YORK®	Integral VSD Hydronic Kit For YLAA Chillers
APPLICATION DATA	Supersedes: 150.72-AD1 (714) | Form 150.72-AD1 (1215)

INTRODUCTION

All chiller applications require a hydronic pump system to circulate a heat transfer fluid through the heat exchanger. Commonly the pump is supplied and installed separately from the chiller, adding to the installation cost. Also, the pump and other components are located indoors consuming valuable floor space.

The integral hydronic kit option is designed to lower the added installation costs and decrease the usable indoor floor space occupied by mechanical equipment. By offering a factory installed hydronic kit within the framework of the chiller, hydronic components that where formerly each installed separately are now included in a package that can be easily installed and ready for operation.

DEFINITION OF TERMS

Hydronic – Relating to a system that transfers heat by circulating a fluid through a closed system of pipes. The fluid circulated is commonly water.

Impeller – The rotating component inside of a centrifugal pump that moves the fluid.

NPSHa – (Net Positive Suction Head Available) The absolute pressure of the fluid at the inlet of the pump. NPSHa is dependent on the system design.

NPSHr – (Net Positive Suction Head Required) Pressure needed to prevent the pump from cavitating. Determined by pump manufacturer and commonly published with the pump curve. The NPSHr plus the vapor pressure of the fluid being circulated must be less than the NPSHa.

Evaporator – Heat exchanger inside of the chiller that transfers heat away from the heat transfer fluid.

System Loop Volume – The total volume of heat transfer fluid inside of the system piping and components.

Sensorless: Pre-programs the pump curve parameters into the integrated controls. They include flow, head, power and speed.

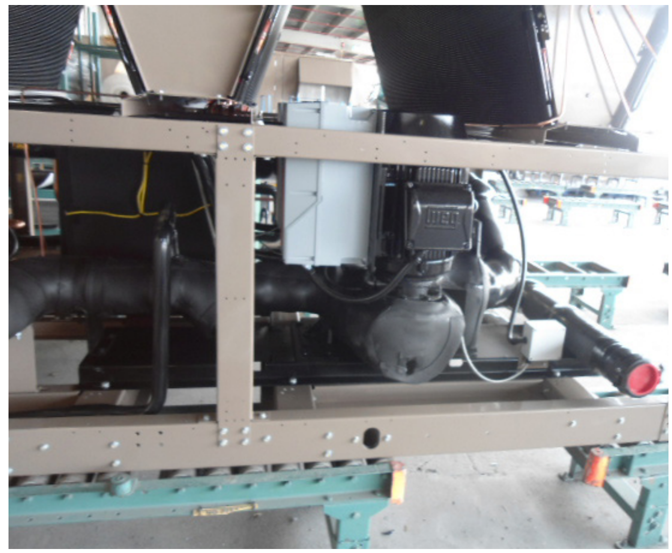


FIGURE 1 – TYPICAL HYDRONIC KIT COMPONENTS IN AN AIR-COOLED CHILLER (SHOWN WITH CONDENSER FAN REMOVED).

COMPONENT DEFINITIONS

Pump – Circulates the heat transfer fluid through the system.

Strainer – Wire mesh to stop debris from damaging the pump impeller.

Suction Guide – Straightens fluid flow before entering the suction of the pump and contains an integral wire mesh strainer.

Expansion Tank – Diaphragm style expansion tank provides thermal expansion provision, a system pressure reference, and maintains the required pump NPSH (available by Special Quote - 8.2 gallon capacity).

Customer Connections – Inlet and Outlet connections for the heat transfer fluid flowing in and out of the chiller.

Flow Switch – Device to indicate when flow is present and relay a signal to the chiller control panel.

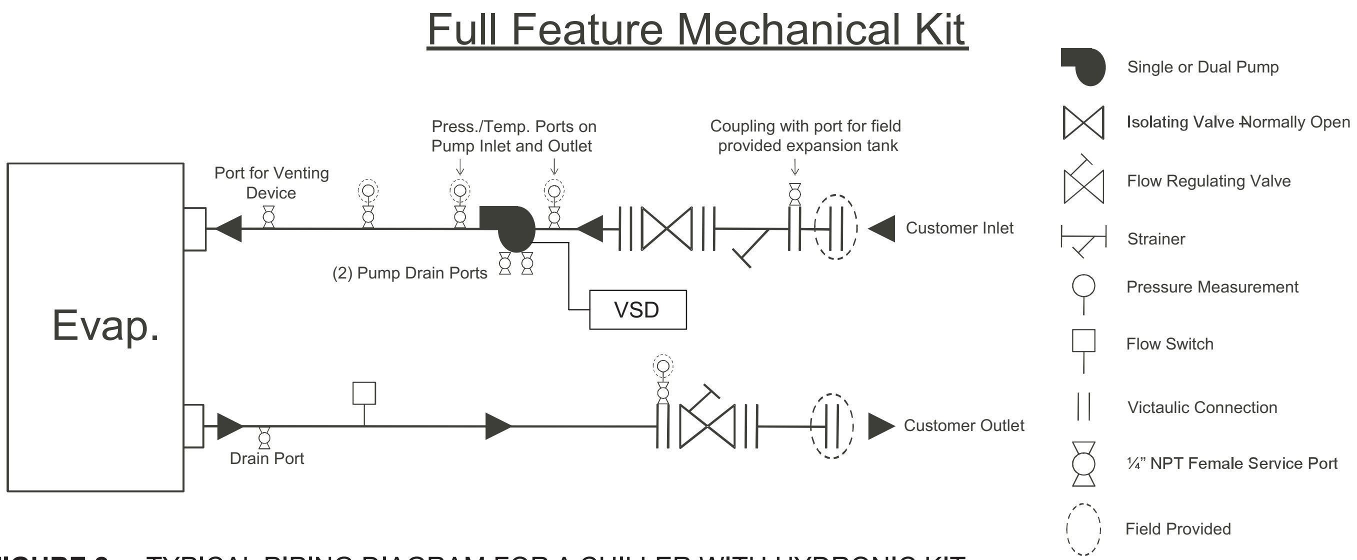


FIGURE 2 – TYPICAL PIPING DIAGRAM FOR A CHILLER WITH HYDRONIC KIT

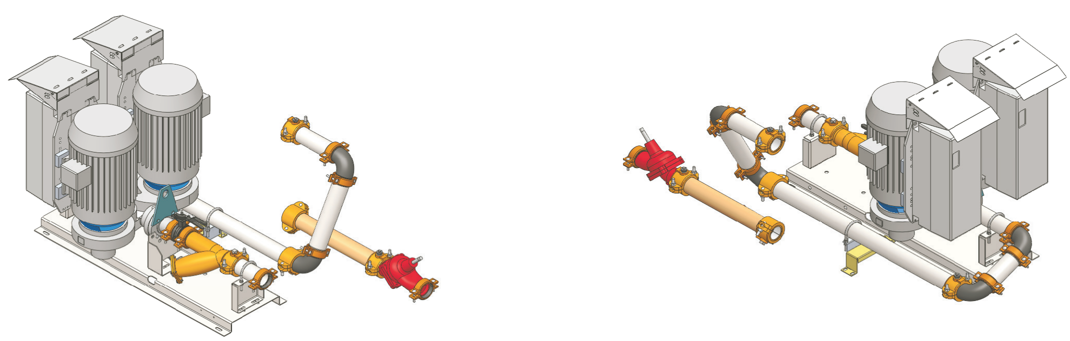


FIGURE 3 – RENDERING OF PUMP PACKAGE

Circuit Balancing Valve – Provides flow balancing and measurement through a multi-turn handwheel adjustment.

Check Valve – Installed on the discharge side of the pump to prevent reverse flow. Only required when dual or standby pump is used.

Standby Pump – Dual pump configuration that provides standby pump operation in the event of a pump failure.

Variable Speed Drive- Regulates the speed of the pump motor to control flow.

FEATURES AND BENEFITS

Intregral Package – The hydronic kit is factory installed within the framework of the chiller including the integrated pump controls in the control panel.

Single Point Power – Chiller and pump power connections are single point reducing installation time and cost.
Remote On/Off Control – Pump can be turned on and off remotely through the chiller micropanel.

Freeze Protection – For low ambient operation use of a glycol solution is recommended for freeze protection. However for chilled water systems, hydronic kit piping and components should be heated and insulated for freeze protection. If a glycol solution or any heat transfer fluid other than water is used, adjustment factors need to be applied to the following pump selection procedure.

Variable Speed Drive - Reduces the commisioning time needed to balance the system and can save energy when used in a variable primary flow arrangement. Also reduces motor wear as there is no inrush during start up.

Triple Duty Valve - Can be used as a balancing valve, check valve, or shut off valve.

PUMP SELECTION

Manufacturers offer multiple pump sizes for each chiller model to provide the ability to closely match the system requirements. Most offer an automated pump selection program that can be used for a quick and easy pump selection. If this program is not available or if a manual selection is desired, the following steps can be followed to make a pump selection for the hydronic kit option.

1. Determine the required flow (GPM). This value will be calculated with the chiller selection. Pump design flow must be within the limits of the chiller.

   ex. 15 Ton Chiller: 35 GPM

2. Calculate the external system pressure loss (ft) for all piping and components external to the chiller.

   ex. 55 ft

3. Calculate the internal pressure loss from the heat exchanger in the chiller and any internal hydronic piping loss (ft) using pressure drop charts provided by the manufacturer.

   ex. 20 ft

4. Add the internal and external pressure losses.

   ex. 55 ft + 20 ft = 75 ft

5. Plot the flow (GPM) and the sum of the two pressure losses above (ft) on the pump curve provided by the manufacturer.

   ex. See Figure 4

6. Select a pump curve with an impeller diameter that intersects the design point and provides the desired efficiency. If the design point does not fall directly on the curve, one can select the next step larger size of impeller and use the circuit balancing valve to adjust the system head requirements and adjust for small variations from the selected pump curve. If special requirements exist consult the manufacturer for availability of custom impeller trims.

   ex. Impeller diameter: 4.50in (from Figure 4)

7. To determine the horsepower required follow the selected pump curve to the end of its operating range and select the next highest power line. **This prevents the motor from overloading and resulting in possible motor damage.**

   ex. Horsepower: 2 HP (from Figure 4)

8. The pump efficiency can be read from the pump curve using the efficiency lines typically labeled as a percentage.

   ex. Efficiency: 55% (from dashed lines in Figure 4)

FIGURE 4 – EXAMPLE PUMP CURVE

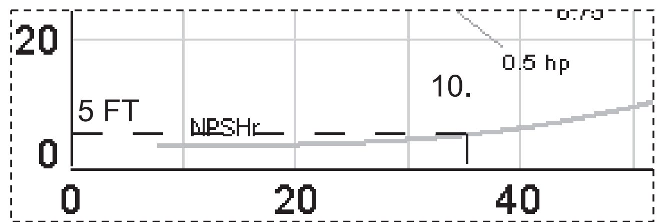


FIGURE 5 – EXAMPLE PUMP NPSHR

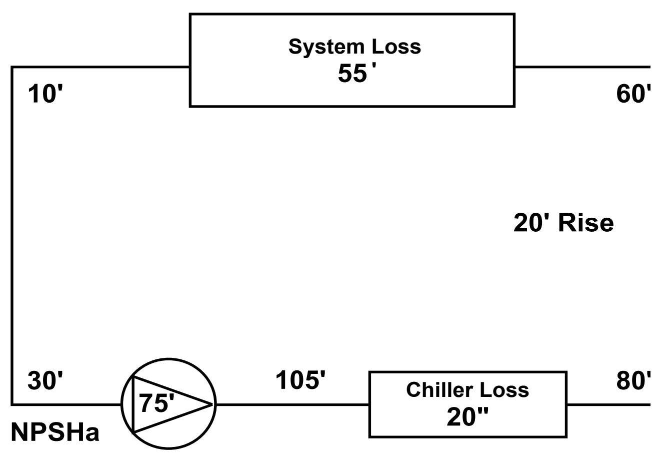


FIGURE 6 – EXAMPLE SYSTEM DESIGN

10. The pump NPSHr required can also be read from most pump curves. When selecting a pump one must make sure that the system designed NPSHa available is greater than the NPSHr required by the pump plus the fluid vapor pressure.

    ex. NPSHr = 5 ft (from Figure 5)
    NPSHa = 30 ft (from Figure 6)
    VP = 0.4 ft (Water at 50ºF)
    NPSHr + VP < NPSHa

If the system flow or pressure exceeds that of the pump curves provided by the manufacturer, the hydronic kit is not available for your application and a separate pump must be provided.

INSTALLATION AND START-UP

Isolation Valves

Isolation valves are recommended at the inlet and outlet water connections on the chiller for servicing the strainer and the pumps.

EXPANSION TANK

If the system loop volume is greater than that allowed by the factory provided expansion tank, a larger field supplied expansion tank must be installed. Freeze protection for field installed expansion tank is not provided by the manufacturer.

MULTIPLE CHILLERS IN PARALLEL

Multiple chillers with hydronic kits can be connected in parallel if greater capacities are required. When arranging chillers in this configuration the expansion tank should not be included at the chiller, and a larger field supplied expansion tank is required at a common point in the system.

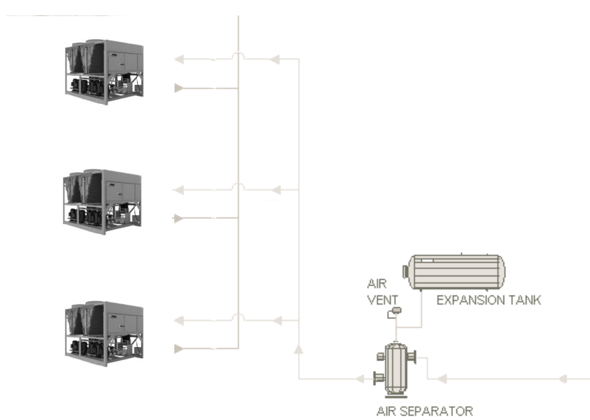


FIGURE 7 – EXPANSION TANK LOCATION FOR A MULTIPLE CHILLER CONFIGURATION

AIR SEPARATION

Chillers with a hydronic kit will require a field provided air separation device. The air separator should be located on the suction side of the pump at the highest temperature point in the system. Air in a closed loop system can cause cavitation in the pump, which will potentially cause a pump failure.

SYSTEM FLUSH

After the installation of a chiller with a hydronic kit, an initial system flush is required to clear construction debris and other contaminants from the system piping. It is recommended to fill the system through a water meter to provide a reference point for loop volume readings. After the initial system flush is completed the hydronic kit strainer should be cleaned to prevent unwanted pressure drop.

MINIMUM LOOP VOLUME

The chilled water loop must contain a minimum of 3 gallons of fluid volume per ton of chiller capacity in order to maintain leaving water temperature stability in normal operation. In process type applications where chilled water temperature stability is critical, the loop volume should be increased to 6 or more gallons per ton. In variable flow applications the loop volume should be increased to 8 or more gallons per ton.

If the designed loop volume does not provide adequate volume a water storage or “buffer” tank must be installed on the suction side of the pump to increase the system loop volume. The buffer tank should contain provisions for venting to ensure no entrapped air during the system fill and internal baffling to ensure proper mixing.

The above should be satisfactory guidelines for most applications. However, Johnson Controls will not be responsible for any resulting operation abnormalities, due to unique or unplanned application matters. It is always good practice to include as much water volume as possible. This increases the thermal mass and “flywheel” effect within the system. This promotes stable water temperature control and increases the reliability by reducing compressor cycling.

BYPASS LOOP

A bypass loop can be used to maintain minimum flow rate for the evaporator when a variable primary pumping system is used. The water volume of pipework between chiller and bypass loop must be calculated and should meet the guidelines above. Installing too close to the chiller may increase compressor cycling and reduce the service life. *"Figure 8 - Bypass Loop" on page 5* is an example of a bypass loop installed too close to the chiller.

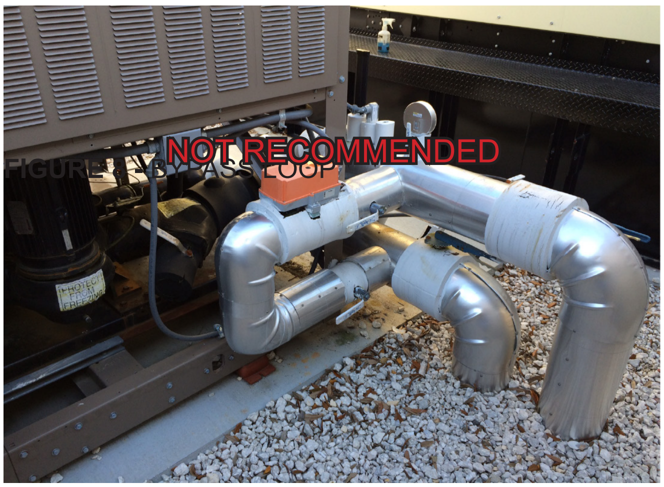
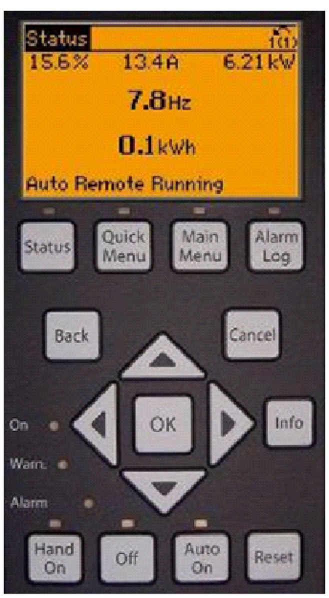


FIGURE 8 - BYPASS LOOP

HOW TO COMMISSION THE PUMP VFD

1. Put pump in HAND mode.

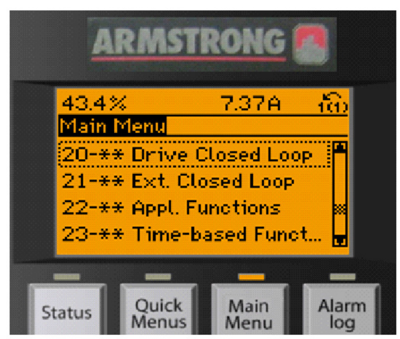


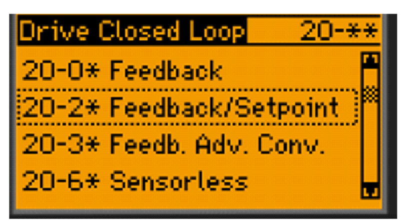
2. Change parameter 0-20 (default value is option 1601 – "Reference [Unit]") to option 1850 "Sensorless Readout" to display Sensorless flow readout on top left corner of screen.

3. Change parameter 0-22 (default value is option 1610 – "Power [kW]") to option 1654 "Feedback 1 [unit]" to display Sensorless pressure readout on top right corner of screen.

4. Check with customer regarding new actual flow and head and verify what flow is required. Ramp the pump up or down to achieve requested flow. Record the VFD sensorless flow and pressure – this will be your new setpoint.

5. Set parameter 20-21 to the Sensorless Pressure readout taken in the previous step.





6. Set parameter 22-89 to the Sensorless Flow readout taken in the previous step.

7. Set parameter 22-87 to a value that is X% of the value in 20-21. This percentage needs to be calculated based on the design flow and the published minimum flow for the unit. This ensures that the drive will not allow the pump to operate below the minimum flow of the chiller. You have now readjusted the quadratic control curve to match actual site conditions.

8. Change parameter 0-20 back to default value of option 1601 – “Reference [Unit]”.

9. Change parameter 0-22 back to default value of option 1610 – “Power [kW]”.

10. Put the VFD back into AUTO mode.

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