

# E.W. Howell Co., LLC

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## REQUEST FOR INFORMATION

No. 00044

**TITLE:** Water Flow Meters

**DATE:** 3/10/2010

**PROJECT:** BNL CCWF-II

**JOB:**

**TO:** Attn: Alan Raphael  
Brookhaven National Laboratory  
Brookhaven Sciences Associates, LLC  
Project Modernization Office  
Upton, NY 11973-5000  
Phone: 631-344-5854

**STARTED:**

**COMPLETED:**

**REQUIRED:** 3/17/2010

### WORK

**IMPACT:** Unknown

### SCHEDULE

**IMPACT:** Unknown

### COST

**IMPACT:** Unknown

### QUESTION:

3/10/2010

Water Flow Meters

The flow meters indicated below located in the 8" and 12" CHW lines to the chillers do not have enough pipe distance for them to work properly.

There are several options to resolve this problem:

1. Reduce the pipe diameter from 8" to 6" to increase flow velocity. Please see file CCF2FT692A.
2. Maintain 8" diameter and switch to conditioning orifice plates, as indicated in the calc sheet.

Please see attached flow calculations.

CC: Bill Harrison, George Santorilla, File

### PROPOSED SOLUTION:

### ANSWER:

PROVIDE THE SPECIFIED FLOW SENSORS IN THE LOCATIONS SHOWN ON THE DESIGN DRAWINGS. THE 3% TO 7% ACCURACY PREDICTED BY THE FLOW SENSOR MANUFACTURER, PER THE ATTACHED E-MAIL, IS ACCEPTABLE RELATIVE TO THE EXISTING CHILLER FLOW SENSOR PERFORMANCE.  
W. HARRISON, GIFFELS/IBL GROUP 4-7-10

Requested By: E.W. Howell Co., LLC

Date: \_\_\_\_\_

Signed: \_\_\_\_\_  
Lauren Bergin

## Bill Harrison

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**From:** Derek.Ott@emerson.com  
**Sent:** Wednesday, March 24, 2010 5:12 PM  
**To:** Bill Harrison  
**Cc:** channing@bnl.gov; mpt2@bnl.gov; Ed Piendel  
**Subject:** RE: Flow sensor location

Bill,

Regarding the 12" line, I would predict an inaccuracy range of 3-7%. The 12" line coming off of the 36" main line is going to act like an elbow. 3 feet is not enough spacing to the next elbow for the flow profile to recover coming off of the 36" line. Therefore, this is essentially a double elbow out-of-plane setup. Double elbows out of plane of each other will cause the flow to corkscrew and that effect takes many pipe diameters to filter it out. Per the Annubar straight run chart, we recommend 23 pipe diameters if the Annubar is in-plane with the second elbow or 28 pipe diameters if the Annubar is out-of-plane.

The 3-7% predicted inaccuracy is assuming that the butterfly valve will stay full open. A butterfly valve full open will cause some flow disturbance, but if it starts modulating then additional swirl will be added to the flow profile and cause more inaccuracy.

The other unknown is going to be the re-circ line. That will also introduce some type of swirl into the 12" flow profile and its difficult to predict how much it will affect the performance of the Annubar.

The Annubar in the 12" line at its current proposed location should still be very repeatable. The published spec on repeatability is  $\pm 0.1\%$  and I would expect the bar to still meet this, definitely within 0.5% as long as the installation is done correctly.

For the 8" line, all three elbows have to be taken into account as there is not enough spacing between each one. My estimate on this one is the same at 3-7%. The middle elbow is out-of-plane with the first elbow but it is in-plane with the third elbow. The third elbow should help condition the flow a little but there will still be a corkscrew effect in the line from the first two elbows. This should also be very repeatable although the flow profile will not be ideal.

Let me know what questions you have based on these comments.

Thanks,

**Derek Ott** | Applications Engineer | Dieterich Standard, Inc., Division of Rosemount  
**Emerson Process Management** | 5601 North 71st Street | Boulder | CO | 80301-9000 | USA  
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derek.ott@emerson.com

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**From:** Bill Harrison [mailto:Bill.Harrison@IBIGroup.com]  
**Sent:** Wednesday, March 24, 2010 11:46 AM  
**To:** Ott, Derek [PROCESS/RMT/BOUL]  
**Cc:** channing@bnl.gov; mpt2@bnl.gov; Ed Piendel  
**Subject:** RE: Flow sensor location

Derek,

Please see the reply to your questions in red below.

Regards,

**Bill Harrison**

Senior Mechanical Engineer

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**From:** Derek.Ott@emerson.com [mailto:Derek.Ott@emerson.com]

**Sent:** Tuesday, March 23, 2010 6:49 PM

**To:** Bill Harrison

**Cc:** channing@bnl.gov; mpt2@bnl.gov

**Subject:** RE: Flow sensor location

Bill,

To make sure I understand the piping layout, here are some questions/comments:

- 1) Are valves FV 649 & 650 fully open or do they modulate? Reply: They are fully open. Butterfly valve? Reply: Yes, they are butterfly valves.
- 2) Looks like the 12" chiller line comes off the 36" CHR line → through the FV valve → up to a 90° elbow → and then 7' 6" to the Annubar. Please correct me if I'm reading the drawing incorrectly. Reply: You are reading the drawings correctly.
- 3) What's the vertical dimension from the valve to the elbow? I don't see that dimension called out, but it appears to be just a couple of pipe diameters. Reply: The distance is about 3 feet. The drawings scale at 1/8" = 1'-0".
- 4) Is the 8" re-circ line running all of the time also, introducing additional flow into the vertical up run? Reply: The flow in the 8" line increases as the chilled water return temperature increases above 52F.
- 5) Looks like the 8" re-circ line is coming off the 36" CHS line → into a 90° elbow vertically → into a 90° elbow horizontally → into another 90° elbow horizontally → and then to the Annubar 1' 4" away. Reply: You are correct. The 90 deg. elbow ahead of the Annubar is a short radius el. All other elbows are long radius.
- 6) So far the DP's look fine for 3000 to 3500 GPM in the 12" line and 1200 to 1500 GPM in the 8" line. For liquid applications, the recommended minimum DP is 0.25" H<sub>2</sub>O and those flows are well above that value. Also, Rod Reynolds numbers have to be taken into account but those flow are high enough without having to worry about transitional or laminar flow conditions. Reply: Flow in the 8" line is currently between 0 and 500 gpm. The flows will increase as the HVAC and process heat exchangers return water at higher temperatures.

Thank you,

**Derek Ott** | Applications Engineer | Dieterich Standard, Inc., Division of Rosemount

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**From:** Bill Harrison [mailto:Bill.Harrison@IBIGroup.com]

**Sent:** Monday, March 22, 2010 1:05 PM

**To:** Ott, Derek [PROCESS/RMT/BOUL]

**Cc:** Channing, Christopher; Toscano, Mark

**Subject:** Flow sensor location

Derek,

Attached are the following:

1. Part prints of drawings that show the flow sensor locations and the Flow Meter Schedule.
2. Our mark-up of the analysis sent to us by the Contractor with the request for information.

3. A subsequent analysis regarding the re-circ line flow sensors FT-691 and FT-692.

Regarding the 8" re-circ line, we do not want to reduce the 8" to a 6" due to the limited delta-p between the chilled water supply and return headers. Similarly, we do not want to use conditioning orifice plates due to the excessive delta-p. Note that the flow in the re-circ line may be as much as 1,200 to 1,500 gpm and not limited to the 600 gpm scheduled.

We are most concerned about the accuracy of FT-645 and FT-646 in the 12" chilled water return to the chiller. The flow rate will be essentially constant at 3,500 gpm +/- 10%. If necessary, we can calculate the re-circ flow measured by FT-691 and FT-692 knowing the return, re-circ and mixed water temperatures and the total flow to the chillers as measured by FT-645 and FT-646.

We will appreciate your assessment of the proposed flow sensor locations.

Thanks,

**Bill Harrison**

Senior Mechanical Engineer

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