

Parr Oxygen Combustion Vessels

For Reliable Combustion Procedures

Combustion with oxygen in a sealed Parr vessel has been accepted for many years as a standard method for converting solid and liquid combustible samples into soluble forms for chemical analysis. It is a reliable method whose effectiveness stems from its ability to treat samples quickly and conveniently within a closed system without losing any of the sample or its combustion products. All hydrocarbons are oxidized to carbon dioxide and water by the reaction, and all sulfur compounds are converted to soluble forms and absorbed in a small amount of water placed in the vessel. Organic chlorine compounds are converted to HCl or chlorides. Any mineral constituents remain as ash, but other inorganic elements such as arsenic, boron and all of the halogens are recovered with the vessel washings. The entire procedure is simple and straightforward, with its superiority over other sample preparation methods derived primarily from its: speed, safety and significant sample size. Samples large enough to be statistically significant can be treated in these vessels with complete sample recovery.

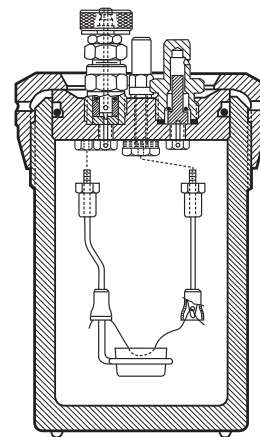
Many applications. The reliability of the oxygen vessel method has led to its acceptance as the basic procedure for determining sulfur, halogens, and other elements in a broad range of combustible materials, particularly:

- Sulfur in coal, coke and refuse derived fuels.
- Sulfur in petroleum products.
- Chlorine in petroleum and other combustible samples.

Other halogens and elements such as: arsenic, mercury, phosphorus and boron can also be determined by oxygen vessel methods. Heavy metals present as trace elements in combustible samples can be determined by adding a quartz liner described on page 13. A full discussion of oxygen vessel methods, including a listing of standard ASTM, ANSI, API, IP test procedures and an extensive bibliography is provided in Parr Manual 207M. Copies are available on request at no charge.

The 1108 Oxygen Vessel

This is the standard, 350 mL, general purpose vessel which is widely used in all Parr 6100, 6200, and 1341 Calorimeters, and in the 1901 Oxygen Vessel Apparatus. It will safely burn samples (usually weighing about one gram) which liberate up to a maximum of 8000 calories per charge using oxygen-charging pressures up to 40 atm. All designs used in the 1108 Vessel have been developed specifically to give the user a reliable vessel that is easy to handle, easy to maintain and safe for its intended use. Separate valves are provided for charging the vessel with oxygen and for releasing gases at the end of a test. Oxygen is admitted through a check valve. Gases are released through a needle valve. Deflector nuts on the inlet and outlet passages divert the incoming gas and protect the valves from the combustion flame. Both valves can be replaced. The firing circuit is completed through a grounded electrode which also supports the combustion capsule. An insulated electrode with ceramic flame protection carries the firing current to the fuse wire.



Parr 1108 Oxygen Combustion Vessel

The standard 1108 Vessel is made of a special niobium-stabilized stainless steel selected for its excellent resistance to the mixed nitric and sulfuric acids produced in a vessel combustion. This is a superior alloy which is suitable for most combustion tests, yet neither it nor any other stainless steel will resist the corrosive atmosphere produced when burning samples containing halogen compounds. For these applications Parr offers the 1108CL Vessel described below.

A Chlorine-Resistant Vessel

Parr also offers a 1108CL Vessel which is the same as the 1108 model, but with a head and cylinder made of an alloy with superior corrosion resistance to the free chlorine and halogen acids released when burning chlorinated samples. Users who intend to test waste materials and combustible solvents are urged to select the 1108CL Vessel instead of the 1108 for its longer service life under extreme corrosive conditions. Vessel maintenance is also improved. In most cases 1108CL Vessels returned to the factory for scheduled maintenance can be restored to optimum finish simply by repolishing instead of having to rebore the cylinder to remove pits. The 1108CL Vessel may be purchased separately or it can be substituted for the standard 1108 Vessel in any Parr calorimeter or combustion apparatus.

An oxygen filling system and other accessories for the 1108 Vessels can be ordered from listings on page 15, or a vessel complete with all necessary accessories can be obtained by ordering the 1901 Oxygen Vessel Apparatus described on page 13.

Ordering Guide

Model No.	Description
1108	Oxygen Combustion Vessel, 350 mL, Alloy 20Cb-3 Stainless Steel
1108CL	Oxygen Combustion Vessel, 350 mL, for Chlorine Service

Oxygen Vessel Apparatus

Complete Systems for Vessel Combustion Procedures

This is the convenient way to purchase an oxygen vessel with a full set of operating accessories. Although any of the components of this apparatus may be purchased separately, by purchasing a complete apparatus the user can be sure they will have all of the equipment needed for vessel combustion operations. The 1901 Apparatus with an 1108 Vessel will handle most procedures. It consists of:

1	1108	Oxygen Combustion Vessel
1	A387A	Water Bath
1	1825	Oxygen Filling Connection
1	2901	Ignition Unit
2	A468E	Ignition Cords
1	A38A	Vessel Head Support Stand
1	421A	Vessel Lifter
6	43AS	Combustion Capsules
3	45C10	Cards of 10-cm Fuse Wire (5 m/card)
1	3601	Package of 100 Gelatin Capsules
1	set	Extra Gaskets and Sealing Rings
1	206M	Instruction Manual

Similar oxygen vessel apparatus with accessories listed above can be furnished with an 1108CL Vessel, with an 1108 Vessel with platinum electrodes and a quartz liner, or with an 1121 Oxygen Vessel. Spare parts kits are available also.



Ordering Guide

Oxygen Vessel Apparatus with 1108 Vessel

1901EB	115v 50/60 Hz
1901EE	230v 50/60 Hz

Oxygen Vessel Apparatus with 1108CL Vessel

1901CLEB	115v 50/60 Hz
1901CLEE	230v 50/60 Hz

Oxygen Vessel Apparatus with 1108FB Vessel, platinum electrodes, and quartz liner

1911EB	115v 50/60 Hz
1911EE	230v 50/60 Hz

A Quartz Liner for the 1108 Oxygen Vessel



For Determining Trace Elements in Combustible Samples

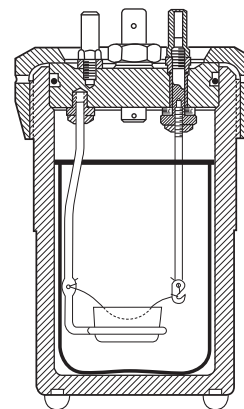
Trace elements in coal, oil and other combustible samples are readily determined by AA or ICP spectroscopy following combustion in an oxygen vessel. However, trace amounts of heavy metals leached from the vessel walls

and electrodes during combustion can cause problems. This can be avoided by using a platinum-lined vessel, but a platinum lining is expensive. As an alternate, Parr offers a quartz liner for the 1108 Vessel which does not provide the full protection of platinum, but is, nevertheless, an effective substitute. In this arrangement the burning sample comes in contact with only the quartz liner and platinum electrodes. Reprints of papers describing the successful use of an 1108 Vessel with quartz liner for trace analysis by AA spectroscopy are available from Parr.

The Quartz Liner

The quartz liner for the 1108 Vessel consists of a quartz cup, 61 mm dia. x 86 mm deep, with a 514A flat quartz cover. Holes are provided in the cover for inserting platinum electrodes which support a fused silica sample cup and a short platinum fuse wire. All of the parts needed for adding this liner are provided in the 1912 Quartz Liner Conversion Set, consisting of:

1	513A	Quartz Liner
1	514A	Quartz Cover
1	4AFB	Platinum Straight Electrode
1	5AFB	Platinum Loop Electrode
2	68AC	Lock Nut, T316SS
1	45C3	Platinum Fuse Wire, 300 cm
4	43A3	Fused Silica Combustion Capsules



Users who do not have an 1108 Vessel should order the 1911 Oxygen Vessel Apparatus listed above which provides a vessel complete with a quartz liner and all accessories.

Ordering Guide

Model No.	Description
1912	Conversion Set for adding a quartz liner to an 1108 oxygen vessel

Special Oxygen Vessels



1109A



1109X



1104



1121

Parr offers a number of special purpose oxygen vessels, some of which are described briefly below. Users interested in any of these or other special-purpose vessels are urged to contact Parr for additional details.

1109A Semimicro Oxygen Combustion Vessel.

This 22 mL vessel is the smallest Parr combustion vessel. It will handle samples that range from 25 to 200 milligrams, liberating 22 to 1200 calories when burned in oxygen using initial pressures up to 35 atmospheres. Outputs of up to 2400 calories can be accommodated as long as the sample is self-oxidizing and reacted in an inert atmosphere where the reaction peak pressure does not exceed the maximum working pressure (MWP) of the vessel. It requires an 1824 filling connection.

1109X High Strength Semimicro Oxygen Combustion Vessel. The 1109X is similar in most aspects as the 1109A Vessel but has been specially strengthened to be suitable for testing energetic materials and it is optimized for the measurement of small energy releases.

1104 High-Strength Vessel. This is a 240 mL, extra-heavy oxygen vessel for combustion tests with gun powder, explosives and other samples which burn with extreme violence. It will handle samples liberating up to 12,000 calories using oxygen charging pressures up to 45 atm. Extra strength is built into all parts of the vessel. A removable combustion cage can be installed to baffle the combustion forces when treating fast-burning high-energy samples.

1121 Large-Capacity Vessel. This is an 1850 mL oxygen vessel developed for users who want to analyze slow-burning cellulosic materials using larger samples than can be treated in the 1108 vessel. It will accommodate samples weighing up to 10 grams using oxygen charging pressures up to 20 atm, but these limits vary and must be checked experimentally for each sample. The vessel will hold vacuum, making it particularly useful for determining trace amounts of tritium, carbon-14, or heavy metals in vegetable matter.

1122 Large-Capacity Vessel. Same as 1121 except for the smaller capacity of 920 mL, and samples up to 5 grams.

Ordering Guide

Part No.	Description
1109A	Semimicro Oxygen Vessel, 22 mL
1109X	High Strength Semimicro Oxygen Vessel, 22 mL
1104	High Pressure Oxygen Vessel, 240 mL, with Capsule Support Cage and one 217A Combustion Capsule and 5A3 Loop Electrode
1104B	High Pressure Oxygen Vessel, 240 mL, with 5A3 Loop Electrode. (No combustion cage and no capsule)
1121	Oxygen Vessel, 1850 mL, T316SS with two valves and 0-3000 psi pressure gage
1122	Oxygen Vessel, 920 mL, T316SS with two valves and 0-3000 psi pressure gage

Oxygen Vessel Accessories

Oxygen Filling Connections

These connections provide all of the valves, gages, and couplings needed for charging Parr oxygen vessels from a commercial oxygen tank under manual control. They are made in three styles which are identical except for the coupling on the vessel filling hose. All units fit a standard 1A oxygen tank having a CGA 540 outlet with a right-handed thread. Two pressure gages are provided. The larger gage, graduated from 0 to 55 atmospheres, shows the pressure to which the vessel has been charged, while the smaller gage shows the available pressure in the supply tank. Gas flow to the vessel is controlled by a needle valve in the gage block. There is an automatic relief valve to prevent over-charging during the filling operation.



Ordering Guide

Part No.	Description
1823	Oxygen Filling Connection with Flat Gasket Coupling for use with 1104 Vessels
1824	Oxygen Filling Connection with Snap Coupling for use with 1109A and 1109X Vessels
1825	Oxygen Filling Connection with Slip-on Coupling for use with 1108 Vessels
1825A	Oxygen Filling Connection with Threaded Connection for use with 1121/1122 Vessels

Combustion Capsules

The 43A Fuel Capsules listed below are used in all 1108 Oxygen Vessels. Other capsules in the list are for special purpose vessels as indicated.



Ordering Guide

Part No.	Description
43AS	Combustion Capsule, Stainless Steel
43A3	Combustion Capsule, Fused Silica/Quartz
43A5	Combustion Capsule, Platinum – 3% Rhodium
43A6	Combustion Capsule, Platinum – 3% Rhodium w/ flanged rim
169AC	Combustion Capsule, Platinum, for 1109A and 1109X Vessel
208AC	Combustion Capsule, Inconel, for 1109A and 1109X Vessel
217A	Heavy Combustion Capsule for 1104 Vessel
446A	Combustion Cup, Stainless Steel, for 1121/1122 Vessel



Ignition Unit

These units provide the proper electric current for firing a Parr oxygen vessel from a 115 or 230 volt line. Each carries a push switch, pilot light and output binding posts for connections to 7 or 10 cm vessel fuses. Connecting cords must be ordered separately.

Ordering Guide

Part No.	Description
2901EB	Ignition Unit, 115v 50/60 Hz
2901EE	Ignition Unit, 230v 50/60 Hz
A468E	Ignition Cord, 3-ft., single cord with spade terminal one end, banana plug other end. Use with 1108 or 1121 Vessels. Package of two.

Fuse Wire

Parr 45C10 Fuse Wire is a 34 B&S gage, nickel-chromium resistance wire wound on a 10 cm card for ease in cutting a fuse to length. Platinum wire is sold by length as shown.



Ordering Guide

Part No.	Description
45C2	Fuse Wire, Platinum, 26 ga, priced per foot
45C3	Fuse Wire, Platinum, 36 ga, 300 cm coil
45C10	Fuse Wire, Ni-alloy, 10 cm card, 500 pieces per card, for oxygen vessels (3 cards/package)