

INVITATION TO SUBMIT A RESEARCH PROPOSAL ON AN ASHRAE RESEARCH PROJECT

1784-TRP, “Repeatability and reproducibility assessment of ASHRAE Standard 52.2 as currently amended”

Attached is a Request-for-Proposal (RFP) for a project dealing with a subject in which you, or your institution have expressed interest. Should you decide not to submit a proposal, please circulate it to any colleague who might have interest in this subject.

Sponsoring Committee: TC 2.4, Particulate Air Contaminants and Particulate Removal Equipment
Co-sponsored by: SSPC 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

Budget Range: \$195,000 may be more or less as determined by value of proposal and competing proposals.

Scheduled Project Start Date: **April 1, 2019** or later.

All proposals must be received at ASHRAE Headquarters by 8:00 AM, EST, December 17th. NO EXCEPTIONS, NO EXTENSIONS. Electronic copies must be sent to rpbids@ashrae.org. Electronic signatures must be scanned and added to the file before submitting. The submission title line should read: 1784-TRP, “Repeatability and reproducibility assessment of ASHRAE Standard 52.2 as currently amended”, and “*Bidding Institutions Name*” (electronic pdf format, ASHRAE’s server will accept up to 10MB)

If you have questions concerning the Project, we suggest you contact one of the individuals listed below:

For Technical Matters

Technical Contact
Geoff Crosby
Lydall Performance Materials
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For Administrative or Procedural Matters:

Manager of Research & Technical Services (MORTS)
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Contractors intending to submit a proposal should so notify, by mail or e-mail, the Manager of Research and Technical Services, (MORTS) by December 3rd in order that any late or additional information on the RFP may be furnished to them prior to the bid due date.

All proposals must be submitted electronically. Electronic submissions require a PDF file containing the complete proposal preceded by signed copies of the two forms listed below in the order listed below. **ALL electronic proposals are to be sent to rpbids@ashrae.org.**

All other correspondence must be sent to ddaniel@ashrae.org and mvaughn@ashrae.org. Hardcopy submissions are not permitted. **In all cases, the proposal must be submitted to ASHRAE by 8:00 AM, EST, December 17, 2018. NO EXCEPTIONS, NO EXTENSIONS.**

The following forms (Application for Grant of Funds and the Additional Information form have been combined) must accompany the proposal:

- (1) ASHRAE Application for Grant of Funds (electronic signature required) and
- (2) Additional Information for Contractors (electronic signature required) ASHRAE Application for Grant of Funds (signed) and

ASHRAE reserves the right to reject any or all bids.

State of the Art (Background)

ASHRAE Standard 52.2, which specifies test equipment and procedures for determining particle filter efficiencies, was first published in 1999. Results are used to classify tested filters according to their Minimum Efficiency Reporting Value (MERV). Commercial filter MERVs range from 4-16.

In 2001, several laboratories participated in ASHRAE research project 1088-RP Coordinate and analyze inter-laboratory testing of filters under ASHRAE Standard 52.2 to determine the adequacy of the Apparatus Qualification Tests (final report 2005). That project organized inter-laboratory testing to validate the new standard. It found that there were variations in results that sometimes led to the unacceptable situation that some laboratories determined different MERVs for the same filter. Recommendations were presented to address this situation. The 52.2 Committee has further investigated and addressed variation through informal inter-laboratory testing by 52.2 participants, and through ASHRAE research projects such as 1287-RP Particle Counter Specifications for use with Standard 52.2.

Based on these efforts, SSPC 52.2 has recently approved changes to the Standard, including restricting measuring instruments to optical particle counters, laying down specifications for the counters, narrowing the acceptable range of relative humidity to use in the test rig, and changing some of the efficiency ranges used to calculate MERV. These changes have been published as 52.2-2017. Today, there is no data to establish the combined effect of all changes since 2005 on measured filter efficiencies.

Furthermore, Appendix J: Optional Method of Conditioning a filter Using Fine KCl Particles to Demonstrate Efficiency Loss that Might be Realized in Field Applications was adopted after the 1088-RP round robin was completed. This also needs to be evaluated for variability.

It would be expected that labs recruited for this research will be able to run 52.2-2017 by the time this research is approved.

Justification and Value to ASHRAE

ASHRAE Standard 52.2 is under continuous maintenance, and this project provides an opportunity for test method improvements. The standard is currently widely used in areas concerned with filtration and Indoor Air Quality, including implementation of ASHRAE Standards 62.1 and 62.2. People affected by the standard include building operators, filter manufacturers, HVAC PIs, HVAC manufacturers, government, and research facilities. Many people working in these areas are ASHRAE members and will be impacted by the effectiveness of the Standard. Improving Standard 52.2 will also make it more acceptable to filter manufacturers and suppliers, testing laboratories, and international standard developers.

This project also supports the ASHRAE 2014 Strategic Plan. One Goal in the Strategic Plan is “Adapt: Work collaboratively within the global community to increase the value, usefulness and accessibility of building sciences and technology”. This includes working to “ensure that ASHRAE’s products, programs, and services are well aligned to meet the needs of the global building industry.” Likewise, INITIATIVE 3: Applied Product Development is aimed at the changing “world of prescriptive and performance-based standards.” ASHRAE plans to make sure that its standards are applicable to the changing needs of the world. Also, under the OUTCOMES AND MEASURES: THE PLAN’S STRATEGIC IMPACT section, ASHRAE will continue its work to “Improve building performance” by assessing progress and making needed adjustments”. This project aims to improve the outcome of the ASHRAE 52.2 test, and so will help building owners and operators choose filters that will improve the air quality portion of building performance. An improved Standard 52.2 will increase the test method’s use and world-wide acceptance. Therefore, this project readily meets these three goals in the 2014 Strategic Plan.

The knowledge gained from this project may be used to improve ASHRAE 52.2 as well as test methods related to ASHRAE 52.2, such as ASHRAE Standard 145.2 and the ISO particle filter test method 16890-2, and methods for ultrafine particle filter testing.

This project will provide information for inclusion in the HVAC Systems and Equipment Handbook, Chapter 29: Air cleaners for particulate contaminants.

Objectives

The objective of this project is to determine repeatability and variability of the ASHRAE 52.2-2017 (inclusive of all changes since 2001) test method and to recommend improvements to the methods. Testing will include measurement of the pressure drop, initial efficiency, and efficiency after dust loading. Appendix J conditioning with fine KCl particles would be conducted as a subset on high efficiency filters. As recommended in 1088-RP, dust holding capacity testing will not be included (revisions to Standard 52.2 did not affect these procedures).

A scheme of initial efficiency testing needs to be devised that will explore variances in filter media, filter type and filter efficiency etc. Data collected should permit ranking of the sources of variance examined, and should also deliver information on whether the overall variance of the test method has improved since 1088-RP was conducted. Current standard states acceptable variability of +/- five percentage points on any given particle size channel when comparing reference efficiency curves as a starting point.

The results of this project would be reviewed and evaluated by SSPC 52.2 and TC 2.4 for possible action items (further research, tightening methodology / practices, etc.) to further improve Standard 52.2.

Scope:

This project is divided into 4 tasks as shown below. The completion of each task will serve as a project milestone.

- 1) Selection of 52.2 test laboratories
- 2) Test design and filter selection
- 3) Data collection
- 4) Data analysis and reporting

Task 1 - Selection of 52.2 test laboratories:

In this task, the PI will determine which labs are running ASHRAE 52.2-2017 and contact them to determine their capabilities and willingness to participate in the project. The PI should include in their bid the criteria, process and method in lab selection. At a minimum, the laboratories must have a quality control procedure for monitoring the validity of tests and calibrations undertaken. Since ASHRAE has agreed that the labs may be compensated for their testing as this is an expensive test to run, testing service agreements, including cost and timeframes, should be discussed with the labs at this point.

The PI will prepare a short report for PMS, which should include at least two proposals that should include overall estimated costs, number of labs (at least 5), number of filters planned to test, other useful information for PMS so that it enables their evaluation. The costing information is intended to help the PMS understand the tradeoffs in terms of number of possible tests; the total cost of the project is not changeable, but the distribution of the testing could be if the discussion leads in that direction. The PMS should reply within 2 weeks so that the project may continue.

Results will be reported blind, but the participating laboratories will receive their own test results to allow them to compare their data with the group results.

Task 2 - Test Design and Filter Selection:

In this task, the PI will prepare the test design which will include repeated tests from one lab to allow examination of intra-lab variation and from the multiple labs for inter-lab comparisons. Also, during this stage the PI should contact the labs and start collecting the QA data and procedures for analysis. To consider the task complete the PI will submit a written report on the test design which would typically include, test set-up, data collection methods and reporting format. Also, as part of the report, the PI is expected to submit a list of filters selected for testing.

Filters for consideration should at least include MERV 8, MERV 11, MERV 14, MERV 14A (per 52.2 Appendix J) and MERV 16.

Task 3 -Data Collection:

Once the Task 1 and 2 reports have been approved, the test labs should begin testing as soon as possible. As part of this task it is expected that the PI will prepare a timeline/schedule of the data collection process and keep track of the testing schedules at the different test labs, and will submit timely (biweekly) updates to the PMS committee via email.

Task 4 -Data Analysis and Reporting:

As the data is received for the QA and for the specific tests, the PI will analyze the data per the approved test plan which shall be based on ASTM E-691-99: Standard practice for conducting an inter-laboratory study to determine the precision of a test method. During this period, data updates shall be presented at ASHRAE meetings. The final report will be written; however, it is suggested that the findings be communicated, as reasonable, even before the final report is completed. The final report shall include communication of variability, sources of variability, and recommendations to reduce variability. The final report shall include recommendations for improvements in the MOT, if improvements prove to be needed. The report will be submitted to the committee for review and approval.

Deliverables:

Progress, Financial and Final Reports, Technical Paper(s), and Data shall constitute the deliverables (“Deliverables”) under this Agreement and shall be provided as follows:

a. Progress and Financial Reports

Progress and Financial Reports, in a form approved by the Society, shall be made to the Society through its Manager of Research and Technical Services at quarterly intervals; specifically on or before each January 1, April 1, June 10, and October 1 of the contract period.

Furthermore, the Institution’s Principal Investigator, subject to the Society’s approval, shall, during the period of performance and after the Final Report has been submitted, report in person to the sponsoring Technical Committee/Task Group (TC/TG) at the annual and winter meetings, and be available to answer such questions regarding the research as may arise.

b. Task Completion Reports required by the PMS

During the project, the PI will be required to obtain approval from the PMS before proceeding further at the following milestones (not necessarily in chronological order):

1. Selection of laboratories
2. Test design and filter selection
3. Data collection
4. Data analysis and reporting

It is anticipated that a short-written report will be submitted by the PI at all four of these decision points, and that the PMS will provide the PI with a response within one month of submittal.

While the exact payment schedule will be negotiated between the PI and ASHRAE, a proposed payment schedule would be:

1. 25% down at the signing of the contract
2. 15% upon completion of Scope Milestone 1
3. 20% upon completion of Scope Milestone 2
4. 15% upon completion of Scope Milestone 3
5. 15% upon completion of Scope Milestone 4
6. 10% upon completion of final report and submission of technical papers.

c. Final Report

A written report, design guide, or manual, (collectively, "Final Report"), in a form approved by the Society, shall be prepared by the Institution and submitted to the Society's Manager of Research and Technical Services by the end of the Agreement term, containing complete details of all research carried out under this Agreement, including a summary of the control strategy and savings guidelines. Unless otherwise specified, the final draft report shall be furnished, electronically for review by the Society's Project Monitoring Subcommittee (PMS).

Tabulated values for all measurements shall be provided as an appendix to the final report (for measurements which are adjusted by correction factors, also tabulate the corrected results and clearly show the method used for correction).

Following approval by the PMS and the TC/TG, in their sole discretion, final copies of the Final Report will be furnished by the Institution as follows:

- An executive summary in a form suitable for wide distribution to the industry and to the public.
- Two copies; one in PDF format and one in Microsoft Word.

d. *Science & Technology for the Built Environment* or ASHRAE Transactions Technical Papers

One or more papers shall be submitted first to the ASHRAE Manager of Research and Technical Services (MORTS) and then to the "ASHRAE Manuscript Central" website-based manuscript review system in a form and containing such information as designated by the Society suitable for publication. Papers specified as deliverables should be submitted as either Research Papers for HVAC&R Research or Technical Paper(s) for ASHRAE Transactions. Research papers contain generalized results of long-term archival value, whereas technical papers are appropriate for applied research of shorter-term value, ASHRAE Conference papers are not acceptable as deliverables from ASHRAE research projects. The paper(s) shall conform to the instructions posted in "Manuscript Central" for an ASHRAE Transactions Technical or HVAC&R Research papers. The paper title shall contain the research project number (1784-RP) at the end of the title in parentheses, e.g., (1784-RP).

All papers or articles prepared in connection with an ASHRAE research project, which are being submitted for inclusion in any ASHRAE publication, shall be submitted through the Manager of Research and Technical Services first and not to the publication's editor or Program Committee.

e. Data

Data is defined in General Condition VI, "DATA"

f. Project Synopsis

A written synopsis totaling approximately 100 words in length and written for a broad technical audience, which documents 1. Main findings of research project, 2. Why findings are significant, and 3. How the findings benefit ASHRAE membership and/or society in general shall be submitted to the Manager of Research and Technical Services by the end of the Agreement term for publication in ASHRAE Insights

The Society may request the Institution submit a technical article suitable for publication in the Society's ASHRAE JOURNAL. This is considered a voluntary submission and not a Deliverable. Technical articles shall be prepared using dual units; e.g., rational inch-pound with equivalent SI units shown parenthetically. SI usage shall be in accordance with IEEE/ASTM Standard SI-10.

Level of Effort

The estimated cost of the project is \$195,000 and it is expected to take 12-18 months. It is anticipated that 4 professional-months of effort will be needed from the principal investigator. In addition to the PI, the testing will be compensated. Since these are expensive tests to run, these costs must be covered in the proposal costing.

Project Milestones:

No.	Major Project Completion Milestone	Deadline Month
1	Selection of laboratories and challenge gas for the tests	2
2	Test Design and filter selection	3
3	Data Collection	12
4	Data Analysis and Reporting	18

Proposal Evaluation Criteria

Proposals submitted to ASHRAE for this project should include the following minimum information:

No.	Proposal Review Criterion	Weighting Factor
1	PI's understanding of Work Statement as revealed in proposal. Logistical and technical problems associated	20%
2	PI's capability in terms of facilities and methodology for conducting project. a) Organization of the project and plan b) Data collection Technical expertise	25%
3	Qualification of personnel for this project a) Team qualifications and experience Responsibility of project manager	30%
4	Detailed work plan with well-defined milestones	10%
5	Probability of PI's research plan meeting the objectives	10%
6	Student involvement a) Extent of student participation on PI team Likelihood that involvement in project will encourage entry into HVAC&R industry.	5%

References

1. ASHRAE 2017. Standard 52.2-2017: Method of testing general ventilation air-cleaning devices for removal efficiency by particle size.
2. ASHRAE 2009. Standard 62.1: Ventilation for acceptable indoor air quality.
3. ASHRAE 2005. 1088-RP: Coordinate and analyze inter-laboratory testing of filters under ASHRAE Standard 52.2 to determine the adequacy of the Apparatus Qualification Tests.
4. ASTM International 1999. ASTM E-691-99: Standard practice for conducting an inter-laboratory study to determine the precision of a test method.