No. 239M

Parr Instrument Company

Operating Instruction Manual

4600 & 4700

General Purpose Pressure Vessels

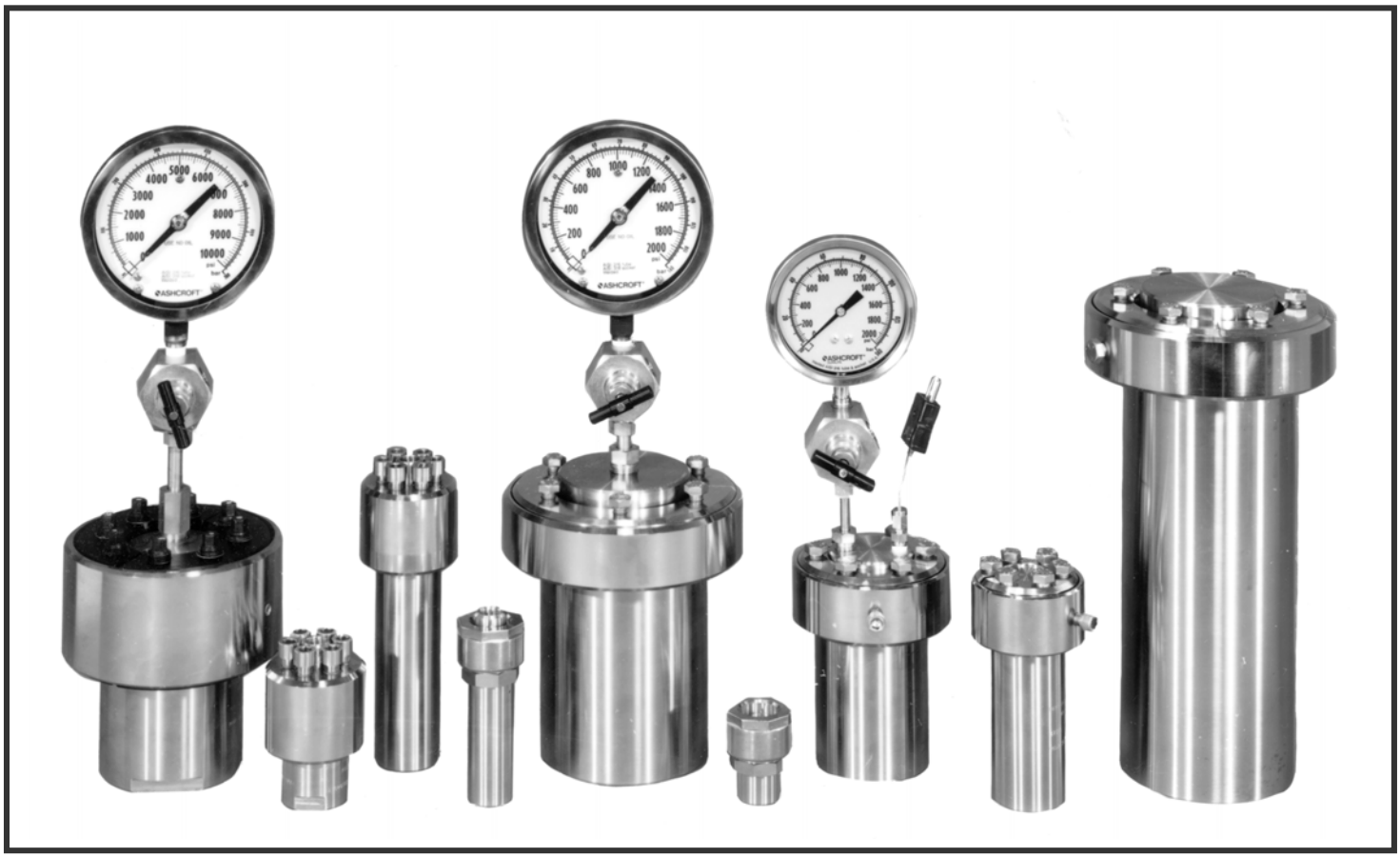


TABLE OF CONTENTS

Related Instructions

The following Parr publications can be ordered to further your understanding of this instrument and its component parts:

No.	Description
230M	Safety Precautions to be observed when operating Pressure Reaction Equipment.
231M	Operating Instructions for Parr Safety Rupture Discs
232M	Operating Instructions for Series 4840 Temperature Controllers
323M	Operating Instructions for Parr Pressure Relief Valves
201M	Limited Warranty

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

Scope

These instructions cover the basic operating steps to be followed when using a variety of pressure vessels manufactured by the Parr Instrument Company. They include temperature and pressure ratings for Series 4600 and 4700 General Purpose Pressure Vessels, also instructions for the gage block assemblies commonly used with these vessels. This material is intended to be used in conjunction with several related instruction sheets listed on page 2 covering safety precautions and other information applicable to Parr pressure equipment. The user should study all of these instructions carefully before starting to use any Parr pressure vessels in order to obtain a complete understanding of the capabilities and limitations of these vessels, and to be well aware of the precautions to be observed in their operation.

Users Responsibility

All Parr Reactors and pressure vessels are designed and manufactured with great care to assure safe operation when used within their prescribed temperature and pressure limits.

But . . . the basic responsibility for safety when using this equipment rests entirely with the user; who must:

1. **Select a reactor or pressure vessel** which has the capability, pressure rating, corrosion resistance and design features that are suitable for its intended use. Parr engineers will be glad to discuss available equipment and material options with prospective users, but the final responsibility for selecting a reactor or pressure vessel that will perform to the user's satisfaction in any particular reaction or test must rest with the user – not with Parr.

   In exercising the responsibility for the selection of pressure equipment, the prospective user is often faced with a choice between over or under-designed equipment. The hazards introduced by under-designed pressure vessels are readily apparent, but the penalties that must be paid for over-designed apparatus are often overlooked . Recognizing these criteria, Parr reactors and pressure vessels are offered in several different styles, each designed for convenient use in daily operation within certain temperature and pressure limits, using gaskets, closures and other elements carefully selected for safe operation within the limits specified for that design. But in order to preserve the validity of these designs, all temperature and pressure limits must be observed, and no attempt should be made to increase these limits by making alterations or by substituting components which are not recommended by Parr Instrument Company.
2. **Install and operate** the equipment within a suitable barricade, if required, with appropriate safety accessories and in full compliance with local safety codes and rules.
3. **Establish training procedures** to ensure that any person handling the equipment knows how to use it properly.
4. **Maintain the equipment** in good condition and establish procedures for periodic testing to be sure the vessel remains structurally sound.

Unpack Carefully

Unpack the equipment carefully and check all parts against the packing list. If shipping damage is discovered, report it immediately to the delivering carrier. The vessel, heater and temperature controller may be packed separately for convenience in shipping, but these parts are easily reassembled. Examine the vessel closely for any loose parts or shipping damage and be sure to check all wrappings and packing materials thoroughly so as not to overlook any parts which might otherwise be discarded.

Pressure and Temperature Limits

The working pressure and temperature for these vessels must not exceed the maximum limits established for each design and listed in the Working Limits and Parts List section of these instructions.

Limits for vessels made of other materials and for other operating temperatures can be determined as described in Instruction Sheet No. 230M. No attempt should be made to increase these limits by making alterations or by substituting components which are not recommended by Parr Instrument Company. It must be understood that lower pressure and temperature limits may be required for modified reactors and for vessels made of special alloys not listed in Instruction Sheet No. 230M. Limits for such vessels will be determined by the physical characteristics of the material of construction and will be prescribed on an individual basis.

The maximum working pressure and temperature for any vessel is governed by the design of the vessel and the strength of the material from which it is constructed. There is also a close relationship between working pressure and temperature since the strength of any material will normally fall off as the temperature is increased.

Temperature and pressure limits are also affected by the physical properties and temperature limits of the gaskets and seals used in the vessel, and by any valves, gages or other fittings attached to the vessel. Obviously, the safe operating pressure of any system can be no higher than that of its lowest rated component.

4601 1000 mL Vessel with Blank Head

4611 1000 mL Vessel with 4317 Gage Block Assembly

Split Ring Closures

Most Parr pressure vessels are equipped with a unique split ring cover clamp in which the head of the vessel is clamped to the cylinder by a hardened steel ring which has been split into two sections. These sections slide into place from the sides without interfering with any fittings attached to the head.

The closing force is developed by simply tightening a set of compression bolts in the ring sections with a hand wrench. As a further convenience, larger Parr vessels in one and two gallon sizes, and certain high temperature and high pressure vessels, are equipped with split ring closures which do not require an outer retaining ring or drop band. This allows the vessel to be opened and closed by simply sliding the split ring section into place from the sides and tightening the compression bolts while the cylinder remains in place in its heater or other fixed support.

4761 300 mL Vessel with Split Ring Closure and 4316 Gage Block Assembly

Split Ring Closure Operations

All vessels with split ring closures, except the larger Series 4660, 4670 and 4680 sizes, must be removed from the heater and set on a bench or table top before attempting to remove the split rings and head.

1. To Open The Vessel: open the gas release valve to discharge any internal pressure; then loosen the compression bolts in the split ring sections. Loosen the cone pointed screw in the outer band and lower the band to rest on the table. The ring sections can now be removed, and the head with all attached fittings is free to be lifted from the cylinder.

2. Before Closing The Vessel, examine the head seal carefully to be sure that it is in good condition. The seal should not have any nicks or be hardened, discolored, or deformed. Examine the mating surfaces on the cylinder and head to be sure they are clean and free from burrs; then set the head on the cylinder.

3. To Close The Vessel, put the two split ring halves around the head and cylinder flanges, fasten the latches or tighten the bolts as assembled before.

4. Routinely inspect the bolts on split ring closures for lubrication and cleanliness. These screws should not be allowed to dry because the threads will seize. Regularly apply Parr High Temperature Anti-Seize Lubricant before this happens.

Self-Sealing O-Ring Closure

The self-sealing design features an O-ring retained in a groove on the vessel head. This design is self sealing and the split ring does not require or have the compression bolts used with the flat gasket.

Screw Cap Closures

On the smallest Parr vessels a threaded sleeve and screw cap are used to clamp the head to a cup. This is a union type coupling in which proper alignment between the head and cup is always assured since neither of these parts rotates when the screw cap is tightened. The flat gasket is held in a recess in the head. The seal is made as the lip of the cup is compressed against the gasket through tightening the screw cap and sleeve. All components must be kept clean. The gasket must be replaced whenever it becomes worn or damaged. Any nicks in gasket recess area or to the sealing face of the cup must be avoided.

Operating 4700 Screw Cap Vessels

To close the Series 4700 Screw Cap Vessels: raise the sleeve against the top rim of the cup; set the cover on the cup and attach the screw cap. Turn the screw cap down until it is finger tight; then set the vessel in a Parr A22AC3 bench socket and tighten the cap firmly with a 21AC4 box wrench.

4712 45 mL Screw Cap Vessel with A281HC Coupling and A122VB Valve

Parr Pressure Vessel Seals

Several different cover sealing arrangements are used in Parr Pressure Vessels, each selected for easy access to the interior of the vessel as well as for safe operation within the pressure and temperature limits for which the vessel is designed. Both flat compression type gaskets and O-rings are used in these designs.

The various gasket materials used in Parr pressure vessels are listed in Table I. Since several of these materials are produced by different suppliers under different trade names, the ASTM generic designation is used in these instructions to identify the type of sealing material (or materials) recommended for each Parr vessel.

Contained Flat Gaskets

Contained Flat Gaskets are used in vessels for moderate pressure under conditions in which the gasket material will retain its physical form up to the maximum temperature for which the vessel and closure are designed. This type of closure requires a ring of compression screws or a screw cap to preload the gasket with a force greater than the highest pressure to be developed within the vessel. If the internal pressure should exceed the gasket loading, the vessel will leak.

O-Rings

O-Rings made of an elastomeric material and held in an o-ring groove provide a convenient sealing arrangement for various Parr vessels. This type of seal does not require preloading from a ring of compression screws since the required sealing force develops from pressure within the vessel and increases automatically as the internal pressure is raised.

Seals for Operating Temperatures up to 350 °C

Parr uses both flat contained gaskets and O-rings made of different materials, each with a different maximum working temperature. Flat gaskets made of PTFE fluoropolymer resins are the recommended choice for many applications since PTFE materials are inert to most chemicals. PTFE gaskets will provide good seals under repeated opening and closing of the vessel if the gasket temperature does not exceed 350°C.

O-rings are available in several different materials for use within the temperature limit listed in the following table.

Pressure and Temperature Limits	
O-Ring Material	**Maximum Temp.**
NBR	150 °C
FKM	225 °C
FFKM	275 °C
PTFE	350 °C

Gaskets for Operating Temperatures above 350 °C

Parr uses a flexible form of graphite which has proven to be an excellent high temperature sealing material. It has almost unlimited temperature range, retaining its structure at temperatures well above the maximum at which a metal gasket can operate, and offering broad corrosion resistance as well.

Metal Gaskets can be furnished if required for special applications. These are usually made of stainless steel machined to a unique diamond shape with edges which fit into supporting grooves in the head and cylinder of the vessel. This type of gasket requires careful maintenance and a uniform loading applied by tightening a ring of compression bolts with a torque wrench. For easier handling, Parr has replaced its diamond shaped metal gaskets with flat, flexible graphite gaskets (FG) described above. But it will continue to furnish metal gaskets in custom vessels for applications in which a metal gasket appears to offer the best solution to a difficult sealing problem.

Gasket Material Designations

Common or Trade Name	Type of Material	ASTM Designation
nitrile, buna-N	butadiene/acryloelastomer	NBR
Viton®	fluoroelastomer	FKM
Kalrez®	perfluoroelastomer	FFKM
ethylene/propylene	ethylene propylene copolymer elastomer	EP
Teflon®	tetrafluoroethylene	PTFE
Grafoil®	flexible graphite	FG

1. Viton® is a registered trademark of DuPont.
2. Kalrez® is a registered trademark of DuPont.
3. Teflon® is a registered trademark of DuPont.
4. Grafoil® is a registered trademark of UCAR Carbon Inc.

Sealing The Vessel

Vessels with split ring closures are sealed by tightening the compression bolts in the split ring sections with a wrench furnished with the apparatus. To ensure uniform loading, turn down each bolt finger tight, then tighten to the limit described below for the type of gasket being used. Do not over-tighten the compression bolts as this can generate excessive strain on the closure.

Vessels with a Flat PTFE Gasket. Tighten the compression bolts using a criss-cross pattern, applying a firm but hard pull to each screw. Use a torque wrench to apply 25 ft-lbs to each compression bolt. Let the vessel stand for about five minutes after the initial tightening, then tighten again to 25-ft lbs. This will compensate for any tendency of the PTFE gasket to flow under the loading pressure.

Vessels with an O-ring seal. The self-sealing design features an O-ring retained in a groove on the vessel head. This design is self sealing and the split ring does not require or have the compression bolts used with the flat gasket.

Vessels with a Flexible Graphite Gasket. A torque wrench should be used to tighten the compression bolts on vessels equipped with a flexible graphite gasket. Since both 6-point and 12 point bolts are used on various Parr high pressure vessels, the user must be sure that the torque wrench is fitted with an adapter which matches the bolts on which it will be used.

To ensure uniform loading, clamp the cylinder in a vise service fixture or attach an anti-rotation clamp; inspect the gasket and set the head in place. Slide the split ring sections into position, turn each of the compression bolts finger-tight, then apply the sealing force with a torque wrench in the following manner:

Pick a starting bolt and tighten it to approximately 15 ft-lbs. Then by-pass the adjacent bolts and move around the closure to a bolt approximately 180 degrees from the start. Torque the second bolt and continue in the same pattern until all are snug at 20 ft-lbs. Then repeat the procedure, increasing the torque to the required limit shown in the table below.

Torque Required For Sealing Vessels with Flexible Graphite Gaskets

Vessel Series No.	Maximum Working Pressure, PSI	Graphite Gasket No.	Torque Required ft-lb
4740	8500	1829HCKL	15
4650	6000	457HC3KL	40
4670	3000	1812HCKL	35
4680	6000	1808HCKL	40

It may be possible to extend the useful life of a flexible graphite gasket by coating the sealing surfaces on both the vessel and the gasket with a silicone-base lubricant. The user may also want to rough up the sealing surface on the cylinder with a 300 grit abrasive paper to ensure that the gasket will remain in the head groove and will not stick to the cylinder.

Vessels with a Metal Gasket. Pressure vessels with a metal gasket require a uniform loading on the gasket carefully applied by tightening a ring of compression bolts with a torque wrench. The amount of torque to be applied will vary with different vessels and with the intended maximum working pressure. Specific sealing instructions will be provided for any Parr pressure vessels with a metal gasket furnished on special order.

Sealing 4740 High Pressure Vessels

Closing operations for the 1.0 inch I.D., Series 4740 high pressure vessels are similar to those described for larger vessels with flexible graphite gaskets, except on the 4740 Series the compression screws are carried in a screw cap instead of in a split ring. When closing a 4740, clamp the cylinder in a vise; check the graphite gasket to be sure that it fits properly in the head groove; set the head on the cylinder and add the compression ring. Check the screw cap to be sure that the six screws have been turned back so that they do not project through the cap, then screw the cap onto the cylinder. Turn it down as far as it will go, then back it off about 1/8 turn. Now, tighten the screws with a torque wrench with an initial10 ft-lbs using the criss-cross pattern described for larger vessels. After all have been tightened to 10 ft-lbs, repeat the procedure, increasing the torque until all have been tightened to the recommended 15 ft-lb limit.

Gage Block Assemblies

Parr gage block assemblies combine the function of an inlet valve, a pressure gage and a safety rupture disc in a compact assembly on a block which can be attached to the head of a pressure vessel with a single connecting tube. There is a threaded socket in the block for a gas connection with a pressure hose or tubing using a Type A coned pressure fitting. Coned pressure fittings are also used on the tube which connects the block to the pressure vessel. The valve in this assembly controls the flow of gas into the vessel and the gage shows the internal pressure when the valve is closed. Two styles are offered: The 4316 gage block assembly has a 3-1/2" dia. pressure gage and a Type A socket connector. This unit is normally used on smaller vessels where space is limited.

The 4317 gage block assembly has a 4-1/2" dia. gage and a Type B connector. It is typically furnished on vessels one liter and larger.

4316

4317

Pressure Gages

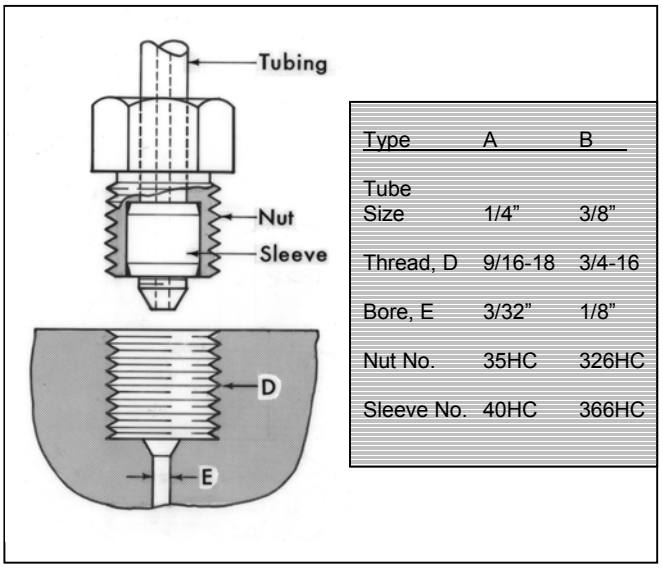
Pressure gages display in both psi and bar in various ranges for use on Parr gage block assemblies. The available ranges are shown in the gage block parts list. All of these gages have stainless steel cases with T316SS Bourdon tubes and ¼" NPT male connections. Gages constructed of Alloy 400 are available on special order.

Safety Rupture Discs

Detailed instructions for the safety rupture disc installed in Parr gage blocks and heads are provided in a separate Instruction Sheet No. 231M. The user should review these instructions carefully. Please note that the operating pressures in the vessel should not exceed 70% of the range of the pressure gage and rupture disc. Also note the warning that the discharge port from the rupture disc must always be directed away from all operating personnel. A compression fitting for use with 3/8" O.D. tubing is attached to the rupture disc body. It is recommended that tubing be attached to this connector to carry any discharge to a fume hood or safe area in the event of an over-pressure. The free or discharge end of any attached tubing must be anchored securely.

Coned Pressure Fittings

The coned pressure fittings used to connect gage blocks, pressure hoses and other detachable parts to Parr pressure vessels are illustrated below. These fittings have a sleeve with a left-handed thread which screws onto the end of a thick-walled tube plus a compression nut to complete the assembly. When screwed into a matching socket, these parts form a rigid joint which will remain tight over a wide temperature and pressure range, yet the joint can be made and broken repeatedly without destroying the sealing faces. No gasket is required.



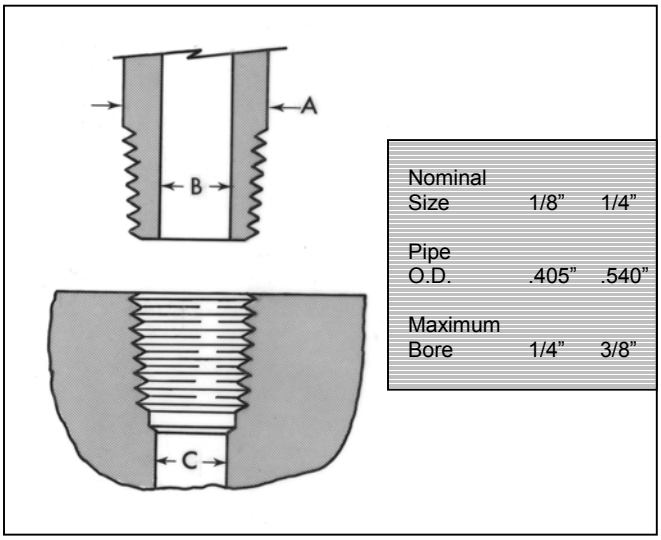
Type	A	B
Tube Size	1/4"	3/8"
Thread, D	9/16-18	3/4-16
Bore, E	3/32"	1/8"
Nut No.	35HC	326HC
Sleeve No.	40HC	366HC

When using these coned connectors, screw the sleeve onto the tube as far as it will go; then insert the end of the tube into the head or gage block and tighten the compression nut firmly while holding the block stationary with the gage facing in the desired direction. Note that this assembly behaves like a pipe union, allowing the connecting tube or hose to remain stationary while the joint is tightened.

Note: PTFE tape is not required on these connectors.

Tapered Pipe Threads

The pressure gage, needle valves and other fixed attachments on Parr vessel heads have tapered pipe threads which are not to be disturbed after they have been screwed into place. If it becomes necessary to remove any of these fittings, the pipe threads must be coated with PTFE tape, flexible graphite tape, or similar luting material on reassembly.



Nominal Size	1/8"	1/4"
Pipe O.D.	.405"	.540"
Maximum Bore	1/4"	3/8"

General Maintenance Notes

1. Periodically inspect all electrical wiring and pressure connections for excessive corrosion. Suspect parts should be replaced by components only supplied by Parr Instrument Company.

2. Always use appropriate wrenches on all fittings and valves. Never use pliers or pipe wrenches.

3. Head and cylinder service fixtures are available for convenience and protection of components during maintenance of your reactor.

4. A light coating of thread lubricant, such as Parr High Temperature Anti-Seize Lubricant, (424HC2) should be applied to the straight threads of coned pressure connections as well as to the nose of the mating piece this will help to obtain a tight joint.

   Note: PTFE tape should be used only on all tapered (NPT) threads not NPS straight threads.

5. NPT (National Pipe Taper) threads should not be disassembled any more than necessary. It will become increasingly difficult to maintain a tight seal with these tapered threads if the joint is made and broken repeatedly.

6. Do not use oil or anti-seize lubricant on threads or fittings if the vessel is to be used with oxygen.

7. If your vessel is equipped with a loose compression ring be sure that it is in place on the head before attaching any head fittings. The compression ring cannot be installed after fittings have been screwed into the head.

8. Clean all threads and gas passages thoroughly and remove all tape fragments when overhauling a vessel. An ultrasonic bath is excellent for cleaning metal parts, but do not place a thermocouple probe, pressure gage, face seals or ball bearings in an ultrasonic bath. Periodic cleaning may be performed on the exterior surfaces of the reactor stand with a damp cloth. All power should be disconnected when cleaning.

9. Routinely inspect the bolts on split ring closures for lubrication and cleanliness. These screws should not be allowed to dry because the threads will seize. Regularly apply Parr High Temperature Anti-Seize Lubricant before this happens. It is important to keep the bolts lubricated so they will not seize and also to achieve the intended torque value.

10. Routinely inspect screw cap threads for wear and cleanliness.

11. If servicing assistance is needed, contact Parr Instrument Company direct at the address shown on the back of these instructions.

Periodic Pressure Tests

All cylinders used in Parr pressure vessels are tested under hydrostatic pressure to 1.3 times their maximum rating before they are released from the factory. Micrometer caliper measurements are taken during this test to check the deflection of the walls and bottom of the cylinder under pressure. Excessive deflection or failure of the metal to resume its original dimensions after pressure is released indicates that a cylinder is potentially unsafe and it will be rejected. Similar tests should be made at regular intervals during the life of each cylinder, particularly whenever the user suspects that his equipment has been overstressed or damaged.

Some laboratories maintain hydraulic test facilities and make it a rule that all pressure vessels must be tested at regular intervals. Records are kept of deflections at specific test pressures so that any increase in deflection becomes a warning that the metal has lost strength. Any cylinder which fails to return to its original dimensions after application of the prescribed hydrostatic tests should be discarded as unsafe for further use.

Users who do not have pressure test facilities can return any Parr pressure vessel to the factory for hydrostatic testing and overhaul. This should be done whenever the metal shows excessive damage from corrosion or whenever an over-pressure or other unusual occurrence raises any safety questions. Please call Parr for a return authorization number for any repair work. Apparatus returned for testing and overhaul should be shipped prepaid to the Parr Instrument Company, 211-53rd Street, Moline, Illinois 61265. An order or letter of instructions should be mailed to the same address, as no repair work will be started without specific instructions.

Material Designations for Alloys other than T316SS

CAA	Titanium Gr4
CAD	Titanium Gr2
CC	Carpenter 20 Cb3
CF	Hastelloy C-2000
CG	Hastelloy B2
CH	Hastelloy C-276
CM	Monel 400
CT	Inconel
CXA	Zirconium 702
CXB	Zirconium 705

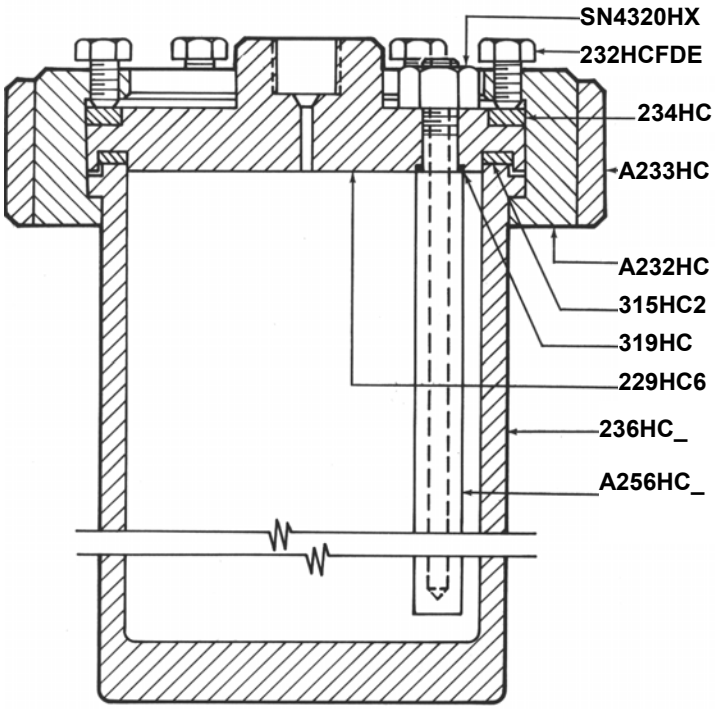
SERIES 4600 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4601	1000 mL	Head, Blank
4602	2000 mL	Head, Blank
4611	1000 mL	Head, one "B" Socket Opening
4612	2000 mL	Head, one "B" Socket Opening
4621	1000 mL	Head, one "B" Socket Opening & Thermowell
4622	2000 mL	Head, one "B" Socket Opening & Thermowell

Working Limits

Maximum Working Pressure (T316SS)	1900 psi 130 bar
Maximum Working Temperature with PTFE confined flat gasket	350 °C

Part No.	Description Flat Gasket Seal
229HC3	Head, Type "B" Socket Opening
229HC6	Head, Type "B" Socket & Thermowell
942HC75	Head, Blank
236HC10	Cylinder, 1000 mL, 5.32" deep
236HC20	Cylinder, 2000 mL, 10.44" deep
315HC2	Head Gasket, PTFE
315HC4KL	Head Gasket, Flexible Graphite
A232HC	Split Ring pair, with cap screws
232HCFDE	Cap Screw for above (6 required)
A233HC	Drop Band with Screw
233HCF	Drop Band Screw
234HC	Compression Ring
A256HC	Thermowell, 2000 mL w/ nut & gasket
A256HC2	Thermowell, 1000 mL w/ nut & gasket
SN4320HX	Thermowell Nut
319HCFH	Thermowell Gasket, Silver
319HCFG	Thermowell Gasket, Gold
A472E2	Thermocouple, 9-1/2", 1000mL
A472E6	Thermocouple, 15-1/2", 2000mL
2584HC	Head/Cylinder Service Fixture
398HC	Pyrex Liner, 1000 mL
398HCHA	PTFE Liner, 1000 mL
399HC	Pyrex Liner, 2000 mL
399HCHA	PTFE liner, 2000 mL



Recommended Bolt Torque:
PTFE - 25 ft / lbs
Flexible Graphite - 35 ft / lbs

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

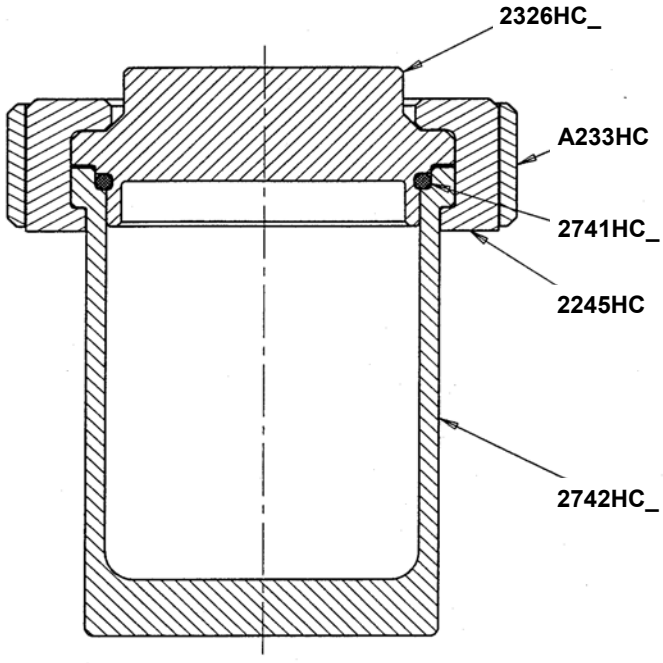
SERIES 4600Q WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4601Q	1000 mL	Head, Blank
4602Q	2000 mL	Head, Blank
4611Q	1000 mL	Head, one "B" Socket Opening
4612Q	2000 mL	Head, one "B" Socket Opening
4621Q	1000 mL	Head, one "B" Socket Opening & Thermowell
4622Q	2000 mL	Head, one "B" Socket Opening & Thermowell

Working Limits

Maximum Working Pressure (T316SS)	1900 psi 130 bar
Maximum Working Temperature	
with FKM O-Ring	225 °C
with FFKM O-Ring	275 °C

Part No	Description O-Ring Seal
2326HC	Head, Blank
2326HC2	Head, Type "B" Socket Opening
2326HC3	Head, Type "B" Socket Opening & Thermowell
2742HC10	Cylinder, 1000 mL, 5.32" deep
2742HC20	Cylinder, 2000 mL, 10.44" deep
2245HC	Split Ring, pair
A233HC	Drop Band with Screw
233HCF	Drop Band Screw
2741HCJV	O-Ring FKM
2741HCJK	O-Ring FFKM
265HC12	Thermowell for 2000 mL vessel
265HC7	Thermowell for 1000 mL vessel
48HC	Thermowell Gasket, Silver
48HCFG	Thermowell Gasket, Gold Plated
A472E2	Thermocouple, 9-1/2", 1000mL
A472E6	Thermocouple, 15-1/2", 2000mL
2584HC	Head/Cylinder Service Fixture
398HC	Pyrex Liner, 1000 mL
398HCHA	PTFE Liner, 1000 mL
399HC	Pyrex Liner, 2000 mL
399HCHA	PTFE Liner, 2000 mL



*For special material vessels add material code for head, cylinder or internal fittings per page 12.

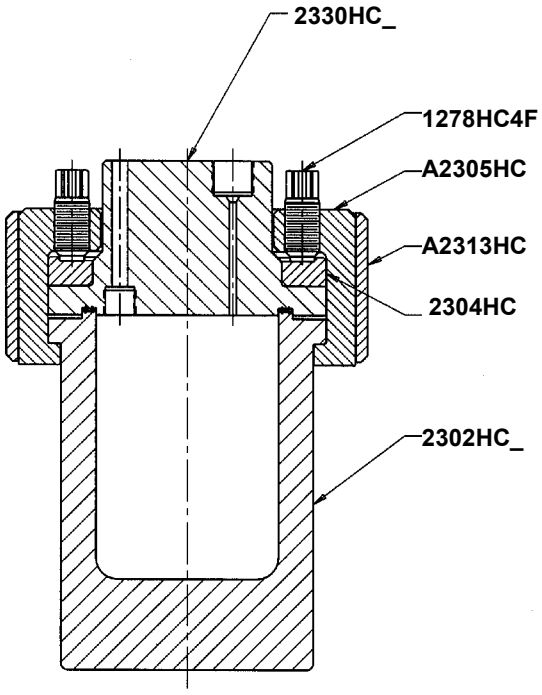
SERIES 4605-4626 HP / HT WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4605	600 mL	Head, Blank
4606	1200 mL	Head, Blank
4615	600 mL	Head, one Type "B" Socket Opening
4616	1200 mL	Head, one Type "B" Socket Opening
4625	600 mL	Head, one Type "B" Socket Opening & Thermowell
4626	1200 mL	Head, one Type "B" Socket Opening & Thermowell

Working Limits

Maximum Working Pressure (T316SS)	5000 psi 345 bar
Maximum Working Temperature with PTFE confined flat gasket	350 °C

Part No	Description Flat Gasket Seal
2330HC	Head, Blank
2330HC2	Head, Type "B" socket
2330HC3	Head, Type "B" socket & Thermowell
2302HC	Cylinder, 600 mL
2302HC10	Cylinder, 1200 mL
2304HC	Compression Ring
A2305HC	Split Ring
1278HC4F	Compression Bolts 5/8 – 18 (8 req.)
A2313HC	Drop Band
233HCF	Bolt for Drop Band
2303HC	Head Gasket, PTFE
2303HC2KL	Gasket, Flexible Graphite
265HC20	Thermowell, 600 mL
2651HC21	Thermowell, 1200 mL
48HC	Thermowell Gasket, Silver
48HCFG	Thermowell Gasket, Gold Plated
A472E2	Thermocouple, 9-1/2”, 1000mL
A472E6	Thermocouple, 15-1/2”, 2000mL
2585HC	Head/Cylinder Service Fixture
2312HC	Pyrex Liner, 600 mL
2312HC2	Pyrex Liner, 1200 mL
2312HC3	PTFE Liner, 600 mL
2312HC4	PTFE Liner, 1200 mL



Recommended Bolt Torque:
5000 PSI 45 ft / lbs
2100 PSI 25 ft / lbs

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

SERIES 4650 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4651	250 mL	Head, one "B" Socket Opening & Thermowell
4652	500 mL	Head, one "B" Socket Opening & Thermowell
4653	1000 mL	Head, one "B" Socket Opening & Thermowell

Working Limits

Maximum Working Pressure (T316SS)

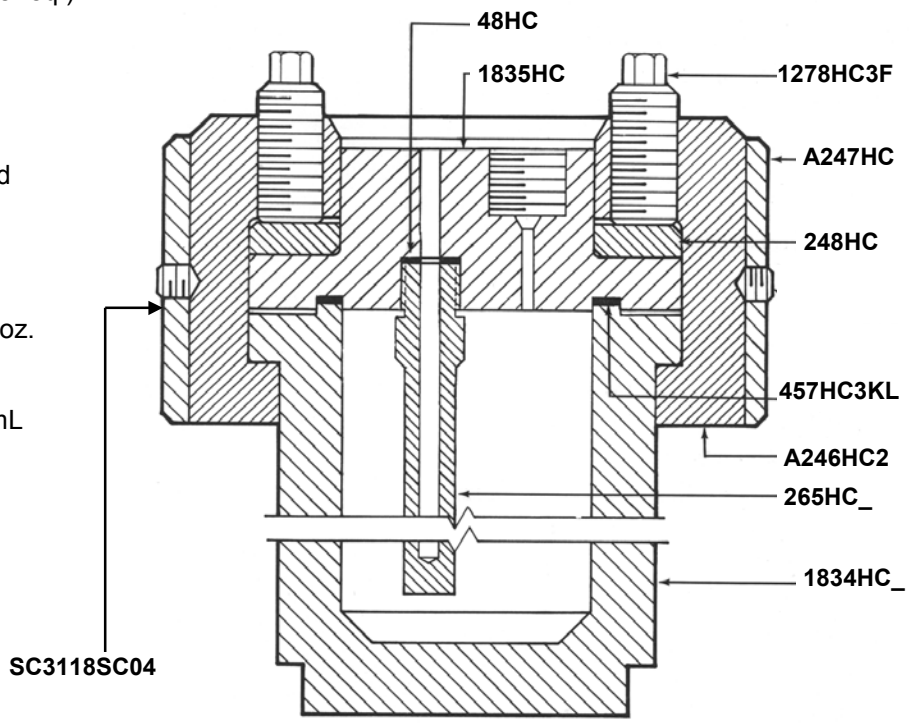
@500 °C	5900 psi	407 bar
@600 °C	4200 psi	290 bar

Maximum Working Temperature 600 °C

Part No	Description Flat Gasket Seal
1835HC	Head, Type "B" Socket Opening & Thermowell
1834HC	Cylinder, 250 mL, 3.25" deep
1834HC2	Cylinder, 500 mL, 6.63" deep
1834HC3	Cylinder, 1000 mL, 13.13" deep
457HC3KL	Head Gasket, Flexible Graphite
457HC2	Head Gasket, PTFE
A246HC2	Split ring, pair, with compression bolts
1278HC3F	Compression bolts for above (8 req.)
A247HC	Drop Band with set screws
SC3118SC04	Set screw for above
TX15SK	5/32 Socket screw key
248HC	Compression Ring
48HC	Thermowell gasket, silver
48HCFG	Thermowell gasket, gold plated
263HC	Thermowell, 1" deep
265HC	Thermowell, 3-1/4" deep
265HC2	Thermowell, 6-1/2" deep
265HC4	Thermowell, 8" deep
424HC2	High Temp. Anti-seize lube, 1 oz.
A472E	Thermocouple, 7-1/2”, 250mL
A472E2	Thermocouple, 9-1/2”, 500mL
A472E6	Thermocouple, 15-1/2”, 1000mL

Recommended Bolt Torque:

5000-6000 PSI	**40 ft / lbs**
2100 PSI	**25 ft / lbs**



*For special material vessels add material code for head, cylinder or internal fittings per page 12.

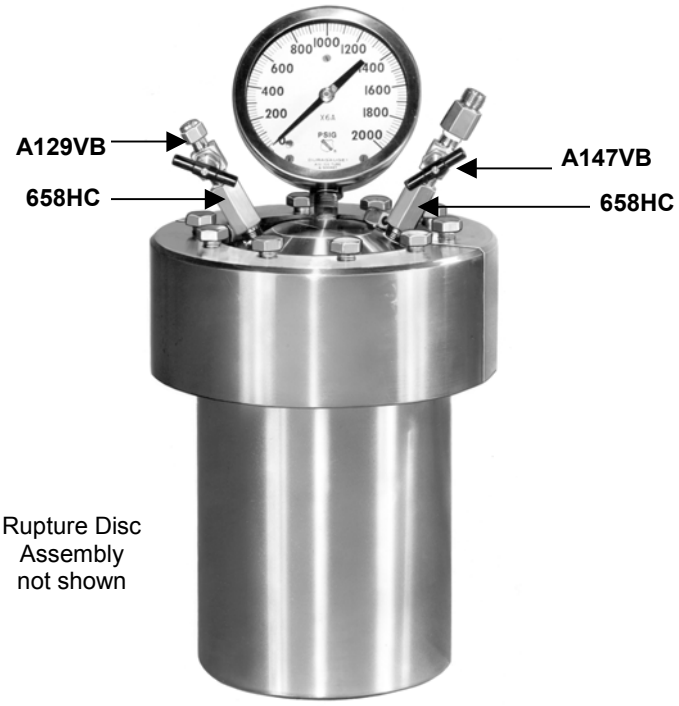
SERIES 4660 WORKING LIMITS AND PARTS LISTS

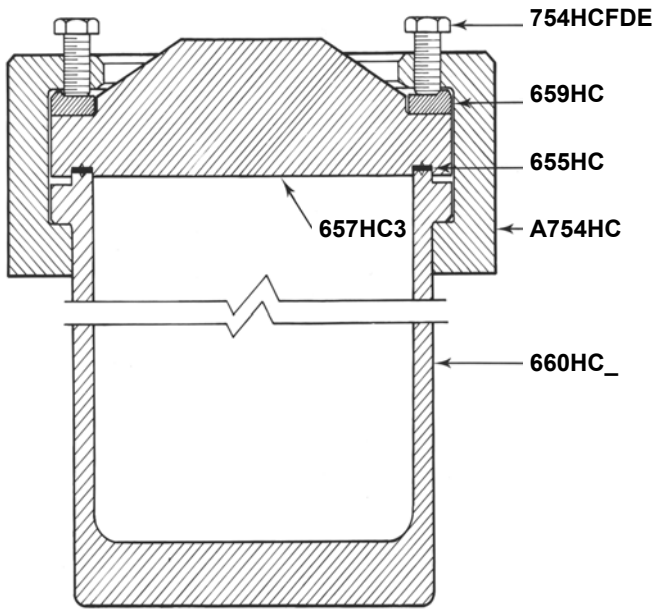
Model No	Size	Head Style
4661	3.8 L	Head, Blank
4662	3.8 L	Head, Valves
4665	7.6 L	Head, Blank
4666	7.6 L	Head, Valves

Working Limits

Maximum Working Pressure		
@ 350 °C (T316SS)	1900 psi	130 bar
Maximum Working Temperature		
with PTFE		350 °C

Part No	Description Flat Gasket Seal
657HC3	Head, Blank
657HC16	Head with 5 threaded openings
660HC	Cylinder, 3.785 L (1 gal), 8.62" deep
660HC6	Cylinder, 7.6 L (2 gal), 17.2" deep
655HC	Head Gasket, PTFE
655HC3KL	Head Gasket, Flexible Graphite
659HC	Compression Ring
A754HC	Split Ring with compression bolts
754HCFDE	Compression Bolts (10 required)
48HC	Thermowell gasket, silver
48HCFG	Thermowell gasket, gold plated
265HC4	Thermowell, 8" deep
A935HC	Thermowell, 16.68" deep
A472E6	Thermocouple, 15-1/2", 1 G
A472E5	Thermocouple, 21-1/2", 2 G
56HCPD	Pressure gauge, 4-1/2", 0-1000 psi
56HCPF	Pressure gauge, 4-1/2", 0-2000 psi
56HCPG	Pressure gauge, 4-1/2", 0-3000 psi
A131VB	Angle Valve, 1/4" NPT (M)
A129VB	Valve, Straight, 1/4" NPT(M) X 1/4"T
A147VB	Valve, Straight, 1/4" NPT(M)
658HC	Valve Extension
686HC	Dip Tube, 1 G
686HC3	Dip Tube, 2 G
A92HWAD	Connector for Dip Tube
A707HC2	Rupture Disc Assembly (See Manual 231M)
708HCP10CT	Rupture disc, Inconel, 1000 psi
708HCP20CT	Rupture disc, Inconel, 2000 psi
708HCP30CT	Rupture disc, Inconel, 3000 psi
2587HC	Head/Cylinder Service Fixture
894HC	Pyrex Liner, 1 G
894HC2	Pyrex Liner, 2 G
894HC4HA	PTFE Liner, 1 G
894HC5HA	PTFE Liner, 2 G





Recommended Bolt Torque:
PTFE - 25 ft / lbs
Flexible Graphite - 35 ft / lbs

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

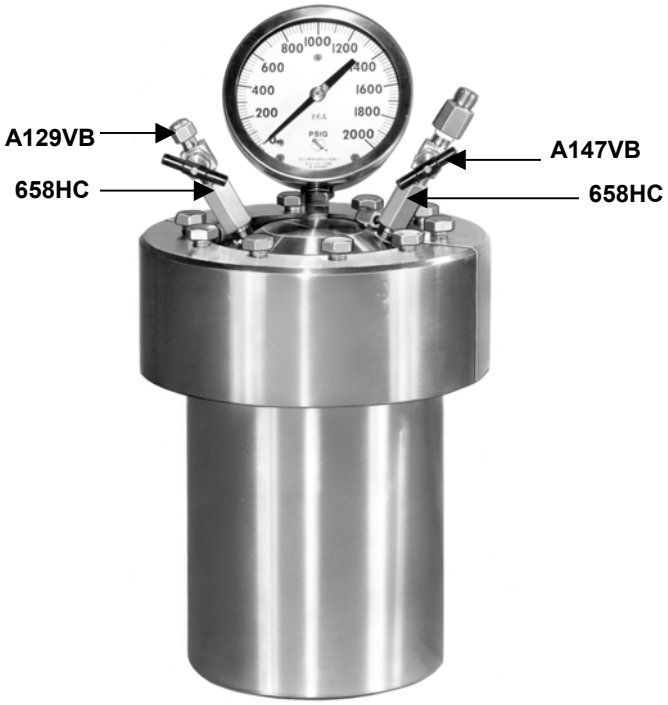
SERIES 4660Q WORKING LIMITS AND PARTS LISTS

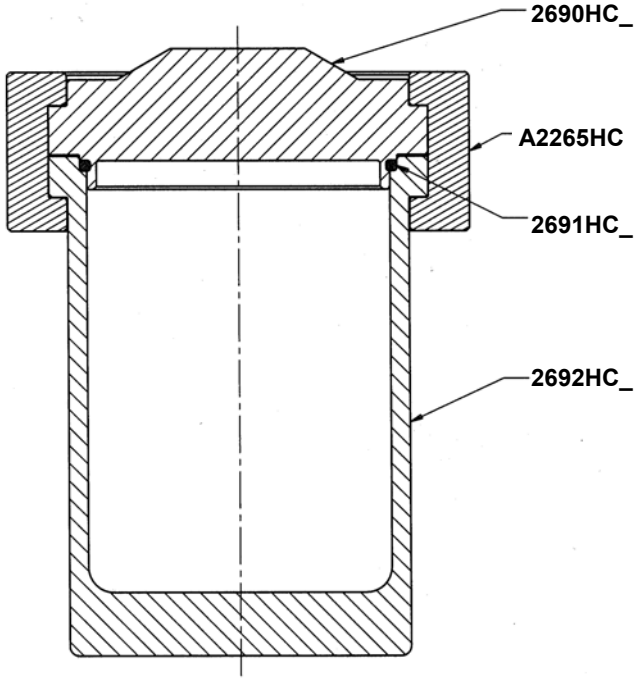
Model No	Size	Head Style
4661Q	3.8 L	Head, Blank
4662Q	3.8 L	Head, Valves
4665Q	7.6 L	Head, Blank
4666Q	7.6 L	Head, Valves

Working Limits

Maximum Working Pressure (T316SS)	1900 psi	130 bar
Maximum Working Temperature		
with FKM O-Ring		225 °C
with FFKM O-Ring		275 °C

Part No	Description O-Ring Seal
2690HC2	Head, Blank
2690HC3	Head with 5 threaded openings
2692HC10	Cylinder, 3.785 L (1 gal), 8.62" deep
2692HC20	Cylinder, 7.57 L (2 gal), 17.25" deep
A2265HC	Split Ring with latches
48HC	Thermowell gasket, silver
48HCFG	Thermowell gasket, gold plated
265HC4	Thermowell, 8" deep
A935HC	Thermowell, 16.68" deep
A472E6	Thermocouple, 15-1/2”, 1 G
A472E5	Thermocouple, 21-1/2”, 2 G
56HCPD	Pressure gauge, 4-1/2", 0-1000 psi
56HCPF	Pressure gauge, 4-1/2", 0-2000 psi
56HCPG	Pressure gauge, 4-1/2", 0-3000 psi
2691HCJV	O-Ring, FKM
2691HCJE	O-Ring, EP
A129VB	Valve, Straight, 1/4"NPT (M) x 1/4"T
A130VB	Angle Valve, T316SS, 1/4"NPT (M) x 1/4"T
A131VB	Angle Valve, T316SS, 1/4"NPT (M)
A147VB	Valve, Straight, 1/4” NPT (M)
A707HC2	Rupture Disc Assembly (See Manual 231M)
708HCP10CT	Rupture disc, Inconel, 1000psi
708HCP20CT	Rupture disc, Inconel, 2000 psi
708HCP30CT	Rupture disc, Inconel, 3000 psi
658HC	Valve Extension
686HC	Dip Tube, 1 G
686HC3	Dip Tube, 2 G
A92HWAD	Connector for Dip Tube
2587HC	Head/Cylinder Service Fixture
894HC	Pyrex Liner, 1 G
894HC2	Pyrex Liner, 2 G
894HC4HA	PTFE Liner, 1 G
894HC5HA	PTFE Liner, 2 G





*For special material vessels add material code for head, cylinder or internal fittings per page 12.

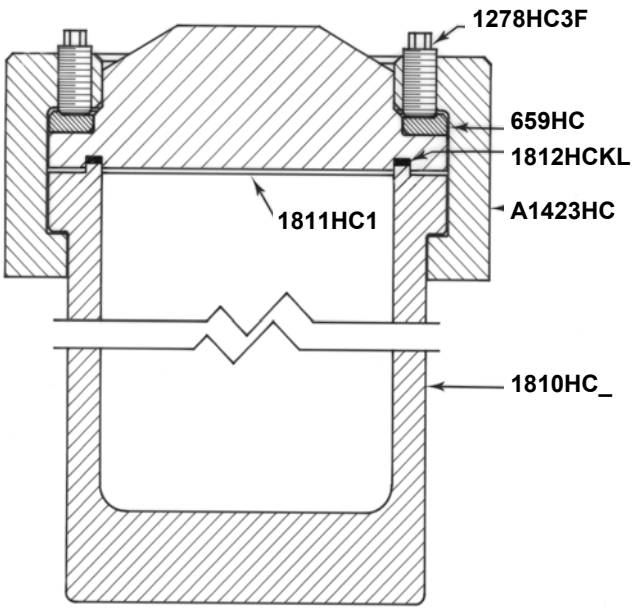
SERIES 4670 – 4674 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4671	3.8 L	Head, Blank
4672	3.8 L	Head, Valves
4673	5.8 L	Head, Blank
4674	5.8 L	Head, Valves

Working Limits

Maximum Working Pressure		
@500 °C (T316SS)	3000 psi	207 bar
@600 °C (T316SS)	2200 psi	152 bar
Maximum Working Temperature		
with PTFE		350 °C
with FG		500 °C

Part No	Description Flat Gasket Seal
1811HC1	Head, blank
1811HC6	Head with five openings
1810HC	Cylinder, 3.8 L, 9.95" deep
1810HC3	Cylinder, 5.8 L, 15.19" deep
1812HCHA	Head Gasket, PTFE
1812HCKL	Head Gasket, Flexible Graphite
659HC	Compression Ring
A1423HC	Split ring, pair, with compression Bolts
1278HC3F	Compression bolt for above (16 required)
265HC4	Thermowell, 7.75" deep
265HC10	Thermowell, 11.87" deep
48HC	Thermowell Gasket, Silver
48HCFG	Thermowell Gasket, Gold Plated
A472E6	Thermocouple, 15-1/2”, 1G
A472E5	Thermocouple, 21-1/2”, 1.5G
209HC4	Bushing
208HC11	Adapter, Valve, ¼ NPTM
208HC13	Adapter, Valve, ¼ NPTM X ¼ NPTF
208HC15	Adapter, Angled, two ¼ NPTF
A176VB	Valve, ¼ NPTF
491HCAD	Nipple, Hex, Brass, ¼ NPTM
1446HC	Adapter, “A” cone, X ¼ NPTM
A1417HC	Rupture Disc Assembly (See 231M)
2587HC	Head/Cylinder Service Fixture



Recommended Bolt Torque:
3000 PSI 35 ft / lbs

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

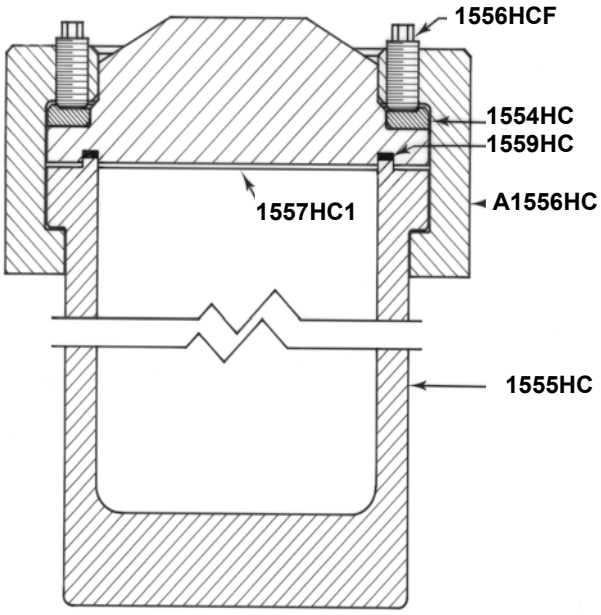
SERIES 4676 – 4677 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4676	5 gal	Head, Blank
4677	5 gal	Head, Valves

Working Limits

Maximum Working Pressure		
@350 °C (T316SS)	1900 psi	131 bar
Maximum Working Temperature		
with PTFE		350 °C

Part No	Description Flat Gasket Seal
1557HC1	Head, blank
1557HC3	Head, w/ openings for inlet & outlet valves, thermowell, rupture disc and gage
1555HC	Cylinder, 5 gal, 16.68" deep
1555HC2	Cylinder, 5 gal, w/ 3/4" NPT bottom opening
1559HC	Head gasket, PTFE
1559HC2KL	Head gasket, Flexible Graphite
1554HC	Compression Ring
A1556HC	Split ring, pair, with compression bolts
1556HCF	Compression bolt for above (12 required)
A278VBAD	Valve, straight, 3/8" NPT (M), T316SS
A279VBAD	Valve, angle, 3/8" NPT (M), T316SS
265HC15	Thermowell, 15.94”
1571HC	Head Lift Rings
1593HC	Cylinder Lift Rings
1566HC	Valve Extension
A472E5	Thermocouple, 21-1/2”, SS
56HCPD	Pressure gauge, 4-1/2", 0-1000 psi
56HCPF	Pressure gauge, 4-1/2", 0-2000 psi
56HCPG	Pressure gauge, 4-1/2", 0-3000 psi
A707HC2	Rupture Disc Assembly (See Manual 231M)
708HCP10CT	Rupture disc, Inconel, 1000 psi
708HCP20CT	Rupture disc, Inconel, 2000 psi
708HCP30CT	Rupture disc, Inconel, 3000 psi
1567HC	Dip Tube, 3/8” O.D.
275VBAD	Connector, 3/8” NPT (M) x 3/8”T



Recommended Bolt Torque:

PTFE	**500 PSI**	**35 ft / lbs**
	1000 PSI	**70 ft / lbs**
	1500 PSI	**100 ft / lbs**
	1900 PSI	**135 ft / lbs**

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

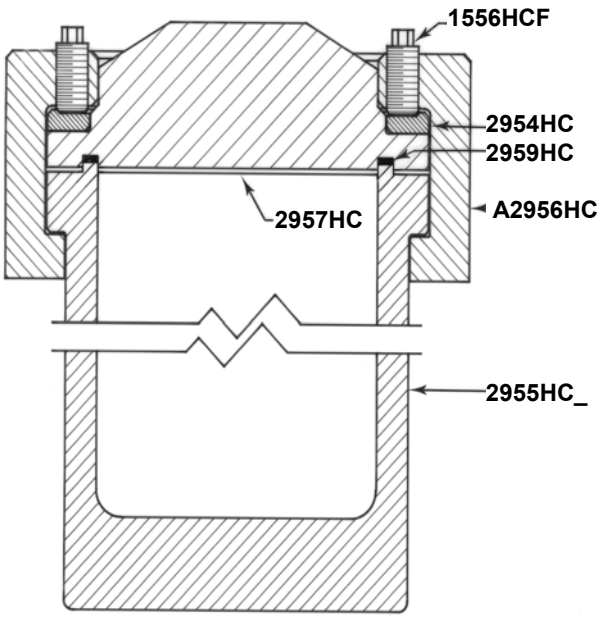
SERIES 4678 – 4679 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4678	2.5 gal	Head, Blank
4679	2.5 gal	Head, Valves

Working Limits

Maximum Working Pressure @350 °C (T316SS)	1900 psi	131 bar
Maximum Working Temperature with PTFE		350 °C

Part No	Description Flat Gasket Seal
2957HC10	Head, Blank
2957HC11	Head, w / openings, w/inlet & outlet valves, thermowell, rupture disc and gage
2955HC	Cylinder, 10 L
2955HC2	Cylinder, 10 L w/ ¾"NPT
A2956HC	Split Ring
1556HCF	Compression bolt for above (12 required)
A278VBAD	Valve, straight, 3/8" NPTM, T316SS
A279VBAD	Valve angle, 3/8" NPTM, T316SS
265HC10	Thermowell, 12.12"
1571HC	Head Lift Rings
1593HC	Cylinder Lift Rings
2959HC	PTFE Gasket
2954HC	Compression Ring
1566HC	Valve Extension
A472E6	Thermocouple, 15-1/2"
56HCPD	Pressure gauge, 4-1/2", 0-1000 psi
56HCPF	Pressure gauge, 4-1/2", 0-2000 psi
56HCPG	Pressure gauge, 4-1/2", 0-3000 psi
A707HC2	Rupture Disc Assembly (See Manual 231M)
708HCP10CT	Rupture disc, Inconel, 1000 psi
708HCP20CT	Rupture disc, Inconel, 2000 psi
708HCP30CT	Rupture disc, Inconel, 3000 psi
1567HC	Dip Tube, 3/8" O.D.
275VBAD	Connector, 3/8" NPT (M) x 3/8"T



Recommended Bolt Torque:

PTFE	500 PSI	25 ft / lbs
	1000 PSI	70 ft / lbs
	1500 PSI	100 ft / lbs
	1900 PSI	135 ft / lbs

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

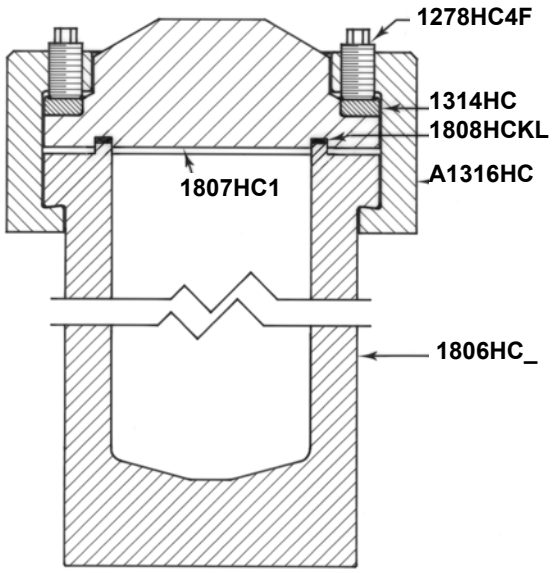
SERIES 4680 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4680	1000 mL	Head, Blank
4681	1800 mL	Head, one “B” Socket Opening & Thermowell
4682	1000 mL	Head, Blank
4683	1800 mL	Head, one “B” Socket Opening & Thermowell

Working Limits

Maximum Working Pressure		
@350 °C (T316SS)	6000 psi	414 bar
@500 °C (T316SS)	5000 psi	345 bar
@600 °C (T316SS)	4000 psi	276 bar
Maximum Working Temperature		
with PTFE		350 °C
with FG		600 °C

Part No	Description Flat Gasket Seal
1807HC1	Head, Blank
1807HC4	Head, Type “B” Socket Opening & Thermowell
1806HC	Cylinder, 1000 mL, 6.24" deep
1806HC3	Cylinder, 1800 mL, 10.62" deep
1808HCHA	Head Gasket, PTFE
1808HCKL	Head Gasket, Flexible Graphite
1314HC	Compression Ring
A1316HC	Split ring, pair, w/ compression bolts
1278HC4F	Compression bolts for above (12 required)
48HC	Thermowell gasket, silver
48HCFG	Thermowell gasket, gold plated
265HC6	Thermowell, 5.75" deep
265HC8	Thermowell, 10.19" deep
36HC5	Handles
1368HC	Torque Wrench
1369HC	Torque Adapter
A472E2	Thermocouple, 9-1/2”, SS
A472E6	Thermocouple, 15-1/2”, SS
2586HC	Head/Cylinder Service Fixture
1441HC	Pyrex Liner, 1000 mL
1442HC	Pyrex Liner, 1800 mL
1441HCHA	PTFE Liner, 1000 mL
1442HCHA	PTFE Liner, 1800 mL



Recommended Bolt Torque:
PTFE 2100 PSI 25 ft / lbs
PTFE or Graphoil
4000 – 6000 PSI 40 ft / lbs

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

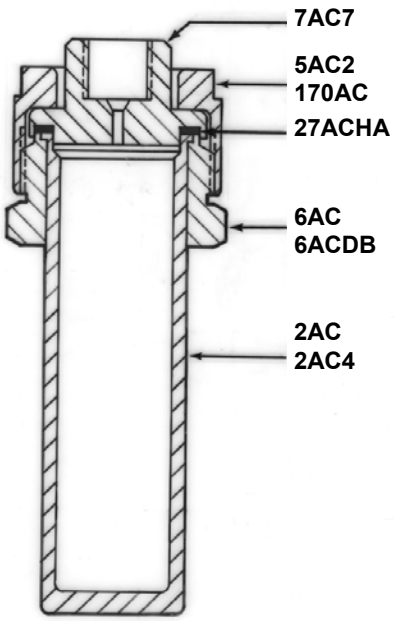
SERIES 4700 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style	Closure Material
4701	22 mL	Head, Blank	Brass
4702	22 mL	Head, one Type "A" Socket Opening	Brass
4703	22 mL	Head, Blank	Steel
4704	22 mL	Head, one Type "A" Socket Opening	Steel
4711	45 mL	Head, Blank	Brass
4712	45 mL	Head, one Type "A" Socket Opening	Brass
4713	45 mL	Head, Blank	Steel
4714	45 mL	Head, one Type "A" Socket Opening	Steel

Working Limits

Maximum Working Pressure (T316SS)	1000 psi	69 bar
Maximum Working Temperature		
with Brass Closure		250 °C
with Steel Closure		300 °C

Part No	Description Flat Gasket Seal
2AC	Cup, 22 mL, 1.62" deep
2AC4	Cup, 45 mL, 3.81" deep
5AC2	Screw Cap, brass, plated
170AC	Screw cap, alloy steel
6AC	Body Sleeve, brass, plated
6ACDB	Body Sleeve, alloy steel
7AC7	Cover with Type "A" socket opening
7AC8	Cover with 1/4" NPT opening
7AC11	Cover, flat, blank
27ACHA	Gasket, PTFE
21AC4	Wrench, 1-5/8" octagon
A22AC3	Holder Socket with screws



Recommended Torque with PTFE Gasket:

15 ft / lbs	500 PSI
20 ft / lbs	1000 PSI
30 ft / lbs	1500 PSI
40 ft / lbs	1700 PSI

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

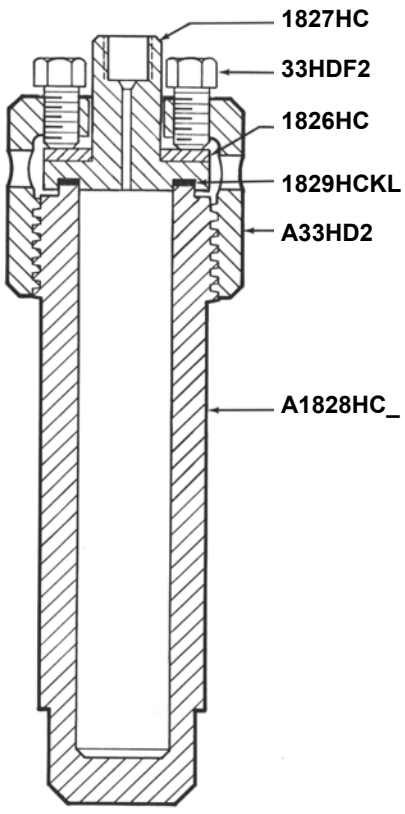
SERIES 4740 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4740	75 mL	Head, one Type "A" Socket Opening
4742	22 mL	Head, one Type "A" Socket Opening

Working Limits

Maximum Working Pressure		
@350 °C	8500 psi	586 bar
@600 °C	1850 psi	128 bar
Maximum Working Temperature		600 °C

Part No	Description Flat Gasket Seal
1827HC	Head with one Type "A" Socket
A1828HC	Cylinder, 75 mL, w/ A33HD2 screw cap
A1828HC2	Cylinder, 22 mL, w/ A33HD2 screw cap
1829HCKL	Head Gasket, Flexible Graphite
1826HC	Compression Ring
A33HD2	Screw cap with cap screws, alloy steel
33HDF2	Cap screw for above (6 required)
*A33HD2CH	Screw Cap, Hastelloy C
27ACHA	PTFE Gasket
40HD	Pyrex Liner, 75 mL



Recommended Bolt Torque:
8500 PSI 15 ft / lbs

*Required for max work pressure 5700 psi at 600 °C temp. for vessel of T316SS.

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

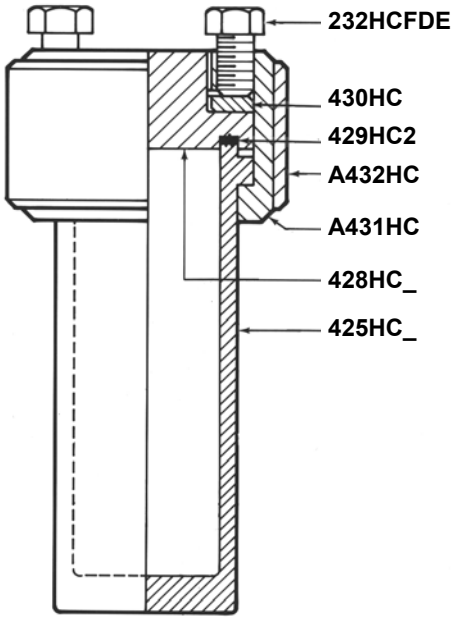
SERIES 4750 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4750	125 mL	Head, Blank
4751	125 mL	Head, one Type "A" Socket Opening
4752	200 mL	Head, Blank
4753	200 mL	Head, one Type "A" Socket Opening
4754	125 mL	Head, one Type "A" Socket Opening & 1/8" NPT with Thermocouple
4755	200 mL	Head, one Type "A" Socket Opening & 1/8" NPT with Thermocouple

Working Limits

Maximum Working Pressure @ 350 °C (T316SS)	3000 psi	207 bar
Maximum Working Temperature		350 °C

Part No	Description Flat Gasket Seal
428HC	Head, blank
428HC3	Head, with Type "A" socket
428HC9	Head, with two 1/8" NPT
428HC11	Head, Type "A" socket & 1/8" NPT
428HC22	Head, Type "A" socket & 1/8" NPT for thermowell
425HC	Cylinder, 128 mL, 4.44" deep
425HC3	Cylinder, 200 mL, 6.94" deep
429HC2	Gasket, PTFE
429HC2KL	Gasket, Flexible Graphite
430HC	Compression Ring
A431HC	Split ring, pair, with cap screws
232HCFDE	Cap Screw for above (6 required)
A432HC	Drop band with set screw
456HCF2	Set screw for above
A833HC	Male Connector for thermocouple
A472E	Thermocouple, 7-1/2", SS
A472E2	Thermocouple, 9-1/2", SS
A138CA	Male Connector for thermowell
A1453HC	Thermowell



Recommended Bolt Torque:
PTFE or Graphoil
15 ft / lbs max

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

SERIES 4760 – 4777 WORKING LIMITS AND PARTS LISTS

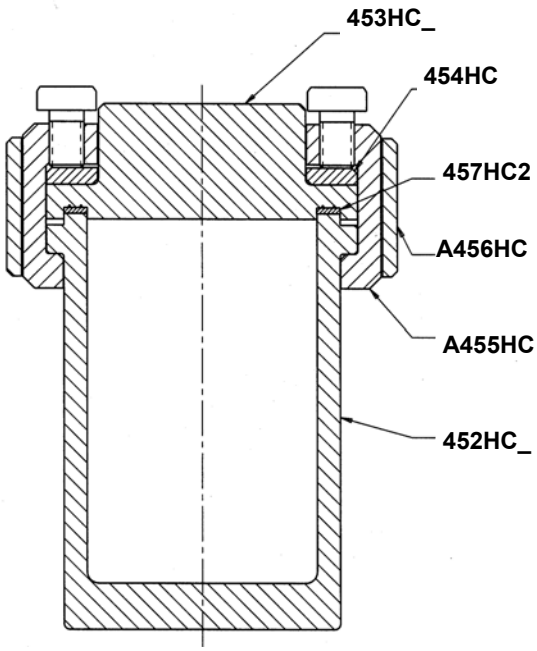
Model No	Size	Head Style
4760	300 mL	Head, Blank
4761	300 mL	Head, one Type "A" Socket
4762	450 mL	Head, Blank
4763	450 mL	Head, one Type "A" Socket
4764	600 mL	Head, Blank
4765	600 mL	Head, one Type "A" Socket
4766	300 mL	Head, one Type "A" Socket & 1/8” NPT
4767	450 mL	Head, one Type "A" Socket & 1/8” NPT
4768	600 mL	Head, one Type "A" Socket & 1/8” NPT
4772	160 mL	Head, Blank
4773	160 mL	Head, one Type "A" Socket
4774	160 mL	Head, one Type "A" Socket & 1/8” NPT
4775	100 mL	Head, Blank
4776	100 mL	Head, one Type "A" Socket
4777	100 mL	Head, one Type "A" Socket & 1/8” NPT

Working Limits

Maximum Working Pressure		
@350 °C	2950 psi	207 bar
Maximum Working Temperature		
with PTFE confined flat gasket		350 °C

Part No	Description Flat Gasket Seal
453HC	Head with one Type "A" Socket
453HC4	Head, blank
453HC5	Head, with one Type "A" Socket & 1/8” NPT
453HC79	Head, with Type “A” Socket & 1/8” NPT for thermowell (special material)
452HC	Cylinder, 300 mL, 3.94" deep
452HC2	Cylinder, 450 mL, 5.94" deep
452HC3	Cylinder, 600 mL, 7.94" deep
452HC9	Cylinder, 160 mL, 2.00" deep
452HC8	Cylinder, 100 mL, 2.00" deep, 2” ID
457HC2	Gasket, PTFE
457HC3KL	Gasket, Flexible Graphite
454HC	Compression Ring
A455HC	Split ring, pair, with cap screws
232HCFDE	Cap screw for above (6 required)
A456HC	Drop band with set screw
456HCF	Set screw for above
A833HC	Connector for thermocouple
A472E	Thermocouple, 7-1/2”, SS
A472E2	Thermocouple, 9-1/2”, SS
A472E3	Thermocouple, 11-1/2, SS
A1453HC	Thermowell
A138CA	Connector for thermowell
2583HC	Head/Cylinder Service Fixture

Recommended Bolt Torque:
PTFE - 25 ft / lb
Flexible Graphite - 35 ft / lb



Liners

Volume	Pyrex	PTFE
100 mL	762HC7	762HC7HA
160 mL	762HC8	762HC8HA
300 ML	762HC	762HC4HA
450 mL	762HC2	762HC5HA
600 mL	762HC3	762HC6HA

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

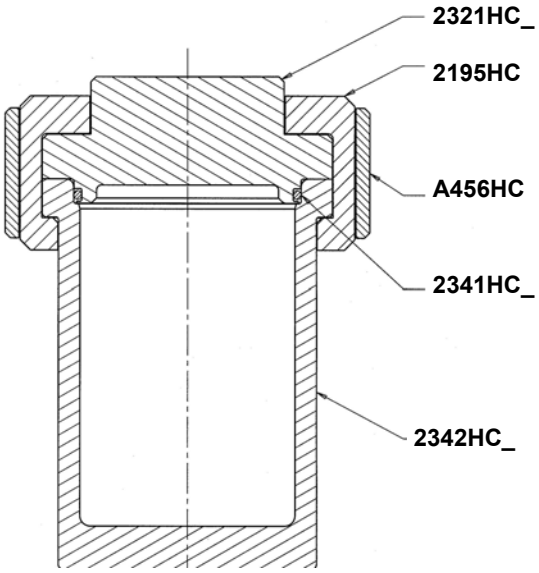
SERIES 4760Q - 4777Q WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4760Q	300 mL	Head, Blank
4761Q	300 mL	Head, one Type "A" Socket
4762Q	450 mL	Head, Blank
4763Q	450 mL	Head, one Type "A" Socket
4764Q	600 mL	Head, Blank
4765Q	600 mL	Head, one Type "A" Socket
4766Q	300 mL	Head, one Type "A" Socket & 1/8” NPT
4767Q	450 mL	Head, one Type "A" Socket & 1/8” NPT
4768Q	600 mL	Head, one Type "A" Socket & 1/8” NPT
4772Q	160 mL	Head, Blank
4773Q	160 mL	Head, one Type "A" Socket
4774Q	160 mL	Head, one Type "A" Socket
4775Q	100 mL	Head, Blank
4776Q	100 mL	Head, one Type "A" Socket
4777Q	100 mL	Head, one Type "A" Socket & 1/8” NPT

Working Limits

Maximum Working Temperature

with FKM O-Ring	225 °C
with FFKM O-Ring	275 °C



Part No	Description O-Ring Seal
2321HC	Head, blank
2321HC2	Head with Type "A" socket
2321HC3	Head with Type "A" socket & 1/8” NPT
2342HC	Cylinder, 300 mL, 3.94" deep
2342HC2	Cylinder, 450 mL, 5.94" deep
2342HC3	Cylinder, 600 mL, 7.94" deep
2342HC4	Cylinder, 100 mL, 2.00” deep, 2” ID
2342HC5	Cylinder, 160 mL, 2.00" deep
2341HCJV	O-Ring, FKM
2341HCJK	O-Ring, FFKM
2195HC	Split ring, pair
A456HC	Drop band with set screw
456HCF	Set screw for above
A833HC	Connector for thermocouple
A472E	Thermocouple, 7-1/2”, SS
A472E2	Thermocouple, 9-1/2”, SS
A472E3	Thermocouple, 11-1/2, SS
A1453HC	Thermowell
A138CA	Connector for thermowell
2587HC	Head/Cylinder Service Fixture

Liners

Volume	Pyrex	PTFE
100 mL	762HC7	762HC7HA
160 mL	762HC8	762HC8HA
300 ML	762HC	762HC4HA
450 mL	762HC2	762HC5HA
600 mL	762HC3	762HC6HA

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

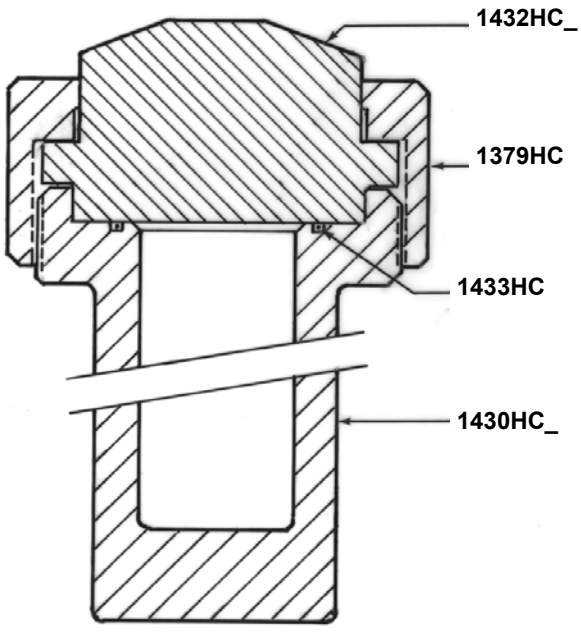
SERIES 4790 WORKING LIMITS AND PARTS LISTS

Model No	Size	Head Style
4791	25 mL	Head, with 4 openings
4792	50 mL	Head, with 4 openings
4793	100 mL	Head, with 4 openings

Working Limits

Maximum Working Pressure (T316SS)		
@275 °C	3000 psi	207 bar
Maximum Working Temperature		
with FKM O-Ring		225 °C
with FFKM O-Ring		275 °C
with EP O-Ring		150 °C
with PTFE O-Ring		350 °C

Part No	Description O-Ring Seal and Screw Cap
1432HC	Head w/three 1/8” NPT & rupture disc port, T316SS
1430HC	Cylinder, 25 mL, 2" deep
1430HC2	Cylinder, 50 mL, 2.25" deep
1430HC3	Cylinder, 100 mL, 4.5" deep
1433HCJE	O-Ring Gasket, EP
1433HCJK	O-Ring Gasket, FFKM
1433HCJV	O-Ring Gasket, FKM
1379HC	Screw Cap
1431HC	Pyrex Liner, 50 mL
1431HC2	Pyrex Liner, 100 mL
1431HCHA	PTFE Liner, 50 mL
1431HC2HA	PTFE Liner, 100 mL



EXTERNAL PARTS LIST FOR SERIES 4790

195VBAD	Tee, 1/8” NPT
836HC	Gage Adapter
420HC	Adapter, A socket x 1/8” NPT
A888HC2	Rupture Disc Assembly (See Manual 231M)
526HCPD	Rupture Disc, 1000 psi
526HCPF	Rupture Disc, 2000 psi
526HCPG	Rupture disc, 3000 psi
593HCPD	Pressure Gage, 0-1000 psi
593HCPF	Pressure Gage, 0-2000 psi
593HCPG	Pressure Gage, 0-3000 psi
A122VB	Valve, Straight, 1/8” NPT (M)
A146VB	Valve, Angle, 1/8” NPT (M)
A472E4	Thermocouple, 5-1/2”
A472E	Thermocouple, 7-1/2”
A833HC	Connector for Thermocouple
1467HC	Thermowell
A138CA	Thermowell Connector
1443HC	Dip Tube, 25 mL
1443HC2	Dip Tube, 50 mL
1443HC3	Dip Tube, 100 mL
2589HC	Head/Cylinder Service Fixture

*For special material vessels add material code for head, cylinder or internal fittings per page 12.

SERIES 4790 ALTERNATE PARTS LISTS

Vessel with O-Ring Seal & Easy Close Split Ring

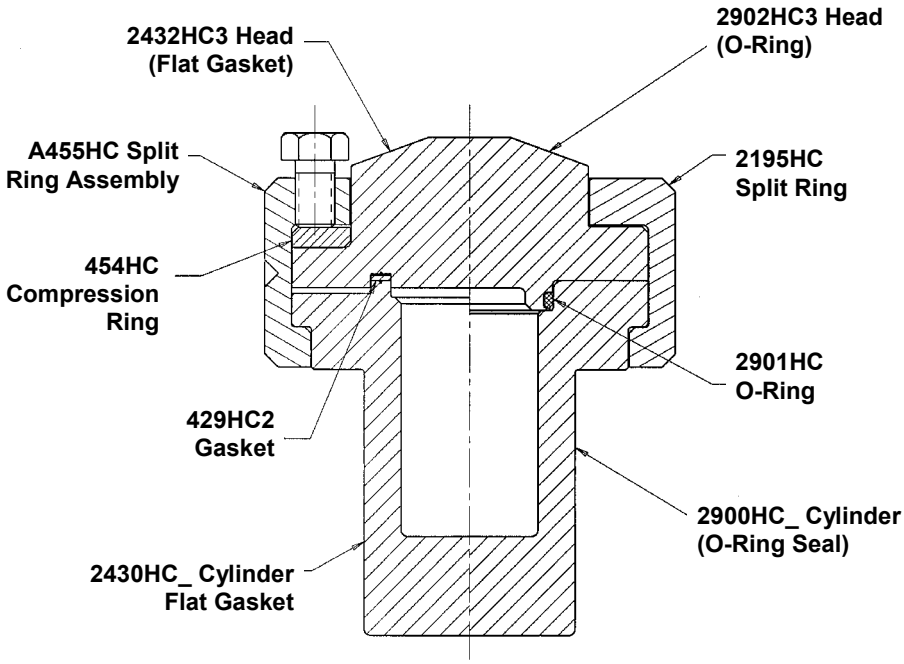
2522HC3	Head with three 1/8" NPT & rupture disc port
2520HC	Cylinder, 25 mL
2520HC2	Cylinder, 50 mL
2520HC3	Cylinder, 100 mL
2521HCJV	O-Ring, FKM
2521HCJK	O-Ring, FFKM
2195HC	Split Ring
A456HC	Drop Band

Vessel with PTFE Flat Gasket & Split Ring

2432HC3	Head with three 1/8" NPT & rupture disc port
2430HC	Cylinder, 25 mL
2430HC2	Cylinder, 50 mL
2430HC3	Cylinder, 100 mL
429HC2	Head Gasket, PTFE
454HC	Compression Ring
A455HC	Split Ring
A456HC	Drop Band
232HCFDE	Bolt for Split Ring

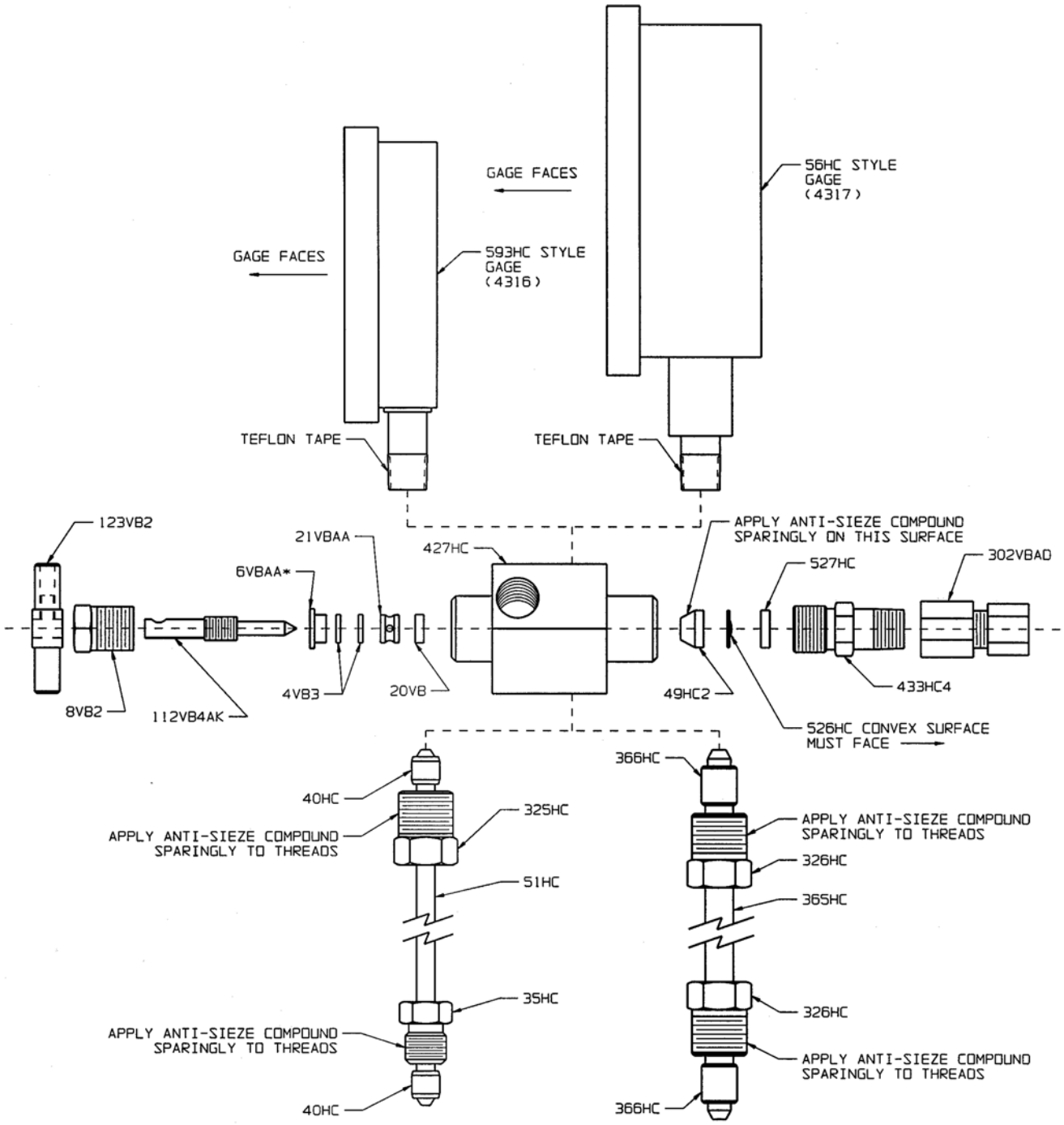
EXTERNAL PARTS LIST FOR SERIES 4790

195VBAD	Tee, 1/8" NPT
836HC	Gage Adapter
420HC	Adapter, A socket x 1/8" NPT
A888HC2	Rupture Disc Assembly (See Manual 231M)
526HCPD	Rupture Disc, 1000 psi
526HCPF	Rupture Disc, 2000 psi
526HCPG	Rupture disc, 3000 psi
593HCPD	Pressure Gage, 0-1000 psi
593HCPF	Pressure Gage, 0-2000 psi
593HCPG	Pressure Gage, 0-3000 psi
A122VB	Valve, Straight, 1/8" NPT (M)
A146VB	Valve, Angle, 1/8" NPT (M)
A472E4	Thermocouple, 5-1/2"
A472E	Thermocouple, 7-1/2"
A833HC	Connector for Thermocouple
1467HC	Thermowell
A138CA	Thermowell Connector
1443HC	Dip Tube, 25 mL
1443HC2	Dip Tube, 50 mL
1443HC3	Dip Tube, 100 mL
2588HC	Head/cylinder Service Fixture Flat Gasket
2589HC	Head/Cylinder Service Fixture O-Ring
1431HC	Pyrex Liner, 50 mL
1431HC2	Pyrex Liner, 100 mL
1431HCHA	PTFE Liner, 50 mL
1431HC2HA	PTFE Liner, 100 mL



Recommended Bolt Torque:
PTFE - 15 ft / lb
Flexible Graphite - 15 ft / lb

*For special material vessels add material code for head, cylinder or internal fittings per page 12.



"A" SOCKET CONNECTION (4316)

"B" SOCKET CONNECTION (4317)

4316 - 4317 Gage Block Assemblies Parts List

112VB4AK	Valve needle
123VB2	Valve handle
126VB	Lantern ring for high temp service (Use w/4VB4KL packing w/out 20VB)
20VB	Valve seat, Kel-F
21VBAA	Lantern ring (see also 126VB)
302VBAD	Tube connector, 1/4"NPT (F) x 3/8 OD tube
325HC	Compression Nut
326HC	Compression nut for 3/8" tube
35HC	Compression nut, short
365HC	Connecting tube, 3/8" OD x 3" length
366HC	Collar, LH thread, 3/8" tube
4VB3	Packing ring, PTFE (2 required)
4VB4KL	Packing ring, Flexible Graphite
40HC	Collar, L.H. thread
427HC	Gage block, bare
433HC4	Rupture disc nut
49HC2	Orifice, cone bottom
51HC	Connecting tube, 1/4" OD x 3-1/4"
526HC	**Rupture discs, alloy 600** (See Manual 231M)
526HCPD	1000 psi
526HCPF	2000 psi
526HCPG	3000 psi
526HCPH	5000 psi
526HCPJ	8000 psi
526HCPL	12000 psi
527HC	Orifice ring
56HC	Pressure gages, 4-1/2" dia, T316SS
56HCPA	0-100 psi
56HCPB	0-200 psi
56HCPC	0-600 psi
56HCPD	0-1000 psi
56HCPF	0-2000 psi
56HCPG	0-3000 psi
56HCPH	0-5000 psi
56HCPK	0-10000 psi
593HC	**Pressure gages, 3-1/2" dia. T316SS**
593HCP1AD	0-100 psi
593HCP2AD	0-200 psi
593HCP3AD	0-300 psi
593HCP6AD	0-600 psi
593HCPD	0-1000 psi
593HCPF	0-2000 psi
593HCPG	0-3000 psi
6VBAA	Packing Cover
8VB2	Packing nut

Gage block parts for use on vessels rated for 3000 psig if user intends to operate at maximum rating:

A175VB	Relief valve, set at 3100 psi
526HCP33YD	Rupture Disc, scored, 3300 psi
593HCP40AD	Pressure gage, 3-1/2" dia., 0-4000 psi

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