

# Tune up your cooling system now!

## Application Note

When the weather is warm outside, it's imperative to make sure that your building's mechanical cooling systems are working at maximum efficiency. Since budgets are still tight, nobody wants high energy costs or, worse, an equipment failure. Emergency maintenance is so much more expensive than routine maintenance. The best way to avoid either of these bad scenarios is to perform a cooling system tune up.

Here's a list of check points and values to get you started. A good place to start the tune up is by listing some typical heating, ventilation, and air conditioning (HVAC) rules of thumb.

### Checks by equipment type

Since types of cooling equipment can vary widely, typical spring start-up checks are listed by equipment type, from water chillers to cooling towers, air handlers and package cooling equipment (rooftops and heat pumps).

#### Water chillers

**Note:** Always review and follow manufacturer's recommendations.

#### Electrical checks

- Use an insulation tester on oil pump motor and record readings.
- Use an insulation tester on compressor motor at the starter terminals; record readings.

- Measure and record oil pump voltage and amperage.
- Inspect the motor starter for signs of overheating, arcing, burns, etc.
- Clean starter cabinet.
- Inspect starter and starter components for discoloration, burns, moisture, etc.
- Inspect wires for discoloration and burns.
- Test accuracy of motor current (amp meter).
- Test tightness of terminal connections.
- Inspect contacts and change as necessary.
- Measure operating voltage and record.

- Check sensor readings for accuracy.
- Tighten terminal connections on the oil pump motor.
- Verify operation of the oil heater.
- Check starter contacts and change as necessary.

#### Oil and lubrication system

- Change oil and filter; test oil for acidity and check oil level.
- Clean purge drum and oil separator; change oil in purge pump and oil separator.
- Test oil again after start up for test lab analysis.
- Verify operation of oil cooling system if applicable.



- Clean oil strainer; change oil filter once per year.
- Analyze compressor oil.
- Check oil pump heater and purge oil heater operation.

### Miscellaneous

- Leak test system at piping flange connections, exterior refrigerant lines, etc.
- Lubricate and check operation of purge unit.
- For centrifugals, inspect vane motor, shaft, fitting; lubricate inlet vane linkage.
- Check water strainers; clean if needed.
- Start unit; log operating conditions after unit stabilizes.
- Use thermography to check for heat losses and bad insulation.
- Check operation of variable speed drive.
- Check water flow in branch piping.

### Cooling towers

- Remove debris from in and around unit; flush as needed.
- Check and clean strainers, bleed, overflow, drain.
- Lubricate fan motor bearings per manufacturer's recommendations.
- Change oil in gear reducer assembly per manufacturer's recommendations.
- Check motor pulley, belts, motor mounts, and alignment. Replace or adjust as needed.
- Check motor operating conditions.
- Check operation of variable speed drive on tower fans.
- Inspect electrical connections, contactors, relays, operating/safety controls.
- Clean make-up float valve assembly; check for proper operation.
- Check operating conditions. Adjust as needed.
- Check temperature and flow sensors for accurate readings.

### Air handlers

- Take pressure drop readings across filters; change when indicated.
- Check air flow with pitot tube or at flow measuring station.

- Check sensor readings at building control system. Calibrate if necessary.
- Check air flow at diffusers.
- Check indoor CO2 readings for indoor air quality and ventilation.
- Check economizer operation versus sequence of operation.
- Check and clean fan assembly.
- Lubricate fan bearings.
- Check belts and sheaves.
- Tighten all nuts and bolts.
- Check motor mounts and vibration pads.
- Check electrical conditions and motor operation.
- Lubricate and adjust associated dampers and linkage.
- Check fan operation.
- Clean outside air intake screen.
- Check and clean drains and drain pans.
- Check and clean strainers, steam traps, and hand valves.
- Inspect and clean filters, coils, and humidifiers.
- Clean external surfaces as needed.
- Measure and record voltage and current at fan motors.

### Package cooling equipment (rooftops and heat pumps)

- Check compressor evaporator and condenser pressures.
- Check operating voltage and current readings.
- Check filter pressure drop
- Check thermostat accuracy with recording meter and temperature sensor.
- Check fan operation.
- Check reversing valve operation for cooling switchover.
- Check airflow and static pressure.

Doing some of the checks listed above will definitely pay off. Now is a great time to take the initiative and save energy and reduce excessive downtime!

### Typical HVAC values

**Note:** Don't assume that these are laws—they're only typical values. Each specific HVAC system is different, and the values must be verified for each application.

<b>Air movement</b>	6 air changes/hour
<b>Ventilation rate</b>	25 CFM/person
<b>Fan energy</b>	1000 to 1500 CFM/hp
<b>Chiller size</b>	300 to 400 ft <sup>2</sup> /ton
<b>Chilled water</b>	2.4 GPM/ton (10 °F rise)
<b>Condenser water</b>	3 GPM/ton (10 °F rise)
<b>Chiller input</b>	7 to .8 KW/ton
<b>Chillers, pumps, and towers</b>	9 to 1.0 KW/ton
<b>VAV</b>	55 °F cooling
	10 % box leakage flow
	40 to 50 % minimum fan volume
<b>People load</b>	450 BTU/person/hour

### Common HVAC equations

#### Sensible air conditioning

BTU/hr. = CFM x 60 min/hr x .075 lb/ft<sup>3</sup> x .24 BTU/lb x DT

BTU/hr = 1.08 x CFM x DT

#### Latent air conditioning

BTU/hr. = 60 min/hr X .075 lb/ft<sup>3</sup> x CFM x DH

BTU/hr. = 4.5 x CFM x DH

#### Water heating and cooling

BTU/hr. = GPM x 60 min/hr x 8.33 lb/gal x 1 BTU/lb/°F x DT

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