FläktGroup SEMCO

SPECIALIZED HEALTHY AIR SOLUTIONS

NEUTON™

APPLICATION NOTE FOR MULTIPLE ZONES/OFFICES WITH SIMILAR LOAD PROFILES

To help improve the comfort of the worker, a new concept is being used to maintain individual office/ zone control.

Individual comfort is increasingly becoming the standard in modern, forward-thinking offices. This applies to lighting, furniture ergonomics, and even ergonomics of the computer peripherals like the keyboard and mouse. Now there is an efficient, effective way for employees to control the temperature of their office without interfering with other employees' preferences.

More and more office designs switching to individual temperature controls for offices (small zones) rather than trying to control large open spaces (large zones) where temperature, humidity, and, ultimately, comfort can vary widely across a zone.

To help improve the comfort their employees, employers want to give individual temperature control to each office. Engineers can look to chilled beams, which are an excellent solution to the problem of managing comfort in individual spaces. However, concerns can arise that this will increase the costs of the overall heated and chilled water source.

NEUTON®-Multiple Zone is the solution to help effectively apply chilled beams for individual comfort management. NEUTON® can be employed to reduce primary piping loop installation cost by allowing for a novel two pipe design approach. Rather than requiring a supply and return primary piping loop for both the chilled and hot water distribution (4 pipe), the incorporation of NEUTON®-Multiple Zone devices allows chilled and hot water to be pulled from the primary loops with the return water being injected back into the same primary loop (1 pipe). For many building types, the 2 pipe approach can significantly reduce the cost of the primary distribution piping; the most costly component of a chilled/heating beam system.

So how can NEUTON®-Multiple Zone help my design for multiple office controls?

NEUTON®-Multiple Zone configured to serve multiple zones/offices with similar load profiles

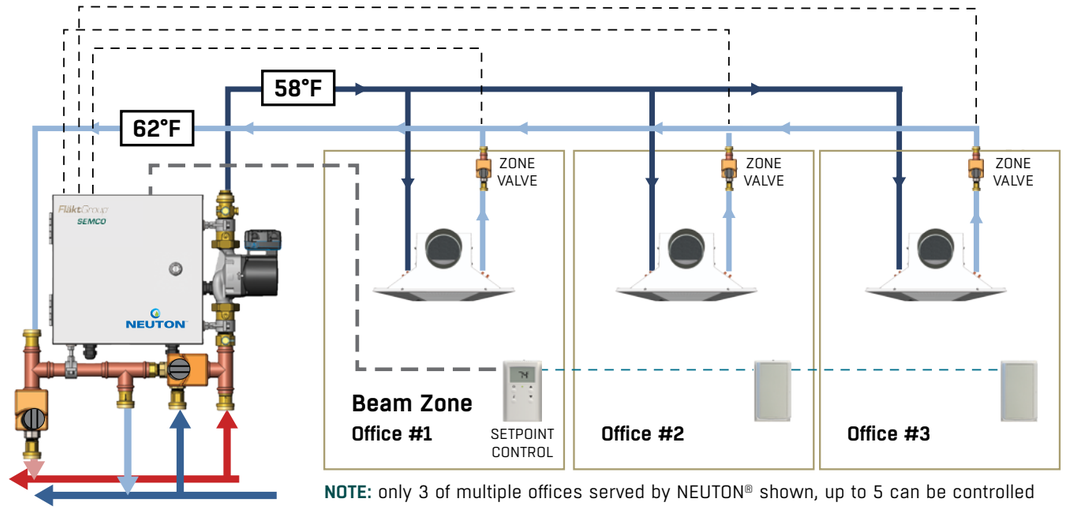
It is very common to have a project that involves multiple large zones (i.e. classrooms, labs, open office space) but also numerous small zones (individual offices) served by only one chilled/heating beam. It is not practical or necessary to have a pump module for each of these smaller zones.

NEUTON®-Multiple Zone has the capacity to serve numerous offices with one unit. The flow capacity is typically adequate to serve 5 individual offices each containing one or two chilled beams served by 1 GPM of water flow. Each office will have an individual thermostat controlling a traditional on/off control valve. The main control smart sensor feeding NEUTON®-Multiple Zone must be located in a "representative office" or return air plenum leaving the bank of offices in order to determine cooling/heating demand and space dew point for condensation control.

The main design requirement for using this approach is to be certain that each of the offices have a similar load profile. For example, all have similar window area, are facing a similar direction and have a similar number of occupants. It is a good idea to locate the main smart sensor within the zone that is likely to see the highest latent load profile. Each room will still sense the humidity level to ensure the worse case load is still protected.

FIGURE 1 provides a schematic showing how a single NEUTON®-Multiple Zone can be configured to serve multiple offices. In this case, rather than serving a single zone, it is serving a bank of numerous small zones, each having a beam or two. In this configuration, NEUTON®-Multiple Zone delivers the necessary water flow and temperature needed along with other key control functions, while traditional control valves modulate the amount of heating or cooling output delivered to the individual offices.

This allows the use of the traditional chilled and hot water main loop temperatures, as with the larger zones. It also provides the many operational and piping first cost advantages previously discussed while allowing small offices/ zones to employ NEUTON®-Multiple Zone pump modules in a cost effective manner.



NOTE: only 3 of multiple offices served by NEUTON® shown, up to 5 can be controlled

FIGURE 1. NEUTON®-Multiple Zone applied to serve multiple offices with one device

SOME FEATURES & BENEFITS OF NEUTON®-MULTIPLE ZONE

- **Award-winning Technology** - The third-party ASHRAE member judges responsible for choosing the AHR 2016 Innovation Award winners saw the unique value that NEUTON® offered to the HVACR community. Their choice of NEUTON® as the award winner in the plumbing category was based on "innovative design, creativity, application, value and market impact.

- **Cut beam loop pump energy by up to 90%** - NEUTON®-Multiple Zone ECM high efficiency, variable speed pumps operate at a fraction of the cost of traditional pump loop and two-way valves (For more information, please see **EXAMPLE 2** on **PAGE 7**.)

- **Increased chiller efficiency compared to conventional beam system designs** - traditional beam designs operate with low chilled water differential temperatures (typically 6°F) while NEUTON®-Multiple Zone results in differentials up to 14°F with higher return water temperatures

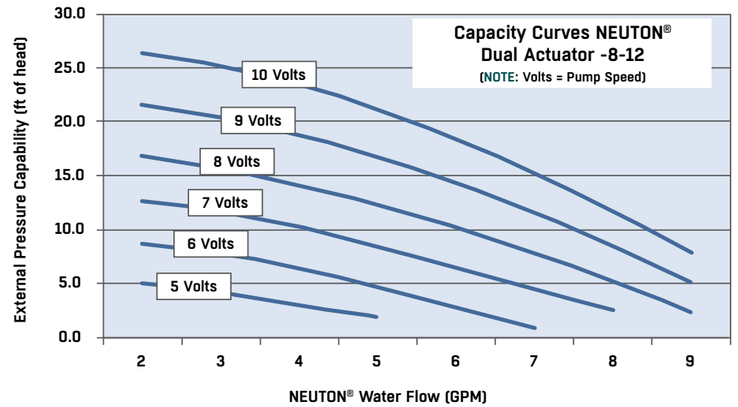
- **Improved response to occupied/unoccupied and low load conditions** – novel control sequences vary water flow and/or temperature to the beams, as needed, to adjust to steep changes in space temperature (i.e. morning warm up) using "boost" mode.

DESIGN CONSIDERATIONS

FIGURE 2 shows the pump flow for the 8 and 11 GPM versions of the NEUTON-Multiple Zone pump module.

When using a single NEUTON®-Multiple Zone to service multiple office spaces with similar loading, consider the following in your design:

NEUTON® DUAL ACTUATOR-8-12 CAPACITY CURVES AT MULTIPLE PUMP SPEEDS



NEUTON® DUAL ACTUATOR -11-12 CAPACITY CURVES AT MULTIPLE PUMP SPEEDS

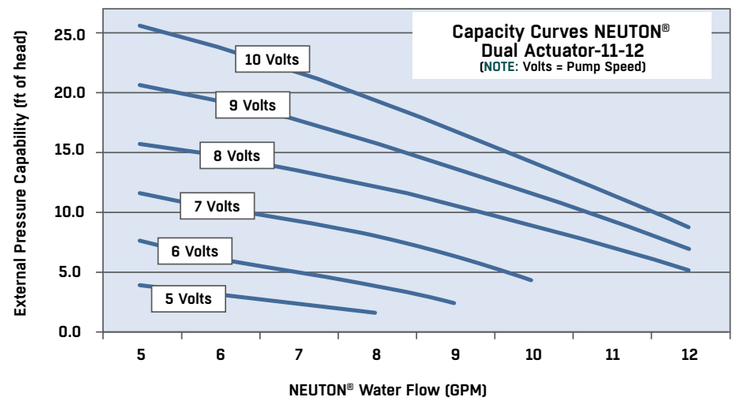


FIGURE 2. Capacity curves for NEUTON®-Multiple Zone CCBPM-8-12 and CCBPM-11-12 at various pump speeds

1) No less than 1 GPM per Beam should be used.

2) Must return at least 25% of the flow when the zones are all closed

3) A zone sensor must be wired back to NEUTON®-Multiple Zone to manage the space dew point control.

4) "Smart Sensor" location must represent all of the zones

5) The zone sensors are to be daisy chained together as they all provide feedback for the NEUTON®-Multiple Zone controls.

6) A maximum of 5 offices with the same latent load can be controlled using the existing controller.

7) Zone valves are to be wired back to NEUTON®-Multiple Zone for the controls to function correctly.

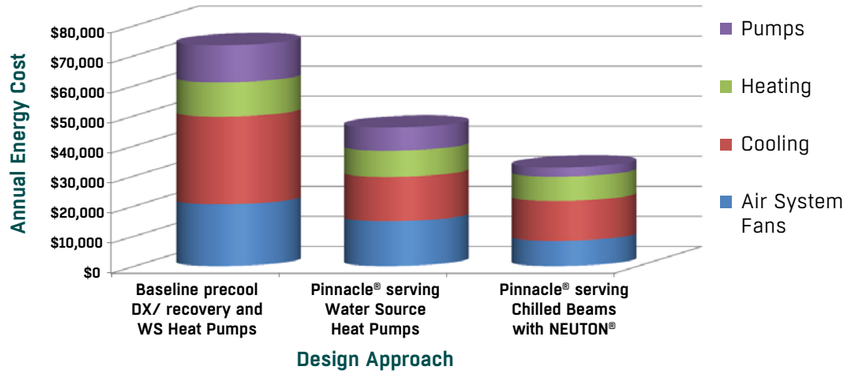


FIGURE 3. Energy modeling completed for an actual High School project comparing three design approaches which highlights the significant fan and pump energy savings offered by the chilled beam and NEUTON®-Multiple Zone combination

EXAMPLE 1: ENERGY BENEFITS OF CHILLED BEAMS COMBINED WITH NEUTON-MULTIPLE ZONE

While there are numerous advantages associated with the application of chilled beams, including excellent air distribution, improved indoor air quality, reduced maintenance, the elimination of condensate management and low noise level, one of the major benefits is substantial energy savings.

Combining chilled beams with NEUTON®-Multiple Zone pump modules provides two primary sources of energy savings; substantially lower airflow requirements compared to conventional systems and reduced pumpenergy consumption made possible by NEUTON®-Multiple Zone. Chilled beams require only a fraction (typically 50% less) of the airflow used by more conventional systems such as heat pumps, fan coils or VAV systems at design (See **FIGURE 3**).

The high efficiency, variable flow pumps incorporated within NEUTON®-Multiple Zone allow for a substantial reduction in the amount of energy required to pump the necessary water flow through the chilled beam distribution system. These savings result from both the low energy consumed by the high efficiency ECM motors designed into NEUTON® pumps and the benefits of variable flow compared to traditional on/off operation currently employed by most chilled beam systems (See **FIGURE 4**).

FIGURE 4. Variable flow using high efficiency pump vs. conventional pump and on/off control valve

100% Load	Load Provided	GPM	Pump Head	Watts Consumed	Percentage On	Percentage Reduction
On/Off Approach	24,000	6	13 ft.	369	100%	-
NEUTON®	24,000	6	13 ft.	123	100%	**67%**
80% Load	Load Provided	GPM	Pump Head	Watts Consumed	Percentage On	Percentage Reduction
On/Off Approach	19,200	6	13 ft.	295	80%	-
NEUTON®	19,200	3	5.5 ft.	26	100%	**91%**
60% Load	Load Provided	GPM	Pump Head	Watts Consumed	Percentage On	Percentage Reduction
On/Off Approach	14,400	6	14 ft.	222	60%	-
NEUTON®	14,400	3	5.5 ft.	20	75%	**91%**

EXAMPLE 2: PUMP ENERGY REDUCTION

To showcase the potential pump energy reduction, a baseline pump that is operated continuously to serve an on/off control valve cycled to provide the necessary zone cooling output is compared with a high efficiency, variable flow pump to deliver peak coil cooling power (24,000 BTUs), 80% of peak (19,200 BTUs) and 60% of peak (14,400 BTUs).

The baseline system is assumed to use a standard efficiency pump delivering 6 GPM of chilled water to the beam zone requiring 13 feet of head pressure. This pump operates continuously at peak cooling load with the zone water flow being cycled on and off by the control valve, as needed, to satisfy the space thermostat set point.

The NEUTONenergy consumption made possible by NEUTON®-Multiple Zone. Chilled beams require only a fraction (typically 50% less) of the airflow used by more conventional systems such as heat pumps, fan coils or VAV systems at design (See **FIGURE 3**).-Multiple Zone approach uses a high efficiency ECM pump operated to reduce flow down to 50% of maximum (6 GPM to 3 GPM), then cycled on and off once the cooling output at this minimum flow exceeds that needed to satisfy space conditions.

In both cases, the cooling delivered to the space by the primary air is the same, and is already subtracted from the space cooling load requirements for the purpose of this example. All water temperatures, room conditions and primary airflows are identical for each case.

As shown by **FIGURE 4**, the ability to deliver variable zone water flow using a high efficiency motor results in substantial pump energy savings. This figure compares the baseline system with a high efficiency variable flow zone pump. As shown, a 67% reduction in pump energy consumption is recognized at peak load (full flow) conditions. More importantly, as the system operates at the part load conditions (80% and 60% of peak) the energy consumed by the ECM variable speed pump is reduced by 91%, requiring only 9% of that consumed by the baseline system.

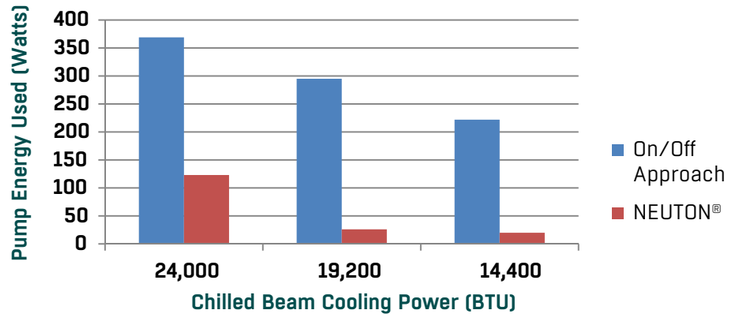


FIGURE 5. Variable flow using high efficiency pump vs. conventional approach shown graphically

For more information, please visit us at www.semcohvac.com.

For more specific information on NEUTON® and how it can be applied with examples, read our NEUTON® Technical Guide at http://info.semcohvac.com/tech-neuton

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