Hardware Installation Manual

Modular Silicon Expansion Valve (MSEV)
High Capacity Modular Silicon Expansion Valve (HC-MSEV)
Very High Capacity Modular Silicon Expansion Valve (VHC-MSEV)
Universal SuperHeat Controller/Sensor (USHX)
Digital Pressure Temperature Sensor (DPTS)

Revision 1.9

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Published: Nov 2021

This manual is applicable to the following MSEV model numbers:

- A12V-U112
- A12V-U116
- A12V-U118
- A12V-U120
- A12V-U124
- A12V-C112
- A12V-C116
- A12V-C119
- A12V-C122
- A12V-C124
- A12V-C127
- A12V-C132
- A12V-C134
- A24V-U112
- A24V-U116
- A24V-U118
- A24V-U120
- A24V-U124
- A24V-C112
- A24V-C116
- A24V-C119
- A24V-C122
- A24V-C124
- A24V-C127
- A24V-C132
- A24V-C134

This manual is applicable to the following HC-MSEV model numbers:

- A12V-C332
- A12V-C338
- A12V-C343
- A12V-C348
- A12V-C352
- A12V-C355
- A12V-C358
- A24V-C332
- A24V-C338
- A24V-C343
- A24V-C348
- A24V-C352
- A24V-C355
- A24V-C358

This manual is applicable to the following VHC-MSEV model numbers:

- A12V-C6612
- A12V-C6650
- A12V-C6715
- A12V-C6773
- A12V-C6799
- A24V-C6612
- A24V-C6650
- A24V-C6715
- A24V-C6773
- A24V-C6799

This manual is applicable to the following USHX model numbers:

- USHC-G1.3b-BAAAXXX
- USHC-G1.5a-BAAAXXX
- USHS-G1.3b-BAAAXXX
- USHS-G1.5a-BAAAXXX

This manual is applicable to the following DPTS model numbers:

- DPTS-G1.3b-BAAAXXX
- DPTS-G1.5a-BAAAXXX

Additional Product Markings for USHC-G1.3b, USHS-G1.3b, USHC-G1.5a, USHS-G1.5a, DPTS-1.3b and DPTS-1.5a

- Operating Control
- Independently Mounted
- Pollution Degree 2
- Impulse Voltage: 300 V
- SELV Circuit Voltage I/O
- Operating Pressure: 21 to 240 psia
- Proof Pressure: 600 psi
- Burst Pressure: 1500 psi

Table of Contents

1 Before You Begin

1.1 About This Manual

The following table shows a summary of the sections in this document and their descriptions.

Table 1-1 Descriptions of the Sections in the Document

Section Title	Description
Before You Begin	This section provides preliminary information about the products.
Mechanical Installation	This section provides instructions about the mechanical installation of the MSEV series and the USHX in the system.
Electrical Wiring	This section provides instructions about the electrical wiring of the MSEV series valve and the USHX.
Troubleshooting	This section provides solutions to potential problems.
Best Practices for MSEV and USHC Install	This section provides recommendations that can be followed for best MSEV and USHX install

1.2 Document Conventions

The following table shows a list of symbols found in this document and their descriptions.

Table 1-2 Descriptions of Symbols in the Document

Symbol	Description
	*WARNINGS* indicate that the action you are taking could either cause injury to yourself or could harm your products and systems.
	*IMPORTANT NOTES* appear in the text to indicate additional information that should be noted.

1.3 Acronyms

The following table shows a list of acronyms used in this document.

Table 1-3 Acronyms and Abbreviations in the Document

Acronym	Description
MSEV	Modular Silicon Expansion Valve
HC-MSEV	High Capacity Modular Silicon Expansion Valve
VHC-MSEV	Very High Capacity Modular Silicon Expansion Valve
MSEV Series	MSEV, HC-MSEV and VHC-MSEV
MEMS	Microelectromechanical Systems
EEV	Electronic Expansion Valve
TXV	Thermostatic Expansion Valve
HVAC/R	Heating, Ventilation, Air Conditioning, and Refrigeration
USHX	Universal SuperHeat Controller or Sensor
USHC	Universal SuperHeat Controller
USHS	Universal SuperHeat Sensor
DPTS	Digital Pressure Temperature Sensor
ID / OD	Inner Diameter / Outer Diameter
AC / DC	Alternating Current / Direct Current

1.4 About the MSEV Series and the USHX

The MSEV series valves **Modular Silicon Expansion Valve (MSEV), High Capacity Modular Silicon Expansion Valve (HC-MSEV)** and the **Very High Capacity Modular Silicon Expansion Valve (VHC-MSEV)**, shown in **Figure 1-1** MSEV Family, are two-stage proportional control expansion valves that utilize DunAn Microstaq's patented silQflo® technology. The silQflo is a microelectromechanical systems (MEMS) microvalve technology used to provide precise mass flow control for industry-standard HVAC and refrigeration applications. The MSEV consists of a MEMS pilot valve which acts as a first stage valve that applies varying fractions of fluid line pressure onto the second stage spool valve according to the command signal provided by the Universal SuperHeat Controller (USHC). The MSEV is installed at the inlet of the evaporator.

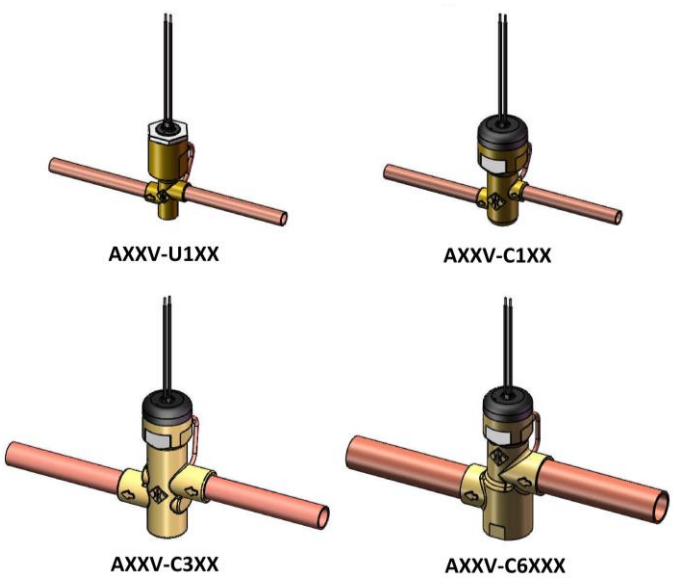


Figure 1-1 MSEV Family

The **Universal SuperHeat Controller/Sensor** (USHX), shown in **Figure 1-3**, is offered either as a:

a. Universal SuperHeat **Controller** (USHC): To drive and control a MSEV series valve.

b. Universal SuperHeat **Sensor** (USHS) or Digital Pressure Temperature **Sensor** (DPTS): To measure and report temperature, pressure, and superheat values.

The USHX consists of an internal MEMS pressure sensor and a processing unit. It uses a wiring harness, shown in **Figure 1-2**, to measure the evaporator temperature and control a MSEV series valve**.** The USHX is installed at the outlet of the evaporator; it mounts on a ¼" access fitting and utilizes the Modbus RTU communication protocol for user interaction.

Figure 1-3 USHX

Figure 1-2 USHX Wiring Harness

The USHX and its wiring harness pin assignments are shown in **Table 1-4**.

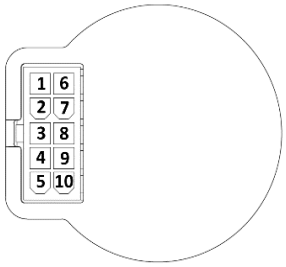
Table 1-4 USHX and Wiring Harness Pin Assignments

USHX Series Model Numbers

- USHC-G1.3b-BAAAXXX
- USHS-G1.3b-BAAAXXX
- USHC-G1.5a-BAAAXXX
- USHS-G1.5a-BAAAXXX

DPTS Series Model Numbers

- DPTS-G1.3b-BAAAXXX
- DPTS-G1.5a-BAAAXXX



Pin Number	Pin Name	Pin Function	Type of Wire	Wiring Harness Model WH-USHX-AX
Pin 1	AC2	Power Input	Red, 18 AWG	✓
Pin 6	AC1	Power Input	Black, 18 AWG	✓
Pin 3	DATA-	RS485- Communication	Black, 24 AWG, Shielded	✓
Pin 4	DATA+	RS485+ Communication	Red, 24 AWG, Shielded	✓
Pin 2	DGND	Digital Signal Ground and Thermistor Signal Ground	Green, 22 AWG	✓
Pin 9	SENS	Thermistor Power	Black, 24 AWG	✓
Pin 7	PWM+	PWM Output	White, 18 AWG	✓
Pin 8	PWM-	PWM Output	White, 18 AWG	✓
Pin 5	GPB	General Purpose – Not Utilized	Brown, 20 AWG	✓
Pin 10	GPA	General Purpose – Not Utilized	Purple, 20 AWG	✓

Note:
✓ = Available

2 Mechanical Installation

This section describes the mechanical installation of a MSEV series valve and USHX. **Figure 2-1** below shows an example of a typical system where the MSEV series valve and USHX devices would be integrated. Like conventional thermostatic expansion valves (TXVs) or electronic expansion valves (EEVs), the MSEV series valve is installed at the inlet of the evaporator. The USHC, which drives and controls the MSEV series valve, is installed at the outlet of the evaporator, in place of the TXV bulb or EEV controller sensing device. The MSEV series and USHC are connected together by a wiring harness. A thermistor at the outlet of the evaporator measures the temperature, and the USHC is powered by the Class 2 power source.

Do NOT turn the power source ON until installation of MSEV series valve, USHX and wiring harness is complete. For the user's own safety, **only** Class 2 power source should be used to power the MSEV series and USHX devices.

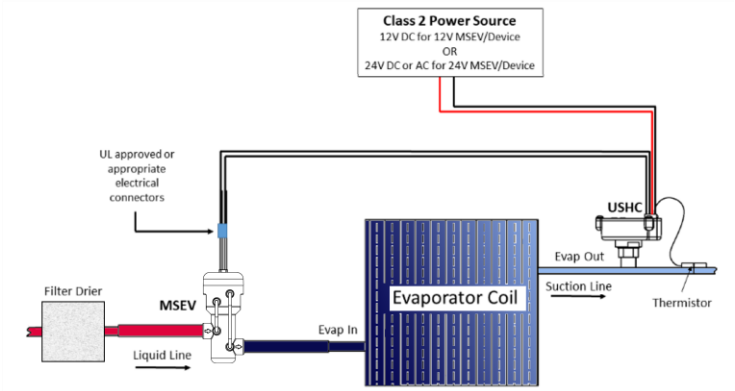


Figure 2-1 MSEV series valve and USHC installation schematic

2.1 Installing a MSEV Series Valve

To install the MSEV series valve, complete the following steps:

1. Pump down and recover any residual refrigerant from the system.
2. Remove the current TXV and its bulb or EEV and its controller by cutting. Take care to minimize the risk of introducing contaminates into the system when removing the existing valve.
3. Before continuing, clean the copper connections of the MSEV series valve. The OD of the MSEV, HC-MSEV and VHC-MSEV copper tubes are 3/8", 5/8" and 3/4" respectively.

   Do NOT reduce the length of the copper tubes when brazing.
   Flare fittings should be used if the copper tubes length is reduced.

4. Position the valve as displayed in **Figure 2-2** and ensure the arrow mark aligns with the direction of fluid flow. The blue arrows show which way fluid is supposed to flow through the valve. Also ensure that the MSEV series valve is installed in an upwards orientation or at any angle less than 90° in either direction (represented by the curved green arrows).

The MSEV series valve cannot be installed in a downwards orientation (shown in curved red arrows). It will not function as intended if installed in this way.

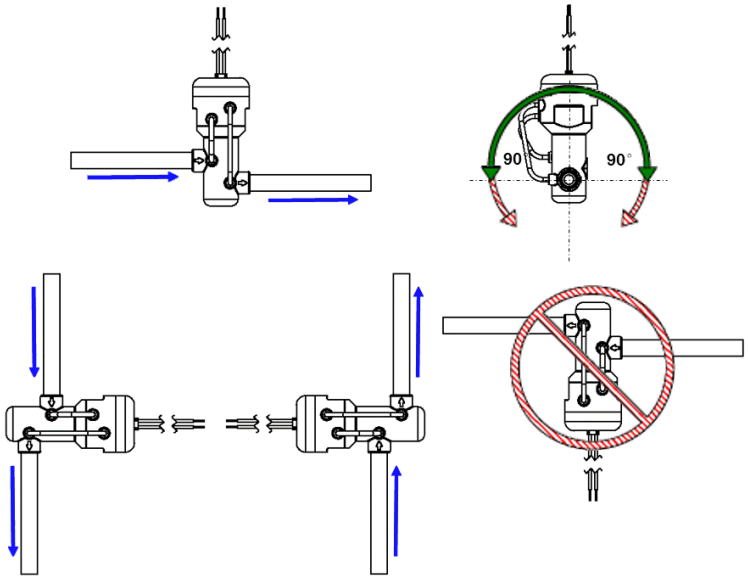


Figure 2-2: MSEV series valve installation orientation

5. Wrap the valve body with a wet cloth before brazing.

6. Connect the MSEV series valve to the inlet of the evaporator by brazing. Allow the valve to air-cool after brazing.

While brazing, direct heat away from the valve body. Ensure that the temperature of the valve body does not exceed 221°F (105°C).

Ensure to purge with Nitrogen gas while brazing.

The following brazing material is recommended due to its low flow fluidity rating:

Brazing Rod Manufacturer: Harris Product Groups
Part Number 15620F1 - 0.05" x 1/8" x 20" (1.27 mm x 3.18 mm x 508 mm)

Brazing Rings Manufacturer: Harris Product Groups
Part Number RF15375 for 3/8” MSEV copper tubes
RF15625 for 5/8” HC-MSEV copper tubes
RF15875 for 7/8” VHC-MSEV copper tubes

7. It is mandatory to install a brand-new filter drier at the inlet of the MSEV series valve as indicated in Figure 2-1. It can be installed at about 6” away from the valve. The MSEV series valve must be protected against contaminants to ensure its optimal operation.

DMQ highly recommends using a filter drier with a 20-micron filtration rating.

8. The MSEV series valve installation process is now complete.

2.2 Installing the USHX

To install the USHX, complete the following steps:

1. Pump down and recover any residual refrigerant from the system. This may have already been done if a MSEV series valve was installed before this step.
2. Obtain any ¼" access fitting that is compatible with the system. In this section, a ¼" access fitting with a 3/16" OD extended tube is used as an example to demonstrate the installation process.
3. See **Figure 2-3** and **Figure 2-4** below for the proper orientation of the USHX. When installing the device on a horizontal copper line as shown in **Figure 2-3**, the USHX can only be installed up to a 45° angle from the vertical axis in either direction (represented by the curved green arrows). When installing the device on a vertical copper line as shown in **Figure 2-4**, the USHX cannot be installed at a downward angle (represented by the red arrow).

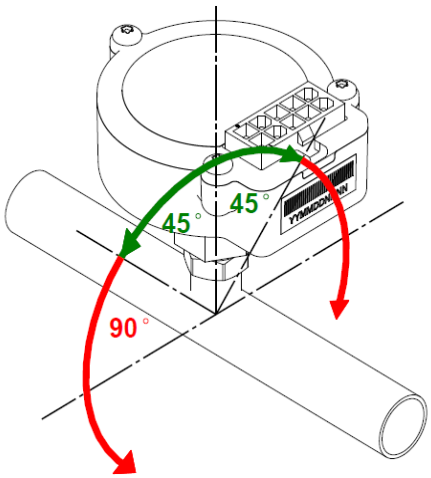


Figure 2-3: USHX installation orientation on a horizontal copper line

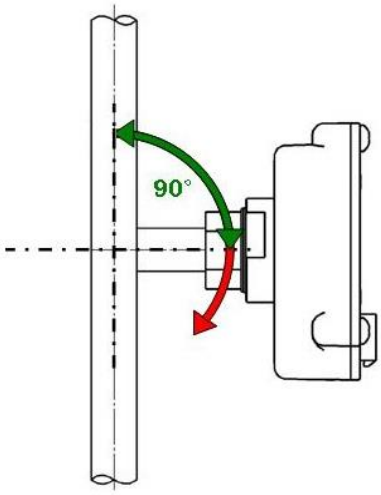


Figure 2-4: USHX installation orientation on a vertical copper line

4. Drill a hole into the copper line that extended tubes may fit in to. The location of this hole should be about 6" away from the outlet of the evaporator.

Care must be taken to not introduce copper shavings into the copper line while the hole is being drilled.

5. Remove the valve core of the access fitting before brazing.
6. Braze the access fitting to the copper line and allow it to air-cool after brazing.
7. Place the valve core back onto the access fitting and tighten the connection. This step completes the installation of the ¼" access fitting. The final result should look similar to what is shown below in **Figure 2-5**.

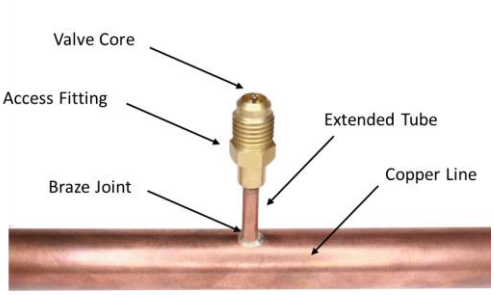


Figure 2-5: Brazed access fitting

8. Mount the USHX onto the access fitting. First, turn the USHX clockwise by hand until some resistance is observed. Then, use a torque wrench to tighten the USHX to 70 in-lb as shown in **Figure 2-6**.

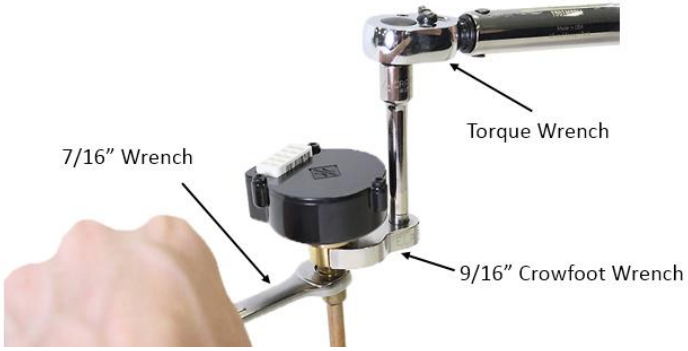


Figure 2-6 USHX Installation with Torque Wrench (70 in-lb)

When torque wrench not available use 7/16" and 9/16" wrenches to tighten the USHX as shown in **Figure 2-7**. Using two wrenches will ensure that the brazed joint is not damaged during tightening.

Do NOT turn the power source ON during the installation of the wiring harness.

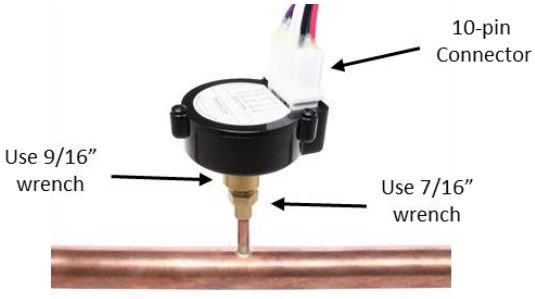


Figure 2-7 Installed USHX with attached 10-pin wiring harness

9. Attach the wiring harness (10-pin connector) to the USHX as shown in **Figure 2-7**.

If the USHX is located in a wet or potentially wet environment, apply dielectric or super lube synthetic grease inside the 10-pin connector of the wiring harness.

10. Install the thermistor at the outlet of the evaporator and close to the access fitting using a zip tie, as shown below in **Figure 2-8**. The thermistor should be located at either the 10 o'clock or 2 o'clock position only.

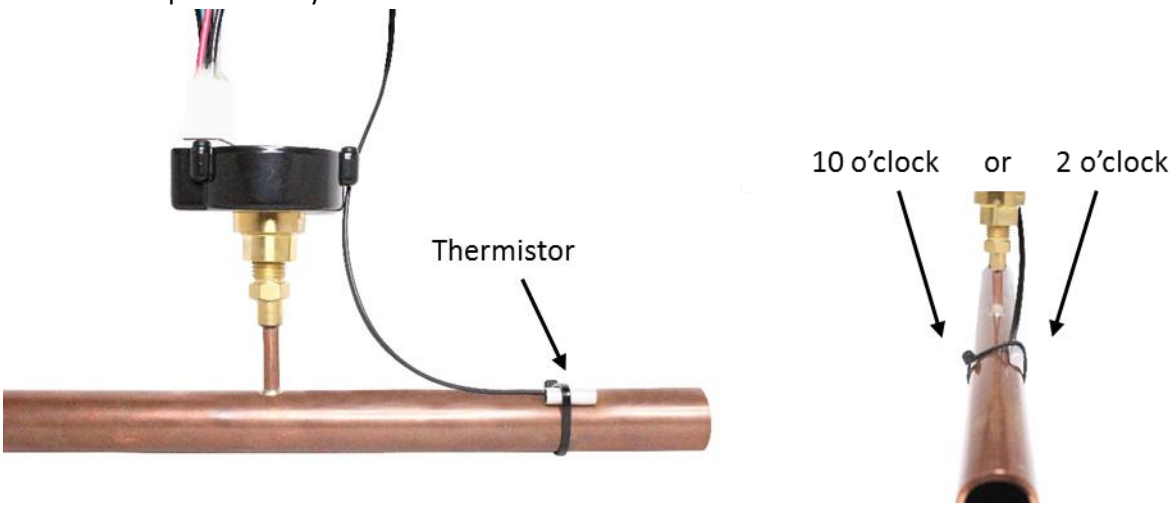


Figure 2-8 Thermistor installation at evaporator outlet

Ensure that the thermistor wire is not tied down to the tubing. The zip tie should only be tied around the thermistor body.

Apply thermal grease between the thermistor and the copper line to obtain the most accurate temperature readings.

11. Wrap the thermistor with the insulation material and secure the insulation in place using a zip tie. The final result should be similar to what is shown below in **Figure 2-9** .

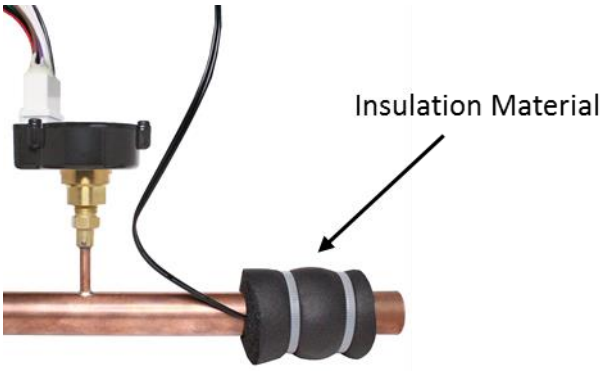


Figure 2-9 Insulation secured to the thermistor

12. Check for leaks at all the braze joints after brazing.
13. Pull a vacuum on the system until 250 microns is reached.
14. Restore refrigerant to the system.
15. Perform another check for leaks at all braze joints.
16. Refer to **Section 3 (Electrical Wiring)** to complete the electrical wiring of the system.

17. Refer to **USHX Software User Interface Manual** to set up communications between the USHX and the computer.
18. Supply power to the USHX with a power supply and power it on.
19. Ensure that the settings in the GUI meet the system requirements (i.e., double check the **Refrigerant**, **Target Superheat**, **Device Mode**, and other settings).
20. Power on the HVAC/R system and the MSEV series valve and USHX will automatically begin functioning.
21. Observe the superheat temperature values in the GUI Status tab to ensure that the system is performing nominally. Adjust the system settings through the GUI if necessary.

3 Electrical Wiring

After the mechanical installation of the MSEV series valve(s) and/or USHX(s) into the system, complete the electrical wiring of the system by completing the following steps. Refer directly **Section 3.2** to if more than one unit was installed.

3.1 Single USHC and MSEV Series Valve or Single USHS

Do NOT turn the power source ON until all electrical wiring setup is complete.

1. Check the voltage type (either 12V or 24V) of the MSEV series valve. It can be found on the MSEV series valve model number label. The power source required will be based on the MSEV series valve voltage type.

   Ensure that the power source voltage matches the MSEV series voltage type. If a 12V MSEV series valve is powered by a 24V power source, the valve will fail due to an over-voltage. If a 24V MSEV series valve is powered by a 12V power source, the valve will not fully open due to an under-voltage.

2. Obtain a **Class 2** 24 VAC transformer with a capacity of 40 to 100 VA and an output of 24 VAC at a frequency of 60 Hz. Alternatively, a 120 VAC to 12 VDC or 120 VAC to 24 VDC **Class 2** step-down power supply with a 40 to 100 W power rating may be used. The schematics of the power sources are shown below in **Figure 3-1**.

   For the user's own safety, **only** Class 2 power sources should be used to power the MSEV series valve and USHX devices.

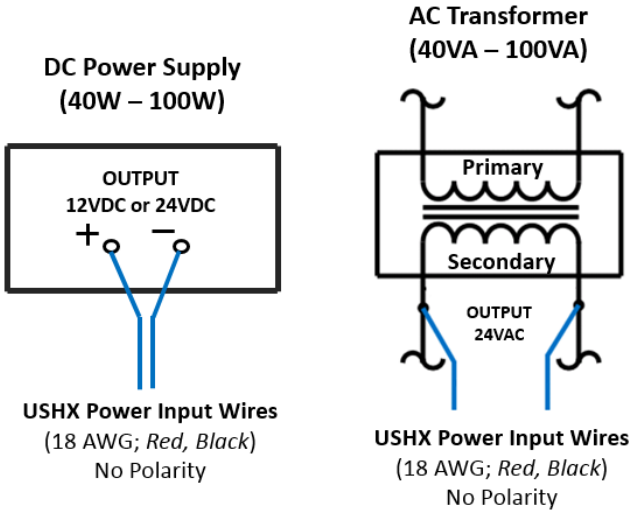


Figure 3-1 Class 2 DC and AC power sources

3. Double check the power source output voltage (AC transformer secondary or DC power supply output).

The reading should be at or near 12VDC, 24VDC, or 24VAC depending on the MSEV series valve and power source. When supplying 24V, the voltage must be within the range of 24V to 27.6V. When supplying 12V, the voltage must be within the range of 12V to 13.8V.

4. Once the power source output voltage has been identified and checked to be accurate, ensure that the power supply is OFF before continuing with the steps below.

5. The power input wires (18 AWG red/black wires) on the wiring harness should be connected to the power source as shown below in ***Figure 3-2***.

The USHX power input wires are non-polar, so the wire ordering and colors are not significant for the purposes of this step in the procedure. All connectors used between the USHX, power source, and a MSEV series valve should be UL-approved.

The wiring schemes of the 'Single USHC and MSEV series valve' and 'Single USHS Setup' are the same except that the PWM output wires of the USHS for the 'Single USHS Setup' process should be disconnected, terminated with wire nuts, and wrapped with electrical tape so that they do not form short circuits with each other or any other wires or metal surfaces. As for the 'Single USHC and MSEV series valve Setup' process, the PWM output wires should be connected to the MSEV series valve as shown below in **Figure 3-2**.

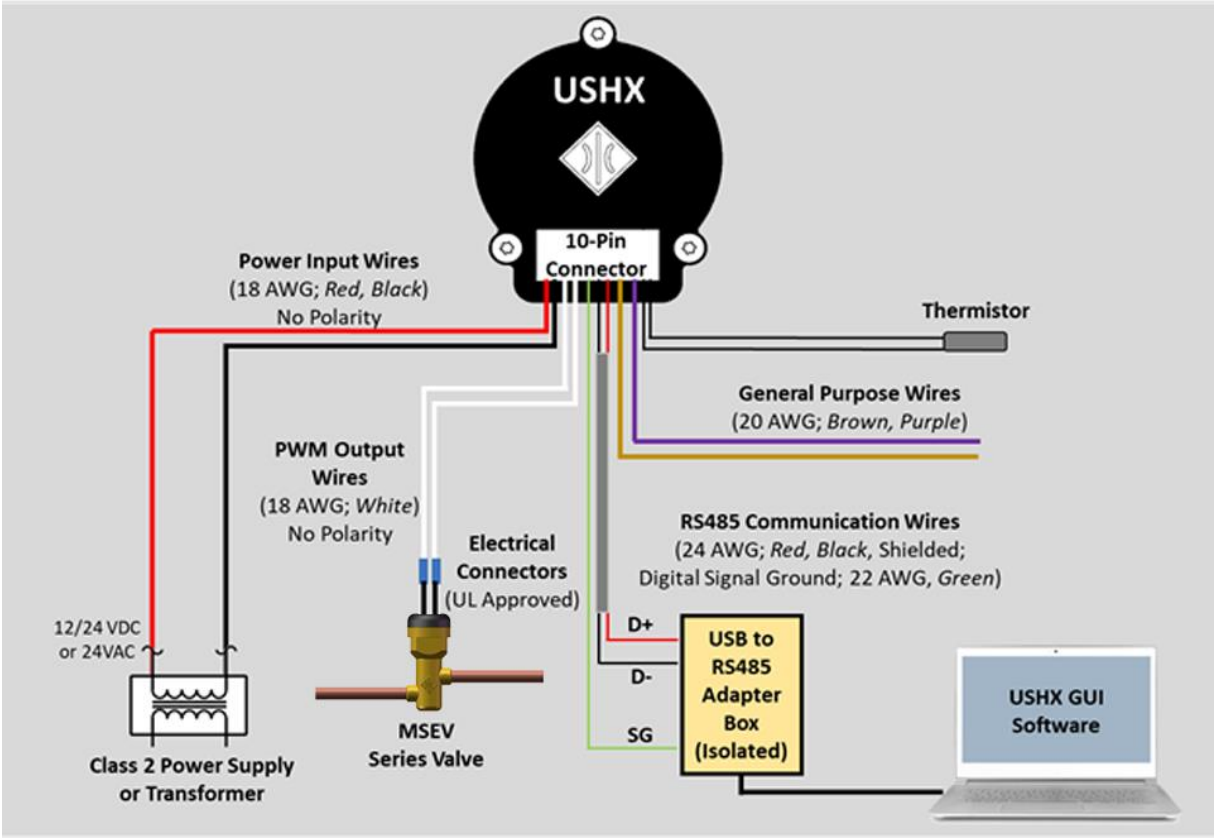


Figure 3-2: Single USHC and MSEV series valve wiring diagram

6. Connect the RS485 communication wires (2-wire gray cord that contains a red and a black wire and the green data ground wire) to the D+, D-, and SG terminals on the USB-to-RS485 converter as shown below in **Figure 3-3**. For the USHX setup, the RS485 will require an adapter with built-in **electrical isolation**.

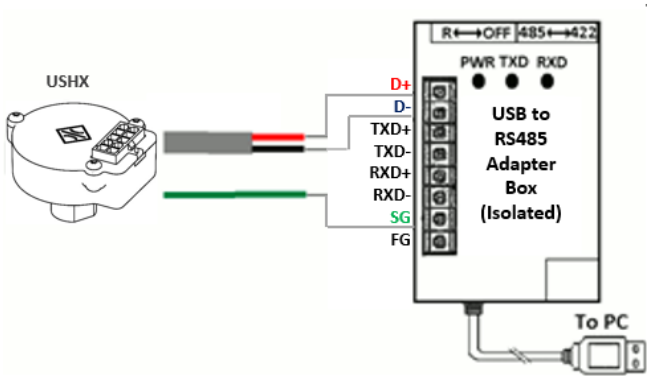


Figure 3-3 USHX-to-RS485 converter connection

7. Connect the RS485 adapter box to the computer via a USB port.

8. Connect the PWM output wires (two 18 AWG white wires) to the MSEV/HC-MSEV/VHC-MSEV electrical connections. These wires are non-polar.

9. The general-purpose wires (20 AWG brown/purple wires) must remain unconnected, be terminated with wire nuts, and wrapped with electrical tape so they do not form short circuits with each other or any other wires or metal surfaces.

10. Tape any dangling wires to existing structures such as copper and water lines with at least 4-5 sections of electrical tape each. Use zip ties on top of the electrical tape in a neat and organized manner to further secure the wires.

⚠ Ensure that all cables are distanced from fans, high voltage wires (120-208 VAC), and potential areas of water. Ensure that any bare cable leads are covered with electrical tape and do not touch other wire leads or any metal structures.

11. The electrical wiring for Single USHC and MSEV/HC-MSEV/VHC-MSEV or Single USHS setup is now complete.

3.2 Multiple USHCs and MSEV Series Valves or Multiple USHSs

⚠ Do NOT turn the power source ON until all electrical wiring setup is complete.

1. Check the voltage type (either 12V or 24V) of the MSEV series valves. It can be found on the MSEV series valve model number label. The power source required will be based on the MSEV series valve voltage type.

⚠ Ensure that the power source voltage matches the MSEV series valve voltage type. If a 12V MSEV series valve is powered by a 24V power source, the valve will fail due to

an over-voltage. If a 24V MSEV series valve is powered by a 12V power source, the valve will not fully open due to an under-voltage.

2. Obtain a **Class 2** 24 VAC transformer with a capacity of 40 to 100 VA and an output of 24 VAC at a frequency of 60 Hz. Alternatively, a 120 VAC to 12 VDC or 120 VAC to 24 VDC **Class 2** step-down power supply with a 40 to 100 W power rating may be used. The schematics of the power sources are shown below in **Figure 3-4**. See ***Table 3-1*** below to determine what minimum capacity/power rating requirements must be met with these power sources based on the number of MSEV series valves installed.

For the user's own safety, **only** Class 2 power sources should be used to power the MSEV series valves and USHX devices.

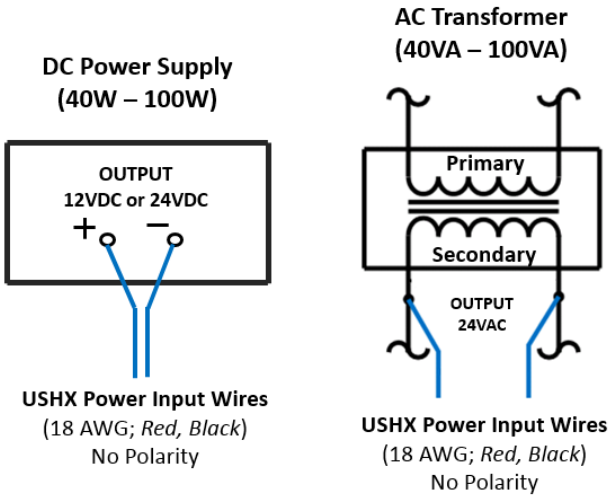


Figure 3-4 Class 2 AC and DC power sources

Table 3-1: AC Transformer Minimum Capacity and DC Power Supply Minimum Power Rating Required Based on Number of* MSEV series valves *Installed

MSEV Series Valve Voltage Type	Number of MSEV series valves per Power Source (**Maximum 6**)	AC Transformer Minimum Capacity Required (Volt-Amps)	DC Power Supply Minimum Power Rating Required (Watts)
12V or 24V	1	40 VA	40 W
	2	50 VA	50 W
	3	60 VA	60 W
	4	70 VA	70 W
	5	80 VA	80 W
	6	100 VA	100 W

3. Install the transformer or power supply at the center of the all the USHXs.

The below wiring methodology is recommended so that the load of the controllers on either end of the transformer will be the same. Below example uses 3-wire and shielded cable.

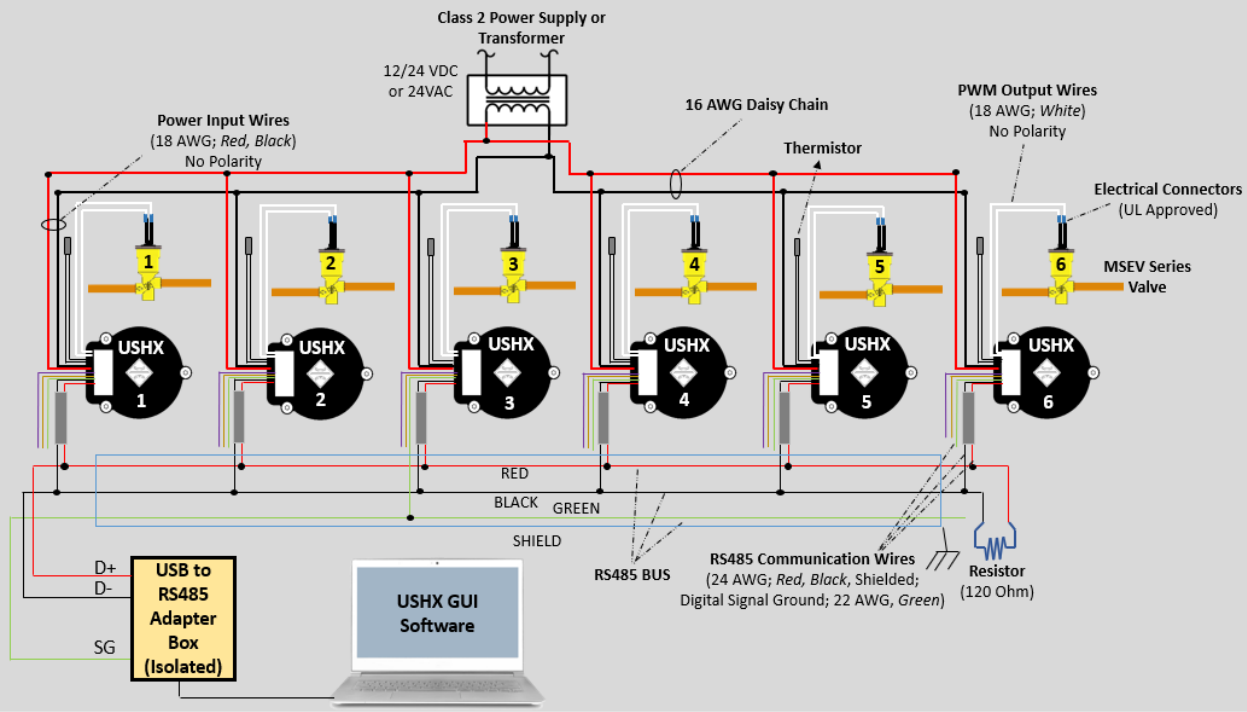


Figure 3-5 Multiple USHCs and MSEV series valves networking diagram

The wiring schemes of the 'Multiple USHCs and MSEV Series Valves' setup and 'Multiple USHSs' setup are the same except that the PWM output wires of each USHS for the 'Multiple USHSs' setup process should be disconnected, terminated with wire nuts, and wrapped with electrical tape so that they do not form short circuits with each other or any other wires or metal surfaces. As for the 'Multiple USHCs with Multiple MSEV Series Valves' setup process, the PWM output wires should be connected to the valves as shown in **Figure 3-5**.

4. Double check the power source output voltage (AC transformer secondary or DC power supply output).

The reading should be at or near 12VDC, 24VDC, or 24VAC depending on the MSEV series valve and power source. When supplying 24V, the voltage must be within the range of 24V to 27.6V. When supplying 12V, the voltage must be within the range of 12V to 13.8V. Do **NOT** Earth-ground the power source output.

5. Once the power source output voltage has been identified and checked to be accurate, ensure that the power supply is off before continuing with the steps below.

6. Form a daisy chain with the power lines by connecting the USHX power input cables (18 AWG red/black wires) that are closest to the transformer on either side (USHX 3 and 4), as shown in **Figure 3-5**. Use 16 AWG stranded copper wire for extensions.

The USHX power input wires are non-polar, so the wire ordering and colors are not significant for the purposes of this step in the procedure. All connectors used between the USHX, power source, and MSEV series valve should be UL approved. If the USHC power input wires do not reach the system transformer add 16 AWG extensions to the cables as needed.

7. Run the power input wires from USHX 3 to USHX 2 and then from USHX 2 to USHX 1 as shown in **Figure 3-5**.
8. Run the power input wires from USHX 4 to USHX 5 and then from USHX 5 to USHX 6.
9. The USB-to-RS485 adapter is used for USHX communications. Each USHX wiring harness includes RS485 data communication wires (2-wire gray cord that contains a red and a black wire and the green data ground wire).
10. Create a daisy chain for the RS485 BUS as shown in **Figure 3-5**. Connect the gray RS485 communication wire of USHX 1 to USHX 2. Use similar communication cables when extensions are required. Do not connect the data ground wire between USHX 1 and 2. It should remain unconnected and protected with wire nuts and wrapped with electrical tape.
11. Similarly connect USHX 2 to USHX3 and then USHX 3 to USHX 4. Repeat this pattern until USHX 6.
12. For each transformer, only one USHX data ground wire should be connected to the RS485 adapter signal ground input. As shown above in **Figure 3-5**, only the data signal ground wire (green wire) of USHX 3 is connected to the RS485 adapter signal ground input.
13. At the end of each daisy chain, install a 120 Ω termination resistor, as shown in **Figure 3-5.**
14. Connect the two PWM output wires (two 18 AWG white wires) of each USHX harness to the electrical connections of corresponding MSEV series valve. These wires are non-polar.
15. Additional general-purpose wires (20 AWG brown/purple wires), if they exist on the harness, must remain unconnected, be terminated using wire nuts, and wrapped with electrical tape so that they do not form short circuits with each other or any other wires or metal surfaces.
16. Tape any dangling wires to existing structures such as copper and water lines with at least 4-5 sections of electrical tape each. Use zip ties on top of the electrical tape in a neat and organized manner to further secure the wires.

Ensure that all cables are distanced from fans, high voltage wires (120-208 VAC), and potential areas of water. Ensure that any bare cable leads are covered with electrical tape and do not touch other wire leads or any metal structures.

17. The electrical wiring for Multiple USHCs and MSEV series valves or Multiple USHSs is now complete.
18. Refer back to **Section 2.2 (Installing the USHX), Step 17** and complete the remaining steps to finalize the hardware installation process.

4 Troubleshooting

This document describes useful troubleshooting techniques for the MSEV series valves when valve is not performing as expected in the system. Before troubleshooting, review the important notes below to prevent any additional damage during the troubleshooting process. Contact DMQ directly for support as needed.

Important Notes:

- This troubleshooting guide assumes everything else in the HVAC/Refrigeration system (compressor, evaporator, condenser, filter drier, fans, etc.) are in good working condition.
- Check that all wiring connections are in accordance with the Hardware Installation Manual.
- It is highly recommended to install a new filter drier in every instance where an MSEV is removed.
- Electrostatic discharge precautions must be taken when working with the MSEV & USHX wiring.
- POWER to the USHX MUST BE DISCONNECTED when a USHX or a harness is replaced or when wiring changes are made.

1. **Installation & Orientation**
   Verify the valve installation and orientation as per instructions and also shown in **Figure 4-1**.

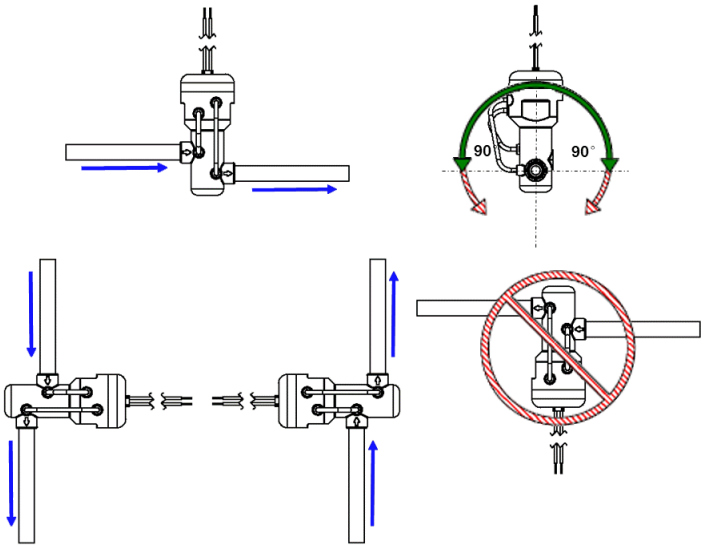


Figure 4-1 MSEV series valve installation orientation

2. **Valve Sizing**
   Verify the correct valve model is installed per system capacity requirement. The nominal capacity tables of all valve model numbers are shown in MSEV, HC-MSEV & VHC-MSEV datasheets.

Figure 4-2 MSEV series valve model number

3. **Electrical Resistance and Voltage input:**
   - Do not probe USHX wiring harness directly as shown in **Figure 4-3**

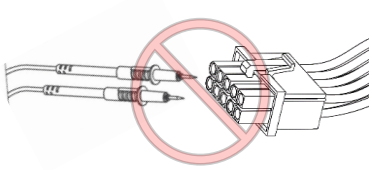


Figure 4-3 Do not probe USHX wiring harness directly

   - Procure and use a Mini-Universal MATE-N-LOK (TE Internal # 1-770858-0) mating connector and place it onto the wiring harness connector as shown in **Figure 4-4**

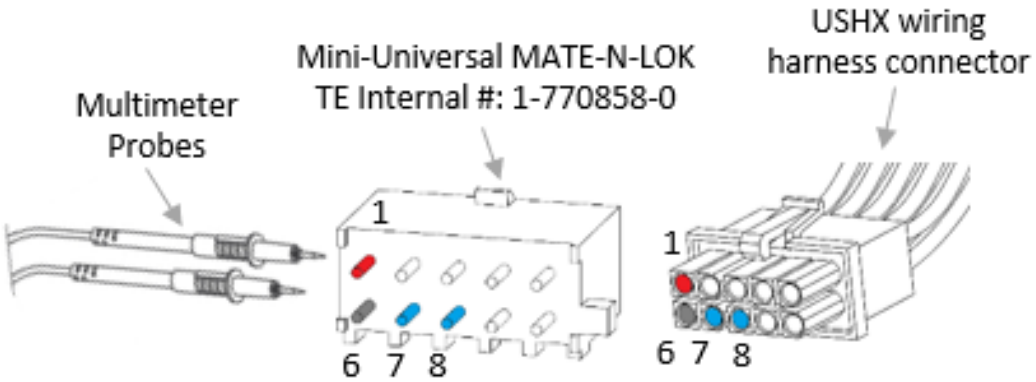


Figure 4-4: Probe the Mini-Universal MATE-N-LOK (connected to USHX wiring harness) to Measure Valve Resistance and Voltage Input

   - Measure the valve resistance across Pin7 and Pin8 on the MATE-N-LOK. Check if values are within range shown in **Table 4-1**. Contact DMQ when the values are out of range.
   - Measure the voltage input to the USHX across Pin1 and Pin6 on the MATE-N-LOK. Check if values are within range in **Table 4-1**. DO NOT let the probe bridge Pin1 and Pin6. Replace power source when values are out of range.

Valve Type	Cold Resistance Range	Voltage Input Range
A24V	36 – 43 Ω	24 – 27.6V
A12V	8 – 14 Ω	12 – 13.8V

Table 4-1 Acceptable MSEV resistance range & USHX voltage input range

4. Valve does not fully open or high superheat

Do not AC voltage for this troubleshooting steps 4 & 5, valve may be damaged if used.

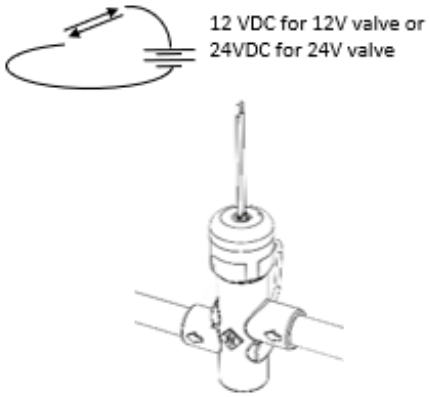


Figure 4-5: Power cycling

- Ensure power is <u>disconnected</u> to the USHX by either turning OFF the power source or unplug the wiring harness connector from USHX
- Disconnect MSEV black wires from the USHX wiring harness white wires
- Power cycle the MSEV at rate of 1 to 2 secs ON and 1 to 2 secs OFF for 10 times directly with the DC voltage (bypass USHC) with corresponding to valve type as shown in **Figure 4-5**, preferably while the compressor is running.
- Directly apply a continuous DC voltage to the MSEV and then run the compressor.
- Observe for rapid change in suction pressure and/or evaporator out temperature and ensure superheat goes below 5°F.
- If the observation is not as expected then replace the valve.

5. Valve does not fully close or low superheat

- Ensure power is <u>disconnected</u> to the USHX by either turning OFF the power source or unplug the wiring harness connector from USHX
- Disconnect MSEV black wires from the USHX wiring harness white wires
- Power cycle the MSEV at rate of 1 to 2 secs ON and 1 to 2 secs OFF for 10 times directly with the DC voltage (bypass USHC) per power required as shown in Figure 4-5, preferably while the compressor is running.
- Do not apply any DC voltage to the MSEV and then run the compressor.
- Observe for compressor to trip on low suction pressure.
- If the observation is not as expected then replace the valve

6. USHX temperature reading below -60°F

- When thermistor reads -60°F, change the wiring harness as the thermistor is damaged.

5 Best practices for MSEV and USHC Install

The operator should strictly follow the instructions below for MSEV installation and operation:

- Install 20-micron filter in front of each MSEV. Recommended type is Sporlan catch all filter drier. Prior to install, ensure that filter drier is blown out with dry air or nitrogen gas to ensure that any residual particulates is dispelled.
- Do NOT cut the copper tubes of MSEV when brazing. Flare fittings must be used if copper tubes are needed to be cut.
- Nitrogen gas purging is required while brazing. Bleed nitrogen gas (1.5psi-2psi) from the USHX Schrader port when brazing outlet of valve and similarly bleed nitrogen gas from high side pressure port when brazing at the inlet of the valve.
- The following brazing material is recommended due to its low flow fluidity rating:

  Brazing Rod Manufacturer: Harris Product Groups
  Part Number 15620F1 - 0.05" x 1/8" x 20" (1.27 mm x 3.18 mm x 508 mm)

  Brazing Rings Manufacturer: Harris Product Groups
  Part Number RF15375 for 3/8” MSEV copper tubes
  RF15625 for 5/8” HC-MSEV copper tubes
  RF15875 for 7/8” VHC-MSEV copper tubes
- Ensure the temperature of the housing body does not exceed 221^{o}F. Use many wet rags to avoid this overheating.
- During the copper tube cleaning process, prevent any residue from entering the system or the MSEV. Blow the nitrogen gas from opposite end to avoid this.

The operator should strictly follow the instructions below for USHC installation and operation:

- Power to the USHC must be turned OFF and the wiring harness connector should be unplugged from USHC while making any valve, USHC or wiring changes.
- Wires must not be exposed or shorted when USHC is powered.
- Wires must not be cut or scraped when the USHC is powered.
- All unused wire ends must be terminated with the wire nuts or insulated properly before power is applied to the USHC.
- The USHX will be damaged if any exposed or incorrectly terminated wire from the wire harness is in contact with metal chassis.
- Avoid overtightening wires to copper tubing to prevent creating wire cuts or breakages.
- Avoid routing the network/thermistor cable near 120/240VAC lines, motors, or devices with large magnetic fields
- Follow Electrostatic discharge (ESD) precautions before handling the USHC.
- Power source (24VAC transformer or 24VDC power supply) used for USHC (s) should not be shared with any other device.
- Use an isolated RS485 adapter for communication between USHC and the Modbus Master controller.
- When multiple USHC are networked and RS485 Master communication is isolated, only one USHC power source should be earth grounded
- Do not probe the pins on the white connector of the USHC or the wiring harness.