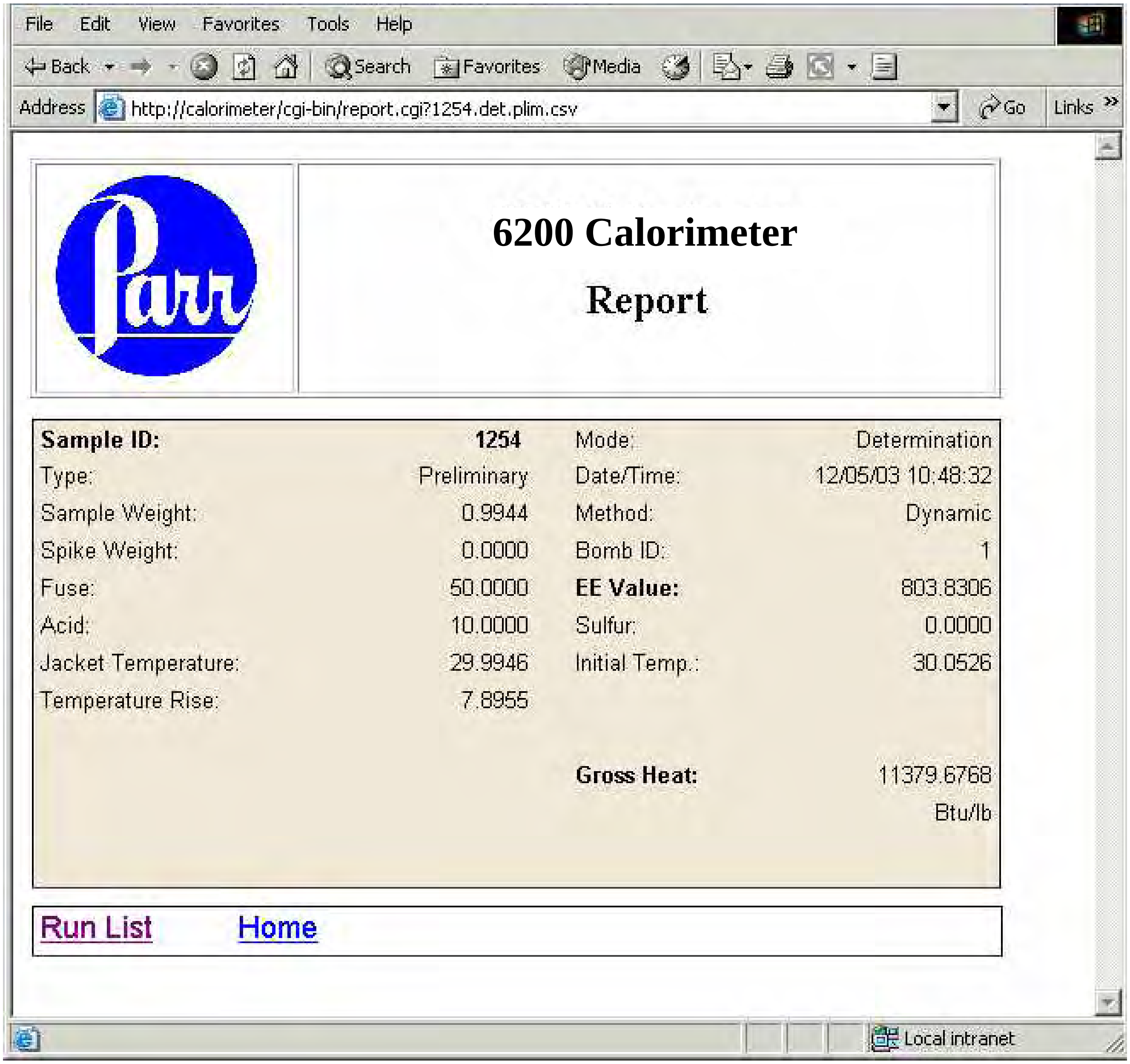


Clicking on the Sample Data tab displays a list of reports currently in the instrument memory.



APPENDIX D

Clicking on any given report will provide a display as follows.



APPENDIX D

Bar Code Port

The use of barcodes in the laboratory has become a highly accurate, rapid and inexpensive way to identify samples. When purchasing this feature, the user must supply Parr with the MAC address of the calorimeter (found in the Software & Hardware Info menu screen). This allows Parr to activate the feature key.

In order to enable the calorimeter to use the bar code feature, the feature key needs to be entered into the instrument. Select the “Program Information and Control” key from the Main Menu. Next, select “Feature Key” and enter the feature key purchased from Parr Instrument Company into the instrument by using the touchpad. Pressing the key labeled “ABC” allows the user to switch from upper case letters, to lower case letters and finally to numerals.. A CD containing all the necessary documentation and setup information for using both the scanner and the printer is provided at the time of purchase. A PC based program used for printing bar coded labels is also provided on this CD.

Network Data Devices

These keys allow the user to specify the IP addresses of one or more Balance Interface devices on the network. Balance Interface devices are polled from device 1 to 15 for sample and / or spike weights when the weight entry mode is set to Network.

APPENDIX E TECHNICAL SERVICE

Should you need assistance in the operation or service of your instrument, please contact the Technical Service Department.

Telephone: **(309) 762-7716**
Toll Free: **1-800-872-7720**
Fax: **(309) 762-9453**
Email: **parr@parrinst.com**

Any correspondence must include the following basic information:

1. The model and serial # of the instrument.
2. Date purchased.
3. Software version(s) shown on the "Software and Hardware Information" page.
4. Help system revision. This is displayed by pressing the <MAIN MENU> key and then the <HELP> key.

When calling by phone, it is helpful if the person is close to the instrument in order to implement any changes recommended by the Technical Service Department.

Return for Repair

To return the instrument for repair, please call the Technical Service Department for shipping instructions and a RETURN AUTHORIZATION NUMBER. This number must be clearly shown on the outside of the shipping carton in order to expedite the repair process.

If you have not saved the original carton and traps, please request an A1341DD packaging return kit.

We prefer the calorimeter to be shipped in our cartons and traps to prevent shipping damage.

Ship repair to:

Parr Instrument Company
Attn: Service Department, RMA# XXXX
211- 53rd Street
Moline, Illinois 61265

APPENDIX E

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APPENDIX F 6200 CALORIMETER PARTS LIST

Principal Assemblies in Calorimeter

Item	Description
1108	Oxygen Combustion Vessel
A391DD	Oval Bucket
A570DD	Regulator Assembly, Oxygen
A1279DD	Controller Assembly
A1311DDEB	Pump Assembly, Circulating, 115V
A1311DDEE	Pump Assembly, Circulating, 230V
A1268DD	Motor Assembly, Pump, 12V
A1276DD	Cold Water Solenoid
A1284DD	Stirrer Hub Assembly
A297E	Lead Wire
A1278DD	Oxygen Solenoid, w/o fittings
1940E	Power Supply
897E	Capacitor, 40V, 81000 uF
1317DD	Lid Seal
1417E2	Thermistor Bucket
538VB	Male Connector 1/8 NPTM-T-BT Nylon
549DD	Gas Spring
139E23	Fuse Fast/ Act 15 Amp 250V
1641E	Pump Fuse (F1), Fast-Act, 1 Amp, 250VAC
1641E2	Heater Fuse (F2), Fast-Act, 2.5 Amps, 250VAC

WARNING: For continued protection against possible hazard, replace fuses with same type and rating of fuse.

Parts List for A1279DD Controller Assembly

Item	Description
1217DD	Gasket for Display
1803E	Inverter, Backlighting
A1397E2	Internal Cable Terminal / Balance Port
A1397E3	Internal Cable Printer Port
A1792E	Board, Display Transition
A1793E3	CPU Board 6200
A1794E	Input / Output Board
A1806E	Cable, backlight, inverter
A1808E	Cable
A1809E	Cable
A1821E	Speaker Assembly with Cable
A1822E	Power Cable Assembly
A1823E	Touchscreen Cable Assembly
A1876E	Touchscreen LCD with Cable (1802E)

APPENDIX F

Parts List for Temperature Control Assembly

Item	Description
1281DD	Manifold, Temperature Control
1417E	Thermistor, Jacket
538VB	Male Connector, 1/8 NPTM-T-BT Nylon
252HWHJ	Elbow, Hose Barb, 1/2 x 3/8 M
280HWHJ	Elbow, Hose Barb, 1/4 T X3/8 M
A1275DDEB	Cartridge, Heater Assembly 120V
A1275DDEE	Cartridge, Heater Assembly 240V
535VB	Male Connector, 1/4T x 3/8 NPTM
337VB	Male Connector, 1/4T x 1/8 NPTM
283VB	Adapter, Male 1/4T x 1/8 NPTM
A1276DD	Cold Water Solenoid Assembly w/ connector
117HW3	Elbow, Male, 1/4T x 1/8 NPTM

Parts List for A1284DD2 Stirrer Hub Assembly

Item	Description
1282DD	Hub, Stirrer
1283DD2	Shaft, Stirrer
1242DD3	Pulley, Timing
682DD	Snap Ring, Internal .50
683DD	Wave Spring, .50 OD
684DD	Ball Bearing
A540DD	Stirrer Assembly
1288DD	Coupler, Stirrer Shaft
1242DD3F	Set Screw

Spare and Installation Parts List

Item	Description
20VB	Valve Seat
230A	O-Ring, Bomb Head, 2-3/8 ID
238A	O-Ring, 3/16 ID
394HCJE	O-Ring, 3/8 ID
415A	O-Ring, 7/16 ID
3414	Benzoic Acid Pellets, 0.2 g, 100 pcs
3415	Benzoic Acid Pellets, 1 g, 100 pcs
421A	Bomb Lifter
43AS	Sample Capsule, SS
45C10	Fuse Wire, 10 CM
475A	Service Clamp Head
A92HWBB	Male Connector 1/4Tx 1/8 NPT
115HW	115HW Tube ¼ OD Copper 10 Ft
A719E	Cordset 115V
A719EEE	Cordset 230V
HJ0025TB035	Tube, Nylon ¼ OD
406A	Lock Nut
7VBCM	Monel Washer

APPENDIX F

Parts List for Water Tank Assembly

Item	Description
1301DD	Water Tank, 6200
386VB	Nipple, ½ NPT, Nylon
413VB	Cap, ½ NPT, Nylon
387VB	Elbow,1/2" NPT, Plastic
1020DD	Plug Cap
271HWHJ	Hose Barb, Male, 1/2T – 1/2NPTM

Parts List for Cooling Water Supply

Item	Description
328VB	Union, Bulkhead ¼ Tube
196VB	Valve, Brass, ¼ Tube
343VB	Port Connector, ¼ Tube, Brass
A1276DD	Cold Water Solenoid Assembly w / connectors

Parts List for Oxygen Filling System

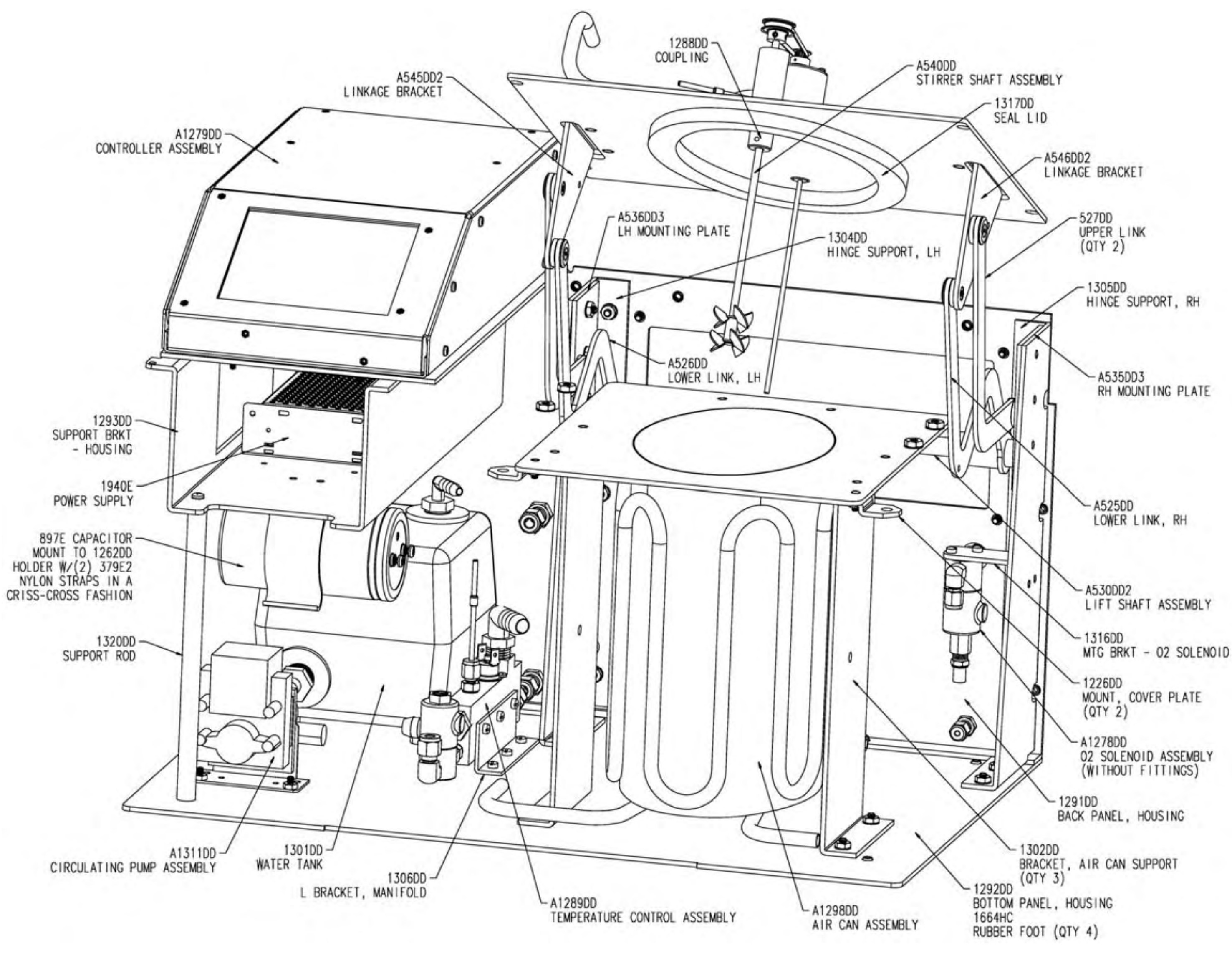
Item	Description
244VB	Union Bulkhead, 1/8 Tube
A476A3	Slip Connector w / 1/8 NPT
438VB	Elbow, 45 °, 1/8 NPT x 1/8 Tube
HX0012TB024	High Pressure Tube, 1/8, Nylon
180VB	Male Elbow 1/8 T x 1/8 NPTM
527VB	Restrictor 0.012 – 1/8 NPT
A1278DD	Oxygen Solenoid Assembly, w/o fittings
697HC2	Filter Sintered Bronze
243VB2	Male Connector, 1/8 T x 1/8 NPT
394HCJE	O-Ring EP 3/8 ID x 1/16 CS

Parts List for 6200 Stirrer Motor and Drive

Item	Description
1285DD	Mount, Motor, 6200
1241DD2	Belt Timing, 6200
1242DD	Pulley Timing 6200
A1268DD	Motor, Stirrer, 6200

APPENDIX F

Figure F-1
6200 Oxygen Bomb Calorimeter Cutaway Front



APPENDIX F

Figure F-2
6200 Oxygen Bomb Calorimeter Cutaway Rear

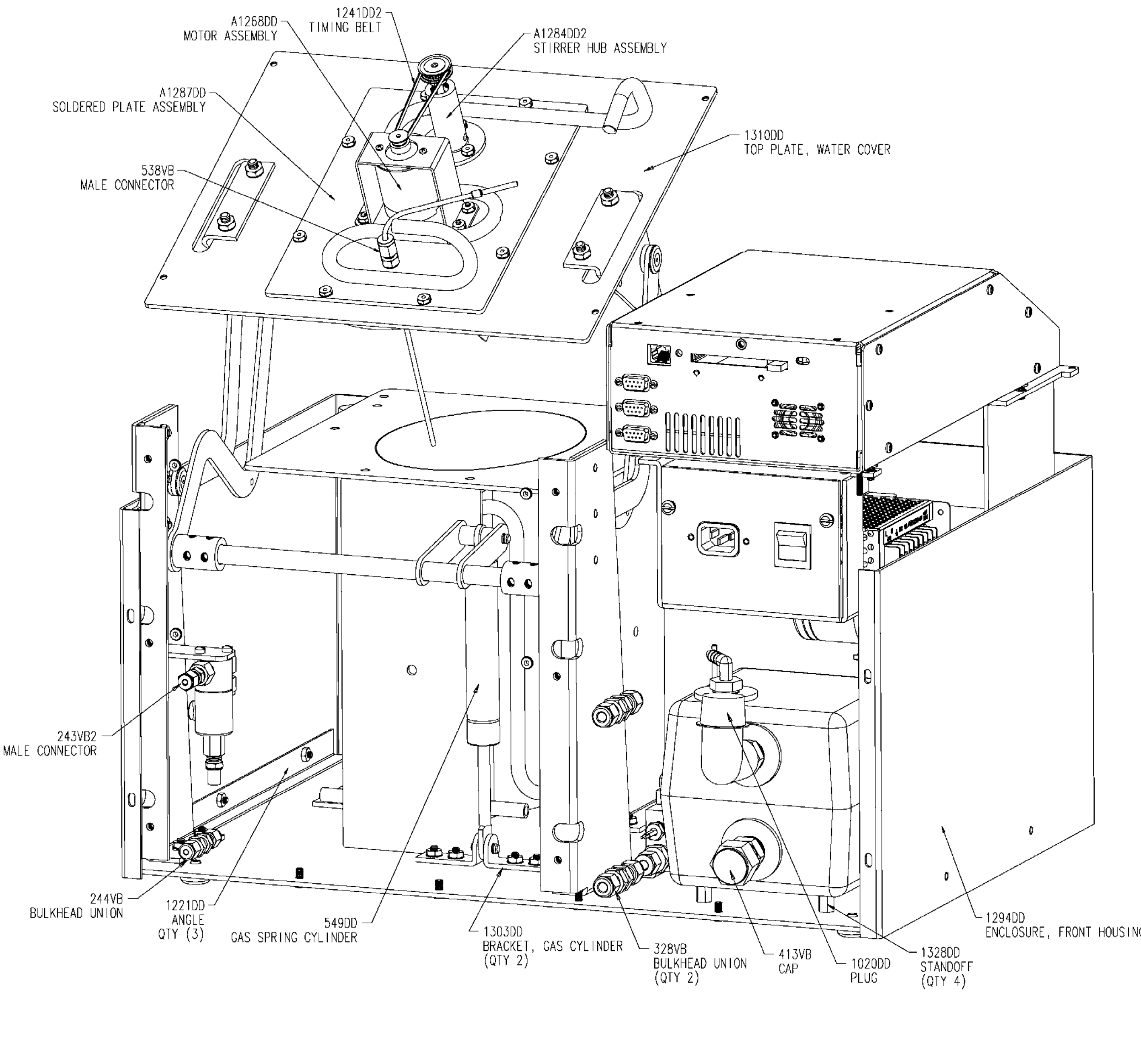
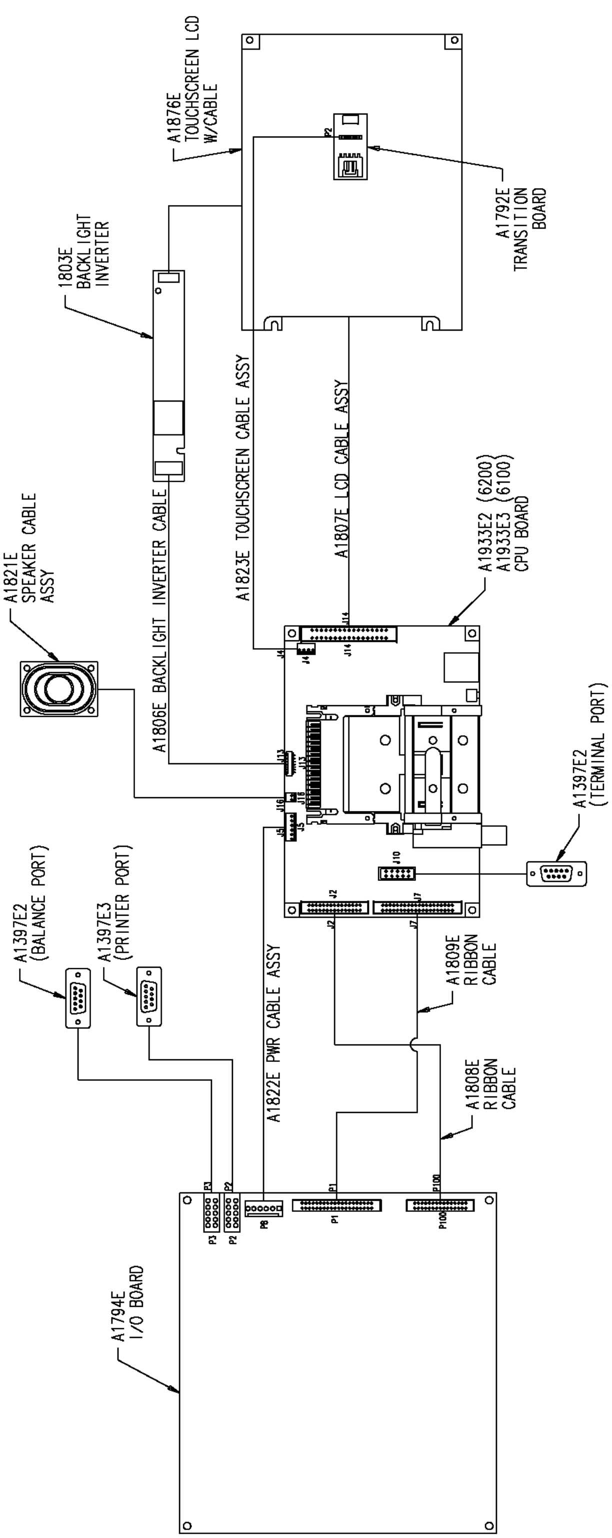


Figure F-3
A1279DD Control Schematic



APPENDIX F

Figure F-4
Oxygen Solenoid Assembly & Fittings

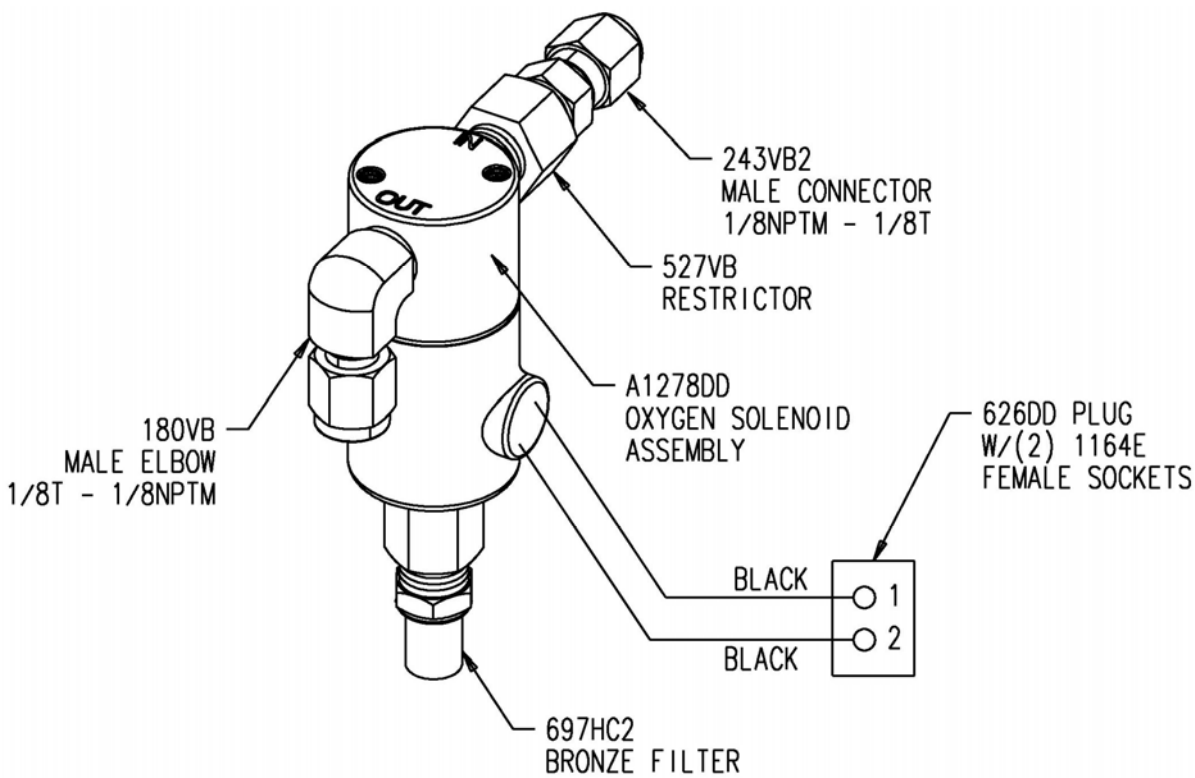
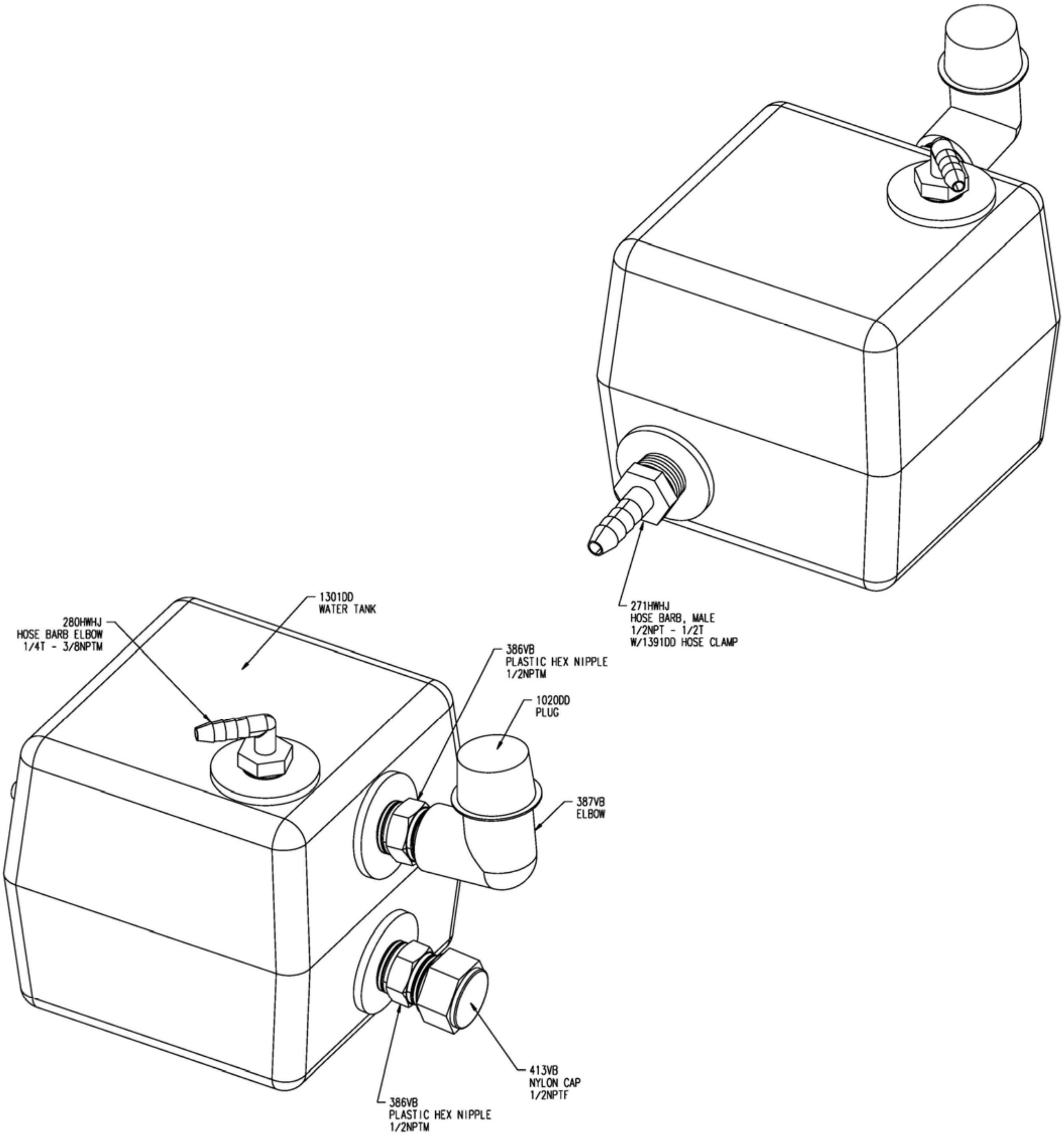
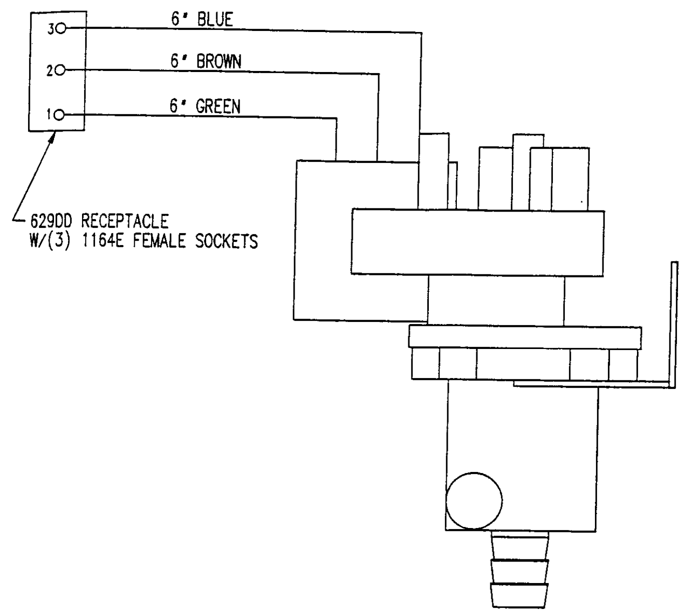


Figure F-5
Water Tank Assembly

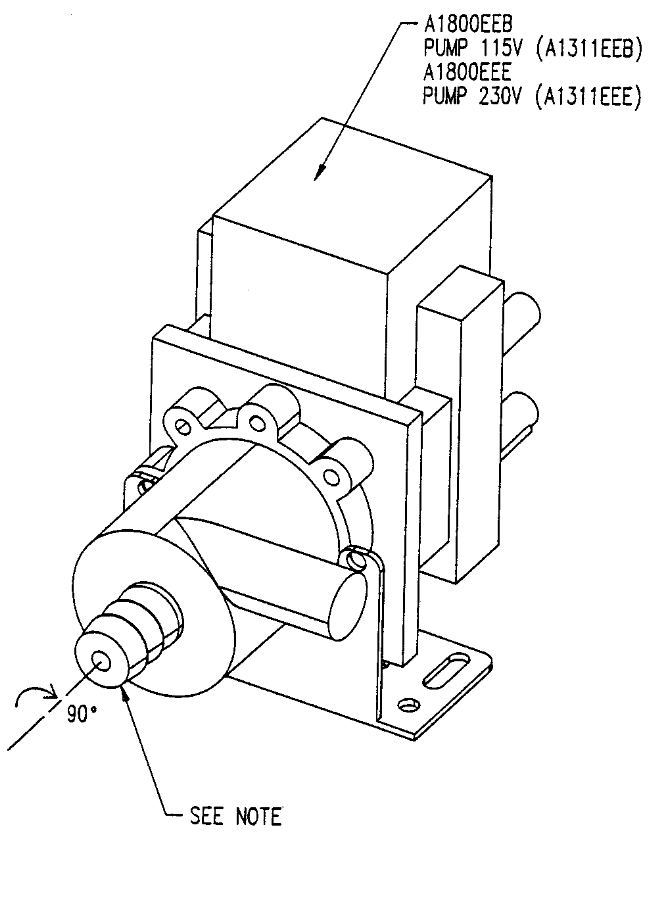


APPENDIX F

Figure F-6
A1311DD Circulating Pump Assembly with Fittings

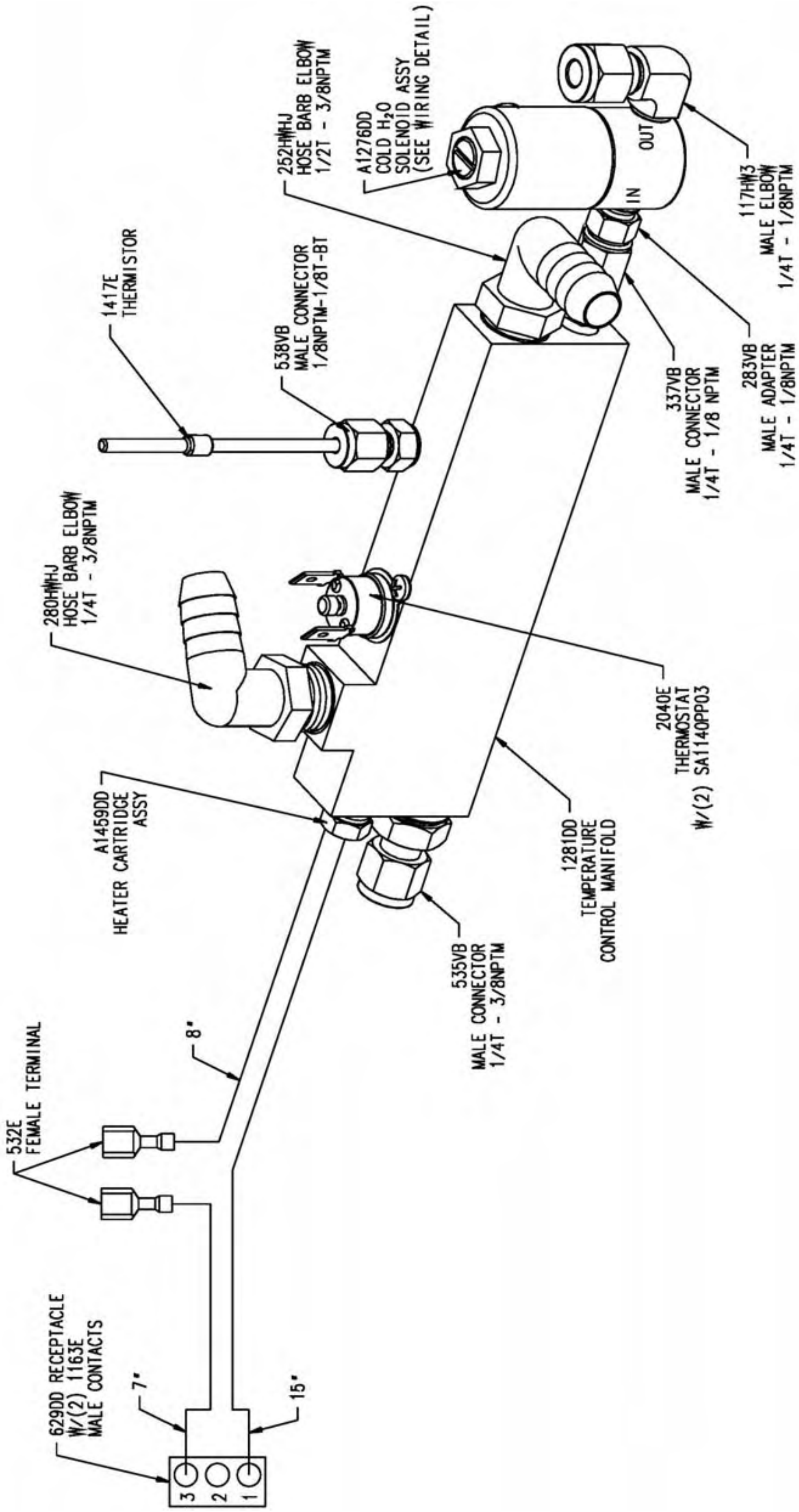


NOTE:
ROTATE PUMP HOUSING 90° FROM
A1800E PURCHASED CONFIGURATION AS SHOWN



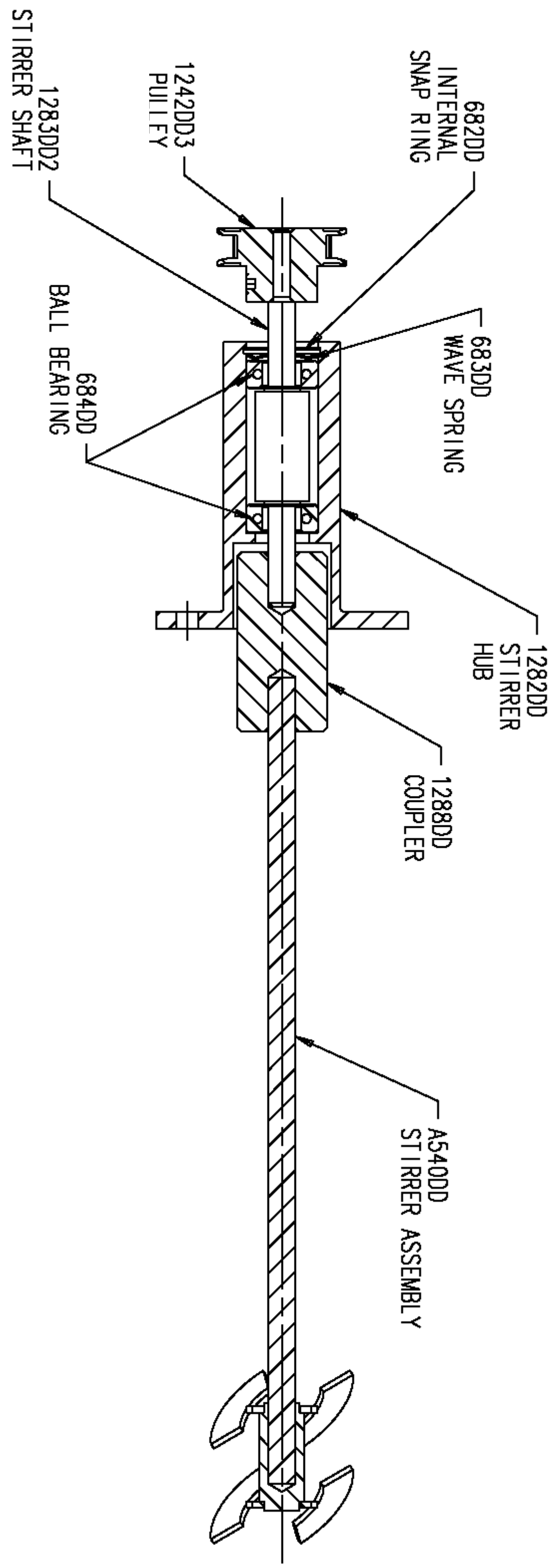
APPENDIX F

Figure F-7
Temperature Control Assembly with Fittings



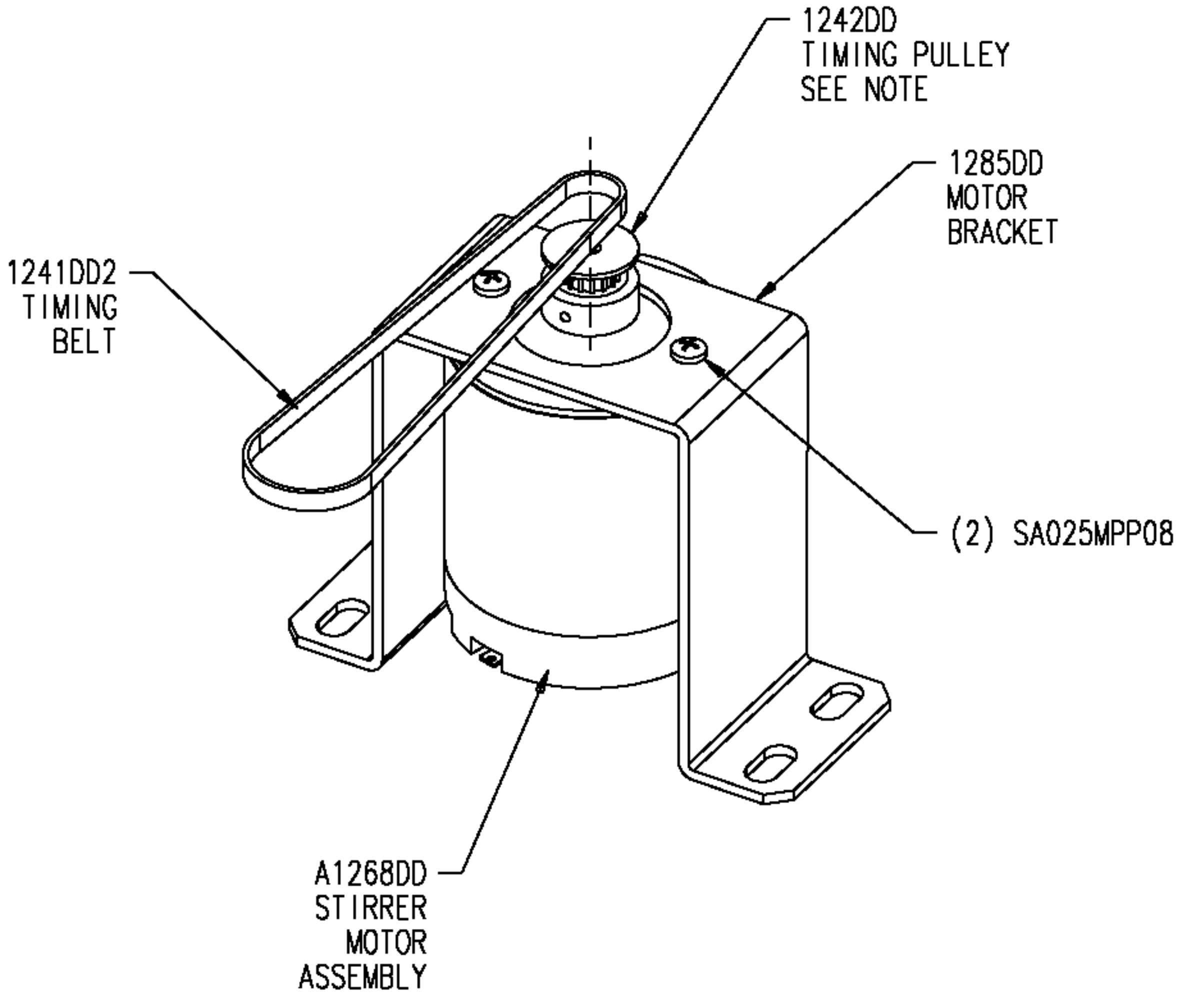
APPENDIX F

Figure F-8
A1284DD2 Stirrer Hub Assembly



APPENDIX F

Figure F-9
Stirrer Motor Assembly



NOTE:
APPLY (LOCKTITE OR EQUIVALENT) THREAD SEALANT
TO SET SCREW IN 1242DD PULLEY
BEFORE INSTALLING

PARR INSTRUMENT COMPANY

211 Fifty - Third Street
Moline, Illinois 61265 USA
309 / 762-7716 800 / 872-7720
Fax 309 / 762-9453

http://www.parrinst.com parr@parrinst.com

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