



DISTRICT COOLING METERING CODE



EFFECTIVE DATE: 01/11/2023



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Changes History Sheet

DOC. CHANGE REQUEST NO. & DATE	PAGE NO.	SUMMARY OF CHANGE	NEW EFFECTIVE DATE
DoE-DCR-058,11/10/2023	All	Technical review and modifications recommended by the DC code review panel and approved by DoE	01/11/2023





Preface

The District Cooling Metering Code has been developed to govern the design and operation of Meters used in the provision of District Cooling Service in the Emirate of Abu Dhabi.

The District Cooling Code is divided into the following Chapters:

1. **Introduction** that describes the legal basis, purpose and scope of the Code;
2. **Definitions, Abbreviations & Units** that describes certain words and abbreviations used in the Code, and explains the units of measurement used in the Code;
3. **District Cooling Metering General Conditions** that describe provisions of general application and include requirements and arrangements not otherwise referred to in the Code including the role and constitution of the District Cooling Metering Code Review Panel; and
4. **District Cooling Metering Technical Requirements** that describe the requirements for meter design, accuracy, testing and data collection.





1. Introduction

1.1 Citation

This Code is the District Cooling Metering Code second edition, implemented pursuant to Law 11.

1.2 Commencement

This Code came into force on the date of its publication, and is issued by the Regulator pursuant to DoE Chairman Decision No (44) of 2019 and Law No (11) of 2018.

1.3 Purpose

This Code is intended to ensure that Meters used in conjunction with the provision of DC Services are designed, operated and maintained to meet minimum levels of performance reliability and accuracy.

1.4 Scope

DC Plant Meters

Provisions of this Code apply, as specified, to DC Providers relative to DC Plant Meters. Some provisions, as specified, apply only to New DC Plant Meters.

ETS Meters

Provisions of this Code apply, as specified, to DC Providers and DC Retailers relative to Meters used for billing purposes in the provision of DC Services. Some provisions, as specified, apply only to New Meters.

1.5 Revision

This Code may be amended or revoked by the Regulator at any time.





1.6 Codes, Standards and References

Standards and references used in the development of this District Cooling Metering Code include:

- European Standard EN 1434-1:2016
- European Standard EN 1434-5:2016
- European Standard EN 1434-6:2016
- ISO/IEC 17025
- Pearl Rating System for Estidama: Building Rating System Design & Construction





2. Definitions, Abbreviations & Units

2.1 Interpretation

Words defined in this Code begin with capital letters when used in the Code.

Words and expressions other than those defined in this Code which are defined in Law No (2), shall have the meanings ascribed to them in Law No (2).

Words using the singular or plural number also include the plural or the singular number respectively.

Unless otherwise specified, days shall mean calendar days.

2.2 Definitions

Accredited Test Facilities means a calibration/testing laboratory accredited to ISO/IEC 17025 or equivalent.

Alternative Metering Solution for Tenant Meters means an acceptable metering solution where CHW flow volumes alone are used to determine DC Services charges for Tenants.

Billing Period – means the period over which Cooling Energy and Cooling Demand is measured for the purposes of billing.

Building – means buildings and associated structures and facilities constructed or to be constructed by, or on behalf of, Customers.

Building Side – means the Building System side at the Point of Delivery.





Building System – means a Chilled Water system and associated equipment within a Building.

Chilled Water – means cool water used in a closed hydronic system for Air Conditioning or process cooling applications.

Chilled Water Return – means Chilled Water which has a flow direction toward a DC Plant (in a DC Network) or toward ETS Equipment (in a Building System).

Chilled Water Supply – means Chilled Water which has a flow direction toward a Building (in a DC Network) or toward Air Conditioning units (in a Building System).

Cooling Demand – means the Cooling Load that is the basis for billing for DC Services.

Cooling Energy – means the removal of heat energy.

Cooling Load – means the rate of removal of heat energy.

Customer – means a person or entity that includes, but is not limited to, an owner of a Building or an apartment, home unit or other form of segregated accommodation within a Building, or an owners' association in relation to a Building, or an industrial facility, who contracts with a DC Retailer or DC Provider for DC Retailer Services.

DC Plant – means the central cooling plant and all associated equipment, including chillers, pumps, piping, TES facilities, Cooling Towers, emergency power supply equipment, control systems, electrical equipment and other installations and ancillary equipment, used or useful in the production of Cooling Energy and the distribution of Chilled Water, operated and maintained for purpose of supporting the provision of DC Provider Services.





DC Plant Meter – means any apparatus owned, operated and maintained by the DC Provider used to measure Cooling Energy, Cooling Load or water flow within the DC Plant.

DC Provider – means an entity which generates Cooling Energy and distributes such Cooling Energy to DC Retailers or to Customers using DC Provider Facilities pursuant to a District Cooling Provider licence.

DC Provider Facilities – means equipment and facilities including the DC Plant, DC Network and DC Provider ETS Equipment, and any other type of equipment installed, designed, constructed, operated and maintained by the DC Provider for the purpose of providing Cooling Services to DC Retailers or to Buildings up to the applicable Points of Delivery and Points of Return.

DC Provider Meter – means any apparatus owned, operated and maintained by the DC Provider used in or in connection with DC Provider Facilities for the purpose of determining the Cooling Energy and Cooling Demand of a DC Retailer, Building or group of Buildings.

DC Provider Services – means any activity by a DC Provider related to the generation of Cooling Energy and the distribution of such Cooling Energy to DC Retailers or to Customers.

DC Retailer – means an entity which acquires Cooling Energy from a DC Provider or from another DC Retailer for the purpose of resale of such acquired Cooling Energy to Customers; a DC Provider which serves a Customer directly may also act as a DC Retailer.

DC Retailer Facilities – means equipment and facilities owned, designed and installed by the DC Retailer as required for the supply of DC Retailer Services to Customers.





DC Retailer Meter – means any apparatus owned, operated and maintained by the DC Retailer used in or in connection with DC Retailer Facilities for the purpose of determining the Cooling Energy and Cooling Demand of a Building or a group of Buildings.

DC Retailer Services – means any activity by a DC Provider or DC Retailer related to:

- a. The provision of Cooling Energy by the DC Provider to Customers; or
- b. The purchase of Cooling Energy by means of Chilled Water from a DC Provider and resale of the Cooling Energy to Customers.

DC Retailer Side – means the DC Retailer side at the Point of Delivery (to Retailer).

DC Service – means provision and sale of Cooling Energy by means of Chilled Water from a DC Provider to a DC Retailer or Customer, or from a DC Retailer to a Customer.

DC System – means the equipment comprising a system of centralized production and distribution of Cooling Energy in the form of Chilled Water from a DC Plant to multiple Buildings through a DC Network.

Delta T – means the difference in temperature between Chilled Water Supply and Chilled Water Return.

Direct Connection – means supply of Cooling Energy from a DC Provider to a DC Retailer, or from a DC Retailer to a Customer, without transfer of Cooling Energy through one or more heat exchangers.

District Cooling – means the centralized production and distribution of Cooling Energy in the form of Chilled Water from a DC Plant to multiple Buildings through a DC Network.





Energy Transfer Station – means equipment used to facilitate the interconnection and transfer of Cooling Energy between DC Provider Facilities and DC Retailer Facilities, or between DC Retailer Facilities and a Building System.

ETS Meter – means a Meter installed in an ETS.

Exemption – means an exemption from a specified provision of this Code, granted by the Regulator.

Existing Meter – means a Meter which was installed before the effective date of this Code.

Good Industry Practice – means in relation to any undertaking and any circumstances, the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking.

Heat Exchanger – means heat transfer equipment installed as part of the ETS in an Indirect Connection.

Indirect Connection – means supply of Cooling Energy from a DC Provider to a DC Retailer or DC Customer, or from a DC Retailer to a Customer, using one or more Heat Exchangers.

Instation – means a computer-based system which collects or receives data on a routine basis from a Meter.

Landlord Areas – means areas in a Building with multiple Tenants which are common areas (halls, lobbies, etc.) not occupied by Tenants.

Licensed Entity – means a DC Provider or DC Retailer licensed to provide DC Provider Services or DC Retailer Services, respectively.





Meter – means a set of equipment for measuring Cooling Energy and Cooling Load and which may refer to a DC Provider Meter or DC Retailer Meter.

New DC Plant Meter – means a DC Plant Meter which has been installed after the effective date of this Code.

New Meter – means a Meter which has been installed after the effective date of this Code.

Peak Cooling Load – means the maximum instantaneous Cooling Load during a certain time period (day, month, year).

Periodic Inspection and Testing – means an inspection and test performed to determine the accuracy of equipment which have been put into service in accordance with this Code.

Point of Delivery (to DC Retailer) – means, for an Indirect Connection, the supply pipe flange on the DC Retailer Side of the heat exchanger(s) forming part of the DC Provider's Facilities; and for a Direct Connection, the point at which the supply pipe flange forming part of the DC Provider's Facilities connects with the DC Retailer Facilities. See Section 5, Annexes

Point of Delivery (to Customer) – means, for an Indirect Connection, the supply pipe flange on the Building Side of the heat exchanger(s) connected to the Building System; and for a Direct Connection, the point at which the supply pipe flange forming part of the DC Retailer Facilities connects with the Building System. See Section 5, Annexes

Point of Return (from DC Retailer) – means, for an Indirect Connection, the return pipe flange on the DC Retailer Side of the heat exchanger(s) forming part of the DC Provider's Facilities; and for a Direct Connection, the point at which the return pipe





flange forming part of the DC Provider's Facilities connects with the DC Retailer Facilities. See Section 5, Annexes

Point of Return (from Customer) – means, for an Indirect Connection, the return pipe flange on the Building Side of the heat exchanger(s) connected to the Building System; and for a Direct Connection, the point at which the return pipe flange forming part of the DC Retailer Facilities connects with the Building System. See Section 5, Annexes

Qualified Persons – means a person who has been certified by the Regulator to undertake a specific activity.

Reconditioning and Recalibration – means a repair or corrective activity to ensure that the accuracy of Meters is within the permissible tolerance for service through another Service Interval. Reconditioning may include recalibration, cleaning, replacing batteries and/or replacement of defective or worn parts.

Regulator – means the Abu Dhabi Department of Energy (or any successor organisation or entity, from time to time).

Service Interval – means the time between Periodic Inspection and Testing events.

Tenant – means the occupant of an apartment, home unit, office or other form of segregated space within a Building.

Tenant Cooling Energy – means the Cooling Energy of a Tenant.

2.3 Abbreviations

°C – degrees Celsius

CHW – Chilled Water





DC -- District Cooling

ΔT – Delta T

ETS – Energy Transfer Station

HEX – Heat Exchanger

2.4 Units

Error! Not a valid bookmark self-reference. shows the numerical units used in this document. **(Alternative units can be used in accordance with ‘Table 1 Units and Units conversion’ of the DC Technical Code)**

Table 1: Units

	Unit	Abbreviation
Cooling Energy	kiloWatt-hours cooling	kWh _c
Cooling Load or Demand	kiloWatts cooling	kW _c
Volume	litre	l
Flow	litres per second	l/s
Length	centimetre	cm
Temperature	degree celsius	°C
Conductivity	micro-Siemens per centimetre	μs/cm
Mass	milligram	mg
	gram	g
	kilogram	kg



3. General Conditions

3.1 Introduction

These General Conditions contain provisions which are of general application to the District Cooling Metering Code.

3.2 Registration

Each Licensed Entity is required to register in writing with the Regulator each Meter at or associated with each site where such Licensed Entity provides DC Service.

Registration information for New Meters shall include:

1. Identity of the Licensed Entity owning the Meter;
2. Identity of the entity receiving DC Service;
3. Full technical description of the Meter;
4. Single line drawing of the installation;
5. All applicable calibration documentation applying to the Meter; and
6. Confirmation by the Licensed Entity that the Meter is compliant with the Code.

Registration information for Existing Meters shall include items 1-5 above.

Each Licensed Entity shall notify the Regulator regarding the disconnection of any Meter, including full registration information on the Meter and the reason for disconnection.

3.3 Maintenance of Register and Documents

The Regulator shall establish and keep up to date a register of all Meters, including any site disconnections as notified to it pursuant to this Code.



3.4 Code Exemptions

If, for financial reasons or reasons of practicality, Meters to which this Code applies do not comply with some or all of the requirements of the Code, the Licensed Entity may make an application to the Regulator for an Exemption. Such application should be made in writing and the response to any such application shall also be in writing.

The Regulator shall be responsible for maintaining an up-to-date register of all Exemption applications together with their approval status. District Cooling Metering Code Review Panel members shall be informed of the outcome of such applications.

DC Providers shall be notified by the Regulator if a DC Retailer to which it provides service has made an application for an Exemption.

3.5 District Cooling Metering Code Review Panel

The Regulator shall establish and maintain a single panel, which shall be a standing body to carry out the functions referred to below. The panel shall:

1. Keep the District Cooling Metering Code and its working under review;
2. Review all suggestions for amendments to the District Cooling Metering Code;
3. Publish recommendations as to amendments to the District Cooling Metering Code that DC Providers, DC Retailers, Customers or the Panel feels are necessary or desirable and the reasons for the recommendations;
4. Issue guidance in relation to the District Cooling Metering Code and its implementation, performance and interpretation when asked to do so by any DC Providers, DC Retailers, or Customers; and
5. Consider what changes are necessary to the District Cooling Metering Code arising out of any unforeseen circumstances.

The Panel shall consist of a membership determined by the Regulator.

The Panel shall establish and comply at all times with its own rules and procedures relating to the conduct of its business, which shall be approved by the Regulator.





3.6 Duty of Good Faith and Standard of Conduct

Each party to the Code shall at all times in its dealings with the other parties to this Code:

1. Act in good faith; and
2. Act in accordance with Good Industry Practice.





4. District Cooling Metering Technical Requirements

4.1 Introduction

These District Cooling Metering Technical Requirements specify:

1. Quantities to be measured and recorded by Meters;
2. Meter components and technology;
3. Metering points;
4. Required accuracy of Meters;
5. Procedures for calibration, installation, testing and commissioning of Meters;
6. Procedures for periodic inspection and testing of Meters;
7. Requirements and procedures relating to data collection; and
8. Handling of disputes relating to Meters.

4.2 Measured Quantities

The quantities summarised in Table 2 shall be measured in DC Plant Meters. The quantities summarised in

Table 3 shall be measured in ETS Meters, unless the Meter is a Tenant Meter subject to a Code Exemption per Section 4.5 (in which case only parameters 11 and 12 apply).





Table 2: Measured Quantities in DC Plant Meters

Parameter #	Parameter measured	Unit of measurement	Location of measurement	Purpose of measurement
1	CHW Flow Rate to DC Network	litres/second	DC Network Supply Header	Determine DC Provider Cooling Energy production; compliance with KPIs 2-5
2	Peak CHW Flow Rate to DC Network	litres/second	DC Network Supply Header	Determine DC Provider Peak Cooling Load
3	CHW Make-Up Water Flow Rate	litres/second	Chilled water make up line	Water management; determine compliance with KPI 7
4	Cooling Tower Make-Up Water Flow Rate	litres/second	Condenser Cooling System	Water management
5	Potable Water Supply Flow Rate	litres/second	PW Supply from Water Utility	Water management; determine compliance with KPI 6
6	Recycled Water Supply Flow Rate	litres/second	RW Supply from Water Utility	Water management
7	Seawater Supply Flow Rate	litres/second	Seawater Intake Pipe	Water management
8	Wastewater Flow Rate	litres/second	Sewer Disposal Point	Regulatory compliance
9	CHW Supply Temperature to DC Network	°C	DC Network Supply Header	Determine DC Provider Cooling Energy production; compliance with KPIs 2-5
10	CHW Return Temperature from DC Network	°C	DC Network Return Header	Determine DC Provider Cooling Energy production; compliance with KPIs 2-5

Table 3: Measured Quantities in ETS Meters

Parameter #	Parameter measured	Unit of measurement	Location of measurement	Purpose of measurement
11	CHW Flow Rate to ETS from DC Network	litres/second	Supply side of ETS	Determine Cooling Energy delivered to ETS
12	Peak CHW Flow Rate to ETS from DC Network	litres/second	Supply side of ETS	Determine Peak Cooling Load delivered to ETS
13	CHW Supply Temperature to ETS	°C	DC Supply Side of ETS	Determine Cooling Energy delivered to ETS
14	CHW Return Temperature to ETS	°C	DC Supply Side of ETS	Determine Cooling Energy delivered to ETS



The quantities summarised in Table 4 shall be calculated from the measured quantities in DC Plant Meters. The quantities summarised in Table 5 shall be calculated from the measured quantities in ETS Meters, unless the Meter is a Tenant Meter subject to a Code Exemption per Section 4.5 (in which case only parameter ETS 4 shall apply).

Table 4: Calculated Quantities in DC Plant Metering (Alternative units can be used in accordance with 'Table 1 Units and Units conversion' of the DC Technical Code)

Parameter #	Parameter calculated	Unit of measurement	Location of measurement
DC 1	DC System Delta T	°C	9, 10
DC 2	Totalised Cooling Energy to DC Network	kWh _c	1, 9, 10
DC 3	Instantaneous Peak Cooling Load	kW _c	2, 9, 10
DC 4	Totalised CHW Make-Up Volume	litres	3
DC 5	Totalised Cooling Tower Make-Up Volume	litres	4
DC 6	Totalised PW Volume	litres	5
DC 7	Totalised RW Volume	litres	6
DC 8	Totalised Seawater Volume	litres	7
DC 9	Totalised Wastewater Volume	litres	8

Table 5: Calculated Quantities in ETS Metering (Alternative units can be used in accordance with 'Table 1 Units and Units conversion' of the DC Technical Code)

Parameter #	Parameter calculated	Unit of measurement	Location of measurement
ETS 1	ETS Delta T	°C	13, 14
ETS 2	Totalised Cooling Energy	kWh _c	11, 13, 14
ETS 3	Instantaneous Peak Cooling Load	kW _c	12, 13, 14
ETS 4	Totalised CHW Flow Volume	litres	11

4.3 Meter Components and Technology

4.3.1 Meter Components

Meters shall consist of the following, unless the Meter is a Tenant Meter subject to a Code Exemption per Section 4.5 (in which case only item 1 applies):



1. A CHW flow meter;
2. Paired temperature sensors; and
3. An energy calculator that integrates the CHW flow and temperature data.

4.3.2 Meter Technology

New flow meters shall be fast responding type (capable of measuring rapid dynamic variations in the exchanged heat) in order to ensure adequate performance during short peaks in consumption.

New Magnetic Induction (MID) flow meters shall be used only if the following DC System CHW qualities can be consistently achieved:

1. Minimum CHW conductivity according to flow meter manufacturer's requirements (typically $\geq 5 \mu\text{s/cm}$); and
2. CHW magnetite content less than 0.1 mg/kg.

4.3.3 Design of Metering Installation

New Metering installations shall be designed to facilitate the future on-site testing of Meters. Appropriate test pipe work shall be provided to facilitate on site verification testing of the Meter. Such test pipework should also enable efficient removal of Meters for off-site re-calibration whilst minimising any disruption to metered flow.

4.3.4 Sealing

A security seal shall be fitted to all New and existing Meters to prevent access to components which may affect its metrological characteristics or affect the ability of the meter to record actual consumption. Alternatively, meters can be password protected to prevent unauthorized access to meter settings. This security seal shall perform the function of:

1. Identifying that no internal access has been gained to the Meter; and
2. That the Meter functioned to acceptable standards when sealed.





Licensed Entities shall ensure that the Meters for which they are responsible are sealed.

Licensed Entities shall arrange for all Meters and their associated communications equipment to be sealed following registration, or Reconditioning and Recalibration, or any test or inspection thereof, except where sealing is deemed impractical in the reasonable opinion of the Regulator with regard to the physical configuration at each site. No seals applied shall be broken or removed except in the presence of, or with the consent of, the Licensed Entity responsible for the Meter.

4.4 Metering Points

Section 5, Annexes – ETS Metering Points describes and illustrates Points of Supply and Points of Return under a range of possible relationships between DC Providers, DC Retailers and Customers. The schematic diagrams in Figure 1 and Figure 2 indicate the location of flow meters and temperature sensors for the various types of connections. The location of the flow meter is the Metering Point. Existing Meter installations may differ from the arrangement depicted in Section 5, Annexes.

All Tenant areas and Landlord Areas for which DC Service is initiated after the effective date of this Code shall be individually metered, in accordance with requirement achievement RE-R2: Energy Monitoring & Reporting the Pearl Rating System for Estidama: Building Rating System Design & Construction.

4.5 Alternative Metering Solution for Tenant Meters

Licensed Entities may apply to the Regulator for a Code Exemption to use an Alternative Metering Solution for Tenant Meters.

In an Alternative Metering Solution for Tenant Meters, it is acceptable to measure Cooling Energy and Cooling Demand in accordance with the following requirements and procedures:





1. DC Service to the Building occupied by Tenants shall be measured by a Meter meeting all requirements of Section 4.3.
2. For each Tenant, Meters may consist of a CHW flow meter only, and the following quantities shall be measured and recorded—
 - a. CHW volumetric flow rate (l/s)
 - b. Totalized CHW volume (l)
3. Cooling Energy for a Tenant for a Billing Period shall be = TEP x BTE

In which —

$$TEP = \frac{TF}{BTF} + TFAP * (BTF - \Sigma TF)$$

$$TFAP = \frac{\text{Individual Tenant Floor Area}}{\text{Total Building Floor Area including Tenant Areas and Landlord Areas}}$$

TF = Individual Tenant CHW flow volume over the Billing Period

ΣTF = Sum of all Tenant CHW flow volumes over the Billing Period

BTF = Total CHW flow over the Billing Period for the entire building, including common areas and fresh air cooling, as determined by the DC Provider Meter or DC Retailer Meter installed to quantify Cooling Energy for the entire Building

BTE = Total Cooling Energy over the Billing Period for the entire building, including common areas and fresh air cooling, as determined by the DC Provider Meter or DC Retailer Meter installed to quantify Cooling Energy for the entire Building

4. Cooling Demand for a Tenant for a Billing Period shall be = TFAP x BTD

In which—





Individual Tenant Floor Area

$$\text{TFAP} = \frac{\text{Total Building Floor Area including Tenant Areas and Landlord Areas}}{\text{Total Building Floor Area including Tenant Areas and Landlord Areas}}$$

BTD = Total Cooling Demand over the Billing Period for the entire building, including common areas and fresh air cooling, as determined by the DC Provider Meter or DC Retailer Meter installed to quantify Cooling Demand for the entire Building

4.6 Accuracy Requirements

The requirements of this Section shall apply to all New Meters.

The relative error of Meters, positive or negative, is expressed in percent and calculated from the CHW flow rate in the case of the flow sensor and CHW temperature difference in the case of the energy calculator and the temperature sensor pair.

Table 6 shows the maximum permissible relative error of each Meter component, where:

1. The error, E_f , relates the indicated value to the conventional true value of the relationship between flow sensor output signal and mass or volume.
2. The error, E_t , relates the indicated value to the conventional true value of the relationship between temperature sensor pair output and temperature difference.
3. The error E_c , relates the indicated value to the conventional true value of the Cooling Energy.





4. Q_{max} is the maximum permitted CHW flow, according to the manufacturer, where the flow meter is able to function continuously without exceeding the maximum pressure drop, and Q is the actual CHW flow during the test.
5. ΔT_{min} is the minimum permitted ΔT , according to the manufacturer, under which the Meter shall function properly, and ΔT is the actual temperature difference between CHW Return and CHW Supply during the test.

Table 6: Meter Accuracy Requirements

Component	Accuracy Standard	Reference Standard
Flow Meters		
$Q_{max} > 3 \text{ m}^3/\text{hr}$	$E_f = \pm (2 + 0.02 Q_{max}/Q)$, with a maximum tolerance of 5%	1
$Q_{max} \leq 3 \text{ m}^3/\text{hr}$	$E_f = \pm (3 + 0.05 Q_{max}/Q)$, with a maximum tolerance of 5%	2
Temperature sensor pair	$E_t = \pm (0.5 + 3 \times \Delta T_{min}/\Delta T)$	3
Energy calculator	$E_c = \pm (0.5 + \Delta T_{min}/\Delta T)$	4

Reference standards

1. European Standard EN 1434-1:2016, Heat meters – Part 1: General requirements, Class 2 flow meter
2. European Standard EN 1434-1:2016, Heat meters – Part 1: General requirements, Class 3 flow meter
3. European Standard EN 1434-1:2016, Heat meters – Part 1: General requirements, temperature sensor pair
4. European Standard EN 1434-1:2016, Heat meters – Part 1: General requirements, energy calculator
5. Accuracy limit to meet Standard EN 1434 or ISO 17025.

4.7 Calibration, Installation, Testing and Commissioning

The requirements of this Section shall apply to all New Meters.

Initial verification of Meter accuracy shall be established using procedures compliant with European Standard EN 1434-5:2016 (Part 5: Initial verification tests) or ISO 17025.

Meters shall be installed and commissioned using procedures compliant with European Standard EN 1434-6:2016 (Part 6: Installation, commissioning, operational monitoring and maintenance) or ISO 17025



Licensed Entities shall provide evidence to the Regulator confirming that, following commissioning, Meters meet requirements of the Code. This evidence shall include a signed and dated commissioning record.

4.8 Periodic Inspection and Testing

Periodic Inspection and Testing of Meters shall be performed to:

1. Determine the accuracy of each component of the Meter and compare with the requirements set out in Table 6; and
2. Determine if accuracy is acceptable or if Reconditioning and Recalibration, or replacement, is required.

If the Periodic Inspection and Testing determines that the accuracy of the component is not acceptable, the Meter shall undergo Reconditioning and Recalibration, or be replaced.

If the Periodic Inspection and Testing determines that the accuracy of the component is acceptable, the Meter shall remain in service until the next Periodic Inspection and Testing.

Recalibration of Meters shall only be undertaken by suitably Accredited Test Facilities (normally the accredited facilities of the original manufacturer or the Accredited Test Facilities of a third party test laboratory).

Periodic Inspection and Testing shall be performed by Qualified Persons.

Periodic Inspection and Testing shall be performed no less frequently than the intervals indicated in Table 7. If an Existing Meter, based on the results of the Periodic Inspection and Testing, does not meet all requirements of the DC Metering Code for New Meters, it shall be Reconditioned or Replaced.





Table 7. Maximum Interval Between Meter Component Inspection and Testing

Meter Component	Maximum interval (years)
Large flow meters ($Q_{\max}^1 > 3 \text{ m}^3/\text{h}$)	5
Small flow meters ($Q_{\max}^1 \leq 3 \text{ m}^3/\text{h}$)	10
Temperature sensors	10
Energy calculator	10

¹ Q_{\max} is the maximum permitted CHW flow, according to the manufacturer, where the flow meter is able to work continuously without exceeding the maximum pressure drop.

4.9 Data Requirements and Procedures

4.9.1 Meter Data Storage Requirement

DC Plant Meters shall be capable of storing locally in extended, non-volatile memory at least the following:

1. Monthly value of Peak Cooling Load (kW_c) with timestamp
2. Monthly value of peak CHW volumetric flow rate (l/s) with timestamp
3. Totalised Cooling Energy (kWh_c) on any hourly basis
4. Totalised CHW volume (l) on an hourly basis
5. Totalised CHW Make-Up Water on a monthly basis
6. Totalised Cooling Tower Make-Up Water on a monthly basis
7. Totalised Potable Water Supply on a monthly basis
8. Totalised Recycled Water Supply on a monthly basis
9. Totalised Seawater Supply on a monthly basis
10. Totalised Wastewater Flow on a monthly basis
11. Programmed parameters/settings
12. Error/alarm codes with timestamp



ETS Meters shall be capable of storing locally in extended, non-volatile memory at least the following, unless the Meter is a Tenant Meter subject to a Code Exemption per Section 4.5 (in which case only item 1 applies):

- 1 Monthly value of Peak Cooling Load (kW_c) with timestamp
- 2 Monthly value of peak CHW volumetric flow rate (l/s) with timestamp
- 3 Totalised Cooling Energy (kWh_c) on any hourly basis
- 4 Totalised CHW volume (l) on an hourly basis
- 5 Programmed parameters/settings
- 6 Error/alarm codes with timestamp

4.9.2 Data Collection Requirement

The following ETS Meter data shall be available for remote collection by the Licensed Entity's Instation by a routine hourly interrogation, and for repeat or ad hoc collections of data as required, unless the Meter is a Tenant Meter subject to a Code Exemption per Section 4.5 (in which case only items 3 and 4 are required, and may be read locally):

1. Cooling Load (kW)
2. Totalised Cooling Energy (kWh_c)
3. CHW volumetric flow rate (l/s)
4. Totalised CHW volume (l)
5. CHW Supply Temperature ($^{\circ}C$)
6. CHW Return Temperature ($^{\circ}C$)
7. Temperature difference between CHW Supply and Return ($^{\circ}C$)
8. Error/Alarm indications

Instation data storage facilities shall as a minimum include storage capacity of 24 hours per day for a minimum of 365 days for all data values.

Any "read" operation shall not delete or alter any stored metered data.

4.9.3 Data Collection Methodology

For the purposes of remote interrogation, the Licensed Entity may use its own data communications network or, failing this, shall enter into, manage and monitor contracts to provide for the provision and maintenance of all data.



In each case, the prime considerations shall be security of data transfer, reliability and adherence to national and/or international communications standards and protocols.

In the event of any fault or failure on such communication lines or any error or omission in data transmitted, the Licensed Entity shall retrieve such data by manual on-site interrogation.

4.10 Disputes

In the event that the Licensed Entity is able to resolve a dispute regarding Meters to the satisfaction of all parties in dispute, such resolution may be implemented as soon as is reasonably practicable without further approval of the Regulator.

In the event that the Licensed Entity is unable to resolve any dispute regarding Meters or any issue relating to compliance with the Code to the satisfaction of all parties in dispute, then it shall be referred to the Regulator.



5. Annexes

The Energy Transfer Station (ETS) serves as the point of transfer of Cooling Energy from one entity to another. The transfer may occur between:

- The DC Provider and DC Retailer;
- The DC Provider and Customer (if the DC Provider also is the DC Retailer); or
- The DC Retailer and Customer.

There are two main types of ETS connections through which Cooling Energy is transferred:

- Indirect Connection, in which Cooling Energy is transferred from one system to another through a heat exchanger (HEX); or
- Direct Connection, in which Cooling Energy is transferred in CHW conveyed from one system to another without use of a HEX.

The ETS incorporates the physical boundary for ownership and responsibility for equipment. Generally, at the ETS the Meter is composed of a flow meter, paired temperature sensors and an integrator for calculating cooling energy consumption and demand for billing. For an Alternative Metering Solution for Tenant Meters, per Section 4.5, the Tenant Meter is composed of a flow meter.

Table 8 summarizes potential relationships between DC Providers, DC Retailers and Customers. This table provides abbreviations and color-coding for the subsequent Figures.

Table 9 provides definition of the Point of Delivery and Point of Return under a range of circumstances.

Figure 1 illustrates the delineation of responsibility for facilities and the Points of Delivery and Points of Return when the DC Provider is same entity as the DC Retailer. Figure 2 illustrates the delineation of responsibility for facilities and the Points of Delivery and Points of Return when the DC Provider and the DC Retailer are different






entities. Existing Meter installations may differ from the arrangement depicted in the Figures.

Table 8: Overview of Potential Relationships Between DC Provider, DC Retailer and Customers

Scenario	Who is the Retailer?	Connections Between	
		Provider & Retailer	Retailer & Customer
1.a.	Provider	Same Entity	Indirect
1.b.	Provider	Same Entity	Direct
2.a.	Separate Retailer	Indirect	Indirect
2.b.	Separate Retailer	Direct	Indirect
2.c.	Separate Retailer	Indirect	Direct
2.d.	Separate Retailer	Direct	Direct

Abbreviations and color codes

- S Chilled water supply
- R Chilled water return
- HX Heat exchanger
- BS Building system *
- M Flow Meter
- T Temperature sensor
-  Flange
- RPOD Point of Delivery (to Retailer)
- RPOR Point of Return (to Retailer)
- CPOD Point of Delivery (to Customer)
- CPOR Point of Return (to Customer)
- DC Provider Facilities
- DC Retailer Facilities
- DC Customer Facilities

* This could be an entire building or individual units within a building.





Table 9: Definitions of Point of Delivery and Point of Return

Scenario	Points of Delivery and Return for Service to DC Retailer		Points of Delivery and Return for Service to Customer	
	Point of Delivery to Retailer (RPOD) is defined as:	Point of Return to Retailer (RPOR) is defined as:	Point of Delivery to Customer (CPOD) is defined as:	Point of Return to Customer (CPOR) is defined as:
DC Provider is the same as the DC Retailer	1.a. (Not applicable)	(Not applicable)	Supply pipe flange on the Building Side of the Heat Exchanger	Return pipe flange on the Building Side of the Heat Exchanger
	1.b. (Not applicable)	(Not applicable)	Point at which supply pipe flange forming part of the DC Provider's Facilities connects with the Building System	Point at which return pipe flange forming part of the DC Provider's Facilities connects with the Building System
DC Provider and DC Retailer are separate entities	2.a. Supply pipe flange on the DC Retailer Side of the Heat Exchanger(s) forming part of the DC Provider's Facilities	Return pipe flange on the DC Retailer Side of the Heat Exchanger(s) forming part of the DC Provider's Facilities	Supply pipe flange on the Building Side of the heat exchanger(s) connected to the Building System	Return pipe flange on the Building Side of the heat exchanger(s) connected to the Building System
	2.b. Point at which supply pipe flange forming part of the DC Provider's Facilities connects with the DC Retailer Facilities	Point at which return pipe flange forming part of the DC Provider's Facilities connects with the DC Retailer Facilities		
	2.c. Supply pipe flange on the DC Retailer Side of the Heat Exchanger(s) forming part of the DC Provider's Facilities	Return pipe flange on the DC Retailer Side of the Heat Exchanger(s) forming part of the DC Provider's Facilities	The point at which the supply pipe flange forming part of the DC Retailer Facilities connects with the Building System	The point at which the return pipe flange forming part of the DC Retailer Facilities connects with the Building System
	2.d. Point at which supply pipe flange forming part of the DC Provider's Facilities connects with the DC Retailer Facilities	Point at which return pipe flange forming part of the DC Provider's Facilities connects with the DC Retailer Facilities		





Figure 1: Points of Delivery and Return When DC Provider is DC Retailer

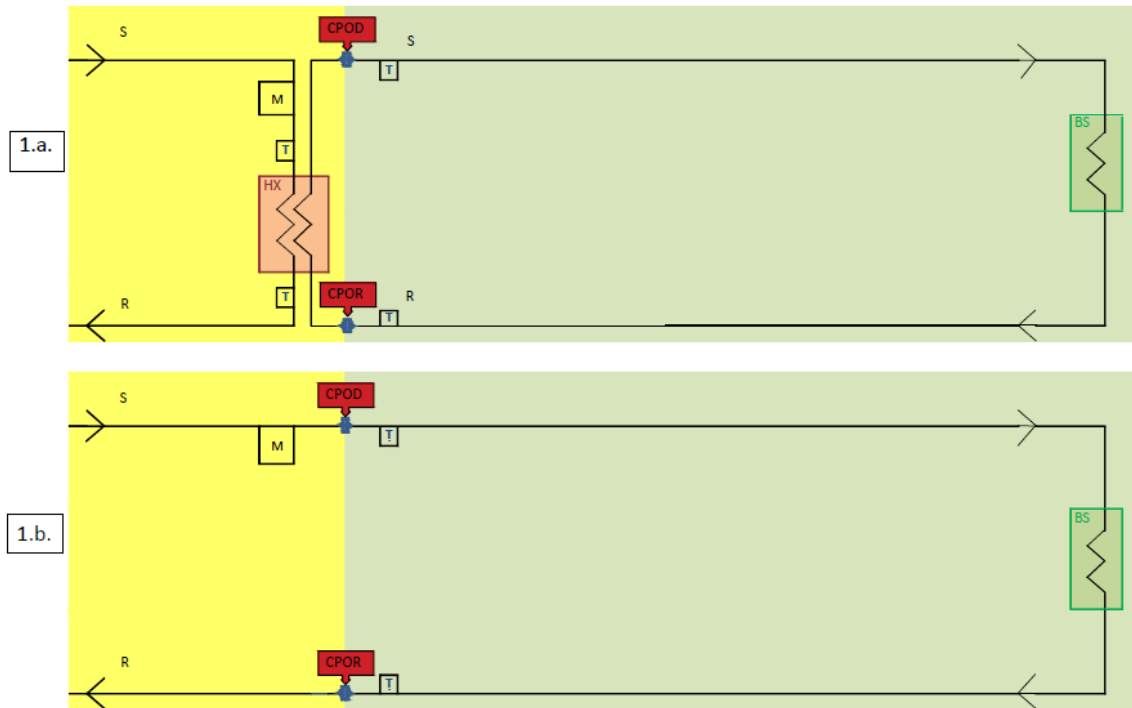




Figure 2: Points of Delivery and Return When DC Provider and DC Retailer Are Separate Entities

