4555-4558

2.6 & 5 Gallon Reactor Systems

Operating Instruction Manual





PREFACE 3

Scope 3
Related Instructions 3
Intended Usage 3
Safety Information 3
General Specifications 3
Explanation of Symbols 4
Environmental Conditions 4
Unpack Carefully 4
Provisions for Lifting and Carrying 4
Cleaning & Maintenance 4
Users Responsibility 5

INSTALLATION 6

Pressure and Temperature Limits 6
Assemble the Reactor 6
Moveable Head Vessel 6
Fixed Head Vessel 7
A1761HC3 400/415V 3-Phase "Y" Slave Box Control 7

IDENTIFY THE VALVES 8

Gas Inlet Valve 8
Gas Release Valve 8
Liquid Sampling Valve 8

OTHER VESSEL HEAD FITTINGS 9

Safety Rupture Disc 9
Type J Thermocouple 9
Pressure Gage 9
Gage and Valve Adapters 9

ACCESSORIES 9

Internal Cooling Coils 9
Stirrer Drive Systems 9
Quick Disconnect Drive Coupler 10
Air Motor 10
Variable Speed Electric Motor 10
Spare Parts Kit 10

HOW TO USE THE VESSEL 11

Flat Gasket or Self Sealing O-ring Closure 11
Open the Vessel 11
Before Closing the Vessel 11
Close the Vessel 11
Gas Connections 12
Pressurizing the Vessel 12
Do Not Overfill the Vessel 12
Releasing Pressure 12
Withdrawing Liquid Samples 12
The Shaft Seal 12
Reactors With Slave Box Controls 12
Initial Operating Test 13

MAINTENANCE 14

General Maintenance Notes 14
Fuses 14
Periodic Pressure Tests 15
Technical Support 15

PARTS LIST 16

Vessel Parts 16
Internal Parts 17
External Fittings 17
Drive Parts List 19
Stand Parts 19
Slave Boxes 19
Heaters 19

Drawings 20

Motor/Drive Detail 20
Moveable Head Vessel Reactor 21
Fixed Head Vessel Reactor Drawings 24

PREFACE

Scope

These instructions include information for the installation and operation of standard Models 4555, 4556, 4557, and 4558 (2.6 and 5 Gallon volume) Reactors. It should be noted that these reactors can be custom designed to accommodate a customer's specific operating parameters. This may impact certain areas of these instructions or related instructions mentioned within this manual.

These instructions cover the basic steps to be followed in installing these reactors and describe the function of all principal components. They are intended to be used in conjunction with several related instruction sheets listed on the previous page which provide information describing several components which are common to most pressure reaction apparatus. These instructions also include safety precautions and other information applicable to all pressure equipment.

The user should study all of these instructions carefully before starting to use these reactors to fully understand the capabilities and limitations of the equipment, and to be well aware of the precautions to be observed in the operation.

Related Instructions

The following publications are also available to further your understanding of this instrument and its component parts:

No.	Description of Instructions
201M	*Limited Warranty*
230M	*Safety Precautions to be observed when operating Pressure Reaction Equipment*
231M	*Safety Rupture Discs*
548M	*4848 Reactor Controllers*
234M	*Magnetic Drives*
323M	*Pressure Relief Valves*
FX004	*Health & Safety Assurance Certification*

Intended Usage

This system has been designed for use as a low pressure reactor system. It has been designed, built, and tested to strict physical and electrical standards. However, it is the user's responsibility to install and operate it in conformance with local pressure and electrical codes. If the instrument is used in a manner not specified by Company, the protection provided by the equipment may be impaired.

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.

General Specifications

Electrical Ratings

Controller ratings are found in the Operating Instructions for the controller supplied with your reactor and on the controller data plate.

Before connecting a controller 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: Controllers can be operated from either a 50 or 60 Hertz power supply without affecting their operation or calibration.

Slave Boxes:

Part No.	Volts	Hertz	Amps
A1761HCEE	230 VAC	50/60	50.0
A1761HC3	400/415V 3-P "Y"	50/60	20.0 / Leg Amp

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

Thermocouple: Unless otherwise specified, all Series 4848 Controllers operate with a Type J (iron-constantan) thermocouple. The total resistance of the thermocouple and the lead wires should not exceed 100 ohms. If the resistance of the thermocouple circuit is higher, it will reduce the sensitivity of the control system.

Explanation of Symbols

II	On position, full power heater switch
I	On position, half power heater switch
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.
	This **CAUTION** symbol indicates that the surface may be hot.
	**Protective Earth (PE) terminal**. Provided for connection of the Protective Earth (green or green/yellow) supply system conductor.

Environmental Conditions

This instrument is intended to be used indoors.



Caution!
Do not use in hazardous atmospheres.

Operating: 15 ºC to 35 ºC; maximum relative humidity of 80% non-condensing.

Installation Category II (over voltage) in accordance with IEC 664.

Pollution degree 2 in accordance with IEC 664.

Altitude Limit: 2,000 meters.

Storage: -25 to 65 °C; 10 to 85% relative humidity.

Unpack Carefully

Unpack the equipment carefully and check all the parts against the packing list. If shipping damage is discovered, report it immediately to the delivering carriers. Examine the components closely for any loose parts or shipping damage and be sure to check all layers of packing materials thoroughly so as not to overlook any parts which might otherwise be discarded.

Provisions for Lifting and Carrying

The Series 4555-58 Reactors and its components are extremely heavy. Before moving ensure all cables are disconnected. Use proper and safe lifting techniques and equipment when installing or moving the Series 4555-58 Reactors and/ or its components.

Cleaning & Maintenance

Periodic cleaning may be performed on the exterior surfaces of the controller with a lightly dampened cloth containing mild soap solution. All power should be disconnected and the power cord should be unplugged 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 Company in order to determine which part(s) may need to be replaced or serviced.



Ensure that any hot surfaces have had adequate time to cool before cleaning or maintaining the reactor and/or its components.

Users Responsibility

All 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** that has the capability, pressure rating, corrosion resistance, and design features that are suitable for its intended use. Company 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.

   In exercising the responsibility for the selection of pressure equipment, the prospective user is often faced with the 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, 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 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.

   All standard pressure vessels are provided with either a suitable relief device or a means to attach one (typically in the form of a plugged opening). When a pressure vessel is delivered without a pressure venting device, it is the customer's responsibility to provide pressure relief in order to protect the operator and the equipment from destructive high pressures. If you need more information or need help in selecting a proper relief device, please contact Company.

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.

INSTALLATION

Pressure and Temperature Limits

The working pressure and temperature at which any reactor or pressure vessel can be used will depend upon the design of the vessel and the materials used in its construction. Since all materials lose strength at elevated temperatures, any pressure rating must be stated in terms of the temperature at which it applies. The standard material of construction for Company is Type 316 Stainless Steel.

Limits for vessels made of other materials and for other operating temperatures can be obtained from Customer Service. No attempt should be made to increase these limits by making alterations or by substituting components which are not recommended by the Company. It must also be understood that lower pressure and temperature limits may be required for modified reactors and for vessels made of special alloys.

Limits for vessels will be determined by the physical characteristics of the vessel material and will be prescribed on an individual basis.

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.

All reactors show the maximum safe operating pressure and temperature imprinted on the cylinder.

The working pressure and temperature in these five gallon and ten liter reactors must not exceed the following maximum limits:

Pressure and Temperature Limits		
Vessel Material	**Maximum Pressure**	**Maximum Temperature**
T316 SS	1900 psi	350 °C PTFE Flat Gasket
T316 SS	1900 psi	225 °C FKM O-ring
T316 SS	1900 psi	300 °C FFKM O-ring

Assemble the Reactor

These reactors require a work area in a well ventilated area with convenient access to an electric outlet, running water and a drain. This unit needs to be placed at least 10 inches away from walls or flammable materials.
Use the associated assembly reference drawings included in this manual to help identify parts to assemble the reactor.

Moveable Head Vessel

1. Certain assembly of the stand must be done prior to use. Take the A1575HC lift tube assembly with the top bushings/housings on it and lower the tube through the work surface and center stand section. Place the end of the tube over the bottom bushing.

2. If applicable, mount the hoist by hooking it to the lift tube assembly. If it is an electric hoist, plug it into receptacle provided in the arm of lift tube assembly.

3. The wiring for the electric hoist, motor, and tachometer is routed through the lift tube and out through the bottom bearing support. Route this wiring through the conduit ducts underneath the center stand bottom shelf and up through the conduit duct on the left rear leg of the center stand. Connect these wires to the appropriate connectors.

4. Install two Lift Rings (1593HC) in cylinder flange. Attach one Lift Ring (1593HC) into the Lift Plate (1594HC). Attach two Lift Cables (A1595HC) to the lift plate in the holes that are 180° apart. Attach Lift Cables to the Lift Rings in cylinder. Attach this assembly to the lift hoist hook. Lift the cylinder and carefully lower into the heater. Remove the two Lift Rings from the cylinder flange after it is in the heater.

5. If applicable, install the Bottom Drain Valve into bottom of cylinder, through the bottom of the heater.

6. Lift the head with three Lift Cables (A1595HC) attached to the lift plate in the holes that are 120° apart. Attach the cables to the three 1571HC Lift Eyes on the head. Lift the head and place carefully on the cylinder to avoid damage to the sealing surfaces.

7. Install the Split-Rings per instructions in section, "How to Use the Vessel" (p. 11-13).

8. If the drive coupler needs to be adjusted to center the coupler halves, loosen the mounting bolts of the motor and move the motor assembly as required to center the drive couplers. Tighten the bolts while holding the motor assembly in position.

Fixed Head Vessel

CAUTION! Bolt the stand to the floor using the holes in the base of the unit.

1. For the apparatus to be fully stable in all configurations, the base of this unit must be securely fastened to the floor before operation. Four 3-hole inside corner brackets are provided (3159HC). Brackets will accommodate 5/16" diameter anchoring hardware (not provided). See drawing A3130HC Basic Main Support Frame Pkg. shown in "Drawings" section (p. 27).

2. See drawing A3140HC Pneumatic Vertical Lift Pkg in the appendix. Moving parts, potential pinch-point. Keep hands clear.

3. See drawing A3170HC 2 Hinged Split-Ring Pkg in the appendix. Moving parts, potential pinch-point. Keep hands clear.

Setting up the stand

1. If the motor has been removed for shipping purposes, reinstall the motor. Refer to drawings A3160HC and A3160HC2 (p. 31-33).

2. If furnished with band heaters, install prior to mounting the cylinder.

3. Install (3) cylinder standoffs in cylinder bottom (if not already installed). Refer to drawing A3150HC2 (p. 30).

4. Handles are provided to assist in lifting the cylinder. Lift the cylinder and place it on the cylinder support plate, lining up the holes with the cylinder standoffs. Install retaining hardware. Refer to drawing A3150HC2 (p. 30).

5. Connect pneumatics. A quick disconnect fitting has been provided on the back of the unit for airline connection. User is responsible for providing air source.

6. Lift "up" on joystick to raise cylinder, push "down" to lower. The joystick can provide speed control up to the maximum preset speed. Lift up slowly to raise the head and cylinder into position for attaching the fixed head support rods to the upper motor platform. Refer to drawing (p. 28-29).

Pnematic Lift Components



Joystick


Pressure Regulator

7. **NOTE:** The maximum lifting capacity can be adjusted using the pressure regulator pressure setting. Adjust by lifting up on the top cap and turning clockwise to increase the amount of pressure being sent to the pneumatic cylinder. Turn counterclockwise to decrease the amount of pressure. After adjusting, press the cap down to lock. Depending on vessel size, type, and weight, regulator will be preset at factory for 60 to 80 psi.

8. **NOTE:** The motor coupling and the drive coupler can be aligned. If adjustment is required, loosen the motor bolts to realign and then retighten bolts.

9. If furnished with a flexible mantle heater and/or a bottom drain valve, install at this time.

A1761HC3 400/415V 3-Phase "Y" Slave Box Control

Installation of a 3-phase slave box requires a switch or circuit breaker installed in the building.

1. It shall be in close proximity to equipment and within easy reach of the operator.

2. It shall be marked as disconnecting device for the equipment.

IDENTIFY THE VALVES

Gas Inlet Valve

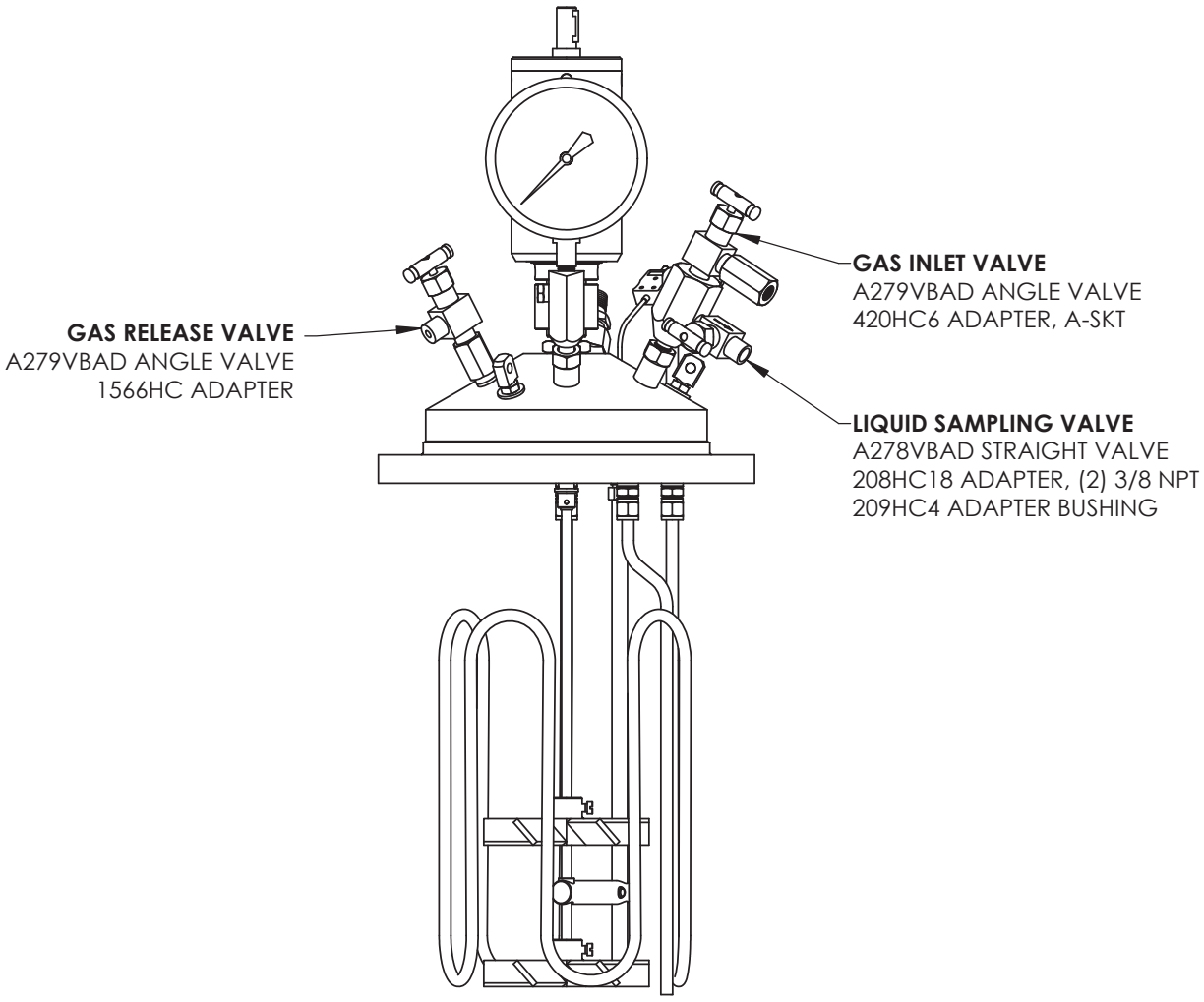
The gas inlet valve is easily identified when the vessel is open by noting that it is connected to a dip tube which extends to a point near the bottom of the cylinder. Typically, this is an angle valve with an attached fitting which provides a socket for attaching the A495HC pressure hose furnished with the reactor.

Gas Release Valve

The gas release valve is connected to a plain opening on the underside of the head. Gas released from this valve will be drawn from the top of the reactor.

Liquid Sampling Valve

The liquid sampling valve is attached to the same fitting as the gas inlet valve and connected to the same dip tube. With this arrangement, incoming gas is always introduced below the surface of the liquid and the operator is provided with a means for clearing the dip tube to be sure that any sample taken during a run will be representative of the charge. This can be done by opening the gas valve momentarily to force any liquid in the dip tube back into the reactor before withdrawing a sample from the sampling valve.



OTHER VESSEL HEAD FITTINGS

Safety Rupture Disc

There is a safety rupture disc attached to the head which is intended to rupture and release the pressure before it reaches a dangerous level. A metal tag wired to the safety head identifies the burst pressure at room temperature for that particular disc. A similar tag is furnished with each replacement disc. This tag must remain with the apparatus at all times so that both present and future operators will be aware of the disc rating. Users should read the discussion of rupture discs given in Instruction Manual No. 231M for a complete description of the characteristics of rupture discs and the precautions to be observed when operating pressure equipment protected by this type of safety device.

Type J Thermocouple

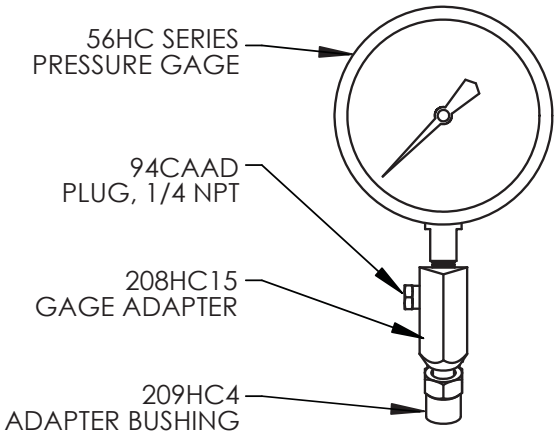
A Type J thermocouple in a 1/8" dia. stainless steel sheath is furnished with the reactor. Insert this thermocouple into the head thermowell and connect it to the thermocouple socket on the rear panel of the temperature controller using the A470E2 extension wire furnished with the reactor.

Pressure Gage

A pressure gage, typically a 0-2000 psi with a T316 Stainless Steel Bourdon tube, is mounted on the head using attachment fittings similar to those used for the inlet/sampling valve assembly

Gage and Valve Adapters

The pressure gage and the combined gas inlet and sampling valves are attached to the head with an adapter which allows these fittings to be drawn up tightly when facing in any direction. To attach these fittings to the head, screw the gage or valves firmly into the adapter, and then run the 209HC4 bushing onto the threaded stem as far as it will go. Screw this assembly into the head until the nose of the adapter is seated; then back it off until the valve or gage is facing in the desired direction. Now hold the fitting firmly in place and close the joint by tightening the 209HC4 bushing. This connection can be made and broken repeatedly without destroying the sealing faces. A light coating of thread lubricant, such as No. 424HC2 High Temperature Anti-Seize Lube, applied to the threads and to the nose of the adapter will help to obtain a tight joint.



ACCESSORIES

Internal Cooling Coils

Cooling coils can be installed in any of these reactors. Reactors purchased without a coil can have this feature added by ordering the appropriate parts from Company.

Cooling coils are made in serpentine configurations. A serpentine coil does not interfere with the use of a liner. Plugs are available to seal the cooling coil opening when the coil is not used.

Replacement coils are furnished with excess tubing at the ends to allow for any adjustments that might be required when installing a new coil. Align the replacement coil with the internals before retightening the connections. Remove any sharp burrs and attach the elbow connectors. Use only moderate force when tightening these elbows so that the ferrules will not be crimped too deeply into the tube. If tightened too hard it will be difficult to remove the brass ferrules without damaging the tube, making it impossible to reuse the coil after it has been removed from the vessel head.

Stirrer Drive Systems

Two types of drive systems are available on the 4555 Series Reactors. They are the direct drive and the gearbox drive. The direct drive has the motor mounted vertically above the reactor with the drive coupler connected to the motor shaft. This will produce speeds from 0 to 1700 RPM. The gearbox drive is offered with three different speed ranges. They are 3:1 ratio, 5:1 ratio, and 10:1 ratio. These are usually used in low RPM, high stirring load applications.

Quick Disconnect Drive Coupler

The top coupler half is stationary mounted with a set screw to the drive motor shaft. The bottom coupler half provides vertical movement for quick disconnect of the couplers. The bottom coupler is held in the up or engaged position by a spring loaded ball that rests in a detent in the square drive key. The spring loaded ball inside the threaded hole in the bottom coupler half and is adjustable to obtain the necessary force to hold coupler in drive or engaged position.

Moveable vessel only: If the coupler needs to be adjusted to align the coupler halves over each, either relocate the drive motor or the overarm plate or, on moveable vessel designs, loosen the mounting bolts of the 1578HC Top Bearing Housing and move the A1575HC Series Welded Overarm Assembly as required to align the drive couplers. Tighten the mounting flange bolts while holding the welded overarm assembly in position.

Reference page 20 for Motor/Drive detail drawing.

Air Motor

Variable stirring speeds from 100 to 2000 rpm can be obtained by replacing the standard motor with a 1678HC air motor. This motor operates on compressed air which must be supplied at 20 psig minimum pressure with at least 10CFM available at that pressure. It is furnished with a speed control valve and oiler, all assembled on a mounting bracket.

To operate reactors equipped with an air motor, mount the drive system firmly on the heater and connect the air hose to a compressed air line. Fill the oiler with SAE 10 oil and adjust the oiler to feed one drop per minute into the air stream. For long continuous runs at high speeds the oiling rate should be increased to three drops per minute.

If the motor becomes sluggish, flush it with a non-flammable solvent in a well ventilated area. Disconnect the airline and muffler and pour a small amount of solvent into the inlet port. Rotate the shaft by hand in both directions for a few minutes; then connect the air line and run the motor until there is not further trace of solvent in the exhaust. If the muffler felts are dirty, wash them in solvent or replace them. Re-lubricate the motor with a squirt of oil into the chamber and reassemble. If it becomes necessary to disassemble the motor to replace the vanes, follow directions given in the instruction sheet published by the Gast Manufacturing Corp., Benton Harbor, Michigan.

Variable Speed Electric Motor

Reactors are normally equipped with a DC variable speed motor supplied and controlled through the 4848M/A3600HC_Series controller. Instructions for connecting and operating these motors are included in the controller Instruction Manual No. 548M. This motor is usually installed in a drive system designed to produce stirring speeds up to 1700 rpm.

Spare Parts Kit

Company can furnish spare parts kits for these reactors which will provide a reserve supply of parts and tools sufficient to handle most normal replacements and emergency repairs during a year of heavy usage. These kits contain replacement gaskets, packing, O-rings, shafts, bearings, and rupture discs. They can be ordered from any Dealer or direct from Company. The order must specify the reactor size and indicate type of rupture disc, stirrer drive. It is advantageous to provide the serial number stamped on the vessel head or cylinder.

HOW TO USE THE VESSEL

The vessels used in Model 4555, 4556, 4557, and 4558. Reactors have two types of closures: fixed head and moveable head. They are designed so that the vessel cylinder and heater can remain together while the head and split-rings are attached or removed.

Flat Gasket or Self Sealing O-ring Closure

The flat gasket is held in a recess in the vessel head and a machine pilot on the cylinder closes the recess to completely contain the gasket. The split-ring closure used with this gasket has compression bolts which must be tightened to develop loading on the gasket. The closure is designed so that the compression bolts in the split-ring sections must make contact within a lip on the compression ring which will bring the split sections into their proper position. When opening these vessels, the compression bolts must be loosened enough to clear the retaining lip on the compression ring before the split-ring sections can be removed.

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 used with this sealing system does not require nor have the compression bolts as with the flat gasket.

Open the Vessel

Open the gas release valve to discharge any internal pressure; then loosen the compression bolts in the split-ring sections (flat gasket design). The split-ring sections can now be removed, and the head with all attached fittings is free to be separated from the cylinder.

For moveable heads, Disconnect the drive by pulling down on the bottom 1743HC Coupler Halve to disengage the 1746HC Spider from it and swing the lift tube assembly positioning the lift plate/lift cables over the head and attach the three cables to the lift eyes in the head until all internal appendages clear the cylinder lip. Rotate the head assembly around and lower it into the rear service position of the right hand stand assembly. Handle the head carefully so as not to damage the stirring shaft and other appendages when they are outside of the cylinder. The cylinder may also be removed from the heater and lowered into the front service position of the right hand stand assembly.

For fixed heads, slowly and carefully lower the cylinder using the joystick on the pneumatic lift.

Before Closing the Vessel

Examine the head gasket carefully to be sure that it is in good condition. In flat gasket designs, after considerable use, some of the PTFE gasket may extrude into a thin, ragged edge around the inside diameters. This does not necessarily mean that the gasket must be replaced, but the extruded portion should be removed with a sharp knife. Examine the mating surfaces on the cylinder and head to be sure they are clean and free from burrs.

Close the Vessel

For moveable heads, lift the head carefully from its service position and lower into the cylinder. Slide the two split-ring sections into place. Tighten each of the compression bolts with the wrench furnished with the apparatus or with a torque wrench. Tightening should proceed in a crisscross pattern rather than progressively around the circle. Let the vessel stand for about five minutes after initial tightening; then tighten the cap screws again. This will compensate for any tendency of the PTFE gasket to flow under the loading pressure.

The recommended bolt torque for sealing a vessel with a PTFE flat gasket is shown in the chart below. Rotate the drive into position. Connect the drive by pushing up on the lower coupler halve to engage it into the spider. Make sure the ball detent of the lower coupler snaps into position.

For fixed heads, raise the cylinder slowly and carefully in to position. Slide the two split-ring halves into place and secure the latches. Tighten the compression bolts in the same manner as noted above.

Recommended Bolt Torque for 2.6 Gallon Vessels

Pressure (psi)	Torque (ft-lb)
500 psi	25 ft-lb
1000 psi	50 ft-lb
1500 psi	75 ft-lb
1900 psi	100 ft-lb

Recommended Bolt Torque for 5 Gallon Vessels

Pressure (psi)	Torque (ft-lb)
500 psi	35 ft-lb
1000 psi	70 ft-lb
1500 psi	100 ft-lb
1900 psi	135 ft-lb

Gas Connections

Gas connections are dependent on applications. For general usage, use the pressure hose furnished with the reactor. Screw the Type "A" coned pressure fitting into the adapter attached to the gas inlet valve and tighten the compression nut firmly. Do not use any thread dope on the coned fitting. The A495HC pressure hose is made of reinforced Nylon which can be used for all non-corrosive gases at pressures up to 2500 psig. For operations involving corrosive gases, this hose should be replaced with an A490HC hose which has a PTFE lining and a braided stainless steel outer covering. An A506HC all metal hose is also available in stainless steel and other corrosion resistant materials. All of these hoses have the same fittings.

Pressurizing the Vessel

Check all valves carefully before admitting gas into the system. The liquid sampling valve must remain closed throughout the charging procedure. The gas release valve must also be closed unless the vessel is to be purged, or unless there is to be a continuous flow through the reactor during a run. Always make certain that the pressure in the gas tank is greater than the pressure in the vessel; otherwise liquid will be forced out of the vessel and into the gas tank when the inlet valve is opened. If there is any possibility that the tank pressure might not be high enough to force gas into the reactor, install a one way check valve (optional) in the gas line to prevent any reverse flow. With the inlet valve open and the flow control valve on the gas tank closed, open the main valve on the gas tank only about one-quarter turn; then use the flow control valve or the valve on a pressure regulator to control the flow of gas into the vessel. After the desired pressure has been reached, close the tank valves and the vessel inlet valve and disconnect the hose at the vessel end.

Do Not Overfill the Vessel

Always watch the pressure gage closely when admitting gas so as not to exceed the maximum working limit. Remember that any subsequent increase in temperature will raise the pressure. Also, be sure that the amount of liquid placed in the vessel is carefully controlled. As a general rule, the liquid charge should not exceed two-thirds of the capacity of the cylinder. Too much liquid in the vessel can lead to development of dangerous pressures if sufficient space is not provided for expansion when the liquid is heated. This hazard is explained in greater detail in a warning statement included in the Safety Instruction Manual No. 230M.

Releasing Pressure

Use the gas release valve to reduce the pressure in the vessel if the reactor is accidentally overcharged when filling. Use this valve also to release any excess pressure during a run and to exhaust the vessel at the end of a run. If the discharge gases are flammable or toxic, discharge to an exhaust hood or to any other safe release point.

Withdrawing Liquid Samples

Liquid samples may be withdrawn from the sampling valve attached to the same adapter as the gas inlet valve whenever the vessel is pressurized. Always close the inlet valve before withdrawing a liquid sample and open the sampling valve cautiously because liquid will be discharged with considerable force. Be particularly careful if the temperature of the sample is above its boiling point at atmospheric pressure. If so, it will “flash” and be lost as soon as it is released from the vessel. This problem can be avoided by connecting an optional 4353 Sample Collection Vessel to the sampling valve to collect the liquid into an appropriate receiver. The addition of a small amount of gas can be used to clear the dip tube between liquid samples so that the next sample drawn through the tube will truly be representative of the mixture.

The Shaft Seal

The stirrer shafts on these reactors are sealed with a magnetically coupled drive. Operating and Maintenance instructions for these are provided in Instruction Manual No. 234M.

Reactors With Slave Box Controls

Reactors can be set up with a wide variety of heaters. Single zone flexible mantle type heaters or 3-zone ceramic fiber, band or aluminum block type heaters can be used depending on the customer’s requirements. For the high powered 3-zone type heaters, Company offers a series of slave box controls. Having zone control allows a wide range of heating power to be selectable by the operator. These slave controls are used in conjunction with the 4848M Master Controllers.

Note: 3-Zone Heater locations are traditionally:

Zone 1 = Bottom Heater
Zone 2 = Middle Heater
Zone 3 = Top Heater

A1761HCEE 3-Zone Slave Control Box

The A1761HCEE slave control box is supplied with a 250 volt, 50 amp (NEMA 6-50P) power plug. A 230 volt, 50 or 60 Hz, single phase power supply capable of a maximum current draw of 40 amperes is required.

The A1761HCEE slave control box has 3 heater outputs each corresponding with a respective heated zone. There is a 4 position selectable switch, on the front panel, which can switch the heaters off or turn on zone 1, zones 1 and 2, or zones 1, 2 and 3.

Also located on the front panel are 3 manual reset, high limit switches. These switches will trip if an alarm condition is present on the master controller. Once the alarm condition has been resolved, ensure the selector switch is in the "off" position, and reset each switch by pushing in each button until it latches. These switches may have to be set when the unit is first powered on.

A1761HC3 3-Zone Slave Box Control

The A1761HC3 slave control box is supplied with an IEC 60309, 5 pin, 32 amp power plug. A 400 to 415 volt, 3-phase power supply wired in a 5-wire WYE configuration capable of supplying a maximum of 20 amperes is required.

The A1761HC3 slave control box has 3 heater outputs each corresponding with a respective heated zone. There is a 4 position selectable switch, on the front panel, which can switch the heaters off or turn on zone 1, zones 1 and 2, or zones 1, 2 and 3. Also located on the front panel is a manual reset, high limit switch. This switch will trip if an alarm condition is present on the master controller. Once the alarm condition has been resolved, ensure the selector switch is in the "off" position, and reset the switch by pushing it upwards until it latches. This switch may have to be set when the unit is first powered on.

Initial Operating Test

Read all operating instructions carefully so as to be well acquainted with the correct procedures for handling the vessel and for operating the controller and other accessories. An initial operating test should be made, with only water, to check the apparatus before starting the first experimental runs. For this initial test, fill the cylinder not more than half-full of water and run the temperature up to 150 °C while checking the apparatus for leaks and observing the performance of the temperature controller.

MAINTENANCE

General Maintenance Notes

1. Periodically inspect all electrical wiring and pressure connections for excessive corrosion or wear. Suspect parts should be replaced by components only supplied by 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. To reinstall straight thread (NPS) fittings to the head, screw the gage or valves firmly into the adapter. Run the bushing onto the threaded stem as far as it will go. Screw this assembly into the head until the nose of the adapter is seated; then back it off until the valve or gage is facing in the desired direction (no more than one full turn). Hold the fitting firmly in place and close the joint by tightening the bushing. This connection can be made and broken repeatedly without destroying the sealing surfaces. A light coating of thread lubricant, such as High Temperature Anti-Seize Lubricant, applied to the straight threads and to the nose of the adapter 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 lightly dampened cloth containing mild soap solution. All power should be disconnected when cleaning.

9. Routinely inspect cap screws on split-ring closure for lubrication and cleanliness. It is important to clean and lubricate periodically with High Temperature Anti-Seize Lubricant so that the required torque is accurately applied.

10. If servicing assistance is needed, contact Company directly. Contact information can be found on the next page and on the back cover of these instructions.

Fuses

The replacement of protective fuses should be performed by qualified personnel.

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

Part No.	Description	Slave Box	Type	Ratings
1535E	Heater Fuse	A1761HC3	KAC	25 Amps, 600VAC
185E	Master Controller Fuse	A1761HC3	Slo-Blo	5 Amps, 250VAC
2094E	Heater Fuse	A1761HCEE	Fast-Acting	25 Amps, 250VAC
2093E	Main Fuse	A1761HCEE	Fast-Acting	50 Amps. 250 VAC
139E8	Lift Fuse	A1761HCEE	Slo-Blo	2.5 Amps, 250VAC

Periodic Pressure Tests

Each cylinder used in a stirred reactor is tested under hydrostatic pressure to the higher of 1.43 times the rated working pressure at room temperature or 1.30 times the rated working pressure corrected for temperature before it is released from the factory. Micrometer caliper measurements are taken during this test to check the deflection of the walls 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, and particularly whenever the user suspects that the 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 that fails to return to its original dimensions after application of the prescribed hydrostatic test should be discarded as unsafe for further use.

Users who do not have pressure test facilities can return any Company 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 overpressure or other unusual occurrence raises any safety questions.

To return a vessel for repair, contact Company for a return authorization number (RMA).

An order or letter of instructions should be mailed to the same address, as no repair work will be started without specific instructions and a Health & Safety Assurance Certification form (FX004) signed by a responsible user.

Technical Support

Company strives to provide our customers with world class support. When contacting Company for technical support, please provide the complete serial number etched on the side or the bottom of the vessel cylinder. Serial numbers are a long string of letters and numbers. See highlighted text in figure below for an example of a complete serial number.

Each Company operating instruction manual binder includes a customized Parts List that contains a list of the parts in the major components of your Company Reactor. Do not discard this Parts List. You should use this parts list for reordering consumable and replacement parts to ensure that you order the correct items for your reactor system.

PARTS LIST

For special material reactor vessels, add material code as a suffix to the standard part number for head, cylinder, and/or internal fittings made from alternate materials

CA - Titanium
CB - Alloy Cb-20
CC - Alloy 20Cb3
CG - Alloy B-2
CH - Alloy C-276
CM - Monel
CX - Zirconium
CT - Inconel

Vessel Parts

Heads

Part No.	Description
1557HC Series	5G Flat Gasket
3187HC Series	5G O-ring Seal
2957HC Series	2.6G Flat Gasket
3197HC Series	2.6G O-ring Seal

Compression Rings

Part No.	Description
1554HC	5G Flat Gasket
N/A	5G O-ring Seal
2954HC	2.6G Flat Gasket
N/A	2.6G O-ring Seal

Cylinders

Part No.	Description
1555HC Series	5G Flat Gasket
3185HC Series	5G O-ring Seal
2955HC Series	2.6G Flat Gasket
3195HC Series	2.6G O-ring Seal

Accessories

Part No.	Description
1556HCF	Compression Bolts
1571HC	Lift Eye (Head)
1593HC	Lift Ring (Cylinder)
891DD	5/8" Comb. Wrench

Split-Rings

For Moveable Head Vessels

Part No.	Description
A1556HC	5G Flat Gasket
A3186HC	5G O-ring Seal
A2956HC	2.6G Flat Gasket
A3196HC	2.6G O-ring Seal

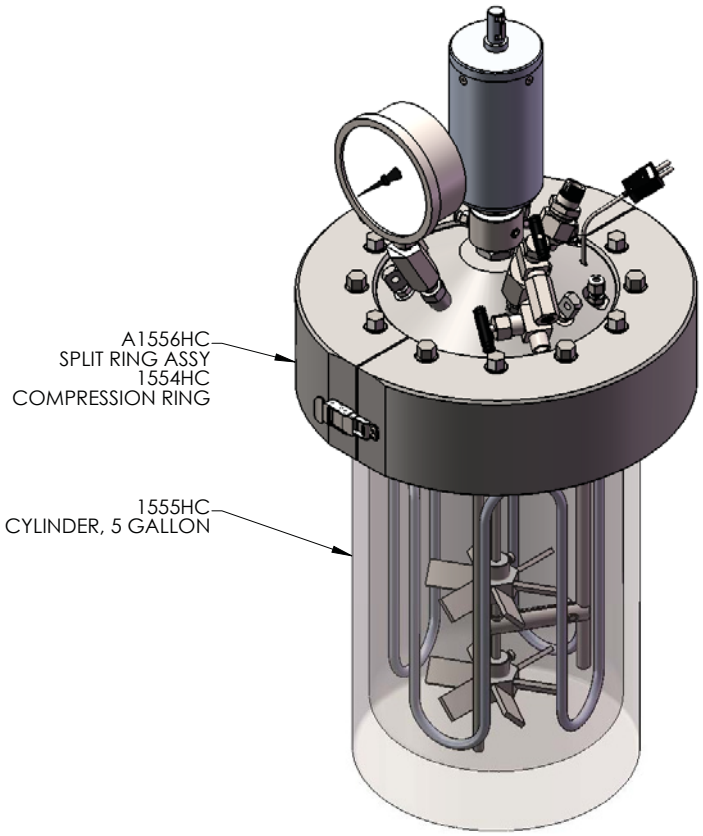
Split-Rings

For Fixed Head Vessels

Part No.	Description
A1556HC2	5G Flat Gasket
A3186HC3	5G O-ring Seal
A2956HC2	2.6G Flat Gasket
A3196HC2	2.6G O-ring Seal

Head Seals

Part No.	Description
1559HC	5G Flat Gasket PTFE
3184HCJV	5G O-ring Seal FKM
2959HC	2.6G Flat Gasket PTFE
3194HCJV	2.6G O-ring Seal FKM



Internal Parts

Thermowell

Part No.	Description
265HC15	Thermowell, 5G 15.94"L
265HC10	Thermowell, 2.6G 12.12"L
48HC	Thermowell, Gasket, Silver
48HCCN	Thermowell, Gasket, Nickel
48HCFG	Thermowell, Gasket, Gold (for Special Alloy)

Dip Tubes

Part No.	Description
1567HC Series	Inlet (Dip) Tube
275VBAD	Male Connector to hold tube

Shafts

Part No.	Description
1025HC28	Upper Stub Shaft, 5G, Magnetic Drive
A1030HC27	Lower Shaft Assembly, 5G, Magnetic Drive
1025HC45	Upper Stub Shaft, 2.6G, Magnetic Drive
A1030HC44	Lower Shaft Assembly, 2.6G, Magnetic Drive
2135HC9	Shaft, 5G, Footless Magnetic Drive
2135HC21	Shaft, 2.6G, Footless Magnetic Drive

**Footless Magnetic Drive requires internal 2137HC housing with 358HC2F screws and 216HCKF bushing.*

Impellers

Part No.	Description
1569HC	Impeller, 5G, Magnetic Drive
709HC	Impeller, 2.6G, Magnetic Drive
A2138HC3	Impeller, 5G, Footless Magnetic Drive
A2138HC2	Impeller, 2.6G, Footless Magnetic Drive
709HCF	Impeller Screw, ¼-20 thread (for all the above)

Stirrer Support Brackets

Part No.	Description
A1570HC	Support Bracket, 5G
A380HC3	Support Bracket, 2.6G
380HCF	Bolt, 5/16-18 thread (for all the above)

External Fittings

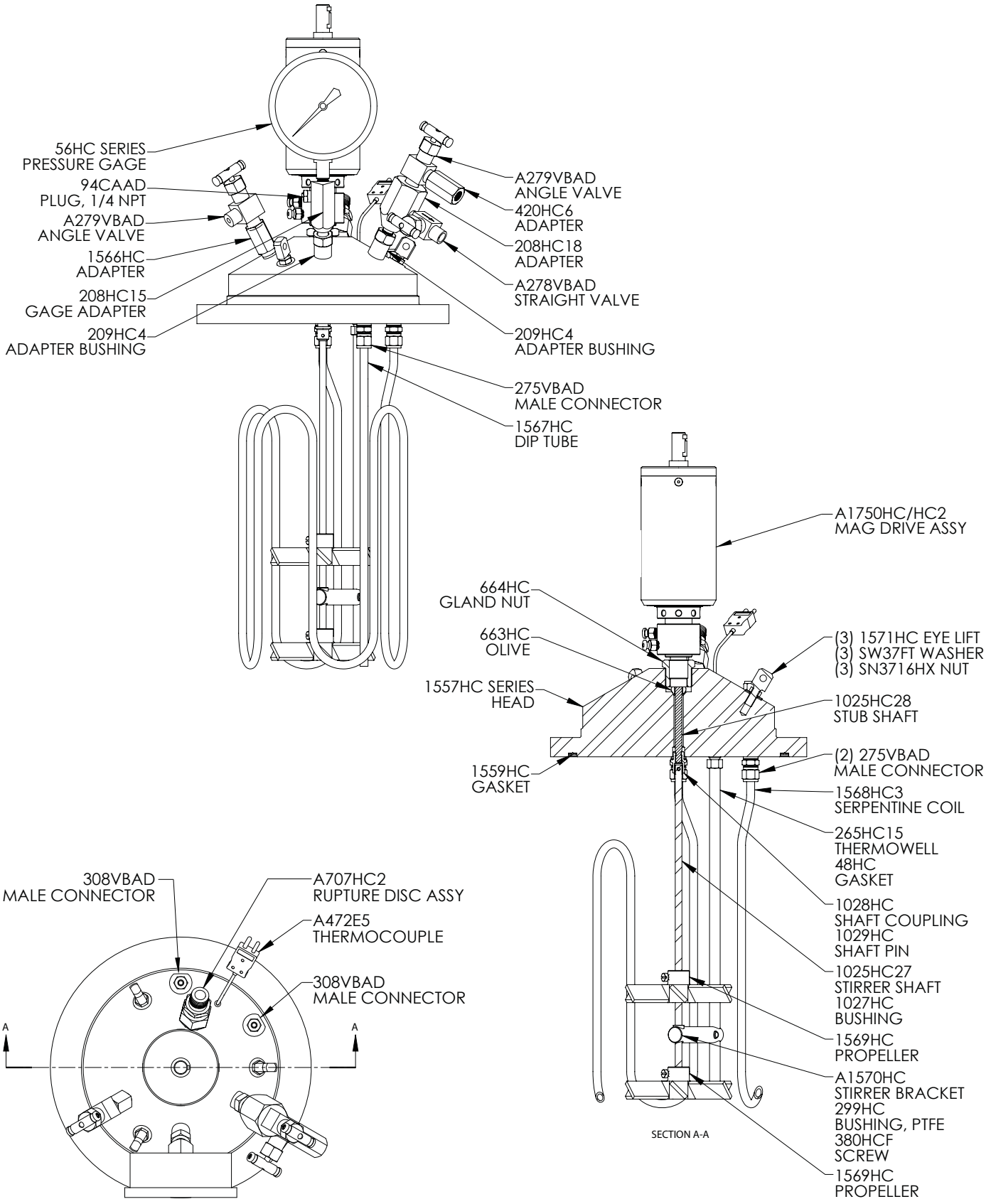
Part No.	Description
94CAAD	Plug, Hex Head, 1/4NPTM, T316SS
A278VBAD	Valve, Straight 3/8" NPTM (Liquid Sampling)
A279VBAD	Valve, Angled 3/8" NPTM x 3/8" NPTM (Gas Release)
A279VBAD	Valve, Angled 3/8" NPTM x 3/8" NPTM (Gas Inlet)
420HC6	Adapter, 3/8" NPTF x A socket (Inlet Hose)
1566HC	Adapter, 3/8" NPTM x 3/8" NPTF (Gas Release)
208HC18	Valve Adapter, two 3/8" NPTF (Gas Inlet/ Liquid Sampling)
208HC15	Gage Adapter, two 1/4" NPTF
209HC4	Bushing for gage and valve adapters
56HC	Series Gages, 4-1/2", psi/bar
664HC3	Magnetic Stirrer Plug (optional – use with 663HC olive)
A472E5	Thermocouple, Grounded Type J, 21-1/2"
A511E2	Thermocouple, Type J, Bayonet
A707HC2	Safety Rupture Disc Assembly without disc (See 231M)
A1750HC	Magnetic Drive (See 234M)
A1750HC2	Double Magnetic Drive Assembly (See 234M)
A2170HC	Footless Magnetic Drive (See 234M)
A2170HC2	Double Footless Magnetic Drive Assembly (See 234M)
664HC	Nut, Gland, Magnetic Drive seal
663HC	Olive, Magnetic Drive seal
2136HC	Gasket, Footless Magnetic Drive
A740HC	Cooling Sleeve for Magnetic Drive Assemblies
715HC	O-ring, NBR (for Cooling Sleeve)
716HC	Quick Disconnect (for Cooling Sleeve)

Cooling Coils and Fittings

Part No.	Description
1568HC3	Serpentine Cooling Coil, 3/8T, 5G
2968HC2	Serpentine Cooling Coil, 3/8T, 2.6G
275VBAD	Male Connector, 3/8T x 3/8NPTM Bored Thru, T316
288VBAD	Female Elbow, 3/8T x 1/8NPTF, T316
308VBAD	Male Connector, 1/4T x 1/4NPT, T316

Vessel Parts

(Moveable Head Vessel Shown)



Drive Parts List

Motor

Part No.	Description
A388E2ES	Motor, 1/2 HP VS 90VDC
A388E2EQ	Motor, 1/2 HP EXP VS 90VDC
A388E2ER	Motor 1/2 HP EXP VS 180VDC
A388E2ET	Motor 1/2 HP VS 180VDC
A388E3ER	Motor 3/4 HP EXP VS 180VDC
A388E3ET	Motor 3/4 HP VS 180VDC
1678HC	Air Motor

Shaft Couplings

Part No.	Description
1743HC	Chamfered Coupling Half
1744HC	Machined Coupling Half
1746HC	Spider

Optional Tach Parts

Part No.	Description
1564HC	Optical Wheel
A1060E	Tach Sensor Assembly 5G/2.6G Moveable Head Vessel
A1001E9	Tach Sensor Assembly 5G/2.6G Fixed Head Vessel
A1177E	Optical Tach Harness (10 ft)

Stand Parts

Lift System

(Moveable Head Vessel)

Part No.	Description
A1575HC	Lift Tube Assembly , Direct Drive
A1575HC2	Lift Tube Assembly, Gear Box Drive
1578HC	Housing, Bearing; Aluminum Top
1579HC	Housing, bearing; Aluminum Bottom
1580HC	Bushing, Brass; Top
1581HC	Bushing, Brass; Bottom
1593HC	Lift Ring, Cylinder
A1595HC	Plate, Lift (Stirred)
1594HC	Plate, Lift (Non-Stirred)
1680HC	Spacer
1743HC	Chamfered Coupling Half
1746HC	Spider, Coupling
1744HC	Machined Coupling Half
1766HC	Grommet, insulating

Floor Stand Parts

(Fixed Head Vessel)

Part No.	Description
A2760HC2	Pneumatic Lift Package with Regulator, Hand Lever & Tubing
3174HC	Shield, Magnetic Drive
2446HC	Thumb Screws for Shield
3154HC	Cylinder Mounting Pad
2548HC3	Lift Handle
2759HC	Lift Handle Grommet
1743HC	Chamfered Coupling Half
1746HC	Spider, Coupling
1744HC	Machined Coupling Half

Slave Boxes

Parts Used in A1761HCEE Slave Boxes

Part No.	Description
139E8	Fuse, Slo-blo, 250V 3AG
2094E	Fuse, Fast-Acting, 250 vac, 25 amp
2092E	Fuse Holder
2093E	Fuse, Fast-Acting, 250 vac, 50 amp
2095E	Fuse Holder
542E	Circuit Breaker, .08 Amp
1119E	Relay, 25 Amp

Parts Used in A1761HC3 Slave Box

Part No.	Description
185E	Fuse, Slo-blo, 250V
1119E	Relay, 25 Amp
1524E	Circuit Breaker
1535E	Fuse
1536E	Fuse Holder

Heaters

(Moveable Head Vessel Only)

Part No.	Description
A1600EEE	Mantal Heater, 5G, 2500W
A1590HCEE	Ceramic Heater, 5G, 4500W, 3 zone

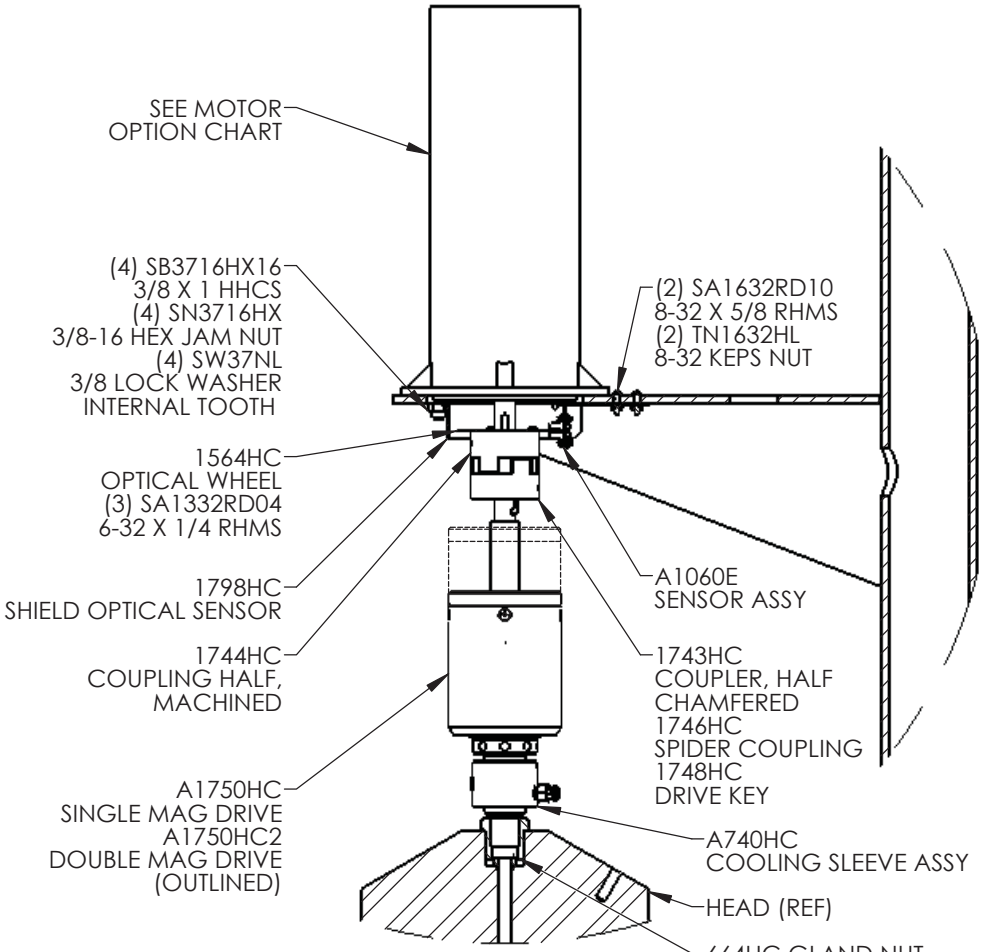
(Fixed Head Vessel)

Part No.	Description
A1930EEE	Band Heater 5G, 2000W
A1932EEE	Band Heater 2.6G, 1200W
A1600E2EE	Mantal Heater, 2.6G, 2000W
A1600E3EE	Mantal Heater, 5G, 2500W

Drawings

Motor/Drive Detail

MOTOR OPTIONS				
A388E2ES	1/2 HP	90VDC	VAR SPEED	
A388E2ET	1/2 HP	90VDC	VAR SPEED	
A388E2EQ	1/2 HP	90VDC	VAR SPEED	EXP PROOF
A388E2ER	1/2 HP	180VDC	VAR SPEED	EXP PROOF
A388E3ET	3/4 HP	180VDC	VAR SPEED	
A388E3ER	3/4 HP	180VDC	VAR SPEED	EXP PROOF
1678HC	AIR MOTOR			

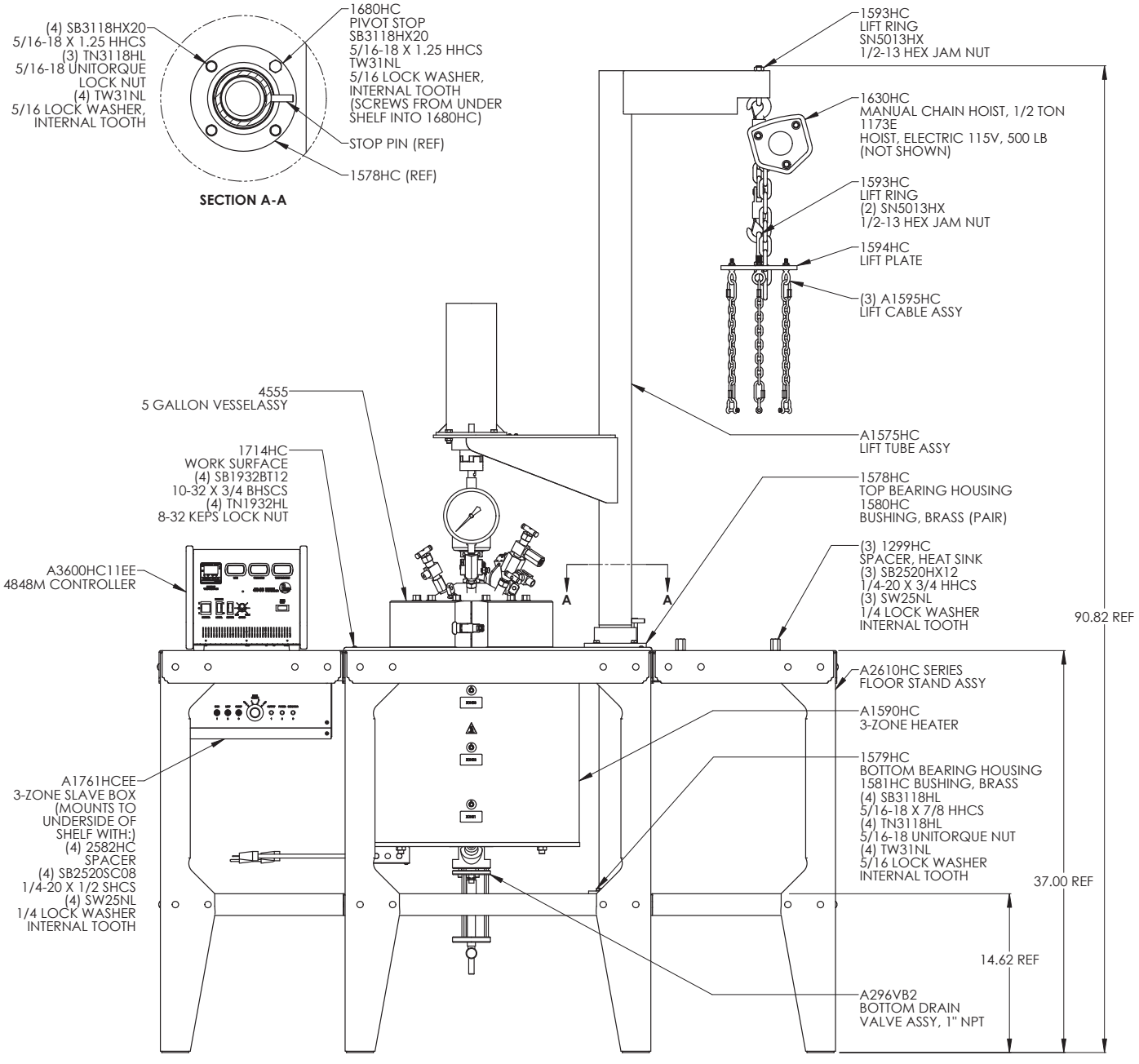


MOTOR/DRIVE DETAIL

Moveable Head Vessel Reactor

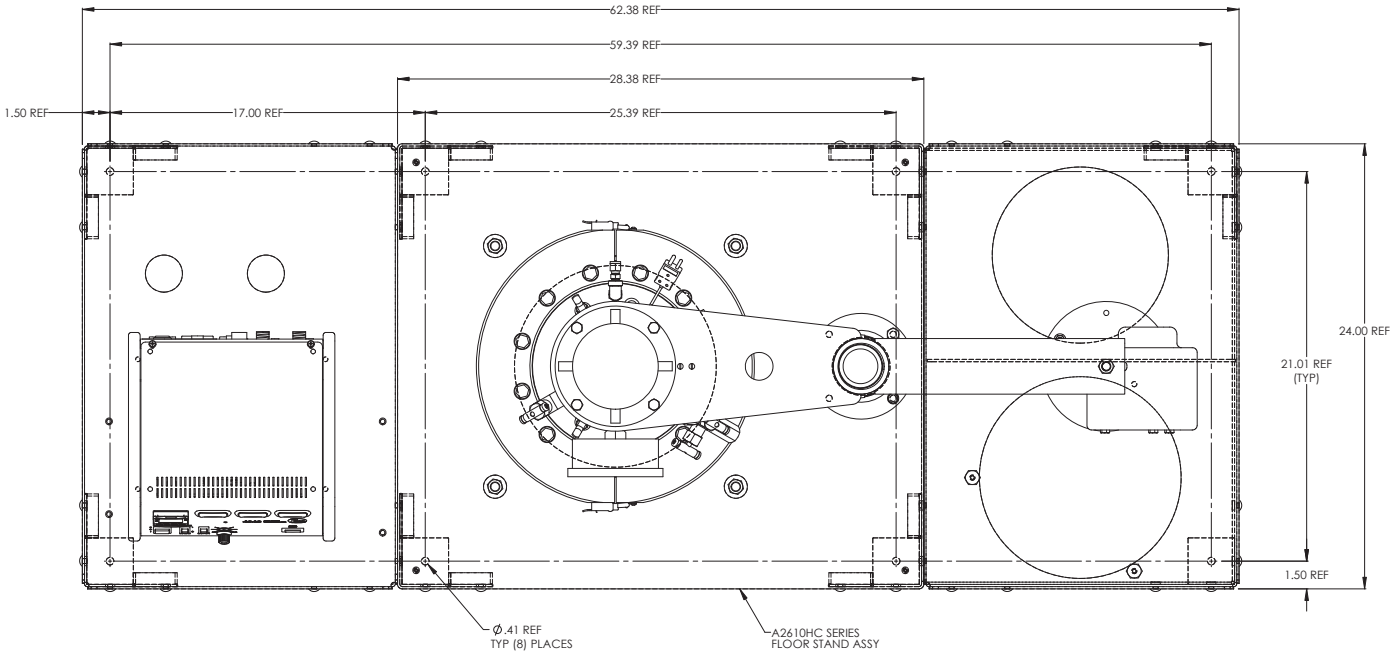
5 Gallon Assembly

Layout View



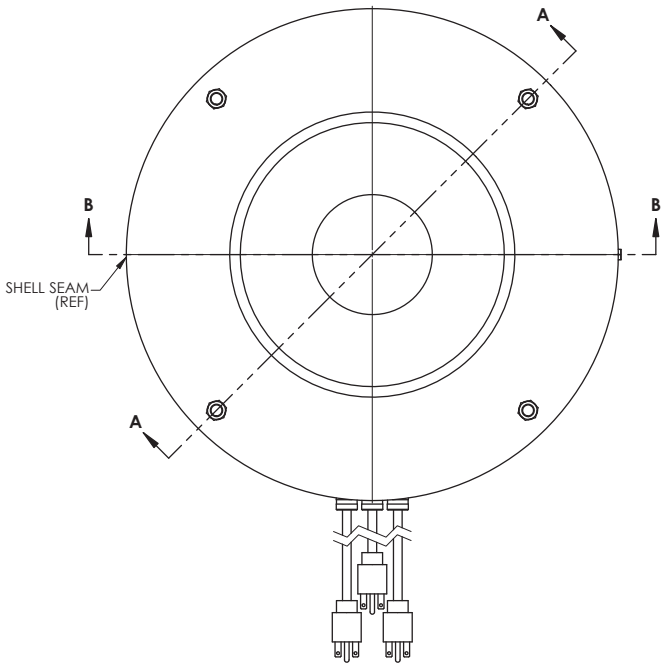
5 Gallon Assembly

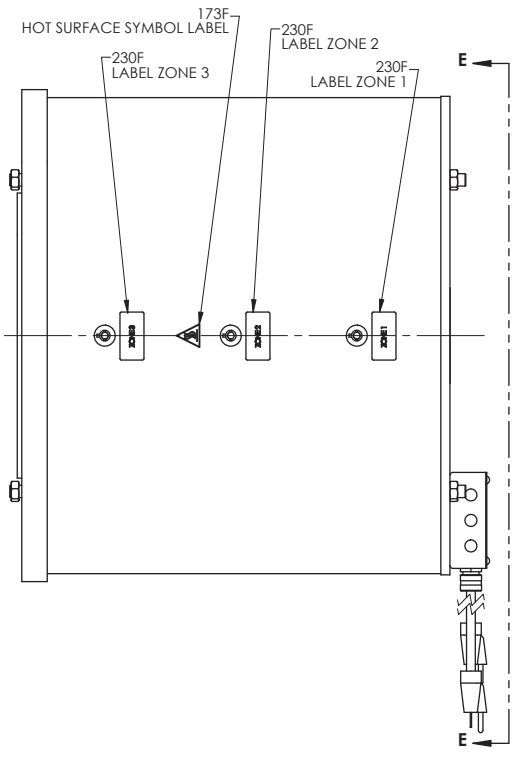
Top View



Ceramic Heater 3-Zone, 5 Gallon 230V/7550 Watt

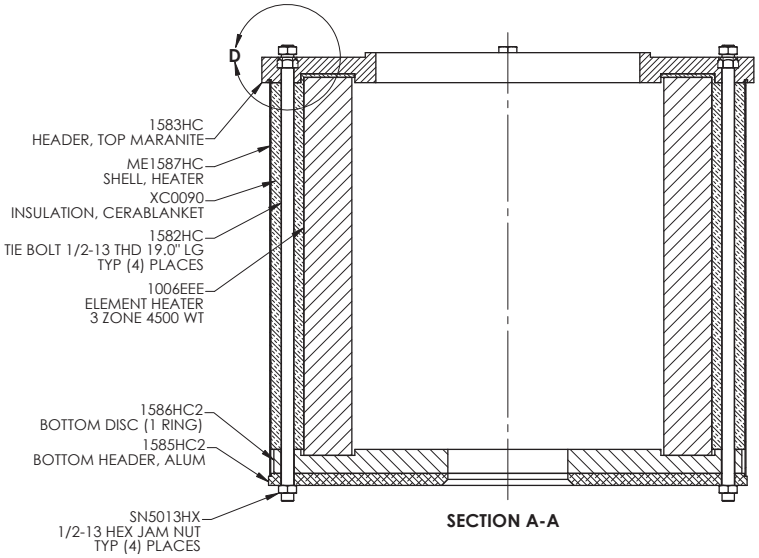
For use with 4555 Reactor



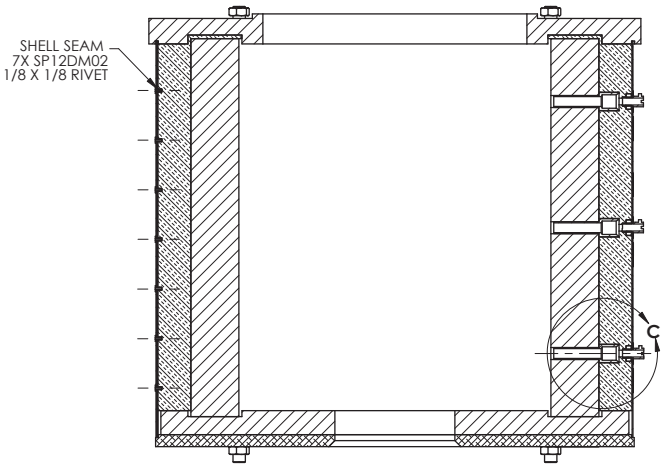


Ceramic Heater 3-Zone, 5 Gallon 230V/7550 Watt (Continued)

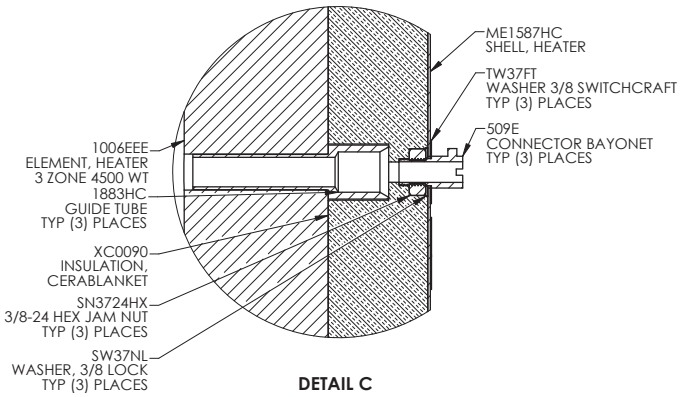
For use with 4555 Reactor



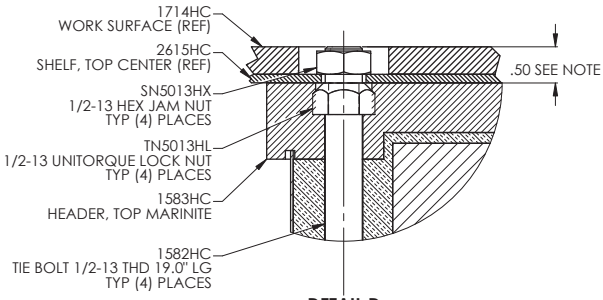
SECTION A-A



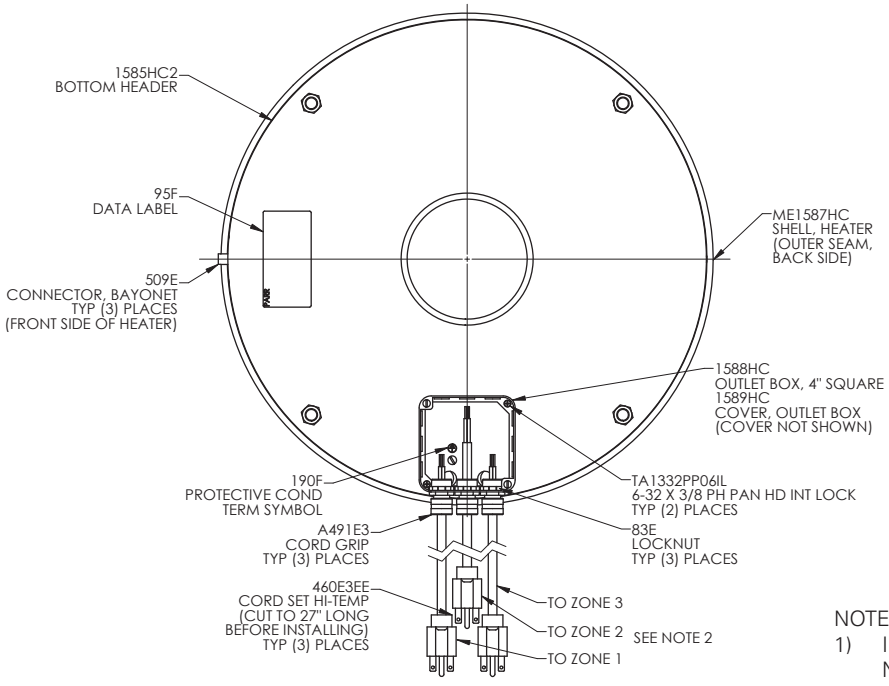
SECTION B-B



DETAIL C



DETAIL D



SECTION E-E

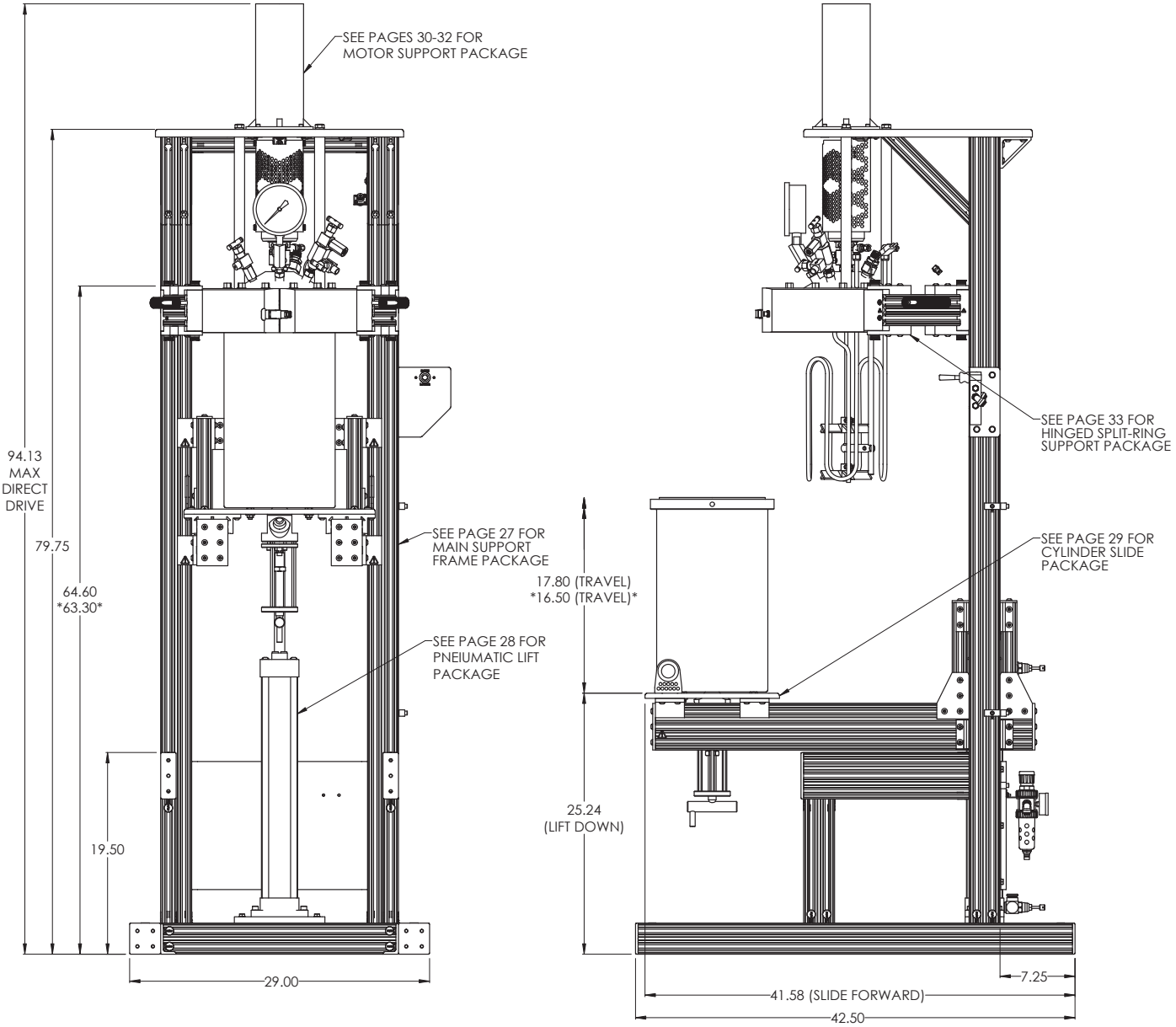
NOTES:

1) INSTALL (4) TN5013HL 1/2-13 UNITORQUE LOCK NUTS ONTO (4) 1582HC TIE BOLTS AS SHOWN IN DETAIL "D" .50 BELOW TOP OF 1582HC TIE BOLT.

Fixed Head Vessel Reactor Drawings

5 Gallon Fixed Head Reactor Stand

General Arrangement

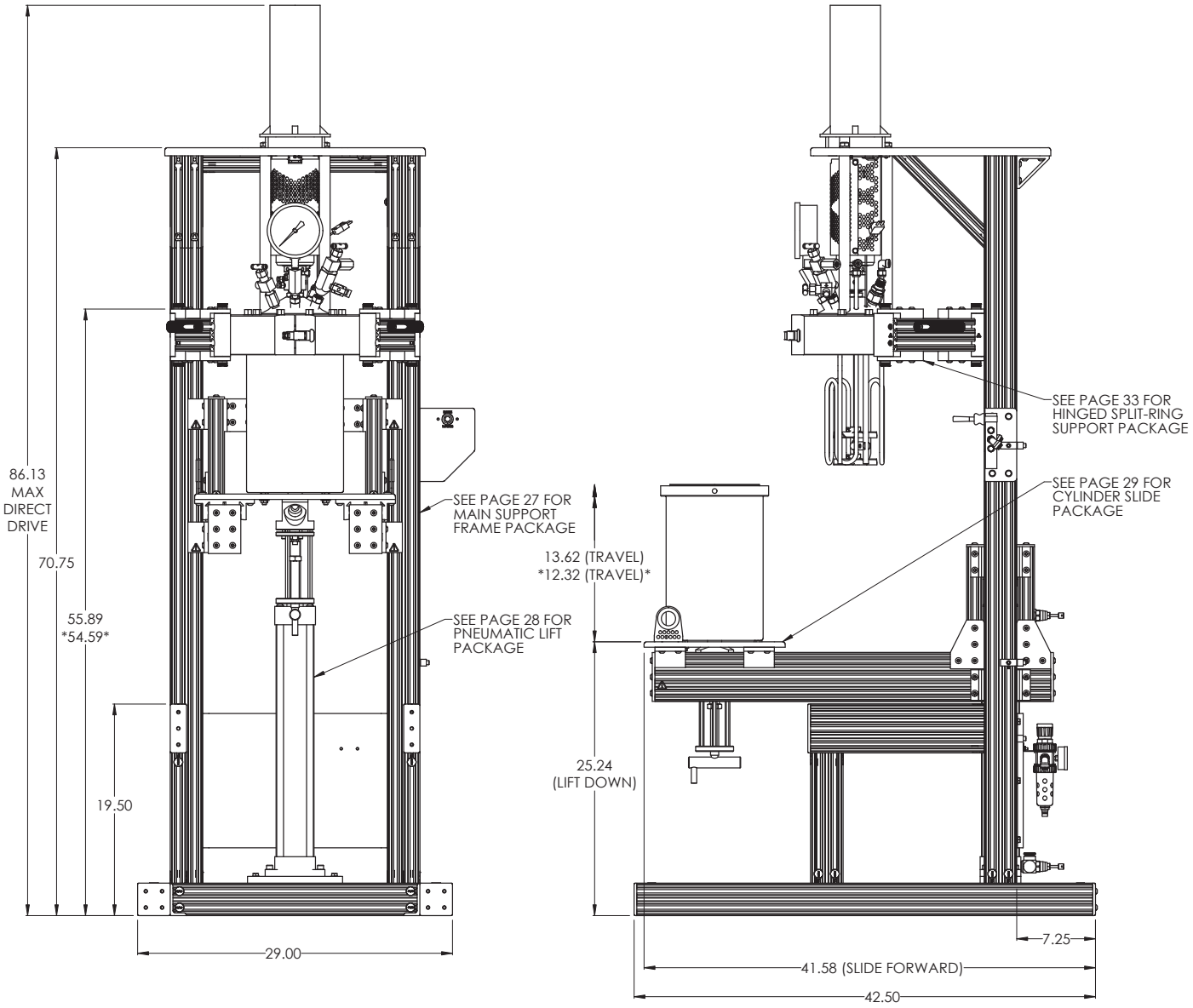


FRONT VIEW
CYLINDER RAISED
* DENOTES DIMENSION WHEN USING A2170HC2 FOOTLESS MAG DRIVE

RIGHT SIDE VIEW
CYLINDER FORWARD
* DENOTES DIMENSION WHEN USING A2170HC2 FOOTLESS MAG DRIVE

2.6 Gallon Fixed Head Reactor Stand

General Arrangement

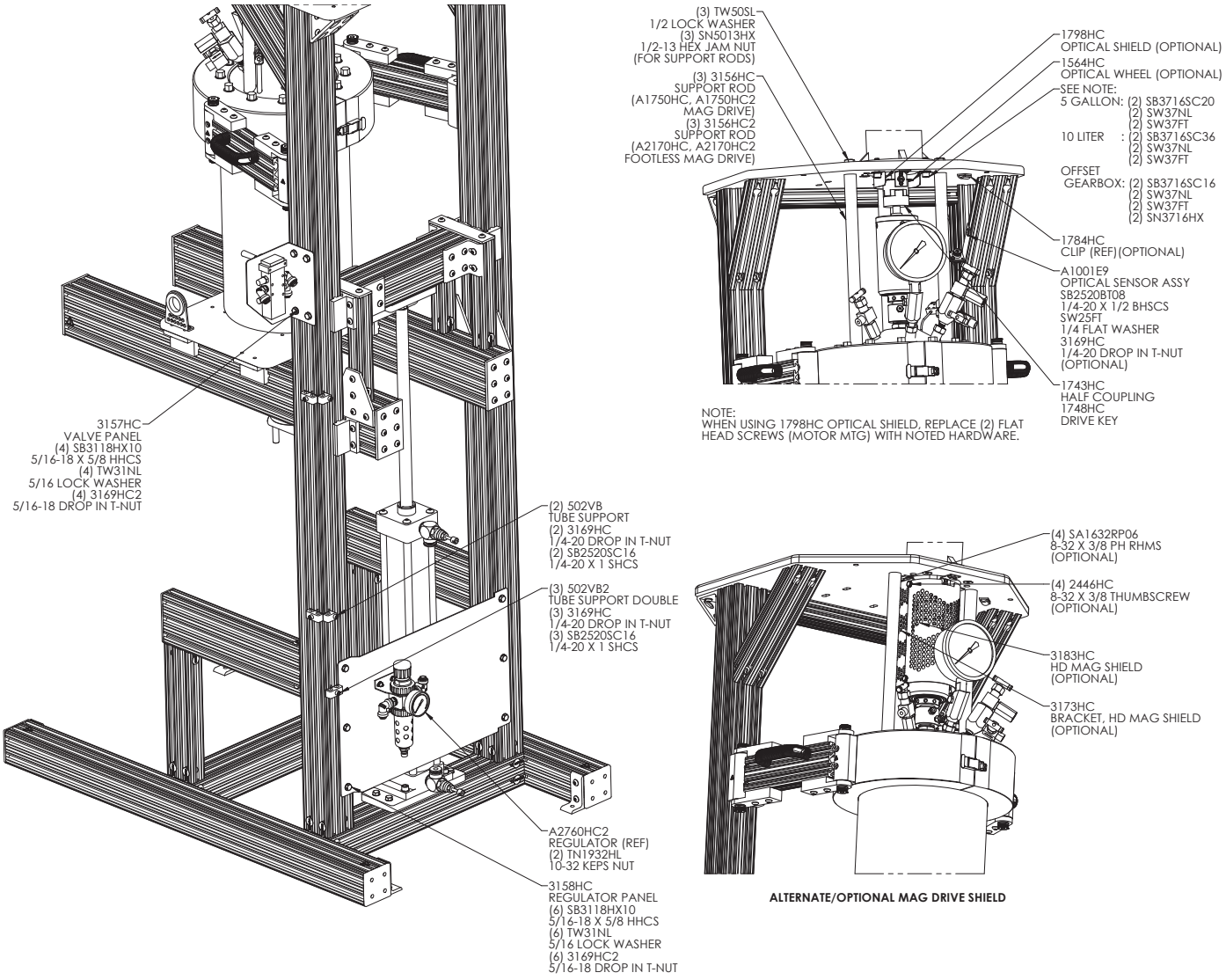


FRONT VIEW
CYLINDER RAISED
*DENOTES DIMENSION WHEN USING A2170HC2 FOOTLESS MAG DRIVE

RIGHT SIDE VIEW
CYLINDER FORWARD
*DENOTES DIMENSION WHEN USING A2170HC2 FOOTLESS MAG DRIVE

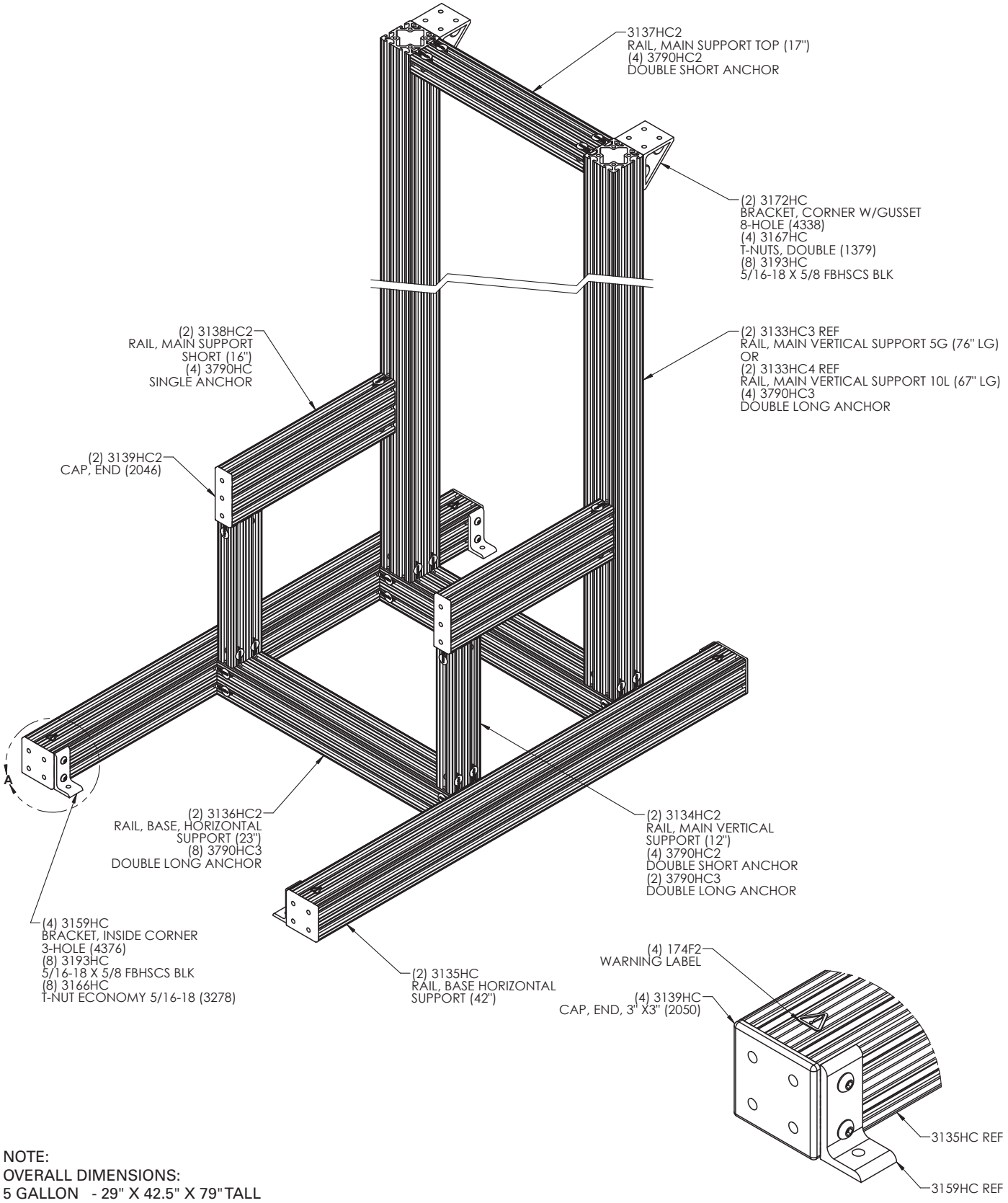
5 Gallon Fixed Head Reactor Stand

General Arrangement, Detailed



Fixed Head Reactor Stand

Basic Main Support Frame Package

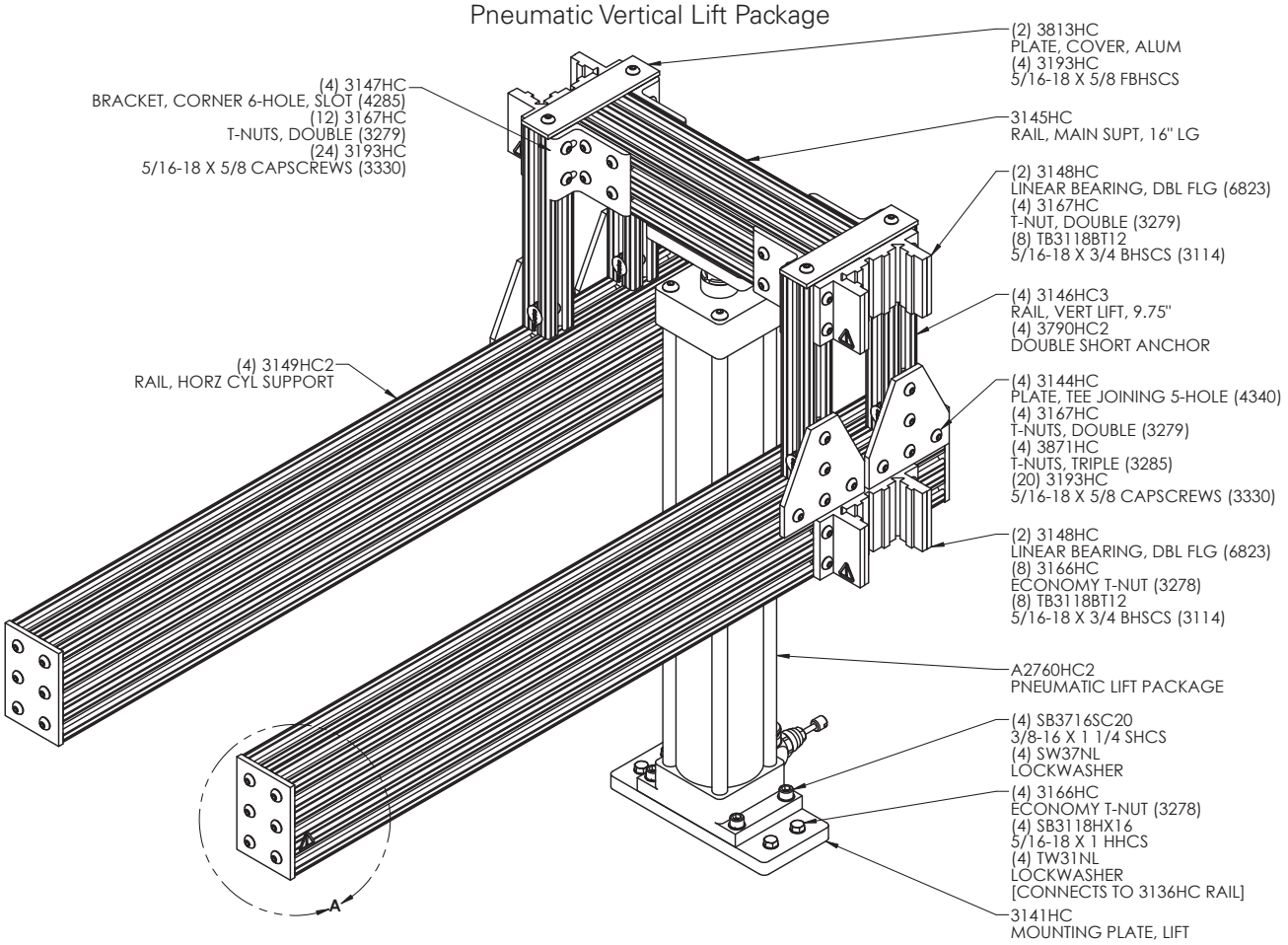


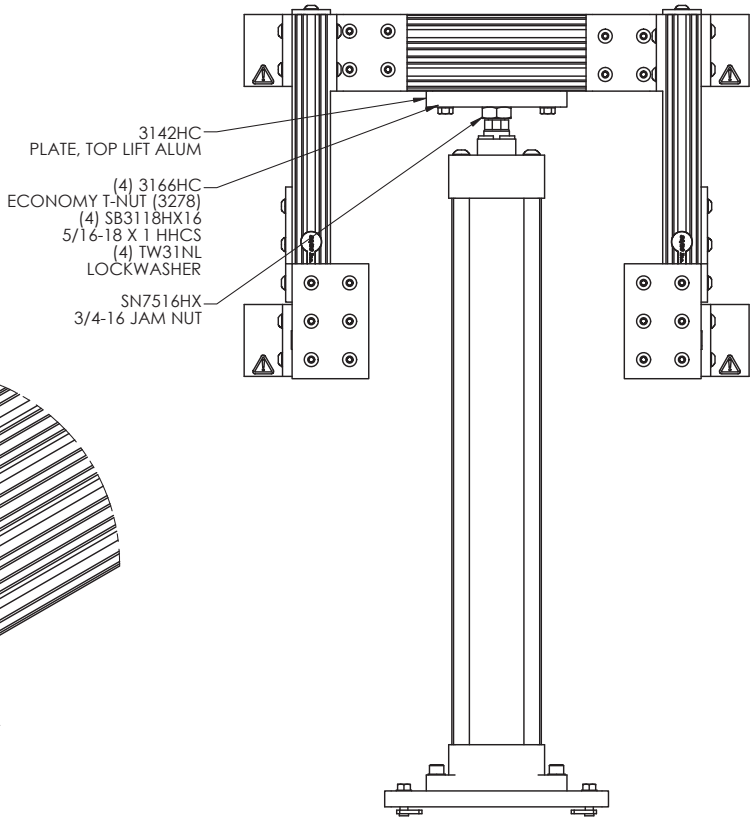
DETAIL A

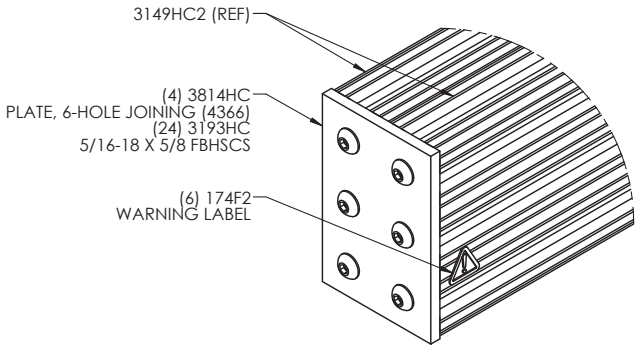
NOTE:
OVERALL DIMENSIONS:
5 GALLON - 29" X 42.5" X 79"TALL
2.6 GALLON - 29" X 42.5" X 70"TALL

Fixed Head Reactor Stand

Pneumatic Vertical Lift Package



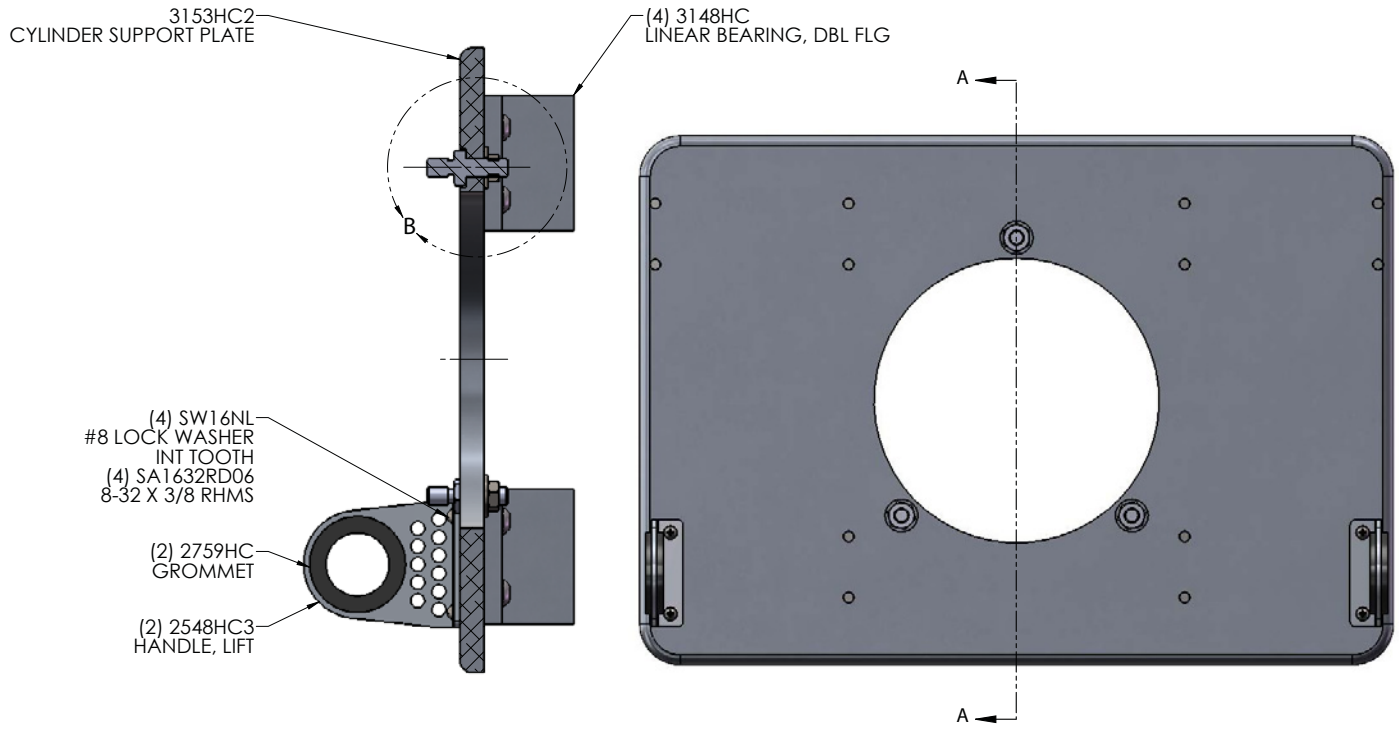




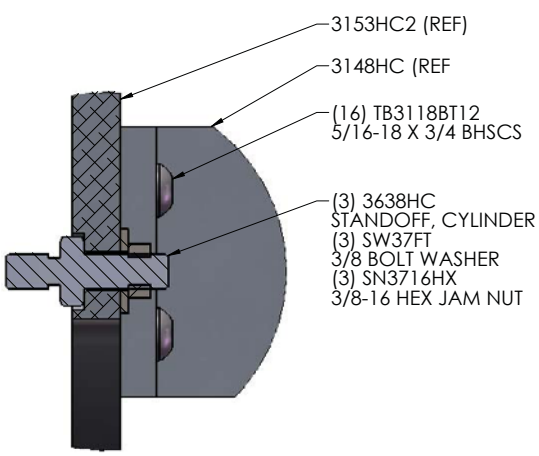
DETAIL A

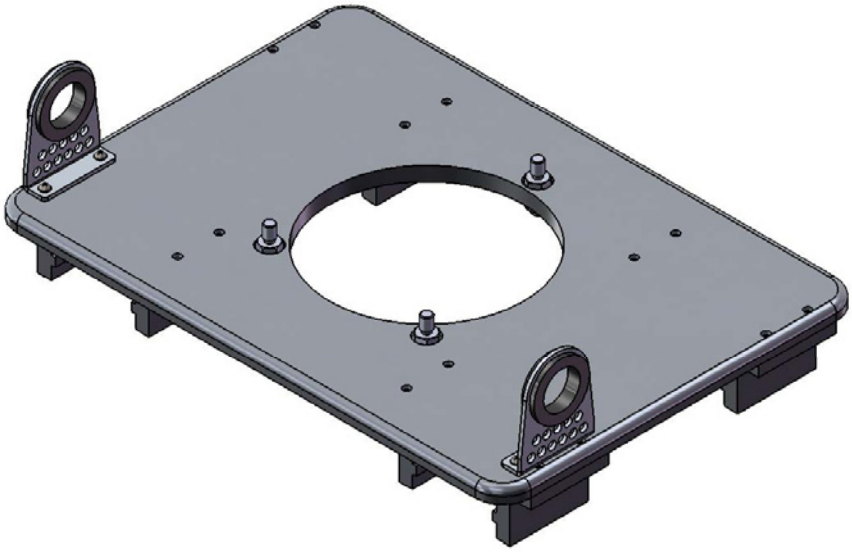
Fixed Head Reactor Stand

Horizontal Slide Package

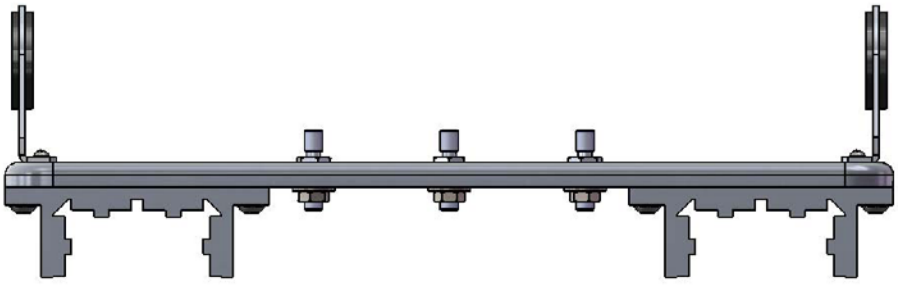


SECTION A-A





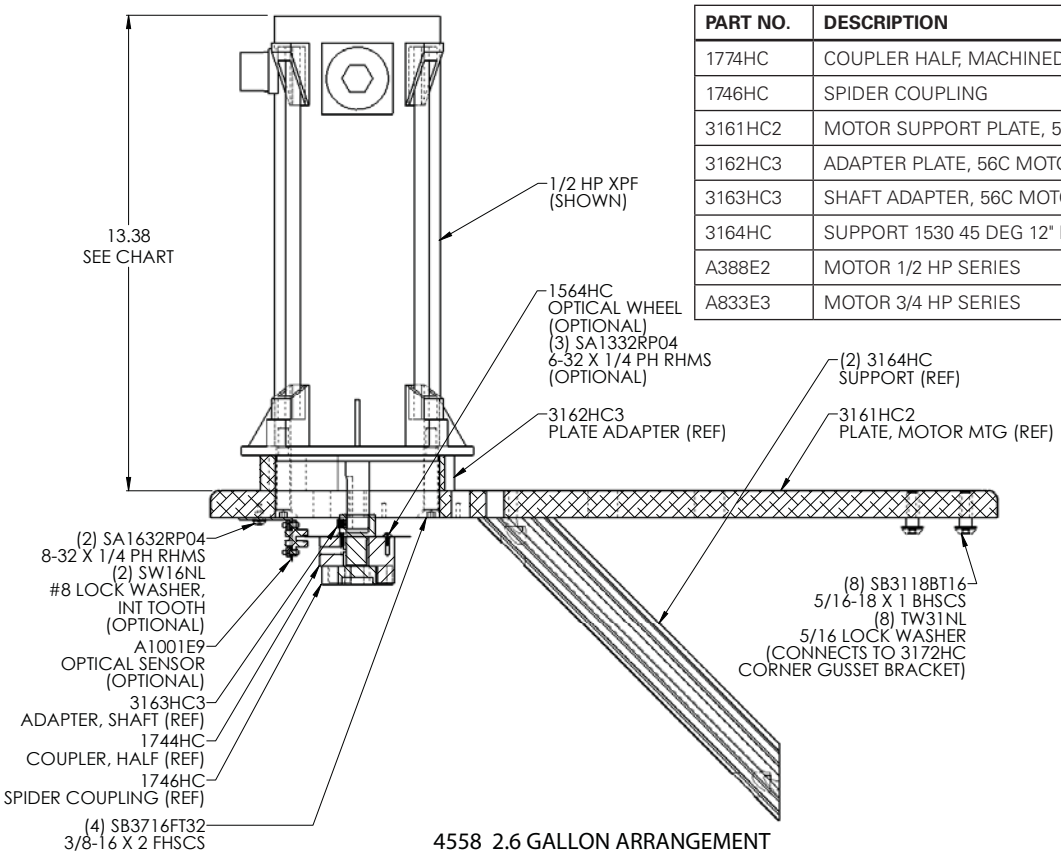
DETAIL B



Motor Support Platform Package

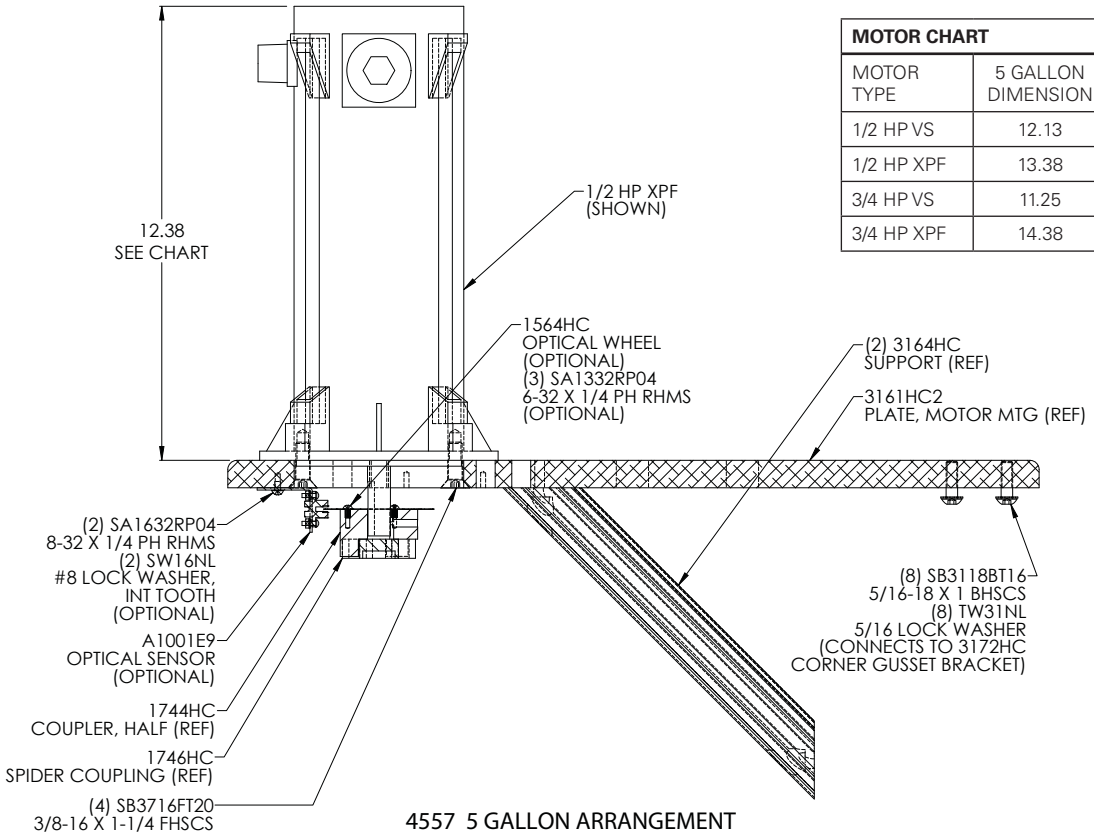
For Reactors with 56C Motors (Direct Drive)

PART NO.	DESCRIPTION	QTY
1774HC	COUPLER HALF, MACHINED	1
1746HC	SPIDER COUPLING	1
3161HC2	MOTOR SUPPORT PLATE, 56C	1
3162HC3	ADAPTER PLATE, 56C MOTOR, 2.6 G	1
3163HC3	SHAFT ADAPTER, 56C MOTOR, 2.6 G	1
3164HC	SUPPORT 1530 45 DEG 12" LG	2
A388E2	MOTOR 1/2 HP SERIES	1
A833E3	MOTOR 3/4 HP SERIES	1



4558 2.6 GALLON ARRANGEMENT

MOTOR CHART		
MOTOR TYPE	5 GALLON DIMENSION	2.6 GALLON DIMENSION
1/2 HP VS	12.13	13.13
1/2 HP XPF	13.38	13.38
3/4 HP VS	11.25	12.25
3/4 HP XPF	14.38	15.38

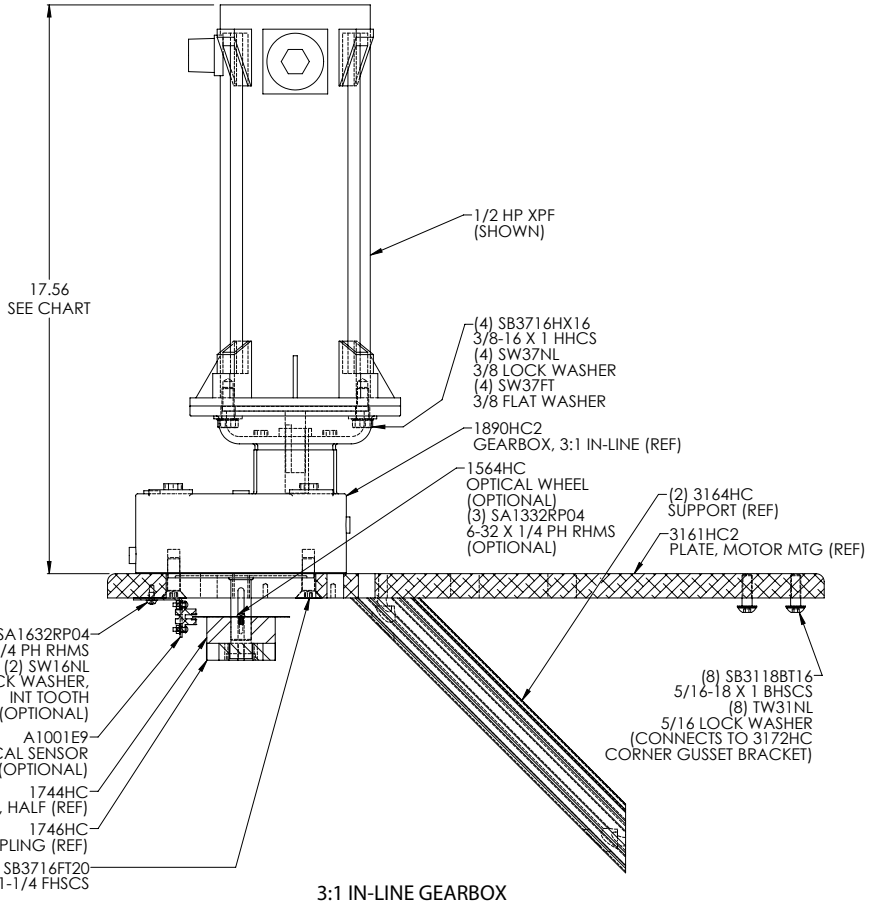


4557 5 GALLON ARRANGEMENT

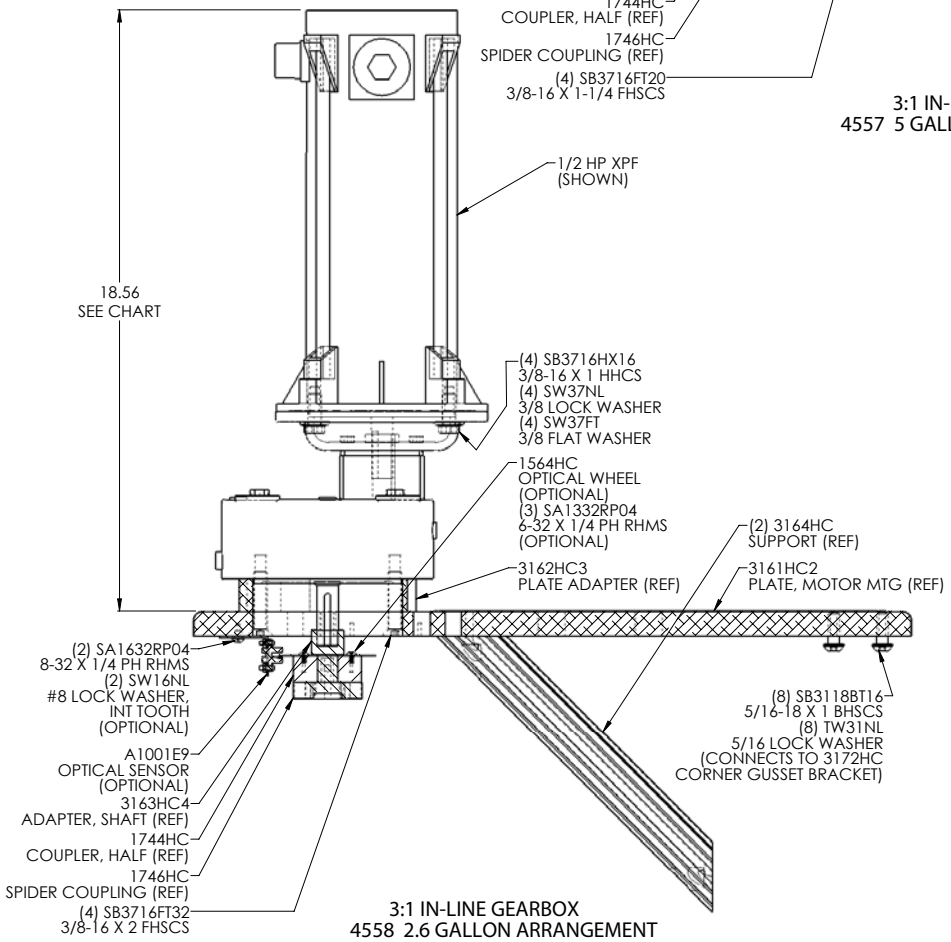
Motor Support Platform Package

For Reactors with 56C Motors (Gear Boxes)

PART NO.	DESCRIPTION	QTY
1774HC	COUPLER HALF, MACHINED	1
1746HC	SPIDER COUPLING	1
1890HC2	GEARBOX, 3:1 INLINE	1
2025HC	GEARBOX, 5:1 OFFSET	1
2025HC2	GEARBOX, 10:1 OFFSET	1
3161HC2	MOTOR SUPPORT PLATE, 56C	1
3162HC3	ADAPTER PLATE, 56C MOTOR, 2.6 G	1
3163HC4	SHAFT ADAPTER, 56C MOTOR, 2.6 G	1
3163HC5	SHAFT ADAPTER, 56C 5:1 GEARBOX	1
3164HC	SUPPORT 1530 45 DEG 12" LG	2
A388E2	MOTOR 1/2 HP SERIES	1
A833E3	MOTOR 3/4 HP SERIES	1



3:1 IN-LINE GEARBOX
4557 5 GALLON ARRANGEMENT

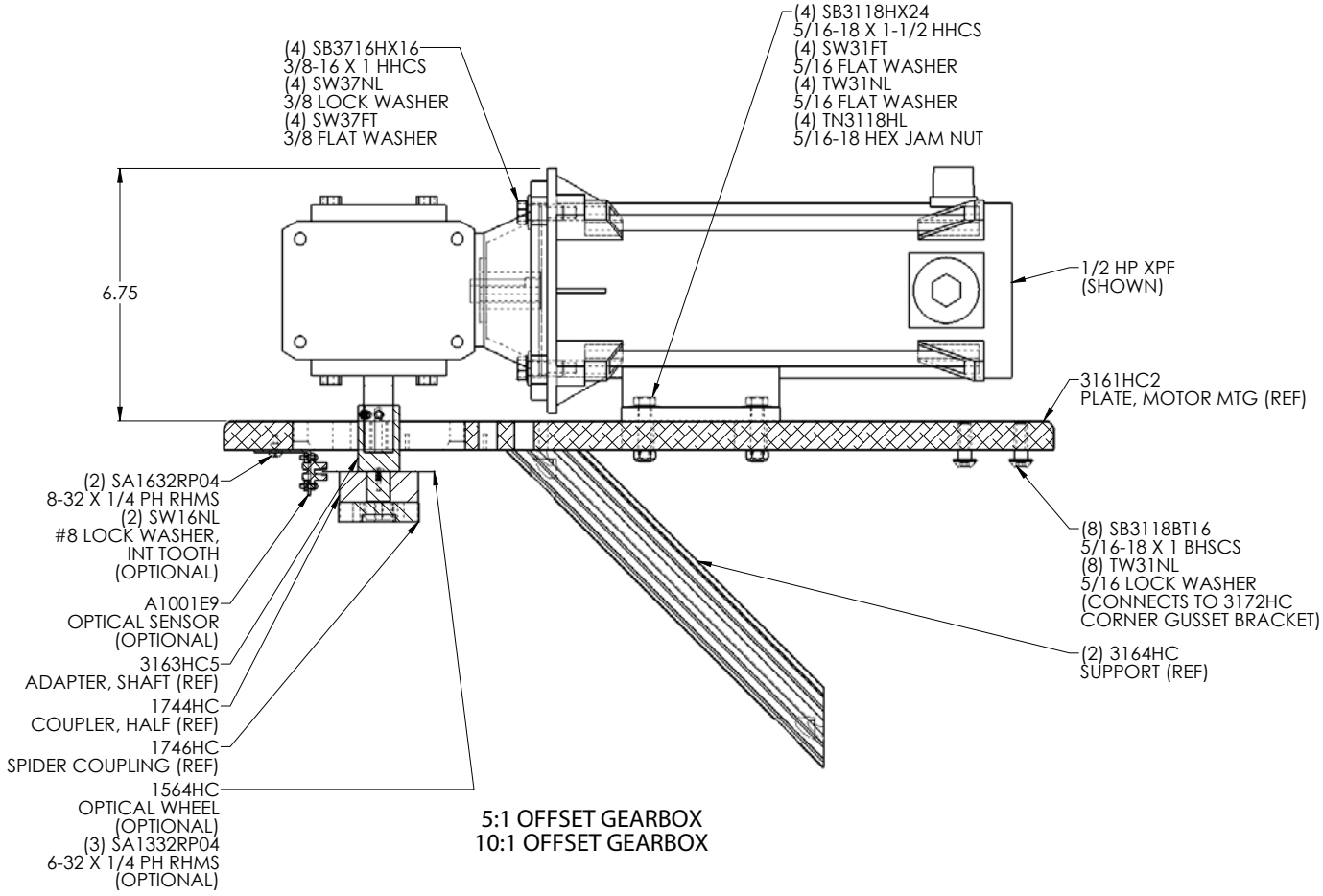


3:1 IN-LINE GEARBOX
4558 2.6 GALLON ARRANGEMENT

MOTOR CHART		
MOTOR TYPE	5 GALLON DIMENSION	2.6 GALLON DIMENSION
1/2 HP VS	17.32	18.32
1/2 HP XPF	17.56	18.56
3/4 HP VS	16.44	17.44
3/4 HP XPF	19.57	20.57

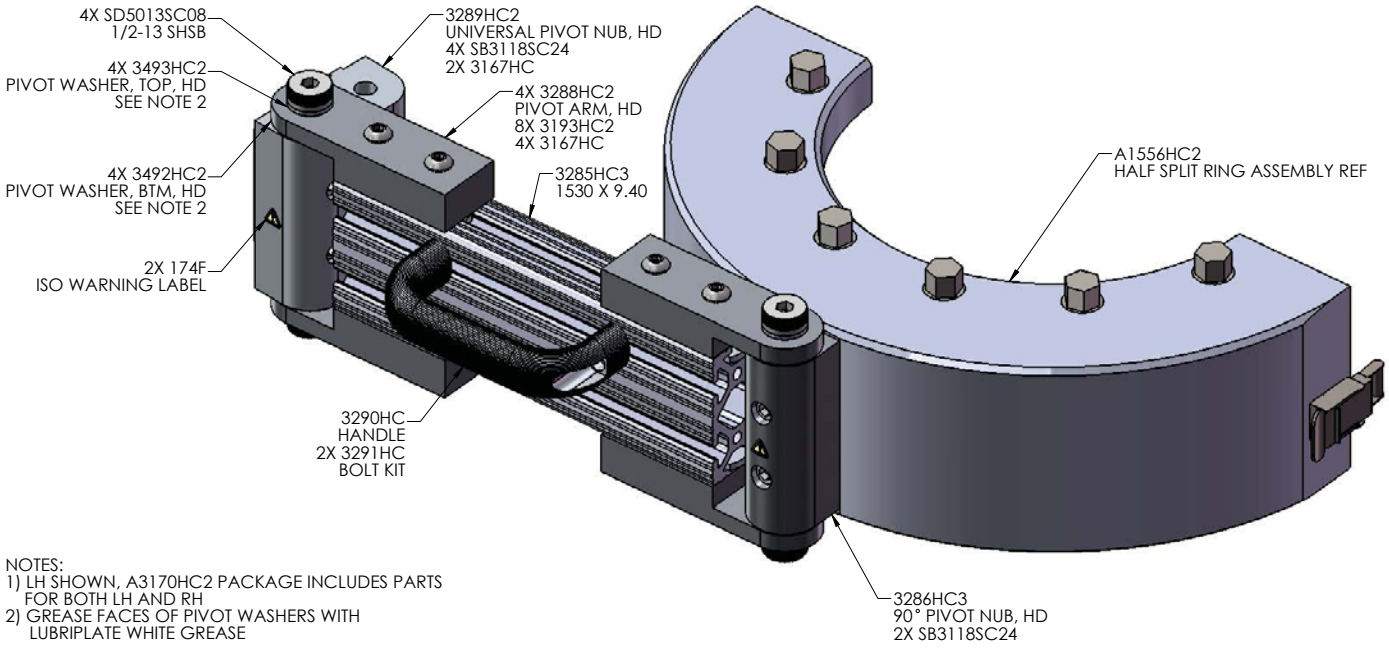
Motor Support Platform Package (Continued)

For Reactors with 56C Motors (Gear Boxes)



Hinged Split-Ring Assembly, HD

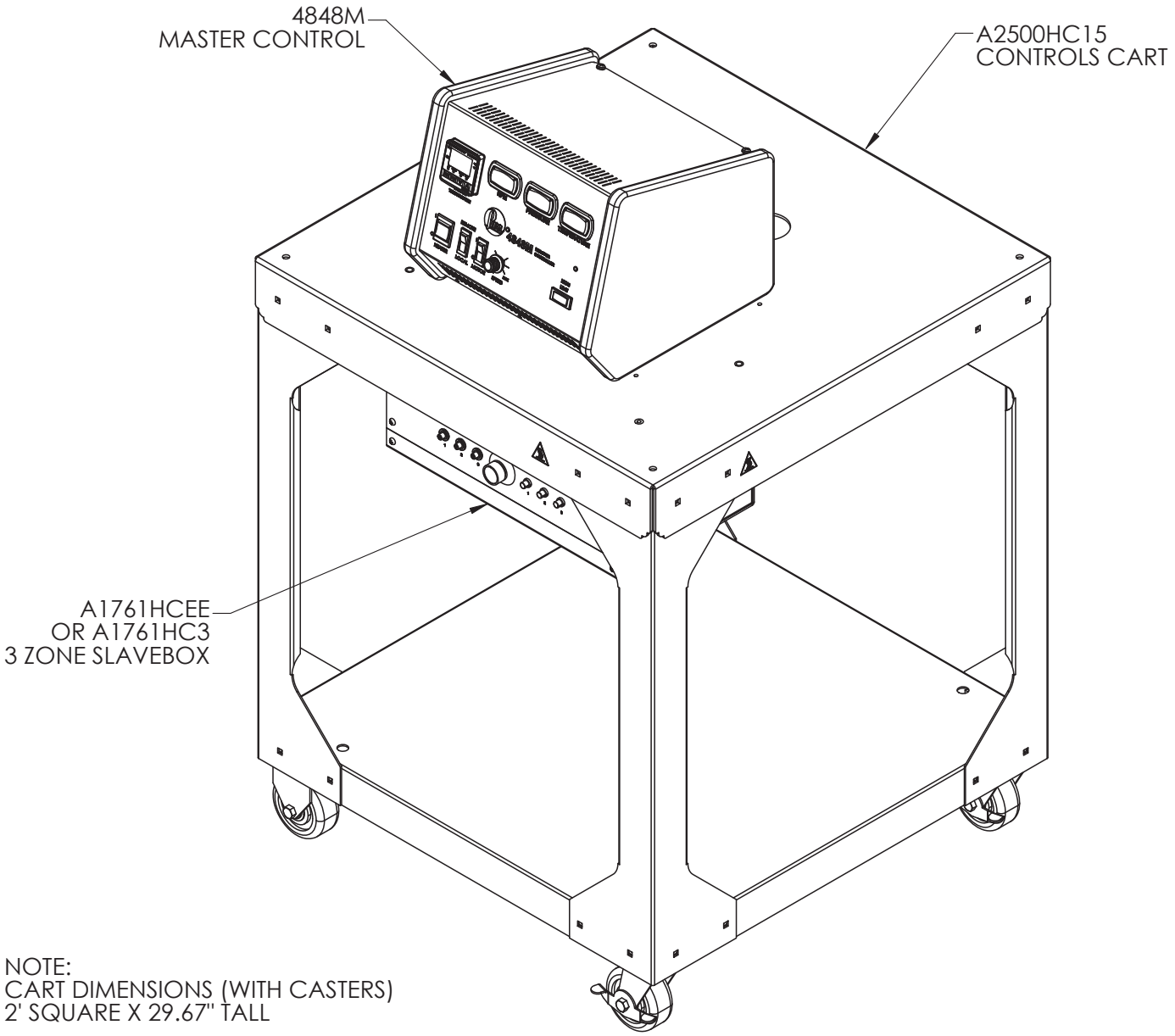
For 4557 and 4558 Fixed Head Reactors



NOTES:
1) LH SHOWN, A3170HC2 PACKAGE INCLUDES PARTS FOR BOTH LH AND RH
2) GREASE FACES OF PIVOT WASHERS WITH LUBRIPLATE WHITE GREASE

Controller Cart

For 4557 and 4558 Fixed Head Reactors



NOTE:
CART DIMENSIONS (WITH CASTERS)
2' SQUARE X 29.67" TALL



Parr Instrument Company

211 53rd Street
Moline, Illinois 61265-1770 USA
Phone: 1-309-762-7716 or 1-800-872-7720
Fax: 1-309-762-9453
E-mail: parr@parrinst.com
http://www.parrinst.com