AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

TC/TG/MTG/TRG MINUTES COVER SHEET

(Minutes of all Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/~~TG/MTG/TRG~~ No. 6.1 DATE June 28, 2013

TC/~~TG/MTG/TRG~~ TITLE Hydronic and Steam Equipment and Systems
DATE OF MEETING June 25, 2013 LOCATION Denver, CO

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Jason Atkisson	2011	Ramez Afify	2011	
Julia Keen	2010	Tricia Bruenn	2009	
Ken Luther	2011	John Glunt	2009	
Michael McDermott	2011	Trevor Houck	2010	
Rex Scare	2011	Edward Tsui (non-quorum)	2011	
Steve Tredinnick	2009			

DISTRIBUTION

All Members of TC/TG/MTG/TRG plus the following:	
TAC Section Head:	John Dunlap
TAC Chair:	William F. McQuade
All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters:	ALI/PDC - Donald L. Brandt Chapter Tech. Transfer - Maggie Moninski Research - Stephen S. Hancock Special Pubs - Francis A. Mills Standard - Debra H. Kennoy 2016 HB Systems - Forrest S. Yount 2009 HB Fundamentals - David P. Yuill
Manager Of Standards Manager Of Research & Technical Services	Stephanie Reiniche Mike Vaughn

1. **Call to Order:**
   Chair Keen called the meeting to order. The Chair welcomed all in attendance, and self-introductions were made. An attendance sheet was passed and signed by those in attendance. A quorum was present with attendance by 6 of 11 voting members including 1 non-quorum voting member..

   Technical Committee 6.1 is concerned with all aspects of hydronic and steam systems. This includes the application of boilers, chillers, terminal units, and all accessories and controls making up the total system as well as the design of the integrated system. In addition to comfort applications of both heating and cooling, snow melting systems are included. Cooperation with other TCs is recognized in areas such as control, noise and vibration, refrigeration, pumps and hydronic and service water piping.

2. Setting of the Agenda:
   The Chair passed out an updated Agenda.

3. Approval of Dallas Meeting Minutes:
   Motion by Rex Scare, seconded by Jason Atkisson to approve the past meeting minutes. Motion passed 6-0-0 (with the Chair voting).

4. Recognition of Liaisons:
   Mark Owen of the ASHRAE Handbook Staff was present and available for questions.

   Section Head John Dunlap acknowledged outgoing Chair Julia Keen's service to the committee with a certificate of appreciation. Section Head Dunlap is completing his service in this position, and is being replaced by Mark Hegberg.

5. **Chair's Report**
   Chair Keen summarized the key items from the Section 6 Breakast.

   (a) The ASHRAE Code of Ethics is to be adhered to by those doing ASHRAE business whether or not they are an ASHRAE member. The link will be provided on future agendas https://www.ashrae.org/about-ashrae/adhrae-code-of-ethics.
   (b) The PowerPoint presentation regarding the role and responsibilities of the TCs is available at the ASHRAE Technical Activities Committee website, https://www.ashrae.org/standards-research--technology/technical-committees. Note presentation of this presentation to the local chapters earns PAOE points for the Chapter.
   (c) Members were reminded to periodically check and correct, if needed, their bios on the ASHRAE website. Additionally, a new classification field has been added for a member's affiliation. ASHRAE is asking all members to update their bios with this by July 1, 2013, for the purposes of ensuring the proper diversity and representation on the committees.
   (d) All attending members will be receiving an e-mail in the coming days offering member's the option of having a thank you letter for service sent to their employer. The member will need to indicate their desire for this and to whom it should be sent.

6. Sub-Committee Reports

A. Programs: Mike McDermott (Chair). Subcommittee meeting minutes of June 24, 2013, are attached.

Chair McDermott reviewed the tracks for programs for New York. He also discussed the new program introduced at this meeting, special sessions.

TC 6.1 sponsored Seminar 13 (Chilled Water Systems for YEA Members: What Gen Xers and Baby Boomers Have Done Wrong) at this meeting. TC 6.1 also co-sponsored Special Session 5 (Workshop: Building Owners Share Experiences with Hydronic Radiant Cooling Systems Coupled with DOAS – What Works and What Doesn't) and Seminar 28 (The Largest Zero-Energy Building: What is Under the Hood?). Chair McDermott thanked Jason Atkisson and Mick Schwedler for their work on the well-attended Seminar 13!

A look ahead for the New York, Seattle, and Chicago programs is attached.

Ideas for future programs are always welcome to Mike McDermott.

B. Research: Tom Cappellin (Chair). Subcommittee meeting minutes of June 24, 2013, are attached.

Mark Hegberg suggested the proposed research project for verifying Pressure Independent and Flow Limiting Control Valves be held until the work of SPC 208 (Method of Test for Determining Hydronic System Balance Valve Capacity) was completed.

Regarding the research project for ECM Pumps, Frank Myers suggested contacting the Department of Energy for their standards regarding efficiency.

Frank Myers also added 90.1-2016 was focusing more on system efficiencies vs. individual efficiencies. This may affect the research project regarding the most efficient path to get heat into the space (steam vs. hot water).

(Discussion of SPC155/RP196 is located under G. Standards of these meeting notes.)

C. Handbook: Rex Scare (Chair). Subcommittee meeting minutes of June 23, 2013, are attached.

Chair Scare asked for more volunteers to participate in the review of the chapters. Any corresponding member not in attendance is welcome to volunteer and become part of the editing/review process.

Three chapter revisions will be voted on in New York. They are:

- Systems and Equipment / Chapter 13 – Hydronic Heating & Cooling System Design

- Systems and Equipment / Chapter 14 – Condenser Water Systems
- Systems and Equipment / Chapter 48 – Heat Exchangers

Also in New York,

- Systems and Equipment / Chapter 44 – Centrifugal Pumps will be reviewed with the plan to vote this chapter out in Seattle.
- Systems and Equipment / Chapter 47 – Valves. Chair Scare asked for all suggested changes and comments be submitted prior to New York.

The subcommittee is still looking for lead authors for Chapter 28 (Unit Ventilators, Unit Heaters and Makeup Air units) and Chapter 36 (Hydronic Heat Distributing Units and Radiators).

Chapter 22 (F) Pipe Sizing and Chapter 46 (S) Pipes, Tubes, and Fittings are still being merged into one chapter.

D. Chilled Water Sub Committee : Steve Tredinnick (Chair).

Chair Tredinnick stated the work on the new Handbook chapter on Chilled Water Plant Design scheduled for 2016 will begun, since the ASHRAE District Cooling Guide is completed and released.

Additionally, he reviewed the E-Quest data to be used from the ASHRAE Headquarters.

E. Membership: John Glunt (Chair). Chair Glunt was absent from the meeting.

Julia Keen reminded the visitors to the meeting to access the ASHRAE website for those wishing to become a corresponding member of TC 6.1 (https://www.ashrae.org/standards-research--technology/technical-committees/applying-for-membership-on-a-technical-committee) for information.

F. Professional Development (ALI). Greg Towsley (Chair): Chair Towsley reports there are no actions for the TC from the Professional Development Committee.

SDL 7 (Water System Design) at ASHRAE for review and typesetting before moving forward with the SI Version, however, it is now reported as lost by ASHRAE.

The SDL 12 (Fundamentals of Heating System Design) still in progress (Mark Hegberg).

G. Standards: Mike O'Rourke (Chair).

Standard 55: Chair O'Rourke reported the 2013 version is about to be published.

Standard 155/RP196: Frank Myers reports a quorum was not present at the recent meeting. Work is in process to develop a work plan and a teleconference is scheduled for July 8 to go

over the core fundamental questions for the work plan. Previously reported TC 6.1 may be asked to vote on the original contract either in Denver or by electronic ballot, however, there was no motion in that meeting to move forward on the contract. The original contractor with the university has retired, but is willing to continue his work on this at no charge, provided there are no objections from the university.

Standard 90.1: Greg Towsley reported the committee is taking no more proposals for 2013, it is being wrapped up for printing by the end of the year.

Addendum ak received two supportive comments and will move forward.

He reported the focus of 90.1-2016 is a whole system initiative. 90.1 has established two sub-committees to focus on chilled water plant systems and packaged rooftop systems. TC 6.1 has been asked to participate in the chilled water plant system subcommittee, which is being chaired by Jeff Boldt.

Mark Hegberg stated his opinion 90.1 should not be delving into hydronic system design, as this is the focus of the technical committee. Design should not be dictated through 90.1. Hegberg stated the TC should dictate design based on human comfort.

Julia Keen stated 90.1 is concerned with energy efficiency and not on human comfort.

Mick Schwedler stated 90.1 gets away from a descriptive path stating the minimum system performance and not a specific system design.

Jason Atkisson, Greg Towsley, David Lee, and Steve Tredinnick volunteered to participate on the 90.1 subcommittee.

Chair Keen stated she is encouraged by 90.1 getting TC 6.1 more engaged in this process. Jason Atkisson said 90.1 should be applauded for the formation of this subcommittee.

H. WEB Site: Jason Atkisson (Chair) Chair Atkisson stated the website is up to date. The committee is looking for someone to volunteer to take over the duties of the website.

7. Liaison Reports from other TC's and Organizations.

Cary Smith, the incoming vice chairman of TC 6.8 (Geothermal Heat Pump and Energy Recovery Applications), discussed the work of TC 6.1 regarding the lack of modeling solutions for ground source heat pump systems.

Don Prather, representing the Air Conditioning Contractors Association, discussed the newly formed Radiant Hydronic Council. More information on this can be found at www.acca.org.

TC 6.5 is voting next month on RP1383 regarding the software to model the mean radiant temperature in a space.

8. Old Business:

(a) Greg Towsley reported the Department of Energy is scheduled to set rule making regarding commercial and industrial pump efficiency. There will be a comment period and preliminary rule making, followed by the final rule making is expected in 2016 with the standard going into effect in 2019.

(b) Robert Bean reported the status of the Carlson/Holohan Industry Award of Excellence. The 'wheel' has been separated from the award, and plans are to donate the 'wheel' to the Smithsonian Institute or ASHRAE Headquarters.

(c) Chair Keen stated she did not receive any comments to the IAPMO (International Association of Plumbing and Mechanical Officials) proposal to make major revisions to the hydronic requirements in the UMC (Uniform Mechanical Code) she had distributed via e-mail. Ken Luther (krluther@q.com) volunteered to collect all the comments. They should be e-mailed to him by September 1. He will develop a spreadsheet for the submission of these comments, which members wishing to comment should e-mail Ken for a copy.

9. New Business:

(a) Chair Keen stated the TC currently has a total of 12 chapters to edit (this includes the merging of the 2 chapters previously discussed, plus the new chilled water plant design chapter). The TC Section inquired if the TC was interested in reducing some of this workload to other TCs where appropriate.

(b) Chapter 15 (S) - Medium and High Temperature Water heating system. Chair Keen recommended this chapter be assigned to TC 6.2 (with TC 6.1 as the co-author). Mark Hegberg stated the committee had previously voted to keep the chapter in the Handbook with no maintenance or updates.

(c) Chapter 28 (S) – Unit Ventilators, Unit Heaters and Makeup Air units. Chair Keen recommended this chapter be re-assigned to TC 5.3. Jason Atkisson made a motion to re-assign this chapter to TC 5.3, seconded by Rex Scare. The motion passed 6-0-0 (with the Chair voting).

(d) Chair Keen proposed the TC review the scope of its work, specifically in regards to the coverage of systems and equipment, recommending the split of TC 6.1 into two TCs, one for equipment and one for systems. The advantages would be to encourage more participation in the TCs as currently several members have expressed interest in becoming a voting member (it is important to some attendees to be a voting member to justify their attendance at the meetings to their employer). The ability to focus on the responsibilities of the committee with the time allotted at the meetings (often the work cannot be completed due to the number of items needing to be discussed – i.e. the number of handbook chapters).

(i) There was much discussion on this issue. Ken Luther was concerned this proposal would result in more meetings to be attended by members who would want to be involved in both topics. Mark Hegberg suggested the addition of more sub-committees in lieu of adding a new TC. He said there were other TC's in the past, which left TC 6.1 and have since rejoined TC 6.1. Also, thnumber of voting members on the committee cam be reevaluated.

(ii) Chair Keen formed a special sub-committee to report back to the full committee. The committee will be chaired by Bill Coad, with Rex Scare and Scott Fisher, to review the many suggestions and discussion brought forth on this issue.

(e) Rex Scare motioned to revise the title of TC 6.1 from 'Hydronic and Steam Heating Equipment and Systems' to become 'Hydronic and Steam Equipment and Systems'. Ken Luther seconded the motion. The motion passed 6-0-0 (with the Chair voting).

(f) Chair Keen thanked Trevor Houck for the completion of his service as a voting member on the committee. Greg Towsley is the incoming voting member on the committee.

(g) Chair Keen recognized Tricia Bruenn as the incoming Chair and Rex Scare as the incoming Vice-Chair.

10. Meeting Adjournment:

Motion by Ken Luther, seconded by Scott Fisher, to adjourn the meeting. Meeting adjourned at 3:23pm.

Submitted by,
Bob Walker.
TC 6.1 Secretary

TC Sign-in Sheet

Meeting Info: TC 6.1 Date: 6-25-13

Name	Affiliation	E-mail	Member (VM,CM,Guest)	YEA Member?
Alison Williams	LBNL	aawilliams@lbl.gov	Guest	–
Aykut Yilmaz	AHRI	ayilmaz@ahrinet.org	CM	
Mehdi Doura	Lochinvar	mdoura@lochinvar.com	CM	
* Thomas Neill	MESTEK	TNEILL@MESTEK.com	CM	
Mike McDermott	Prog Chair	mmcdermott@grummanbutkus.com		
Mike O'Rourke	TWA Panel	mpor43@aol.com	CM	
Egils Dzelzitis	[illegible]	egils@[illegible]	CM	
Fred Goldner	EMAA	FGOLDNER@EMAA.COM	CM	
Gary Smith	TC-6.8 Sound Geothermal	dcsmith@soundgt.com	G	
Don Prather	ACCA	donald.prather@acca.org	CM	
* Jason Atkisson	Affiliated Engineers	jatkisson@aeieng.com	VM	
Frank Myers	PVI Industries, LLC	fmyers@ix.netcom.com	CM	
Hooman Daneshmand	TA	hdaneshmand@tahydronicscollege.com	CM	✓
Rajendera K. Kapoor	Member SYSKA Hennessy	Raj.RajKapoor@Gmail.com	Will like to be CM	
Julia Keen	Kansas State	jkeen@ksu.edu	VM	

'*' by name indicates willingness to act as reviewer

TC Sign-in Sheet

Meeting Info: TC 6.1 Date: 6-25-13

Name	Affiliation	E-mail	Member (VM,CM,Guest)	YEA Member?
Chris Kerback	Bell & Gossett	chris.kerback@xylemine.com	Guest	Y
JACK KANG	Bell & Gossett	jack.kang1@xylemine.com	Guest	Y
KIM CROSS	PATTERSON	KCROSS@PATTERSONPUMPS.COM	CM	
BILL REILLY	VICTAULIC	WREILLY@VICTAULIC.COM	GUEST	N
MARK HEGBERG	APOLLO		CM	N
DAN MEREDITH	PENN STATE	dxm15@psu.edu		
MARK OWEN	ASHRAE STAFF	mowen@ashrae.org	GUEST	N
ROBERT BEAN	ICC/HH	K9CAVE@SHAW.CA	CM	N.

'*' by name indicates willingness to act as reviewer

TC Sign-in Sheet

Meeting Info: TC 6.1 Date: 6-25-13

Name	Affiliation	E-mail	Member (VM,CM,Guest)	YEA Member?
Alison Williams	LBNL	aawilliams@lbl.gov	Guest	–
Aykut Yilmaz	AHRI	ayilmaz@ahrinet.org	CM	
Mehdi Doura	Lochinvar	mdoura@lochinvar.com	CM	
* Thomas Neill	Mestek	TNEILL@MESTEK.com	CM	
Mike McDermott	Prog Chair	mmcdermott@grummanbutkus.com		
Mike O'Rourke	TWA Panel	mpor43@aol.com	CM	
Egils Dzelzitis	[illegible]	egils@[illegible]	CM	
Fred Goldner	EMAA	FGOLDNER@EMAA.COM	CM	
Gary Smith	TC-6.8 Sound Geothermal	dcsmith@soundgt.com	G	
Don Prather	ACCA	donald.prather@acca.org	CM	
* Jason Atkisson	Affiliated Engineers	jatkisson@aeieng.com	VM	
Frank Myers	PVI Industries, LLC	fmyers@ix.netcom.com	CM	
Hooman Daneshmand	TA	hdaneshmand@tahydronicscollege.com	CM	✓
Rajendera K. Kapoor	Member Syska Hennessy	Raj.RajKapoor@Gmail.com	Will like to be CM	
Julia Keen	Kansas State	jkeen@ksu.edu	VM	

'*' by name indicates willingness to act as reviewer

DENVER MEETING MINUTES

PROGRAMS SUBCOMMITTEE

ASHRAE TC 6.1 "HYDRONICS AND STEAM HEATING EQUIPMENT AND SYSTEMS"

A. Meeting was called to order at 2:15 pm, 24 June 2013 at Denver, by Mike McDermott

B. Members and Visitors projected attendance

	Name	Position
1.	Mike McDermott	Programs Subcommittee Chair
2.	Julia Keen	Chair
3.	Scott Fisher	Corresponding Member
4.	Bob Walker	Secretary
5.	Rex Scare	Handbook Committee Chair
6.	Jason Atkisson	Web Master
7.	Edward Tsui	Member
8.	Hans Hanson	Corresponding Member

C. Current and future programs will be discussed.

1. We have several programs that were presented in Denver:

SPECIAL SESSION 5 (INTERMEDIATE)

Workshop: Building Owners Share Experiences with Hydronic Radiant Cooling Systems Coupled with DOAS: What Works and What Doesn't?

Track: HVAC&R Systems & Equipment
Room: Plaza Ballroom A
Sponsor: 06.01 Hydronic and Steam Equipment and Systems, 06.05 Radiant Heating and Cooling
Chair: Paul A. Torcellini, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

Although chilled beam technology has existed for more than 60 years, it has had problems in the past. Condensation of moisture on the cooled surfaces sometimes damaged ceiling materials (e.g., plaster) and created conditions favorable to biological growth. Current systems usually require dedicated outdoor air systems (DOAS) and tight building envelopes to manage humidity. Radiant ceilings, used in combination with a DOAS, can reduce commercial building HVAC energy consumption relative to the old stand-by variable air volume (VAV) systems. This workshop allows building owners to share experiences with installed passive chilled beam DOAS hydronic systems – what works and what doesn't?

1. Case Study #1: NREL
***Shanti D. Pless, Member**, National Renewable Energy Laboratory, Golden, CO*
2. Passive Beams with Underfloor Air Distribution: An American Tale
***Fred Betz, P.E., Member**, PEDCO E&A Services, Cincinnati, OH*
3. Engineer and Technical Expert for Panel Discussion
***Peter Simmonds, Ph.D., Fellow Member**[1] and **David Okada, P.E., Member**[2],*

(1)IBE Consulting Engineers, Sherman Oaks, CA, (2)Arup, Seattle, WA

SEMINAR 13 (INTERMEDIATE)

Chilled Water Systems for YEA Members: What the Gen Xers and Baby Boomers Have Done Wrong

Track: HVAC&R Systems & Equipment
Room: Governors Square 16

Sponsor: 06.01 Hydronic and Steam Equipment and Systems
Chair: Mick Schwedler, P.E., Member, Trane Co., La Crosse, WI
This session is ideal for YEA members so they don't repeat the mistakes the Gen Xers and baby boomers have made. In this seminar the audience helps identify mistakes too commonly made in chilled water systems. Presenters share specific job mitigation techniques as well as design methods used to overcome the issues.

1. Chilled Water System Design and Problem Mitigation - Part 1
***Jason A. Atkisson, P.E., Member**, Ross & Baruzzini, Inc., St. Louis, MO*

2. Chilled Water System Design and Problem Mitigation - Part 2

***Mick Schwedler, P.E., Member**, Trane Co., La Crosse, WI*

11:00 AM-12:30 PM

SEMINAR 28 (INTERMEDIATE)

The Largest Zero-Energy Building: What is Under the Hood?

Track: Mile-High Efficiency & Equipment
Room: Plaza Ballroom A
Sponsor: 02.08 Building Environmental Impacts and Sustainability, 06.01 Hydronic and Steam Equipment and Systems
Chair: Paul A. Torcellini, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO
The NREL Research Support Facility claims to be the largest zero-energy office building in the world. The seminar dives into the "nuts and bolts" of the building hardware including the mechanical systems (hydronic heating and cooling with dedicated outside air using transpired collectors, a basement labyrinth, and evaporative cooling), lighting systems (daylighting and electrical), envelope (glazing and envelope systems), and design of the plug loads that integrate together to create a building that was constructed at no additional cost yielding a 50% energy savings.

1. Building Program Requirements and Envelope
***Tom Hootman**, RNL Design, Denver, CO*

2. Lighting Systems
***Jennifer Scheib**, National Renewable Energy Laboratory, Golden, CO*

3. Heating, Cooling, and Ventilating Systems
***David Okada, P.E., Member**, Arup, Seattle, WA*

4. Miscellaneous and Plug Loads Cannot Be Ignored
***Shanti D. Pless, Member**, National Renewable Energy Laboratory,Golden, CO*

SEMINAR 38 (BASIC)

The Fundamentals of Radiant Cooling System Design and Construction

Track: HVAC&R Systems & Equipment
Room: Plaza Ballroom B
Sponsor: 06.05 Radiant Heating and Cooling
Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ
As more and more jurisdictions and building owners are answering the call in establishing higher energy-use standards for their new construction projects, design teams are looking beyond traditional HVAC solutions to provide greater energy efficiency while maintaining occupant comfort and safety. A system approach that continues to gain momentum is in-slab radiant cooling. A radiant cooling design strategy embodies the integration of architectural design and HVAC systems design with overall energy efficiency in mind. This seminar explores the fundamental concepts of how radiant cooling systems work, how they are constructed and controlled, and how they can be used as part of an energy-efficient design solution.

1. Radiant Slabs: On-Site Fabricated Heat Exchangers
***Robert Bean P.L.(Eng.) R.E.T., Member**, Healthy Heating, Calgary, AB, Canada*

2. Designing Radiant Floors From Basics
***Peter Simmonds, Ph.D., Fellow Member**, IBE Consulting Engineers, Sherman Oaks, CA*

3. Radiant Cooling System Design From Concept to Completion
***Andrew Reilman, P.E., Member**, Syska Hennessy Group, Culver City, CA*

2. Feedback from CEC on rejected programs – One forum did not make it. We may want to add more detail.
3. See attachment 1 look ahead spread sheet for future programs.
4. For detailed information on how the above programs as to be assembled and submitted visit ASHRAE's web site for information and direction.

D. Adjournment of subcommittee at 4:15 pm.

TC -6.1 Programs Look Ahead - Denver 2013 Meeting

Year	**2014**
Date	Jan 18-22
City	New York
Tracks	www.ashare.org/newyork/
1	HVAC & R Systems and Equipment
2	HVAC & R Fundamentals and Applications
3	Environmental Health Through Indoor Environmental Quality
4	Controls
5	International Design
6	Commissioning
7	Hydronic System Design For Large Buildings
8	Tall Buildings: Performance Meets Policy
Technical Paper	Paper: April 19, 2013
Conference Paper	Abstract: March 19, 2013; Paper:July 2, 2013
	Towards the ASHRAE 2020 Vision with an Efficiency Increase to a Pump Product Range - Greg Towsley
Seminar	Proposal: August 13, 2013
	Steam System Design Fundamentals - Rex Scare
	Hydronics for Tall Buildings - Ken Luther
	Introduction to Hydronic System Design - Jason/jeff /Julia
	Boiler, Valve and Pump Selection - Tricia Bruin
	Building Assessments of Hydronic Systems- Greg Towsley
	Tall Building Central Plants – Steve Tredinnick
	Co-sponsered with TC-7.1: Integrated Design of Hydronics Systems with One Pipe Loop(Jason/Joseph Val Simmons)
Forum	Proposal: August 13, 2013
	Chiller Plant Control Fundamentals and Optimization - Ed Tsui
	Integration of Thermal Storage Hydronic Systems - Hans Hanson and TC-6.9, TC-4.1 (workshop)

TC -6.1 Programs Look Ahead - Denver 2013 Meeting

Year	**2014**	**2015**
Date	June 28-July 2	Jan 24-28
City	Seattle	Chicago
Tracks	www.ashare.org/seattle/	www.ashare.org/chicago/
1	HVAC & R Systems and Equipment	HVAC & R Systems and Equipment
2	HVAC & R Fundamentals and Applications	HVAC & R Fundamentals and Applications
3	Research Summit - High Performance Buildings	
4	Environmental Health Through Indoor Environmental Quality	
5	Geothermal Applications	
6	Standards	Standards
7	Facilty Management: Operations, Technology and Energy Improvements	Facilty Management: Operations, Technology and Energy Improvements
	Refrigeration	
8	Professional Skills	
Technical Paper	Paper: September 23, 2013	Paper: April 19, 2014
Conference Paper	Abstract: Sept. 23, 2013; Paper: Jan. 9, 2014	Abstract: March 15, 2014; Paper: Jan. 2, 2014
Seminar	Proposal: January 6, 2014	Proposal: August 13, 2014
		Pressure Independent Control Valves Case Studies - Robert Walker
	Radiant Cooling DOAS case Studies - Mike McDermott/Robert Bean	
	How ASHRAE Std 90 can affect Hydronic Design - Jason/Mick	
	Pressure Independent Control Valves Fundimentals and Applications - Robert Walker	
Forum	Proposal: January 6, 2014	Proposal: Aug 13, 2014
	Effects of pipe aging on pump head - Scott Fisher	
	The Battle in Seattle - Chilled Water System Control (Delta P or Valve Position)	

RESEARCH SUBCOMMITTEE REPORT
ASHRAE TC 6.1 "Hydronic & Steam Heating Equipment & Systems"
ASHRAE ANNUAL CONFERENCE – Denver, CO
Monday, June 24, 2013
Thomas E. Cappellin – Chair

NOTES FROM RESEARCH SUBCOMMITTEE CHAIR'S BREAKFAST:

1. ASHRAE's Current Projects:
    a. 58 active RPs having total value >$ 11 million.
    b. Since June, 2012:
        i. 14 projects were completed.
        ii. 11 new projects were started.
        iii. 14 Tentative Research Projects (TRPs) were released for bid. No projects were on-hold this year waiting to bid due to a shortage of funding.
2. WS and RTAR Status as of Denver Meeting:
    a. RAC evaluated 5 RTARs (conditionally accepted 2 / returned 2 / rejected 1).
    b. RAC evaluated 2 WSs (conditional accept 1 / returned 1).
    c. There are 7 potential TRPs ready for bid in fall 2013.
    d. There are currently no TRPs ready for bid.
3. Innovative Research Grants:
    a. Seed funding for novel research (up to $125k):
        i. Ideas must have potential to significantly advance the state-of-the-=art in HVAC engineering.
        ii. Intended to encourage out-of-the-box research.
        iii. $50k per year for two years. Additional $25k possible with industrial matching.
        iv. May award "0-1" each year (process is very competitive).
    b. Proposal Process:
        i. Pre-proposal (12-page white paper).
        ii. Reviewed by RPS/RAC (and invited experts) during AHRAE's winter meeting.
        iii. Invited full proposals reviewed by RAS/RAC at their spring meeting.
    c. Last year was the first time that proposals were solicited for INGs.
        i. 18 pre-proposals and five invited full proposals were received. None were awarded.
        ii. Language, guidelines and timeline were modified for the 2nd round.
        iii. 18 pre-proposals and three invited full proposals were received. RAC discussed them and made a recommendation to Tech Council.
4. TC's Are Encouraged to Generate More Research:
    a. The number of RTARs (5) and WS (2) for RAC to evaluate was quite low which may cause a shortage of promising research projects in the near future.
    b. It takes between 1-2 years before a research topic is approved and ready for bid.
    c. If ASHRAE does not receive more project ideas during 2013/14 Society year, it may run out of projects to bid.
5. RAC has updated the RTAR forms to enable easier preparation by authors.
    a. The various sections now have limitations on number of word s allowed.
6. An RTAR example has been placed on ASHRAE's web site.
7. Instructions For Proposal Evaluation Subcommittee (PES):

a. ASHRAE Research Manual – Section 6 – Solicited Proposals:
    i. Section 6.1 Evaluation of Solicited Proposals – (evaluation criteria / approval flow)
    ii. Section 6.2 Instructions for Proposal Evaluation Subcommittee – (purpose / scope / members / evaluation and selection of contractor)

8. Evaluation / Contractor Selection:
    a. The PES will be responsible for evaluating proposals and for recommending to the TC, the contractor to perform the research. The Research Liaison (or a designated substitute RAC member) will be present during the PES evaluation meetings to assist with evaluation procedures.
    b. Before the PES meets:
        i. Each PES member individually reviews and scores all proposals received for the project.
        ii. Each proposal is scored using the proposal evaluation criteria published in the Request for Proposal which was posted on the ASHRAE website to solicit the proposals.
        iii. The PES will then meet to discuss the proposals, either in person or by conference call with prior approval by the Research Liaison.
    c. During the PES meeting:
        i. Each PES member will discuss their opinion of the merits and weaknesses of each proposal with the other PES members. They can also reveal the initial scores they gave each proposal individually per the evaluation criteria.
        ii. After the discussion has been completed, the PES members will complete, or revise individually, their proposal Evaluation Form (PEF) scores based on their personal preference.
        iii. The PES Chair uses the completed PEFs from all PES members to calculate average scores for each proposal and fills out the Summary Sheet for Reporting Evaluation of Proposals.
        iv. As the first step, the PES selects and votes on a bidder to be recommended to the TC. It can be the lowest cost responsive bidder or a higher cost bidder based on the criteria presented in Section 6.1. If a higher cost proposal is recommended, the PES must also provide an explanation on the Summary Sheet to justify this recommendation.

9. The Summary Sheet, and copies of all PEFs and supporting documentation, must be provided – confidentially - to the sponsoring committee for submission to MORTS.

10. Nominations to be considered for RAC Membership should be E-mailed to Mike Vaughn (mvaughn@ashrae.org). Self-nominations are welcome.

NOTES FROM RESEARCH SUBCOMMITTEE MEETING:

1. Scott Fisher RTAR:

   RAC has rejected this RTAR (No. 1695). This committee has dropped this RTAR from any future action.

2. Mehdi Shahrestani (University of Reading in the U.K.) has proposed an RTAR titled "Developing a New Model for Dynamic Simulation of Hydronic Systems." Mehdi's research project deals with developing a computational method of comparing simulations of constant flow hydronic systems to variable flow systems , including all components (pumps, control valves, balancing valves, heating/cooling coils, pipes and fittings). The research project is intended to provide an accurate modeling and precise performance evaluation of Hydronic systems.

   Mr. Mehdi will prepare an RTAR for review by TC 6.1 Research Subcommittee during the New York Winter Meeting.

3. Justin Westmorland and Dick Erby have both volunteered to author a proposed RTAR titled "Steam System versus Heating Hot Water Efficiency Comparison." This research project would include site energy and power plant source energy together to produce a total energy and CO^2 comparison. The resulting comparison may be helpful with new "Green" design standards and Federal MACT requirements.

4. Review of additional topics for development into RTAR submittals:
   a. Copper Tube Fitting Flow Factors and the Hydronic Coil Characteristic Modeling (Mark Hegberg).
   b. Allowance for Aging in Steel and Iron Pipes installed in open hydronic piping systems (Scott Fisher).
   c. Establishing good practice design for minimum and maximum copper tube fluid velocity utilized in open and closed hydronic systems. This would establish values for designers to consider in order to prevent oversizing the piping (too low velocity) or advancing wear of the internal pipe surfaces (too high velocity). This may be a project needing coordination with the Copper Tube Piping Association (Need Author).
   d. Fluid flow control valves having flow limiting and flow regulating characteristics – do they perform as advertised, or are they an expensive disappointment (Robert Walker)?
   e. Performance of ECM motors when applied to pumps – do they provided speed control and energy savings as advertised (Hans B. Hansen)?

5. Motion was tendered to adjourn (and unanimously accepted) the TC 6.1 Research Subcommittee meeting.

END OF MINUTES

Attachments: Attendance Sign-in sheets – two pages.
Current RTAR example forms – five pages

ATTENDANCE LIST

ASHRAE TC 6.1 HYDRONIC & STEAM HEATING EQUIPMENT & SYSTEMS - "RESEARCH" SUBCOMMITTEE

3:15 – 4:15pm - June 24, 2013 – Tower Court B - Tower Building – 2nd Level

Name	Company and Address	Committee Position	Preferred Phone or E-mail Address
Thomas E. Cappellin	E.L. Pruitt Company Inc. 3090 Colt Road Springfield, IL 62707	Subcommittee Chair	tcappellin@msn.com
Edward Tsui	Intelligent Technologies	VM	kcedward@ intelligent-net.com
Scott Fishier	State Farm Mutual	CM	Scott.fishier. AG4J@ statefarm.com
Julia Keen	Kansas State	Chair 6.1	jkeen@ ksu.edu
JASON ATKISSON	AFFILIATED ENGINEERS	Website	jatkisson@ aeieng.com
STEVE HANCOCK	TRANE	SES & RESEARCH LIAISON	STEVE. HANCOCK@ trane. COM
HANS B. HANSEN	GRUNDFOS DENMARK	CM	hbhansen@grundfos.com
Mike McDermott	Grumman Butkus	Program Chair	mmcdermott@ grummanbutkus com

ATTENDANCE LIST

ASHRAE TC 6.1 HYDRONIC & STEAM HEATING EQUIPMENT & SYSTEMS - "RESEARCH" SUBCOMMITTEE

3:15 – 4:15pm - June 24, 2013 – Tower Court B - Tower Building – 2nd Level

Name	Company and Address	Committee Position	Preferred Phone or E-mail Address
Bob Walker	BELIMO AMERICAS 1475 St Lawrence CT Fenton, MI 48430	Sec'y	586 945 1198 robert.walker@us.belimo.com
Rex Scaife	Armstrong Int'l	Handbook Chair	Rexs@ armstronginternational.com

Research Topic Acceptance Request Cover Sheet

Date: February 16, 2012

(Please Check to Insure the Following Information is in the Work Statement)

- A. Title ☑
- B. Applicability to ASHRAE Research Strategic Plan ☑
- C. Application of the Results ☑
- D. State-of-the-Art (background) ☑
- E. Advancement to State-of-the-Art ☑
- F. Justification and Value to ASHRAE ☑
- G. Objective ☑
- H. Estimated Duration ☑
- I. References ☑

Title:
Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Chilled Beams

RTAR# 1666
(To be assigned by MORTS)

Results of this Project will affect the following Handbook Chapters, Special Publications, etc.:

Underfloor Design Guild, DV Design Guide (RP-949), Standard 62.1 Table 6-2, Fundamentals, Applications,

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Responsible TC/TG: TC 5.3

Date of Vote: January 24, 2012

For		12
Against	*	0
Abstaining	*	1
Absent or not returning Ballot	*	5
Total Voting Members		18

Co-sponsoring TC/TG/MTG/SSPCs (give vote and date):
TC 4.7 (7-0-0-0-CNV) January 25,2012

RTAR Lead Author: Fred Bauman, Ian Nelson
Expected Work Statement Lead Author: Fred Bauman, Ian Nelson

Potential Co-funders (organization, contact person information):
Chilled Beam Manufacturers, AHRI

Research Classification:
- ☑ **Basic/Applied Research**
- ☐ **Advanced Concepts**
- ☐ **Technology Transfer**

	Yes	No
Has an electronic copy been furnished to the MORTS?	✓	
Has the Research Liaison reviewed the RTAR?	✓	

* Reasons for negative vote(s) and abstentions

Chair abstained

DRAFT RTAR Template

Title: Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Chilled Beams.

Summary

Describe in summary form the proposed research topic, including what is proposed, why this research is important, how it will be conducted, and why ASHRAE should fund it (50 words maximum)

The project deliverable will be a research report presenting the following: (1) updated literature review of passive beams and combined stratified with passive beams (SPB) systems, (2) detailed description of experimental methods and results, (3) detailed description of CFD model, validation, and simulation results, (4) new guidelines for design and operation of SPB systems to achieve good energy and comfort performance, and (4) analysis of results and development of new calculation methods, energy simulation algorithms, and design tools, if applicable. A full set of all experimental data collected and CFD simulation results will accompany the final report. Upon completion of the project, a technical paper will be prepared to summarize the results of the research, including new guidelines and design tools for SPB systems.

Background

Provide the state of the art with key references (at the end of this document) substantiating it (300 words maximum)

Stratified air distribution systems are known to offer improvement in indoor air quality [1, 2, 3, 4, 5]. These systems are also known to offer some reduction in HVAC energy use [7, 8]. Guidelines for their application have been published by ASHRAE [6]. Building energy modeling of stratified systems has proven to be more challenging, but capabilities have been developed and are now available [7]. Although active chilled beams always result in a well mixed room, ceiling-mounted radiant cooling panels or passive chilled beams can provide additional sensible cooling for stratified air distribution systems.

Although, many studies have reported on displacement ventilation systems combined with chilled ceilings [8] including the impact of these systems on thermal comfort, air quality and energy efficiency [9, 16]., none have reported on the interaction of passive chilled beams and stratified air distribution systems. Limited research on passive beams reported airflow patterns for an isolated passive beam in an environmental chamber with a uniform floor heat load. However the emphasis of these studies was on the velocity profiles of the generated thermal plume [17] and the interaction of a single heat load representing a person at a workstation positioned beneath the passive beam and the beam [18]. Neither study considered the interaction of the passive chilled beam with a stratified air distribution system.

Experimental data collected in environmental chambers has characterized the effect on airflow parameters of combined displacement ventilation and radiant panel systems. Ceiling temperatures lower than 16°C were shown to cause increased local air velocities near the floor, disrupting the displacement airflow pattern [10]. The ceiling temperatures must also be controlled to maintain a temperature stratification that does not exceed the limits for thermal comfort [11]. Heat source thermal plumes were shown to reduce the local velocity of the cooler air induced by the ceilings [14, 15]. Many studies have shown that even with high capacity cooling loads (62 W/m2) the combined systems do not generate velocities that cause draft [10, 11, 12]. The relationship between stratification and the ceiling cooling load was studied and reported that as the fraction of ceiling cooling capacity to the total cooling capacity increased, the room air stratification decreased [16]. Additionally, CFD was used in many studies to model the airflow characteristics and predict the thermal comfort of occupants [14, 15].

All of the research publications reviewed above used radiant panels as the equipment type in the chilled ceiling studies. The characteristics of heat transfer and the resultant airflow pattern for radiant panels is significantly different from passive chilled beams. The conclusions from the combined chilled ceiling plus displacement ventilation (CC/DV) systems do not necessarily apply to stratified systems using passive chilled beams.

Recently, the design, construction, and operation of a new call center with UFAD and passive beams was described [21]. Although the building is performing well from an energy and comfort point of view, one of the lessons learned was the finding that the passive beams disrupted (reduced) stratification more than expected. This result occurred despite CFD simulations during the design phase that predicted otherwise, indicating that the combination of a stratified system with passive beams is still not well understood.

Research Need

Use the state of the art described above as a basis to specify the need for the proposed effort (250 words maximum)

Passive chilled beams combined with stratified air distribution systems perform differently than combined systems using radiant panels, primarily due to the downward convective flow produced by the passive beams. Presently, no studies report the resultant airflow characteristics. Many of the current guidelines for combined systems are only applicable to radiant panel designs, namely the ceiling surface temperature specifications. The experimental data obtained in this project will be used to prepare design guidelines for combined systems that are applicable to passive chilled beams and specify the operating parameters necessary to achieve thermal comfort.

The analysis of the test results will enable designers to predict the significant environmental parameters based on the passive beam design and operational specifications. New algorithms will also enable the development of new and improved energy modeling capabilities for SPB systems.

Project Objectives

Based on the identified research need(s), specify the objectives of the solicited effort that will address all or part of these needs (150 words maximum)

The objectives of this project will be to:

Perform review of literature and selected passive beam projects (if available) to confirm the state of the art and consider opportunities for advancement in parallel with the deliverables identified above.

Conduct full-scale tests with a representative selection of passive chilled beams in combination with stratified air distribution systems (DV and UFAD) for specified test conditions and covering a full range of beam capacity values from zero to the maximum needed to disrupt the stratified performance of the room.

Develop a CFD model of a prototype SPB system and validate against experimental results. Using the validated CFD model, conduct supporting simulations to guide the selection of critical experimental test configurations and enlarge, where appropriate, the database generated by this project.

Analyze the test results to determine new guidelines, calculation methods, or design tools for purposes of predicting the temperature stratification and ventilation performance of the stratified environment.

Develop algorithms or regression equations to predict SPB system performance suitable for implementation in building energy simulation programs.

Expected Approach

Describe in a manner that may be used for assessment of project viability, cost, and duration, the approach that is expected to achieve the proposed objectives (200 words maximum).

Check all that apply: Lab testing [✓] Computations [ ], Surveys [ ], Field tests [✓] Analyses and modeling [✓] Validation efforts [ ] Other (specify) ( )

Conduct full-scale tests with a representative selection of passive chilled beams in combination with stratified air distribution systems (DV and UFAD) for specified test conditions and covering a full range of beam capacity values from zero to the maximum needed to disrupt the stratified performance of the room.

Develop a CFD model of a prototype SPB system and validate against experimental results. Using the validated CFD model, conduct supporting simulations to guide the selection of critical experimental test configurations and enlarge, where appropriate, the database generated by this project.

Analyze the test results to determine new guidelines, calculation methods, or design tools for purposes of predicting the temperature stratification and ventilation performance of the stratified environment.

Develop algorithms or regression equations to predict SPB system performance suitable for implementation in building energy simulation programs.

Relevance and Benefits to ASHRAE

Describe why this effort is of specific interest to ASHRAE, its impact, and how it will benefit ASHRAE and the society. How does it align with ASHRAE Strategic Plans and Initiatives? How does it advance the state of the art in this area in general? Are there other stakeholders that should be approached to obtain relevant information or co-funding? (350 words maximum)

The experimental results and recommendations will result in previously unavailable new design and operating guidelines for combined stratified with passive beams (SPB) systems. New tools and models will improve the ability of designers to evaluate and predict the energy and comfort performance of SPB systems. The improved understanding achieved from this project will allow this promising integrated technology to be considered more confidently by system designers. This will reinforce the value of ASHRAE guidelines to building system designers and help to ensure mechanical system design and installation provides comfort while supporting ASHRAE's net-zero energy design strategies.

Anticipated Funding Level and Duration

Funding Amount Range: $ 150,000 to 200,000

Duration in Months: 18 to 24

References

List the key references cited in this RTAR

[1] Lee, K.S., Z. Jiang, and Q. Chen. 2009. Air distribution effectiveness with stratified air distribution systems. ASHRAE Transactions, 115(2).

[2] Zhang P. 2007. Ventilation Considerations for Indoor Environmental Quality for a Control Center. Proceedings of Clima 2007.

[3] Rimmer J., B. Tully and M. Buck. 2010 Displacement Ventilation as a Viable Solution for Patient Rooms. Proceedings of Clima 2010.

[4] Seppänen, O. 2007. Ventilation Strategies for good indoor air quality and energy efficiency, Proceedings of 2nd PALENC Conference and 28th AIVC Conference on Building Low Energy Cooling and Advanced Ventilation Technologies in the 21st Century, pp. 929 – 35.

[5] Bolster, D. T. and P. F. Linden. 2007. Contaminants in ventilated filling boxes. J. Fluid Mech. (2007), vol. 591, pp. 97–116.

[6] Chen, Q. and L. Glicksman. 2003. System performance evaluation and design guidelines for displacement ventilation. Atlanta, GA: ASHRAE 2003.

[7] Webster, T., F. Bauman, F. Buhl and A. Daly. 2008. Modeling of Underfloor Air Distribution (UFAD) Systems, Proceedings from the Third National Conference of IBPSA-USA, Berkeley, USA

[8] S.B. Riffat, X. Zhao, P.S. Doherty (2004). "Review of research into and application of chilled ceilings and displacement ventilation systems in Europe." International Journal of Energy Research 28: 257-286.

[9] Novoselac A. and Srebric J. 2002. A critical review on the performance and design of combined cooled ceiling and displacement ventilation systems. Energy and Buildings, 34 (5), 497-509.

[10] D.L. Loveday, K. C. P., A.H. Take, S.Hodder, L.D. Jeal (1998). "Designing for Thermal Comfort in Combined Chilled Displacement Ventilation Environments." ASHRAE Transactions 104: 901-911.

[11] Behne M. 1999. Indoor air quality in rooms with cooled ceilings. Mixing ventilation or rather displacement ventilation. Energy and Buildings, 30, 155-166.

[12] K. Fitzner, Displacement ventilation and cooled ceilings, results of laboratory tests and practical installations, Proceedings of Indoor Air '96 1 (1996) 41-50.

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[14] F. Alamdari, N. Eagles, Displacment ventilation and chilled ceilings, Technical Note TN 2/96: 1-32, Building Services Research and Information Association (BSRIA), 1996

[15] H. Brohus, Influence of a cooled ceiling on indoor air qualtiy in a displacement ventilated room examined by means of CFD, Proceedings of Roomvent '98 1 (1998) 53-60.

[16] Schiavon S., Bauman F., Tully B., and Rimmer J. 2012. Room air stratification in combined chilled ceiling and displacement ventilation systems. HVAC&R Research, Vol. 18 (1). http://escholarship.org/uc/item/6xp8p3sx.

[17] J. Fredriksson, M. Sandberg, B. Moshfegh (2001). "Experimental investigation of the velocity field and airflow pattern generated by cooling ceiling beams." Building and Environment 36: 891-899.

[18] R. Kosonen, P. Saarinen, H. Koskela, A. Hole (2010). "Impact of heat load location and strength on air flow pattern with a passive chilled beam system." Energy and Buildings 42: 34-42.

[19] Jiang, Z., Q. Chen., K. Lee, and G. Xue. In press (2012). "Establishment of Design Procedures to Predict Room Airflow Requirements in Partially Mixed Room Air Distribution Systems." Final Report to ASHRAE, ASHRAE Research Project RP-1522. Building Energy and Environment Engineering LLP, Lafayette, IN.

[20] Bauman, F., S. Schiavon, T. Webster, and K.H. Lee. 2010. "Cooling Load Design Tool for UFAD Systems." ASHRAE Journal, pp. 62-71, September.

[21] Weidner, S., J. Doerger, and M. Walsh. 2009. Cooling with less air: Underfloor air and chilled beams. ASHRAEJournal, December.

TC6.1 Handbook Subcommittee Meeting Minutes 6/23/2013

Attendees:

Rex Scare	Scott Fisher
Bob Walker	Hans Hansen
Steve Tredinneck	Mick Schwedler
Jason Atkisson	Rick Mohammed
Mike McDermott	Julia Keen
Edward Tsui	

- Dallas minutes approved – Motion by Jason Atkisson, 2nd by Julia Keen….motion carried.
- Julia shared with the committee a discussion that took place at the Section 6 meeting. There was concern whether TC6.1 was over burdened with the number of chapters we are charged with. Julia sent the following proposal to John Dunlap of Section 6.
    - TC6.2 take the lead on chapter 15 since it is commonly seen in district systems and TC6.1 would act as a Co-author. TC5.3 or TC6.3 be assigned chapter 28 as this does not make sense to be under our committee. Chapter 47 to be Co-authored with TC1.4.
    - Create a new technical committee in section 6 titled Hydronic and Steam Equipment and drop "equipment" from the TC6.1 title. This committee then would be assigned chapters 28, 32, 36, 44, and 48. This would allow TC6.1 to concentrate on system design and focus on chapters 11, 13, 14, 46, and 47 in Systems and Equipment; as well as Chapter 22 in Fundamentals.
- We discussed a comment ASHRAE received regarding “Four Pipe Common Load Systems” in Chapter 13, Hydronic Heating and Cooling. The comments received were to remove the statement “These systems are not allowed for new application in energy standards such as ASHRAE 90.1 and are mentioned here for historical reference.” It was determined to reword this statement to clarify that this is in reference to the return piping mixing hot and cold water, not the valve construction or leakage. The statement will be reworded as “Due to the mixing of hot and chilled return water streams, these systems are not allowed for new application in energy standards such as ASHRAE 90.1 and are mentioned here for historical reference.”
- Discussion took place on comments received on the following chapters:
    - Chapter 48 - Heat Exchangers
    - Chapter 47 - Valves
    - Chapter 14 - Condenser Water Systems
- Chapter 48 and 14 will require a few minor updates. Scott Fisher will be updating Chapter 48 and Steve Tredinnick will be updating Chapter 14. Both Chapter 14 and 48 will be sent out to the Handbook subcommittee for a final review. These chapters will then be sent to the TC6.1 voting members to allow them time to review as we will plan to have an approval vote in NYC in January 2014.
- Chapter 47 had multiple changes and we are looking for more reviewers before approving.
- Chapter 44 – Pumps will be discussed in NYC in January 2014.
- TC6.1 has 11 chapters in the 2016 Systems and Equipment handbook, below is the list of chapters with lead author listed. We still have (3) chapters that need a lead author and will be discussed at the full committee meeting.
    - Chapter 11 – Steam Systems (Lead Author: Ramez Afify)
    - Chapter 13 – Hydronic Heating and Cooling System Design (Lead Author: Mick Schwedler)
    - Chapter 14 – Condenser Water Systems (Lead Author: Steve Tredinnick)
    - Chapter 15 – Medium and High Temperature Water heating system **(Lead Author: Available)**
    - Chapter 28 – Unit Ventilators, Unit Heaters and Makeup Air units **(Lead Author: Available)**
    - Chapter 32 – Boilers (Lead Author: Evans Lizardos)

- Chapter 36 – Hydronic Heat Distributing Units and Radiators **(Lead Author: Available)**
- Chapter 44 – Centrifugal Pumps (Lead Author: Neils Bidstrup)
- Chapter 46 – Pipes, Tubes, and Fittings (Being combined with Fundamentals Chapter 22)
- Chapter 47 – Valves (Lead Author: Bob Walker)
- Chapter 48 – Heat Exchangers (Lead Author: Scott Fisher)

- Fundamentals Chapter 22 will be combined with Chapter 46 above and is still in need of a lead author.
- Meeting adjourned at 7:10 pm