

TC/TG/TRG MINUTES COVER SHEET

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

TC/TG/TRG NO.: TC 4.1 DATE: Amended March 5, 2011

TC/TG/TRG TITLE: LOAD CALCULATION DATA AND PROCEDURES

DATE OF MEETING: June 28, 2010 LOCATION: Albuquerque, NM

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Voting Chris Wilkins Rolando Legarreta Robert Doeffinger Curtis Pederson Steven Bruning Jeffrey Spitler James Pegues Larry Sun Glenn Friedman Charles Barnaby Non-Voting Doug Hittle Stephen Roth Som Shrestha Stephen Roth Gary Wingfield	2009 2009 2007 2007 2008 2007 2008 2008 2009 2010	Voting Non Voting Lynn Bellenger Joe Ferdelman		

DISTRIBUTION:

All Members of TC/TG/TRG

ADDITIONAL DISTRIBUTION:

TAC Chairman: Charles Wilkin, P.E.
 TAC Section Head: Walter T. Grondzik
 Chapter Tech Transfer: Andrew L. Cochrane
 Research Liaison: Dr. T. Agami Reddy
 ALI/PDC: Filza H. Walters
 Special Publications: John A. Clark, P.E.
 2013 HB Fundamentals: Peter Simmonds, PhD
 Standard Liaison: James R. Tauby
 Manager of Standards: Stephanie C. Reinche
 Staff Liaison: Michael R. Vaughn

June 28, 2010
Committee Meeting Minutes
TC4.1 Load Calculations Data and Procedures
Albuquerque, NM

1. Meeting called to order at 2:15 p.m. by Chris Wilkins.
2. Roll call: 9 present out of 10 voting members; Barnaby showed after roll call.
3. Self Introductions.
4. Previous Meeting Minutes Approval – Orlando Meeting Minutes - Distributed.
 - a. Motion by Bruning; Second by Pegues; Motion Carries 9-0-0.
5. No Liaisons were present at the time.
6. Research Sub-Committee Report
 - a. There is a new Research Plan for 2010-2015. A Draft will be available on line.
 - b. There is a current RTAR for HB, Doug Hittle to review, re-structure and submit. A Supplementary letter to consolidate all information and get in by August 15; if any recommendations for additional research suggestions, this will be taken at the Las Vegas meeting.
 - c. Minutes for Louisville RP-1482 heat gain from common office equipment. Were presented for approval
 - d. See Attached Report by Doeffinger.
 - e. Motion by Doeffinger in absence of votes at Louisville to accept such report second by Spittler; with no further discussion; Motion carries 9-0-0.
7. Programs subcommittee Report.
 - a. Friedman mentioned that the program presented by Bruning was excellent, with great turn out.
 - b. Friedman presented he proposed program for Las Vegas; in discussion Sun recommended to consolidate and change the name to “LOAD CALCULATIONS CONSIDERATIONS FOR LOW ENERGY DESIGN” and to be approved as noted having Barnaby, Wilkins, and Legarreta as speakers.
 - c. Motion by Friedman to propose a seminar with the above topic and mentioned presenters; second by Doeffinger; with no further discussion motion is approved 9-0-0.
 - d. Friedman to write the abstract and submit to CEC.
 - e. Next BIM seminar should be in Montreal. Wilkins recommended to not using names, but show interoperability; using the same project building (ASHRAE Headquarters); Legarreta stated that the BIM program should be presented in Montreal and Chicago. That should be decided in Montreal per Wilkins and Friedman.
8. Standards
 - a. Motion by Friedman to move forward the revised method of test for determining heat gains for office equipment; Spittler second.
 - b. Discussion: Bruning to become Liaison with Standards therefore it should be removed from list of people interested. In discussion the first vote needed is to provide a title, purpose and scope as it has been identified in previous

- meetings; Doeffinger made a motion to accept, Pederson second the motion; with no further discussion motion passes 9-0-1 Chairman Wilkins abstained .
- c. Second Item for this proposed Standard is to identify a Chair; Motion by Doeffinger to have Glenn Friedman as Chair, second by Pederson. Motion passes 9-0-1.
 - d. There is no news on Standard `183 after voted in last meetings votes.
 - e. Bruning reported for joint RP-1463 PMS Meeting, that even the scope only required 48 tests, the research team has done over 200; this research project will probably yield 2 seminars and one published paper. Plus one transactions; projected timeline is for Montreal.
9. Suzanne reported the following:
- a. ASHRAE will be taking advantage of retirees that can review papers, etc. if we know of anyone please pass the information to Suzanne and timelines.
 - b. ASHRAE committees should take advantage of webinars, conference calls, meetings, etc. go to meeting.com; contact Mike Vaughn for further information.
 - c. Development of applications for I phone and I pads.
 - d. When new members approach committees they don't feel welcome. Committees should mentor new members.
 - e. Tuesday in the morning there will be training for program chairs, etc.
10. Handbook report by Steve Bruning (See attached).
- a. Barnaby informed Manual J is now an ANSI Standard; for next HB sub-committee meeting to review if chapter 17 Residential Loads is in need of editing to match Manual J as a Standard.
 - b. Minor revisions to Non-Residential Loads are needed per the attached list in HB Report.
11. Old or New Business needing attention.
- a. Reduce meeting space time as needed. PMS meetings should start using webinars or for something with no formal schedule.
12. Splitter Motion to adjourn meeting; Wilkins second.
13. General Meeting adjourned at 4:10 P.M.

Attachments:

Research Sub-Committee Report
Programs Sub-Committee Report
HB Sub-Committee Report
Attendance Sign-in Sheet
TC 4.1 Current Roster



Agenda for - TC4.1 Load Calculation Data & Procedures

**Albuquerque
June 28, 2010**

**TC4.1 Load Calculation Data and Procedures
Monday, June 28, 2010 2:15 PM to 4:15 PM
CC Dona Ana (GL East)**

- | | |
|---|--------------------|
| 1. Call to Order | Chris Wilkins |
| 2. Roll Call | Joe Ferdelman |
| 3. Introduction of Visitors | Chris Wilkins |
| 4. Approval and/or Corrections to Orlando Meeting Minutes | Chris Wilkins |
| 5. Liaison Comments | |
| Handbook | Peter Simmonds |
| Research | John House |
| Programs | ? |
| ALi | Florentino Mendez |
| Staff-Research/Tech Services | Michael R. Vaughn |
| Staff-Standards | Stephanie Reiniche |
| Section Head | Suzanne Levisieur |
| 6. Research Subcommittee Report | Robert Doeffinger |
| 7. Programs Subcommittee Report | Glenn Friedman |
| 8. Standards Subcommittee Report | Glenn Friedman |
| 9. Handbook Subcommittee Report | Steve Bruning |
| Residential Chap 29 | |
| Non-Residential Chap 30 | |
| 10. Old Business | Chris Wilkins |
| 11. New Business | Chris Wilkins |
| 12. Adjournment | Chris Wilkins |



Meetings

TC 4.1 Load Calculation Data and Procedures (20/10)

Monday 2:15-4:15p (CC) Dona Ana (GL-East)

*Sponsoring: Seminar 8 BIM Load Calculations - Pain or
Pleasure? A Case Study Involving the ASHRAE Headquarters
Building*

TC 4.1 Handbook

Sunday 3:00-4:00p (CC) Nambe (LL)

TC 4.1 Research (10/5)

Sunday 4:00-5:00p (CC) Nambe

TC 4.1 Programs & Standards (10/5)

Sunday 5:00-6:00p (CC) Nambe

Introduction of officers and voting members for 2010:

Chris Wilkins	Chair	Voting
Rolando Legarreta	ViceChair	Voting
Joseph Ferdelman	Secretary	Non-Voting
Steven Bruning	Handbook Subc Chair	Voting
Robert Doeffinger, Jr	Research Subc Chair	Voting
Glenn Friedman	Stds/Prog Subc.Chair	Voting
Lynn Bellenger		Voting
Curtis Pedersen		Voting
James Pegues		Voting
Jeff Spittler		Voting
Larry Sun		Voting



® ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

TC4.1 Load Calculation Data & Procedures

Albuquerque, NM

June 26-30, 2010

Handbook Subcommittee Report

Sunday, June 27, 3:00 PM to 4:00 PM

Convention Center, Nambe Room

1. **Handbook Committee Liaison Comments:** Peter Simmonds, Liaison to TC4.1. – at Fundamentals coordination meeting Sunday morning Peter confirmed the below submittal dates for our chapters.

2. **Schedule for 2013 HoF Chapters:**
 - 2010 June – Complete Review of Chapters – Identify Improvements – Assign revisers
 - 2011 January – Revisers report progress – provide draft individual revisions
 - 2011 June – Rough draft overall chapters
 - 2012 January – Full draft overall chapters reviewed by Handbook subcommittee
 - 2012 April – Deadline for new research results to be incorporated in chapters
 - 2012 June – Final chapters approved by full TC**
 - 2012 July 12 – Chapter 17 submitted to Simmonds/ASHRAE
 - 2012 July 19 – Chapter 18 submitted to Simmonds/ASHRAE
 - 2013 June – HoF Published

3. **Handbook CD+:**

CD+ being discontinued in favor of Handbook On-Line. Inclusion of enhancements like master example, RTS and CTS spreadsheets being considered.

LBL has completed their UFAD load calc tool that might be a good addition to the enhanced features once ASHRAE has those set up for on-line access. Fred Bauman will send link to access to Steve Bruning to pass along to TC4.1.

4. **Chapter 17 Residential Loads:**

Discussed three reviews received and handed out. Additional comments were

 - infiltration loads look low, particularly for older existing homes
 - heating warm-up time addressed, but not cooling pull-down time
 - in example, heating load from slab edge looks high relative to other components

See attached summary of Improvements Needed. Revisers to be assigned at full TC meeting.

TC4.1 Handbook Subcommittee 2009 HOF Chapter 17

Residential Cooling and Heating Load Calculations

Reviser:

Possible Improvements List

June 28, 2010

Doeffinger

R-1

Review empahsis on infiltration and ventilation relative to typical residential construction. Coordinate with Chapter 16 and possible revisions to that chapter. Reviewer comment that I&V emphasis is "overblown".

R-2

Incorporate editorial comments from Som Shrestha Word file.

R-3

Example - recheck infiltration load - very high relative to the rest of the load components. Re-examine appropriatness of calculation method for typical residential construction.

R-4

Chapter addressses warm-up load but not cool-down. Research availability of data and incorporate.

R-5

Recheck example- load for uninsulated slab edge very high relative to other components.

Unique Tracking Number Assigned by MORTS tbd
RESEARCH TOPIC ACCEPTANCE REQUEST (RTAR) FORM
Sponsoring TC/TG/SSPC: TC 4.1

Title:

"*Revise Load Calculation Applications Manual (2009)*"

Abstract

This project revises the ASHRAE *Load Calculation Applications Manual* (Spitler, 2009) to incorporate significant advances for peak cooling and heating load estimating data and procedures resulting from recently completed ASHRAE research.

Applicability to ASHRAE Research Strategic Plan:

This project directly supports goal E1 in the Education and Outreach theme of the 2005-2010 Research Strategic Plan: "Make the results of ASHRAE sponsored and cooperative research available to the technical community". The proposed project will incorporate the results of four recent ASHRAE-funded research projects (RP-1363, RP-1453, RP-1311, RP-1362) into a new edition of the *Load Calculation Applications Manual*. This will require updating chapters discussing load calculation procedures, spreadsheet software for performing the calculations, and the example problem which demonstrates use of the procedures. By publishing this information in an application manual, a format likely to be more widely used in engineering practice and teaching than the *Handbook - Fundamentals* alone, the research results will reach a wider audience and provide greater benefit to our industry.

Research Classification:

Technology Transfer

TC/TG/SSPC Vote:

10 yes/ 0 no/ 0 abstain

Reasons for Negative Votes and Abstentions:

NA

Estimated Cost:

\$100,000

Estimated Duration:

18 months

RTAR Lead Author

James Pegues
Carrier Corporation
james.f.pegues@carrier.utc.com

Expected Work Statement Lead Author

James Pegues
Carrier Corporation
james.f.pegues@carrier.utc.com

Co-sponsoring TC/TG/SSPCs and votes:

none

Possible Co-funding Organizations:

none

Application of Results:

This research project will produce an ASHRAE Special Publication: the *Load Calculation Applications Manual, 2nd edition*. Separate versions of the manual using IP units and SI Metric units will be produced.

State-of-the-Art (Background):

ASHRAE research project RP-1326, *Load Calculation Applications Manual*, produced an application manual representing current state of the art for peak cooling and heating load procedures and data. By publishing this information in an application manual it was hoped the information would reach a wider audience than that reached by the *Handbook - Fundamentals* alone, thereby increasing the effective use of the information by our industry.

The 2009 edition of the *Load Calculation Applications Manual* utilized information from the 2005 *Handbook - Fundamentals* and the decades of ASHRAE and industry research the *Handbook* is based upon. A few pertinent research projects, among many, contributing to this information were projects dealing with:

- The Heat Balance Method (Pedersen, Fischer and Liesen, 1997).
- The Radiant Time Series Method (Spitler, Fisher, and Pedersen, 1997).
- Design Weather Data (Thevenard and Humphries, 2005).

- Clear Sky Solar Radiation Profiles (Threlkeld, 1963).
- Calculation of solar heat gain for fenestration with shading devices (Klems and Warner, 1997)
- Heat gain from lighting fixtures (Fisher and Chantrasrisalai, 2006).
- Heat gain from commercial cooking equipment (Fisher, 1998).
- Heat gain from office equipment (Wilkins and Hosni, 2000).

Shortly after the first edition of the *Load Calculation Applications Manual* was finished, four ASHRAE research projects were completed which made significant advances in procedures and data for clear sky solar radiation profiles, design weather data, calculation of solar heat gain for fenestration shading devices and heat gain from commercial cooking equipment. This creates an information gap between the first edition of the Applications Manual and the new state of the art. The objective of this proposed project is to close the information gap by incorporating the new research into a second edition of the Applications Manual.

Advancement to the State-of-the-Art:

Four ASHRAE research projects completed in 2009 made important advances in the state of the art for estimating peak cooling loads:

- **RP-1453** - Updating ASHRAE Climatic Data for Design and Standards - Provides new procedures for accurately representing design day clear sky solar radiation profiles. These replace existing procedures originally formulated in the late 1950s and early 1960s. This project also provided new climatic design data based on the latest weather observations worldwide.
- **RP-1363** - Generation of Hourly Design Day Weather Data - Provides new procedures for accurately representing design day dry-bulb and wet-bulb temperature profiles.
- **RP-1311** - Improving Load Calculations for Fenestration with Shading Devices - Provides new procedures and data for calculating solar heat gain for fenestration and fenestration shading devices such as blinds, shades, drapes, and screens.
- **RP-1362** - Revised Heat Gain and Capture and Containment Exhaust Rates for Commercial Cooking Appliances - Provides new data for kitchen equipment heat gains, based on current equipment types and the latest measurement techniques.

In addition, ongoing ASHRAE research is likely to further advance the state of the art and will be worthy of inclusion in a revised Application Manual. Among the ongoing projects worthy of consideration:

- **RP-1482** - Update to Measurements of Office Equipment Heat Gain Data - Will provide new data for office equipment heat gains, based on current equipment types and the latest measurement techniques.
- **RP-1416** - Development of Internal Surface Convection Correlations for Energy and Load Calculation Methods - Will provide new data and procedures for determining internal surface convection coefficients.

Inclusion of results from RP-1453, RP-1363, RP-1311 and RP-1362 will bring the *Load Calculation Applications Manual* up to par with state of the art information in the *2009 Handbook - Fundamentals*. Inclusion of results from further projects such as RP-1482 and RP-1416 will extend the state of the art represented in the Applications Manual further.

In addition to documenting state-of-the-art load calculation procedures, the manual also demonstrates the use of the procedures with examples. The 1st edition of the manual used the pre-renovation ASHRAE HQ building for these examples. The 2nd edition will utilize the post-renovation ASHRAE HQ building. In this way use of state-of-the-art procedures for a state-of-the-art building can be demonstrated.

Justification and Value to ASHRAE:

Compiling current state of the art information about cooling and heating load estimating into a single focused publication is essential to ASHRAE and its members. It places the information in a readily accessible format for practitioners that is efficient to use. It provides academic members with information in a format effective for teaching environments. It facilitates the wider dissemination of ASHRAE research results to the industry, furthering ASHRAE's mission.

Objectives:

The objective of the project is to revise the *Load Calculations Application Manual, 1st edition* to produce a second edition. The second edition will

- Incorporate results from recently completed ASHRAE research projects RP-1453, RP-1363, RP-1311 and RP-1362.
- Incorporate results from ongoing ASHRAE research projects completed in a timely manner. Possible projects include RP-1482 and RP-1416.
- Update the example problems to utilize floor plan and construction data for the renovated ASHRAE HQ building.
- Update the software spreadsheets included with the manual to incorporate the new load calculation procedures.
- Offer separate IP units and SI Units versions of the manual.

Specific portions of the manual that will be updated to achieve these objectives include:

- Chapter 4 - Update to reference new procedures for clear sky solar radiation and design temperature/humidity profile calculations. Update sample climate data tables to use current data.
- Chapter 6 - Update to include new cooling equipment heat gain data, and possibly new office equipment heat gain data.
- Chapter 7 - Update to incorporate new shaded fenestration solar heat gain calculation procedures and data tables.
- Chapter 8 - Update the example problem to utilize floor plan and construction data for the renovated ASHRAE HQ building, and to incorporate the new load calculation data and procedures.
- Radiant Time Series Method (RTSM) Spreadsheet Software - Update software to include new data and calculation procedures.
- Appendix B - Update to reflect changes made to the RTSM spreadsheet software.
- Appendix D - Update to document the new clear sky solar radiation calculation procedures and data.

In the list above, it is anticipated that changes to Chapter 8 and the RTSM spreadsheet software will be a significant part of the project cost.

Finally, it should be noted TC 4.1's longer term goal is to place the *Load Calculation Applications Manual* on continuous maintenance, synchronizing its revision with the publication of the *Handbook - Fundamentals* so that both publications continually represent state of the art for cooling and heating load estimating procedures and data. This proposed project is the first step in establishing a continuous maintenance regime.

Key References:

ASHRAE Research Completed Prior to 2009

Fisher, D.R. 1998. New recommended heat gains for commercial cooking equipment. *ASHRAE Transactions* 104(2):953-60.

Fisher, D.E. and C. Chantrasrisalai. 2006. Lighting heat gain distribution in buildings. ASHRAE RP-1282, *Final Report*.

Klems, J.H. and J.L. Warner. 1997. Solar heat gain coefficient of complex fenestrations with a venetian blind for differing slat angles. *ASHRAE Transactions* 103(1):1026-1034

Pedersen, C.O., D.E. Fisher, and R.J. Liesen. 1997. Development of a heat balance procedure for calculating cooling loads. *ASHRAE Transactions* 103(2):459-468.

Spitler, J.D., D.E. Fisher, and C.O. Pedersen, 1997. The radiant time series cooling load calculation procedure. *ASHRAE Transactions* 103(2).

Spitler, J.D. 2009. *Load Calculation Applications Manual*. ASHRAE Research Project 1326.

Thevenard, D. and R. Humphries. 2005. The calculation of climatic design conditions in the 2005 ASHRAE Handbook - Fundamentals. *ASHRAE Transactions* 111(1):457-466.

Threlkeld, J.L. 1963. Solar irradiation of surfaces on clear days. *ASHRAE Transactions* 69:24.

Wilkins, C.K. and M.H. Hosni. Heat gain from office equipment. *ASHRAE Journal* 42(6):33-44.

New ASHRAE Research Completed During 2009

Hedrick, R. 2009. Generation of hourly design-day weather data (RP-1363). ASHRAE Research Project, *Final Report*.

Swierczyna, R., P.A. Sobiski, and D. Fisher. 2009. Revised heat gain and capture and containment exhaust rates from typical commercial cooking appliances (RP-1362). ASHRAE Research Project, *Final Report*.

Thevenard, D. 2009. Updating the ASHRAE climatic data for design and standards (RP-1453). ASHRAE Research Project, *Final Report*.

Wright, J.L., C. Barnaby, M.R. Collins and N.A. Kotey. 2009. Improving load calculations for fenestrations with shading devices. ASHRAE Research Project RP-1311, *Final Report*.



® FORM FOR PROPOSING STANDARD/GUIDELINE PROJECT

Name: Glenn Friedman
Address: Taylor Engineering
1080 Marina Village Parkway, Suite 501, Alameda, CA 94501
Phone: (510) 263-1542
Fax: (510) 749-9136
Email: GFRIEDMAN@TAYLOR-ENGINEERING.COM

Representing:

- Self
 TC/TG TC4.1
 ASHRAE Committee _____
 Other Standards Writing Organization _____

If this is the recommendation of the TC/TG, the following must be completed:

TC/TG Vote Yes (Yes-No-Abstain-Absent)

This TC/TG vote was taken at a TC/TG Meeting: Date: 6/28/2010 Location Albuquerque, NM

This TC/TG vote was taken by Letter Ballot: Date: _____

TC/TG Recommendation for Chair: _____

TC/TG Vote for Chair: _____ (Yes-No-Abstain-Absent)

This TC/TG vote was taken at a TC/TG Meeting: Date: 6/28/2010 Location Albuquerque, NM

This TC/TG vote was taken by Letter Ballot: Date: _____

Please complete the following:

- I would like to propose a Standard Guideline
- What type of a document is required? Method of Test
- Is research required on this project before the standard or guideline can be written?
 Yes No
- Proposed Cognizant TC/TG (if known): TC4.1
- Does the document need ANSI accreditation? Yes No
- Can another group produce the document more effectively? Yes No
- What is the likely frequency of revision of the document? 5-10 years
- Can the topic be addressed through revision of an existing document?



® FORM FOR PROPOSING STANDARD/GUIDELINE PROJECT

Return Form to:

Attn: Procedures Administrator

ASHRAE

1791 Tullie Cir, NE

Atlanta, GA 30329

Telephone: 404.636.8400

Fax: 404.321.5478

Email: procadm@ashrae.net

TC 4.1 Meeting Sign-in Sheet

Albuquerque, NM
June 28, 2010

	Name	Member Status (Voting, Non-Vote, Etc.)	Chairman	Affiliation	Email	Telephone
1	Christopher Wilkins ✓	Voting	Chairman	Holtam-ICS	Cwilliams@holtam-ics.com	(803) 658-4891
2	Glenn Friedman ✓	Voting	Standards/Program Subc.	Taylor Eng.	gfriedman@taylor-engineering.com	570 263-1542
3	Rolando Legarreta ✓	Voting	Vice Chair/Webmaster	Alegro Eng.	rlegarrete@alegro	915-533-0700
4	Lynn Bellenger (NO)	Voting	Member			
5	Joe Ferdelman (NO)	Voting	Secretary			
6	Robert Doeffinger ✓	Voting	Research Subcommittee	ZMM, Inc.	r.cd@zmm.com	304 842 0159
7	Curtis Pederson ✓	Voting	Member	U of Illinois	cpeders@uiuc.edu	612 525 0660
8	Steven Bruning ✓	Voting	Handbook Sub-Committee	OSU	spitler@okstate.edu	405-744-6578
9	Jeffrey Spittler ✓	Voting	Member	CARRIER CORP	JAMES.F.AGUES@CARRIER.ITE.COM	515-432-9526
10	Jim Pegues ✓	Voting	Member	Carrier Corp.	robert.howe@carrier.ite.com	
11	Bob Howe	Voting	Guest	TKS	lism@tkscorp.com	
12	Barry Sun	Voting	Member	wrightsoft	clawson@wrightsoft.com	781-862
13	Chris Barnab	Voting	CONF	Florida State U	hittle@cs.cobalt.net	909 888 1157
14	Dale HITTLE	NV	CONF	Carrier Corp.	SCOTH@CARRIER.ITE.COM	415-225-0030
15	Stephen Roth	NV	Member Conf	ORNL	shrestha@ornl.gov	515-507-4646
16	SOM SHRESTHA	PEM, NV	CONF	Thermo Fluids Tech	amirjokar@gmail.com	
17	Amir JOKAR		GUEST			
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Unique Tracking Number Assigned by MORTS tbd
RESEARCH TOPIC ACCEPTANCE REQUEST (RTAR) FORM
Sponsoring TC/TG/SSPC: TC 4.1

Title:

"*Revise Load Calculation Applications Manual (2009)*"

Abstract

This project revises the ASHRAE *Load Calculation Applications Manual* (Spitler, 2009) to incorporate significant advances for peak cooling and heating load estimating data and procedures resulting from recently completed ASHRAE research.

Applicability to ASHRAE Research Strategic Plan:

This project directly supports goal E1 in the Education and Outreach theme of the 2005-2010 Research Strategic Plan: "Make the results of ASHRAE sponsored and cooperative research available to the technical community". The proposed project will incorporate the results of four recent ASHRAE-funded research projects (RP-1363, RP-1453, RP-1311, RP-1362) into a new edition of the *Load Calculation Applications Manual*. This will require updating chapters discussing load calculation procedures, spreadsheet software for performing the calculations, and the example problem which demonstrates use of the procedures. By publishing this information in an application manual, a format likely to be more widely used in engineering practice and teaching than the *Handbook - Fundamentals* alone, the research results will reach a wider audience and provide greater benefit to our industry.

Research Classification:

Technology Transfer

TC/TG/SSPC Vote:

10 yes/ 0 no/ 0 abstain

Reasons for Negative Votes and Abstentions:

NA

Estimated Cost:

\$100,000

Estimated Duration:

18 months

RTAR Lead Author

James Pegues
Carrier Corporation
james.f.pegues@carrier.utc.com

Expected Work Statement Lead Author

James Pegues
Carrier Corporation
james.f.pegues@carrier.utc.com

Co-sponsoring TC/TG/SSPCs and votes:

none

Possible Co-funding Organizations:

none

Application of Results:

This research project will produce an ASHRAE Special Publication: the *Load Calculation Applications Manual, 2nd edition*. Separate versions of the manual using IP units and SI Metric units will be produced.

State-of-the-Art (Background):

ASHRAE research project RP-1326, *Load Calculation Applications Manual*, produced an application manual representing current state of the art for peak cooling and heating load procedures and data. By publishing this information in an application manual it was hoped the information would reach a wider audience than that reached by the *Handbook - Fundamentals* alone, thereby increasing the effective use of the information by our industry.

The 2009 edition of the *Load Calculation Applications Manual* utilized information from the *2005 Handbook - Fundamentals* and the decades of ASHRAE and industry research the *Handbook* is based upon. A few pertinent research projects, among many, contributing to this information were projects dealing with:

- The Heat Balance Method (Pedersen, Fischer and Liesen, 1997).
- The Radiant Time Series Method (Spitler, Fisher, and Pedersen, 1997).
- Design Weather Data (Thevenard and Humphries, 2005).

- Clear Sky Solar Radiation Profiles (Threlkeld, 1963).
- Calculation of solar heat gain for fenestration with shading devices (Klems and Warner, 1997)
- Heat gain from lighting fixtures (Fisher and Chantrasrisalai, 2006).
- Heat gain from commercial cooking equipment (Fisher, 1998).
- Heat gain from office equipment (Wilkins and Hosni, 2000).

Shortly after the first edition of the *Load Calculation Applications Manual* was finished, four ASHRAE research projects were completed which made significant advances in procedures and data for clear sky solar radiation profiles, design weather data, calculation of solar heat gain for fenestration shading devices and heat gain from commercial cooking equipment. This creates an information gap between the first edition of the Applications Manual and the new state of the art. The objective of this proposed project is to close the information gap by incorporating the new research into a second edition of the Applications Manual.

Advancement to the State-of-the-Art:

Four ASHRAE research projects completed in 2009 made important advances in the state of the art for estimating peak cooling loads:

- **RP-1453** - Updating ASHRAE Climatic Data for Design and Standards - Provides new procedures for accurately representing design day clear sky solar radiation profiles. These replace existing procedures originally formulated in the late 1950s and early 1960s. This project also provided new climatic design data based on the latest weather observations worldwide.
- **RP-1363** - Generation of Hourly Design Day Weather Data - Provides new procedures for accurately representing design day dry-bulb and wet-bulb temperature profiles.
- **RP-1311** - Improving Load Calculations for Fenestration with Shading Devices - Provides new procedures and data for calculating solar heat gain for fenestration and fenestration shading devices such as blinds, shades, drapes, and screens.
- **RP-1362** - Revised Heat Gain and Capture and Containment Exhaust Rates for Commercial Cooking Appliances - Provides new data for kitchen equipment heat gains, based on current equipment types and the latest measurement techniques.

In addition, ongoing ASHRAE research is likely to further advance the state of the art and will be worthy of inclusion in a revised Application Manual. Among the ongoing projects worthy of consideration:

- **RP-1482** - Update to Measurements of Office Equipment Heat Gain Data - Will provide new data for office equipment heat gains, based on current equipment types and the latest measurement techniques.
- **RP-1416** - Development of Internal Surface Convection Correlations for Energy and Load Calculation Methods - Will provide new data and procedures for determining internal surface convection coefficients.

Inclusion of results from RP-1453, RP-1363, RP-1311 and RP-1362 will bring the *Load Calculation Applications Manual* up to par with state of the art information in the *2009 Handbook - Fundamentals*. Inclusion of results from further projects such as RP-1482 and RP-1416 will extend the state of the art represented in the Applications Manual further.

In addition to documenting state-of-the-art load calculation procedures, the manual also demonstrates the use of the procedures with examples. The 1st edition of the manual used the pre-renovation ASHRAE HQ building for these examples. The 2nd edition will utilize the post-renovation ASHRAE HQ building. In this way use of state-of-the-art procedures for a state-of-the-art building can be demonstrated.

Justification and Value to ASHRAE:

Compiling current state of the art information about cooling and heating load estimating into a single focused publication is essential to ASHRAE and its members. It places the information in a readily accessible format for practitioners that is efficient to use. It provides academic members with information in a format effective for teaching environments. It facilitates the wider dissemination of ASHRAE research results to the industry, furthering ASHRAE's mission.

Objectives:

The objective of the project is to revise the *Load Calculations Application Manual, 1st edition* to produce a second edition. The second edition will

- Incorporate results from recently completed ASHRAE research projects RP-1453, RP-1363, RP-1311 and RP-1362.
- Incorporate results from ongoing ASHRAE research projects completed in a timely manner. Possible projects include RP-1482 and RP-1416.
- Update the example problems to utilize floor plan and construction data for the renovated ASHRAE HQ building.
- Update the software spreadsheets included with the manual to incorporate the new load calculation procedures.
- Offer separate IP units and SI Units versions of the manual.

Specific portions of the manual that will be updated to achieve these objectives include:

- Chapter 4 - Update to reference new procedures for clear sky solar radiation and design temperature/humidity profile calculations. Update sample climate data tables to use current data.
- Chapter 6 - Update to include new cooling equipment heat gain data, and possibly new office equipment heat gain data.
- Chapter 7 - Update to incorporate new shaded fenestration solar heat gain calculation procedures and data tables.
- Chapter 8 - Update the example problem to utilize floor plan and construction data for the renovated ASHRAE HQ building, and to incorporate the new load calculation data and procedures.
- Radiant Time Series Method (RTSM) Spreadsheet Software - Update software to include new data and calculation procedures.
- Appendix B - Update to reflect changes made to the RTSM spreadsheet software.
- Appendix D - Update to document the new clear sky solar radiation calculation procedures and data.

In the list above, it is anticipated that changes to Chapter 8 and the RTSM spreadsheet software will be a significant part of the project cost.

Finally, it should be noted TC 4.1's longer term goal is to place the *Load Calculation Applications Manual* on continuous maintenance, synchronizing its revision with the publication of the *Handbook - Fundamentals* so that both publications continually represent state of the art for cooling and heating load estimating procedures and data. This proposed project is the first step in establishing a continuous maintenance regime.

Key References:

ASHRAE Research Completed Prior to 2009

Fisher, D.R. 1998. New recommended heat gains for commercial cooking equipment. *ASHRAE Transactions* 104(2):953-60.

Fisher, D.E. and C. Chantrasrisalai. 2006. Lighting heat gain distribution in buildings. ASHRAE RP-1282, *Final Report*.

Klems, J.H. and J.L. Warner. 1997. Solar heat gain coefficient of complex fenestrations with a venetian blind for differing slat angles. *ASHRAE Transactions* 103(1):1026-1034

Pedersen, C.O., D.E. Fisher, and R.J. Liesen. 1997. Development of a heat balance procedure for calculating cooling loads. *ASHRAE Transactions* 103(2):459-468.

Spitler, J.D., D.E. Fisher, and C.O. Pedersen, 1997. The radiant time series cooling load calculation procedure. *ASHRAE Transactions* 103(2).

Spitler, J.D. 2009. *Load Calculation Applications Manual*. ASHRAE Research Project 1326.

Thevenard, D. and R. Humphries. 2005. The calculation of climatic design conditions in the 2005 ASHRAE Handbook - Fundamentals. *ASHRAE Transactions* 111(1):457-466.

Threlkeld, J.L. 1963. Solar irradiation of surfaces on clear days. *ASHRAE Transactions* 69:24.

Wilkins, C.K. and M.H. Hosni. Heat gain from office equipment. *ASHRAE Journal* 42(6):33-44.

New ASHRAE Research Completed During 2009

Hedrick, R. 2009. Generation of hourly design-day weather data (RP-1363). ASHRAE Research Project, *Final Report*.

Swierczyna, R., P.A. Sobiski, and D. Fisher. 2009. Revised heat gain and capture and containment exhaust rates from typical commercial cooking appliances (RP-1362). ASHRAE Research Project, *Final Report*.

Thevenard, D. 2009. Updating the ASHRAE climatic data for design and standards (RP-1453). ASHRAE Research Project, *Final Report*.

Wright, J.L., C. Barnaby, M.R. Collins and N.A. Kotey. 2009. Improving load calculations for fenestrations with shading devices. ASHRAE Research Project RP-1311, *Final Report*.