Time
Begin: _____
End: _____

JOB AID	
TASK: HVAC Module B –Test Performance of Pump (C-7)	**Page 1 of 5**

Purpose:	**Learn to test performance of pump.**
When:	

Tools / Equipment/Materials	
• Ladders	• Calculator
• Drawings	• Centrifugal chiller and auxiliaries
• Hand tools	• Watt meter, volt meter
• Extension cord	• Instruments
• Pump curves	• Ultrasonic Flow Meter
• Flashlight	• Water pump
• Data Sheets	• Centrifugal Pump
• Protective gloves	
Safety Equipment / Procedures	
• Personal Protection Equipment/Clothing (*PPE/PPC Daily Wear*)	• Safety goggles/Eye protection

Perform These Actions:	**Do These Steps/Notes:**
CAUTION: Conform to All USC Safety and Environmental Requirements	
Test Performance of Pump	
1. Preliminary office work	• Gather all applicable plans and specifications (ie. shop drawings, "as built" drawings, manufacturer's catalogs showing pump terminal description and capacities, manufacturers' data and recommendation on testing pumps, including pump curves.) • Acquire test data sheet.
2. Perform preliminary field inspection	• Put on eye protection. • Inspect job site and turn off pump motor. • Disconnect switch. • Record name plate data of motor and pump on test sheet and compare with submittal or equipment schedule data.
3. Check ump rotation	• Turn on disconnect switch and start pump motor. • Check and correct recorded rotation, if necessary. • Compare motor rotation with the arrow on the pump casing showing proper rotation. • If wrong, reverse motor rotation. • Reverse two mag-starter load side electrical wires to correct rotation.

Perform These Actions:	Do These Steps/Notes:
CAUTION: Conform to All USC Safety and Environmental Requirements	
4. Condition of System	• Turn off service disconnect to pump. • Measure with V.O.M. (voltage, OHM, meter) line voltage to service disconnect. • Measure with V.O.M. (voltage, OHM, meter) load voltage to service disconnect. • Verify voltage to be off. • Install lockout/tagout device. **(C)** • Hold isolation valves and place in closed position. • Repeat step for remaining valve. • Slowly start to drain water from pump. • Observe pressure gauge. • Ensure pressure starts to decrease to OPSI. Note: Valves are holding. • Determine correct size socket for removal of strainer access cover. Note: Sizes may vary • Install socket on impact gun. • Remove access cover bolts. • Two (2) bolts remain (loose but not out). (See illustration 1-1). • Remove strainer access cover by using mallet. (Little force needed). (Additional water will be released). • Ensure water is drained. • Remove two (2) remaining bolts. • Grasp cover firmly. • Place access cover and bolts away from working area. • Grasp strainer on outer edge that is exposed. • Remove and clean strainer with little force. • Transport strainer to wash station. • Spray water in direction opposite in which debris has been collected. • Brush off any other debris with wire brush. • **Eye protection required** • Clean surface area of old gasket material • Pump housing. • Strainer access cover (See illustration 1-2). • Install strainer (e.g. If strainer was removed horizontally, install horizontal).

Perform These Actions:	Do These Steps/Notes:
	• Apply anti-seize lubricant on all bolts. • Apply anti-seize lubricant on pump housing of pump and strainer access cover. • Place new gasket on strainer access cover (as shown on illustration 1-3). • Install remaining bolts on strainer access cover (see illustration 1-4). • Slowly open isolation valve. • Check for leaks around gasket area of strainer access cover. • Remove all air contained in pump housing. • Remove electrical “lockout” device. • Turn on service disconnect and turn on pump. • Check and set make up water regulator to maintain 5 to 10 psig at the highest point of water distribution. • Adjusted temperature controllers to full flow condition.
5. Piping	• Release (automatically or manually) trapped air at each highest point in the piping which water changes its direction to downward flow. • Check location of common test gauge.
6. Temperature Controller	• Put suction and discharged pressure tap as close to the pump as possible. • Set controllers to full water flow condition.
7. Verification of centrifugal pump impeller size	• Get the correct pump curve. • Turn the pump off. • Close discharge valve. • Verify that suction valve is fully open. • Turn the pump on. • Use existing oil test gage and read and record the pressure on the suction and discharge sides of pump. • Turn off pump. • Calculate psi rise across the pump by subtracting the suction pressure from the discharge pressure. PSI Rise = (Discharge Pressure - Suction Pressure) • Multiply the pump psi rise by 2.31 ft/psi to get the rise in ft. of water. Shut Off Head = PSI Rise X 2.31 ft/psi

Perform These Actions:	Do These Steps/Notes:
CAUTION: Conform to All USC Safety and Environmental Requirements	
7. Verification of centrifugal pump impeller size (continued)	• Plot the shut off head on the vertical axis of the pump curve at zero flow and identify impeller size. (See Illustration A.) Use Pump curve B-260E for 5A 1510 pump. Suction Pressure = 64 psig Discharge Pressure = 83 psig Pressure Rise = 19 psig Shut Off Head = 19 psig X 2.31 = 43.89 ft of water Plotting 43.89 ft head at 0 flow, the **IMPELLER SIZE = 7"**
8. Determining pump flow	• Open discharge valve. • Turn on pump. • Measure and record suction and discharge pressure. • Measure and record motor amperage and voltage.
	Pressure Rise = 78 psig - 64.5 psig = 13.5 psig Total Dynamic Head = 13.5 psig X 2.31ft/psig = 31 ft.
	• Use pump curve and plot 31 ft. head against the 7" impeller size. • Ensure that at the point of intersection it reads 82.5% efficiency, 8 BHP @ 850 GPM.
9. Checking pump BHP	• Estimate pump operating BHP. Use the formula: BHP = (GPM X TDH) / (3960 X EFFP) = 850GPM X 31ft. / (3960 X 82.5%) = **8BHP**
10. Data sheet	• Fill out and complete data sheet.
(OPTIONAL) Estimate the Operating Cost/Year • $.10/KW-HR • 5840 HR/YR	= BHP (.746KW/BHP) X HR/YR X Cost/KW-HR Motor Off = 8(.746 KW/BHP) X 5840 HR/YR X $.10/KW-HR (.917) = **$3800/YR**

The Result Will Be:

This Task Has Been Completed When These Standards Have Been Met:

- ☐ The pump head was measured and compared to design data.
- ☐ Actual water flow was determined & compared to design data.
- ☐ Actual operating BHP was estimated.
- ☐ The water quantities measured were within ± 10% of design quantities.
- ☐ Final test and balance report was completed.
- ☐ The heat transfer at the evaporator was determined.
- ☐ The power input was measured at full load condition.
- ☐ The coefficient of performance was calculated.
- ☐ Area was clean and free of debris.
- ☐ No safety hazard was created.

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