BATTLE OF BRITAIN BUNKER

LONDON BOROUGH OF HILLINGDON

OUTLINE SCOPE OF WORKS FOR REFURBISHMENT AND WATER MANAGEMENT

July 2020

Prepared by

Martin Ashley Architects

for

The London Borough of Hillingdon

BATTLE OF BRITAIN BUNKER

Outline Schedule of Refurbishment Works

Notes to be read in conjunction with the attached plans –
2270_01_10 A Phase II - Above Ground Proposals
2270_01_11 A Phase II - Bunker level proposals_West Bunker
2270_01_12 A Phase II - Bunker level proposals_East Bunker
2270_01_13 A PHASE II_ Plan & Elevations AA and BB to Entrance Structure
2270_01_14 A PHASE II_ Plan & Elevation CC to Entrance Structure
2270_01_15 A PHASE II_Section Through Y Plant Room
2270_01_16 A PHASE II_Detail Section Through Y Plant Room
2270_01_17 A PHASE II_ Section Through X Plant Room
2270_01_18 A PHASE II_Detail Section Through X Plant Room
2270_01_19 A PHASE II_Pill Box Plan and Section as Proposed
2270_01_20 A PHASE II_Historic railings

SITE

The Bunker is located on the former RAF Uxbridge site which abuts Dowding Park to the west, new housing to the East in Wren Avenue, close to Vine Lane, and the Hillingdon golf course to the South. The Bunker is built on a site which slopes down to the river Pinn, flowing north to south, with the main entrance at the upper level and an escape exit near to the river path. The new Visitor Centre is adjacent to the North side of the Bunker.

BACKGROUND

The Bunker was constructed in 1938 as the underground operations room replacing a ground level facility and became operational just before the start of WWII in September 1939. During the Battle of Britain in 1940 it was the nerve centre for directing the fighter protection over London and the South East. The bunker was built on two levels containing a viewing platform overlooking the large plotting room and tote board where the deployment of aircraft over the region was displayed. The internal layout of the Bunker remains largely unchanged, it contains its original air filtration system provided by two independent plant rooms, mains, and standby power supplies, together with telephone exchanges and offices. It was closed for operational use in 1958, the plotting room was restored in the 1970s when the Bunker became a museum.
RAF Uxbridge closed in 2010 and was acquired by the London Borough of Hillingdon from the Ministry of Defence. The building is Grade 1 Listed.
The Bunker complex is part of the site visitor experience, the tours usually start with an introduction in the Visitor Centre and guided parties of up to 50 people may visit at one time. The Bunker is open to the public but can also be hired for private functions and for filming, relating to the Battle of Britain and WWII.

CONSTRUCTION

The Bunker was built using reinforced concrete to form a two-storey rectangular box connected to the surface by staircases to the East and to the West, the concrete was protected by asphalt to prevent water ingress. The lower floor level is approximately 18 metres below ground level, the depth was limited by River Pinn and construction problems resulting from the London clay. As the Bunker was still considered to be vulnerable to damage from a 230kg bombs additional layers of reinforced concrete ‘Burster Courses’ were formed over the roof of the Bunker, between layers of soil. These layers extend

beyond the footprint of the Bunker. Four reinforced concrete shafts from the two independent plant rooms, provide intake and exhaust air supplies to the filter units, which distribute the air around the bunker using metal ducting. Power cables from mains supplies and stand by generators run down the staircases, together with telephone cables.

CURRENT SITUATION

The building has suffered incidents of flooding extending back many decades. Hydrostatic pressure and ground level storm water surcharging the entrance area have resulted in water descending the entrance and exit stairs. There are also recurrent damp problems, where water has also entered the plant rooms through the ventilation shafts. Parts of the building are below the level of the river Pinn which may result in the water table being above the floor level of the corridor. The existing ventilation equipment continues to be used but is a matter of concern as it is part of the 1938 installation and does not comply with current standards.

The underground drainage to the site was surveyed in December 2017. Some of the blockages and defects were rectified in February 2018 by Metro-Rod, but the defective access chamber S1 was not accessible/known at that time.
Asbestos survey of building interior have been previously undertaken (however a survey specific to this schedule of works will be required), ecological survey of the site around the Bunker, and a CCTV survey of the ventilation shafts.

The asbestos survey reviewed previous reports and concluded that the chance of finding further asbestos is highly unlikely.
The Preliminary Ecological report did not find that the site contained any protected or notable species within the one kilometre grid, within which the site is located. The report did not find any presence of bats within the Bunker or the airshafts.

The CCTV survey of the ventilation shafts revealed that the air intake shaft Y1 to the lower plant room Y, was damaged and water was seen to be leaking into the shaft. Shaft Y1 was excavated and confirmed that the asphalt had been breached and resulting in water ingress when the water level reached the level of the breach. The works involved excavating through the two burster slabs, inserting permanent concrete rings to provide a retaining structure, repairing the asphalt and back filling with free draining aggregate.

The three other shafts were found to be in good condition when surveyed in 2018, but some water ingress has since been observed and hence the wish to repeat the process on shafts X1, X2 & Y2 alongside other works to improve surface water management.

The level of the entrance path and flanking walls were raised in Spring 2021 and the roadway curb was lowered beside the old air raid shelter to encourage water away from the entrance. The exit door was overhauled and fitted with a hood to reduce the risk of water ingress from above.

During these works, it was observed that the base of access chamber S1 just outside the site boundary had washed away and that the surface water drainage was causing a flood management holding pond approximately 20m from the entrance to fill up. At times when the holding pond had filled and subsequently, water could be seen bubbling under the entrance blast wall and entering Plantroom X air shafts. The defective drainage system serves the Birch Crescent housing estate.

OWNERSHIP

Ownership and responsibility for maintenance of the Bunker was transferred from the MOD to London Borough of Hillingdon, together with the Freehold of the site.

The adjacent Visitor Centre is open to the public, the access road must be kept clear for vehicles arriving and leaving the site, and must be kept clean from excavated material.
The Bunker is part of the visitor attraction and will be used by tour groups.
The contractor must liaise with the manager of the Visitor Centre regarding deliveries and vehicle movements.

The trees and vegetation surrounding the exit and plantrooms are to be cleared by the client's own contractor, to provide access to the works around airshafts X & Y.

SCOPE OF THE WORKS

The Scope of the works aims to reduce the risk of water entering the bunker and comprises a number of defined work locations or packages of works:

Generally

- Undertake the recommendations of a specialist drainage consultant/design.

External

- Improve the existing surface water drainage system in order to direct the uphill Birch Crescent Estate flood water away from the bunker.
- Install land drains around the entrance and exit buildings, airshafts and across the site to intercept water before reaching vulnerable locations.
- Repair the leaking air shafts X1, X2 and Y2.
- Undertake local asphalt repairs to the entrance, exit and air shafts.
- Adjust the ground surface falls to encourage water away from current ingress locations

Internal

- Install internal pumps with associated services connections to help eject water if in the event that it does enter the building.
- Remove a modern internal partition wall and reinstate historic handrails.
- Remove the modern suspended Exit corridor ceiling.
- Undertake paint analysis and reinstate finishes to historic evidence.

DEEP EXCAVATIONS

Provide all necessary temporary trackway, protections, shuttering, ladders, platforms, and gas monitoring to allow safe working within the excavation/to the damaged area of concrete of each airshaft. Provide a mechanical hoist fixed to the shuttering /scaffold for the removal of the soil around the shaft and allow for moving the soil to an agreed location adjacent to the excavation. Protect the excavation with a temporary roof and allow for providing a pump and lighting to keep the excavation free from ground water. Monitor and record vibration, follow the Structural Engineers defined parameters for acceptable vibration limits. The excavation works will require an element of hand work, monitor Carbon monoxide in the excavation produced by heavy plant to ensure safety within the excavated spaces.
Construct new temporary access path from the access road on the East side of the site to the excavation sites, to allow spoil and new materials to be transported across the site. Remove excess spoil arising.
Form site compound with welfare facilities on the East side of the site as shown on drawing 2270/01/10 beside the replica Hurricane. Ensure that the site and site compound are maintained in a clean and tidy condition as far as possible.

Please refer to Appendix A – Historic England List Description Extract

Item	Description	Cost (£)
1.00	**Water Management**	
1.01	EXTERNAL WATER MANAGEMENT	
1.02	Subject to confirmation by drainage specialist/Hydrologist and specific instruction, for the purposes of tender, allow to undertake the following works:	
1.03	SOUTH BOUNDARY SOAKAWAY Excavate area beside boundary to accommodate new soakaway comprising Wavin Aquacell Plus R soakaway units geotextile wrapped and bedded in free draining material. Location to be agreed onsite as R12/122. For the purposes of tender allow soakaway to be 160m³ (6m wide x 15m long x 2m deep with outfall/overflow discharging into the gravel filled South boundary ditch/channel. Provide 500mm earth covering over the soakaway with 500mm good quality topsoil. The base of the soakaway is to be not less than 1500mm below the invert of access chamber S1. Excavate and install Plastidrain drainage pipework, approx. 15m long from access chamber S1 to the South boundary soakaway as R12/110. Excavate South Boundary ditch 600mm wide x 1.5m deep over a length of 30m downhill from the soakaway, line with geotextile, lay 200mm diameter Wavin Twin Wall perforated filter drain bedded in free draining shingle as R12/116 from soakaway running downhill. Cover gravel with geotextile and 300mm topsoil.	
1.04	ACCESS CHAMBER S1 The existing chamber base has washed away. The drain is located just outside the site boundary, is active and carries large volumes of surface water from the adjacent Wren Avenue housing estate during rainfall. Manage the works to provide continuity of surface water drainage. Entirely excavate/demolish the existing access chamber S1, remove all material arising. Form new concrete base, chamber and benching to the same depth/invert as existing to current Building Regulations. All entry and exit pipes (where not redundant) are to match the size of existing. Reform drainage connections upstream and downstream to new soakaway.	
1.05	CHANNEL DRAIN Install new heavy duty 200mm wide channel drain with grating and frame across the road at the upper gate threshold connected to the reconstructed access chamber S1.	

	Available from: Wavin Parsonage Way SN15 5PN Chippenham Wiltshire United Kingdom Tel: +44 0 1249 766600 **Catalog code Wavin** *200HDC100* **Diameter** *200* CivilChan-Hvy-Duty-Chan-200-Flat-280-L=1 (wavin.com)	
1.06	EXISTING BUNDED OVERFLOW POND. Fully remove the existing entry/exit chamber top, walls, grille and base. Remove 25m long concrete open channel drain from the bottom of the pond. Re-landscape the bund banks and place earth arising into the overflow pond and grade the ground surface to a consistent gradient from the Yew tree root plate down to the roadside curb. The bund banks occupy two sides of a triangle with a total length of approx. 45m x 1.5m high with a total volume of approx 70m³. NO ENTRY SIGN Remove the 'No Entry' sign beside the corner of the bunded overflow pond.	
1.07	ROADWAY CURB Lower the roadway curb between the boundary gate beside S1 and the new roadway hump to promote water run off drainage towards the South boundary.	
1.08	TARMAC MAKING GOOD All disturbed areas, areas affected by excavators/traffic etc. Allow 30m²in the location of access chamber S1 and the new channel drain.	
1.09	TARMAC HUMP Install new Tarmac hump across the roadway to direct water running downhill towards the South boundary.	
1.10	RESEEDING/MAKING GOOD. All disturbed, excavated, and trafficked surfaces to receive good quality topsoil to a depth of 300mm, prepared, finely raked, and densely reseeded.	
2.00	ENTRANCE MEMORIAL GARDEN The bunker site is carefully tended by volunteers and grounds maintenance personnel. Whilst the presentation of the site is tidy, it is not historically correct. The arrangement of planting, lawn and fencing is distinctly suburban and would be easily observed by aerial reconnaissance. There are vestigial traces of slabs and	

	possible structures adjacent to the entrance and it is not inconceivable that a suburban presentation might have been the ideal camouflage. Whilst a full return to wartime presentation might be desirable to provide a more authentic context and experience, the precise details of this are not presently known. The existing presentation is respectful but sanitises, dilutes, and obscures the blunt authenticity and titanic struggles that unfolded at this site. The true memorial to the lives and losses is the bunker itself which is presently hidden behind a fence, hedge, and brambles. It is suggested that the view to the bunker entrance could be opened-up so that the memorial and flagpoles stand against the setting of the Bunker entrance to provide a simpler presentation and direct line of site to promote a more emotive, visceral, thought provoking experience and implied contact with where the RAF personnel would have walked, worked, and fought for the freedom of Western Europe.	
2.01	MEMORIAL GARDEN REPRESENTATION As part of the proposed excavation works around the Entrance building and Plantroom X there will need to be access for heavy excavators. The heavy plant will inevitably have a temporary impact and this impact can in part be mitigated by keeping traffic routes as short as possible. Subject to consultation with volunteers, consent, and instruction, allow to carry out the following works: Relocate the stand pipe on the North end of the fence, location to be agreed. Allow to extend by 10m. Remove the larch fencing Remove trees identified on the plan to allow excavator access and cut back brambles and ground foliage to facilitate excavations. Retain the laurel hedge, trim and lower to achieve a hedge 600mm high x 1m thick. Extend the hedge round to the ENTRANCE steps flank wall to mask the stepped bank. The memorial stone stands in a semi-circular recessed lawn. The lawn is enclosed by a low wall beside the bunker that effectively acts as a dam to prevent surface water running from the roadway to the semi-buried entrance building. An alternative presentation would be to slightly raise the grassed area to fall back towards the roadway and reduce the risk of water percolating to the bunker as it currently does: effectively burying the existing wall. Subject to consent and for the purposes of tender, allow to build up the level of the grassed area and raise the paving around the base of the memorial stone to achieve a 1 in 60 gradient to the roadway curb. Allow to provide new York stone (assumes the existing paving will not be salvageable due to its cement bedding). Prepare the ground surface with new top soil (assumed average depth of 300mm), fine raked and densely seeded.	

3.00	ENTRANCE EXCAVATIONS & REPAIRS Excavate around the buried sides of the ENTRANCE building/Guard Room to u/s foundation level, for the purposes of tender allow to excavate to a depth of 3m down from the approach path surface. Allow to install 200mm diameter Wavin Twin Wall perforated filter drain bedded in free draining shingle draining to new access chamber as R12/116. Allow for 15m long trenches on the East side and a 6m long trench beside the blast wall on the South side connected to a new access chamber beside the entrance steps, mole under the entrance steps.	
3.01	ENTRANCE SOAKAWAY Form new drain in the Entrance well beside the Entrance door connected to the new access chamber. Excavate and install 15m long drain Plastidrain 150mm drainage pipework from new access chamber to a new soakaway located close to the replica Spitfire as R12/110. Construct new soakaway comprising Wavin Aquacell Plus R soakaway units geotextile wrapped and bedded in free draining material. Precise location to be agreed onsite as R12/122. For the purposes of tender allow 18m³ (eg 4m wide x 3m long x 1.5m). The top of the Soakaway is to be 500mm below the level of the entrance well drain.	
3.02	ENTRANCE ROADWAY CHANNEL DRAIN CONNECTION Allow to form new 6m long connection from the roadway channel drain to the new access chamber.	
3.03	ENTRANCE ASPHALT REPAIRS – refer to 2270/01/13 Remove blistered and patched asphalt roofing over Entrance Area and Guard House, remove blistered asphalt to South side of roof over stairs. Allow for reroofing Entrance Area and Guard House with new asphalt. Cut back asphalt arris along North and South sides and replace with new asphalt, refer to drawing for location.	
3.04	ENTRANCE BUILDING ASPHALT REPAIRS Check and repair asphalt while exposed during excavations. For the purposes of tender allow 4nr 500mm x 500mm patch repairs to each of the East and West walls. Allow to remove and reapply asphalt to the entire blast wall from base of foundations to wall top allow 20m².	
3.05	ENTRANCE STAIR ASPHALT REPAIRS Undertake a deep excavation down to the level of the mid landing to expose the wall exterior where allowing water ingress on the NE side. Allow to undertake patch repairs:	

	2nr, 1m x 1m 1nr, 2m x 2m	
3.06	ENTRANCE STAIR CABLE GASKET Allow to unbolt, clean meeting faces and reseal the lead cable gasket. Descale, galvanize and refix cover plates securing the lead gasket.	
4.00	EXIT STAIR CABLE GASKET Allow to unbolt, cut away lead cable gasket and clean the exposed faces behind. Allow to make new Code 9 lead gasket with sealed cable spigots to match existing. Descale, galvanize, reseal the gasket and refix cover plates securing the perimeter.	
4.01	EXIT STAIR ASPHALT REPAIRS Undertake a deep excavation down to the level of the mid landing to expose the wall exterior where allowing water ingress on the NE side. Allow to undertake patch repairs: 2nr, 1m x 1m 1nr, 2m x 2m	
4.02	EXIT EXCAVATIONS & REPAIRS Excavate/grade down the path level between the boundary gate and existing channel drain. Remove the channel drain. Excavate around the buried sides of the EXIT building and flanking retaining walls to 500mm below the external exit door level. Allow to install 200mm diameter Wavin Twin Wall perforated filter drain bedded in free draining shingle as R12/116. Allow for 15m long trenches on the East and West sides and a 6m long trench above the stairs to discharge to the river bank.	
4.03	ENTRANCE ASPHALT REPAIRS – refer to 2270/01/13 Remove blistered and patched asphalt roofing over Entrance Area and Guard House, remove blistered asphalt to South side of roof over stairs. Allow for reroofing Entrance Area and Guard House with new asphalt. Cut back asphalt arris and along vertical faces on East, South and West sides and replace with new asphalt, refer to drawing for location. For the purposes of tender allow 10nr patch repairs ranging in size as noted below: 2nr x 1000mm x 1000mm 2nr 500mm x 500mm 2nr 500mm x 250mm 2nr x 300mm x 300mm. 2nr 300mm x 200mm	
4.04	EXIT BUILDING ASPHALT REPAIRS: Allow for carrying out local repairs to damaged asphalt over roof to Exit stairs. Check and repair asphalt while exposed.	

	Cut back asphalt arris and along vertical faces on East, North and West sides and replace with new asphalt, refer to drawing for location. For the purposes of tender allow 10nr patch repairs ranging in size as noted below: 2nr x 1000mm x 1000mm 2nr 500mm x 500mm 2nr 500mm x 250mm 2nr x 300mm x 300mm. 2nr 300mm x 200mm	
4.05	EXIT SCREED ALTERATIONS Remove existing concrete screed in area outside the EXIT door. Prepare and lay new screed by raising the surface up 100mm higher than existing against the EXIT door threshold. Raise the Exit threshold by a further 50mm As part of these works PROVISIONALLY ALLOW to: • lift the central access chamber cover. • In the event that the cover is jammed shut, allow to lift the cover and fame complete. • Release the cover and frame and overhaul to good working order. • Replace cover seal. • Investigate the chamber, clear all water and debris inside and thoroughly clean. • Allow to install and new drain in the base of the chamber leading to the river bank. • Reseal around services penetrations • Reinstate cover to to stand up 15mm above the new screed level. • Provisionally allow to install a new sealed cover below the historic cover.	
4.06	EXIT DOOR FRAME -Refer to 2270/01/15 The external steel door consists of a 10mm thick steel plate hung on 3no. steel strap hinges which are welded to a 100 x50mm steel channel frame, this is held against an asphalt coated concrete surround by two steel channel braces fixed at 45degrees to each side of the door and bedded on their own foundations. The door frame has rusted at ground level and stands on two temporary channel sections. • Raise the exit door & frame up 100mm. • Release the door from its frame. • Cut the raking struts flush with the face of the frame. • Extend the frame legs allow 300mm long extension/replacement sections • Reweld the raking struts to the frame in its new position. • Raise magnetic lock keep to ensure effective operation. • Prime all bare metal, followed by 2 coats of oil gloss paint. • Repaint all surfaces on completion. Rub down paintwork and redecorate with 2 coats of oil gloss paint. • Raise and refix the frame. • Reseal frame hood to asphalt.	
5.00	X1, X2 AND Y2 AIR SHAFT REPAIRS Air intake shaft Y1 has been repaired. This entailed:	

	• new temporary access path from the excavation works to the access road on the east side of the site to allow spoil and new materials to be transported across the site. • protect the airshaft shaft as work proceeds. • lift off and set aside the applied roof. • Clean interior of shaft & remove all debris, clean grilles. • Undertake vibration monitoring during works. • Excavate down around the airshaft to the first burster course. • Carefully break/excavate down through the 2nr burster courses, the earth between and below using a Hymac with braker arm (method subject to approval). • retain excavations with sheet piling • scaffold access for hand digging • pumping away percolating water • temporary lighting • CO gas monitoring. • clean off the air shaft and top of the plant room roof • asphalt repair as required. • Strike scaffold • lay 50mm cushioning slabs on 50mm thick Dow Floormate • crane lifting 3000mm diameter concrete rings as a permanent retaining structure FP McCanns manhole chamber rings to BS EN 1017/BS 5911-3, 900mm high by 3000mm diameter, around air shaft up to 200mm below ground level. • backfilling with free draining material • Remove retaining piling. • Back fill excavation around concrete rings with excavated soil. • landscape the ground surface to fall away/eliminate ponding/standing water. • reinstate the applied roof. The same process is now to be undertaken to air intake shaft X1 and air exhaust shafts X2 and Y2. The excavations will create considerable ground disturbance, please endeavour to keep this to a minimum. There are significant historic features in close proximity such as the Pill box, defensive wire entanglements and embanked earth features which must not be damaged. The air shafts are vulnerable structures and great care is required when manoeuvring heavy plant adjacent. Allow to: Carefully cut back the airshaft asphalt coating around the leaking damaged area. Allow for removing the asphalt on each side of the shaft, to a height of 1m. Remove loose concrete in the area of the crack, mechanically clean any rusted reinforcement and treat with a rust inhibiter. And ROCOL triple protection cold galvanizing spray. Repair area of broken concrete as advised by structural engineer. Following drying out period (TBA) apply base coat of hot asphalt to exposed concrete, followed by 2nd coat of asphalt, thickness to match existing.	

	On completion of the back filling, all 4nr air shafts are to receive a perimeter cloak of Cetco Voltex (or similar to approval) to extend 300mm up the sides of the air shafts and to a diameter of 4m to prevent water percolating down into the retaining concrete rings from above. The Cetco Voltex is to be bedded to achieve a slight mound at the base of each shaft and covered with 300mm thick good quality topsoil and densely seeded.	
6.00	GROUND DRAINAGE OVER PLANTROOMS X & Y Install 200mm diameter Wavin Twin Wall perforated filter drain bedded in free draining shingle as R12/116 on the top surface of the upper burster slab. The drain is to be laid in a loop around the airshaft concrete rings and to drain downhill to the North for shafts X1 & X2 and to the South for shafts Y1 & Y2 as shown on the drawings.	
7.00	INTERNAL WORKS The Bunker contains original features, surfaces, and fixtures from its period of construction and subsequent military use. All of these are to be retained.	
8.00	ASBESTOS The presence and location of asbestos containing materials is not known/guaranteed. Previous asbestos surveys have been undertaken and are available for reference. The following may contain asbestos: • Historic fabric wrapped bitumen coated and painted heavy cables. • Historic partition walls to Plantrooms X & Y. • Gaskets to the air handling ducts. • Historic rope seal to gas tight door at top of Entrance stair. • Exit corridor ceiling. • Plotting room wall beneath the gallery • Debris beneath the plotting room floor/gallery • Services penetrations at doorways • High level corridor ceiling void • Painted surfaces • Floor finishes. The contractor is to undertake their own assessment in association with the works and the locations which they expect to disturb.	
9.00	INTERNAL WATER MANAGEMENT	
9.01	AIR SHAFT GUTTERS The existing ductwork is fixed to the ceiling below each airshaft. Water running down the airshafts enters the ductwork and causes decay of the ductwork and air handling equipment from within. A raft of exterior measures are proposed to reduce the risk of this occurring. However, if water does enter the airshafts there needs to be means of collecting it and pumping it back out again. The exiting metal air ducts have a cross section measuring 610mm x 610mm.	

	Check that the airduct gaskets do not contain asbestos. Record and dismantle the sections of ductwork beneath the plantroom ceiling for shafts X1, X2, Y1 and Y2. Adapt/shorten the ductwork by 150mm. Fabricate new stainless steel duct components forming a channel/gutter bolted to the ceiling. The gutter is to be 100mm wide x 150mm deep forming a square on plan to allow air to pass through an aperture measuring 530mm x 530mm. The top outer edge of the gutter is to include a flange to enable it to be bolted to the plantroom ceiling. The existing duct flange is to bolt to the underside of the gutter. The gutter is to have 2nr removable rodding/inspection points on opposing corners and a 65mm min outlet spigot and pipework running down to the sump below. The outlet pipe is to be demountable to enable clearance if it becomes blocked. In the case of X1 and Y1, the pipe will run down and across to the X2 or Y2 sumps following an unobstructed route along the NE wall close to floor level before dropping into the sump. The gutter pipes for shafts X2 and Y2 will drop by a straighter route down to the new X2 and Y2 sumps formed in the floor below. The entrance stair/Transformer pit pump will discharge to sump X2, the ejector room pump will discharge to sump Y2. This also allows any water that does fall onto the plantroom floors to drain or be swept into the sump and pumped away.	
9.02	AIR DUCT REPAIRS The existing ducts and their flanges may need some repair. Allow to may new 1nr section complete with top and bottom flanges. Allow to replace angle section perimeter flange 660mm x 660mm with 50 x 6mm section. Descale and repaint removed sections of airshaft to match existing. Allow for removal/reinstatement of ductwork that may otherwise impede access.	
9.03	X2 & Y2 SUMPS Form new sumps in the floor beneath air shafts X2 and Y2 (exact location to be agreed. Sumps to measure 500mm x 500mm x 200mm deep. Sumps to be rendered with SIKA waterproof render. Allow for removal/reinstatement of ductwork/air handling equipment etc that may otherwise impede access.	
9.04	SUMP PUMPS Existing pumps are located in the following locations: Ejector room Plantroom Y (loose) EXIT stair. Remove the existing pumps. Install new pumps as GRUNDFOS quotation 1005109818 dated 12/3/21 attached at Appendix B, 5nr new pumps in the following locations:	

Pump location	Discharge pipe route	Power supply

	1. New sump formed in floor below airshaft X2. Location and dimension to be agreed with Architect and Conservation Officer	Discharge pipe to rise up airshaft X2 and discharge 400mm above ground surface.	From Plantroom X	
	2. Transformer pit beside plantroom X	Pipe to run at low level to X2 sump	From Plantroom X	
	3. Ejector room	Discharge pipe (copper) to run at high level along South corridors through stud wall into Plantroom Y and down into sump Y2.	From Ejector Room	
	4. Below airshaft Y2. Location and dimension to be agreed with Architect and Conservation Officer	Discharge pipe to rise up airshaft X2 and discharge 400mm above ground surface.	From Plantroom Y	
	5. Exit stairs	Discharge pipe to rise up the stair and discharge outside the Exit door. Channel to be formed in new screed along the South side.	From Plantroom Y	
10.00	ENTRANCE STAIR PARTITION/BALUSTRADE REINSTATEMENT Remove partition between electrical transformer and staircase landing. Reinstate existing balustrade currently located beside the historic electrical intake. The historic balustrade is approximately 910mm high and the transformer pit is approximately 400mm deep. To help guard the level change, allow to install galvanized steel gratings on galvanized steel angle frames with legs approx. 400mm long to bring the top of the grating level with the floor outside plantroom X. The grating and supporting frame can be made up in four sections installed around the transformer: 425mm x 1870mm long 690mm x 1865mm long 720mm x 1865mm long 590mm x 1870mm long Proprietary supplier/manufacturer to Contractor's choice subject to approval.			

	Grating aperture to be laid to consistent North – South orientation.	
10.01	ENTRANCE STAIR DRAINAGE CHANNEL Carefully lift the landing boarding – reinstate on completion. Form discrete 35mm deep x 80mm wide channel in the landing to divert water coming from the entrance staircase above to drain towards the existing transformer sump. Channel to be cut with diamond disc and lined with waterproof screed.	
10.02	ENTRANCE STAIR TRANSFORMER LOCATION The existing enclosure has become mould spotted due to lack of air flow. Upon removal of the partition wall, clean down the painted walls and ceiling with mild detergent and antifungal wash. Provisionally allow to repaint the walls and ceiling.	
11.00	EXIT STAIR BALUSTRADE Provisional allowance – subject to instruction Allow to remove existing non-historic galvanized steel tube balustrade. Make and install/fix new 'L' shaped handrail following the pattern of the Entrance landing handrails complete with profiled timber handrail and fixings. 2.1m long with 0.5m leg. The standards measure 30mm x 30mm standards set in pairs spaced 160mm apart. Rails 50mm x 12mm thick. Timber handrail 58mm wide x 55mm high, with routed channel in underside for concealed fixing rail 30mm wide x 6mm thick.	
11.01	EXIT CORRIDOR CEILING The existing suspended ceiling has been installed below the level of historic services and prevents maintenance access to them. Subject to 3nr trial investigation areas each 1m long x the corridor width, take down the suspended ceiling and cart away materials arising. Clean, prepare and repaint exposed previously painted fixtures and surfaces.	
12.00	CROSS SITE LAND DRAIN The area of grass over the South corner of the Bunker is persistently damp. Allow to excavate down to the surface of the upper burster slab and install new 300mm diameter Wavin Twin Wall perforated filter drain bedded in free draining shingle as R12/116. Allow for 22m long trench running ~South West to discharge to the South boundary.	
13.00	**M&E works**	
13.01	For further information on this section please see Martin Thomas Associates Report.	

14.00	VENTILATION	
14.01	Commission test of existing ventilation system, carry out legionella testing	
14.02	Adapt existing ventilation system to current regulation requirements according to level of occupancy (established by the Employer's Fire Safety Audit) of the museum.	
14.03	Install new WC extract fan, provision of all connecting ductwork, controls	
14.04	Professionally clean all ductwork and provide additional ductwork access doors to permit the cleaning and inspection	
14.05	Identify the cause of the reported failure to VFD 17 and rectify	
14.06	Plant guard specialist to design and fabricate PETG	
14.07	Provide permanent blanking plates upstream and downstream of the gas filters	
15.00	ELECTRICAL SYSTEM	
15.01	Employer to undertake and provide Fire Safety Report recommendations.	
16.00	FIRE STRATEGY AND FIRE ALARM SYSTEM	
16.01	Employer to carry out Fire Risk Assessment and provide recommendations of the new fire strategy.	
16.02	FIRE DOORS The door at the top of the Entrance stair has a chamfered door frame and perimeter seal to act as a gas tight door – this is the only one surviving in the bunker. A number of doors have been replaced that do not follow this pattern and hence detract from the presentation of the bunker. Review fire door locations according to new fire strategy and whether some can be removed if non-historic. Paint analysis of doors and frames to confirm likely installation date. A number of doors, frames and skirtings show evidence of an 'Air Force' blue paint which is thought to be an original or early colour scheme. Subject to paint analysis, allow to repaint 28nr doors, frames, architraves and lower level skirtings as M60/112, colour blue, to be confirmed.	
16.03	FIRE DOOR/LOBBY REMOVALS Subject to the findings of the Fire Safety Audit allow the following works:	

	Allow to remove 2nr modern fire doors, frames and modern plasterboard nib walls and make good where removed. Allow to make good and redecorate walls where 2nr fire doors and frames have been removed.	
16.04	NEW FIRE DOORS Allow to install 7nr new fire doors, frames and architraves in place of existing complete with Yale or Briton door closers to exactly match the design, details and finish of the existing door at the top of the Entrance stair complete with all fittings and Georgian wired glass vision panel.	
16.05	Review location and suitability of existing fire dampers. Allow to replace 10nr.	
16.06	Allow to install new fire alarm system in compliance with BS5839. Cabling and fittings to be concealed as much as possible not to interfere with visitors' experience.	
17.00	SANITARY SYSTEM	
17.01	Review existing toilet installation against current building regulations. Review associated pipework and plumbing system.	
17.02	Undertake Legionella risk assessment.	
17.03	Service the mains cold water stopcock located within the male toilet to ensure ease of operation.	
17.04	Provide a double non-return valve on the female WC hose union bib tap or replace tap with a non-hose union bib tap.	
17.05	Install a time switch to limit the operation of the water heater during normal hours of occupation.	
18.00	**External Refurbishment**	
18.01	PAINT ANALYSIS Undertake paint analysis in the following locations: Entrance building exterior Entrance Handrail Entrance flank walls Airshafts X1, X2, Y1 & Y2 exterior Exit building exterior Pillbox exterior Air Raid Shelter entrance and interior Internal fire doors, frames architraves and skirtings to confirm likely installation date/original colour scheme. For paint analysis, contact Catherine Hassall: cmhassall@btinternet.com 07535626951	

18.02	REPAINTING Subject to paint analysis Reinstate camouflage paint to: Entrance building Entrance Handrail Entrance flank walls Airshafts X1, X2, Y1 & Y2 Exit building. Pillbox Air Raid Shelter entrance. Redecorate interior surfaces where disturbed/made good. Internal fire doors and frames. Prepare and paint as M60/112 Colour TBC subject to paint analysis.	
18.03	ENTRANCE STEP NOSINGS Remove existing extruded aluminium nosings. Prepare and install new AATI cast bronze/gunmetal nosings Reference SN3/HDLT/100 Website: www.aati.co.uk Weblink: www.aati.co.uk/rail/products/sn3-hdlt-100 Available from: AATi Rail Limited, 11 Swinborne Drive, Springwood Industrial Estate, Braintree, Essex, CM7 2YP • 01376 346278 • 01376 346666 • info@aati.co.uk	
18.04	ENTRANCE MASONRY REPAIRS/POINTING Carry out localised repointing and repairs entrance steps and brick walls. Allow 5nr small cement repairs to steps. Allow to replace 1nr concrete step Allow to repoint 4m² in numerous small areas	
18.05	PILLBOX REPAIRS AND REPRESENTATION The Pillbox was originally constructed as a hexagonal brick and concrete structure but was extended in its early history with the addition of brick spurs on each corner to create deep embrasures with in-situ cast concrete lintels supported on the brick spurs. The embrasure spurs and lintels appear hastily constructed, poorly founded, were not well bonded to the main structure and have since moved away from the original structure allowing gaps to be exploited and expanded by roots.	

	Cut back vegetation. Retain the Pillbox roof camouflage soil. Lay temporary separating layer around the Pillbox during works to ensure soft landscape features do not become degraded by the works. The concrete lintels are relatively thin and tilt back towards the Pillbox. Carefully clear debris from within the embrasure openings and lay separating layer. Install temporary props into each embrasure. Carefully bag up the soil on the lintels and roof and place on the ground beside from where it came. Expose the junction between the embrasure extension and the original roof slab. Carefully open up the former entrance door and blocked embrasures. Salvage bricks if possible/clean off hard bedding for reuse. Make good door jambs. Allow access to examine interior. Subject to instruction, clear interior debris and lightly brush the ceiling and walls taking care not to loosen any historic surfaces. Undertake brick repairs to each embrasure spur to match the type, size, colour and texture of the existing, allow 100nr in total. Bricks to approval. Rebed and point with Aalborg Portland sulphate resistant cement 1:3 parts well graded sharp sand colour/character matched to existing. Clean/wash out the embrasure lintel/slab junction/gap. Deep pack and point open gaps and cracks with Aalborg Portland sulphate resistant cement 1:3 parts well graded sharp sand. Rebed, resin pin and point the cracked end of Spur 1 with 3nr x M10 x 500mm long resin pins. Deep pack, point and dog cramp across gaps between lintels with 2nr cramps M12 x 800mm long – allow 12nr. Resin pin each brick spur with 4nr M12 x 800mm long resin fixed ties. Dog cramp each lintel back to the Pillbox with 3nr M12 1000mm long resin anchored cramps. Expose rust jacking reinforcement in lintel soffit. Cut away concrete adjacent, descale and ROCOL spray and mortar repair with Aalborg Portland sulphate resistant cement and aggregates to match colour and texture of the concrete. Allow 10 linear metres Mortar repair concrete face where open/disaggregated, 6nr areas 500mm long x 150mm high. Fill the top surface of the lintels level with free draining material and cover the entire roof with Cetco Voltex. Reinstate roof top camouflage soil over Cetco Voltex as formerly arranged, replicating any undulations or features if present. Apply clear waxoil to exposed steel features in the embrasures. Apply clear waxoil to barbed wire entanglement picket posts – allow 6nr. Install new face fixed galvanised and painted steel door, angle frame, hinges, bolts, lock and hold back following the pattern of the surviving Entrance/Exit doors but clearly identifiable as a modern addition. Remove props, debris arising and clear away temporary separating layers. Allow to repaint the exterior following results of paint analysis.	
18.06	AIR RAID SHELTER REPAIRS AND REPRESENTATION The entrance to the Air Raid Shelter has been blocked by earth. Although not presently certain, the structure is likely to comprise a linear vault with blast wall	

	at the entrance with a roof slab extension, similar in construction to the Pill Box slab extensions and with similar issues. It is believed that the slab extension was not well bonded and may have partially dropped and was backfilled to provide support and to make it safer. The mound covering the shelter has a concrete slab 900 x 900 x 150mm thick at its North end visible in the grass. This may possibly have been an emergency exit. Cut back vegetation around the entrance and exit. Lay temporary separating layer around the entrance and exit locations during works to ensure soft landscape features do not become degraded by the works. Lift the exit slab to gain ladder access to the interior for inspection, initially by camera. If safe to do so, enter the shelter via the exit to determine method for propping and excavation. Install props inside to support the entrance slab extension. Carefully excavate the blocking spoil (allow 8 cubic metres) taking care to ensure that the slab is supported/stable as works proceed and install props as required once excavated. Allow access to examine interior. Subject to instruction, clear interior debris (allow 2 cubic metres) and lightly brush the ceiling and walls taking care not to loosen any historic surfaces. Undertake brick repairs to the entrance walls to match the type, size, colour and texture of the existing. Bricks to approval. Rebed and point with Aalborg Portland sulphate resistant cement, 1:3 parts well graded sharp sand colour/character matched to existing. Excavate the roof top soil to expose the junction with the extension slab. Clean/wash out the roof extension slab junction. Deep pack and point with Aalborg Portland sulphate resistant cement, 1:3 parts well graded sharp sand. Overlay the junction with a strip of Cetco Voltex extending 0.5m either side of the junction. Subject to Structural Engineer's guidance, allow to install 2nr galvanised UC 100 x 150 I beams 1.2m long under the extension slab. Form associated bearing pockets and pads to suit. Remove props, debris arising and clear away temporary separating layers. Reinstate and mortar bed exit slab. Reinstate roof top soil over Cetco Voltex, remove temporary separating layer. Subject to evidence and instruction, allow to Install new galvanised and painted steel door, frame, hinges, bolts, lock and hold back following the pattern of the surviving Entrance/Exit doors but clearly identifiable as a modern addition. Subject to evidence and instruction, allow to install new painted timber door and frame with hinges, lock and door furniture.	
18.07	GRAVEL PATHWAYS Prepare ground and lay compacted gravel/hoggin paths to the Pillbox, the Rear EXIT and Air Raid Shelter 600mm wide by 13m, 25m and 3m long respectively.	
19.00	**Internal Refurbishment**	
19.01	REPAINTING	

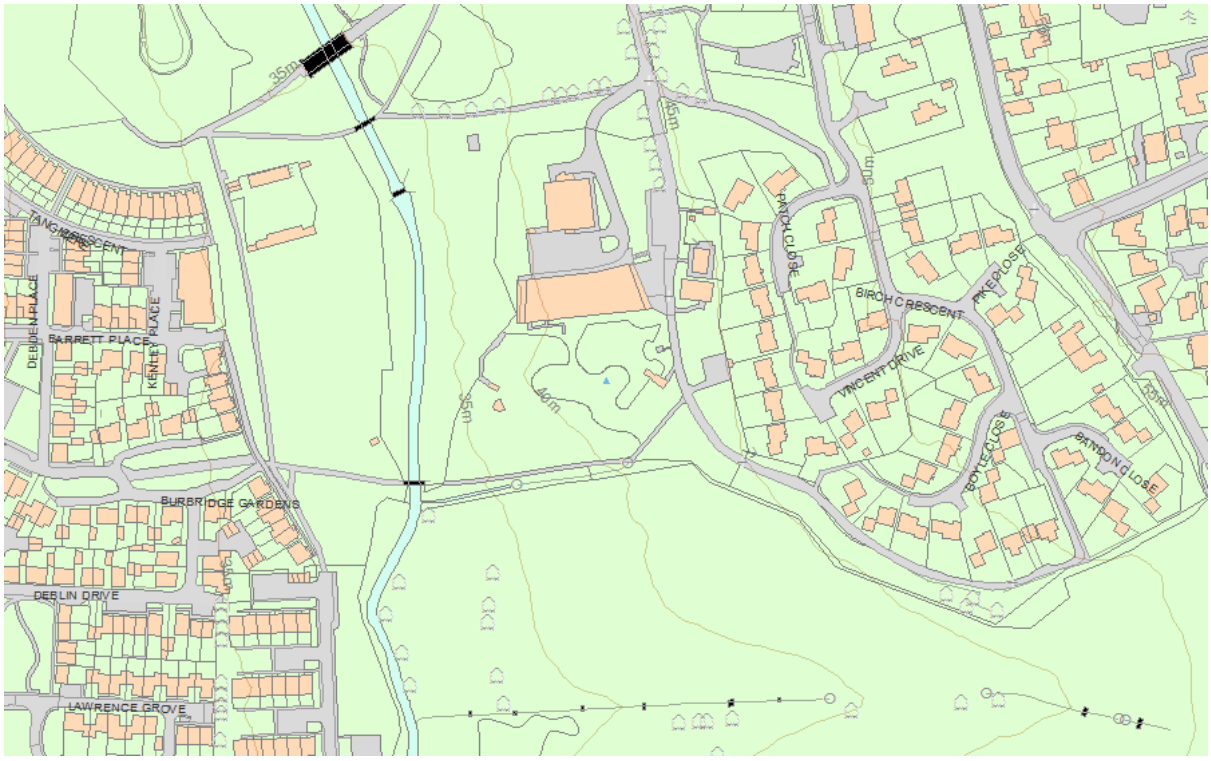
	Redecorate surfaces degraded by water ingress where readily accessible/visible. Allow to descale, clean, prepare, stabilise and repaint 4nr areas 1.5m x 1.5m. (The intention is to undertake the minimum necessary to achieve a presentable standard.)	
19.02	STEELWORK TREATMENT & PAINTING In both plantrooms, fully descale rusted steel duct supports, apply Zinga galvanic paint, prepare and repaint to match existing.	
19.03	FLOOR SURFACES Remnants of early floor coverings survive outside and within the plotting room and trapped beneath the timber framing of the plotting room gallery. These show an 'Air Force' blue colour similar to that observed on some of the joinery. Subject to approved sample and instruction: Allow to prepare, adhere and apply Marmoleum vinyl floor surface to all the lower level corridors around the control rooms and lobbies, Exit corridor and Exit lower landing as marked on the plan. Available from: Forbo Flooring UK Limited High Holborn Road Ripley, Derbyshire England, DE5 3NT Tel:01773 744 121 Email:info.flooring.uk@forbo.com Website: www.forbo-flooring.co.uk Ref: 3711/371135 cloudy sand Thickness: 3.5mm Typical width 1.4m Allow total liner length 125m Allow to remove/adjust/reinstate doors to facilitate.	
19.04	CORRIDOR SUMPS Associated with the flooring works, small depressions have been formed along the corridors to act as local water collection points. These comprise pockets chiselled into the reinforced concrete approx. 300mm x 300mm x 300mm deep (The reinforcement has not been cut through). Subject to instruction, allow to fill the pockets with waterproof concrete (SIKA) trowelled flush with the floor surface. Allow to fill 5nr pockets.	
19.05	COMPLETION. SITE TIDYING AND INSPECTION. Clean down all areas affected by the works/used for access to the works internally and externally and leaving clean and tidy on completion. Remove temporary roadways/separating layers and leave seeded lawn areas in condition suitable for lawn moving. The contractor is to offer the works as complete for inspection. Notify the Architect when complete and ready for final inspection.	

20.00	AS BUILT DRAWINGS MAA will provide a set of drawings for the Contractor to mark up. Provide marked up set of drawings with notes for MAA to produce set of As built drawings.	
20.01	O&M FILE Provide O&M File at completion, this will be a requirement of certification of Practical Completion.	

APPENDIX A

Historic England List Description Extract

GROUP OPERATIONS ROOM
Overview
Heritage Category: Listed Building
Grade: I
List Entry Number: 1392556
County: Greater London Authority
District: Hillingdon (London Borough)
National Grid Reference: TQ 06548 83514



DETAILS

804/0/10078 RAF UXBRIDGE 01-DEC-05 Group Operations Room

GV I 11 Group operations block. Commenced late 1938, completed August 1939, built to designs of Bob Creer of Air Ministry's Directorate of Works and Buildings. Reinforced concrete with internal structure of rolled steel joists. The bunker is entered via steps set in an angled passage with shuttered concrete lining.

INTERIOR: is remarkably intact. Steel door to lobby, a wire-mesh grille into which another door is set providing an additional method of screening visitors to the building. A line of steep steps, flanked on both walls by fixed power cabling, descends to the bunker; these and other steps in the bunker are flanked where necessary by iron railings, cast to Art Deco-inspired patterns. Timber doors, brass switch plates and wall-mounted electrical trunking throughout. The functioning of the bunker depended on

supply of electrical power, telecommunications equipment and a secure ventilation system. Plant Rooms X and Y retain original electrical generating and air filtration plant, that in Room Y having a filtration unit manufactured by Porton Down Experimental Station with casing by Portsmouth Dockyard, this being an indication of the pioneering nature of this bunker. Air compression system for ejecting sewage. Fuse Room with complete set of fuse boxes, for ventilation, lighting, teleprinters, GPO power and small power. GPO Room with original boxing and telecommunications plant. Message centre with original fittings including Lampson voice tubes.

Operations and plotting room has along one side a raised dais with panelled front for controllers, affording a clear view of the map table (with original map refixed to it) and the Slat Board that recorded the state of readiness etc of fighter squadrons within the Group: this board is a reconstruction (c1968) of a type of board system introduced in October 1940, some of the marked blackboarding of the earlier Tote Board system surviving to its rear. Information was cross-referred to a colour-coded clock, which remains wall-mounted in its original position to the left of the board. Above and flanking the dais are the rooms occupied by senior RAF and Army personnel, with original glass-fronted screens projecting into the room.

HISTORICAL NOTE: This underground operations room, built in 1938, played a role of fundamental importance in the economic marshalling of air defence which sustained victory in the Battle of Britain and in other key actions of the Second World War. By September 1940 Britain had become the first nation in history to retain its freedom and independence through air power. The RAF thus ended the aura of Nazi invincibility that had characterised its Blitzkrieg tactics elsewhere in Europe, providing a glimmer of hope to resistance movements in occupied countries, which in turn - via the voice of the media - encouraged the pro-British interventionist lobby within the United States and laid the groundwork for Anglo-American co-operation and the American rearmament that preceded the Japanese attack on Pearl Harbour. Finally, the denial of Britain to the Luftwaffe ensured its retention for continued resistance to the Axis powers, the invasion of northern Europe in 1944 and, more controversially, the bomber offensive against targets in Germany: it has also been argued that without victory in the Battle of Britain the Soviet army would not have stopped at the Elbe in 1945, with obvious and very different consequences for the political geography of Europe in the second half of the twentieth century. The airfields associated with the Battle of Britain of 1940 relate to historic sites and fabric stretching from those used by the RAF to those used by or built especially for the Luftwaffe, including the now-protected sites at Paris Le Bourget and Deelen in the Netherlands. Of all the sites which became involved in The Battle of Britain, none have greater resonance in the popular imagination than those of the sector airfields within these Groups which bore the brunt of the Luftwaffe onslaught and, in Churchill's words, 'on whose organisation and combination the whole fighting power of our Air Force at this moment depended' (Churchill, 292). It was 11 Group, commanded by Air Vice Marshall Keith Park from his underground headquarters at RAF Uxbridge, which occupied the front line in this battle, with its 'nerve centre' sector stations at Northolt, North Weald, Biggin Hill, Tangmere, Debden and Hornchurch taking some of the most sustained attacks of the battle, especially between 24 August and 6 September when these airfields and later aircraft factories became the Luftwaffe's prime targets.

This structure bears a very direct relationship in terms of its internal plan, detailing, fixtures and form to its intended function. This includes a pioneering system of air filtration, internal communications systems and telecommunications equipment all designed to ensure the continuation of operations in a hostile environment, one that anticipates the design of military and civil defence headquarters in the Cold War period. The plotting room, surrounded by operations and control cabins, comprises the strategic heart of this building. The original map has been refixed to the plotting table, and the Tote Board which recorded the state of readiness of fighter squadrons has survived in part behind a late 1960s reconstruction of the Slat Board system introduced in October 1940. It has otherwise survived in a remarkably complete state of preservation, very much as described by Churchill on his visit on 15 September 1940, with a raised dais for controllers and glass-fronted boxes for senior commanders protruding above the plotting table. From this room, during the Battle of Britain, Air Vice Marshall

Keith Park commanded the deployment of squadrons within 11 Group's sector stations. Filtered information was sent from Royal Observor Corps' posts and radar stations to Fighter Command's HQ at Bentley Priory, Stanmore, and simultaneously to the Group operations rooms, whose commanders took the critical decisions concerning both the deployment of anti-aircraft gunfire and fighter sectors under their command. 11 Group's strategic importance also ensured that - in addition to co-ordinating regular fighter sweeps over the Channel and occupied Europe - this building played a key role in the deployment of fighter squadrons for the evacuation from Dunkirk in May 1940, the ill-fated Dieppe raid of 1942, the invasion of NW Europe in 1944 and subsequent operations, and the defence of London and the south east against the V1 rocket menace. It continued to serve as an operations room in the early phase of the Cold War, closing in 1958.

The operational infrastructure which was being put in place by Sir Hugh Dowding - in command of Fighter Command during the Battle of Britain - from March 1936, which had its origins in his earlier position on the Air Council as Member for Research and Development. Although historians have drawn attention to the production of obsolete aircraft (notoriously exemplified by the Fairey Battle) in order to achieve crude parity with Luftwaffe figures, the early development and sophistication of German radar technology and the speed and manoevrability of the new generation of monoplane fighters designed by Camm, Mitchell and Messerschmitt, there is a broad consensus of opinion that it was the infrastructure put in place by Dowding that provided the key to the incisive and economic marshalling of fighter squadrons which guaranteed Fighter Command's survival in the Battle of Britain of 1940. The essence of this relationship of technology to command and control has become familiar to students of the Battle. It saw the system of Chain Home radar stations (the first five of which became operational in 1938, further to development work at Bawdsey) and Observor Corps posts linked by telephone and teleprinter to the Filter Room at Fighter Command Headquarters (Bentley Priory), where the plots were checked with those of adjacent stations before decisions concerning deployment and attack could be made. In his detailed description of the 11 Group operations bunker at Uxbridge, Churchill (1949: 293-7) wrote: 'All the ascendancy of the Hurricanes and Spitfires would have been fruitless but for this system of underground control centres and telegraph cables, which had been devised and built before the war under Dowding's advice and impulse'. It could be said, indeed, that 'Dowding controlled the battle from day to day, Park controlled it from hour to hour, and the 11 Group sector controllers from minute to minute (Wood and Dempster, 1969: 84-90).

So successful was this defence system that the Luftwaffe's own defences were realigned on the British model: one of the critical links in the latter's chain is the operations block at Deelen, now protected by the Dutch government. As a consequence of their historical importance, surviving examples of sector operations rooms within 11 Group (at Debden and Northolt) have been recommended for statutory protection, and two sector operations blocks on key stations in 12 and 13 Group to the north (Catterick and Duxford). This is the most important of all the fighter operations blocks to have survived, being in a much better state of preservation than the other Group operations headquarters at Watnall (Nottinghamshire: 12 Group), Newcastle (13 Group) and Box (Wiltshire: 10 Group). The operations and filter rooms at Bentley Priory (II*) have been removed and its underground operations block, built during the Second World War, substantially remodelled in the 1980s.

RAF Uxbridge's principal function in the inter-war period was the training of recruits, for whom barracks built around an extensive parade ground had been erected in 1928. Close to the operations block is one surviving wing of Building 79 (Sergeant's Mess), which served as an operations room before the completion of the bunker, and Building 79 (The Stand-by Set House) which retains original generating plant by Bellis and Morcombe.

David Reynolds, '1940: Fulcrum of the Twentieth Century?', International Affairs, 66 (1990), pp.325-50; Bruce Barrymore Halpenny, Action Stations 8: Military Airfields of Greater London (Cambridge, 1984), pp.235-43; Operations Record Books, PRO AIR 28/ 872, 1144, 1281, 1286, 1431 and 1655-6; W.G. Ramsey (ed), The Battle of Britain Then and Now, (5th edition, London, 1989), 14-28; Churchill,

W. The Second World War. Volume II: Their Finest Hour (London, 1949); Lake, J. and Schofield, J., 'Conservation and the Battle of Britain'. In The Burning Blue. A New History of the Battle of Britain, Addison, P. and Crang, J. (eds), 229-242 (London, 2000); Wood, D. and Dempster, D. The Narrow Margin (London, 1969).

APPENDIX B

GRUNDFOS QUOTATION 1005109818 - dated 12/3/21.

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

Ms. Marta Santacroce
MARTIN ASHLEY ARCHITECTS
46-48 LONDON ROAD
LONDON
LONDON
TW1 3RJ

Grundfos Pumps Ltd
Grovebury Road
Leighton Buzzard
LU7 4TL
Tel: 01525 850000
Email: grundfos-uk@sales.grundfos.com
www.grundfos.co.uk

Date: 12/03/21

Battle of Britain Bunker

Dear Ms. Marta Santacroce,

Thank you for your valued enquiry, please find enclosed our quotation. Prices quoted are subject to VAT at the appropriate rate at the time of invoicing.

Deliveries are carriage paid to UK Mainland and Northern Ireland addresses, during standard weekday working hours, unless otherwise stated. We would like to draw your attention to the fact that delays may occur due to the current Brexit situation. For that reason, our quoted delivery times may be affected during the transition period. Carriage does not include any offloading costs. Express and specific delivery services are available, plus additional handling charges may apply for spares orders. Please contact our Customer Sales Centre on 01525 850000 - Option 1 or grundfos-uk@sales.grundfos.com for more information.

Our quotation is valid for 30 days from today's date, after which time we reserve the right to modify the terms offered. This offer is based on Grundfos Pumps Ltd standard conditions of sale which are enclosed. We also reserve the right to apply any customs tariffs at the applicable rates if these become a mandatory requirement when the UK leaves the EU.

Products in this quotation shown as an "optional and/or alternative item" are not included in the total price.
Please note that certain products may require commissioning, details are available from Grundfos Service on 01525 850000 - Option 2, or service-uk@sales.grundfos.com. Service Contracts are also available upon request.

A new 5 year guarantee - Grundfos Go Guarantee - is now available on selected e-products from our commercial and industrial product ranges. Please find full details at www.grundfos.co.uk/ggg.

We trust that our quotation meets your requirements, please do not hesitate to contact us if we can be of further assistance.

Yours sincerely,

Neil Wilson

IMPORTANT
Please refer quotation number **1005109818** when placing order via Extranet, EDI , email.

The person responsible for your account is:

Account Responsible: Alex Phelps
Email: aphelps@grundfos.com
Mobile:

Website: www.grundfos.co.uk
Product Information: Grundfos Product Center

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

LATEST NEWS

MY GRUNDFOS

Log-on now. For quick and easy access to product availability, list price, order status, spare part kits and replacement pumps.

Go to MyGrundfos

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

NOTE: Click the product code (article in blue) for more information in the Grundfos Product Center.

Pos	Product		Qty	Unit Net Price	Total Net Price
10	**Various Pumps - Supply & Installation**	Scope of work; Supply and installation of various pumps to remove surface water run-off from within bunker including all electrical reconnections and renewal of existing pipework in 1.25" ABS pipe. Including; 3 x Unilift KP 350 AV 1 Pumps 1 x Twin Pump 1.5kw MD Multilift Packaged Pump Station All mechanical and elctrical consumable parts required All labour to complete installation Site supervision Project delivery Exclusions; Grundfos have not included for any civil works and have assumed this will be acrried out by others, as required. Grundfos could provide a quotation for any civils works identified but would need to conduct a full site survey to be able to submit an offer.	1	30,316.00	30,316.00
				Total Net (GBP) without options and alternatives:	**30,316.00**

Validity of the quotation: 10/04/21

The production and delivery of the offered/ordered products may be affected by the measures taken in various countries due to the COVID-19. Therefore, any statement of delivery time can be taken only as an indication based on the current information, and Grundfos reserves the right to postpone any indicated delivery time without prior notice.

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

CONDITIONS OF SALE AND SERVICE
The Customer's attention is particularly drawn to the provisions of condition 13 (Warranty and Limitation of Liability)
1. INTERPRETATION
1.1 The definitions and rules of interpretation in this condition apply in these Conditions.
Agreement: the contract between Grundfos and the Customer for the supply of Equipment and/or Services in accordance with the Order and these Conditions
Business Day: a day other than a Saturday, Sunday or bank or public holiday in England when banks in London are open for non-automated business.
CDM Regulations: the Construction (Design and Management) Regulations 2015
Conditions: these terms and conditions as amended from time to time in accordance with condition 19.
Customer: the person, firm or company who purchases Equipment and/or Services from Grundfos.
Data Protection Legislation: all legislation and regulatory requirements in force from time to time relating to the use of personal data and the privacy of electronic communications, including, without limitation (i) any data protection legislation from time to time in force in the UK including the Data Protection Act 2018 or any successor legislation, as well as (ii) the General Data Protection Regulation ((EU) 2016/679) and any other directly applicable European Union regulation relating to data protection and privacy (for so long as and to the extent that the law of the European Union has legal effect in the UK).
Delivery Location: the location set out in the Order for delivery of the Equipment and/or Services or such other location as the parties may agree.
Equipment: all equipment, materials, goods and/or products, or any part or parts thereof, supplied by Grundfos to the Customer under this Agreement or used by Grundfos or its subcontractors in the supply of the Services.
Equipment Specification: any specification for the Equipment, including any relevant plans or drawings, that is agreed in writing by the Customer and Grundfos.
Event of Default: any occurrence of the events set out in condition 17.1 or 17.2.
Force Majeure Event: acts, events, omissions or accidents beyond its reasonable control, including (without limitation) strikes, lock-outs or other industrial disputes (whether involving any supplier, contractor or agent of Grundfos or any other party beyond its reasonable control), failure of a utility service or transport network, act of God, war or threat of war, sabotage, riot, civil commotion, malicious damage, compliance with any law or governmental order, rule, regulation or direction, import or export embargoes, accident, breakdown of plant or machinery, fire, flood, storm or default of suppliers or subcontractors, difficulties in obtaining raw materials, labour, fuel, parts or machinery.
Grundfos: Grundfos Pumps Limited (Company No: 00805960) whose registered office is at Grovebury Road, Leighton Buzzard, Bedfordshire LU7 4TL.
Health and Safety File: the health and safety file required by the CDM Regulations.
In-put Material: all documents, information, tools and materials of the Customer required by Grundfos for the proper provision of the Services.
Intellectual Property Rights: patents, rights to inventions, copyright and related rights, trade marks, business names and domain names, rights in get-up, goodwill and the right to sue for passing off, rights in designs, database rights, rights to use, and protect the confidentiality of, confidential information (including know-how), and all other intellectual property rights, in each case whether registered or unregistered and including all applications and rights to apply for and be granted, renewals or extensions of, and rights to claim priority from, such rights and all similar or equivalent rights or forms of protection which subsist or will subsist now or in the future in any part of the world.
Maintenance Schedule: the maintenance schedule attached to the Order setting out the Services to be supplied by Grundfos to the Customer.
Order: the service support agreement or site visit request form in each case on Grundfos' standard terms (whichever is applicable) including any schedules attached to the service support agreement or site visit request form.
Payment Schedule: the payment schedule attached to the Order setting out the charges applicable for the provision of the Services by Grundfos to the Customer.
Premium Service: the service package in accordance with Grundfos' terms as set out in the Agreement.
Quotation: a written quotation issued by Grundfos.
Services: the services to be provided by Grundfos under this Agreement as set out in the Order or site visit request form together with any other services which Grundfos provides, or agrees to provide, to the Customer.
Site visit request form: Grundfos' Site Visit and Commissioning Request Form, or the equivalent internet log, which the Customer completes.
Time and Materials Rate: the rates set out in the Order.
Warranty: (Subject to condition 5.5) the warranty provided by Grundfos in respect of the Services as set out in condition 8.4 and Equipment as set out in condition 5.1 of these Conditions (as applicable).
Warranty Period: for product codes UPS2, UPS3, ALPHA1, ALPHA2, ALPHA3 and SCALA2 the warranty period shall be 5 years from the date of the manufacture and in all other cases the warranty period shall be 24 months from installation or 30 months from the date of manufacture (whichever expires soonest).
1.2 Headings in these conditions shall not affect their interpretation.
1.3 A person includes a natural person, corporate or unincorporated body (whether or not having separate legal personality).
1.4 The schedules and annexes form part of this Agreement.
1.5 A reference to writing or written includes fax and email and electronic chat messages.
1.6 Any obligation in this Agreement on a person not to do something includes, without limitation, an obligation not to agree, allow, permit or acquiesce in that thing being done.
1.7 References to schedules and annexes are to the schedules and annexes of the Order.
1.8 A reference to a statute or statutory provision is a reference to it as amended or re-enacted. A reference to a statutory provision includes all subordinate legislation make under that stature or statutory provision.
2. Basis of Agreement
2.1 The Order constitutes an offer by the Customer to purchase Equipment and/or Services in accordance with these Conditions.
2.2 The Order shall only be deemed to be accepted on the earlier of:
(a) an authorised representative of Grundfos issues written acceptance of the Order; or
(b) Grundfos delivers the Equipment and/or commences providing Services to the Customer in line with the Order, at which point and on which the date this Agreement shall come into existence.
2.3 Any samples, drawings, descriptive matter or advertising issued by Grundfos and any descriptions of the Equipment or illustrations or descriptions of the Services contained in Grundfos' catalogues or brochures are issued or published for the sole purpose of giving an approximate idea of the Services and/or Equipment described in them.
No warranty or guarantee is given for their accuracy and they shall not form part of this Agreement or have any contractual force.
2.4 These Conditions shall:
(a) apply to and be incorporated into this Agreement;
(b) prevail over any other terms that the Customer seeks to impose or incorporate; and
(c) prevail over any terms or conditions implied by law, trade custom, practice or course of dealing between Grundfos, the Customer or otherwise.
2.5 These Conditions are subject to any terms, conditions and/or provisions set out in the Order. In the event of any conflict between the terms of these Conditions and the terms of the Order, the provisions of the Order shall prevail, but any special terms granted in respect of any one Order are not applicable to any subsequent Order without the express consent in writing by Grundfos.
2.6 Quotations shall only be valid if issued in writing.
2.7 Any Quotations are given on the basis that no Agreement shall come into existence except in accordance with condition 2.2. Any Quotation is valid for a period of 30 days from its date (unless otherwise agreed by Grundfos), provided that Grundfos has not previously withdrawn it.
2.8 All of these Conditions shall apply to the supply of both Equipment and Services except where application to one or the other is specified.
2.9 Any special terms agreed to by Grundfos for any Order shall not apply to any subsequent Order without the express agreement of an authorised representative of Grundfos.
2.10 The Customer is responsible for ensuring the accuracy of the terms of the Order and for providing to Grundfos in good time any necessary information required by Grundfos to enable Grundfos to perform its obligations under the Agreement.
2.11 Grundfos' minimum order value is £55.00. Orders between £55.00 and £335 for pumps or £130 for Category 4 items will be subject to a £37 handling fee.
3. Equipment
3.1 The Equipment is described in Grundfos' catalogues as modified in any Equipment Specification.
3.2 Unless confirmed in writing by Grundfos, Grundfos makes no representation as to the suitability of the Equipment for the Customer's particular purpose. The Customer will be responsible for ensuring that the Equipment is suitable for its particular purpose and Grundfos shall have no liability to the Customer if the Equipment is not suitable for the Customer's particular purpose (so far as legally possible).
3.3 Grundfos (and/or its subcontractors, suppliers or agents) reserves the right to:
(a) change the design, construction or composition of the Equipment or the materials or equipment used in the Equipment as it shall think fit; and
(b) amend the Equipment Specification of the Equipment if required by any applicable statutory requirements, and shall, in any case, notify the Customer of any such changes (if such changes are effected after this Agreement has come into existence but before the Equipment and/or Services have been fully performed).
3.4 Samples of Equipment are available for inspection at Grundfos' offices. The samples are ex – stock at the time of viewing and are without guarantee as to colour or dimensions at the time of delivery. The viewing of a sample does not create a sale by sample.
4. Delivery of Equipment

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

4.1 Grundfos shall deliver the Equipment to the Delivery Location.
4.2 Delivery of the Equipment shall be completed on:
(a) the completion of unloading of the Equipment at the Delivery Location or (in the absence of any specified Delivery Location by the Customer) upon Grundfos informing the Customer that the Equipment is ready; or
(b) (if the Customer or its agents and/or representatives elect to unload the Equipment themselves) upon Grundfos placing the Equipment at the disposal of the Customer, its agents or representatives at the agreed point.
4.3 Grundfos' obligation under condition 4.1 is limited to delivering the Equipment only as near to the Delivery Location as a safe hard road permits. The Customer is to provide to Grundfos, free of charge, reasonable assistance with unloading (unless the Customer elects to unload the Equipment itself).
4.4 Any dates quoted for delivery of the Equipment are approximate only, and the time of delivery is not of the essence. Grundfos shall not be liable for any delay (or any additional costs arising out of the delay) in delivery of the Equipment that is caused by a Force Majeure Event or the Customer's failure to provide Grundfos with adequate delivery instructions or any other instructions that are relevant to the supply of the Equipment.
4.5 The Equipment may be delivered in advance of the quoted delivery date upon giving reasonable notice to the Customer.
4.6 If the Customer fails to take delivery of the Equipment or fails to give Grundfos adequate delivery instructions at the time stated for delivery (otherwise than by reason of Grundfos' sole fault) then, without prejudice to any other right or remedy available to Grundfos:
(a) delivery of the Equipment shall be deemed to have been completed at 9.00am on the next Business Day following the day on which Grundfos notified the Customer that the Equipment was ready; and
(b) Grundfos may:
(i) Charge a re-delivery fee if delivery is rearranged by Grundfos and the Customer;
(ii) store the Equipment until actual delivery takes place, and charge the Customer for all related costs and expenses (including insurance) of such storage;
(iii) apply Grundfos' returns policy as set out in condition 6; or
(iv) sell the Equipment at the best price readily obtainable and (after deducting all reasonable storage and selling expenses) charge the Customer for any shortfall below the price payable by the Customer for the Equipment and Services (as applicable) under this Agreement.
4.7 If the parties have agreed on express delivery, the dates quoted for such delivery and agreed delivery dates are approximate only as delivery may vary due to factors not within Grundfos' reasonable control, e.g. leisurely or delayed customs clearance or other import or export obstacles. The parties agree that time of delivery is not of the essence and that Grundfos shall not be liable for any delay (or any additional costs arising out of the delay) in delivery caused by such events.
4.8 Grundfos may deliver the Equipment by instalments.
4.9 If Equipment is not received by the customer within 7 days of notification of dispatch by Grundfos or if it is received in a damaged condition or the quantity received differs from the quantity advised by Grundfos the Customer shall notify Grundfos in writing. If such written notice is not received by Grundfos within 10 days of the date of Grundfos' dispatch notification, Grundfos will not be liable in respect of any loss or damaged suffered.
4.10 If a proof of delivery is required a £10 handling fee will apply.
4.11 Proof of delivery shall only be retained by Grundfos for 3 months following delivery. After 3 months it shall be assumed by both parties that delivery successfully took place unless there is evidence to the contrary.
4.12 A £20 handling fee will apply per order to all orders for spares, pump components, spares kits and ancillary items such as flanges, unions etc.
5. Quality of Equipment
5.1 For the duration of the Warranty Period, Grundfos warrants that the Equipment shall:
(a) (subject to conditions 5.3 and 5.4) conform in all material respects with the Equipment Specification; and
(b) be free from defects in design, material and workmanship.
5.2 Subject to condition 5.3, if:
(a) the Customer gives notice in writing during the Warranty Period within 14 days of discovery that some or all of the Equipment does not comply with the Warranty set out in condition 5.1;
(b) Grundfos is given a reasonable opportunity to examine such Equipment; and
(c) the Customer (if reasonably asked to do so by Grundfos) returns such Equipment to Grundfos (at Grundfos' cost), then Grundfos shall, at its option, repair or replace the defective Equipment, or refund the price of the defective Equipment in full. Repairs shall only be carried out between 8am and 5pm on Business Days agreed between Grundfos and Customer.
5.3 Grundfos shall not be liable for the Equipment's failure to comply with the Warranty if:
(a) the Customer makes any further use of such Equipment after giving a notice in accordance with condition 5.2 unless otherwise approved by Grundfos (such approval not to be withheld unreasonably);
(b) the defect arises because the Customer failed to follow Grundfos' or manufacturer's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Equipment or (if there are none) good trade practice;
(c) the defect arises as a result of Grundfos following any drawing, design supplied by the Customer or the Equipment Specification;
(d) the Customer alters, dismantles or repairs such Equipment without the written consent of Grundfos;
(e) the defect arises as a result of fair wear and tear, wilful damage, negligence, or abnormal working conditions; or
(f) the Equipment differs from its description as a result of changes made to ensure they comply with applicable statutory or regulatory standards.
5.4 Except as provided in this condition 5, Grundfos shall have no liability to the Customer in respect of the Equipment's failure to comply with the Warranty.
5.5 The terms of these Conditions shall apply to any repaired or replacement Equipment supplied by Grundfos under condition 5.2 but for the avoidance of doubt, the Warranty Period for any repaired or replaced Equipment shall be 12 months from the date of the repair.
6. Return of Equipment
6.1 Equipment may not be returned to Grundfos except by the prior written permission of an authorised representative of Grundfos. Contact grundfos-uk@sales.grundfos.com with the original purchase order number to arrange a return. Any such return shall be liable for any handling and restocking fees charged by Grundfos.
6.2 All Equipment requested to be returned to Grundfos will be subject to a minimum 35% restocking fee (subject to inspection). Equipment must be returned in its original packaging.
6.3 Equipment can only be returned within 6 months of the date of dispatch by Grundfos. All returns will be subject to inspection to ascertain age, condition and type.
6.4 Equipment returned without prior authorisation will be refused delivery by Grundfos.
6.5 The following Equipment cannot be returned for credit in any circumstance:
(a) items with a net value of less than £125 (per item):
(b) repair kits, power cable, engineered to order, third party sourced and obsolete items.
6.6 Any Equipment that has been in contact with hazardous liquids must be cleaned, sealed in appropriate packaging, clearly labelled and accompanied by a COSHH certification by the Customer. Any carrier used must be licensed to carry to transport the relevant hazardous liquids.
7. Title and Risk
7.1 The risk in the Equipment shall pass to the Customer on completion of delivery in accordance with condition 4.
7.2 Title to the Equipment shall not pass to the Customer until Grundfos receives payment in full (in cash or cleared funds) for the Equipment and any other equipment or goods that Grundfos has supplied to the Customer in respect of which payment has become due in which case title to the Equipment shall pass at the time of payment of all such sums.
7.3 Until title to the Equipment has passed to the Customer, the Customer shall:
(a) hold the Equipment (or any receipts received from the Customer where the Customer has sold the Equipment) on a fiduciary basis as Grundfos' bailee;
(b) store the Equipment separately from all other goods held by the Customer (where possible) so that they remain readily identifiable as Grundfos' property;
(c) not remove, deface or obscure any identifying mark or packaging on or relating to the Equipment (unless reasonably required for the functioning use of the Equipment by the Customer);
(d) maintain the Equipment in satisfactory condition and keep it insured against all risks for their full price on Grundfos' behalf from the date of delivery;
(e) notify Grundfos immediately if the Customer becomes subject to any Event of Default;
(f) give Grundfos such reasonable information relating to the Equipment as Grundfos may require from time to time;
(g) give Grundfos at least 30 days' notice of its intention to move or relocate the Equipment to a new location. Grundfos may (at Grundfos' sole discretion) supervise the dismantling and removal of the Equipment, and inspect and reinstall the Equipment at the new location. Any supervision and work undertaken in respect of the relocation shall be charged at the prevailing Time and Material Rates and is payable by the Customer in accordance with condition 11; and
(h) give Grundfos at least 14 days' notice of its intention to take any steps to appoint an administrator.
7.4 The Customer may incorporate the Equipment into or with any other goods provided that any new goods incorporating the Equipment shall become the sole and exclusive property of Grundfos and shall be separately stored and marked so as to be identifiable as being manufactured by or containing Equipment belonging to Grundfos.
7.5 Subject to condition 7.7, the Customer may resell the Equipment in the ordinary course of its business (but not otherwise) before Grundfos receives payment for the Equipment. However, if the Customer resells the Equipment before that time:
(a) It does so as principal and not as Grundfos' agent;
(b) Title to the Equipment shall pass from Grundfos to the Customer immediately before the time at which resale by the Customer occurs.

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

7.6 If before title to the Equipment passes to the Customer the Customer becomes subject to an Event of Default, then, without limiting any other right or remedy Grundfos may have, Grundfos may at any time:
(a) the Customer's right to resell the Equipment or use it in the ordinary course of its business ceases immediately;
(b) reasonably require the Customer to deliver up all Equipment in its possession; and
(c) if the Customer fails to do so promptly, enter any premises of the Customer where the Equipment is stored in order to recover them; and
(d) the Customer shall pay Grundfos' reasonable costs (including legal costs) for any recovery of the Equipment pursuant to condition 7.7(c).
8. Supply of Services
8.1 Grundfos shall provide the Services to the Customer in accordance with the Maintenance Schedule in all material respects and in accordance with the duration and timescales specified in the Order.
8.2 Grundfos shall use all reasonable endeavours to meet any performance dates for the Services specified in this Agreement, but any such dates shall be estimates only and time shall not be of the essence for the performance of the Services.
8.3 Grundfos shall have the right to make any changes to the Services which are necessary to comply with any applicable law or safety requirement, or which do not materially affect the nature or quality of the Services, and Grundfos shall notify the Customer in any such event. If Grundfos requests a change for any other reason, the Customer shall not unreasonably withhold or delay consent to it.
8.4 Grundfos warrants to the Customer that the Services will be provided using reasonable care and skill.
8.5 Grundfos shall use reasonable endeavours to observe all health and safety rules and regulations, and any other reasonable security requirements that apply at the Customer's premises and that have been communicated to it provided that it shall not be liable under this Agreement if, as a result of such observation, it is in breach of any of its obligations under this Agreement.
9. Maintenance Service Times
9.1 Services will be carried out during the working times as specified in the Maintenance Schedule.
9.2 Grundfos' standard daily fee rates for each individual person are calculated on the basis of an eight-hour day between 8.00am and 5.00pm on Business Days. Grundfos shall be entitled to charge for any Services undertaken outside of these hours at the Time and Materials Rate in effect at the relevant time
9.3 Grundfos shall use reasonable endeavours to attend the Delivery Location, but if Grundfos is prevented by any reason outside his control or under the control of the Customer, from installing the Equipment or carrying out the Services at the time of the visit, it shall not constitute a material breach of this Agreement. If additional visits are required to the Delivery Location which are not accounted for in the Maintenance Schedule, Grundfos reserves the right to charge the Customer at the Time and Materials Rate for all additional time incurred.
10. Customer's obligations
10.1 The Customer shall:
(a) ensure that the terms of the Order and the Equipment Specification are complete and accurate;
(b) co-operate with Grundfos in all matters relating to this Agreement;
(c) provide Grundfos, its employees, agents, consultants and subcontractors, with access to the Customer's premises, office accommodation and other facilities as reasonably required by Grundfos to provide the Services and/or deliver the Equipment;
(d) prepare the Customer's premises (or the location where the Services are to be performed) for the supply of the Services and/or the Equipment;
(e) provide adequate lighting, heating, power and ventilation as per Grundfos' reasonable requirements;
(f) inform Grundfos' engineer or representative on each visit about any unsatisfactory running or irregular performance of the Equipment or equipment in respect of which the Services are undertaken.
(g) ensure the Equipment is installed and kept in suitable premises and under suitable conditions, permit only trained and competent personnel to use it and follow any operating instructions as Grundfos may give from time to time;
(h) provide a site visit request form to Grundfos in respect of any Services to be carried out by Grundfos, its agents, subcontractors, consultants or employees (as the case may be);
(i) provide to Grundfos, in a timely manner, such In-put Material and other information as Grundfos may require and ensure that it is accurate in all material respects;
(j) be responsible (at its own cost) for preparing and maintaining the relevant premises for the supply of the Services and/or Equipment, including identifying, monitoring, removing and disposing of any hazardous materials from its premises in accordance with all applicable laws, before and during the supply of the Services and/or Equipment at those premises;
(k) inform Grundfos of all health and safety rules and regulations and any other reasonable security requirements that apply at the Customer's premises;
(l) ensure that all In-Put Materials are in good working order and suitable for the purposes for which it is used in relation to the Services;
(m) keep all Grundfos' materials, equipment, documents and other property (Grundfos Property) at the Customer's premises in safe custody at its own risk, keep all Grundfos Property in good condition until returned to Grundfos and not dispose of or use the Grundfos Property other than in accordance with Grundfos' written instructions and authorisations; and
(n) obtain and maintain all necessary licences and consents and comply with all relevant legislation in relation to the Services, the installation of the Equipment and the use of In-put Material in all cases before the date on which the Services are to start.
10.2 If Grundfos' performance of any of its obligations in respect of the Services is prevented or delayed by any act or omission by the Customer (including its agents, subcontractors, consultants or employees) or failure by the Customer to perform any relevant obligation (Customer Default):
(a) Grundfos shall without limiting its other rights or remedies have the right to suspend performance of the Services until the Customer remedies the Customer Default, and to rely on the Customer Default to relieve it from the performance of any of its obligations under this Agreement to the extent the Customer Default prevents or delays Grundfos' performance of any of its obligations;
(b) Grundfos shall not be liable for any costs or losses sustained or incurred by the Customer arising directly or indirectly from Grundfos' failure or delay to perform any of its obligations as set out in this condition 10.2; and
(c) the Customer shall reimburse Grundfos on written demand for any costs or losses sustained or incurred by Grundfos arising directly or indirectly from the Customer Default.
10.3 The Customer shall be liable to pay to Grundfos, on demand, all reasonable costs, charges or losses sustained or incurred by Grundfos (including, without limitation, any direct, indirect or consequential losses, loss of profit and loss of reputation, loss or damage to property and those arising from injury to or death of any person and loss of opportunity to deploy resources elsewhere) arising directly or indirectly from the Customer's fraud,
negligence, failure to perform or delay in the performance of any of its obligations under this Agreement, subject to Grundfos confirming such costs, charges and losses to the Customer in writing.
10.4 The Customer shall not, without the prior written consent of Grundfos, at any time from the date of this Agreement to the expiry of 12 months after the last date of supply of the Services, solicit or entice away from Grundfos or employ (or attempt to employ) any person who is, or has been, engaged as an employee of Grundfos in the provision of the Services.
11. The CDM Regulations
11.1 The Customer and Grundfos agree that the Customer is to be treated for the purposes of the CDM Regulations as the Client for the purposes of the CDM Regulations.
11.2 The Customer agrees to ensure that the Works are carried out in accordance with the CDM Regulations.
11.3 The Customer shall ensure that the Health and Safety File is maintained correctly and is available for inspection in accordance with the CDM Regulations.
11.4 The Customer shall indemnify and keep the Owner indemnified against liability for any breach of the Customer's obligations under or in connection with this condition 11.
12. Charges and Payment
12.1 The price for the Equipment shall be the price set out in the Order or, if no price is quoted, the price set out in the published price list of Grundfos (or Grundfos as the case may be) as at the date of delivery. Unless otherwise stated in the Order, the price of the Equipment is exclusive of all costs and charges of packaging, insurance, transport of the Equipment, which shall be paid by the Customer when it pays for the Equipment.
12.2 In the case of Product Services Service contracts, Installation Works and Engineered to Order products Grundfos reserves the right to request a deposit payment and/or payment milestones. The amount or means of calculating such payment shall be set out in the Quotation.
12.3 Grundfos reserves the right to require (at its option) a parent company guarantee or a personal guarantee from the directors of the Customer at any time in relation to all outstanding amounts due to Grundfos from the Customer from time to time.
12.4 The charges for Services shall be set out in the Payment Schedule.
12.5 Unless stated otherwise all prices are given on a DAP (delivered at place) basis.
12.6 Grundfos reserves the right to:
(a) increase its standard daily fee rates for the Services. Grundfos will give the Customer reasonable notice in writing of any such increase before the proposed date of the increase. If such increase is not acceptable to the Customer, it shall notify Grundfos in writing within 14 days of the date of Grundfos' notice and either of Grundfos or the Customer shall have the right, without limiting its other rights or remedies, to terminate
this Agreement by giving 14 days' written notice (or any other reasonable notice period if performance of the Order is due to commence within 14 days) to Grundfos or Customer (as applicable); and
(b) increase the price of the Equipment, by giving notice to the Customer at any time before delivery, to reflect any increase in the cost of the Equipment to Grundfos that is due to:

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

(i) any factor beyond the control of Grundfos (including foreign exchange fluctuations, increases in taxes and customs' charges and duties, and increases in labour, materials, fuel and other manufacturing costs);
(ii) any request by the Customer to change the delivery date(s), quantities or types of Equipment ordered, or the Equipment specification; or
(iii) any delay caused by any instructions of the Customer in respect of the Equipment or failure of the Customer to give Grundfos adequate or accurate information or instructions in respect of the Equipment.
12.7 In respect of Equipment, Grundfos shall invoice the Customer on or at any time after completion of delivery. If delivery of the Equipment is made in instalments, Grundfos may invoice the Customer in instalments. In respect of Services, Grundfos shall invoice the Customer in accordance with the Payment Schedule.
12.8 The Customer shall pay each invoice submitted by Grundfos:
(a) within 30 days of the date of the invoice or in accordance with any other payment terms agreed by Grundfos in writing; and
(b) in full and in cleared funds to a bank account nominated in writing by Grundfos, and
time for payment shall be of the essence of this Agreement.
12.9 All amounts payable by the Customer under this Agreement are exclusive of amounts in respect of value added tax chargeable from time to time (VAT). The Customer shall pay any VAT which is chargeable on the supply of the Services and/or Equipment at the same time as payment is due for the supply of the Services and/or Equipment.
12.10 Grundfos may in its sole discretion elect to provide a credit facility to the Customer but is not obliged to do so. Any credit facility offered will be on written terms agreed by Grundfos and the Customer.
12.11 Without prejudice to any other right or remedy that it may have, if the Customer fails to pay Grundfos on the due date, Grundfos may:
(a) charge interest on such sum from the due date for payment at an annual rate equal to the set rate of interest provided under the Late Payment of Commercial Debt (Interest) Act 1998 as varied from time to time accruing on a daily basis and being compounded quarterly until payment is made, whether before or after any judgment and the Customer shall pay the interest immediately on demand;
(b) charge compensation for late payment at a set rate depending on the size of the debt in accordance with the Late Payment of Commercial Debt Regulations 2002 (SI 2002 No 1674). The minimum charge applicable is £40.00, the maximum applicable is £100.00;
(c) appropriate any payment by the Customer to any outstanding invoice as Grundfos may think fit not withstanding any purported appropriation by the Customer; and
(d) suspend the provision of further Services until payment has been made in full.
12.12 The Customer shall pay all amounts due under this Agreement in full without any set-off, counterclaim, deduction or withholding except as required by law. Grundfos may, without limiting its other rights or remedies, set off any amount owing to it by the Customer against any amount payable by Grundfos to the Customer.
12.13 All sums payable to Grundfos under this Agreement shall become due immediately on its termination, despite any other provision. This condition 12.10 is without prejudice to any right to claim for interest under the law, or any such right under this Agreement.
12.14 Grundfos shall have a lien on all of the Customer's property in Grundfos' possession for all sums due at any time by the Customer to Grundfos subject to Grundfos giving not less than one month's written notice to the Customer. Grundfos shall be entitled to use, sell and dispose of any such property as agent for the Customer at the Customer's expense. The proceeds of such sale shall be applied towards the payment of monies due to Grundfos and Grundfos shall be discharged of any liability in relation to such property as a result of any sale.
13. Warranty and Limitation of Liability
THE CUSTOMER'S ATTENTION IS SPECIFICALLY DRAWN TO THIS CONDITION
13.1 Nothing in these Conditions shall limit or exclude Grundfos' liability for:
(a) death or personal injury caused by its negligence, or the negligence of its employees, agents or subcontractors;
(b) fraud or fraudulent misrepresentation;
(c) breach of the terms implied by section 2 of the Supply of Goods and Services Act 1982 (title and quiet possession);
(d) breach of the terms implied by section 12 of the Sale of Goods Act 1979 (title and quiet possession); or
(e) defective products under the Consumer Protection Act 1987.
13.2 Subject to condition 13.1:
(a) Grundfos shall under no circumstances whatsoever be liable to the Customer, whether in contract, tort (including negligence), breach of statutory duty, or otherwise, for any loss of profit, turnover, data, business opportunity, anticipated savings, any indirect or consequential loss or any damage to goodwill arising under or in connection with this Agreement;
(b) Grundfos' total liability to the Customer where the Customer has provided Grundfos with incorrect weights, dimensions, capacity performance or other information shall in no circumstances exceed the price of the Equipment supplied in accordance with such incorrect information; and
(c) Grundfos' total liability to the Customer in respect of all other losses arising under or in connection with this Agreement, whether in contract, tort (including negligence), breach of statutory duty, or otherwise, shall in no circumstances exceed £1million.
13.3 The terms implied by sections 13 to 15 of the Sale of Goods Act 1979 and the terms implied by sections 3 to 5 of the Supply of Goods and Services Act 1982 are, to the fullest extent permitted by law, excluded from this Agreement.
13.4 This condition 13 shall survive termination of this Agreement.
13.5 The Customer shall indemnify Grundfos for any costs suffered by Grundfos for claims from any third party which arise by virtue of the Customer having resold the Equipment (unless such claim arises solely from Grundfos' negligence).
14. Confidentiality and Grundfos' property
14.1 Each party (receiving party) shall keep in strict confidence all technical or commercial know-how, specifications, inventions, processes or initiatives which are of a confidential nature and have been disclosed to the receiving party by the other party (disclosing party), its employees, agents or subcontractors, and any other confidential information concerning the disclosing party's business, its products and services which the receiving party may obtain. The receiving party shall only disclose such confidential information to those of its employees, agents and subcontractors who need to know it for the purpose of discharging the receiving party's obligations under this Agreement, and shall ensure that such employees, agents and subcontractors comply with the obligations set out in this condition as though they were a party to this Agreement. The receiving party may also disclose such of the disclosing party's confidential information as is required to be disclosed by law, any governmental or regulatory authority or by a court of competent jurisdiction.
14.2 Neither party shall use the other's confidential information for any purpose other than to perform its obligations under this Agreement.
15. Intellectual Property Rights
15.1 (Subject to condition 15.2) all Intellectual Property Rights in or arising out of or in connection with:
(a) the Equipment;
(b) the Services; or
(c) any manuals or documentation given by Grundfos to the Customer,
shall be owned by Grundfos and nothing in this agreement shall transfer or assign any such Intellectual Property Rights to the Customer.
15.2 The Customer acknowledges that, in respect of any third party Intellectual Property Rights, the Customer's use of any such Intellectual Property Rights is conditional on Grundfos first obtaining a written licence from the relevant licensor on such terms as will entitle Grundfos to license such rights to the Customer.
15.3 The Customer grants to Grundfos a fully paid up, non-exclusive, royalty free, non-transferable licence to copy and modify any In-put Material for the purpose of providing the Services to the Customer.
15.4 The Customer shall indemnify Grundfos against all liabilities, costs, expenses, damages and losses (including any direct, indirect or consequential losses, loss of profit, loss of reputation and all interest, penalties and legal costs (on a full indemnity basis) and all other reasonable professional costs and expenses) suffered or incurred by Grundfos for actual or alleged infringement of a third party's Intellectual Property Rights arising out of or in connection with Grundfos' use of the Equipment Specification.
16. Data protection
16.1 Both parties will comply with all applicable requirements of the Data Protection Legislation. This condition 16 is in addition to, and does not relieve, remove or replace, a party's obligations under the Data Protection Legislation. In this condition 16 Applicable Laws means (for so long as and
to the extent that they apply to the Supplier) the law of the European Union, the law of any member state of the European Union and/or Domestic UK Law; and Domestic UK Law means any Data Protection Legislation from time to time in force in the UK including the Data Protection Act 2018 or any successor legislation.
16.2 Without prejudice to the generality of condition 16.1 each party shall, in relation to any Personal Data processed in connection with the performance by that party of its obligations under the Agreement:
(a) ensure that it has in place appropriate technical and organisational measures to protect against unauthorised or unlawful processing of Personal Data and against accidental loss or destruction of, or damage to, Personal Data, appropriate to the harm that might result from the unauthorised or unlawful processing or accidental loss, destruction or damage and the nature of the data to be protected, having regard to the state of technological development and the cost of implementing any measures (those measures may include, where appropriate, pseudonymising and encrypting Personal Data, ensuring confidentiality, integrity, availability and resilience of its systems and services, ensuring that availability of and access to Personal Data can be restored in a timely
manner after an incident, and regularly assessing and evaluating the effectiveness of the technical and organisational measures adopted by it);
(b) assist the other party, at the other party's cost, in responding to any request from a Data Subject and in ensuring compliance with its obligations under the Data Protection Legislation with respect to security, breach notifications, impact assessments and consultations with supervisory authorities or regulators;

Quotation 1005109818

Account/customer number: 9022035371
External reference: Battle of Britain Bunker

(c) notify the Customer without undue delay on becoming aware of a Personal Data breach;
(d) at the written direction of the other party, delete or return Personal Data and copies thereof to the other party on termination of the agreement unless required by Applicable Law to store the Personal Data; and
(e) maintain complete and accurate records and information to demonstrate its compliance with this condition 16.
16.3 Neither party consents to the other appointing any third-party processor of Personal Data under the Contract.
17. Termination
17.1 Without limiting its other rights or remedies, Grundfos or Customer may terminate this Agreement with immediate effect by giving written notice to the other party if:
(a) the other party commits a material breach of its obligations under this Agreement and (if such breach is remediable) fails to remedy that breach within 7 days after receipt of written notice to do so;
(b) the other party takes any step or action in connection with its entering administration, provisional liquidation or any composition or arrangement with its creditors (other than in relation to a solvent restructuring), being wound up (whether voluntarily or by order of the court, unless for the purpose of a solvent restructuring), having a receiver appointed to any of its assets or ceasing to carry on business [or, if the step or action is taken in another jurisdiction, in connection with any analogous procedure in the relevant jurisdiction;
(c) the other party suspends, or threatens to suspend, or ceases or threatens to cease to carry on all or a substantial part of its business; or
(d) the other party's financial position deteriorates to such an extent that in the terminating party's opinion the other party's capability to adequately fulfil its obligations under the Contract has been placed in jeopardy.
17.2 Without limiting its other rights or remedies, Grundfos may terminate this Agreement with immediate effect by giving written notice to the Customer if:
(a) there is a change of control of the Customer (as defined in section 574 of the Capital Allowances Act 2001);
(b) the Customer is unable or unwilling to procure any guarantee required by Grundfos in accordance with condition 12.3; or
(c) the Customer's financial position deteriorates to such an extent that in Grundfos' opinion the Customer's capability to adequately fulfil its obligations under the Contract has been placed in jeopardy or Customer fails to pay any amount due under this Agreement on the due date for payment.
17.3 Without limiting its other rights or remedies, Grundfos may suspend the supply of Services or all further deliveries of Equipment under this Agreement or any other agreement between the Customer and Grundfos if the Customer becomes subject to an Event of Default, or Grundfos reasonably believes that the Customer is about to become subject to any of them.
17.4 On termination of this Agreement for any reason:
(a) the Customer shall immediately pay to Grundfos all of Grundfos' outstanding unpaid invoices and interest and, in respect of Services supplied but for which no invoice has yet been submitted, Grundfos shall submit an invoice, which shall be payable by the Customer immediately on receipt;
(b) the Customer shall return all of Grundfos' materials and any deliverables which have not been fully paid for and which have not been installed as part of a bigger system. If the Customer fails to do so, then Grundfos may enter the Customer's premises and take possession of them. Until they have been returned, the Customer shall be solely responsible for their safe keeping and will not use them for any purpose not connected with this Agreement;
(c) the accrued rights and remedies of the parties as at termination shall not be affected, including the right to claim damages in respect of any breach of this Agreement which existed at or before the date of termination or expiry;
(d) conditions which expressly or by implication have effect after termination shall continue in full force and effect; and
(e) Grundfos shall have a lien over all of the Customer's property in Grundfos' possession in respect of all sums due at any time from the Customer to Grundfos. Provided that Grundfos gives at least 14 days' prior written notice, Grundfos shall be entitled to use, sell and dispose of such property as agent for and at the expense of the Customer and apply the proceeds towards the payment of monies due and outstanding from the Customer to Grundfos. Thereafter, Grundfos shall be discharged of any liability in respect of the Customer's property.
17.5 On termination of this Agreement (however arising), any of these Conditions that expressly or by implication is intended to have effect after termination (or expiry) shall survive and continue in full force and effect.
18. Force majeure
Grundfos shall have no liability to the Customer under this Agreement if it is prevented from, or delayed in performing, its obligations under this Agreement or from carrying on its business by any Force Majeure Event.
19. Variation
Except as provided in these Conditions, no variation of this Agreement or these Conditions or of any of the documents referred to in them shall be valid unless it is in writing and signed by or on behalf of each of the authorised representatives of the parties.
20. Waiver
20.1 A waiver of any right under this Agreement is only effective if it is in writing and it applies only to the circumstances for which it is given. No failure or delay by a party in exercising any right or remedy under this Agreement or by law shall constitute a waiver of that (or any other) right or remedy, nor preclude or restrict its further exercise. No single or partial exercise of such right or remedy shall preclude or restrict the further exercise of that (or any other) right or remedy.
20.2 Unless specifically provided otherwise, rights arising under this Agreement are cumulative and do not exclude rights provided by law.
21. Severance
21.1 If any provision of this Agreement (or part of any provision) is found by any court or other authority of competent jurisdiction to be invalid, illegal or unenforceable, that provision or part-provision shall, to the extent
required, be deemed not to form part of this Agreement, and the validity and enforceability of the other provisions of this Agreement shall not be affected.
21.2 If a provision of this Agreement (or part of any provision) is found illegal, invalid or unenforceable, the provision shall apply with the minimum modification necessary to make it legal, valid and enforceable.
22. Entire agreement
22.1 This Agreement constitutes the whole agreement between the parties and supersedes all previous agreements between the parties relating to its subject matter.
22.2 Each party acknowledges that, in entering into this Agreement, it has not relied on, and shall have no right or remedy in respect of, any statement, representation, assurance or warranty (whether made negligently or innocently) (other than for breach of contract), as expressly provided in this Agreement.
22.3 Nothing in this condition shall limit or exclude any liability for fraud.
23. Assignment
23.1 The Customer shall not, without the prior written consent of Grundfos, assign, transfer, charge, mortgage, subcontract or deal in any other manner with all or any of its rights or obligations under this Agreement.
23.2 Grundfos may at any time assign, transfer, charge, mortgage, subcontract or deal in any other manner with all or any of its rights under this Agreement and may subcontract or delegate in any manner any or all of its obligations under this Agreement to any third party or agent.
23.3 Each party that has rights under this Agreement is acting on its own behalf and not for the benefit of another person.
24. No partnership or agency
Nothing in this Agreement is intended to, or shall be deemed to, constitute a partnership or joint venture of any kind between any of the parties, nor constitute any party the agent of another party for any purpose. No party shall have authority to act as agent for, or to bind, the other party in any way.
25. Rights of third parties
A person who is not a party to this Agreement shall not have any rights under or in connection with it.
26. Notices
26.1 Any notice required to be given under this Agreement shall be in writing and shall be delivered personally, or sent by pre-paid first-class post, recorded delivery or by commercial courier to the registered office or the address stated in the Order (or as otherwise notified to the other party in writing).
26.2 Any notice shall be deemed to have been duly received if delivered personally, when left at the correct address or, if sent by pre-paid first-class post or recorded delivery, at 9.00am on the second Business Day after posting, or if delivered by commercial courier, on the date and at the time that the courier's delivery receipt is signed.
26.3 This condition 26 shall not apply to the service of any proceedings or other documents in any legal action.
26.4 A notice required to be given under this Agreement shall also be validly served if sent by e-mail.
27. Governing law and jurisdiction
27.1 This Agreement, and any dispute or claim arising out of or in connection with it or its subject matter or formation (including non-contractual disputes or claims), shall be governed by, and construed in accordance with, the law of England and Wales.
27.2 The parties irrevocably agree that the courts of England and Wales shall have exclusive jurisdiction to settle any dispute or claim that arises out of, or in connection with, this Agreement or its subject matter or formation (including non-contractual disputes or claims).