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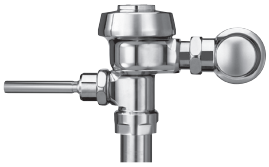
Control Stop

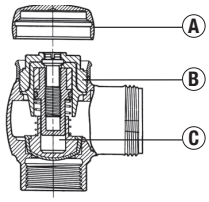


H-700 Series Bak-Chek® control stops and replacement parts (available for 3/4" and 1" water supply inlet pipes)

Replaces H-600 and H-540 Series control stops

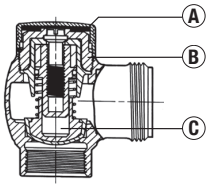
CONTROL STOP AND REPLACEMENT PARTS

H-700 Stop, chrome plated: Screwdriver Angle Stop with H-1010-A Vandal Resistant Cap



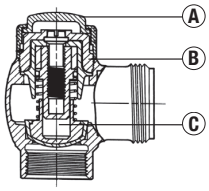
Code No.	Part No.	Description
Complete Stops		
3308384	H-700-A	3/4" NPTF inlet for adjustable tail
3308386	H-700-A	1" NPTF inlet for adjustable tail
3308385	H-700-AG	3/4" NPTF inlet for ground joint tail
3308387	H-700-AG	1" NPTF inlet for ground joint tail
3308388	H-700-AW	1" Whitworth inlet for adjustable tail
Repair Parts		
3308772	H-1010-A	Ⓐ Vandal Resistant Cap*, chrome plated
0308612	H-622	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

H-710 Stop, chrome plated: Screwdriver Angle Stop with H-573-A Locking Vandal Resistant Cap



Complete Stops		
0388025	H-710-A	3/4" NPTF inlet for adjustable tail
0388022	H-710-A	1" NPTF inlet for adjustable tail
0388026	H-710-AG	3/4" NPTF inlet for ground joint tail
0388024	H-710-AG	1" NPTF inlet for ground joint tail
0388037	H-710-AW	1" Whitworth inlet for adjustable tail
0388062	H-710-AAR	1" BSP British Standard Pipe inlet for adjustable tail
0388043	NH-710-A	1" NPTF inlet for adjustable tail (Naval brass)
0388048	NH-710-AG	3/4" NPTF inlet for ground joint tail (Naval brass)
0388058	NH-710-AG	1" NPTF inlet for ground joint tail (Naval brass)
0388042	NH-710-AW	1" Whitworth inlet for adjustable tail (Naval brass)
0388045	NH-710-AGW	1" Whitworth inlet for ground joint tail (Naval brass)
0388044	NH-710-AGS	1" NPSM inlet for ground joint tail (Naval brass)
Repair Parts		
3308840	H-573-A	Ⓐ Locking Vandal Resistant Cap*, chrome plated
0308612	H-622	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

H-720 Stop, chrome plated: Screwdriver Angle Stop with H-574 Short bumper Cap (-YO Variation)



Complete Stops		
0388034	H-720-A	1" NPTF inlet for adjustable tail
0388033	H-720-AG	1" NPTF inlet for ground joint tail
0388038	H-720-AW	1" Whitworth inlet for adjustable tail
Repair Parts		
3308866	H-574	Ⓐ Stop Cap with Seat Bumper*, chrome plated
0308612	H-622	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

*Refer to page 98 for diagrams of our Stop Caps and page 99 for the components supplied in our Control Stop Repair Kits.

CONTROL STOP AND REPLACEMENT PARTS

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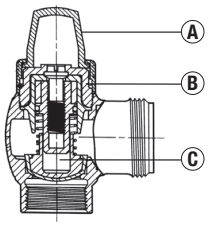
Control Stop

CONTROL STOP AND REPLACEMENT PARTS

H-725 Stop, chrome plated: Screwdriver Angle Stop with H-576 Extended Bumper Cap (-YG Variation)



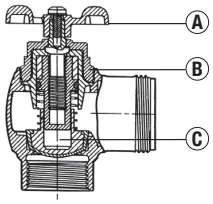
Complete Stops

0388035	H-725-A	1" NPTF inlet for adjustable tail
0388057	H-725-AG	1" NPTF inlet for ground joint tail
0388039	H-725-AW	1" Whitworth inlet for adjustable tail
0388047	NH-725-AGW	1" Whitworth inlet for ground joint tail (Naval brass)

Repair Parts

3308867	H-576	(A) Stop Cap with Extended Seat Bumper chrome plated
0308612	H-622	(B) Bonnet, chrome plated
3308853	H-541-ASD	(C) Control Stop Repair Kit*

H-730 Stop, rough brass: Concealed Wheel Handle Angle Stop



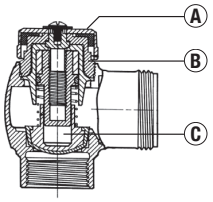
Complete Stops

0388011	H-730-A	3/4" NPTF inlet for adjustable tail
0388010	H-730-A	1" NPTF inlet for adjustable tail
0388014	H-730-AG	3/4" NPTF inlet for ground joint tail
0388013	H-730-AG	1" NPTF inlet for ground joint tail
0388012	H-730-AW	1" Whitworth inlet for adjustable tail
0388056	NH-730-AG	3/4" NPTF inlet for ground joint tail (Naval brass)
0388017	NH-730-AG	1" NPTF inlet for ground joint tail (Naval brass)
0388041	NH-730-AW	1" Whitworth inlet for adjustable tail (Naval brass)
0388046	NH-730-AGW	1" Whitworth inlet for ground joint tail (Naval brass)

Repair Parts

3308872	H-1011-A	(A) Concealed Wheel Handle Repair Kit*
0208083	H-623	(B) Bonnet, rough brass
3308860	H-1006-A	(C) Control Stop Repair Kit*

H-735 Stop, chrome plated: Exposed Wheel Handle Angle Stop



Complete Stops

0388007	H-735-A	3/4" NPTF inlet for adjustable tail
0388006	H-735-A	1" NPTF inlet for adjustable tail
0388009	H-735-AG	3/4" NPTF inlet for ground joint tail
0388008	H-735-AG	1" NPTF inlet for ground joint tail

Repair Parts

3308060	H-1002-A	(A) Exposed Wheel Handle Repair Kit*
0308615	H-623	(B) Bonnet, chrome plated
3308855	H-541-AWH	(C) Control Stop Repair Kit*

*Refer to page 106 for diagrams of Stop Caps and page 99 for the components supplied in our Control Stop Repair Kits.

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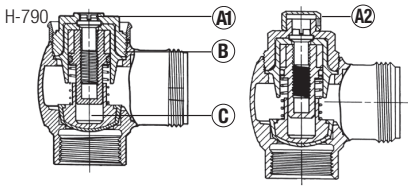
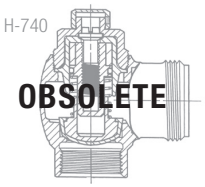
Control Stop

CONTROL STOP AND REPLACEMENT PARTS

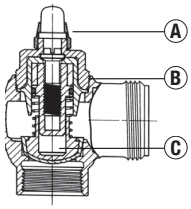
H-740 Stop, chrome plated: Screwdriver Angle Stop with H-37 Cap (Regal® Valve Stop) – OBSOLETE
H-790 Stop, chrome plated: Screwdriver Angle Stop with Vandal Resistant Cap (for Regal or Regal XL Valve Stop)





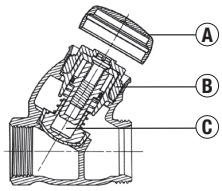
Code No.	Part No.	Description
Complete Stops For Regal® flushometers		
0388031	H-740-A	3/4" NPTF inlet for adjustable tail – **OBSOLETE**
0388029	H-740-A	1" NPTF inlet for adjustable tail – **OBSOLETE**
0388040	H-740-AG	3/4" NPTF inlet for ground joint tail – **OBSOLETE**
0388028	H-740-AG	1" NPTF inlet for ground joint tail – **OBSOLETE**
Complete Stops For Regal® "XL" flushometers		
0388064	H-790-A	3/4" NPTF inlet for adjustable tail
0388065	H-790-A	1" NPTF inlet for adjustable tail
0388068	H-790-AG	3/4" NPTF inlet for ground joint tail
0388067	H-790-AG	1" NPTF inlet for ground joint tail
Repair Parts		
5388002	H-528	Ⓐ1 Hole Plug
5388001	H-1012-A	Ⓐ2 Vandal Resistant Socket Cap*, chrome plated with set screw, for Regal "XL" flushometer – 6 per package
0308612	H-622	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

H-745 Stop, chrome plated: Screwdriver Angle Stop with J-2/J-7 Bumper (for Regal® Valve Stop) (-YO/-YG Variations) – OBSOLETE



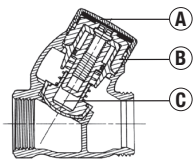
Complete Stops		
0388035	H-725-A	1" NPTF inlet for adjustable tail
Repair Parts		
5310034	J-2/J-7	Ⓐ Cap*, chrome plated – 6 per package – **OBSOLETE**
0308991	H-639	Ⓑ Bonnet, chrome plated – **OBSOLETE**
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit* – **OBSOLETE**

H-750 Stop, chrome plated: Screwdriver Straight Stop with H-1010-A Vandal Resistant Cap



Complete Stops		
3308389	H-750-AG	1" NPTF inlet for ground joint tail
Repair Parts		
3308772	H-1010-A	Ⓐ Vandal Resistant Cap*, chrome plated
0308612	H-622	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

H-760 Stop, chrome plated: Screwdriver Straight Stop with H-573-A Locking Vandal Resistant Cap



Complete Stops		
0388023	H-760-AG	1" NPTF inlet for ground joint tail
Repair Parts		
0308738	H-573-A	Ⓐ Locking Vandal Resistant Cap*, chrome plated
0308612	H-622	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

*Refer to page 98 for diagrams of our Stop Caps and page 99 for the components supplied in our Control Stop Repair Kits.

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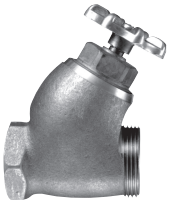
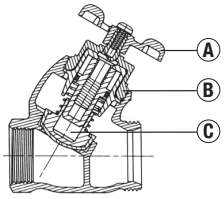
Control Stop

ONTROL STOP AND REPLACEMENT PARTS

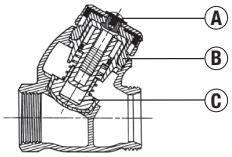
H-770 Stop, rough brass: Concealed Wheel Handle Straight Stop





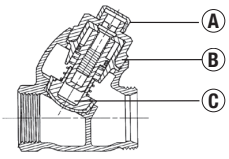
Complete Stops		
0388030	H-770-AG	1" NPTF inlet for ground joint tail
Repair Parts		
3308872	H-1011-A	Ⓐ Concealed Wheel Handle Repair Kit*
0208083	H-623	Ⓑ Bonnet, rough brass
3308860	H-1006-A	Ⓒ Control Stop Repair Kit*

H-775 Stop, chrome plated: Exposed Wheel Handle Straight Stop



Complete Stops		
0388036	H-775-AG	1" NPTF inlet for ground joint tail
Repair Parts		
3308060	H-1002-A	Ⓐ Exposed Wheel Handle Repair Kit*
0308615	H-623	Ⓑ Bonnet, chrome plated
3308855	H-541-AWH	Ⓒ Control Stop Repair Kit*

H-780 Stop, chrome plated: Screwdriver Straight Stop with H-37 Cap (Regal® Valve Stop) and H-795 Stop, chrome plated: Screwdriver Straight Stop with Vandal Resistant Cap (for Regal or Regal XL Valve Stop)

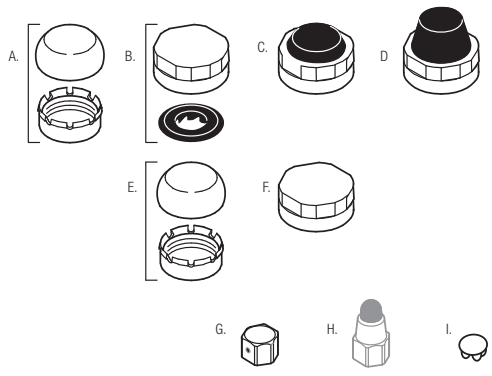


Complete Stops For Regal® flushometers		
0388027	H-780-AG	1" NPTF inlet for ground joint tail – **OBSOLETE**
Complete Stops For Regal® "XL" flushometers		
0388079	H-795-AG	1" NPTF inlet for ground joint tail
Repair Parts		
5388001	H-1012-A	Ⓐ Vandal Resistant Socket Cap*, chrome plated with set screw, for Regal "XL" flushometer – 6 per package
0308991	H-639	Ⓑ Bonnet, chrome plated
3308853	H-541-ASD	Ⓒ Control Stop Repair Kit*

For H-790 Stop, refer to information shown for H-740 and H-790 Stops
For H-795 Stop, refer to information shown for H-780 and H-795 Stops

CONTROL STOP AND REPLACEMENT PARTS FOR H-540, H-600 AND H-700 SERIES CONTROL STOPS

Replacement Stop Caps for Screwdriver Control Stops for H-540, H-600, and H-700 Series Control Stops



Item No.	Code No.	Part No.	Description
For 1" H-600 and H-700 Series Stops and 3/4" H-700 Series Stops			
A.	**3308772**	H-1010-A	Vandal Resistant Stop Cap, chrome plated, with Sleeve
	5308954	H-628	Plastic Sleeve only – 6 per package
B.	**3308840**	H-573-A	Locking Vandal Resistant Stop Cap, chrome plated
C.	**3308866**	H-574	Stop Cap, chrome plated with Seat Bumper (-YO)
D.	**3308867**	H-576	Stop Cap, chrome plated with Extended Seat Bumper (-YG)
For 3/4" H-600 Series Stops			
E.	**3308790**	H-1009-A	Vandal Resistant Stop Cap, chrome plated, with Sleeve and 3/4" Bonnet
	5308952	H-614	Plastic Sleeve only – 6 per package
F.	**0308848**	H-582	Stop Cap, chrome plated
For all H-40, H-440, H-540 and H-740 Series Stops			
G.	**5388001**	H-1012-A	Vandal Resistant Stop Cap with set screw, chrome plated – 6 per package
H.	**5310034**	J-2/J-7	Stop Cap, chrome plated with Seat Bumper – 6 per package – **OBSOLETE**
I.	**5388002**	H-528	Hole Plug

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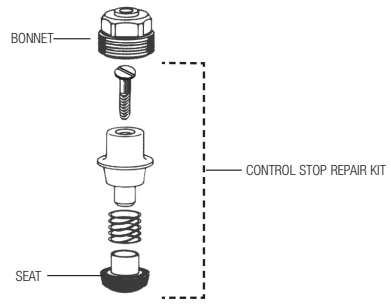
Control Stop

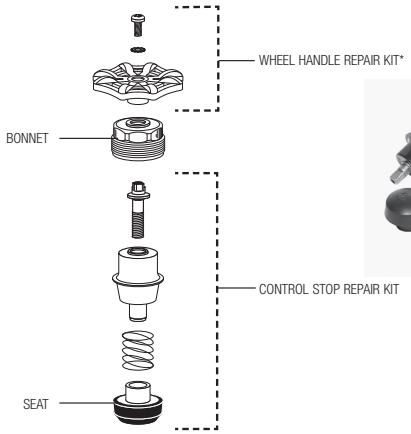
CCONTROL STOP AND REPLACEMENT PARTS FOR H-540, H-600 AND H-700 SERIES CONTROL STOPS

Screwdriver Control Stop Repair Kits



Code No.	Part No.	Description
Complete Repair Kits		
3308853	H-541-ASD	For 1" H-540, H-600 and H-700 Series Stops and 3/4" H-700 Series Stops
3308856	H-543-ASD	For 3/4" H-540 and H-600 Series Stops
Bonnets		
0308612	H-622	For 1" H-600 and H-700 Series Stops and 3/4" H-700 Series Stops
0308991	H-639	For 1" H-540 and H-740 Series Stops and 3/4" H-740 Series Stops
0308843	H-577	For 3/4" H-600 Series Stops – **OBSOLETE**
0308601	H-538	For 3/4" H-540 Series Stops – **OBSOLETE**
Seat only – 6 per package		
5308850	H-584	For 1" H-540, H-600 and H-700 Series Stops and 3/4" H-700 Series Stops
5308836	H-569	For 3/4" H-540 and H-600 Series Stops

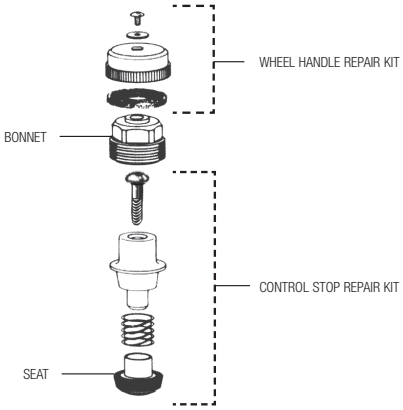
Concealed Wheel Handle Control Stop Repair Kits – Note: Repair Kit includes H-1011-A Wheel Handle Repair Kit



Complete Repair Kits		
3308860	H-1006-A	For 1" H-540, H-600 and H-700 WH Series Stops and 3/4" H-700 WH Series Stops
3308859	H-1007-A	For 3/4" H-540 and H-600 Series Stops
Wheel Handle Repair Kit — Note: Repair Kit includes handle, screw and lockwasher		
3308872	H-1011-A	For all Concealed Wheel Handle Stops
Bonnets		
0208083	H-623	For 1" H-540, H-600 and H-700 WH Series Stops and 3/4" H-700 Series Stops
0308705	H-561	For 3/4" H-540, H-600 Series Stops – **OBSOLETE**
Seat only – 6 per package		
5308850	H-584	For 1" H-540, H-600 and H-700 WH Series Stops and 3/4" H-700 WH Series Stops
5308836	H-569	For 3/4" H-540 and H-600 Series Stops

NOTE: H-540 and H-600 Series concealed wheel handle stops made prior to 1993 featured a design identical to the exposed wheel handle design. These stops can be repaired using an exposed wheel handle repair kit or converted to the current design by using a concealed wheel handle repair kit.

Exposed Wheel Handle Control Stop Repair Kits



Complete Repair Kits		
3308855	H-541-AWH	For 1" H-540, H-600 and H-700 WH Series Stops and 3/4" H-700 Series Stops
3308858	H-543-AWH	For 3/4" H-540 and H-600 Series Stops
Wheel Handle Repair Kit — Note: Repair Kit includes handle, washer, screw and lockwasher		
3308060	H-1002-A	For all Exposed Wheel Handle Stops
5308059	H-1003-A	Screw and Lockwasher only – 12 per package
Bonnets		
0308615	H-623	For 1" H-540, H-600 and H-700 WH Series Stops and 3/4" H-700 Series Stops
0308705	H-561	For 3/4" H-540 and H-600 Series Stops – **OBSOLETE**
Seat only – 6 per package		
5308850	H-584	For 1" H-540, H-600 and H-700 WH Series Stops and 3/4" H-700 WH Series Stops
5308836	H-569	For 3/4" H-540 and H-600 Series Stops

NOTE: 1" and 3/4" H-700 Series stops use "common stop" repair kits. 1" and 3/4" H-540 and H-600 Series stops use stop repair kits unique to each size. See the "common stop" on page 102 for more details.

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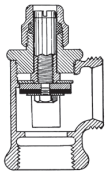
Control Stop

CONTROL STOP AND REPLACEMENT PARTS FOR OLDER CONTROL STOPS

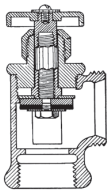
Code No.	Part No.	Description

H-10-A 1" Screwdriver Angle Stop, (also fits H-15-A 1" Screwdriver Straight Stop) — used from 1920's through 1940's

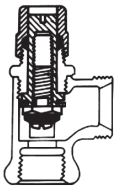
5308077	H-12	Packing only – 12 per package
—	—	Bonnet no longer available

H-10-A 1" Wheel Handle Angle Stop (also fits H-15-A 1" Wheel Handle Straight Stop) — Used from 1920's through 1940's

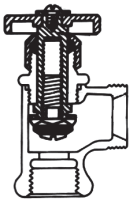
5308077	H-12	Packing only – 12 per package
—	—	Bonnet no longer available

H-20-A 1/2" and 3/4" Screwdriver Angle Stop (also fits H-30-A Screwdriver Straight Stop) — Used from 1920's through 1950's

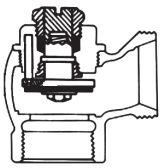
5308077	H-12	Packing only – 12 per package
—	—	Bonnet no longer available

H-20-A 1/2" and 3/4" Wheel Handle Angle Stop (also fits H-30-A Wheel Handle Straight Stop) — Used from 1920's through 1950's

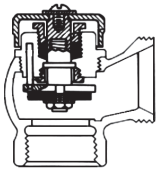
5308077	H-12	Packing only – 12 per package
—	—	Bonnet no longer available

H-40-A 3/4" and 1" Screwdriver Angle Stop (also fits H-45-A Screwdriver Straight Stop) — Used from 1930's through 1960's

3308277	H-47-A-SD	Repair kit includes packing ring, key socket, lock shield, retaining ring, screw assembly, and packing
0308176	H-39-A-SD	Bonnet assembly repair kit includes a bonnet assembled with packing ring, key socket, retaining ring, screw assembly, and packing plus our H-37 Vandal Resistant Stop Cap that replaces the lock shield
5308077	H-12	Packing only – 12 per package
0308167	H-39	Bonnet Only

H-40-A 3/4" and 1" Wheel Handle Angle Stop (also fits H-45-A Wheel Handle Straight Stop) — Used from 1930's through 1960's

3308278	H-47-A-WH	Repair kit includes packing ring, screw, wheel handle, key stem, gland for wheel handle, retaining gland, screw assembly, washer and packing
0308175	H-39-A-WH	Bonnet assembly repair kit includes a bonnet assembled with packing ring, screw, wheel handle, key stem, gland for wheel handle, retaining gland, screw assembly, washer and packing
5308077	H-12	Packing only – 12 per package
0308170	H-39	Bonnet Only

NOTE: STOPS PRIOR TO 1964 WERE GROUND JOINT

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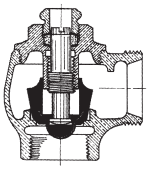
Repair Parts and Maintenance Guide **P1**

Control Stop

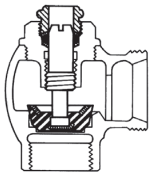
CONTROL STOP AND REPLACEMENT PARTS

H-340-A 3/4" and 1" Screwdriver and Wheel Handle Angle Stops — Used from 1940's through 1950's



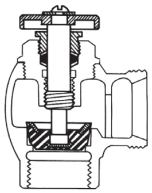
Code No.	Part No.	Description
		The only replacement part available for this stop is the rubber plug.
0308433	H-382-A	Rubber Plug

H-440-A 3/4" Screwdriver Angle Stop — Used from 1950's through 1960's



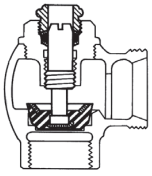
3308442	H-484-A-SD	Repair kit includes lock shield, packing, key stem, rubber plug, and packing ring
0308432	H-439-AU	Bonnet assembly repair kit includes a bonnet assembled with packing, key stem, rubber plug, and packing ring plus our H-37 Vandal Resistant Stop Cap that replaces the lock shield
0308434	H-439	Bonnet
0308490	H-484-A	Rubber Plug
5308077	H-12	Packing only – 12 per package

H-440-A 3/4" Wheel Handle Angle Stop — Used from 1950's through 1960's



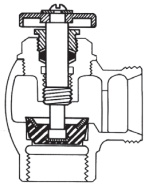
0308435	H-439	Bonnet
0308490	H-484-A	Rubber Plug
5308077	H-12	Packing only – 12 per package

H-440-A 1" Screwdriver Angle Stop (also fits H-445-A Screwdriver Straight Stop) — Used from 1950's through 1960's



3308453	H-482-A-SD	Repair kit includes lock shield, packing, key stem, rubber plug, and packing ring
0308428	H-439-A	Bonnet assembly repair kit includes a bonnet assembled with packing ring, key socket, retaining ring, screw assembly, and packing plus our H-37 Vandal Resistant Stop Cap that replaces the lock shield
0308434	H-439	Bonnet
0308489	H-482-A	Rubber Plug
5308077	H-12	Packing only – 12 per package

H-440-A 1" Wheel Handle Angle Stop (also fits H-445-A Wheel Handle Straight Stop) — Used from 1950's through 1960's



0308435	H-439	Bonnet
0308489	H-482-A	Rubber Plug
5308077	H-12	Packing only – 12 per package

NOTE: H-440 Series control stops were used with Sloan's "Quiet Flush" flushometer models.
NOTE: All obsolete control stops are for ground joint tailpiece connections.
NOTE: Sloan has made other stops up to 1964. If you have an older stop that is not listed on these two pages, the repair parts are obsolete. Prior to 1964, all stops were ground joint connections; the H-700-AG series stops, 3/4" and 1" angle stops, and 1" straight stops, are the current replacement.

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Repair Parts and Maintenance Guide **P1**

Control Stop

THE "COMMON STOP"

In 1996, Sloan began using the H-700 series of control stops with all flushometers. This "common stop" offers 3/4" and 1" supply inlet size options, yet uses a single repair kit for both urinal and water closet stops. This change primarily affects the H-700 series 3/4" stops, which now use the same repair kit as 1" stops. Repair kits for the smaller H-540 and H-600 3/4" stops remain available and are included in this section.

The "common stop" body offers precise control over flow rates delivered through the valve. This feature is important, especially for 1-gallon urinal designs. This finite flow adjustment makes the difference between a proper flush and an ineffective flush that splashes and spills.

The "common stop" internal components are interchangeable with their counterparts in older H-600 and H-540 stops. The distinctively contoured seat plug in the "common stop" allows a finer flow rate adjustment similar to that of a needle valve. Unlike natural rubber components that can be destroyed by water treatment products, our synthetic Permex™ rubber seat plugs resist the effects of chloramines. Our stop spring, formerly brass, is now constructed of stainless steel. This helps prevent corrosion from the increasingly aggressive water supplies we see today.

All complete "common stops" now have bonnets stamped with an H-700 series number. Both exposed and concealed wheel handle stops are stamped H-700-WH series. The H-740 and H-780 stops that replace the H-540 series stops used with Regal valves are stamped H-740 series.

CONTROL STOP DESIGNS

Supply Inlets

Sloan supplies control stops in two basic inlet sizes:

1. 3/4" NPTF — For most urinal flushometers
2. 1" NPTF — For all water closet flushometers and blow-out urinal flushometers

Control stops are also available in some models with the following inlets for specialized and export applications:

1. 1" Whitworth thread
2. 1" BSP British Standard Pipe inlet
3. 1" NSPM Straight thread — for use with shipboard Sil-Braz fittings

Tailpiece Connections

The majority of flushometers supplied by Sloan since 1964 feature an adjustable tailpiece. Connection of the valve tailpiece to the control stop is made with a sliding O-ring seal.

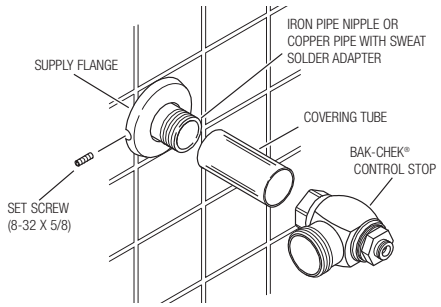
Older valves (produced before 1964), and valves furnished for salt-water installations, and all straight stops utilized a metal-to-metal ground joint (GJ) connection.

When replacing an older stop, it is important to note which type of stop connection is required.

Stops for use with salt water must be made from Naval brass.

GENERAL INSTALLATION INSTRUCTIONS

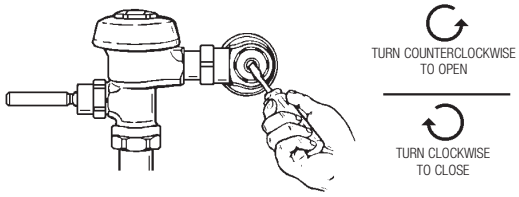
Install the Sloan Bak-Chek® control stop to water supply line with outlet positioned as required. Tighten the control stop coupling with a wrench.



CONTROL STOP ADJUSTMENT

After installation or service, readjust the control stop to meet the flow rate required for the proper cleansing of the fixture. Open the control stop COUNTERCLOCKWISE one full turn from the closed position. Activate flushometer.

Adjust control stop after each flush until the rate of flow delivered properly cleanses the fixture. Turn the control stop adjustment screw (or wheel handle) COUNTERCLOCKWISE to increase the flow rate or CLOCKWISE to decrease the flow rate.



Important: A Sloan flushometer is engineered for quiet operation. Excessive water flow creates noise, while too little water flow may not satisfy the needs of the fixture. Proper adjustment is made when the plumbing fixture is cleansed after each flush without splashing water out from the lip AND a quiet flushing cycle is achieved.

The control stop should never be opened to the point where the flow from the valve exceeds the flow capability of the fixture. In the event of a valve failure, the fixture must be able to accommodate a continuous flow from the valve.

MAINTENANCE AND CLEANING

Control stops have moving parts that may wear over time. Deterioration of rubber parts may result in an incomplete seal. If you can not shut off the stop completely, or if leakage is visible at the adjustment screw, order one of our control stop repair kits and rebuild the control stop.

DO NOT USE abrasive or chemical cleaners to clean flushometers. These cleaners may dull the luster and attack the chrome or special decorative finishes. Use **ONLY** mild soap and water, and then wipe dry with a clean cloth or towel. While cleaning the bathroom tile, protect the flushometer from any splattering of cleaner. Acids and cleaning fluids can discolor or remove chrome plating.

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Repair Parts and Maintenance Guide **P1**

Flush Connections and Flanges

Complete Flush Connection Assemblies
Chrome Plate Finish for Exposed Installations

Code No.	Part No.	Description
For Models 110/111		
0393007	V-600-AA	CP Vacuum Breaker 1-1/2" x 9"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 113		
0393008	V-600-AA	CP Vacuum Breaker 1-1/2" x 13-1/2"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 114		
0393011	V-600-AA	CP Vacuum Breaker 1-1/2" x 32-1/2"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 115		
0393009	V-600-AA	CP Vacuum Breaker 1-1/2" x 21-1/2"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 116		
0393010	V-600-AA	CP Vacuum Breaker 1-1/2" x 24-1/2"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 117		
0393009	V-600-AA	CP Vacuum Breaker 1-1/2" x 21-1/2"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 180		
0393006	V-600-AA	CP Vacuum Breaker 1-1/4" x 9"
0306140	F-5-AU	CP Spud Coupling 1-1/4" x 3"
For Model 186		
0393004	V-600-AA	CP Vacuum Breaker 3/4" x 9"
0306125	F-5-AW	CP Spud Coupling 3/4" x 2-1/2"
For Model 300/310		
0306060	F-2-AU	CP Coupling 1-1/4"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306196	F-7	CP Flange w//Prongs 1" x 2-3/4"
0306209	F-7	CP Flange Flat 1-1/4" x 3-1/8"
0306555	F-21-AA	Elbow 1-1/2" x 1-1/4" x 4"
0393007	V-600-AA	CP Vacuum Breaker 1-1/2" x 9"
0396009	F-43-A	CP Outlet & Street El 1"
0396093	F-101	CP Outlet
For Model 320		
0301149	A-35	Reducer Bushing 1" NPT x 3/4 NPT
0306052	F-2-AW	CP Coupling Assembly 3/4"
0306125	F-5-AW	CP Spud Coupling 3/4" x 2-1/2"
0306188	F-7	CP Flange Flat 3/4" x 2-23/32"
0306343	F-15-A	CP Elbow Tail Assembly 3/4" x 4"
0393004	V-600-AA	Vacuum Breaker 3/4" x 9"
0396009	F-43-A	CP Outlet & Street El 1"
0396093	F-101	CP Outlet 1-1/2" x 4-1/2"

Complete Flush Connection Assemblies
Chrome Plate Finish for Exposed Installations (continued)

Code No.	Part No.	Description
For Model 120		
0306093	F-2-AT	CP Coupling 1-1/2"
0393003	V-600-A	CP Vacuum Breaker
0396293	F-109	CP Tube 1-1/2" x 8" x 5" Bend
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 121		
0306093	F-2-AT	CP Coupling 1-1/2"
0393003	V-600-A	CP Vacuum Breaker
0396316	F-109	CP Tube 1-1/2" x 13" x 5" Bend
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 122		
0306093	F-2-AT	CP Coupling 1-1/2"
0393003	V-600-A	CP Vacuum Breaker
0396322	F-109	CP Tube 1-1/2" x 21" x 5" Bend
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 136		
0393038	V-600-AA	CP Vacuum Breaker 1-1/2" x 36"
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
For Model 137		
0306093	F-2-AT	CP Coupling 1-1/2"
0393003	V-600-A	CP Vacuum Breaker
0396339	F-109	CP Tube 1-1/2" x 36" x 5""
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"

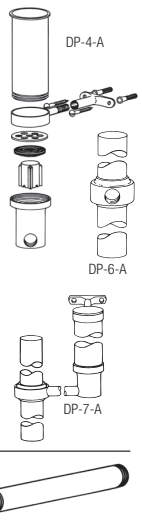
Drip Pocket Flush Connection Assemblies and Parts

DP-4-A Includes:		
0330015	DP-4-A	Drip Pocket
0330026	DP-1002-A	Float & Seat Repair Kit For DP-4-A
0330002	DP-2-A	Drip Pocket Wall Support (Available upon request)
DP-6-A Includes:		
0330021	DP-6-A	1-1/2" x 18-1/2" CP Outlet
DP-7-A Includes:		
0330002	DP-2-A	D.P. Wall Support
0330015	DP-4-A	Drip Pocket Assembly
0330021	DP-6-A	Drip Pocket Flush Connection
0330004	F-33	Extension Nipple

Use on the following flush valve: 118

Special F-33 Includes:

0330004	F-33	Extension for DP-4-A



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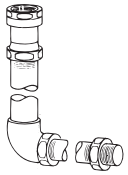
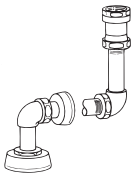
Flush Connections and Flanges

Complete Flush Connection Assemblies
Rough Brass Finish for Concealed Installations

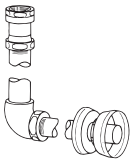
Code No.	Part No.	Description
For Model 150		
0323011	V-500-A	RB Vacuum Breaker
0306087	F-2-A	RB 1-1/2" Coupling w/S30
0306569	F-22	RB Outlet 1" NPT Female
For Model 152		
0323177	V-500-AA	RB Vacuum Breaker 1-1/2" x 22" w/ 3" Score
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" Coupling
—	F-100	RB Outlet - Specify Size



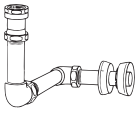
Code No.	Part No.	Description
For Model 153/155		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306237	F-7	CP Flange w/Prongs 1-1/2" x 2-3/4"
0306400	F-15-A	CP Elbow 1-1/2" x 4"
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0323176	V-500-AA	1-1/2" x 17-1/2" w/ 3" Score
—	F-102	CP Outlet - Specify Size



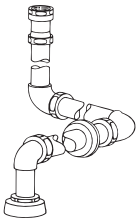
Code No.	Part No.	Description
For Model 154		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306237	F-7	CP Flange 1-1/2" x 2-3/4" w/Prongs
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0323177	V-500-AA	RB Vacuum Breaker 1-1/2" x 22 w/ 3" Score
—	F-102	CP Outlet - Specify Size



Code No.	Part No.	Description
For Model 140		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306237	F-7	CP Flange w/Prongs 1-1/2" x 2-3/4"
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0306688	F-25-A	RB Elbow/Tail 1-1/2" x 10" C/E w/ 3" Score
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/ 3" Score
—	F-102	CP Outlet - Specify Size

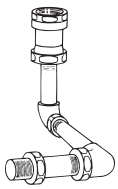


Code No.	Part No.	Description
For Model 142		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306237	F-7	CP Flange w/Prongs 1-1/2" x 2-3/4"
0306400	F-15-A	CP Elbow 1-1/2" x 4"
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0306688	F-25-A	RB Elbow/Tail 1-1/2" x 10 C/E w/ 3" Score
0323207	V-500-AA	RB Vacuum Breaker 1-1/2" x 6" w/ 3" Score
—	F-102	CP Outlet - Specify Size



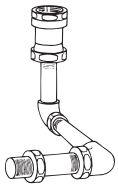
Complete Flush Connection Assemblies
Rough Brass Finish for Concealed Installations (continued)

Code No.	Part No.	Description
For Model 143		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0306688	F-25-A	RB Elbow/Tail 1-1/2" x 10" C/E w/ 3" Score
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2 w/ 3" Score
—	F-100	RB Outlet - Specify Size



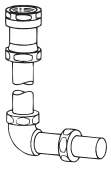
Code No.	Part No.	Description
For Model 144		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0306688	F-25-A	RB Elbow/Tail 1-1/2" x 10" C/E w/ 3" Score
0323208	V-500-AA	RB Vacuum Breaker 1-1/2" x 7-1/2" w/ 3" Score
—	F-100	RB Outlet - Specify Size

Code No.	Part No.	Description
For Model 192		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306140	F-5-AU	CP Spud Coupling
0306237	F-7	CP Flange w/Prongs 1-1/2" x 2-3/4"
0306472	F-15-A	CP Elbow/Tail 1-1/2" x 1-1/4" x 4"
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/ 3" Score
—	F-102	CP Outlet -Specify Size



Code No.	Part No.	Description
For Model 195		
0306054	F-2-AW	RB Coupling 3/4"
—	F-15-A	Specify Size
0323003	V-500-AA	RB Vacuum Breaker 3/4" x 10-1/2"
For Model 197		
0306125	F-5-AW	CP Spud Coupling 3/4" x 2-1/2"
0306186	F-7	CP Flange 3/4" x 2-3/4"
0306375	F-15-A	CP Elbow/Tail 3/4" x 5"
0306376	F-15-A	CP Elbow/Tail 3/4" x 14"
0323003	V-500-AA	RB Vacuum Breaker 3/4" x 10-1/2"

Code No.	Part No.	Description
For Model 190		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306059	F-2-AU	RB Coupling 1-1/4"
0306088	F-2-AT	RB Coupling 1-1/2"
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/3" Score
—	F-110	Specify Size



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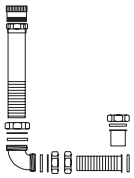
Repair Parts and Maintenance Guide **P1**

Flush Connections and Flanges

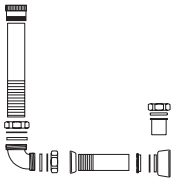
Complete Flush Connection Assemblies
Rough Brass Finish for Concealed Installations (continued)

Code No.	Part No.	Description
For Model 312		
0306060	F-2-AU	CP Coupling 1-1/4"
0306087	F-2-A	RB 1-1/2" Coupling w/S30
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306209	F-7	CP Flange Flat 1-1/4" x 3-1/8"
0306555	F-21-AA	CP Elbow 1-1/2" x 1-1/4" x 4"
0306569	F-22	RB Outlet 1" NPT Female x 1-1/2"
0393007	V-600-AA	CP Vacuum Breaker 1-1/2" x 9"

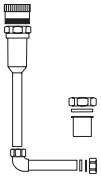
For Model 313		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306087	F-2-A	RB 1-1/2" Coupling w/S30
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0306569	F-22	RB Outlet 1" NPT Female x 1-1/2"
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0322026	V-79	RB 1" Adapter
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/3" Score
—	F-100	RB Outlet



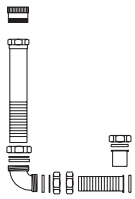
For Model 318		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306087	F-2-A	RB 1-1/2" Coupling w/S30
0306146	F-5-AT	CP Spud Coupling 1-1/2" x 3"
0306237	F-7	CP Flange w/Prongs 1-1/2" x 2-3/4"
0306569	F-22	RB Outlet 1" NPT Female x 1-1/2"
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" SJ Coupling
0322026	V-79	RB 1" Adapter
	F-102	CP Outlet - Specify Size
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/3" Score



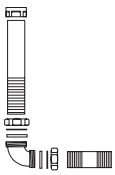
For Model 323		
0206160	F-22	RB 3/4" Outlet Female
0306054	F-2-AW	RB 3/4"
0306087	F-2-A	RB 1-1/2" Coupling w/S30
0306366	F-15-A	RB Elbow Tail Assembly 3/4" x 11"
0322021	V-79	RB 3/4" Adapter Inlet
0323003	V-500-AA	RB Vacuum Breaker 3/4" x 10-1/2"



For Model 343		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306059	F-2-AU	RB Coupling 1-1/4"
0306087	F-2-A	RB 1-1/2" Coupling w/S30
0306091	F-2-A	RB 1-1/2" Coupling w/S21
0306569	F-22	RB Outlet 1" NPT Female x 1-1/2"
0322026	V-79	RB 1" Adapter
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/ 3" Score
—	F-110	RB 1-1/2" Flange x 1-1/4" Tube w/Score



For Model 139		
0206146	F-21	RB 1-1/2" EI Double Male Slip
0306619	F-2-AA	RB Two Sets F-2-A 1-1/2" Coupling
0323312	V-500-AA	RB Vacuum Breaker 1-1/2" x 33-1/2" w/3" Score
0396210	F-102	RB Tube 1-1/2" x 10" w/Score



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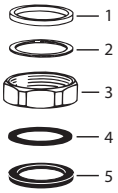
Repair Parts and Maintenance Guide **P1**

Flush Connections and Flanges

Couplings and Gaskets

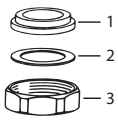
Item No.	Code No.	Part No.	Description
F-2-A			
1-3	**0306052**	F-2-A	3/4" CP Coupling Assembly
	0306054	F-2-A	3/4" RB Coupling Assembly
	0306077	F-2-A	1" CP Coupling Assembly
	0306060	F-2-A	1-1/4" CP Coupling Assembly
	0306059	F-2-A	1-1/4" RB Coupling Assembly
	0306093	F-2-A	1-1/2" CP Coupling Assembly
	0306088	F-2-A	1-1/2" RB Coupling Assembly
3-4	**0306092**	F-2-A	1-1/2" CP Coupling Assembly
	0306087	F-2-A	1-1/2" RB Coupling Assembly
1	**5306113**	F-5	3/4" SJ Gasket
	5306115	F-5	1" SJ Gasket
	5322176	VBF-5	1-1/4" SJ Gasket
	5322001	VBF-5	1-1/2" SJ Gasket
2	**5306055**	F-3	3/4" Friction Ring
	5306056	F-3	1" Friction Ring
	5306057	F-3	1-1/4" Friction Ring
	5306058	F-3	1-1/2" Friction Ring
3	*	F-2	3/4" CP Coupling
	*	F-2	3/4" RB Coupling
	*	F-2	1" CP Coupling
	*	F-2	1-1/4" CP Coupling
	*	F-2	1-1/4" RB Coupling
	0306045PK	F-2	1-1/2" CP Coupling
	*	F-2	1-1/2" RB Coupling
4	**5319086**	S-30	1-1/2" Gasket
5	**0319079**	S-21	1-1/2" Rigid Seat
3-5	**0306091**	F-2-A	1-1/2" with S-21 Seat

*N/A order appropriate F-2-A



NF-2-A

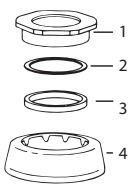
1	**0396264**	F-105	1-1/2" x 1-1/4" SJ Gasket
1-3	**0314011**	NF-2-A	1-1/2" x 1-1/4" SJ Reducing Coupling Assembly



Spud Coupling Assemblies

F-5-A			
1-4	**0306125**	F-5-A	3/4" CP Spud Coupling Assembly
	0306132	F-5-A	1" CP Spud Coupling Assembly
	0306140	F-5-A	1-1/4" CP Spud Coupling Assembly
	0306146	F-5-A	1-1/2" CP Spud Coupling Assembly
1-3	**0306516**	F-20-AW	3/4" Spud Coupling
	0306524	F-20-AU	1-1/4" Spud Coupling
	0306526	F-20-AT	1-1/2" Spud Coupling
2	**5306055**	F-3	3/4" Friction Ring
	5306056	F-3	1" Friction Ring
	5306057	F-3	1-1/4" Friction Ring
	5306058	F-3	1-1/2" Friction Ring
3	**5306113**	F-5	3/4" SJ Gasket
	5306115	F-5	1" SJ Gasket
	5322176	VBF-5	1-1/4" Gasket
	5322001	VBF-5	1-1/2" Gasket
4	**0306189**	F-7	3/4" Spud Flange
	0306197	F-7	1" Spud Flange
	0306214	F-7	1-1/4" Spud Flange
	0306238	F-7	1-1/2" Spud Flange

Note: 3-1/2" spud flange available in old style only.



Wall Flange For Tubing

Code No.	Part No.	Description
F-7 (2-3/4" O.D. X 5/8" Deep)		
0306204	F-7	1-1/4" Tube Flange
0306237	F-7	1-1/2" Tube Flange

Supply Flange For Iron Pipe

F-7 (2-3/4" O.D.)		
0306191	F-7	3/4" IPS CP Supply Flange
0306196	F-7	1" IPS CP Supply Flange
0306205	F-7	1-1/4" IPS CP Supply Flange

F-7 (2-3/4" O.D. Flat)		
0306167	F-7	1/2" IPS CP Supply Flange
0306188	F-7	3/4" IPS CP Supply Flange
0306201	F-7	1" IPS CP Supply Flange
0306209	F-7	1-1/4" IPS CP Supply Flange

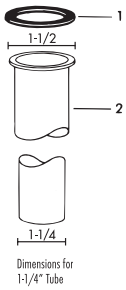
F-45-A

0396019	F-45-A	3/4" Heavy Supply Flange with Set Screw for IPS
0396020	F-45-A	1" Heavy Supply Flange with Set Screw for IPS

For additional flanges, see 4.9.1

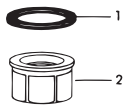
Outlets

Item No.	Code No.	Part No.	Description
F-1 (Flanged)			
1	**5319086**	S-30	Gasket
2	**0306007**	F-1	1-1/2" x 1-1/4" x 6" CP Flanged Outlet
	0306009	F-1	1-1/2" x 1-1/4" x 8" CP Flanged Outlet
	0306012	F-1	1-1/2" x 1-1/4" x 10" CP Flanged Outlet
	0306013	F-1	1-1/2" x 1-1/4" x 12" CP Flanged Outlet
	0306031	F-1	1-1/2" x 6" CP Flanged Outlet
	0306034	F-1	1-1/2" x 8" CP Flanged Outlet
	0306039	F-1	1-1/2" x 10" CP Flanged Outlet
	0306044	F-1	1-1/2" x 12" CP Flanged Outlet



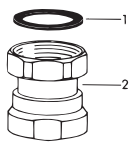
F-22

1	**5319086**	S-30	Gasket
2	**0206159**	F-22	1/2" IPS RB Female Outlet
	0206160	F-22	3/4" IPS RB Female Outlet
	0306569	F-22	1" IPS RB Female Outlet



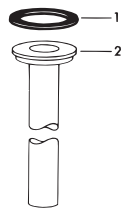
F-22-A

1-2	**0306574**	F-22-A	1-1/4" IPS RB Union Outlet Assembly
	0306575	F-22-A	1-1/4" IPS CP Union Outlet Assembly
1	**5319086**	S-30	Gasket



F-29-A

1	**5319086**	S-30	Gasket
2	**0306767**	F-29-A	3/4" x 6" CP Outlet
	0306769	F-29-A	3/4" x 7-1/2" RB Outlet
	0306773	F-29-A	3/4" x 8-1/2" CP Outlet
	0306791	F-29-A	3/4" x 10-1/2" RB Outlet



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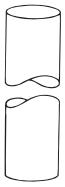
Flush Connections and Flanges

Outlets (continued)

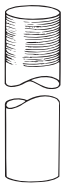
Code No.	Part No.	Description
F-101		
0396060	F-101	3/4" x 4-1/2" CP Outlet
0396100	F-101	1-1/2" x 6" CP Outlet
0396113	F-101	1-1/2" x 9" CP Outlet
0396119	F-101	1-1/2" x 10-1/2" CP Outlet
0396127	F-101	1-1/2" x 13-1/2" CP Outlet
0396134	F-101	1-1/2" x 18-1/2" CP Outlet
0396142	F-101	1-1/2" x 21-1/2" CP Outlet
0396147	F-101	1-1/2" x 24-1/2" CP Outlet



F-102 (Scored - Both Ends)		
0396175	F-102	1-1/4" x 5" RB Outlet, 3-3/4" "L" Dimension
0396176	F-102	1-1/4" x 6" RB Outlet, 4-3/4" "L" Dimension
0396177	F-102	1-1/4" x 7" RB Outlet, 5-3/4" "L" Dimension
0396178	F-102	1-1/4" x 8" RB Outlet, 6-3/4" "L" Dimension
0396179	F-102	1-1/4" x 9" RB Outlet, 7-3/4" "L" Dimension
0396180	F-102	1-1/4" x 10" RB Outlet, 8-3/4" "L" Dimension
0396181	F-102	1-1/4" x 11" RB Outlet, 9-3/4" "L" Dimension
0396182	F-102	1-1/4" x 12" RB Outlet, 10-3/4" "L" Dimension
0396183	F-102	1-1/4" x 13" RB Outlet, 11-3/4" "L" Dimension
0396184	F-102	1-1/4" x 14" RB Outlet, 12-3/4" "L" Dimension
0396185	F-102	1-1/4" x 15" RB Outlet, 13-3/4" "L" Dimension
0396186	F-102	1-1/4" x 16" RB Outlet, 14-3/4" "L" Dimension
0396678	F-102	1-1/2" x 5" RB Outlet, 3-3/4" "L" Dimension
0396674	F-102	1-1/2" x 6" RB Outlet, 4-3/4" "L" Dimension
0396194	F-102	1-1/2" x 7" RB Outlet, 5-3/4" "L" Dimension
0396201	F-102	1-1/2" x 8" RB Outlet, 6-3/4" "L" Dimension
0396206	F-102	1-1/2" x 9" RB Outlet, 7-3/4" "L" Dimension
0396210	F-102	1-1/2" x 10" RB Outlet, 8-3/4" "L" Dimension
0396214	F-102	1-1/2" x 11" RB Outlet, 9-3/4" "L" Dimension
0396217	F-102	1-1/2" x 12" RB Outlet, 10-3/4" "L" Dimension
0396220	F-102	1-1/2" x 13" RB Outlet, 11-3/4" "L" Dimension
0396221	F-102	1-1/2" x 14" RB Outlet, 12-3/4" "L" Dimension
0396224	F-102	1-1/2" x 15" RB Outlet, 13-3/4" "L" Dimension
0396715	F-102	1-1/2" x 16" RB Outlet, 14-3/4" "L" Dimension

Outlets (continued)

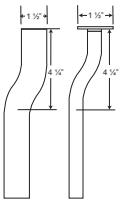
Code No.	Part No.	Description
Special F-102 (Scored - One End)		
0396163	F-102	1-1/4" x 8" CP Outlet, 3-3/4" "L" Dimension
0396164	F-102	1-1/4" x 9" CP Outlet, 4-3/4" "L" Dimension
0396171	F-102	1-1/4" x 15" CP Outlet, 10-3/4" "L" Dimension
0396669	F-102	1-1/2" x 8" CP Outlet, 3-3/4" "L" Dimension
0396670	F-102	1-1/2" x 9" CP Outlet, 4-3/4" "L" Dimension
0396671	F-102	1-1/2" x 10" CP Outlet, 5-3/4" "L" Dimension
0396679	F-102	1-1/2" x 11" CP Outlet, 6-3/4" "L" Dimension
0396672	F-102	1-1/2" x 12" CP Outlet, 7-3/4" "L" Dimension
0396673	F-102	1-1/2" x 13" CP Outlet, 8-3/4" "L" Dimension
0396713	F-102	1-1/2" x 14" CP Outlet, 9-3/4" "L" Dimension
0396714	F-102	1-1/2" x 15" CP Outlet, 10-3/4" "L" Dimension
0396716	F-102	1-1/2" x 16" CP Outlet, 11-3/4" "L" Dimension



F-201		
0396455	F-201	1-1/2" x 1-1/4" x 9" CP Outlet
0396456PK	F-201	1-1/2" x 1-1/4" x 11" CP Outlet
0396461	F-201	1-1/2" x 1-1/4" x 11" CP Outlet
0396464	F-201	1-1/2" x 1-1/4" x 21-1/2" CP Outlet
0396468PK	F-201	1-1/2" x 1-1/4" x 10" CP Outlet

Offset Outlet Tubes

0396202	F-66-A	3/4" x 1" Offset x 13-1/4"
0396203	F-67-A	3/4" x 1-1/2" Offset x 13-1/4"
0396204	F-68-A	3/4" x 2" Offset x 13-1/4"
0396530	F-188	1-1/2" x 1" Offset x 13-1/4"
0396532	F-189	1-1/2" x 1-1/2" Offset x 13-1/4"
0396534	F-190	1-1/2" x 2" Offset x 13-1/4"



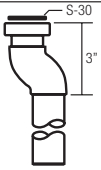
Designed for use with V-600-A or V-500-A "short" Vacuum Breaker. Each tube is 13-1/4" in length.

For 3/4" tubes, and "short" Vacuum Breaker, use F-2-A Coupling S-30 Gasket (Code No. **0306092**).

For 1-1/2" tubes, and "short" Vacuum Breaker, use F-2-A Coupling with Slip Gasket (Code No. **0306093**)

F-31-AA (For High Clearance Offset and Rigid Application)

0306919	F-31-AA	1-1/2" x 8-1/4" CP Flanged and Coupling Outlet ASM W/1" Offset
0306921	F-31-AA	1-1/2" x 8-1/4" CP Flanged and Coupling Outlet ASM W/2" Offset
0306922	F-31-AA	1-1/2" x 9-3/4" CP Flanged and Coupling Outlet ASM W/2" Offset



F-182 Flanged Outlet Tube w/Offset

0396525	F-182	1-1/2" x 8" x 1-1/2" Offset

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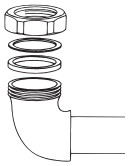
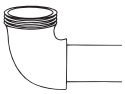
Flush Connections and Flanges

Elbows

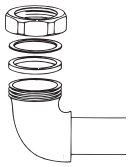
Code No.	Part No.	Description
F-15-A		
0306341	F-15-A	3/4" CP SJ WII with Tail 4-5/8" C to E
0306472	F-15-A	1-1/4" CP SJ WII with Tail 4-5/8" C to E
0306340	F-15-A	3/4" RB SJ Ell & Tail F/ 3-3/4" L Dimension
0306344	F-15-A	3/4" RB SJ Ell & Tail F/ 5-3/4" L Dimension
0306350	F-15-A	3/4" RB SJ Ell & Tail F/ 6-3/4" L Dimension
0306355	F-15-A	3/4" RB SJ Ell & Tail F/ 7-3/4" L Dimension
0306358	F-15-A	3/4" RB SJ Ell & Tail F/ 8-3/4" L Dimension
0306362	F-15-A	3/4" RB SJ Ell & Tail F/ 9-3/4" L Dimension
0306366	F-15-A	3/4" RB SJ Ell & Tail F/ 10-3/4" L Dimension



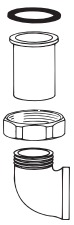
F-21-AA		
0306555	F-21-AA	1-1/2" x 1-1/4" CP Ell with Tail 5 C to E
0306558	F-21-AA	1-1/2" x 1-1/4" CP Ell with Tail 8 C to E



F-25-A		
0306671	F-25-A	1-1/2" RB SJ Ell with Tail 4" C to E
0306678	F-25-A	1-1/2" RB SJ Ell with Tail 5-1/2" C to E
0306682	F-25-A	1-1/2" RB SJ Ell with Tail 7-1/2" C to E
0306683	F-25-A	1-1/2" RB SJ Ell with Tail 8-1/2" C to E
0306687	F-25-A	1-1/2" RB SJ Ell with Tail 9" C to E
0306688	F-25-A	1-1/2" RB SJ Ell with Tail 9-1/2" C to E
0306712	F-25-A	1-1/2" RB SJ Ell with Tail 14" C to E
0306737	F-25-A	1-1/2" RB SJ Ell with Tail 18-1/2" C to E
0306719	F-25-A	1-1/2" RB SJ Ell with Tail 20" C to E

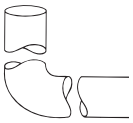


F-43-A		
0396009	F-43-A	1" CP Outlet A7 Street Ell (Royal®)
0396010	F-43-A	1" CP Outlet A7 Street Ell (Crown®)



Tube Ends

Code No.	Part No.	Description
F-109		
0396265	F-109	1-1/4" x 5" x 8-1/2" CP Tube Bend
0396283	F-109	1-1/4" x 5" x 11-1/2" CP Tube Bend
0396288	F-109	1-1/4" x 5" x 13-1/2" CP Tube Bend
0396289	F-109	1-1/4" x 5" x 16" CP Tube Bend
0396290	F-109	1-1/4" x 5" x 21" CP Tube Bend
0396291	F-109	1-1/4" x 5" x 24" CP Tube Bend
0396293	F-109	1-1/2" x 5" x 8-1/2" CP Tube Bend
0396310	F-109	1-1/2" x 5" x 11-1/2" CP Tube Bend
0396316	F-109	1-1/2" x 5" x 13-1/2" CP Tube Bend
0396320	F-109	1-1/2" x 5" x 16" CP Tube Bend
0396322	F-109	1-1/2" x 5" x 21" CP Tube Bend
0396326	F-109	1-1/2" x 5" x 24" CP Tube Bend



Miscellaneous

V-75		
0322013	V-75	Inlet Adaptor for old style Royal®
0322015	V-75	Inlet Adaptor for old style Crown®

Special V-79		
0322021	Spl V-79	3/4" RB Inlet Adaptor
0322026	Spl V-79	1" RB Inlet Adaptor

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Flushometer Parts
Quick Reference Guide

V-500-AA VACUUM BREAKER FLUSH CONNECTION

Code No.	Part No.	Description
5323006	V-500-AA	CP Vacuum Breaker 1-1/4" x 9"
5323005	V-500-AA	CP Vacuum Breaker 3/4" x 9"
5323007	V-500-AA	CP Vacuum Breaker 1-1/2 x 9"
0323229	V-500-AA	CP Vacuum Breaker 1-1/2" x 22-1/2" w/2" Offset
0323225	V-500-AA	CP Vacuum Breaker 1-1/2" x 22-13/16" w/1" Offset
0323227	V-500-AA	CP Vacuum Breaker 1-1/2" x 22-5/8" w/1-1/2" Offset
0323230	V-500-AA	CP Vacuum Breaker 1-1/2" x 25-1/2" w/2" Offset
0323226	V-500-AA	CP Vacuum Breaker 1-1/2" x 25-13/16" w/1" Offset
0323228	V-500-AA	CP Vacuum Breaker 1-1/2" x 25-5/8" w/1-1/2" Offset
0323013	V-500-AA	CP Vacuum Breaker 1-1/2" x 10-1/2"
0323014	V-500-AA	CP Vacuum Breaker 1-1/2" x 13-1/2"
0323017	V-500-AA	CP Vacuum Breaker 1-1/2" x 15"
0323015	V-500-AA	CP Vacuum Breaker 1-1/2" x 21-1/2"
0323016	V-500-AA	CP Vacuum Breaker 1-1/2" x 24-1/2"
0323021	V-500-AA	CP Vacuum Breaker 1-1/2" x 26"
0323057	V-500-AA	CP Vacuum Breaker 1-1/2" x 32"
0323002	V-500-AA	CP Vacuum Breaker 1-1/4" x 10-1/2"
0323018	V-500-AA	CP Vacuum Breaker 1-1/4" x 13-1/2"
0323026	V-500-AA	CP Vacuum Breaker 1-1/4" x 15"
0323020	V-500-AA	CP Vacuum Breaker 1-1/4" x 21-1/2"
0323012	V-500-AA	CP Vacuum Breaker 1" x 9"
0323004	V-500-AA	CP Vacuum Breaker 3/4" x 10-1/2"
0323210	V-500-AA	CP Vacuum Breaker 3/4" x 15"
0323188	V-500-AA	RB Vacuum Breaker 1-1/2" x 11-1/2" w/3" Score
0323142	V-500-AA	RB Vacuum Breaker 1-1/2" x 13-1/2" w/3" Score
0323176	V-500-AA	RB Vacuum Breaker 1-1/2" x 17-1/2" w/3" Score
0323177	V-500-AA	RB Vacuum Breaker 1-1/2" x 22" w/3" Score
0323209	V-500-AA	RB Vacuum Breaker 1-1/2" x 30-1/2" w/3" Score
0323207	V-500-AA	RB Vacuum Breaker 1-1/2" x 6" w/3" Score
0323208	V-500-AA	RB Vacuum Breaker 1-1/2" x 7-1/2" w/3" Score

V-600-AA VACUUM BREAKER FLUSH CONNECTION

Code No.	Part No.	Description
0393029	V-600-AA	CP Vacuum Breaker 1-1/2" x 22-1/2" w/2" Offset
0393025	V-600-AA	CP Vacuum Breaker 1-1/2" x 22-13/16" w/1" Offset
0393027	V-600-AA	CP Vacuum Breaker 1-1/2" x 22-5/8" w/1-1/2" Offset
0393030	V-600-AA	CP Vacuum Breaker 1-1/2" x 25-1/2" w/2" Offset
0393026	V-600-AA	CP Vacuum Breaker 1-1/2" x 25-13/16" w/1" Offset
0393028	V-600-AA	CP Vacuum Breaker 1-1/2" x 25-5/8" w/1-1/2" Offset
0393008	V-600-AA	CP Vacuum Breaker 1-1/2" x 13-1/2"
0393031	V-600-AA	CP Vacuum Breaker 1-1/2" x 15"
0393009	V-600-AA	CP Vacuum Breaker 1-1/2" x 21-1/2"
0393010	V-600-AA	CP Vacuum Breaker 1-1/2" x 24-1/2"
0393038	V-600-AA	CP Vacuum Breaker 1-1/2" x 36"
3393007	V-600-AA	CP Vacuum Breaker 1-1/2" x 9" package
0393039	V-600-AA	CP Vacuum Breaker 1-1/4" x 13-1/2"
0393045	V-600-AA	CP Vacuum Breaker 1-1/4" x 21-1/2"
3393006	V-600-AA	CP Vacuum Breaker 1-1/4" x 9" package
0393046	V-600-AA	CP Vacuum Breaker 3/4" x 10-1/2"
0393047	V-600-AA	CP Vacuum Breaker 3/4" x 15"
3393004	V-600-AA	CP Vacuum Breaker 3/4" x 9" package

F-7 SUPPLY FLANGE

0306167	F-7	CP Flange Flat 1/2" IPS x 2-23/32"
0306188	F-7	CP Flange Flat 3/4" x 2-23/32"
0306238	F-7	CP Flange Spud 1-1/2" x 3" w/Prongs
0306214	F-7	CP Flange Spud 1-1/4" x 3" w/Prongs
0306197	F-7	CP Flange Spud 1" x 2-1/2" w/Prongs
0306189	F-7	CP Flange Spud 3/4" x 2-1/2" w/Prongs
0306205	F-7	CP Flange Supply 1-1/4" x 3"
0306196	F-7	CP Flange Supply 1" x 2-3/4" w/Prongs
0306191	F-7	CP Flange Supply 3/4" x 2-3/4" w/Prongs
0306209	F-7	CP Flange Supply Flat 1-1/4" x 3-1/8"
0306201	F-7	CP Flange Supply Flat 1" x 3-1/8"
0306204	F-7	CP Flange Tube 1-1/4" x 2-3/4" w/Prongs
0306237	F-7	CP Flange Tube 1-1/2" x 2-3/4" w/Prongs

F-15-A ELBOW FLUSH CONNECTION

0306341	F-15-A	CP Elbow Tail Assembly SJ 3/4" x 4"
0306362	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 10"
0306366	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 11"
0306340	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 4"
0306344	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 6"
0306350	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 7"
0306355	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 8"
0306358	F-15-A	RB Elbow Tail Assembly SJ 3/4" x 9"

F-100 FLARED END FLUSH CONNECTION

Code No.	Part No.	Description
0396160	F-100	RB Outlet 1-1/2" x 11-1/2" w/3" Score
0396167	F-100	RB Outlet 1-1/2" x 13-1/2" w/3" Score
0396168	F-100	RB Outlet 1-1/2" x 19-1/2" w/3" Score
0396169	F-100	RB Outlet 1-1/2" x 23-1/2" w/3" Score
0396156	F-100	RB Outlet 1-1/2" x 3-1/4" w/3" Score
0396157	F-100	RB Outlet 1-1/2" x 5-1/2" w/3" Score
0396158	F-100	RB Outlet 1-1/2" x 7-1/2" w/3" Score
0396159	F-100	RB Outlet 1-1/2" x 9-1/2" w/3" Score
0396161	F-100	RB Outlet 1-1/2" x 9-1/2" w/9" Score

F-109 TUBE BEND

Code No.	Part No.	Description
0396310	F-109	CP Tube Outlet 1-1/2" x 11-1/2" x 5" Bends
0396283	F-109	CP Tube Outlet 1-1/4" x 11-1/2" x 5" Bends
0396288	F-109	CP Tube Outlet 1-1/4" x 13-1/2" x 5" Bends
0396293	F-109	CP Tube Outlet 1-1/2" x 8-1/2" x 5" Bends
0396265	F-109	CP Tube Outlet 1-1/4" x 8-1/2" x 5" Bends
0396316	F-109	CP Tube Outlet 1-1/2" x 13" x 5" Bends
0396320	F-109	CP Tube Outlet 1-1/2" x 16" x 5" Bends
0396322	F-109	CP Tube Outlet 1-1/2" x 21" x 5" Bends
0396326	F-109	CP Tube Outlet 1-1/2" x 24" x 5" Bends
0396289	F-109	CP Tube Outlet 1-1/4" x 16" x 5" Bends
0396290	F-109	CP Tube Outlet 1-1/4" x 21" x 5" Bends
0396291	F-109	CP Tube Outlet 1-1/4" x 24" x 5" Bends

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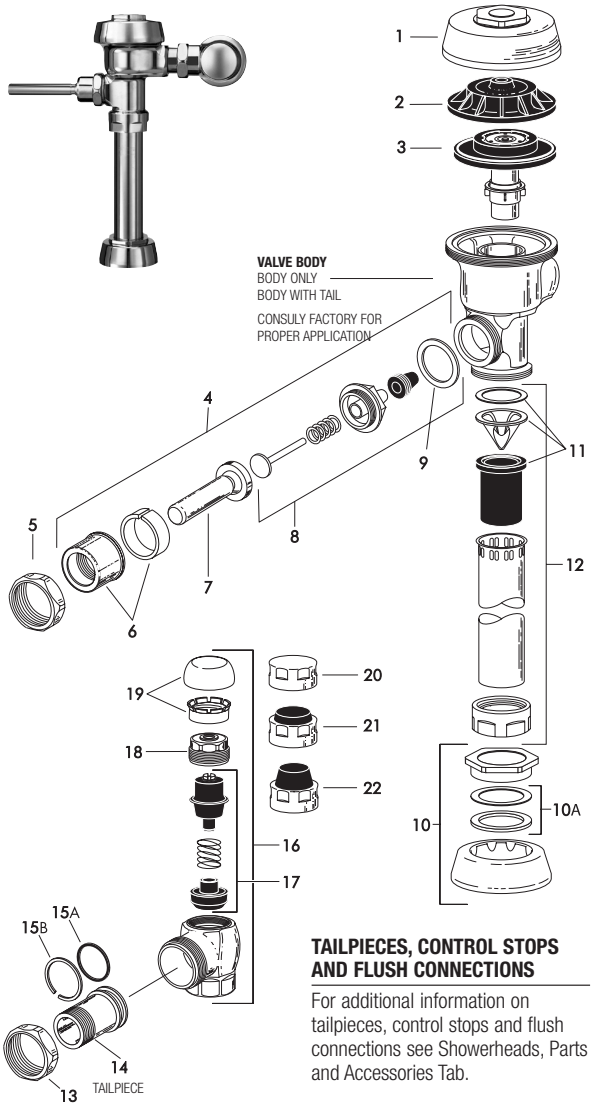
Royal®
Flushometer



TAILPIECES, CONTROL STOPS AND FLUSH CONNECTIONS

For additional information on tailpieces, control stops and flush connections see Showerheads, Parts and Accessories Tab.

ITEM 10A. SLIP JOINT GASKETS AND RINGS

Size	Code No.	Part No.	Description
1-1/2"	**5306058**	F-3	Red Friction Ring
	5322001	VBF-5	Black Slip Joint Gasket
	0319086/5319086	S-30	Flexible Seat
	0319079	S-21	Rigid Seat (rubber over brass)
1-1/2" x 1-1/4"	**0396062**	F-105	Slip Joint Gasket – Rigid
1-1/4"	**5306057**	F-3	Red Friction Ring
	5322176	VBF-5	Black Slip Joint Gasket
	0307052/5307052	G-21	Rigid Seat (rubber over brass)
1"	**5306056**	F-3	Red Friction Ring
	5306115	F-5	Black Slip Joint Gasket
3/4"	**5306055**	F-3	Red Friction Ring
	5306113	F-5	Black Slip Joint Gasket

* See pages 102-103 for additional lengths
† For use with 1" and 3/4" H-700-A and 1" H-600-A Bak-Chek® screwdriver control stop
‡ For use with 3/4" H-600-A Bak-Chek® screwdriver control stop
RW for use with Reclaimed Water Flushometers

PARTS LIST

Item No.	Code No.	Part No.	Description
1.	**0301172PK**	A-72	CP Cover
	0301435PK	A-72-HE	CP High Efficiency Cover
2.	**0301168**	A-71	Inside Cover
	0301336	A-71-1	Inside Cover (Purple)
3.	—		Dual-Filtered Bypass Diaphragm Assembly (refer to table and diagram on following page)
4.	**0302390**	B-73-A	CP ADA-Compliant Triple Seal Handle Assembly
	0302267	B-73-A-PH	CP ADA-Compliant Triple Seal Handle Assembly
5.	**0301082**	A-6	CP Handle Coupling
6.	**0302109**	B-7-A	CP Socket Assembly
7.	**0302389**	B-74-A	CP ADA-Compliant Handle
	0302264	B-74-A-PH	CP ADA-Compliant Handle (Purple Handle)
8.	**3302306**	B-51-A	Triple Seal Handle Repair Kit
9.	**5301139**	A-31	Handle Gasket – 48 per package
10.	**0306125**	F-5-AW	3/4" (19 mm) CP Spud Coupling Assembly
	0306140	F-5-AU	1-1/4" (32 mm) CP Spud Coupling Assembly
	0306146	F-5-AT	1-1/2" (38 mm) CP Spud Coupling Assembly
10A.	**SEE SLIP JOINT GASKETS AND RINGS TABLE BELOW LEFT**		
11.	**3323182**	V-651-A	High Back Pressure Vacuum Breaker Repair Kit
12.	**3393004**	V-600-AA	3/4" (19 mm) x 9" (228 mm) CP Vacuum Breaker
	3393006	V-600-AA	1-1/4" (32 mm) x 9" (228 mm) CP Vacuum Breaker
	3393007	V-600-AA	1-1/2" (38 mm) x 9" (228 mm) CP Vacuum Breaker
13.	**0308676**	H-550	CP Stop Coupling
14.	**0308801**	H-551-A	CP Adjustable Tailpiece 2-1/16" (52 mm long) Standard Length*
15A.	**5308696**	H-553	O-ring – 24 per package
15B.	**5308381**	H-552	Locking Ring – 12 per package
16.	**3308386**	H-700-A	1" (25 mm) CP Bak-Chek® Screwdriver Stop
	0388141	H-700-A-RW	1" (25 mm) CP Bak-Chek® Screwdriver Stop
	3308384	H-700-A	3/4" (19 mm) CP Bak-Chek® Screwdriver Stop
	0388142	H-700-A-RW	3/4" (19 mm) CP Bak-Chek® Screwdriver Stop
17.	**3308853**	H-541-ASD	Control Stop Repair Kit †
	3308856	H-543-ASD	Control Stop Repair Kit ‡
18.	**0308612**	H-622	CP Bonnet †
	0308892	H-608-RW	CP Bonnet †
	0308843	H-577	CP Bonnet ‡ – **DISCONTINUED**
19.	**3308772**	H-1010-A	Vandal Resistant Control Stop Cap Assembly †
	3308790	H-1009-A	Vandal Resistant Control Stop Cap Assembly ‡ H-600 3/4" Stop only
20.	**0308738**	H-573	Control Stop Cap CP †
	0308848	H-582	Control Stop Cap CP ‡
21.	**3308866**	H-574	Control Stop Cap with Bumper † (–YO Variation)
22.	**3308867**	H-576	Control Stop Cap with Extended Bumper † (–YG Variation)
23.	**3388015**	H-1015	Flow Control Kit (not Shown) (HEU Only)
24.	**3308735**	H-634-AA-RW	1" (25 mm) Sweat Solder Kit w/ Cast Set Screw Purple Flange (not shown)
	3308736	H-636-AA-RW	3/4" (19 mm) Sweat Solder Kit w/ Cast Set Screw Flange (not shown)
	3308785	H-636-AA	1" (25 mm) Sweat Solder Kit w/ Cast Set Screw Purple Flange (not shown)
	3308788	H-636-AA	3/4" (19 mm) Sweat Solder Kit w/ Cast Set Screw Flange (not shown)

Sloan products are also available in satin, brushed nickel, chrome, gold and polished brass finishes – contact factory for part numbers.

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Royal® Flushometer

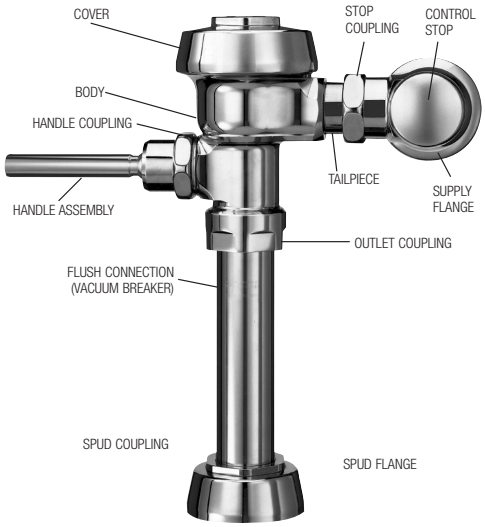
DUAL-FILTERED DIAPHRAGM ASSEMBLY

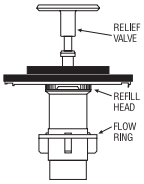
Available in diaphragm only and Royal® Performance™ Kits.

Royal® Performance™ Kit includes dual-filtered diaphragm assembly (item 3), handle repair kit with triple seal packing (item 8), high back pressure vacuum breaker repair kit (item 11), and one tailpiece O-ring (item 15A). DIAPHRAGM ONLY KIT contains "drop-in" dual-filtered diaphragm assembly (item 3) ONLY.

The dual-filtered diaphragm can be used in Royal,® Regal,® and similar diaphragm-style valve bodies. For use in Sloan valve bodies with a bell-shaped cover (manufactured before 1964), replace the bottom filter ring in these kits with a blue A-108 filter ring (not shown Sloan Code No. **5301283**).

NOTE: In January 1998, the Royal® diaphragm design was upgraded to a preassembled unit with two (2) plastic filtering rings attached to the rubber diaphragm (one on top and one on bottom). If the flushometer you are servicing has our older, segmented diaphragm with brass by-pass hole, refer to our Regal section for additional troubleshooting information.





THE COLORS OF THE RELIEF VALVE AND THE REFILL HEAD PLUS THE SHAPE OF FLOW RING IDENTIFY THE FLUSH VOLUME OF A DUAL-FILTERED DIAPHRAGM ASSEMBLY.

ROYAL® PERFORMANCE KIT

Code No.	Part No.	Description	Relief Valve†	Refill Head*	Flow Ring
3301070	A-1101-A	Low Consumption Water Closets-1.6 gpf (6.0 Lpf)**	Green	Gray	Smooth
3301071	A-1102-A	Water Saver Water Closets-3.5 gpf (13.2 Lpf)**	White	Gray	Smooth
3301072	A-1103-A	9 Liter European Water Closets-2.4 gpf (9.0 Lpf)	Blue	Gray	Smooth
3301073	A-1106-A	Wash Down Urinals-0.5 gpf (1.9 Lpf)	Green	Black	Smooth
3301074	A-1107-A	Low Consumption Urinals-1.0 gpf (3.8 Lpf)**	Green	Black	Slotted
3301075	A-1108-A	Water Saver Urinals-1.5 gpf (5.7 Lpf)**	Black	Black	Smooth

*CLOSET REFILL HEADS (GRAY) HAVE LARGER SLOTS THAN URINAL REFILL HEADS (BLACK).

DIAPHRAGM ONLY KIT

Code No.	Part No.	Description	Relief Valve†	Refill Head*	Flow Ring
3301502	A-1041-A	Low Consumption Water Closets-1.6 gpf (6.0 Lpf)**	Green	Gray	Smooth
3301501	A-1038-A	Water Saver Water Closets-3.5 gpf (13.2 Lpf)**	White	Gray	Smooth
3301505	A-1044-A	9 Liter European Water Closets-2.4 gpf (9.0 Lpf)	Blue	Gray	Smooth
3301504	A-1043-A	Wash Down Urinals-0.5 gpf (1.9 Lpf)	Green	Black	Smooth
3301503	A-1042-A	Low Consumption Urinals-1.0 gpf (3.8 Lpf)**	Green	Black	Slotted
3301500	A-1037-A	Water Saver Urinals-1.5 gpf (5.7 Lpf)**	Black	Black	Smooth
3301506	A-1045-A	High-Efficiency Water Closets-1.28 gpf (4.8 Lpf)	Blue	Gray	Smooth
3301142	A-1047-A	High-Efficiency Urinals-0.25 gpf (1.0 Lpf) with White Inserts	White	HEU Black	Smooth
3301143	A-1050-A	High-Efficiency Urinals-0.125 gpf (0.5 Lpf) with White Inserts	Blue	HEU Black	Smooth
3301594	A-1075-A-BX	High-Efficiency Water Closets-1.28 gpf (4.8 Lpf) RW	Blue	Black	Smooth
3301592	A-1073-A-BX	High-Efficiency Urinals-0.5 gpf (1.9 Lpf) RW	Green	Black	Smooth + Slotted
3301591	A-1077-A-BX	High-Efficiency Urinals-0.25 gpf (1.0 Lpf) RW	White	HEU Black	Smooth
3301590	A-1070-A-BX	High-Efficiency Urinals-0.125 gpf (0.5 Lpf) RW	Blue	HEU Black	Smooth

† Consult factory for availability of replacement plastic relief valves (green, black, blue, and white) and brass relief valves.
NOTE: For older water closets that require 4.5 gpf (17.0 Lpf), choose kits A-1102-A or A-1038-A, but remove the flow ring before use. For blowout-style urinals that require 3.5 gpf (13.2 Lpf), choose kits A-1102-A or A-1038-A. For service sinks that require 6.5 gpf (24.6 Lpf), order A-36-A diaphragm repair kit (not shown Sloan Code No. **3301036**) and remove the flow ring before use. Regulations for low consumption fixtures prohibit the use of higher flush volumes.

*CLOSET REFILL HEADS (GRAY) HAVE LARGER SLOTS THAN URINAL REFILL HEADS (BLACK).

** WATER SAVER (3.5 GPF CLOSET AND 1.5 GPF URINAL) AND LOW CONSUMPTION (1.6 GPF CLOSET AND 1.0 GPF URINAL) FIXTURES MUST USE MATCHING GPF (LPF) DIAPHRAGM KITS; USING A SMALLER GPF (LPF) KIT IN FIXTURES NOT INTENDED FOR LESS VOLUME WILL RESULT IN INADEQUATE DILUTION IN URINALS AND IMPROPER EVACUATION IN CLOSETS.

RW for use with Reclaimed Water Flushometers.

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Royal® Flushometer

TROUBLESHOOTING GUIDE

ATTENTION INSTALLERS: With the exception of the control stop inlet, **DO NOT USE** pipe sealant or plumbing grease on any valve component or coupling! To protect the chrome or special finish of Sloan flushometers, **DO NOT USE** toothed tools to install or service these valves. Use our A-50 Super-Wrench or other smooth-jawed wrench to secure couplings. Regulations for low consumption fixtures (1.6 gpf/6.0 Lpf closets and 1.0 gpf/3.8 Lpf urinals) prohibit use of higher flush volumes.

1. **Flushometer does not function (no flush).**
   - A. Control stop or main supply valve is closed. Open control stop or main supply valve.
   - B. Handle assembly is damaged. Replace B-73-A handle or repair with B-51-A handle repair kit.
   - C. Relief valve is damaged. Replace relief valve.
2. **Handle leaks.**
   - A. Handle seal or handle assembly is damaged. Replace B-73-A handle or repair with B-51-A handle repair kit.
3. **Water splashes from fixture.**
   - A. Control stop is open wider than necessary. Adjust control stop for desired delivery of water volume.
   - B. Water saver/conventional diaphragm assembly is installed on low consumption fixture or closet diaphragm assembly is installed on urinal fixture. Determine the required flush volume (see label on valve or markings on fixture). Replace diaphragm assembly or relief valve for appropriate flush volume of fixture.
4. **Volume of water is insufficient to adequately siphon fixture.**
   - A. Control stop is not open wide enough. Adjust control stop for desired delivery of water volume.
   - B. Diaphragm assembly is damaged. Replace diaphragm assembly.
   - C. Low consumption diaphragm assembly is installed on water saver/ conventional fixture or urinal diaphragm assembly is installed on closet fixture. Determine the required flush volume (see label on valve or markings on fixture). Replace diaphragm assembly or relief valve for appropriate flush volume of fixture.
   - D. Inadequate water volume or pressure is available from supply. Increase flow rate or pressure to the valve. If gauges are not available to measure supply pressure/volume, remove relief valve from diaphragm assembly and open the control stop.

     If the fixture siphons: Additional water volume is required. Install higher flushing volume relief valve or diaphragm assembly or cut flow ring from guide. **IMPORTANT: LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURE OR FLUSHOMETER.**

     If the fixture **DOES NOT** siphon (or a low consumption flush is required): Additional steps must be taken to increase the water pressure and/or volume at the water supply. Contact fixture manufacturer for minimum supply requirements of fixture.
5. **Flushometer valve closes immediately (short flush).**
   - A. Worn or damaged diaphragm assembly. Replace diaphragm assembly.
   - B. Handle assembly is damaged. Replace B-73-A handle or repair with B-51-A handle repair kit.
   - C. Low consumption diaphragm assembly is installed on water saver/ conventional fixture or urinal diaphragm assembly is installed on closet fixture. Determine the required flush volume (see label on valve or markings on fixture). Replace relief valve or diaphragm assembly for appropriate flush volume of fixture.
6. **Length of flush is too long (long flush) or fails to shut off.**
   - A. Bypass hole (upper filter ring) of diaphragm assembly is dirty. Remove the diaphragm assembly. Disassemble the filter rings from the diaphragm, wash under running water, and reassemble. Replace as necessary.
   - B. Relief valve or diaphragm assembly is damaged. Replace relief valve or diaphragm assembly.
   - C. Water saver/conventional diaphragm assembly is installed on low consumption fixture or closet diaphragm assembly is installed on urinal fixture. Determine the required flush volume (see label on valve or markings on fixture). Replace diaphragm assembly or relief valve for appropriate flush volume of fixture.
   - D. Inside cover is damaged. Install new A-71 part.
   - E. Line water pressure dropped and is insufficient to close valve. Close the control stop until pressure is restored.
   - F. Relief valve is not seated properly. Disassemble diaphragm components (relief valve, filter rings, and diaphragm unit), wash under running water, and reassemble. Replace as necessary.
7. **Chattering noise is heard during flush.**
   - A. Inside cover is damaged. Install new A-71 part.
   - B. Relief valve or diaphragm assembly is damaged. Replace relief valve or diaphragm assembly.

CARE AND CLEANING INSTRUCTIONS

DO NOT USE abrasive or chemical cleaners to clean flushometers that may dull the luster and attack the chrome or decorative finish. Use **ONLY** mild soap and water, then wipe dry with a clean towel or cloth. When cleaning the bathroom tile, protect the flushometer from any splattering of cleaner. Acids and cleaning fluids can discolor or remove chrome plating.

When assistance is required, please contact Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614).

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Repair Parts and Maintenance Guide **P1**

Tailpiece

TAILPIECES

The tailpiece is the connection between the valve body and the control stop.

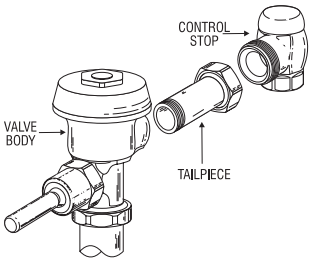
Sloan adjustable and ground joint tailpieces are threaded into the valve body at the factory. Sloan tailpieces are available in a variety of lengths to accommodate installation rough-in errors and unique installation requirements.

Sloan flushometer brands feature three types of tailpiece connections:

H-551 ADJUSTABLE TAILPIECE

H-5 GROUND JOINT TAILPIECE

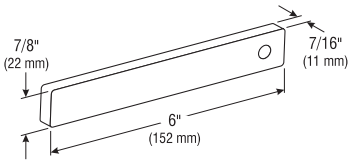
H-130-A ADJUSTABLE GROUND JOINT TAILPIECE



H-551-A

TAILPIECE REPLACEMENT

H-530 TAILPIECE REMOVAL BAR
0334014

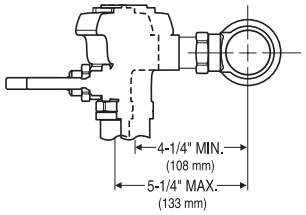


Sloan adjustable and ground joint tailpieces are assembled into the valve body using a pipe thread. Significant force is used to drive the tailpiece into the valve body. As such, removal of the old tailpiece may be difficult.

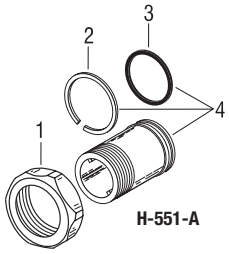
For replacement, we recommend using the **H-530 tailpiece removal bar** (Code No. **0334014**). Remove the flushometer cover and interior parts. Secure the tailpiece removal bar vertically in a vice. Place the flushometer tailpiece over the bar. The cast lugs inside the tailpiece will catch on the bar. Insert a length of 3/4" pipe into the barrel of the valve body. Unscrew tailpiece from valve body.

Assemble the new tailpiece into the valve body in the reverse manner. Use teflon tape (or pipe sealant) on tailpiece pipe threads. Ensure that both the coupling and the locking ring (adjustable tailpiece only) are on the tailpiece before tightening the assembly. Do NOT use sealant on the first few threads of the tailpiece.

H-551-A ADJUSTABLE TAILPIECE CONNECTION



The majority of flushometers supplied by Sloan since 1964 feature the H-551-A adjustable tailpiece. The valve tailpiece connects to the control stop with a sliding O-ring seal. The H-551-A adjustable tailpiece standard length is 2-1/16" (54 mm). This is designed for a standard flushometer installation in which the distance between the centerline of the valve and the centerline of the water supply inlet is 4-3/4" (121 mm). The adjustable tailpiece allows for a variance of ±1/2" (13 mm) from this nominal dimension.



H-551-A

Item No.	Code No.	Part No.	Description
1.	**0308676**	H-550	Coupling CP
	0308690	H-550	Coupling RB
2.	**5308381**	H-552	Locking Ring – 12 per package
3.	**5308696**	H-553	O-Ring – 24 per package
4.	**0308801**	H-551-A	2-1/16" (53 mm) Tailpiece Assembly† CP
	0308802	H-551-A	2-1/16" (53 mm) Tailpiece Assembly† RB
	0308803	H-551-A	3-1/16" (78 mm) Tailpiece Assembly† CP
	0308805	H-551-A	4-1/16" (103 mm) Tailpiece Assembly† CP
	0308807	H-551-A	5-1/16" (129 mm) Tailpiece Assembly† CP
	0308809	H-551-A	6-1/16" (154 mm) Tailpiece Assembly† CP

† Each tailpiece assembly includes an H-553 O-Ring and an H-552 locking ring.

Abbreviations: CP: chrome plated; RB: rough brass

Sloan Valve Company can also provide products not shown in our current catalog.
For our special finishes, consult factory for part numbers.

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Repair Parts and Maintenance Guide

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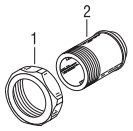
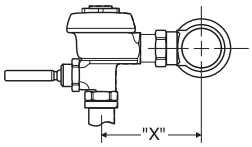
Tailpiece

NH-5 GROUND JOINT TAILPIECE CONNECTION

Older valves (prior to 1964), valves furnished for salt-water installations, and all Sloan flushometers furnished with straight stops use a metal-to-metal ground joint (GJ) tailpiece connection. The standard length of the H-5 tailpiece is 1-3/4" (44 mm) for a standard 4-3/4" (121 mm) rough-in dimension; other lengths are available in 1/4" (6 mm) increments.



The ground joint tailpiece connection cannot be adjusted in the field, so rough-in must be exact. Replacement NH-5 tailpieces can compensate for rough-in errors.



CHROME PLATED COMPONENTS

Item No.	Code No.	Description	
1.	**0308063**	H-6 Coupling	
2.	**See below**	NH-5 Ground Joint Tailpiece	
		"X"	**Tailpiece Length**
	0308019	4-1/4" (108 mm)	1-1/4" (32 mm)
	0308023	4-1/2" (114 mm)	1-1/2" (38 mm)
	0308026	4-3/4" (121 mm)	1-3/4" (44 mm)
	0308030	5" (127 mm)	2" (51 mm)
	0308031	5-1/4" (133 mm)	2-1/4" (57 mm)
	0308033	5-1/2" (140 mm)	2-1/2" (64 mm)
	0308034	5-3/4" (146 mm)	2-3/4" (70 mm)
	0308035	6" (152 mm)	3" (76 mm)
	0308037	6-1/4" (159 mm)	3-1/4" (83 mm)
	0308038	6-1/2" (165 mm)	3-1/2" (89 mm)
	0308040	6-3/4" (171 mm)	3-3/4" (95 mm)
	0308041	7" (178 mm)	4" (102 mm)
	0308042	7-1/4" (184 mm)	4-1/4" (108 mm)
	0308043	7-1/2" (191 mm)	4-1/2" (114 mm)
	0308044	7-3/4" (197 mm)	4-3/4" (121 mm)
	0308045	8" (203 mm)	5" (127 mm)
	0308047	8-1/2" (216 mm)	5-1/2" (140 mm)
	0308050	9" (229 mm)	6" (152 mm)

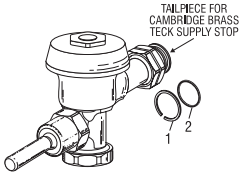
ROUGH BRASS COMPONENTS

1.	**0308063**	H-6 Coupling	
2.	**See below**	NH-5 Ground Joint Tailpiece	
		"X"	**Tailpiece Length**
	0308028	4-3/4" (121 mm)	1-3/4" (44 mm)

NOTE: "X" indicates the distance between the centerline of valve and the centerline of the water supply. Ground joint couplings are notched for identification.

"XDT" FLUSHOMETER FOR CANADIAN TECK VALVES

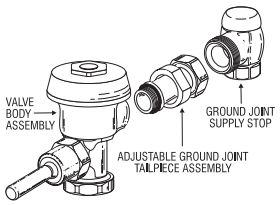
Sloan can provide a flushometer with a tailpiece that can connect to a Cambridge Brass Teck (Wal-teck) supply stop. This special valve assembly is specified as our "–XDT" variation. This tailpiece cannot be replaced in the field.



Item No.	Code No.	Part No.	Description
1.	**5308934**	H-501	Locking Ring – 6 per package
2.	**5308958**	H-589	O-Ring – 6 per package

H-130-A ADJUSTABLE GROUND JOINT TAILPIECE CONNECTION

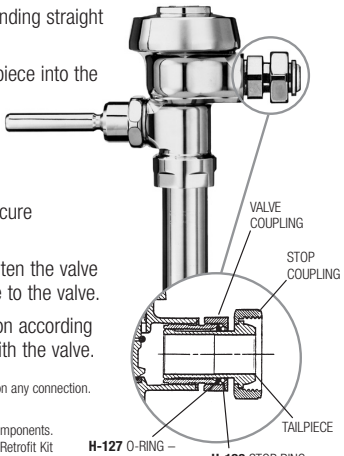
To accommodate adjustability in a ground joint connection, Sloan developed the H-130-A adjustable ground joint tailpiece connection. This is commonly supplied on valves used in retrofit applications where an existing ground joint supply stop (made by either Sloan or another manufacturer) is utilized. The H-130-A tailpiece is supplied as our "–XD" variation and requires a special valve body. It **cannot** be used to replace an H-551-A or an H-5 tailpiece.



TO INSTALL THE ADJUSTABLE GROUND JOINT TAILPIECE:

NOTE: flushometer should be standing straight and not leaning to either side.

- Screw threaded end of the tailpiece into the flushometer body.
- Continue turning until tailpiece matches up to the end of the existing supply stop.
- Tighten the stop coupling to secure the valve to the supply stop.
- Using a flat-jawed wrench, tighten the valve coupling to secure the tailpiece to the valve.
- Continue flushometer installation according to the instructions packaged with the valve.

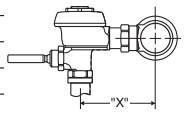


NOTE: DO NOT use pipe dope or thread sealant on any connection. Lubricate O-ring ONLY with water!

O-ring and stop ring are available as individual components. All other items are sold only in H-130-A tailpiece Retrofit Kit (see table below).

TAILPIECE RETROFIT KIT (WHEN USED WITH GROUND JOINT SUPPLY STOP)

Code No.	"X" †	Part No.
0308976	4-3/4" (121 mm)	H-130-A-1 ‡
0308983	5-3/4" (146 mm)	H-130-A-2
0308984	6-3/4" (171 mm)	H-130-A-3
0308979	7-3/4" (197 mm)	H-130-A-4



† When used with a Sloan ground joint supply stop, the tailpiece can be adjusted to a shorter or longer length (± 1/2" or 12 mm from the "X" dimension shown). When used with Delany ground joint supply stop, the tailpiece can be adjusted up to 1" (25 mm) longer from the "X" dimension shown.

‡ Unless otherwise specified, the H-130-A-1 tailpiece is furnished as standard with all "–XD" variation flushometer valves.

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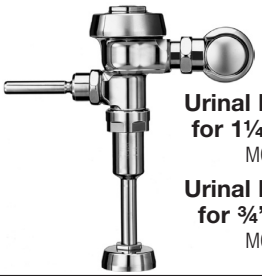
Code No. 0816195
Rev. 6 (02/15)

SLOAN®

INSTALLATION INSTRUCTIONS FOR EXPOSED ROYAL® FLUSHOMETERS

Closet Flushometer for 1½" Top Spud
MODELS 110/111, 113, 115 & 116

Service Sink Flushometer for 1½" Top Spud
MODEL 117



Urinal Flushometer for 1¼" Top Spud
MODEL 180

Urinal Flushometer for ¾" Top Spud
MODEL 186

Closet Flushometer for 1½" Back Spud
MODELS 120, 121 & 122

PRIOR TO INSTALLATION

Before you install the flushometer, be sure the items listed below are installed. Also, refer to the rough-in diagram below.

- Closet fixture •Drain line •Water supply line

IMPORTANT:

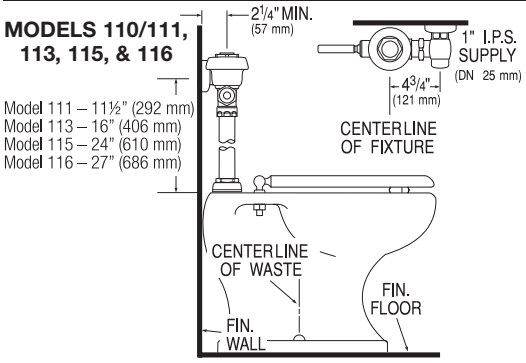
- **ALL PLUMBING SHOULD BE INSTALLED IN ACCORDANCE WITH APPLICABLE CODES AND REGULATIONS.**
- **WATER SUPPLY LINES MUST BE SIZED TO PROVIDE AN ADEQUATE VOLUME OF WATER FOR EACH FIXTURE.**
- **FLUSH ALL WATER LINES PRIOR TO MAKING CONNECTIONS.**

Sloan's flushometers are designed to operate with 15 to 80 psi (103 to 552kPa) of water pressure. **THE MINIMUM PRESSURE REQUIRED TO THE VALVE IS DETERMINED BY THE TYPE OF FIXTURE SELECTED.**

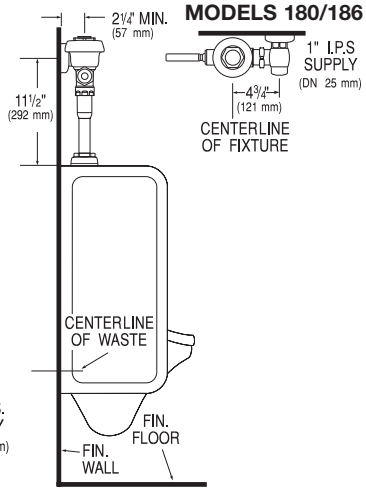
Consult fixture manufacturer for minimum pressure requirements. Most High Efficiency water closets require a minimum flowing pressure of 25 psi (172 kPa). Many building codes and the ASME A112.19.2 fixture standard list Maximum static water pressure as 80 PSI (552 kPa).

ROUGH-INS

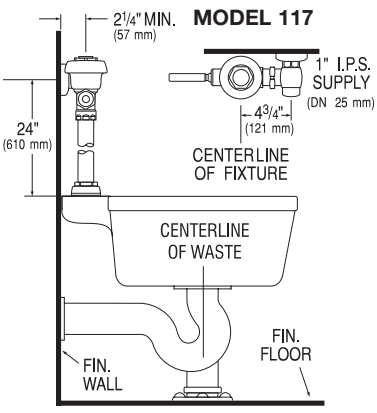
MODELS 110/111, 113, 115, & 116



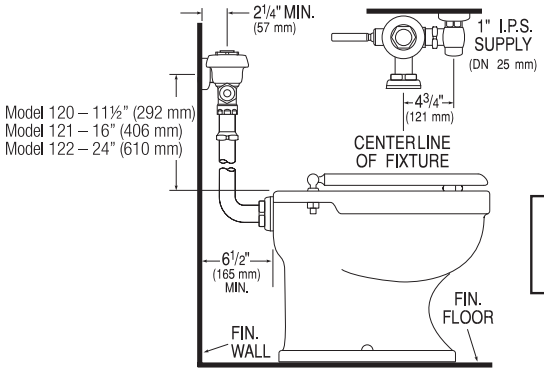
MODELS 180/186



MODEL 117



MODELS 120, 121, & 122



!!! IMPORTANT !!!

WHEN MOUNTED ON AN ADA ACCESSIBLE BOWL, THE ROUGH-IN TO THE SUPPLY INLET SHOULD BE NO HIGHER THAN 37½" OR THE HANDLE WILL EXCEED MAXIMUM HEIGHT ALLOWANCES UNDER ADA GUIDELINES.

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TOOLS REQUIRED FOR INSTALLATION

- Straight blade screwdriver
- Sloan A-50 Super-Wrench™, Sloan A-109 Plier Wrench or smooth jawed spud wrench

!!! IMPORTANT !!!

PROTECT THE CHROME OR SPECIAL FINISH OF SLOAN FLUSHOMETERS — DO NOT USE TOOTHED TOOLS TO INSTALL OR SERVICE THESE VALVES. USE A SLOAN A-50 SUPER-WRENCH™, SLOAN A-109 PLIER WRENCH OR SMOOTH JAWED SPUD WRENCH TO SECURE ALL COUPLINGS. SEE "CARE AND CLEANING" SECTION.

!!! IMPORTANT !!!

NEVER OPEN CONTROL STOP TO WHERE THE FLOW FROM THE VALVE EXCEEDS THE FLOW CAPABILITY OF THE FIXTURE. IN THE EVENT OF A VALVE FAILURE, THE FIXTURE MUST BE ABLE TO ACCOMMODATE A CONTINUOUS FLOW FROM THE VALVE.

!!! IMPORTANT !!!

WITH THE EXCEPTION OF CONTROL STOP INLET, DO NOT USE PIPE SEALANT OR PLUMBING GREASE ON ANY VALVE COMPONENT OR COUPLING!

!!! IMPORTANT !!!

THIS PRODUCT CONTAINS MECHANICAL AND/OR ELECTRICAL COMPONENTS THAT ARE SUBJECT TO NORMAL WEAR. THESE COMPONENTS SHOULD BE CHECKED ON A REGULAR BASIS AND REPLACED AS NEEDED TO MAINTAIN THE VALVE'S PERFORMANCE.

Please take the time to read this manual to ensure proper product installation and longevity.

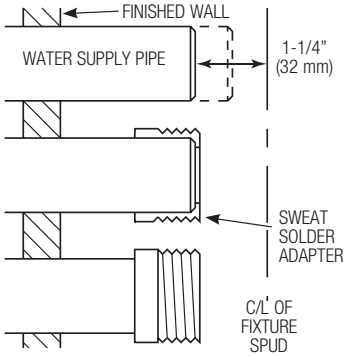
When further assistance is required, please contact your local Sloan Representative or Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614)

1 - INSTALL OPTIONAL SWEAT SOLDER ADAPTER (ONLY IF YOUR SUPPLY PIPE DOES NOT HAVE A MALE THREAD)

A Measure from finished wall to C/L of fixture spud. Cut pipe 1¼" (32 mm) shorter than this measurement. Chamfer O.D. and I.D. of water supply pipe.

B Slide threaded adapter fully onto pipe.

C Sweat solder the Adapter to pipe.

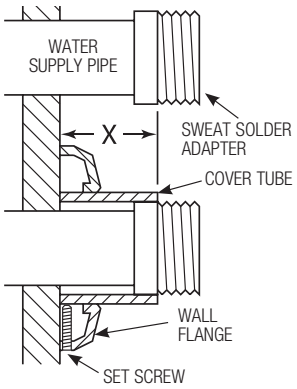


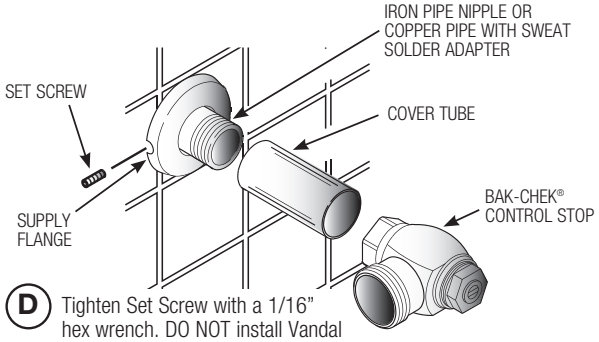
2 - INSTALL COVER TUBE, WALL FLANGE AND CONTROL STOP TO SUPPLY PIPE

A Measure from finished wall to first thread of Adapter or threaded supply pipe (dimension "X"). Cut Cover Tube to this length.

B Slide Cover Tube over pipe. Slide Wall Flange over Cover Tube until against wall.

C Thread Control Stop onto pipe. Tighten with a wrench.





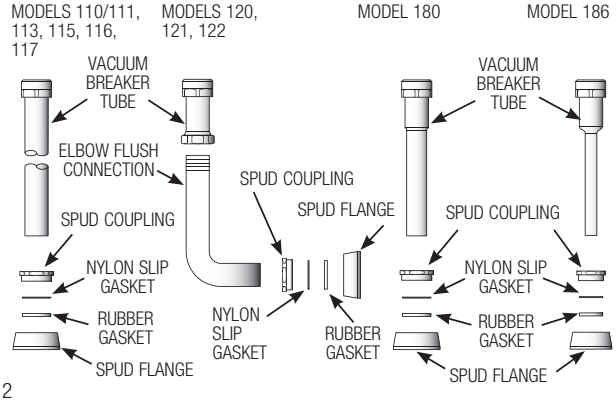
D Tighten Set Screw with a 1/16" hex wrench. DO NOT install Vandal Resistant Stop Cap at this time.

3 - INSTALL VACUUM BREAKER FLUSH CONNECTION

A Slide Spud Coupling, Nylon Slip Gasket, Rubber Gasket and Spud Flange over Vacuum Breaker Tube.

B Insert Tube into Fixture Spud.

C Hand tighten Spud Coupling onto Fixture Spud.



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4 - INSTALL FLUSHOMETER AND TRIPLE SEAL HANDLE ASSEMBLY

NOTE

For high efficiency urinal flushometers (0.5, 0.25 and 0.125 gpf), it is necessary to first insert the flow control component into the tailpiece assembly. See the H1015A flow control kit and separate instructions for details on how to install.

A Lubricate tailpiece O-ring with water. Insert Adjustable Tailpiece into Control Stop. Tighten Tailpiece Coupling by hand.

B Align Flushometer directly above the Vacuum Breaker Flush Connection by sliding the Flushometer Body IN or OUT as needed. Tighten Vacuum Breaker Coupling by hand.

NOTE

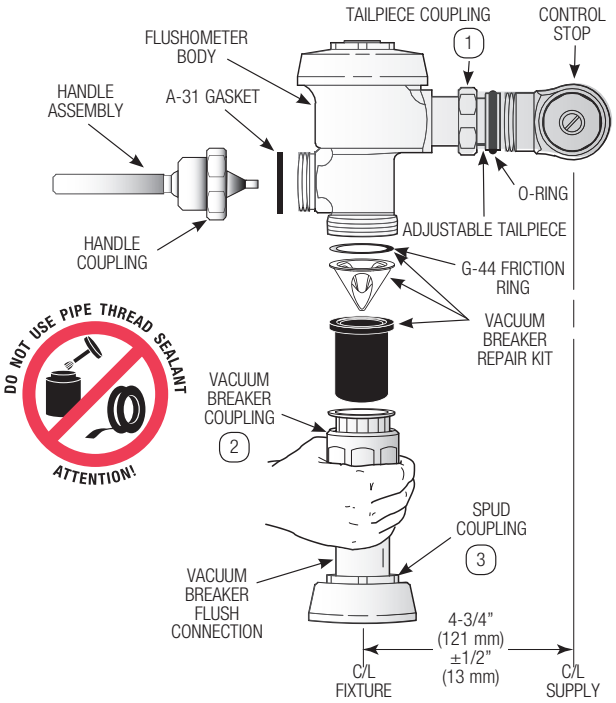
Maximum adjustment of the Sloan Adjustable Tailpiece is 1/2" (13 mm) IN or OUT from the standard 4-3/4" (121 mm) (centerline of Flushometer to centerline of Control Stop).

If roughing-in measurement exceeds 5-1/4" (133 mm), consult factory for longer tailpiece.

C Align Flushometer Body and securely tighten first the Tailpiece Coupling (1), then the Vacuum Breaker Coupling (2), and finally the Spud Coupling (3). Use a wrench to tighten these couplings in the order shown.

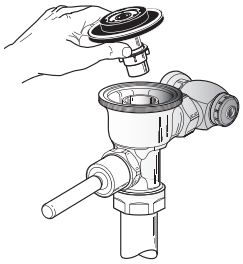
D Install the red A-31 Handle Gasket on the Handle Assembly. Insert the Handle Assembly into the Handle opening in the Flushometer Body. Securely tighten the Handle coupling with a wrench.

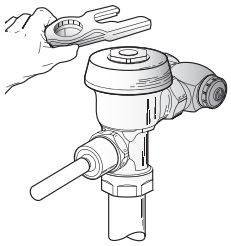
Sloan's triple-sealed Flushometer Handle is ADA-complaint.



5 - FLUSH OUT SUPPLY LINE

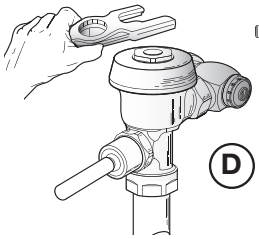
A Make sure Control Stop is CLOSED and remove Flushometer Outer Cover.

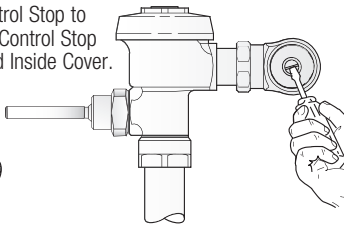




B Remove Inside Cover and lift out Inside Parts Assembly.

C Reinstall Outside and Inside Cover wrench tight. Open Control Stop to flush supply line. Close Control Stop and remove Outside and Inside Cover.





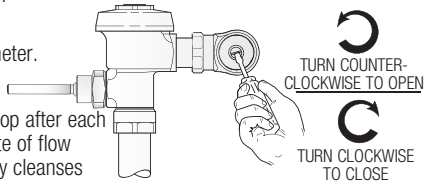
D Reinstall Inside Parts Assembly, Inside Cover and Outside Cover wrench tight.

6 - ADJUST CONTROL STOP AND INSTALL VANDAL RESISTANT STOP CAP

A Open Control Stop COUNTERCLOCKWISE one FULL turn from closed position.

B Activate Flushometer.

C Adjust Control Stop after each flush until the rate of flow delivered properly cleanses the fixture.

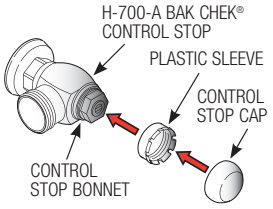


!!! IMPORTANT !!!

Sloan's flushometers are engineered for quiet operation. Excessive water flow creates noise, while too little water flow may not satisfy the needs of the fixture. Proper adjustment is made when plumbing fixture is cleansed after each flush without splashing water out from the lip AND a quiet flushing cycle is achieved.

Never open Control Stop to where the flow from the valve exceeds the flow capability of the fixture. In the event of a valve failure, the fixture must be able to accommodate a continuous flow from the valve.

D Install Vandal Resistant Control Stop Cap onto Control Stop.
- Thread the Plastic Sleeve onto the Stop Bonnet until it is snug (tighten only by hand; do not use pliers or a wrench).
- Place the metal Control Stop Cap over the plastic Sleeve and use the palm of the hand to push or "pop" the Cap over the fingers of the Plastic Sleeve. The Cap should spin freely.

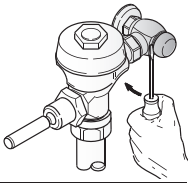


Important: DO NOT install Cap onto Sleeve unless the Sleeve has been threaded onto Control Stop Bonnet. If the Sleeve and Cap are assembled off of the Control Stop, the Sleeve WILL NOT come apart from the Cap.

P1

VANDAL RESISTANT CONTROL STOP CAP REMOVAL

Use a large flat screwdriver as a lever to remove the Cap from the Control Stop. Insert the screwdriver blade between the bottom edge of the Cap and the flat surface of the Control Stop body as shown. Push the screwdriver handle straight back toward the wall to gently lift the Cap. If necessary, work the screwdriver around the diameter of the Cap until you can grasp the Cap and lift it completely off the Sleeve. The Sleeve should remain attached to the bonnet of the Control Stop.



TROUBLESHOOTING GUIDE

1. Flushometer does not function (no flush).

A. Control stop or main valve is closed. Open control stop or main valve.
B. Handle assembly is damaged. Replace handle or install handle repair kit.
C. Relief Valve is damaged. Replace relief valve.

2. Volume of water is not sufficient to siphon fixture.

A. Control stop is not open wide enough. Adjust control stop for desired delivery of water volume.
B. Diaphragm assembly is damaged. Replace diaphragm assembly.
C. Incorrect diaphragm assembly is installed in flushometer; for instance, urinal assembly inside a closet flushometer, or low consumption assembly inside a higher consumption fixture. Determine the flush volume required by the fixture and replace diaphragm. Use valve label and markings on fixture for reference.
D. Water supply volume or pressure is inadequate. If no gauges are available to properly measure supply pressure or volume of water at the flushometer, then remove the relief valve from the diaphragm assembly, reassemble the flushometer and completely open the control stop.
- If the fixture siphons, more water volume is required. Install a higher flushing volume diaphragm. **IMPORTANT – LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURE OR FLUSHOMETER.**
- If the fixture DOES NOT siphon or if a low consumption flush is required, steps must be taken to increase the water supply pressure and/or volume. Contact the fixture manufacturer for minimum water supply requirements of the fixture.

3. Length of flush is too short (short flush).

A. Diaphragm assembly is worn or damaged. Replace diaphragm assembly.
B. Handle assembly is damaged. Replace handle or install handle repair kit.
C. Incorrect diaphragm assembly is installed in flushometer; for instance, urinal assembly inside a closet flushometer, or low consumption assembly inside a higher consumption fixture. Determine the flush volume required by the fixture and replace diaphragm. Use valve label and markings on fixture for reference.

4. Length of flush is too long (long flush) or continuous.

A. Metering bypass hole (upper filter ring) in diaphragm is clogged. Remove the diaphragm assembly. Remove the primary and secondary filter rings from the diaphragm, wash under running water, and reassemble. Replace as necessary.
B. Diaphragm or relief valve is damaged. Replace diaphragm or relief valve.
C. Incorrect diaphragm assembly is installed in flushometer; for instance, closet assembly inside a urinal flushometer, or water saver assembly inside a low consumption flushometer. Determine the flush volume required by the fixture and replace the diaphragm. Use valve label and markings on fixture for reference.
D. Inside cover is damaged. Replace Inside cover.
E. Supply line water pressure has dropped and is not sufficient to close the valve. close control stop until pressure is restored.
F. Relief valve is not seated properly. Disassemble diaphragm components (relief valve, filter rings, and diaphragm unit), wash under running water, and reassemble. Replace as necessary.

5. Chattering noise is heard during flush.

A. Inside cover is damaged. Replace inside cover.
B. Relief valve or diaphragm is damaged. Replace relief valve or diaphragm assembly.

6. Handle Leaks.

A. Handle seal or assembly is damaged. Replace handle or install handle repair kit.

7. Water splashes from fixture.

A. Control stop is open wider than necessary. Adjust control stop for desired delivery of water volume.
B. Water saver/conventional diaphragm assembly is installed on low consumption fixture or closit diaphragm assembly is installed on urinal fixture. Determine the required flush volume (see label on valve or markings on fixture). Replace diaphragm assembly or relief valve for appropriate flush volume of fixture.

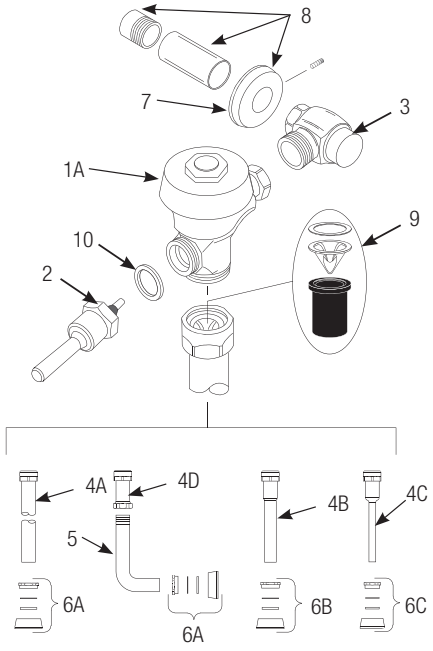
When assistance is required, please contact your local Sloan Representative or Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614)

CARE AND CLEANING

DO NOT use abrasive or chemical cleaners (including chlorine bleach) to clean Flushometers that may dull the luster and attack the chrome or special decorative finishes. Use ONLY mild soap and water, then wipe dry with clean cloth or towel.

While cleaning the bathroom tile, protect the Flushometer from any splattering of cleaner. Acids and cleaning fluids will discolor or remove chrome plating.

PARTS LIST



Item No.	Part No.	Description
1	†	Valve Assembly
2	B-73-A	ADA Compliant Handle Assembly
3	H-700-A	Bak-Chek® Control Stop
4A	V-600-AA	1½" (38 mm) Vacuum Breaker Assembly ‡
4B	V-600-AA	1¼" (32 mm) Vacuum Breaker Assembly
4C	V-600-AA	¾" (19 mm) Vacuum Breaker Assembly
4D	V-600-A	Vacuum Breaker Assembly
5	F-109	1½" (38 mm) Elbow Flush Connection
6A	F-56-A	1½" (38 mm) Spud Coupling Assembly
6B	F-57-A	1¼" (32 mm) Spud Coupling Assembly
6C	F-58-A	¾" (19 mm) Spud Coupling Assembly
7	F-7	Supply Flange (Supplied when Valve is not Ordered with Sweat Solder Kit)
8	H-633-AA	1" (25 mm) Sweat Solder Kit with Cast Set Screw Flange
	H-636-AA	¾" (19 mm) Sweat Solder Kit with Cast Set Screw Flange
9	V-651-A	High Back Pressure Vacuum Breaker Repair Kit
10	A-31	Handle Gasket

† Part number varies with valve model variation; consult factory.
‡ Length varies with valve model variation; consult factory.

NOTE: The information contained in this document is subject to change without notice.

SLOAN • 10500 SEYMOUR AVENUE • FRANKLIN PARK, IL 60131
Phone: 1-800-9-VALVE-9 or 1-847-671-4300 • Fax: 1-800-447-8329 or 1-847-671-4380 • sloan.com

Code No. 0816195 Rev. 6 (02/15)

P1

Sloan Flushometers Maintenance Schedule

Manual diaphragm flushometer

			Life Expectancy Industry Standard / Sloan Standard	3/4+ years	3/5+ years	15/20+ years
	**Handle assembly** Internal parts	**Maintenance Indicator** 1. Leaking around the handle 2. Drooping handle 3. Short erratic flush		✓		
	**Vacuum breaker** Internal (baffle and sack)	**Maintenance Indicator** 1. Leaking around the vacuum breaker vent holes during flush cycle		✓		
	**Inside cover**	**Maintenance Indicator** 1. Slow leaks into the fixture 2. Flush cycle too long or too short 3. Grooves cut into inner cover from diaphragm segments		✓		
	**Diaphragm kit** Regal	**Maintenance Indicator** 1. Slow leaks into the fixture 2. Flush cycle too long or too short		✓		
	**Diaphragm kit** Royal/Sloan	**Maintenance Indicator** 1. Slow leaks into the fixture. 2. Flush cycle too long or too short			✓	
	**Stop assembly** Internal parts	**Maintenance Indicator** 1. Leaking around the stop 2. Failure to completely shut off water 3. Excessive wrench marks on bonnet			✓	
	**Brass parts** Body, outside cover, stop and vacuum breaker tube	**Maintenance Indicator** 1. Compromised chrome finish 2. Missing or distorted threads				✓
	**Flanges & connections**	**Maintenance Indicator** 1. Compromised chrome finish 2. Missing or distorted threads 3. Excessive wrench marks on coupling 4. Leaking around connections				✓

P1

Sloan Flushometers Maintenance Schedule

Battery-powered diaphragm flushometers

(Same as manual diaphragm flushometer with exception of following parts)

		Life Expectancy Industry Standard / Sloan Standard	3/4+ years	3/6+* years	5/7+ years	20/25+ years
	**Batteries-alkaline**	**Maintenance Indicator** 1. Blinking LED 2. Unit will not flush		✓		
	**Sensor ring cover assembly** (includes solenoid)	**Maintenance Indicator** 1. Unit will not flush 2. Unit will continuously leak into fixture			✓	

Hardwired diaphragm flushometers

(Same as battery-powered diaphragm flushometer with exception of following parts)

	**Actuator cartridge assembly**	**Maintenance Indicator** 1. Leaking around button upon activation	✓			
	**Solenoid**	**Maintenance Indicator** 1. Unit will not flush 2. Unit will continuously leak into fixture			✓	
	**Transformer**	**Maintenance Indicator** 1. Unit will flush intermittently or not at all				✓

*Sloan battery operated flushometers provide a blinking low battery signal when the batteries need to be replaced. Failure to replace batteries when needed can cause leakage and may result in damage to the flushometer electronics.

P1

Sloan Flushometers Maintenance Schedule

Hydraulic actuator flushometers

(Same as manual diaphragm flushometer with exception of hydraulic push button assembly)

			Life Expectancy Industry Standard / Sloan Standard	3/4+ years	3/5+ years
	Hydraulic push button assembly	Maintenance Indicator 1. Leaking around the button upon activation		✓	

Manual piston flushometer

(Same as manual diaphragm flushometer with exception of piston kits)

	Piston kit-GEM-2	Maintenance Indicator 1. Slow leaks into the fixture 2. Flush cycle too long or too short		✓	
	Piston kit-Crown	Maintenance Indicator 1. Slow leaks into the fixture 2. Flush cycle too long or too short			✓

This maintenance guide is intended to be a guide, based on Sloan's 110 years of experience.
There are many factors that impact how long flushometers and their parts last, including the following:

- Water quality
- Vandalism and abuse
- Regular maintenance
- High traffic
- Proper installation
- Plumbing system

Please note that life expectancy is different than warranty. Sloan's limited 3 year warranty applies to all Sloan parts.

P2

SYMMONS® the smart choice™

Symmetrix®

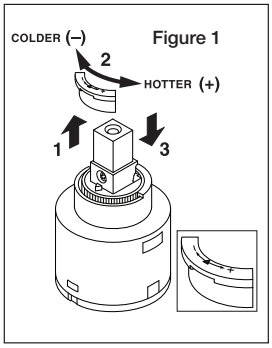
Lavatory Faucet S-20 Series
Installation and Service Instructions

For California Residents
WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Installation

Caution: Be sure to turn off hot and cold water supplies before installing or servicing faucet.

1. Loosely install the anchor bar (KN-23), spacer (KN-26) and nut (L-36) on the mounting bolts and place gasket on base of faucet. Push faucet supplies and anchor bolt/spacer/nut assemblies with gasket through holes in sink. Secure faucet to sink by tightening nuts from underside. (If sink or counter surface is uneven, use putty or sealant to make proper seal under base.)
2. Connect hot supply to left tube and cold supply to right tube using appropriate connectors.
3. Pop-up drain installation:
   a) Remove pop-up plug, tail piece and flange from the drain body. Make sure that locknut is threaded all the way down onto the body with flat friction washer in middle and beveled washer on top.
   b) Apply plumbers putty or sealant to bottom of flange.
   c) Install drain body through drain opening in lavatory and screw flange onto the drain body making sure that the threads are completely engaged for proper sealing and strength of the connection. Apply joint compound to all threaded parts to insure proper seal. Apply putty or teflon tape to tail piece before attaching to drain body.
   d) Tighten locknut to compress the beveled flange evenly across the bottom of the drain opening taking care not to over tighten the locknut, causing damage to the lavatory.
   e) Remove one of two ball washers from inside the threaded cavity. Insert pop-up plug and pivot rod into body. Add one ball washer (the second ball washer should remain inside the body) to the outside of the ball. Tighten the retaining nut until the ball is seated on the internal and external ball washers.
   Note: The pop-up plug can be installed either in the removable or non-removable position, depending on the location of the hole located in the guide at the bottom of the plug.
   f) Slide the pivot rod through one side of the spring clip, then the appropriate adjustment hole and then other side of the spring clip.
   g) Insert lift rod through faucet housing and the top of the lift strap and secure it in place by tightening the screw.
   Note: To ensure proper operation of lift rod and pop-up, some adjustment of the linkage may be required. There are two possible adjustment points: 1) lift strap to lift rod and 2) lift strap to pivot rod.
4. It is very important to thoroughly flush the supply lines to prevent foreign matter, i.e. copper chips, sand, stones, etc. from damaging the sealing surfaces of cartridge.
   Remove aerator and turn valve handle on to full cold position, open cold supply. Without closing, turn handle to full hot and open hot supply. Let water run in hot only and cold only positions long enough to flush supply lines thoroughly. Shut off faucet and replace aerator. Check for leaks.
5. The handle limit stop can be set to limit handle turn to the hot position. The limit mechanism is factory set to allow full handle travel. To adjust the limit stop, turn handle to the full hot position and lift handle to open faucet approximately half way to obtain a smooth flow for correct initial temperature measurement.



Limit stop adjust

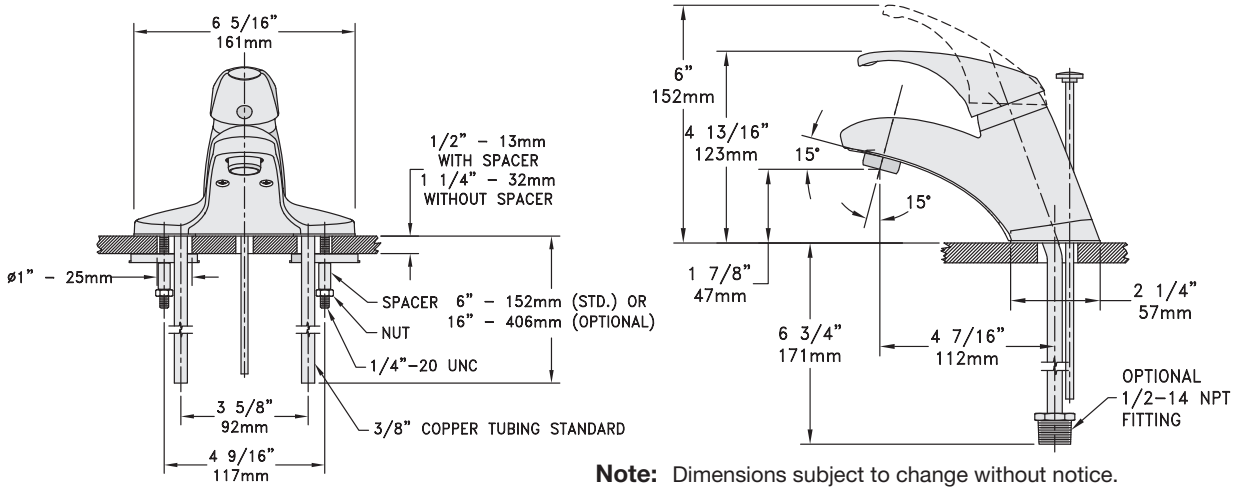
6. If when faucet is on and in full hot position and water is too hot, shut off water, remove plug button (KN-157), loosen set screw (L-22) and remove handle (KN-3RB, KN-3BRB or LN-135). Lift limit stop ring using a small flat head screw driver and rotate clockwise to lower temperature. If water is not hot enough, rotate counter clockwise (See Figure 1 above). After correct temperature is achieved, reattach handle, reversing procedure above.

Replacing cartridge (KN-4)

1. Remove plug button (KN-157), loosen set screw (L-22) and remove handle (KN-3RB, KN-3BRB or LN-135).
2. Engage tabs in cartridge wrench (LN-34) with slots in compression ring (KN-2) and use screwdriver in wrench holes or pliers on wrench and turn counter clockwise until compression ring engages with cap (LN-8). Continue turning counter clockwise so that cap/ring assembly is removed from the body (LN-371). Remove cartridge and o-ring seal (KN-4).
3. Install new cartridge while taking care to maintain position of the o-ring seal at the base of the cartridge. Match posts in base of cartridge with alignment holes in valve body during assembly.
4. Reassemble faucet in reverse fashion. Thread cap onto body firmly by hand. Do not use a wrench which may damage the finish. Tighten compression ring (KN-2) finger tight using the wrench (LN-34) then 1/4 to 1/2 turn further.
5. Set hot water limit stop in accordance with installation step 5 above.

P2

Dimensions Symmetrix Lavatory Faucet, *S-20-2*



Note: Dimensions subject to change without notice.

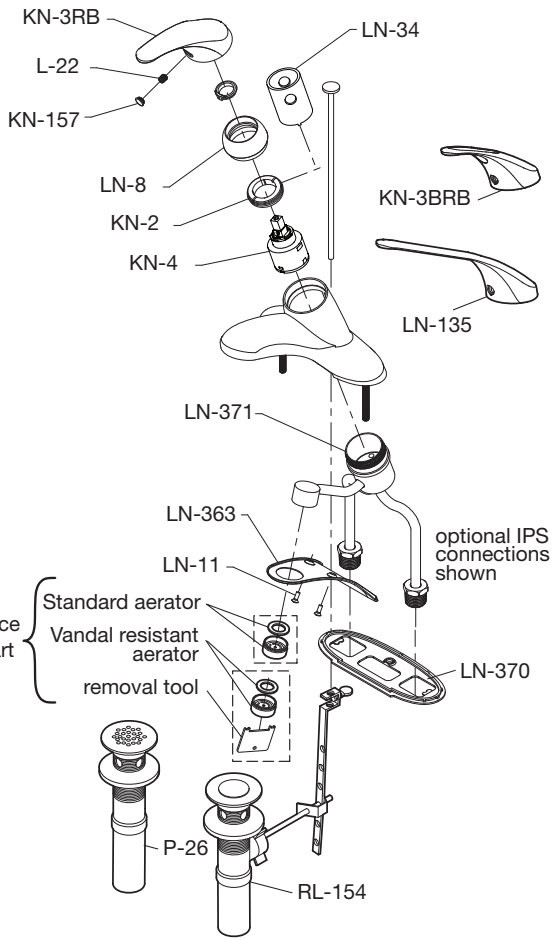
Parts Assembly Symmetrix Lavatory Faucet, *S-20 Series*

KN-2	Compression ring
KN-3RB*	Solid handle
KN-3BRB*	Loop handle
KN-4	Cartridge
KN-23	Anchor bar (2)
KN-26	Mounting spacer (2)
KN-157	Plug button
LN-8*	Valve cap
LN-11*	Screw (2)
LN-15*	Aerator without removal key
LN-34	Cartridge wrench
LN-135	6" lever handle with red/blue indicators
LN-363*	Undercover plate
LN-370	Mounting gasket
LN-371	Cartridge housing assembly
L-22	Set screw
L-36	Mounting nut (2)
RL-154*	Pop-up drain assembly (complete)
P-26	Grid drain assembly (complete)

For Decorative Finish Faucets add suffix to parts marked with an asterisk as follows:

Suffix -STN Satin finish

Aerator (flow regulator)	Part Number	
	Standard Aerators	Vandal Resistant with removal tool
2.2 gpm (8.3L/min)	LN-15*	LN-101*
1.5 gpm (5.7L/min)	FLR-110-1.5*	RL-288 (non-aerated)
1.0 gpm (3.8L/min)	FLR-110-1.0*	RL-288-VP-1.0 (non-aerated)
0.5 gpm (1.9L/min)	----	LN-100*
Removal tool part number, LL-60K		



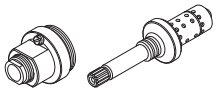
P3/P4

SYMMONS® Origins®
the smart choice™

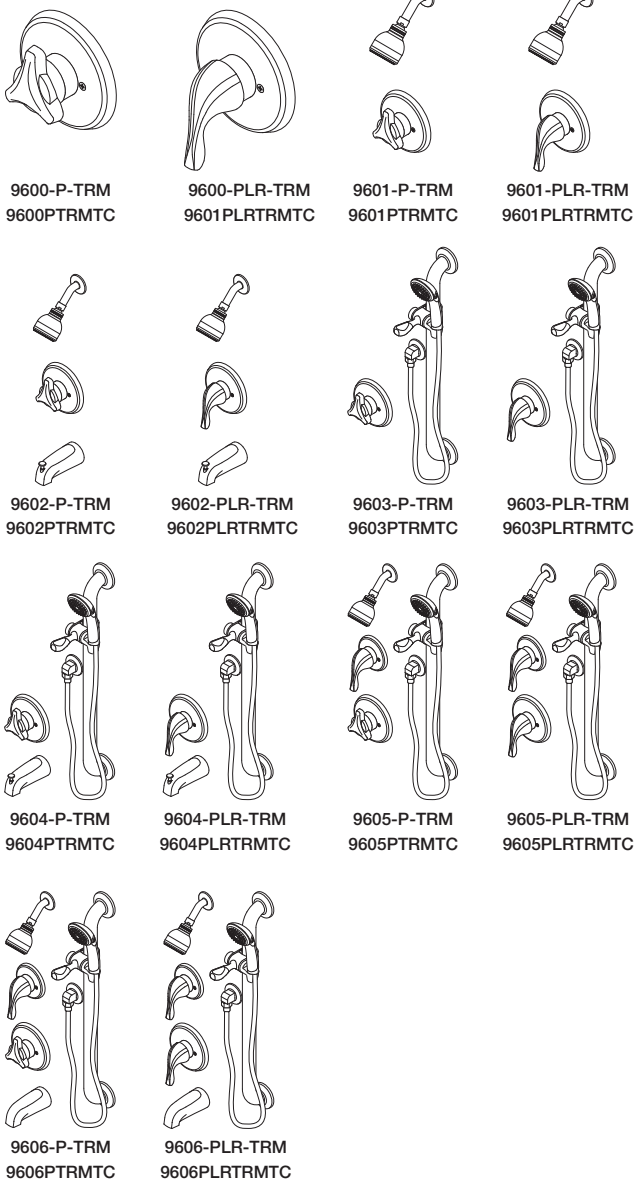
Origins Trim Series
Origins Trim Series with TA-10 Flow Control Spindle & T-12A Cap Assembly
Installation & Operation Instructions

Model Numbers

TRIM ONLY	TRIM, TA-10, T-12A
9600-P-TRM Shower Valve Trim	**9600PTRMTC** Shower Valve Trim
9600-PLR-TRM Shower Valve Trim	**9600PLRTRMTC** Shower Valve Trim
9601-P-TRM Shower Trim	**9601PTRMTC** Shower Trim
9601-PLR-TRM Shower Trim	**9601PLRTRMTC** Shower Trim
9602-P-TRM Tub/Shower Trim	**9602PTRMTC** Tub/Shower Trim
9602-PLR-TRM Tub/Shower Trim	**9602PLRTRMTC** Tub/Shower Trim
9603-P-TRM Hand Shower Trim	**9603PTRMTC** Hand Shower Trim
9603-PLR-TRM Hand Shower Trim	**9603PLRTRMTC** Hand Shower Trim
9604-P-TRM Tub/Hand Shower Trim	**9604PTRMTC** Tub/Hand Shower Trim
9604-PLR-TRM Tub/Hand Shower Trim	**9604PLRTRMTC** Tub/Hand Shower Trim
9605-P-TRM Shower/Hand Shower Trim	**9605PTRMTC** Shower/Hand Shower Trim
9605-PLR-TRM Shower/Hand Shower Trim	**9605PLRTRMTC** Shower/Hand Shower Trim
9606-P-TRM Tub/Shower/Hand Shower Trim	**9606PTRMTC** Tub/Shower/Hand Shower Trim
9606-PLR-TRM Tub/Shower/Hand Shower Trim	**9606PLRTRMTC** Tub/Shower/Hand Shower Trim



T-12A TA-10



9600-P-TRM 9600PTRMTC
9600-PLR-TRM 9601PLRTRMTC
9601-P-TRM 9601PTRMTC
9601-PLR-TRM 9601PLRTRMTC
9602-P-TRM 9602PTRMTC
9602-PLR-TRM 9602PLRTRMTC
9603-P-TRM 9603PTRMTC
9603-PLR-TRM 9603PLRTRMTC
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9605-PLR-TRM 9605PLRTRMTC
9606-P-TRM 9606PTRMTC
9606-PLR-TRM 9606PLRTRMTC

Compliance

- ASME A112.18.1/CSA B125.1

Warranty

Limited Lifetime - to the original end purchaser in consumer/residential installations.
5 Years - for industrial/commercial installations.
Refer to www.symmons.com/warranty for complete warranty information.
Go to www.symmons.com/register to register your Symmons product.

P3/P4

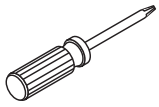
1. Recommended Tools

FIGURE 1


Adjustable Wrench


Allen Wrench (3mm)


Drill

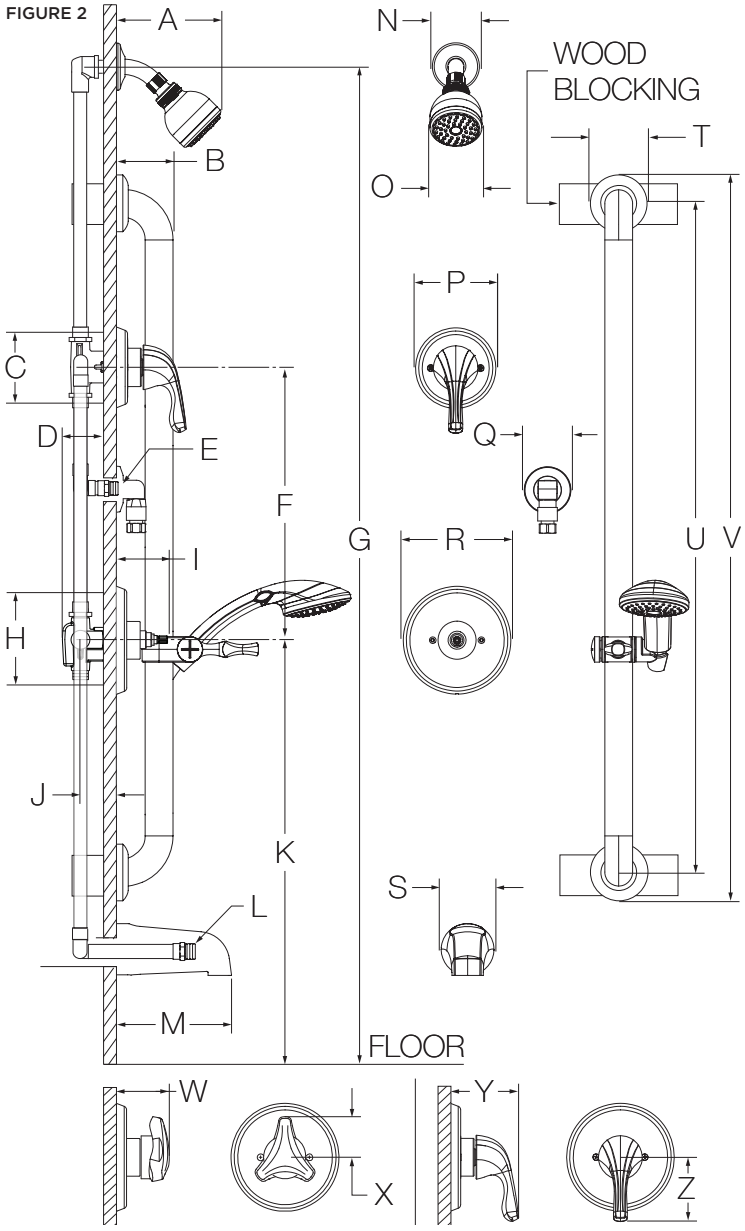

Phillips Screwdriver


Safety Glasses


Thread Seal Tape

2. Dimensions

FIGURE 2



Measurements	
A	6-3/8″, 162 mm
B	3″, 76 mm
C	Diverter Valve Hole Size Min. Ø 3″, 76 mm Max. Ø 3-1/4″, 83 mm
D	3 1/2″, 89 mm
E	Male 1/2″ NPT fitting must protrude 3/8″ from finished wall
F	Ref. 10″, 254 mm
G	Ref. 77″, 1956 mm
H	Shower Valve Hole Size Min. Ø 3″, 76 mm Max. Ø 4″, 102 mm
I	2-7/8″, 73 mm
J	Rough-in 2-3/8″ ± 1/2″, 60 mm ± 13 mm
K	**9600, 9601, 9603, 9605:** Ref. 42″, 1067 mm **9602, 9604, 9606:** Ref. 32″, 813 mm
L	Male 1/2″ NPT fitting must protrude 4″ from finished wall
M	5-1/2″, 140 mm
N	Ø 2-1/2″, 64 mm
O	Ø 2-3/4″, 70 mm
P	Ø 4-1/4″, 108 mm
Q	Ø 2-1/2″, 64 mm
R	Ø 5-3/4″, 146 mm
S	Ø 2-1/2″, 64 mm
T	Ø 3-1/8″, 79 mm
U	36″, 914 mm
V	39″, 991 mm
W	2-7/8″, 73 mm
X	2-1/8″, 54 mm
Y	3-5/8″, 92 mm
Z	3-3/8″, 86 mm

Notes:

1) Valve body and piping not included and shown as reference only.
2) Plaster shield (p/n T-176) for dry wall, plaster or other type walls 1/2″ or greater.
3) All dimensions measured from nominal rough-in (see J as reference).
4) Dimensions subject to change without notice.

P3/P4

3. Parts Breakdown (Model Numbers Ending in TRMTC)

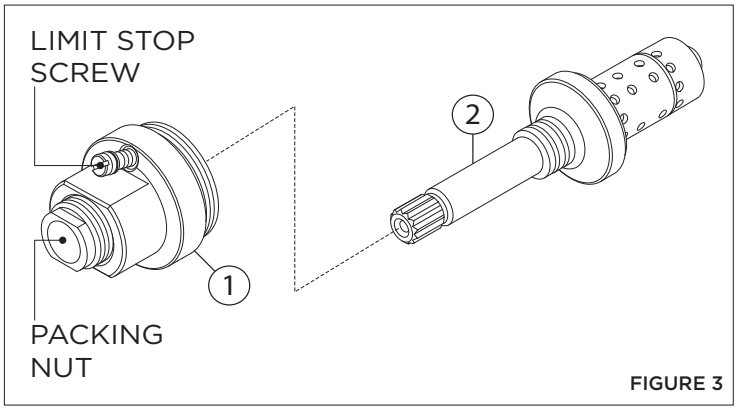


FIGURE 3

Replacement Parts		
Item	Description	Part Number
1	Cap Assy.	T-12A
2	Flow Control Spindle	TA-10

IMPORTANT: Model numbers ending in **TRMTC** coordinate with Temptrol pressure balancing valves ordered with Test Cap. The Test Cap is used to allow pressurization of system. **Do not** remove test cap from valve during wall construction, installation of valve or pressurization of system.

⚠ **WARNINGS:**

1. Test cap rated for pressure testing up to 200 psi maximum. **DO NOT** exceed 200 psi while pressure testing valve body.
2. Do not expose valve with test cap to heat for longer than 2 minutes when soldering copper tubing. Doing so may damage the internal components of the valve and will void the product warranty.
3. Ensure test cap is re-torqued to **30 lb-ft** after soldering valve body.

4. Installation - Remove Test Cap (Model Numbers Ending in TRMTC)

Flow control spindle (TA-10) and cap assembly (T-12A) will come factory assembled for all model numbers ending in **TRMTC**. When ready to remove Test Cap and install trim, follow the instructions below:

1) Check for leaks around the valve assembly and all pipe fittings.

2) Remove test cap from valve (FIGURE 4.1).

3) If system is dirty, flush valve.

4) Thread flow control spindle and cap assembly into valve body. Turn clockwise to secure to valve (FIGURE 4.2).

FIGURE 4.1

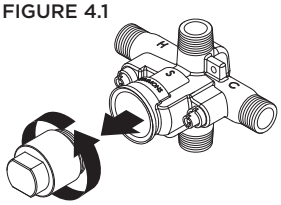
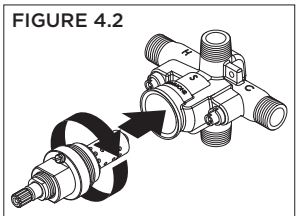


FIGURE 4.2



5. Installation - Adjust Packing Nut (Model Numbers Ending in TRMTC)

1) Turn hot and cold supplies on. Valve will not operate unless both hot and cold water supply pressures are on.

2) Place handle over flow control spindle.

3) Tighten packing nut for positive frictional resistance as handle is rotated from shut-off position across adjustment range.

6. Installation - Setting Limit Stop Screw (Model Numbers Ending in TRMTC)

The temperature limit stop screw limits valve handle from being turned to maximum position resulting in excessive hot water discharge temperatures.

⚠ **WARNING:** Failure to adjust limit stop screw properly may result in serious scalding.

1) Turn hot and cold supplies on. Valve will not operate unless both hot and cold water supply pressures are on.

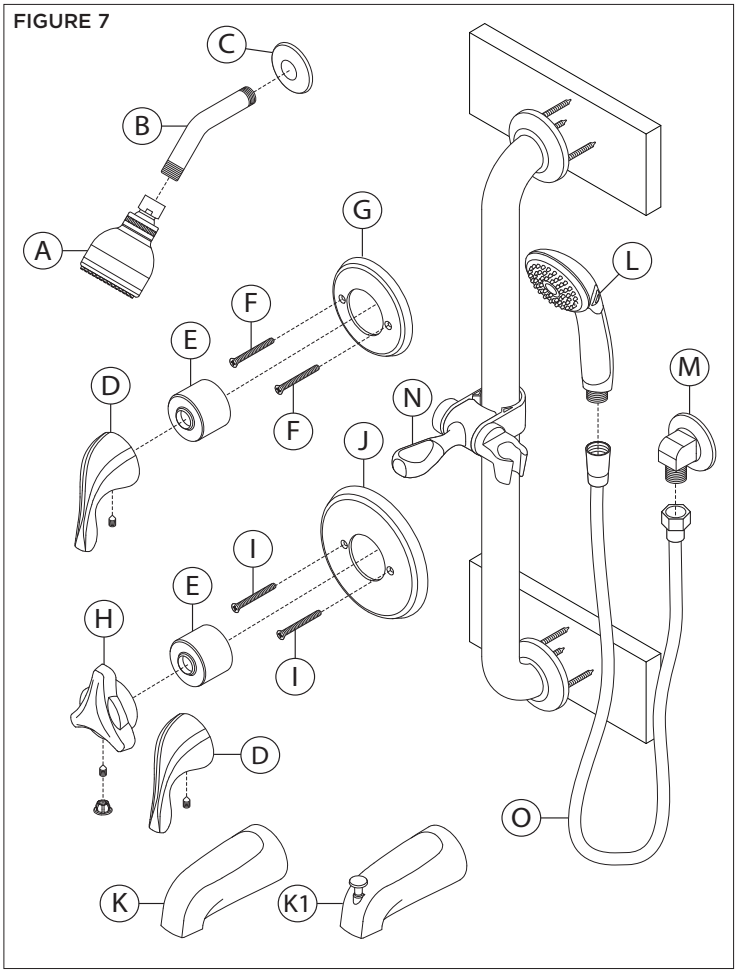
2) Place handle on flow control spindle and open valve to maximum desired temperature.

3) Turn limit stop screw clockwise until it seats.

P3/P4

7. Parts Breakdown

FIGURE 7



*Order in-line vacuum breaker (EF-109) for hand shower systems without dual checks.

Replacement Parts		
Item	Description	Part Number
A	Showerhead	4-141
B C	Shower Arm Flange	300S
D	'PLR' Handle	RTS-063
E	Dome Cover	T-19
F G	Diverter Escutcheon Screws	96-66-DIV-ESC
H	'P' Handle	RTS-061
I J	Shower Escutcheon Screws	**Standard (P):** 9600-P-ESC **Brass (P):** 9600-P-B-ESC **Standard (PLR):** 9600-PLR-ESC **Brass (PLR):** 9600-PLR-B-ESC
K K1	Tub Spout Diverter Tub Spout	060 054
L	Hand Shower	ADACHS
M	Wall Elbow	40A
N	Slide Mechanism	FP-SM6
O	60" Hose	RTS-045

Notes:

1) Append appropriate suffix for premium finish.
2) Append appropriate flow rate to showerhead or hand shower for low flow.
3) Apply a bead of silicone around the perimeter of all shower trim installed flush to the finished wall. Leave opening on bottom of escutcheons for weep hole.
4) Apply plumber tape to all threaded connections.

P3/P4

8. Installation - Shower Valve Trim

1) Secure large shower escutcheon to Temptrol pressure balancing valve using mounting screws (FIGURE 8.1).

2) Install dome cover by turning clockwise (FIGURE 8.2).

3) Install 'P' handle to shower valve. Secure with set screw. Install plug button (FIGURE 8.3).

4) Install 'PLR' handle to shower valve. Secure with set screw (FIGURE 8.4).

FIGURE 8.1

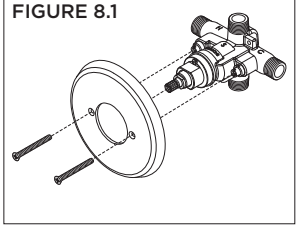
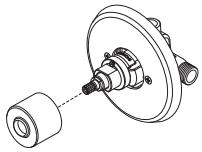


FIGURE 8.2



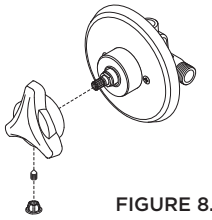


FIGURE 8.3

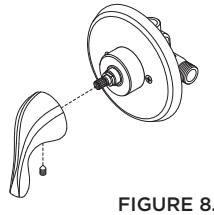


FIGURE 8.4

9. Installation - Diverter Valve Trim

1) Secure small diverter escutcheon to Symmons diverter valve using mounting screws (FIGURE 9.1).

2) Install dome cover by turning clockwise (FIGURE 9.2).

3) Install handle to diverter valve. Secure with set screw (FIGURE 9.3).

FIGURE 9.1

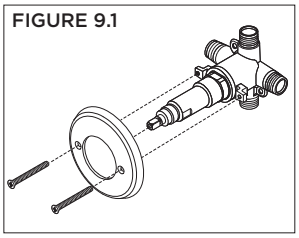


FIGURE 9.2

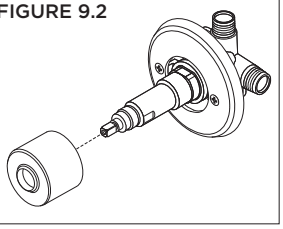
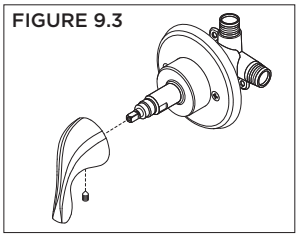


FIGURE 9.3



10. Installation - Showerhead & Tub Spout

1) Attach arm and flange to shower pipe. Turn clockwise to tighten (FIGURE 10.1).

2) Install showerhead to shower arm. Turn clockwise to tighten (FIGURE 10.2).

3) Install tub spout to stub out pipe. Turn clockwise to tighten (FIGURE 10.3).

FIGURE 10.1

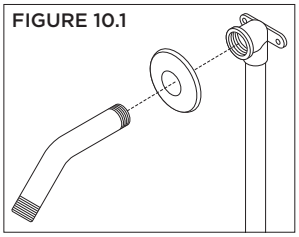


FIGURE 10.2

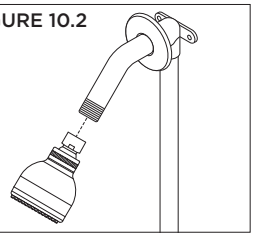
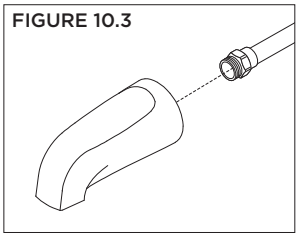


FIGURE 10.3



P3/P4

11. Installation - Slide Bar Assembly

1) Remove slide bar ends from slide bar flanges. Using flanges as a guide, drill 1/8" pilot holes into studs or wood blocking. With slide bar in position, secure to wall using screws. Attach slide bar ends to bar flanges (FIGURE 11.1).

2) Remove screw cap from slide mechanism (FIGURE 11.2).

3) Remove wand holder from slide mechanism (FIGURE 11.3).

4) Remove lever handle from slide mechanism (FIGURE 11.4).

5) Install slide mechanism components to slide bar following STEPS 11.2 - 11.4 in reverse. Flat edge on (N1) and (N2) must be aligned. Arrows on (N1) and (N3) identify bottom side (FIGURE 11.5).
Note: Adjust screw cap for ease of movement of slide assembly.

6) Press tabs on wall elbow flange. Install wall elbow to pipe fitting. Turn clockwise to secure (FIGURE 11.6).

7) Attach small end of hand shower hose to wall elbow. Turn clockwise to tighten (FIGURE 11.7).

8) Attach large end of hand shower wand. Turn clockwise to tighten (FIGURE 11.8).

FIGURE 11.1

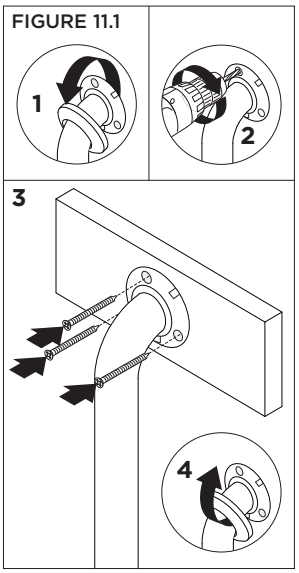


FIGURE 11.5

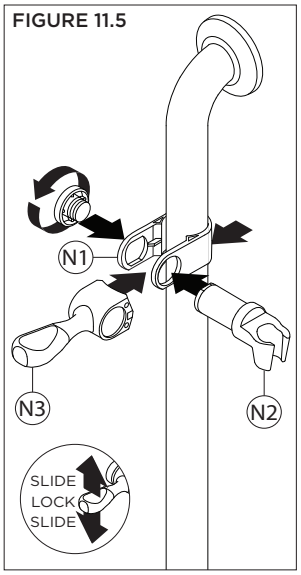


FIGURE 11.2

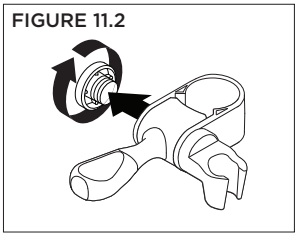


FIGURE 11.6

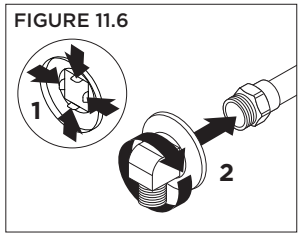


FIGURE 11.3

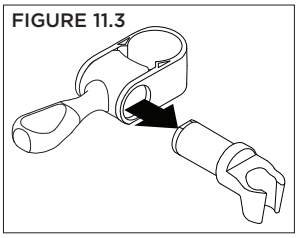


FIGURE 11.7

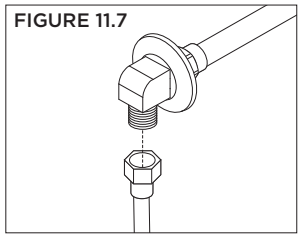


FIGURE 11.4

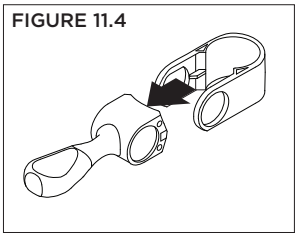
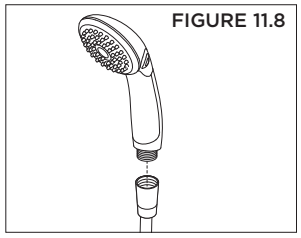


FIGURE 11.8



P3/P4

12. Operation (Temperature Control)

1) Turn shower handle counter-clockwise approximately 1/4 turn to put valve in cold position (FIGURE 12.1).

2) Turn shower handle counter- clockwise approximately 1/2 turn to put valve in warm position (FIGURE 12.2).

3) Turn shower handle counter- clockwise approximately 3/4 turn to put valve in hot position (FIGURE 12.3).

FIGURE 12.1

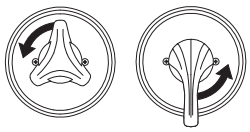


FIGURE 12.2

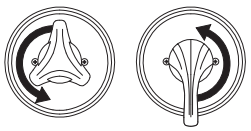
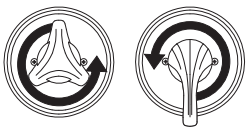


FIGURE 12.3



13. Operation (Dual Outlet Diverter Control)

Note: Additional handle positions for same output are illustrated.

1) Cartridge is factory set to divert to function 1 (FIGURE 13.1).

2) Turn handle to position 2 to divert to function 2 (FIGURE 13.2).

3) Turn handle to position 3 to share functions 1 and 2 (FIGURE 13.3).

FIGURE 13.1

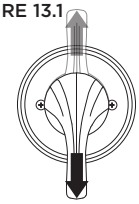


FIGURE 13.2

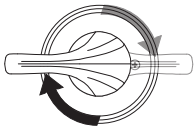


FIGURE 13.3

14. Operation (Triple Outlet Diverter Control)

1) Cartridge is factory set to divert to function 1 (FIGURE 14.1).

2) Turn handle to position 2 to divert to function 2 (FIGURE 14.2).

3) Turn handle to position 3 to divert to function 3 (FIGURE 14.3).

4) Turn handle to position 4 to share functions 2 and 3 (FIGURE 14.4).

5) Turn handle to position 5 to share functions 1 and 3 (FIGURE 14.5).

6) Turn handle to position 6 to share functions 1 and 2 (FIGURE 14.6).

FIGURE 14.1

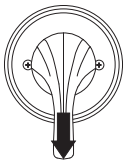


FIGURE 14.2

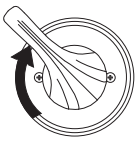


FIGURE 14.3

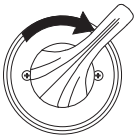


FIGURE 14.4

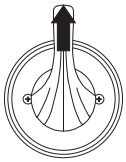
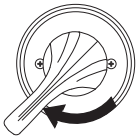


FIGURE 14.5

FIGURE 14.6



P3/P4

15. Troubleshooting Chart

Problem	Cause	Solution
Finish is spotting.	Elements in water supply may cause water staining on finish.	Clean finished trim area with a soft cloth using mild soap and water or a non-abrasive cleaner and then quickly rinse with water.

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P5

INSTALLATION INSTRUCTIONS FOR THE MODEL 830-AA SERVICE SINK WITH INTEGRAL VACUUM BREAKER

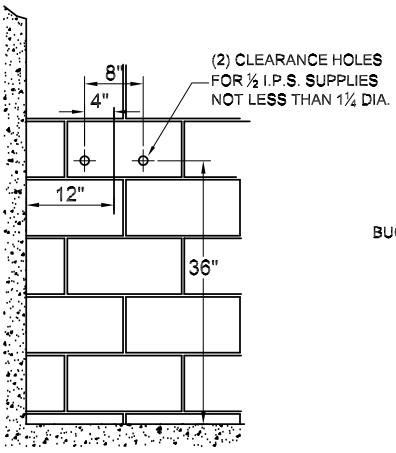

Fig. 1

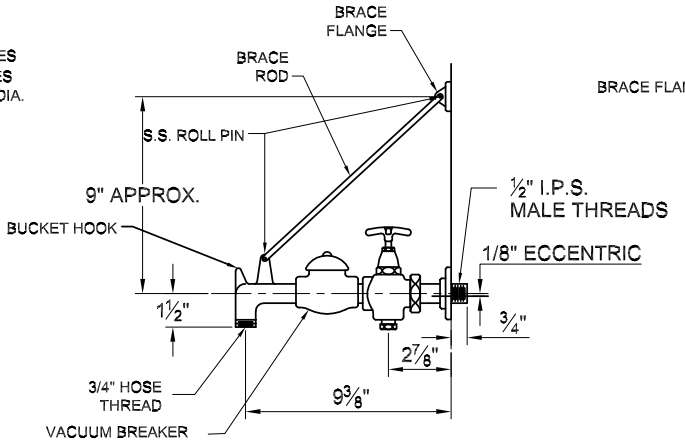

Fig. 2

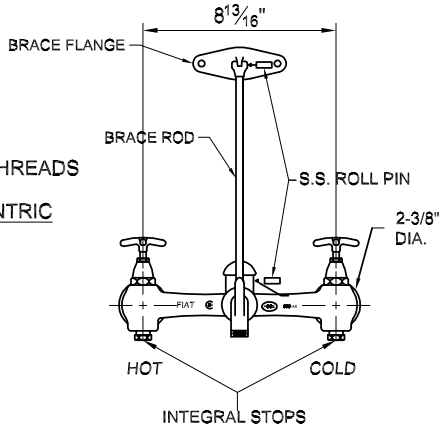

Fig. 3

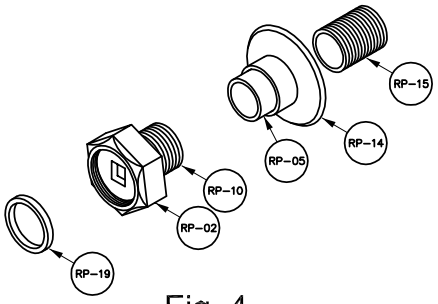

Fig. 4

INSTALLATION INSTRUCTIONS

1. Unpack the valve and check for any damage that may have occurred during shipment.
2. Drill the supply holes for the hot and cold sides of the valve as per Fig. 1
3. Remove RP-02, RP-10, and RP-19 from the hot and cold sides of the valve and assemble as shown in Fig. 4 and place onto supply pipe for hot and cold water.
4. Once Step 3 is complete attach the valve to RP-02. NOTE: If RP-19 is not placed as shown in Fig. 4 the connection will leak.
5. Attach Brace Rod to nozzle with S.S. roll pin. Once this is completed, attach the Brace Flange to Brace Rod with S.S. roll pin. Position the Brace Flange against the wall and mark two hole locations for the Brace Flange holes and secure the Brace Flange to the wall.

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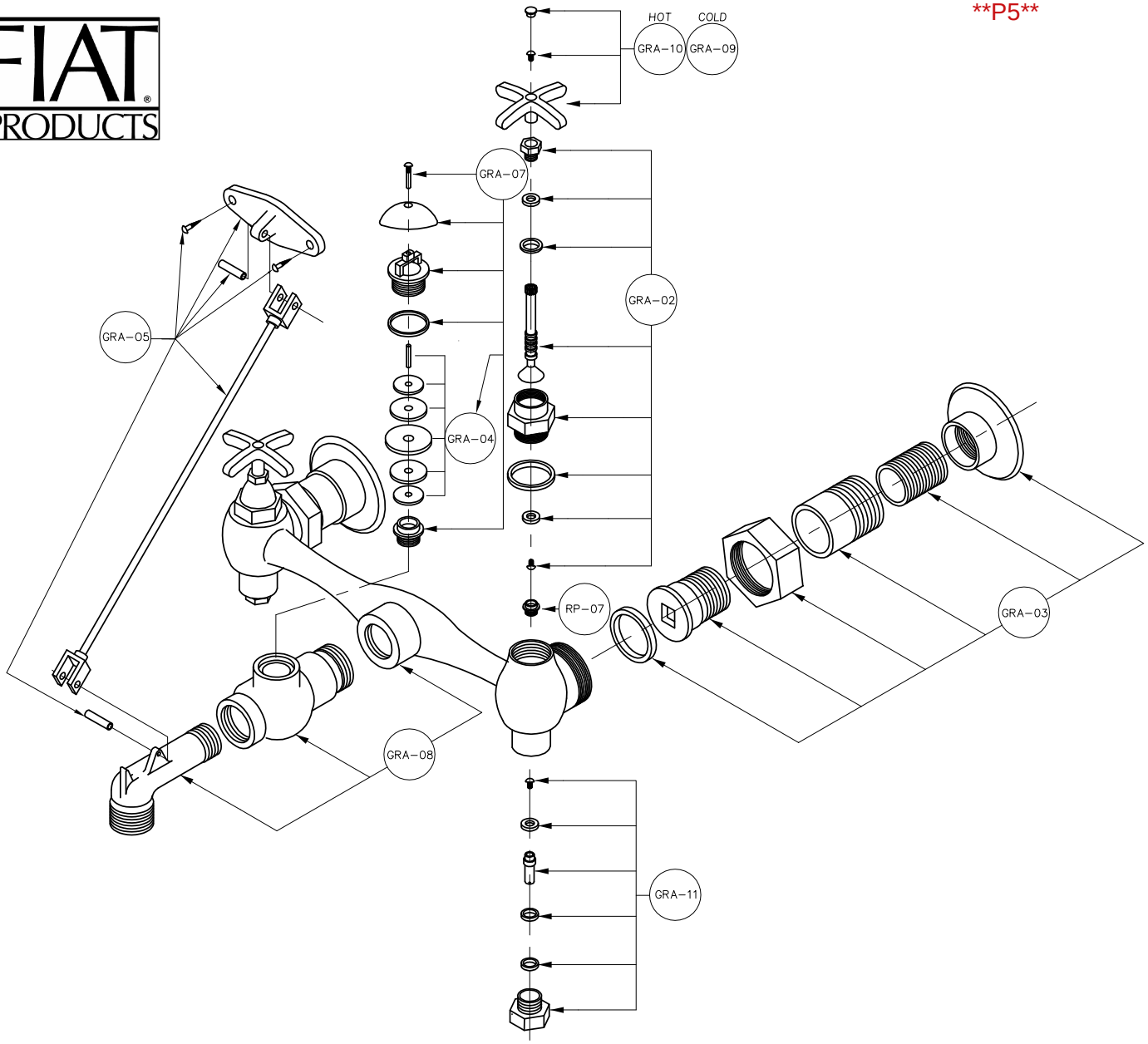
P5

FIAT PRODUCTS



GROUP RELACEMENT ASSEMBLY PARTS LIST

GRA-02 HANDLE MOUNTING GROUP ASSEMBLY
- SPINDLE
- SEAT WASHER
- SEAT WASHER SCREW
- PACKING NUT
- BRASS WASHER
- PACKING
- HANDLE HUB
- HUB WASHER

GRA-03 COUPLING ASSEMBLY
- COUPLING NUT
- BUSHING(SOCKET)
- SWIVEL
- WALL FLANGE
- WASHER
- NIPPLE

GRA-05 BRACE ASSEMBLY
- WOOD SCREW (2)
- BRACE FLANGE
- S.S. ROLL PIN (2)
- WALL BRACE ROD

GRA-07 VACUUM BREAKER ASSEMBLY
- SEAT
- V.B. HUB
- CAP
- V.B. HUB WASHER
- V.B. CAP SCREW
- GRA-04 ASSEMBLY

GRA-08 BODY ASSEMBLY
- NOZZLE
- CENTER BODY
- V.B. BODY

GRA-09 COLD HANDLE ASSEMBLY
- HANDLE
- HANDLE SCREW
- COLD INDEX

GRA-10 HOT HANDLE ASSEMBLY
- HANDLE
- HANDLE SCREW
- HOT INDEX

GRA-11 INTEGRAL STOP ASSEMBLY
- SPINDLE
- BRASS WASHER
- WASHER
- PACKING NUT
- SEAT WASHER SCREW
- PACKING

RP-07 SEAT

830AA Installation Instructions (9/30/09)

P6

With proper care and maintenance, your Elkay faucet will give you a lifetime of service. Below are the suggestions for the care and cleaning of your Elkay Faucet.

Faucet Cleaning

- Clean faucets daily to avoid build-up of soap or mineral deposits, as these tend to have an adverse effect on the appearance of the product.
- For typical cleaning, wipe faucet well with a damp cloth and dry thoroughly with a soft towel. Drying helps avoid water spots.
- DO NOT use cleaning products containing ammonia, bleach, alcohol or other harsh chemicals and DO NOT use any form of abrasives (e.g. abrasive sponges or steel wool) which are damaging to metal surfaces.
- Faucet spray faces may become dirty over time. With Elkay's easy-clean rubber spray face, cleaning is as easy as rubbing with a finger to clean. This is recommended to do on a daily basis.

Chrome

With chrome finished faucets common household cleaners (e.g. dish soap) can be used.* However, cleaners should be rinsed off thoroughly and the faucet should be dried.

Oil Rubbed Bronze

With oil rubbed bronze faucets Windex original can be used .* However, cleaners should be rinsed off thoroughly and the faucet should be dried.

*Though household cleaners CAN be used, simply using a damp towel and drying thoroughly is still recommended.

Care and Maintenance

- These simple steps will extend the life of your faucet.
- The water in certain areas of the world can be very caustic - standing water around the product can cause damage. Be sure to remove standing water with a dry, soft cloth as soon as possible.
- For chrome and brushed finishes, as often as once a week, you can apply a paste wax or special, non-abrasive, brass coating (for polished brass)
- Before applying a protective coating (paste wax), gently brush the entire fixture using a soft tooth brush. This will remove any dirt or deposit build-up.
- DO NOT APPLY POLISH

Replacing Parts

If your Elkay faucet is leaking it may be time to replace the faucet's cartridge. To learn more about this process, please reference this article on replacing your cartridge. However, Elkay recommends that replacing a cartridge should be done by a professional.

Failure to follow care and cleaning will void your warranty. For additional information, please visit Elkay.com.

P6

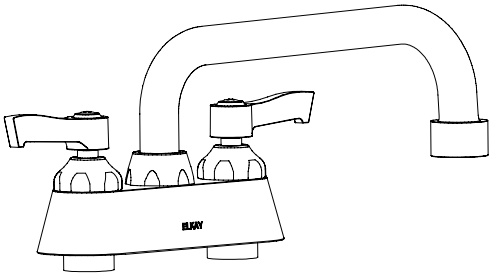
Home Remedies for Cleaning

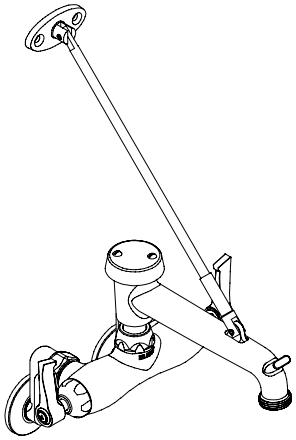
- For major stains or grime on your faucets, a mixture of a half a cup of white vinegar and a half cup of water will help. Dip a cloth into the solution and rub away the grime or stain. The solution should then be rinsed off and dried to prevent damage to the finish of your faucet.
- The above mixture is also recommended for spray faces with built up debris. Use a toothbrush with this mixture to try to dislodge any debris obstructing the water flow.
- Another solution for major grime or stains, is a small amount of baking soda and water on a toothbrush. This should remove any nasty stains. Again, the solution should then be rinsed off and dried to prevent damage to the finish of your faucet.
- DO NOT allow any part of your Elkay faucet to soak in either of the above mixtures. It is also recommended to test the above mixtures on an unseen part of your faucet to see what affect it has to the finish of your faucet.

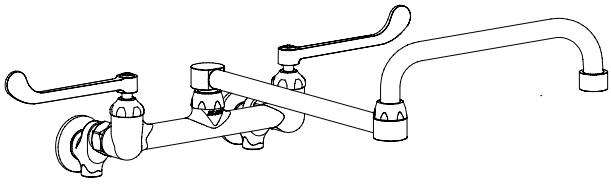
P6

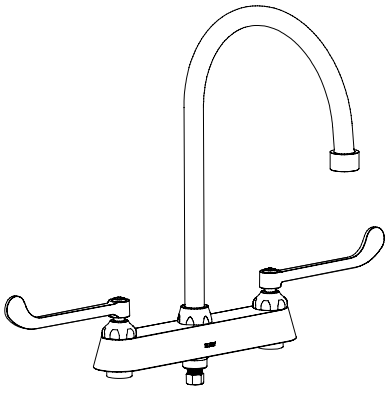
ELKAY®

Installation Instructions for Wall Mount and Deck Mount Faucets









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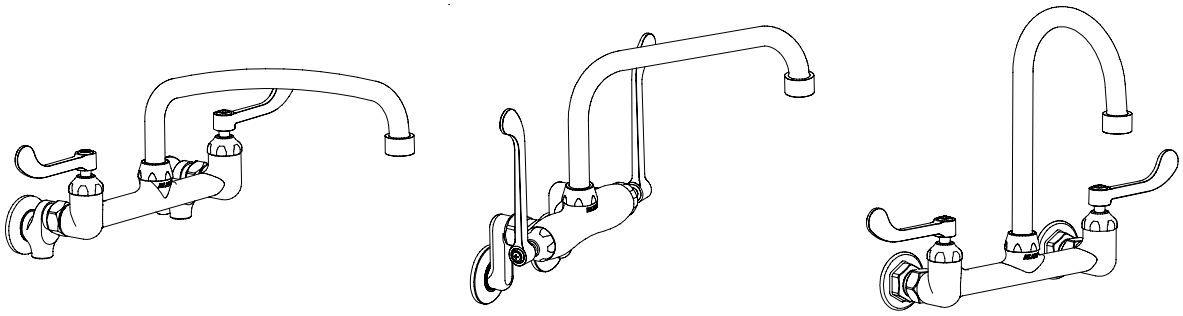
WALL MOUNT ASSEMBLY



General Instructions

- Turn off the water supply at the main source.
- Hand tighten all parts prior to tightening with wrench. Do not force parts together.
- Handle plated surfaces with care, being careful not to scratch with tools.
- Wall mount faucets have a ½" I.P.S. female flanged inlet.
- For easier assembly, you may purchase as an accessory, the LKMK462 mounting kit (see Figure 2).

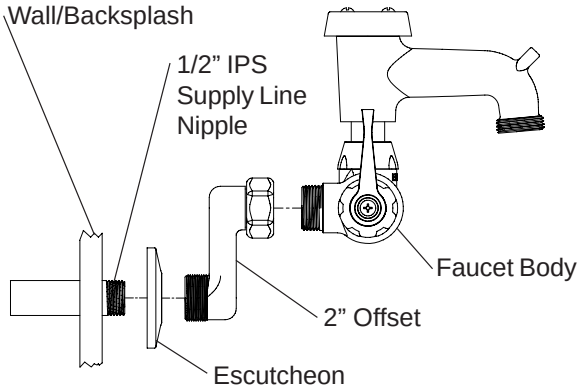


Figure 1

Assemble Faucet to Backsplash

1. Apply teflon tape or pipe joint compound to supply line nipples.
2. Place nipples through holes in backsplash.
3. Assemble each flanged inlet to one nipple, then the other.
4. Using the optional LKMK462, apply in order behind the back-splash: rubber washer, washer, lock nut and elbow (see Figure 2).
5. Thread flanged inlet loosely against wall or backsplash.
6. Carefully orient, mount and hand tighten the faucet to the two flanges. Besure to include the washers provided.
7. Use wrench to tighten flange against backsplash. (Maintain alignment of faucet or spout to sink while tightening).
8. Wrench tighten flanges to faucet body.
9. Make sure drain is attached and turn on water supply - being sure to check for leaks. Wrench tighten where needed.

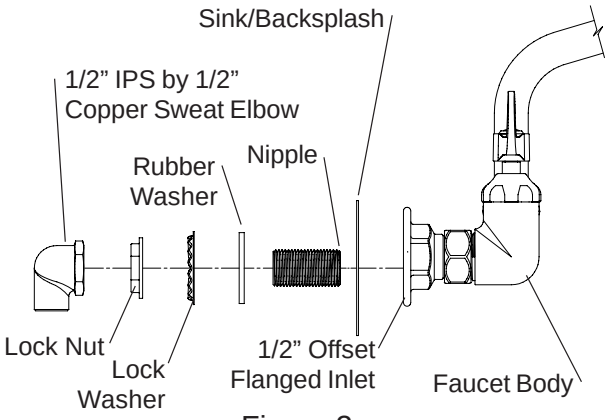


Figure 2

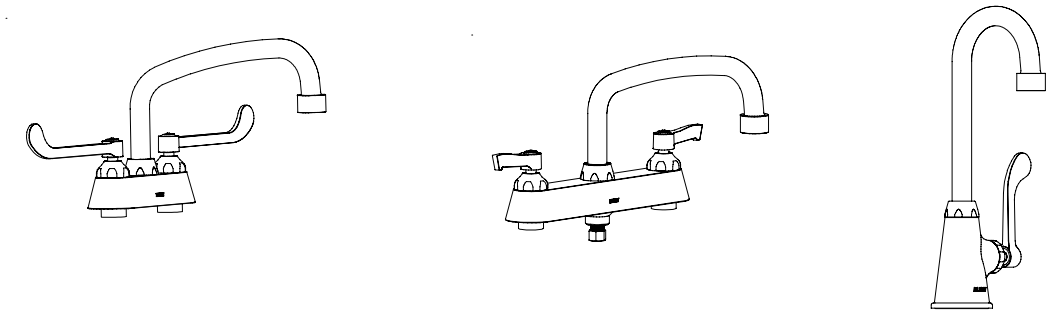
A55483 (Rev. B - 9/10)

P6

TO FIX SPOUT IN POSITION

1. Prior to spout installation, remove provided lock pin from sealed bag.
2. Place lock pin in the pierced hole at the base of the spout.
3. Align pin with slots in the ring found inside the throat of the spout connection on the faucet body.
4. Tighten spout nut to appropriate torque.

DECK MOUNT ASSEMBLY



General Instructions

- Turn off the water supply at the main source.
- Hand tighten all parts prior to tightening with wrench. Do not force parts together.
- Handle plated surfaces with care, being careful not to scratch with tools.
- All deck mount faucets and spouts come complete with compression nut and one piece nutwasher for ½" O.D. tube.

Assemble Base to Sink Deck

1. Apply Teflon tape or pipe joint compound to the threads on the shank(s).
2. Place shank(s) through holes in deck.
3. Apply in order: nutwasher and nut (see Figure 3).
4. Hand tighten nutwasher against deck of sink. (Maintain alignment of faucet or spout to sink while tightening.
5. Attach supply lines.
6. Make sure drain is attached and turn on water supply – being sure to check for leaks. Tighten with wrench where needed.

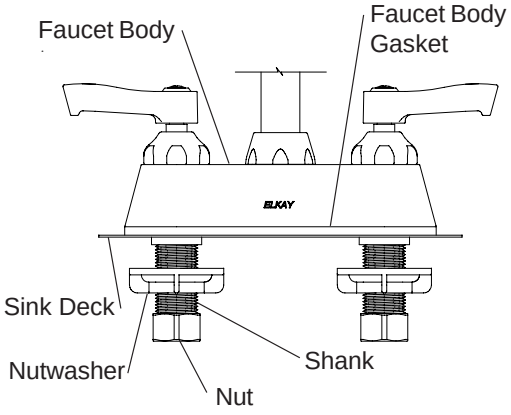


Figure 3

P6

IMPORTANT END USER INFORMATION

Care and Cleaning Instructions

Your Elkay faucet has been constructed of the finest materials. However, certain precautions must be taken to maintain the lustrous decorative finish.

Do not use abrasive cleaners or harsh chemical cleansers on this product which could damage the finish.

A warm water wash with a wipedown using a soft cloth will generally remove dry water spots. Never use alcohol or other organic solvents.

ELKAY

COMMERCIAL SINKS AND FAUCETS LIMITED WARRANTY

Elkay warrants commercial sink and faucet products to be free of defects in workmanship and materials for a period of 5 years from the date of purchase. This warranty does not cover transportation or installation charges. Contact Elkay customer service (630-572-3192) for complete details and conditions.

TO OBTAIN SERVICE UNDER WARRANTY

1. Write to: Elkay
   Attention: Consumer Service
   2222 Camden Court
   Oak Brook, Illinois 60523

2. Include a letter containing the following information:

   a. Date of purchase and installation

   b. Description of nature of defect.

   c. Model number or description of model and/or component part if possible.

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PRODUCT SPECIFICATIONS

Elkay 4" Centerset with Exposed Deck Faucet with 5" Gooseneck Spout 2" Lever Handles Chrome. Faucet has a flow rate of 1.5 GPM, and is made of Chrome Plated Brass material, with a Quarter Turn Ceramic Disc valve. Faucet requires 2 faucet holes.

Mounting Type:	Deck Mount
Special Features:	Low Flow Solid Brass Construction Spout swing restriction pin
Finish:	Chrome (CR)
Handle Type:	2" Lever Handle
Deck Clearance:	8-1/8"
Spout Reach:	5"
Spout Height:	10-3/4"
Hole Drillings:	2
Material:	Chrome Plated Brass
Valve Type:	Quarter Turn Ceramic Disc
Valve Connection:	1/2" NPSM Male
Flow Rate:	1.5 GPM
Faucet Hole Spread:	4
Spout Type:	Gooseneck

Special Note: 1.5 GPM flow regulator installed (2.2 GPM flow regulator also included with faucet)

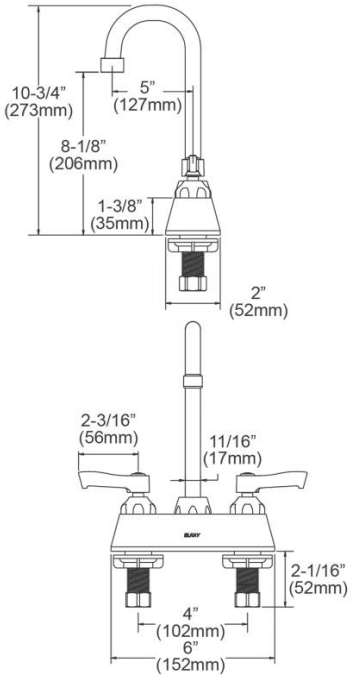
Chrome
(CR)

AMERICAN PRIDE. A LIFETIME TRADITION.
Like your family, the Elkay family has values and traditions that endure. For almost a century, Elkay has been a family-owned and operated company, providing thousands of jobs that support our families and communities.

Product Compliance: ADA & ICC A117.1
ASME A112.18.1/CSA B125.1
NSF 61
NSF 372 (lead free)

Complies with ADA & ICC A117.1 accessibility requirements when installed according to the requirements outlined in these standards.

Clean and Care Manual (PDF)
Installation Instructions (PDF)
Limited Warranty (PDF)



PART:_____QTY: _____

PROJECT:_____

CONTACT:_____

DATE:_____

NOTES:_____

APPROVAL:

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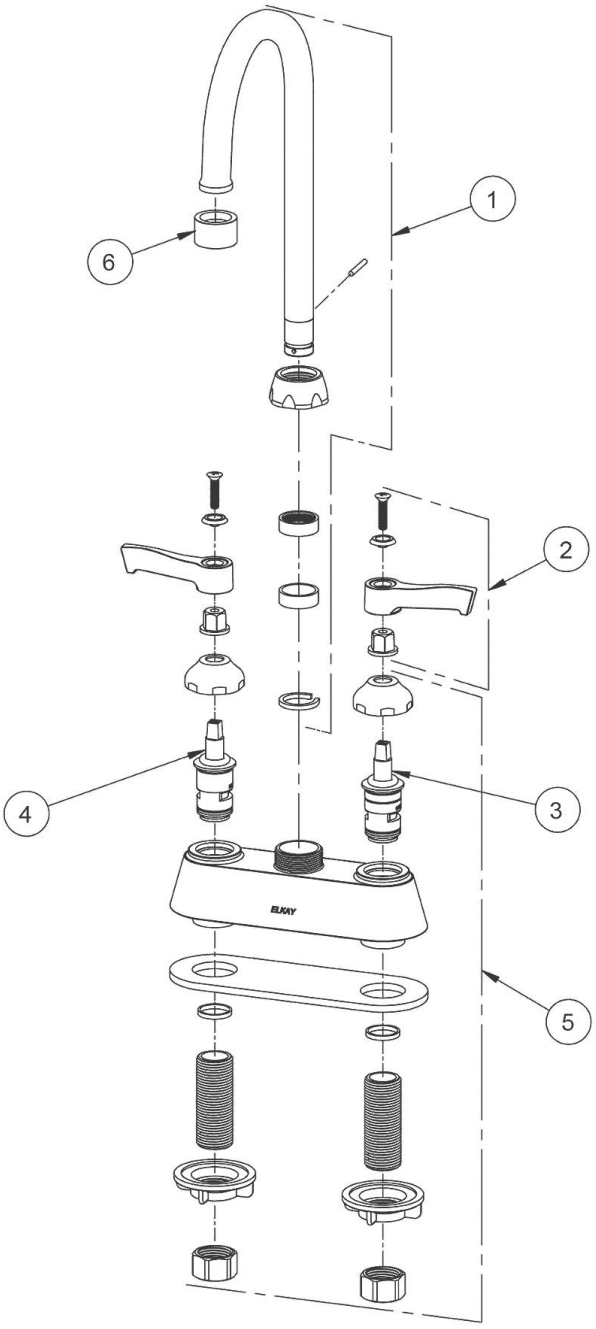

ITEM	IND. PART	DESCRIPTION
1	A55401	Spout
2	45918C	Handle, 2"
3	45923C	Right Cold Cartridge
4	45924C	Left Hot Cartridge
5	45917C	Body
6	LK734	2.2 GPM VR Aerator

SHW-I-S_100161683_2000017192_Rev AC

SHIELD™
COMMERCIAL WATER HEATERS

Installation & Service Manual

Models: SNR126-065, SNR151-100, SNR201-100, SNA151-100, SNA201-100, SNA286-125, SNA401-125, AND SNA501-125

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

-- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

-- WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

-- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

IMG00460

DESIGN CERTIFIED®

CERTIFIED®

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions in this manual before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

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Please read before proceeding

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

⚠ WARNING **Installer** – Read all instructions, in this manual before installing. Perform steps in the order given.

Have this water heater serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the water heater – Please have the water heater model and serial number from the water heater rating plate.

Consider piping and installation when determining water heater location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 10). Failure to comply could result in severe personal injury, death, or substantial property damage.

When servicing the water heater –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow the water heater to cool before performing maintenance.

⚠ WARNING If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death

-- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

-- WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

-- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

Water heater operation –

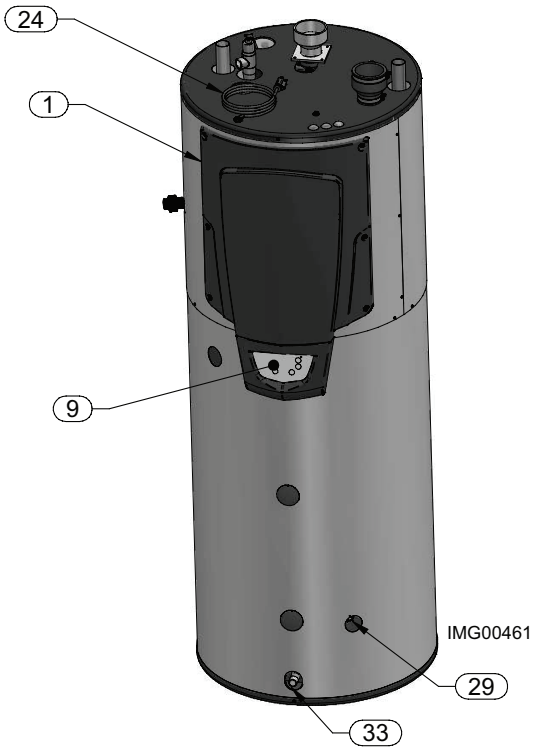
- Do not block flow of combustion or ventilation air to the water heater.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this water heater if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

The Shield - How it works...

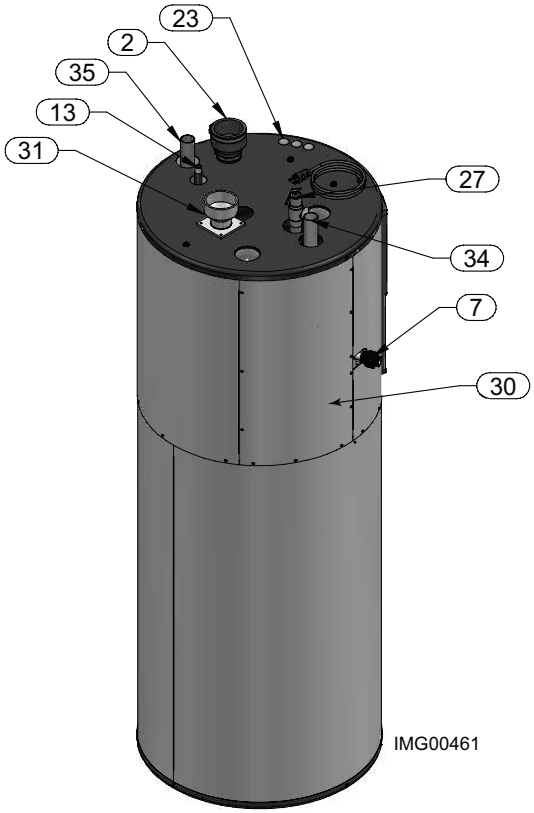
1. **Access cover - front**
   Provides access to the gas train, heat exchanger and controls.
2. **Air intake adapter**
   Allows for the connection of the PVC air intake pipe to the water heater.
3. **Air pressure switch**
   The air pressure switch detects blocked inlet conditions.
4. **Air shroud (501-125 Model Only_Not Shown)**
   The air shroud directs air and gas flow into the blower.
5. **Blower**
   The blower pulls in air and gas through the venturi (item 32). Air and gas mix inside the blower and are pushed into the burner, where they burn inside the combustion chamber.
6. **Burner (not shown)**
   Made with metal fiber and stainless steel construction, the burner uses pre-mixed air and gas and provides a 5 to 1 firing rate.
7. **Condensate drain connection**
   Connects the condensate drain line to 1/2" PVC.
8. **Electronic Control Module**
   The electronic control responds to internal and external signals and controls the blower, gas valve, and pump to meet the demand.
9. **Electronic display**
   The electronic display consists of 4 buttons, and a liquid crystal display. The display is used to make adjustments and read water heater status.
10. **Flame inspection window (not shown)**
    The quartz glass window provides a view of the burner surface and flame.
11. **Flame sensor**
    Used by the control module to detect the presence of burner flame.
12. **Flue gas sensor (not shown)**
    This sensor monitors the flue gas exit temperature. The control module will modulate and shut down the water heater if the flue gas temperature gets too hot. This protects the flue pipe from overheating.
13. **Gas connection pipe**
    Threaded pipe connection, either 1/2", 3/4", or 1", depending on the model. This pipe should be connected to the incoming gas supply for the purpose of delivering gas to the water heater.
14. **Gas shutoff switch (151-100 - - 286-125 Models Only)**
    An electrical switch designed to cut power from the gas valve to prevent gas flow to the burner.
15. **Gas shutoff valve (401-125 -- 501-125 Models Only)**
    Manual valve used to isolate the gas valve from the gas supply.
16. **Gas valve**
    The gas valve senses the negative pressure created by the blower, allowing gas to flow only if the gas valve is powered and combustion air is flowing.
17. **Heat exchanger access cover**
    Allows access to the combustion side of the heat exchanger coils.
18. **Heat exchanger inlet temperature sensor**
    This sensor monitors the inlet water temperature to the heat exchanger.
19. **Heat exchanger outlet temperature sensor**
    This sensor monitors heat exchanger outlet water temperature.
20. **Ignition electrode**
    Provides direct spark for igniting the burner.
21. **Line voltage junction box**
    The junction box contains the connection points for the line voltage power.
22. **Low voltage connection board**
    The connection board is used to connect external low voltage devices.
23. **Low voltage wiring connections (knockouts)**
    Conduit entryway for the low voltage connection board.
24. **Power cord**
    The power cord allows for quick connection to 120V supply.
25. **Pump**
    Circulates water between the tank and the heat exchanger.
26. **Pump relay**
    Switches power to the pump.
27. **Relief valve**
    Protects the heat exchanger from over pressure and temperature conditions. The relief valve is set at 150 PSI.
28. **Stainless steel heat exchanger**
    Allows water to flow through specially designed coils for maximum heat transfer, while providing protection against flue gas corrosion. The coils are encased in a jacket that contains the combustion process.
29. **Tank sensor**
    Used by the control to monitor the temperature of the tank.
30. **Pump access panel**
    Panel used to gain access to the pump and condensate trap; also used to gain access to the outlet water sensor on Models 286-125 -- 501-125 only.
31. **Vent pipe connection**
    Allows for the connection of the vent pipe system to the water heater.
32. **Venturi**
    The venturi controls air and gas flow into the burner.
33. **Water heater drain valve**
    Location from which the water heater can be drained.
34. **Water inlet**
    Copper sweat connection for cold water supply that returns water from the system to the heat exchanger, either 1-1/2" or 2", depending on the model.
35. **Water outlet**
    Copper sweat connection that supplies hot water to the system, either 1-1/2" or 2", depending on the model.
36. **Over-temp switch (286-125 --501-125 Models Only)**
    An electrical switch designed to shut down water heater operation in the event the outer back of the heat exchanger, directly above the flue connection exceeds 604°F (318°C). This is a one time switch and could warrant a heat exchanger replacement. Check the integrity of the rear refractory at the back of the upper coil if the switch opens.
37. **Burner door temperature switch (Models 286-125 - 501-125 Only)**
    An electrical switch designed to shut down water heater operation in the event the combustion chamber access cover exceeds 500°F (260°C). This switch may only be reset by a qualified service technician AFTER the underlying cause has been identified and corrected. Check the integrity of the front refractory on the inside of the combustion chamber access cover if the switch opens.

The Shield - How it works... *(continued)*

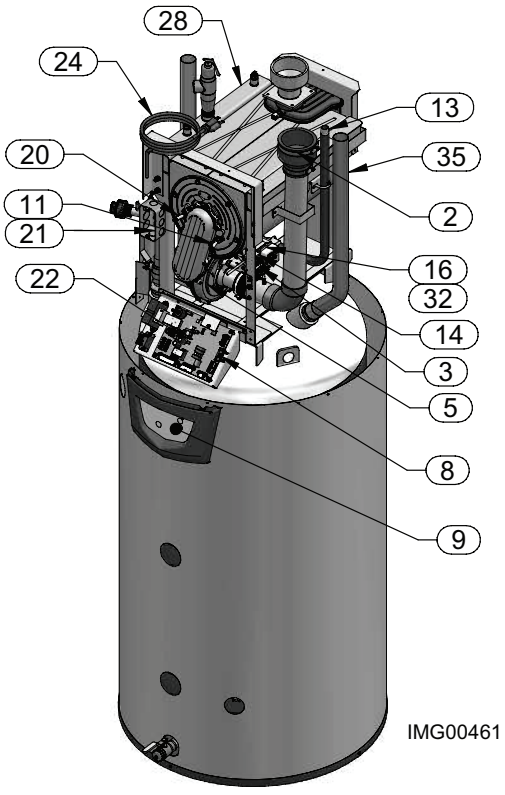
Models 126-065 – 201-100



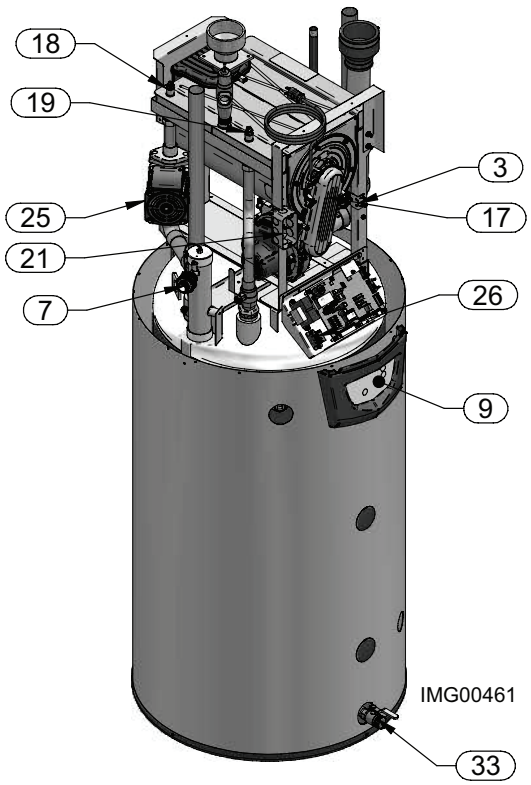
Front View - Models 126-065 -- 201-100



Rear View - Models 126-065 -- 201-100



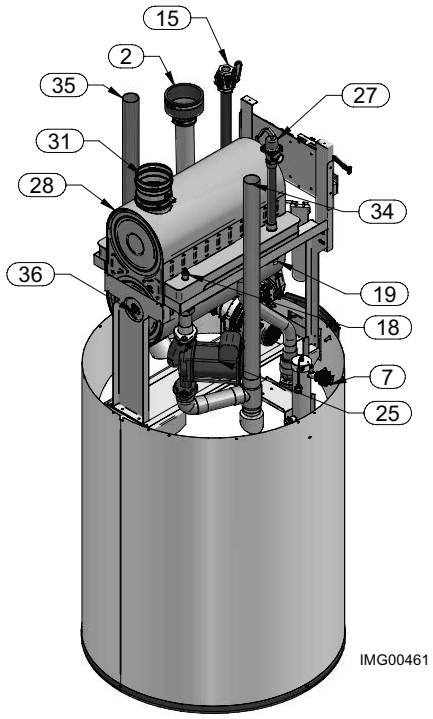
Left Side (inside unit) -- Models 126-065 -- 201-100



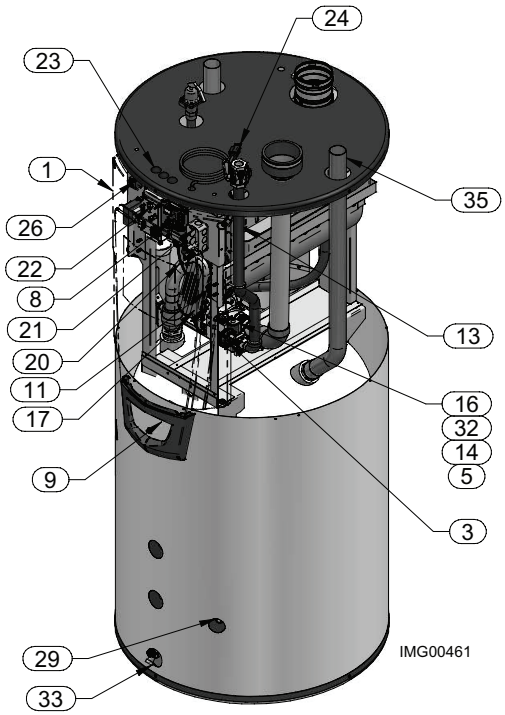
Right Side (inside unit) -- Models 126-065 -- 201-100

The Shield - How it works...

Models 286-125 -- 401-125

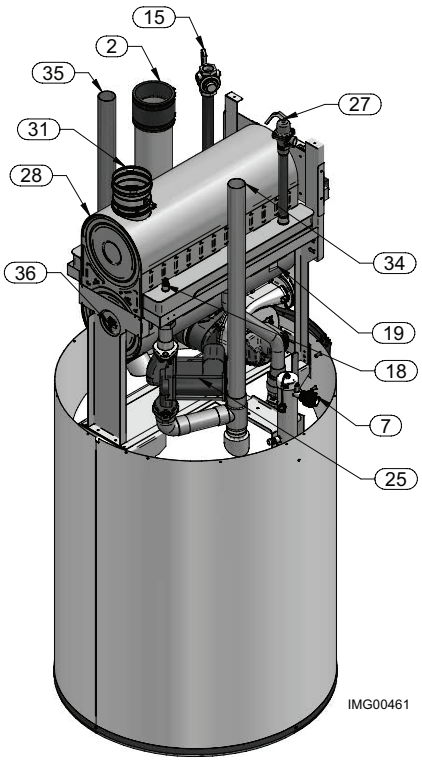


Rear View - Models 286-125 -- 401-125

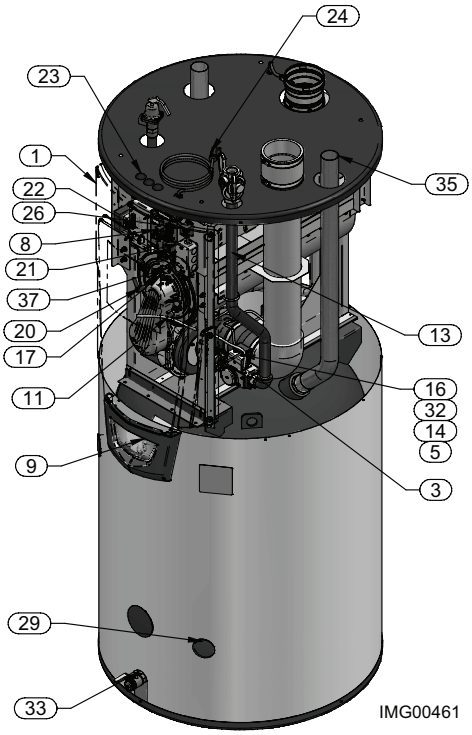


Right Side (inside unit) - Models 286-125 – 401-125

Model 501-125



Rear View - Model 501-125



Right Side (inside unit) - Model 501-125

Ratings

HLW

LOW LEAD CONTENT

Model Number Note: Change "N" to "L" for L.P. gas models.	CSA Input Modulation Btu/hr (Note 2)		Water Content Gallons	Water Connections	Gas Connections	Vent/Air Size (Note 1,4)
	Min	Max				
SNR126-065	25,000 - 125,000		68	1-1/2"	1/2"	3"
SNR151-100	30,000 - 150,000		91	1-1/2"	1/2"	3"
SNA151-100	30,000 - 150,000		91	1-1/2"	1/2"	3"
SNR201-100	39,800 - 199,000		91	1-1/2"	1/2"	3"
SNA201-100	39,800 - 199,000		91	1-1/2"	1/2"	3"
SNA286-125	57,000 - 285,000		116	2"	3/4"	4"
SNA401-125	79,800 - 399,000		117	2"	1"	4"
SNA501-125	100,000 - 500,000		117	2"	1"	4"

NOTICE Maximum allowed working pressure is located on the rating plate.

Notes:

1. Shield water heaters require special gas venting. Use only the vent materials and methods specified in the Shield Installation and Service Manual.
2. Standard Shield water heaters are equipped to operate from sea level to 4,500 feet **only** with no adjustments. The water heater will de-rate by 4% for each 1,000 feet above sea level up to 4,500 feet.
3. High altitude Shield water heaters are equipped to operate from 3,000 to 12,000 feet **only**. The water heater will de-rate by 2% for each 1,000 feet above sea level. High altitude models are manufactured with a different control module for altitude operation, but the operation given in this manual remains the same as the standard models. A high altitude label (as shown in FIG. A) is also affixed to the unit.

   Derate values are based on proper combustion calibration and CO_2's adjusted to the recommended levels.
4. The Shield 286-125 model can be alternatively vented using a 3" vent/air size. If the 3" vent/air size is used, the maximum vent/air pipe lengths are limited to 60 equivalent feet each.

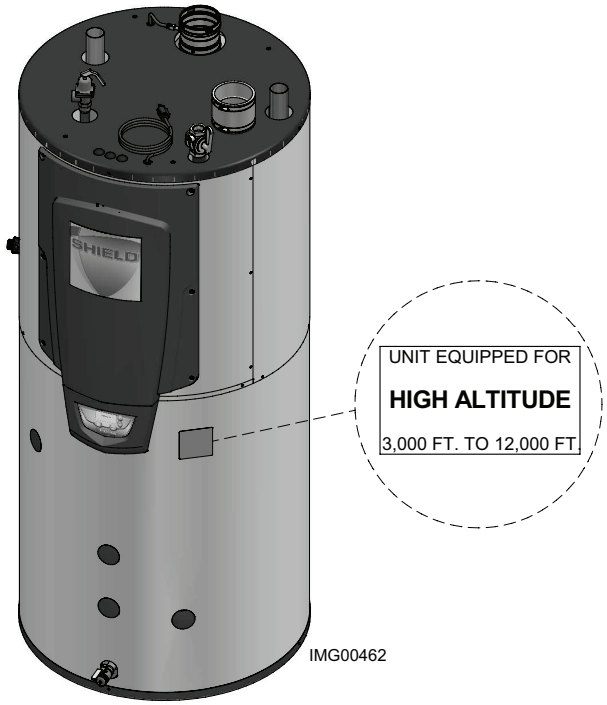


***Figure A** High Altitude Label Location*

1 Determine water heater location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The Shield water heater gas manifold and controls met safe lighting and other performance under tests specified in ANSI Z21.10.3 – latest edition.

Before locating the water heater, check:

1. Check for nearby connection to:
   - Water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the water heater. Remove any combustible materials, gasoline and other flammable liquids.

⚠ WARNING Failure to keep water heater area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The Shield water heater must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.

⚠ WARNING This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F.

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

⚠ WARNING This appliance requires a special venting system. The vent connection to the appliance must be made with the CPVC pipe section provided with the appliance. The field provided vent fittings must be cemented to the CPVC pipe section. Use only the vent materials, primer and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

Closet and alcove installations

A closet is any room the water heater is installed in which is less than 433 cubic feet for 126-065 and 201-100 models and 638 cubic feet for the 286-125 through 501-125 models.

An alcove is any room which meets the criteria for a closet with the exception that it does not have a door.

Example: Room dimensions = 6 feet long, 6 feet wide, and 9 foot ceiling = 6 x 6 x 9 = 324 cubic feet. This would be considered a closet for a Shield Water Heater.

⚠ WARNING For closet and alcove installations as shown in FIG.'s 1-1 and 1-2, CPVC or stainless steel vent material must be used inside the structure. The ventilating air openings shown in FIG.'s 1-1 and 1-2 are required for this arrangement. Failure to follow this warning could result in fire, personal injury, or death.

Provide clearances:

Clearances from combustible materials

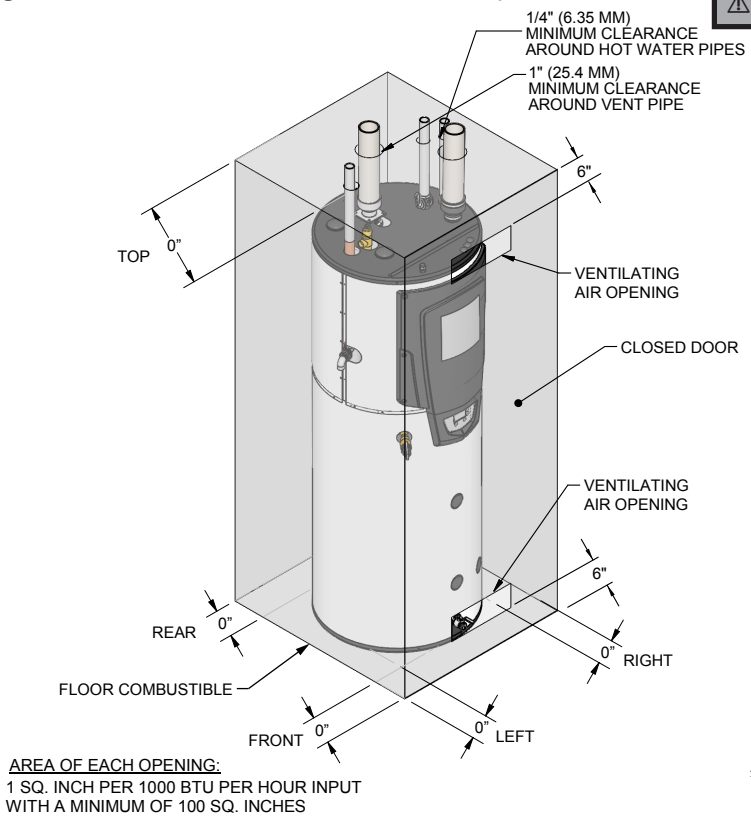
1. Hot water pipes—at least 1/4" from combustible materials.
2. Vent pipe – at least 1" from combustible materials.
3. See FIG.'s 1-1 and 1-2 on page 9 for other clearance minimums.

Clearances for service access

1. See FIG.'s 1-1 and 1-2 on page 9 for recommended service clearances. If you do not provide the minimum clearances shown, it may not be possible to service the water heater without removing it from the space.

1 Determine water heater location *(continued)*

Figure 1-1 *Closet Installation - Minimum Required Clearances*



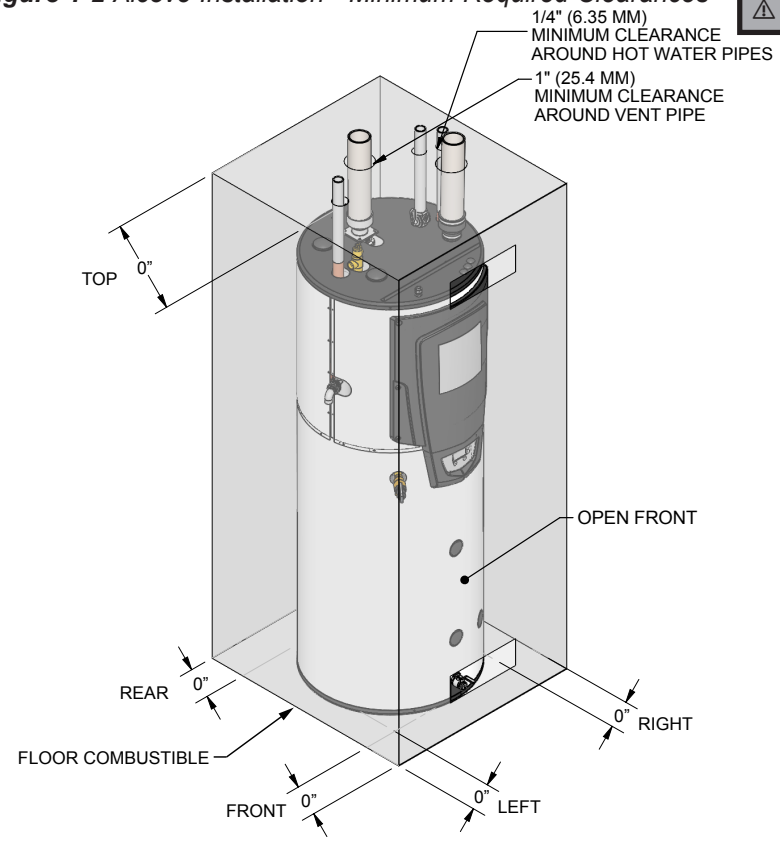
⚠ WARNING

For closet installations, CPVC, polypropylene or stainless steel vent material MUST BE used in a closet structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

RECOMMENDED SERVICE CLEARANCES:

Top -	18" (457 mm)
Left/Right Side -	24" (610 mm)
Front -	24" (610 mm)

Figure 1-2 *Alcove Installation - Minimum Required Clearances*



⚠ WARNING

For alcove installations, CPVC, polypropylene or stainless steel vent material MUST BE used in an alcove structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

RECOMMENDED SERVICE CLEARANCES:

Top -	18" (457 mm)
Left/Right Side -	24" (610 mm)
Front -	24" (610 mm)

1 Determine water heater location

Table 1A Corrosive Contaminants and Sources

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

Flooring and foundation

Flooring

The Shield water heater is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠ WARNING Do not install the water heater on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

When local codes require compliance with NSF 5, the heater must be sealed to the floor with a food grade silicone to prevent debris and harborage of vermin under the heater.

If flooding is possible, elevate the water heater sufficiently to prevent water from reaching the water heater.

Remove water heater from wood pallet

1. Remove the sides and the top of the crate.
2. Remove the blocks on the base of the crate to allow for easier removal.
3. The water heater can then be slid off the base of the crate for installation.

NOTICE Do not drop the water heater or bump the jacket on the floor or pallet. Damage to the water heater can result.

Prevent combustion air contamination

Install air inlet piping for the Shield water heater as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, for products and areas which may cause contaminated combustion air.

⚠ WARNING Ensure that the combustion air will not contain any of the contaminants in Table 1A. Contaminated combustion air will damage the water heater, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also, avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine water heater location *(continued)*

When using an existing vent system to install a new water heater:

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 2 - General Venting. For polypropylene or stainless steel venting, an adapter of the same manufacturer must be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 2A. Check to see that this size is used throughout the vent system.
- **Manufacturer** - For a stainless steel or polypropylene application, you must use only the listed manufacturers and their type product listed in Tables 2E and 2G for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 2 through 4 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Sidewall or Vertical options listed in the General Venting Section. For stainless steel vent, only use terminations listed in Table 2H for the manufacturer of the installed vent.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Water Heater Section, this page.

With polypropylene and stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used; with PVC/CPVC vent, see the Installing Vent or Air Piping Section on page 20.

⚠ WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

When removing a water heater from existing common vent system:

⚠ DANGER Do not install the Shield water heater into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

At the time of removal of an existing water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

a. Seal any unused openings in the common venting system.

b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.

c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.

f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

1 Determine water heater location

Maintain minimum specified clearances for adequate operation. All installations must allow sufficient space for servicing the vent connections, water pipe connections, piping and other auxiliary equipment, as well as the appliance.

Multiple appliances may be installed in a modular water heater installation. Multiple appliances may be installed side by side with no clearance between adjacent appliances because this appliance is approved for zero clearance from combustible surfaces.

Consult the *Venting* section of this manual for specific installation instructions for the appropriate type of venting system that you will be using.

Combustion and ventilation air requirements for appliances drawing air from the equipment room

Provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

The equipment room MUST be provided with properly sized openings to assure adequate combustion air and proper ventilation.

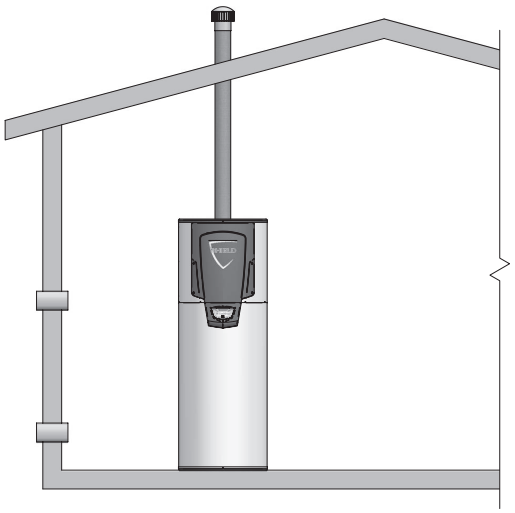


***Figure 1-3**_Combustion Air Direct from Outside*

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the equipment room (see FIG. 1-3):

   (a) Combustion air opening, with a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per KW). This opening must be located within 12" (30 cm) of the bottom of the enclosure.

   (b) Ventilation air opening, with a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure.

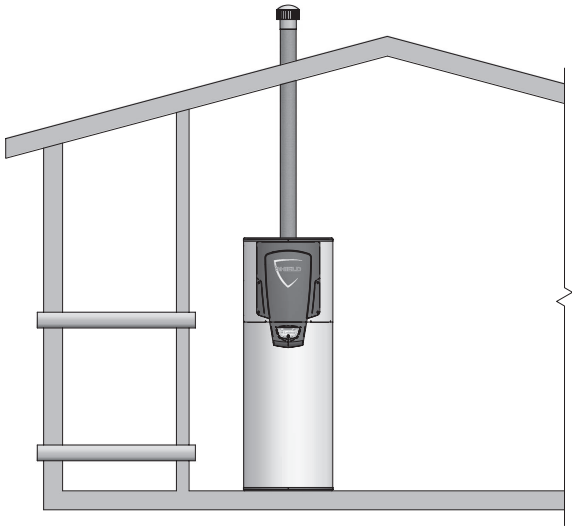


***Figure 1-4**_Combustion Air Through Ducts*

2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the equipment room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 Btu/hr (11 cm^2 per kW) of input (see FIG. 1-4).

1 Determine water heater location *(continued)*

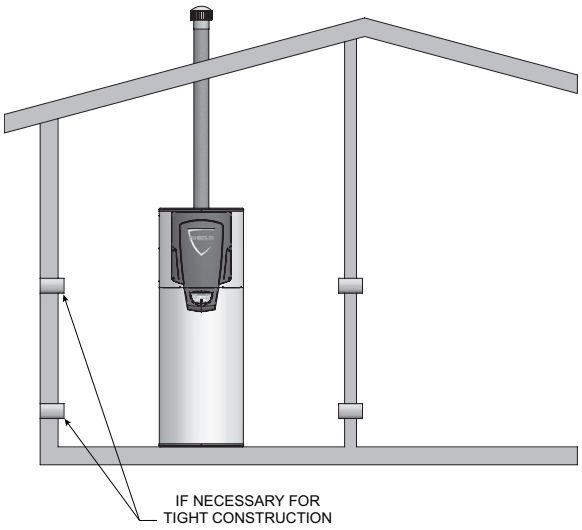


***Figure 1-5**_Combustion Air from Interior Space*

3. If air is taken from another interior space, each of the two openings specified above should have a net free area of one square inch for each 1000 Btu/hr (22 cm^2 per kW) of input, but not less than 100 square inches (645 cm^2) (see FIG. 1-5).

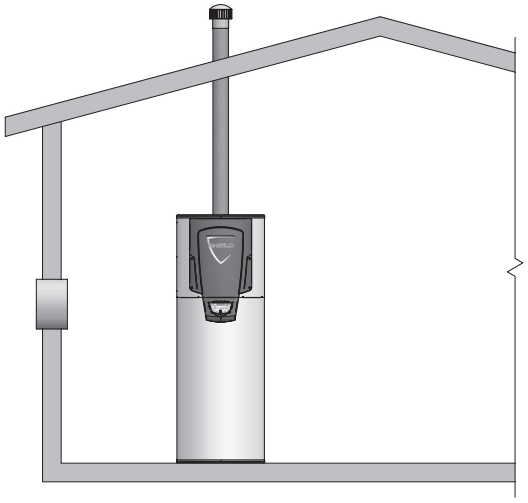


***Figure 1-6**_Combustion Air from Outside - Single Opening*

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 Btu/hr (7 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure (see FIG. 1-6).

TABLE - 1B
MINIMUM RECOMMENDED COMBUSTION AIR SUPPLY TO EQUIPMENT ROOM

Model Number	FIG. 1-3 *Outside Air from 2 Openings Directly from Outdoors		FIG. 1-4 *Outside Air from 2 Ducts Delivered from Outdoors		FIG. 1-5 **Inside Air from 2 Ducts Delivered from Interior Space		FIG. 1-6 *Outside Air from 1 Opening Directly from Outdoors, in^2
	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2	
126-065	32 (207 cm^2)	32 (207 cm^2)	63 (407 cm^2)	63 (407 cm^2)	125 (807 cm^2)	125 (807 cm^2)	42 (271 cm^2)
151-100	38 (246 cm^2)	38 (246 cm^2)	75 (484 cm^2)	75 (484 cm^2)	150 (968 cm^2)	150 (968 cm^2)	50 (323 cm^2)
201-100	50 (323 cm^2)	50 (323 cm^2)	100 (646 cm^2)	100 (646 cm^2)	200 (1,291 cm^2)	200 (1,291 cm^2)	67 (433 cm^2)
286-125	72 (465 cm^2)	72 (465 cm^2)	143 (923 cm^2)	143 (923 cm^2)	285 (1,839 cm^2)	285 (1,839 cm^2)	95 (613 cm^2)
401-125	100 (646 cm^2)	100 (646 cm^2)	200 (1,291 cm^2)	200 (1,291 cm^2)	400 (2,581 cm^2)	400 (2,581 cm^2)	134 (865 cm^2)
501-125	125 (807 cm^2)	125 (807 cm^2)	250 (1,613 cm^2)	250 (1,613 cm^2)	500 (3,226 cm^2)	500 (3,226 cm^2)	167 (1,078 cm^2)

*Outside air openings shall directly communicate with the outdoors. When combustion air is drawn from the outside through a duct, the net free area of each of the two openings must have twice (2 times) the free area required for Outside Air/2 Openings. The above requirements are for the water heater only; additional gas fired appliances in the equipment room will require an increase in the net free area to supply adequate combustion air for all appliances.

Combined interior space must be 50 cubic feet per 1,000 Btu/hr input. **Buildings MUST NOT be of *"Tight Construction". For buildings of ***"Tight Construction",** provide air openings into the building from outside.

*No combustion air openings are needed when the water heater is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances. **Buildings MUST NOT be of *"Tight Construction".**

***"Tight Construction"** is defined as a building with less than 0.40 ACH (air changes per hour).

1 Determine water heater location

Combustion air requirements are based on the latest edition of the National Fuel Gas Code, ANSI Z223.1; in Canada refer to the latest edition of CGA Standard CAN B149.1. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers. Where two openings are provided, one must be within 12" (30cm) of the ceiling and one must be within 12" (30cm) of the floor of the equipment room. Each opening must have net free area as specified in the chart above (Table 1B). Single openings shall commence within 12" (30cm) of the ceiling.

⚠ CAUTION Under no circumstances should the equipment room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

The combustion air supply must be completely free of any flammable vapors that may ignite or chemical fumes which may be corrosive to the appliance. Common corrosive chemical fumes which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue collectors, and the vent system.

The result is improper combustion and a non-warrantable, premature appliance failure.

EXHAUST FANS: Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be immediately corrected. If a fan is used to supply combustion air to the equipment room, the installer must make sure that it does not cause drafts which could lead to nuisance operational problems with the appliance.

2 General venting

Direct venting options - Sidewall Vent

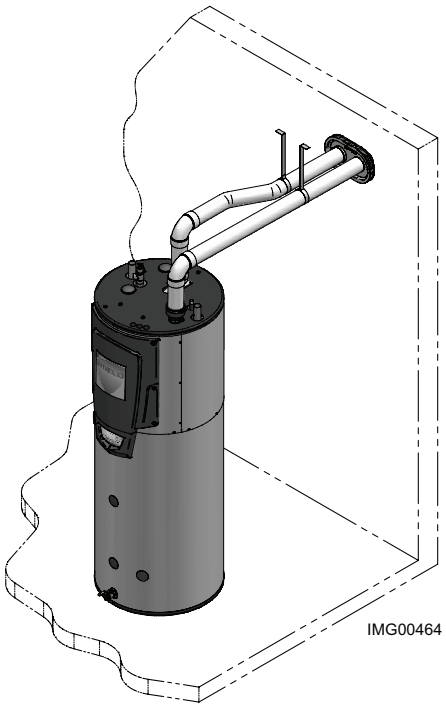


Figure 2-1 *Two-Pipe Sidewall Termination - See page 23 for more details*

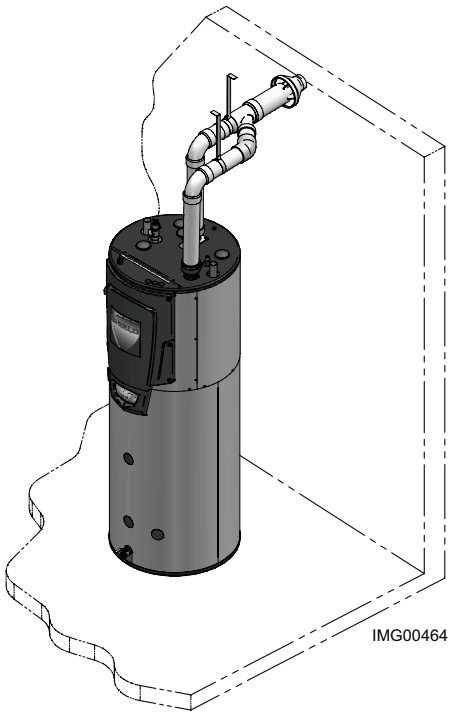


Figure 2-2 *PVC/CPVC Concentric Sidewall Termination - See page 30 for more details*

Direct venting options - Vertical Vent

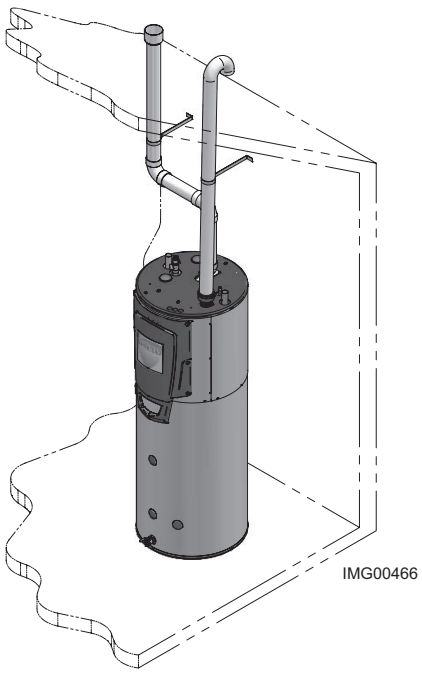


Figure 2-3 *Two-Pipe Vertical Termination - See page 33 for more details*

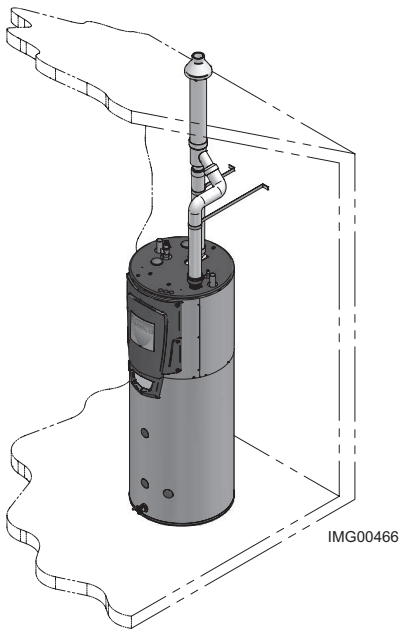


Figure 2-4 *PVC/CPVC Concentric Vertical Termination - See page 35 for more details*

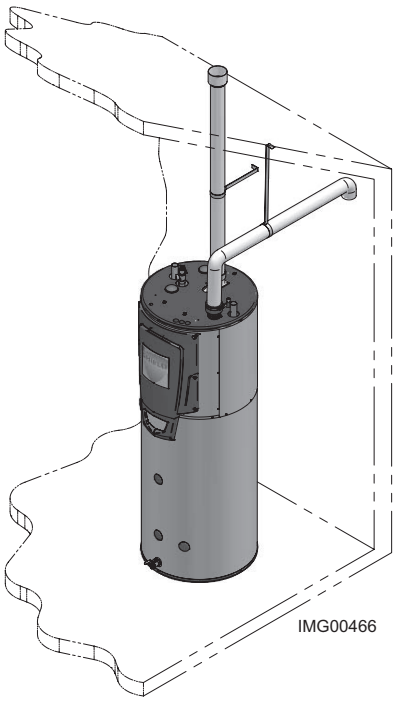


Figure 2-5 *Vertical Vent, Sidewall Air*

2 General venting

Install vent and combustion air piping

⚠ DANGER The Shield water heater must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

⚠ WARNING This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed in Tables 2D, 2E, and 2G for vent pipe, and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

⚠ WARNING For closet and alcove installations, CPVC, polypropylene or stainless steel material MUST BE used in a closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.

⚠ CAUTION Improper installation of venting systems may result in injury or death.

NOTICE Follow the instructions in Section 1, page 11 of this manual when removing a water heater from an existing vent system.

⚠ WARNING Do not connect any other appliance to the vent pipe or multiple water heaters to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

The Shield water heater vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Shield water heater using any other means.

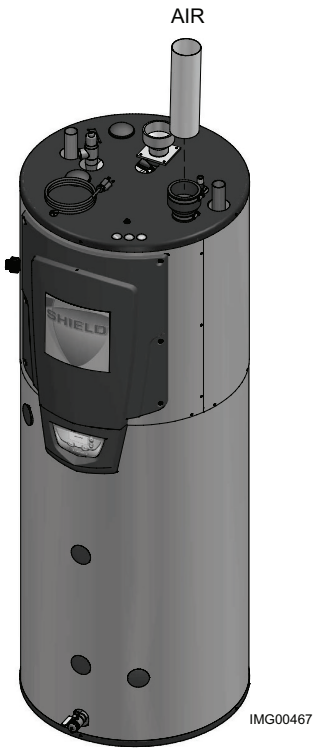
You must also install air piping from outside to the water heater air intake adapter unless following the Optional Room Air instructions on page 19 of this manual. The resultant installation is direct vent (sealed combustion).

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 2-6) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided on the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.

2. **Vent Connector** (FIG.'s 2-7 thru 2-10) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 2-6 *Near Water Heater Air Piping*



2 General venting *(continued)*

Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/fittings. For concentric vent installations, the inner vent tube must be replaced with field supplied certified vent material to comply with this requirement.
4. The 3" Concentric Vent Kit available from Lochinvar (see Section 3 – *Sidewall Termination – Optional Concentric Vent*) and the 3" Concentric Vent Kit available from IPEX are both approved for use on the Shield water heater. Both kits are listed to the ULC-S636 standard for use in Canada.

Sizing

The Shield water heater uses model specific combustion air intake and vent piping sizes as detailed in Table 2A below.

Table 2A *Air Intake/Vent Piping Sizes*

Model	Air Intake	Vent
126-065 -- 201-100	3 inches	3 inches
286-125 -- 501-125	4 inches	4 inches

NOTICE Increasing or decreasing combustion air or vent piping sizes is not authorized.

Minimum / Maximum allowable combustion air and vent piping lengths are as follows:

Combustion Air = 12 equivalent feet minimum / 100 equivalent feet maximum

Vent = 12 equivalent feet minimum / 100 equivalent feet maximum

NOTICE When using the alternative 3" vent and combustion air piping with a Shield 286-125 model, the maximum allowable combustion air and vent piping lengths are limited to 60 equivalent feet each. The minimum allowable combustion air and vent pipe lengths remain 12 equivalent feet each.

When determining equivalent combustion air and vent length, add 5 feet for each 90° elbow and 3 feet for each 45° elbow.

EXAMPLE: 20 feet of PVC pipe + (4) 90° elbows + (2) 45° elbows + (1) concentric vent kit (100140480) = 49 equivalent feet of piping.

NOTICE The appliance output rating will reduce by up to 1.5% for each 25 feet of vent length, except when using the alternative 3" vent for the Shield 286-125 model which may de-rate by up to 4% for each 25 feet of vent length.

Table 2B *Concentric Vent Kit Equivalent Vent Lengths*

Model	Kit Number	Equivalent Vent Length
126-065 -- 201-100	100140480	3 feet
286-125	100140484	3 feet
401-125	100140484	5 feet
501-125	100140484	30 feet

2 General venting

Materials

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

PVC, CPVC, Polypropylene or ABS
Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
Galvanized steel vent pipe with joints and seams sealed as specified in this section.
Type "B" double-wall vent with joints and seams sealed as specified in this section.
AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠ WARNING Using air intake materials other than those specified can result in personal injury, death or property damage.

NOTICE The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type "B" double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.
b. Do not install seams of vent pipe on the bottom of horizontal runs.
c. Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.
d. Ensure that the air inlet pipes are properly supported.

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. The PVC, CPVC, ABS, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene manufacturer's instructions when using polypropylene material as an inlet pipe.

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

2 General venting *(continued)*

Optional room air

NOTICE Optional room air is intended for commercial applications. Combustion air piping to the outside is recommended for residential applications.

Commercial applications utilizing the Shield water heater may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option the following conditions and considerations must be followed.

- The unit MUST be installed with the appropriate room air provisions.
- The equipment room MUST be provided with properly sized openings to assure adequate combustion air. Please refer to instructions provided with the room air kit (100157615 - Models 126-065 -- 201-100 and 100157616 - Models 286-125 -- 501-125).
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- Using the room air configuration makes the unit vulnerable to combustion air contamination from within the building. Please review Section 1, Prevent Combustion Air Contamination, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

⚠ WARNING When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the water heater, they can form strong acids. The acid can eat through the water heater wall, causing serious damage and presenting a possible threat of flue gas spillage or water heater water leakage into the building.

Please read the information given in Table 1A, page 10, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the water heater combustion air inlet, have your installer pipe the water heater combustion air and vent to another location, per this manual.

⚠ WARNING If the water heater combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

⚠ WARNING To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 10 before installing the water heater or air inlet piping.

If contaminants are found, you MUST:

- Remove contaminants permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

2 General venting

PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in Table 2D.

Installing vent and air piping

⚠ WARNING The vent connection to the appliance must be made with the starter CPVC pipe section provided with the 286-501 models (starter piece is factory installed on the 126-201 models) if PVC/CPVC vent is to be used. The field provided vent fittings must be cemented to the CPVC pipe section using an "All Purpose Cement" suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 2D to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the water heater (to allow drainage of condensate).

⚠ WARNING Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

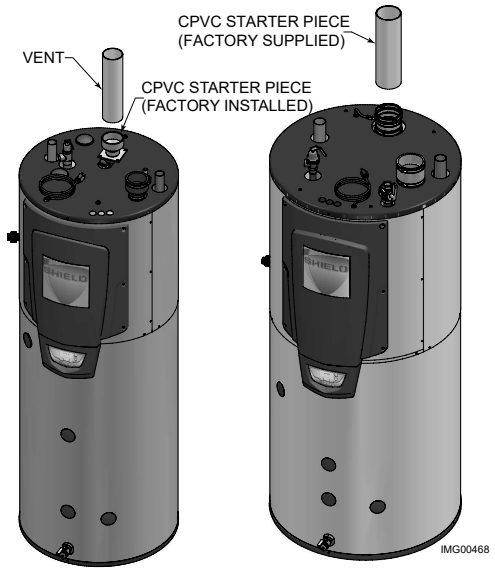
1. Work from the water heater to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   e. Apply a second coat of cement to the pipe.
   f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
   g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

Table 2D *PVC/CPVC Vent Pipe, and Fittings*

Approved PVC/CPVC Vent Pipe and Fittings		
Item	**Material**	**Standard**
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 80	ANSI/ASTM F439
	PVC - DWV	ANSI/ASTM D2665
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE		

NOTE: In Canada, CPVC and PVC vent pipe, fittings and cement/primer must be ULC-S636 certified.

Figure 2-7 *Near Water Heater PVC/CPVC Venting*



2 General venting *(continued)*

Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 2E.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

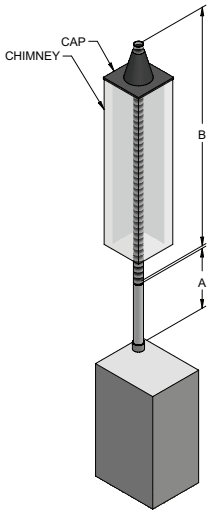
When determining equivalent combustion air and vent length for polypropylene single-wall piping:

- 1 foot of Duravent 4 inch single-wall pipe is equivalent to 1.6 feet of piping

Flexible polypropylene

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations (FIG. 2-8).

Figure 2-8 *Near Boiler Flexible Polypropylene Venting*



Duravent 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	60 FT	90 FT
20 FT	53 FT	80 FT
30 FT	47 FT	70 FT
40 FT	40 FT	60 FT
50 FT	33 FT	50 FT
60 FT	27 FT	40 FT
70 FT	20 FT	30 FT
80 FT	13 FT	20 FT
90 FT	7 FT	10 FT

Duravent 4"

"A" DIM	"B" DIM	
4" RIGID	4" FLEX	5" FLEX
10 FT	30 FT	90 FT
20 FT	27 FT	80 FT
30 FT	23 FT	70 FT
40 FT	20 FT	60 FT
50 FT	17 FT	50 FT
60 FT	13 FT	40 FT
70 FT	10 FT	30 FT
80 FT	7 FT	20 FT
90 FT	3 FT	10 FT

Centrotherm 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	45 FT	90 FT
20 FT	40 FT	80 FT
30 FT	35 FT	70 FT
40 FT	30 FT	60 FT
50 FT	25 FT	50 FT
60 FT	20 FT	40 FT
70 FT	15 FT	30 FT
80 FT	10 FT	20 FT
90 FT	5 FT	10 FT

Centrotherm 4"

"A" DIM	"B" DIM
4" RIGID	4" FLEX
10 FT	33 FT
20 FT	29 FT
30 FT	26 FT
40 FT	22 FT
50 FT	18 FT
60 FT	15 FT
70 FT	11 FT
80 FT	7 FT
90 FT	4 FT

*NOTES: 1) FLEX PIPE MAY ONLY BE RUN IN A VERTICAL ORIENTATION
2) ALL VENT LENGTHS REPRESENTED IN ABOVE CHARTS ARE EQUIVALENT LENGTHS.
3) SECTION A IS EQUIVALENT FEET OF RIGID PIPE, WHICH MAY INCLUDE 45 AND 90° ELBOWS. PLEASE SEE SIZING SECTION FOR DETERMINING EQUIVALENT FEET.

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NOTICE The installer must use a specific vent starter adapter at the flue collar connection. The adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 2F for approved vent adapters. Discard CPVC starter piece.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 2-9).

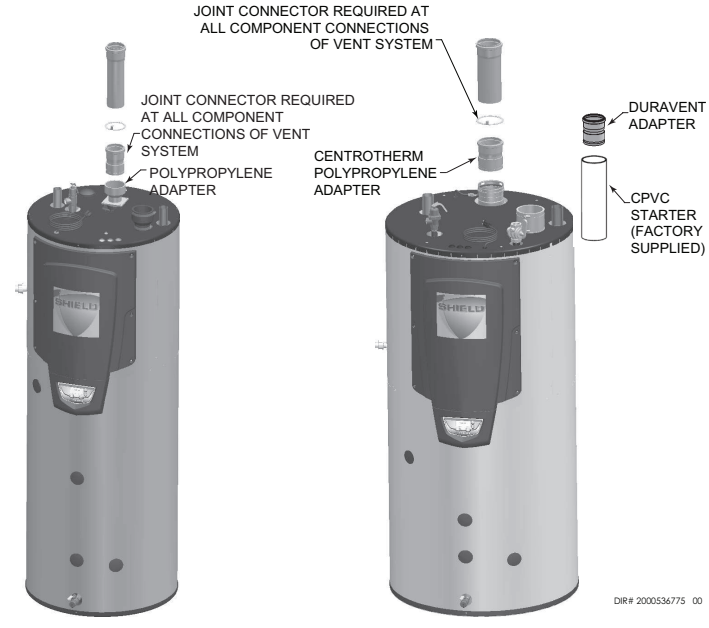
⚠ WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

⚠ WARNING Use only the adapters and vent system listed in Tables 2E and 2F. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer's installation instructions supplied with the vent system.

Figure 2-9 *Near Water Heater Polypropylene Venting*



MODELS: 126-065 - 201-100

MODELS: 286-125 - 501-125

Table 2E *Polypropylene Vent Pipe and Fittings*

Approved Polypropylene Vent Manufacturers	
Make	**Model**
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

Table 2F *Approved PolypropyleneTerminations*

Model	Centrotherm InnoFlue SW				Duravent Polypro		
	Polypropylene Adapter	Joint Connector	Sidewall Retaining Bracket*	Sidewall Adapter*	Polypropylene Adapter	Joint Connector	Sidewall Kit*
126-065 -- 201-100	ISAAL0303	IANS03	IATP0303	ISTAGL0303	3PPS-ADL	3PPS-LB	3PPS-HLK
286-125 -- 501-125	ISAAL0404	IANS04	IATP0404	ISTAGL0404	4PPS-AD-M	4PPS-LB	4PPS-HLK

* These parts are only needed if the sidewall termination assembly is used (see FIG. 3-4B on page 28).

2 General venting

Stainless steel vent

This product has been approved for use with stainless steel using the manufacturers listed in Table 2G. This unit requires Category IV venting.

⚠ WARNING Use only the materials, vent systems, and terminations listed in Tables 2G and 2H. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system. See Table 2H for approved vent adapters. Discard CPVC starter piece.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

Figure 2-10 *Near Water Heater Stainless Steel Venting*

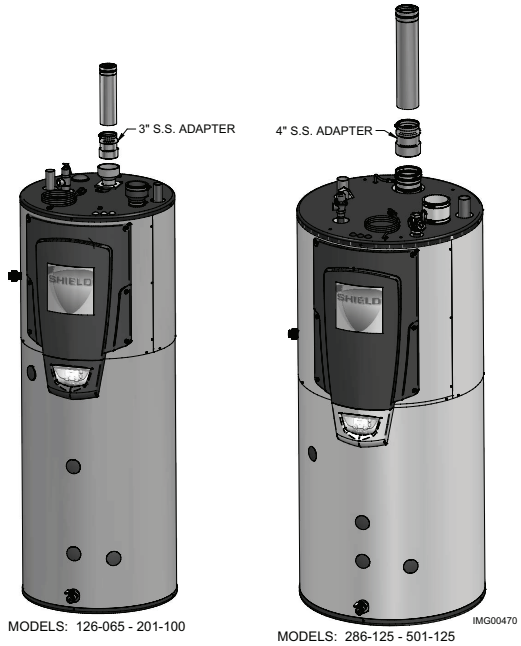


Table 2G *Stainless Steel Vent Pipe and Fittings*

Approved Stainless Steel Vent Manufacturers	
Make	**Model**
Dura Vent (M & G Group)	FasNSeal Vent / FasNSeal Flex* Vent
Z-Flex (Nova Flex Group)	Z-Vent
Heat Fab (Selkirk Corporation)	Saf-T Vent
Metal Fab	Corr/Guard
Security Chimney	Secure Seal

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

Table 2H *Approved Stainless Steel (S.S.) Terminations and Adapters*

Model	ProTech FasNSeal			Heat Fab Saf-T Vent			Z Flex Z-Vent		
	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination
126-065 -- 201-125	300715	FSBS3 FSRC3(R.C)	303889	9301PVC	9392 5300CI	9314TERM	2SVSLA03	2SVSTP03 2SVSRCX03	2SVSTEX0390
286-125 -- 501-125	F303759	FSBS4 FSRC4(R.C.)	FSAIH04 303888	9401PVC	9492 5400CI	9414TERM	2SVSLA04	2SVSTP04 2SVSRCX04	2SVSTEX0490
Metal Fab Corr/Guard				**Security Chimney** Secure Seal					
126-065 -- 201-125	3CGIA	3CGSWHT 3CGSWC	3CGSW90LT	--	--	--			
286-125 -- 501-125	4CGIA	4CGSWHT 4CGSWC	4CGSW90LT	SS4PVCU	SS4STU SS4RCBU	SS4ST90AU			

3 Sidewall direct venting

Vent/air termination – sidewall

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or pets.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠ WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.
   h. Do not locate the terminations over public walkways.
   i. Do not locate the terminations near soffit vents, crawl space vents, or other areas where condensate or vapor could create a nuisance, hazard, or cause property damage.
   j. Do not locate the terminations where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 3-1A *PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent*

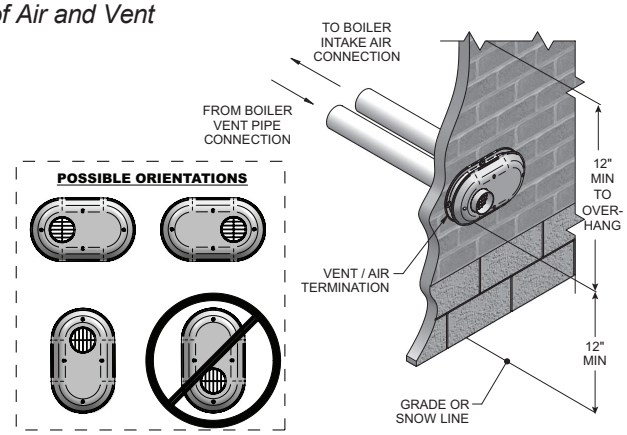


Table 3A *Sidewall Vent Kits*

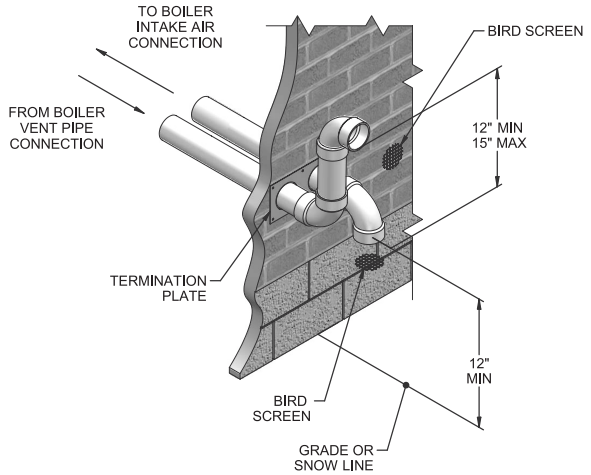
Model	Kit Number	Vent Size
126-065 -- 201-100	100157610	3 inch vent
286-125 -- 501-125	100157611	4 inch vent

If using the alternate sidewall termination:

3. The air piping must terminate in a down-turned elbow as shown in FIG. 3-1B. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 3-1B.

⚠ WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 3-1B. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential water heater shutdown.

Figure 3-1B *Alternate PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent w/Field Supplied Fittings*



3 Sidewall direct venting

Vent/air termination – sidewall

Figure 3-1C *Alternate PVC/CPVC/SS/ Polypropylene Venting Arrangement (if Space Allows) w/Field Supplied Fittings*

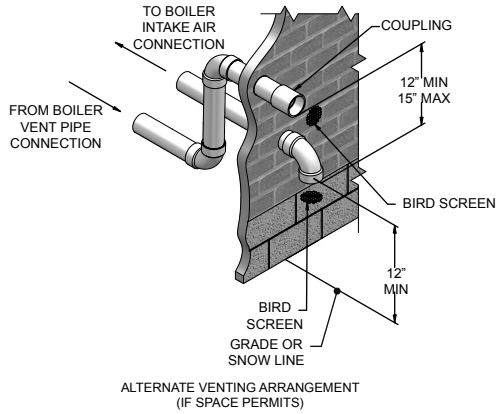
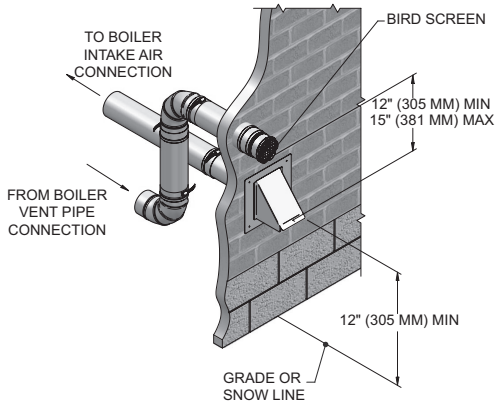


Figure 3-1D *Alternate SS Venting Arrangement - Typical Stainless Steel Sidewall Termination of Air and Vent w/Field Supplied Fittings, Utilizing a Hood Intake*



5. Maintain clearances as shown in FIG.'s 3-1A thru 3-3B, pages 23 - 27. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet from adjacent walls.
      - No closer than 12 inches below roof overhang.
   b. Air inlet must terminate at least 12 inches above grade or snow line; at least 12 inches below the vent termination; and the vent pipe must not extend more than 24 inches vertically outside the building as shown in FIG. 3-1B. Condensate could freeze and block vent pipe.
   c. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet horizontally.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Figure 3-2A *Clearance to Gravity Air Inlets*

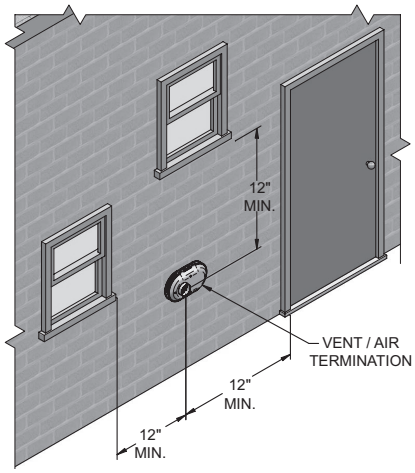
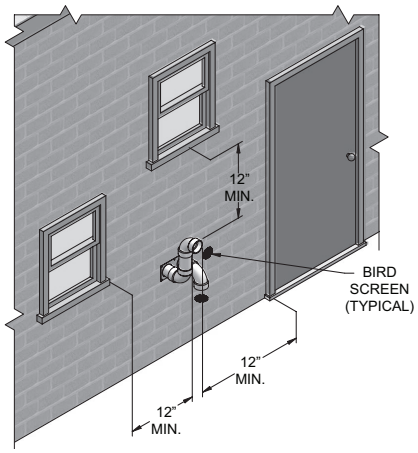


Figure 3-2B *Alternate Clearance to Gravity Air Inlets w/ Field Supplied Fittings*



3 Sidewall direct venting *(continued)*

Figure 3-3A *Direct Vent Terminal Clearances*

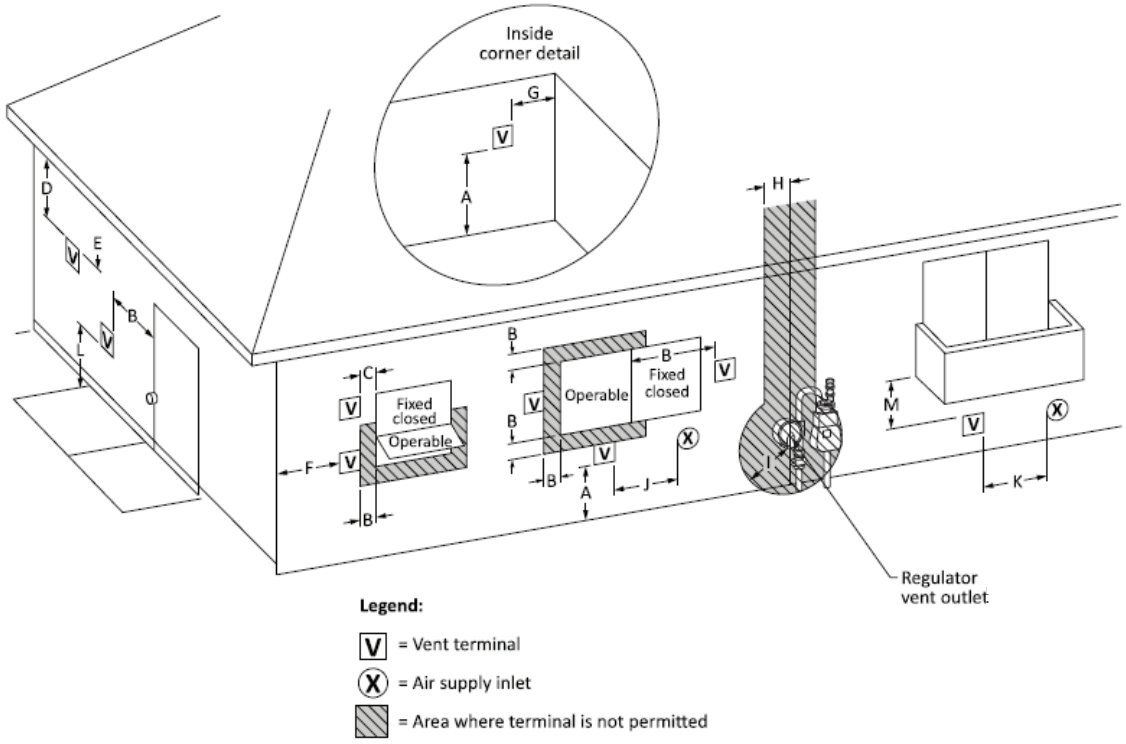


Table 3B *Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*

3 Sidewall direct venting

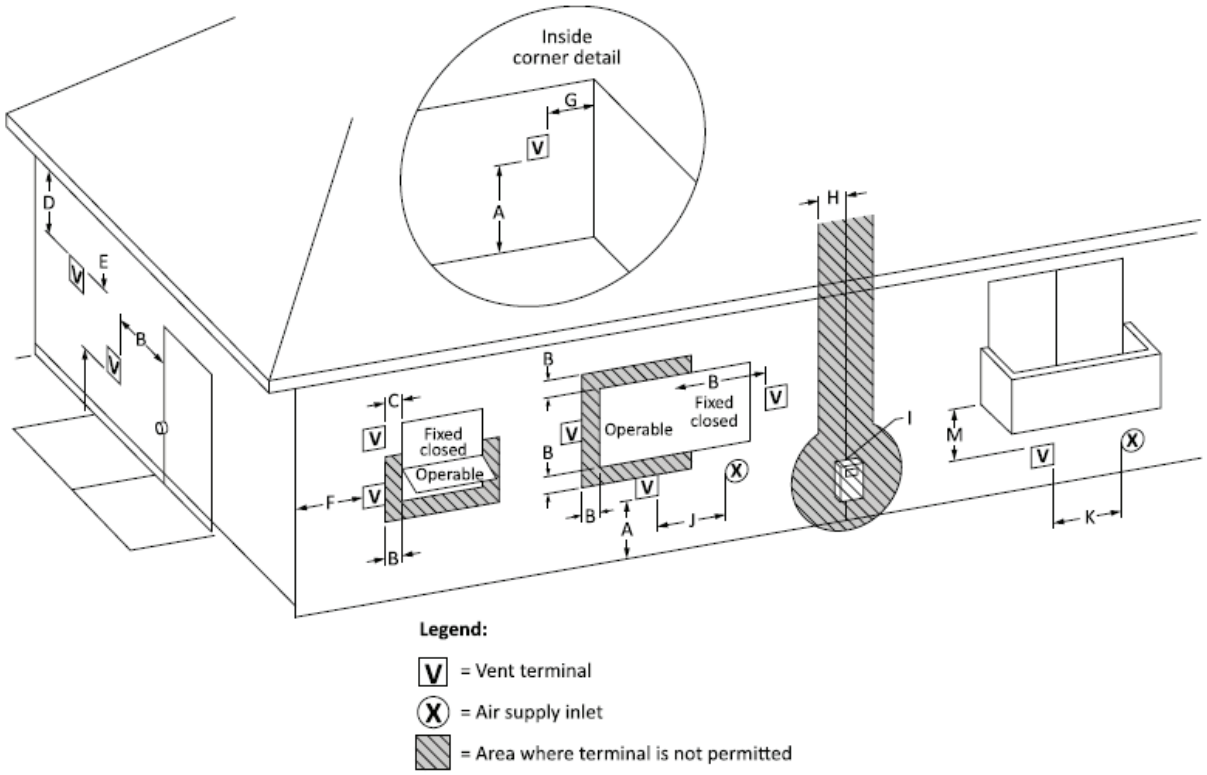
***Table 3B** Direct Vent Terminal Clearances (continued)*

J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	*
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he floor.

NOTES:
1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code
2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

***Figure 3-3B** Other than Direct Vent Terminal Clearances*



3 Sidewall direct venting *(continued)*

Table 3C *Other than Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	7 ft (2.13 m)
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he floor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

3 Sidewall direct venting

Prepare wall penetrations

1. Use the factory supplied wall plate as a template to locate the vent and air intake holes and mounting holes.
   Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
   Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
   Drill 3/16" diameter holes for inserting the plastic anchors into the wall.
2. For Polypropylene Only: Install the vent and air intake sidewall adapters from Table 2F on page 21 into the vent plate. Slide the sidewall retaining bracket down the sidewall adapters flush to the vent plate (FIG. 3-4B).
3. For PVC/CPVC Only: Install the vent and air intake piping through the wall into the vent plate openings. Use RTV silicone sealant to seal the air pipe. Use the cement/primer listed in Table 2D on page 20 to seal the vent pipe.
4. Mount and secure the vent plate to the wall, using stainless steel screws.
5. Seal all gaps between the pipes and wall. Seal around the plate to the wall assuring no air gaps.
6. Assemble the vent cap to the vent plate (see FIG.'s 3-4A and 3-4B). Insert the stainless steel screws into the vent cap screw hole openings and securely attach the vent cap to the vent plate.
7. Seal all wall cavities.
8. PVC/CPVC terminations are designed to accommodate any wall thickness of standard constructions per the directions found in this manual.
9. Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Figure 3-4A *PVC/CPVC Sidewall Termination Assembly*

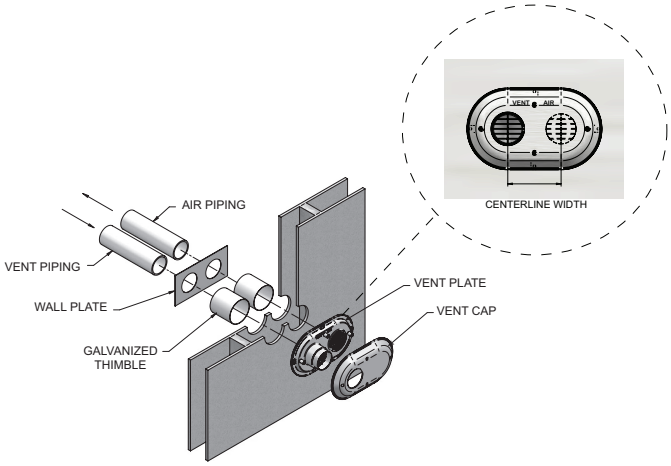
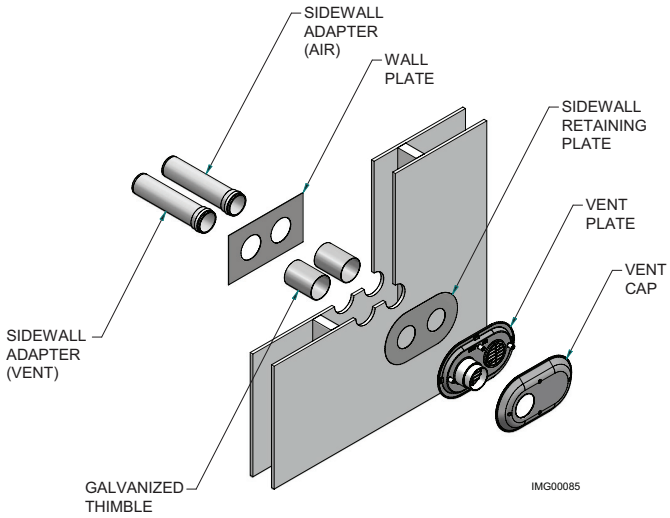


Table 3D *Sidewall Vent Centerline Dimensions*

Model	Air	Vent	Centerline Width
126-065 -- 201-100	3"	3"	5 5/8"
286-125 -- 501-125	4"	4"	5 5/8"

Figure 3-4B *Polypropylene Sidewall Termination Assembly*

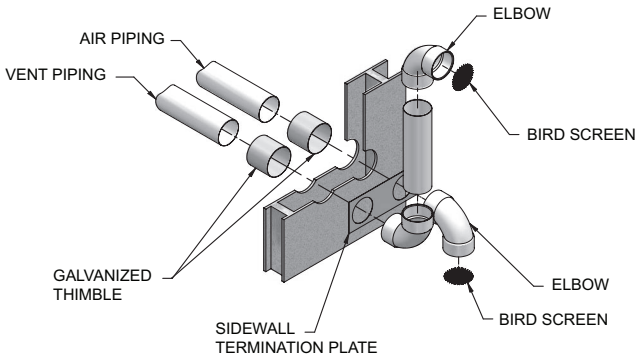


3 Sidewall direct venting *(continued)*

Prepare wall penetrations (Alternate - Field Supplied Option)

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      - 4½ inch hole for 3 inch vent pipe
      - 5½ inch hole for 4 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole as shown in FIG. 3-4C.
3. Use a sidewall termination plate as a template for correct location of hole centers.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

Figure 3-4C *Alternate Sidewall Termination Assembly w/Field Supplied Fittings*



Multiple vent/air terminations

1. When terminating multiple Shield water heaters terminate each vent/air connection as described in this manual (FIG. 3-5A).

⚠ WARNING All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place wall penetrations to obtain minimum clearance of 12 inches between edge of air inlet and adjacent vent outlet, as shown in FIG. 3-5A for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Shield water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

Figure 3-5A *Multiple Vent Terminations (must also comply with* ***Figure 3-1A****)*

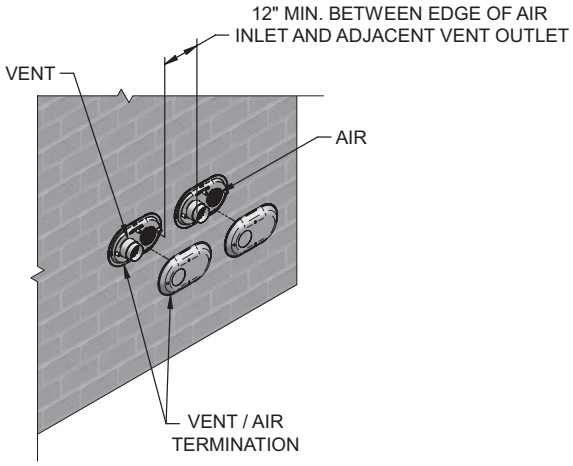
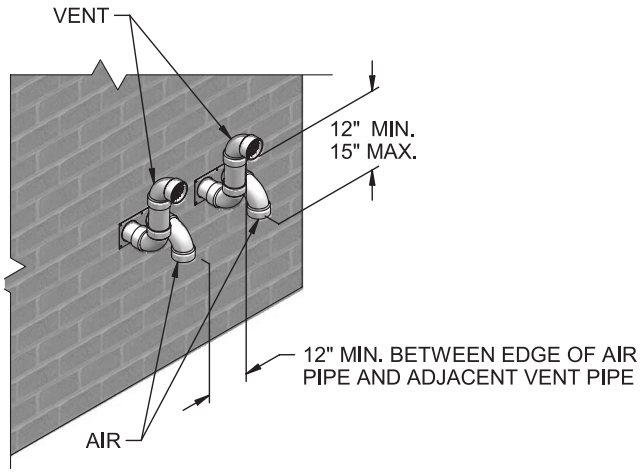


Figure 3-5B *Alternate Multiple Vent Terminations w/Field Supplied Fittings (must also comply with* ***Figure 3-1B****)*



3 Sidewall direct venting

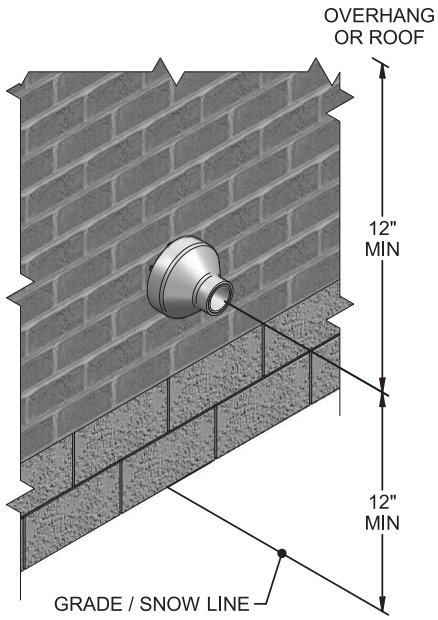
Sidewall termination – optional concentric vent

Description and usage

Lochinvar offers optional concentric combustion air and vent pipe termination kits (Factory Kit #100140480 for 3" diameter - Models 126-065 - 201-100 and #100140484 for 4" diameter - Models 286-125 - 501-125). Both combustion air and vent pipes must attach to the termination kit. The termination kits must terminate outside the structure and must be installed as shown in FIG. 3-6.

The required combustion vent pipe materials are listed in Table 2D, on page 20 of this manual.

Figure 3-6 *Concentric Sidewall Termination*



Sidewall termination installation

1. Determine the best location for the termination kit (see FIG. 4-6).
2. Reference the *Determine Location Section* on page 23 of this manual for general termination considerations.
3. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.
4. Partially assemble the concentric vent termination kit. Clean and cement using the procedures found in these instructions.
   a. Cement the Y concentric fitting to the larger kit pipe (FIG.'s 3-7 and 3-8).
   b. Cement the rain cap to the smaller diameter kit pipe (FIG.'s 3-7 and 3-8).

Figure 3-7 *Kit Contents_100140480 - 126-065 -- 201-100*

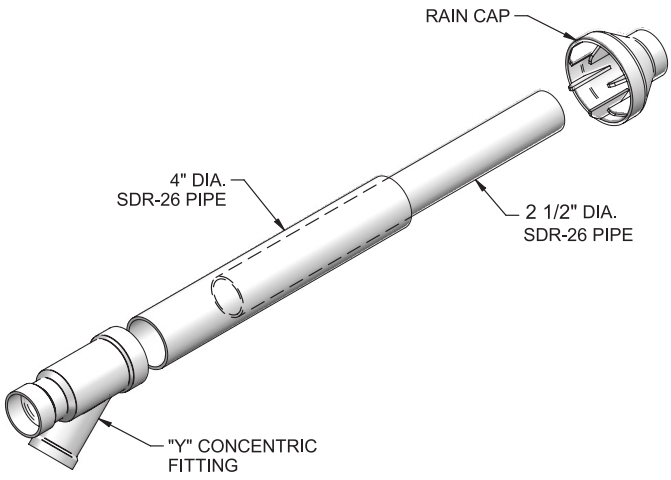
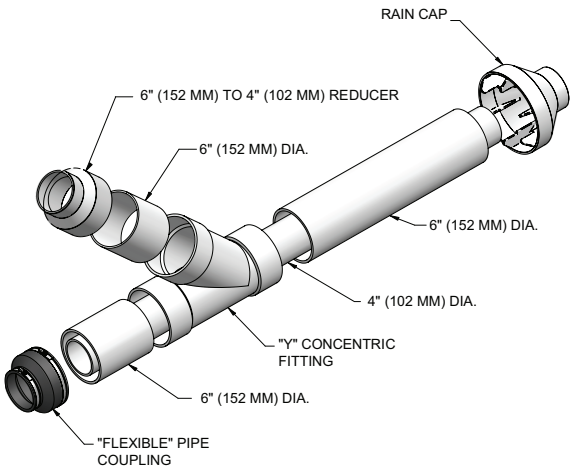


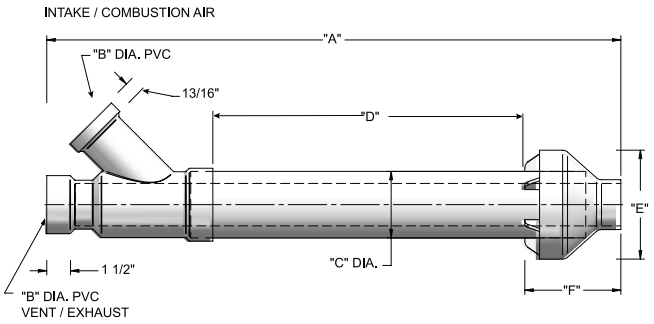
Figure 3-8 *Kit Contents_100140484 - 286-125 -- 501-125*



3 Sidewall direct venting *(continued)*

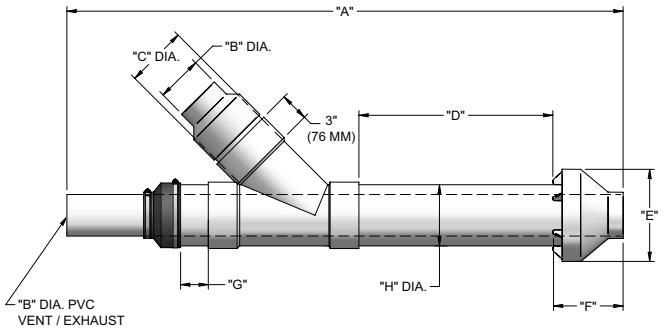
Sidewall termination – optional concentric vent

Figure 3-9 *Concentric Vent Dimensional Drawing - Models 126-065 -- 201-100 / 100140480*



A	B	C	D*	E	F
38 7/8"	3"	4 1/2"	21 1/8"	7 3/8"	6 1/2"

Figure 3-10 *Concentric Vent Dimensional Drawing - Models 286-125 -- 501-125 / 100140484*



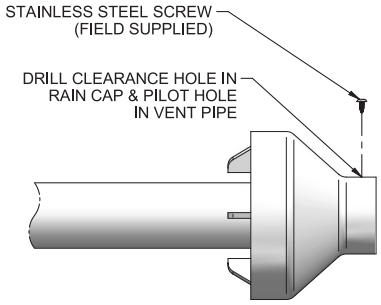
A	B	C	D	E	F	G	H
60"	4"	6"	21 1/8"	10"	7 5/8"	3"	6 5/8"

NOTICE Instead of cementing the smaller pipe to the rain cap, a field-supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 3-11).

⚠ WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

Figure 3-11 *Rain Cap to Vent Pipe Alternate Assembly*



6. Install the Y concentric fitting and pipe assembly through the structure's hole.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

7. Install the rain cap and small diameter pipe assembly into the Y concentric fitting and large pipe assembly. Ensure small diameter pipe is bottomed and cemented in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

8. Secure the assembly to the structure as shown in FIG. 3-12 using field-supplied metal strapping or equivalent support material.

NOTICE Ensure termination location clearance dimensions are as shown in FIG. 3-6.

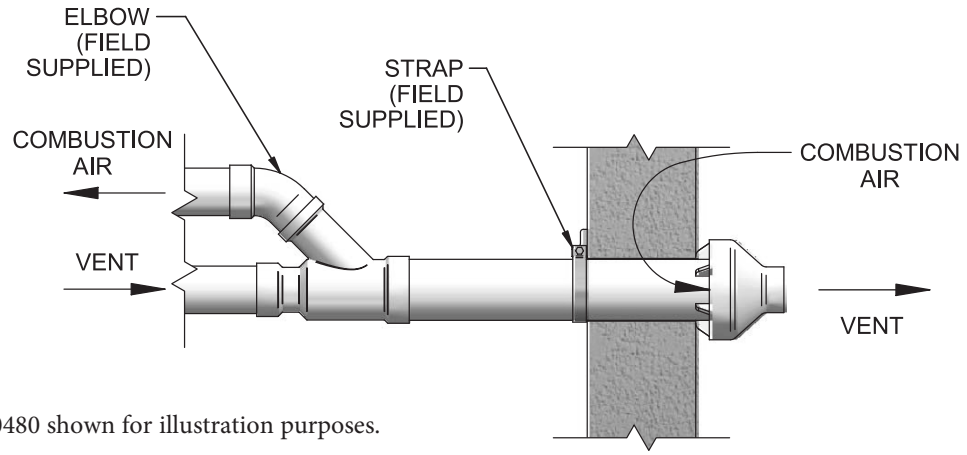
NOTICE If assembly needs to be extended to allow sidewall thickness requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field-supplied SDR-26 PVC (D2241) pipe for 100140480 and standard schedule 40 PVC for 100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 3-9 and 3-10).

NOTICE If assembly depth needs to be reduced, dimension D can be as short as possible.

3 Sidewall direct venting

Sidewall termination – optional concentric vent

Figure 3-12 *Concentric Vent Sidewall Attachment*



Note: 100140480 shown for illustration purposes.

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.

9. Cement appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 3-12 for proper pipe attachment.

10. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing sidewall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 3-13). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 3-13. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

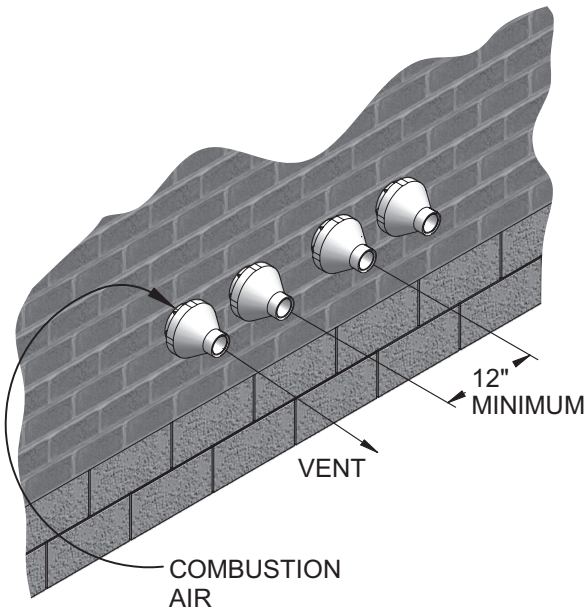


Figure 3-13 *Concentric Vent and Combustion Air Termination*

4 Vertical direct venting

Vent/air termination – vertical

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. Prepare the vent termination and the air termination elbow (FIG. 4-1A) by inserting bird screens. Bird screens should be obtained locally.
3. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
4. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
5. The vent piping must terminate in an up-turned coupling as shown in FIG. 4-1A. The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap as illustrated in FIG. 4-1B maintain at least 36" (914 mm) above the air inlet. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 1 foot for PVC and 3 feet for stainless steel, above the air intake.
6. Maintain the required dimensions of the finished termination piping as shown in FIG. 4-1A.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

⚠ WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

***Figure 4-1A** Vertical Termination of Air and Vent*

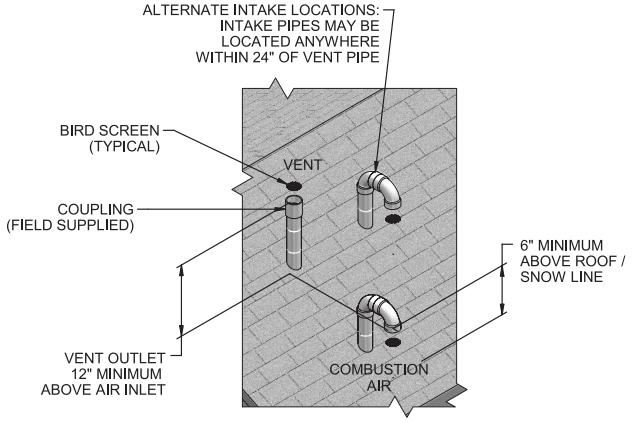
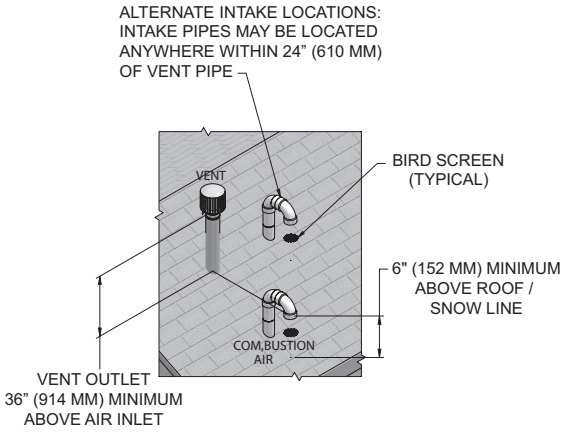


***Figure 4-1B** Stainless Steel Vertical Termination of Air and Vent*



8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

4 Vertical direct venting

Vent/air termination – vertical

Prepare roof penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      - 4½ inch hole for 3 inch vent pipe
      - 5½ inch hole for 4 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole.
3. Space the air and vent holes to provide the minimum spacing shown in FIG. 4-1A, page 33.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Multiple vent/air terminations

1. When terminating multiple Shield water heaters, terminate each vent/air connection as described in this manual (FIG. 4-2).

⚠ WARNING Terminate all vent pipes at the same height and all air pipes at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches between edge of air intake elbow and adjacent vent pipe of another water heater for U.S. installations (see FIG. 4-2). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Shield water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

Figure 4-2 *Vertical Terminations with Multiple Water Heaters*

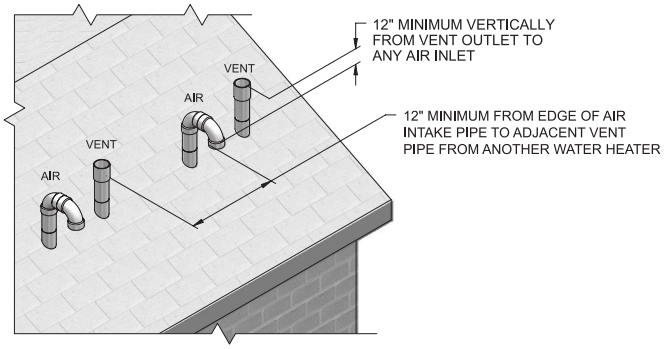
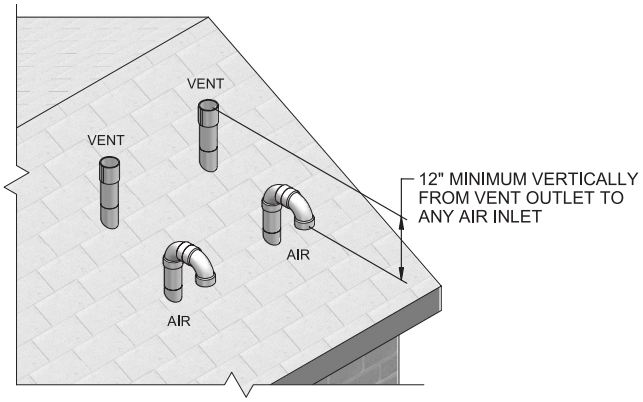


Figure 4-3 *Alternate Vertical Terminations with Multiple Water Heaters*



4 Vertical direct venting *(continued)*

Vertical termination – optional concentric vent

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit. Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in FIG. 4-4.

Field supplied pipe and fittings are required to complete the installation.
The required combustion air and vent pipe fittings are listed in Table 2D, on page 20 of this manual.

Vertical termination installation

1. See Section 4, Vertical Direct Venting - Determine Location (where applicable).
2. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.
3. Partially assemble the concentric vent termination kit. Clean and cement following the cleaning procedures in these instructions.
   a. Cement the Y concentric fitting to the larger diameter kit pipe (see FIG.'s 3-7 and 3-8, page 30).
   b. Cement rain cap to the smaller diameter kit pipe (see FIG.'s 3-7 and 3-8, page 30).
   c. Do not attach a U-Bent to the rain cap. Doing so could cause recirculation (see FIG. 4-5).

Figure 4-4 *Concentric Vertical Termination*

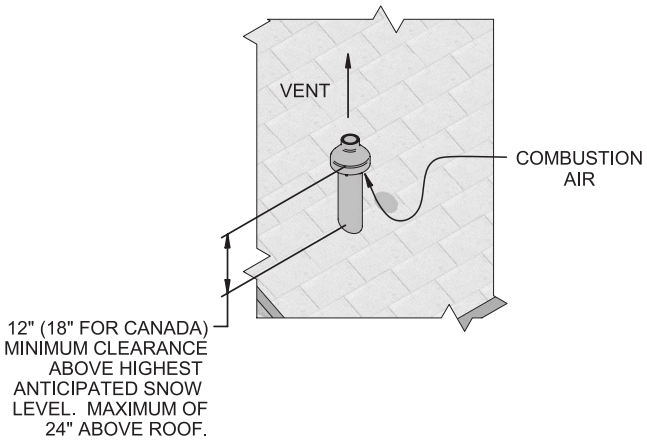


Figure 4-5 *Do Not Install U-Bent to Rain Cap*

NOTICE

Instead of cementing the smaller pipe to the rain cap, a field supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 3-11, page 31).

⚠ WARNING

When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

4 Vertical direct venting

Vertical termination – optional concentric vent

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

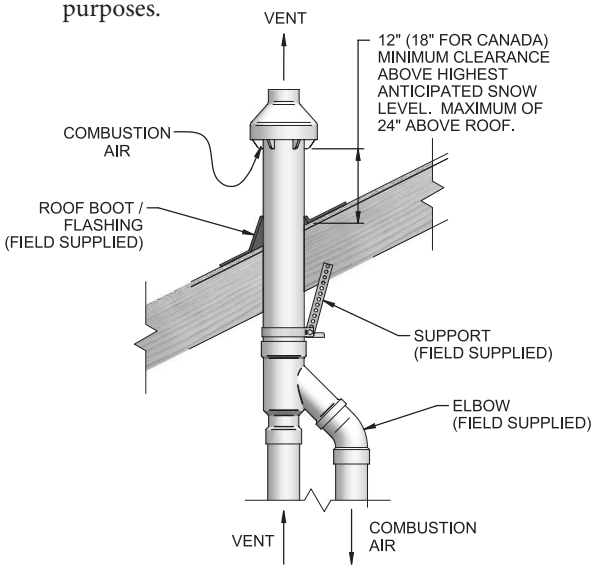
4. Install the Y concentric fitting pipe assembly up through the structure's hole and field supplied roof boot/flashing.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

5. Secure the assembly to the roof structure as shown below in FIG. 4-6 using field supplied metal strapping or equivalent support material.

Figure 4-6 *Concentric Vent Roof Installation*

Note: 100140480 shown for illustration purposes.



NOTICE Ensure termination height is above the roof surface or anticipated snow level (12 inches in U.S.A. or 18 inches in Canada) as shown in FIG. 4-4, page 35.

NOTICE If assembly is too short to meet height requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field supplied SDR-26 PVC (D2241) pipe for #100140480 and standard schedule 40 PVC for #100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 3-9 and 3-10, page 31).

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur.

6. Install the rain cap and the small diameter pipe assembly into the roof penetration assembly. Ensure the small diameter pipe is cemented and bottomed in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

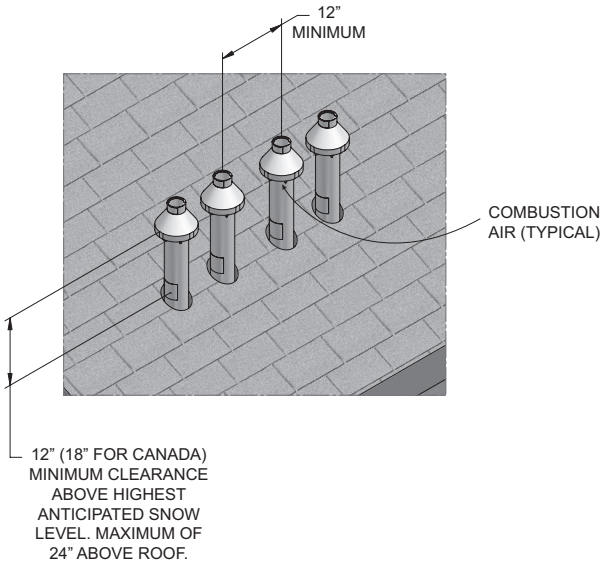
7. Cement the appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 4-6 for proper pipe attachment.

8. Operate the appliance through one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 4-7). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 4-7. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 4-7 *Concentric Vent and Combustion Air Vertical Termination*



5 System piping

System water piping methods

Observe a minimum of one inch clearance around all un-insulated hot water pipes when openings around the pipes are not protected by non-combustible materials.

⚠ WARNING Failure to install and maintain a new, listed temperature and pressure relief valve will release the manufacturer from any claim, which might result from excessive temperature and pressures.

Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). HYDROGEN GAS IS EXTREMELY FLAMMABLE. To prevent the possibility of injury under these conditions, we recommend the hot water faucet to be open for several minutes at the kitchen sink before you use any electrical appliance, which is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. Do not smoke or have an open flame near the faucet at the time it is open.

General piping information

Basic steps are listed below along with illustrations on the following pages (FIG.'s 5-2 thru 5-4), which will guide you through the installation of the Shield water heater.

1. BEFORE PROCEEDING WITH THE INSTALLATION, CLOSE THE MAIN WATER SUPPLY VALVE. After shutting off the main water supply, open a faucet to relieve the water line pressure to prevent any water from leaking out of the pipes while making the water connections to the water heater. The COLD water inlet and HOT water outlet are identified on the water heater. Make the proper plumbing connections between the water heater and the plumbing system to the building. Install a shutoff valve in the cold water supply line.
2. If this water heater is installed in a closed water supply system, such as the one having a backflow preventer in the cold water supply, provisions must be made to control thermal expansion. DO NOT operate this water heater in a closed system without provisions for controlling thermal expansion. Warranties do not cover damages from thermal expansion such as pressure bulges and/or deformities. Your water supplier or local plumbing inspector should be contacted on how to control this situation.
3. After installation of the water lines, open the main water supply valve and fill the water heater. While the water heater is filling, open several hot water faucets to allow air to escape from the water system. When a steady stream of water flows through the faucets, close them and check all water connections for possible leaks.
4. Never operate the water heater without first being certain it is filled with water.

Scalding

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased temperature water. By setting the thermostat on this water heater to obtain the increased temperature water required by these appliances, you may create the potential for scald injury. To protect against injury, you should install an ASSE approved mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from the local plumbing supplier.

Figure 5-1 *Scald Warning*

Water temperatures over 125°F (52°C) can cause severe burns instantly or death from scalds.
Children, disabled, and elderly are at highest risk of being scalded.

See instruction manual before setting the thermostat at the water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, consult local plumbing supplier.

5 System piping

The following chart (Table 5A) details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

***Table 5A** Approximate Time / Temperature Scald Chart*

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second

Water chemistry

NOTICE The required temperature rise and the standard circulating pump are sized based on the heating of potable water with a specified water chemistry. See Table 9A in Start-Up Section for recommendations.

Water with a hardness of less than 5 grains per gallon will usually have a pH which can be aggressive and corrosive causing non-warrantable damage to the pump and associated piping. Corrosion due to water chemistry generally shows up first in the hot water system because heated water increases the rate of corrosive chemical reactions.

Piping components

Check valves:

Field supplied. Check valves are recommended for installation as shown in FIG.'s 5-2 thru 5-4.

Water heater isolation valves:

Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the water heater.

Anti-scald mixing valve:

Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F.

Unions:

Field supplied. Recommended for unit serviceability.

Temperature and pressure relief valve:

Factory supplied on water heaters. The temperature and pressure relief valve is sized to ASME specifications.

Strainer:

Field supplied. Required to help eliminate debris from causing damage to the heat exchanger. When installing in a pre-existing system, it is recommended to install a filter in the recirculation line capable of removing debris left in the system.

Building Recirculation Filter:

Field supplied as required (see Table 9A). When required, helps to eliminate debris from causing damage to the heat exchanger.

⚠ CAUTION Check recirculation pump size to verify it is sized for filter addition and upsize if necessary.

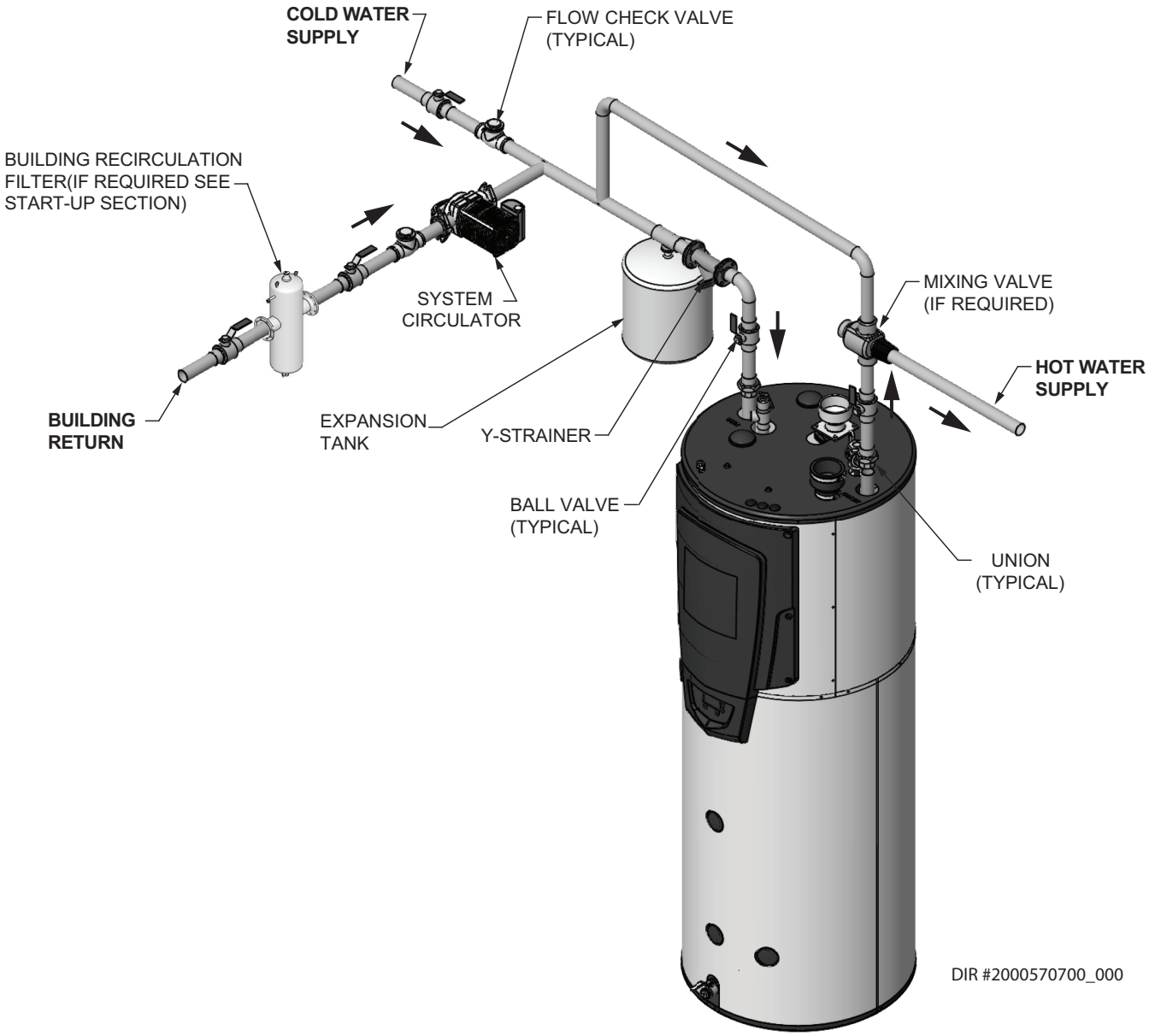
⚠ CAUTION No valves shall be placed between the relief valve, heat exchanger, or tank. The relief valve shall be piped to a suitable drain as close as possible to the heater with no reducing couplings or other restrictions. The piping must be sloping away from the heater at all times.

See the * piping illustrations included in this section, FIG.'s 5-2 thru 5-4 for suggested guidelines in piping the Shield water heater.

NOTICE *Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping *(continued)*

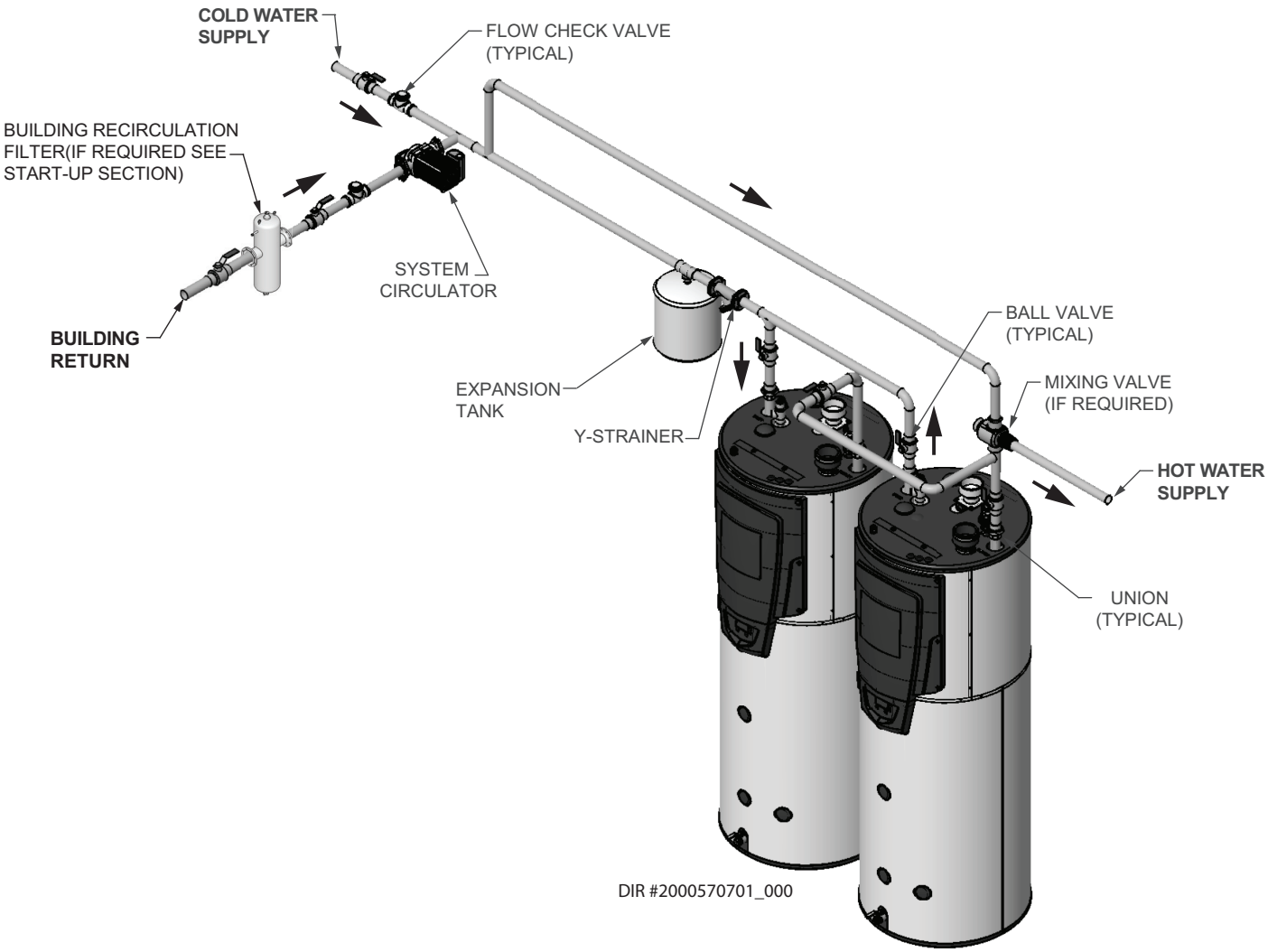
Figure 5-2 *Single Unit*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping

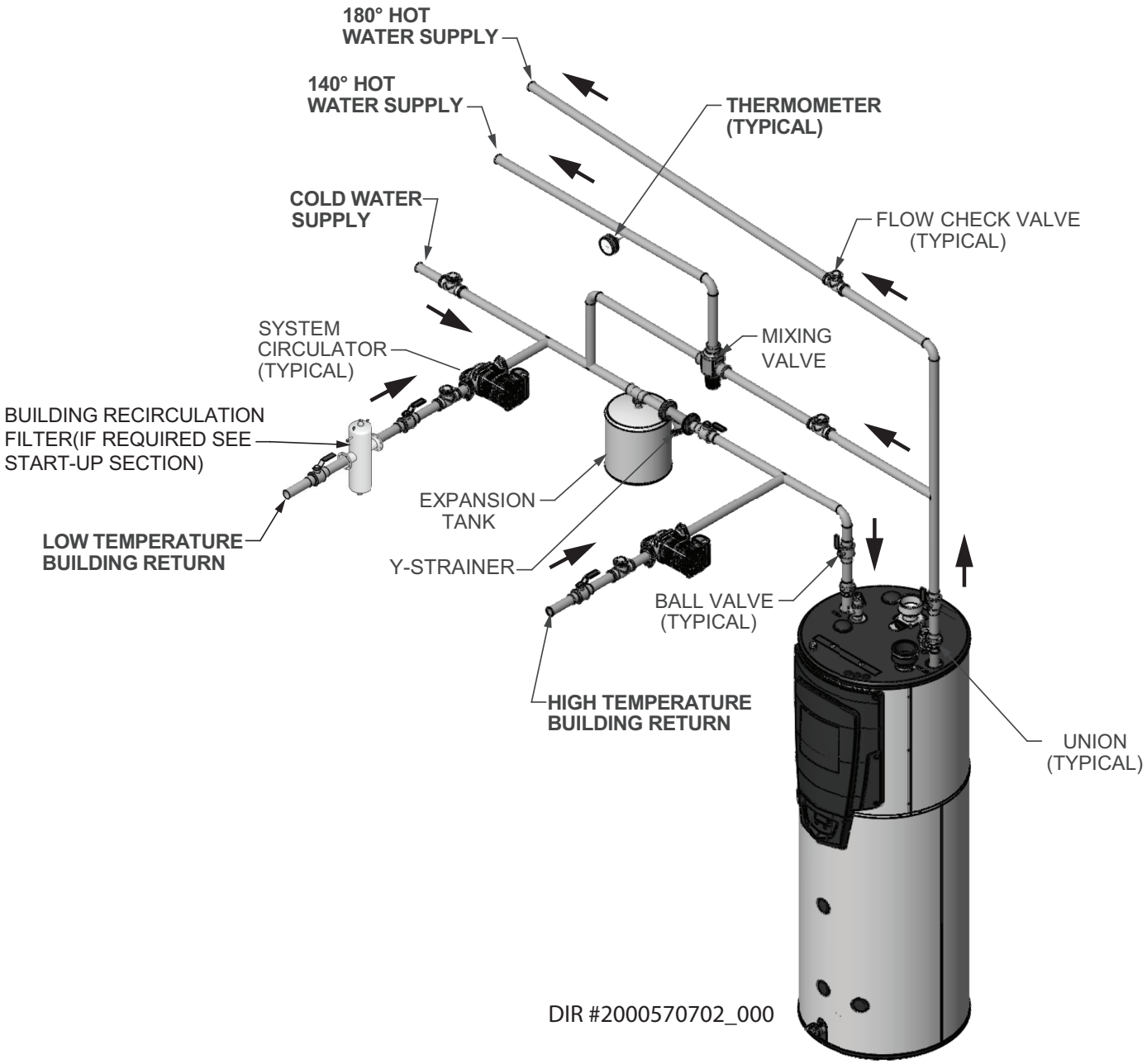
Figure 5-3 *Multiple Units*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping *(continued)*

Figure 5-4 *Two Temperature - Single Unit*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Gas connections

Connecting gas supply piping

1. Install ground joint union for servicing, when required.
2. On Models 126-065 -- 286-125 install a manual shutoff valve in the gas supply piping outside water heater jacket when required by local codes or utility requirements.
3. In Canada – When using manual main shutoff valves, it must be identified by the installer.

Figure 6-1 *Gas Supply Piping - Models 126-065 -- 286-125*

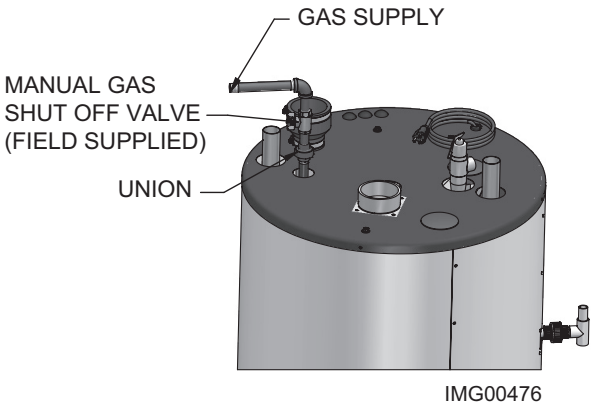
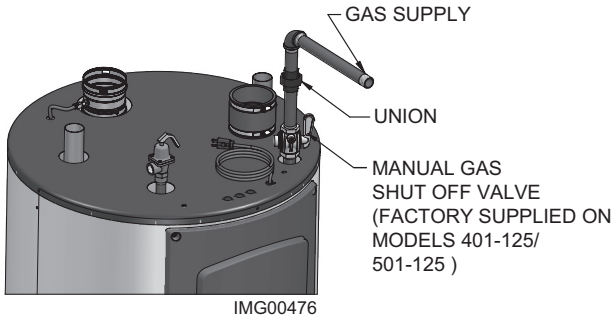


Figure 6-2 *Gas Supply Piping - Models 401-125 -- 501-125*



4. Support piping with hangers, not by the water heater or its accessories.

⚠ WARNING The gas valve and blower will not support the weight of the piping. Do not attempt to support the weight of the piping with the water heater or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

5. Purge all air from the gas supply piping.
6. Before placing the water heater in operation, check the water heater and its gas connection for leaks.
   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
   c. The appliance and its gas connection must be leak tested before placing it in operation.

⚠ WARNING Do not check for gas leaks with an open flame – use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

7. Use pipe sealing compound compatible with propane gases. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

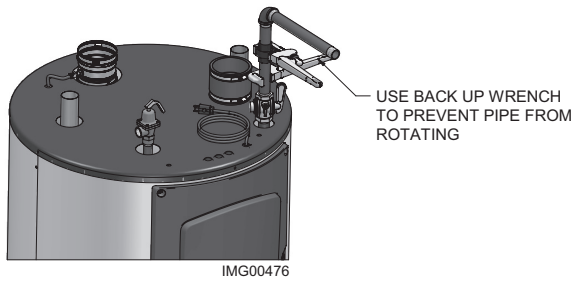
6 Gas connections *(continued)*

⚠ WARNING Failure to apply pipe sealing compound as detailed in this manual can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Use two wrenches when tightening gas piping at water heater (FIG. 6-3), using one wrench to prevent the water heater gas line connection from turning. Failure to support the water heater gas connection pipe to prevent it from turning could damage gas line components.

Figure 6-3 *Inlet Pipe with Backup Wrench*



NOTICE Maximum inlet gas pressure must not exceed the value specified. Minimum value listed is for the purposes of input adjustment.

⚠ WARNING Ensure that the high gas pressure regulator is at least 10 feet upstream of the appliance.

Natural gas:

Pipe sizing for natural gas

1. Refer to Table 6A for pipe length and diameter. Based on rated water heater input (divide by 1,000 to obtain cubic feet per hour).
   a. Table 6A is only for natural gas with specific gravity 0.60 inches, with a pressure drop through the gas piping of 0.30 inches w.c.
   b. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 for Canadian installations).

Natural gas supply pressure requirements

1. Pressure required at the gas valve inlet pressure port:
   - Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   - Minimum 4 inches w.c. with gas flowing (verify during water heater startup).

2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 14 inches w.c. at any time. Adjust lockup regulator for 14 inches w.c. maximum.

Propane gas:

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane Supply Pressure Requirements

1. Adjust propane supply regulator provided by the gas supplier for 14 inches w.c. maximum pressure.

2. Pressure required at gas valve inlet pressure port:
   - Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   - Minimum 8 inches w.c. with gas flowing (verify during water heater startup).

6 Gas connections

***Table 6A** Natural Gas Pipe Size Chart*

Capacity of Schedule 40 Metallic Pipe in Cubic Feet of Natural Gas Per Hour (based on .60 specific gravity, 0.30" w.c. pressure drop)														
Pipe Size (Inches)	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	131	90	72	62	55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	273	188	151	129	114	104	95	89	83	79	70	63	58	N/A
1	514	353	284	243	215	195	179	167	157	148	131	119	109	102
1 1/4	1,060	726	583	499	442	400	368	343	322	304	269	244	224	209
1 1/2	1,580	1,090	873	747	662	600	552	514	482	455	403	366	336	313
2	3,050	2,090	1,680	1,440	1,280	1,160	1,060	989	928	877	777	704	648	602
2 1/2	4,860	3,340	2,680	2,290	2,030	1,840	1,690	1,580	1,480	1,400	1,240	1,120	1,030	960
3	8,580	5,900	4,740	4,050	3,590	3,260	3,000	2,790	2,610	2,470	2,190	1,980	1,820	1,700
4	17,500	12,000	9,660	8,270	7,330	6,640	6,110	5,680	5,330	5,040	4,460	4,050	3,720	3,460

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check inlet gas supply

NOTICE CSA or UL listed flexible gas connections are acceptable, but you must exercise caution to ensure that the line has adequate capacity to allow your water heater to fire at full rate. Consult with local codes for proper installation or service procedures.

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.

If you experience a pressure drop greater than 1 inch w.c., the meter, regulator, or gas line is undersized or in need of service. Perform the steps below when checking inlet gas supply:

1. Disconnect power from the appliance.
2. Shut off gas to the appliance.
3. Loosen the set screw one (1) full turn from inside the pressure tap on top of the gas valve. Place the tubing of the manometer over the tap once the set screw is loosened as shown in FIG.'s 6-4 thru 6-6.
4. Slowly turn on the gas supply at the field installed manual gas valve.
5. Reconnect power to the appliance.
6. Adjust the temperature set point on the control panel of the electronic control module to call for heat.
7. Observe the gas supply pressure as the burner fires at 100% of rated input. Percent of burner input will be displayed on the control panel.
8. Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in this section of the manual.
9. If gas supply pressure is within normal range and no adjustments are needed, proceed on to Step 11.
10. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the control.
11. Disconnect power from the appliance.
12. Shut off the gas to the appliance.
13. Remove the manometer from the pressure tap on top of the gas valve. Re-tighten the set screw inside the pressure tap.

⚠ WARNING When re-tightening the set screw, be sure to tighten securely to prevent gas leaks.

Do not check for gas leaks with an open flame -- use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

14. Reconnect gas to the appliance.
15. Reconnect power to the appliance.
16. Adjust the temperature set point on the control panel of the electronic control module to the desired water temperature so the appliance will call for heat.

6 Gas connections *(continued)*

17. Check burner performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame pattern should be stable. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

***Figure 6-4** Inlet Gas Supply Check - Models 126-065 -- 286-125*

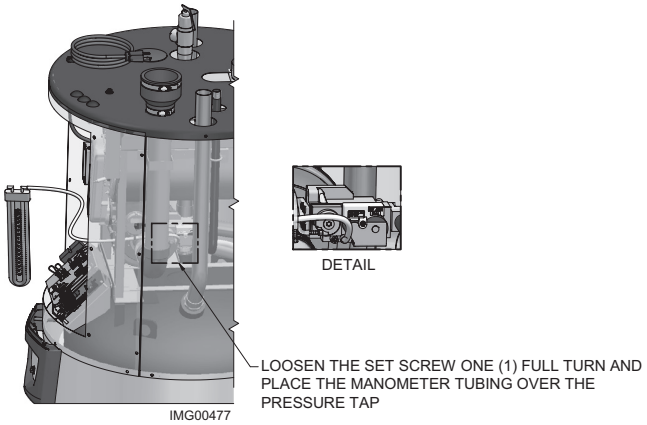


***Figure 6-5** Inlet Gas Supply Check - Model 401-125*

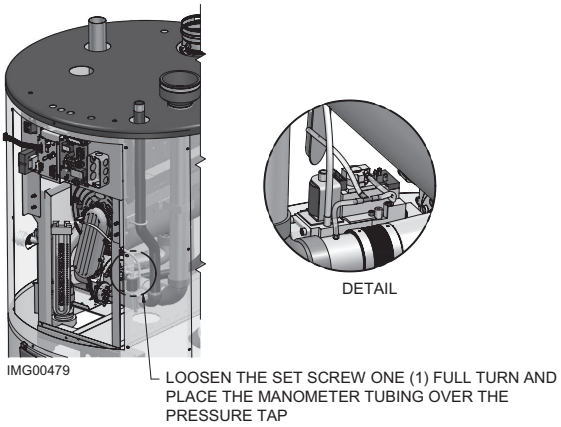
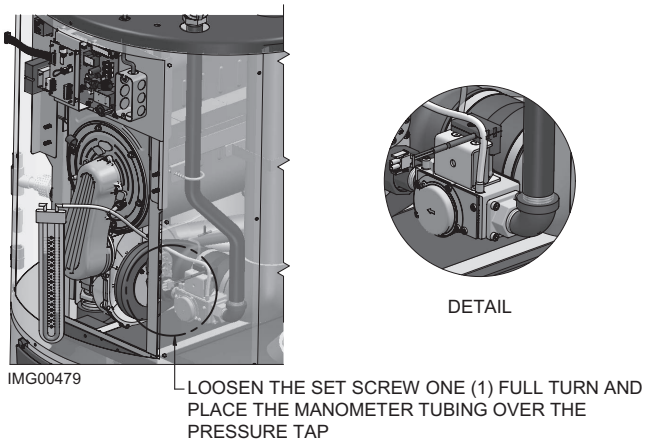


***Figure 6-6** Inlet Gas Supply Check - Model 501-125*



Gas pressure

The gas pressure must remain between 4 inches w.c. (natural), 8 inches w.c. (LP) minimum and 14 inches w.c. (natural and LP) maximum during stand-by (static) mode and while in operating (dynamic) mode. If an in-line regulator is used, it must be a minimum of 10 feet from the Shield water heater. It is very important that the gas line is properly purged by the gas supplier or utility company. Failure to properly purge the lines or improper line sizing, will result in ignition failure.

The problem is especially noticeable in NEW LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines.

Gas valve replacement

The gas valve MUST NOT be replaced with a conventional gas valve under any circumstances. As an additional safety feature, this gas valve has a flanged connection to the venturi and blower.

⚠ WARNING Failure to follow all precautions could result in fire, explosion, or death!

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

7 Field wiring

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

NOTICE Wiring must be N.E.C. Class 1.

If original wiring as supplied with the water heater must be replaced, use only type 105°C wire or equivalent.

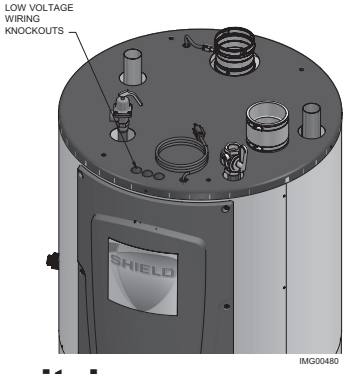
The water heater must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

⚠ CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Low voltage connections

1. Route all low voltage wires through the knockouts in the top of the water heater, as shown in FIG. 7-1.
2. Connect low voltage wiring to low voltage connection board as shown in FIG. 7-3 on page 47 of this manual and the water heater wiring diagram.

Figure 7-1 *Routing Field Wiring*



Enable switch

An external switch or contact may be used to enable/disable the water heater. To connect the enable switch, remove the jumper wire from across the ENABLE terminals on the low voltage connection board and connect the wires from the switch in its place. Note that the freeze protection feature will still fire the heater even though the enable input is open.

Louver relay output / louver proving switch input

When installed using the optional room air configuration, the heater is able to control powered louvers used to allow outside air into the room. Connect the 24VAC control relay coil to the LOUVER RELAY output on the low voltage connection board. Remove the jumper wire from the LOUVER PROVING SWITCH terminals on the low voltage connection board and connect the louver proving switch wires in its place.

Installation must comply with:

1. National Electrical Code and any other national, state, provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

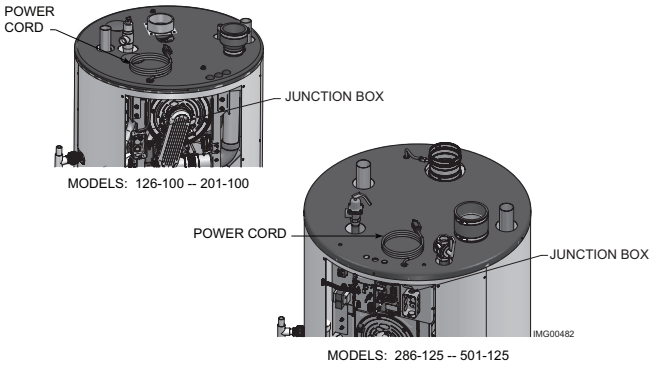
Power cord connection

This water heater is designed to operate with 120 VAC and 60 Hz power supply. If allowed by local codes, connect the power cord provided with the heater to a GFI protected outlet on a separate circuit and breaker (15 amp recommended). Ensure the circuit cannot be interrupted by a switch used to control lights or other appliances.

If local codes do not allow for the use of the power cord, remove the cord from the junction box found on the side of the control support bracket (FIG. 7-2) and attach conduit to the junction box. Route the wires out of the appliance to a GFI protected outlet on a separate circuit and breaker (15 amp recommended).

⚠ WARNING Use of an extension cord is NOT allowed. If a suitable electrical outlet is not within reach of the supplied power cord, a new receptacle must be installed or the power cord must be replaced with hard conduit as described above.

Figure 7-2 *Remove Power Cord*



Runtime contacts

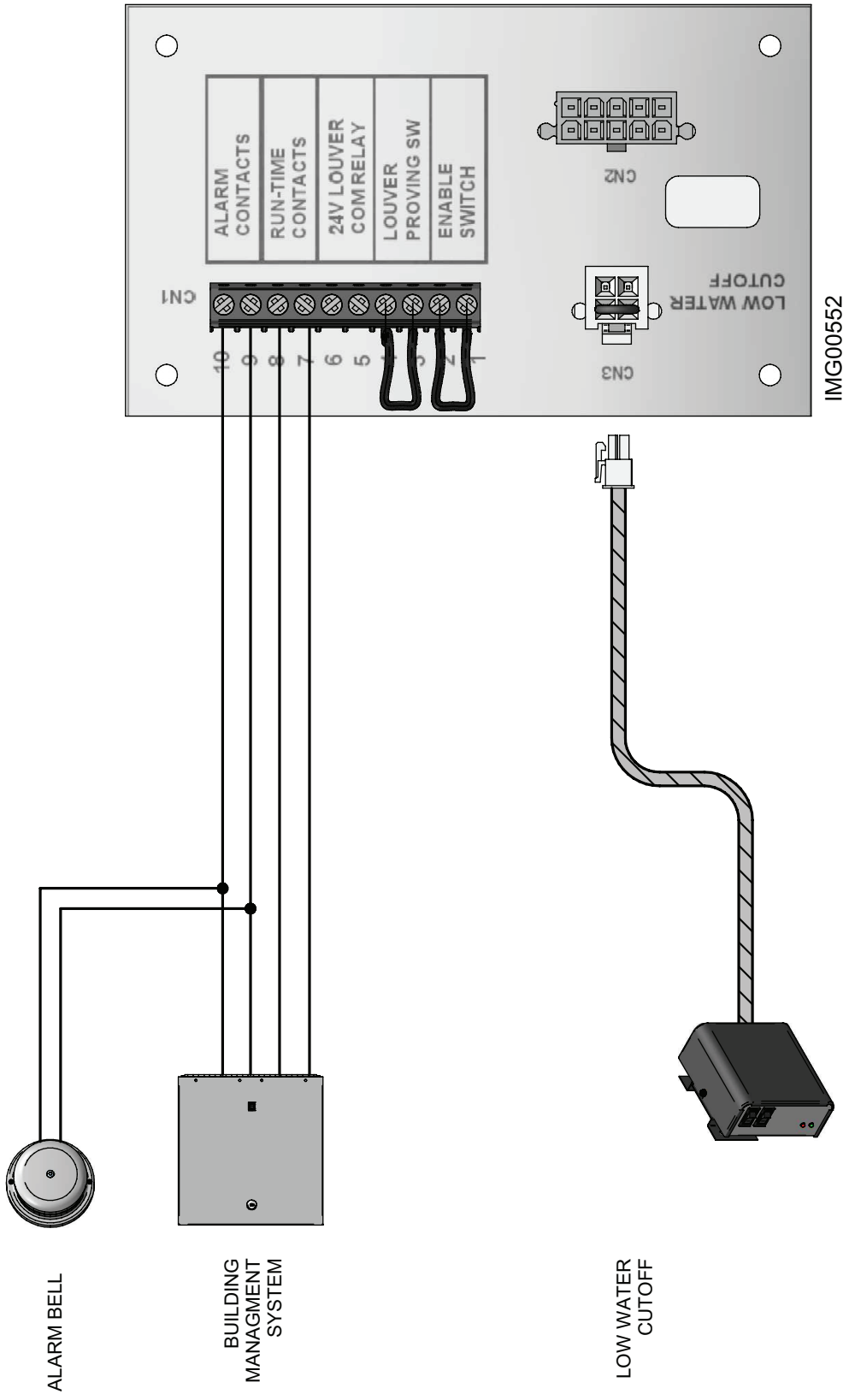
The electronic control closes a set of dry contacts whenever the burner is running. This is typically used by Building Management Systems to verify that the water heater is responding to a call for heat.

Alarm contacts

The electronic control closes another set of contacts whenever the water heater is locked out or the power is turned off. This can be used to turn on an alarm, or signal a Building Management System that the water heater is down. Note that the alarm contacts will close momentarily after each call for heat.

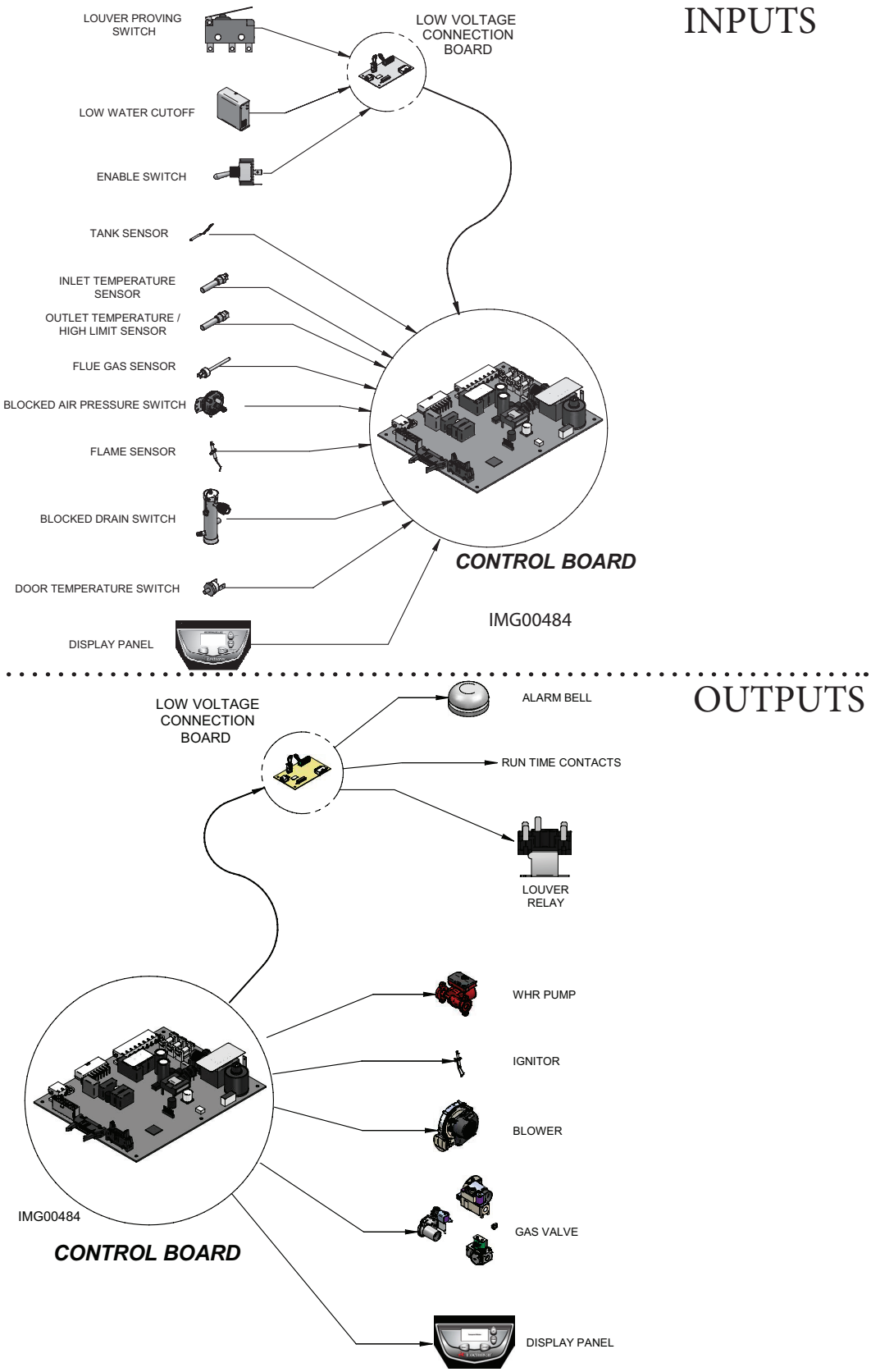
7 Field wiring *(continued)*

Figure 7-3 *Low Voltage Field Wiring Connections*



7 Field wiring

Figure 7-4 *Control Inputs/Outputs*



8 Condensate disposal

Condensate drain

1. This water heater is a high efficiency appliance that produces condensate.
2. Slope condensate tubing down and away from the water heater into a drain or condensate neutralizing filter. Condensate from the Shield water heater will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A Neutralizer Kit is available from the factory (100157721).

Note: The Neutralizer Kit MUST BE installed horizontally.

3. Do not expose condensate line to freezing temperatures.

NOTICE

Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

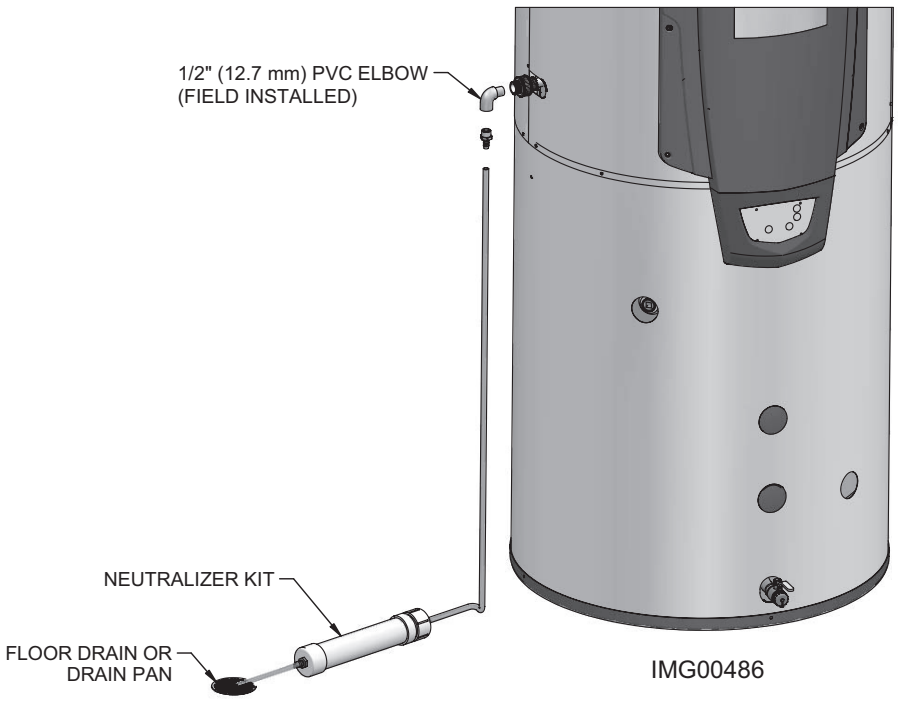
NOTICE

To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the water heater condensate trap, resulting in potential water damage to property.

4. A condensate removal pump is required if the water heater is below the drain. When installing a condensate pump, select one approved for use with condensing water heaters and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired to the auxiliary device proving switch terminals on the low voltage connection board.

Figure 8-1 *Condensate Disposal*



9 Start-up

Check/control water chemistry

NOTICE Conduct water quality testing prior to installing the appliance. Various solutions are available to adjust water quality.

See the following table for properly operating the water heater with the appropriate water chemistry. Good water quality will help extend the life of the appliance by reducing the effects of scale buildup and corrosion.

***Table 9A** Water Chemistry*

WATER CHEMISTRY		
Specification	**Range**	**Requirement**
Hardness	< 5 gpg	Follow recommendations detailed below (See Notice 3)
	5 to 12 gpg	No action required - standard pump
	> 12 gpg	Water softening system required (See Notice 4)
Dissolved Solids	< 350 ppm	Hardness level must be met
pH Level	6.5 to 8.5	Acceptable range
Chloride	< 150 ppm	Acceptable range

NOTICE

1. Do not use the water heater to directly heat swimming pool or spa water.

2. At initial fill and during water heater start-up and testing, check system thoroughly for any leaks. Repair all leaks before proceeding further.

3. When water hardness levels are less than 5 gpg or 85.5 mg/l, the following is recommended:

   a. Flush and clean existing water heating system prior to installation.

   b. Inspect and, if necessary, replace the anodes in any existing tanks.

   c. Install a Y-strainer on the inlet of each water heater as detailed in this section.

   d. Limit the run time of the hot water recirculation loop.

   e. Filter the hot water recirculation loop to a level of 10 microns. CAUTION: Check recirculation pump size to verify it is sized for filter addition and upsize if necessary.

4. When water softener is required, a Template Assisted Crystallization system is recommended.

Check for gas leaks

⚠ WARNING Before starting the water heater, and during initial operation, smell near the floor and around the water heater for gas odorant or any unusual odor. Remove the top access panel and smell the interior of the water heater enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

⚠ WARNING Propane water heaters only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Inspect/fill condensate system

Inspect/check condensate lines and fittings

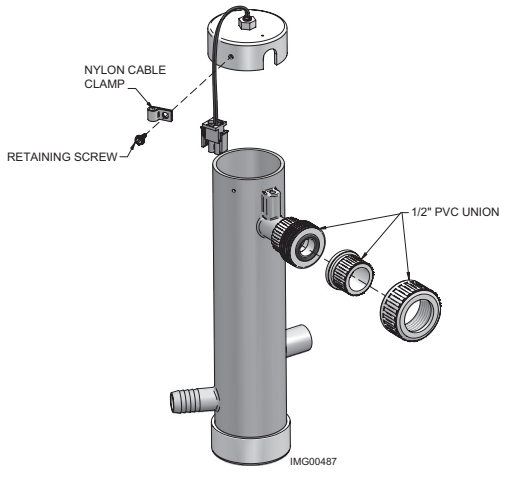
1. Inspect the condensate drain line, condensate PVC fittings and condensate trap.

Fill condensate trap with water

1. Remove the PVC cap retaining screw from the PVC cap (FIG. 9-1).
2. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 9-1).
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
5. Replace the retaining screw.

⚠ WARNING The condensate trap (FIG. 9-1) must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

***Figure 9-1** Condensate Trap*



9 Start-up *(continued)*

Final checks before starting the water heater

- ❑ Read this manual to familiarize yourself with electronic control module operation. Read pages 52 and 53 for proper steps to start the water heater.
- ❑ Verify the water heater and system are full of water and all system components are correctly set for operation.
- ❑ Verify the preparation procedures of Section 9, pages 50 and 51 have been completed.
- ❑ Fill the vent condensate trap with water (removing the retaining screw in order to remove the 2 inch PVC cap with the switch located at the top of the trap). Replace the cap. Press the cap onto the trap until the cap makes contact with the drain. Replace the retaining screw.
- ❑ Verify electrical connections are correct and securely attached.
- ❑ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

Start the water heater

1. Read and follow the Operating instructions in FIG.'s 9-2 and 9-3, pages 52 and 53.

If water heater does not start correctly

1. Check for loose connections, blown fuse or service switch off.
2. Is external limit control (if used) open? Is water temperature above 200°F?
3. Is tank set point set below tank temperature?
4. Is gas turned on at meter and water heater?
5. Is incoming gas pressure less than 4 inches w.c.?

If none of the above corrects the problem, refer to the *Troubleshooting* section of this manual.

Check system and water heater

❑ Check water piping

1. Check system piping for leaks. If found, shut down the water heater and repair immediately.
2. Check Delta T. Ensure Delta T is less than 30°F, if not, reference *Section 12 - Troubleshooting*.
3. Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause hot water distribution problems and noise.

❑ Check vent piping and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping.

⚠ WARNING Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

❑ Check gas piping

1. Check around the water heater for gas odor following the procedure on page 42 of this manual *(Connecting Gas Supply Piping)*.

⚠ WARNING If you discover evidence of any gas leak, shut down the water heater at once. Find the leak source with a bubble test and repair immediately. Do not start the water heater again until corrected. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check flame and combustion

1. Shut the water heater down by pressing the UP button for five (5) seconds.
2. Locate the flue sensor in the vent connection. Remove the flue sensor and grommet from the unit. **Note:** Combustion measurements will be made at this point.
3. Place the water heater in active position by pressing the UP button for five (5) seconds.
4. Press ENTER plus the UP button for five (5) seconds to enter Service Mode.
5. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
6. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 9A. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the *Troubleshooting* section of this manual for possible causes and corrective actions.
7. Once the combustion analysis is complete, exit Service Mode.

Table 9A *Flue Products Chart*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

8. Replace the flue sensor and grommet into the vent connection.
9. Place the Shield water heater back into normal operation.

⚠ WARNING You must replace the flue sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

9 Start-up

Figure 9-2 *Operating Instructions - Models 126-065 -- 286-125*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

Do not try to light any appliance.

Do not touch any electric switch; do not use any phone in your building.

Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

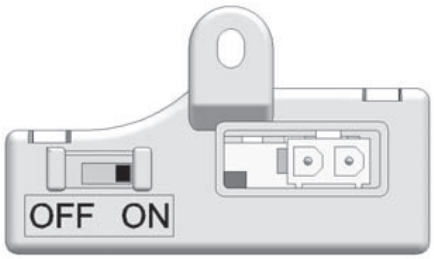
If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to move the gas control switch. Never use tools. If the switch will not move by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove front door.
6. Move switch to the "OFF" position.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Move the switch to the "ON" position.
9. Install front door.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Move switch the "OFF" position.
5. Install front door.

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9 Start-up *(continued)*

Figure 9-3 *Operating Instructions - Models 401-125 -- 501-125*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

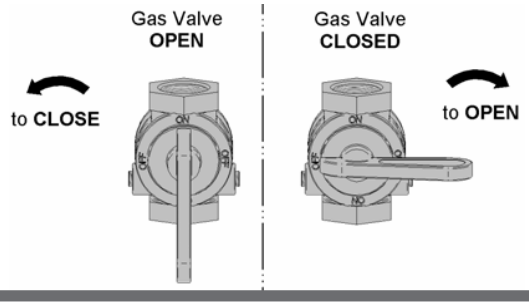
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove top cover.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install top cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove top cover.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force
5. Install top cover.

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10 Operating information

General

How the water heater operates

The Shield water heater combines an advanced stainless steel heat exchanger, electronic control module, and tank that allows fully condensing operation. The blower pulls in air and pushes flue products out of the heat exchanger and flue piping. The control module regulates blower speed to control the water heater firing rate. The gas valve senses the amount of air flowing into the water heater and allows only the right amount of gas to flow. An internal pump circulates the water between the tank and heater and mixes the incoming water to provide maximum efficiency.

Temperature control

Modulation

The Shield water heater is capable of modulating its firing rate from a minimum of 20% to a maximum of 100%. The firing rate is dictated by the hot water draw and various other temperature limitations.

Night setback

The controller may be programmed to reduce the tank set point during a certain time each day. There are seven (7) start and seven (7) stop triggers.

Flame current support

To prevent nuisance shutdowns when the water heater is firing at minimum rates, the control will increase fan speed when the flame signal drops too low.

Protection features

Outlet temperature, flue temperature, and temperature rise limiting

The heat exchanger outlet temperature is monitored by the heat exchanger outlet temperature sensor. When the heat exchanger outlet temperature exceeds 190°F, the unit will reduce the fan speed. If the heat exchanger outlet water temperature exceeds 198°F the control will shut the unit down until it cools off.

The control module monitors the flue temperature by a sensor located in the flue exhaust. If the flue temperature exceeds 215°F the control will reduce the maximum fan speed. If the flue temperature exceeds 225°F (107°C) the control will shut the unit down. The unit will restart automatically once the flue temperature drops 10°F (6°C) and the minimum off time has expired.

The control monitors the temperature difference between the heat exchanger inlet and the heat exchanger outlet sensors. If this difference exceeds 40°F the control will reduce the fan speed. If the temperature difference exceeds 45°F the control will shut the unit down. The unit will restart automatically once the temperature difference has dropped below 40°F and the minimum off time has expired.

Freeze protection

DO NOT install the water heater in a room likely to freeze.

The following integral feature of the electronic control module provides some protection for the water heater.

- The electronic control module provides freeze-up protection as follows when the water heater water temperature drops below 45°F:
- Below 45°F, the internal pump operates constantly.
- Below 37°F, the burner turns on.
- The burner and pump will turn off if water heater water temperature rises above 45°F.

⚠ CAUTION This feature of the electronic control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the water heater.

Runtime and alarm outputs

The water heater provides dry contacts for indicating when the water heater is running, and when it is unable to operate.

Error logging

The control will hold in memory the last 10 faults. The date and time of the occurrence will be recorded as well. Only the 10 most current occurrences will be held in memory.

10 Operating information *(continued)*

Water heater temperature regulation

Operating temperature (target)

The electronic control module senses water temperature in the tank and regulates water heater ignition and firing rate to achieve a target temperature. The target temperature can be set between 60°F and 185°F.

High limit operations

The Shield water heater is equipped with a fixed automatic reset high limit and an adjustable manual reset high limit. The automatic reset high limit has a set point of 200°F and the manual reset high limit has a maximum set point of 210°F.

When the outlet temperature exceeds 200°F, the automatic high limit action occurs. The water heater shuts down until the outlet water temperature cools below 190°F, and a 60 second timer has expired. If the outlet temperature continues to increase, the manual reset high limit action will occur at 210°F.

High limit test procedure

NOTICE Please note that the brackets ([]) denote screen status.

1. Connect the water heater to 120V power.
2. Note the outlet temperature shown on the display.
3. Press and hold the ENTER and DOWN keys until "P01" appears in the lower digits on the display.
4. Press and hold the DOWN key until the set point shown in the upper digits is less than the outlet temperature (or it reaches its minimum setting, whichever is higher).
5. Press the ENTER key four (4) times. The word "SET" will appear on the display.
6. Once the outlet temperature reaches the new Manual Reset High Limit setting, the control will lock out, run the blower and DHW pump, and display "E15" in the lower digits on the display. It may be necessary to activate Service Mode to bring the outlet temperature above the Manual Reset High Limit set point. Press and hold the ENTER and UP keys for 5 seconds to activate Service Mode.
7. Press the ENTER and DOWN keys again until 'P01" appears in the lower digits.
8. Press and hold the UP key to readjust the set point to the desired setting.
9. Press the ENTER key four (4) times. The word "SET" will appear on the display.
10. Press the RESET key to clear the Manual Reset High Limit.
11. If Service Mode was activated, press ENTER for 5 seconds to deactivate Service Mode.

Adjustable control parameters

Date and time

The control uses an internal clock for the night setback feature and for logging of events. For these features to work correctly, the clock must be set when the water heater is first installed or anytime the water heater has been powered off for more than 15 minutes. Note that hours are displayed as 24 hour time (2:00PM = 14:00). Days are displayed as a number (Monday = 1, Tuesday = 2, ..., Sunday = 7).

NOTICE The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

User adjustable parameters

To access the User Adjustable Parameter Menu, press and hold the ENTER button for five (5) seconds. Once pressed, the temperature unit's adjustment will be shown. Press the ENTER button to cycle to other adjustment values. Once you have cycled through all of the values, the new values will be saved.

***Table 10A** User Adjustable Parameters*

Code	Description
u01	Temperature Units (°C/°F)
u02	Hot Water Set Point
u03	Year
u04	Month
u05	Day
u06	Hour
u07	Minute

Installer settings

Set the Hot Water (HW) Temperature as follows:

1. Press and hold the ENTER button for five (5) seconds.
2. Press ENTER again and the u02 Screen should appear.
3. Press the UP and DOWN buttons to set the temperature.
4. Once you have successfully set the temperature, press the ENTER button seven (7) times to save your data.

10 Operating information

Table 10B Temperature Parameter Settings

Code	Description	Factory Default	Min	Max
p01	Manual Reset High Limit Set Point	210	32	210
p02	Night Setback Set Point	0	0	90
p03	Maximum Tank Set Point	125	32	190
p04	HW Pump Delay	0:30	0:00	0:40:00
--	HW Temp	125	60	185

Installer adjustable parameters

To access the Installer Adjustable Parameter Menu, press and hold the ENTER and DOWN buttons simultaneously for five (5) seconds. Once pressed, the temperature unit's adjustment will be shown. Press the OK button to cycle to other adjustment values. Once you have cycled through all of the values, the new values will be saved.

Table 10C Installer Adjustable Parameters

Code	Description
p01	Manual Reset High Limit
p02	Night Setback Offset
p03	Maximum Tank Set Point
p04	Pump Delay Time

Night setback

Access the Night Setback Menu by pressing the UP and DOWN buttons simultaneously for five (5) seconds.

This feature allows the user to lower the tank set point at certain times each week. The Night Setback Offset (see *Installer Adjustable Parameters*, this page) determines how much the set point is lowered. The times at which the set point is lowered are controlled by seven (7) start triggers and seven (7) stop triggers. Each trigger can be set to any time on any day. When the internal clock (see *User Adjustable Parameters*, page 55) reaches a start trigger, Night Setback will begin. When the internal clock reaches a stop trigger, Night Setback will end. When a start trigger and a stop trigger are programmed to the same day and time, the stop trigger will have priority, so Night Setback will not become active. (The default settings are all set to the same day and time.) Use the following procedure to adjust the triggers:

1. Press the UP and DOWN buttons simultaneously for five (5) seconds.
2. The top digits on the display will show the trigger type. To change from ON to OFF, or back, press the UP or DOWN button, then press the ENTER button.
3. The trigger number will then appear. Press the UP or DOWN buttons to change the trigger number you are programming, then press the ENTER button.
4. The day of the week (1 - 7) for that trigger will then appear in the lower digits on the display (1 = Monday, 2 = Tuesday, etc.,). Press the UP or DOWN buttons to change the day of the week, then press the ENTER button.
5. The time for that trigger then appears in a 24 hour format (for example, 2:00 PM = 1400), with the hours digits flashing. Use the UP and DOWN buttons to adjust the hours, then press the ENTER button.
6. The minutes digits will then start flashing. Press the UP and DOWN buttons to adjust the minutes. If you are finished programming all of the triggers, press and hold the ENTER key for 5 seconds. Otherwise, press the ENTER button once. The bottom digits will clear and the top digits will show ON or OFF again. Go back to Step 2 of this procedure.

Low water cutoff protection

The electronic control module uses sensing of both heat exchanger supply and return temperatures. If the flow rate is too low or either temperature too high, the control module modulates and shuts the burner down. This ensures water heater shutdown in the event of low water or low flow conditions in the heat exchanger.

To turn the heater ON/OFF

To turn the heater ON, press the UP button and hold it for five (5) seconds. To turn the heater OFF, press the UP button and hold again for five (5) seconds.

Service mode

To control the modulation of the heater for troubleshooting procedures, the Service Mode can be accessed by pressing the ENTER and UP buttons simultaneously, holding them for five (5) seconds. Once in the Service Mode, the UP and DOWN buttons control the speed of the blower. To toggle between the maximum and minimum speeds, press the ENTER button momentarily. When ready to return to the normal state, press the ENTER button for five (5) seconds. The control will also leave Service Mode in the event of a lockout.

Error logging

To access the error log, press the DOWN button for five (5) seconds. The error codes will be displayed beginning with the most recent. The top number indicating the error number starting with "1" being the most recent. The bottom of the display will show the following information in two (2) second intervals:

1. Error Code
2. Hour and Minute of the Error
3. Date of the Error
4. Year of the Error

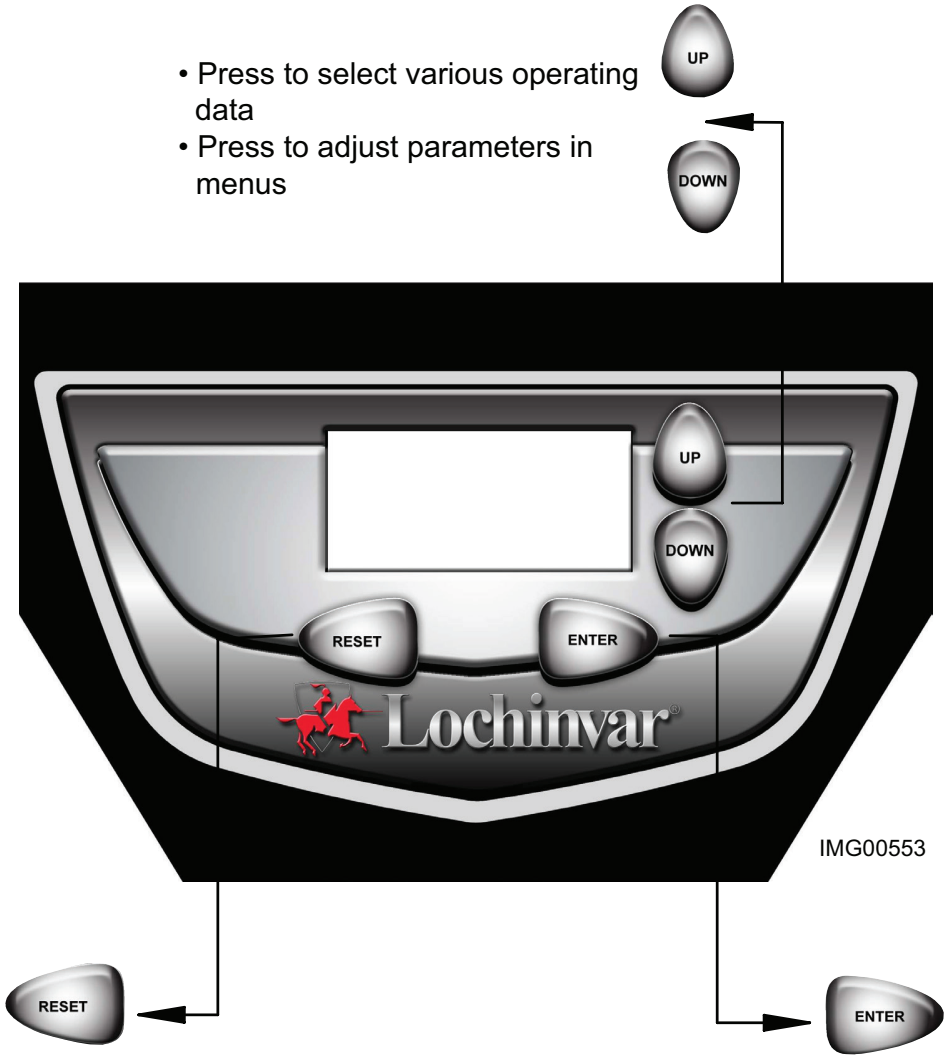
To view the next error press the UP button. To pause the information on the screen, press and hold the ENTER button, when released it will skip to the next value. To leave the Error Log Menu press and hold the DOWN button for five (5) seconds.

10 Operating information *(continued)*

Shield control module

Use the control panel (FIG. 10-1) to set temperatures, operating conditions, and monitor water heater operation.

Figure 10-1 *Control Panel*



11 Maintenance

Maintenance and annual startup

Table 11A *Service and Maintenance Schedules*

Service technician (see the following pages for instructions)	
ANNUAL START-UP	**General:** • Address reported problems • Inspect interior; clean and vacuum if necessary; • Clean condensate trap and fill with fresh water • Check for leaks (water, gas, flue, condensate) • Verify flue and air lines in good condition and sealed tight • Check system water pressure/system piping/expansion tank • Check control settings • Check ignition and flame sense electrodes (sand off any deposits; clean and reposition) • Check wiring and connections • Perform start-up checkout and performance verification per Section 9 in this manual. • Flame inspection (stable, uniform) • Flame signal (at least 10 microamps at high fire) • Clean the heat exchanger if flue temperature is more than 54°F above return water temperature. • Check anode rods. • Check Delta T (Temperature Rise) **If combustion or performance indicate need:** • Clean heat exchanger • Remove and clean burner using compressed air only • Clean the blower wheel

Owner maintenance	
Daily	• Check water heater area
Monthly	• Check vent piping • Check air piping • Check relief valve • Check condensate drain system • Check Delta T (Temperature Rise) • Remove debris from Y-strainer per manufacturer's instructions • Check building recirculation filter (if filter required)
Every 6 months	• Check water heater piping (gas and water) for leaks • Operate relief valve • Check water chemistry

11 Maintenance *(continued)*

⚠ WARNING Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the water heater. Failure to perform the service and maintenance could result in damage to the water heater or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING The water heater should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the water heater designated in Table 11A and explained on the following pages must be performed to assure maximum water heater efficiency and reliability. Failure to service and maintain the water heater and system could result in equipment failure.

⚠ WARNING Electrical shock hazard – Turn off power to the water heater before any service operation on the water heater except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect water heater area

1. Verify that water heater area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 of this manual. If any of these are present in the water heater intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual.

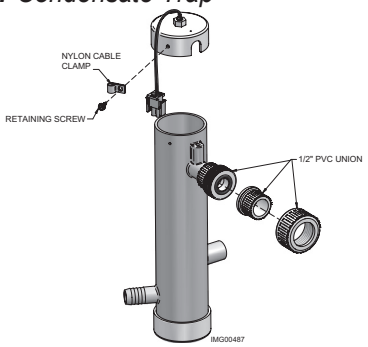
Inspect water heater interior

1. Remove the pump access panel and inspect the interior of the water heater.
2. Vacuum any sediment from inside the water heater and components. Remove any obstructions.

Clean condensate trap

1. Inspect the condensate drain line, condensate PVC fittings, and condensate trap.
2. Remove the PVC cap retaining screw from the PVC cap (FIG. 11-1).
3. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 11-1).
4. Remove any sediment in the trap.
5. Fill with fresh water until the water begins to pour out of the drain.
6. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
7. Replace the retaining screw.

Figure 11-1 *Condensate Trap*



⚠ WARNING The condensate trap must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

Check all piping for leaks

⚠ WARNING Eliminate all system or water heater leaks. Leaking water may cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in Section 7 - Gas Connections.

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.
2. Verify that water heater vent discharge and air intake are clean and free of obstructions.

⚠ WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the water heater heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

11 Maintenance

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the water expands due to temperature increase or contracts as the water cools. Tanks must be approved for potable water systems. See Section 5 - System Piping for suggested best location of expansion tanks.

Check water heater relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 5 - System Piping before proceeding further.

⚠ WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the water heater relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the water heater until a new relief valve has been installed.

2. After following the warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

Inspect ignition and flame sense electrodes

1. Remove the ignition and flame sense electrodes from the water heater heat exchanger access cover.
2. Remove any deposits accumulated on the ignition/flame sense electrode using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrode, making sure gasket is in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect water heater ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all water heater wiring

1. Inspect all water heater wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the control module display to Parameter Mode and check all settings. Adjust settings if necessary. See Section 10 of this manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform start-up and checks

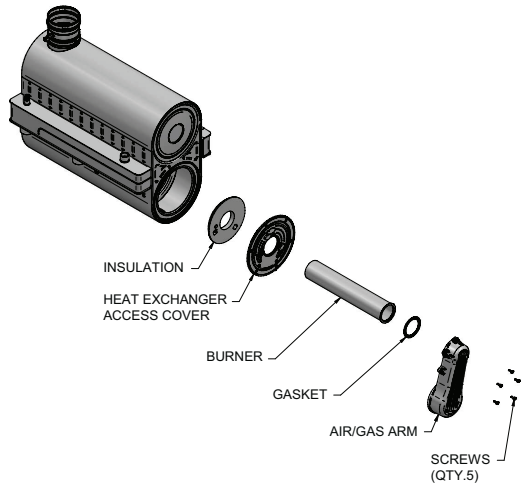
1. Start water heater and perform checks and tests specified in Section 9 - Start-up.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

11 Maintenance *(continued)*

Check burner flame

1. Inspect flame through observation window.
2. If the flame is unsatisfactory at either high fire or low fire, turn off water heater and allow water heater to cool down. Remove the burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.
3. Remove the burner, reference FIG. 11-2 below.
4. When replacing the burner, ensure gasket is in good condition and positioned correctly (FIG. 11-2).

***Figure 11-2** Burner Assembly*



Check flame signal

1. At high fire the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 12 - Troubleshooting for other procedures to deal with low flame signal.

Review with owner

1. Emphasize the need to perform the maintenance schedule specified in this manual.
2. Remind the owner of the need to call a licensed contractor should the water heater or system exhibit any unusual behavior.

Handling ceramic fiber materials

REMOVAL OF COMBUSTION CHAMBER LINING

⚠ WARNING The combustion chamber insulation in this appliance contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)." Normal operating temperatures in this appliance are below the level to convert ceramic fibers to cristobalite. Abnormal operating conditions would have to be created to convert the ceramic fibers in this appliance to cristobalite.

The ceramic fiber material used in this appliance is an irritant; when handling or replacing the ceramic materials it is advisable that the installer follow these safety guidelines.

- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent airborne dust.
- Remove the combustion chamber lining from the appliance and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

Cleaning heat exchanger

For recommended materials; including brush, appropriate extension(s), refractory cover, and detailed instructions see Table 11B - Heat Exchanger Cleaning Kits on page 62.

1. Shut down water heater:
   - Follow the "To Turn Off Gas to Appliance" instructions for the water heater in Section 9 - Startup.
   - Do not drain the water heater unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the water heater to cool to room temperature if it has been firing.

11 Maintenance

3. Remove the nuts securing the heat exchanger access cover to the heat exchanger and set aside.
4. Remove the heat exchanger access cover, burner, and gas/air arm assembly.

⚠ WARNING The water heater contains ceramic fiber materials. Use care when handling these materials per instructions in this manual. Failure to comply could result in severe personal injury.

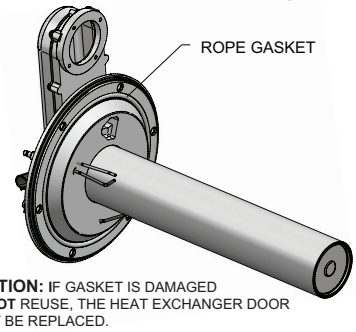
5. Remove the condensate hose from the heat exchanger end. Connect a field supplied 3/4" diameter hose to a drain pan. Using field supplied means, cover the refractory in the back of the combustion chamber of the heat exchanger.
6. Use a vacuum cleaner to remove any accumulation on the water heater heating surfaces. Do not use any solvent.
7. Brush the heat exchanger while dry using a nylon bristle brush. **Caution:** DO NOT use a metal brush. Re-vacuum the heat exchanger.
8. Finish cleaning using a clean cloth dampened with warm water. Rinse out debris with a low pressure water supply.
9. Allow the heat exchanger to thoroughly dry.
10. Remove the field supplied rear refractory cover from the back of the combustion chamber of the heat exchanger and reassemble.
11. Close isolation valves on piping to isolate water heater from system. Attach a hose to the water heater drain and flush water heater thoroughly with clean water by using purging valves to allow water to flow through the water make-up line to the water heater.
12. Perform start-up and check-out procedures in the Check Flame and Combustion - Section 9 - Startup on page 51 of this manual.
13. Replace the access cover and restore water heater to operation.

***Table 11B** Heat Exchanger Cleaning Kits*

Model	Kit Number	Part Number	Component Description
126-065 -- 201-100 286-125 -- 401-125	100157627	100140243	Rear Refractory Cover
		100162565*	Nylon 4" Wheel Brush*
		100162566	3mm Allen Wrench
		100162568	1/4" x 24" Drill Extension
501-125	100157628	100140243	Rear Refractory Cover
		100162565*	Nylon 4" Wheel Brush*
		100162567	1/4" x 12" Drill Extension
		100162568	1/4" x 24" Drill Extension

⚠ CAUTION * Do NOT use a metal brush. Only use the kit provided brush or an equivalent replacement nylon brush.

***Figure 11-3** Rope Gasket - Heat Exchanger Door*



NOTICE Rope gasket is intended for sealing combustion (FIG. 11-3). If damaged DO NOT reuse, the heat exchanger door must be replaced. Consult factory for replacement heat exchanger door (kit 100173749).

Oiled bearing circulators

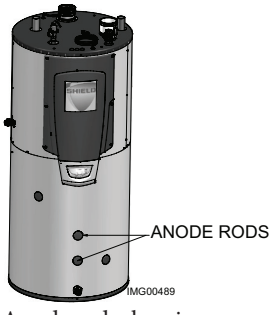
1. The circulator shipped with the Shield water heater is water-lubricated. No oiling is required.
2. Check other circulators in the system. Oil any circulators requiring oil, following circulator manufacturer's instructions. Over-oiling will damage the circulator.

Magnesium anode rod inspection

Glass lined storage tanks have a magnesium anode(s) (FIG. 11-4) to provide cathodical protection of the lining and minimize corrosion. Aggressive water conditions in some areas of the country may accelerate the deterioration of the anode(s). The anode(s) should be periodically removed and inspected to determine if replacement is necessary.

The heater must be valved off from the system and fully drained to remove an anode for inspection. Anodes are supplied in threaded fittings on the side of the tank. Adequate service clearance is required to allow removal of an anode. The anode(s) should be replaced when more than six inches of the core wire is exposed at either end of the rod.

***Figure 11-4** Anode Location*



NOTICE Anode rods showing excessive decomposition may indicate electrolysis. An earth ground should be attached to the vessel to divert stray current and prevent tank damage.

12 Troubleshooting

⚠ WARNING Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to the water heater before servicing. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Never jumper (bypass) any device except for momentary testing as outlined in the Troubleshooting chart. Severe personal injury, death, or substantial property damage can result.

Before troubleshooting:

1. Have the following items:
   a. Voltmeter that can check 120 VAC, 24 VAC, and 12 VDC.
   b. Continuity checker.
   c. Contact thermometer.
2. Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to water heater.
3. Make sure the tank is calling for heat.
4. Make sure all external limit controls are installed and operating.

Check the following:

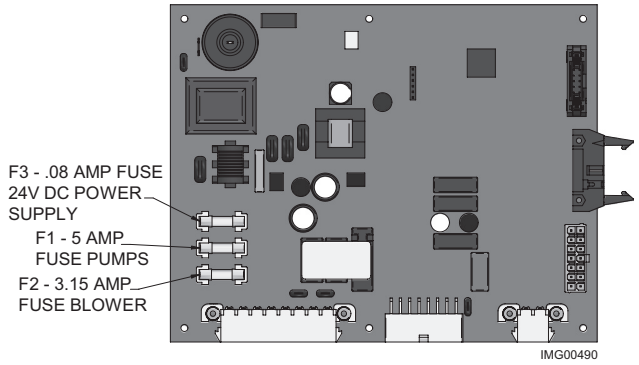
1. Wire connectors to control module and connection board are securely plugged in.
2. Gas pressures:
   - Maximum: 14 inches w.c. (natural and LP) with no flow (lockup) or with water heater on
   - Minimum: 4 inches w.c. (natural), 8 inches w.c. (LP) with gas flowing (verify during water heater startup)

Check control module fuses

NOTICE ALWAYS check control module fuses before replacing control module or any major components (blower, etc.). If one of these fuses is blown, it can prevent the control module or other components from operating.

1. Turn OFF power to the water heater at the external disconnect switch.
2. Remove front access cover.
3. Remove the control module cover.
4. Inspect fuses F2, F3, F4, and F5, see FIG. 12-1 below.

Figure 12-1 *Control Module Fuses*



5. The water heater is shipped with three (3) spare fuses in a plastic bag attached to the control module cover.
6. If necessary, replace open fuse (F3 is 1.25 amps, F2 and F4 are 3.15 amps, and F5 is 5 amps).

Note: Fuses F2 - F5 are all slow blow fuses.

⚠ WARNING Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death, or substantial property damage.

7. Install control module cover and front access cover after fuse inspection.
8. Restore power to the water heater at the external disconnect switch and verify water heater operation (Section 9 - Start-up) after completing water heater service.

12 Troubleshooting

***Table 12A** Troubleshooting Chart - No Display*

FAULT	CAUSE	CORRECTIVE ACTION
No Display	- No 120 VAC supplied to unit.	• Check external line switch, fuse, or breaker. • Check wiring harness connection between display board and main control board. Connect harness at both points.
	- Bad display board.	• Replace board.
	- Bad main control board.	• Replace the main control board.
	- Blown fuse.	• Replace fuse F3 on the main control board, see page 63 of this manual.
No Burner Operation	- Tank temperature set point satisfied.	• Review temperature setting.
	- Unit locked out on fault.	• Consult display for specific fault. Refer to fault descriptions on page 67 of this manual for corrective actions.
Unit Does Not Modulate Above 50%	- Flue sensor open.	• Verify that the flue sensor is located in the flue outlet.
		• Check wiring connections at the flue sensor.
		• Check the resistance of the flue sensor and compare to Table 12D on page 65 of this manual.

12 Troubleshooting *(continued)*

Checking temperature sensors

The water heater temperature sensors (inlet water, outlet water, tank water, and flue) are all resistance type devices. The following tables show the correct values for the sensors at various temperatures. Use an ohmmeter to read the resistance of the sensor at a known temperature. If the resistance of the sensor does not closely match its corresponding table, replace the sensor.

Table 12B - *Inlet Tank Sensor Resistance vs. Temperature*

Temperature °F	Resistance Ω	Temperature °F	Resistance Ω
50	18,780	158	1,990
68	12,263	176	1,458
86	8,194	194	1,084
104	5,592	212	817
122	3,893	--	--
140	2,760	--	--

Table 12C - *Outlet Water Sensor Resistance vs. Temperature*

S1a (Wire Color - R/BK and Y)				S1b (Wire Color - G and Y)			
Temperature	Resistance	Temperature	Resistance	Temperature	Resistance	Temperature	Resistance
50	19,553	158	2,004	50	40,030	158	3,478
68	12,690	176	1,464	68	25,030	176	2,492
86	8,406	194	1,084	86	16,090	194	1,816
104	5,715	212	816	104	10,610	212	1,344
122	3,958			122	7,166		
140	2,786			140	4,943		

Table 12D - *Flue Temperature Sensor Resistance vs. Temperature*

Temperature °F	Resistance Ω	Temperature °F	Resistance Ω
68	14,773	176	1,707
86	9,804	194	1,266
104	6,652	212	952
122	4,607	230	726
140	3,252	248	560
158	2,337	--	--

12 Troubleshooting

***Table 12E** Troubleshooting Chart - Noisy System*

FAULT	CAUSE	CORRECTIVE ACTION
Noisy Operation	- Supply gas problem. Natural gas pressures should be between 4 inches w.c. and 14 inches w.c. LP gas pressures should be between 8 inches w.c. and 14 inches w.c.	• Refer to Section 6 - Gas Connections for detailed information concerning the gas supply.
	- Gas/air mixture problem.	• Refer to the Gas Valve Adjustment Procedure on page 74 of this manual for the proper gas valve setting. Verify that the vent/air intake lengths do not exceed the maximum listed in the General Venting section.
	- Dirty/damaged burner.	• Refer to page 62 in this manual for the burner removal and inspection procedure. Clean or replace the burner as necessary.
	- Low water flow through the heat exchanger.	• Very pump operation.
	- Air in the piping system.	• Properly purge all air from the piping system.
No Pump Operation	- Blown fuse.	• Replace fuse F5 on the control board, see page 63 of this manual.
	- Faulty pump.	• Replace pump.
	- Faulty pump relay.	• Replace pump relay.
	- Internal fault on control board.	• Replace main control board.
Relief Valve Opening	- System pressure exceeds relief valve setting.	• Lower the system pressure below the 150 PSI rating of the supplied relief valve.

12 Troubleshooting *(continued)*

***Table 12F** Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E00	Invalid lockout code.	• Reset control module. • Switch power OFF and ON. • Replace control module.
E01	The control module has detected parameter settings that are corrupted.	• Replace control module.
E02 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The actual fan RPM is more than 30% above or below the fan speed RPM target.	• Vent/air intake lengths exceed the maximum allowed lengths. Refer to Section 2 - General Venting for proper lengths. • Check for obstruction or blockage in the vent/air intake pipes or at terminations. • Check the wiring connections at the fan and at the main control board. • Replace the fan. • Replace the main control board.
	Blown fuse.	• Replace fuse F2 on the control board, see page 63 of this manual.
E04 (will require a manual reset once condition has been corrected. Press the RESET button on the display to reset.)	Either the optional flow switch or the optional low water cutoff is not making.	• Check pump operation on a call for heat. • Check for closed valves or obstructions in the piping. • Verify system is full of water and all air has been purged from the system. • Check for loose or misplaced jumpers if flow switch or LWCO is not installed.
	Blown fuse.	• Replace fuse F3 on the control board, see page 63 of this manual.
E05 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The flame detector circuit is seeing a flame signal when the gas valve is closed.	• Verify flame is not present. If present, turn off gas supply and replace gas valve. • Check supply voltage for proper polarity. • Check external wiring for voltage feedback. • Check the flame rod and make sure it is clean. • Check the internal wiring for bad connections. • Replace main control board.

12 Troubleshooting

Table 12F (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E06	The outlet water temperature has exceeded the setting of the automatic reset high limit.	• Adjust the set point of the auto reset limit to a higher setting up to a maximum of 200°F. Reference Section 10 - Operating Information for adjusting procedures. • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly into the heating system. Refer to Section 5 - System Piping for the proper piping methods for the Shield water heater. • Check 120 vac to boiler pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. • Replace the main control board if necessary. • If 120 vac is present on a call for heat and the pump is not operating, replace the pump. • If operating on something other than an outlet sensor, check temperature setting of the main control board. • If the optional manual reset high limit has tripped, check setting of the device. • Check resistance of water sensors and compare to Table 12B on page 65 of this manual. Replace sensor if necessary.
E07 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	Either the air pressure switch, the O-temp heat exchanger switch, or the burner door temperature switch has opened. **⚠ WARNING** If the burner door temperature switch trips, the burner door and the burner door temperature switch will be extremely HOT. Allow the unit to cool before touching. Failure to follow this warning could result in severe personal injury, death, or substantial property damage.	**AIR PRESSURE SWITCH** • Check the wiring connections to switch. Wires should be connected to the common and normally closed terminals. • Air intake lengths exceed the maximum allowed lengths. Refer to Section 2 - General Venting for proper lengths. • Check for obstruction or blockage in the air intake pipes or at terminations. • Check reference hoses connected to the air pressure switch for blockage or obstruction. • Inspect the burner. Reference page 61 of this manual for removal and cleaning procedures. Replace if necessary. • Inspect the heat exchanger. Reference page 61 of this manual for removal and cleaning procedures. • Faulty air pressure switch. Replace switch. **O-TEMP HEX SWITCH (Applies to the 286 Model Only):** • Check the wiring connections to the fuse on the heat exchanger. • Check continuity across the thermal fuse. If open, replace heat exchanger. **BURNER DOOR TEMPERATURE SWITCH (Applies to the 286-125 -- 501-125 Models Only):** • The underlying cause of the fault must be identified and resolved by a qualified service technician before resetting the burner door temperature switch. • Check continuity across two contacts. Wires should be connected at both poles of the normally closed switch. • Faulty burner door temperature switch. Replace burner door temperature switch.

12 Troubleshooting *(continued)*

***Table 12F** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E08	Louver proving switch open.	• Check wiring to louver proving switch. • Check louver proving switch.
E09	The blocked drain switch has detected excessive condensate build up inside the unit.	• Check condensate tube from unit to floor drain for proper installation and obstructions. • Inspect condensate trap for blockage. Clean if necessary. • Check for loose wiring connection at wire harness plug. • Bad blocked drain switch. Replace switch.
E11 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The unit has lost flame signal four (4) times during a call for heat.	• Inspect spark electrode and associated wiring for damage and connection. Reference page 60 of this manual for removal and cleaning procedures. Replace if necessary. • Check for proper electrical grounding of the unit. • Check incoming supply gas pressure. Natural gas pressures should be between 4 - 14 inches w.c. and LP gas pressures should be between 8 - 14 inches w.c. Refer to Section 6 - Gas Connections for detailed information concerning the gas supply. • Verify that the plastic hose from the gas valve to the air inlet is connected and is not damaged. • Verify that the vent/air intake pipes are correctly installed and that there are no obstructions. • Check for 24 vac to the gas valve at the 2-pin connection on the side of the main control board during the ignition attempt. If no voltage is present, replace the main control board. • If 24 vac is present at the main control board, check the wiring between the main control board and the gas valve. Replace the wiring if necessary. Do not disconnect the wiring from the gas valve and attempt to measure voltage at that point. The main control board can detect if the gas valve is not connected and will display the Gas Valve or Gas Valve Fail fault. • If 24 vac is present, check the outlet of the valve to ensure the valve is flowing gas. With a manometer connected to the outlet tap of the gas valve, when the unit is in the prepurge period, there should be a negative pressure present. When the valve is energized a change in pressure should occur. If the pressure change does not occur, the gas valve is not opening. Replace the gas valve. • Inspect flame sensor and associated wiring. Reference page 60 of this manual for removal and cleaning procedures. Replace if necessary. • Inspect and clean the heat exchanger as necessary. Reference page 61 of this manual for cleaning procedures. • Inspect the burner. Reference page 61 of this manual for removal and cleaning procedures. Replace if necessary. • Replace the main control board.
E12 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The unit has failed to prove main burner ignition after four (4) attempts.	
n05	The fan speed is being increased due to the flame current going below 5 microamps.	

12 Troubleshooting

***Table 12F** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E13	The flue temperature has exceeded 250°F.	• Inspect the heat exchanger. Reference page 61 of this manual for the procedure on how to clean the flue side of the heat exchanger. • Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 12D on page 65 of this manual. Replace the sensor if necessary. • Verify that the vent/air intake pipes are properly installed and that there are no obstructions. • Replace the main control board.
b05	The flue temperature has exceeded 240°F.	
n04	The fan speed is being limited due to the flue temperature exceeding 215°F.	
E15 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The outlet water temperature has exceeded the 210°F manual reset high limit (MRHL) setting.	• Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly into the heating system. Refer to Section 5 - System Piping for the proper piping methods for the Shield water heater. • Check 120 vac to pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. • Replace the main control board if necessary. • If 120 vac is present on a call for heat and the boiler pump is not operating, replace the pump. • If operating on something other than an outlet sensor, check temperature setting of the main control board. • Check resistance of water sensors and compare to Table 12B on page 65 of this manual. Replace sensor if necessary.
b03	The outlet water temperature has exceeded 195°F.	
n02	The fan speed is being limited due to the outlet temperature exceeding 185°F.	
E18 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The control module reads an excessive temperature difference between the two outlet sensors.	• Check wiring to sensor. Make sure wiring is connected and not damaged. Reconnect / repair wiring if necessary. • Measure the resistance of the sensor and compare to the resistance in Table 12B on page 65 of this manual. Replace sensor if necessary. • Replace control module.
E19 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	One or both of the flue sensors is open or shorted.	• Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 12D on page 65 of this manual. Replace the sensor if necessary. • Replace the main control board.

12 Troubleshooting *(continued)*

***Table 12F** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E21 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	One or both of the outlet sensors has opened or shorted.	• Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistances of the sensors and compare the resistances to the tables on page 65. Replace if necessary.
E22 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The inlet sensor is open.	• Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged.
E23 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The inlet sensor is shorted.	
b01	The temperature has reached the set point + 4°F.	• None
b02	The main control board has received a call for heat too quickly after the previous call for heat has ended.	• The control board will release the call for heat after 60 seconds. • The control board will release the call for heat if the outlet temperature drops 10°F.
b04	The temperature rise across the heat exchanger has exceeded 45°F.	• Verify that the system is full of water and that all air has been properly purged from the system. • Check for 120 vac to the pump motor on a call for heat. If voltage is not present, check the wiring on the pump relay back to the main control board. Replace the main control board if necessary. • If 120 vac is present on a call for heat and the pump is not operating, replace the pump. • Scale accumulation in the heat exchanger. Verify that the water chemistry meets the requirements listed in Section 5 - System Piping.
n03	The fan speed is being limited due to the temperature rise across the heat exchanger exceeding 40°F.	

12 Troubleshooting

Table 12F *(continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
b06	120 vac input to the main control board has dropped below 80 vac.	• Check 120 vac supply to the transformer. • Check wiring connections at the low voltage terminal strip. • Check the wire size/length to remote devices. • Replace the transformer. • Check 24V.
n01	The flue temperature did not change after the burner started firing.	• Verify that the flue sensor is installed. • Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged.
n06	Tank sensor is not connected.	• Check the tank sensor and its associated wiring. Repair or replace as needed.
n07	The inlet sensor has been disconnected.	• Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 65 of this manual. • Replace the sensor if necessary.
n08	The inlet sensor has been shorted.	• Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 65 of this manual. • Replace the sensor if necessary.

12 Troubleshooting *(continued)*

Combustion Analysis Procedure

1. Shut the water heater down by pressing the UP button for five (5) seconds.
2. Locate the flue sensor in the vent connection. Remove the flue sensor and grommet from the unit. **Note:** Combustion measurements will be made at this point.
3. Place the water heater in active position by pressing the UP button for five (5) seconds.
4. Press ENTER plus the UP button for five (5) seconds to enter Service Mode.
5. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
6. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 12G. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the *Troubleshooting* section of this manual for possible causes and corrective actions.
7. Once the combustion analysis is complete, exit Service Mode.
8. Replace the flue sensor and grommet into the vent connection.
9. Place the Shield water heater back into normal operation.

⚠ WARNING You must replace the flue sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

***Table 12G** Flue Products*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

***Table 12H** Troubleshooting Chart - Combustion Levels*

POSSIBLE CAUSE	CORRECTIVE ACTION
Vent/Air Intake Length or Obstruction	• Refer to Section 2 - General Venting for the proper venting and air intake methods for the Shield water heater. • Check for obstructions at the vent/air intake terminals.
Gas Supply Pressure	• Refer to Section 7 - Gas Connections for the proper gas supply for the Shield water heater.
Dirty/Damaged Burner	• Refer to page 61 of this manual for burner removal and cleaning procedures. • Replace burner if necessary.
Gas Valve Adjustment	• Refer to page 74 of this manual for the gas valve adjustment procedure.

12 Troubleshooting

Gas valve adjustment procedure

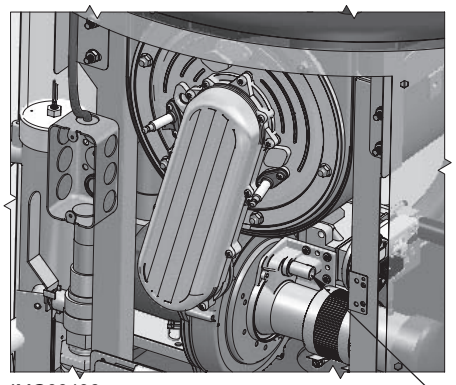
If adjustment of the gas valve is deemed necessary, use the following procedures: (**Note:** The procedures below are model specific.)

Models 126-065 -- 286-125

Locate the throttle adjustment screw on the side of the venturi valve (FIG. 12-2). Using a screwdriver, turn the screw a 1/4 turn **clockwise** to decrease CO_2 levels or a 1/4 turn **counterclockwise** to increase CO_2 levels. After performing one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12H on page 73 or replace the gas valve.

Figure 12-2 *Gas Valve Adjustment: Models 126-065 -- 286-125*

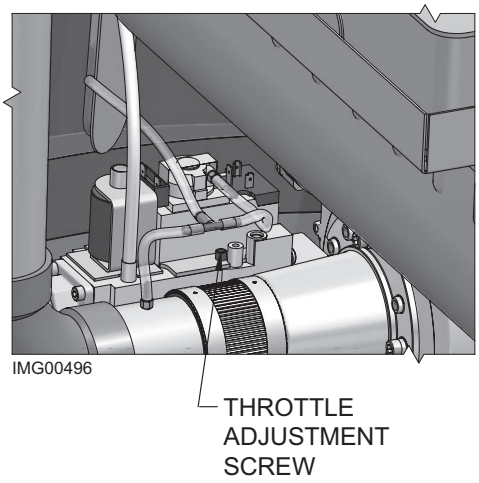


Model 401-125

Locate the throttle adjustment screw on the top of the gas valve, see FIG. 12-3. Using a screwdriver, turn the screw 1/8 turn **counterclockwise** to increase CO_2 levels or 1/8 turn **clockwise** to decrease CO_2 levels. After one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12H on page 73 or replace the gas valve.

Figure 12-3 *Gas Valve Adjustment: Model 401-125*

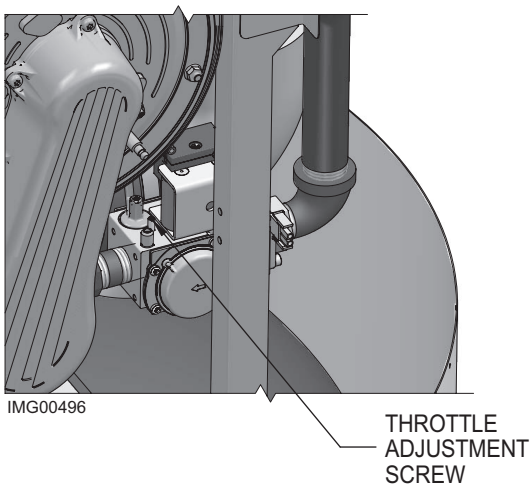


Model 501-125

Locate the throttle adjustment screw on top of the gas valve, see FIG. 12-4. Using a screwdriver, turn the screw a 1/4 turn **counterclockwise** to increase CO_2 levels or a 1/4 turn **clockwise** to decrease CO_2 levels. After one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

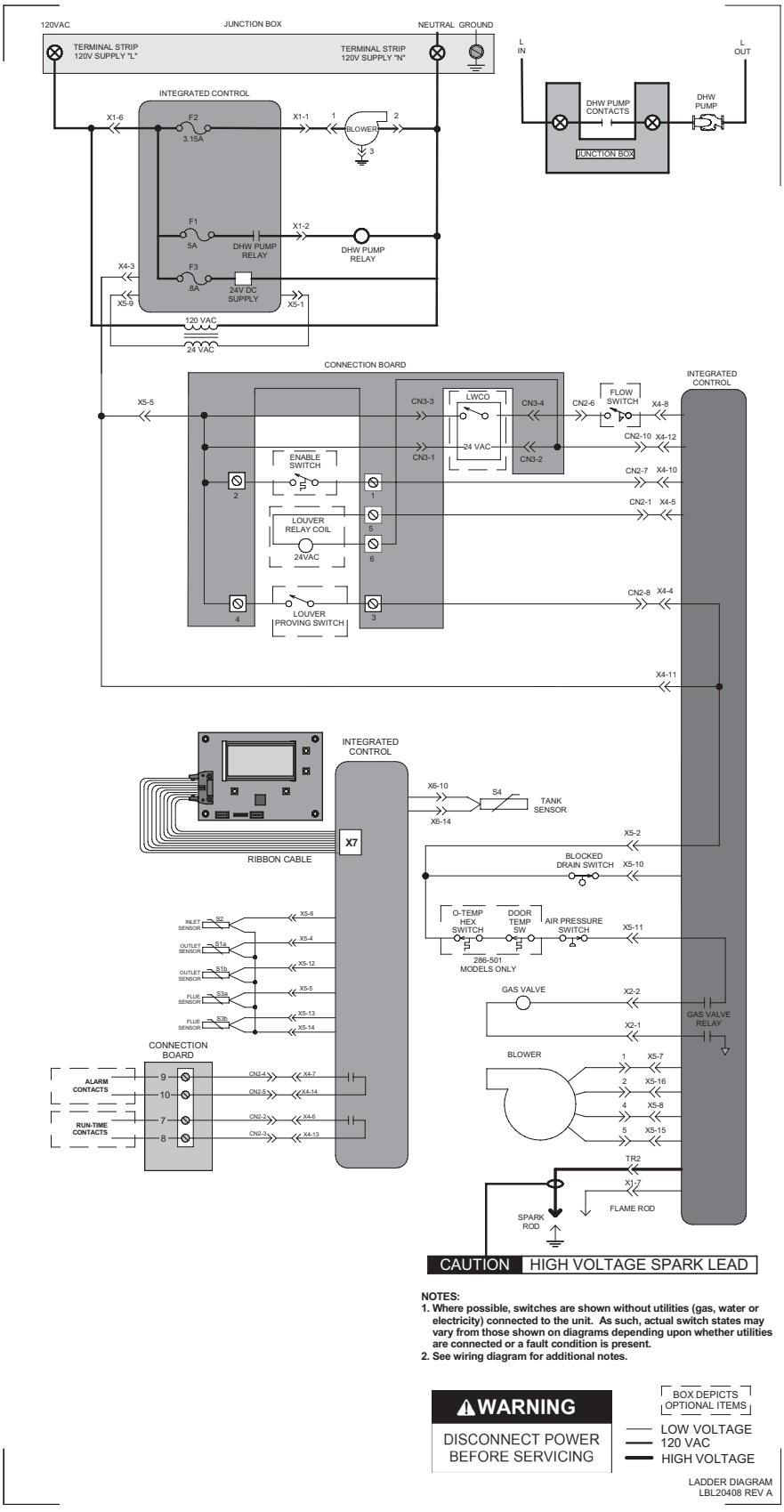
If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12H on page 73 or replace the gas valve.

Figure 12-4 *Gas Valve Adjustment: Model 501-125*



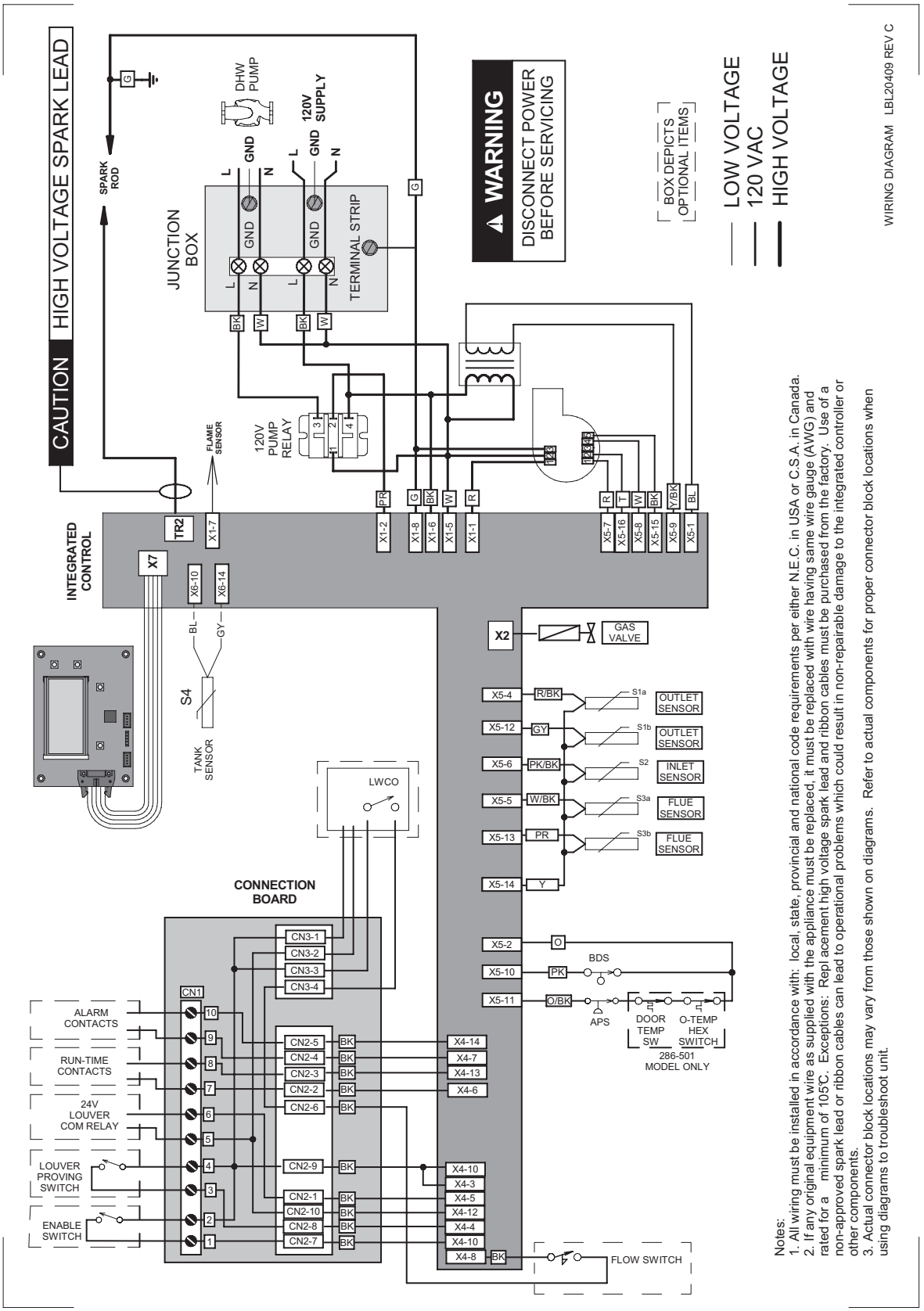
13 Diagrams

Figure 13-1 *Ladder Diagram*



13 Diagrams

Figure 13-2 *Wiring Diagram*



Notes

Notes

Notes

Revision Notes: *Revision A (ECO #C12258) initial release.*

Revision B (ECO #C12665) reflects the addition of the CSA Low Lead Content logo.

Revision C (ECO #C11814) reflects the addition of Metal Fab and Security Chimney to the manual.

Revision D (ECO #C13833) reflects the removal of the page number reference on page 15, the addition of the corrosive contaminant warning on page 3 (R06313), changes made to Table 6A - Gas Piping Chart on page 41 (R6621), the addition of the Temperature Parameter Setting Table and HW Temperature Setting instructions on pages 52 and 53 (R6658), edits made to the callouts on page 5 (R06493), along with updating the flex piping information (R06464) on page 21.

Revision E (ECO #C14411) reflects a note that the SNA286-125 model can be vented using 3" diameter pipe up to a maximum of 60 equivalent feet, pages 7 and 17, along with changing out LBL20026 and LBL20025 (R6979).

Revision F (ECO #C14713) reflects high altitude updates.

Revision G (ECO #C14988) reflects the correction of FIG. 2-2 on page 15.

Revision H (ECO #C15251) reflects the addition of the burner door temperature switch updates (R6322).

Revision I (ECO C16918) reflects the update of ratings information on page 7 (R07744), FIG. 3-13 description on page 29 (R07478), water chemistry information on page 35 (R07142), and water column information on page 40.

Revision K (Change #500000930) reflects edits made to FIG 4-7 on page 33.

Revision L (PCP# 3000001537 / CN# 500001784) reflects the addition of a note that the starter is factory installed on the 126-201 models under General Venting on page 20.

Revision M (PCP# 3000000426 / CN# 500000623) reflects the addition of combustion clearance dimensions in FIG.'s 1-1 and 1-2 on page 9.

Revision N (PCP# 3000004287 / CN# 500004864) reflects a change to the numbers of the Polypropylene Adapters in Table 2F on page 21. Figure 2-9 has also been updated.

Revision P (PCP# 3000005143 / CN# 500006666) reflects the addition of new venting category information on pages 25 through 27.

Revision R (PCP# 3000004438 / CN# 500005574) reflects an update to the flue temperatures on page 54.

Revision T (PCP# 3000006133 / CN# 500007549) reflects the addition of a PVC-DWV vent fitting in Table 2D on page 20.

Revision U (PCP# 3000008814 / CN# 500008824) reflects changes in the water chemistry information on pages 38-41, 50, and 58.

Revision V (PCP #3000022251 / CN #500012175) reflects an update to the Delta T limits on pages 54 on and 71.

Revision W (PCP #3000023864 / CN #500013813) reflects an update to the water chemistry chart on page 50.

Revision X (PCP #3000027532 / CN #500017086) reflects the addition of Table 12C.

Revision Y (PCP #3000030854 / CN #500020183) reflects the addition of the building recirculation filter on pages 38 and 58, an update to Notice 3 on page 50, and an update to the piping diagrams.

Revision AA (PCP #3000031981 / CN #500021055) reflects an update to the wiring diagram in Figure 13-2.

Revision AB (PCP #3000033358 / CN #500022063) reflects update made to the wiring diagram.

Revision AC (PCP #3000033359 / CN #500022168) reflects an update to the input minimum and maximum rates on page 7.

SHW-I-S_MM #100161683_DIR #2000017192_Rev AC
07/19

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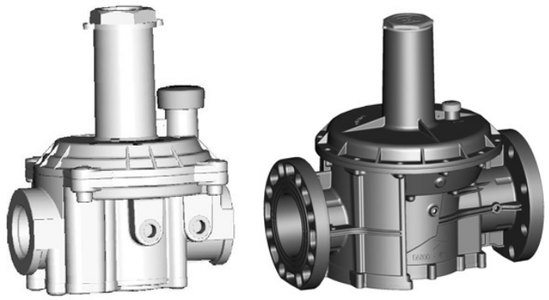
US OPERATING AND MAINTENANCE MANUAL SINGLE GOVERNOR

FR MANUEL DE FONCTIONNEMENT ET D'ENTRETIEN DU GOVERNOR MODELE SIMPLE

E MANUAL DE OPERACIÓN Y MANTENIMIENTO

GOVERNOR GAS REGULATOR
REGULATEUR DE GAZ GOVERNOR
REGULADOR DE GAS GOVERNOR



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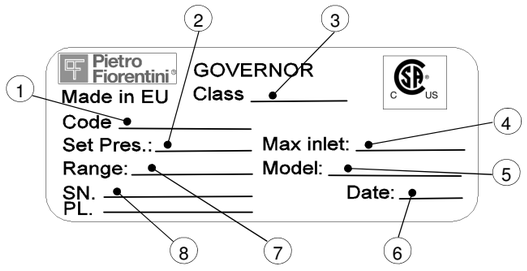

1. Code-model
   Modèle-Code
   Código-modelo
2. Outlet Pressure
   Pression de sortie
   Presión de salida
3. Class
   Classe
   Clase
4. Max operating pressure
   Max pression de fonctionnement
   Max. presión de operación
5. Model
   Modèle
   Modelo
6. Production date
   Date de production
   Fecha de producciòn
7. Spring range
   Range de ressort
   Range de resorte
8. Serial Number + Lot
   Numero de serie + Lot
   Número de serie + Lote

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US GOVERNOR GAS REGULATOR

The ½" - 4" Governor gas regulators comply with and are certified to CSA 6.22a-2005 and ANSI Z21.80a-2005 for 2 PSIG inlet applications. The Governor design incorporates an integral vent limiter in the regulator. To ensure the installation complies with CSA 6.22a-2005 and ANSI Z21.80a-2005, the vent cap should be left in place and at no time should any restriction or plug be installed in the vent cap of the regulator. When using an external vent limiter, the flat top of the vent limiter must always be facing up, with the threads facing down, so it operates properly. If mounting the regulator in position (B) or (C), you must use the 90 degree external vent limiter adapter to ensure the vent limiter faces up (Fig. 2).

FR REGULATEUR DE GAZ GOVERNOR

Les régulateurs de ½" - 4" sont conformes et certifiés aux normes CSA 6.22a-2005 et ANSI Z21-80a-2005 pour des applications avec entrée de 2 PSIG. La conception du régulateur Governor inclut un limiteur intégral d'évent. Afin de s'assurer que l'installation soit conforme aux normes CSA 6.22a-2005 et ANSI Z21-80a-2005 le couvercle de l'évent doit être laissé à sa place et il ne faut jamais installer aucune restriction ou bouchon sur le couvercle de l'évent du régulateur. Lorsqu'un limiteur d'évent externe est utilisé, le dessus plat du limiteur d'évent doit toujours être vers le haut, avec le filetage vers le bas pour qu'il fonctionne correctement. Si le régulateur est installé en position (B) ou (C), vous devez utiliser l'adaptateur 90 degré du limiteur d'évent externe pour s'assurer que le limiteur d'évent soit vers le haut (Fig. 2).

E REGULADOR DE GAS GOVERNOR

El GOVERNOR de presion de gas de ½" a 4" cumple con y esta certificado bajo CSA 6.22a-2005 y ANSI Z21.80a-2005 para aplicaciones con entrada de 2 PSIG. El diseño del GOVERNOR incorpora una limitador integral de venteo en el regulador. Para asegurar que la instalación cumple con CSA 6.22a-2005 y ANSI Z21.80a-2005, la tapa del venteo debe dejarse en su lugar y por ninguna razón debe instalarse una restricción o tapón en el venteo del regulador. Cuando utilice un limitador externo de venteo, la superficie plana del limitador de venteo debe estar orientada hacia arriba, con la rosca orientada hacia abajo, para que opere correctamente. Si el regulador es instalado en posición (B) o (C), debe utilizar en el limitador externo de venteo un adaptador de 90˚ para asegurarse que el limitador este orientado hacia arriba (Fig. 2).

US The single unit Governor regulator is designed and CSA certified for 2 PSIG maximum inlet pressure. Inlet pressures above 2 PSIG require an over pressure protection device.
The Governor design incorporates an integral vent limiter in the regulator. To ensure that installation of the Governor regulator complies with CSA 6.22a-2005 and ANSI Z21.80a-2005, the vent cap, or external vent limiter (if installed), should be left in place and at no time should any restriction or plug be installed in the vent connection of the regulator. If venting is required, use a union at the vent connection and install a vent line to the atmosphere, in accordance with all local codes, standards and requirements.

15 feet is the maximum vent line distance that can be run before affecting the performance of the regulator.
Recommended diameter of the vent line for model:
- 1/4" NPT x Ø6mm pour le modèle: 1/2" - 3/4" - 1" NPT
- 1/2" NPT x Ø10mm pour le modèle: 1 1/4" - 1 1/2" - 2" NPT
- 1/2" NPT x Ø12mm pour le modèle: 2 1/2" - 3" - 4" ASME

FR Le régulateur Governor, modèle unité simple est conçu et certifié CSA pour pression maximum d'entrée de 2 PSIG. Les pressions d'entrée supérieures à 2 PSIG exigent un mécanisme de protection contre la surpression.
Le projet du régulateur inclut un limiteur d'évent intégral dans le régulateur. Afin de s'assurer que l'installation du Governor soit conforme aux normes CSA 6.22a-2005 et ANSI Z21-80a-2005, le bouchon de vent, ou le limiteur de vent externe (si installé), doit etre laissé en place et aucune restriction ni aucune prise doit etre installée dans la connection de vent du regulateur. Si un event est nécessaire, il faut utiliser un raccord sur la connexion de l'évent et installer une ligne d'évent à l'atmosphère en conformité avec toutes les normes et conditions ainsi que les codes locaux.

15 pieds est la distance maximale d'évent qu'on peut parcourir avant d'affecter la performance du régulateur.
Diamètre recommandé de la ligne d'évent pour le modèle:
- 1/4" NPT x Ø6mm pour le modèle: 1/2" - 3/4" - 1" NPT
- 1/2" NPT x Ø10mm pour le modèle: 1 1/4" - 1 1/2" - 2" NPT
- 1/2" NPT x Ø12mm pour le modèle: 2 1/2" - 3" - 4" ASME

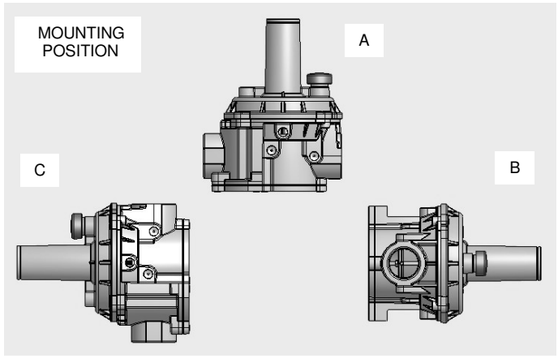
E El regulador GOVERNOR simple es disenado y certificado por CSA para 2 PSIG de presion de entrada maxima. Para presiones arriba de 2 PSIG, se require el uso de un dispositivo de proteccion por sobre presion.
El diseño del GOVERNOR incorpora una limitador integral de venteo. Para asegurarse que el GOVERNOR cumple con CSA 6.22-a-2005 y ANSI Z21.80a-2005, la tapa del venteo o el limitador de venteo (si es instalado), deben dejarse en su lugar y por ninguna razón debe instalarse una restricción o tapón en el venteo del regulador. Si el venteo es requerido, use una unión en la conexión del venteo e instale una línea de venteo a la atmosfera, de acuerdo con todos los códigos, estándares y requerimientos locales.

15 pies es la maxima longitud de la linea de venteo sin que se afecte el desempeño del regulador.
Diámetro recomendado de la linea de venteo para el modelo:
- 1/4" NPT x Ø6mm pour le modèle: 1/2" - 3/4" - 1" NPT
- 1/2" NPT x Ø10mm pour le modèle: 1 1/4" - 1 1/2" - 2" NPT
- 1/2" NPT x Ø12mm pour le modèle: 2 1/2" - 3" - 4" ASME

THE GOVERNOR GAS REGULATOR CAN BE MOUNTED IN A VERTICAL AND HORIZONTAL POSITION.

LE RÉGULATEUR DE GAZ GOVERNOR PEUT ÊTRE INSTALLÉ EN POSITION VERTICALE ET HORIZONTALE.

EL REGULADOR DE GAS GOVERNOR PUEDE SER MONTADO EN POSICION VERTICAL Y HORIZONTAL.



ADJUSTMENT SPRINGS
You will need a 7/16" Allen wrench to remove the cap 1, and 7/16" or 8mm Allen wrench on 1/2" to 1 1/2" models and 7/16" or 12 mm Allen wrench on 2" and larger models to adjust the spring.

RESSORTS DE RÉGLAGE
Vous devez utiliser un clé Allen de 7/16" afin de retirer le bouchon pos. 1 et un clè Allen de 7/16" ou 8 mm sur 1/2 "à 1 1/2" modèles et une clé Allen de 7/16"ou 12 mm sur 2" et les grands modèles pour ajuster le ressort.

RESORTES DE AJUSTE
Se require de una llave Allen de 7/16" para remover la tapa 1, y una llave de 7/16" o 8 mm para los modelos de 1/2" a 1 1/2" y una llave Allen de 7/16" o 12 mm para modelos de 2" y mayores para ajuste del resorte.

ADJUSTMENT SPRINGS
RESSORTS DE REGLAGE
RESORTES DISPONIBLES

GOVERNOR MODEL	1/2"- 3/4"- 1"	1/2"- 3/4"- 1"	1 1/4" - 1 1/2"	2"	2 1/2" - 3" - 4"
SPRING RANGE COLOR	SPRINGS CODE				
2" - 5" w.c. **Green** 0.072 - 0.18 psig	64470219	64470228	64470246	64470255	64470320
3" - 8" w.c. **Red** 0.1 - 0.29 psig	64470220	64470229	64470247	64470256	64470324
6" - 14" w.c. **Black** 0.21 - 0.5 psig	64470397	64470380	64470381	64470382	64470383
9.8" - 27.5" w.c. **Yellow** 0.354 - 0.99 psig	64470295	64470297	64470299	64470301	64470321
23.6" - 59" w.c. **Violet** 0.85 - 2.12 psig	64470296	64470298	64470300	64470302	64470322
55" - 118" w.c **Orange** 1.98 - 4.25 psig		64470235	64470253	64470262	64470323

US SPECIFICATIONS

Inlet pressure range: 4" w.c. to 7 PSIG
Maximum Emergency Inlet Exposure Pressure: 80 PSIG
CSA Certified Maximum inlet pressure: 2 PSIG
Outlet pressure range: 2" w.c. to 0.5 PSIG for CSA Class I
Minimum operating differential pressure: Δ P: 1" w.c.
CSA Outlet pressures to 0.5 PSIG for Compliance
Temperature class: -40° F to + 150° F (-40° C to +65.5° C)
Suitable for use with Natural Gas, LPG, Propane-air and any non-corrosive gas
Designed for Indoor and Outdoor Installations.

NOTE: Installers and servicers must be trained, competent and should have the knowledge on how to install and maintain the equipment correctly.

1. INSTALLATION INSTRUCTIONS: All work should be carried out by trained, qualified and authorized personnel using the correct tools and equipment to install and adjust the regulator to all relevant standards, local codes, requirements and procedures. Ensure the installation is approved and the piping is clear of all oil and debris and has been tested for leaks. Make sure the piping is supported and no stressful force is placed upon the regulator. The regulator can be mounted in horizontal and vertical positions with the directional flow arrow facing in the direction of the flow. Preferably, the regulator should be mounted in horizontal position (A) on the pipe with the pressure adjustment screw upright. If using an external vent limiter, the flat top of the vent limiter must be facing up, with the threads facing down, so it operates properly. If mounting the regulator in position (B) or (C), you must use the 90 degree external vent limiter adapter to ensure the vent limiter faces up (Fig. 2). When venting is required, remove the cover of the vent cap using a union at the connection, then connect the vent pipe, being careful to place the outlet in a safe place, in accordance to all local codes, standards, and requirements. If the outlet pipe increases or decreases more than 1 pipe size, an external control line is recommended.

2. STARTUP: Slowly open the inlet shut-off valve. Slowly, partially open the downstream valve to allow a slow pressurizing of the downstream system. After the downstream system is pressurized, completely open the downstream shut-off valve. Verify that there is no leakage in the system. Verify that the burner ignition is connected. Verify the working pressure at different flow rates and check lock up pressure at a flow rate of 0.

3. USE OF THE INLET AND OUTLET PRESSURE TEST PORT (OPTIONAL):
Before any use of the test ports, close the inlet valve completely and depressurize the Governor. The test ports usually have a plastic pipe cap in them, and if so, remove the cap. With the regulator removed from the line, activate the port by drilling a 1/16" hole in the port. Install the regulator and connect the gauge to the port. Slowly open the inlet shut-off valve and check for leaks within the connected measuring equipment. Continue the start-up as indicated in step 2. When the measuring equipment is disconnected, plug the test port by using a threaded plug.

4. PRESSURE REGULATION ADJUSTMENT: The Governors are set by the factory to the regulation pressure indicated on the nameplate. You will need a 7/16" Allen wrench to remove cap 1, and 7/16" or 8mm Allen wrench on 1/2" to 1 1/2" models and 7/16" or 12 mm Allen wrench on 2" and larger models to adjust the spring. To adjust pressure, unscrew cap 1, turning ring nut 4 clockwise to increase the pressure, and counter-clockwise to decrease the pressure.

5. CHANGING THE SETTING BY SPRING REPLACEMENT: Choose the required type of spring as indicated on the table. Unscrew cap 1 and ring nut 4. Remove the existing spring and insert the new spring. Note the new setting value on the label. Reassemble the above parts and make a new setting as indicated in step 4. When the adjustments is finished, secure cap 1 and seal it, if necessary.

6. REPLACING THE FILTER CARTRIDGE (OPTIONAL): Close the inlet and outlet valves and slowly depressurize the Governor regulator. Ensure that there is no pressure inside the Governor regulator, then remove the screws on the cover pos. 6. Remove the cover pos. 3. Remove the filter cartridge pos. 5 and replace it with the new one. Place the new cartridge in its seat and ensure that the new cartridge fits perfectly inside the Governor housing guide. CAREFULLY inspect the O-ring seal and replace it, if necessary. Reassemble the cover, making sure that the cartridge fits perfectly in the cover seat and tighten the screws crosswise. Pressurize the Governor regulator by SLOWLY opening the inlet valve. Check the seal around the cover and the screws using foam or soapy water. After a successful test, SLOWLY open the outlet valve.

7. RECOMMENDATIONS: Check the equipment condition periodically. Check the downstream pressure periodically. Verify that the whole system works perfectly (the smell of gas odor indicates a leak). Perform periodical maintenance on all regulated equipment.

FR SPECIFICATIONS

Gamme de pression d'entrée: 4" w.c. à 7 PSIG.
Possibilité de pression d'entrée maximum en situation d'urgence: 80 PSIG.
Pression d'entrée maximum certifié CSA : 2 PSIG.
Gamme de pression de sortie: 2" w.c. à 0.5 PSIG pour CSA Classe I
Pression différentielle minimale de fonctionnement Δ P : 1" w.c.
Pression de sortie à 0.5 PSIG pour conformité CSA.
Classe de température: -40° F à + 150° F (-40° C à +65.5° C)
Prévu pour utilisation avec du Gaz Naturel, GPL, Air Propane et tout gaz non corrosif.
Conçu pour des installations intérieures et extérieures.

REMARQUE: Le personnel préposé à l'entretien doit être formé et compétent et il doit avoir la connaissance pour installer et entretenir correctement l'équipement.

1. DIRECTIVES D'INSTALLATION : Tout le travail doit être effectué par du personnel formé, qualifé et autorisé, qui utilise les instruments et l'équipement approprié pour installer et régler le régulateur selon toutes les normes relatives, conditions et procédures ainsi que les codes locaux. Il faut s'assurer que l'installation soit approuvée, et que la tuyauterie ne contienne pas d'huile ou des débris et qu'elle ait été vérifiée contre toutes fuites. S'assurer que la tuyauterie est soutenue et qu'aucune tension n'est mise sur le régulateur. Le régulateur peut être installé dans les positions verticale et horizontale avec la flèche dans le sens de la direction du flux. De préférence, le régulateur doit être installé en position horizontale (A) sur le tuyau avec la vis de réglage de pression vers le haut. Lorsqu'un limiteur d'évent externe est utilisé, le dessus plat du limiteur d'évent doit toujours être vers le haut, avec le filetage vers le bas pour qu'il fonctionne correctement. Si le régulateur est installé en position (B) ou (C), vous devez utiliser l'adaptateur 90 degré du limiteur d'évent externe pour s'assurer que le limiteur d'évent soit vers le haut (Fig. 2). Lorsqu'un évent est requis, enlever le couvert de l'évent, utilisant un raccord sur la connexion, ensuite connecter l'évent en s'assurant de positionner la sortie dans un endroit sécuritaire, en conformité avec toutes les normes et conditions ainsi que les codes locaux. Si les tuyaux de sortie augmente ou diminue de plus de 1 la taille du tuyau, une ligne de commande externe est recommandée.

2. DÉMARRAGE: Ouvrir lentement la vanne d'entrée. Lentement ouvrir partiellement la vanne en aval pour permettre une pressurisation lente du système en aval. Après que le système en aval est pressurisé, ouvrir complètement la vanne en aval. Vérifier qu'il n'y ait pas de fuites dans le système. Vérifier que l'allumage du brûleur soit branché. Vérifier la pression de fonctionnement à différents débits et vérifier la fermeture complète de la pression à un débit de 0.

3. EMPLOI DU PORT D'ESSAI DE LA PRESSION D'ENTRÉE ET DE SORTIE (OPTIONNEL): avant d'utiliser les ports d'essai, il faut fermer complètement la vanne d'entrée et dépressuriser le régulateur Governor. Les ports d'essai ont normalement un bouchon en plastique à l'intérieur, si c'est le cas, il faut enlever le bouchon. Lorsque le régulateur est enlevé de la ligne, il faut faire un trou de 1/16" dans le port pour l'utilisation. Installer le régulateur et brancher la jauge au port. Ouvrir lentement la vanne d'entrée et vérifier s'il y a des fuites à l'équipement de mesurage (optionnel). Continuer le démarrage comme indiqué au paragraphe 2. Lorsque l'équipement de mesurage est débranché, boucher le port d'essai avec un bouchon fileté.

4. RÉGLAGE DE LA PRESSION: les régulateurs Governor sont réglés en usine selon la pression indiquée sur le régulateur. Vous devez utiliser un clé Allen de 7/16" afin de retirer le bouchon pos. 1 et un clè Allen de 7/16" ou 8 mm sur 1/2" à 1 1/2" modèles et une clé Allen de 7/16 "ou 12 mm sur 2" et les grands modèles pour ajuster le ressort. L'échelle de pression du ressort est indiquée sur la plaque signalétique. Pour ajuster la pression, dévisser le couvercle 1, ensuite tourner en la bague 4 en sens horaire pour augmenter la pression et en sens anti-horaire pour la diminuer.

5. CHANGEMENT DU RÉGLAGE EN REMPLAÇANT LE RESSORT :
Choisir le type de ressort requis comme indiqué dans la table; dévisser le couvercle 1 et la bague 4. Enlever le ressort existant et introduire le nouveau ressort et noter la nouvelle valeur de réglage sur l'étiquette. Remonter les pièces susmentionnées et faire un nouveau réglage tel qu'indiqué à l'étape 3 ci-haut. Lorsque le réglage est terminé, fixer le couvercle 1 et sceller si nécessaire.

6. REMPLACEMENT DE LA CARTOUCHE DU FILTRE (OPTIONNEL): fermer les vannes d'entrée et de sortie et dépressuriser lentement le régulateur. Assurez-vous qu'il n'y ait pas de pression dans le régulateur, ensuite enlever les vis sur le couvercle pos. 6. Enlever le couvercle pos 3, enlever la cartouche du filtre pos 5 et la remplacer avec la nouvelle. Placer la nouvelle cartouche dans son siège et s'assurer que la nouvelle cartouche s'adapte parfaitement à l'intérieur du guide d'emplacement du régulateur. SOIGNEUSEMENT inspecter la bague O-ring et la remplacer si nécessaire. Remonter le couvercle en vous assurant que la cartouche s'adapte parfaitement au siège à l'intérieur du couvercle, et serrer les vis par un mouvement croisé. Pressurizer le régulateur en ouvrant LENTEMENT la vanne d'entrée. Vérifier le joint d'étanchéité autour du couvercle et des vis utilisant de la mousse ou de l'eau savonneuse. Après une vérification réussie, ouvrir LENTEMENT la vanne de sortie.

7. RECOMMANDATIONS: ne pas utiliser le régulateur Governor comme un levier. Vérifier périodiquement les conditions de l'équipement. Vérifier périodiquement la pression en aval. Vérifier que tout le système fonctionne parfaitement (l'odeur de gaz indique une fuite). Effectuer une maintenance périodique sur l'équipement réglé.

E ESPECIFICACIONES

Presión de entrada: 4" w.c. a 7 PSIG.
Maxima presión de entrada en caso de emergencia: 80 PSIG.
Presión de entrada maximum certificada CSA : 2 PSIG.
Rango de presión de salida: 2" w.c a 0.5 PSIG para CSA Clase I.
Mínima presión diferencial de operación ΔP: 1" w.c.
Para conformidad con CSA presiones de salida hasta 0,5 PSIG.
Clase de temperatura: -40°F to + 150°F (-40°C +65.5°C)
Adecuado para su uso con Gas Natural, LPG, Propano-aire y cualquier otro gas no corrosivo.
Diseñado para instalación interior y exterior.

NOTA: Instaladores y operadores deben ser entrenados, competentes y deben tener conocimiento sobre la instalacion y mantenimiento correcto del producto.

1. INSTRUCCIONES DE INSTALACION: todo trabajo debe ser realizado por personal entrenado, calificado y autorizado, utilizando las herramientas y equipo correctos y setear el regulador segun los estandares, codigos locales, requerimientos y procedimientos. Asegurarse que la instalacion es aprobada y la tuberia este libre de aceite, suciedad y ha sido probada para fugas. Asegurarse que la tubería este soportada y no hayan fuerzas que produzcan un estrés sobre el regulador. El regulador puede ser instalado en posicion vertical y horizontal con el sentido de flujo segun la direccion de la fecha. Preferiblemente, el regulador debe ser montado en la tubería en la posición horizontal (A) con la tuerca de ajuste de la presión hacia arriba. Cuando se utiliza un limitador de venteo externa, la parte superior plana del limitador de venteo debe estar siempre al día con el hilo hacia abajo para que funcione correctamente. Si el regulador está instalado en posición (B) o (C), debe utilizar en el limitador externo de venteo un adaptador de 90° para asegurarse que el limitador este orientado hacia arriba (Fig. 2). En caso de requerir venteo, remover la tapa del venteo utilizando una union en la conexion, luego conecte la tuberia de venteo, siendo cuidadoso de llevar la salida en un lugar seguro de acuerdo con código, estándar y requerimiento local. Si la tubería de salida aumenta o disminuye más de 1 tamaño de la tubería, se recomienda una línea de control externo.

2. ARRANQUE: lentamente abra la valvula de corte a la entrada. Lentamente, abra parcialmente la valvula a la salida para permitir presurización del sistema aguas abajo. Luego que el sistema aguas abajo este presurizado, abra completamente la valvula de corte de salida. Verifique que no hay fugas en el sistema. Verifique que la ignicion del horno este conectado. Verfique la presión operacional a diferentes flujos y chequee la presión de cirre a flujo cero.

3. USO DEL PUERTO DE PRUEBA DE PRESION DE ENTRADA Y SALIDA (OPTIONAL): antes de usar cualquiera de los puertos de prueba, cierre la valvula de entrada completamente y despresurice el Governor. Los puertos de prueba tienen usualmente una tapa de plástico, si es asi, remueva la tapa. Con el regulador retirado de la tubería, activar el puerto perforando un orificio de 1/6" en el puerto. Instalar el regulador y conectar una manometro en el puerto. Lentamente abra la valvula de corte a la entrada y verifique que no hay fugas en el equipo de medición de presion. Continue con el arranque como esta descrito en el paso 2. Cuando el equipo de medición sea desconectado, tape el puerto de prueba usando una tapon roscado.

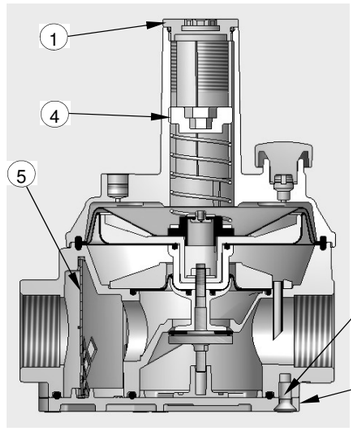
4. AJUSTE DE LA PRESION DE REGULACION: el Governor es ajustado por la fabrica a la presión de regulación indicada en el regulador. Se require de una llave Allen de 7/16" para remover la tapa 1, y una llave de 7/16" o 8 mm para los modelos de 1/2" a 1 1/2" y una llave Allen de 7/16" o 12 mm para modelos de 2" y mayores para ajuste del resorte. El rango de ajuste de presión del resorte esta indicado en la placa. Para ajustar la presión, destornille la tapa 1, de vuelta a la tuerca 4 en sentido horario para incrementar la presión y en sentido anti-horario para reducir la presión.

5. CAMBIANDO EL AJUSTE MEDIANTE LA SUBSTITUCION DEL RESORTE
Elija el tipo de resorte requerido como esta indicado en la table. Remueva la tapa 1 y la tuerca 4. Remueva el resorte existente e inserte el Nuevo resorte. Anotar el nuevo valor de ajuste en la etiqueta. Reensamble las partes anteriores y obtenga el nuevo punto de ajuste como esta indicado en el paso 4. Cuando ha completado el ajsute, asegure la tapa 1 y ponga el precinto, si es necesario.

6. SUBSTITUCION DEL CARTUCHO DE FILTRACION (OPCIONAL):
Cerrar lentamente las valvulas de entrada y salida y lentamente despresurizar el Governor. Asegurarse que no hay presión interna en el regulador Governor, luego remueva los tornillos en la tapa pos. 6. Remueva la tapa pos. 3, remueva el cartucho de filtracion pos. 5 and substituya con uno nuevo. Colocar el el nuevo cartucho en su asiento, y asegurarse que el nuevo cartucho entra perfectamente dentro de la guía de la abertura. CUIDADOSAMENTE inspeccione el sello O-Ring y reemplazarlo, si es necesario. Re-ensamblar la tapa, asegurandose que el cartucho entra perfectamente en el asiento de la tapa, y ajuste los tornillos en orden cruzado. Presurizar el regulador Governor, LENTAMENTE abriendo la valvula de entrada. Chequear el sello alrededor de la tapa y los tornillos utilizando espuma o agua jabonosa. Despues de una prueba exitosa, LENTAMENTE abrir la valvula de salida.

7. RECOMENDACIONES: Chequear la condicion del equipo perioodicamente. Chequear la presión aguas abajo periódicamente. Verificar el que sistema completo funciona perfectamente (el olor a gas indica la existencia de una fuga). Realizar mantenimiento periódico en todo equipo regulado.

Fig. 1



For Indoor installations: no external vent is needed as per CSA 6.22a -2005 and ANSI Z21.80a-2005 IN ACCORDANCE WITH ALL LOCAL CODES AND STANDARDS

Pour installations intérieures: Aucun évent nécessaire, conformément aux normes CSA 6.22a-2005 et ANSI Z21.80a-2005 LORSQUE CELA EST ACCEPTÉ PAR LES NORMES ET CODES LOCAUX.

Para instalaciones interiores: El venteo al exterior no es requerido de acuerdo con CSA 6.22-a-2005 y ANSI Z21.80a-2005, CUANDO ES ACEPTADO POR CODIGO Y ESTANDAR LOCAL

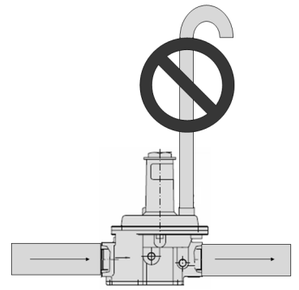
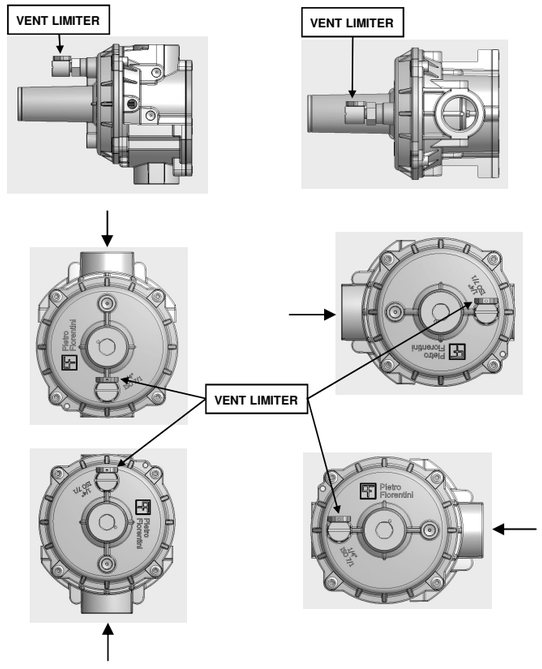


Fig. 2



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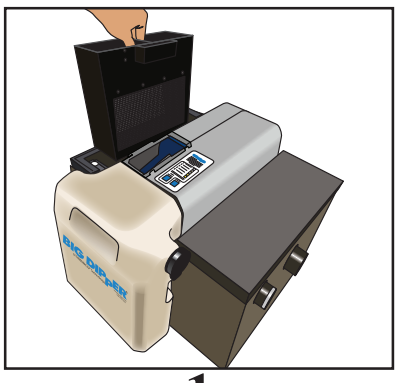
Maintenance Poster

Daily • Diariamente • 日常维护



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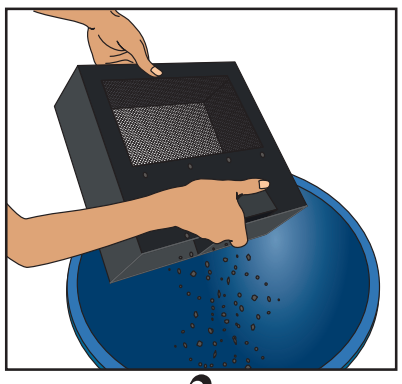

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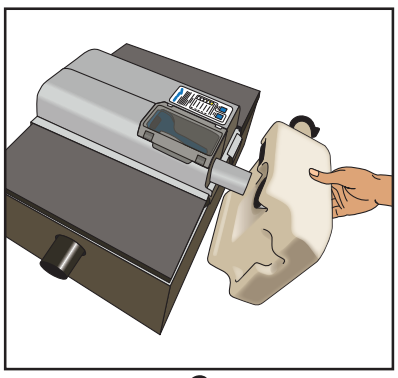

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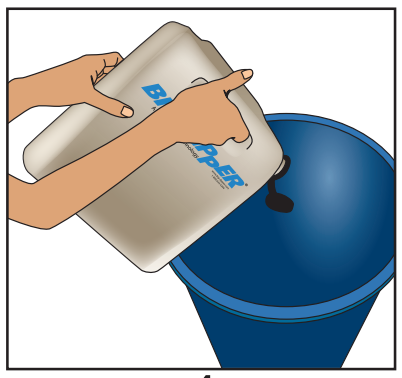

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Daily

1 & 2 - Remove solids strainer basket and empty into trash. Spray down solids strainer basket.
3 & 4 - Empty collected grease into recycling barrel or dispose in trash.

Diariamente

1 & 2 - Vacíe los residuos alimenticios capturados en el cedazo/canasta en un recipiente para basura. Enjuague el cedazo/canasta después de vaciarlo.
3 & 4 - Vacíe la grasa recolectada en el barril de reciclaje.

每日一次

1 & 2 - 把滤网里的残渣到入垃圾桶，并将滤网冲洗干净。
3 & 4 - 将废油收集桶中的废油倒入废油回收桶。

Weekly • Semanalmente • 每周维护

Weekly

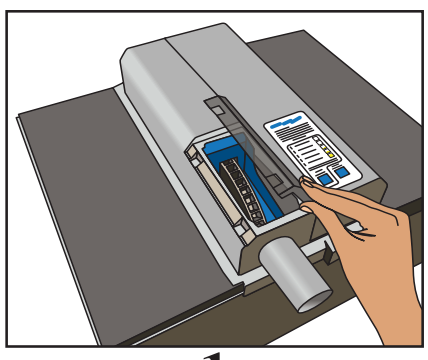
1 - Open Wiper Assembly Cover.
2 & 3 - Remove and clean blue wiper assembly.
4 - Replace wiper assembly. Clean grease outlet trough.

Semanalmente

1 - Levante la cubierta de las aspas limpiadoras.
2 & 3 - Remueva y limpie las aspas azules.
4 - Regrese las aspas azules y limpie el canal de la salida de la grasa.

每周一次

1 - 打开污水箱盖。
2 & 3 - 清洁括油刀片。
4 - 清洁废油出口处。



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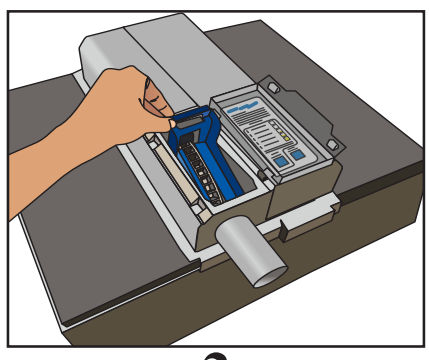

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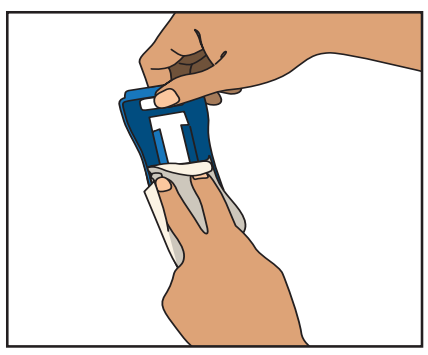

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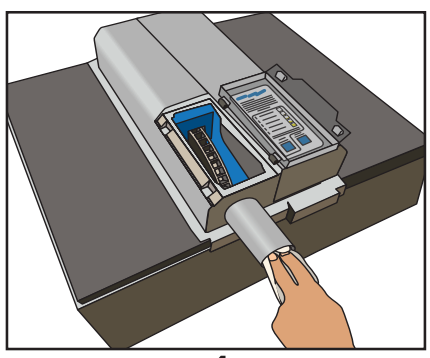
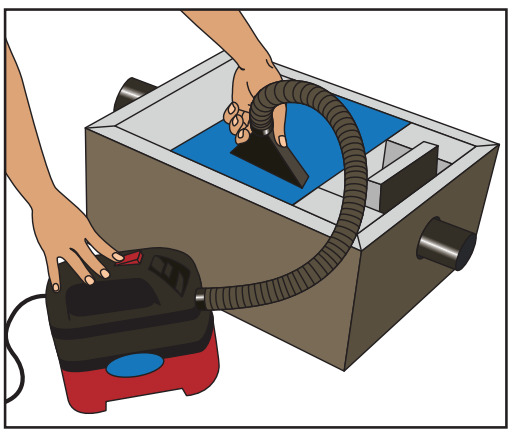


4

Quarterly • Trimestral • 每月维护



Quarterly

1 - Vacuum out fine sediment from bottom of tank OR stir up sediment at bottom of tank with long handled spoon while water is running through unit.

Trimestral

1 - Aspire los sedimentos finos del fondo del tanque O agite estos sedimentos con una cuchara de mango largo mientras el agua esta corriendo através de la unidad.

每月一次

1 -用真空器吸出箱底的沉淀物，或用长柄勺子搅动箱底的沉淀物，同时以清水将其冲出。

info@thermaco.com • www.big-dipper.com • 1-800-633-4204

P-IS-51000-MAINT

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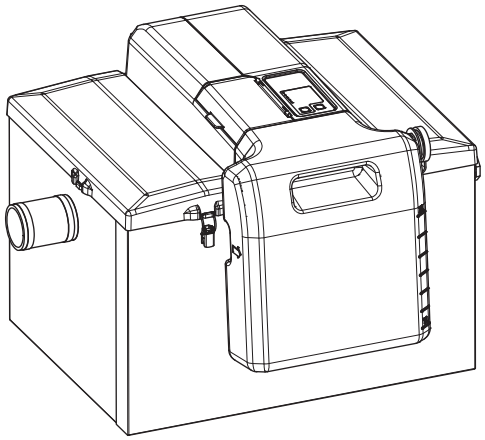
Installation & Operation Instructions For Big Dipper 51k Series Internal Strainer (IS) Units

Models W-200-IS, W-250-IS, W-350-IS and W-500-IS (Including 230 VAC Units)



* *Please consult Thermaco, Inc. for specific models tested, certified and/or listed by these organizations.*

Toll Free: (800) 633-4204 • V: (336) 629-4651 • F: (336) 626-5739
info@thermaco.com • www.big-dipper.com

AFJ

Part# MNL-ISPS51000

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51K Series

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BIG DIPPER®
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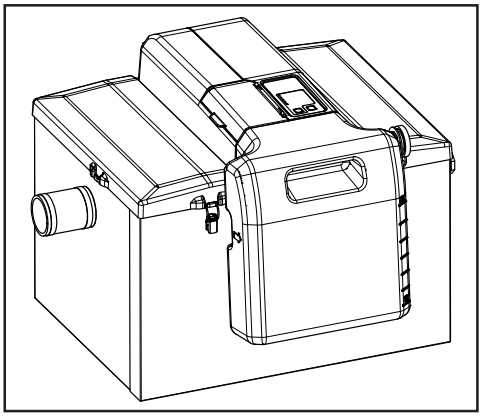
51K Series

Big Dipper® Internal Strainer (IS) System Overview

Big Dipper Internal Strainer System Overview



The **Thermaco, Inc. Big Dipper®** Automatic Grease and Oils Removal System removes free-floating grease & oils from kitchen drain water flows. As most food service facility managers already know, grease buildup within a building's plumbing drainage system is a major cause of problems due to drain line blockages. These problems jeopardize normal operations as well as create health and safety hazards within the facility itself.

The proper installation of a Big Dipper System can reduce or eliminate grease problems. Use of the Big Dipper assures minimization and/or elimination of costly sewer surcharges and fines through efficient separation and removal of free-floating grease & oils. In addition, the Big Dipper also helps reduce or eliminate pumping and disposal costs associated with conventional grease separators or interceptors. The recovered grease & oils are substantially water-free and are suitable for recycling by local rendering and/or biodiesel companies.

The Big Dipper system is an automatic, self-cleaning device. As greasy kitchen effluent drains from kitchen fixtures, the unit contains the grease & oils. These separate from the effluent and rise to the surface of the separator tank. The unit automatically skims the contained grease & oils and transfers the grease & oils to a collection container. A digital control maintains the self cleaning operation, activating the skimming wheel periodically based on the setting chosen. Only the "cleaned" water exits the unit and flows into the facility drain lines. The Big Dipper IS automatic systems operate most efficiently when servicing single fixtures such as a 1 to 3-compartment sink or a pre-rinse station.

The Big Dipper system's compact footprint allows installation directly at the source where grease problems originate. The system design also allows easy maintenance and operation requiring only a minimal amount of daily and weekly maintenance to maintain peak operating performance.

The Big Dipper system design allows for maximum installation flexibility. Reversing the system operation is a simple as rotating the cover assembly of the unit.

Hydromechanical grease interceptors (formerly referred to as grease traps), grease separators, automatic recovery units, grease removal devices and other similar plumbing devices receiving kitchen flows from sinks, floor drains, woks and other food bearing sources may generate odors. The 51k Series Big Dipper has been designed to seal in odors and prevent them from leaking into the kitchen through the tank lids. It does not prevent odors related to the rest of the plumbing system including but not limited to: open floor drains, air gaps, external solids straining devices, improper venting, and odors generated elsewhere in the plumbing system. These odors are usually prevented by good area ventilation, frequent fluid inputs, good product maintenance practices and proper product installation. Additional pretreatment steps not performed by the Big Dipper automatic grease interceptor, including aeration, chlorination, improved area ventilation and additional maintenance control, may be needed at some sites.

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BIG DIPPER®
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Big Dipper® Internal Strainer (IS) System Maintenance

Big Dipper® Internal Strainer (IS) System Maintenance

Daily Maintenance:

(A) Empty the clear plastic grease/oils collection container (located beside the unit) prior to its becoming full once each day. The Big Dipper recovers grease and oil virtually water-free so that they can be recycled. The collector container should be washed periodically so as to maintain the easy viewing translucent characteristic of the collector. Contents may be disposed of in rendering barrel with permission of rendering company or as solid food waste. To dispose in this manner, empty grease into plastic bucket lined with trash bag and allow contents to solidify at room temperature or in cooler before throwing into garbage.

(B) The internal strainer basket should be removed and emptied into a garbage container by shaking briskly. Wash the inside and outside surfaces of the strainer after emptying.

Weekly Maintenance:

(A) Check the collection trough and the wiper blades for any solids build-up. Wipe off any accumulated deposits and assure that the wiper blade assembly is re-placed properly.

(B) Press the Skim Start/Stop button (on the bottom-right of the user interface) to ensure that the motor and skimming wheel are still operating correctly. Press again to stop test. This will not affect the normal run-time of the unit.

(C) Check the thickness of the grease layer at the top of the unit. There should be no appreciable amount of grease or oil left in the tank immediately after the daily automatic skimming cycle. If there is more than a 1/2” (13 mm) thick layer of grease after the skimming cycle, this indicates a need to increase the skimming time. Increase the digital control settings accordingly until a clean unit appearance is obtained after the automatic skimming cycle. A simple guide is to change to the next higher setting and run for a period of time until enough grease is being skimmed from the tank.

Quarterly Maintenance:

(A) The internal strainer basket in the unit is designed to remove incidental solids from kitchen drain flows. Over a period of time, sediment consisting of very fine particles may begin to accumulate on the bottom of the unit. If this build-up is allowed to continue, it may eventually block the outlet baffle. To prevent this from occurring, remove the lid and stir the bottom of the unit with a long handled spatula while water is flowing to flush out the sediment. Occasionally drain and clean the unit thoroughly. Properly used, a wet-vac may be appropriate for this purpose.

***CAUTION! DISCONNECT POWER TO UNIT BEFORE CLEANING to prevent damage to the unit and personal injury**
***NOTE: Before energizing unit after cleaning, fill tank with water to protect wipers and heater from damage**

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51K Series

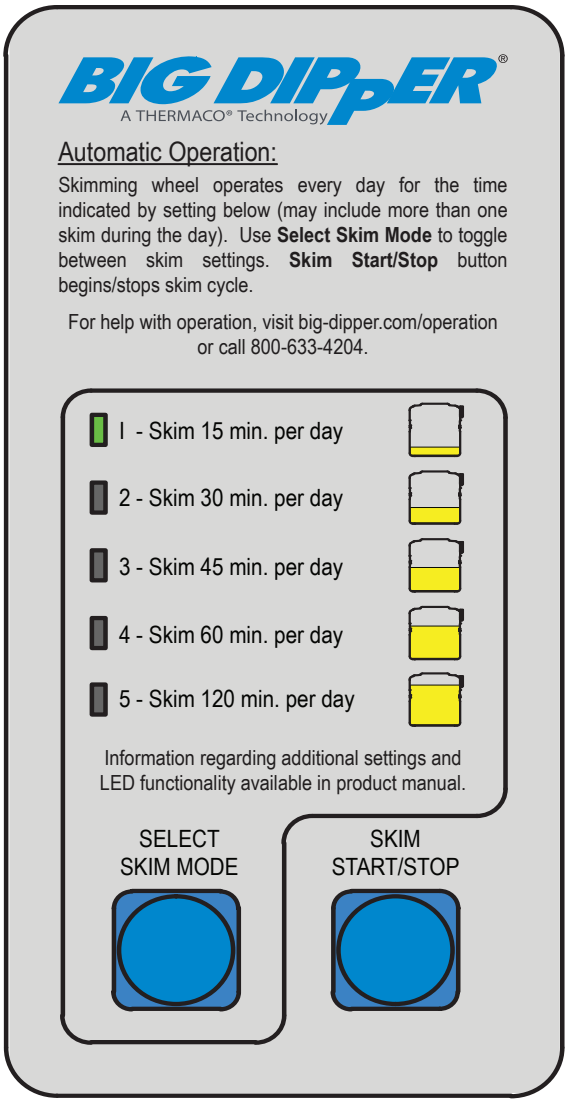
Big Dipper® IS System
Digital Control Operation

Timed Skimming Default

Using the "User Interface" five levels of skimming may be selected in the "default" mode using the 'Select Skim Mode' button. By selecting one of the skim settings – 1, 2, 3, 4, or 5 - the skimming time per day (indicated to the right of the light) is activated. The LED associated with the selected button is illuminated continuously as an indicator of the selected skim cycle and as a "power on" indicator. If the skimming level is changed during an active skimming cycle, the next active skim cycle will be at the new setting (The LED associated with the newly selected level will change immediately). If the skimming cycle is changed between active skimming cycles the next skim cycle will be at the new level.

The skim cycle will occur at the same time each day. This is determined by the time at which power is applied to the unit. In the case of setting 5, the unit will skim for 60 minutes every 12 hours. To choose a new skim time, disengage power to the unit and reapply power at the time when skim cycle is desired.

All skim cycles will last no more than 60 minutes at one time. In the case of setting 5 in default mode or settings in extreme mode, the electrical assembly will run more than one 60 minute cycle per day.



Motor Exercising

For all selected skimming levels with system delays greater than 12 hours the skimmer motor will be energized for 5 seconds every 12 hours. Only the motor will be energized (no heater operation) at these exercising times.

Skim Start/Stop Button Operation

Any time the start button is depressed operation begins for the selected skim level. Pressing this button does not effect the normal timing of the unit. Pressing this button again will stop the current skim.

Heater Operation

By default, the heater activates 60 minutes prior to a scheduled skim cycle. The heater will operate under thermistor control with settings of 130°F heater off point, 120°F heater on point for the duration of the preheat and skim cycle.

Extreme Modes

Two (2) additional run-times are accessible which allow the unit to operate more frequently.

- 2+5 - When lights 2 and 5 are both illuminated, the unit will skim for 60 minutes every 6 hours
- 3+5 - When lights 3 and 5 are both illuminated, the unit will skim for 60 minutes every 4 hours

Selecting Default or Extreme skimming

To toggle between the two skimming levels remove power from the Big Dipper® either by unplugging the unit or lifting the center module to open the interlock switch. Reapply power while holding the Select Skim Mode button depressed. The number of LEDs illuminated will be the skim level indicator – 1 LED for the default modes and two for the extreme modes. When toggled from extreme to default mode, level 3 will be initially selected.

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BIG DIPPER®
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Big Dipper® IS System Troubleshooting

Big Dipper unit overflows

(1) Check to see that the outlet pipe is not reduced to a smaller size, the outlet piping is vented, has as few 90 degree outlet turns as possible, and that no "P" trap is installed on the outlet. Re-plumb the piping, if necessary. Check outlet piping for clogs. Have a plumber clean the line, if necessary.

(2) Make sure that the solids strainer is in place and emptied daily.

(3) Check the bottom of the grease chamber for excessive solids and silt buildup which may be blocking the outlet baffle. Disconnect the power and use a long handled spatula or similar instrument to stir the bottom while water flows through the unit. If necessary, drain and clean the sediment from the unit. To prevent recurrence, schedule this cleaning to be done on a regular basis (properly used, a wet vac may be appropriate for cleaning sediment from the bottom of the unit).

(4) Make sure the flow rate to the unit does not exceed the maximum flow rate, which is shown on the nameplate. If necessary, have a plumber install an approved flow control to restrict the inlet flow to the specified level or install a properly sized Big Dipper for the application.

Excessive water observed in the grease collection container

(1) Check Digital Control for excessive run time. Unit will pick up incidental water after all grease is removed. If necessary, reduce the digital control setting (i.e. 3 to 2) until no water is observed in the grease collection container.

No grease is collected in the container

(1) Check to be sure the power is on and the correct setting is chosen. One of the setting buttons should be illuminated. If none of the setting buttons are illuminated, the unit is not powered.

(2) Lift the sump cover and clean away any buildup that may be present on the wiper blades or collection trough. Make sure the wiper blade(s) are properly in place on the skimmer wheels. Replace wiper blades when worn or warped.

(3) Press the Skim Start/Stop Button on the bottom of the user interface to ensure that the skimming wheel turns. CAUTION: Keep your hands away from moving parts to avoid possible injury. If the skimmer motor does not come on, the motor assembly may need to be replaced.

(4) Check for congealed grease in the unit. If the Big Dipper's heating element is not warming the unit, the heating element may need to be replaced.

(5) Some sites do not generate enough grease to be captured by the skimming process. Set Control for minimum operation - Setting 1 for Light Skimming Operation.

Objectionable odor

(1) Clean the solids strainer and grease collection container more frequently.

(2) Make sure grease/oil is being skimmed properly from the unit.

(3) Check Digital Control for excessive run time. Unit will pick up incidental water after all grease is removed. If necessary, reduce the skim setting (i.e. 3 to 2) until no water is observed in the grease collection container.

(4) If excessive sediment has collected on the bottom of the unit, clean the unit as described in item 3 in "Big Dipper unit overflows."

(5) Hydromechanical grease interceptors, grease traps, automatic recovery units, grease removal devices and other similar plumbing devices receiving kitchen flows from sinks, floor drains, woks and other food bearing sources may generate odors. While the Advanced Odor Protection features of your Big Dipper are designed to keep odors from escaping the lid, there may be other factors influencing odor evolution and dissemination. These include room ventilation, kitchen menu, ambient temperatures, ware washing practices, grease/oil input, daily input fluid volume, sanitizers, installation plumbing design and product maintenance/upkeep. Odors are usually prevented by good area ventilation, frequent fluid inputs, good product maintenance practices and proper product installation. Additional pretreatment steps not performed by the Big Dipper automatic grease interceptor, including aeration, chlorination, improved area ventilation and additional maintenance control, may be needed at some sites.

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BIG DIPPER®
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51K Series

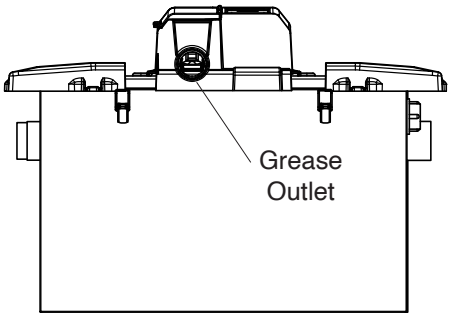
How To Reverse Big Dipper® IS System Operation

How To Reverse Big Dipper® IS System Unit Operation

***ALWAYS UNPLUG UNIT BEFORE REMOVING LID**
***SYSTEM WILL NOT OPERATE UNLESS CENTER MODULE IS IN PLACE**

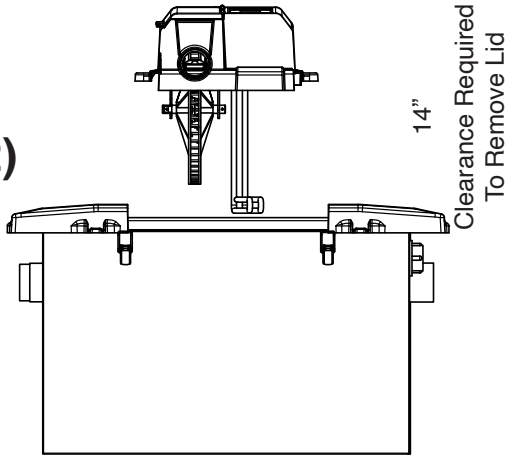
*Note:
W-750-IS has one (1) module.
W-1000-IS has two (2) modules.

1)



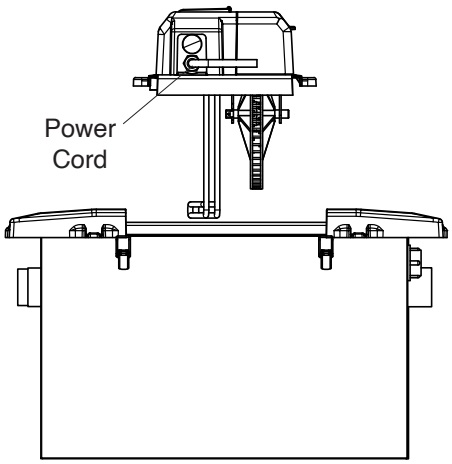
1) Unlatch the Unit lid. Pull the side wings outward.

2)



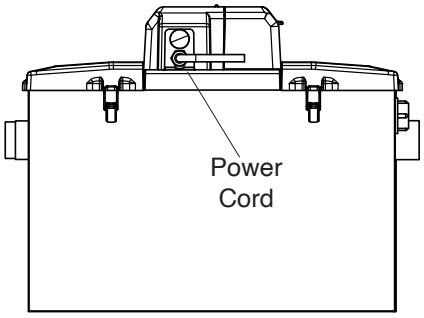
2) Lift the center module up off of the unit, ensuring clearance for the heater.

3)



3) Rotate the center module 180º.

4)



4) Lower the center module back down on top of the unit. Move the two side wings back into place & fasten all latches.

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BIG DIPPER®
A THERMACO® Technology

51K Series

Big Dipper® IS System Plumbing Installation

Big Dipper® IS System Plumbing Installation

Locating the Unit

To minimize grease build-up in piping, a Big Dipper system should be located as close as possible to the fixture it is serving. The system should be visible and easily accessible for maintenance and inspection. The unit must be in a level position. **Be sure to check the Specification Sheet for your model for the exact clearances needed for installation.** If the system is located directly on the floor, the bottom should be sealed to the floor with an approved silicone type sealant. Make sure the height above the Internal Strainer access cover is enough to remove the strainer basket.

Inlet/Outlet Piping

The inlet and outlet piping connections require flexible sleeve pipe couplings. Keep outlet piping as straight as possible. Use only "sweep" connections. **Do not reduce the pipe sizing on the outlet piping.** Do not install "P" trap on outlet connection of system. (Note: The system already has an internal gas trap). Failure to install to these instructions voids Thermaco's Warranty.

Flow Controls

Big Dipper Systems are tested and rated with an external flow control. We caution against any installation that does not use an external flow control. Each Big Dipper comes with the recommended flow control device.

Fill Unit With Water Before Powering

Big Dipper systems, equipped with an electric heating element, MUST be filled with water before energizing the power to the system. Failure to do so may damage the electric heating element. These elements will NOT be replaced under Thermaco's Warranty.

Venting the Outlet

An outlet vent or approved vacuum breaker of at least 1/2 the diameter of the system's outlet connection must be present as close as possible to the Big Dipper outlet to prevent possible siphonage problems. Failure to provide a vent for the system voids Thermaco's Warranty for the system.

For High Head Height Applications Over Six (6) Feet (1.95 m)

Big Dipper systems are equipped with an internal flow regulator located inside the inlet end of the system. Verify its location and placement prior to connecting the inlet piping. If your code requires a vertical type flow regulator, an approved control with a flow rating matching the system's flow rate should be used. Note: When a Big Dipper is servicing multiple fixtures, some codes require separate flow controls for each fixture. See following pages for suggested high head height flow regulation installation.

Do Not Use With Food Grinders, Potato Peelers or Waste Disposal Units

If the system is connected to a Waste Disposal Unit, Garbage Grinder or Potato Peeler, Thermaco's Warranty will be void.

Fill Unit With Water and Disconnect During Periods of Kitchen Inactivity

Big Dipper systems MUST be filled with water and the power must be disconnected during any inactivity lasting longer than two (2) weeks. Failure to do so may damage the unit. Thermaco's Warranty will be void if proper precaution is not taken for extended periods of kitchen inactivity.

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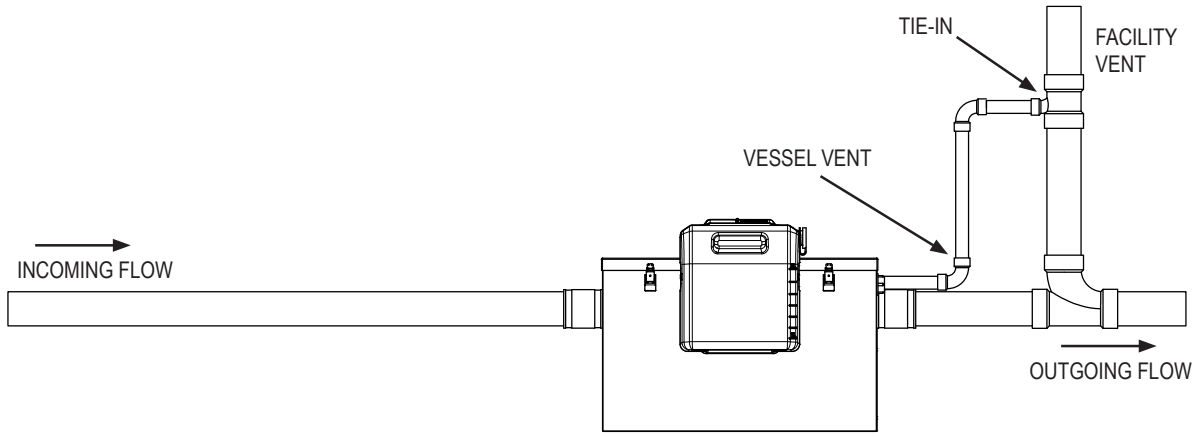
The following drawings show proposed venting for Big Dipper units in various situations. **Check state or local plumbing code to determine proper installation for your facility.**

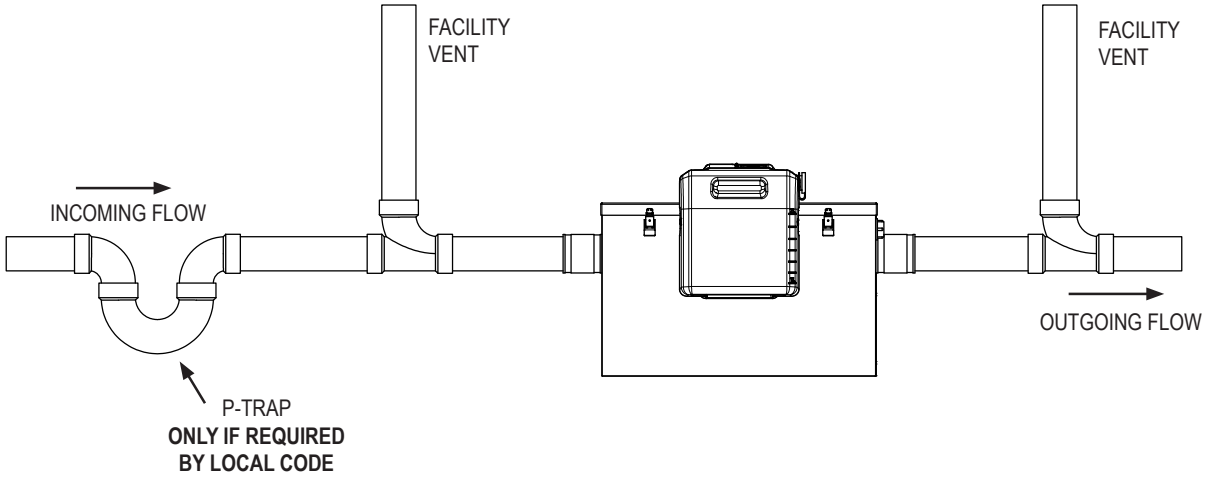
Sites without Upstream Facility Vents or Other Air Relief

Installations without Upstream Facility Vents or other Air Relief require the use of the vessel vent (also referred to as a chamber vent) to prevent air bound conditions. Thermaco provides a 1" NPT connection by which this **vessel vent may be connected from the unit to atmosphere** (preferred) or the facility vent. Do not connect vessel vent to air admittance valve.



Sites with Upstream Facility Vents

Sites using facility vents upstream of the Big Dipper unit do not require the use of a vessel vent. In this case, the open inlet design of the unit works in conjunction with the facility vent and upstream P-trap to facilitate air movement into and out of the interior grease interceptor air space and prevents air bound conditions from occurring. P-trap is only required in certain districts, and is not recommended by Big Dipper.



NOTE: Drawing for reference only. Equipment must be installed in compliance with all applicable laws, regulations and codes, including plumbing codes. Installation should be performed by a qualified plumber.

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BIG DIPPER®
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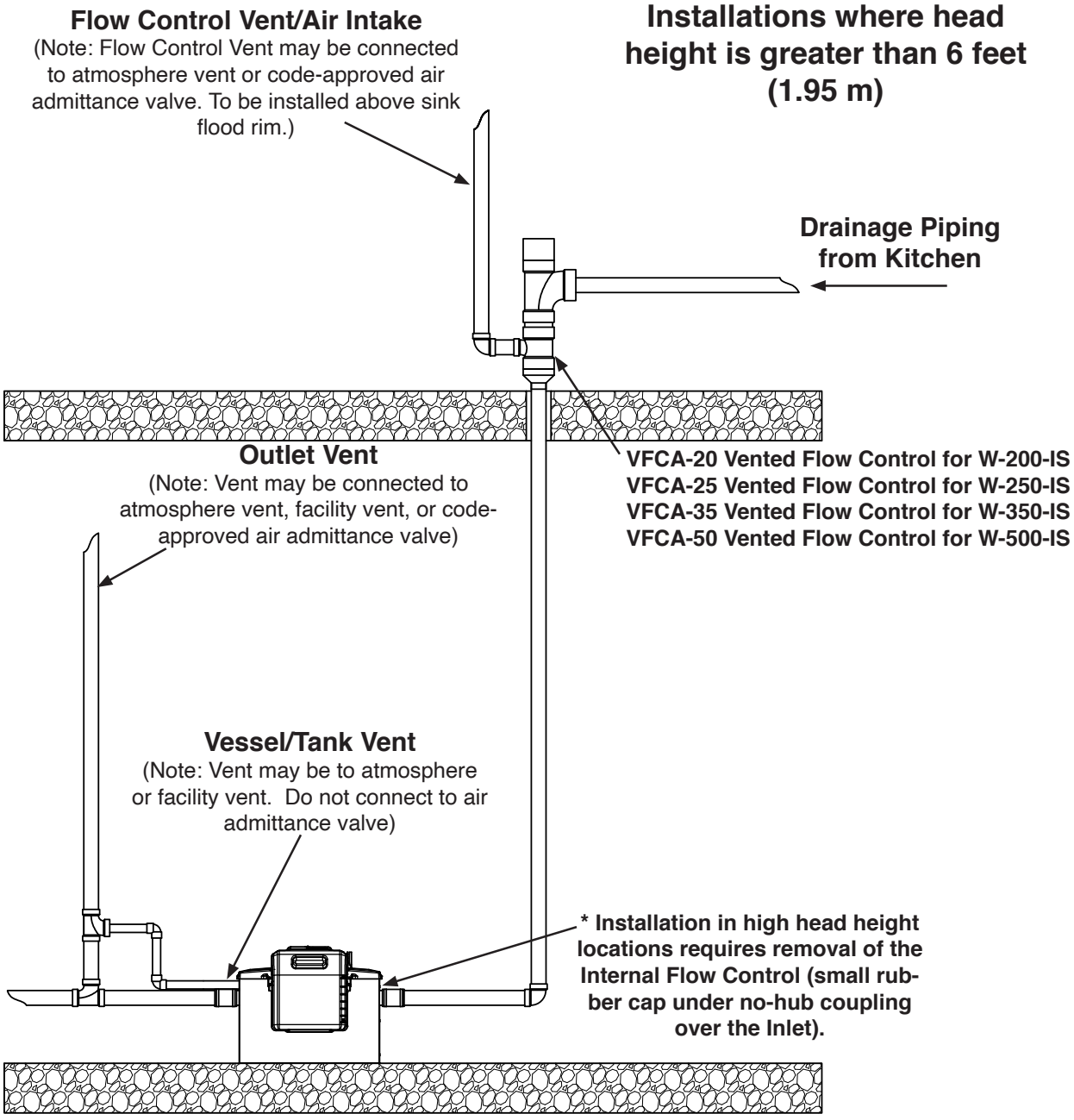
Big Dipper® IS System Plumbing Installation

Sometimes space restrictions require the installation of Big Dipper units in basement locations where significant head pressure becomes a factor. The **Big Dipper® VFCA Vented Flow Control** module provides an option for use with installations where a significant amount of head pressure is present (greater than 6 ft./1.95 m) or where applicable regulations require vented flow controls. A Vented Flow Control helps reduce problems associated with high head pressure and helps slow the drainwater flow down. The VFCA kit contains an appropriate fitting and flow control orifice. **Multiply Big Dipper sizing calculations by 1.5 when using a VFCA.**



NOTE: Drawing for reference only. Equipment must be installed in compliance with all applicable laws, regulations and codes, including plumbing codes. Installation should be performed by a qualified plumber.

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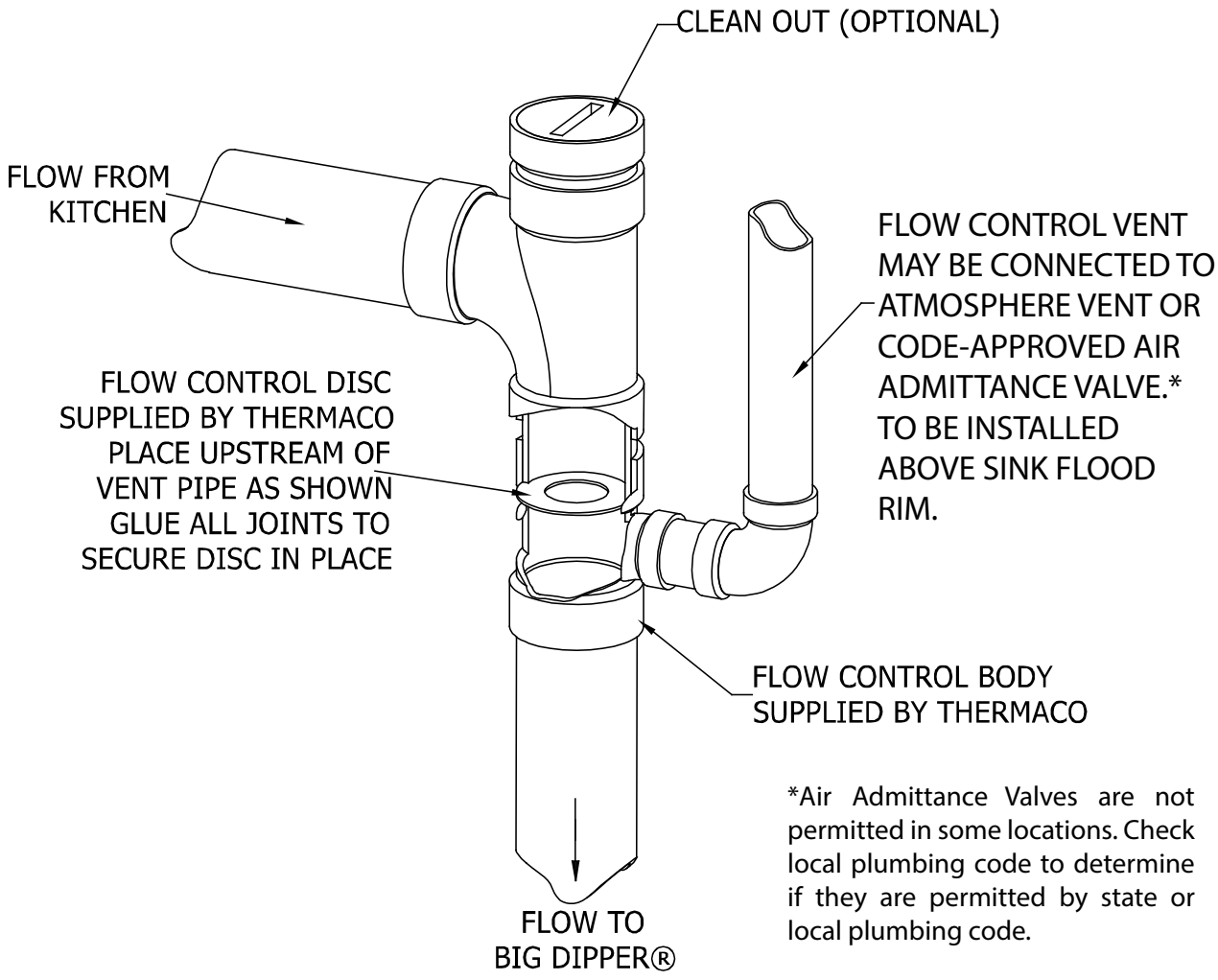
VFCA Vented Flow Control Installation Instructions



*Air Admittance Valves are not permitted in some locations. Check local plumbing code to determine if they are permitted by state or local plumbing code.

IMPORTANT!

The flow control should be installed after the last fixture as close as possible to the under side of the lowest fixture. If the flow control is installed more than 2 feet below the lowest fixture consult the manufacturer for a more restrictive disc. Remove the rubber flow control from the Big Dipper system.

Note: This equipment must be installed to comply with all applicable national, state, and local plumbing codes for your area. Installation should only be performed by a qualified plumber.

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BIG DIPPER®
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Big Dipper® IS System Electrical Installation

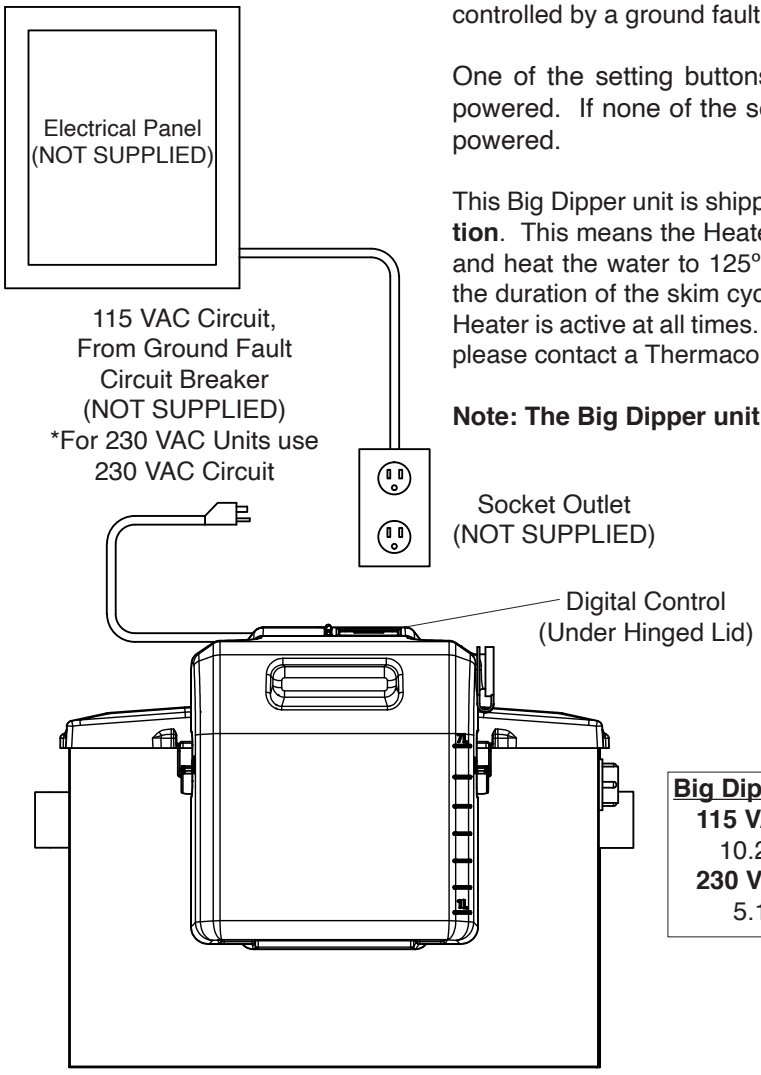
Big Dipper® IS System Electrical Installation

Big Dipper Internal Strainer Series Models utilize one Push Button Digital Time Controller. The Digital Control is located under the hinged lid of the motor enclosure on top of the lid of Big Dipper (See Digital Control Operation Instructions). **The Big Dipper should only be plugged into a properly grounded 3-prong 115 VAC or 230 VAC outlet.** If possible, the power supply outlet for the Big Dipper should be connected to an electrical circuit controlled by a ground fault circuit breaker.

One of the setting buttons should be illuminated to show the unit is powered. If none of the setting buttons are illuminated, the unit is not powered.

This Big Dipper unit is shipped from the Factory wired for **Preheat Operation**. This means the Heater will come on 1 hour prior to scheduled skim and heat the water to 125°F ±5 and maintain this temperature range for the duration of the skim cycle. Continuous Heater Operation is where the Heater is active at all times. To switch to alternative heating programming, please contact a Thermaco representative for further instructions.

Note: The Big Dipper unit will not operate when the lid is removed.



Big Dipper Electrical Requirements

115 VAC Models:
10.2 Amps @ 115 VAC 50/60Hz (1173 Watts)

230 VAC Models:
5.1 Amps @ 230 VAC 50/60Hz (1173 Watts)

Note:
Digital Control Supplied with system.
Drawing for reference only. Equipment must be installed in compliance with all applicable laws, regulations and codes, including electrical codes. Installation should be performed by a qualified electrician.

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BIG DIPPER®
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Big Dipper® IS
Safety & Grounding Instructions

Important Safety Instructions

WARNING

When using electric appliances, basic precautions should always be followed, including the following:

a) Read all instructions before using the appliance.
b) Do not contact moving parts.
c) Only use attachments recommended or sold by the manufacturer.
d) Do not use outdoors.
e) Do no unplug by pulling on cord. To unplug, grasp the plug, not the cord.
f) Unplug from outlet when not in use and before servicing or cleaning.
g) Connect to a properly grounded outlet only. See Grounding Instructions.

Save These Instructions

Grounding Instructions

This appliance must be grounded. In the event of malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This appliance is equipped with a cord having an equipment-grounding conductor and a grounding plug. The plug must be plugged into an appropriate outlet that is properly installed and grounded in accordance with all local codes and ordinances.

DANGER- Improper connection of the equipment-grounding conductor can result in a risk of electric shock. The conductor with insulation having an outer surface that is green with or without yellow stripes is the equipment-grounding conductor. If repair or replacement of the cord or plug is necessary, do not connect the equipment-grounding conductor to a live terminal. Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if in doubt as to whether the appliance is properly grounded. Do not modify the plug provided with the appliance - if it will not fit the outlet, have a proper outlet installed by a qualified electrician.

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BIG DIPPER®
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Big Dipper® IS
Grounding Instructions

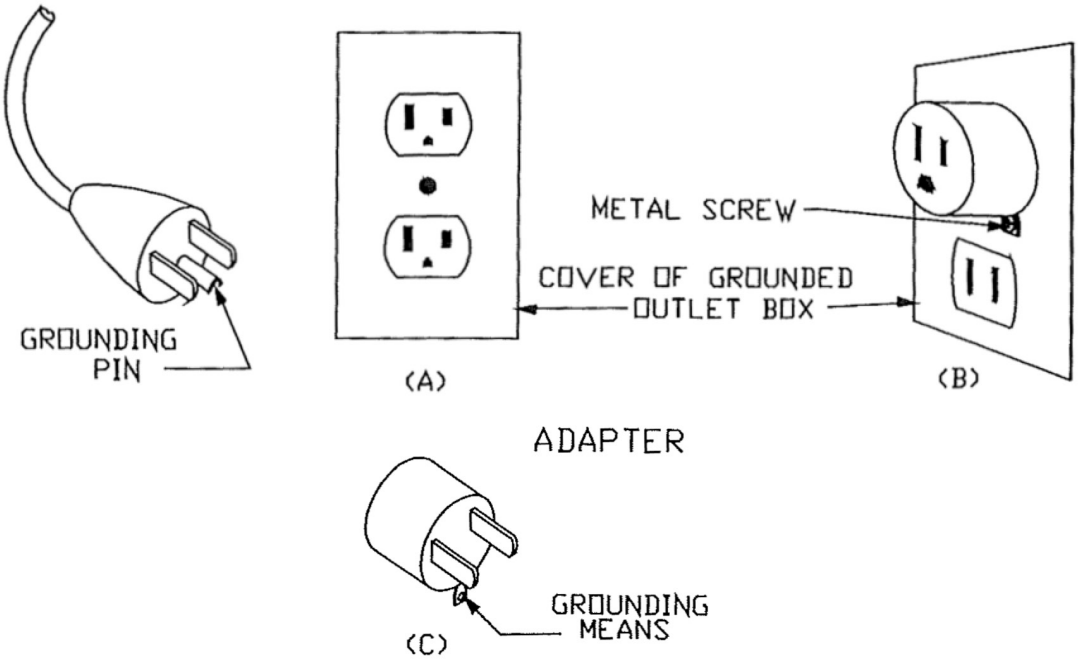
Grounding Instructions

115 V Units

This appliance is for use on a nominal 115 V circuit, and has a grounding plug that looks like the plug illustrated in drawing A below. A temporary adapter, which looks like the adapter illustrated in drawing B and C, may be used to connect this plug to a 2-pole receptacle as shown in sketch B if properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet can be installed by a qualified electrician. The green colored rigid ear, lug, and the like, extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box cover. Whenever the adapter is used, it must be held in place by the metal screw.

230 V Units

This appliance is for use on a circuit having a nominal rating more than 120 V and is factory equipped with a specific electric cord and plug. No adapter should be used with this appliance. If the appliance must be reconnected for use on a different type of electric circuit, the reconnection should be made by qualified service personnel; and after the reconnection, the appliance should comply with all local codes and ordinances.



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BIG DIPPER®
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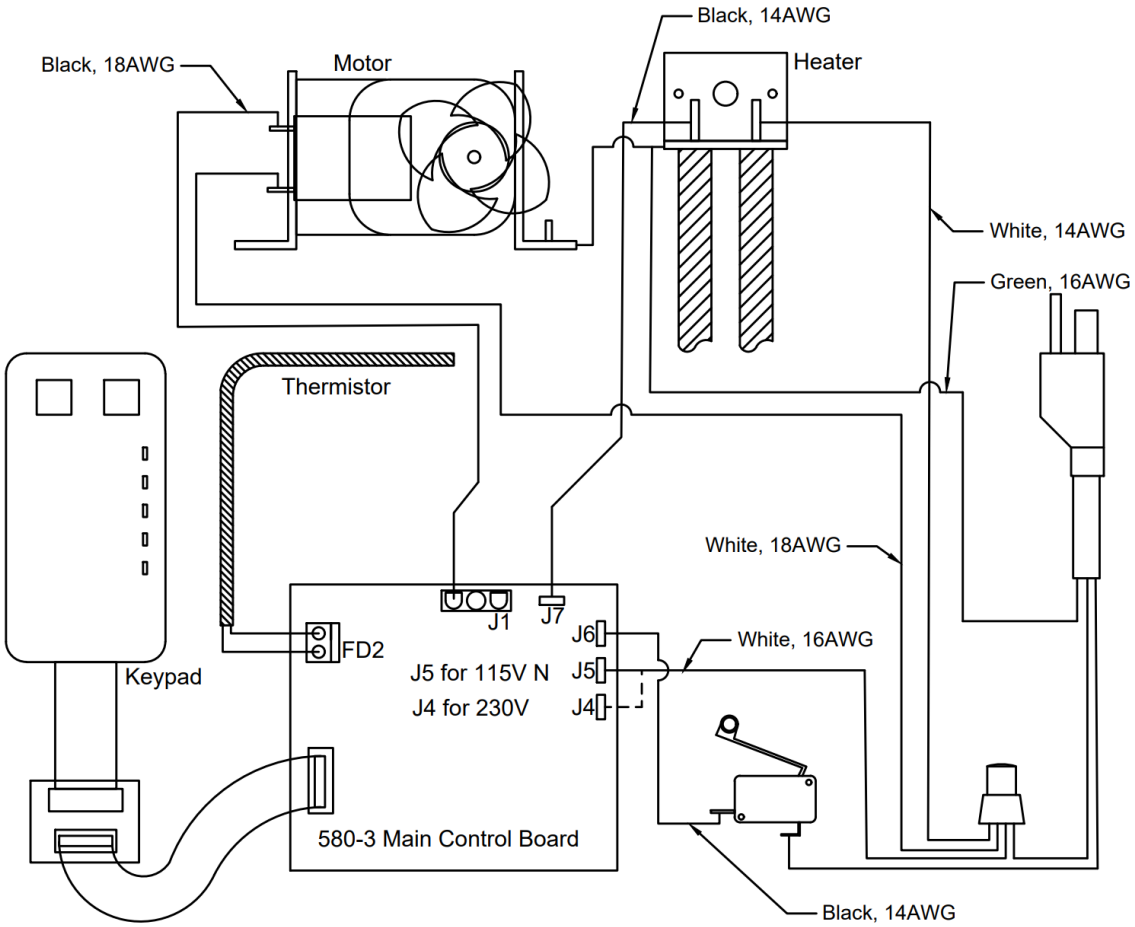
Big Dipper® IS System Wiring Diagram

Wiring Diagram For Big Dipper Models W-200-IS Through W-500-IS



NOTE:
220-240V Units (International Units) have the following wire color changes:
On the POWER SUPPLY CORD:
The Black Wire becomes Brown
The White Wire becomes Blue
The Green Wire becomes Yellow/Green

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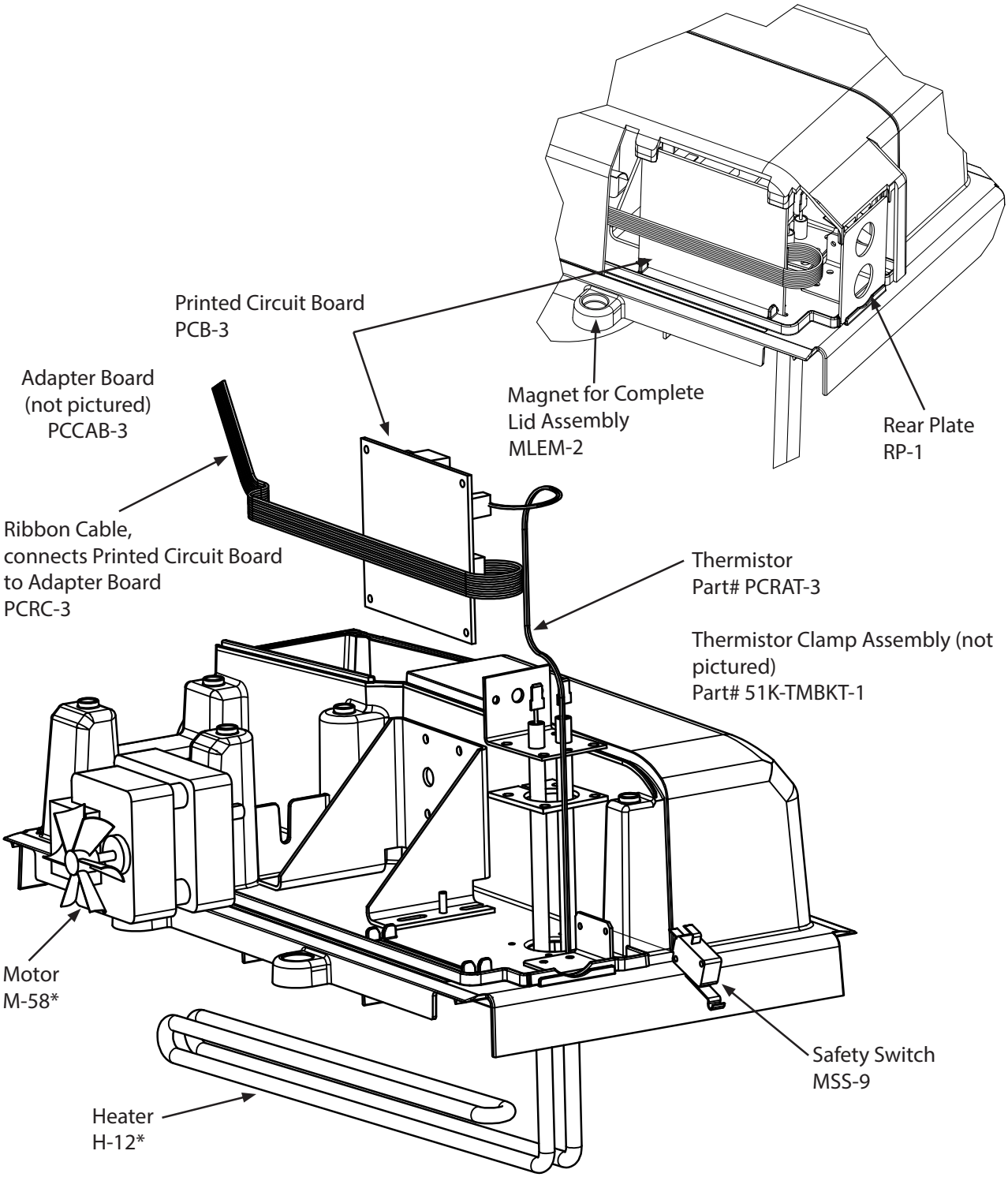
Big Dipper® IS System
Electrical Components



***230 VAC Units use M-58-230 and H-12-230**

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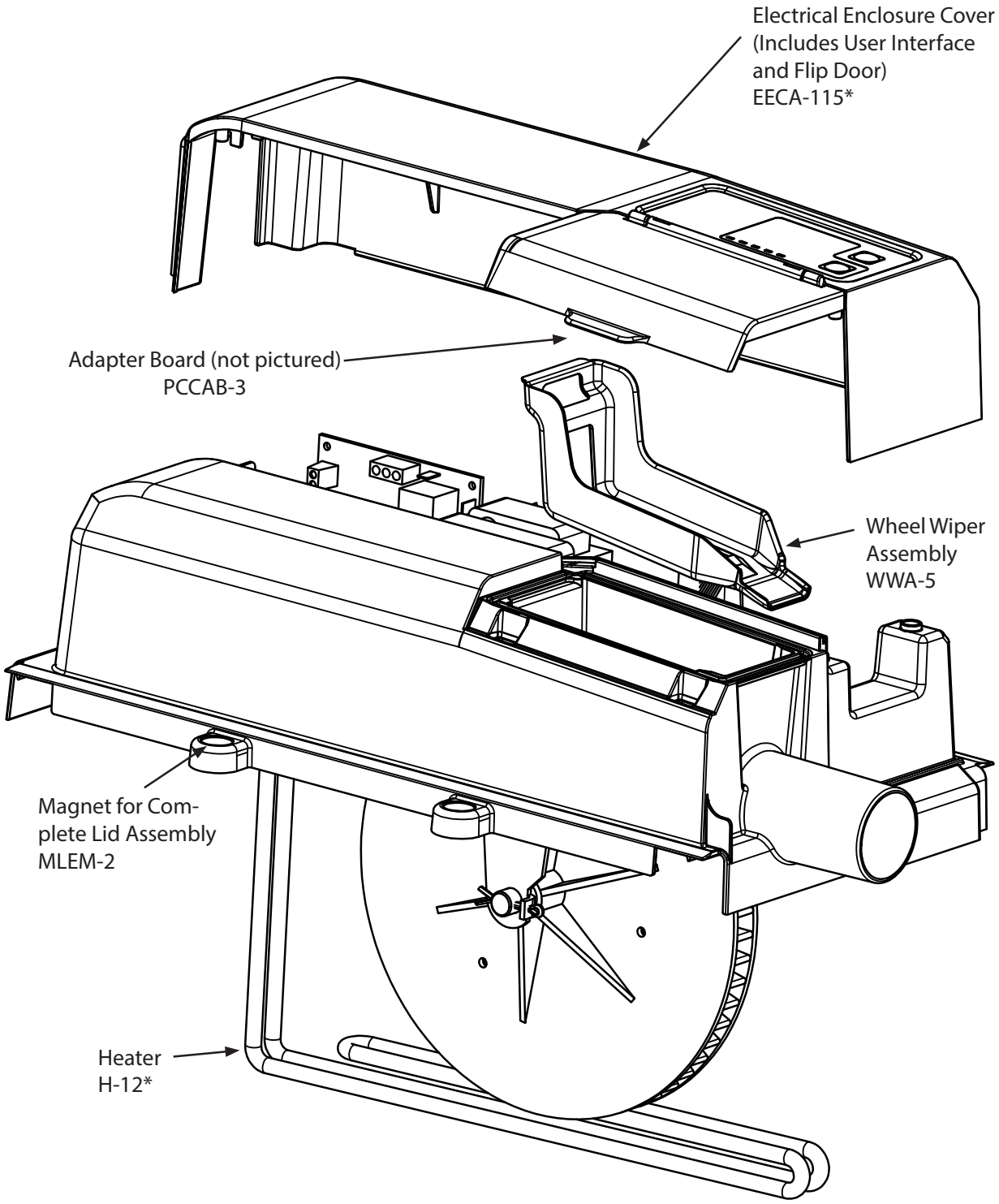
Big Dipper® IS System Component Identification



***230 VAC Units use M-58-230, H-12-230, and EECA-230**

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BIG DIPPER®
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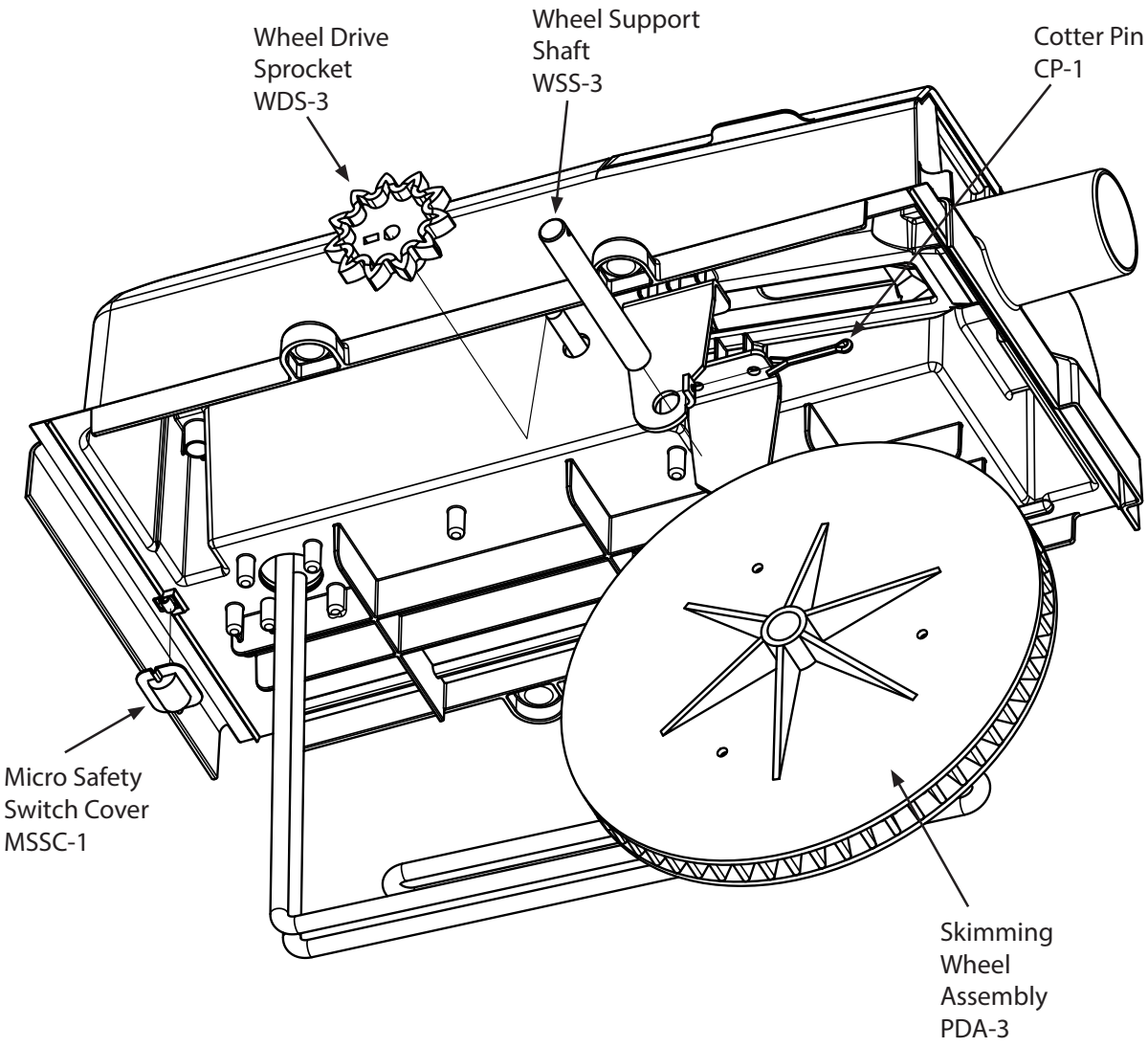
Big Dipper® IS System Component Identification



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BIG DIPPER®
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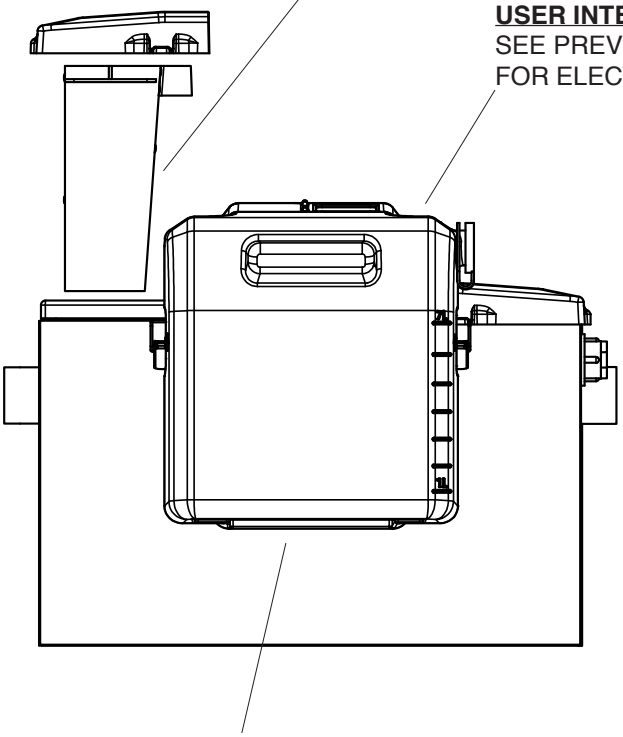
Big Dipper® IS System Replacement Parts

Big Dipper® IS System Replacement Parts

SOLIDS STRAINER BASKET

FOR MODEL#	USE PART#
W-200-IS THROUGH W-250-IS	ST-21
W-350-IS & W-500-IS	ST-62



USER INTERFACE (Under Cover)
SEE PREVIOUS PAGES REGARDING REPLACEMENT PARTS FOR ELECTRICAL ASSEMBLY

GREASE/OILS COLLECTION CONTAINER
FOR W-200-IS THROUGH W-500-IS USE PART# GC-10

NOT SHOWN:

MOTOR (1 per unit)
PART# M-58
M-58-230 in 230 VAC Units

HEATER (1 per unit)
PART# H-12
H-12-230 in 230 VAC Units

INTERNAL FLOW CONTROL (1 per unit)
PART# MFC-20 FOR W-200-IS
PART# MFC-25 FOR W-250-IS
PART# MFC-35 FOR W-350-IS
PART# MFC-50 FOR W-500-IS

TANK GASKET
PART# RGA-14-PS

WHEEL WIPER ASSEMBLY (1 per unit)
PART# WWA-5

WHEEL DRIVE SPROCKET (1 per unit)
PART# WDS-3

SKIMMING WHEEL ASSEMBLY (1 per unit)
PART# PDA-3

SAFETY SWITCH
PART# MSS-9

HEATER GASKET
PART# HTG-300

FLIP DOOR MAGNETS (2 per unit)
PART# FDM-2

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BIG DIPPER®
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Big Dipper® Limited Warranty & Remedy

Thermaco Incorporated (“Thermaco”) warrants to the original user that (i) the tank, wrap, lid ends, grease collector, and internal strainer assembly of the product manufactured by Thermaco and delivered with this warranty (the “Product”) shall be free from material defects in workmanship and materials during the lifetime of the plumbing system in which such Product is initially installed, subject to the terms and conditions of this warranty and (ii) the electrical assembly delivered with this warranty shall be free from material defects in workmanship and materials for a period of thirty-six (36) months from the date of original invoice to the distributor (if sold by an authorized Thermaco distributor) or the date of invoice to the purchaser (if sold directly by Thermaco). Notwithstanding the foregoing, this warranty shall not cover, and Thermaco shall have no obligation to repair or replace, any of the following component parts of the Product: gaskets, wiper blades, flip door gaskets, magnets, and flow control.

Any and all warranty claims must be made in writing to Thermaco at 646 Greensboro Street, Asheboro, NC 27203, promptly after discovery of the warrantied defect and within the applicable warranty period. Following and subject to Thermaco’s preliminary approval of a warranty claim, the warrantied Product must be delivered, prepaid, to Thermaco, together with proof of purchase (which must be dated), the Product’s serial number, and a return authorization number issued by Thermaco. If Thermaco determines upon examination that the Product is defective and that the warranty conditions are satisfied, Thermaco’s sole obligation under this warranty, and the original user’s sole and exclusive remedy, is the repair or replacement, at Thermaco’s sole discretion, of the defective equipment, component, or parts. Any replacements will be furnished F.O.B. point of shipment. Thermaco reserves the right to ship the user replacement parts with installation instructions. If Thermaco determines that the part, component, or the Product is not defective or that any condition of this warranty is not satisfied, then Thermaco shall have no obligation to the original user to repair or replace any such part, component, or the Product, and any return of such part, component, or the Product shall be at the original user’s cost.

This warranty shall not cover any defect in an otherwise covered Product resulting directly or indirectly from (and the occurrence of any of the following shall void any otherwise applicable warranty claim): (i) failure to install, operate or maintain the product in accordance with Thermaco’s instructions and procedures, including, without limitation, use in excess of rated flow, improper electrical service, use to remove emulsified fats and oils or use that fails to comply with applicable laws, regulations or codes, use outside or outdoors, or failing to disconnect power to the Product during any inactivity lasting longer than two consecutive weeks; (ii) damage in transit, handling or installation; (iii) modifications, adjustments, repairs, or alterations made by persons other than Thermaco representatives or certified plumbers or electricians (with respect to the electronic components); (iv) any change in the original installation or change to the original use of the Product; or (v) other causes not arising out of defects in workmanship or materials. Thermaco shall not be responsible for damage to products resulting from vault flooding, sewer line back-up, pumping or lift station failure, ambient water flow or other sources of water damage. This warranty does not cover equipment or parts not manufactured by Thermaco. Original user’s costs relating to any service, adjustment, removal, repair, packing, or otherwise incurred with respect to the defect prior to submission for warranty are the responsibility of the original user. No distributor, sales person or other person is authorized to make any warranty statements on behalf of Thermaco regarding Thermaco products other than as set forth in this warranty. This statement of warranty supersedes and replaces any quote, brochure, or other statement or document with respect to warranty of the Product.

EXCEPT AS EXPRESSLY SET FORTH ABOVE, THERMACO MAKES NO REPRESENTATIONS, WARRANTIES OR GUARANTEES, EITHER EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER OR NOT THERMACO HAD KNOWLEDGE OF THE ORIGINAL USER’S PARTICULAR REQUIREMENTS OR NEEDS, OR WITH RESPECT TO ODOR GENERATION OR OTHER INCIDENTALS RELATING TO USE OF THE PRODUCT.

The sole and exclusive remedy with respect to this warranty any other claim relating to defects or any other condition or use of the Product, however caused, and whether such claim is based upon warranty, contract, tort, strict liability or any other theory, is LIMITED to the repair or replacement of the effected Product, component, or parts, in each case excluding labor or any other cost to remove or install the Product, at Thermaco’s sole option, refund of the original purchase price. IN NO EVENT SHALL THERMACO BE LIABLE, WHETHER IN CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, INDEMNITY OR ANY OTHER LEGAL THEORY, FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR FOR ANY OTHER LOSS OR COST OF A SIMILAR TYPE. UNDER NO CIRCUMSTANCES WILL THE AGGREGATE LIABILITY OF THERMACO FOR ANY CAUSE OF ACTION RELATED TO THE PRODUCTS COVERED HEREBY EXCEED THE NET PURCHASE PRICE RECEIVED BY THERMACO FOR THE PRODUCTS. Any action or suit by the initial user against Thermaco relating to the Product must be brought within three (3) years of the date of the invoices referenced above in cases pertaining to the electrical assembly. This Warranty is made only for the benefit of the original user and is void upon any transfer of ownership.

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VALVE TAG	DESCRIPTION	LOCATION
001HWS	1ST FLOOR SOUTH	BOILER ROOM 135
002HWS	2ND FLOOR NORTH	BOILER ROOM 135
003HWS	2ND FLOOR SOUTH	BOILER ROOM 135
004HWS	3RD FLOOR NORTH	BOILER ROOM 135
005HWS	3RD FLOOR SOUTH	BOILER ROOM 135
006HWS	4TH FLOOR NORTH	BOILER ROOM 135
007HWS	4TH FLOOR SOUTH	BOILER ROOM 135
008HWS	5TH FLOOR	BOILER ROOM 135
009HWS	ADDITION	BOILER ROOM 135
001HWR	1ST FLOOR SOUTH	BOILER ROOM 135
002HWR	2ND FLOOR	BOILER ROOM 135
003HWR	3RD FLOOR	BOILER ROOM 135
004HWR	ADDITION SIDE	BOILER ROOM 135
005HWR	5TH FLOOR	BOILER ROOM 135
006HWR	4TH FLOOR	BOILER ROOM 135
003DHW	HOT WATER VALVE ADDITION	129-120 DOORWAY
005DHW	RECIRCULATION VALVE ADDITION	129-120 DOORWAY
005DCW	COLD WATER VALVE ADDITION	129-120 DOORWAY
003DCW	COLD WATER VALVE ADDITION	130-WATER FOUNTAIN
013DHW	HOT WATER VALVE 2ND FLOOR	ROOM 127
001GAS	RTU 283 GAS VALVE 2ND FLOOR	ROOM 127
001DHW	HOT VALVE 2ND FLOOR SHOWER ROOM ADDITION	ROOM 126
001DCW	COLD VALVE 2ND FLOOR SHOWER ROOM ADDITION	ROOM 126
002GAS	ROOFTOP	BOILER ROOM 135
003GAS	LAUNDRY ROOM & KITCHEN	BOILER ROOM 135
004GAS	LAUNDRY ROOM VALVE	BOILER ROOM 135
005GAS	KITCHEN GAS VALVE	BOILER ROOM 135
006GAS	PRIMARY BOILER BURNER	BOILER ROOM 135
007GAS	MEMBER 1 BOILER BURNER	BOILER ROOM 135
008GAS	WATER HEATER	BOILER ROOM 135
009GAS	WATER HEATER	BOILER ROOM 135
008DCW	OLD BUILDING COLD WATER VALVE	HALLWAY OUTSIDE 257
006DHW	OLD BUILDING HOT WATER VALVE	HALLWAY OUTSIDE 257
011DCW	LAUNDRY ROOM COLD WATER VALVE	HALLWAY ACROSS 264
012DHW	LAUNDRY ROOM HOT WATER VALVE	HALLWAY ACROSS 264
012DCW	STAFF ROOM COLD WATER SHUT	INSIDE ROOM 249
011DHW	STAFF ROOM HOT WATER VALVE	INSIDE ROOM 249
002HW	RETURN HEAT VALVE	HALLWAY ACROSS 208
003HW	RETURN HEAT VALVE	HALLWAY ACROSS 204
008DHW	HOT WATER SHOWER ROOM VALVE	HALLWAY ACROSS 235
009DCW	COLD WATER SHOWER ROOM VALVE	HALLWAY ACROSS 235
013DCW	COLD DRINKING FOUNTAIN VALVE	HALLWAY OUTSIDE 227
018DCW	WATER FOUNTAIN SHUT OFF	HALLWAY 427
017DHW	5TH FLOOR HOT WATER SHUT	HALLWAY 433
019DCW	5TH FLOOR COLD WATER SHUT	HALLWAY 433
018DHW	4TH FLOOR HOT SHOWER VALVE	HALLWAY ACROSS 437

SHIELD™
COMMERCIAL WATER HEATERS

Installation & Service Manual

Models: SNR126-065, SNR151-100, SNR201-100, SNA151-100, SNA201-100, SNA286-125, SNA401-125, AND SNA501-125

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

-- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

-- WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

-- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

IMG00460

DESIGN CERTIFIED®

CERTIFIED®

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions in this manual before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

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Please read before proceeding

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

⚠ WARNING **Installer** – Read all instructions, in this manual before installing. Perform steps in the order given.

Have this water heater serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the water heater – Please have the water heater model and serial number from the water heater rating plate.

Consider piping and installation when determining water heater location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 10). Failure to comply could result in severe personal injury, death, or substantial property damage.

When servicing the water heater –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow the water heater to cool before performing maintenance.

⚠ WARNING If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death

-- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

-- WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

-- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

Water heater operation –

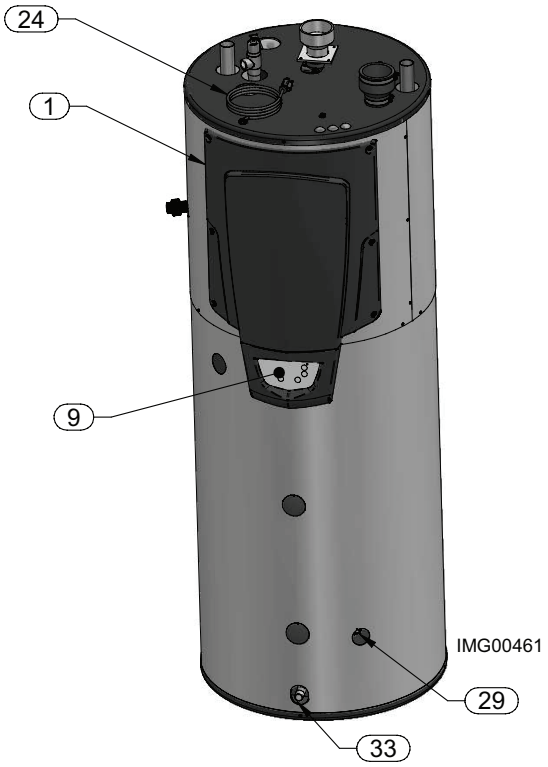
- Do not block flow of combustion or ventilation air to the water heater.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this water heater if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

The Shield - How it works...

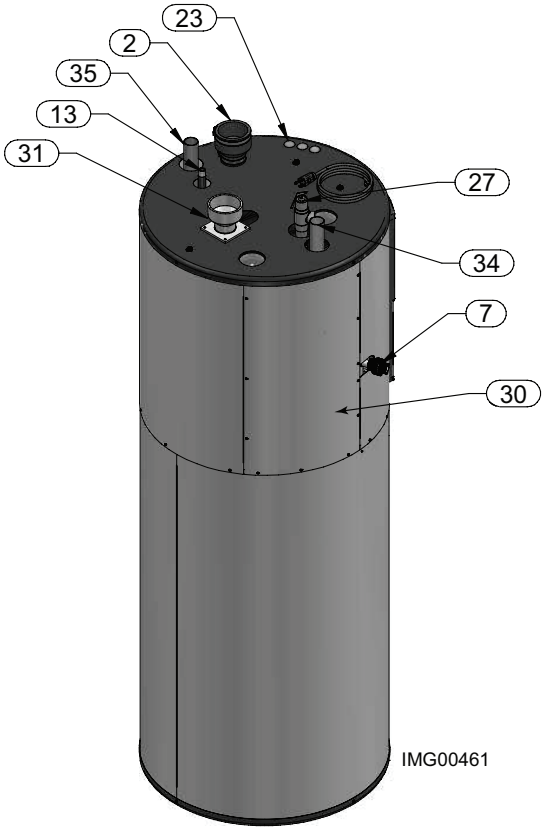
1. **Access cover - front**
   Provides access to the gas train, heat exchanger and controls.
2. **Air intake adapter**
   Allows for the connection of the PVC air intake pipe to the water heater.
3. **Air pressure switch**
   The air pressure switch detects blocked inlet conditions.
4. **Air shroud (501-125 Model Only_Not Shown)**
   The air shroud directs air and gas flow into the blower.
5. **Blower**
   The blower pulls in air and gas through the venturi (item 32). Air and gas mix inside the blower and are pushed into the burner, where they burn inside the combustion chamber.
6. **Burner (not shown)**
   Made with metal fiber and stainless steel construction, the burner uses pre-mixed air and gas and provides a 5 to 1 firing rate.
7. **Condensate drain connection**
   Connects the condensate drain line to 1/2" PVC.
8. **Electronic Control Module**
   The electronic control responds to internal and external signals and controls the blower, gas valve, and pump to meet the demand.
9. **Electronic display**
   The electronic display consists of 4 buttons, and a liquid crystal display. The display is used to make adjustments and read water heater status.
10. **Flame inspection window (not shown)**
    The quartz glass window provides a view of the burner surface and flame.
11. **Flame sensor**
    Used by the control module to detect the presence of burner flame.
12. **Flue gas sensor (not shown)**
    This sensor monitors the flue gas exit temperature. The control module will modulate and shut down the water heater if the flue gas temperature gets too hot. This protects the flue pipe from overheating.
13. **Gas connection pipe**
    Threaded pipe connection, either 1/2", 3/4", or 1", depending on the model. This pipe should be connected to the incoming gas supply for the purpose of delivering gas to the water heater.
14. **Gas shutoff switch (151-100 - - 286-125 Models Only)**
    An electrical switch designed to cut power from the gas valve to prevent gas flow to the burner.
15. **Gas shutoff valve (401-125 -- 501-125 Models Only)**
    Manual valve used to isolate the gas valve from the gas supply.
16. **Gas valve**
    The gas valve senses the negative pressure created by the blower, allowing gas to flow only if the gas valve is powered and combustion air is flowing.
17. **Heat exchanger access cover**
    Allows access to the combustion side of the heat exchanger coils.
18. **Heat exchanger inlet temperature sensor**
    This sensor monitors the inlet water temperature to the heat exchanger.
19. **Heat exchanger outlet temperature sensor**
    This sensor monitors heat exchanger outlet water temperature.
20. **Ignition electrode**
    Provides direct spark for igniting the burner.
21. **Line voltage junction box**
    The junction box contains the connection points for the line voltage power.
22. **Low voltage connection board**
    The connection board is used to connect external low voltage devices.
23. **Low voltage wiring connections (knockouts)**
    Conduit entryway for the low voltage connection board.
24. **Power cord**
    The power cord allows for quick connection to 120V supply.
25. **Pump**
    Circulates water between the tank and the heat exchanger.
26. **Pump relay**
    Switches power to the pump.
27. **Relief valve**
    Protects the heat exchanger from over pressure and temperature conditions. The relief valve is set at 150 PSI.
28. **Stainless steel heat exchanger**
    Allows water to flow through specially designed coils for maximum heat transfer, while providing protection against flue gas corrosion. The coils are encased in a jacket that contains the combustion process.
29. **Tank sensor**
    Used by the control to monitor the temperature of the tank.
30. **Pump access panel**
    Panel used to gain access to the pump and condensate trap; also used to gain access to the outlet water sensor on Models 286-125 -- 501-125 only.
31. **Vent pipe connection**
    Allows for the connection of the vent pipe system to the water heater.
32. **Venturi**
    The venturi controls air and gas flow into the burner.
33. **Water heater drain valve**
    Location from which the water heater can be drained.
34. **Water inlet**
    Copper sweat connection for cold water supply that returns water from the system to the heat exchanger, either 1-1/2" or 2", depending on the model.
35. **Water outlet**
    Copper sweat connection that supplies hot water to the system, either 1-1/2" or 2", depending on the model.
36. **Over-temp switch (286-125 --501-125 Models Only)**
    An electrical switch designed to shut down water heater operation in the event the outer back of the heat exchanger, directly above the flue connection exceeds 604°F (318°C). This is a one time switch and could warrant a heat exchanger replacement. Check the integrity of the rear refractory at the back of the upper coil if the switch opens.
37. **Burner door temperature switch (Models 286-125 - 501-125 Only)**
    An electrical switch designed to shut down water heater operation in the event the combustion chamber access cover exceeds 500°F (260°C). This switch may only be reset by a qualified service technician AFTER the underlying cause has been identified and corrected. Check the integrity of the front refractory on the inside of the combustion chamber access cover if the switch opens.

The Shield - How it works... *(continued)*

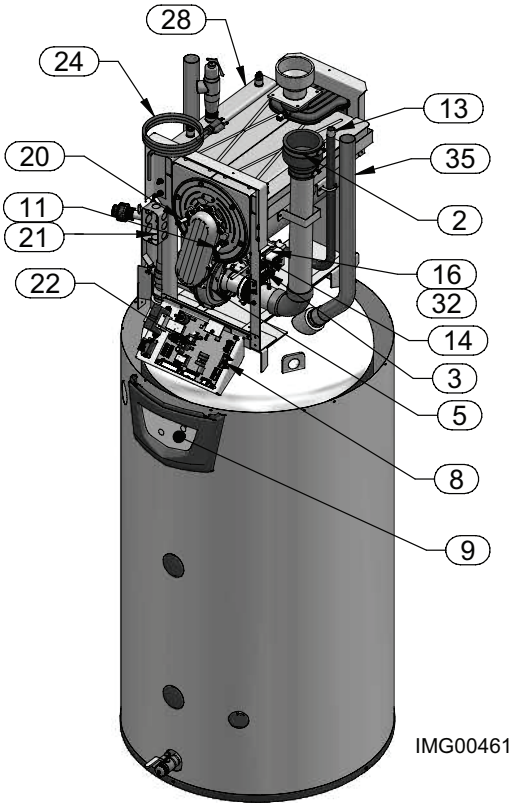
Models 126-065 – 201-100



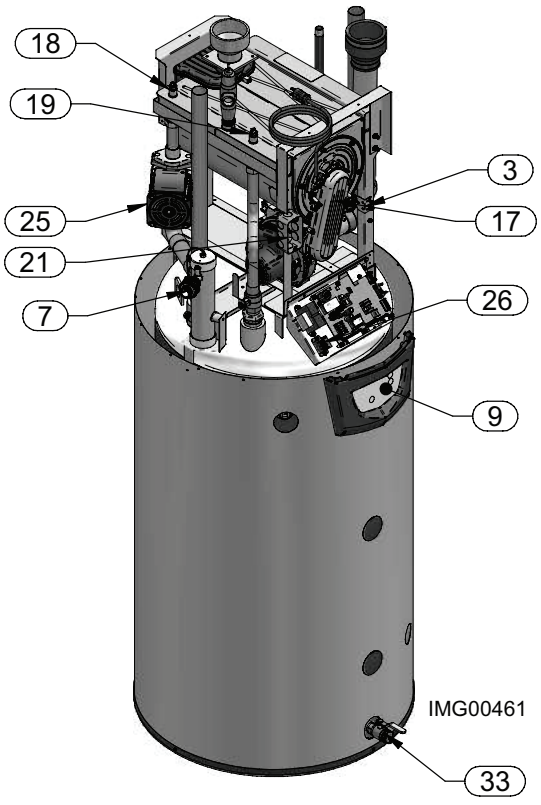
Front View - Models 126-065 -- 201-100



Rear View - Models 126-065 -- 201-100



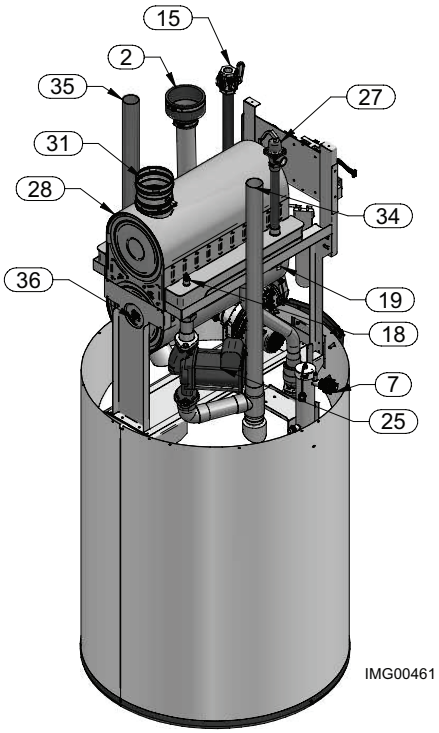
Left Side (inside unit) -- Models 126-065 -- 201-100



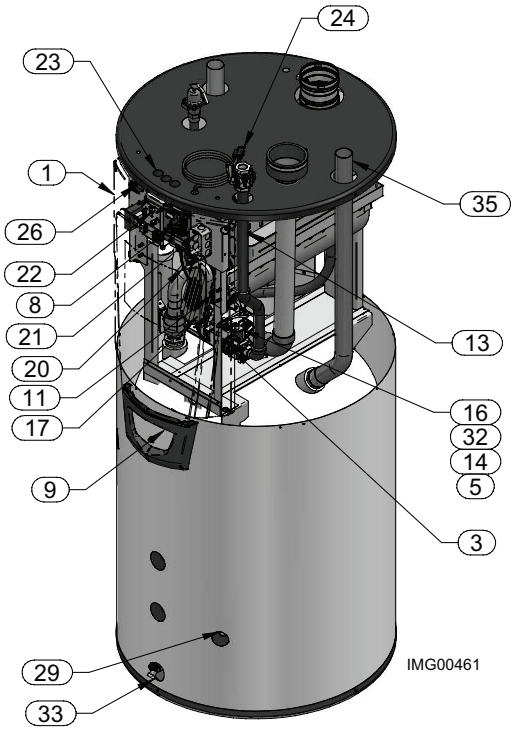
Right Side (inside unit) -- Models 126-065 -- 201-100

The Shield - How it works...

Models 286-125 -- 401-125

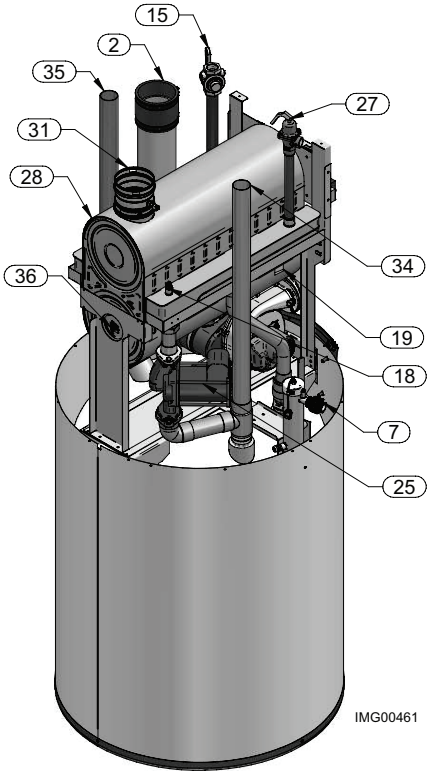


Rear View - Models 286-125 -- 401-125

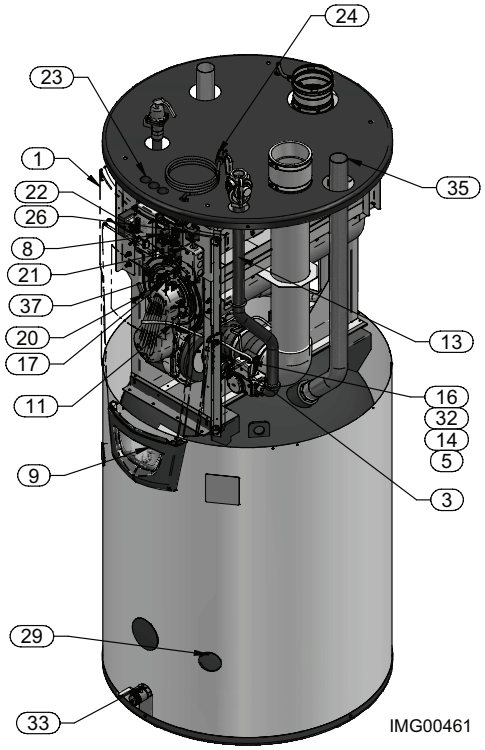


Right Side (inside unit) - Models 286-125 – 401-125

Model 501-125



Rear View - Model 501-125



Right Side (inside unit) - Model 501-125

Ratings

HLW

LOW LEAD CONTENT

Model Number Note: Change "N" to "L" for L.P. gas models.	CSA Input Modulation Btu/hr (Note 2)		Water Content Gallons	Water Connections	Gas Connections	Vent/Air Size (Note 1,4)
	Min	Max				
SNR126-065	25,000 - 125,000		68	1-1/2"	1/2"	3"
SNR151-100	30,000 - 150,000		91	1-1/2"	1/2"	3"
SNA151-100	30,000 - 150,000		91	1-1/2"	1/2"	3"
SNR201-100	39,800 - 199,000		91	1-1/2"	1/2"	3"
SNA201-100	39,800 - 199,000		91	1-1/2"	1/2"	3"
SNA286-125	57,000 - 285,000		116	2"	3/4"	4"
SNA401-125	79,800 - 399,000		117	2"	1"	4"
SNA501-125	100,000 - 500,000		117	2"	1"	4"

NOTICE Maximum allowed working pressure is located on the rating plate.

Notes:

1. Shield water heaters require special gas venting. Use only the vent materials and methods specified in the Shield Installation and Service Manual.
2. Standard Shield water heaters are equipped to operate from sea level to 4,500 feet **only** with no adjustments. The water heater will de-rate by 4% for each 1,000 feet above sea level up to 4,500 feet.
3. High altitude Shield water heaters are equipped to operate from 3,000 to 12,000 feet **only**. The water heater will de-rate by 2% for each 1,000 feet above sea level. High altitude models are manufactured with a different control module for altitude operation, but the operation given in this manual remains the same as the standard models. A high altitude label (as shown in FIG. A) is also affixed to the unit.

   Derate values are based on proper combustion calibration and CO_2's adjusted to the recommended levels.
4. The Shield 286-125 model can be alternatively vented using a 3" vent/air size. If the 3" vent/air size is used, the maximum vent/air pipe lengths are limited to 60 equivalent feet each.

Figure A *High Altitude Label Location*

1 Determine water heater location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The Shield water heater gas manifold and controls met safe lighting and other performance under tests specified in ANSI Z21.10.3 – latest edition.

Before locating the water heater, check:

1. Check for nearby connection to:
   - Water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the water heater. Remove any combustible materials, gasoline and other flammable liquids.

⚠ WARNING Failure to keep water heater area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The Shield water heater must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.

⚠ WARNING This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F.

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

⚠ WARNING This appliance requires a special venting system. The vent connection to the appliance must be made with the CPVC pipe section provided with the appliance. The field provided vent fittings must be cemented to the CPVC pipe section. Use only the vent materials, primer and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

Closet and alcove installations

A closet is any room the water heater is installed in which is less than 433 cubic feet for 126-065 and 201-100 models and 638 cubic feet for the 286-125 through 501-125 models.

An alcove is any room which meets the criteria for a closet with the exception that it does not have a door.

Example: Room dimensions = 6 feet long, 6 feet wide, and 9 foot ceiling = 6 x 6 x 9 = 324 cubic feet. This would be considered a closet for a Shield Water Heater.

⚠ WARNING For closet and alcove installations as shown in FIG.'s 1-1 and 1-2, CPVC or stainless steel vent material must be used inside the structure. The ventilating air openings shown in FIG.'s 1-1 and 1-2 are required for this arrangement. Failure to follow this warning could result in fire, personal injury, or death.

Provide clearances:

Clearances from combustible materials

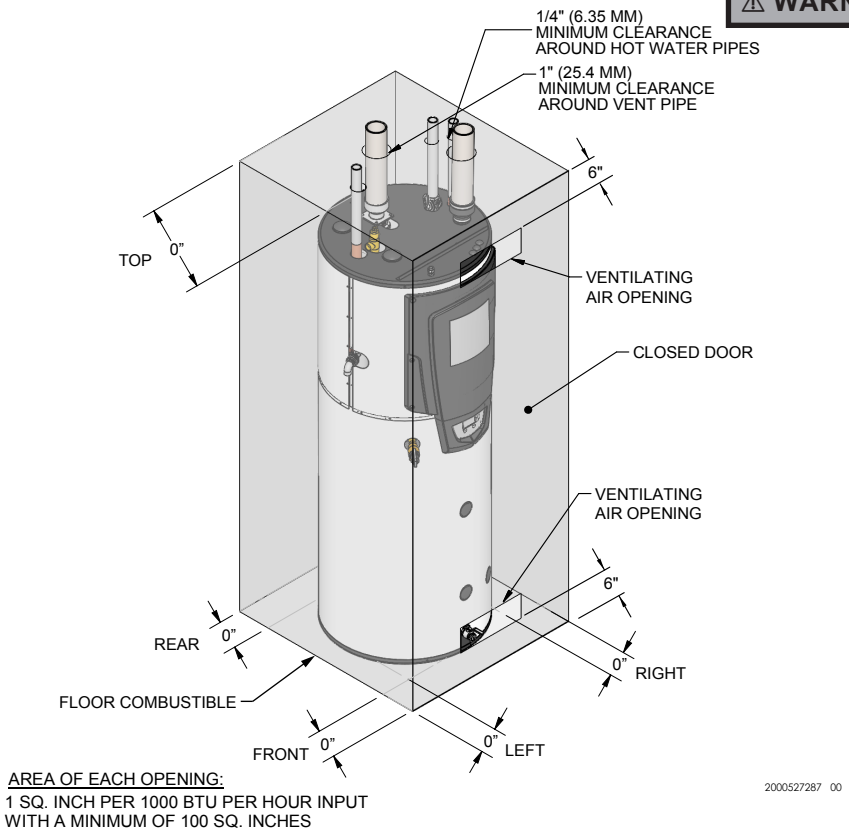
1. Hot water pipes—at least 1/4" from combustible materials.
2. Vent pipe – at least 1" from combustible materials.
3. See FIG.'s 1-1 and 1-2 on page 9 for other clearance minimums.

Clearances for service access

1. See FIG.'s 1-1 and 1-2 on page 9 for recommended service clearances. If you do not provide the minimum clearances shown, it may not be possible to service the water heater without removing it from the space.

1 Determine water heater location *(continued)*

Figure 1-1 *Closet Installation - Minimum Required Clearances*



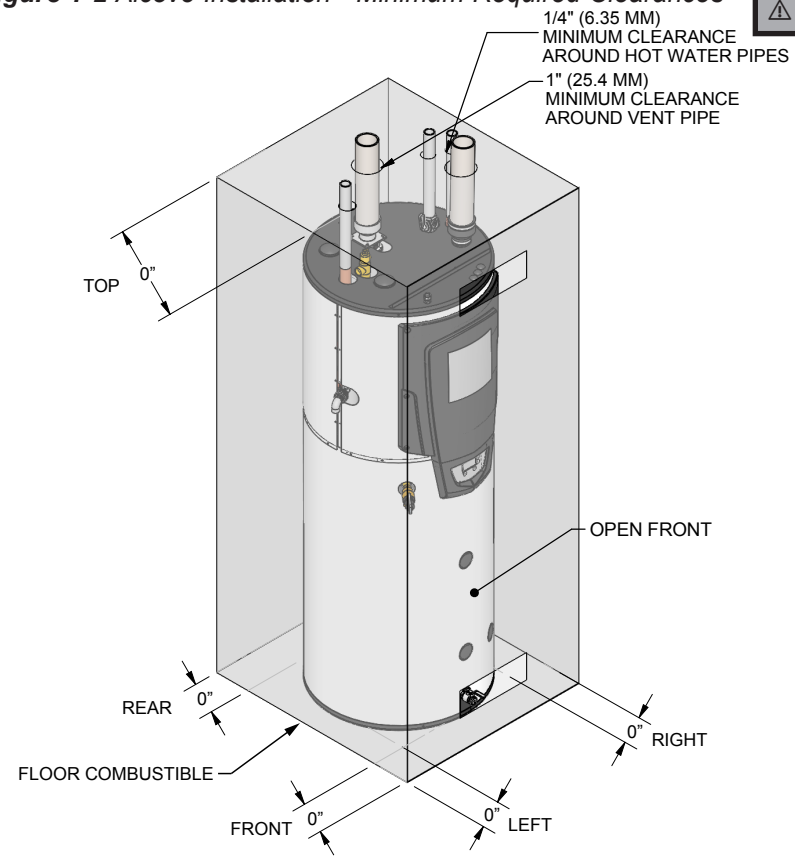
⚠ WARNING

For closet installations, CPVC, polypropylene or stainless steel vent material MUST BE used in a closet structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

RECOMMENDED SERVICE CLEARANCES:

Top -	18" (457 mm)
Left/Right Side -	24" (610 mm)
Front -	24" (610 mm)

Figure 1-2 *Alcove Installation - Minimum Required Clearances*



⚠ WARNING

For alcove installations, CPVC, polypropylene or stainless steel vent material MUST BE used in an alcove structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

RECOMMENDED SERVICE CLEARANCES:

Top -	18" (457 mm)
Left/Right Side -	24" (610 mm)
Front -	24" (610 mm)

1 Determine water heater location

Table 1A Corrosive Contaminants and Sources

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

Flooring and foundation

Flooring

The Shield water heater is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠ WARNING Do not install the water heater on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

When local codes require compliance with NSF 5, the heater must be sealed to the floor with a food grade silicone to prevent debris and harborage of vermin under the heater.

If flooding is possible, elevate the water heater sufficiently to prevent water from reaching the water heater.

Remove water heater from wood pallet

1. Remove the sides and the top of the crate.
2. Remove the blocks on the base of the crate to allow for easier removal.
3. The water heater can then be slid off the base of the crate for installation.

NOTICE Do not drop the water heater or bump the jacket on the floor or pallet. Damage to the water heater can result.

Prevent combustion air contamination

Install air inlet piping for the Shield water heater as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, for products and areas which may cause contaminated combustion air.

⚠ WARNING Ensure that the combustion air will not contain any of the contaminants in Table 1A. Contaminated combustion air will damage the water heater, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also, avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine water heater location *(continued)*

When using an existing vent system to install a new water heater:

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 2 - General Venting. For polypropylene or stainless steel venting, an adapter of the same manufacturer must be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 2A. Check to see that this size is used throughout the vent system.
- **Manufacturer** - For a stainless steel or polypropylene application, you must use only the listed manufacturers and their type product listed in Tables 2E and 2G for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 2 through 4 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Sidewall or Vertical options listed in the General Venting Section. For stainless steel vent, only use terminations listed in Table 2H for the manufacturer of the installed vent.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Water Heater Section, this page.

With polypropylene and stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used; with PVC/CPVC vent, see the Installing Vent or Air Piping Section on page 20.

⚠ WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

When removing a water heater from existing common vent system:

⚠ DANGER Do not install the Shield water heater into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

At the time of removal of an existing water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

a. Seal any unused openings in the common venting system.

b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.

c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.

f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

1 Determine water heater location

Maintain minimum specified clearances for adequate operation. All installations must allow sufficient space for servicing the vent connections, water pipe connections, piping and other auxiliary equipment, as well as the appliance.

Multiple appliances may be installed in a modular water heater installation. Multiple appliances may be installed side by side with no clearance between adjacent appliances because this appliance is approved for zero clearance from combustible surfaces.

Consult the *Venting* section of this manual for specific installation instructions for the appropriate type of venting system that you will be using.

Combustion and ventilation air requirements for appliances drawing air from the equipment room

Provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

The equipment room MUST be provided with properly sized openings to assure adequate combustion air and proper ventilation.

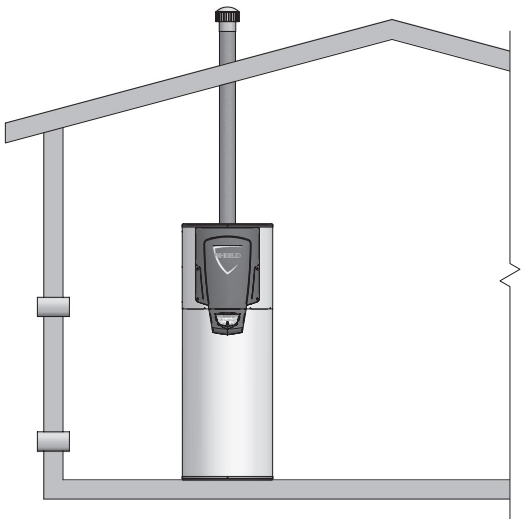


***Figure 1-3**_Combustion Air Direct from Outside*

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the equipment room (see FIG. 1-3):

   (a) Combustion air opening, with a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per KW). This opening must be located within 12" (30 cm) of the bottom of the enclosure.

   (b) Ventilation air opening, with a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure.

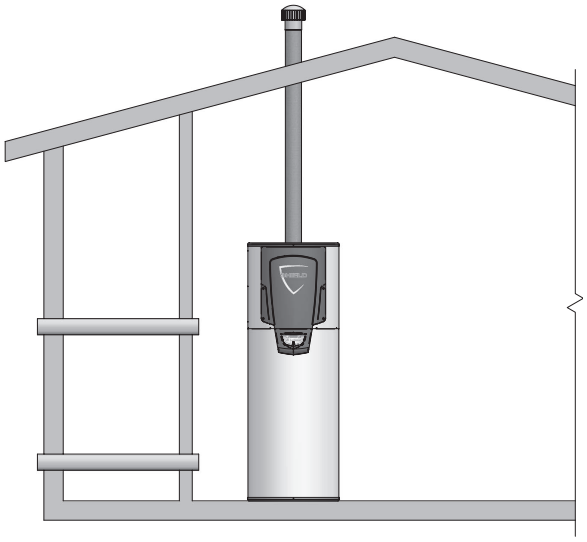


***Figure 1-4**_Combustion Air Through Ducts*

2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the equipment room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 Btu/hr (11 cm^2 per kW) of input (see FIG. 1-4).

1 Determine water heater location *(continued)*

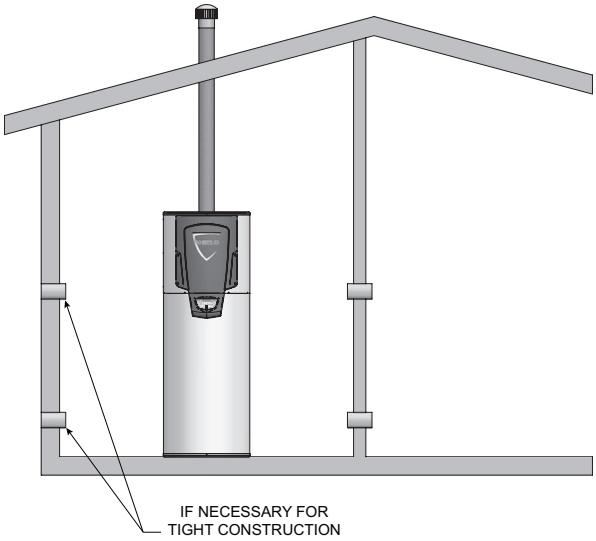


***Figure 1-5**_Combustion Air from Interior Space*

3. If air is taken from another interior space, each of the two openings specified above should have a net free area of one square inch for each 1000 Btu/hr (22 cm^2 per kW) of input, but not less than 100 square inches (645 cm^2) (see FIG. 1-5).

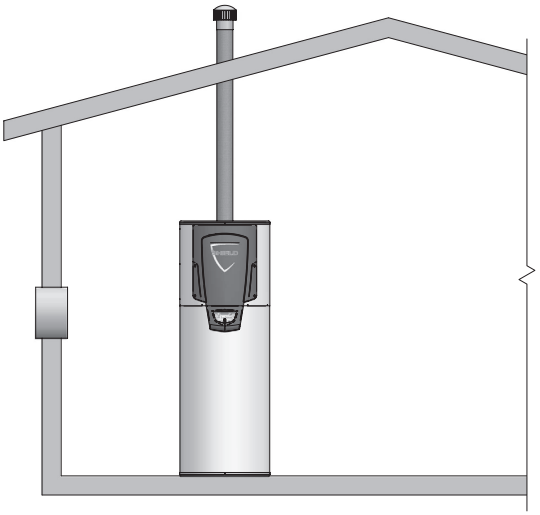


***Figure 1-6**_Combustion Air from Outside - Single Opening*

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 Btu/hr (7 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure (see FIG. 1-6).

TABLE - 1B
MINIMUM RECOMMENDED COMBUSTION AIR SUPPLY TO EQUIPMENT ROOM

Model Number	FIG. 1-3		FIG. 1-4		FIG. 1-5		FIG. 1-6
	*Outside Air from 2 Openings Directly from Outdoors		*Outside Air from 2 Ducts Delivered from Outdoors		**Inside Air from 2 Ducts Delivered from Interior Space		*Outside Air from 1 Opening Directly from Outdoors, in^2
	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2	
126-065	32 (207 cm^2)	32 (207 cm^2)	63 (407 cm^2)	63 (407 cm^2)	125 (807 cm^2)	125 (807 cm^2)	42 (271 cm^2)
151-100	38 (246 cm^2)	38 (246 cm^2)	75 (484 cm^2)	75 (484 cm^2)	150 (968 cm^2)	150 (968 cm^2)	50 (323 cm^2)
201-100	50 (323 cm^2)	50 (323 cm^2)	100 (646 cm^2)	100 (646 cm^2)	200 (1,291 cm^2)	200 (1,291 cm^2)	67 (433 cm^2)
286-125	72 (465 cm^2)	72 (465 cm^2)	143 (923 cm^2)	143 (923 cm^2)	285 (1,839 cm^2)	285 (1,839 cm^2)	95 (613 cm^2)
401-125	100 (646 cm^2)	100 (646 cm^2)	200 (1,291 cm^2)	200 (1,291 cm^2)	400 (2,581 cm^2)	400 (2,581 cm^2)	134 (865 cm^2)
501-125	125 (807 cm^2)	125 (807 cm^2)	250 (1,613 cm^2)	250 (1,613 cm^2)	500 (3,226 cm^2)	500 (3,226 cm^2)	167 (1,078 cm^2)

*Outside air openings shall directly communicate with the outdoors. When combustion air is drawn from the outside through a duct, the net free area of each of the two openings must have twice (2 times) the free area required for Outside Air/2 Openings. The above requirements are for the water heater only; additional gas fired appliances in the equipment room will require an increase in the net free area to supply adequate combustion air for all appliances.

Combined interior space must be 50 cubic feet per 1,000 Btu/hr input. **Buildings MUST NOT be of *"Tight Construction". For buildings of ***"Tight Construction",** provide air openings into the building from outside.

*No combustion air openings are needed when the water heater is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances. **Buildings MUST NOT be of *"Tight Construction".**

***"Tight Construction"** is defined as a building with less than 0.40 ACH (air changes per hour).

1 Determine water heater location

Combustion air requirements are based on the latest edition of the National Fuel Gas Code, ANSI Z223.1; in Canada refer to the latest edition of CGA Standard CAN B149.1. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers. Where two openings are provided, one must be within 12" (30cm) of the ceiling and one must be within 12" (30cm) of the floor of the equipment room. Each opening must have net free area as specified in the chart above (Table 1B). Single openings shall commence within 12" (30cm) of the ceiling.

⚠ CAUTION Under no circumstances should the equipment room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

The combustion air supply must be completely free of any flammable vapors that may ignite or chemical fumes which may be corrosive to the appliance. Common corrosive chemical fumes which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue collectors, and the vent system.

The result is improper combustion and a non-warrantable, premature appliance failure.

EXHAUST FANS: Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be immediately corrected. If a fan is used to supply combustion air to the equipment room, the installer must make sure that it does not cause drafts which could lead to nuisance operational problems with the appliance.

2 General venting

Direct venting options - Sidewall Vent

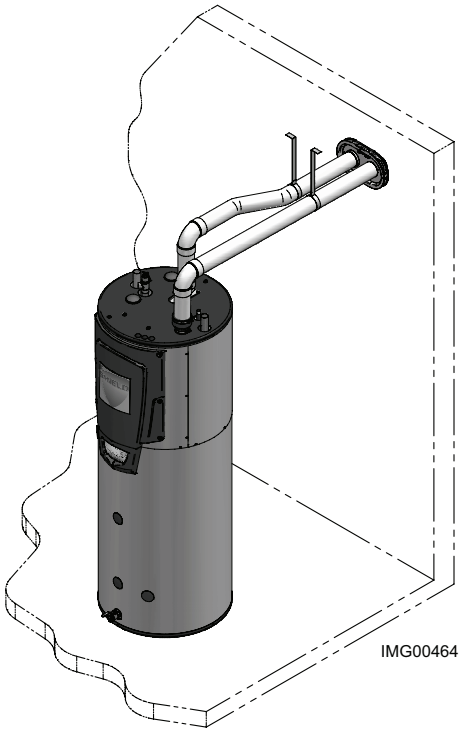


Figure 2-1 *Two-Pipe Sidewall Termination - See page 23 for more details*

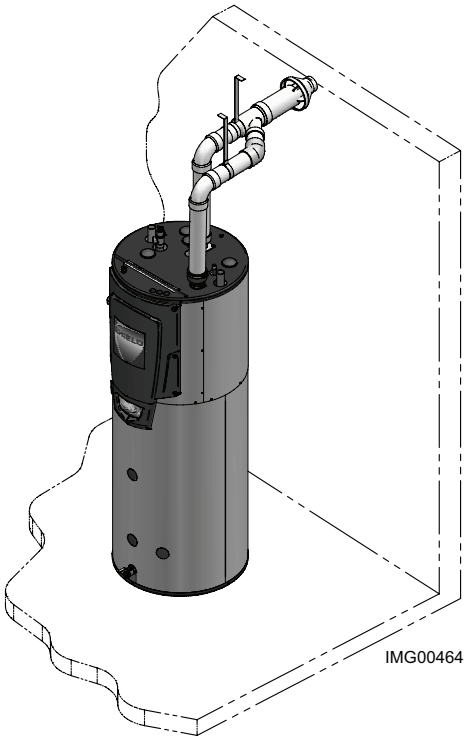


Figure 2-2 *PVC/CPVC Concentric Sidewall Termination - See page 30 for more details*

Direct venting options - Vertical Vent

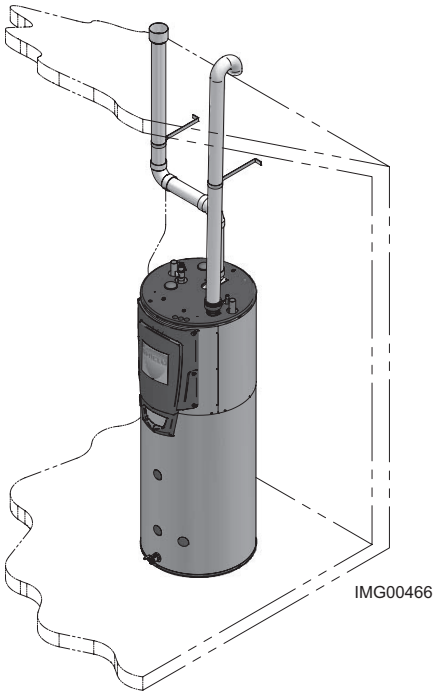


Figure 2-3 *Two-Pipe Vertical Termination - See page 33 for more details*

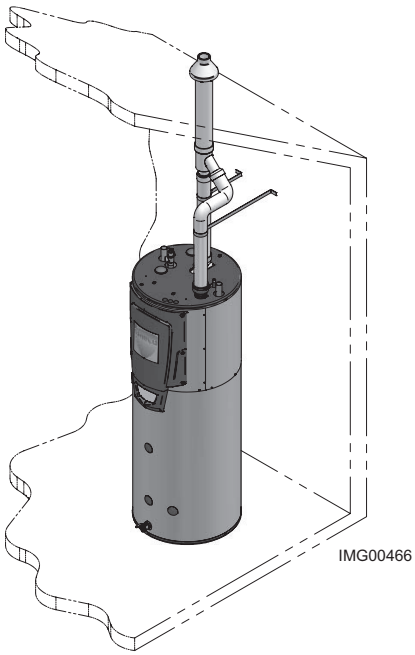


Figure 2-4 *PVC/CPVC Concentric Vertical Termination - See page 35 for more details*

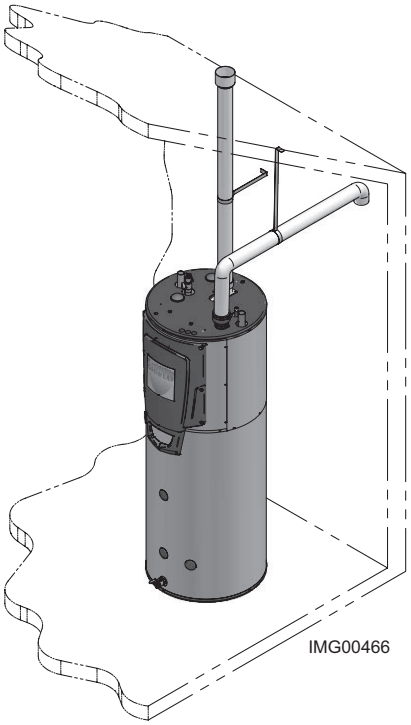


Figure 2-5 *Vertical Vent, Sidewall Air*

2 General venting

Install vent and combustion air piping

⚠ DANGER The Shield water heater must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

⚠ WARNING This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed in Tables 2D, 2E, and 2G for vent pipe, and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

⚠ WARNING For closet and alcove installations, CPVC, polypropylene or stainless steel material MUST BE used in a closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.

⚠ CAUTION Improper installation of venting systems may result in injury or death.

NOTICE Follow the instructions in Section 1, page 11 of this manual when removing a water heater from an existing vent system.

⚠ WARNING Do not connect any other appliance to the vent pipe or multiple water heaters to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

The Shield water heater vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

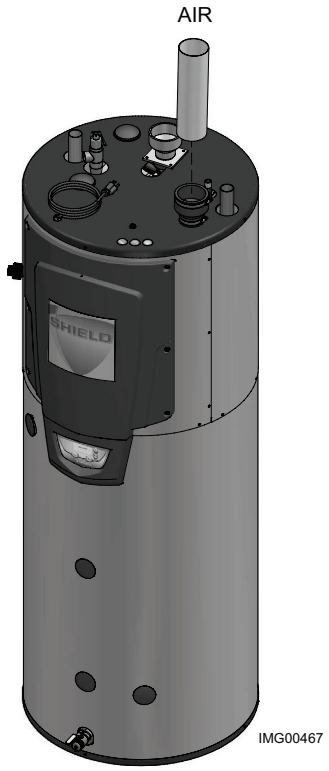
You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Shield water heater using any other means.

You must also install air piping from outside to the water heater air intake adapter unless following the Optional Room Air instructions on page 19 of this manual. The resultant installation is direct vent (sealed combustion).

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 2-6) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided on the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
2. **Vent Connector** (FIG.'s 2-7 thru 2-10) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 2-6 *Near Water Heater Air Piping*



2 General venting *(continued)*

Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/fittings. For concentric vent installations, the inner vent tube must be replaced with field supplied certified vent material to comply with this requirement.
4. The 3" Concentric Vent Kit available from Lochinvar (see Section 3 – *Sidewall Termination – Optional Concentric Vent*) and the 3" Concentric Vent Kit available from IPEX are both approved for use on the Shield water heater. Both kits are listed to the ULC-S636 standard for use in Canada.

Sizing

The Shield water heater uses model specific combustion air intake and vent piping sizes as detailed in Table 2A below.

Table 2A *Air Intake/Vent Piping Sizes*

Model	Air Intake	Vent
126-065 -- 201-100	3 inches	3 inches
286-125 -- 501-125	4 inches	4 inches

NOTICE Increasing or decreasing combustion air or vent piping sizes is not authorized.

Minimum / Maximum allowable combustion air and vent piping lengths are as follows:

Combustion Air = 12 equivalent feet minimum / 100 equivalent feet maximum

Vent = 12 equivalent feet minimum / 100 equivalent feet maximum

NOTICE When using the alternative 3" vent and combustion air piping with a Shield 286-125 model, the maximum allowable combustion air and vent piping lengths are limited to 60 equivalent feet each. The minimum allowable combustion air and vent pipe lengths remain 12 equivalent feet each.

When determining equivalent combustion air and vent length, add 5 feet for each 90° elbow and 3 feet for each 45° elbow.

EXAMPLE: 20 feet of PVC pipe + (4) 90° elbows + (2) 45° elbows + (1) concentric vent kit (100140480) = 49 equivalent feet of piping.

NOTICE The appliance output rating will reduce by up to 1.5% for each 25 feet of vent length, except when using the alternative 3" vent for the Shield 286-125 model which may de-rate by up to 4% for each 25 feet of vent length.

Table 2B *Concentric Vent Kit Equivalent Vent Lengths*

Model	Kit Number	Equivalent Vent Length
126-065 -- 201-100	100140480	3 feet
286-125	100140484	3 feet
401-125	100140484	5 feet
501-125	100140484	30 feet

2 General venting

Materials

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

PVC, CPVC, Polypropylene or ABS
Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
Galvanized steel vent pipe with joints and seams sealed as specified in this section.
Type "B" double-wall vent with joints and seams sealed as specified in this section.
AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠ WARNING Using air intake materials other than those specified can result in personal injury, death or property damage.

NOTICE The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type "B" double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.

b. Do not install seams of vent pipe on the bottom of horizontal runs.

c. Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.

d. Ensure that the air inlet pipes are properly supported.

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. The PVC, CPVC, ABS, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene manufacturer's instructions when using polypropylene material as an inlet pipe.

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

2 General venting *(continued)*

Optional room air

NOTICE Optional room air is intended for commercial applications. Combustion air piping to the outside is recommended for residential applications.

Commercial applications utilizing the Shield water heater may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option the following conditions and considerations must be followed.

- The unit MUST be installed with the appropriate room air provisions.
- The equipment room MUST be provided with properly sized openings to assure adequate combustion air. Please refer to instructions provided with the room air kit (100157615 - Models 126-065 -- 201-100 and 100157616 - Models 286-125 -- 501-125).
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- Using the room air configuration makes the unit vulnerable to combustion air contamination from within the building. Please review Section 1, Prevent Combustion Air Contamination, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

⚠ WARNING When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the water heater, they can form strong acids. The acid can eat through the water heater wall, causing serious damage and presenting a possible threat of flue gas spillage or water heater water leakage into the building.

Please read the information given in Table 1A, page 10, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the water heater combustion air inlet, have your installer pipe the water heater combustion air and vent to another location, per this manual.

⚠ WARNING If the water heater combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

⚠ WARNING To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 10 before installing the water heater or air inlet piping.

If contaminants are found, you MUST:

- Remove contaminants permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

2 General venting

PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in Table 2D.

Installing vent and air piping

⚠ WARNING The vent connection to the appliance must be made with the starter CPVC pipe section provided with the 286-501 models (starter piece is factory installed on the 126-201 models) if PVC/CPVC vent is to be used. The field provided vent fittings must be cemented to the CPVC pipe section using an "All Purpose Cement" suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 2D to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the water heater (to allow drainage of condensate).

⚠ WARNING Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

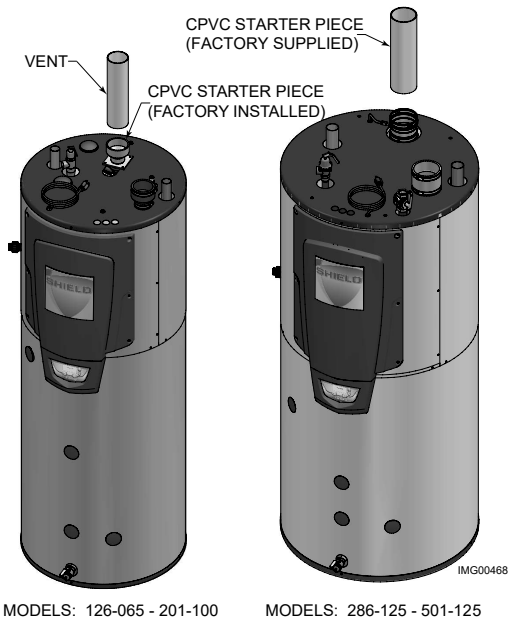
1. Work from the water heater to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   e. Apply a second coat of cement to the pipe.
   f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
   g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

Table 2D *PVC/CPVC Vent Pipe, and Fittings*

Approved PVC/CPVC Vent Pipe and Fittings		
Item	**Material**	**Standard**
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 80	ANSI/ASTM F439
	PVC - DWV	ANSI/ASTM D2665
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE		

NOTE: In Canada, CPVC and PVC vent pipe, fittings and cement/primer must be ULC-S636 certified.

Figure 2-7 *Near Water Heater PVC/CPVC Venting*



2 General venting *(continued)*

Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 2E.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

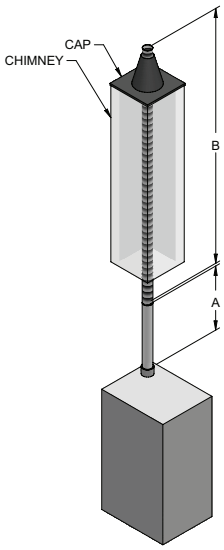
When determining equivalent combustion air and vent length for polypropylene single-wall piping:

- 1 foot of Duravent 4 inch single-wall pipe is equivalent to 1.6 feet of piping

Flexible polypropylene

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations (FIG. 2-8).

Figure 2-8 *Near Boiler Flexible Polypropylene Venting*



Duravent 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	60 FT	90 FT
20 FT	53 FT	80 FT
30 FT	47 FT	70 FT
40 FT	40 FT	60 FT
50 FT	33 FT	50 FT
60 FT	27 FT	40 FT
70 FT	20 FT	30 FT
80 FT	13 FT	20 FT
90 FT	7 FT	10 FT

Duravent 4"

"A" DIM	"B" DIM	
4" RIGID	4" FLEX	5" FLEX
10 FT	30 FT	90 FT
20 FT	27 FT	80 FT
30 FT	23 FT	70 FT
40 FT	20 FT	60 FT
50 FT	17 FT	50 FT
60 FT	13 FT	40 FT
70 FT	10 FT	30 FT
80 FT	7 FT	20 FT
90 FT	3 FT	10 FT

Centrotherm 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	45 FT	90 FT
20 FT	40 FT	80 FT
30 FT	35 FT	70 FT
40 FT	30 FT	60 FT
50 FT	25 FT	50 FT
60 FT	20 FT	40 FT
70 FT	15 FT	30 FT
80 FT	10 FT	20 FT
90 FT	5 FT	10 FT

Centrotherm 4"

"A" DIM	"B" DIM
4" RIGID	4" FLEX
10 FT	33 FT
20 FT	29 FT
30 FT	26 FT
40 FT	22 FT
50 FT	18 FT
60 FT	15 FT
70 FT	11 FT
80 FT	7 FT
90 FT	4 FT

*NOTES: 1) FLEX PIPE MAY ONLY BE RUN IN A VERTICAL ORIENTATION
2) ALL VENT LENGTHS REPRESENTED IN ABOVE CHARTS ARE EQUIVALENT LENGTHS.
3) SECTION A IS EQUIVALENT FEET OF RIGID PIPE, WHICH MAY INCLUDE 45 AND 90° ELBOWS. PLEASE SEE SIZING SECTION FOR DETERMINING EQUIVALENT FEET.

IMG00840

NOTICE The installer must use a specific vent starter adapter at the flue collar connection. The adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 2F for approved vent adapters. Discard CPVC starter piece.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 2-9).

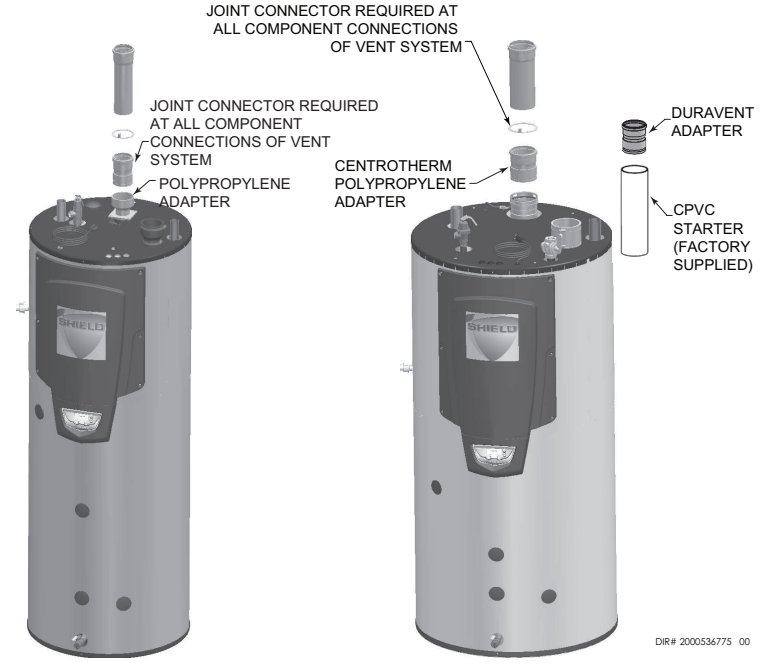
⚠ WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

⚠ WARNING Use only the adapters and vent system listed in Tables 2E and 2F. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer's installation instructions supplied with the vent system.

Figure 2-9 *Near Water Heater Polypropylene Venting*



MODELS: 126-065 - 201-100

MODELS: 286-125 - 501-125

Table 2E *Polypropylene Vent Pipe and Fittings*

Approved Polypropylene Vent Manufacturers	
Make	**Model**
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

Table 2F *Approved PolypropyleneTerminations*

Model	Centrotherm InnoFlue SW				Duravent Polypro		
	Polypropylene Adapter	Joint Connector	Sidewall Retaining Bracket*	Sidewall Adapter*	Polypropylene Adapter	Joint Connector	Sidewall Kit*
126-065 -- 201-100	ISAAL0303	IANS03	IATP0303	ISTAGL0303	3PPS-ADL	3PPS-LB	3PPS-HLK
286-125 -- 501-125	ISAAL0404	IANS04	IATP0404	ISTAGL0404	4PPS-AD-M	4PPS-LB	4PPS-HLK

* These parts are only needed if the sidewall termination assembly is used (see FIG. 3-4B on page 28).

2 General venting

Stainless steel vent

This product has been approved for use with stainless steel using the manufacturers listed in Table 2G. This unit requires Category IV venting.

⚠ WARNING Use only the materials, vent systems, and terminations listed in Tables 2G and 2H. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system. See Table 2H for approved vent adapters. Discard CPVC starter piece.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

Figure 2-10 *Near Water Heater Stainless Steel Venting*

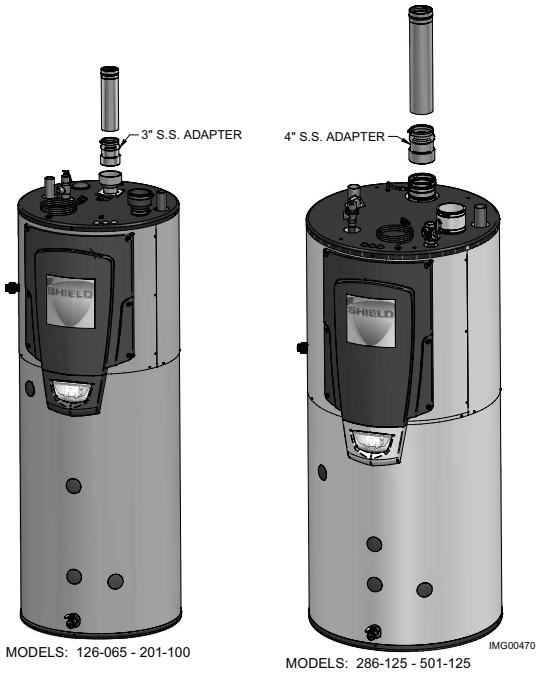


Table 2G *Stainless Steel Vent Pipe and Fittings*

Approved Stainless Steel Vent Manufacturers	
Make	**Model**
Dura Vent (M & G Group)	FasNSeal Vent / FasNSeal Flex* Vent
Z-Flex (Nova Flex Group)	Z-Vent
Heat Fab (Selkirk Corporation)	Saf-T Vent
Metal Fab	Corr/Guard
Security Chimney	Secure Seal

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

Table 2H *Approved Stainless Steel (S.S.) Terminations and Adapters*

Model	ProTech			Heat Fab			Z Flex		
	FasNSeal			Saf-T Vent			Z-Vent		
	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination
126-065 -- 201-125	300715	FSBS3 FSRC3(R.C)	303889	9301PVC	9392 5300CI	9314TERM	2SVSLA03	2SVSTP03 2SVSRCX03	2SVSTEX0390
286-125 -- 501-125	F303759	FSBS4 FSRC4(R.C.)	FSAIH04 303888	9401PVC	9492 5400CI	9414TERM	2SVSLA04	2SVSTP04 2SVSRCX04	2SVSTEX0490
Metal Fab				**Security Chimney**					
Corr/Guard				Secure Seal					
126-065 -- 201-125	3CGIA	3CGSWHT 3CGSWC	3CGSW90LT	--	--	--			
286-125 -- 501-125	4CGIA	4CGSWHT 4CGSWC	4CGSW90LT	SS4PVCU	SS4STU SS4RCBU	SS4ST90AU			

3 Sidewall direct venting

Vent/air termination – sidewall

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or pets.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠ WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.
   h. Do not locate the terminations over public walkways.
   i. Do not locate the terminations near soffit vents, crawl space vents, or other areas where condensate or vapor could create a nuisance, hazard, or cause property damage.
   j. Do not locate the terminations where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 3-1A *PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent*

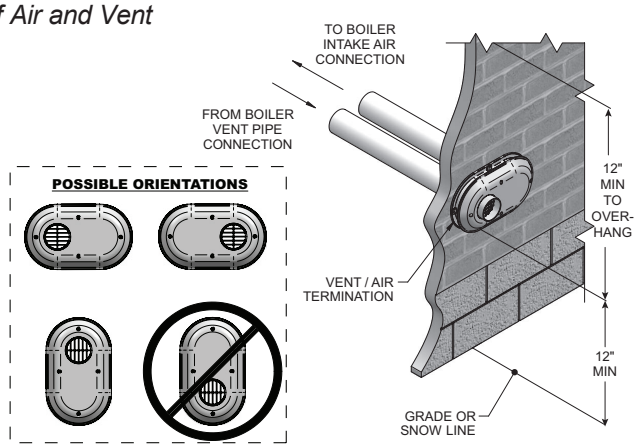


Table 3A *Sidewall Vent Kits*

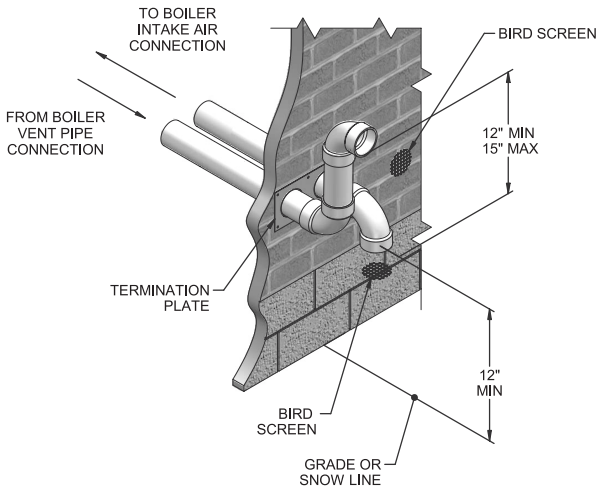
Model	Kit Number	Vent Size
126-065 -- 201-100	100157610	3 inch vent
286-125 -- 501-125	100157611	4 inch vent

If using the alternate sidewall termination:

3. The air piping must terminate in a down-turned elbow as shown in FIG. 3-1B. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 3-1B.

⚠ WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 3-1B. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential water heater shutdown.

Figure 3-1B *Alternate PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent w/Field Supplied Fittings*



3 Sidewall direct venting

Vent/air termination – sidewall

Figure 3-1C *Alternate PVC/CPVC/SS/ Polypropylene Venting Arrangement (if Space Allows) w/Field Supplied Fittings*

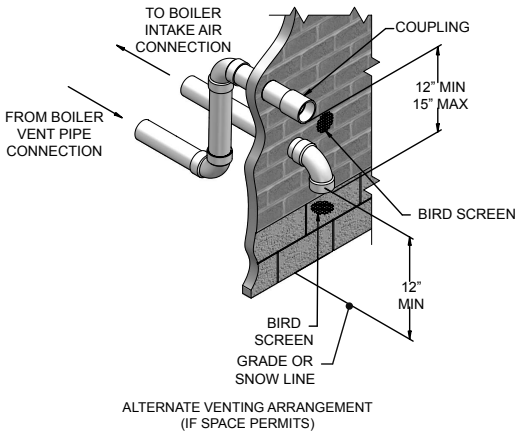
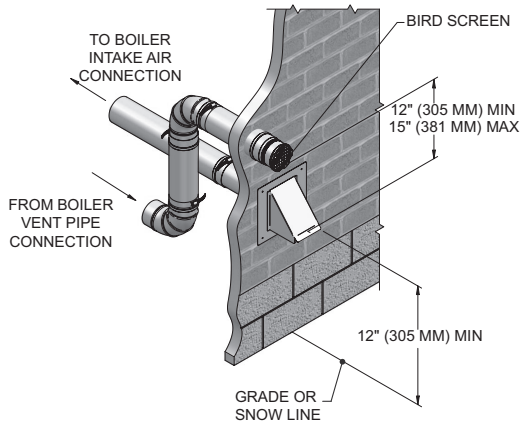


Figure 3-1D *Alternate SS Venting Arrangement - Typical Stainless Steel Sidewall Termination of Air and Vent w/Field Supplied Fittings, Utilizing a Hood Intake*



5. Maintain clearances as shown in FIG.'s 3-1A thru 3-3B, pages 23 - 27. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet from adjacent walls.
      - No closer than 12 inches below roof overhang.
   b. Air inlet must terminate at least 12 inches above grade or snow line; at least 12 inches below the vent termination; and the vent pipe must not extend more than 24 inches vertically outside the building as shown in FIG. 3-1B. Condensate could freeze and block vent pipe.
   c. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet horizontally.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Figure 3-2A *Clearance to Gravity Air Inlets*

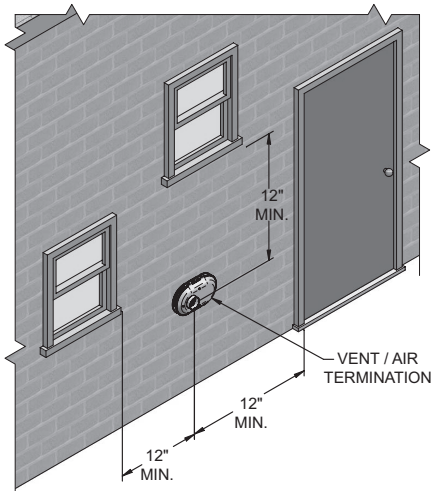
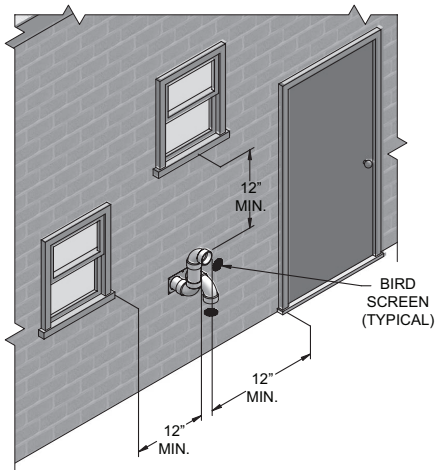


Figure 3-2B *Alternate Clearance to Gravity Air Inlets w/ Field Supplied Fittings*



3 Sidewall direct venting *(continued)*

Figure 3-3A *Direct Vent Terminal Clearances*

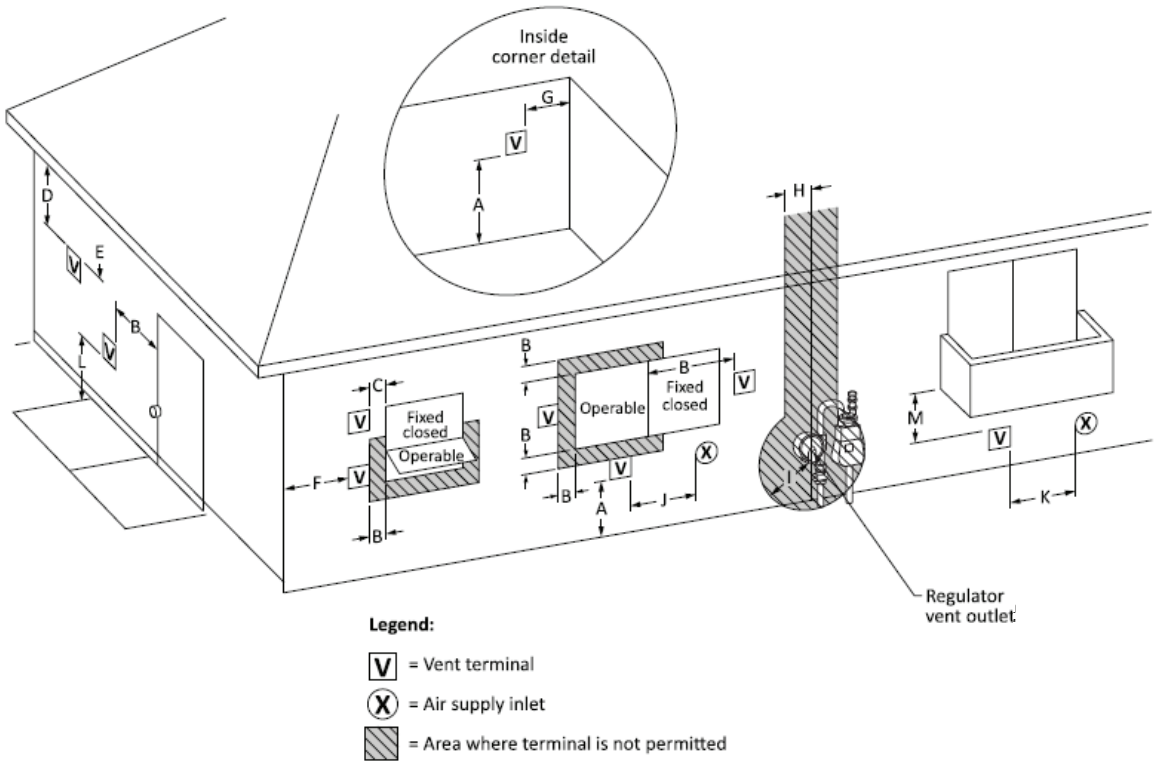


Table 3B *Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*

3 Sidewall direct venting

***Table 3B** Direct Vent Terminal Clearances (continued)*

J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	*
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

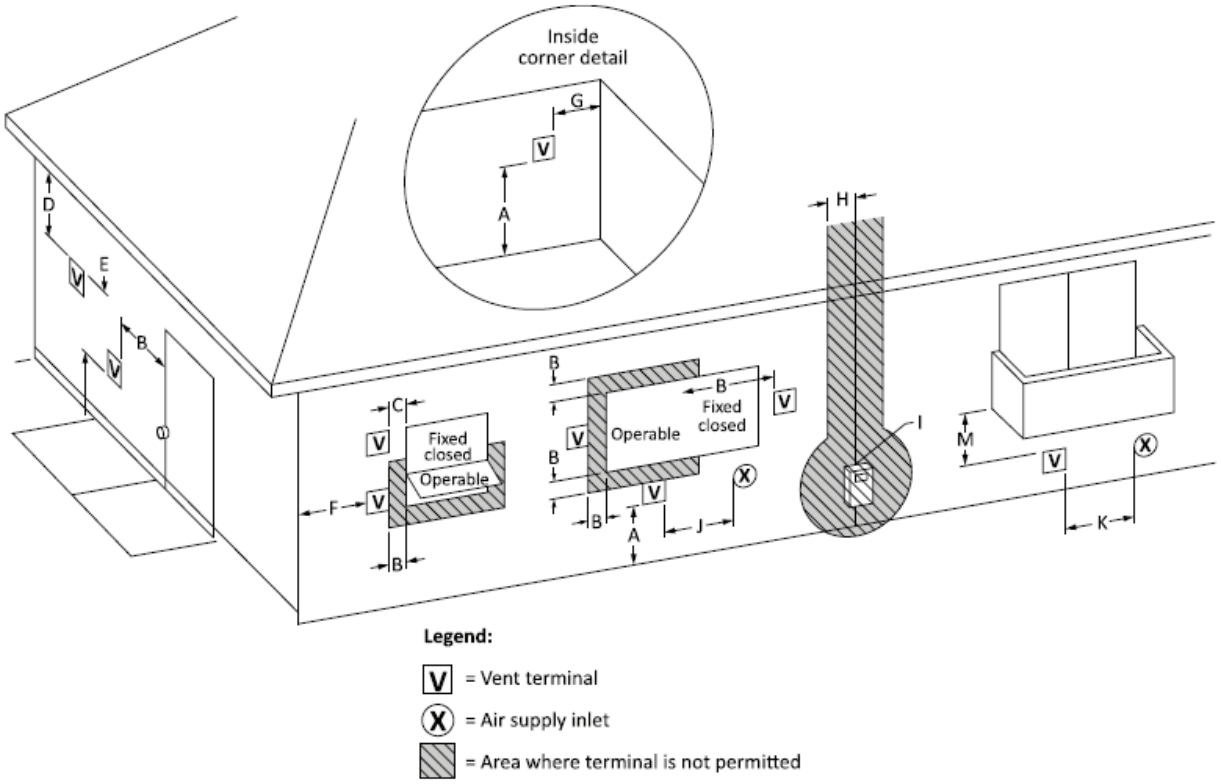
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he floor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

***Figure 3-3B** Other than Direct Vent Terminal Clearances*



3 Sidewall direct venting *(continued)*

***Table 3C** Other than Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	7 ft (2.13 m)
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he floor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

3 Sidewall direct venting

Prepare wall penetrations

1. Use the factory supplied wall plate as a template to locate the vent and air intake holes and mounting holes.
   Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
   Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
   Drill 3/16" diameter holes for inserting the plastic anchors into the wall.
2. For Polypropylene Only: Install the vent and air intake sidewall adapters from Table 2F on page 21 into the vent plate. Slide the sidewall retaining bracket down the sidewall adapters flush to the vent plate (FIG. 3-4B).
3. For PVC/CPVC Only: Install the vent and air intake piping through the wall into the vent plate openings. Use RTV silicone sealant to seal the air pipe. Use the cement/primer listed in Table 2D on page 20 to seal the vent pipe.
4. Mount and secure the vent plate to the wall, using stainless steel screws.
5. Seal all gaps between the pipes and wall. Seal around the plate to the wall assuring no air gaps.
6. Assemble the vent cap to the vent plate (see FIG.'s 3-4A and 3-4B). Insert the stainless steel screws into the vent cap screw hole openings and securely attach the vent cap to the vent plate.
7. Seal all wall cavities.
8. PVC/CPVC terminations are designed to accommodate any wall thickness of standard constructions per the directions found in this manual.
9. Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Figure 3-4A *PVC/CPVC Sidewall Termination Assembly*

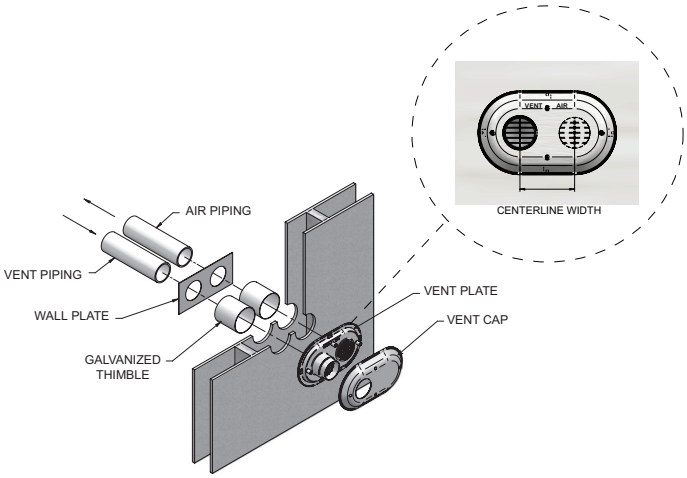
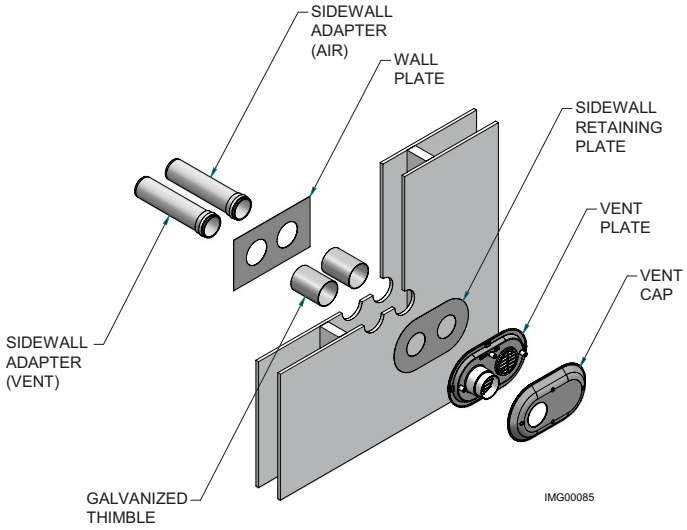


Table 3D *Sidewall Vent Centerline Dimensions*

Model	Air	Vent	Centerline Width
126-065 -- 201-100	3"	3"	5 5/8"
286-125 -- 501-125	4"	4"	5 5/8"

Figure 3-4B *Polypropylene Sidewall Termination Assembly*

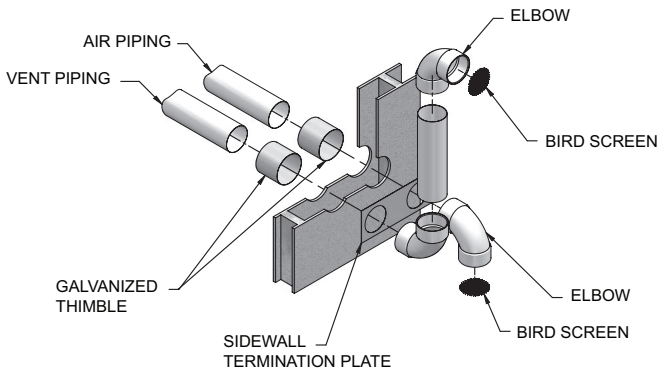


3 Sidewall direct venting *(continued)*

Prepare wall penetrations (Alternate - Field Supplied Option)

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      - 4½ inch hole for 3 inch vent pipe
      - 5½ inch hole for 4 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole as shown in FIG. 3-4C.
3. Use a sidewall termination plate as a template for correct location of hole centers.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

***Figure 3-4C** Alternate Sidewall Termination Assembly w/Field Supplied Fittings*



Multiple vent/air terminations

1. When terminating multiple Shield water heaters terminate each vent/air connection as described in this manual (FIG. 3-5A).

⚠ WARNING All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place wall penetrations to obtain minimum clearance of 12 inches between edge of air inlet and adjacent vent outlet, as shown in FIG. 3-5A for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Shield water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

***Figure 3-5A** Multiple Vent Terminations (must also comply with **Figure 3-1A**)*

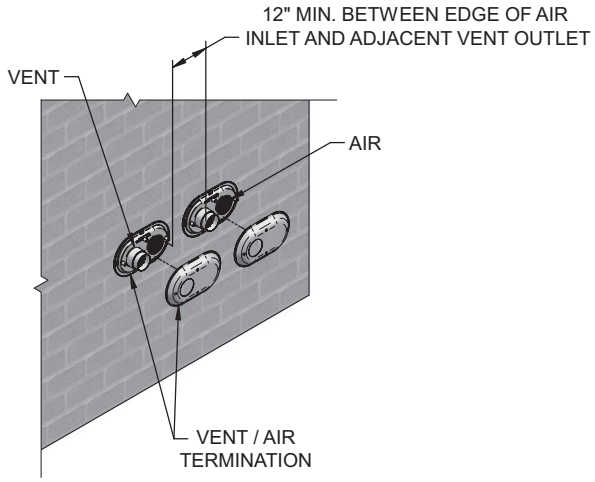
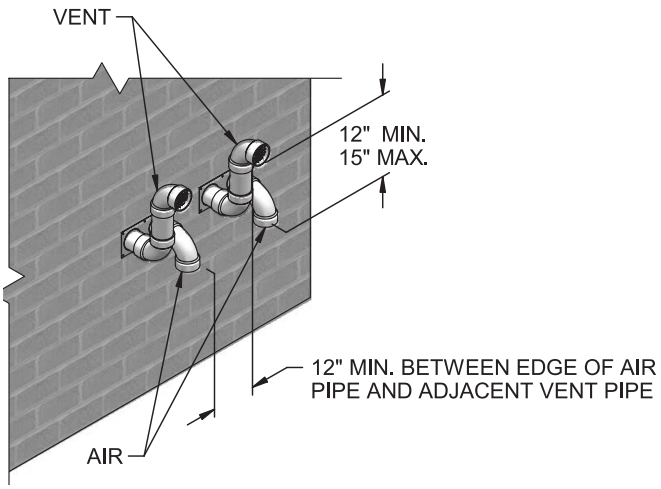


***Figure 3-5B** Alternate Multiple Vent Terminations w/Field Supplied Fittings (must also comply with **Figure 3-1B**)*



3 Sidewall direct venting

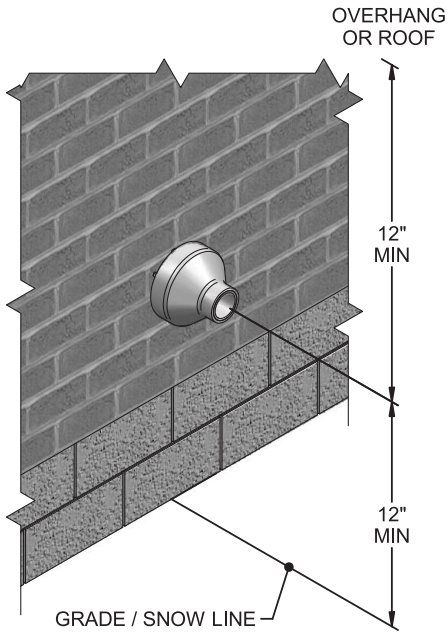
Sidewall termination – optional concentric vent

Description and usage

Lochinvar offers optional concentric combustion air and vent pipe termination kits (Factory Kit #100140480 for 3" diameter - Models 126-065 - 201-100 and #100140484 for 4" diameter - Models 286-125 - 501-125). Both combustion air and vent pipes must attach to the termination kit. The termination kits must terminate outside the structure and must be installed as shown in FIG. 3-6.

The required combustion vent pipe materials are listed in Table 2D, on page 20 of this manual.

Figure 3-6 *Concentric Sidewall Termination*



Sidewall termination installation

1. Determine the best location for the termination kit (see FIG. 4-6).

2. Reference the *Determine Location Section* on page 23 of this manual for general termination considerations.

3. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.

4. Partially assemble the concentric vent termination kit. Clean and cement using the procedures found in these instructions.

   a. Cement the Y concentric fitting to the larger kit pipe (FIG.'s 3-7 and 3-8).
   b. Cement the rain cap to the smaller diameter kit pipe (FIG.'s 3-7 and 3-8).

Figure 3-7 *Kit Contents_100140480 - 126-065 -- 201-100*

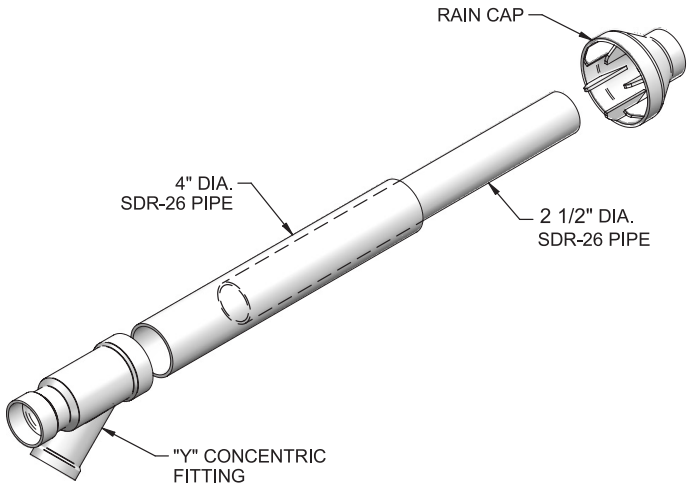
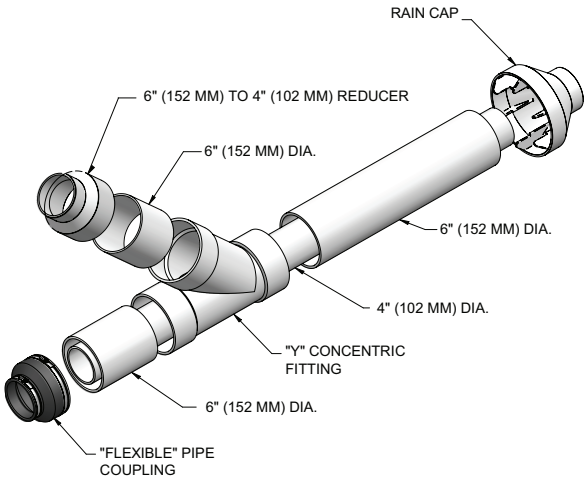


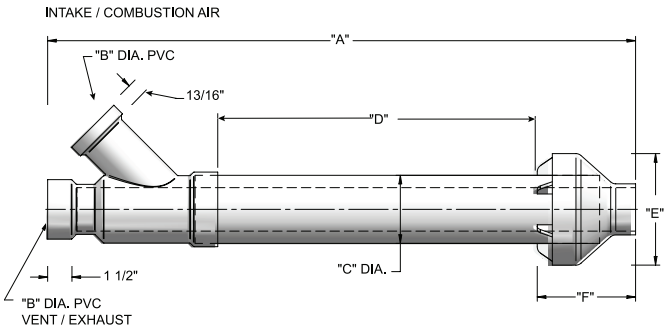
Figure 3-8 *Kit Contents_100140484 - 286-125 -- 501-125*



3 Sidewall direct venting *(continued)*

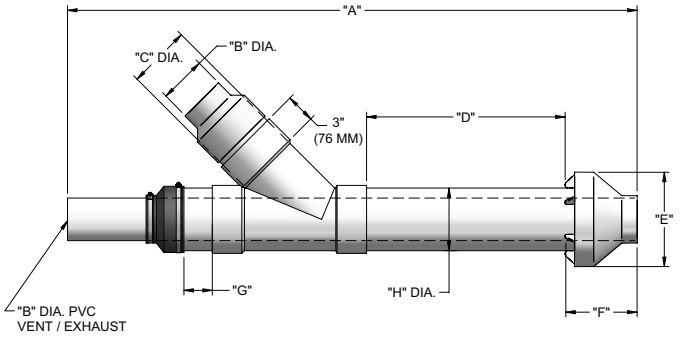
Sidewall termination – optional concentric vent

Figure 3-9 *Concentric Vent Dimensional Drawing - Models 126-065 -- 201-100 / 100140480*



A	B	C	D*	E	F
38 7/8"	3"	4 1/2"	21 1/8"	7 3/8"	6 1/2"

Figure 3-10 *Concentric Vent Dimensional Drawing - Models 286-125 -- 501-125 / 100140484*



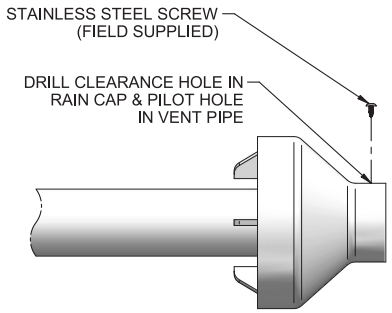
A	B	C	D	E	F	G	H
60"	4"	6"	21 1/8"	10"	7 5/8"	3"	6 5/8"

NOTICE Instead of cementing the smaller pipe to the rain cap, a field-supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 3-11).

⚠ WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

Figure 3-11 *Rain Cap to Vent Pipe Alternate Assembly*



6. Install the Y concentric fitting and pipe assembly through the structure's hole.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

7. Install the rain cap and small diameter pipe assembly into the Y concentric fitting and large pipe assembly. Ensure small diameter pipe is bottomed and cemented in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

8. Secure the assembly to the structure as shown in FIG. 3-12 using field-supplied metal strapping or equivalent support material.

NOTICE Ensure termination location clearance dimensions are as shown in FIG. 3-6.

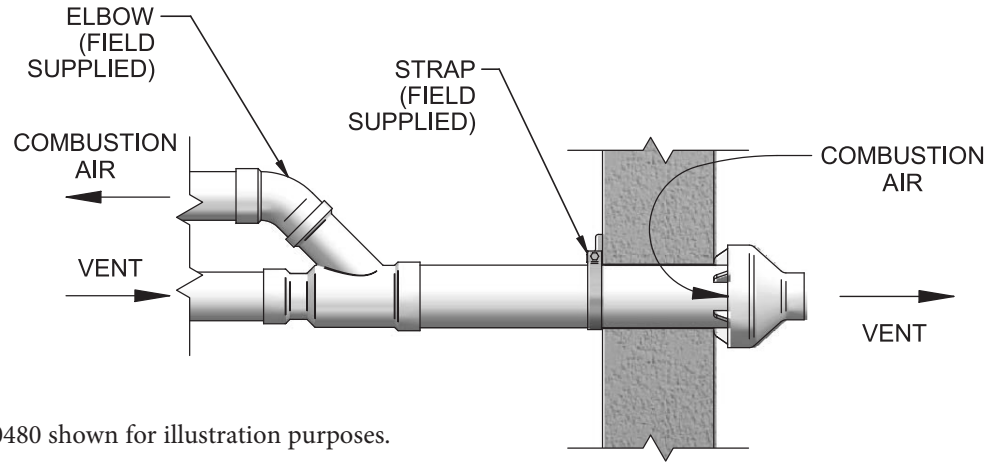
NOTICE If assembly needs to be extended to allow sidewall thickness requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field-supplied SDR-26 PVC (D2241) pipe for 100140480 and standard schedule 40 PVC for 100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 3-9 and 3-10).

NOTICE If assembly depth needs to be reduced, dimension D can be as short as possible.

3 Sidewall direct venting

Sidewall termination – optional concentric vent

Figure 3-12 Concentric Vent Sidewall Attachment



Note: 100140480 shown for illustration purposes.

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.

9. Cement appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 3-12 for proper pipe attachment.

10. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing sidewall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 3-13). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 3-13. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

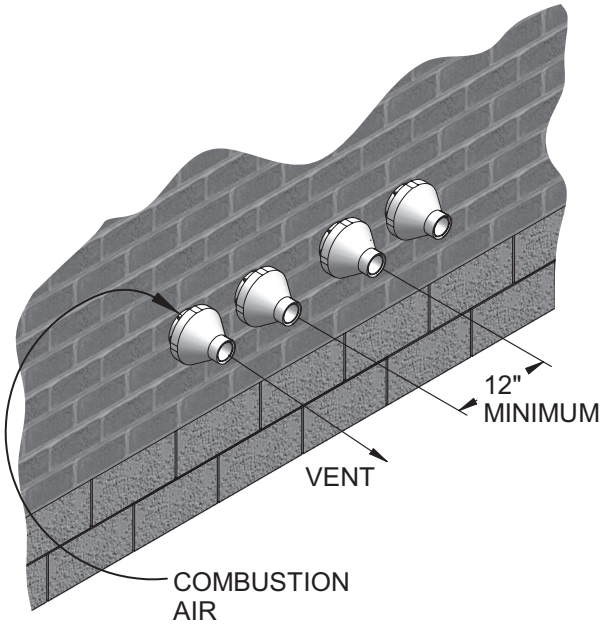


Figure 3-13 Concentric Vent and Combustion Air Termination

4 Vertical direct venting

Vent/air termination – vertical

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. Prepare the vent termination and the air termination elbow (FIG. 4-1A) by inserting bird screens. Bird screens should be obtained locally.
3. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
4. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
5. The vent piping must terminate in an up-turned coupling as shown in FIG. 4-1A. The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap as illustrated in FIG. 4-1B maintain at least 36" (914 mm) above the air inlet. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 1 foot for PVC and 3 feet for stainless steel, above the air intake.
6. Maintain the required dimensions of the finished termination piping as shown in FIG. 4-1A.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

⚠ WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

Figure 4-1A *Vertical Termination of Air and Vent*

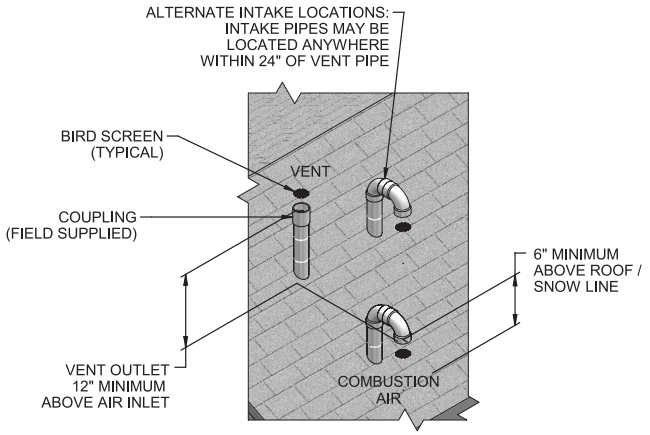
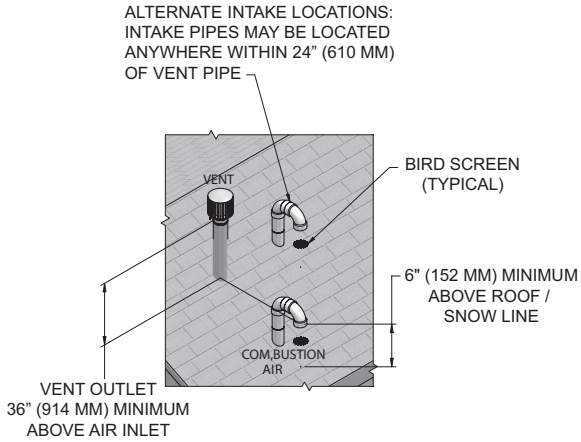


Figure 4-1B *Stainless Steel Vertical Termination of Air and Vent*



8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

4 Vertical direct venting

Vent/air termination – vertical

Prepare roof penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      - 4½ inch hole for 3 inch vent pipe
      - 5½ inch hole for 4 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole.
3. Space the air and vent holes to provide the minimum spacing shown in FIG. 4-1A, page 33.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Multiple vent/air terminations

1. When terminating multiple Shield water heaters, terminate each vent/air connection as described in this manual (FIG. 4-2).

⚠ WARNING Terminate all vent pipes at the same height and all air pipes at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches between edge of air intake elbow and adjacent vent pipe of another water heater for U.S. installations (see FIG. 4-2). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Shield water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

Figure 4-2 *Vertical Terminations with Multiple Water Heaters*

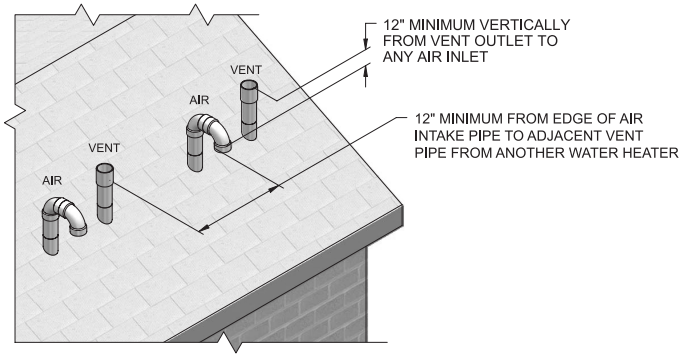
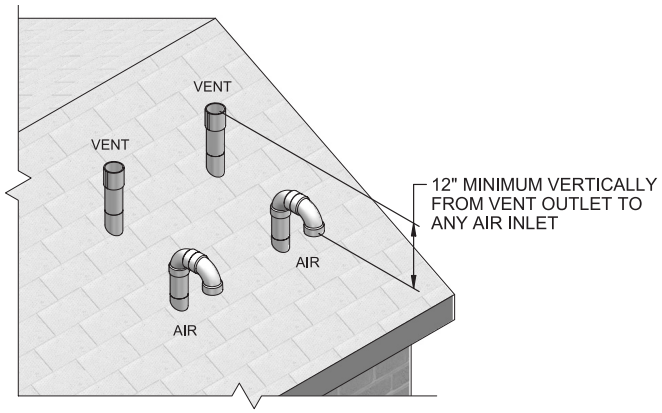


Figure 4-3 *Alternate Vertical Terminations with Multiple Water Heaters*



4 Vertical direct venting *(continued)*

Vertical termination – optional concentric vent

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit. Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in FIG. 4-4.

Field supplied pipe and fittings are required to complete the installation.

The required combustion air and vent pipe fittings are listed in Table 2D, on page 20 of this manual.

Vertical termination installation

1. See Section 4, Vertical Direct Venting - Determine Location (where applicable).
2. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.
3. Partially assemble the concentric vent termination kit. Clean and cement following the cleaning procedures in these instructions.
   a. Cement the Y concentric fitting to the larger diameter kit pipe (see FIG.'s 3-7 and 3-8, page 30).
   b. Cement rain cap to the smaller diameter kit pipe (see FIG.'s 3-7 and 3-8, page 30).
   c. Do not attach a U-Bent to the rain cap. Doing so could cause recirculation (see FIG. 4-5).

Figure 4-4 *Concentric Vertical Termination*

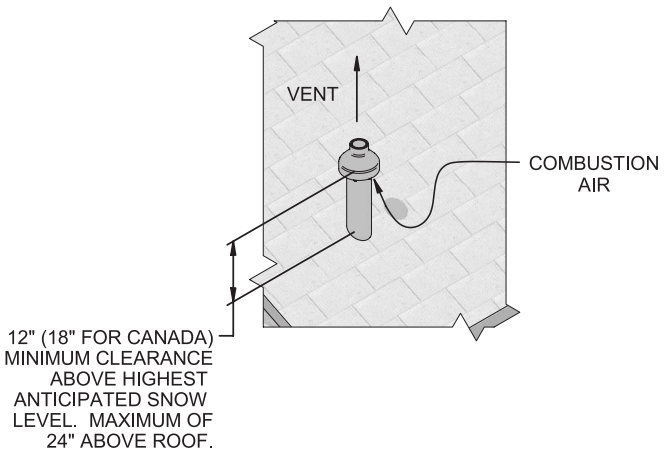


Figure 4-5 *Do Not Install U-Bent to Rain Cap*

NOTICE Instead of cementing the smaller pipe to the rain cap, a field supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 3-11, page 31).

⚠ WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

4 Vertical direct venting

Vertical termination – optional concentric vent

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

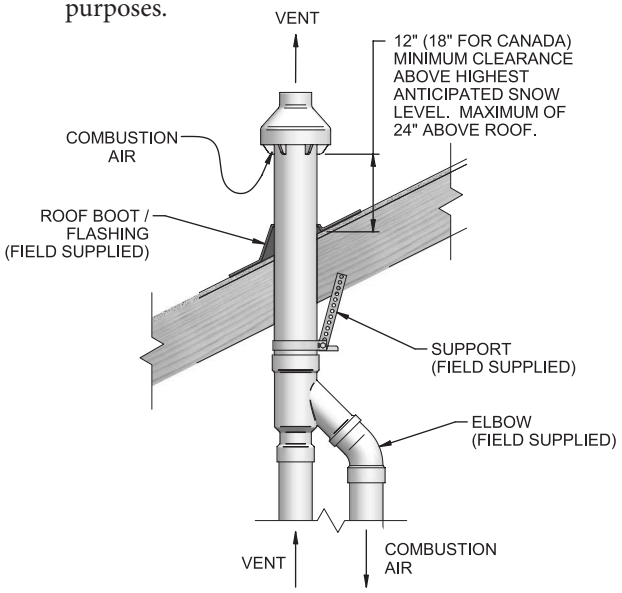
4. Install the Y concentric fitting pipe assembly up through the structure's hole and field supplied roof boot/flashing.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

5. Secure the assembly to the roof structure as shown below in FIG. 4-6 using field supplied metal strapping or equivalent support material.

Figure 4-6 *Concentric Vent Roof Installation*

Note: 100140480 shown for illustration purposes.



NOTICE Ensure termination height is above the roof surface or anticipated snow level (12 inches in U.S.A. or 18 inches in Canada) as shown in FIG. 4-4, page 35.

NOTICE If assembly is too short to meet height requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field supplied SDR-26 PVC (D2241) pipe for #100140480 and standard schedule 40 PVC for #100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 3-9 and 3-10, page 31).

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur.

6. Install the rain cap and the small diameter pipe assembly into the roof penetration assembly. Ensure the small diameter pipe is cemented and bottomed in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

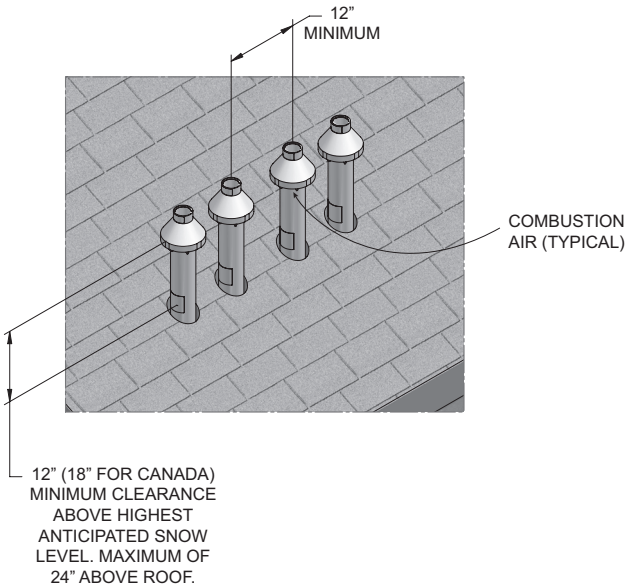
7. Cement the appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 4-6 for proper pipe attachment.

8. Operate the appliance through one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 4-7). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 4-7. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 4-7 *Concentric Vent and Combustion Air Vertical Termination*



5 System piping

System water piping methods

Observe a minimum of one inch clearance around all un-insulated hot water pipes when openings around the pipes are not protected by non-combustible materials.

⚠ WARNING Failure to install and maintain a new, listed temperature and pressure relief valve will release the manufacturer from any claim, which might result from excessive temperature and pressures.

Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). HYDROGEN GAS IS EXTREMELY FLAMMABLE. To prevent the possibility of injury under these conditions, we recommend the hot water faucet to be open for several minutes at the kitchen sink before you use any electrical appliance, which is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. Do not smoke or have an open flame near the faucet at the time it is open.

General piping information

Basic steps are listed below along with illustrations on the following pages (FIG.'s 5-2 thru 5-4), which will guide you through the installation of the Shield water heater.

1. BEFORE PROCEEDING WITH THE INSTALLATION, CLOSE THE MAIN WATER SUPPLY VALVE. After shutting off the main water supply, open a faucet to relieve the water line pressure to prevent any water from leaking out of the pipes while making the water connections to the water heater. The COLD water inlet and HOT water outlet are identified on the water heater. Make the proper plumbing connections between the water heater and the plumbing system to the building. Install a shutoff valve in the cold water supply line.
2. If this water heater is installed in a closed water supply system, such as the one having a backflow preventer in the cold water supply, provisions must be made to control thermal expansion. DO NOT operate this water heater in a closed system without provisions for controlling thermal expansion. Warranties do not cover damages from thermal expansion such as pressure bulges and/or deformities. Your water supplier or local plumbing inspector should be contacted on how to control this situation.
3. After installation of the water lines, open the main water supply valve and fill the water heater. While the water heater is filling, open several hot water faucets to allow air to escape from the water system. When a steady stream of water flows through the faucets, close them and check all water connections for possible leaks.
4. Never operate the water heater without first being certain it is filled with water.

Scalding

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased temperature water. By setting the thermostat on this water heater to obtain the increased temperature water required by these appliances, you may create the potential for scald injury. To protect against injury, you should install an ASSE approved mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from the local plumbing supplier.

Figure 5-1 *Scald Warning*

Water temperatures over 125°F (52°C) can cause severe burns instantly or death from scalds.
Children, disabled, and elderly are at highest risk of being scalded.

See instruction manual before setting the thermostat at the water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, consult local plumbing supplier.

5 System piping

The following chart (Table 5A) details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

***Table 5A** Approximate Time / Temperature Scald Chart*

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second

Water chemistry

NOTICE The required temperature rise and the standard circulating pump are sized based on the heating of potable water with a specified water chemistry. See Table 9A in Start-Up Section for recommendations.

Water with a hardness of less than 5 grains per gallon will usually have a pH which can be aggressive and corrosive causing non-warrantable damage to the pump and associated piping. Corrosion due to water chemistry generally shows up first in the hot water system because heated water increases the rate of corrosive chemical reactions.

Piping components

Check valves:

Field supplied. Check valves are recommended for installation as shown in FIG.'s 5-2 thru 5-4.

Water heater isolation valves:

Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the water heater.

Anti-scald mixing valve:

Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F.

Unions:

Field supplied. Recommended for unit serviceability.

Temperature and pressure relief valve:

Factory supplied on water heaters. The temperature and pressure relief valve is sized to ASME specifications.

Strainer:

Field supplied. Required to help eliminate debris from causing damage to the heat exchanger. When installing in a pre-existing system, it is recommended to install a filter in the recirculation line capable of removing debris left in the system.

Building Recirculation Filter:

Field supplied as required (see Table 9A). When required, helps to eliminate debris from causing damage to the heat exchanger.

⚠ CAUTION Check recirculation pump size to verify it is sized for filter addition and upsize if necessary.

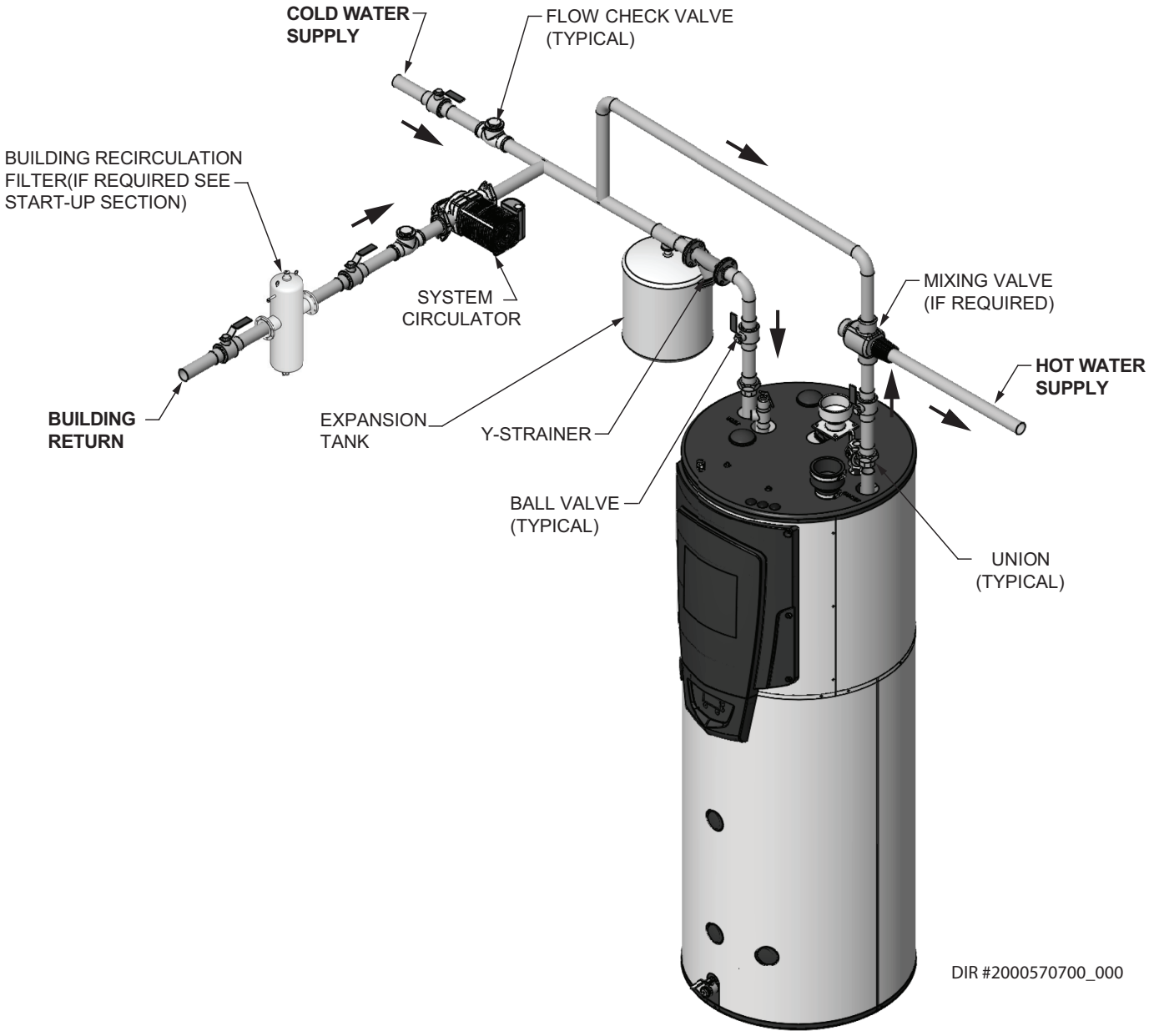
⚠ CAUTION No valves shall be placed between the relief valve, heat exchanger, or tank. The relief valve shall be piped to a suitable drain as close as possible to the heater with no reducing couplings or other restrictions. The piping must be sloping away from the heater at all times.

See the * piping illustrations included in this section, FIG.'s 5-2 thru 5-4 for suggested guidelines in piping the Shield water heater.

NOTICE *Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping *(continued)*

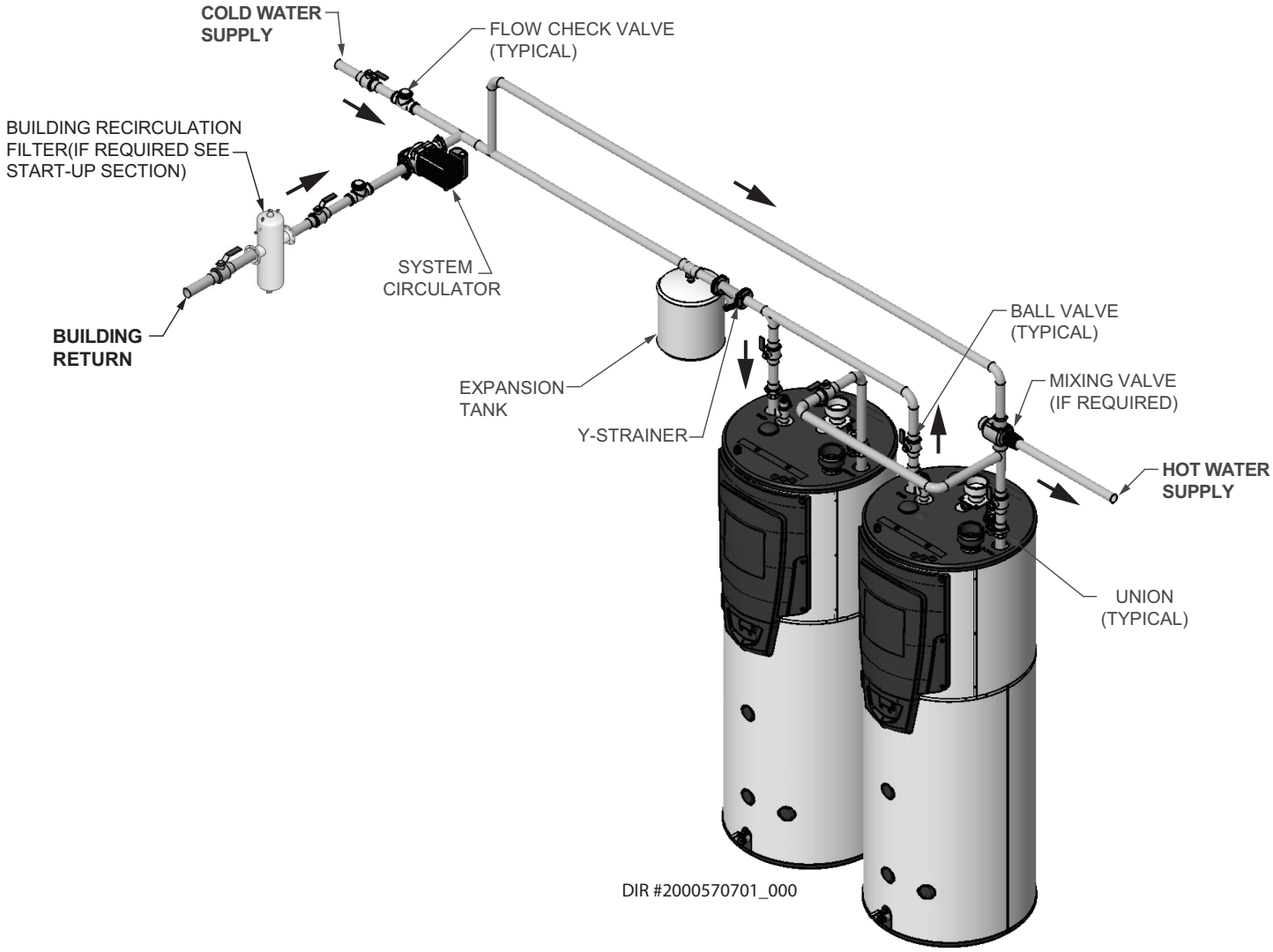
Figure 5-2 *Single Unit*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping

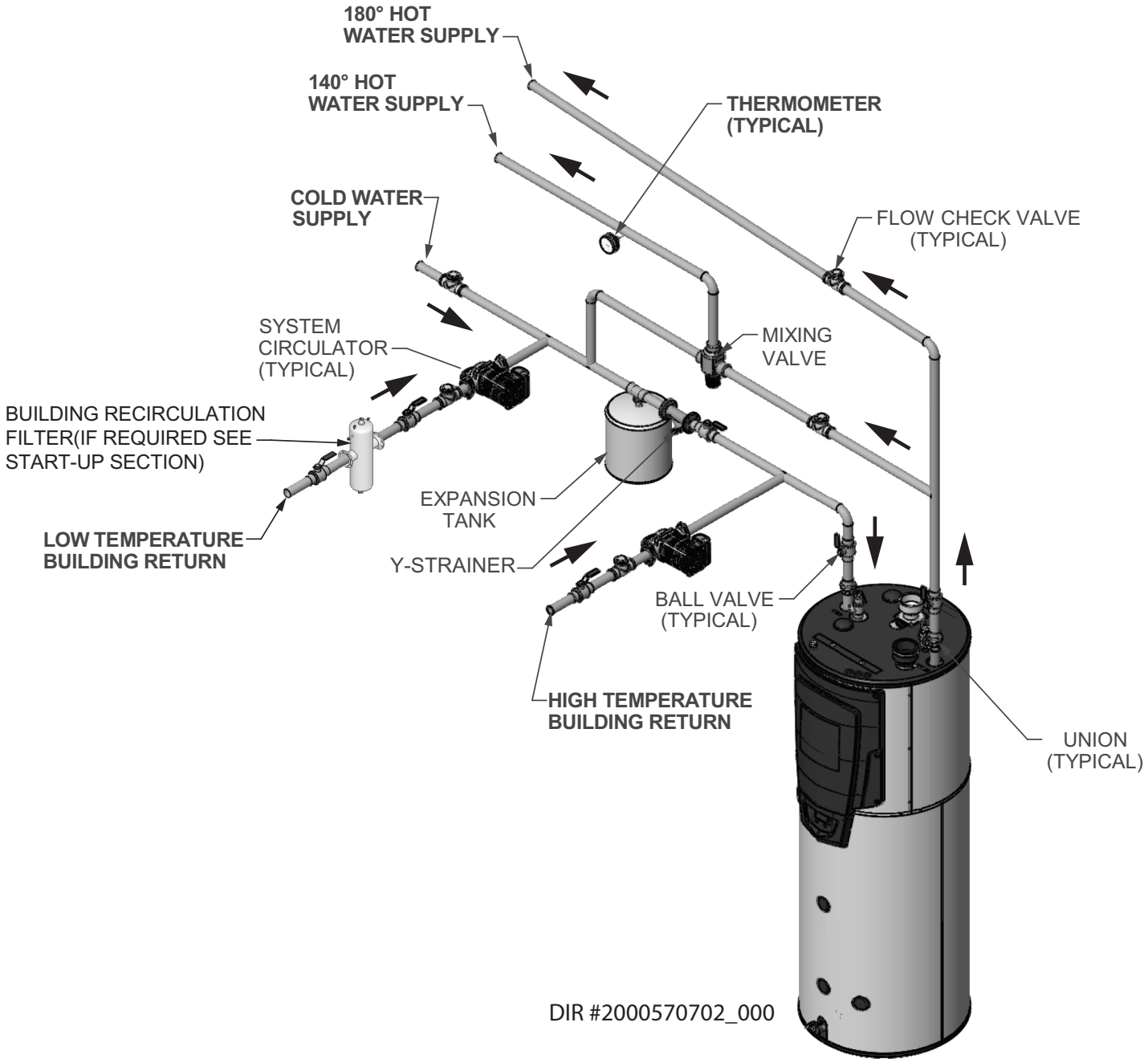
Figure 5-3 *Multiple Units*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping *(continued)*

Figure 5-4 *Two Temperature - Single Unit*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Gas connections

Connecting gas supply piping

1. Install ground joint union for servicing, when required.
2. On Models 126-065 -- 286-125 install a manual shutoff valve in the gas supply piping outside water heater jacket when required by local codes or utility requirements.
3. In Canada – When using manual main shutoff valves, it must be identified by the installer.

Figure 6-1 *Gas Supply Piping - Models 126-065 -- 286-125*

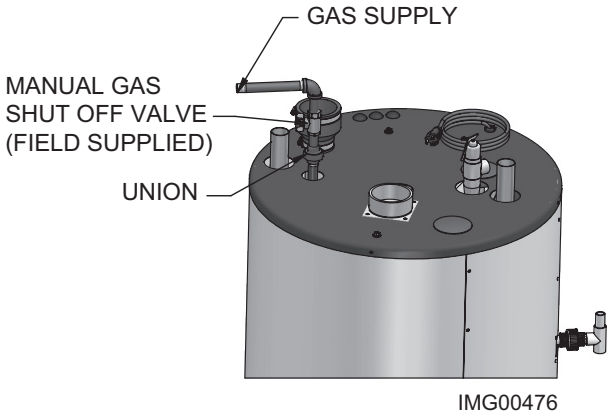
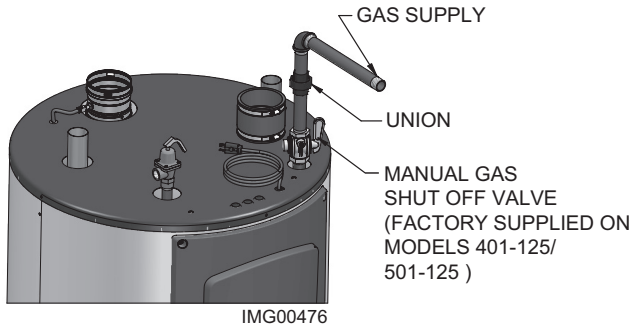


Figure 6-2 *Gas Supply Piping - Models 401-125 -- 501-125*



4. Support piping with hangers, not by the water heater or its accessories.

⚠ WARNING The gas valve and blower will not support the weight of the piping. Do not attempt to support the weight of the piping with the water heater or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

5. Purge all air from the gas supply piping.
6. Before placing the water heater in operation, check the water heater and its gas connection for leaks.
   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
   c. The appliance and its gas connection must be leak tested before placing it in operation.

⚠ WARNING Do not check for gas leaks with an open flame – use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

7. Use pipe sealing compound compatible with propane gases. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

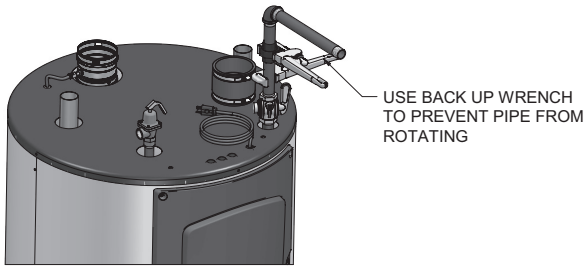
6 Gas connections *(continued)*

⚠ WARNING Failure to apply pipe sealing compound as detailed in this manual can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Use two wrenches when tightening gas piping at water heater (FIG. 6-3), using one wrench to prevent the water heater gas line connection from turning. Failure to support the water heater gas connection pipe to prevent it from turning could damage gas line components.

***Figure 6-3** Inlet Pipe with Backup Wrench*



NOTICE Maximum inlet gas pressure must not exceed the value specified. Minimum value listed is for the purposes of input adjustment.

⚠ WARNING Ensure that the high gas pressure regulator is at least 10 feet upstream of the appliance.

Natural gas:

Pipe sizing for natural gas

1. Refer to Table 6A for pipe length and diameter. Based on rated water heater input (divide by 1,000 to obtain cubic feet per hour).
   a. Table 6A is only for natural gas with specific gravity 0.60 inches, with a pressure drop through the gas piping of 0.30 inches w.c.
   b. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 for Canadian installations).

Natural gas supply pressure requirements

1. Pressure required at the gas valve inlet pressure port:
   - Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   - Minimum 4 inches w.c. with gas flowing (verify during water heater startup).

2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 14 inches w.c. at any time. Adjust lockup regulator for 14 inches w.c. maximum.

Propane gas:

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane Supply Pressure Requirements

1. Adjust propane supply regulator provided by the gas supplier for 14 inches w.c. maximum pressure.

2. Pressure required at gas valve inlet pressure port:
   - Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   - Minimum 8 inches w.c. with gas flowing (verify during water heater startup).

6 Gas connections

Table 6A *Natural Gas Pipe Size Chart*

Capacity of Schedule 40 Metallic Pipe in Cubic Feet of Natural Gas Per Hour (based on .60 specific gravity, 0.30" w.c. pressure drop)														
Pipe Size (Inches)	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	131	90	72	62	55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	273	188	151	129	114	104	95	89	83	79	70	63	58	N/A
1	514	353	284	243	215	195	179	167	157	148	131	119	109	102
1 1/4	1,060	726	583	499	442	400	368	343	322	304	269	244	224	209
1 1/2	1,580	1,090	873	747	662	600	552	514	482	455	403	366	336	313
2	3,050	2,090	1,680	1,440	1,280	1,160	1,060	989	928	877	777	704	648	602
2 1/2	4,860	3,340	2,680	2,290	2,030	1,840	1,690	1,580	1,480	1,400	1,240	1,120	1,030	960
3	8,580	5,900	4,740	4,050	3,590	3,260	3,000	2,790	2,610	2,470	2,190	1,980	1,820	1,700
4	17,500	12,000	9,660	8,270	7,330	6,640	6,110	5,680	5,330	5,040	4,460	4,050	3,720	3,460

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check inlet gas supply

NOTICE CSA or UL listed flexible gas connections are acceptable, but you must exercise caution to ensure that the line has adequate capacity to allow your water heater to fire at full rate. Consult with local codes for proper installation or service procedures.

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.

If you experience a pressure drop greater than 1 inch w.c., the meter, regulator, or gas line is undersized or in need of service. Perform the steps below when checking inlet gas supply:

1. Disconnect power from the appliance.
2. Shut off gas to the appliance.
3. Loosen the set screw one (1) full turn from inside the pressure tap on top of the gas valve. Place the tubing of the manometer over the tap once the set screw is loosened as shown in FIG.'s 6-4 thru 6-6.
4. Slowly turn on the gas supply at the field installed manual gas valve.
5. Reconnect power to the appliance.
6. Adjust the temperature set point on the control panel of the electronic control module to call for heat.
7. Observe the gas supply pressure as the burner fires at 100% of rated input. Percent of burner input will be displayed on the control panel.
8. Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in this section of the manual.
9. If gas supply pressure is within normal range and no adjustments are needed, proceed on to Step 11.
10. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the control.
11. Disconnect power from the appliance.
12. Shut off the gas to the appliance.
13. Remove the manometer from the pressure tap on top of the gas valve. Re-tighten the set screw inside the pressure tap.

⚠ WARNING When re-tightening the set screw, be sure to tighten securely to prevent gas leaks.

Do not check for gas leaks with an open flame -- use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

14. Reconnect gas to the appliance.
15. Reconnect power to the appliance.
16. Adjust the temperature set point on the control panel of the electronic control module to the desired water temperature so the appliance will call for heat.

6 Gas connections *(continued)*

17. Check burner performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame pattern should be stable. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

***Figure 6-4** Inlet Gas Supply Check - Models 126-065 -- 286-125*

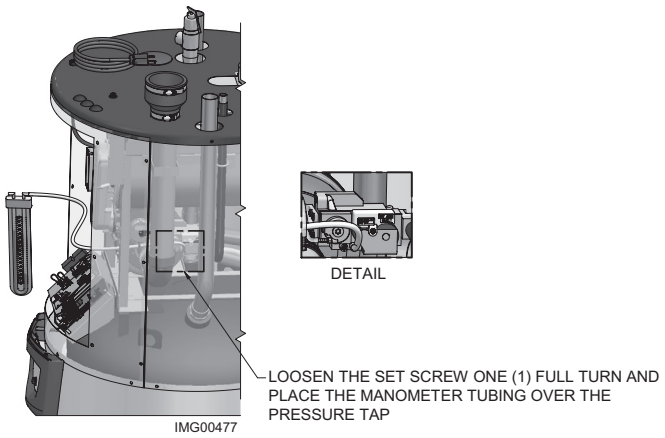


***Figure 6-5** Inlet Gas Supply Check - Model 401-125*

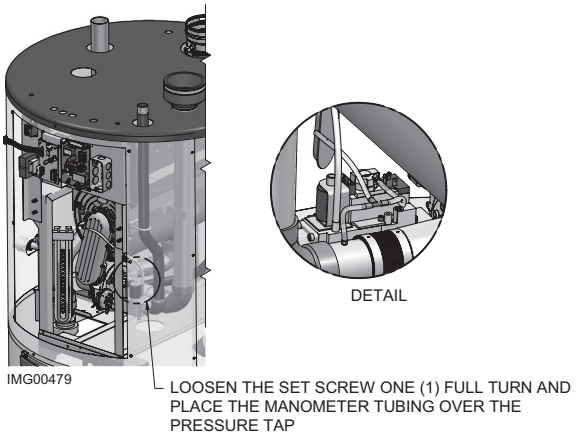
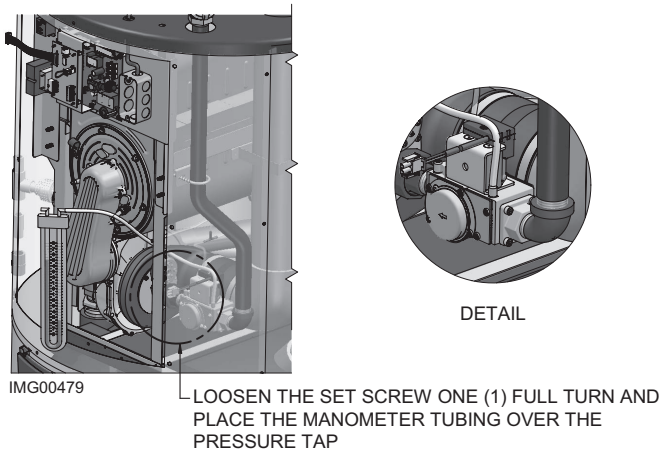


***Figure 6-6** Inlet Gas Supply Check - Model 501-125*



Gas pressure

The gas pressure must remain between 4 inches w.c. (natural), 8 inches w.c. (LP) minimum and 14 inches w.c. (natural and LP) maximum during stand-by (static) mode and while in operating (dynamic) mode. If an in-line regulator is used, it must be a minimum of 10 feet from the Shield water heater. It is very important that the gas line is properly purged by the gas supplier or utility company. Failure to properly purge the lines or improper line sizing, will result in ignition failure.

The problem is especially noticeable in NEW LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines.

Gas valve replacement

The gas valve MUST NOT be replaced with a conventional gas valve under any circumstances. As an additional safety feature, this gas valve has a flanged connection to the venturi and blower.

⚠ WARNING Failure to follow all precautions could result in fire, explosion, or death!

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

7 Field wiring

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

NOTICE Wiring must be N.E.C. Class 1.

If original wiring as supplied with the water heater must be replaced, use only type 105°C wire or equivalent.

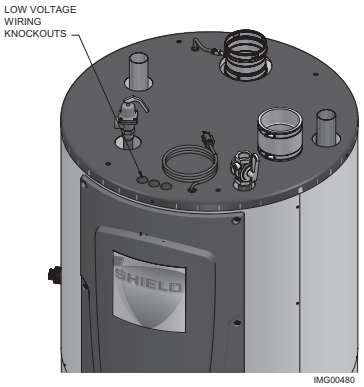
The water heater must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

⚠ CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Low voltage connections

1. Route all low voltage wires through the knockouts in the top of the water heater, as shown in FIG. 7-1.
2. Connect low voltage wiring to low voltage connection board as shown in FIG. 7-3 on page 47 of this manual and the water heater wiring diagram.

Figure 7-1 *Routing Field Wiring*



Enable switch

An external switch or contact may be used to enable/disable the water heater. To connect the enable switch, remove the jumper wire from across the ENABLE terminals on the low voltage connection board and connect the wires from the switch in its place. Note that the freeze protection feature will still fire the heater even though the enable input is open.

Louver relay output / louver proving switch input

When installed using the optional room air configuration, the heater is able to control powered louvers used to allow outside air into the room. Connect the 24VAC control relay coil to the LOUVER RELAY output on the low voltage connection board. Remove the jumper wire from the LOUVER PROVING SWITCH terminals on the low voltage connection board and connect the louver proving switch wires in its place.

Installation must comply with:

1. National Electrical Code and any other national, state, provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

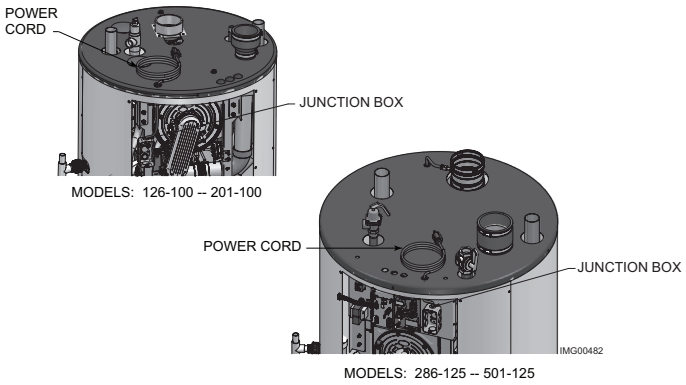
Power cord connection

This water heater is designed to operate with 120 VAC and 60 Hz power supply. If allowed by local codes, connect the power cord provided with the heater to a GFI protected outlet on a separate circuit and breaker (15 amp recommended). Ensure the circuit cannot be interrupted by a switch used to control lights or other appliances.

If local codes do not allow for the use of the power cord, remove the cord from the junction box found on the side of the control support bracket (FIG. 7-2) and attach conduit to the junction box. Route the wires out of the appliance to a GFI protected outlet on a separate circuit and breaker (15 amp recommended).

⚠ WARNING Use of an extension cord is NOT allowed. If a suitable electrical outlet is not within reach of the supplied power cord, a new receptacle must be installed or the power cord must be replaced with hard conduit as described above.

Figure 7-2 *Remove Power Cord*



Runtime contacts

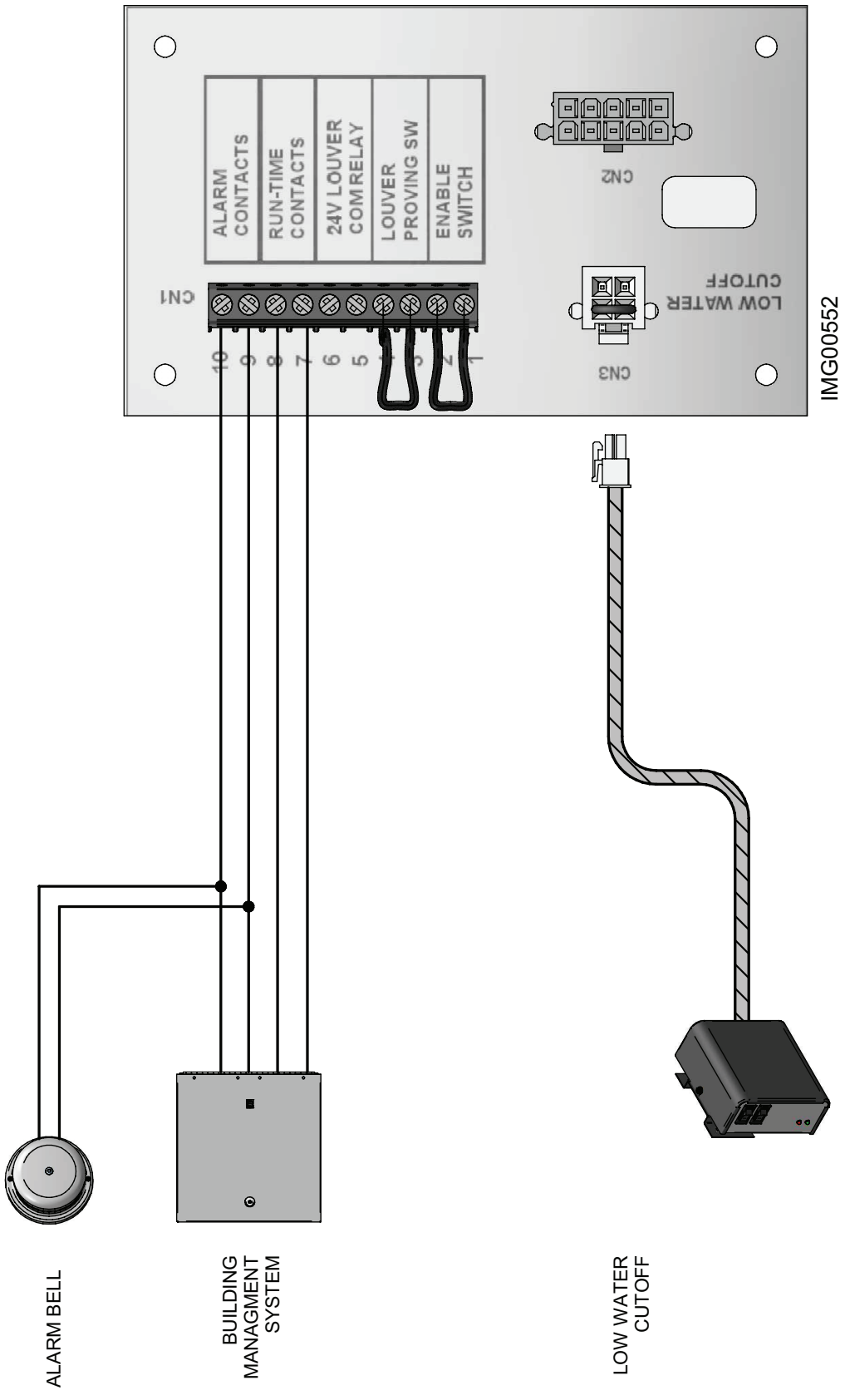
The electronic control closes a set of dry contacts whenever the burner is running. This is typically used by Building Management Systems to verify that the water heater is responding to a call for heat.

Alarm contacts

The electronic control closes another set of contacts whenever the water heater is locked out or the power is turned off. This can be used to turn on an alarm, or signal a Building Management System that the water heater is down. Note that the alarm contacts will close momentarily after each call for heat.

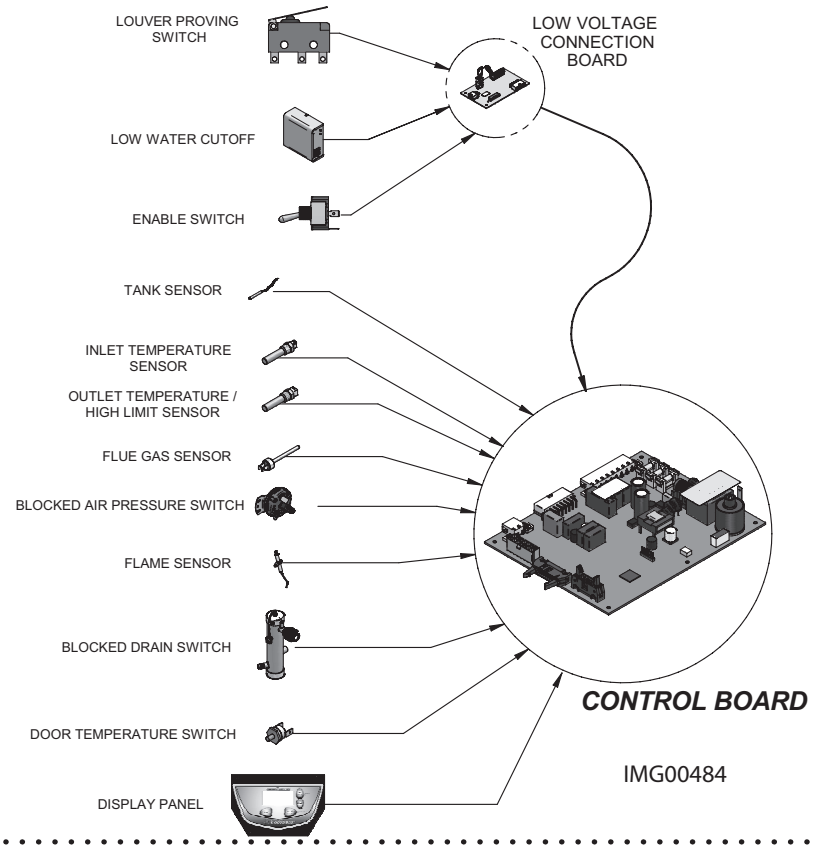
7 Field wiring *(continued)*

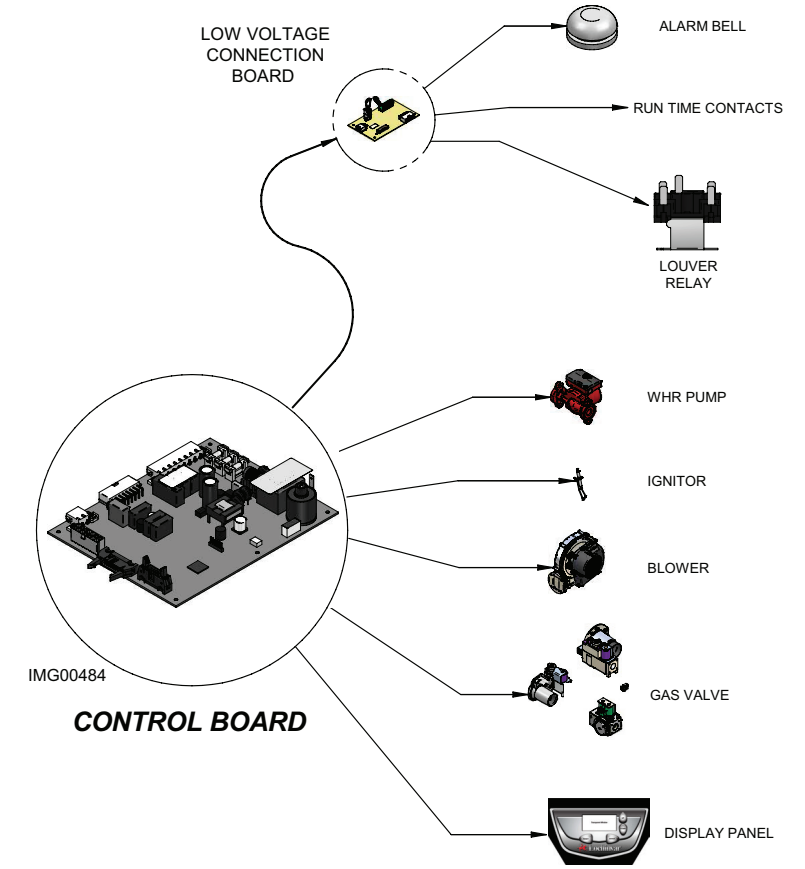
Figure 7-3 *Low Voltage Field Wiring Connections*



7 Field wiring

Figure 7-4 *Control Inputs/Outputs*





8 Condensate disposal

Condensate drain

1. This water heater is a high efficiency appliance that produces condensate.
2. Slope condensate tubing down and away from the water heater into a drain or condensate neutralizing filter. Condensate from the Shield water heater will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A Neutralizer Kit is available from the factory (100157721).

Note: The Neutralizer Kit MUST BE installed horizontally.

3. Do not expose condensate line to freezing temperatures.

NOTICE

Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

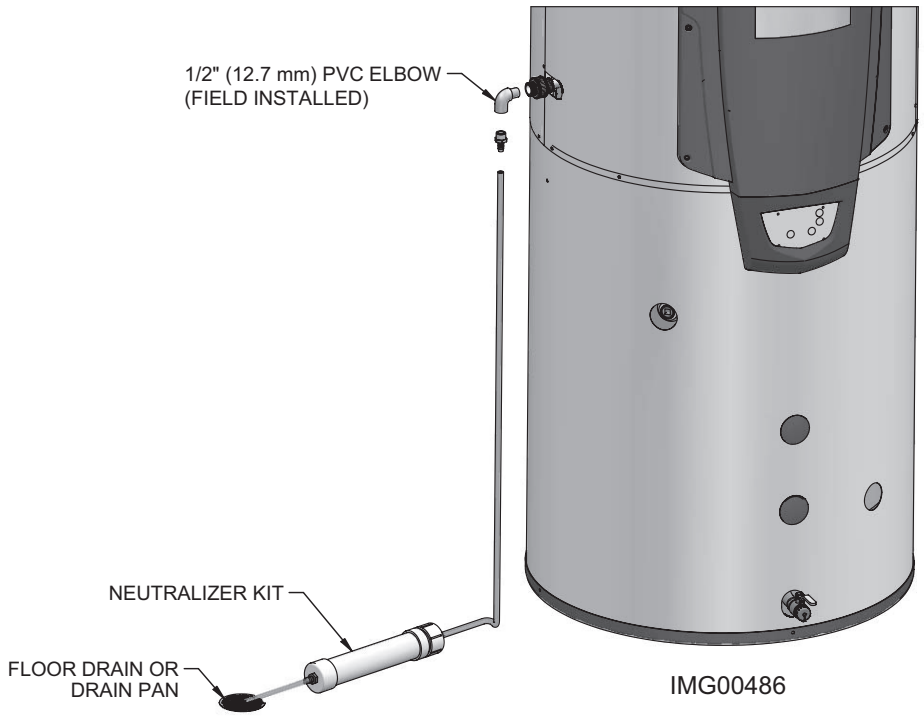
NOTICE

To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the water heater condensate trap, resulting in potential water damage to property.

4. A condensate removal pump is required if the water heater is below the drain. When installing a condensate pump, select one approved for use with condensing water heaters and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired to the auxiliary device proving switch terminals on the low voltage connection board.

Figure 8-1 *Condensate Disposal*



9 Start-up

Check/control water chemistry

NOTICE Conduct water quality testing prior to installing the appliance. Various solutions are available to adjust water quality.

See the following table for properly operating the water heater with the appropriate water chemistry. Good water quality will help extend the life of the appliance by reducing the effects of scale buildup and corrosion.

***Table 9A** Water Chemistry*

WATER CHEMISTRY		
Specification	**Range**	**Requirement**
Hardness	< 5 gpg	Follow recommendations detailed below (See Notice 3)
	5 to 12 gpg	No action required - standard pump
	> 12 gpg	Water softening system required (See Notice 4)
Dissolved Solids	< 350 ppm	Hardness level must be met
pH Level	6.5 to 8.5	Acceptable range
Chloride	< 150 ppm	Acceptable range

NOTICE

1. Do not use the water heater to directly heat swimming pool or spa water.

2. At initial fill and during water heater start-up and testing, check system thoroughly for any leaks. Repair all leaks before proceeding further.

3. When water hardness levels are less than 5 gpg or 85.5 mg/l, the following is recommended:

   a. Flush and clean existing water heating system prior to installation.

   b. Inspect and, if necessary, replace the anodes in any existing tanks.

   c. Install a Y-strainer on the inlet of each water heater as detailed in this section.

   d. Limit the run time of the hot water recirculation loop.

   e. Filter the hot water recirculation loop to a level of 10 microns. CAUTION: Check recirculation pump size to verify it is sized for filter addition and upsize if necessary.

4. When water softener is required, a Template Assisted Crystallization system is recommended.

Check for gas leaks

⚠ WARNING Before starting the water heater, and during initial operation, smell near the floor and around the water heater for gas odorant or any unusual odor. Remove the top access panel and smell the interior of the water heater enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

⚠ WARNING Propane water heaters only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Inspect/fill condensate system

Inspect/check condensate lines and fittings

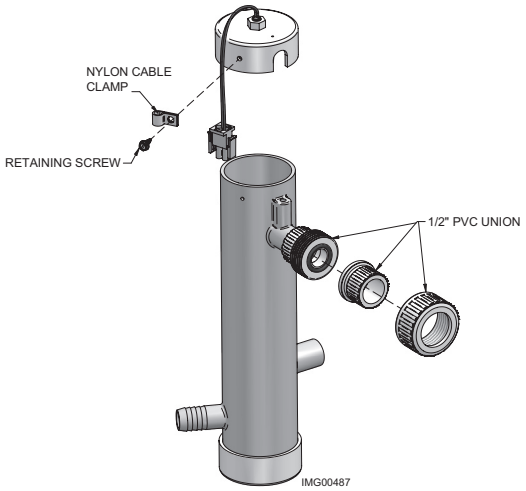
1. Inspect the condensate drain line, condensate PVC fittings and condensate trap.

Fill condensate trap with water

1. Remove the PVC cap retaining screw from the PVC cap (FIG. 9-1).
2. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 9-1).
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
5. Replace the retaining screw.

⚠ WARNING The condensate trap (FIG. 9-1) must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

***Figure 9-1** Condensate Trap*



9 Start-up *(continued)*

Final checks before starting the water heater

- ❑ Read this manual to familiarize yourself with electronic control module operation. Read pages 52 and 53 for proper steps to start the water heater.
- ❑ Verify the water heater and system are full of water and all system components are correctly set for operation.
- ❑ Verify the preparation procedures of Section 9, pages 50 and 51 have been completed.
- ❑ Fill the vent condensate trap with water (removing the retaining screw in order to remove the 2 inch PVC cap with the switch located at the top of the trap). Replace the cap. Press the cap onto the trap until the cap makes contact with the drain. Replace the retaining screw.
- ❑ Verify electrical connections are correct and securely attached.
- ❑ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

Start the water heater

1. Read and follow the Operating instructions in FIG.'s 9-2 and 9-3, pages 52 and 53.

If water heater does not start correctly

1. Check for loose connections, blown fuse or service switch off.
2. Is external limit control (if used) open? Is water temperature above 200°F?
3. Is tank set point set below tank temperature?
4. Is gas turned on at meter and water heater?
5. Is incoming gas pressure less than 4 inches w.c.?

If none of the above corrects the problem, refer to the *Troubleshooting* section of this manual.

Check system and water heater

❑ Check water piping

1. Check system piping for leaks. If found, shut down the water heater and repair immediately.
2. Check Delta T. Ensure Delta T is less than 30°F, if not, reference *Section 12 - Troubleshooting*.
3. Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause hot water distribution problems and noise.

❑ Check vent piping and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping.

⚠ WARNING Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

❑ Check gas piping

1. Check around the water heater for gas odor following the procedure on page 42 of this manual *(Connecting Gas Supply Piping)*.

⚠ WARNING If you discover evidence of any gas leak, shut down the water heater at once. Find the leak source with a bubble test and repair immediately. Do not start the water heater again until corrected. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check flame and combustion

1. Shut the water heater down by pressing the UP button for five (5) seconds.
2. Locate the flue sensor in the vent connection. Remove the flue sensor and grommet from the unit. **Note:** Combustion measurements will be made at this point.
3. Place the water heater in active position by pressing the UP button for five (5) seconds.
4. Press ENTER plus the UP button for five (5) seconds to enter Service Mode.
5. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
6. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 9A. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the *Troubleshooting* section of this manual for possible causes and corrective actions.
7. Once the combustion analysis is complete, exit Service Mode.

***Table 9A** Flue Products Chart*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

8. Replace the flue sensor and grommet into the vent connection.
9. Place the Shield water heater back into normal operation.

⚠ WARNING You must replace the flue sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

9 Start-up

Figure 9-2 *Operating Instructions - Models 126-065 -- 286-125*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

Do not try to light any appliance.

Do not touch any electric switch; do not use any phone in your building.

Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

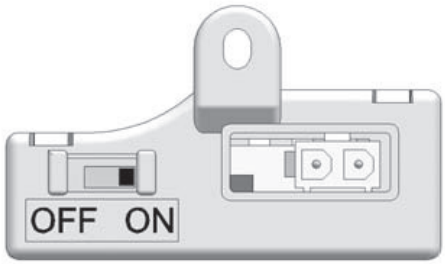
If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to move the gas control switch. Never use tools. If the switch will not move by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove front door.
6. Move switch to the "OFF" position.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Move the switch to the "ON" position.
9. Install front door.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Move switch the "OFF" position.
5. Install front door.

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9 Start-up *(continued)*

Figure 9-3 *Operating Instructions - Models 401-125 -- 501-125*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

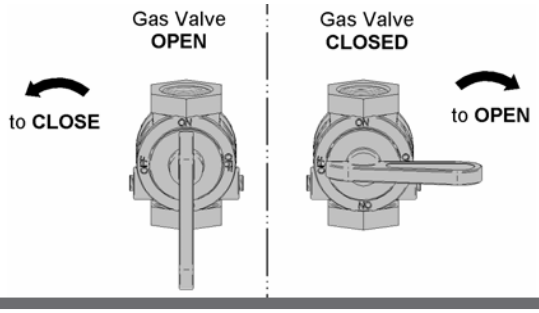
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove top cover.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install top cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove top cover.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force
5. Install top cover.

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10 Operating information

General

How the water heater operates

The Shield water heater combines an advanced stainless steel heat exchanger, electronic control module, and tank that allows fully condensing operation. The blower pulls in air and pushes flue products out of the heat exchanger and flue piping. The control module regulates blower speed to control the water heater firing rate. The gas valve senses the amount of air flowing into the water heater and allows only the right amount of gas to flow. An internal pump circulates the water between the tank and heater and mixes the incoming water to provide maximum efficiency.

Temperature control

Modulation

The Shield water heater is capable of modulating its firing rate from a minimum of 20% to a maximum of 100%. The firing rate is dictated by the hot water draw and various other temperature limitations.

Night setback

The controller may be programmed to reduce the tank set point during a certain time each day. There are seven (7) start and seven (7) stop triggers.

Flame current support

To prevent nuisance shutdowns when the water heater is firing at minimum rates, the control will increase fan speed when the flame signal drops too low.

Protection features

Outlet temperature, flue temperature, and temperature rise limiting

The heat exchanger outlet temperature is monitored by the heat exchanger outlet temperature sensor. When the heat exchanger outlet temperature exceeds 190°F, the unit will reduce the fan speed. If the heat exchanger outlet water temperature exceeds 198°F the control will shut the unit down until it cools off.

The control module monitors the flue temperature by a sensor located in the flue exhaust. If the flue temperature exceeds 215°F the control will reduce the maximum fan speed. If the flue temperature exceeds 225°F (107°C) the control will shut the unit down. The unit will restart automatically once the flue temperature drops 10°F (6°C) and the minimum off time has expired.

The control monitors the temperature difference between the heat exchanger inlet and the heat exchanger outlet sensors. If this difference exceeds 40°F the control will reduce the fan speed. If the temperature difference exceeds 45°F the control will shut the unit down. The unit will restart automatically once the temperature difference has dropped below 40°F and the minimum off time has expired.

Freeze protection

DO NOT install the water heater in a room likely to freeze.

The following integral feature of the electronic control module provides some protection for the water heater.

- The electronic control module provides freeze-up protection as follows when the water heater water temperature drops below 45°F:
- Below 45°F, the internal pump operates constantly.
- Below 37°F, the burner turns on.
- The burner and pump will turn off if water heater water temperature rises above 45°F.

⚠ CAUTION This feature of the electronic control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the water heater.

Runtime and alarm outputs

The water heater provides dry contacts for indicating when the water heater is running, and when it is unable to operate.

Error logging

The control will hold in memory the last 10 faults. The date and time of the occurrence will be recorded as well. Only the 10 most current occurrences will be held in memory.

10 Operating information *(continued)*

Water heater temperature regulation

Operating temperature (target)

The electronic control module senses water temperature in the tank and regulates water heater ignition and firing rate to achieve a target temperature. The target temperature can be set between 60°F and 185°F.

High limit operations

The Shield water heater is equipped with a fixed automatic reset high limit and an adjustable manual reset high limit. The automatic reset high limit has a set point of 200°F and the manual reset high limit has a maximum set point of 210°F.

When the outlet temperature exceeds 200°F, the automatic high limit action occurs. The water heater shuts down until the outlet water temperature cools below 190°F, and a 60 second timer has expired. If the outlet temperature continues to increase, the manual reset high limit action will occur at 210°F.

High limit test procedure

NOTICE Please note that the brackets ([]) denote screen status.

1. Connect the water heater to 120V power.
2. Note the outlet temperature shown on the display.
3. Press and hold the ENTER and DOWN keys until "P01" appears in the lower digits on the display.
4. Press and hold the DOWN key until the set point shown in the upper digits is less than the outlet temperature (or it reaches its minimum setting, whichever is higher).
5. Press the ENTER key four (4) times. The word "SET" will appear on the display.
6. Once the outlet temperature reaches the new Manual Reset High Limit setting, the control will lock out, run the blower and DHW pump, and display "E15" in the lower digits on the display. It may be necessary to activate Service Mode to bring the outlet temperature above the Manual Reset High Limit set point. Press and hold the ENTER and UP keys for 5 seconds to activate Service Mode.
7. Press the ENTER and DOWN keys again until 'P01" appears in the lower digits.
8. Press and hold the UP key to readjust the set point to the desired setting.
9. Press the ENTER key four (4) times. The word "SET" will appear on the display.
10. Press the RESET key to clear the Manual Reset High Limit.
11. If Service Mode was activated, press ENTER for 5 seconds to deactivate Service Mode.

Adjustable control parameters

Date and time

The control uses an internal clock for the night setback feature and for logging of events. For these features to work correctly, the clock must be set when the water heater is first installed or anytime the water heater has been powered off for more than 15 minutes. Note that hours are displayed as 24 hour time (2:00PM = 14:00). Days are displayed as a number (Monday = 1, Tuesday = 2, ..., Sunday = 7).

NOTICE The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

User adjustable parameters

To access the User Adjustable Parameter Menu, press and hold the ENTER button for five (5) seconds. Once pressed, the temperature unit's adjustment will be shown. Press the ENTER button to cycle to other adjustment values. Once you have cycled through all of the values, the new values will be saved.

***Table 10A** User Adjustable Parameters*

Code	Description
u01	Temperature Units (°C/°F)
u02	Hot Water Set Point
u03	Year
u04	Month
u05	Day
u06	Hour
u07	Minute

Installer settings

Set the Hot Water (HW) Temperature as follows:

1. Press and hold the ENTER button for five (5) seconds.
2. Press ENTER again and the u02 Screen should appear.
3. Press the UP and DOWN buttons to set the temperature.
4. Once you have successfully set the temperature, press the ENTER button seven (7) times to save your data.

10 Operating information

Table 10B Temperature Parameter Settings

Code	Description	Factory Default	Min	Max
p01	Manual Reset High Limit Set Point	210	32	210
p02	Night Setback Set Point	0	0	90
p03	Maximum Tank Set Point	125	32	190
p04	HW Pump Delay	0:30	0:00	0:40:00
--	HW Temp	125	60	185

Installer adjustable parameters

To access the Installer Adjustable Parameter Menu, press and hold the ENTER and DOWN buttons simultaneously for five (5) seconds. Once pressed, the temperature unit's adjustment will be shown. Press the OK button to cycle to other adjustment values. Once you have cycled through all of the values, the new values will be saved.

Table 10C Installer Adjustable Parameters

Code	Description
p01	Manual Reset High Limit
p02	Night Setback Offset
p03	Maximum Tank Set Point
p04	Pump Delay Time

Night setback

Access the Night Setback Menu by pressing the UP and DOWN buttons simultaneously for five (5) seconds.

This feature allows the user to lower the tank set point at certain times each week. The Night Setback Offset (see *Installer Adjustable Parameters*, this page) determines how much the set point is lowered. The times at which the set point is lowered are controlled by seven (7) start triggers and seven (7) stop triggers. Each trigger can be set to any time on any day. When the internal clock (see *User Adjustable Parameters*, page 55) reaches a start trigger, Night Setback will begin. When the internal clock reaches a stop trigger, Night Setback will end. When a start trigger and a stop trigger are programmed to the same day and time, the stop trigger will have priority, so Night Setback will not become active. (The default settings are all set to the same day and time.) Use the following procedure to adjust the triggers:

1. Press the UP and DOWN buttons simultaneously for five (5) seconds.
2. The top digits on the display will show the trigger type. To change from ON to OFF, or back, press the UP or DOWN button, then press the ENTER button.
3. The trigger number will then appear. Press the UP or DOWN buttons to change the trigger number you are programming, then press the ENTER button.
4. The day of the week (1 - 7) for that trigger will then appear in the lower digits on the display (1 = Monday, 2 = Tuesday, etc.,). Press the UP or DOWN buttons to change the day of the week, then press the ENTER button.
5. The time for that trigger then appears in a 24 hour format (for example, 2:00 PM = 1400), with the hours digits flashing. Use the UP and DOWN buttons to adjust the hours, then press the ENTER button.
6. The minutes digits will then start flashing. Press the UP and DOWN buttons to adjust the minutes. If you are finished programming all of the triggers, press and hold the ENTER key for 5 seconds. Otherwise, press the ENTER button once. The bottom digits will clear and the top digits will show ON or OFF again. Go back to Step 2 of this procedure.

Low water cutoff protection

The electronic control module uses sensing of both heat exchanger supply and return temperatures. If the flow rate is too low or either temperature too high, the control module modulates and shuts the burner down. This ensures water heater shutdown in the event of low water or low flow conditions in the heat exchanger.

To turn the heater ON/OFF

To turn the heater ON, press the UP button and hold it for five (5) seconds. To turn the heater OFF, press the UP button and hold again for five (5) seconds.

Service mode

To control the modulation of the heater for troubleshooting procedures, the Service Mode can be accessed by pressing the ENTER and UP buttons simultaneously, holding them for five (5) seconds. Once in the Service Mode, the UP and DOWN buttons control the speed of the blower. To toggle between the maximum and minimum speeds, press the ENTER button momentarily. When ready to return to the normal state, press the ENTER button for five (5) seconds. The control will also leave Service Mode in the event of a lockout.

Error logging

To access the error log, press the DOWN button for five (5) seconds. The error codes will be displayed beginning with the most recent. The top number indicating the error number starting with "1" being the most recent. The bottom of the display will show the following information in two (2) second intervals:

1. Error Code
2. Hour and Minute of the Error
3. Date of the Error
4. Year of the Error

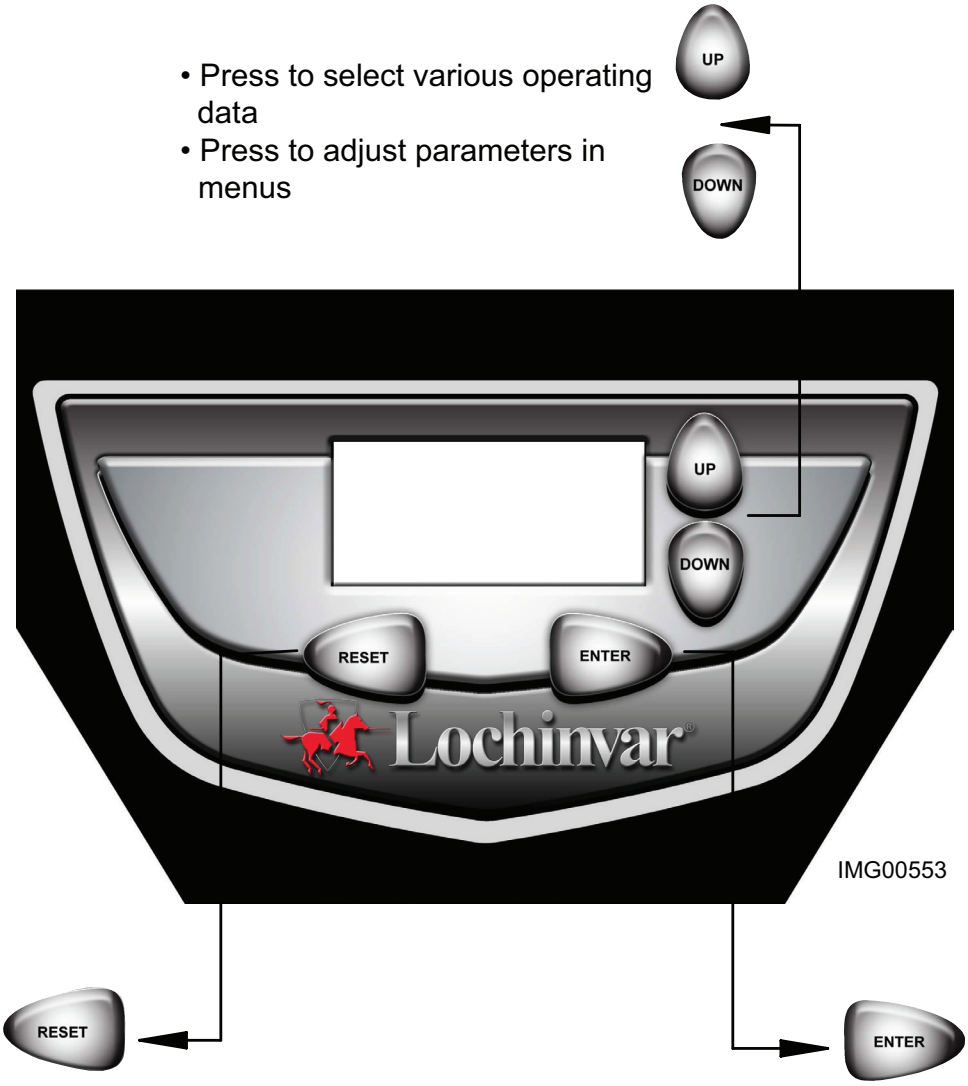
To view the next error press the UP button. To pause the information on the screen, press and hold the ENTER button, when released it will skip to the next value. To leave the Error Log Menu press and hold the DOWN button for five (5) seconds.

10 Operating information *(continued)*

Shield control module

Use the control panel (FIG. 10-1) to set temperatures, operating conditions, and monitor water heater operation.

Figure 10-1 *Control Panel*



11 Maintenance

Maintenance and annual startup

Table 11A *Service and Maintenance Schedules*

Service technician (see the following pages for instructions)	
ANNUAL START-UP	**General:** • Address reported problems • Inspect interior; clean and vacuum if necessary; • Clean condensate trap and fill with fresh water • Check for leaks (water, gas, flue, condensate) • Verify flue and air lines in good condition and sealed tight • Check system water pressure/system piping/expansion tank • Check control settings • Check ignition and flame sense electrodes (sand off any deposits; clean and reposition) • Check wiring and connections • Perform start-up checkout and performance verification per Section 9 in this manual. • Flame inspection (stable, uniform) • Flame signal (at least 10 microamps at high fire) • Clean the heat exchanger if flue temperature is more than 54°F above return water temperature. • Check anode rods. • Check Delta T (Temperature Rise) **If combustion or performance indicate need:** • Clean heat exchanger • Remove and clean burner using compressed air only • Clean the blower wheel

Owner maintenance	
Daily	• Check water heater area
Monthly	• Check vent piping • Check air piping • Check relief valve • Check condensate drain system • Check Delta T (Temperature Rise) • Remove debris from Y-strainer per manufacturer's instructions • Check building recirculation filter (if filter required)
Every 6 months	• Check water heater piping (gas and water) for leaks • Operate relief valve • Check water chemistry

11 Maintenance *(continued)*

⚠ WARNING Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the water heater. Failure to perform the service and maintenance could result in damage to the water heater or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING The water heater should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the water heater designated in Table 11A and explained on the following pages must be performed to assure maximum water heater efficiency and reliability. Failure to service and maintain the water heater and system could result in equipment failure.

⚠ WARNING Electrical shock hazard – Turn off power to the water heater before any service operation on the water heater except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect water heater area

1. Verify that water heater area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 of this manual. If any of these are present in the water heater intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual.

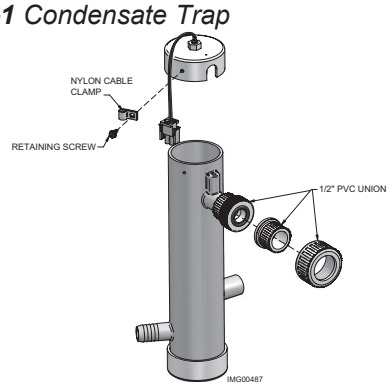
Inspect water heater interior

1. Remove the pump access panel and inspect the interior of the water heater.
2. Vacuum any sediment from inside the water heater and components. Remove any obstructions.

Clean condensate trap

1. Inspect the condensate drain line, condensate PVC fittings, and condensate trap.
2. Remove the PVC cap retaining screw from the PVC cap (FIG. 11-1).
3. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 11-1).
4. Remove any sediment in the trap.
5. Fill with fresh water until the water begins to pour out of the drain.
6. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
7. Replace the retaining screw.

Figure 11-1 *Condensate Trap*



⚠ WARNING The condensate trap must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

Check all piping for leaks

⚠ WARNING Eliminate all system or water heater leaks. Leaking water may cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in Section 7 - Gas Connections.

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.
2. Verify that water heater vent discharge and air intake are clean and free of obstructions.

⚠ WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the water heater heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

11 Maintenance

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the water expands due to temperature increase or contracts as the water cools. Tanks must be approved for potable water systems. See Section 5 - System Piping for suggested best location of expansion tanks.

Check water heater relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 5 - System Piping before proceeding further.

⚠ WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the water heater relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the water heater until a new relief valve has been installed.

2. After following the warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

Inspect ignition and flame sense electrodes

1. Remove the ignition and flame sense electrodes from the water heater heat exchanger access cover.
2. Remove any deposits accumulated on the ignition/flame sense electrode using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrode, making sure gasket is in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect water heater ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all water heater wiring

1. Inspect all water heater wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the control module display to Parameter Mode and check all settings. Adjust settings if necessary. See Section 10 of this manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform start-up and checks

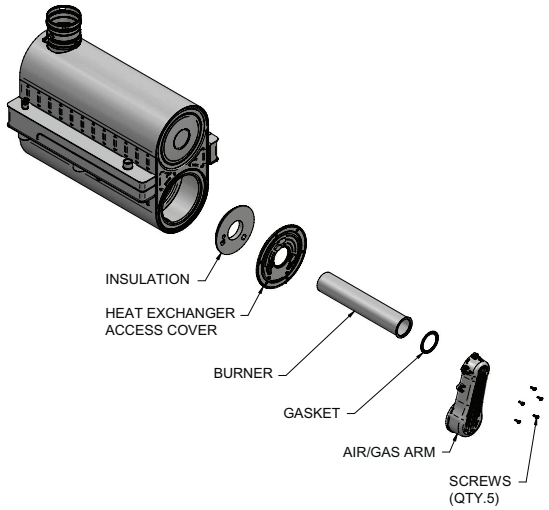
1. Start water heater and perform checks and tests specified in Section 9 - Start-up.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

11 Maintenance *(continued)*

Check burner flame

1. Inspect flame through observation window.
2. If the flame is unsatisfactory at either high fire or low fire, turn off water heater and allow water heater to cool down. Remove the burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.
3. Remove the burner, reference FIG. 11-2 below.
4. When replacing the burner, ensure gasket is in good condition and positioned correctly (FIG. 11-2).

***Figure 11-2** Burner Assembly*



Check flame signal

1. At high fire the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 12 - Troubleshooting for other procedures to deal with low flame signal.

Review with owner

1. Emphasize the need to perform the maintenance schedule specified in this manual.
2. Remind the owner of the need to call a licensed contractor should the water heater or system exhibit any unusual behavior.

Handling ceramic fiber materials

REMOVAL OF COMBUSTION CHAMBER LINING

⚠ WARNING The combustion chamber insulation in this appliance contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)." Normal operating temperatures in this appliance are below the level to convert ceramic fibers to cristobalite. Abnormal operating conditions would have to be created to convert the ceramic fibers in this appliance to cristobalite.

The ceramic fiber material used in this appliance is an irritant; when handling or replacing the ceramic materials it is advisable that the installer follow these safety guidelines.

- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent airborne dust.
- Remove the combustion chamber lining from the appliance and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

Cleaning heat exchanger

For recommended materials; including brush, appropriate extension(s), refractory cover, and detailed instructions see Table 11B - Heat Exchanger Cleaning Kits on page 62.

1. Shut down water heater:
   - Follow the "To Turn Off Gas to Appliance" instructions for the water heater in Section 9 - Startup.
   - Do not drain the water heater unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the water heater to cool to room temperature if it has been firing.

11 Maintenance

3. Remove the nuts securing the heat exchanger access cover to the heat exchanger and set aside.
4. Remove the heat exchanger access cover, burner, and gas/air arm assembly.

⚠ WARNING The water heater contains ceramic fiber materials. Use care when handling these materials per instructions in this manual. Failure to comply could result in severe personal injury.

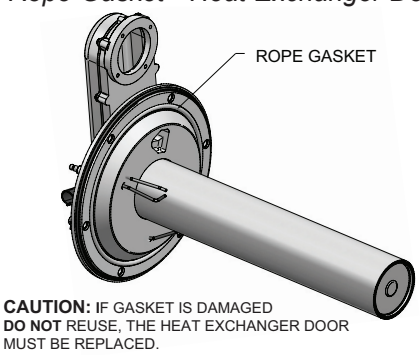
5. Remove the condensate hose from the heat exchanger end. Connect a field supplied 3/4" diameter hose to a drain pan. Using field supplied means, cover the refractory in the back of the combustion chamber of the heat exchanger.
6. Use a vacuum cleaner to remove any accumulation on the water heater heating surfaces. Do not use any solvent.
7. Brush the heat exchanger while dry using a nylon bristle brush. **Caution:** DO NOT use a metal brush. Re-vacuum the heat exchanger.
8. Finish cleaning using a clean cloth dampened with warm water. Rinse out debris with a low pressure water supply.
9. Allow the heat exchanger to thoroughly dry.
10. Remove the field supplied rear refractory cover from the back of the combustion chamber of the heat exchanger and reassemble.
11. Close isolation valves on piping to isolate water heater from system. Attach a hose to the water heater drain and flush water heater thoroughly with clean water by using purging valves to allow water to flow through the water make-up line to the water heater.
12. Perform start-up and check-out procedures in the Check Flame and Combustion - Section 9 - Startup on page 51 of this manual.
13. Replace the access cover and restore water heater to operation.

Table 11B *Heat Exchanger Cleaning Kits*

Model	Kit Number	Part Number	Component Description
126-065 -- 201-100 286-125 -- 401-125	100157627	100140243	Rear Refractory Cover
		100162565*	Nylon 4" Wheel Brush*
		100162566	3mm Allen Wrench
		100162568	1/4" x 24" Drill Extension
501-125	100157628	100140243	Rear Refractory Cover
		100162565*	Nylon 4" Wheel Brush*
		100162567	1/4" x 12" Drill Extension
		100162568	1/4" x 24" Drill Extension

⚠ CAUTION * Do NOT use a metal brush. Only use the kit provided brush or an equivalent replacement nylon brush.

Figure 11-3 *Rope Gasket - Heat Exchanger Door*



NOTICE Rope gasket is intended for sealing combustion (FIG. 11-3). If damaged DO NOT reuse, the heat exchanger door must be replaced. Consult factory for replacement heat exchanger door (kit 100173749).

Oiled bearing circulators

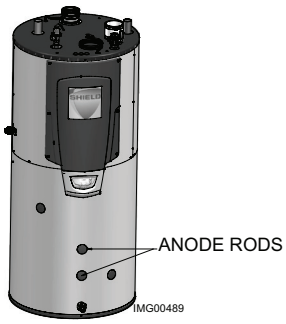
1. The circulator shipped with the Shield water heater is water-lubricated. No oiling is required.
2. Check other circulators in the system. Oil any circulators requiring oil, following circulator manufacturer's instructions. Over-oiling will damage the circulator.

Magnesium anode rod inspection

Glass lined storage tanks have a magnesium anode(s) (FIG. 11-4) to provide cathodical protection of the lining and minimize corrosion. Aggressive water conditions in some areas of the country may accelerate the deterioration of the anode(s). The anode(s) should be periodically removed and inspected to determine if replacement is necessary.

The heater must be valved off from the system and fully drained to remove an anode for inspection. Anodes are supplied in threaded fittings on the side of the tank. Adequate service clearance is required to allow removal of an anode. The anode(s) should be replaced when more than six inches of the core wire is exposed at either end of the rod.

Figure 11-4 *Anode Location*



NOTICE Anode rods showing excessive decomposition may indicate electrolysis. An earth ground should be attached to the vessel to divert stray current and prevent tank damage.

12 Troubleshooting

⚠ WARNING Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to the water heater before servicing. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Never jumper (bypass) any device except for momentary testing as outlined in the Troubleshooting chart. Severe personal injury, death, or substantial property damage can result.

Before troubleshooting:

1. Have the following items:
   a. Voltmeter that can check 120 VAC, 24 VAC, and 12 VDC.
   b. Continuity checker.
   c. Contact thermometer.

2. Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to water heater.

3. Make sure the tank is calling for heat.

4. Make sure all external limit controls are installed and operating.

Check the following:

1. Wire connectors to control module and connection board are securely plugged in.

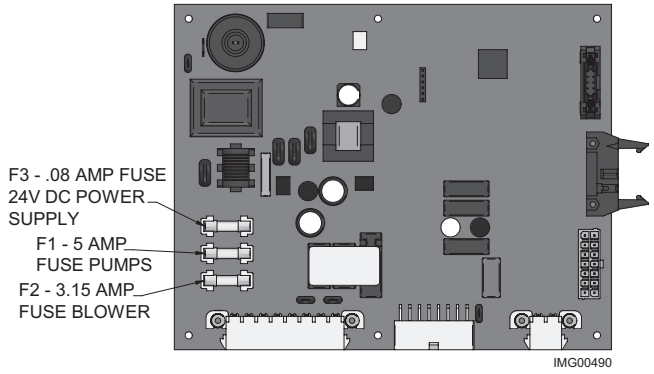
2. Gas pressures:
   - Maximum: 14 inches w.c. (natural and LP) with no flow (lockup) or with water heater on
   - Minimum: 4 inches w.c. (natural), 8 inches w.c. (LP) with gas flowing (verify during water heater startup)

Check control module fuses

NOTICE ALWAYS check control module fuses before replacing control module or any major components (blower, etc.). If one of these fuses is blown, it can prevent the control module or other components from operating.

1. Turn OFF power to the water heater at the external disconnect switch.
2. Remove front access cover.
3. Remove the control module cover.
4. Inspect fuses F2, F3, F4, and F5, see FIG. 12-1 below.

Figure 12-1 *Control Module Fuses*



5. The water heater is shipped with three (3) spare fuses in a plastic bag attached to the control module cover.

6. If necessary, replace open fuse (F3 is 1.25 amps, F2 and F4 are 3.15 amps, and F5 is 5 amps).

Note: Fuses F2 - F5 are all slow blow fuses.

⚠ WARNING Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death, or substantial property damage.

7. Install control module cover and front access cover after fuse inspection.

8. Restore power to the water heater at the external disconnect switch and verify water heater operation (Section 9 - Start-up) after completing water heater service.

12 Troubleshooting

Table 12A *Troubleshooting Chart - No Display*

FAULT	CAUSE	CORRECTIVE ACTION
No Display	- No 120 VAC supplied to unit.	• Check external line switch, fuse, or breaker. • Check wiring harness connection between display board and main control board. Connect harness at both points.
	- Bad display board.	• Replace board.
	- Bad main control board.	• Replace the main control board.
	- Blown fuse.	• Replace fuse F3 on the main control board, see page 63 of this manual.
No Burner Operation	- Tank temperature set point satisfied.	• Review temperature setting.
	- Unit locked out on fault.	• Consult display for specific fault. Refer to fault descriptions on page 67 of this manual for corrective actions.
Unit Does Not Modulate Above 50%	- Flue sensor open.	• Verify that the flue sensor is located in the flue outlet.
		• Check wiring connections at the flue sensor.
		• Check the resistance of the flue sensor and compare to Table 12D on page 65 of this manual.

12 Troubleshooting *(continued)*

Checking temperature sensors

The water heater temperature sensors (inlet water, outlet water, tank water, and flue) are all resistance type devices. The following tables show the correct values for the sensors at various temperatures. Use an ohmmeter to read the resistance of the sensor at a known temperature. If the resistance of the sensor does not closely match its corresponding table, replace the sensor.

Table 12B - *Inlet Tank Sensor Resistance vs. Temperature*

Temperature °F	Resistance Ω	Temperature °F	Resistance Ω
50	18,780	158	1,990
68	12,263	176	1,458
86	8,194	194	1,084
104	5,592	212	817
122	3,893	--	--
140	2,760	--	--

Table 12C - *Outlet Water Sensor Resistance vs. Temperature*

S1a (Wire Color - R/BK and Y)				S1b (Wire Color - G and Y)			
Temperature	Resistance	Temperature	Resistance	Temperature	Resistance	Temperature	Resistance
50	19,553	158	2,004	50	40,030	158	3,478
68	12,690	176	1,464	68	25,030	176	2,492
86	8,406	194	1,084	86	16,090	194	1,816
104	5,715	212	816	104	10,610	212	1,344
122	3,958			122	7,166		
140	2,786			140	4,943		

Table 12D - *Flue Temperature Sensor Resistance vs. Temperature*

Temperature °F	Resistance Ω	Temperature °F	Resistance Ω
68	14,773	176	1,707
86	9,804	194	1,266
104	6,652	212	952
122	4,607	230	726
140	3,252	248	560
158	2,337	--	--

12 Troubleshooting

Table 12E *Troubleshooting Chart - Noisy System*

FAULT	CAUSE	CORRECTIVE ACTION
Noisy Operation	- Supply gas problem. Natural gas pressures should be between 4 inches w.c. and 14 inches w.c. LP gas pressures should be between 8 inches w.c. and 14 inches w.c.	• Refer to Section 6 - Gas Connections for detailed information concerning the gas supply.
	- Gas/air mixture problem.	• Refer to the Gas Valve Adjustment Procedure on page 74 of this manual for the proper gas valve setting. Verify that the vent/air intake lengths do not exceed the maximum listed in the General Venting section.
	- Dirty/damaged burner.	• Refer to page 62 in this manual for the burner removal and inspection procedure. Clean or replace the burner as necessary.
	- Low water flow through the heat exchanger.	• Very pump operation.
	- Air in the piping system.	• Properly purge all air from the piping system.
No Pump Operation	- Blown fuse.	• Replace fuse F5 on the control board, see page 63 of this manual.
	- Faulty pump.	• Replace pump.
	- Faulty pump relay.	• Replace pump relay.
	- Internal fault on control board.	• Replace main control board.
Relief Valve Opening	- System pressure exceeds relief valve setting.	• Lower the system pressure below the 150 PSI rating of the supplied relief valve.

12 Troubleshooting *(continued)*

Table 12F *Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E00	Invalid lockout code.	• Reset control module. • Switch power OFF and ON. • Replace control module.
E01	The control module has detected parameter settings that are corrupted.	• Replace control module.
E02 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The actual fan RPM is more than 30% above or below the fan speed RPM target.	• Vent/air intake lengths exceed the maximum allowed lengths. Refer to Section 2 - General Venting for proper lengths. • Check for obstruction or blockage in the vent/air intake pipes or at terminations. • Check the wiring connections at the fan and at the main control board. • Replace the fan. • Replace the main control board.
	Blown fuse.	• Replace fuse F2 on the control board, see page 63 of this manual.
E04 (will require a manual reset once condition has been corrected. Press the RESET button on the display to reset.)	Either the optional flow switch or the optional low water cutoff is not making.	• Check pump operation on a call for heat. • Check for closed valves or obstructions in the piping. • Verify system is full of water and all air has been purged from the system. • Check for loose or misplaced jumpers if flow switch or LWCO is not installed.
	Blown fuse.	• Replace fuse F3 on the control board, see page 63 of this manual.
E05 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The flame detector circuit is seeing a flame signal when the gas valve is closed.	• Verify flame is not present. If present, turn off gas supply and replace gas valve. • Check supply voltage for proper polarity. • Check external wiring for voltage feedback. • Check the flame rod and make sure it is clean. • Check the internal wiring for bad connections. • Replace main control board.

12 Troubleshooting

Table 12F (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E06	The outlet water temperature has exceeded the setting of the automatic reset high limit.	• Adjust the set point of the auto reset limit to a higher setting up to a maximum of 200°F. Reference Section 10 - Operating Information for adjusting procedures. • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly into the heating system. Refer to Section 5 - System Piping for the proper piping methods for the Shield water heater. • Check 120 vac to boiler pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. • Replace the main control board if necessary. • If 120 vac is present on a call for heat and the pump is not operating, replace the pump. • If operating on something other than an outlet sensor, check temperature setting of the main control board. • If the optional manual reset high limit has tripped, check setting of the device. • Check resistance of water sensors and compare to Table 12B on page 65 of this manual. Replace sensor if necessary.
E07 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	Either the air pressure switch, the O-temp heat exchanger switch, or the burner door temperature switch has opened. **⚠ WARNING** If the burner door temperature switch trips, the burner door and the burner door temperature switch will be extremely HOT. Allow the unit to cool before touching. Failure to follow this warning could result in severe personal injury, death, or substantial property damage.	**AIR PRESSURE SWITCH** • Check the wiring connections to switch. Wires should be connected to the common and normally closed terminals. • Air intake lengths exceed the maximum allowed lengths. Refer to Section 2 - General Venting for proper lengths. • Check for obstruction or blockage in the air intake pipes or at terminations. • Check reference hoses connected to the air pressure switch for blockage or obstruction. • Inspect the burner. Reference page 61 of this manual for removal and cleaning procedures. Replace if necessary. • Inspect the heat exchanger. Reference page 61 of this manual for removal and cleaning procedures. • Faulty air pressure switch. Replace switch. **O-TEMP HEX SWITCH (Applies to the 286 Model Only):** • Check the wiring connections to the fuse on the heat exchanger. • Check continuity across the thermal fuse. If open, replace heat exchanger. **BURNER DOOR TEMPERATURE SWITCH (Applies to the 286-125 -- 501-125 Models Only):** • The underlying cause of the fault must be identified and resolved by a qualified service technician before resetting the burner door temperature switch. • Check continuity across two contacts. Wires should be connected at both poles of the normally closed switch. • Faulty burner door temperature switch. Replace burner door temperature switch.

12 Troubleshooting *(continued)*

***Table 12F** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E08	Louver proving switch open.	• Check wiring to louver proving switch. • Check louver proving switch.
E09	The blocked drain switch has detected excessive condensate build up inside the unit.	• Check condensate tube from unit to floor drain for proper installation and obstructions. • Inspect condensate trap for blockage. Clean if necessary. • Check for loose wiring connection at wire harness plug. • Bad blocked drain switch. Replace switch.
E11 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The unit has lost flame signal four (4) times during a call for heat.	• Inspect spark electrode and associated wiring for damage and connection. Reference page 60 of this manual for removal and cleaning procedures. Replace if necessary. • Check for proper electrical grounding of the unit. • Check incoming supply gas pressure. Natural gas pressures should be between 4 - 14 inches w.c. and LP gas pressures should be between 8 - 14 inches w.c. Refer to Section 6 - Gas Connections for detailed information concerning the gas supply. • Verify that the plastic hose from the gas valve to the air inlet is connected and is not damaged. • Verify that the vent/air intake pipes are correctly installed and that there are no obstructions. • Check for 24 vac to the gas valve at the 2-pin connection on the side of the main control board during the ignition attempt. If no voltage is present, replace the main control board. • If 24 vac is present at the main control board, check the wiring between the main control board and the gas valve. Replace the wiring if necessary. Do not disconnect the wiring from the gas valve and attempt to measure voltage at that point. The main control board can detect if the gas valve is not connected and will display the Gas Valve or Gas Valve Fail fault. • If 24 vac is present, check the outlet of the valve to ensure the valve is flowing gas. With a manometer connected to the outlet tap of the gas valve, when the unit is in the prepurge period, there should be a negative pressure present. When the valve is energized a change in pressure should occur. If the pressure change does not occur, the gas valve is not opening. Replace the gas valve. • Inspect flame sensor and associated wiring. Reference page 60 of this manual for removal and cleaning procedures. Replace if necessary. • Inspect and clean the heat exchanger as necessary. Reference page 61 of this manual for cleaning procedures. • Inspect the burner. Reference page 61 of this manual for removal and cleaning procedures. Replace if necessary. • Replace the main control board.
E12 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The unit has failed to prove main burner ignition after four (4) attempts.	
n05	The fan speed is being increased due to the flame current going below 5 microamps.	

12 Troubleshooting

Table 12F *(continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E13	The flue temperature has exceeded 250°F.	• Inspect the heat exchanger. Reference page 61 of this manual for the procedure on how to clean the flue side of the heat exchanger. • Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 12D on page 65 of this manual. Replace the sensor if necessary. • Verify that the vent/air intake pipes are properly installed and that there are no obstructions. • Replace the main control board.
b05	The flue temperature has exceeded 240°F.	
n04	The fan speed is being limited due to the flue temperature exceeding 215°F.	
E15 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The outlet water temperature has exceeded the 210°F manual reset high limit (MRHL) setting.	• Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly into the heating system. Refer to Section 5 - System Piping for the proper piping methods for the Shield water heater. • Check 120 vac to pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. • Replace the main control board if necessary. • If 120 vac is present on a call for heat and the boiler pump is not operating, replace the pump. • If operating on something other than an outlet sensor, check temperature setting of the main control board. • Check resistance of water sensors and compare to Table 12B on page 65 of this manual. Replace sensor if necessary.
b03	The outlet water temperature has exceeded 195°F.	
n02	The fan speed is being limited due to the outlet temperature exceeding 185°F.	
E18 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The control module reads an excessive temperature difference between the two outlet sensors.	• Check wiring to sensor. Make sure wiring is connected and not damaged. Reconnect / repair wiring if necessary. • Measure the resistance of the sensor and compare to the resistance in Table 12B on page 65 of this manual. Replace sensor if necessary. • Replace control module.
E19 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	One or both of the flue sensors is open or shorted.	• Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 12D on page 65 of this manual. Replace the sensor if necessary. • Replace the main control board.

12 Troubleshooting *(continued)*

***Table 12F** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E21 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	One or both of the outlet sensors has opened or shorted.	• Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistances of the sensors and compare the resistances to the tables on page 65. Replace if necessary.
E22 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The inlet sensor is open.	• Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged.
E23 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The inlet sensor is shorted.	
b01	The temperature has reached the set point + 4°F.	• None
b02	The main control board has received a call for heat too quickly after the previous call for heat has ended.	• The control board will release the call for heat after 60 seconds. • The control board will release the call for heat if the outlet temperature drops 10°F.
b04	The temperature rise across the heat exchanger has exceeded 45°F.	• Verify that the system is full of water and that all air has been properly purged from the system. • Check for 120 vac to the pump motor on a call for heat. If voltage is not present, check the wiring on the pump relay back to the main control board. Replace the main control board if necessary. • If 120 vac is present on a call for heat and the pump is not operating, replace the pump. • Scale accumulation in the heat exchanger. Verify that the water chemistry meets the requirements listed in Section 5 - System Piping.
n03	The fan speed is being limited due to the temperature rise across the heat exchanger exceeding 40°F.	

12 Troubleshooting

Table 12F *(continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
b06	120 vac input to the main control board has dropped below 80 vac.	• Check 120 vac supply to the transformer. • Check wiring connections at the low voltage terminal strip. • Check the wire size/length to remote devices. • Replace the transformer. • Check 24V.
n01	The flue temperature did not change after the burner started firing.	• Verify that the flue sensor is installed. • Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged.
n06	Tank sensor is not connected.	• Check the tank sensor and its associated wiring. Repair or replace as needed.
n07	The inlet sensor has been disconnected.	• Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 65 of this manual. • Replace the sensor if necessary.
n08	The inlet sensor has been shorted.	• Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 65 of this manual. • Replace the sensor if necessary.

12 Troubleshooting *(continued)*

Combustion Analysis Procedure

1. Shut the water heater down by pressing the UP button for five (5) seconds.
2. Locate the flue sensor in the vent connection. Remove the flue sensor and grommet from the unit. **Note:** Combustion measurements will be made at this point.
3. Place the water heater in active position by pressing the UP button for five (5) seconds.
4. Press ENTER plus the UP button for five (5) seconds to enter Service Mode.
5. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
6. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 12G. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the *Troubleshooting* section of this manual for possible causes and corrective actions.
7. Once the combustion analysis is complete, exit Service Mode.
8. Replace the flue sensor and grommet into the vent connection.
9. Place the Shield water heater back into normal operation.

⚠ WARNING You must replace the flue sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

***Table 12G** Flue Products*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

***Table 12H** Troubleshooting Chart - Combustion Levels*

POSSIBLE CAUSE	CORRECTIVE ACTION
Vent/Air Intake Length or Obstruction	• Refer to Section 2 - General Venting for the proper venting and air intake methods for the Shield water heater. • Check for obstructions at the vent/air intake terminals.
Gas Supply Pressure	• Refer to Section 7 - Gas Connections for the proper gas supply for the Shield water heater.
Dirty/Damaged Burner	• Refer to page 61 of this manual for burner removal and cleaning procedures. • Replace burner if necessary.
Gas Valve Adjustment	• Refer to page 74 of this manual for the gas valve adjustment procedure.

12 Troubleshooting

Gas valve adjustment procedure

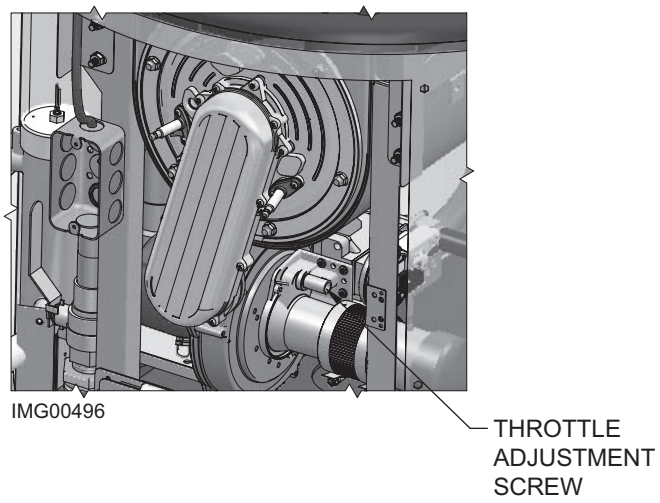
If adjustment of the gas valve is deemed necessary, use the following procedures: (**Note:** The procedures below are model specific.)

Models 126-065 -- 286-125

Locate the throttle adjustment screw on the side of the venturi valve (FIG. 12-2). Using a screwdriver, turn the screw a 1/4 turn **clockwise** to decrease CO_2 levels or a 1/4 turn **counterclockwise** to increase CO_2 levels. After performing one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12H on page 73 or replace the gas valve.

Figure 12-2 *Gas Valve Adjustment: Models 126-065 -- 286-125*

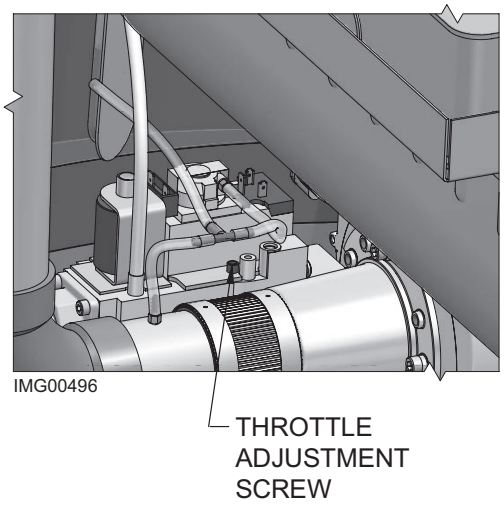


Model 401-125

Locate the throttle adjustment screw on the top of the gas valve, see FIG. 12-3. Using a screwdriver, turn the screw 1/8 turn **counterclockwise** to increase CO_2 levels or 1/8 turn **clockwise** to decrease CO_2 levels. After one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12H on page 73 or replace the gas valve.

Figure 12-3 *Gas Valve Adjustment: Model 401-125*

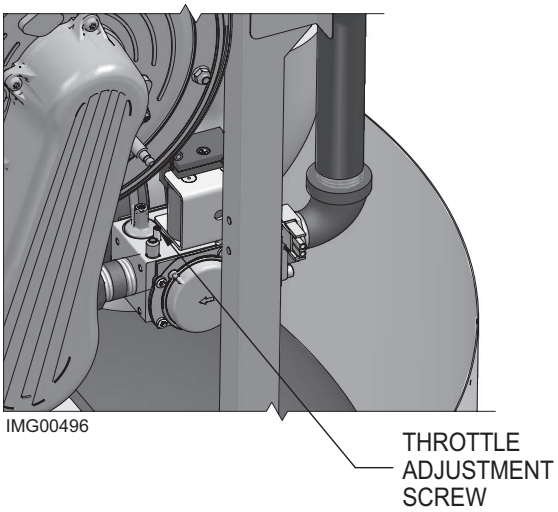


Model 501-125

Locate the throttle adjustment screw on top of the gas valve, see FIG. 12-4. Using a screwdriver, turn the screw a 1/4 turn **counterclockwise** to increase CO_2 levels or a 1/4 turn **clockwise** to decrease CO_2 levels. After one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

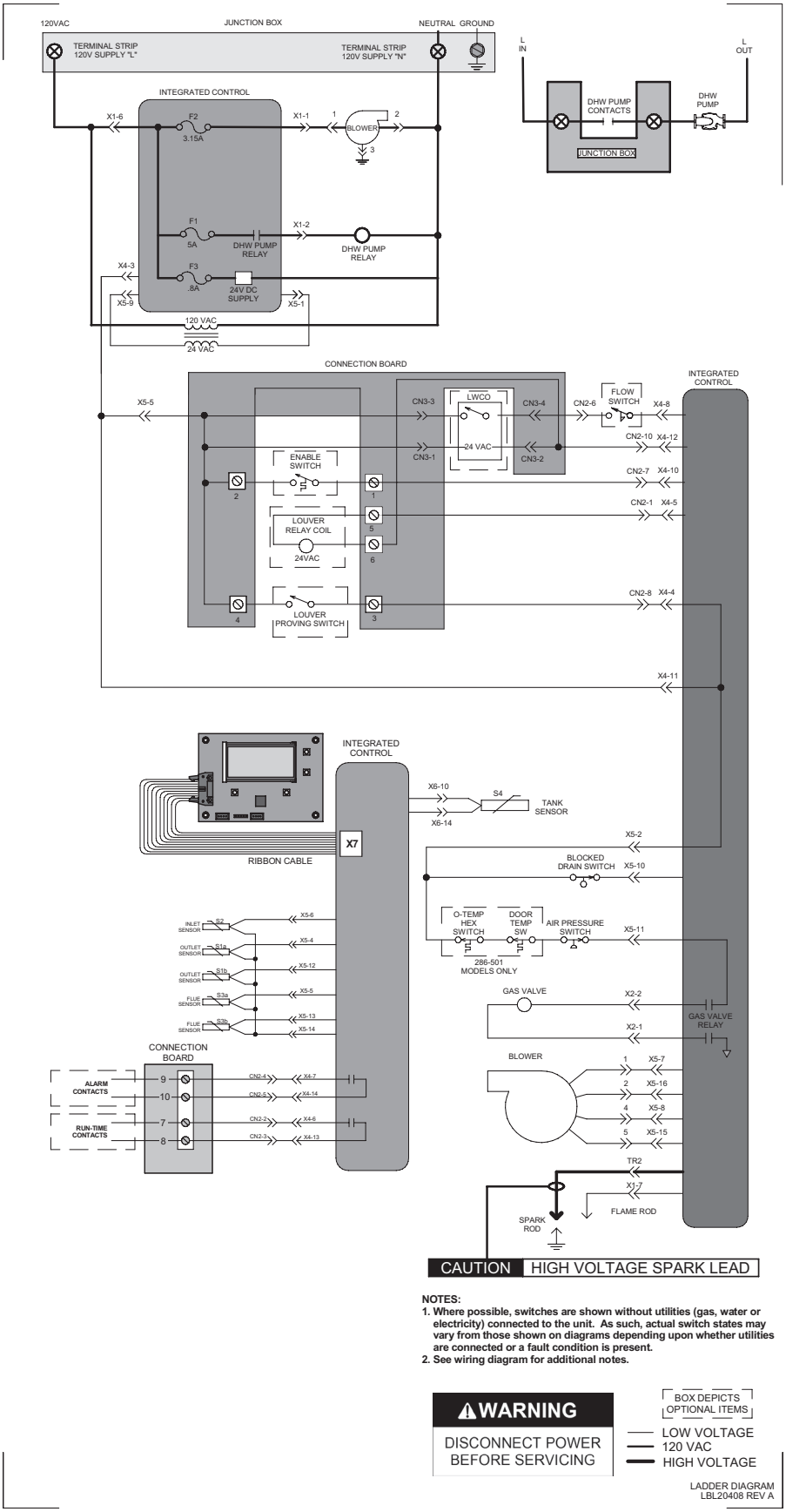
If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12H on page 73 or replace the gas valve.

Figure 12-4 *Gas Valve Adjustment: Model 501-125*



13 Diagrams

Figure 13-1 *Ladder Diagram*



NOTES:

1. **Where possible, switches are shown without utilities (gas, water or electricity) connected to the unit. As such, actual switch states may vary from those shown on diagrams depending upon whether utilities are connected or a fault condition is present.**
2. **See wiring diagram for additional notes.**

⚠WARNING

DISCONNECT POWER BEFORE SERVICING

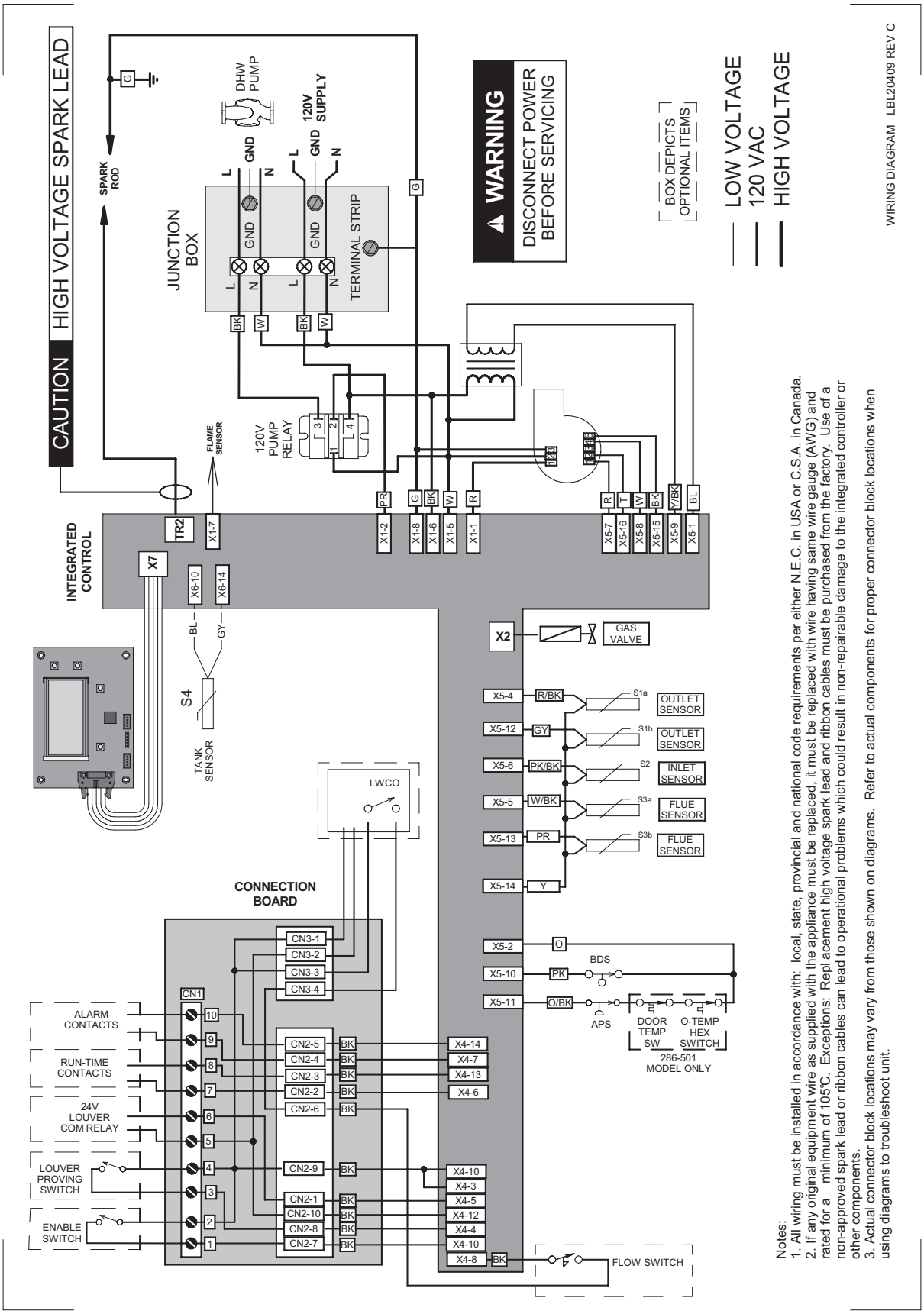
BOX DEPICTS OPTIONAL ITEMS

LOW VOLTAGE
120 VAC
HIGH VOLTAGE

LADDER DIAGRAM
LBL20408 REV A

13 Diagrams

Figure 13-2 *Wiring Diagram*



Notes:
1. All wiring must be installed in accordance with: local, state, provincial and national code requirements per either N.E.C. in USA or C.S.A. in Canada.
2. If any original equipment wire as supplied with the appliance must be replaced, it must be replaced with wire having same wire gauge (AWG) and rated for a minimum of 105°C. Exceptions: Replacement high voltage spark lead and ribbon cables must be purchased from the factory. Use of a non-approved spark lead or ribbon cables can lead to operational problems which could result in non-repairable damage to the integrated controller or other components.
3. Actual connector block locations may vary from those shown on diagrams. Refer to actual components for proper connector block locations when using diagrams to troubleshoot unit.

Notes

Notes

Notes

Revision Notes: *Revision A (ECO #C12258) initial release.*

Revision B (ECO #C12665) reflects the addition of the CSA Low Lead Content logo.

Revision C (ECO #C11814) reflects the addition of Metal Fab and Security Chimney to the manual.

Revision D (ECO #C13833) reflects the removal of the page number reference on page 15, the addition of the corrosive contaminant warning on page 3 (R06313), changes made to Table 6A - Gas Piping Chart on page 41 (R6621), the addition of the Temperature Parameter Setting Table and HW Temperature Setting instructions on pages 52 and 53 (R6658), edits made to the callouts on page 5 (R06493), along with updating the flex piping information (R06464) on page 21.

Revision E (ECO #C14411) reflects a note that the SNA286-125 model can be vented using 3" diameter pipe up to a maximum of 60 equivalent feet, pages 7 and 17, along with changing out LBL20026 and LBL20025 (R6979).

Revision F (ECO #C14713) reflects high altitude updates.

Revision G (ECO #C14988) reflects the correction of FIG. 2-2 on page 15.

Revision H (ECO #C15251) reflects the addition of the burner door temperature switch updates (R6322).

Revision I (ECO C16918) reflects the update of ratings information on page 7 (R07744), FIG. 3-13 description on page 29 (R07478), water chemistry information on page 35 (R07142), and water column information on page 40.

Revision K (Change #500000930) reflects edits made to FIG 4-7 on page 33.

Revision L (PCP# 3000001537 / CN# 500001784) reflects the addition of a note that the starter is factory installed on the 126-201 models under General Venting on page 20.

Revision M (PCP# 3000000426 / CN# 500000623) reflects the addition of combustion clearance dimensions in FIG.'s 1-1 and 1-2 on page 9.

Revision N (PCP# 3000004287 / CN# 500004864) reflects a change to the numbers of the Polypropylene Adapters in Table 2F on page 21. Figure 2-9 has also been updated.

Revision P (PCP# 3000005143 / CN# 500006666) reflects the addition of new venting category information on pages 25 through 27.

Revision R (PCP# 3000004438 / CN# 500005574) reflects an update to the flue temperatures on page 54.

Revision T (PCP# 3000006133 / CN# 500007549) reflects the addition of a PVC-DWV vent fitting in Table 2D on page 20.

Revision U (PCP# 3000008814 / CN# 500008824) reflects changes in the water chemistry information on pages 38-41, 50, and 58.

Revision V (PCP #3000022251 / CN #500012175) reflects an update to the Delta T limits on pages 54 on and 71.

Revision W (PCP #3000023864 / CN #500013813) reflects an update to the water chemistry chart on page 50.

Revision X (PCP #3000027532 / CN #500017086) reflects the addition of Table 12C.

Revision Y (PCP #3000030854 / CN #500020183) reflects the addition of the building recirculation filter on pages 38 and 58, an update to Notice 3 on page 50, and an update to the piping diagrams.

Revision AA (PCP #3000031981 / CN #500021055) reflects an update to the wiring diagram in Figure 13-2.

Revision AB (PCP #3000033358 / CN #500022063) reflects update made to the wiring diagram.

Revision AC (PCP #3000033359 / CN #500022168) reflects an update to the input minimum and maximum rates on page 7.

SHW-I-S_MM #100161683_DIR #2000017192_Rev AC
07/19

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