

Celsius

Equipment Specification and Site Installation Report

30 November 2018



VERSION HISTORY

| Version | Date | Author | Status | Comments |
|---------|------------------|------------------|--------|----------|
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1 INTRODUCTION

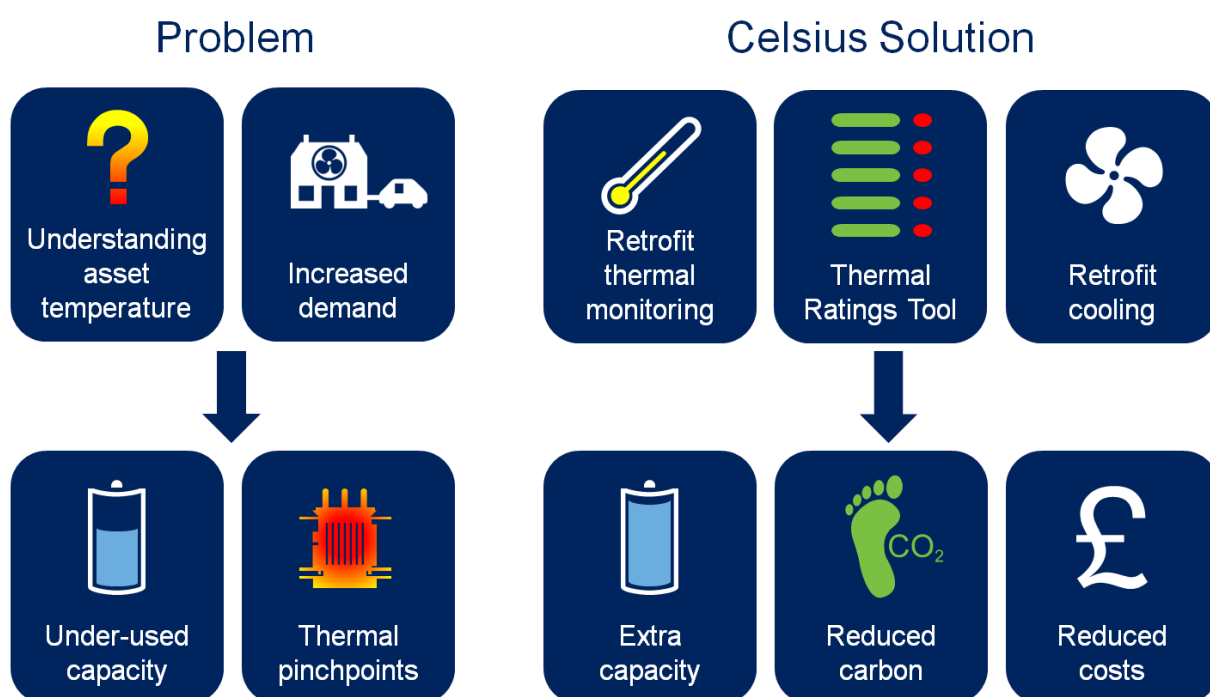
1.1 Scope

This document is evidence of Successful Delivery Reward Criteria TW.3 Publish Cooling equipment specifications and installation reports as specified in the Celsius bid submission document. This document describes the retrofit cooling equipment deployed on the Celsius project, including specifications and installation details.

1.2 The Celsius project background

Celsius is funded via Ofgem's Network Innovation Competition (NIC) funding mechanism. The project was authorised to commence in December 2015 and is expected to be complete by March 2020.

Celsius explores innovative, cost-effective approaches to managing potentially excessive temperatures at distribution substations, which could otherwise constrain the connection of low carbon technologies (LCTs).



Celsius first seeks to identify potential thermal issues by establishing how different distribution substations in differing environments behave thermally under a variety of load and environmental conditions. Celsius will develop the following methodologies to better understand the real thermal ratings of distribution substation assets in order to unlock capacity:

- **Retrofit thermal monitoring:** By using improved technology to measure asset and ambient temperatures, and relating these to a range of environmental, load and seasonal factors, Celsius will enable understanding of real thermal ratings of assets, rather than the nominal ratings that are used today. This will allow improved understanding of the amount of latent capacity which could be accessed without further intervention
- **Thermal ratings tool:** the learning from the retrofit thermal monitoring trials and analysis will be formalised and transferred into a simple tool that can be used by operations and planning employees at any network operator, to better understand the capacity of the existing or planned network.

Celsius will then identify, evaluate and demonstrate retrofit cooling technologies that can be used to directly manage the temperature of assets. By managing temperature in this way,

Celsius will deliver additional capacity release. Customer surveys will establish customer perception of retrofit cooling techniques and whether the application of these techniques is as acceptable to them as traditional reinforcement.

2 COOLING EQUIPMENT

Celsius monitoring equipment was fitted to 520 distribution substations across ENWLs network. From these 520 sites, 100 sites were selected for the cooling trials based on a variety of factors to give a reasonable representation of ENWLs network. This included substation building type, loading, transformer specification, load profile and environmental factors. These were then split into 60 passive cooling sites and 40 active cooling sites.

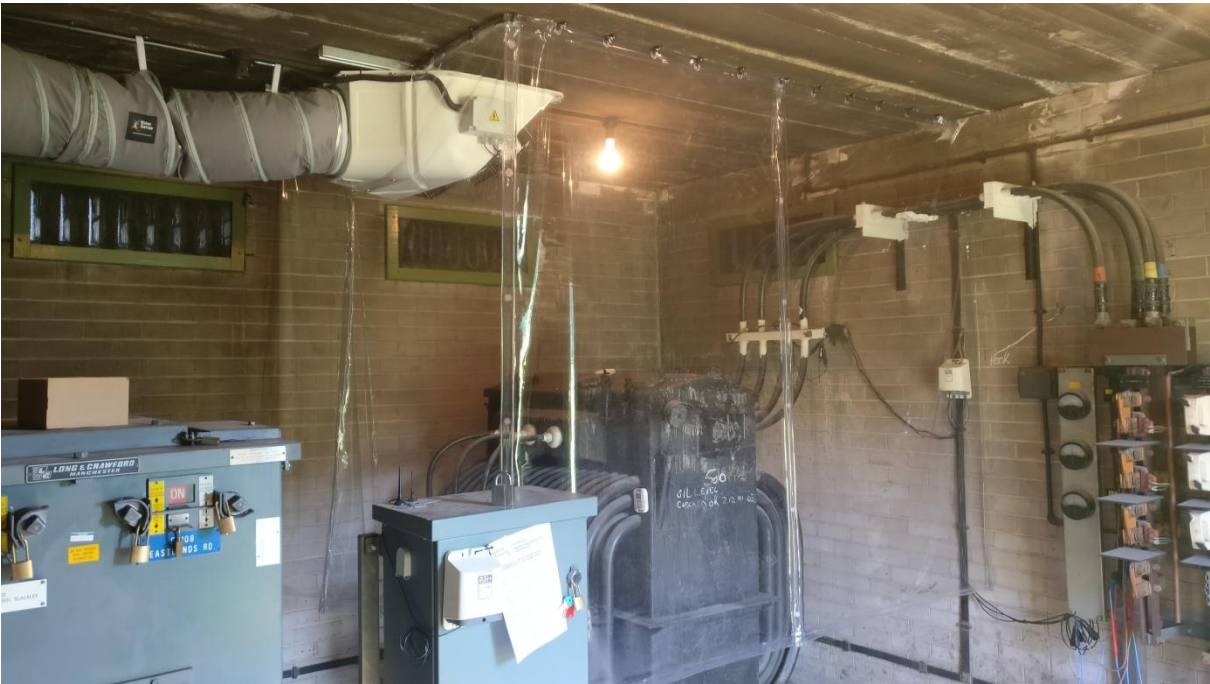
2.1 Active cooling sites

We used two types of active cooling for this project; a negative pressure cooling system (Ekkosense) and a positive pressure cooling system (Passcomm). 20 units of each were installed.

2.1.1 Ekkosense

This system works by drawing hot air away from the transformer and expelling it through a duct outside of the substation. A screen is placed around the transformer with a small gap at low level to ensure that the air is drawn over the transformer and not just extracted from the general substation environment. See Appendix A for specifications.

Figure 1: Ekkosense install



2.1.2 Passcomm

This system works by creating a positive pressure inside the substation. External air is blown into the substation and forced out of high level vents. Existing low level vents may need to be blocked off for the unit to operate efficiently. Care has been taken to place the unit in a position where the cool air blows directly onto the transformer, again to maximise its efficiency. This unit can either be mounted externally or internally to give maximum flexibility to accommodate for different substation layouts. See Appendix B for specifications.

Figure 2: Externally mounted Passcomm install



The Passcomm unit was originally designed for server rooms where air quality is very important. This is the reason the unit has G4 level filtration. It was identified during the trial that this level of filtration was not required for this project and as a result Passcomm have drawn up a re-design of their existing unit to G2 filtration standard which means that the unit can be smaller, quieter and potentially cheaper whilst still delivering the same cooling effect. See Appendix C for the specification.

2.2 Passive cooling sites

A variety of passive cooling techniques were applied to 60 substations using the various techniques stated below.

2.2.1 Additional ventilation

Additional vents were added to 41 substations to aid the natural cooling of the transformer. Twenty one of these were brick built substations, two of which were classed as unusual. This means that they were non-standard e.g. not a traditional stand alone substation but part of a larger building or with multiple rooms. Twenty of these sites were GRP type substations, ten of which also had the roofs painted with solar reflective paint. These vents were placed in the optimal position within the substation based on the thermal flow modelling study completed by the National Physical Laboratory. [Thermal Flow Study](#). See Appendix D for paint specification used on GRP roofs.

For some of the double-skinned brick walls, the external wall was fitted with additional vents (See Figure 3) and the internal wall was core drilled (see Figure 4). This is a cost effective and efficient way of ensuring the structural integrity of the substation is not compromised.

Figure 3: Additional vent on a brick built substation (external)



Figure 4: Core drilling on internal substation wall



Figure 5: Additional vent fitted to a GRP substation



2.2.2 Painting of transformers

Ten outdoor transformers were painted with solar reflective paint. The aim of this is to reduce the amount of heat the asset absorbs from the sun. See Appendix E for paint specification used on transformers.

Figure 6: Transformer painted with solar reflective paint



2.2.3 Shading of transformers

Five outdoor substations were covered with a “Gazebo” type of shading structure. Again the purpose of this is to reduce the amount of heat the asset absorbs from the sun. See Appendix F for shading specifications.

Figure 7: Transformer covered with shading canopy



2.2.4 Cable backfill

A number of cable sites have had temperature and load monitoring fitted directly to the cables. This data will be analysed and the best four sites will be filled with a thermally enhanced backfill (Bentonite and Silica Sand Mix) and the data will then be compared with traditional backfill data to evaluate its performance.

3 SITE LIST

Below is a list of the site locations with the cooling techniques applied to them.

| Sub no. | Site name | Site type | Cooling technique applied |
|---------|-------------------|-------------|---------------------------|
| 211952 | Wentworth Road | Brick built | Passcomm |
| 414690 | Spendmore Lane | Brick built | Passcomm |
| 211510 | Far Moor | Brick built | Passcomm |
| 216839 | Lodge Drive | Brick built | Passcomm |
| 171782 | Temple Road North | Brick built | Passcomm |
| 171758 | Stanley Road | Brick built | Passcomm |
| 410073 | Berry Lane | Brick built | Passcomm |
| 165333 | Nuthurst Road | Brick built | Passcomm |
| 165175 | Boyle Street | Brick built | Passcomm |
| 231042 | Mayor Street | Brick built | Passcomm |
| 165122 | Windsor Road | Brick built | Passcomm |
| 216809 | Lancaster Avenue | Brick built | Passcomm |
| 332812 | Portland Grove | Brick built | Passcomm |
| 323747 | Andrew Street | Brick built | Passcomm |
| 659436 | Shap Road Laundry | GRP | Passcomm |
| 658014 | Brantfell | Brick built | Passcomm |
| 171051 | Alexandra Road S | Brick built | Passcomm |
| 450986 | Lord Square | Integrated | Passcomm |
| 171422 | Clarendon Road T1 | Brick built | Passcomm |
| 171284 | Buckingham Road | Brick built | Passcomm |

| Sub no. | Site name | Site type | Cooling technique applied |
|---------|--------------------|-------------|---|
| 171974 | Maine Road | Brick built | Ekkosense |
| 165221 | Farnham Avenue | Brick built | Ekkosense |
| 315097 | Lower Falinge | Brick built | Ekkosense |
| 314385 | Dean Hsg | Brick built | Ekkosense |
| 641915 | Helmside Drive | Brick built | Ekkosense |
| 414869 | Heaton Close | Brick built | Ekkosense |
| 450029 | Audley Hall | Brick built | Ekkosense |
| 231207 | Green Lane | Brick built | Ekkosense |
| 231178 | Angle Street | Brick built | Ekkosense |
| 171524 | Marsland Road | Brick built | Ekkosense |
| 171526 | Dene Road | Brick built | Ekkosense |
| 232186 | Mount Street | Brick built | Ekkosense |
| 312757 | Factory Street | Brick built | Ekkosense |
| 450255 | Lorne Street | Brick built | Ekkosense |
| 315259 | Summervale House | Brick built | Ekkosense |
| 410155 | Fir Trees | Brick built | Ekkosense |
| 410017 | Emmanuel Street | Brick built | Ekkosense |
| 332812 | Portland Grove | Brick built | Ekkosense |
| 171422 | Clarendon Road T2 | Brick built | Ekkosense |
| 331286 | Offerton Drive | Brick built | Ekkosense |
| 325835 | Brookfield ind Est | Outdoor | Transformer painted with reflective paint |
| 621853 | Crosthwaite Court | Outdoor | Transformer painted with reflective paint |

| Sub no. | Site name | Site type | Cooling technique applied |
|---------|-------------------------|-----------|---|
| 165680 | CWS Broughton | Outdoor | Transformer painted with reflective paint |
| 620620 | Headlands | Outdoor | Transformer painted with reflective paint |
| 455561 | Manor Road | Outdoor | Transformer painted with reflective paint |
| 612788 | Romney Road | Outdoor | Transformer painted with reflective paint |
| 641928 | Schola Green Lane | Outdoor | Transformer painted with reflective paint |
| 327078 | Tame Street | Outdoor | Transformer painted with reflective paint |
| 636050 | Thurstonefield No1 | Outdoor | Transformer painted with reflective paint |
| 325847 | Whitelands Road Ind Est | Outdoor | Transformer painted with reflective paint |
| 171904 | Silverwood Avenue | Outdoor | Shading canopy placed over transformer |
| 171784 | Tesco Stores | Outdoor | Shading canopy placed over transformer |
| 330134 | Dialstone Lane | Outdoor | Shading canopy placed over transformer |
| 417005 | ATE Grimsargh | Outdoor | Shading canopy placed over transformer |
| 415341 | St Leonards | Outdoor | Shading canopy placed over transformer |
| 419894 | Prismo Products | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 165935 | Avondale Road | GRP | Additional vents installed |
| 172004 | Rusholme Place | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 165073 | Seaford Road | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 328629 | Ashton 6th Form College | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 417305 | Saunders Wood | GRP | Additional vents installed |
| 231735 | Carnation Road | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 166531 | Audley Avenue | GRP | Additional vents installed |

| Sub no. | Site name | Site type | Cooling technique applied |
|---------|-----------------------------|-------------|---|
| 166915 | Direct Line | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 166924 | Cawdor Street | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 178381 | Ashley Walk | GRP | Additional vents installed |
| 167259 | Manor Park | GRP | Additional vents installed |
| 178114 | Withington Road | GRP | Additional vents installed |
| 211945 | Chantry Walk | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 231757 | Eustace Street | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 419910 | Buckshaw Village Commercial | GRP | Additional vents installed |
| 338363 | Palace Road | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 327652 | Saddleworth School | GRP | Additional vents installed and GRP roof painted with reflective paint |
| 629174 | South Row | GRP | Additional vents installed |
| 636385 | Queensway | GRP | Additional vents installed |
| 216005 | Acorn Street | Brick built | Additional vents installed |
| 171262 | Brompton Road | Brick built | Additional vents installed |
| 171538 | Devonshire Street N | Brick built | Additional vents installed |
| 165136 | Dudley Street | Brick built | Additional vents installed |
| 171039 | Jessel Close | Brick built | Additional vents installed |
| 212726 | Leicester Avenue | Brick built | Additional vents installed |
| 211851 | Sherwood Drive | Brick built | Additional vents installed |
| 165500 | Victoria Road | Brick built | Additional vents installed |
| 165671 | Whitefriars | Brick built | Additional vents installed |

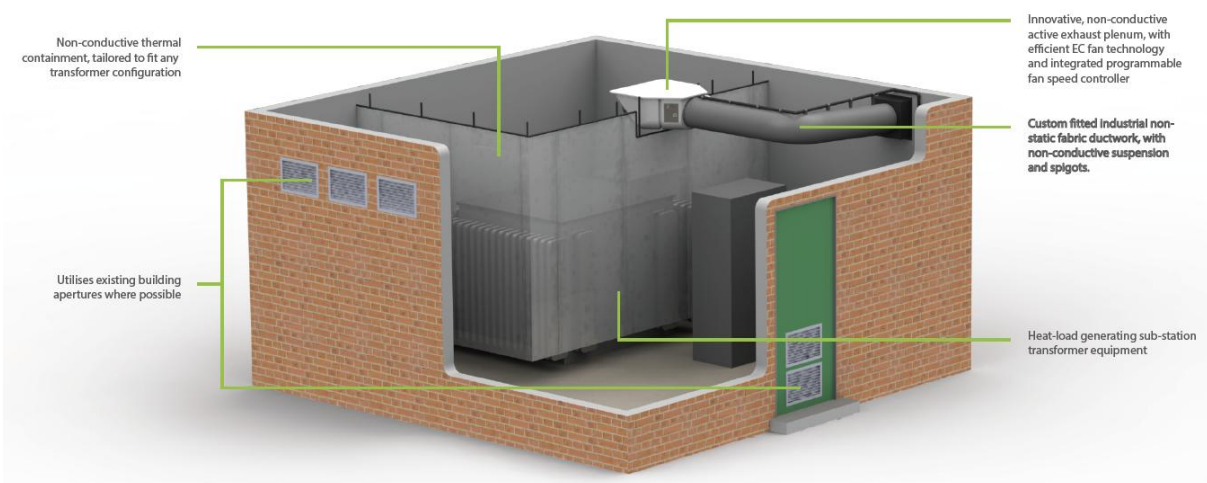
| Sub no. | Site name | Site type | Cooling technique applied |
|---------|-------------------|-------------|----------------------------|
| 312968 | Wordsworth Road | Brick built | Additional vents installed |
| 212304 | Alder Avenue | Brick built | Additional vents installed |
| 415142 | Hough Lane | Brick built | Additional vents installed |
| 211605 | Milton Gr | Brick built | Additional vents installed |
| 172047 | Langport Avenue | Brick built | Additional vents installed |
| 322507 | Regina Avenue | Brick built | Additional vents installed |
| 217277 | St Georges Street | Brick built | Additional vents installed |
| 165184 | Moordown Close | Brick built | Additional vents installed |
| 320739 | Wellington Road | Brick built | Additional vents installed |
| 320618 | Woodend Lane | Brick built | Additional vents installed |
| 165455 | Mount Street | Unusual | Additional vents installed |
| 621389 | Upton Street | Unusual | Additional vents installed |

4 APPENDICES

4.1 Appendix A – Ekkosense Specification

Reduce thermal risk and operational hazards in electrical sub-stations with EkkoSense non-conductive active cooling

Electrical sub-stations can reach high temperatures during the summer months, due to a combination of the transformer producing high heat-loads and in general lack of efficient ventilation in an enclosed environment. Our solution provides low risk installation, due to the use of non-conductive materials and installation methods. We also guarantee significant temperature reduction over passive and typical extract solutions, through the use of containment curtains to create areas of targeted cooling.



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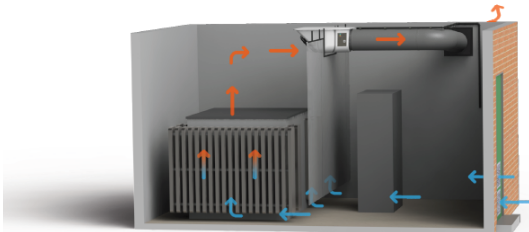
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Principals of Operation



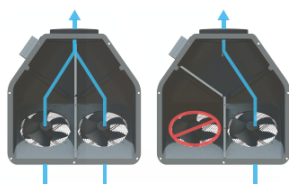
Where possible, existing apertures will be used as fresh air inlets. Cooler outdoor air will enter the room in an uncontained area; any heatload generating equipment will be enclosed with hanging plastic curtains. Cool air will enter the contained area through a gap underneath the curtains and pass over the equipment, causing its heat to be transferred away from the equipment and up towards the ceiling where the active exhaust box is located. Hot rejected air will be drawn into the plastic exhaust plenum via two highly efficient EC axial fans, through the plenum and out of the room through industrial fabric ductwork.

Outstanding Efficiency

Our solution will provide adequate cooling with capacity to spare, whilst reducing risk and saving energy. The install methodology adopted allows temperatures to be maintained as high as possible without causing any risk to equipment. This is because only a critical section of the room needs cooling, therefore only the hottest air will be exhausted. Cutting edge low power EC axial fans and programmable fan speed controls means the fans will only ramp up when required and for the majority of the year will be running at part load, consuming only a fraction of the rated power.

Continuous Operation

The fire retardant fan plenum contains an innovative redundancy mechanism to ensure cooling is maintained is one fan fails. This is achieved using a baffle plate separating the fan plenum, if a fan fails the plate will swing to block the failed fan. This means the working fan will continue to draw air in from the room.

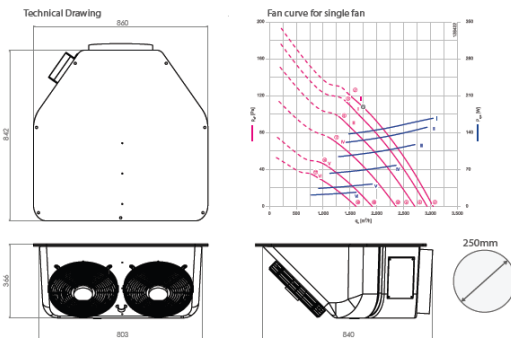


Technical Data

Ekkosense cooling solution for high risk environments has been innovatively designed and manufactured, using the most up to date materials and technologies to create a powerful, reliable and efficient solution.

| Physical Properties Fan and Filter Box Assembly | |
|---|---------------------------|
| Height/Width/Depth | 842/860/842 mm |
| Net Weight | 20 kg |
| Operating Parameters if the Fan | |
| Fan Type | EC Axial |
| Temperature Range | -30°C to 50°C |
| Sound Pressure Level | 68.5dB(A), fan speed 100% |
| Measured in accordance to ISO 5801 | 61.2dB(A), fan speed 50% |
| Volumetric Flow Rate ** | 3000 m ³ /h |
| Power Consumption | |
| Fan Power Supply | 1~200-240V AC |
| Rated Current Input* | 1.70 - 1.40 A |
| Rated Power Input* | 170 W |
| Energy Efficiency | |
| Net Efficiency EER (Free-Cooling ΔT of 10°C) | 59 |
| Cooling Capacity (Free-Cooling ΔT of 10°C) | 10 kW |
| Cooling Capacity (Free-Cooling ΔT of 8°C) | 5 kW |

*These figures will vary depending on fan speed
 ** Airflow rated at clean filter conditions, using EkkoSense recommended install methodology



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Product Datasheet



CoolFlow DCM

Features & Benefits

- Delivering site energy savings of up to 30%.
- Delivering up to 95% electricity costs vs traditional cooling.
- Extends the life of current cooling assets.
- Ability to control existing cooling assets, reducing alarms and maintenance.
- Integrates with 3rd party systems to control existing cooling assets.

| CoolFlow DCM - Technical Specification | |
|--|--|
| Ingress Protection | IP5X (Dust Protection) |
| Filtration Level | G4 when airflow <150m ³ /h G3 when airflow 150-300 m ³ /h |
| Designated Heat Dissipation | 10kW |
| Temperature Against Ambient | 10°C ΔT |
| Fan Speed | Dual Fans - Variable |

| CoolFlow DCM | |
|---------------------------------------|-----------------------|
| Dimensions (HxWxD) | 962mm x 636mm x 630mm |
| Weight | 65kg |
| Sound pressure @ 5m (100% speed) | 47.8 dB (A) |
| Sound pressure @ 3m (100% speed) | 52.3 dB (A) |
| Nominal current input (75% fan speed) | 5.20A |
| Nominal power input (75% fan speed) | 250W |
| Maximum airflow (@ 0Pa ESP) | 3610m ³ /h |
| Maximum airflow (system) | 2800m ³ /h |
| Standard filtration (BS EN 779:2012) | Maintenance free G4 |
| Cooling capacity @ 10°C ΔT | 10kW |
| Cooling Capacity @ 8°C ΔT | 7.6kW |
| Remote Monitoring / Control | Optional |



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Passcool's 10kW rated maintenance-free CoolFlow DCM is a highly efficient, free air cooling system, designed for equipment buildings across a variety of industries. CoolFlow DCM operates a positive pressure system, forcing free external air through a patented G4 certified filtration media, into the building. The positive pressure created forces hot air away from the equipment and cools the room.

CoolFlow DCM is a truly maintenance-free, Free Air Cooling System. With a patented filtration media, CoolFlow DCM delivers true 'fit and forget' cooling for almost any climate worldwide.

Commissioned in countries around the world such as Egypt, Germany and across the UK, CoolFlow DCM has a proven track record of delivering energy efficient cooling whatever the climate. CoolFlow DCM is guaranteed to reduce carbon emissions vs traditional air-conditioning and deliver energy spend savings up to 95%*

Designed to deliver maximum performance in all conditions and working to a Delta T of 10 degrees, CoolFlow provides cabin cooling in even the harshest of climates. The 10kW system is available in both AC and DC formats where required.

Primary and Secondary Cooling

In the most critical of environments, where downtime is not an option, Passcool has the solution;

- 1) Run CoolFlow DCM as the primary cooling source.
- 2) Connect the existing air-conditioning system to the CoolFlow DCM via Remote Control Software Interface.

This allows the secondary cooling source (air-con) to kick in when the external ambient temperatures are too high for free-air cooling to ensure the internal ambient temperature within the building can be maintained below the maximum temperature threshold of the equipment.



Certificate No. 039419

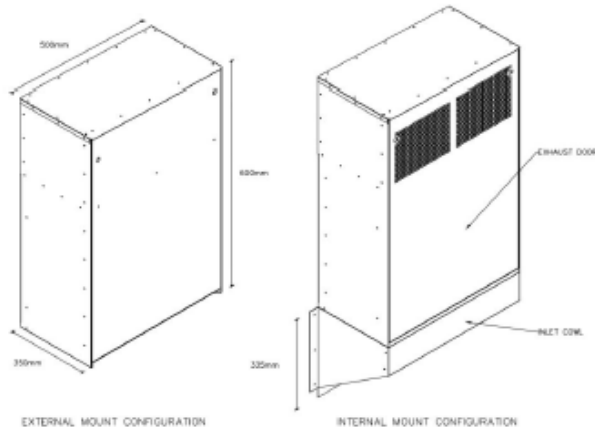
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4.3 Appendix C – Passcomm re-designed unit – Coolflow DCM G2



Product Datasheet



CoolFlow DCM G2

Features & Benefits

- 40% reduction in dB readings at 3m and 5m
- Slimline design for smaller buildings
- G2 filtration results in lower power consumption
- Lightweight design for easier installation
- Internal/External mounting design

| CoolFlow DCM G2 - Technical Specification | |
|---|------------------------|
| Ingress Protection | IP5X (Dust Protection) |
| Filtration Level | Maintenance free G2 |
| Designated Heat Dissipation | 10kW |
| Temperature Against Ambient | 10°C ΔT |
| Fan Speed | Dual Fans - Variable |

CoolFlow DCM G2 offers the same 10kW cooling performance as the standard CoolFlow DCM in a slimmer, lighter and quieter form-factor.

Designed for installation either internally or externally, the DCM G2 offers an alternative for locations where space is limited, and/or residential neighbours are a consideration for external noise output.

The DCM G2 is 40% lighter, quieter and slimmer than the standard CoolFlow DCM. The profile reductions are all achievable as the filtration media is specified at G2. This requires a smaller, quieter fan, enabling a reduction in the dimensions of the system.

The DCM G2 system can also be fitted with a front-facing duct bracket, which allows non-conductive ducting material to be attached. This allows the DCM G2 system to blow free air directly onto specified equipment for optimal cooling results.



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4.4 Appendix D – GRP roof paint specification

Tormastic Colour Coating

AK776

intended uses

For the gloss finishing of wood, metal and cementitious substrates. Normally applied over conventional primer. Most colours will cover in one coat. Ideal for farm and industrial building renovation.

product description

An inorganic and/or organic pigmented resin based paint, good colour stability, thinned with low aromatic white spirits.

product information

| | |
|--------------------------------|--|
| Product reference | AK776 |
| Volume solids | 48% +/- 3% depending on colour |
| Typical thickness | 37-42 microns dft from 83 microns wet |
| Theoretical coverage | 12 square metres per litre at 40 microns dft |
| Practical coverage | Reduce above by up to 20% depending on substrates |
| Appearance/Colour range | Various Colours – gloss finish |
| VOC content | EU limit value for this product (cat A/d): 300 g/l. This product contains max 300 g/l VOC |

application details

| | |
|------------------------------|---------------------------------|
| Mix ratio | N/A |
| Method of application | Brush, suitable roller or spray |
| Cleaner | Tor TH10 |
| Pot Life | N/A |

Drying time

| Substrate Temperature | Touch Dry | Hard Dry | Overcoating Interval | |
|-----------------------|-----------|----------|----------------------|---------|
| | | | Minimum | Maximum |
| 20°C | 4 hours | 16 hours | 16 hours | 7 days |

Note: Drying/curing times will be shortened by higher temperatures and lengthened by lower temperatures

storage and handling

| | |
|-----------------------|---|
| Storage | Store in cool well ventilated conditions |
| Pack Size | 5 litre all colours, 2.5 litre most colours |
| Flash point | Above 32°C |
| Product weight | 0.9-1.15 kilos/litre (varies with colour) |
| Shelf life | 2 years in unopened containers |

surface preparation

Apply to suitably primed surfaces. Some colours may require an undercoat or second topcoat. Previously painted surfaces – patch prime where necessary. Apply one or two full coats of Torlastic over prepared surface.

limitations

May sag if applied too liberally. Maximum heat resistance 125°C.

Drying time may be extended at low temperatures.

Please check Health and Safety Data Sheet as some colours contain lead based pigments.

safety precautions

A copy of the appropriate Health & Safety Data Sheet should be consulted prior to using the product. This can be faxed if urgently required.

Minimum precautions for all paints:

1. Avoid skin and eye contact i.e. wear gloves, goggles, etc
2. Ensure good ventilation, mechanical if necessary.
3. Store and use away from heat and flame.
4. Do not eat or smoke in the vicinity of work.
5. Wash hands before eating.
6. Refer to supply container for additional warning labels.

definitions

| | |
|---------------------------|---|
| Tolerances | All information quoted in this data sheet is subject to normal manufacturing tolerances. |
| Practical coverage | Practical coverage can vary considerably depending on method of application, surface roughness, weather conditions and complexity of the structure. |
| Pot Life | Applies only to two component products and refers to the time the mixture remains usable. |

disclaimer

The information contained herein is to the best of our knowledge true and accurate and is given in good faith but without warranty. The user will be deemed to have satisfied him/herself independently as to the suitability of our products for his/her own particular purpose. In no event shall Tor Coatings be liable for consequential or incidental damages.

This document will normally be updated at least every two years. It is the users responsibility to ensure that they have the current copy.

Updated: March 2012

4.5 Appendix E – Transformer paint specification

Tor tractor enamel

AK485

| | | | | |
|-----------------------------|--|--|-----------------|-------------------------------|
| intended uses | A general purpose, gloss enamel for use on tractors and farm implements. A high flash product. | | | |
| product description | Modified alkyd resin binder pigmented with inorganic/organic pigments and thinned with white spirit. Certain colours contain lead. | | | |
| product information | Product reference | AK485 | | |
| | Volume solids | 47-52% (depending on colour) | | |
| | Typical thickness | 40 microns dft from 80 microns wet | | |
| | Theoretical coverage | 12.5 square metre per litre | | |
| | Practical coverage | 10 square metres per litre | | |
| | Appearance/Colour range | Gloss finish/various standard tractor colours | | |
| | VOC content | 450g/L | | |
| application details | Mix ratio | N/A | | |
| | Method of application | Brush or short pile roller. By reducing with 15-20% Tor TH10 can be also applied by conventional spray | | |
| | Thinner | Tor TH10 | | |
| | Cleaner | Tor TH10 for cleaning equipment | | |
| | Pot Life | N/A | | |
| | Drying time | | | |
| | Substrate Temperature | Touch Dry | Hard Dry | Overcoating Interval |
| | | | | Minimum Maximum |
| | 20°C | 2-4 hours | 16 hours | 16 hours 28 days |
| | Note: Drying/curing times will be shortened by higher temperatures and lengthened by lower temperatures | | | |
| storage and handling | Storage | Store in a safe place out of the reach of children | | |
| | Pack Size | 1 litre, 2.5 litre | | |
| | Flash point | 37°C | | |
| | Product weight | 0.9-1.14 kilos/litre (depending on colour) | | |
| | Shelf life | 2 years in unopened containers | | |

surface preparation

Bare Steel - Chip, scrap and wire brush to ST2 Swedish Standard and prime with Farm Oxide thinned with up to 15% Tor TH10 followed when dry by one or two coats of Tor Tractor Enamel.

Previously Painted - All previously painted areas must be checked for adhesion of existing coatings. If unsound, remove and treat as bare. If sound one or two coats of Tor Tractor Enamel as required.

limitations

Ensure good ventilation during application and drying.

Certain colours may require two coats to ensure satisfactory opacity.

Certain colours contain lead.

Do not apply to surfaces likely to be chewed by animals.

safety precautions

A copy of the appropriate Health & Safety Data Sheet should be consulted prior to using the product. Contact Sales on 0191 4106611.

Minimum precautions for all paints:

1. Avoid skin and eye contact i.e. wear gloves, goggles, etc
2. Ensure good ventilation, mechanical if necessary.
3. Store and use away from heat and flame.
4. Do not eat or smoke in the vicinity of work.
5. Wash hands before eating.
6. Refer to supply container for additional warning labels.

definitions

Tolerances All information quoted in this data sheet is subject to normal manufacturing tolerances.

Practical coverage Practical coverage can vary considerably depending on method of application, surface roughness, weather conditions and complexity of the structure.

Pot Life Applies only to two component products and refers to the time the mixture remains usable.

disclaimer

The information contained herein is to the best of our knowledge true and accurate and is given in good faith but without warranty. The user will be deemed to have satisfied him/herself independently as to the suitability of our products for his/her own particular purpose. In no event shall Tor Coatings be liable for consequential or incidental damages.

This document will normally be updated at least every two years. It is the users responsibility to ensure that they have the current copy.

Updated: Dec 06

AK485

4.6 Appendix F – Shading canopy specification

Qube™ Technical Specifications



Structure Design Parameters

British building codes do not specifically cover structural membrane roofs. There are parts of the Institute of Structural Engineers 'Guide to the Design and Installation of Temporary Structures', and other industry codes and building regulations, which are partially relevant and we adhere to those where appropriate.

Basically, the permanently installed Tensile Membrane Roof must prove to be able to handle safely the same environmental loads as a traditional roof.

Therefore we treat our structures as permanent installations and follow the new Eurocode : Basis of Structural Design.

Eurocode 1: Action on Structures – (Snow loads, Wind Actions etc.)

Eurocode 3: Design of Steel Structures

Eurocode 9: Design of Aluminium Structures

Steelwork conforms to EN1090 and CE marking.

Aluminium Frame Structure

The Frame is manufactured from extruded aluminium profiles, to our own design. We use structural grade - 6082T6 or similar - aluminium, powder-coated to give a maintenance free finish. Connection pieces, footplates and other non-aluminium parts are manufactured in-house from either stainless steel or from steel (grade S275) and zinc coated (hot dip galvanised or electroplated) to give a maintenance free finish.

If required, all frameworks can be finished off to specified colours.

Overall clear width: up to 7.5m **Standard side wall height:** 2.3m **Overall standard height:** 2.4 – 3.5m, depending upon width and final design **Extrusion size:** 140 x 100mm, 4-track kedar system, gutter track, 140 x 130mm

Tensile Membrane Specification

The appearance of the membrane covering all tensile structures is vital to the image and quality of the finished product. We use high-quality coated fabric in our flexible tensile fabric structures which satisfy the highest demands.. Woven as a yarn (PES/glass) and coated (PVC) which is made in Europe and used successfully around the world.

The membrane coating is specifically designed for long life as it absorbs UV radiation independently of the pigment. This allows greater translucency and a significantly reduced environmental impact.

Typical Membrane Specifications Used:

Base fabric of high tenacity polyester;
PVC-coated on both sides;
Surface - high gloss lacquer; Dirt Repellent;
Easy to clean; Dimensionally stable; Resistant to cold; Mildew inhibited

Technical Data: Weight - approx 650 gm²
Tensile Strength - approx 2800 N/5cm
Tear Resistance - approx 300/250 N
Adhesion - approx 100 N/5cm

Flame Retardancy:

BS 7837:1996 – Specification for Flammability Performance for Textiles Used in the Construction of Marquees and Similar Tented Structures

Fire Test to Building Materials:

DIN 4102 B1;NF P 92 - 503: Safety against fire - Building materials – Reaction to fire tests. Electrical burner test used for flexible materials

The above data are averages from production. Product descriptions and suggested uses are general and subject to trial for the intended end use. Production is subject to change.

Qube™ canopies require minimum maintenance. However it is a condition of the guarantee that the drainage channel along the roof beam is kept clear of obstructions (leaves, debris, play equipment etc. Note the position of the drainage hole(s) in the roof beam channel – these will usually be located above one or more of the support legs – and ensure that these are clear. We can provide aluminum gutter covers if required.

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Typical Specifications on Membrane Used:

Base fabric of high tenacity polyester; PVC-coated on both sides; Surface - high gloss lacquer; Dirt Repellent; Easy to clean; Dimensionally stable; Resistant to cold; Mildew inhibited

Technical Data: Weight - approx 650 gm² Tensile Strength - approx 2800 N/5cm Tear Resistance - approx 300/250 N Adhesion - approx 100 N/5cm

Flame Retardancy:

BS 7837:1996 – Specification for Flammability Performance for Textiles Used in the Construction of Marquees and Similar Tented Structures

BS 5867 TYPE B

The above data are averages from production. Product descriptions and suggested uses are general and subject to trial for the intended end use. Production is subject to change.



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