London South Bank University

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PhD Student

Centre for Air Conditioning and Refrigeration Research

School of Engineering

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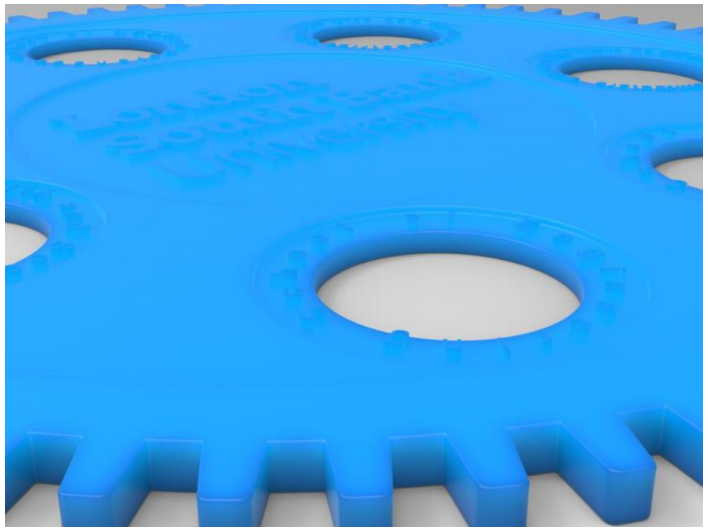
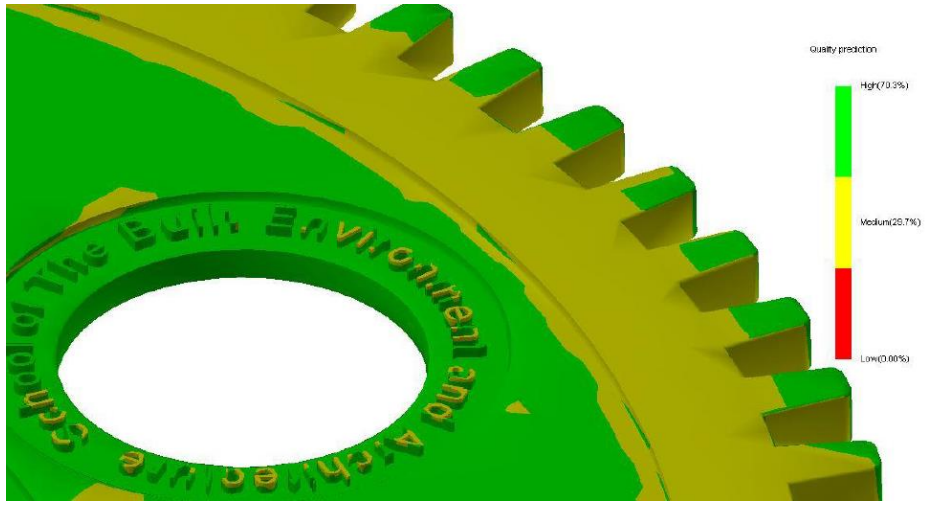
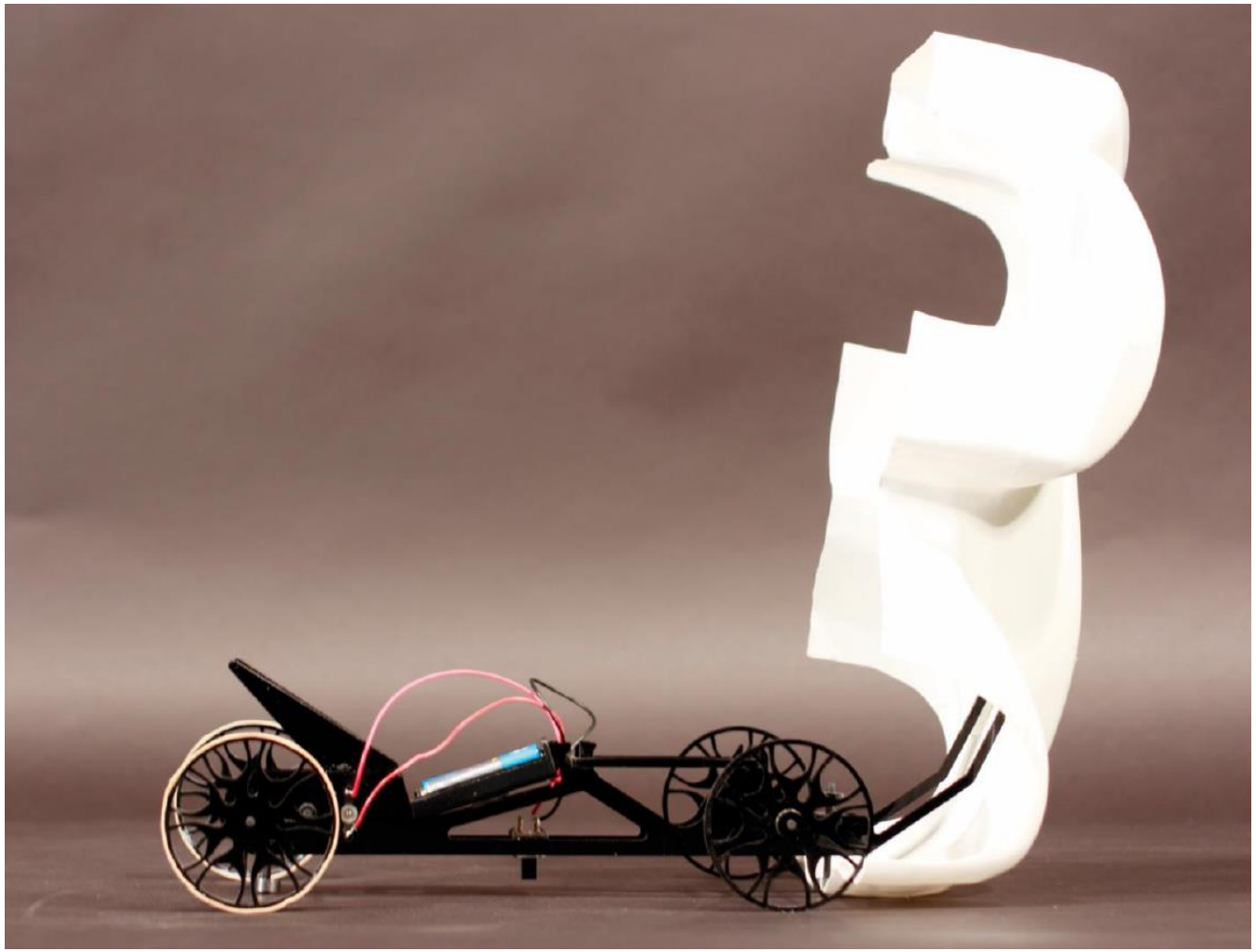
2012-2016 - LSBU

2012-2016 - LSBU





2012-2016 - LSBU



Industrial placement – London Underground

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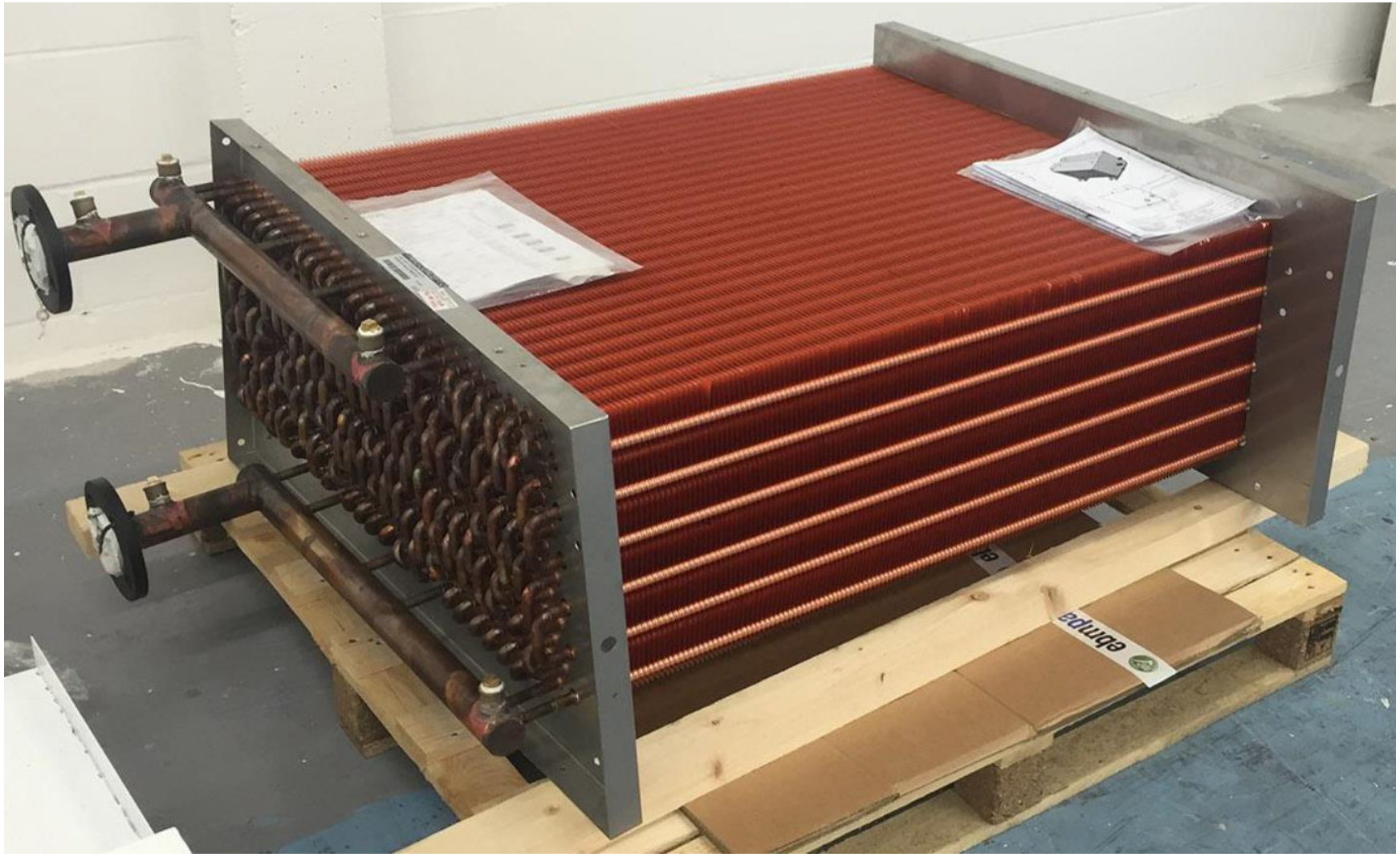

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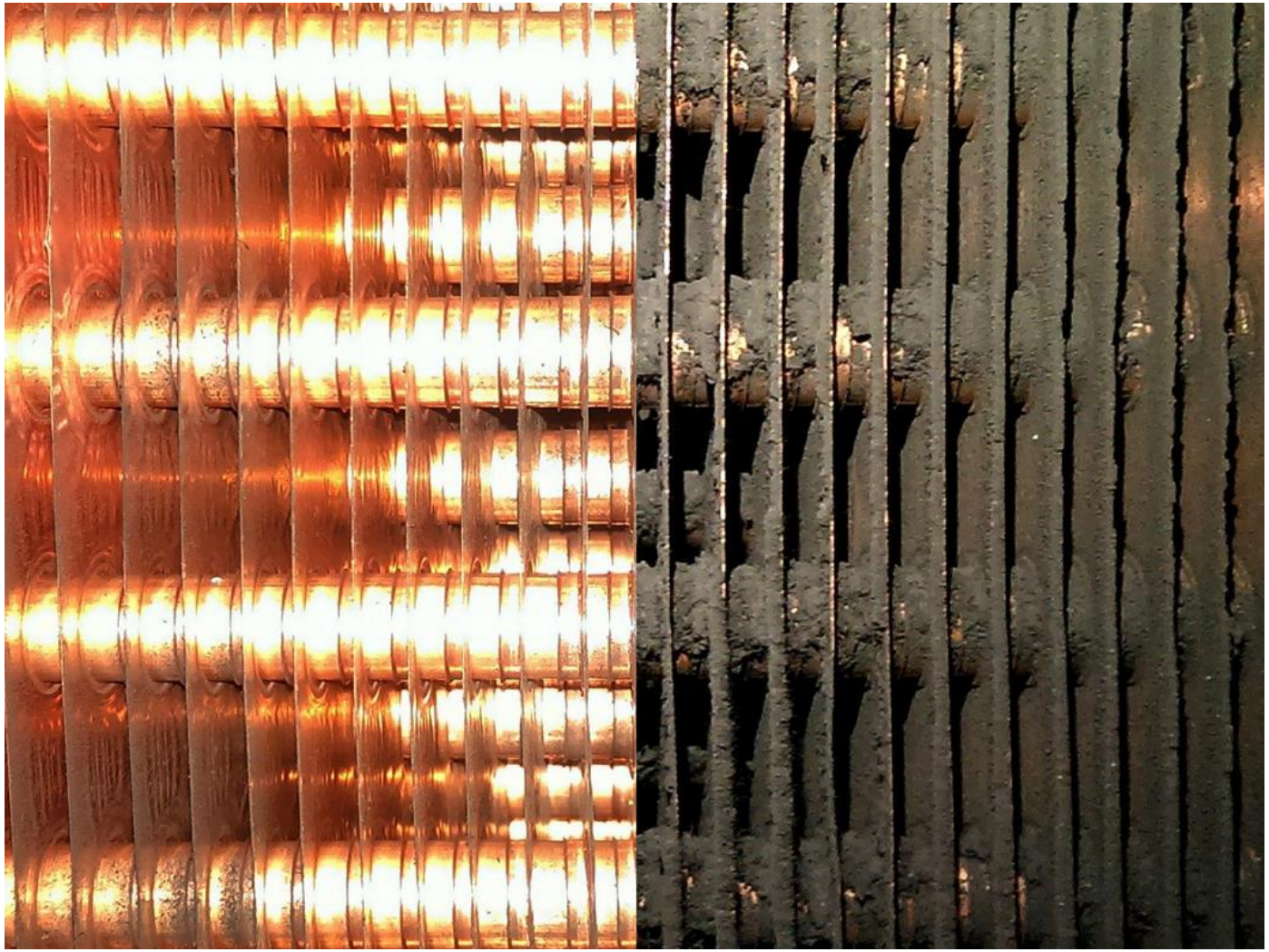

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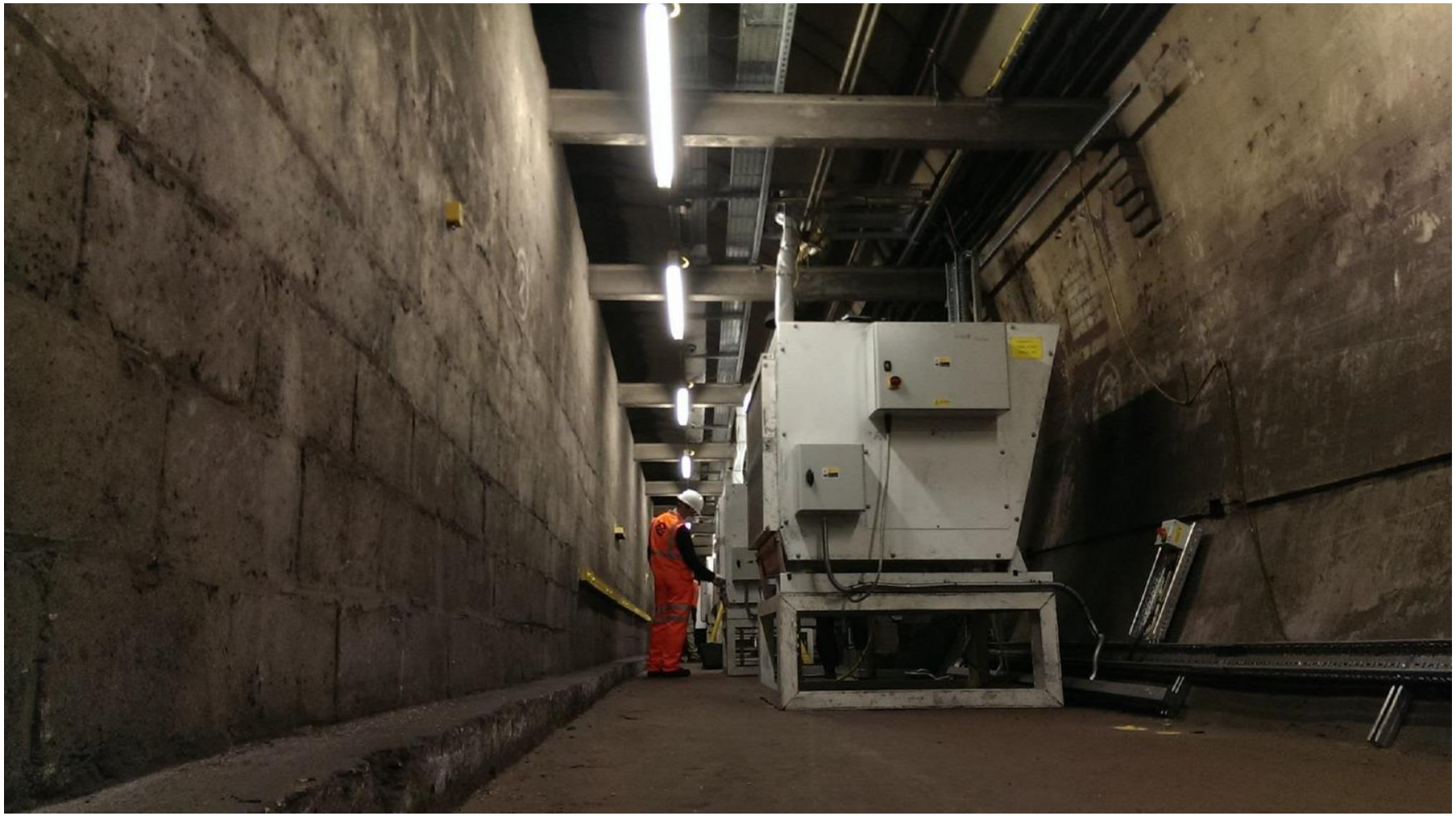

Industrial placement – London Underground

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Industrial placement – London Underground

Collaboration of the Year

WINNER London Underground, London South Bank University and GEA Searle

London Underground's Cooling the Tube programme to design and trial the next-generation platform air-handling unit (PAHU) is an example of a perfect partnership.

Its trial focused on investigating and testing technologies used to prolong cooling operation and developing a cost-effective unit by testing five different prototypes. The idea was to maximise the input from stakeholders and key members of the team in order to achieve the best whole-life cost solution, and as such each stage of the project was conducted in a collaborative manner.

London South Bank University, manufacturer GEA Searle and London Underground Limited (LUL) proved a perfect combination as the core project team to deliver a robust setup, methodology and risk management strategy. During the trial the blend of academic knowledge and practical LUL infrastructure knowledge proved itself by identifying alternative technologies from other industries that could be employed.

The project was a great example of how collaboration can build a foundation of expertise, as it was delivered with knowledge and input from all stakeholders.

> "An admirable, fully encompassing collaboration for an extremely important development"
>
> Judges' comment

Finalists

▸ Baxi and Wheldons

Initiatives introduced as part of this partnership include obligatory Baxi product training for all Wheldons engineers and collaborative working to identify and solve potential design installation problems.

▸ Bosch Commercial and Industrial Heating and BUPA

BUPA's goal is to reduce absolute carbon emissions by 20% and it has liaised with Bosch to aid this goal. So far, 89 projects have been completed and a reduction in carbon use of 4,904 tonnes is anticipated.

▸ Corrigenda Group and Portsmouth City Council

This partnership not only delivers a high-quality, cost-effective service to Portsmouth residents, but also gives Corrigenda stability and builds a relationship that provides the basis for efficient and effective working.

▸ Husky Heat Pumps, enih Homes, T&S Heating and Tesus

This collaboration between nine organisations has taken more than 200 homes out of fuel poverty. The objective for 2016 is to achieve a further tenfold increase by taking a further 2,000 homes out of fuel poverty.

▸ Intergas Heating and Newham Borough Council

Newham Council partnered with Intergas to stop easy-to-remedy problems in its 14,500 homes developing into expensive repairs and to ensure that old boilers would be replaced by more energy-efficient models.

▸ JS Wright & Co and Barratt London

This initiative was introduced to improve customer satisfaction for purchasers of new properties from Barratt London. It allows the two firms to resolve issues that occupiers might face without the need for a service visit.

▸ Potterton Commercial and Christopher Dunphy Ecclesiastical (CDE)

At the heart of this collaboration is a mutual belief that installations should last more than 50 years. Potterton Commercial's five-year guarantee means CDE can offer its own five-year guarantee on its combined installations.

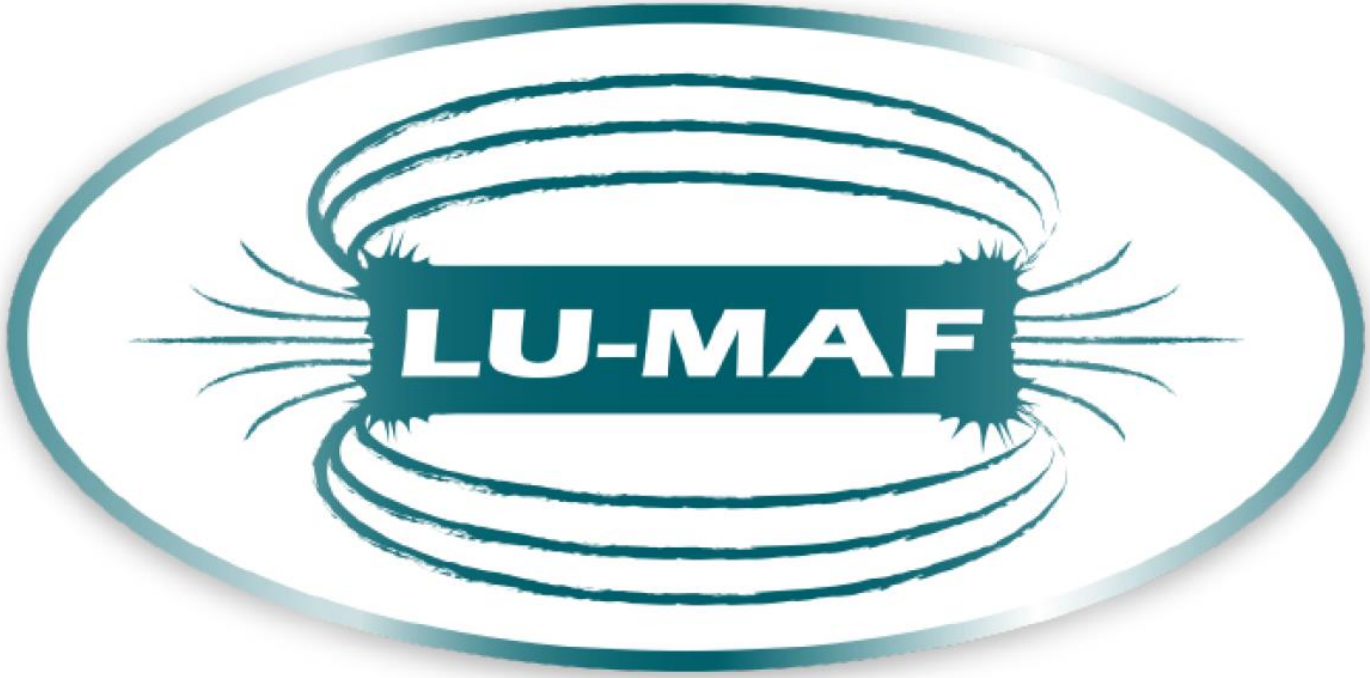
▸ Saltire and North Lanarkshire Council

The aim of this partnership was to achieve energy-efficient heating in sheltered housing. Three such projects have so far successfully been completed, reducing heating bills and increasing peace of mind.

▸ Vokera with Sharp Construction, Fife Council and Napier University

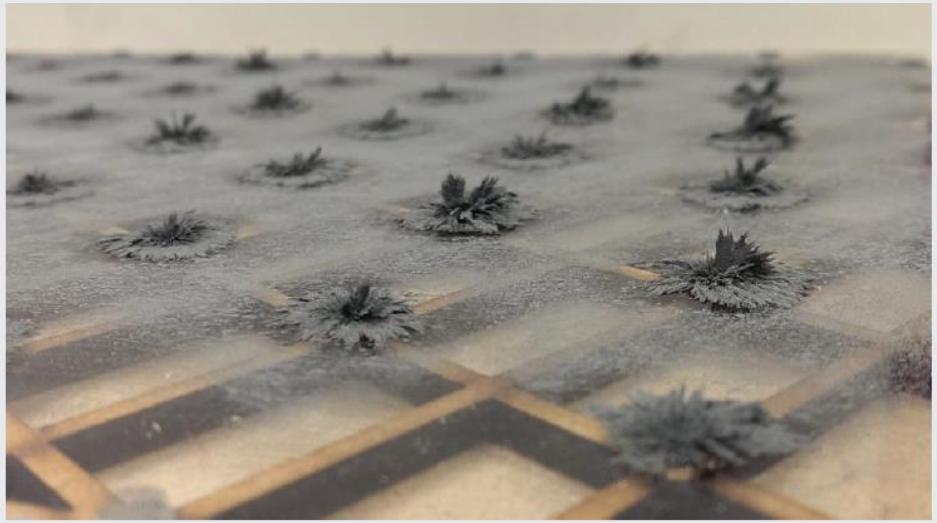
These organisations retrofitted a block of four flats to discover the best way to save energy and money with multi-dwelling units. By having dialogue and clear goals, they came up with solutions that reduced new-build costs.

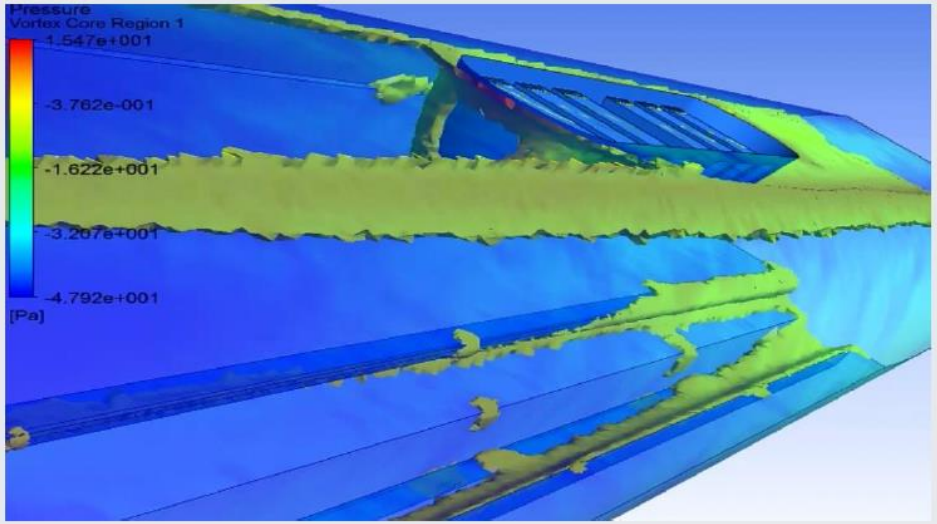
2012-2016 - LSBU



Air filtration for London Underground.

2012-2016 - LSBU





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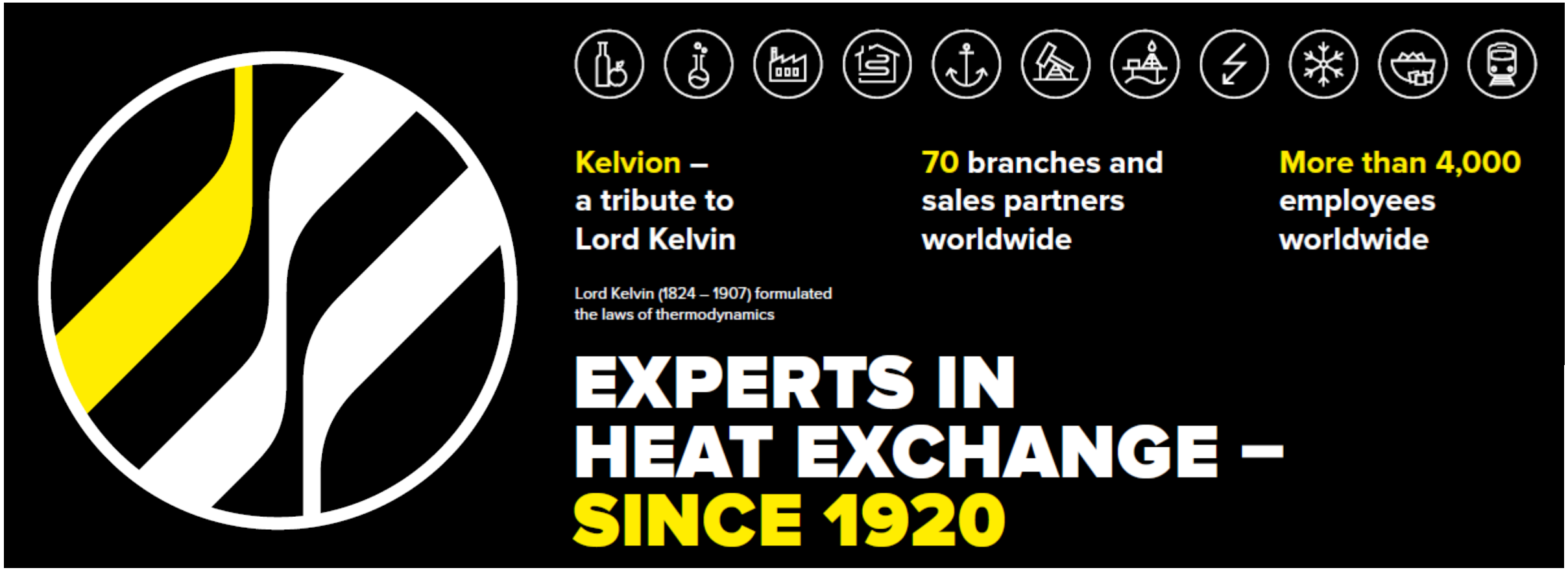
2016-2019 - Kelvion



2016-2019 - Kelvion

Commercial Aircoolers
The Kelvion range of Commercial Air Coolers is designed for most refrigeration applications. In addition to predefined variants, there is the flexibility to include options and accessories to meet our customers' demands.

Their capacity and size are optimized to facilitate the stocking and competitive transportation of products directly, or via our distribution and wholesale channels. Commercial products are defined within the sales brochures, selection software and product configurator – all with specific price lists.

If the products in the Commercial portfolio do not meet your requirements, we have a customized range of Air Coolers that can be configured uniquely to suit.

Customized Aircoolers
If a commercial product does not meet the market demands, our Customized Air Cooler product line offers a design-to-order process, with your application needs as the starting point. We optimize the total quotation process and tailor our manufacturing to fulfil your requirements.

We start with the widest possible product portfolio, offered in our selection software. Our Sales teams can provide non-standard, design-to-order, industrial or OEM solutions. It is a critical feature of our quotation and manufacturing process that we check the design at the earliest opportunity to avoid risk.

In conformity with lead times, we design the best air cooler for your application.

Condensers & Dry Coolers
Kelvion Condensers and Dry Coolers are based upon modular designs. We offer various fan sizes, multiple speeds and suppliers, coupled with an extensive range of tube and fin profiles, to enable products to be tailored accurately to meet the application demands.

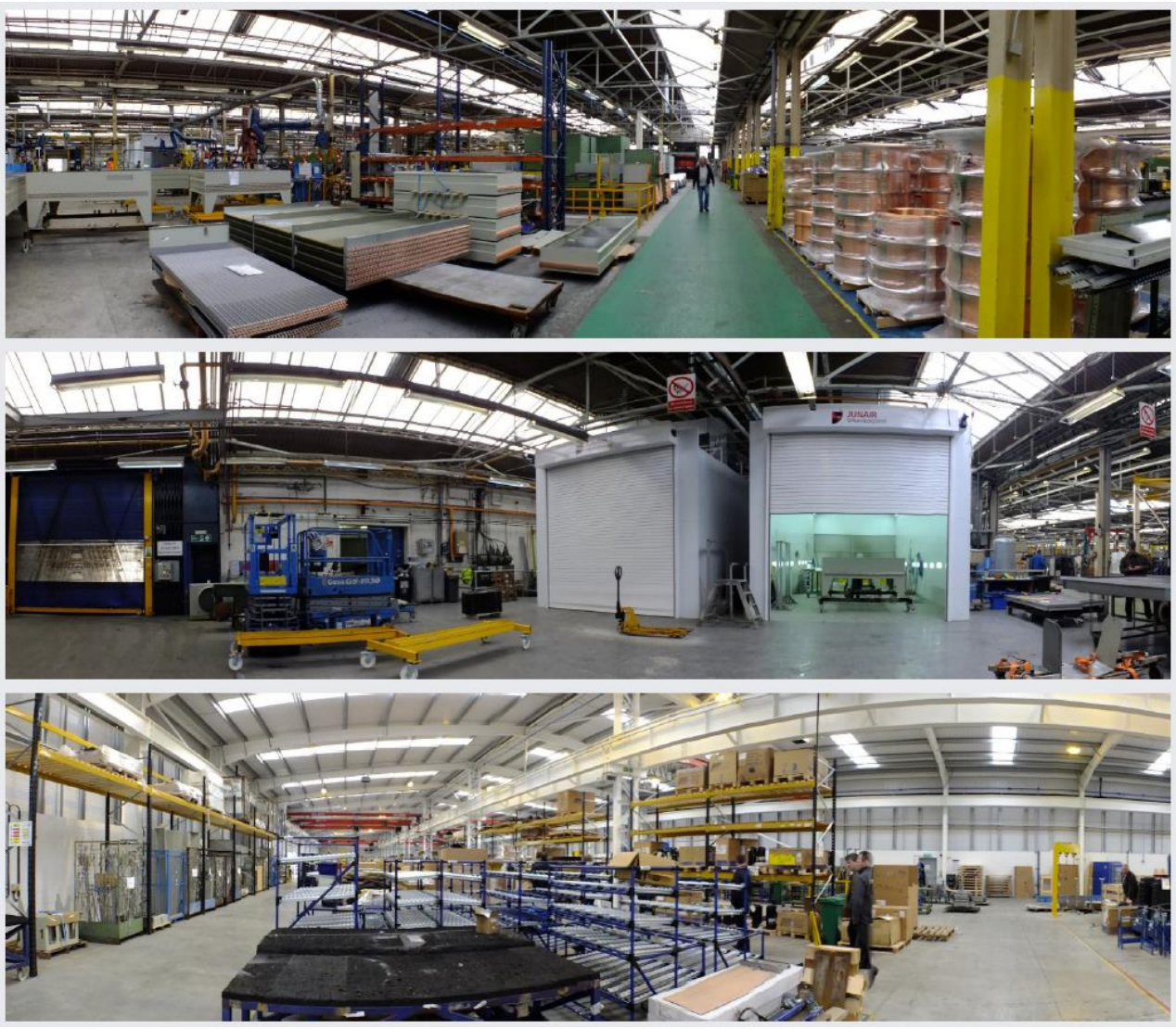
The wide range of fan choices ensures that the optimal balance between air volume and capacity, operational noise levels and power consumption to meet market price levels are achieved. The tube and fins can be supplied in various materials, depending on the internal or external corrosion properties.

The products can be deployed in multiple applications, from standard commercial stock products to customized, made- to-order units.

Coils
Kelvion heat exchanger coils are manufactured with copper tubes and aluminum or copper fins. Special fin profiles, developed by our R&D department, enhance heat transfer and maintain pressure drop at a moderate level. Collars allow for customized fin spacing, as well as providing the contact between the fin block and the tubes. Mechanical expansion of the tubes guarantees a perfect bonding between the fins and tubes for maximum heat transfer. Several tubes are interconnected via brazed return bends to form the coil circuits, which receive the working fluid via brazed tubular headers. The thermodynamic design is created with our in-house developed selection software, based on the measurements in our laboratory conform to DIN EN1216. Rigorous testing supports quality control of our coils.

Our extensive product portfolio, with diverse options, means we can configure our coils to suit specific requirements and applications, leading to cost-optimized and energy-efficient products. Short delivery times and an excellent service ensure customer satisfaction.

2016-2019 - Kelvion



2016-2019 - Kelvion

Summary of laboratory facilities:

- Temperature controlled chamber with full control from -40°C to +60°C
- Dimension of chamber: 16 m long, 7 m wide, 8 m high
- R507A refrigeration plant with nominal cooling capacity range 0.1 kW - 600 kW
- Natural refrigerant plant (CO_2) with nominal loading of 2.5 kW - 150 kW
- Boiler system capable of 2kW - 1,400 kW
- Wind tunnel with flow range of 720 to 50,000 m^3/hr and up to 1000 Pa back pressure
- Heat transfer coefficient test rig, with air flow rate from 0.5 m/s to 9 m/s
- Free field sound pressure and reverberant sound power measurements
- X-Ray micro-tomography for finite analysis of components
- Burst pressure testing up to 620 Bar
- Small environmental chamber with full humidity control, -60°C to +150°C
- Smoke generation and air distribution testing
- Prototype fabrication, motor test facilities

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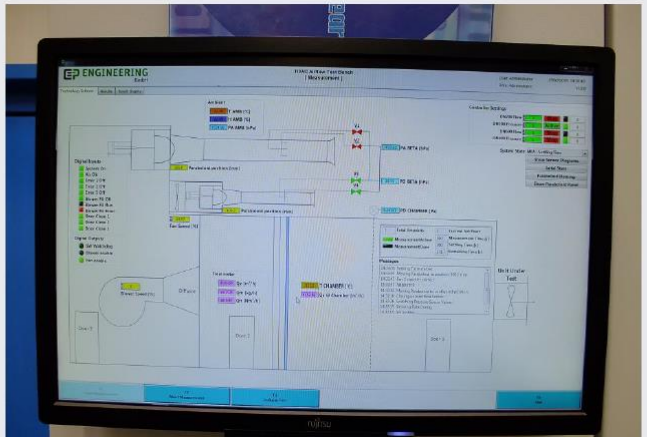

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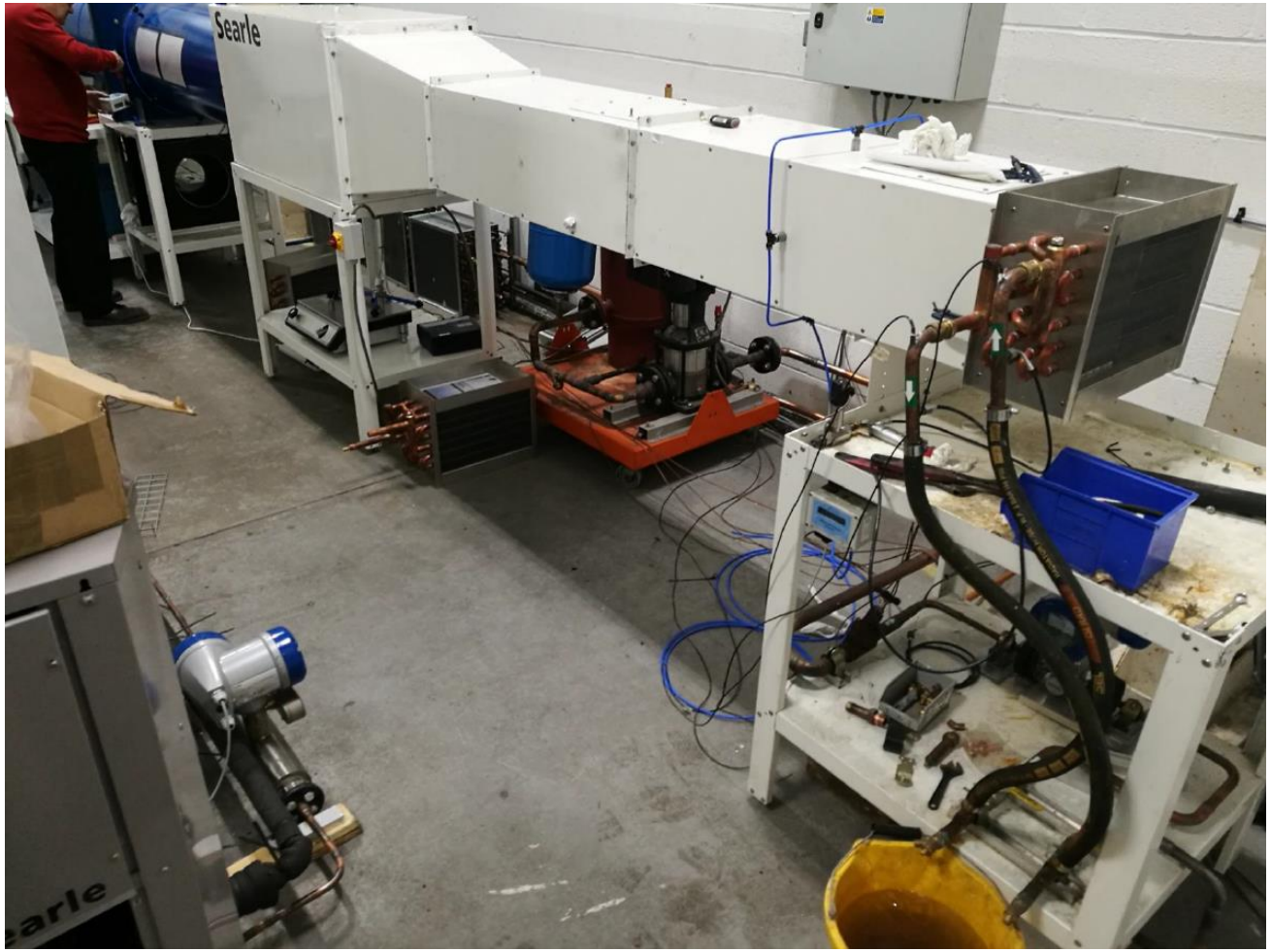

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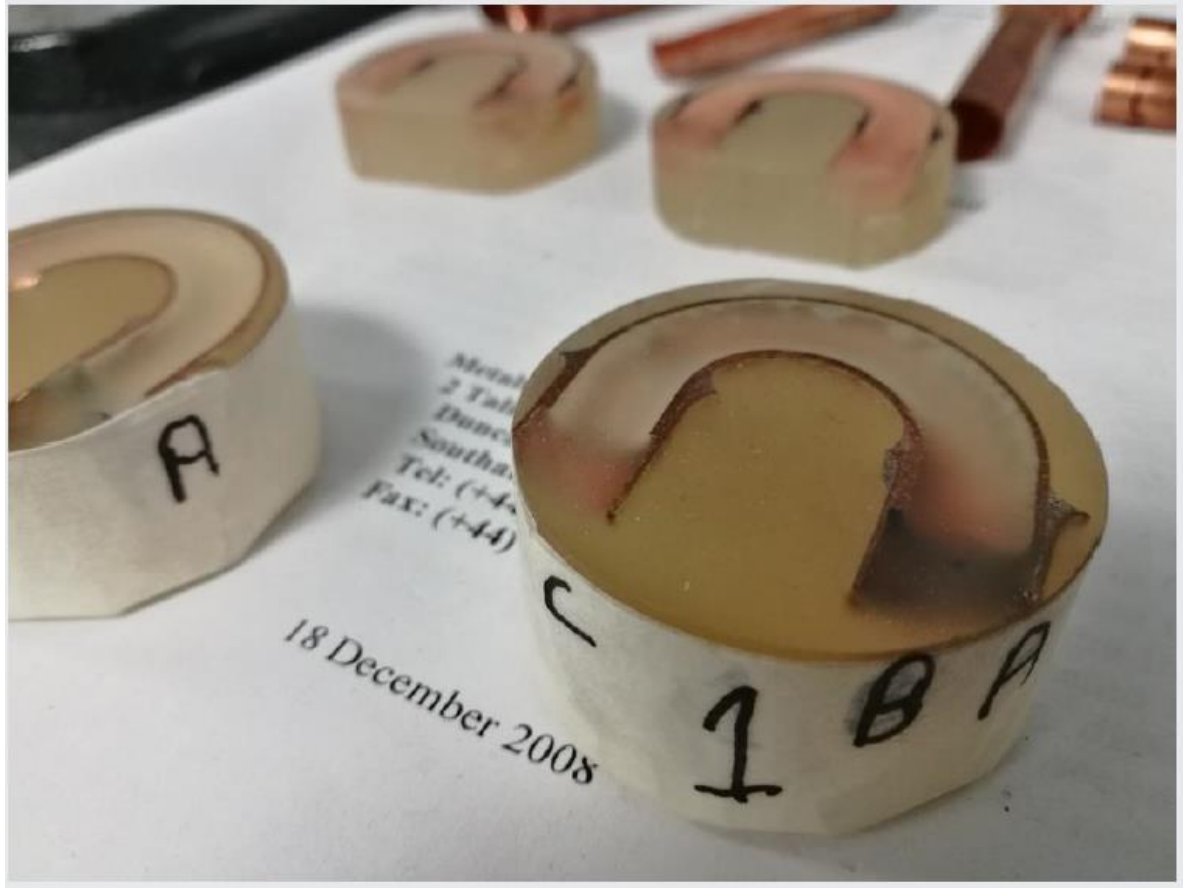


2016-2019 - Kelvion

Coil Face Dimensions

Height [m]	0.254
Length [m]	1.400
Area [m²]	0.356

ERF100208-1400 0.16 mm Al

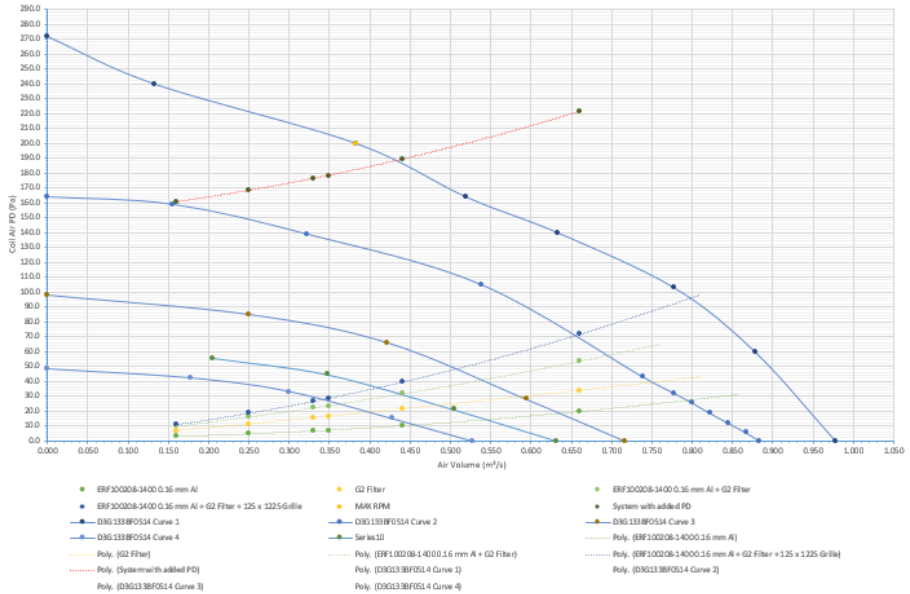
Air Volume (m³/h)	Air Volume (m³/s)	Face Velocity (m/s)	Air PD (Pa)
576	0.160	0.450	2.8
900	0.250	0.703	4.7
1188	0.330	0.928	6.5
1260	0.350	0.984	6.8
1584	0.440	1.237	10.1
2376	0.660	1.856	19.5

G2 Filter

Air Volume (m³/h)	Air Volume (m³/s)	Air PD (Pa)
576	0.160	6.8
900	0.250	11.3
1188	0.330	15.4
1260	0.350	16.5
1584	0.440	21.4
2376	0.660	33.8

ERF100208-1400 0.16 mm Al + G2 Filter

Air Volume (m³/h)	Air Volume (m³/s)	Air PD (Pa)
576	0.160	9.6
900	0.250	16.0
1188	0.330	21.9
1260	0.350	23.3
1584	0.440	31.5
2376	0.660	53.3



ERF100208-1400 0.16 mm Al + G2 Filter + 125 x 1225 Grille

Fouling PD (Pa): 150

Air Volume (m³/h)	Air Volume (m³/s)	Air PD (Pa)	System + Fouling PD (Pa)
576	0.160	10.63	160.63
900	0.250	18.50	168.50
1188	0.330	26.37	176.37
1260	0.350	28.23	178.23
1584	0.440	33.41	183.41
2376	0.660	71.35	221.35

DATA SHEET

Filter Calculations:

Number of Fans:	4
Actual Filter Face Dimensions:	
Width [m]	1.465
Depth [m]	0.225
Area [m²]	0.330

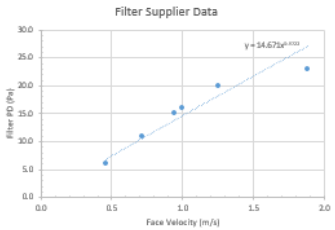
Actual Face Velocity (m/s)	Air PD (Pa)
0.485	6.8
0.758	11.3
1.001	15.4
1.062	16.5
1.335	21.4
2.002	33.8

DATA SHEET

Test Filter Face Dimensions

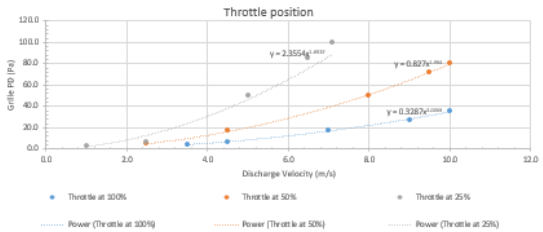
Height [m]	0.592
Length [m]	0.592
Area [m²]	0.350

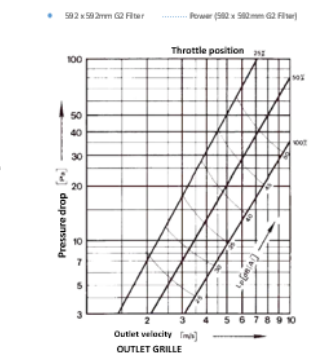
Face Velocity (m/s)	Air PD (Pa)
0.457	6.0
0.713	11.0
0.942	15.0
0.999	16.0
1.255	20.0
1.883	23.0



Grille size (mm):	125 x 1225	225 x 1225
Effective Area (m²):	0.032	0.188
Throttle Position::	100	

Grille size:	Effective Area (m²):
125 x 625	0.0459
125 x 825	0.0611
125 x 1025	0.0763
125 x 1225	0.0915
225 x 625	0.0942
225 x 825	0.1254
225 x 1025	0.1566
225 x 1225	0.1878





	125 x 1225				225 x 1225			
Throttle Position (%):	Face Velocity (m/s)	Air PD (Pa)	Air Volume (m³/s)	Air Volume (m³/h)	Face Velocity (m/s)	Air PD (Pa)	Air Volume (m³/s)	Air Volume (m³/h)
100	1.75	1.02	0.16	576	0.85	0.24	0.16	576
100	2.73	2.52	0.25	900	1.33	0.59	0.25	900
100	3.61	4.43	0.33	1188	1.76	1.03	0.33	1188
100	3.83	4.99	0.35	1260	1.86	1.16	0.35	1260
100	4.81	7.33	0.44	1584	2.34	1.85	0.44	1584
100	7.21	18.03	0.66	2376	3.51	4.20	0.66	2376
50	1.75	2.51	0.16	576	0.85	0.60	0.16	576
50	2.73	6.08	0.25	900	1.33	1.46	0.25	900
50	3.61	10.54	0.33	1188	1.76	2.53	0.33	1188
50	3.83	11.84	0.35	1260	1.86	2.84	0.35	1260
50	4.81	18.65	0.44	1584	2.34	4.48	0.44	1584
50	7.21	41.69	0.66	2376	3.51	10.01	0.66	2376
25	1.75	6.64	0.16	576	0.85	1.75	0.16	576
25	2.73	15.18	0.25	900	1.33	4.00	0.25	900
25	3.61	25.39	0.33	1188	1.76	6.70	0.33	1188
25	3.83	28.32	0.35	1260	1.86	7.47	0.35	1260
25	4.81	43.29	0.44	1584	2.34	11.42	0.44	1584
25	7.21	91.78	0.66	2376	3.51	24.20	0.66	2376

Throttle at 25%		Throttle at 50%		Throttle at 100%	
m/s	Pa	m/s	Pa	m/s	Pa
1.00	3.2	2.50	5.0	3.50	4.1
2.50	7.0	4.50	17.0	4.50	7.0
5.00	50.0	8.00	50.0	7.00	17.5
6.50	85.0	9.50	72.0	9.00	27.5
7.10	100.0	10.00	80.0	10.00	35.0

2016-2019 - Kelvion

Study of benefits of cable tunnel cooling

Current investigation

A study of the combined benefits of:

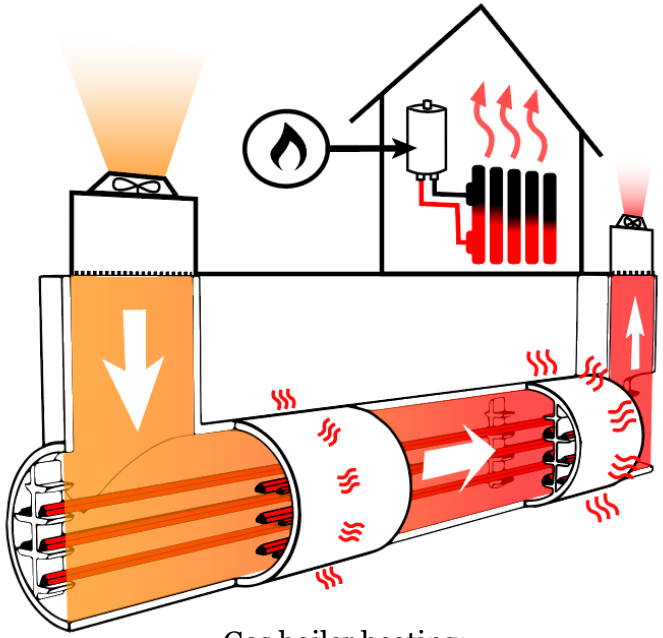
- Cooling on the power cable losses
- Heat recovery from the tunnel

Benefits include savings in:

- Energy consumption
- Carbon emissions
- Revenue

Current investigation

- 64.1 to 310.8 kW
- Heat pump COP of > 3 @ 65°C delivery
- Carbon savings of > 50% for the heat recovery system compared with gas boiler heating
- Strong commercial opportunities

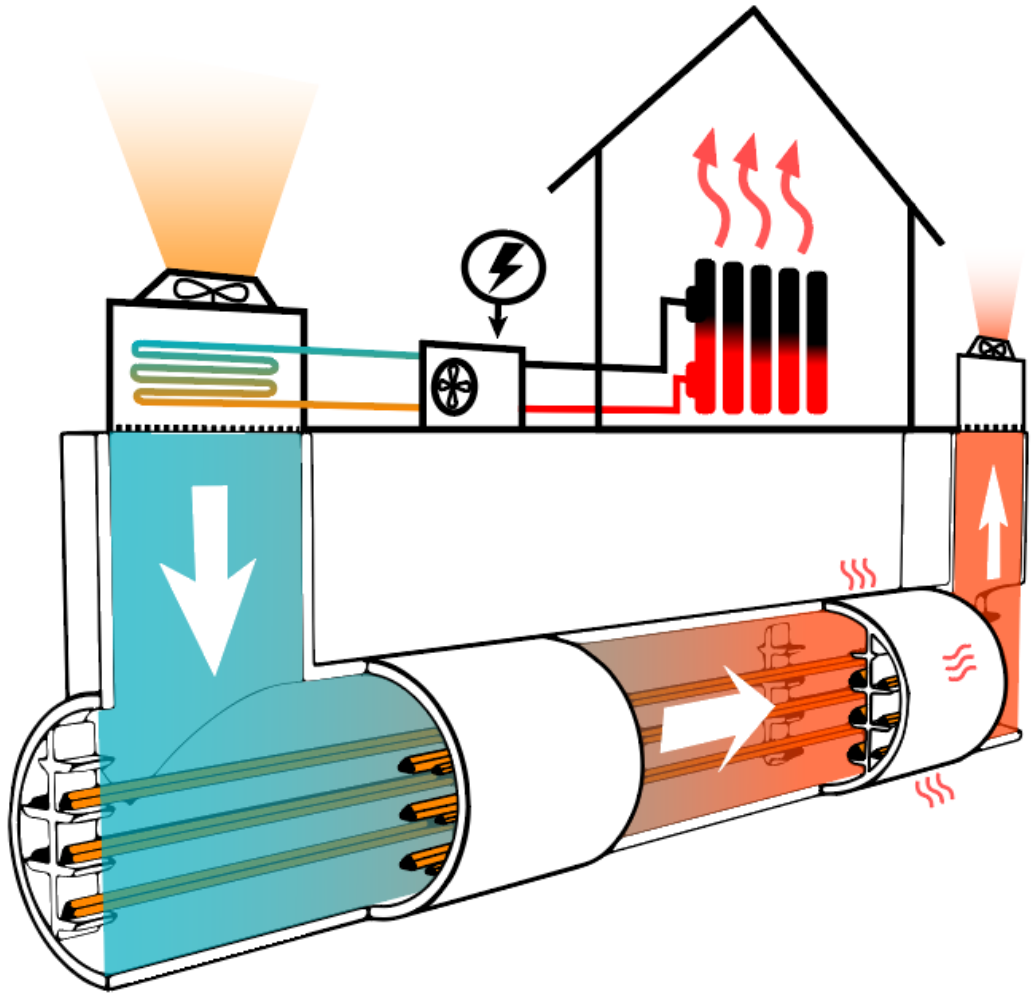


Gas boiler heating:
high tunnel air temperature and high power cable losses

Identified combined annual savings* for a 500m long cable tunnel section:

- **>280,000 $kgCO_2e$**
- **>2GWh**
- **>£60,000**

*Savings due to heat recovery, reduced electricity losses and emissions



Heat recovery from air entering the tunnel supply shaft:
reduced tunnel air temperature and cable losses

Future projects