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for

AS/NZS 4755.3.1:2014 Demand response capabilities and supporting technologies for electrical products - Interaction of demand response enabling devices and electrical products - Operational instructions and connections for air conditioners

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AS/NZS 4755.3.1:2014

Australian/New Zealand Standard™

Demand response capabilities and supporting technologies for electrical products

Part 3.1: Interaction of demand response enabling devices and electrical products—Operational instructions and connections for air conditioners

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-054, Remote Demand Management of Electrical Products. It was approved on behalf of the Council of Standards Australia on 6 November 2014 and on behalf of the Council of Standards New Zealand on 31 October 2014.
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Clean Energy Council
Consumer Electronics Suppliers Association
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Electricity Networks Association New Zealand
Energy Networks Association
Heating, Ventilation and Air Conditioning New Zealand
Smart Grid Australia
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Additional Interests:

ChargePoint
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This Standard was issued in draft form for comment as DR AS/NZS 4755.3.1:2014.

Australian/New Zealand Standard™

Demand response capabilities and supporting technologies for electrical products

Part 3.1: Interaction of demand response enabling devices and electrical products—Operational instructions and connections for air conditioners

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-054, Remote Demand Management of Electrical Products, to supersede AS/NZS 4755.3.1:2012.

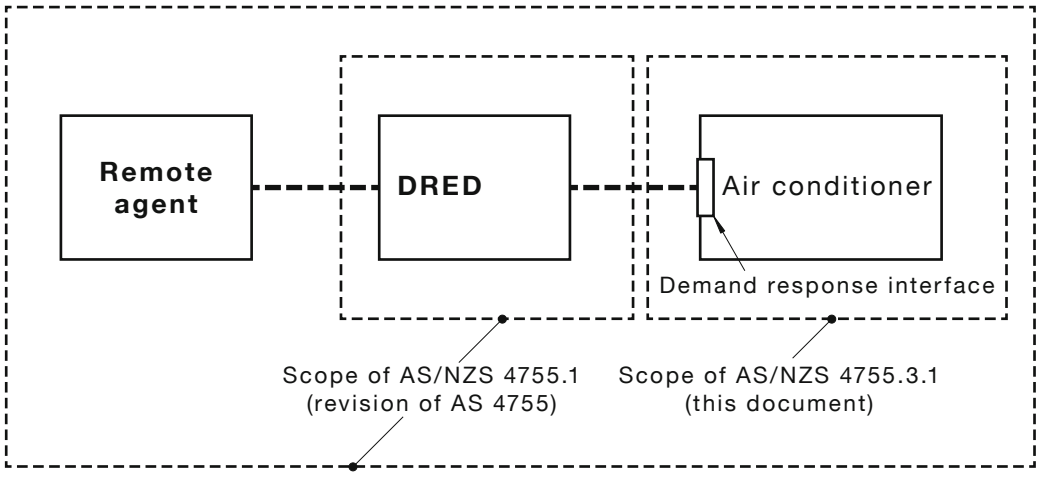
This Standard forms part of a series that is intended to define the nomenclature, architecture and operational instructions for systems that can be used to remotely control electrical products, and to define the demand response capabilities of products. AS 4755—2007, *Framework for demand response capabilities and supporting technologies for electrical products*, will have its title and designation changed to become AS/NZS 4755.1. When complete, the series will comprise the following:

AS/NZS		
4755		Demand response capabilities and supporting technologies for electrical products
4755.1	Part 1:	Framework for demand response capabilities and requirements for demand response enabling devices (DREDs)
4755.3.1	Part 3.1:	Interaction of demand response enabling devices and electrical products—Operational instructions and connections for air conditioners (this Standard)
4755.3.2	Part 3.2:	Interaction of demand response enabling devices and electrical products—Operational instructions and connections for devices controlling swimming pool pump-units
4755.3.3	Part 3.3:	Interaction of demand response enabling devices and electrical products—Operational instructions and connections for electric storage and electric-boosted storage water heaters
4755.3.4	Part 3.4:	Interaction of demand response enabling devices and electrical products—Operational instructions and connections for grid-connected charge/discharge controllers for electric vehicles (EVSEs)

Detailed standards covering demand response operational instructions and interfaces with demand response enabling devices (DREDs) for other electrical products may also be prepared as needs are identified.

The diagram below depicts the structure of this Standard, AS/NZS 4755.3.1. This Standard covers the interaction of air conditioners with DREDs.

This Standard does not cover all aspects of construction and performance, which may be subject to other standards.



It is recommended that this Standard be read in conjunction with AS/NZS 4755.1.

The AS/NZS 4755 series creates a framework that will allow off-the-shelf equipment, communications technologies and electrical products to be integrated and adapted so that demand management solutions may be developed and deployed in a timely and economical fashion.

Although the series has been developed to support situations where demand response is initiated or managed by a remote agent, with the consent of the owner or user of the electrical product, there is no technical barrier that prevents the owner or user managing the operation of compliant electrical products through their own home area network, via the demand response interface.

This Standard pertains to a particular electrical product, the air conditioner. The Standard specifies, for air conditioners—

(a) a standard demand response interface;

(b) a standard set of operational instructions;

(c) the required responses to the operational instructions;

(d) the markings to be applied to products complying with the standard; and

(e) the methods of testing to verify compliance.

This Standard is intended to support demand response programs that optimize the operation of the electricity supply system and allow the efficient planning and use of capital equipment, while minimizing the risks to the comfort and amenity of air conditioner users.

The costs and benefits of making this Standard mandatory are the subject of consideration by Australian and New Zealand Governments. If compliance were mandated, it would also be mandatory to register product details with the regulators of the national energy labelling and minimum energy performance standards program. Information about the status of this Standard and registration procedures (if required) is available at the Australian Government Energy Rating website (www.energyrating.gov.au).

The principal differences between this and the previous edition are as follows:

(i) The reference power level for demand response has been changed from an absolute value (i.e. the energy used while operating at rated capacity in a controlled test environment) to a relative value (i.e. the energy used during normal operation at the same temperature and humidity conditions, either in a controlled environment or in the field).

(ii) A test to ensure that response in DRM 2 differs from response in DRM 3 has been added.

(iii) The prohibition on over-capacity operation (Clause 2.7 in the previous edition) has been removed.

(iv) The required response in the event that the DRED transmits more than one OI at a time has been added (in a new Clause 2.7). This Clause will take effect from the date of publication of this Standard. However, Australian regulatory authorities have indicated that, in the event that compliance with this Standard becomes mandatory, they intend to accept products that would otherwise comply with this Standard (i.e. other than with Clause 2.7) as compliant for up to 3 years from publication of this revision. Users of this Standard should check the Australian Government Energy Rating website (www.energyrating.gov.au) regarding its status for regulatory purposes.

(v) A new Clause 3.7, *Optional low voltage power supply*, has been added. This does not require the provision of such a power supply but specifies requirements for cases where it is provided.

(vi) Section 5, *Testing and verifying demand response capability*, has been clarified. The clarifications include the specification of the most severe conditions under which compliance is required to be tested, and the addition of an alternative method of demonstrating compliance.

(vii) Definitions and terminology have been updated to make this Standard consistent with the other parts of the AS/NZS 4755 series.

For the status of products that have been registered under the previous versions of this Standard, users should check the Australian Government Energy Rating website (www.energyrating.gov.au).

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

Demand response capabilities and supporting technologies for electrical products

Part 3.1: Interaction of demand response enabling devices and electrical products—Operational instructions and connections for air conditioners

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard—

(a) applies to air conditioners that do not contain a DRED, and have a demand response interface intended to connect with a DRED;

(b) specifies a set of operational instructions that will meet the requirements of remote agents wishing to control the energy consumption of air conditioners;

(c) specifies the responses required to the operational instructions;

(d) specifies two alternative methods of connecting the demand response interface to the DRED; and

(e) provides methods of testing to verify compliance.

Air conditioners covered by this Standard include, but are not restricted to, single-phase and three-phase air conditioners of the vapour compression type that fall within the scope of the AS/NZS 3823 series.

NOTE: If compliance with this Standard is made mandatory by the relevant Australian and New Zealand regulatory authorities, then any exclusion of product types, limitations on cooling output or other criteria for limiting regulatory scope will be stated in the regulations.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
4755*	Framework for demand response capabilities and supporting technologies for electrical products
AS/NZS	
3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
3823	Performance of electrical appliances—Air conditioners and heat pumps (series)
3823.2	Part 2: Energy labelling and minimum energy performance standard (MEPS) requirements
4755	Demand response capabilities and supporting technologies for electrical products (series)
4755.1*	Part 1: Framework for demand response capabilities and requirements for demand response enabling devices (DREDs)

* The definitions currently in AS 4755—2007 will be included in the forthcoming AS/NZS 4755.1.

AS/NZS

60335 Household and similar electrical appliances—Safety
60335.1 Part 1: General requirements

ISO
5151 Non-ducted air conditioners and heat pumps—Testing and rating for performance

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 4755 and those below apply.

1.3.1 Air conditioner

A heating and/or cooling device of the vapour compression type, designed primarily to provide conditioned air to an enclosed space, room or zone.

1.3.2 Asserted

The condition of a mechanical switch when the switch is closed, or the condition of an electronic switch when the load current of the switch is turned on.

1.3.3 Authorized person

A person, other than the user, who is authorized by the remote agent, the manufacturer of the electrical product, or both, to access, install or adjust parts or functions of the electrical product not accessible to the user.

1.3.4 Automatic override

A return to normal operation during a demand response event that is not initiated by the user or by the remote agent.

NOTE: This feature is intended to address the possibility of malfunction in the DRED.

1.3.5 Circumvention device

Any control, control device, software, component or part that alters the operating characteristics during any test procedure, resulting in measurements that are unrepresentative of how that product would perform under comparable conditions in normal operation.

1.3.6 Demand response (DR)

The automated alteration of an electrical product's normal mode of operation in response to an initiating signal originating from or defined by a remote agent.

1.3.7 Demand response capability

The ability of an electrical product to provide demand response, when connected to a DRED.

NOTES:

1 The capability may reside in the electrical product itself, or in the combination of the product and a separate DRED. If the demand response capability requires any additional external device, other than a DRED, details of the device(s) need to be specified in the manufacturer's or supplier's documentation.

2 An air conditioner that is *demand response capable* in accordance with AS/NZS 3823.2 has demand response capability as defined in this Standard. An air conditioner that is *potentially demand response capable* as defined in AS/NZS 3823.2 does not have demand response capability as defined in this Standard.

1.3.8 Demand response enabling device (DRED)

A device that provides the functionalities and capabilities to achieve demand response.

1.3.9 Demand response event

The period between the initiation and termination of an operational instruction.

1.3.10 Demand response interface

The physical connections and associated functions that enable an electrical product to receive operational instructions from a DRED.

1.3.11 Demand response mode (DRM)

A mode of operation within specified conditions, constraints or parameters during a demand response event (see Table 1).

1.3.12 Electrical product

A system or device designed to be connected to the grid and to provide, or control the provision of, an energy service, such as cooling, heating, motive power or energy storage. Includes all components required for normal operation and that are generally supplied or installed with the product, such as thermostats or user-operated remote controls.

NOTE: Examples of electrical products include air conditioners, water heaters, swimming pool pump-unit controllers, charge/discharge controllers for electric vehicles [also called Electric vehicle supply equipment (EVSE)] and grid-connected inverter energy systems.

1.3.13 Extra-low voltage

Voltage supplied from a source within the electrical product that does not exceed 50 V between conductors, and between conductors and earth, when the electrical product is supplied at rated voltage.

1.3.14 Maintenance or safety mode

A mode of operation, distinct from normal operation, that is intended to ensure the reliability or safety of the electrical product.

NOTE: Examples include, but are not limited to, oil recovery modes, compressor run down modes, and defrost recovery modes.

1.3.15 Manual override

The capability for the user to initiate a return to normal operation during a demand response event.

1.3.16 Normal operation

Operation under user control, including operation via user-set timers, thermostat settings and other operating parameters.

NOTE: Normal operation includes off-modes, standby modes and other modes that may be set by the user directly or by pre-programming.

1.3.17 Operational instruction (OI)

A signal instructing an electrical product to enter a specific demand response mode (see Table 1).

1.3.18 Rated capacity

The nominal rated capacity claimed by the manufacturer of an air conditioner model determined as follows, as applicable:

(a) *Rated total cooling capacity* As claimed by the manufacturer in accordance with the AS/NZS 3823 series for temperature condition T1. (Units: W or kW.)

(b) *Rated heating capacity* As claimed by the manufacturer in accordance with the AS/NZS 3823 series for temperature condition H1. (Units: W or kW.)

1.3.19 Rated power

Effective electrical power input of the air conditioner as claimed by the manufacturer in accordance with the AS/NZS 3823 series during the determination of rated total cooling capacity and rated heating capacity, as applicable. (Units: W or kW.)

1.3.20 Reduction ratio

The ratio of the compressor run time, speed or loading, while the air conditioner is operating in DRM 2 or DRM 3, to the compressor run time, speed or loading while the air conditioner is in normal operation, calculated in accordance with Clause 5.6.

1.3.21 Remote agent

A person, organization or entity, other than the user, who initiates demand response.

NOTES:

1 Examples include the electricity distributor, electricity retailer, electricity system manager and demand response aggregator.

2 The remote agent will generally have a contractual relationship with the user in which the user gives prior consent for the remote agent to initiate demand response under agreed conditions.

1.3.22 Response time

The time interval from the receipt of an OI until the initiation of the appropriate DRM.

1.3.23 RJ45 socket

The common name for the 8P8C modular connector that is generally used to terminate communications cables.

1.3.24 Safety extra-low voltage (SELV)

Voltage not exceeding 42 V between conductors and between conductors and earth, with the no-load voltage not exceeding 50 V.

When safety extra-low voltage is obtained from the supply mains, it is to be through a safety isolating transformer or a converter with separate windings, the insulation of which complies with double insulation or reinforced insulation requirements.

NOTE: There are differences between the definitions of and requirements for SELV provided in AS/NZS 3000 (where SELV refers to separated extra-low voltage) and AS/NZS 60335.1 (where SELV refers to safety extra-low voltage).

1.3.25 Shall

Indicates that a statement is mandatory.

1.3.26 Should

Indicates a recommendation.

1.3.27 Switch

A device for making and breaking the connection in an electrical circuit.

NOTE: A switch may be electromechanical or solid-state.

1.3.28 User

A person or entity that normally controls the operation of an electrical product.

1.3.29 User settings

The thermostat settings, fan speeds, on and off times, operating modes (heating or cooling) and other settings that are under the control of the user.

SECTION 2 OPERATIONAL INSTRUCTIONS AND DEMAND RESPONSE MODES

2.1 GENERAL PRINCIPLES

The air conditioner shall be capable of operating normally with or without a DRED connected to the interface.

An air conditioner shall be capable of meeting all the requirements of this Standard when one and only one DRED is connected. If an air conditioner has more than one interface complying with Section 3, then the connection of a DRED to any interface shall render all other interfaces inoperative as long as the DRED remains connected to that interface.

NOTE: This refers to air conditioners which may be configured so that there is more than one interface where a DRED may be connected, e.g. an indoor unit as well as an outdoor unit.

The air conditioner should comply with the operational instructions in a way that minimizes inconvenience and discomfort to the user and in a way that avoids drawing the user's attention to changes in operation at the beginning, during or end of a demand response event.

NOTE: Subject to the principles above, the air conditioner may indicate to users that it is in a demand response mode, by means of indicator lights or the display of text or graphic symbols (on fixed indoor or outdoor components or portable remote control units), or by other means, so that a user who notices a change in normal operation can verify that this is due to demand response rather than a malfunction.

2.2 DEMAND RESPONSE MODES

2.2.1 Mandatory and optional demand response modes

Air conditioner demand response modes are indicated in Table 1.

An air conditioner complying with this Standard shall be capable of at least demand response mode 1 (DRM 1).

An air conditioner that is capable of both DRM 2 and DRM 3 may have a fixed capability or a selectable capability. A fixed capability means that both DRM 2 and DRM 3 are permanently and separately available for connection to the DRED. A selectable capability means that either DRM 2 or DRM 3 may be selected by an authorized person, and one of these, but only one, is available for connection to the DRED at any given time.

NOTE: Selection may take place prior to installation, at the time of installation or later. A selectable capability may be designed to be selected once only or re-selectable, e.g. by resetting a dipswitch on a circuit board.

An air conditioner that is on at the start of a demand response event or switched on during a demand response event (either directly by the user or via a timer setting) shall enter the relevant demand response mode (if capable of that mode) within the response time specified in Clause 2.4, and shall remain in that mode for the remainder of the demand response event (i.e. the user cannot override the demand response event solely by switching the air conditioner off then on again), except if the conditions specified in Clause 2.7 are present.

An air conditioner that is not in operation during a demand response event, or ceases operation during a demand response event (either by a direct user command or via a timer setting), shall remain off until switched on by the user or in response to a timer setting (i.e. the end of the demand response event shall not be interpreted as a signal to commence operation).

NOTE: If any user settings other than 'on' and 'off' are affected by a demand response event, the air conditioner should revert to normal operation once the demand response event terminates. This is intended to preserve user preference settings and programming.

If an air conditioner initiates operation in a maintenance or safety mode during a demand response event, it may enter that mode and complete that operation. If the demand response event is still current when the operation is complete, the air conditioner shall enter the required demand response mode within the response time period specified in Clause 2.4.

TABLE 1

AIR CONDITIONER DEMAND RESPONSE MODES

Operational instruction (OI)	Demand response mode (DRM)	Description of operation in this mode	Mandatory for compliance with this Standard (AS/NZS 4755.3.1)
OI 1	DRM 1	Compressor off	Yes
OI 2	DRM 2	The air conditioner continues to cool or heat during the demand response event, but the total electrical energy (kWh) consumed by the air conditioner in a half hour period is not more than 50% of the total electrical energy that would be consumed in a half hour period during normal operation under the same temperature and humidity conditions, and the same user settings.	No
OI 3	DRM 3	The air conditioner continues to cool or heat during the demand response event, but the total electrical energy (kWh) consumed by the air conditioner in a half hour period is not more than 75% of the total electrical energy that would be consumed in a half hour period during normal operation under the same temperature and humidity conditions, and the same user settings.	No

An air conditioner shall have no demand response modes other than those in Table 1.

NOTE: Electrical products covered by other parts of the AS/NZS 4755 series may have additional demand response modes beyond those in Table 1.

An air conditioner shall only respond to the OIs corresponding to the DRMs of which it is capable. It shall not change its mode of operation in response to other OIs; if it is in normal operation at the time it shall remain in normal operation, and if it is in a demand response mode it shall remain in that mode.

NOTE: This applies to OIs transmitted one at a time. See Clause 2.7 regarding multiple OIs.

2.2.2 DRM 2 and DRM 3 operation

To satisfy DRM 2, the air conditioner shall operate in accordance with Equation 1.

To satisfy DRM 3, the air conditioner shall operate in accordance with Equation 2.

$$E_{(2)} \leq R \times 0.50 \quad \ldots (1)$$

$$E_{(3)} \leq R \times 0.75 \quad \ldots (2)$$

where

$E_{(2)}$ = total electrical energy (kWh) used by the air conditioner for all purposes (including compressors, controls and fans) over a 30 min period while operating in DRM 2

$E_{(3)}$ = total electrical energy (kWh) used by the air conditioner for all purposes (including compressors, controls and fans) over a 30 min period while operating in DRM 3

R = total electrical energy (kWh) used by the air conditioner for all purposes (including compressors, controls and fans) over a 30 min period while in normal operation

For verification of compliance with DRM 2 and DRM 3, a tolerance of +10% is permitted for $E_{(2)}$ and $E_{(3)}$.

R, $E_{(2)}$ and $E_{(3)}$ shall all be measured while the air conditioner is operating under the same temperature and humidity conditions and in the same operating mode (i.e. cooling or heating).

If an air conditioner is capable of both DRM 2 and DRM 3, then Equation 3 shall also be satisfied:

$$E_{(3)} - E_{(2)} \geq R \times 0.15 \quad \ldots (3)$$

Air conditioners that are capable of cooling and of DRM 2 or DRM 3, or both, shall be capable of demonstrating compliance with DRM 2 or DRM 3, or both, as applicable, at Conditions T1 and T3 in ISO 5151 (Compliance Method A in Section 5 of this Standard). Alternatively, compliance may be demonstrated using Compliance Method B in Section 5.

Air conditioners that are capable of heating and of DRM 2 or DRM 3, or both, shall be capable of demonstrating compliance with DRM 2 or DRM 3, or both, as applicable, at Condition H1 in ISO 5151 (Compliance Method A in Section 5 of this Standard). Alternatively, compliance may be demonstrated using Compliance Method B in Section 5.

Example:

An air conditioner is capable of DRM 2 and DRM 3 as well as DRM 1. Under normal operation in cooling mode at Condition T1, it uses 1.52 kWh over a 30 min period. After receiving OI 2 it uses 0.80 kWh over a 30 min period. After receiving OI 3 it uses 1.1 kWh over a 30 min period.

$R = 1.52$

$E_{(2)} = 0.80$

To satisfy Equation 1, $E_{(2)} \leq 0.76$. As there is a tolerance of +10%, the energy use in DRM 2 can be up to $0.76 \times 1.1 = 0.84$ kWh. As $E_{(2)} = 0.80$, the air conditioner satisfies Equation 1 and complies with DRM 2.

$E_{(3)} = 1.10$

To satisfy Equation 2, $E_{(3)} \leq 1.14$. As $E_{(3)} = 1.10$, the air conditioner satisfies Equation 2 and complies with DRM 3 (without needing to invoke the tolerance).

$E_{(3)} - E_{(2)} = 1.10 - 0.80 = 0.30$

$R \times 0.15 = 1.52 \times 0.15 = 0.23$

Therefore $E_{(3)} - E_{(2)} \geq R \times 0.15$, so the air conditioner satisfies Equation 3.

NOTE: It is possible, indeed likely, that in practice the duration of demand response events will not be exact multiples of 30 min. However, if responding to OI 2 or OI 3, an air conditioner's control logic will need to anticipate the duration of the event so that it can manage operations to meet Equation 1 or Equation 2. For the purposes of this Standard, the anticipated duration should be 30 min. If the duration of the event extends beyond 30 min, the air conditioner should anticipate that the duration will be a further 30 min and so on. Verification of compliance will be carried out over one or more complete 30 min periods.

The conditions of DRM 2 and DRM 3 shall be met irrespective of changes in user settings during a demand response event (e.g. switching on 'turbo' or 'boost' modes).

2.3 OVERRIDE CAPABILITY

The air conditioner shall not have a manual or automatic override capability.

NOTE: If an override function is to be provided within the demand response system, it may be incorporated in the DRED.

2.4 RESPONSE TIMES

After receiving an OI from the DRED, the air conditioner shall enter the corresponding DRM within one of the following response times, as applicable:

(a) If the air conditioner is a fixed head multi-split system (defined in accordance with the AS/NZS 3823 series), the response time shall be not greater than 3 min.

(b) If the air conditioner is a variable refrigerant flow (VRF) multi-split system (defined in accordance with the AS/NZS 3823 series), the response time shall be not greater than declared in accordance with Appendix A.

(c) If the air conditioner is any other type, the response time shall be not greater than the time taken for the compressor to turn off in response to a user instruction or 60 s, whichever is less.

After receiving an OI from the DRED, if the air conditioner has a compressor of the fixed or single speed type, the compressor shall switch off within the response time specified in Item (c) above. If in DRM 2 or DRM 3 (but not DRM 1), the compressor may then turn on and off again one or more times during each 30 min period, provided that the requirements of Clause 2.2.2 are satisfied.

If the air conditioner is operating in a maintenance or safety mode when receiving an operational instruction, that mode may be completed before entering the required demand response mode.

NOTES:

1 Any randomization (i.e. variation of the time delay between the receipt of a signal by the DRED from the remote agent and the signalling of an operational instruction to the air conditioner) will take place in the DRED.

2 If an air conditioner goes into maintenance or safety mode on three successive attempts, it does not comply with this Standard (see Clause 5.5).

2.5 OPERATION OF AUXILIARY EQUIPMENT

During a demand response event, the air conditioner's control systems and circuits may remain energized. Subject to the principles of Clauses 2.1 and 2.2, the operation of fans in each mode shall be at the discretion of the appliance manufacturer.

2.6 HEATING AND COOLING MODES

The air conditioner shall be capable of responding to OI 1 (and OI 2 or OI 3, or both, if capable of DRM 2 or DRM 3, or both), under each of the user settings of which it is capable, i.e.—

(a) cooling;

(b) heating; or

(c) automatic (i.e. where a target temperature is selected and the unit cools or heats as required to meet that target).

2.7 MULTIPLE OPERATIONAL INSTRUCTIONS

If a DRED connected to an air conditioner transmits more than one of the OIs corresponding to DRMs of which the air conditioner is capable, the air conditioner shall—

(a) if in normal operation, continue in that mode of normal operation; or

(b) if already in a demand response mode, revert to normal operation.

NOTE: Normal operation includes off-modes, standby modes and other modes that may be set by the user directly or by pre-programming.

SECTION 3 INTERFACES

3.1 GENERAL

An air conditioner shall be capable of detecting the assertion and non-assertion of any switch in a connected DRED that is assigned to an OI corresponding to a DRM of which the air conditioner is capable, when the electrical properties of the connection comply with Table 4.

3.2 PHYSICAL INTERFACES

The provision for the physical connection with the DRED shall be either via a terminal block or via an RJ45 socket.

If the interface connector is an RJ45 socket, all voltages shall be safety extra-low voltage (SELV) in accordance with AS/NZS 60335.1. If the interface is a terminal block, all voltages shall be SELV or extra-low voltage (ELV) in accordance with AS/NZS 60335.1. No voltage shall exceed 42 V d.c.

3.3 TERMINAL BLOCK

3.3.1 Terminal block pin assignments

If the provision for the physical connection is a terminal block, the terminal block shall allow a connected DRED to transmit the OIs corresponding to the DRMs of which the air conditioner is capable. The five possible options are illustrated in Figures 1 to 5.

NOTE: Figures 1 to 5 are configuration specifications, not marking requirements, which are specified in Clause 4.4.

FIGURE 1 CONFIGURATION OF THE TERMINAL BLOCK—OPTION 1

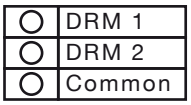


FIGURE 2 CONFIGURATION OF THE TERMINAL BLOCK—OPTION 2

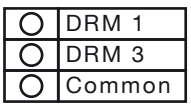
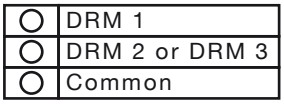


FIGURE 3 CONFIGURATION OF THE TERMINAL BLOCK—OPTION 3



NOTE: In Option 4, either DRM 2 or DRM 3 may be selected in the air conditioner for assignment to the second terminal.

FIGURE 4 CONFIGURATION OF THE TERMINAL BLOCK—OPTION 4

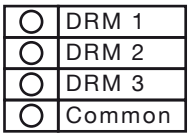


FIGURE 5 CONFIGURATION OF THE TERMINAL BLOCK—OPTION 5

3.3.2 Terminal block specifications

The terminal block on the air conditioner shall comply with AS/NZS 60335.1.

3.4 RJ45 SOCKET

3.4.1 RJ45 socket pin assignment

If the provision for the physical connection is a RJ45 socket, it shall have its terminals configured as specified in Table 2.

TABLE 2

RJ45 SOCKET PIN ASSIGNMENT

Pin	Assignment
1	OI 1
2	OI 2
3	OI 3
4	Not connected (see Note 1)
5	Not connected (see Note 1)
6	Common
7	V+ (see Note 2)
8	V– (see Note 2)

NOTES:

1 Only OIs 1, 2 and 3 are relevant to air conditioners. Pins 4 and 5 may be used in electrical products covered by other parts of the AS/NZS 4755 series.

2 The air conditioner may be equipped with a power supply suitable for use by a DRED, in which case pins 7 and 8 may be used for a direct current power supply (≤42 V d.c.) with polarity as indicated. If power is not provided, pins 7 and 8 shall be shorted.

If the DRED completes the circuit between pin 1 and pin 6, the air conditioner shall receive OI 1.

If the DRED completes the circuit between pin 2 and pin 6, the air conditioner shall receive OI 2.

If the DRED completes the circuit between pin 3 and pin 6, the air conditioner shall receive OI 3.

3.4.2 RJ45 socket specifications

The RJ45 socket shall meet the criteria in Table 3.

TABLE 3

RJ45 SOCKET SPECIFICATIONS

Property	Value	Symbol	Unit
Current rating	≥1.5	A	ampere
Voltage rating (VAC RMS)	≥125	V	volt
Dielectric strength (VAC RMS 50 Hz, 1 min)	≥1000	V	volt
Insulation resistance (MΩ min 500 V)	≥1000	MΩ	megohm

3.5 CIRCUIT TO DRED

The air conditioner shall be capable of detecting the status of the DRED switch in the circuit defined in Figure 6, when the circuit and signals between the DRED and the air conditioner meet the criteria in Table 4.

The voltage provided by the air conditioner between OIx and Common shall be either d.c. or sinusoidal a.c. at the mains supply frequency.

NOTE: Each connection to the DRED may be represented in terms of the basic circuit unit in Figure 6. Connecting circuits corresponding to three separate DRMs would require three such basic units with their Commons connected together.

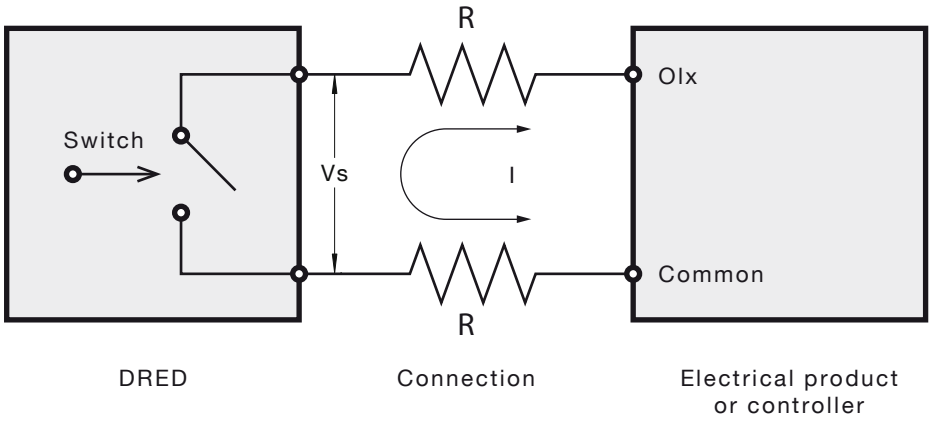


FIGURE 6 BASIC CIRCUIT UNIT

TABLE 4

CIRCUIT AND SIGNAL PARAMETER VALUE RANGES

Parameter	Value	Symbol	Unit
V	≤34.5	V	volt
Vs (d.c.) when carrying 0.03 A d.c.	≤1	V	volt
I (d.c.)	≤0.03	A	ampere
Switch open resistance	>1	MΩ	megohm
R	≤10	Ω	ohm

NOTES:

1 In the 'make' state, the switch submitted to a 0.030 A (30.0 mA) current will cause a voltage drop not larger than 1 V.

2 *R* represents connection d.c. resistance of each cable conductor.

3.6 OPTIONAL 230 V A.C. POWER SUPPLY

The air conditioner may also be equipped with an installer-accessible permanent 230 V, power supply suitable for use by a DRED. The power supply, if provided, shall comply with AS/NZS 60335.1.

Where a 230 V supply is provided, it shall be provided as a terminal block and it shall be capable of providing a current of at least 0.5 A.

3.7 OPTIONAL EXTRA-LOW VOLTAGE D.C. POWER SUPPLY

Where the interface is an RJ45 socket and the air conditioner provides power on pins 7 and 8, the power supply shall not exceed 42 V d.c. between conductors and not exceed 0.577 A. If no power is supplied, pins 7 and 8 shall be shorted.

NOTE: The power supply should be capable of supporting telemetry modems as used in advanced metering infrastructure (AMI) ready electricity meters. Such modems have a typical rated operating range of 6 to 32 V d.c. The power supply should be capable of delivering at least 0.500 A at 6 V d.c.

3.8 LOCATION AND ACCESS

The interface, whether RJ45 socket or terminal block, shall only be accessible by means of a tool, in accordance with AS/NZS 60335.1.

All power supplies, if provided, shall be co-located with the interface, with clearances and separations in accordance with AS/NZS 60335.1.

SECTION 4 LABELLING AND MARKING OF DEMAND RESPONSE CAPABILITY

4.1 GENERAL

This Section specifies requirements for the registration, labelling and marking of air conditioners that comply with this Standard.

NOTE: It is important for both buyers and installers to be able to easily identify whether an air conditioner complies with this Standard, and if so, the demand response modes of which it is capable. The most direct way to inform buyers is via the energy label required for compliance with AS/NZS 3823.2, but this may be removed before delivery or installation. The most reliable way to inform installers is via a permanent marking on the air conditioner. Installers can also check the model number and registration details on the Australian Government Energy Rating website (www.energyrating.gov.au). The registration details will include a statement of whether or not the model complies with this Standard.

4.2 REGISTRATION

If an air conditioner model complies with this Standard, the demand response mode or modes of which it is capable shall be indicated on the registration form in Appendix A.

4.3 POINT OF SALE LABELLING

If an air conditioner model complies with this Standard, and its demand response capabilities are indicated with point of sale labelling, the demand response capabilities shall be indicated on the energy label, in accordance with AS/NZS 3823.2.

NOTES:

1 The manufacturer may be required by regulations to indicate the demand response capabilities of which the model is capable with point of sale labelling.

2 Compliance with the registration, energy labelling and MEPS requirements of AS/NZS 3823.2 is mandatory under Australian and New Zealand law (see www.energyrating.gov.au).

4.4 MARKING

The air conditioner shall be provided with clear and permanent markings that are readily accessible and readable in the installed position.

The markings shall include—

(a) the text ‘AS/NZS 4755’;

(b) an indication of the demand response modes of which the unit is capable;

(c) an indication of whether the interface is SELV; and

(d) an indication of the provision of a d.c. power supply and if a d.c. power supply is provided the specification of this supply.

Figure 7 illustrates an acceptable form of marking. If this form of marking is used, each box shall contain a tick (if the air conditioner has that capability) or remain blank (if it does not have that capability).

FIGURE 7 EXAMPLE OF MARKING ON PRODUCT

If the physical interface is a terminal block, then either—

(i) each terminal shall be engraved or permanently marked with a digit '1', '2' or '3', indicating the corresponding demand response mode, or with '2/3' for terminals corresponding to a selectable demand response mode, and the letter 'C' for the Common; or

(ii) a permanent label with 'AS/NZS 4755' and numbers or characters, or both, indicating which terminal corresponds to each demand response mode and to the Common shall be affixed near the terminal block.

4.5 DOCUMENTATION

The documentation supplied with the air conditioner shall indicate that the air conditioner complies with this Standard (AS/NZS 4755.3.1), and the demand response modes of which it is capable. The documentation shall provide clear information on the correct and safe method and type of interconnecting wiring to the interface.

If the interface is an RJ45 socket that provides d.c. power on pins 7 and 8, the specification of the power supply shall be included in the supplied documentation.

SECTION 5 TESTING AND VERIFYING DEMAND RESPONSE CAPABILITY

5.1 GENERAL

This Section sets out the tests to be undertaken to demonstrate that an air conditioner complies with this Standard.

NOTE: The sequence of testing for registration and for compliance verification is illustrated in Appendix C.

Compliance with DRM 1 is tested in the same way for all air conditioners. There are two options for testing compliance with DRM 2 and DRM 3—Compliance Method A (energy reduction test) and Compliance Method B (capacity reduction test). Compliance testing of an air conditioner to Compliance Method B shall only be undertaken if the air conditioner is actually part of a working installation and the reduction ratios for that model have been previously determined in accordance with Clause 5.6.

Clause 5.7 sets out an optional screening test for basic demand response capability. If this test is undertaken, and the air conditioner fails, it does not comply with this Standard. If it passes, it still cannot be shown to comply with this Standard until compliance with DRM 1, and the other DRMs of which it is claimed to be capable, has been verified.

NOTE: Regulators may wish to use the screening test as part of their compliance and verification strategies.

5.2 GENERAL TEST PROVISIONS

5.2.1 General

The air conditioner shall be tested for response to all the demand response modes of which it is claimed to be capable.

An air conditioner that is capable of cooling shall demonstrate the claimed demand response capability under any cooling condition that the tester selects, provided—

(a) it is within the range of operating conditions of which it is capable; and

(b) the temperature of air entering the outdoor side does not exceed 46°C dry-bulb.

An air conditioner that is capable of heating shall demonstrate the claimed demand response capability under any heating condition that the tester selects, provided—

(i) it is within the range of operating conditions of which it is capable; and

(ii) the temperature of air entering the outdoor side is not less than 7°C dry-bulb and 6°C wet-bulb.

5.2.2 Air conditioners capable of DRM 1 only

For an air conditioner capable of DRM 1 only, it is not necessary to test for compliance with DRM 1 while the unit is operating in a controlled environment, but the testing may be undertaken in a controlled environment when the unit is set up for testing for compliance with the AS/NZS 3823 series. It shall be indicated on the form in Appendix A whether the tests were carried out in a controlled environment.

5.2.3 Air conditioners capable of DRM 2 or DRM 3

For an air conditioner capable of DRM 2 or DRM 3, or both, the initial compliance tests shall be carried out in a controlled environment, and the results reported using the form in Appendix A.

It shall be indicated on the form in Appendix A whether it is intended to allow check tests in the field using Compliance Method B (capacity reduction test). If so, the test in Clause 5.6 shall be undertaken and the required values recorded in the form in Appendix A.

If an air conditioner tested in a non-controlled environment (whether by Compliance Method A or by Compliance Method B) fails to operate in accordance with DRM 2 or DRM 3 (if claimed capable of those DRMs), further verification tests on the same unit (or on different samples of the same model) shall be carried out in a controlled environment before the air conditioner is declared non-compliant. Such further tests shall be carried out at Condition T3 or T1, or both (for tests in cooling mode), or at Condition H1 (for tests in heating mode).

NOTES:

1 Conditions T1 and H1 are defined in the AS/NZS 3823 series. Condition T3 is defined in ISO 5151.

2 The sequence of testing is illustrated in Appendix C.

If the air conditioner is claimed to have a selectable DRM 2 or DRM 3 capability, then only the demand response mode that is pre-selected by the manufacturer shall be tested. If no demand response mode is pre-selected, then the manufacturer's instructions for setting DRM 2 shall be followed, and DRM 2 only shall be tested.

5.2.4 Presence of a circumvention device

Where the behaviour of an air conditioner before, during or after testing indicates the possible presence of a circumvention device, this finding shall be included in the test report.

5.3 SET-UP FOR TESTING (ALL TESTS)

The air conditioner shall be assembled and set up to operate in accordance with the manufacturer's instructions.

A DRED shall be connected to the interface.

If the physical interface on the air conditioner is an RJ45 socket, the DRED switches shall be set up and connected to the RJ45 socket so that the pin assignments in Table 2 and the circuit and signal parameter value ranges in Table 4 can be achieved.

If the physical interface is a terminal block, the DRED switches shall be set up and connected to the terminal block so that the circuit and signal parameter value ranges in Table 4 can be achieved.

The power input to the air conditioner shall be monitored for the duration of the test, with readings captured at not more than 5 s intervals.

For tests undertaken in a laboratory or a controlled environment, the electricity supply to the point of connection of the air conditioner during all tests shall be maintained within the following limits:

(a) For single-phase units: Voltage—230 V a.c. ±1%.

(b) For three-phase units: Voltage—400 V a.c. ±1%.

(c) Frequency—50 Hz ±1%.

5.4 TESTING RESPONSES TO OPERATING INSTRUCTIONS

For each claimed demand response mode, one test shall be undertaken while the air conditioner operates in cooling mode, and one test shall be undertaken while the air conditioner operates in heating mode (if capable of heating). A test may also be undertaken when the air conditioner is in automatic mode.

If the air conditioner has an RJ45 socket, the response shall also be tested by completing the circuits between the Common and pin 4, and between pins 1 and 5, 2 and 5, 3 and 5, 4 and 5, and 5 and 6, for a period of not less than the period specified in the relevant test. Not more than one switch shall be asserted at a time. If the air conditioner changes its mode of operation, it indicates that the pin assignments do not conform to Table 2.

NOTE: This is to guard against unwanted responses to OIs that may be intended for other types of electrical products.

5.5 NON-COMPLIANCE

An air conditioner does not comply with this Standard if, in any of the operating conditions of which it is capable (whether cooling in the cooling setting, heating in the heating setting or heating or cooling in the automatic setting), one or more of the following occur during testing:

(a) The air conditioner fails the screening test (see Clause 5.7).

(b) The air conditioner, while operating, fails to enter the demand response mode of which it is claimed to be capable within the response time specified in Clause 2.4.

(c) The air conditioner, when switched on during a demand response event corresponding to a demand response mode of which it is claimed to be capable, fails to enter that demand response mode immediately (i.e. without starting) or, if it starts, within the response time specified in Clause 2.4.

(d) The air conditioner does not operate in accordance with the requirements of the demand response mode (see Clauses 5.8, 5.9 and 5.10).

(e) The air conditioner changes its mode of operation in response to the completion of any circuit corresponding to an OI, other than OI 1, OI 2 (if the air conditioner is capable of DRM 2) or OI 3 (if the air conditioner is capable of DRM 3).

(f) The information required by Section 4 is missing or incorrect.

If the air conditioner is in a maintenance or safety mode when receiving an operational instruction, that mode may be completed before entering the required demand response mode.

If the air conditioner enters a maintenance or safety mode during a demand response event, the test shall be terminated. The air conditioner shall be left to complete the maintenance or safety mode operation and then be manually switched off. A new test may be commenced after a period of not less than 15 min. If the air conditioner goes into a maintenance or safety mode on three successive test attempts, it does not comply with this Standard.

For Compliance Method A, the energy used by fans and all other auxiliaries shall be taken into account, along with the compressor energy use, in determining energy use in DRM 2 and DRM 3.

5.6 INITIAL TESTING TO DETERMINE REDUCTION RATIOS FOR COMPLIANCE METHOD B (CAPACITY REDUCTION)

5.6.1 Procedure

This test shall be undertaken if compliance is to be determined using Compliance Method B (capacity reduction test). If this test is not undertaken then compliance shall be verified using Compliance Method A (energy reduction test).

The air conditioner shall be installed for testing in a calorimeter or other controlled environment of the type required for establishing rated power and rated capacity under the AS/NZS 3823 series. A DRED shall be connected to the interface on the air conditioner but there shall be no OIs during this test.

For an air conditioner capable of cooling, this test shall be undertaken at condition T1, and for an air conditioner capable of heating, this test shall be undertaken at condition H1.

The procedure shall be as follows:

(a) Operate the air conditioner at the settings used to determine the rated cooling capacity and rated power, for a period of not less than 30 min.

NOTE: This period of operation may be the same as or part of the period used to determine rated power and rated capacity in accordance with the AS/NZS 3823 series.

(b) Determine one of the following values, as appropriate, over a period of 30 min of operation at rated capacity:

(i) For an air conditioner without variable output capacity (as defined in AS/NZS 3823 series), the percentage of time that the compressor runs (T_R).

NOTE: For operation at rated capacity this will usually be 100%.

(ii) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the average speed of the compressor (in Hz) (S_R).

NOTE: The average speed takes into account any times within the 30 min period when the compressor stops altogether. For example, if a compressor runs at 1000 Hz for 10 min, stops for 5 min and runs at 1500 Hz for 15 min, the average speed over the 30 min period is 1083 Hz.

(iii) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the percentage of time that the compressor runs loaded (L_R).

(c) For an air conditioner that claims compliance with DRM 2, adjust the user settings on the air conditioner so that it is operating at 50% of the rated power for 30 min, and determine one of the following values, as appropriate, during that operating period:

(i) For an air conditioner without variable output capacity, the percentage of time that the compressor runs (T_{DRM2}).

(ii) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the average speed of the compressor (in Hz) (S_{DRM2}).

(iii) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the percentage of time that the compressor runs loaded (L_{DRM2}).

(d) For an air conditioner that claims compliance with DRM 3, adjust the user settings on the air conditioner so that it is operating at 75% of the rated power for 30 min, and determine one of the following values, as appropriate, over that operating period:

(i) For an air conditioner without variable output capacity, the percentage of time that the compressor runs (T_{DRM3}).

(ii) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the average speed of the compressor (in Hz) (S_{DRM3}).

(iii) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the percentage of time that the compressor run loaded (L_{DRM3}).

NOTE: Step (d) may not need to be performed if the air conditioner is capable of both DRM 2 and DRM 3 and the reduction ratio for DRM 3 is calculated from the reduction ratio for DRM 2 (see Clause 5.6.2).

5.6.2 Calculation of reduction ratios

At the conclusion of the test procedure, the reduction ratio of the air conditioner shall be calculated.

For an air conditioner claimed to be capable of DRM 2, the following applies:

(a) For an air conditioner without variable output capacity, the compressor run time reduction ratio at DRM 2 (RT_2) shall be defined by Equation 4.

$$RT_2 = (T_{DRM2})/(T_R) \quad \ldots (4)$$

(b) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the speed reduction ratio at DRM 2 (RS_2) shall be defined by Equation 5.

$$RS_2 = (S_{DRM2})/(S_R) \quad \ldots (5)$$

(c) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the loading reduction ratio at DRM 2 (RL_2) shall be defined by Equation 6.

$$RL_2 = (L_{DRM2})/(L_R) \quad \ldots (6)$$

For an air conditioner claimed to be capable of DRM 3, the following applies:

(i) For an air conditioner without variable output capacity, the compressor run time reduction ratio at DRM 3 (RT_3) shall be defined by Equation 7.

$$RT_3 = (T_{DRM3})/(T_R) \quad \ldots (7)$$

(ii) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the speed reduction ratio at DRM 3 (RS_3) shall be defined by Equation 8.

$$RS_3 = (S_{DRM3})/(S_R) \quad \ldots (8)$$

(iii) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the loading reduction ratio at DRM 3 (RL_3) shall be defined by Equation 9.

$$RL_3 = (L_{DRM3})/(L_R) \quad \ldots (9)$$

For an air conditioner claimed to be capable of both DRM 2 and DRM 3, the reduction ratio for DRM 3 shall either be calculated from measured values (using Equations 7, 8 or 9, as appropriate) or directly from the reduction ratios for DRM 2 (using Equations 10, 11 or 12, as appropriate). Where the reduction ratio for DRM 3 is calculated directly from the reduction ratios for DRM 2, the following applies:

(A) For an air conditioner without variable output capacity, the compressor run time reduction ratio at DRM 3 (RT_{3C}) shall be defined by Equation 10.

$$RT_{3C} = RT_2 \times 1.5 \quad \ldots (10)$$

(B) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the speed reduction ratio at DRM 3 (RS_{3C}) shall be defined by Equation 11.

$$RS_{3C} = RS_2 \times 1.5 \quad \ldots (11)$$

(C) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the loading reduction ratio at DRM 3 (RL_{3C}) shall be defined by Equation 12.

$$RL_{3C} = RS_3 \times 1.5 \quad \ldots (12)$$

For an air conditioner claimed to be capable of both DRM 2 and DRM 3, the reduction ratio for DRM 2 shall either be calculated from measured values (using Equations 4, 5 or 6 as appropriate) or directly from the reduction ratios for DRM 3 (using Equations 13, 14 or 15, as appropriate). Where the reduction ratio for DRM 2 is calculated directly from the reduction ratios for DRM 3, the following applies:

(1) For an air conditioner without variable output capacity, the compressor run time reduction ratio at DRM 2 (RT_{2C}) shall be defined by Equation 13.

$$RT_{2C} = RT_3 \times 0.67 \quad \ldots (13)$$

(2) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the speed reduction ratio at DRM 2 (RS_{2C}) shall be defined by Equation 14.

$$RS_{2C} = RS_3 \times 0.67 \quad \ldots (14)$$

(3) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the loading reduction ratio at DRM 2 (RL_{2C}) shall be defined by Equation 15.

$$RL_{2C} = RS_3 \times 0.67 \quad \ldots (15)$$

5.7 SCREENING TEST FOR BASIC DEMAND RESPONSE CAPABILITY (OPTIONAL)

This test is optional. It may be used as an initial screening test. It may be undertaken in a controlled or uncontrolled environment, including in the field, where the air conditioner is part of a working installation.

If this test is undertaken, the procedure shall be as follows:

(a) A DRED of known characteristics shall be connected to the interface.

(b) If the physical interface on the air conditioner is an RJ45 socket, the DRED shall be connected to the RJ45 socket so that the pin assignments in Table 2 and the specifications in Table 3 can be achieved.

(c) If the physical interface is a terminal block, the DRED shall be connected to the terminal block so that the circuit and signal parameter value ranges in Table 4 can be achieved.

(d) The air conditioner shall be set to operate in heating, cooling or automatic mode, by setting the thermostat in relation to the ambient temperature, and shall be permitted to operate for a period of not less than 15 min before the test commences.

(e) The DRED shall transmit OI 1 for a period of not less than 7.5 min, then cease OI 1 for an identical period, then transmit OI 1 again for an identical period, then cease OI 1 again for an identical period, then transmit OI 1 again for an identical period, so that a sequence of at least three periods of OI 1, separated by two periods without OI 1, is completed within 60 min, with all 5 periods of equal duration. After the last period of OI 1, the air conditioner shall be operated without OIs for at least 15 min.

(f) The operation of the air conditioner shall be monitored to ensure that——

  (i) during periods with OI 1, the compressor switches off within the response time required for that type of air conditioner by Clause 2.4, and remains off; and

  (ii) during periods without OI 1, the compressor resumes normal operation.

5.8 VERIFICATION OF CLAIMED COMPLIANCE WITH DRM 1

5.8.1 Interrupting operation by a DRM 1 event

The procedure shall be as follows:

(a) The unit shall be set to operate in heating, cooling or automatic mode, by setting the thermostat in relation to the ambient temperature, and shall be permitted to operate for a period of not less than 30 min before the test commences.

(b) If the air conditioner also claims compliance with DRM 2 or DRM 3, or both, the total electrical energy (kWh) consumed during a continuous 30 min period of operation shall be recorded. This value becomes *R* for Equations 1, 2 and 3.

(c) For all types of air conditioner other than basic multi-split units and variable refrigerant flow units, the unit shall be switched off manually using the method recommended by the manufacturer. The time taken for the compressor to cease operation shall be recorded. This becomes the 'time taken for the compressor to turn off in response to a user instruction' for the determination of the response time in accordance with Clause 2.4(c).

(d) The air conditioner shall be switched on again and shall be permitted to operate for a period of not less than 15 min before the following step is performed.

(e) The DRED shall transmit OI 1 for a period of not less than 7.5 min, then cease OI 1 for an identical period, then transmit OI 1 again for an identical period, then cease OI 1 again for an identical period, then transmit OI 1 again for an identical period, so that a sequence of at least three periods of OI 1, separated by two periods without OI 1, is completed within 60 min, with all 5 periods of equal duration. After the last period of OI 1, the air conditioner shall be operated without OIs for at least 30 min.

(f) The operation of the air conditioner shall be monitored to ensure that—

  (i) during periods with OI 1, the compressor switches off within the response times required for that type of air conditioner in Clause 2.4, and remains off; and

  (ii) during periods without OI 1, the compressor resumes normal operation.

Examples:

7.5 min with OI 1, 7.5 min without OI 1, 7.5 min with OI 1, 7.5 min without OI 1, 7.5 min with OI 1, 30 min without OIs; or 10 min with OI 1, 10 min without OI 1, 10 min with OI 1, 10 min without OI 1, 10 min with OI 1, 35 min without OIs.

5.8.2 Switching on during a DRM 1 event

The procedure shall be as follows:

(a) After the completion of the previous test, the air conditioner shall be left switched off for a period of not less than 30 min. The DRED shall then transmit OI 1.

(b) Not less than 10 min after the start of OI 1, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected, and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions.

(c) The air conditioner compressor shall either remain off or, if it starts operation, switch off again within the response time required by Clause 2.4.

(d) The operation of the air conditioner shall be monitored for at least 15 min to ensure that the compressor remains off.

(e) Whether the air circulation fans operate, and the appearance of any indication or text indicating that the air conditioner is in a demand response mode, shall be noted.

(f) The air conditioner (still not operating due to OI 1) shall be manually switched off within 30 min. The DRED shall cease OI 1 not less than 15 min after the air conditioner is manually switched off. The air conditioner shall be monitored for a period of not less than 15 min to ensure that it remains off.

(g) Not less than 30 min after it was last switched off, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions. The operation of the air conditioner shall be monitored to ensure that it operates normally.

If the air conditioner is capable of being switched on and off by presetting a timer, the test shall be repeated, with times preset for the air conditioner to switch on, off and on again within the time constraints specified above. The mode (cooling, heating or automatic) shall be pre-selected and the temperature setting preset so that the air conditioner would be expected to cool (or heat) under the ambient conditions when it comes on.

5.9 VERIFICATION OF CLAIMED COMPLIANCE WITH DRM 2

5.9.1 Compliance Method A—Energy reduction test

5.9.1.1 *General*

For the purposes of registering the demand response capabilities of an air conditioner using the form in Appendix A, this test shall be carried out in a laboratory where the power supply can be kept within the parameters indicated in Clause 5.3. A temperature and humidity-controlled environment is not necessary.

For the purposes of verifying the claimed demand response capabilities of an air conditioner and reporting the results using the form in Appendix B, this test shall be carried out in a controlled environment, with the conditions maintained at either T1 or T3 (where demand response is being verified during cooling operation) or H1 (where demand response is being verified during heating operation).

5.9.1.2 *Interrupting operation by a DRM 2 event*

The procedure shall be as follows:

(a) The unit shall be set to operate in heating, cooling or automatic mode, by setting the thermostat in relation to the ambient temperature, and shall be permitted to operate for a period of not less than 30 min before the test commences.

(b) The total electrical energy (kWh) consumed over a 30 min period shall be recorded. This value becomes *R* for Equation 1.

(c) The DRED shall transmit OI 2 for a period of 30 min (the ‘first period’), then cease OI 2 for 30 min, then transmit OI 2 for 60 min (the ‘third period’), then cease OI 2 for 30 min (i.e. the test duration is 150 min).

(d) The operation of the air conditioner shall be monitored to ensure that—

  (i) during periods with OI 2, the total electrical energy (kWh) consumed over any complete 30 min period is less than or equal to the energy determined in accordance with Equation 1, plus a 10% tolerance; and

  (ii) during periods without OI 2, the air conditioner resumes normal operation.

5.9.1.3 *Switching on during a DRM 2 event*

The procedure shall be as follows:

(a) After the completion of the previous test, the air conditioner shall be left switched off for a period of not less than 30 min. The DRED shall then transmit OI 2.

(b) Not less than 10 min after the start of OI 2, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected, and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions.

(c) The operation of the air conditioner shall be monitored for a period of either 30 min or 60 min and then OI 2 shall be terminated (without adjusting any user settings).

(d) The operation of the air conditioner shall be monitored to ensure the following:

(i) During periods with OI 2, the total electrical energy (kWh) consumed over any complete 30 min period between the air conditioner being switched on and the subsequent termination of OI 2 is less than or equal to the energy determined in accordance with Equation 1, plus a 10% tolerance.

(ii) The air conditioner continues to operate normally after the termination of OI 2, until manually switched off.

(e) The appearance of text or any other indication that the air conditioner is in a demand response mode shall be noted.

(f) The air conditioner shall be manually switched off within 30 min of the last OI 2 termination. The DRED shall transmit OI 2 again at least 15 min after the air conditioner is switched off and then terminate OI 2 again after not less than 15 min. The air conditioner shall be monitored for a period of 30 min to ensure that it remains off.

(g) Not less than 30 min after it was last switched off, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions. The operation of the air conditioner shall be monitored to ensure that it operates normally.

If the air conditioner is capable of being switched on and off by presetting a timer, the test shall be repeated, with times preset for the air conditioner to switch on, off and on again within the time constraints specified above. The mode (cooling, heating or automatic) shall be pre-selected and the temperature setting preset so that the air conditioner would be expected to cool (or heat) under the ambient conditions when it comes on.

5.9.2 Compliance Method B—Capacity reduction test

5.9.2.1 *General*

This Compliance Method shall only be used if the following conditions are satisfied:

(a) The air conditioner is actually part of a working installation.

(b) The reduction ratios have been previously determined in accordance with Clause 5.6.

5.9.2.2 *Setting up and testing during normal operation*

The procedure shall be as follows:

(a) A DRED of known characteristics shall be connected to the interface.

NOTE: This is intended to ensure that the field test determines the performance of the air conditioner, and is not affected by the performance of the DRED.

(b) If the physical interface on the air conditioner is an RJ45 socket, the DRED shall be connected to the RJ45 socket so that the pin assignments in Table 2 and the cicuit and signal parameter value ranges in Table 4 can be achieved.

(c) If the physical interface is a terminal block, the DRED shall be connected to the terminal block so that the circuit and signal parameter value ranges in Table 4 can be achieved.

(d) The air conditioner shall be set to operate in heating, cooling or automatic mode, by setting the thermostat in relation to the ambient temperature, and shall be permitted to operate for a period of not less than 15 min before the following step is performed.

(e) The following quantities shall be recorded over a period of not less than 15 min of normal operation:

(i) For an air conditioner without variable output capacity (as defined in AS/NZS 3823), the percentage of time that the compressor runs (T_R).

(ii) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the time periods that the compressor is operating and not operating, and the average speed of the compressor during each period of operation (in Hz) (S_R).

(iii) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the percentage of time that the compressor runs loaded (L_R).

(iv) For all types of air conditioners, the ambient (outside) dry-bulb air temperature.

5.9.2.3 *Interrupting operation by a DRM 2 event*

The procedure shall be as follows:

(a) Following the period of normal operation [(Clause 5.9.2.2(e))], the air conditioner shall be switched off for not less than 60 min.

NOTE: This interval is intended to allow the conditioned space to partly return to ambient conditions, so that DRM 2 operation is less affected by reductions in load as the air conditioner approaches the thermostat set point.

(b) The air conditioner shall be switched on in the same mode as previously used for normal operation (i.e. heating, cooling or automatic mode). The thermostat or other operating setting shall not be changed.

(c) After a period of not more than 15 min, the DRED shall transmit OI 2, and the performance of the air conditioner shall be monitored over the same length of time as was used for monitoring normal operation (measured from the time the air conditioner enters DRM 2).

(d) The following shall be measured or calculated, or both:

(i) The time taken for the air conditioner to enter DRM 2.

(ii) The average value of T_{DRM2}, S_{DRM2} or L_{DRM2} (as defined in Clause 5.6.2) over the period of operation in DRM 2.

(e) The appropriate reduction ratio shall be calculated from the values measured in this test, in accordance with Clause 5.6.2.

The air conditioner shall be deemed to comply if the reduction ratio is within +10% of the corresponding value for DRM 2 previously determined in accordance with Clause 5.6.2.

If the reduction ratio is not within these bounds, Compliance Method A (the energy reduction test) of Clause 5.9.1 shall be carried out in a controlled environment, using the same air conditioner (moved from the field to the laboratory) or a different unit of the same model.

5.9.2.4 *Switching on during a DRM 2 event*

The procedure shall be as follows:

(a) After the completion of the previous test, the air conditioner shall be left switched off for a period of not less than 30 min. The DRED shall then transmit OI 2.

(b) Not less than 10 min after the start of OI 2, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected, and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions.

(c) The air conditioner shall be permitted to operate for a period of not less than 15 min and then the DRED shall terminate OI 2 (without adjusting any user settings).

(d) The air conditioner shall be operated for at least 15 min after OI 2 is terminated.

(e) The following shall be measured or calculated, or both:

(i) The time taken for the air conditioner to enter DRM 2 after it is manually switched on.

(ii) The average value of T_{DRM2}, S_{DRM2} or L_{DRM2} over the period of operation in DRM 2.

(f) The appearance of text or any other indication that the air conditioner is in a demand response mode shall be noted.

(g) The reduction ratio during DRM 2 operation shall be calculated in accordance with Clause 5.6.2.

The air conditioner shall be deemed to comply if the reduction ratio is within +10% of the corresponding value for DRM 2 previously determined in accordance with Clause 5.6.2.

If the reduction ratio is not within these bounds, Compliance Method A (the energy reduction test) of Clause 5.9.1 shall be carried out on in a controlled environment, using the same air conditioner (moved from the field to the laboratory) or a different unit of the same model.

5.10 VERIFICATION OF CLAIMED COMPLIANCE WITH DRM 3

5.10.1 Compliance Method A—Energy reduction test

5.10.1.1 *General*

For the purposes of registering the demand response capabilities of an air conditioner using the form in Appendix A, this test shall be carried out in a laboratory where the power supply can be kept within the parameters indicated in Clause 5.2. A temperature and humidity-controlled environment is not necessary.

For the purposes of verifying the claimed demand response capabilities of an air conditioner and reporting the results using the form in Appendix B, this test shall be carried out in a controlled environment, with the conditions maintained at either T1 or T3 (where demand response is being verified during cooling operation) or H1 (where demand response is being verified during heating operation).

5.10.1.2 *Interrupting operation by a DRM 3 event*

The procedure shall be as follows:

(a) The unit shall be set to operate in heating, cooling or automatic mode, by setting the thermostat in relation to the ambient temperature, and shall be permitted to operate for a period of not less than 30 min before the test commences.

(b) The electrical energy (kWh) consumed over a 30 min period shall be recorded. This value becomes R for Equation 2.

(c) The DRED shall transmit OI 3 for a period of 30 min (the ‘first period’), then cease OI 3 for 30 min, then transmit OI 3 for 60 min (the ‘third period’), then cease OI 3 for 30 min (i.e. the test duration is 150 min).

(d) The operation of the air conditioner shall be monitored to ensure the following:

(i) During periods with OI 3, the total electrical energy (kWh) consumed over any complete 30 min period is less than or equal to the energy determined in accordance with Equation 2, plus a 10% tolerance.

(ii) During periods without OI 3, the air conditioner resumes normal operation.

5.10.1.3 *Switching on during a DRM 3 event*

The procedure shall be as follows:

(a) After the completion of the previous test, the air conditioner shall be left switched off for a period of not less than 30 min. The DRED shall then transmit OI 3.

(b) Not less than 10 min after the start of OI 3, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected, and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions.

(c) The operation of the air conditioner shall be monitored for a period of 60 min and then OI 3 shall be terminated (without adjusting any user settings).

(d) The operation of the air conditioner shall be monitored to ensure the following:

(i) During periods with OI 3, the total electrical energy (kWh) consumed over any complete 30 min period between the air conditioner being switched on and the subsequent termination of OI 3 is less than or equal to the energy determined in accordance with Equation 2, plus a 10% tolerance.

(ii) The air conditioner continues to operate normally after the termination of OI 3, until manually switched off.

(e) The appearance of text or any other indication that the air conditioner is in demand response mode shall be noted.

(f) The air conditioner shall be manually switched off within 30 min of the last OI 3 termination. The DRED shall transmit OI 3 again at least 15 min after the air conditioner is switched off and then terminate OI 3 again after not less than 15 min. The air conditioner shall be monitored for a period of 30 min to ensure that it remains off.

(g) Not less than 30 min after it was last switched off, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions. The operation of the air conditioner shall be monitored to ensure that it operates normally.

If the air conditioner is capable of being switched on and off by presetting a timer, the test shall be repeated, with times preset for the air conditioner to switch on, off and on again within the time constraints specified above. The mode (cooling, heating or automatic) shall be pre-selected and the temperature setting preset so that the air conditioner would be expected to cool (or heat) under the ambient conditions when it comes on.

5.10.2 Compliance Method B—Capacity reduction test (optional)

5.10.2.1 *General*

This Compliance Method shall only be used if the following conditions are satisfied:

(a) The air conditioner is actually part of a working installation.

(b) The reduction ratios have been previously determined in accordance with Clause 5.6.

5.10.2.2 *Setting up and testing during normal operation*

The procedure shall be as follows:

(a) A DRED of known characteristics shall be connected to the interface.

NOTE: This is intended to ensure that the field test determines the performance of the air conditioner, and is not affected by the performance of the DRED.

(b) If the physical interface on the air conditioner is an RJ45 socket, the DRED shall be connected to the RJ45 socket so that the pin assignments in Table 2 and the circuit and signal parameter value ranges in Table 4 can be achieved.

(c) If the physical interface is a terminal block, the DRED shall be connected to the terminal block so that the circuit and signal parameter value ranges in Table 4 can be achieved.

(d) The air conditioner shall be set to operate in heating, cooling or automatic mode by setting the thermostat in relation to the ambient temperature, and shall be permitted to operate for a period of not less than 15 min before the following step is performed.

(e) The following quantities shall be recorded over a period of not less than 15 min of normal operation:

(i) For an air conditioner without variable output capacity (as defined in the AS/NZS 3823 series), the percentage of time that the compressor runs (T_R).

(ii) For an air conditioner with variable output capacity achieved by means of an inverter and variable speed compressor, the average speed of the compressor (in Hz) (S_R).

(iii) For an air conditioner with variable output capacity achieved by means of a digital scroll compressor, the percentage of time that the compressor runs loaded (L_R).

(iv) For all types of air conditioners, the ambient (outside) dry-bulb air temperature.

5.10.2.3 *Interrupting operation by a DRM 3 event*

The procedure shall be as follows:

(a) Following the period of normal operation [Clause 5.10.2.2(e)] the air conditioner shall be switched off for not less than 60 min.

NOTE: This interval is intended to allow the conditioned space to partly return to ambient conditions, so that DRM 3 operation is less affected by reductions in load as the air conditioner approaches the thermostat set point.

(b) The air conditioner shall be switched on in the same mode as previously used for normal operation (i.e. heating, cooling or automatic mode). The thermostat or other operating setting shall not be changed.

(c) After a period of not more than 15 min, the DRED shall transmit OI 3, and the performance of the air conditioner shall be monitored over the same length of time as was used for monitoring normal operation (measured from the time the air conditioner enters DRM 3).

(d) The following shall be measured or calculated, or both:

(i) The time taken for the air conditioner to enter DRM 3.

(ii) The average value of T_{DRM3}, S_{DRM3} or L_{DRM3} (as defined in Clause 5.6.2) over the period of operation in DRM 3.

(e) The appropriate reduction ratio shall be calculated from the values measured in this test, in accordance with Clause 5.6.2.

The air conditioner shall be deemed to comply if the reduction ratio is within +10% of the corresponding value for DRM 3 previously determined in accordance with Clause 5.6.

If the reduction ratio is not within these bounds, Compliance Method A (the energy reduction test) of Clause 5.10.1 shall be carried out in a controlled environment, using the same air conditioner (moved from the field to the laboratory) or a different unit of the same model.

5.10.2.4 *Switching on during a DRM 3 event*

The procedure shall be as follows:

(a) After the completion of the previous test, the air conditioner shall be left switched off for a period of not less than 30 min. The DRED shall then transmit OI 3.

(b) Not less than 10 min after the start of OI 3, the air conditioner shall be manually switched on, the mode (cooling, heating or automatic) selected and the temperature setting adjusted so that the air conditioner would be expected to cool (or heat) under the ambient conditions.

(c) The air conditioner shall be permitted to operate for a period of not less than 15 min and then the DRED shall terminate OI 3 (without adjusting any user settings).

(d) The air conditioner shall be operated for at least 15 min after OI 3 is terminated.

(e) The following shall be measured or calculated, or both:

  (i) The time taken for the air conditioner to enter DRM 3 after it is manually switched on.

  (ii) The average value of T_{DRM3}, S_{DRM3} or L_{DRM3} over the period of operation in DRM 3.

(f) The appearance of text or any other indication that the air conditioner is in a demand response mode shall be noted.

(g) The reduction ratio during DRM 3 operation shall be calculated in accordance with Clause 5.6.2.

The air conditioner shall be deemed to comply if the reduction ratio is within +10% of the corresponding value for DRM 3 previously determined in accordance with Clause 5.6.2.

If the reduction ratio is not within these bounds, Compliance Method A (the energy reduction test) of Clause 5.10.1 shall be carried out in a controlled environment, using the same air conditioner (moved from the field to the laboratory) or a different unit of the same model.

5.11 TEST REPORT

The report of the verification of claimed demand response capability shall be in the form set out in Appendix B.

NOTE: Registration authorities may accept the form in Appendix B of AS/NZS 3823.2 as sufficient for purposes of registration of compliance with this Standard, or may request the registration information as set out in Appendix A of this Standard (AS/NZS 4755.3.1).

APPENDIX A

REGISTRATION INFORMATION FOR AIR CONDITIONERS COMPLYING WITH AS/NZS 4755.3.1

(Normative)

In jurisdictions where compliance with this Standard is mandatory for air conditioners, the following information shall be submitted to the regulators, who may place it on a public register.

REGISTRATION INFORMATION

DECLARATION—Compliance with Australian/New Zealand Standard AS/NZS 4755.3.1, ***Demand response capabilities and supporting technologies for electrical products*****, Part 3.1:** ***Interaction of demand response enabling devices and electrical products—Operational instructions and connections for air conditioners.***

Name of applicant			
Company name			
Company address			
Brand name(s)			
GEMS product class (AS/NZS 3823.2, Table 3.1)			
Type of air conditioner? (Clause 2.4)		Fixed head multi-split/Variable refrigerant flow multi-split/Fixed speed/Other	
Operating modes of which unit is capable		Cooling/Heating/Automatic	
Model designation (*for split systems)	System name/number	Indoor unit number/s*	Outdoor unit number/s*
Name of contact person for inquiries			
Address of contact person			
Position/Title			
Telephone			
Facsimile			
E-mail			
Type of interface?		RJ45 socket/Terminal block	
If terminal block, number of terminals?			
Is the connection SELV? (Clause 3.2)		Yes/No	
Does the unit provide low voltage power through pins 7 and 8 of RJ45 socket?		Yes/No	
Was DRM 1 test carried out in a calorimeter room?		Yes/No	
If yes, what were the test conditions maintained for this test		T1/T3/H1	
If no, what were the approximate outdoor and indoor air conditions?		Air entering outdoor side: DB ºC Air entering indoor side: DB ºC	

Time for compressor to turn off when unit is manually switched off	Seconds
Response time in accordance with Clause 2.4	
DRMs claimed (in addition to DRM 1)	DRM 2/DRM 3
What energy reduction tests were undertaken under T1? (see Note)	DRM 2 (in cooling mode) DRM 3 (in cooling mode) DRM 2 (in auto mode) DRM 3 (in auto mode) None
What energy reduction tests were undertaken under T3? (see Note)	DRM 2 (in cooling mode) DRM 3 (in cooling mode) DRM 2 (in auto mode) DRM 3 (in auto mode) None
Which energy reduction tests were undertaken under H1? (see Note)	DRM 2 (in heating mode) DRM 3 (in heating mode) DRM 2 (in auto mode) DRM 3 (in auto mode) None
Is it intended to allow capacity reduction check tests in the field (Compliance Method B)? If yes, then provide the information below. If no, then no further information required	Yes/No
Does this air conditioner have variable output capacity?	Yes/No
If variable output is obtained by use of a variable output compressor, state type	Inverter Digital scroll Multi-stage Inverter+fixed speed Other (state type)
If variable output is obtained by means other than a variable output compressor, state type	Thermostatic or electronic expansion valve Multiple compressors Variable speed fan systems Other (state type)
At T1, value of T_R, S_R or L_R (Clause 5.6)	Insert value (if applicable)
At H1, value of T_R, S_R or L_R (Clause 5.6)	Insert value (if applicable)
At T1, value of T_{DRM2}, S_{DRM2} or L_{DRM2} (Clause 5.6)	Insert value (if applicable) Tested/Calculated from other DRM
At H1, value of T_{DRM2}, S_{DRM2} or L_{DRM2} (Clause 5.6)	Insert value (if applicable) Tested/Calculated from other DRM
At T1, value of T_{DRM3}, S_{DRM3} or L_{DRM3} (Clause 5.6)	Insert value (if applicable) Tested/Calculated from other DRM
At H1, value of T_{DRM3}, S_{DRM3} or L_{DRM3} (Clause 5.6)	Insert value (if applicable) Tested/Calculated from other DRM

NOTE: There is no obligation to undertake tests to all of conditions T1, T3 and H1 for the purposes of making this Declaration, but applicants should be aware that compliance may be tested at any of these conditions (see Clause 5.2.1).

APPENDIX B

VERIFICATION OF CLAIMED DEMAND RESPONSE CAPABILITY FOR AIR CONDITIONERS

(Normative)

Name of testing agency or laboratory			
Testing agency or laboratory address			
Name or identifier of person doing this test			
Name of contact person for inquiries			
Address of contact person			
Position/Title			
Telephone			
Facsimile			
E-mail			
Brand name of tested model			
Model designation (*for split systems)	System name/number	Indoor unit number*	Outdoor unit number*
Type of interface?		RJ45 socket/Terminal block	
If terminal block, number of terminals?			
If terminal block, terminals correctly marked?		Yes/No (if not, write reason)	
Is it claimed that the connection is SELV? (Clause 3.2)		Yes/No	
Is it claimed that the unit provides low voltage power through pins 7 and 8 of an RJ45 socket?		Yes/No (if yes, test whether this is present and report the conclusion)	
Type of air conditioner (for determining response time in accordance with Clause 2.4)		Fixed head multi-split/Variable refrigerant flow/Other	
Was test carried out in a calorimeter room?		Yes/No	
If yes, what were the test conditions maintained for this test		T1/T3/H1	
If no, what were the approximate outdoor and indoor air conditions?		Air entering outdoor side: DB ºC Air entering indoor side: DB ºC	
Time for compressor to turn off when unit is manually switched off		Seconds	

Response time in accordance with Clause 2.4						
When all connectable switches are closed (one at a time), is there any failure to activate claimed demand response modes, any activation of unclaimed demand response modes or any activation of demand response modes that do not correspond to terminal markings or RJ45 pins assignment?			(Yes/No) If yes, report what happened here			
Is unit capable of operating in this user setting?	**Cooling**		**Heating**		**Automatic**	
	Yes/No		Yes/No		Yes/No	
Rated electrical power in this mode (kW to 2 dpl)	kW		kW		Cooling kW Heating kW If in automatic setting, operating mode during this test Heat/Cool	
DRM 1 test (for each operating mode)	Cycling period	min	Cycling period	min	Cycling period	min
Compressor off when OI 1 switch closed?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Normal operation when OI 1 switch open?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Switching on (manually) with OI 1 switch already closed						
Enters DRM 1 as required?	Yes/No		Yes/No		Yes/No	
Note whether fans operate and any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No		Yes/No		Yes/No	
Operates normally when restarted?	Yes/No		Yes/No		Yes/No	
Switching on (preset timer) with OI 1 switch already closed					Timer? Yes/No	
Enters DRM 1 as required?	Yes/No		Yes/No		Yes/No	
Note whether fans operate and any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No		Yes/No		Yes/No	
Operates normally when restarted?	Yes/No		Yes/No		Yes/No	

Is DRM 2 claimed?	Yes/No		If yes, fixed or selectable?		Fixed/Selectable	
			If selectable, what was preset?		DRM 2/DRM 3	
DRM 2 test (for each operating mode)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Record $E_{(2)}$ for Equation 1	First period kWh	Third period kWh	First period kWh	Third period kWh	First period kWh	Third period kWh
Equation 1 satisfied? (with 10% tolerance)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Note any light, text, etc. indicators						
Switching on (manually) with OI 2 switch already closed						
Record $E_{(2)}$ for Equation 1	First period kWh	Third period kWh	First period kWh	Third period kWh	First period kWh	Third period kWh
Equation 1 satisfied? (with 10% tolerance)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Note any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Operates normally when restarted after OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Switching on (preset timer) with OI 2 switch already closed					Timer? Yes/No	
Record $E_{(2)}$ for Equation 1	First period kWh	Third period kWh	First period kWh	Third period kWh	First period kWh	Third period kWh
Equation 1 satisfied? (with 10% tolerance)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Note any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Operates normally when restarted after OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	

Is DRM 3 claimed?	Yes/No		If yes, fixed or selectable?		Fixed/Selectable	
			If selectable, what was preset?		DRM 2/DRM 3	
DRM 3 test (for each operating mode)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Record $E_{(3)}$ for Equation 2	First period kWh	Third period kWh	First period kWh	Third period kWh	First period kWh	Third period kWh
Equation 2 satisfied? (with 10% tolerance)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Note any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Operates normally when restarted OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Switching on (manually) with DRM 3 switch already closed					Timer? Yes/No	
Record $E_{(3)}$ for Equation 2	First period kWh	Third period kWh	First period kWh	Third period kWh	First period kWh	Third period kWh
Equation 2 satisfied? (with 10% tolerance)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Note any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Operates normally when restarted after OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	

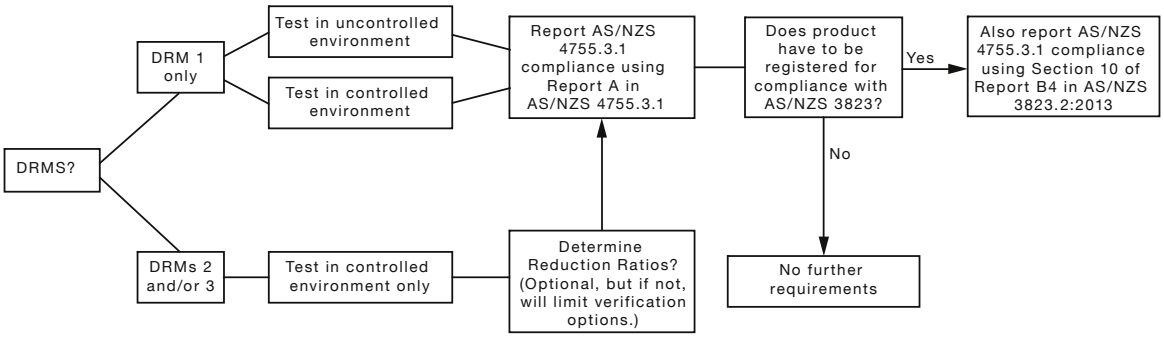
Switching on (preset timer) with DRM 3 switch already closed					Timer? Yes/No	
Record $E_{(3)}$ for Equation 1	First period kWh	Third period kWh	First period kWh	Third period kWh	First period kWh	Third period kWh
Equation 2 satisfied? (with 10% tolerance)	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Note any light, text, etc. indicators						
Remains off when OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Operates normally when restarted after OI ceases?	Yes/No/NA		Yes/No/NA		Yes/No/NA	
Air conditioners that claim both DRM 2 and DRM 3						
Is Equation 3 satisfied?					Yes/No	
Does the air conditioner contain a circumvention device that alters the operation during a test but is not normally activated during normal use?					Yes/No/NA	
Other comments						
Date of test						
Tester signature						

APPENDIX C

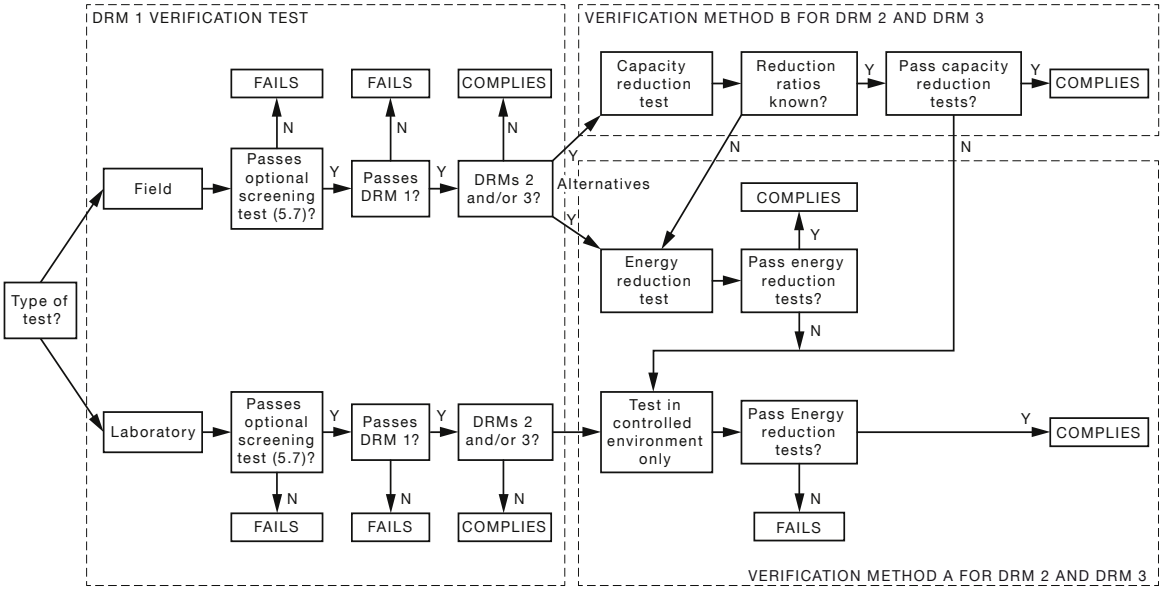
SEQUENCE OF TESTS FOR DETERMINING AND VERIFYING DEMAND RESPONSE CAPABILITY FOR AIR CONDITIONERS

(Informative)

C1 TESTING AND REPORTING COMPLIANCE FOR REGISTRATION PURPOSES



C2 CHECK TESTING TO VERIFY COMPLIANCE



NOTES

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