

Instructions for Installation of Working Fluid



The installation of the Working Fluid (WF) also referred to as the refrigerant is similar to other commercial refrigeration equipment. The following instructions are the basic steps as they pertain to ElectraTherm's ORCs. These instructions are intended for use by an experienced refrigeration technician familiar with the process.

1. Pressure test the entire system, all internal isolation valves must be open. The full internal volume of the S4000 Power+ ORC is approximately 110 gallons (416 Liters)

The internal isolation valves are located at the tank inlet and outlet.

Tank inlet isolation valve



Tank outlet isolation valve

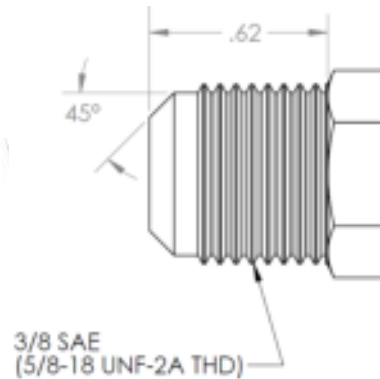


This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

Instructions for Installation of Working Fluid



2. Increase the internal pressure to 7.0 bar (100 psi) with dry nitrogen (N_2). The nitrogen can be connected to any refrigeration access valves, all access valves are 3/8" 45° SAE Male Flare connections, detailed below. The valves on top of the receiver tank are a good point to inject the nitrogen.



3. Once the system is at 7.0 bar (100 psi) turn off the nitrogen supply, and close the access valve that was used. The pressure should not decrease by more than 0.1 bar (2 psi) in an hour.



This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

Instructions for Installation of Working Fluid



4. If the pressure decreases more than 0.1 bar (2 psi) in an hour, use a leak detector spray to inspect all fittings, flanges, expander connection ports and the expander shaft seal. Any leaks must be fixed.



Pictures provided as reference – examples only. A leak could be coming from any flange or other fitting in the working fluid loop.



This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

Instructions for Installation of Working Fluid



5. Once the pressure test is completed successfully, vent the nitrogen and begin evacuating the system with a vacuum pump. The same connection can be used to evacuate the system. A larger valve with a 1/2" SAE Flare connection is located at the condenser inlet. This larger port can help evacuate the system faster. The valve is shipped with a 1/2" X 3/8" adapter, this should be removed to use the larger connection.

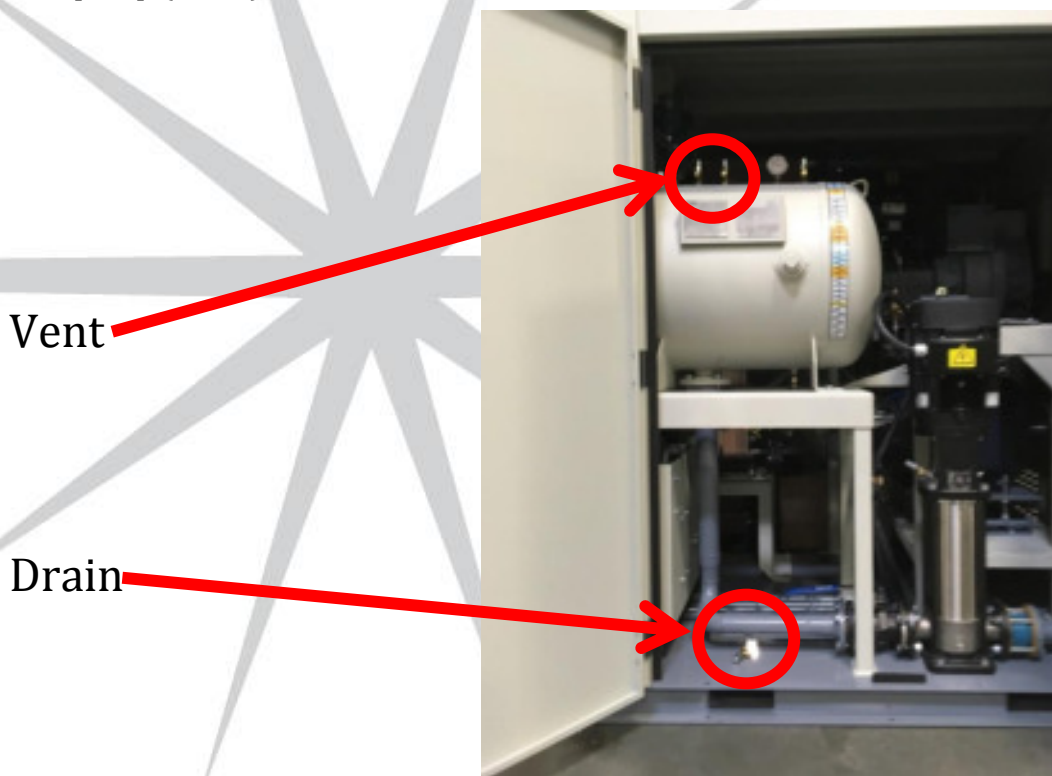


6. The system needs to be evacuated to a vacuum of less than 750 microns. Once under 750 microns, run the vacuum pump for another 30 minutes. (Use a digital vacuum gauge, a dial vacuum gauge is not adequate.) This additional run time helps to dehydrate the system and remove any contaminants that could be off gassing.
7. Shut off the vacuum pump and isolate the system to prevent leak through the hoses. Regularly monitor the vacuum gauge to see if the system can hold a vacuum. The system is leak tight and contaminate free when it can stay below 750 microns for 30 minutes without the pump running. It may fluctuate during this time, if it increases above 750 microns, restart the vacuum pump to pull the system back down. Restart the 30 minute timer after it decreases back below 750 microns.
8. Once the system is fully evacuated, the working fluid can be installed. The exact method will depend on the type of bottles the refrigerant came in and the transfer equipment that you have. The refrigeration technician should be familiar with their equipment, and the bottles available in your area. The following examples are just tips based on the equipment we have seen and worked with, but might not be exact for your application. If you have any questions please contact ElectraTherm.
9. Install the Working Fluid R245fa.
 - a. Minimum of 185 kg (400 lb) of R245fa for a Series 4000
 - b. The ORC leaves the factory with 4 gallons of Zerol 500 mineral oil installed. Do not add oil at commissioning.

This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

GENERAL TIPS FOR INSTALLATION OF THE WORKING FLUID

1. Only approved sources of R245fa are to be used in the Power+ Generator. Currently there are two approved sources for R245fa, Honeywell **Genetron®** and r245fa from Asahi Class Co. (AGC). There are alternate R245fa compounds supplied by other manufacturers on the market but the purity, cleanliness, heat transfer properties, and machine compatibility are unknown to ElectraTherm and cannot therefore be warranted. If other sources of R245fa are used in a Power+ unit, any issues related to the refrigerant cannot and will not be warranted. These may include seal life, bearing life, valve seats, corrosion rates, filter life, and machine output among others. If an alternate source of R245fa is available in your market please contact ElectraTherm for approval.
2. Most of the work for installing the working fluid can be done from the left hand side of the Power+ ORC. Opening the doors on this side of the machine will provide access to the receiver tank and feed pump. There are working fluid access valves on top of the tank (Vent), and in the pipe going between the tank and the pump (Drain).

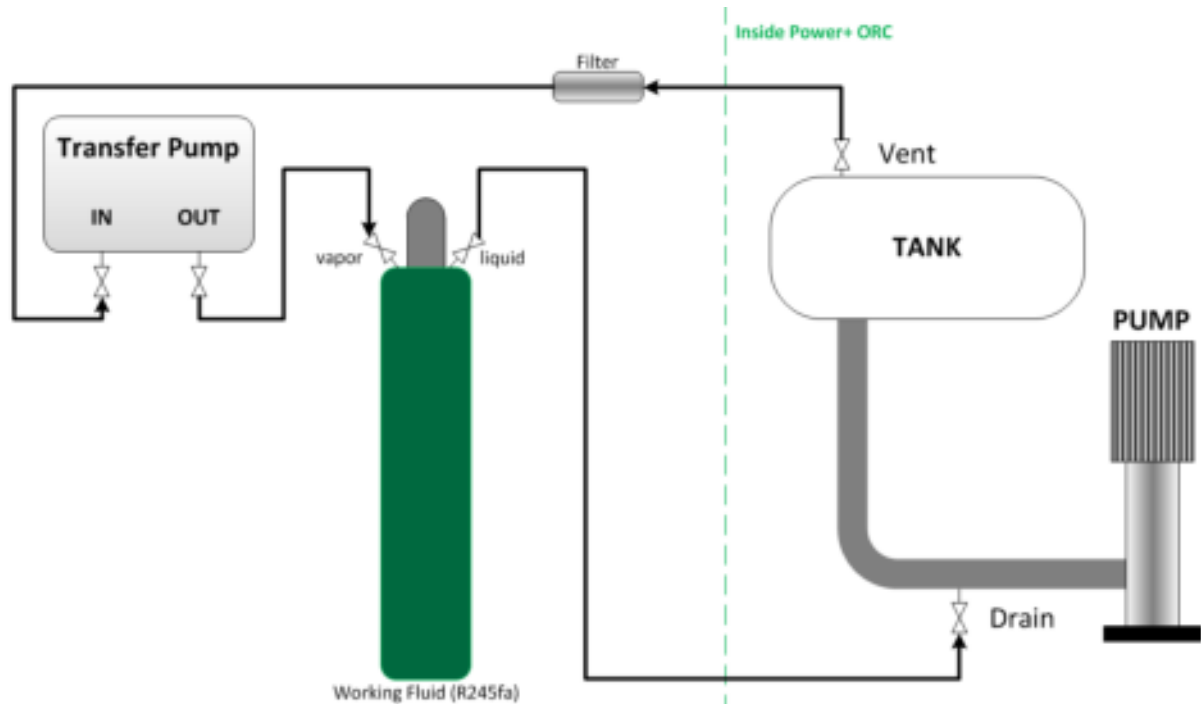


3. A scale can be useful to know when the bottles that are being transferred out of are empty.
4. The type of valves that are on the bottles of working fluid, and type of transfer pump that you have will determine the method used for moving the fluid into the machine.
 - 1) Push – Pull Method for working fluid bottles with two connections, one for vapor and another for liquid
 - 2) Direct Transfer Method for working fluid bottles with only one connection

This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

PUSH – PULL METHOD OF WORKING FLUID TRANSFER

1. In this method vapor is pulled off the top of the tank in the Power+ and pushed into the refrigerant bottle. This creates pressure inside the bottle that forces the liquid from the bottle into the Power+. This method is safe for transfer pumps that cannot handle liquid.

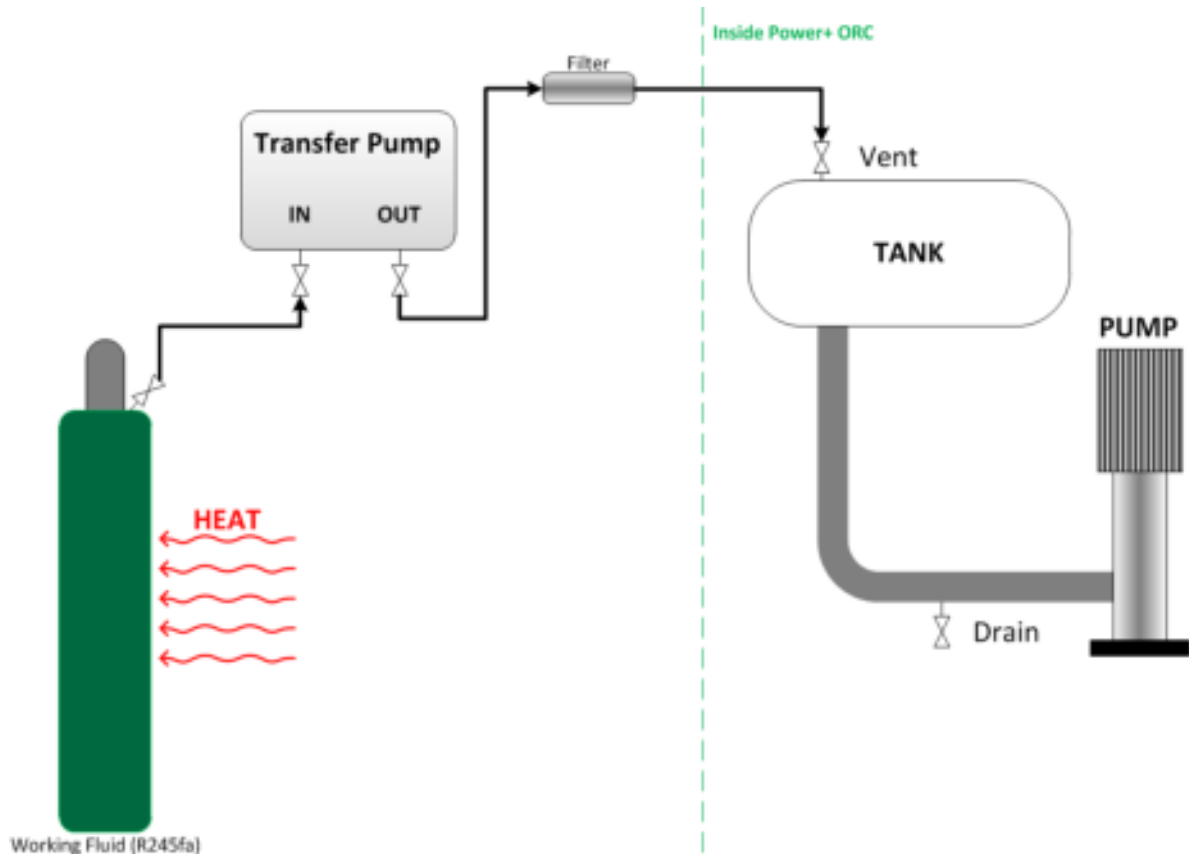


2. A standard filter dryer is installed to protect the pump
3. It is important to get the valves correct, the pump should be pushing into the vapor port on the bottle, and the liquid port should be connected directly to the Power+. Putting liquid through a transfer pump that is only designed for vapor can damage the pump.
4. If the working fluid is cold it will create a vacuum and it is possible for the transfer pump to shut off even with lots of liquid still in the bottle. Adding heat to the bottle or moving the bottle to a warm area can help the process.

This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

DIRECT TRANSFER METHOD OF WORKING FLUID TRANSFER

1. In this method the transfer pump is placed between the refrigerant bottle and the Power+. This method must be used if there is only one connection point on the refrigerant bottle.

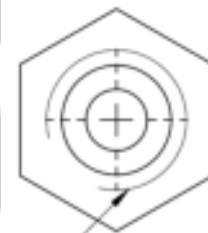


2. No pressure is being added to the bottle in this method, the addition of heat may be necessary to get the fluid to move. If the working fluid is cold it will create a vacuum and it is possible for the transfer pump to shut off even with lots of liquid still in the bottle.
3. This method can transfer vapor or liquid, depending on the valves that are available on top of the tank. Please check the instructions for your transfer pump to know if it can handle liquid, or if you must only transfer vapor. Putting liquid through a transfer pump that is only designed for vapor can damage the pump.

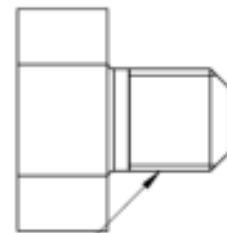
This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

TIPS FOR INSTALLATION OF THE WORKING FLUID (European Version)

- The 50 kg bottles have two valves but only one port so the standard method of “Push-Pull” can’t be done with these bottles. Typically heat is used. If you have to use heat on the bottles avoid direct flame, if the paint gets burnt Honeywell will declare the bottle damaged and force you to purchase the bottle.
- If heat is being used to move the WF into the machine, the cooling water can be turned on so that the system pressure stays low. This will reduce transfer time.
- Putting the WF bottles in the sun or in a warm place will also help your transfer time. This is particularly important when it is winter time and cold outside. However, inside in a warm room is better than outside in the sun, if you have the choice.
- It is not necessary to remove the vapor from the bottles when installing the WF.
- The refrigerant recovery pump that we use, the Bacharach 3700 will shut off when the pressure drops to about -0.5 bars. If the working fluid is cold it is possible for the vacuum pump to shut off even with lots of liquid still in the bottle. You must keep a minimum amount of heat in the WF.
- If the WF was ordered in 50 kg bottles the fitting will most likely be the DIN 477 #6.



.860"-14 WHIT-RH-INT
DIN 477 #6 standard F



5/8"-18 UNF-RH-EXT
3/8" SAE 45° Flare M

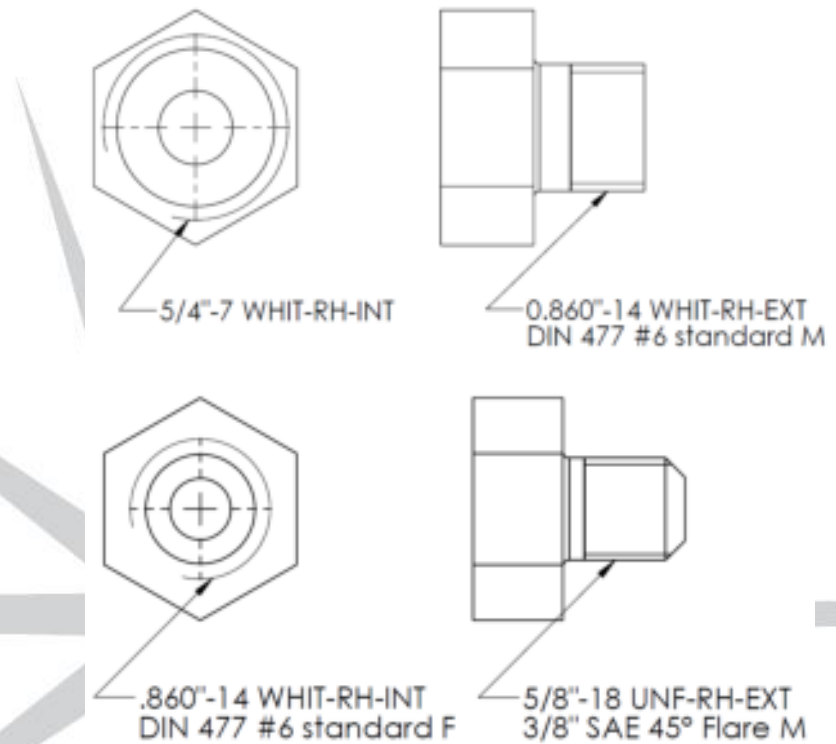
Note: Drawings are only to indicate thread dimensions, and are not to scale.

This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

Instructions for Installation of Working Fluid



- If the WF was ordered in a 450 kg bottle the fitting will most likely be the 5/4" (1-1/4") BSW fitting. There will be two valves on these tanks so two sets of fittings are needed and Push-Pull can be performed. This adapter may need to be made from two pieces. ElectraTherm has not been able to buy them in Europe. You may be able request adapters from Honeywell when the WF is ordered.



Note: Drawings are only to indicate thread dimensions, and are not to scale.

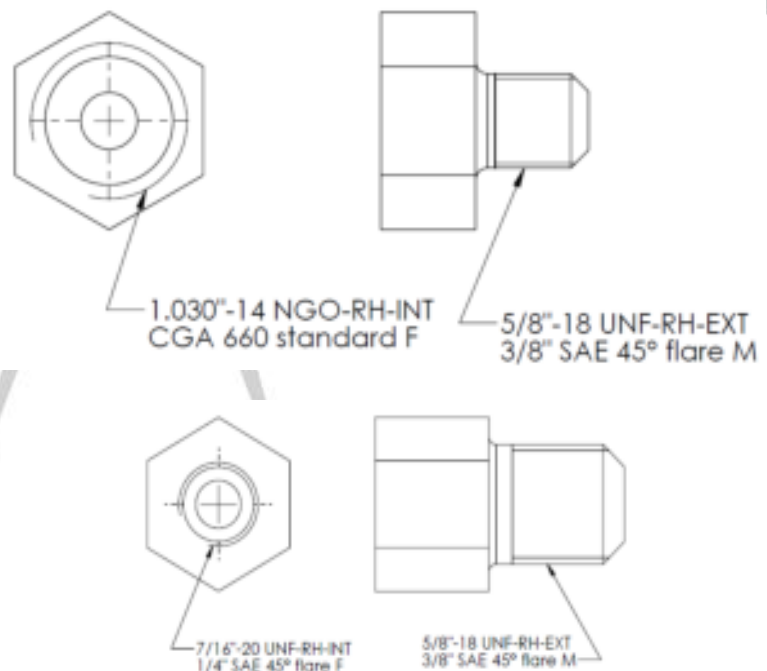
- Most all of the service ports on the ORC are 3/8" SAE male flare. There are also a few Schrader ports and one 1/2" SAE male flare port for connecting a large vacuum pump. Schrader ports are not recommended for WF transfer due to their location.
- We recommend a vacuum pump that moves a minimum of 8 CFM. A larger pump, such as the Edwards RV 12 (rated for 12 CFM) will draw a vacuum faster. We also recommend a refrigerant recovery pump similar to the Bacarach 3700, which uses 3/8" 45° SAE inlet and outlet connections.



This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

TIPS FOR INSTALLATION OF THE WORKING FLUID (US Version)

- The 100 lb. bottles have two valves and two ports. This allows for standard “Push-Pull” refrigerant transfer methods. If the bottle must be heated, do not use direct flame. If the paint gets scorched, Honeywell will not refund the bottle deposit.
- If heat is being used to move the WF into the machine, the cooling water can be turned on so that the system pressure stays low. This will reduce transfer time.
- Putting the WF bottles in the sun or in a warm place will also help your transfer time. This is particularly important when it is winter time and cold outside. However, inside in a warm room is better than outside in the sun, if you have the choice.
- It is not necessary to remove the vapor from the bottles when installing the WF.
- The refrigerant recovery pump that we use, the Bacharach 3700 will shut off when the pressure drops to -6.2 psi. It will not start again until pressure rises above -2.6 psi. If the working fluid is cold it is possible for the transfer pump to shut off even with lots of liquid still in the bottle. You must keep a minimum amount of heat in the WF.
- If the WF was ordered in 100 lb. bottles, the fitting will be a CGA 660 for the liquid port, and a ¼” Male 45° SAE flare.



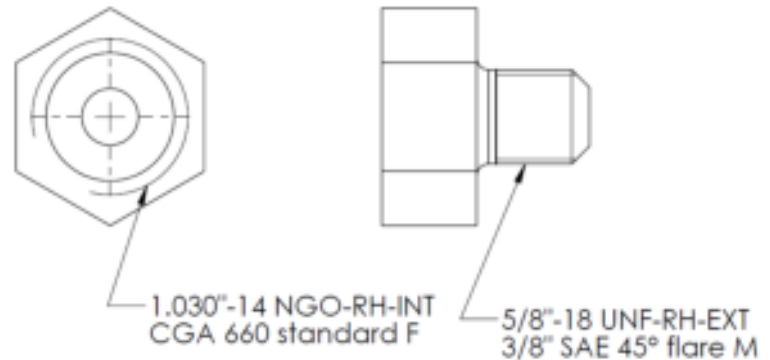
Note: Drawings are only to indicate thread dimensions, and are not to scale.

This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.

Instructions for Installation of Working Fluid



- If the WF was ordered in a 1000 lb. tank, it will require 2x CGA 660 fittings, one for each valve. This adapter may need to be made from two pieces. You may be able request adapters from Honeywell when the WF is ordered.



Note: Drawings are only to indicate thread dimensions, and are not to scale.

- Most all of the service ports on the ORC are 3/8" SAE male flare. There are also a few Schrader ports and one 1/2" SAE male flare port for connecting a large vacuum pump. Schrader ports are not recommended for WF transfer due to their location.
- We recommend a vacuum pump that moves a minimum of 8 CFM. A larger pump, such as the Edwards RV 12 (rated for 12 CFM) will draw a vacuum faster. We also recommend a refrigerant recovery pump similar to the Bacarach 3700, which uses 3/8" 45° SAE inlet and outlet connections.



This document contains confidential and proprietary information and is supplied purely to enable you to evaluate details concerning ElectraTherm products and services. No part of this document may be disclosed or transferred outside ElectraTherm or the current interested parties. No part of this document may be reproduced or transmitted in any form or by any means, including photography and recording, without the written permission of ElectraTherm, an application for which should be addressed to the organization. Such written permission must also be obtained before any part of this document is stored in a retrieval system of any nature.