



AIRAH

The Revision of DA19 - HVAC&R Maintenance

An industry touch point on future development

**FINDINGS AND RECOMENDATIONS ON DA19 -
HVAC&R MAINTENANCE INDUSTRY SURVEY**

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About AIRAH

The Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) is an industry-led organisation that represents the entire heating, ventilation, air conditioning and refrigeration (HVAC&R) value chain, from the tradesperson on site through to university-educated engineers, researchers and business leaders. This overarching perspective – and reach to more than 25,000 industry participants – positions AIRAH well to develop and promote a safe, sustainable, healthy and comfortable built environment for Australia's future.

The 21st century imperatives of emissions reduction and energy productivity present our nation with significant change, challenges and opportunities. It is important that all stakeholders from the built environment and refrigeration sector come together to meet these challenges, because all of us have a part to play in achieving low emissions and in ensuring that technical challenges are met and risks are mitigated.

AIRAH is keen to work with all levels of government to improve the environmental performance and safety considerations of existing and new HVAC&R systems. We envisage a collaborative effort to get and keep positive action firmly on the agenda. AIRAH appreciates that it is important for all stakeholders to understand not only the vital role the HVAC&R industry has in the wider economy, but also the role the industry can play in helping Australia achieve its environmental aspirations, and international and national commitments.

Acknowledgements

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AIRAH would also like to thank the 33 individuals that responded to the survey questions.

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Executive Summary

This short report outlines the feedback received from industry on a survey that AIRAH conducted regarding the future content, scope and format of AIRAH Application Manual DA19 *HVAC&R Maintenance*.

Issues with the manual and how it is applied in industry were highlighted by survey respondents, but solutions were also suggested. These comments and suggestions are summarised in this report, which concludes with a list of recommendations and a proposed “next step” to help progress the revision of the HVAC&R sector maintenance manual.

This survey and report have been produced to help AIRAH develop an approach to the update of DA19. This project provided additional evidence and insights for AIRAH to progress its revision of DA19.

AIRAH’s approach

Because of the feedback received AIRAH will assemble a group of collaborators and technical experts to help update and review DA19 including to:

- Clarify the scope of DA 19 and its relationship to **current regulations and codes**.
- Include more information for clients on the **need and benefits** of maintenance.
- Discuss differing **maintenance objectives** such as risk management, regulatory compliance, safety and duty of care, energy performance, optimisation, and maintenance budgets,
- **Tag** individual maintenance schedules for:
 - Compliance – minimum regulation
 - Energy – Energy cost and sustainability
 - Optimisation – Energy/Outcome/Life cycle
- Investigate the creation of new schedules for typical building types/application types and typical HVAC&R system types and relate these to **risk profiles**, maintenance regimes and tagged maintenance schedules.
- Include a framework for **services optimisation**, a step by step process.
- Add a new section on **Smart Maintenance** covering data driven maintenance approaches including BIM asset management, CMMS, automated equipment/system monitoring, automated fault detection and diagnosis, cloud SaaS.
- Clarify the relationship between DA 19 maintenance schedules and the **equipment manufacturers** specified maintenance tasks.
- **Update the maintenance schedules** to reflect contemporary standards and regulations. Review all tasks and frequencies, normalise/simplify tasks and remove duplication, review ‘complete task/report task’ category for a two-tier approach, review minimum frequency for a two-tier approach.
- Investigate greater split in **AHU categories**.
- **Include** for fire and smoke control systems and components, CO/CO2 monitoring and BMS/control systems/IoT, refrigeration systems, flow/fume hoods.
- Include **generic instructions** on how to approach new or black-box technologies
- **Include technologies** such as ammonia systems, absorption chillers, air cleaning devices, VRF, hybrid evaporative cooler, heat recovery, thermal storage/phase change, VSD, EC motor, UVC light.
- Investigate inclusion of **time estimates for typical tasks**.

AIRAH will also investigate:

- The creation a standalone maintenance procurement guide, in collaboration with FMA, a two-page fact sheet or a more involved specification builder app.
- The potential for development and delivery of online training on HVAC&R Maintenance and the application of DA19.
- The creation of Standard system/equipment type maintenance sheets provided in a readily usable fashion (i.e. one-page forms).

AIRAH Report

The Revision of DA19 - HVAC&R Maintenance

A report on an industry touch point and survey of technical service providers carried out to discover issues and inform future development of the AIRAH Application Manual DA19 HVAC&R maintenance.

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1 DA19 HVAC&R Maintenance context

1.1 DA19 application manual

AIRAH's DA19 application manual provides comprehensive information on the maintenance and maintenance management of HVAC&R building services and systems. The manual discusses how maintenance is planned, supported, specified, contracted, performed, monitored, recorded and managed.

The traditional focus of this manual has been to assist in the development and review of the routine and preventative maintenance programs in use by building services engineers, maintenance engineers and plant engineers and to provide guidance in the preparation of maintenance contracts for HVAC&R building services.

A further purpose is to provide a guide to the programming of the service required for items usually found in HVAC&R systems and where considered necessary, to explain how the maintenance work should be performed. Detailed maintenance schedules are included for common HVAC&R plant items and systems and guidance on how these schedules can be tailored to individual buildings and systems is included.

The manual also incorporates information to assist those responsible for purchasing and managing maintenance, including information on maintenance roles and responsibilities, maintenance planning, maintenance management, and maintenance monitoring, review and assessment.

The sustainability implications of maintenance actions and choices are considered throughout the manual. The role that HVAC&R maintenance can play in reducing the environmental impacts or ecological footprints of buildings or processes. Reducing energy use, conserving water, managing refrigerants and water treatment chemicals are all issues directly linked to and addressed by system maintenance.

An important purpose of the manual is to outline for the owner, the maintenance manager and the maintenance contractor, the extent of service required to maintain a system at peak efficiency at all times. The manual outlines to the system owner/user the choices of the type of maintenance service that can be provided and cautions on the likely shortcomings that can be expected if appropriate maintenance procedures are not followed.



AIRAH's DA19 – HVAC&R maintenance

1.2 HVAC&R maintenance in a regulatory context

The HVAC&R industry operates under a wide range of legislation and regulatory requirements and regimes from all levels of government. The principal areas of regulation encountered by our maintenance industry include:

- Public Health regulations – State-based Legionnaires disease regulations, microbial control inspection testing and maintenance, indoor air quality.
- Fire Safety regulations – Essential services inspection, testing and maintenance; smoke control, fire dampers, fire integrity
- Building regulations – National Construction Code (NCC) requirements set the benchmarks for various state based maintenance regulations for systems (e.g. essential services, ventilation systems, cooling water systems) for annual building occupation or continued system operation.
- Plumbing regulations – Including NCC Volume 3 which includes for maintenance, AS 3500 series, backflow prevention trade waste regulations, and sewage.
- Australian Standards – often address minimum maintenance requirements and standards.
- Environmental regulations – Ozone Protection and Synthetic Greenhouse Gas Management Act and associated regulations, environmental noise regulations, and air pollution regulations.
- Energy regulations – Including Commercial Building Disclosure (incorporating NABERS).
- Ozone and Synthetic Greenhouse Gas regulations – For synthetic refrigerants handling through the Australian Refrigeration Council.
- Occupational safety regulations – Model WHS Act and regulations in most states, or state based OH&S Act and regulations (Victoria and WA), all address safety in design, safety in operation and safety during maintenance.
- Planning regulations – Including specific local requirements imposed through local government-based planning or development consent conditions can include maintenance provisions.
- Local council regulations – Special local planning conditions, food services regulations, and environmental noise enforcement can include maintenance provisions.

AIRAH want to inform and work with all regulators to help bring a HVAC&R voice to the development of the environmental, energy, building, WHS, plumbing, electrical and health regulations that impact the HVAC&R maintenance industry.

1.3 Background to the development of DA19

The scope of the current edition of DA19 includes the maintenance and maintenance management of heating, ventilation, air conditioning and refrigeration (HVAC&R) systems and services. It contains detailed advice and information on the maintenance of HVAC&R building services systems. It does not contain information for other building services such as electrical distribution systems, lighting systems, lifts, fire detection and fire control or suppression systems.

The manual defines what maintenance is, why maintenance is performed and discusses the maintenance roles and responsibilities of the various systems stakeholders. The manual outlines how best to manage maintenance and defines a structured process for the development of maintenance systems appropriate to a specific building or application.

Information is provided in DA19 in a layered structure, starting with general information about maintenance and maintenance management, moving on to more detailed information on maintenance planning, maintenance delivery and maintenance review and leading to detailed technical maintenance instructions in the routine maintenance schedules. Much of the detailed technical resources such as maintenance schedules and audit procedures have been located in the Appendices.

The maintenance described is separate to that obtained under warranty or during the defects liability period. Routine or preventative maintenance, in addition to that obtained under the installation contract, is required throughout the life of the plant to ensure it is kept in good operating condition and that the specified operating requirements are achieved.

DA 19 is not a maintenance specification. Maintenance specifications and programs need to be tailored specifically to a systems plant and operational requirements. DA19 can be used to develop system specific maintenance programs and specifications. The manual provides a comprehensive compilation of standard maintenance schedules for the plant and equipment commonly found in HVAC&R applications. It also illustrates a method of preparing a scheduled maintenance program for a system using the standard schedules of Appendix A.

1.4 HVAC&R Maintenance and compliance

Compliance issues confound maintenance. It is difficult to effectively set and achieve maintenance benchmarks for systems that were not designed or constructed correctly in the first place.

There is anecdotal and documentary evidence of a prominent level of “undiscovered” non-compliance issues within some sectors of the HVAC&R industry. In the property sector, compliance issues often come to light many years after the initial construction, during a fire safety audit, a maintenance audit, or a due diligence pre-purchase inspection of a building.

1.5 Maintenance and safety

The national model Work Health and Safety (WHS) laws comprise a national model WHS Act, national model WHS regulations, and a suite of national model WHS codes of practice.

WHS laws and regulations require employers and people carrying out a business or undertaking (PCBU) to meet certain duties regarding the safety of the workers and workplaces that they have control over.

- **Designers** have a duty to ensure that systems and plant are designed so that the safety risks for installers, operators and maintenance service providers are minimised as far as is reasonably practicable.
- **Installers** of systems and plant have similar duties.
- **Owners and operators** have a duty to ensure any foreseeable risks to workers or occupants are mitigated as far as is reasonably practicable.
- Providing **unsafe access** to HVAC&R systems and plant is illegal. However, the definition of what is “safe”, what is “unsafe” and what is “reasonably practicable” is not always clear.

1.6 Maintenance and Energy Efficiency

The link between maintenance and energy efficiency and the importance of maintenance tools when delivering low emission HVAC&R solutions has been confirmed by government and industry. This has been confirmed by past and current industry energy initiatives such as HVAC HESS, Commercial Building

Disclosure program, the PRIME industry collaborative and most recently by the Ozone Act review undertaken by the Australian Government in 2017.

1.7 PRIME and Maintenance

AIRAH has led the development of PRIME, an initiative developed by a coalition of stakeholders from within the Australian heating, ventilation, air conditioning, and refrigeration (HVAC&R) industry. The industry has been under pressure to help reduce the environmental impact of HVAC&R. Key stakeholders have taken a step back and spent some time evaluating exactly what needs to be done to develop low-emission solutions for the HVAC&R services.

PRIME stands for the five pathways to transition: Professionalism, Regulation, Information, Measurement, and Emission abatement. All of the industry-sourced solutions have been allocated into one of these five categories. Safety is a critical aspect of the PRIME vision, as the industry transitions to the use of low global-warming-potential refrigerants with new safety considerations.

PRIME Vision - An Australian HVAC&R industry that is highly skilled and professional, safe, cost-effective and environmentally effective.

Prime has identified the topic of Maintenance for Energy efficiency as a focus area for the industry transition to low emissions HVAC&R.

2 The DA19 HVAC&R Maintenance Survey

The survey was open for six weeks from May 22nd 2017 to July 3rd 2017.

The following organisations supported AIRAH to raise awareness of the project to industry.

- Air Conditioning and Mechanical Contractors Association (AMCA)
- Chartered Institute of Building Services Engineers (CIBSE)

2.1 Survey questions

After providing some background and context of the current DA19 manual, AIRAH asked the following questions in the survey:

- *What is good in DA19, what do you like and why?*
- *What is not so good in DA19; what don't you like and why?*
- *Are there other formats that DA19 would be useful in?*
- *Are there other purposes for DA19 that should be considered?*
- *Are there other changes in regulation that should be reflected in DA19?*
- *What other changes in standards should be reflected in DA19?*
- *Which of these technologies should be/could be included and where is the information source?*
- *What other technologies could be included and where is the information source?*
- *What other enabling technologies should be included/discussed?*
- *What information on BIM for facilities management should be included/discussed and where is the information source?*
- *How else could DA19 help users understand how to build maintenance programs/specifications?*
- *Should DA19 include more information on how clients should procure maintenance?*
- *How could DA19 include maintenance for different building classes using a risk based approach?*
- *Who are the main people that you think we should talk to about HVAC&R maintenance during the review?*

2.2 Who Responded?

Hundreds of people reviewed the online survey and a total of 33 completed survey responses were received by the closing date.

Respondents came from a variety of backgrounds and sectors, primarily designers and contractors from commercial HVAC, and commercial or industrial refrigeration, as well as building owners and facility managers responsible for asset management.

The people who completed the survey identified themselves as:

- Design engineers and consultants
- Installation and commissioning contractors;
- Service and maintenance contractors;
- Refrigeration contractors;
- Building owners;
- Facilities managers;
- Licensed refrigeration and air conditioning technicians;
- TAFE trainers and students;
- Manufacturers and suppliers;

The survey respondents included people who work in the following sectors:

- Commercial and industrial refrigeration;
- Residential and commercial air conditioning;
- Training and education;
- Supermarket and commercial refrigeration;
- Building management systems and controls; and
- Facility management.

3 The industry overview of DA19

Context: The purpose of DA19 is to provide an industry agreed and recommended approach to HVAC&R plant and equipment maintenance, including recommended actions and typical frequencies. DA19 does what it says on the box, it provides an application methodology for HVAC&R plant maintenance.

The primary AIRAH purpose of the revision is to update the DA19 maintenance schedules to reflect contemporary regulations and Australian standards, include for new HVAC&R technologies, discuss the potential impact of IT including 'SaaS' analytics and 'BIM to FM' pathways.

To discover what industry liked and disliked about the current edition of DA 19 the survey asked the following questions, and received the following responses:

Question: What is good in DA19, what do you like and why?

DA19 comprises a single comprehensive manual which provides a clear structure to develop a HVAC&R maintenance program.

Clear, and provides a step-by-step guide to what is included and excluded from a service visit.

Thorough and descriptive of all plant and equipment, and very easy to follow for technicians.

Well structured, excellent content and covers all facets of maintenance including life cycle and maintenance strategies.

Economical serviceable life span page is great reference. Service schedules are good guides.

It provides users with an industry base line on equipment service schedules and economic life cycles.

It helps us when there is a dispute with the frequency of maintenance being carried out.

DA19 is an important tool on the 'client' side. This does not diminish its value to contractors.

Question: What is not so good in DA19; what don't you like and why?

DA19 is not particularly use friendly to navigate, requiring cross referencing across a myriad of tables. The manual is quite complex and can be a difficult document to relay to technical staff without some interpretation from senior staff.

The DA19 is out of step with current regulations and standards, and may need an update to reflect the state of standards as they have evolved since 2009.

There should be a clarification of the differences and interpretation between Australian standards for Maintenance and the DA19 Maintenance Manual.

DA19 assumes that the maintenance requirements for all equipment is the same in all facility types, which is not the case.

The depth of the knowledge system in DA is not enough, the hierarchy is not enriched and is too simple.

DA19 leaves some elements open to interpretation and often the tables are used and referred to out of context.

Specific tasks should only apply where manufacturers' maintenance programs are not provided.

Some task details are out of date/step with Technology.

Need greater number of categories, particularly for AHU configurations. Air handling unit maintenance could be broken down more for fan coils units and AHUs.

There is no advice in relation to annual fire maintenances.

The frequencies specified for tasks do not represent a practical approach. Many of the tasks are over the top and cost prohibitive.

There is a substantial number of tasks nominated as monthly or quarterly which is often challenged by clients as to the "value add" of that frequency.

Not all DA19 tasks are applicable or commercially viable, yet people that reference DA19 do not understand this.

There are too many actions which should be ""report"" not clean or replace. Clients expect every item written in the DA19 to be delivered, but won't pay.

Same physical tasks described in diverse ways creates needless duplication (i.e. tasks are not normalised

The inclusion and importance of servicing split type units too. What constitutes a clean, because this varies from wiping the covers, cleaning the filters to carrying out a complete low pressure wet wash of the entire head unit and condenser unit.

DA19 maintenance cost implications need to be considered in its entirety. Maintenance to non-ducted high wall splits, ceiling cassettes etc should be changed to Quarterly frequencies, to ensure that ongoing annual maintenance costs do not escalate out of control.

More focus on condensate water drains including traps and pipework.

It is not flexible) and it needs a greater focus on energy efficiency (especially with respect to maintenance of controls).

The maintenance schedules need updating for modern equipment.

DA19 is unbalanced in approach/emphasis on some equipment/systems, for some equipment there are detailed tasks for minor components while more important items are underdone.

There are items included in the service items which are really quite low (in terms of priority) and the descriptors of the higher priority maintenance items are missing or not detailed sufficiently.

Analytics and Remote Control may negate the need for some physical tasks.

Not enough on ammonia systems, and detailed compressor maintenance intervals and the specifics of the recommended checks i.e. recommended thrust clearance check intervals, slide position indicator calibration, compression testing, vibration analysis frequency, grease analysis, expected shaft seal bleed rates etc.

Customers are literally using DA19 as a full scope of works and their HVAC bible, rather than using it as a guide. The customers lack of understanding with DA19, is putting intense pressure on our HVAC industry.

Most tasking and frequencies are over the top, e.g.: tasking and frequencies for a high wall split is monthly maintenance when carried out to DA19, this would in most cases cost more than the price of a small 2kw unit. Have the suggested maintenance scope and frequencies been ratified/verified by manufacturers?

This document should tie in with safe and adequate access for maintenance e.g. Have adequate access panels been installed to carry out all the tasks. Are all areas surrounding the plant clear too?

4 Update to legislation and standards

To discover what legislation and standards the new edition of DA 19 should reference the survey asked the following questions, and received the following responses:

4.1 Update to legislation

Context: The revised DA19 will need to cover recent (post-2009) changes in the Australian regulatory landscape including:

- Maintenance being removed from NCC
- Changes to state health regulations relating to maintenance
- Changes to state essential services maintenance regulations
- Introduction of Model WHS laws– safety in design/maintenance.

Question: Are there other changes in regulation that should be reflected in DA19?

Covering essential services maintenance is tricky as ESM maintenance requirements are not consistent b/w states and territories. State Regulations are far from perfect. Clarity of terminology is absent, processes are not well described, critical tasks are absent from critical stages of the process. There is substantial room for improvement however this is difficult under the framework of the regulation. The possibility of delegating maintenance to a document such as DA19, a document prepared by engineering and building practitioners, should be considered.

The fact that maintenance has been deleted from the NCC is a good reason to review the recommended frequencies to ensure improvement in both actual and perceived value to clients.

The bulk of DA19 would easily go beyond what the NCC recommended, therefore those changes become nearly immaterial as DA19 is best practice, not the minimum. The maintenance requirements also don't change, the bearings still need grease and heat exchangers cleaned. The NCC and other statutory maintenance requirements never covered that unless it was smoke exhaust.

Codes of practice are not law.

DA19 could refer to Safety in design.

Perhaps new refrigerants and natural refrigerants may need to be considered.

Include ESM maintenance.

Include kitchen exhaust regulations and maintenance.

And ductwork inspections.

Include Legionnaires risk mitigation.

4.2 Update to standards

Context: The DA19 schedules will need to be reviewed and updated to reflect changes to:

- AS/NZS 3666.2 and .3 and new part 4 (2011)
- AS1851 Routine Service of fire protection systems and equipment (2012)
- AS/NZS 5149.4 which superseded AS1677.2 (2016)

Question: What other changes in standards should be reflected in DA19?

Include clearly defined interpretations of the requirements in relation to the main standards applying to Maintenance, specifically in our Industry with respect to the BCA - AS 1668 - AS 3666 - AS 1851

Our company is based in New Zealand and many of the NZ safety standards are mere versions of or refer to Australian Standards, so it would be good to **reference NZ Standards** as well if possible.

Have a note in relation to refrigeration concentration issues as this is often not considered in design but may become an issue for the service agent. AS1677.1 (now AS/NZS ISO 817 and AS/NZS 5149.1).

There are changes to refrigerant standards that will influence service frequencies or the maintenance approach.

Maybe include AS 3666.3, and AS 3666.4, risk based approaches.

AS 1668.1 & 2 needs to be driven more and with introduction of CO/CO₂ control.

Australian Standard AS/NZS 2293.2 1995 - inspection and maintenance of Emergency & Evacuation lighting for buildings.

Machine guarding standards.

Australian standards need to recognise the difference between the big end of town and ductless systems - they both harbour the same biofilm. We get told on countless occasions 'the Australian standard only relates to bigger systems'.

5 Include schedules on any newly identified technology

Context: The DA19 schedules will need to be reviewed and updated to incorporate modern technologies:

- Solar absorption/thermally-driven chillers
- Variable Refrigerant Flow (VRF) mini-split
- Thermal storage/phase change refrigeration or air conditioning
- Dual fuel electric/gas powered heat pumps
- Desiccant/Hybrid Liquid Desiccant air conditioning
- Hybrid evaporative coolers
- Internet of things/controllers
- Air cleaning devices

To discover how the new edition of DA 19 should deal with new technologies the survey asked the following questions, and received the following responses:

Question: Which of these technologies should be/could be included and where is the information source?

Rather than try and cater for every emerging technology DA19 should have a section to explain how to manage new or emerging technologies. This should also cater for refrigerants, and other technology. The Equipment or Technology shouldn't be specifically referred to until it is considered mainstream in the market. New technologies and products typically have their own individual customised documents.

DA19 needs to cover the basics that the majority of Commercial Buildings contain and special systems and plant outside that should comply with the Manufacturer's Instructions for safety, efficiency and Maintenance. DA19 should not try to cover everything as it will become irrelevant.

Putting in a framework for services optimisation that works in conjunction with emerging and existing technologies/equipment is something I think could be valuable.

I feel all the above technologies should be included as it's important that DA19 contains commentary on all asset types used to enable HVAC in a building.

Most in the list should be included, some like VRF mini-split more relevant than others e.g. desiccant air conditioning. As in all cases, source of information for maintenance requirements of any system is manufacturing literature.

- **Absorption chillers** from the manufacturer or their distributor within Australia. BROAD chillers would be favourable to provide information.
- **Air cleaning devices** as these are increasing within industry - specific information from manufacturer
- **CO and CO₂ sensors** calibration and systems (car park extraction systems, demand controlled ventilation)
- **Variable Refrigerant Flow (VRF)** mini-split- individual manufacturers, e.g. Daikin, Mitsubishi (VRF split is really an amalgamation of an inverter driven condensing unit and standard FCU)
- **Hybrid evaporative coolers** - Seely International
- **IoT** maintenance should probably be outsourced to DA28

Question: What other technologies could be included and where is the information source?

- **Heat Recovery Systems** – Air Change
- **Thermal storage/phase change** refrigeration or air conditioning
- **BMS** recommended scheduling requirements, Practical Fine tuning of BMS Systems and software support and ownership
- **Variable Speed Drive**
- **EC motors**
- **Ultra violet** light filtration (Air and Water)/Ultra violet c germicidal systems - Contact UV Solutionz New Zealand
- **Condenser fin protection** - what process should be used for cleaning and what not to use.
- **Refrigerants**
- **Drainage**
- **Laminar flow hood**, and other air-conditioning devices in clean room; **Fume hood, snorkeler**, and other ventilation devices in labs

Chiller optimisation software packages such as *Plantpro*, and big data analytics packages such as *Bueno* are a must have in my opinion. A data driven maintenance approach is far more beneficial financially for our customers.

The use of thermal imaging to not only electrical equipment but also to motor bearings for heat and potential wear etc.

Metering is now required for buildings classified in NCC V1 section J8. These meters are to be certified for energy consumption. Manufacturer such as Siemens.

Augmented Reality. References: *Metaio* Augmented Reality Company, developed a program for Mitsubishi, which helped Mitsubishi to have improved their efficiency and saved 30% of training cost

Don't try to cover everything as many are system specific and cannot be generalised. Technology and connectivity is changing so rapidly.

DA19 publication may have to be tailored around the existing manual and a new additional manual produced to cover the newer technology items that are coming on stream.

Chemical treatment of condenser water, there is not a lot of information on the inhibitors and the test results parameters. It would be good if there were more details for these parameters - chemicals used and purpose, the results if outside these parameters, and what is the cause and effect.

6 Update on maintenance methodologies/technologies

Context: DA19 needs to be updated regarding current technology driving innovation in the monitoring of plant and systems and analysing the data returned, enabling automated fault detection and diagnosis, innovative approaches to maintenance scheduling, etc.

Automated fault detection systems - connect sensors on plant (monitoring vibration, heat, current, IAQ etc.) to local controller (via Wi-Fi/Bluetooth/LAN) that sends connect aggregated data (via Ethernet connection) to online cloud based SaaS for analytics and or maintenance intervention

Mobile maintenance platforms – are provided by maintenance/service companies to provide a continuous monitoring/maintenance service.

Question: What other enabling technologies should be included/discussed?

SaaS model currently on the market are focused on helping the maintenance contractor to speed up process and not for FM to gain a greater understanding of what should be done. DA19 needs to bridge the Gap.

DA19 is structured around one specific maintenance approach - scheduled or preventative. Other methods that may be considered and becoming more popular are predictive or risk based. Transforming the manual would be substantial task, possible a separate volume would be required. It may however be worth touching on alternative approaches.

Data analytics and Condition based maintenance.

7 Use of BIM to FM

Context: DA19 needs to provide information on how BIM building models can be leveraged facilitate maintenance/ CMMS.

Question: What information on BIM for facilities management should be included/discussed and where is the information source?

The increasing adoption of BIM means more information is available in a digital form at the time of creating the maintenance plan. The biggest issue here is creating a consistent language between what Equipment is called in a Digital Model versus what Equipment may traditionally have been called in DA19.

Refer to the BIM MEP AUS Initiative as it is a great collaborative national effort between the consultants and Contractors in Australia and is getting it right

The holy grail of FM. Lots of talk about this but struggle to find any real-world examples where this lives up to the hype. Typically, a one directional data transaction

Building Information Models (BIM), when loaded with all equipment details, can be leveraged for maintenance diagnostics, equipment replacement and maintenance scheduling. BIM provides a computerised representation of a building and the equipment that it contains. Equipment represented in the model will have all technical data and drawings attached (at Level of Development (LOD) 600). Equipment can be searched and located easily, and the technical data retrieved quickly. This information can be added to maintenance planning software packages to automatically schedule maintenance activities based on equipment types.

BIM is essentially an information database with a graphical representation and the information contained in the database can be interfaces quickly with many other software packages to manipulate the information. Once these information connections are made, the options are endless

Leverage BIM in trouble-shooting and root-cause identification, especially in Labs and Pharmaceutical Plant where the facilities, pipe lines and equipment are installed in very limited and specified (e.g. energy deck) space, in other word, high-equipment-concentration. BIM helps to find the positions of devices/equipment in complicated & low visibility environment, and greatly improve the efficiency of renovation, e.g. relocate the diffuser when air-flow organization appears not good

8 Application of DA19 - by a client

Context: DA19 should clearly explain how to build a maintenance schedule using the data provided.

Question: How else could DA19 help users understand how to build maintenance programs/specifications?

It should be made clearer from the outset that DA19 is a guide, not a standard and not a regulatory requirement.

DA19 does have a useful worked example however it would seem that most users don't take the time to read DA19 in full. Not sure if this is a training issue, more so than DA19 needs to be improved.

Be Practical with concise minimum requirements that match the intent of the relevant standards.

Create Templates or Apps.

Provision of examples for basic building types.

Workshops and more seminars to educate our customers, on how to build a program would be a great outcome.

The current DA19 details maintenance requirements for components. These may be transformed into schedules for complete systems which is what the FM eventually deals with.

Our industry is in trouble when it comes to maintenance. The market place has us competing with time frames such as 5 minutes to do monthly maintenance on a split system air conditioner, with a full list of tasks as described in DA19. Can the updated version give some standard time estimates to complete a task such as a monthly maintenance on a split or room air conditioner to the extent outlined in DA19 and give examples of budget type maintenance programs for types of equipment. It really is getting embarrassing for our industry. Techs are stuck between a rock and a hard place. They either do the maintenance right and get reprimanded by their manager for taking too long. Or they do the maintenance to the time pace and get reprimanded by the customer because everything starts falling apart. It causes mental health issues that tend to show up either as a complete burn out or they just stop caring and become another unmotivated statistic.

DA19 maintenance is (in its current form) an expensive standard to maintain. There are certain industries which can financially support this standard - but for my service agreements this is too labour intensive whilst predominately addressing low level maintenance issues.

Care needs to be taken so that the DA19 document does not become too ""watered down"" in an attempt to provide a one document covers all situations.

More information on maintenance benefits and need should be pushed to the clients as they are always cutting back the minimum standards and required frequencies to save a dollar. This is only making us all go backwards when we should be driving forward with quality maintenance and less breakdowns and unnecessary CapEx replacements.

9 Procuring maintenance

Question: Should DA19 include more information on how clients should procure maintenance?

Not sure that DA19 should be the document to cover this in detail other than to cover off the usual types of Maintenance Contracts, i.e. scheduled, comprehensive, etc.

No, clients will always have their own ideas or requirements. I'd stay out of it and stick to just being a standard for maintenance.

DA19 is falling into the hands of people who have a lack of understanding around how to build maintenance programs and specifications. So, our customers are tendering out the whole DA19 as a full scope of works.

DA19 provides a useful reference guide. Too often it is used out of context and creates a source of confusion. More work is required to train users of the document, and certainly to ensure that it is used in total rather than just the tables. Whilst the most recent version is a considerable improvement on the past

it still requires some tidy up to ensure that clients don't have to pay a significant premium when applying DA19 schedules versus simply adopting Australian Standards.

Ultimately clients want outcomes and DA19 should be focussed on helping them understand the maintenance cost of delivering outcomes relating to building operation. DA 19 needs to be commercially relevant so clients understand that the theoretical 'cost' of doing all maintenance tasks bears no resemblance to the real world (i.e. what they are prepared to pay for). This means risk profiles should reflect maintenance tasks requested.

The current DA19 highlights the need to be commercially relevant to clients. Too many clients simply advise compliance to DA19 is needed, with no understanding that they are not willing to pay (nor should they) to enable all maintenance tasks listed in DA19 to be done. There needs to be a 'materiality framework' introduced to match risk to cost of maintenance (i.e. cost via time allowances).

Provide examples of common equipment, specifically what "measurements" and "benchmarks" that should be recorded to prove equipment operation.

The focus should be on Contractors and Practitioners who are licensed to carry out the Plumbing, Electrical, and Refrigeration tasks. We see far too many unlicensed people doing the wrong thing, people who see routine maintenance as routine charge, fleecing clients on breakdowns and not completing Statuary Maintenance requirements in line with Standards.

Including time intervals per piece of equipment would give them a guide as to whether they are receiving a competent quotation based on DA19 standards. This would make it fair on all submissions.

Provide categories or levels of service i.e. Premium, Standard, Minor.

Provide software to tick and pick (asset types, actions, frequencies) i.e. simple creation of a maintenance plan specific for a particular building or site or contract, actions should be editable.

Some guidance may be of interest, however different clients would generally have different approaches and that is often outside the scope of the technical staff.

Behind the business model which is mentioned in DA19 (e.g. totally outsourced, totally in-house team, etc.), DA19 could provide more data, business drivers survey results, practices, typical model or resources configuration based on some typical scenario, that's for references and examples to clients, make it more practical. I learned these kinds of information from IFMA and FM Links.

How much does the organization really have to spend (or is allocated) for maintenance? There needs to be a priority for important maintenance items, and then a lower priority for less important maintenance items.

Provide a "guide" to clients outlining how to create a clear scope for a maintenance contract, what is included and excluded, what report formats are required to be in, what records are to be maintained, what qualification of maintenance personnel, safety or risk management requirements.

Content of a specification, maintenance agreement types and responsibilities. The duty-of-care requirements for Owners to be able to prove they are maintaining equipment to legislative requirements. (e.g. to AS1851 requirements).

This type of information would be priceless as most property managers do not have the first idea on what the actual responsibilities and requirements are for their buildings.

10 Include maintenance for different building classes – risk approach?

Context: Currently DA19 provides no differentiation in the maintenance schedules based on risk. Maintenance levels could be differentiated based on specified outcomes e.g.:

- Maintenance for Regulatory Compliance
- Maintenance for energy efficiency
- Maintenance for IEQ
- Maintenance for Critical functions / Critical cooling

Question: How could DA19 include maintenance for different building classes using a risk based approach?

Does it need to differentiate? I'm not sure how this would benefit? If the current DA19 standard is maintained, it would satisfy any of the above.

The legislation (in Qld) doesn't discriminate between classes of buildings and is called up by WHS regulations etc. Typically, systems over 50kW electrical require maintenance, under this capacity the rules are open.

Need to be careful - sometimes risk based maintenance may be at odds with local legislation (e.g. NSW Public Health Act). Some form of automated specification builder might help (e.g. minimum maintenance requirements plus tick a box for enhancements or deviations).

All clients apply DA19 on the premise that every facility is the same. DA19 needs to provide more information as a minimum or an approach on how to deal with operational risk, and energy efficiency.

A risk based approach could be achieved by Tagging of Maintenance Tasks to the above categories. This would require normalisation of maintenance tasks.

The risk based approach should be in the context of the engineering system e.g. reliability of components, assemblies and the entire system. There is no formal differentiation in the level of risk acceptance for different classes of buildings and most likely defining maintenance in such context would be difficult as the targets are unknown. Use of different maintenance regimes however will result in a known level of risk and reliability. Maintenance regimes then could be tailored to various classes of buildings based on risk acceptance levels, an approach which is generally unknown to the broad practitioner, and even less for particular systems.

By adopting standards such as AS 3666.3, and AS 3666.4, which take a more of a risk based approach to maintenance.

It is all about how much money we are allocated to do maintenance, that is what drives the price of Service Agreements not risk. Perhaps risk defines the maintenance budget (at a higher level).

Clearly identify the regulatory requirement level and then leave the others open. This said, the identification of distinct levels or service, and their benefits would be good, like IEQ/Life cycle, why not identify that whilst it will cost more you get longer lasting plant and a better IEQ.

Provide a risk self-assessment tool for readers.

Include discussion on selection of preventive maintenance versus proactive maintenance.

This is another way of exercising some discretion in customising and thereby focussing on the value add for the client.

DA19 should be a best practice document, not a catch-all. Specifics such as EE/IEQ and Critical Functions should be left in the hands of maintenance specialists.

11 Other issues

Question: Are there other formats that DA19 would be useful in?

An electronic format that a company could adapt their schedules too might be helpful. Prepared in such a way that it can be customised and used in tenders - a bit like NATSPEC perhaps.

Spread sheet format with all tasks tagged appropriately, risk profiles of buildings etc.

A DA19 Mobile App.

Would be great to be downloadable into Computerised maintenance systems (CMMS). If it could come in a form that would enable upload into maintenance software programs, it would make online reporting and scheduling a lot easier for the maintenance technicians.

The manual lists maintenance requirements for various system components e.g. tasks and frequencies. These may also be shown in recommended maintenance schedules for systems - tasks to be completed for different systems at selected intervals.

Consider having 'templates' for maintenance inspection sheets and possibly a template for an O&M Manual, to create some consistency within the industry.

Standard system/equipment type sheets would be invaluable if provided to the industry in a readily usable fashion (i.e. one-page forms).

Question: Are there other purposes for DA19 that should be considered?

Priorities are Occupant Health, Plant Life cycle, Efficiency and safe access and conditions for Technicians.

DA19 is structured around one specific maintenance approach - scheduled or preventative. Other methods that may be considered and becoming more popular are predictive or risk based. Transforming the manual would be substantial task, possibly a separate volume would be required. It may however be worth touching on alternative approaches.

A practical minimum requirement for specific plant and equipment that is acceptable to Clients, occupants and Technicians and realistically applies the intent of the Standards not the wide-ranging interpretations of "as per the standards".

Include a DA19 process that enables a risk element to be introduced.

Interaction with essential safety measures maintenance needs to be considered including a detailed procedure for AS 1851 smoke management testing and specific guidance on maintaining items referenced

in AS 1851, perhaps a section on managing integrated Services Testing, baseline data etc. May be a bit of a repeat from AS1851, but I don't think they explain it in an effective way and Mechanical service companies fear AS1851.

I think a big issue for our industry is making what we have work more efficiently. This is not a 'technology' or item specific issue - we need to look at things holistically (this is in addition to item specific maintenance). Putting in a framework for services optimisation that works in conjunction with emerging and existing technologies/equipment is something I think could be valuable.

Provide benchmarks for minimum level of maintenance.

Provide levels of service categories.

DA19 should provide instruction for maintenance management based on an advanced theory and mindset of Full-life Cycle.

The value of DA19 lies in the potential to make more of the industry aware of its existence and then work to having it become a benchmark across the entire industry.

Recognition of design infractions against AS/NZS 1677.2 and how to report this - i.e. machine access for maintenance.

The document should be pushed by our governing organisations for use in technical colleges as a "go to" training document for apprentice training.

Question: Any other suggestions for AIRAH on the content?

Could cross-refer content to some specific photos.

Could include "Things to look out for".

Keep the cost down to enable more people to access it.

More education to our customers within the industry needs to be implemented through workshops, seminars etc. cost implications need to be considered across the board.

11.1 Collaboration

Question: Who are the main people that you think we should talk to about HVAC&R maintenance during the review?

A broad demographic from service providers, FM and industry experts and regulators:

- AMCA Maintenance Managers Committee
- Maintenance contractors
- Consultant engineers
- Building owners/managers who currently use the DA19 for contracts e.g. councils are big players.
- Facility managers who have experience within the HVAC sector when it comes to budgeting and daily client's operations and budgets. Approach the FMA (Nick Burt CEO) and gain a better buy in from the Association and then better future publicity across the wider FMA industry.
- WHS regulators

- State licensing agencies
- State regulators. In NSW this is the Department of Planning

12 Next steps

This short report outlines the feedback received from industry on a survey that AIRAH conducted regarding the future content, scope and format of AIRAH Application Manual DA19 *HVAC&R Maintenance*.

Issues with the manual and how it is applied in industry were highlighted by survey respondents, but solutions were also suggested. These comments and suggestions are summarised in this report, which concludes with a list of recommendations and a proposed “next step” to help progress the revision of the HVAC&R sector maintenance manual.

This survey and report have been produced to help AIRAH develop an approach to the update of DA19. This project provided additional evidence and insights for AIRAH to progress its revision of DA19.

12.1 AIRAH to update and expand DA19

Because of the feedback received AIRAH will assemble a group of collaborators and technical experts to help update and review DA19 including to:

1. Clarify the scope of DA 19 and its relationship to **current regulations and codes** – update schedules and text where appropriate.
2. Include more information for clients on the **need and benefits** of maintenance– update text where appropriate.
3. Discuss differing **maintenance objectives** such as risk management, regulatory compliance, safety and duty of care, energy performance, optimisation, and maintenance budget.
4. **Tag** individual maintenance schedules for:
 - **Compliance** – minimum regulation
 - **Energy** – Energy cost and sustainability
 - **Optimisation** – Energy/Outcome/Life cycle

This would allow maintenance specifiers and providers to differentiate maintenance tasks and frequencies based on stated objectives or a risk based approach.

5. Investigate the creation of new schedules for typical building types/typical applications and typical HVAC&R system types and relate these to **risk profiles**, maintenance regimes and the **tagging** of maintenance schedules.
6. Include a framework for **services optimisation**, a step by step guide to outline the process – include design, application and measurement and verification of optimisation program.
7. Add a new section on **Smart Maintenance** covering data driven maintenance approaches including BIM and asset management, CMMS, automated equipment/system monitoring, automated fault detection and diagnosis, cloud-based SaaS.
8. Clarify the relationship between DA 19 maintenance schedules and the **equipment manufacturers** specified maintenance tasks.
9. **Update the maintenance schedules** to reflect contemporary standards and regulations.
 - Review all tasks and frequencies,

- normalise/simplify tasks and remove duplication,
 - review 'complete task/report task' category for a two-tier approach,
 - review minimum frequency for a two-tier approach.
10. Investigate a greater split in **AHU categories** - AHU/FCA.
 11. **Include** for fire and smoke control systems and components, CO/CO2 monitoring and BMS/control systems/IoT, refrigeration systems, flow/fume hoods.
 12. Include **generic instructions** on how to approach new or black-box technologies
 13. **Include technologies** such as ammonia systems, absorption chillers, air cleaning devices, VRF, hybrid evaporative cooler, heat recovery, thermal storage/phase change, VSD, EC motor, and UVC light.
 14. Investigate inclusion of **time estimates for typical tasks**.

12.2 DA19 Application and training

AIRAH will also investigate:

- The creation of a standalone HVAC&R maintenance procurement tool, in **collaboration with FMA**, a two-page fact sheet or a more involved specification builder app.
- The creation of Standard system/equipment type maintenance sheets provided in a readily usable fashion (i.e. one-page forms).
- The potential for development and delivery of **online training** on the application of DA19.

12.3 Engage with regulators to raise and promote awareness of issues

12.3.1 Minimum access for NCC

AIRAH will continue to collaborate with the Australian Building Codes Board (ABCB) to develop industry guidelines.

AIRAH will work with the Australian Building Codes board (ABCB) in the development **industry agreed guidelines** for **minimum access** to be provided and the **lifecycle implications** of various access-related design and installation decisions.

AIRAH is a member of the Australian Building Codes Board (ABCB) Building Code Committee (BCC). The BCC the peak building technical advisory body provide advice to the ABCB Board to deliver its work program by providing a national forum for regulatory authorities and industry to consider technical matters relevant to building regulation reform.

AIRAH has a close working relationship with the ABCB through partnering on awareness raising initiatives, training, industry input to code reviews and evidence based technical advice.

12.3.2 WHS in the HVAC&R industry

The implications of the WHS Act and Regulations are not well understood by many members of the HVAC&R supply chain. AIRAH will work with the WHS regulators and industry specialists to develop clear guidance on what the industry's legal responsibilities are and how to comply with their intent.

12.3.3 Awareness raising with regulators

Invite state and territory maintenance regulators to participate in AIRAH conferences, division events, training and articles to address specific maintenance issues.

12.4 AIRAHs strategic policy and advocacy

AIRAHs strategic policy and advocacy themes include compliance and the refrigerant transition. AIRAH has also led the industry PRIME initiative, which identifies a broad range of issues relating to maintenance aspects of HVAC&R.

AIRAH will continue to provide leadership in these areas; through close cooperation with the relevant regulators and by ensuring clear information and awareness is provided to the HVAC&R industry through its communication and education channels. These include Ecolibrium, HVAC&R Nation, update emails, national conferences and training programs



AIRAH's HVAC&R Nation is one of the main industry communication and awareness raising avenues

12.4.1 Promote research

Collaborate with the higher education sector and/or WHS regulators to research specific parts of the supply chain/delivery process as it relates to maintenance.

AIRAHs strategic policy and advocacy themes include innovation and research. AIRAH will identify and support relevant researchers to conduct further work in this field to provide further evidence and other opportunities to address the market failures in the maintenance industry supply chains.

12.4.2 Engage and collaborate with PRIME stakeholders on maintenance issues

Engage with **PRIME stakeholders** on projects relevant to maintenance.

PRIME is an initiative developed by a coalition of stakeholders from within the Australian heating, ventilation, air conditioning, and refrigeration (HVAC&R) industry. The industry has been under pressure to help reduce the environmental impact of HVAC&R. Key stakeholders have taken a step back and spent some time evaluating exactly what needs to be done to develop low-emission solutions for the essential HVAC&R services we all depend upon.

PRIME stands for the five pathways to transition: **P**rofessionalism, **R**egulation, **I**nformation, **M**easurement, and **E**mission abatement. All of the industry-sourced solutions have been allocated into one of these five categories. www.primehvacr.com.au

13 An HVAC&R industry Maintenance Strategy

From the findings of the survey, AIRAH recommends an industry strategy is required to create a clear vision and direction to improve the level and quality of maintenance delivery in the HVAC&R industry. It should consider the breakdown of issues in the whole supply chain and how to prioritise actions.

14 Working with AIRAH

AIRAH has a strong history of working with government and industry stakeholders to create a safer sustainable built environment.

AIRAH is recognised as the pre-eminent source of heating, ventilation, air conditioning and refrigeration (HVAC&R) industry training information. AIRAH has developed a range of technical manuals and delivered a range of training and accreditation courses relevant to the trade and engineering design sector. AIRAH frequently engages with the whole supply chain through industry trade nights, conferences and forums, industry training and accreditation programs, and industry exhibitions. AIRAH is recognised within the industry as a trustworthy source of technical information. AIRAH regularly collaborates with government and non-government organisations (e.g. Australian Building Codes Board, Standards Australia) to deliver information seminars, conferences and industry-based training to the HVAC&R industry.

AIRAH will be able to access the relevant audience through its own membership base, through its collaboration partners, and through its alignment with the with the following industry and government organisations:

- Air Conditioning and Refrigeration Mechanics Association (ARMA)
- Air Conditioning and Mechanical Contractors Association (AMCA)
- Air Conditioning and Refrigeration Equipment Manufacturers Association (AREMA)
- Australian Fire and Emergency Service Authorities Council (AFAC)
- Australian Refrigeration Association (ARA)
- Australian Refrigeration Council (ARC)
- Chartered Institute of Building Services Engineers (CIBSE)
- Consumer Electronics Suppliers Association (CESA)
- Department of the Environment and Energy
- Facilities Management Association (FMA)
- Property Council of Australia (PCA)
- Refrigerants Australia (RA)
- Refrigeration and Air Conditioning Contractors Association (RACCA)
- Refrigerated Warehouse and Transport Association (RWTA)
- Standards Australia
- State licensing bodies – e.g. Victorian Building Authority
- End user associations – e.g. the Australian Grocers Association



www.airah.org.au