BASE STANDARDS

October 2022

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INTRODUCTION

This document describes what the Standards are and what they do, how and where they will be used, how they will be made available and revision procedures.

DEFINITION

Base Standards establish technical performance, design and aesthetic standards for the built fabric and technical installations to most facilities located at RAF Lakenheath and RAF Feltwell.

The Base Standards provide a design base for those parties within the management structure and design process including external consultants and contractors.

Specifications ensure sufficiently robust fittings, visual continuity and ease of maintenance, plus adequate services engineering and fire protection and security. Control over materials and design is also exercised by US Forces Regulations such as ETL's, and the UK Building Regulations. Some Regulations and other sources of information are provided with Appendices C and D but is not exhaustive.

This Base Standard is supplemented by separate specialist standards and should be read in conjunction with such as and when appropriate – refer to "Supplementary Resources & Specialist Standards".

The Base Standards 'Section 4 – Design' has been set out to mirror 'Uniformat II - Elemental Classification for Building Specifications' (NIST U.S. Department of Commerce). This being the USVF recognised method of cataloging and identification of materials and building systems on both sites.

'Architectural' items describe internal and external materials and Colours including bollards, carpet laying, doors, fences, kitchen units, locks and ironmongery, paving, roads and parking, sanitary ware, signage, windows, blinds, planters, lamp post protectors, post and chains, benches, cycle shelters gazebos and waste bins to ensure external visual continuity. 'Landscaping' provides specific requirements on ground reinstatement and a plant list that should survive on the sandy soils. The 'Civil/Structural' section includes foul and surface water drainage and hazardous waste to protect our environment. 'Pavements' provide a visual link between spaces and enhance the visual character of the Base. 'Environmental' describes surface water disposal that complies with the Environmental Agency and 'Fire Protection' specifies extinguishers, and hydrants that contribute to Fire Safety. 'Engineering' includes Building Management Systems, Fire Alarms and Electrical and Mechanical Installations to ensure a properly designed installation meets requirements and is compatible with existing installations. 'Communications' includes AFRTS and Premise Wire Architecture, describing specific requirements for these installations. AT/FP provides measures to minimise the threat and effects of terrorism.

GOAL

The use of Base Standards by users, design teams, and contractors will ensure a consistency and continuity in the design and construction of facility interiors, exteriors and technical installations that contribute to 'Installation Excellence'. This will be achieved by increasing reference to the Standards at project briefing, design and construction stages. Facility managers will consult it when assembling a NexGen Service Request.

During the preparation of the Design Instruction, 48 CES will research and contribute to a list of UK and US Regulations, then agreed by the project team, to be taken into consideration in a design proposal. Design Instructions will include the statement: 'Designs must comply with the following documents' which will include the current issue of Base Standards and the agreed list of Regulations. 48 CES Programmers will list all References, Regulations, and the current issue of the Base Standards referred to in their Design Submittals. The Base Standards will be issued by USF or DIO as a Contract Document for design teams and contractors to use during the design and construction process.

AUTHORITY

Responsibility for Base Standards is delegated by the Wing Commander to the BCE as of 08 March 2022.

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Date: 2023.02.20 12:24:48 Z

EDMUND T. SPIVAK, Lt Col, USAF
Commander, 48th Civil Engineer Squadron

BASE STANDARD UPDATE & DEROGATION

The base date for issue of these Base Standards is October 2022.

Revised Base Standards will be issued on an annual basis at the end of the fiscal year with emergency updates added, when needed, as addendums.

Appendix B contains a form to be submitted to update, amend, or include a model, item, or procedure into the next Base Standards. The form is also used to request derogations (waivers) to the current Base Standards.

This form is to be submitted with all relevant information to 48 CES Installation and Facility Standard Working Group for review and comment. Using this form will be the only way a new model/ part or item will be included into the current Base Standard document.

It is the responsibility of the submitter to provide a submission, which is concise and erudite with a full justification and supporting evidence.

SUPPLEMENTARY RESOURCES & SPECIALIST STANDARDS

These Base Standards are supported by supplementary information resources and technical standards applicable to specialisms. As such, the base standards should be read in conjunction with the following supplementary standards as may be applicable:

Supplementary Standards:

- Medical Facilities – Use UK Health Technical Memorandum*

Specialist Technical Standards:

- Medical Facilities – Use UK Health Technical Memorandum*
- Fire Alarm Systems - Guide.
- Above Ground Storage Tanks (AST's) – Diesel Fuel for Heating & Generators - Guide.

Supplementary Resources:

- Tech-012 Project Handover Procedure (Appropriate to Project Manager's & Contractors).
- Engineering Technical Letters (ETL).
- Construction Technical Letters (CTL).

Supplementary Guides:

- Performance Specification Guide – Auto-Start Diesel Generator Sets.
- Building Management Systems (BMS) Graphics Brief

*For any works related to medical facilities or buildings with medical functions, contact 48th Medical Group Medical AP, RAF Lakenheath, Bldg 916 Telephone: (01638) 52-8421 or DSN – 226-8421

DESIGN: GENERAL

The following Base Standards follow Uniformat II structure. For quick reference, refer to index at the back of these Standards.

MANDATORY or ADVISORY as noted.

(ADVISORY)

Details of acceptable materials. Materials from other manufacturers that meet these requirements can be submitted with evidence of comparability for review and approval.

(MANDATORY)

Items selected are robust, likely to be readily available in future and simplifies storage of spares.

Asbestos

The contractor is responsible for conducting any necessary hazardous material surveys for all demolition and renovation projects with the potential to disturb hazardous materials (i.e. asbestos-containing material (ACM)), regardless of build date, prior to construction start date. The survey will be conducted by an appropriate HSE- licensed contractor.

Contact 48 CES/CEIE Environmental Office (DSN 226-3990, Comm: 01638-523990) to determine the availability of any historical documentation to aide in project planning. The contractor shall not rely solely on existing historical documentation and is responsible for determining if work has potential to disturb ACM and requires survey.

The contractor shall ensure compliance with the following procedures:

1. *At least 5 working days prior to surveying, the contractor shall provide 48 CES/CEIE with the following documentation for review:

    - Method Statements/Risk Assessments (RAMS).
    - Procedures for survey.
    - Fit Test Paperwork and equipment inspection/certification (inclusive of Decontamination Units, Hepa vacuums, masks and other related equipment).
    - Competency and certificated training paperwork.
    - Copies of medical clearance (HSE paperwork).
    - Copies of notification paperwork as per ALG Memo 06/12 if applicable.
    - HSE license to work, if applicable under licensed works.

2. 48 CES/CEIE will issue a permit to work for the survey work.

3. The contractor shall ensure all survey reports are provided to 48 CES/CEIE.

4. If any abatement is required, *at least 5 working days prior to work, the contractor shall provide 48 CES/CEIE with the following documentation for review:

    - Method Statements/ Risk Assessments (RAMS).
    - Procedures for removal and demolition.
    - Fit Test Paperwork and equipment inspection/certification (inclusive of Decontamination Units, Hepa. vacuums, masks and other related equipment).
    - Competency and certificated training paperwork.
    - Copies of medical clearance (HSE paperwork).
    - Copies of notification paperwork as per ALG Memo 06/12 if applicable.
    - HSE license to work, if applicable under licensed works.

5. 48 CES/CEIE will issue a permit to work for the abatement work.

6. The contractor shall ensure the following documentation is provided to 48 CES/CEIE following any abatement work:

    - Summary report.
    - Copies of daily site/ works diaries.
    - Copies of transfer notes and any other paperwork required to HSE Standards.

*Please note: In most cases 48 CES/CEIE require a 5 working day turn around for issuing permits unless emergency works are required.

CAD & GIS Data Standards

1. Immediately at final handover the base requires checked, approved, & labelled digital copie(s) on Jewel cased DVD-R's, an electronic copy of the As-Built drawings, and survey data on all newly installed works.

2. All As-Built drawings will be drafted in accordance with AEC CAD Standards current release as well as AEC CAD Graphics Standards current release and Whole Building Design Guide (WBDG). Contractor shall provide As-Built drawings for all phases of works as indicated in the design instruction in addition to red line drawings for any modifications. The electronic As- Built drawing files will be provided for AutoCAD 2020 DWG formats or earlier along with a PDF copy of each drawing file, the files will also be named in accordance with the current release of AEC CAD Standards.

3. All survey data (such as building layout, infrastructure, underground utilities, roads and pavements), mapping, GPS, and Geospatial data will be provided as part of a file geodatabase compatible with ESRI ArcGIS 10.6.1 and attributed in accordance with SDSFIE 4.0.3.1 standards for the attribution tables and metadata.

4. All survey data will be georeferenced in the UTM 31 North coordinate system projection with the WGS-84 datum.

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A – Sub-Structure

A10 Foundations

A1010 Standard Foundations

A1011 Wall Foundations
No site specific content.

A1012 Column Foundation & Pile Caps
No site specific content.

A1013 Perimeter Drainage & Insulation
Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

A1020 Special Foundations

A1021 Pile Foundations
No site specific content.

A1022 Grade Beams
No site specific content.

A1023 Caissons
No site specific content.

A1024 Underpinning
No site specific content.

A1025 Dewatering
No site specific content.

A1026 Raft Foundations
No site specific content.

A1027 Pressure Injected Grouting
No site specific content.

A1029 Other Special Conditions
No site specific content.

A1030 Slab On Grade

A1031 Standard Slab on Grade
No site specific content.

A1032 Structural Slab on Grade
No site specific content.

A1033 Inclined Slab on Grade
No site specific content.

A1034 Trenches, Pits & Bases

No site specific content.

A1035 Under-Slab Drainage & Insulation

Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

A20 Basement Construction

A2010 Basement Excavation

A2011 Excavation for Basements
No site specific content.

A2012 Structure Back Fill & Compaction
No site specific content.

A2013 Shoring
No site specific content.

A2020 Basement Walls

A2021 Basement Wall Construction
No site specific content.

A2022 Moisture Protection
No site specific content.

A2023 Basement Wall Insulation
No site specific content.

A2024 Interior Skin
No site specific content.

B – Shell

B10 Superstructure

B1010 Floor Construction

B1011 Suspended Basement Floors Construction
No site specific content.

B1012 Upper Floors Construction
No site specific content.

B1013 Balcony Floors Construction
No site specific content.

B1014 Ramps
No site specific content.

Shall meet minimum requirements of Accessibility & ADA, whichever is most onerous.

B1015 Exterior Stairs and Fire Escapes
No site specific content.

B1016 Floor Raceway Systems
No site specific content.

B1019 Other Floor Construction
No site specific content.

B1020 Roof Construction

B1021 Flat Roof Construction
No site specific content.

B1022 Flat Roof Construction
No site specific content.

Note: Flat roof construction shall be avoided where practicable. In circumstances where flat roof construction is unavoidable the performance shall be a minimum 20 years design life.

B1023 Canopies
No site specific content.

B1029 Other Roof Systems
No site specific content.

B20 Enclosure

B2010 Exterior Walls

B2011 Exterior Wall Construction

Materials:

B2011.1

Application:	Exterior skin of cavity/ brick walling – RAF Lakenheath only.
Manufacturer:	Wienerberger
Product ref.:	Bourneville Buff Blend
Tested to:	BSEN 771, BSEN 772.
Colour:	
Material:	Natural clay.
Notes:	Mortar, natural bond, stretcher pointing, struck, weathered.

B2011.2

Application:	Exterior skin of cavity/brick walling - Special brick used at RAF Feltwell.
Manufacturer:	Hanson UK
Product ref.:	Butterley range of Kempston bricks
Tested to:	BSEN 771, BSEN 772, BSEN 773.
Colour:	Multi rustic Burghley Red
Material:	Natural Clay
Notes:	Durability - frost resistant strength – 25n/mm^2. Mortar – natural. Bond – stretcher. Pointing - struck, weathered

B2011.3

Application: Walls
Manufacturer: Kingspan Ltd.
Product Ref.: KS1000RW Metal sheet profile.
Tested to:
Colour: BS 08B17, Cream (Vellum).
Material: Foam fillers used in panel joints.
Notes: N/A.

B2011.4

Application: External wall rendering; Exposed steel columns; metal balustrades.
Manufacturer: ICI Dulux Akzo Nobel; Crown Berger
Product Ref: Weathershield
Tested to: BS 4800
Colour: BS 08B29 (Van Dyke Brown)
Material: "Smooth masonry" – water based acrylic resin paint. "All seasons" – solvent based paint
Notes: Prevents rain penetration; Life Span - 15 years without UV light degradation.

B2011.5

Application: Walls [See also ceiling soffits].
Manufacturer: Etex UK (Formally Marley Eternit Ltd)
Product Ref: Equitone
Tested to: N/A.
Colour: White.
Material: Fully compressed light weight, mineral fibre cement
Notes: Size - Sub-frame bolted to structure. Concealed fixings to hangars;
Etex UK Cedral is a cheaper, semi- compressed fibre with painted finish. Rainscreen option available; Use - Suitable for external surfaces. Minimum order quantities of 200-300m² for bespoke colours.

B2012 Parapets

No site specific content.

B2013 Exterior Louvres, Screens & Fencing

B2013.1

Application: Air handling - ventilate roof spaces.
Manufacturer: Not indicated.
Product Ref: Not indicated.
Tested to: Powder coated to BSEN 13438:2005
Colour: BS 08B29 Dark brown matt Van Dyke Brown.
Material: Extruded aluminium frame & fins.
Notes: See fire model; smoke ventilation during a fire and natural ventilation.

B2014 Exterior Sun Control Devices

No site specific content.

B2015 Balcony Walls and Handrails

No site specific content.

B2016 Exterior Soffits Materials

B2016.1

Application:	Soffits [See also Walls].
Manufacturer:	Etex UK (Formally Marley Eternit Ltd)
Product Ref:	'Equitone
Tested to:	N/A.
Colour:	White.
Material:	Fully compressed light weight, mineral fibre cement
Notes:	Size - Sub-frame bolted to structure. Concealed fixings to hangars; Etex UK Cedral is a cheaper, semi- compressed fibre with painted finish. Rainscreen option available; Use - Suitable for external surfaces. Minimum order quantities of 200-300m² for bespoke colours. .

B2020 Exterior Windows

B2021 Windows

Materials

B2021.1

Application:	Outer glazing panel; doors & windows; solar control.
Manufacturer:	Pilkington (UK) Ltd.
Product Ref.:	'Insulight' Series "Energikare''.
Tested to:	
Colour:	Clear or bronze tinting.
Material:	Double glazing. Heat toughened, laminated glass.
Notes:	Energy Efficient; Glass thickness depends on type: e.g. 'Insulight Phon' inner pane minimum 7.5mm thickness; Insulight Sun Glass for solar control.

B2021.2

Application:	Inner glazing panel for doors & windows.
Manufacturer:	Pilkington (UK) Ltd.
Product Ref:	'K' type (Kappa float) glass "Energikare". Energy Efficient.
Tested to:	BSEN 12373-1.2001
Colour:	Georgian bronze tint.
Material:	Double glazing Heat toughened, laminated glass Microscopic metal surface coating
Notes:	'Insulight Phon' glass is 6.4mm glass with 12mm cavity vacuum. Inner pane minimum 7.5mm thickness; Low emission and heat loss.

B2021.3

Application:	Windows
Manufacturer:	Kawneer (UK) Ltd.
Product Ref:	500 (AA541, 543) series Casement.

Tested to: BS 3987/ [Materials]. EN 573-3, 573-4, 755-2/3/4/6/7/8/9. BS1202-2.2001, BSEN 12206-1.
Colour: BS 08B29 outside; white inside frame.
Material: Frame in aluminium extrusions.
Notes:

B2021.4
Application: Punch or Ribbon Run Windows
Manufacturer: Technal (UK) Ltd, (SAPA Ltd)
Product Ref:

Tested to: BS 6375 (Part 1) [Weathertight].
Colour: BS 08B29 outside; white inside frame.
Material: Powder coated Aluminium.
Notes: Double glazing; Mullion 45mm, inner frame 45mm; Thermal break.

B2021.5
Application: Applicable at RAF Feltwell.
Manufacturer: Technal (UK) Ltd, (SAPA Ltd)
Product Ref: Georgian Window.
Tested to: BS3987, EN 573-3, 573-4, 755-2/3/4/6/7/8/9. BS1202-2.2001, BSEN 12206-1. BS
Colour: 08B29 external frame.
Material: Extruded aluminium.
Notes: Window to match existing style.

B2021.6
Application: Applicable to RAF Feltwell.
Manufacturer: Master-Frame Ltd.
Product Ref: Georgian Window where necessary to match existing
Tested to: BS3987, EN 573-3, 573-4, 755-2/3/4/6/7/8/9. BS1202-2.2001, BSEN 12206-1. White
Colour: internal/ external frame.
Material: uPVC.
Notes: Reproduction sash windows to match existing windows.

B2022 Curtain Walls
No site specific content.

B2023 Storefronts
No site specific content.

B2030 - Exterior Doors

LOCKS & IRONMONGERY

(MANDATORY)

General Information

The ASSA 'Modular Locking System' is employed at RAF Lakenheath to ensure a suitable level of security. Compliance with these procedures ensures compatibility with the RAF Lakenheath master keying system. Approval from the Base Civil Engineer is required to deviate from this standard. (ASSA Distinction pattern lever handles with Satin Chrome finish, used with Crown Cut American White Oak doors are considered to provide sufficient colour and luminance in contrast with the door to meet the requirements of the Equality Act 2010 (formally Disability Discrimination Act) and the Building Regulations Part M, 'Access and facilities for disabled people').

The 'Modular Locking System' is manufactured by

ASSAABLOY Door Solutions, Units 3-4 ZK Park, 23 Commerce Way, Croydon. CR0 4ZS.
Website www.assaabloydoorsolutions.co.uk
Tel 0208 688 5191
Email sales@assa.co.uk

ASSA door furniture sets are supplied as standard for 44/45mm thick doors, with fitting instructions.
It may be necessary for the contractor to cut fixing screws to the correct length before fixing. Generally, the screws should be no longer than (and preferably just shorter than) the thickness of the door, otherwise the fitting cannot be tightened fully. Black 'O' rings are provided to be fitted under the screw heads to prevent them coming loose.

Note that for doors of unusual thickness, ASSA can supply different sizes of cylinder rings and screws and extension pieces to bring the cylinder further out from the centreline of the door to ensure that the cylinder and cylinder ring finish flush with each other (ref page 4:46 of the ASSA catalogue).

Note the following:

- Page references are to the 2007 issue of the ASSA catalogue, available on request.
- 5800 is the current cylinder range, which is a development of the 5600 range specified here for Lakenheath.
- Both 5800 and 5600 use exactly the same components except for the keys and the cylinder inner.
- The Master Key system Reference Number provides all the information with regard to side codes etc.

Aluminium Main Entrance Doors

General Notes

All aluminium door manufacturers are to be copied on this specification guide prior to tender.

It is recommended that all aluminium doors be manufactured from sections of at least 90mm to allow sufficient room for fitting of door closers, lock cases and panic bolts to meet the latest CEN standards and Accessibility requirements including Doc. M of Building Regulations.

Sections recommended include:

- Kawneer 350
- Kawneer 605 enhanced
- Glostal
- Schuco

Doors are to be hung on hinges by the door manufacturer to suit the section provided. Flush bolts for double doors are to be supplied by the door manufacturer.

Self-closing devices are to be surface mounted to allow easy access for maintenance. Slide arm closers are preferred to enable easy-action for Accessibility requirements and to remove the vandal/abuse point of scissor arms.

Pull handles are generally to project architects design but should comply with recommendations of BS 8300 with length at a minimum 400mm centres and in Nylon Coloured Finish to contrast with the door finish.

It may be required to specify wall-mounted buffers where damage may occur when handles can strike a wall surface. It is recommended that through corridors and external doors against facing brickwork, a polished black rubber "tailgate" design buffer be specified i.e. AJ 2500/002 125x47x40mm "fixed at handle height to wall".

Please noted, that if the Door manufacturer specifies a different Ironmongery supplier than the one noted in this Base standard, it would be incumbent on the contractor to obtain a letter of compliance from the Door manufacturer as to its suitability for both the specified role/duty and location. Note, all Ironmongery should be able to accept the base standard cylinders, Ovals, and this is a strict requirement.

Contract requirements & procurement route for locks & keys:
Please liaise with the CE locksmith prior to the purchase of any locking system.
The CE locksmith must be advised of the identity of all lock master systems installed in all buildings. The CE locksmith is available on Ext. 5284, Building 529.

Specify Option 10 in specifications to ensure suitable warranty conditions. Specify RAF Lakenheath Identity Code No 9EA1341.

The standard requirement is the provision of 2No. keys to each lock: this may be varied by the building user. All keys must pass the building entrance and the key holder's office.

2No. Master Keys are required for each building custodian: this may be varied by the building custodians

Procurement route for locks and keys:
Contractors are responsible for the purchase of part assembled cylinders from ASSA. ASSA delivers the part assembled cylinders (in sealed packages) to the Lakenheath PM. Key blanks are held by the Lakenheath locksmith.

The Lakenheath PM gives the part assembled cylinders to the CE Locksmith. The CE Locksmith pins the cylinders and cuts the keys, free of charge.

The CE locksmith provides the fully assembled cylinders and required sets of keys to the PM. The PM passes the locks to the contractor for fitting.

The contractor is not allowed to buy blank keys for the system at RAF Lakenheath.

The contractor must provide adequate notice:
1) to allow ASSA to supply the cylinders and keys and
2) to allow the locksmith to pin the cylinders and cut the keys, before they are required on site.

The estimated time required for the locksmith to pin the locks is as follows: 1-49 cylinders: 4 weeks
50-99 cylinders: 6 weeks; 100 cylinders: 8 weeks.

Materials

B2030.1

Cylinders

Cylinder type:	ASSA Twin Combi 5600 on step 3 client exclusive side code.
Master key system:	Reference number 9EA 1341.
Cylinder shape:	ASSA Scandinavian oval to BS EN 1303.
Cylinder keys:	Protected against unauthorised duplication by international Patent Law.
Finish:	Satin Chrome (Finish 13).

B2030.2

Lock-cases

Lock case type:	ASSA Modular range with 70mm back-set. ASSA Modular 1525/1526 with 50mm back-set. Special lock case for use on escape doors when used with 1125 panic exit device.
Finish:	Satin Chrome (Finish 13).

B2030.3

Door Furniture

Lever handles: ASSA 6650 Distinction lever handle range with bolt through fixings (no screw head cover caps)

(Note: the return bend to the door leaf on these lever handles can collide with glazing beads at the same height. Please design glazing in doors accordingly.)
Pull handles: ASSA Scanflex Nordic range – Generally 400mm x 32mm to comply with Accessibility Code of Practise.

Cylinder accessories: ASSA Classic range. External cylinder ring (Escutcheon) internal thumb-turn ref 256/18

External and internal cylinder ring for double cylinder	ref 18256/18
External cylinder ring internal blind rose	ref 2356/18
External blind rose internal cylinder ring	ref 2256/18

(Note:/18 denotes depth of cylinder ring. Assuming 44mm thick door and the lock fitted centrally, an 18mm deep cylinder ring will then finish flush with the face of the cylinder).
Finish: Satin Chrome (Finish 13).

ASSA 1125 Series panic hardware

B2030.4

For single doors:

1No. ASSA 1125 series single point panic latch:	ref 1125
1No. ASSA escape night latch:	ref 1526/50
Or	
for higher security replace lock case 1526 with 1No ASSA escape sash lock:	ref 1525/50
Or	
1No. ASSA 1125 series two point panic bolt:	ref 1125:1

B2030.5

For double doors with non-rebated styles

2No. ASSA 1125 series two point panic bolts:	ref 1125:1
Or	
1No. ASSA 1125 series two point panic bolt:	ref 1125:1
1No. ASSA 1125 series single point panic latch:	ref 1125
1No. ASSA 1526 escape night latch:	ref 1526
Or	
for higher security replace lock case 1526 with 1No. ASSA escape sash lock:	ref 1525/50

B2030.6

For double doors with rebated styles

1No. ASSA 1125 series two point panic bolts:	ref 1125:1
1No. ASSA 1125 series single point panic latch:	ref 1125
1No. ASSA 1526 escape night latch:	ref 1526/50
Or	
for higher security replace lock case 1526 with 1No. ASSA escape sash lock:	ref 1525/50

For external locking/access options on single or double doors add the item below to the specification for use with ASSA panic latch 1125 only.

1No. External handle (handed lever) set:	ref 6650
1set Mounting Kit incl. split spindle, fixings and plate	ref 81.21.62
1No Scandinavian Round single cylinder (external)	ref C5611

1No. Scandinavian Oval single cylinder (internal) ref C5607

B2030.7

ASSA Panic Escape Hardware

Note: Push pads are not allowed under NFPA Regulations. Finish: Brushed stainless steel ASSA 1125 panic latch to BS EN 1125 (a flush fitting, full width push bar micro-switched as standard that operates a mortice escape night latch or escape sash lock for single doors – cylinder for external access optional. Comes in 3 standard widths 67 - 815mm, 816 -1010mm 1011 -1415mm).

ASSA 1125:1 panic bolt to BS EN 1125 Class 6 (a surface mounted, full width push bar that operates vertical rods and two deadlocking steel latches for single or double doors). Comes in 3 standard widths 670-815mm, 816- 1010mm 1011-1415mm, can also be extended up to 3200mm door height as standard).

The ASSA panic exit devices are designed to fit most manufacturers' door sections.

B2030.8

Hinges

All hinges should achieve a minimum standard of BS EN 1935 and carry the CE marking, especially if used on fire doors. Use the correct number of hinges.

Hinge type timber: ASSA Journal supported hinges ref 3248 range to BS EN 1935 grade 13 (Severe Duty).
Finish: Satin Chrome (Finish 13).

B2030.9

Closers

Overhead: ASSA 330 and 250 series cam action to BS EN 1154 and CE Marked
(a range of closers suitable for door weights from 60 – 120kg with adjustable power, and back-check closing options,)
Finish: Satin aluminium.

Fire door systems ASSA FD450 series Fire door electromechanical hold open system releases on signal from fire alarm and co-ordinates double doors to close in correct sequence. Use with 250 cam action closer.

B2030.10

Standalone access control electronic code locks

Battery operated: ASSA Codoor CD3500 for internal use only.
Consider the need for vision screening to prevent observation by others – a painted weather shield (ASSA ref 6160 RS) may suffice – they are transparent plastic.
Hard wired: ASSA Solicode 210CL (or 210DA with built-in Duress alarm) for internal and external use.

B2030.11

Standalone access control electronic card operated locks

Battery operated: ABLOY Timelox Access or Office for use with Mag strip cards, for internal and external use. (Note: must specify for external use)
Hard wired: ABLOY Solicard 1100 for internal and external use.
(Note: Weather shield available)

B2030.12

Electric Strikes

All electric strikes have face plate options to suite Steel, Timber and Aluminium frames. All Electric strikes have the option of a latch bolt monitoring micro-switch. Suitable for external use in 12V-24V AC/DC, (48V as available on request).

Very High security dead bolt ASSA STEAB dead bolt strike 1850kg holding force
High security Fail locked ASSA Solid 131E/16 1300kg holding force
High security Fail safe ASSA Solid 331A/16 1300kg holding force
(Once signaled to do so the True fail safe electric release will release instantly even with up to 500kg of side pressure)
Medium security Fail locked ASSA Solid 14E/10 450kg holding force.

Medium security Fail unlocked ASSA Solid 114A/10 450kg holding force.
Universal Fail locked/ Unlocked 700kg holding force.

Note face plates listed with the relevant electric strike are for timber frames. Alternative face plates are available.

B2030.13

Door Magnets

True fail safe even under side pressure. CE Approved, special design ensures there is no problem with residual magnetism when the lock is opened. Full "L" and "L&Z" supporting and armature housings area available. May be fitted with independent Hall effect micro-switch to monitor that the magnet is active.

Very high security ASSA M8031X002 Shear magnet.

High security ASSA M8011 for single doors.
ASSA M8022 for double doors.

Medium security ASSA M800 Slimline magnet - Mortice fixing
ASSA M8005 Mini Magnet – Surface fixing.

B2030.14

Cam locks for M&E, BMS and Fire Alarm Cabinets

(not normally suited with the main locking system, but an option)
Type ABLOY 10450 5 pin cam lock range for material up to 23mm thick Right-hand operation standard, Left hand operation available.
Finish: Satin Chrome (Finish 13).

Ironmongery door sets for typical applications:

B2030.15

Aluminium Main Entrance Doors – Single Door (Locking – Non-Escape)

1No. ASSA Modular dead lock	ref 2788/50
1No. ASSA Twin Combi single external cylinder	ref C5601
1No. ASSA cylinder accessory set and internal blind rose	ref 2356/18
or if thumb-turn required internally;	
1No. ASSA cylinder accessory set and internal thumb-turn	ref 256/18
1No. ASSA overhead cam action doors closer power adjustable to BSEN1154	ref 250
1No. HEWI Cranked Pull Handle, made to measure (267mm – 599mm C-C) 85mm stand - off, 145mm off –set, 33mm diameter injection moulded nylon, with corrosion resistant steel core. Complete with unique back to back steel fixing bolts, steel securing pins and nylon washers to prevent lateral movement.	ref 33.2020.1.5.2

B2030.16

Aluminium Main Entrance Doors – Double Door (Locking – Non-Escape)

1No. ASSA Modular dead lock	ref 2788/50
1No. ASSA Twin Combi single external cylinder	ref C5601
1No. ASSA cylinder accessory set and internal blind rose	ref 2356/18
thumb-turn required internally;	
1No. ASSA cylinder accessory set and internal thumb-turn	ref 256/18
1No. ASSA overhead cam action doors closer power adjustable to BSEN1154	ref 250
2No. HEWI Cranked Pull Handle, made to measure (267mm – 599mm C-C) 85mm stand - off, 145mm offset, 33mm diameter injection moulded nylon, with corrosion resistant steel core. Complete with unique back to back steel fixing bolts, steel securing pins and nylon washers to prevent lateral movement.	ref 33.2020.1.5.2

B2031 Glazed Doors & Entrances

Specifications used in this instance are British Standard 8214 & US NFPA 80. The most onerous of those requirements is 60 minute fire-rating doors, including glazing, frames, and any hardware used.

Materials:

B2031.1

Application:	Doors in external cladding - 190 thin profile frame. glazed panel
Manufacturer:	Kawneer (UK) Ltd Designer
Product Ref:	58 Swing Door
Tested to:	BS 6375 (weather); 3987.
Colour:	Dark brown, polyester powder coated.
Material:	Aluminium extruded frame.
Notes:	Single/double doors; In/outward/double swing opening.

B2031.2

Application:	External entrances - 44-54mm thick, heavy duty
Manufacturer:	IBC Expamet Components Ltd
Product Ref:	“Weather Plus”.
Tested to:	
Colour:	Stained brown finish.
Material:	Plywood Faced; aluminium substrate.
Notes:	Factory controlled moisture content. Vapour barrier built in.

B2031.3

Application:	Facility buildings - Double leaves; bi-parting mode on a common track & wheels.
Manufacturer:	Technical (UK) Ltd, (SAPA Ltd)
Product Ref:	N/A.
Tested to:	Double glazing to BS 6262.
Colour:	Dark brown polyester powder coat.
Material:	Extruded aluminium frame.
Notes:	Also hinged for emergency use. 3 x 2.1m; 180kg.

B2031.4

Application:	Outer glazing panel; doors & windows; solar control - Heat toughened, laminated glass
Manufacturer:	Pilkington(UK) Ltd.
Product Ref:	‘Insulight’ Series "ENERGIKARE" ENERGY EFFICIENT
Tested to:	BSEN 12373-1.2001
Colour:	Clear or bronze tinting.
Material:	Double glazing.
Notes:	Insulight Sun Glass for solar control. Glass thickness depends on type: e.g. ‘Insulight Phon’. Inner pane minimum 7.5mm thickness.

B2031.5

Application:	Inner glazing panel for doors & windows
Manufacturer:	Pilkington (UK) Ltd
Product Ref:	‘K’ type (Kappa float) glass/ "ENERGIKARE"
Tested to:	BSEN 12373-1.2001
Colour:	Georgian bronze tint
Material:	Double glazing.
Notes:	Low emission and heat loss; Heat toughened, laminated glass Microscopic metal surface coating; Insulight Phon’ glass is 6.4mm glass with 12mm cavity vacuum. Inner pane minimum 7.5mm thickness – subject to detailed design.

B2032 Solid Exterior Doors

Materials:

B2032.1

Application:	External Entrances.
Manufacturer:	Martin Roberts.
Product Ref:	Omni Range.
Tested to:	
Colour:	Dark Brown, polyester powder coat.
Material:	Steel panels.
Notes:	¼ - 4 hours fire rating; Stainless steel trims and ironmongery.

B2033 Revolving Doors

No site specific content.

B2034 Overhead Doors

B2034.1

Application:	Industrial Storage or Garages - RAF Lakenheath.
Manufacturer:	Syston Rolling Shutters Ltd.
Product Ref:	N/A.
Tested to:	BS 476 for fire shutters.
Colour:	Polyester powder coated dark brown mat finish.
Material:	Galvanised curtain, hood & frame.
Notes:	Cross reference: Glazed vision panel; Chain operation; push-up or electrically insulated, thermally insulated.

B2035 Other Doors & Entrance

No site specific content.

B30 Roofing

B3010 Roof Coverings

B3011 Roof Finishes

Materials:

B3011.1

Application: Pitched Roofs.
Manufacturer: Kingspan.
Product ref.: KS1000RW, KS2000RW Metal sheet profile.
Tested to: BS 476 (Insulation): Euroclass B-s1-d0, BSEN13501
Colour: BS 08B29 Van Dyke Brown or BS 08B17, Light Cream
Material: Steel sheet with rigid 30 - 100mm PIR phenolic foam insulation Infil
Notes: Insulation filler, 1m wide; Panel 65 - 135 thick.

B3011.2

Application: Pitched Roofs - Visual Districts.
Manufacturer: Redland Ltd.
Product ref. Regent double Roman plain tile.
Tested to: BS EN 490.
Colour: BS 08B29.
Material: Pigmented concrete.
Warranty: N/A.
Notes: Colour variation for ridge and hip tiles. 318 x 300mm; 47kg/sm.

B3011.3

Application: Pitched Roofs – RAF Feltwell.
Manufacturer: Sandtoft Ltd,
Product ref. 'Plain Tile'.
Tested to: BS EN 490, 491.
Colour: Antique 2 - dark brown.
Material: Pigmented concrete
Notes: Standard flat plain tile, 420 x 334 mm, 50kg/sm.

B3011.4

Application: Pitched Roofs.
Manufacturer: Redland Ltd.
Product Ref: Stonewold II - Tudor brown tile.
Tested to: BS EN 490.
Colour: BS 08B29.
Material: Pigmented concrete.
Notes: The Slate Range.

B3012 Traffic Toppings & Pavement Membranes

No site specific content.

B3013 Roof Insulation & Fill

No site specific content.

B3014 Flashings & Trim

No site specific content.

B3015 Roof Eaves & Soffits

Materials:

B3015.1

Application:	Barge board, fascia, in-fill panels & soffits.
Manufacturer:	Celuform [Specialist Building Products Ltd.]
Product ref.:	N/A.
Tested to:	BS 476 [Fire].
Colour:	Argon '791' (BS 08B29) or white.
Material:	PVC-UE.
Notes:	Polytop stainless steel screws/secret fixings for board system; The system includes trims, beads etc.; As a full package with membranes and battens behind panels.

B3015.2

Application:	Walls and ceiling soffits.
Manufacturer:	Etex UK (Formally Marley Eternit Ltd)
Product ref:	Equitone
Tested to:	N/A
Colour:	White.
Material:	Fully compressed light weight, mineral fibre cement.
Notes:	Etex UK Cedral is a cheaper, semi- compressed fibre with painted finish. Rainscreen option available; Use - Suitable for external surfaces. Minimum order quantities of 200-300m² for bespoke colours.

B3016 Gutters & Downspouts

Above Ground Rainwater Systems

Basis of Design

Refer to index of Specifications and Standards.

Description of System

Rainwater discharge from roof and terrace areas will be collected via receivers comprising gutters and rainwater outlets.

All surface water receivers will connect to piped rainwater systems with vertical stacks dropping through risers within the building.

Rainwater stacks will connect to the below slab drainage system at ground floor level.

The merits of utilising either gravity or syphonic rainwater systems or a combination of both will be reviewed during the design process. Consideration will be given to the high velocities of flow experienced with syphonic rainwater systems.

To avoid any potential rainwater ingress into the building during extreme rainfall events all roof areas and gutters will

incorporate suitably sized and positioned weir overflows, which will discharge excess water to the perimeter of the building.

Rainwater pipes will be provided with rodding access at all changes of direction and directly above floor level prior to connection to drain.

Rainwater pipes located in return air voids or other areas where condensation may occur will be provided with insulation.

UPVC rainwater pipes that penetrate fire barriers will be provided with intumescent fire sleeves to maintain fire separation.

Consideration will be given to the potential for the harvesting and re-use of rainwater collected from roof areas for WC and urinal flushing within the capital cost restraints of the project.

The design rainfall intensity will be calculated in accordance with British Standard recommendations and Met Office data specific to the region.

Guttering systems to have anti-clutter device to help reduce the buildup of foliage.

Testing & Commissioning
Method statements will submitted for approval relating to all testing and commissioning procedures.

Testing and commissioning will be carried out in accordance with the procedures laid down in the appropriate code of practice.

Testing and commissioning will include all necessary adjustment and re-testing of plant to meet the design duties.

Schedule of Materials

Syphonic Rainwater System: HDPE with jointing via electrofusion sleeve couplings.

Materials:

B3016.1

Application:	Roof Drainage - Square down pipes: Box gutters.
Manufacturer:	Hunter Plastics Ltd.
Manufacturer Ref:	Hunter Regency.
Tested To:	BSEN 12056-3
Colour:	Van Dyke Brown; BS 08B29.
Material:	PVC-U through coloured.
Warranty:	N/A.
Notes:	To suit building configuration.

B3016.2

Application:	Roof Drainage - Half round gutter: Round down pipes.
Manufacturer:	Hunter Plastics Ltd./ Osma Wavin/ Marley
Manufacturer Ref:	-.
Tested To:	BSEN 12056-3
Colour:	Van Dyke Brown; BS 08B29
Material:	PVC-U through coloured.
Warranty:	N/A.
Notes:	N/A.

B3016.3

Application: Roof Drainage - Square down pipes: Box gutters.
Manufacturer: Osma Wavin.
Manufacturer Ref: N/A.
Tested To: N/A.
Colour: Van Dyke Brown; BS 08B29.
Material: PVC-U through coloured.
Warranty: N/A.
Notes: Standard drainage system.

B3016.4

Application: Roof Drainage - Half round gutter: Round down pipes.
Manufacturer: Osma Wavin.
Manufacturer Ref: N/A.
Tested To: N/A.
Colour: Van Dyke Brown; BS 08B29.
Material: PVC-U through coloured.
Warranty: N/A.
Notes: N/A.

B3016.5

Application: Roof Drainage – incl. RAF Feltwell.
Manufacturer: Terrain Service Ltd.
Manufacturer Ref: PolyPipe.
Tested To: BSEN 12056-3
Colour: BS 08B29and black.
Material: PVC-U through coloured.
Warranty: N/A.
Notes: Sizes 82, 110, 160mm square or round fall pipes.

B3016.6

Application: Roof Drainage Anti-Clutter Device – incl. RAF Feltwell.
Manufacturer: Hedgehog.
Manufacturer Ref: PolyPipe.
Tested To:
Colour: White, Black, Brown.
Material: Stainless steel core, polypropylene brushes.
Warranty: 10 years.
Notes: 75mm to 200mm diameter, 4m length.

B3020 Roof Openings

B3021 Glazed Roof Openings

Materials

B3021.1

Application: Industrial Buildings with natural top-lighting.
Manufacturer: Monodraught Ltd.
Manufacturer Ref: Sunpipe.
Tested To: BSEN 12056-3

Colour:	BS 08B29 Van Dyke Brown.
Material:	Clear poly-carbonate, sealed dome: Electrolytic ally enhanced anodised: aluminium tube coated with PVD.
Warranty:	N/A.
Notes:	Sizes 1m dia. length & bends unlimited; Moulded GRP up-stand dressed with weather flashing to steel profiled roof; Aluminium egg crate grill ceiling diffuser; brushed nylon open cell, tape gasket at the base of the dome, prevents condensation.

B3021.2

Application:	Industrial Buildings with natural top-lighting.
Manufacturer:	Monodraught Ltd.
Manufacturer Ref:	Sunpipe.
Tested To:	BSEN 12056-3
Colour:	Only black at RAF Feltwell.
Material:	Clear poly-carbonate, sealed dome: Electrolytic ally enhanced anodised: aluminium tube coated with PVD.
Warranty:	N/A.
Notes:	Sizes 1m dia. length & bends unlimited; Moulded GRP up-stand dressed with weather flashing to steel profiled roof; Aluminium egg crate grill ceiling diffuser; brushed nylon open cell, tape gasket at the base of the dome, prevents condensation.

B3022 Roof Hatches

No site specific content.

B3023 Gravity Roof Ventilators

No site specific content.

C – Interiors

C10 Interior Construction

C1010 Partitions

No site specific content.

C1011 Fixed Partitions

Materials:

C1011.1

Application: Skirting Natural – All Areas.
Manufacturer: N/A.
Manufacturer Ref: N/A.
Tested To: N/A.
Colour: Natural unpainted.
Material: American White Oak.
Warranty: N/A.
Notes: Top edge to be square cut or arised; Provide 100mm square edge. Finish to match doors, panels, frames etc.; See notes on Hard Flooring & Carpeting.

C1011.2

Application: Skirting Painted – All Areas.
Manufacturer: N/A.
Manufacturer Ref: N/A.
Tested To: N/A.
Colour: BS 00E55, Brilliant White gloss.
Material: MDF / softwood.
Warranty: N/A
Notes: 100mm high; 2No. primer/ under-coats; 1No. top-coat.

C1011.3

Application: Skirting - Used with 6mm thick carpets.
Manufacturer: Gradus Ltd.
Manufacturer Ref:
Tested To: N/A.
Colour:
Material: Extruded aluminium.
Warranty: Manufacturers standard.
Notes: 2; 3.5; 5 x 100mm sheets; 2.4/ 2.75/ 3.2m long; See stair trims & floor finishes
Use capping seals for up-stand skirting.

C1011.4

Application: Skirting
Manufacturer: Gradus Ltd
Manufacturer Ref:
Tested To: N/A.
Colour:
Material: PVC
Warranty: Manufacturers standard.
Notes: See stair trims & floor finishes.

C1011.5

Application: Medical & Industrial Areas - Welded joints to be used where possible.
Manufacturer: Gradus Ltd.
Product Ref: SI 100
Tested To: N/A.
Colour: White.
Material: PVC
Warranty: Manufacturers standard.
Notes: Moulded section. 100mm high.

C1011.6

Application: Non-Hospital Public Buildings.
Manufacturer: Boston Retail Products.
Manufacturer Ref: N/A.
Tested To: BS 476, 6/ 7
Colour: RAL 8019; Van Dyke brown, Decorative finish.
Material: Cover in PVC-U profiles; aluminium core with impact resistant cushion.
Warranty: Manufacturers standard.
Notes: Vertical & horizontal dados.

C1011.7

Application: Applicable at RAF Lakenheath – Hospital.
Manufacturer: Intrad Ltd
Manufacturer Ref:
Tested To: N/A.
Colour: RAL 8019, Van Dyke brown; Decorative finish.
Material: Cover in PVC-U profiles; aluminium core with impact resistant cushion.
Warranty: Manufacturers standard.
Notes: 90 & 135corners. Also available; decorative wall cladding in same range. Screwed with snap-fixed cover. 75 x 75mm; end-cap 50 x 50mm.

C1011.8

Application: Wall Protection - Where required, such as washrooms, bathrooms
Manufacturer: N/A.
Manufacturer Ref: Altro White Roc range.
Tested To: Class 0 surface spread of flame or equivalent
Colour: Colour chart to match specific requirement.
Material: N/A.
Warranty: Manufacturers standard.
Notes: N/A.

C1012 Demountable Partitions

No site specific content.

C1013 Retractable Partitions

No site specific content.

C1014 Site Built Toilet Partitions

Materials:

C1014.1

Application:	Office, Command & Entertainment Areas.
Manufacturer:	Armitage Shanks Ltd
Product Ref:	IPS Washroom Systems.
Tested To:	N/A.
Colour:	Colour palette to be agreed.
Material:	N/A.
Warranty:	Manufacturers standard.
Notes:	

C1014.2

Application:	Toilet fittings with Public Access.
Manufacturer:	Bradley Corporation (supplier - Relcross Ltd, Wilts).
Product Ref:	Toilet tissue dispenser
Tested To:	N/A.
Colour:	Satin.
Material:	Stainless steel only, 22 gauge.
Warranty:	Manufacturers standard.
Notes:	Contemporary series dispensers; tissue holders; mirrors; soap valves; waste receptacles etc. Hinged access door with vandal.

C1015 Site Built Compartments Cubicles

No site specific content.

C1016 Interior Balustrades & Screens

No site specific content.

C1017 Interior Windows & Storefronts

No site specific content.

C1020 Interior Doors

C1021 Interior Doors

Research ranges of internal doors to suit sites and applications.

Specifications used in this instance are British Standard 8214 & US NFPA 80. The most onerous of those requirements is 60 minute fire-rating doors, including glazing, frames, and any hardware used.

C1022 Interior Door Frames

To tie in with door leaf manufacturer as complete set as applicable. Refer to C1021.

Specifications used in this instance are British Standard 8214 & US NFPA 80. The most onerous of those requirements is 60 minute fire-rating doors, including glazing, frames, and any hardware used.

Materials:

C1022.1

Application:	All Areas - Liner, architrave & stops to be included as required.
Manufacturer:	N/A.
Product Ref:	N/A.
Tested To:	N/A.
Colour:	BS 00E55, Standard finish; White.
Material:	Softwood or, MDF.
Warranty:	N/A.
Notes:	To match existing; 1No. coat of wood primer, 1No. under-coat, 2No. top coats of gloss paint.

C1022.2

Application:	All Areas.
Manufacturer:	N/A.
Product Ref:	N/A.
Tested To:	BS 476 (22) half & one hour fire rated; BS 476 (31.1)
Colour:	N/A.
Material:	Solid oak, or oak veneer wrapped.
Warranty:	N/A.
Notes:	Rebates for intumescent strip; smoke seal; acoustic control as needed, or in door leaf.

C1023 Interior Door Hardware

LOCKS & IRONMONGERY (MANDATORY)

General Information

The ASSA 'Modular Locking System' is employed at RAF Lakenheath to ensure a suitable level of security. Compliance with these procedures ensures compatibility with the RAF Lakenheath master keying system. Approval from the Base Civil Engineer is required to deviate from this standard.

(ASSA Distinction pattern lever handles with Satin Chrome finish, used with Crown Cut American White Oak doors are considered to provide sufficient colour and luminance in contrast with the door to meet the requirements of the Equality Act 2010 (formally Disability Discrimination Act 1995) and the 2004 Edition of the Building Regulations Part M, 'Access and facilities for disabled people').

The 'Modular Locking System' is manufactured by

ASSAABLOY Door Solutions, Units 3-4 ZK Park, 23 Commerce Way, Croydon. CR0 4ZS.
Website www.assaabloydoorsolutions.co.uk
Tel 0208 688 5191
Email sales@assa.co.uk

ASSA door furniture sets are supplied as standard for 44/45mm thick doors, with fitting instructions.
It may be necessary for the contractor to cut fixing screws to the correct length before fixing. Generally, the screws should be no longer than (and preferably just shorter than) the thickness of the door, otherwise the fitting cannot be tightened fully. Black 'O' rings are provided to be fitted under the screw heads to prevent them coming loose.

Note that for doors of unusual thickness, ASSA can supply different sizes of cylinder rings and screws and extension pieces to bring the cylinder further out from the centreline of the door to ensure that the cylinder and cylinder ring finish flush with each other (ref page 4:46 of the ASSA catalogue).

Note the following:

- 5800 is the current cylinder range, which is a development of the 5600 range specified here for Lakenheath.
- Both 5800 and 5600 use exactly the same components except for the keys and the cylinder inner.
- The Master Key system Reference Number provides all the information with regard to side codes etc.

C1023.1

Lockable Office Doors (Internal)

The lock specification provides a single action escape from inside at all times via the lever handle without having to grip or twist a thumb turn. The internal thumb turn only provides the ability to lock the door from inside without restricting escape from inside. The door can be locked/ unlocked from outside with the key. The external lever handle operates the latch bolt only. The internal lever handle operates the latch bolt and dead bolt. This lock is a “split follower” type lock and is handed; please ensure correct handing of spindle follower when ordering.

1No. ASSA Modular escape sash lock with 70mm back-set	ref 1520/70
1No. ASSA Twin Combi single external cylinder	ref C5601
1No. ASSA cylinder accessory set and internal thumb-turn	ref 256
1No.pair ASSA Distinction lever handle	ref 6650
2No. ASSA Special “Split Follower” Spindles	ref 10.23.64
3No. ASSA Journal supported hinges	ref 3248
1No. ASSA overhead cam action doors closer power adjustable to BSEN1154	ref 330

C1023.2

Panic escape single door with external key access only

This provides a panic escape via a full width crash bar at all times to BS EN 1125. The lock is self-locking and deadlocking. The anti-thrust bolt deadlocks the latch when the door is closed. Access from outside can only be with a key.

This provides single point locking only:

When 2 point locking is required, specify panic bolts: ASSA 1125:1 surface mounted on the door leaf.

1No. ASSA Modular deadlocking escape night latch	ref 1526/50
1No. ASSA Twin Combi single external cylinder	ref C5601
1No ASSA Twin Combi single internal cylinder	ref C5607
1No. ASSA external oval cylinder ring	ref 2356/18
1No. ASSA panic latch to BS EN 1125	ref 1125
1No. ASSA external dead knob (pull handle)	ref 496
3No. ASSA Journal supported hinges	ref 3248
1No. ASSA overhead cam action doors closer power adjustable to BSEN1154	ref 250

C1023.3

Panic escape single door with external key access & free access when unlocked

As above, this provides a panic escape via a full width crash bar to BS EN 1125. The anti-thrust bolt deadlocks the latch when the door is closed. This 1525 version has a deadbolt controlled by the cylinder key. When the dead bolt is unlocked this allows free access from both sides of the door. When the deadbolt is locked access from outside is by key only. Escape from inside at all times without the use of a key.

The ASSA 1125 provides single point locking only.

When 2 point locking is required, specify panic bolts: ASSA 1125:1 surface mounted on the door leaf.

1No. ASSA Modular escape sash lock	ref 1525/50
1No. ASSA Twin Combi cylinder set	ref C5601
1No. ASSA Twin Combi single internal cylinder	ref C5607
1No. ASSA external oval cylinder ring	ref 2356/18

1No. ASSA panic latch to BS EN 1125	ref 1125
1No. ASSA Distinction lever handle (external)	ref 6650
3No. ASSA Journal supported hinges	ref 3248
1No. ASSA overhead cam action door closer power adjustable To BS EN 1154	ref 250

The ASSA 1125 provides single point locking only.

When 2 point locking is required, specify panic bolts: ASSA 1125:1 surface mounted on the door leaf.

C1023.4

Panic escape single door with free access from outside when unlocked. No external key access.

As above, this provides a panic escape via a full width crash bar to BS EN 1125. The anti-thrust bolt deadlocks the latch when the door is closed. The door cannot be unlocked from outside. The 1525 escape sash lock allows for escape at all times even when locked, free access from outside when unlocked and no access from outside when locked.

The ASSA 1125 panic latch provides single point locking only.
When 2 point locking is required, specify panic bolts: ASSA 1125:1 surface mounted on the door leaf.

1No. ASSA Modular deadlocking escape sash lock	ref 1525/50
1No. ASSA Twin Combi single internal cylinder	ref C5607
1No. ASSA Distinction lever handle (External)	ref 6650
1No. ASSA external 11mm blind rose	ref 11mm
1No. ASSA panic latch to BS EN 1125	ref 1125
3No. ASSA Journal supported hinges	ref 3248
1No. ASSA overhead cam action door closer power adjustable to BS EN 1154	ref 250

C1023.5

Panic escape double doors with no key entry and plain meeting styles

Both doors would operate independently. Security depends on the operation of the steel deadlocking latch bolts. This provides a panic escape via a full width crash bar to BS EN 1125. The deadlocking latch bolts are self-locking. The door cannot be unlocked from outside.

2No. ASSA 1125 series two point panic bolts	ref 1125:1
6No. ASSA Journal supported hinges	ref 3248
2No. ASSA overhead cam action door closers power adjustable to BS EN 1154	ref 250

C1023.6

Panic escape rebated double door with external key access & free access when unlocked

The specification provides a panic escape via full width crash bars to BS EN 1125. The anti-thrust bolt deadlocks the latch when the door is closed. The active leaf latch and deadbolt can be unlocked from outside via a key.

6No. ASSA Journal supported hinges	ref 3248
2No. ASSA overhead cam action door closer power adjustable to BS EN 1154	ref 250

C1023.7

Toilet Doors to Accessibility Standards

1No. ASSA Modular toilet lock for disabled, complete with emergency override	ref 565T
1No. ASSA Distinction lever handle ½ set (externally only)	ref 6650
3No. ASSA Journal supported hinges	ref 3248

C1023.8

Standard Toilet Doors

1No. ASSA Modular toilet lock complete with emergency override	ref 65T
1No. pair ASSA Distinction lever handle	ref 650
3No. ASSA Journal supported hinges	ref 3248

C1023.9

Internal doors only requiring access control via standalone electronic keypad
All ASSA modular lock-cases which have a spindle follower for use with a lever handle can have a 'Codoor' fitted to them. The Codoor unit uses the same bolt through fixings and is simply held in place by the handles bolting back to back and the cylinder ring bolting through.
The Codoor unit has the following features:

9 individual 4 digit codes operating simultaneously
Anti-tamper feature to prevent access by random code trial All codes are programmed from the keypad

Low battery warning "Always open" feature

The correct ref for the Codoor is:
1No. ASSA Codoor ref CD3500

(Codoors can be bolted back to back to provide access control from both side of the door.

Note: Codoor are for internal use only. Consider painted weather shield to prevent observation).

NB: ASSA recommend the use of the lighter ref 6640 lever furniture instead of 6650 furniture when used in conjunction with Codoor units.

C1023.10

External escape doors requiring access control via a standalone ASSA 'Solicode' electronic keypad that can be used externally. Anti-tailgating available with micro-switch option; duress alarm & other versions available.

1No. ASSA Modular dead locking escape night latch	ref 526/50
1No. ASSA Twin Combi single external cylinder	ref C5601
1No. ASSA Twin Combi single internal cylinder	ref C5607
1No. ASSA cylinder accessory set and internal blind rose	ref 356/18
1No. ASSA Solicode electronic key pad	ref 10CL
1No. ASSA High security fail locked electric release	ref 131E
1No. ASSA panic latch to BS EN 1125	ref 1125
3No. ASSA Journal supported hinges	ref 3248
1No. ASSA overhead door closer power adjustable to BSEN1154	ref 250
1No. ASSA Weather Shield clear plastic	ref 6160RS

C1023.11

Application:	Industrial, Public Buildings & Offices - Inner pane minimum 7.5mm thickness.
Manufacturer:	Pilkington (UK) Ltd.
Product Ref:	Pyroshield wired glass, Energikare.
Tested to:	N/A.
Colour:	Clear glass.
Material:	6mm thick.
Notes:	Energy efficient internal use only; 120 minutes integrity

C1023.12

Application:	Office Doors - Labelling of fire doors – Ironmongery, Statutory signage.
Manufacturer:	Laidlaw Ltd.

Product Ref:	
Tested to:	N/A.
Colour:	N/A.
Material:	Polished aluminium, PA 7.
Notes:	Size - 75 x 75 x 3mm; Cross reference - Supplied with appropriate fixings; Tech Spec - 3mm thick. with radius corners.

C1024 Interior Door Wall Opening Element
No site specific content.

C1025 Interior Door Sidelights & Transoms
No site specific content.

C1026 Interior Hatches & Access Doors
No site specific content.

C1027 Door Painting & Decoration
No site specific content.

C1030 Fittings [Specialities]

C1031 Fabricated Toilet Partitions
No site specific content.

C1032 Fabricated Compartments & Cubicles
(ADVISORY)

Shower enclosures and screens: Ensure they are sufficiently robust. Use only hung side or corner doors. Bi-folding, corner entry and sliding doors must not be specified without approval. The following manufacturer is recommended: Aqata Ltd.

(ADVISORY)

Shower screens (sliding panels to baths):

Power shower or pressurised water installations with pressurised water flow:

Matki Eleganza Double Panel bath screens in silver finish with end panel if required from Matki PLC.
http://www.matki.co.uk

C1033 Storage Shelving & Lockers
No site specific content.

C1034 Ornamental Metals & Handrails
No site specific content.

C1035 Identifying Devices

Materials

C1035.1

Application:	N/A.
Manufacturer:	Modulex Ltd
Product Ref:	‘Compass’ family of signs.
Tested to:	N/A.
Colour:	N/A.
Material:	Aluminium powder coated.
Notes:	Wall mounted or on hangars.

C1036 Closet Specialities

No site specific content.

C1037 General Fittings & Misc. Metals

No site specific content.

C20 Stairs

C2010 Stair Construction

C2011 Regular Stairs
No site specific content.

C2012 Curved Stairs
No site specific content.

C2013 Spiral Stairs
No site specific content.

C2014 Stair Handrails & Balustrades
No site specific content.

C2020 Stair Finishes

C2021 Stair, Tread & Landing Finishes Materials

C2021.1

Application:	Only nosings to be used, which clamp down the stair carpet when fixed.
Manufacturer:	Gradus Ltd
Product Ref:	Stair nosings - AS, AK, AR, G, GR, CT.
Tested to:	N/A.
Colour:	Insert colours to be co-ordinated with carpet or vinyl.
Material:	Brass in Command areas only.
Notes:	Inset trims covering screw fixings to be used instead of screws with pellet fillers.

C2021.2

Application:	All Areas.
Manufacturer:	Gradus Ltd.
Product Ref:	
Tested to:	N/A.
Colour:	N/A.
Material:	Mill finished aluminium or Brass in Command areas.
Notes:	Weekly cleaning is needed. May discolour with some detergents; Butt or mitre joints as per manufacturer.

C2022 Stairs Soffit Finishes
No site specific content.

C2023 Stair Handrails & Balustrades Finishes
No site specific content.

C30 Interior Finishes

C3010 Wall Finishes

C3011 Wall Finishes to Inside Exterior Walls

No site specific content.

C3012 Wall Finishes to Inside Interior Walls

Materials:

C3012.1

Application:	Non-Hospital Public Buildings – Wall Protection.
Manufacturer:	N/A.
Product Ref:	Boston Retail Products
Tested to:	BS 476, 6/ 7
Colour:	RAL 8019, Van Dyke brown; Decorative finish.
Material:	Cover in PVC-U profiles; aluminium core with impact resistant cushion.
Notes:	Vertical & horizontal dados.

C3012.2

Application:	Lakenheath Hospital – Wall Protection.
Manufacturer:	Intrad Ltd.
Product Ref:	
Tested to:	N/A.
Colour:	RAL 8019, Van Dyke brown; Decorative finish.
Material:	Cover in PVC-U profiles; aluminium core with impact resistant cushion.
Notes:	75mm x 75mm; end-cap 50mm x 50mm; 90 & 135 corners; Also available; decorative wall cladding in same range; Screwed with snap-fixed cover.

C3012.3

Application:	All Areas
Manufacturer:	ICI Dulux.
Product Ref:	Generic painted wall
Tested to:	N/A.
Colour:	Brilliant white, BS 00E55
Material:	Emulsion based paint – matt vinyl, or silk vinyl finish.
Notes:	Variations may be acceptable according to specific conditions.

C3012.4

Application:	Offices. Light traffic areas
Manufacturer:	Tektura Wall Coverings Ltd'
Product Ref:	
Tested to:	Class '0' fire rating.
Colour:	
Material:	Paper backed vinyl
Notes:	1.3m x 50m long rolls.

C3012.5

Application: Heavy Trafficked Areas.
Manufacturer: Tektura Wall Coverings Ltd.
Product Ref:
Tested to: Class '0' fire rating.
Colour:
Material: Vinyl backed.
Notes: 1.3m x 50m long rolls.

C3012.6

Application: Communal or Command Areas.
Manufacturer: Tektura Wall Coverings Ltd
Product Ref:
Tested to: Various.
Colour: N/A.
Material: Fabric backed vinyl.
Notes: 1.3m x 50m long rolls; The product has a mildew inhibitor so it is fully washable; 450 gr/sm.

C3012.7

Application: Office Areas.
Manufacturer: Muraspec Wall Coverings Ltd.
Product Ref:
Tested to: Ssurface flame spread. Euroclass B
Colour: Very pale shades as illustrated.
Material: Paper backed vinyl;
Notes: Washable

C3012.8

Application: Communal Areas.
Manufacturer: Muraspec Wall Coverings Ltd.
Product Ref:
Tested to: Surface flame spread. Euroclass B
Colour: N/A.
Material: Fabric backed vinyl
Notes: 1.3m x 50m long rolls. Washable

C3012.9

Application: All Areas.
Manufacturer:
Product Ref:
Tested to: Surface flame spread. Euroclass B
Colour: RAL7035
Material: Emulsion based paint – matt vinyl, or silk vinyl finish.
Notes: Washable; Can be mixed by any reputable paint supplier

C3013 Column Finishes

No site specific content.

C3020 Floor Finishes

C3021 Floor Toppings
No site specific content.

C3021 Traffic Membranes
No site specific content.

C3023 Hardeners & Sealers
No site specific content.

C3024 Flooring

Materials:

C3024.1

Application:	Wash Rooms & Kitchens. (however not full wet rooms)
Manufacturer:	Gerflor Ltd.
Product Ref:	Mipolam Classic
Tested to:	N/A.
Colour:	N/A.
Material:	Homogeneous vinyl.
Notes:	Sweeping & damp mopping with a neutral cleaner recommended; Welded joints; E 120 adhesive. Traditional veining finish; 2m x 20m x 2mm; 3300gr/ sm.

C3024.2

Application:	Preparation Areas - Non-slip & wet.
Manufacturer:	Gerflor Ltd.
Product Ref:	'Tarasafe Standard' rolls.
Tested to:	BS 8203 for installation.
Colour:	Various.
Material:	PUR Vinyl Flooring
Notes:	Noon-woven glass fibre re-enforcing grid. E120 adhesive; 2n x 20m; 2mm & 3mm thick rolls; Seams heat welded; 2900 gr/ sm.

C3024.3

Application:	Industrial areas
Manufacturer:	Gerflor Ltd
Product Ref:	'GTI' tiles.
Tested to:	BSEN ISO 10582
Colour:	Colours various.
Material:	Multi-layered inter-locking vinyl tile.
Notes:	Size 635mmx635mm (600x600mm without dovetail connectivity system) x 6mm o/a thickness; 9365 gr/ sm; Laid loosely, or bonded; Non-slip textured surface

C3024.4

Application: All applications.
Manufacturer: Gerflor Ltd
Product Ref: Mipolam Elegance
Tested to: N/A.
Colour: N/A.
Material: N/A.
Notes: Size 2m x 20m x 2mm thick; or, 608mm x 608mm tiles; 2800 gr/ sm; abrasion resistant; Non-directional finish. Damp proof membrane needed if appropriate.

C3024.5

Application: Communal & multi-purpose areas. Industrial & Educational Areas.
Manufacturer: Altro Flooring
Product Ref: Project Specific
Tested to: N/A.
Colour:
Material:
Notes:

C3024.6

Application: Wet room non slip vinyl
Manufacturer: Altro Flooring
Product Ref: Project Specific
Tested to: EN 13845 Commercial / Light Industrial
Colour: Various tonal alternatives
Material: Heterogeneous PVC 3mm thick
Notes:

C3024.7

Application: Electrical Conductive / Static Dissipative, Electrical rooms, Comms Rooms
Manufacturer: Forbo Flooring Ltd
Product Ref: Sphera SD/ EC depending on application
Tested to:
Colour:
Material:
Notes: 2.00mm thick, 2m wide rolls. Coloured joints to match colour of sheet.

C3024.8

Application: Accommodation Facilities; W et & Communal Areas.
Manufacturer:
Product Ref: Modular Ceramic Tiles.
Tested to: N/A.
Colour: ‘Sand’- beige; ‘Antik’ red. The modular character of the tile makes it patternable.
Material: Unglazed stoneware ceramic.
Notes: Sizes - Modular grid sizes, 100, 200, 300mm., etc. sq. x 10mm thick; Grouted joints w/ mortar/ adhesive base; Resistant to acid, alkali, frost, abrasion etc.

C3025 Carpeting

Materials

C3025.1

Application: General.
Manufacturer: Birch International.
Product Ref: Beta Tech - Broadloom
Tested to: N/A.
Colour: 9.
Material: Pile Yarn - Zeftron 6ix; Primary Backing – Polypropylene; Secondary Backing - Actionbac
Notes: Construction - Cut Pile Graphics; Dyeing Method – Solution; Pile Weight - 1350g/m²; Total Weight - 2560g/m²; Pile Height - 5mm; Gauge - 1/10th; Total Thickness - 7mm nominal; Stitch Rate - 48 per 10cm; Standard Roll and Tiles - 30m x 4m approx.

C3025.2

Application: General.
Manufacturer: Birch International.
Product Ref: Beta Tech - Carpet tiles/ Any tile may be considered acceptable from this manufacturer.
Tested to: N/A.
Colour: 9
Material: Pile Yarn - Zeftron 6ix; Primary Backing – Non Woven; Secondary Backing - Bitumen Compound.
Notes: Construction - Cut Pile Graphics; Dyeing Method – Solution; Pile Weight - 1350g/m²; Total Weight - 5160g/m²; Pile Height - 5mm; Gauge - 1/10th; Total Thickness - 9mm nominal; Stitch Rate - 48 per 10cm; Standard Roll and Tiles - 50cm x 50cm 16 Tiles Per Box.

C3025.3

Application: General.
Manufacturer: Birch International.
Product Ref: Alpha Tech (Multi Tech Broadloom) - Broadloom/ Any broadloom may be considered acceptable from this manufacturer.
Tested to: N/A.
Colour: 12.
Material: Tufted Cut Pile, SD Nylon; Primary Backing – Woven polypropylene, Secondary Backing - impervious Gel.
Notes: Construction - Crossover Loop Pile; Dyeing Method – Solution/Space; Pile Weight – 700g/m²; Total Weight – 1450g/m²; Pile Height – 4.5mm; Gauge - 1/10th; Total Thickness – 6.5mm nominal; Stitch Rate - 43 per 10cm; Number of Tufts 172,000p/m²; - Standard Roll and Tiles – 25m x 4m approx. Minimum 300m² order for broadloom.

C3025.4

Application: General.
Manufacturer: Birch International.
Product Ref: Alpha Tech - Carpet Tiles/ Any tile may be considered acceptable from this manufacturer.
Tested to: N/A.
Colour: 12.
Material: Tufted Cut Pile, Nylon; Backing - Bitumen Compound
Notes: Construction - Tufted Loop Pile; Dyeing Method – Solution/Space; Pile Weight – 525g/m²; Total Weight – 4400g/m²; Pile Height - 4mm; Gauge - 1/10th; Total Thickness – 6.5mm nominal; Stitch Rate - 43 per 10cm; Number of Tufts 172,000p/m²; - Standard Roll and Tiles - 50cm x 50cm.

C3025.5

Application: Military Family Housing properties, Extra Heavy Domestic.
Manufacturer: Cormar Carpet Company.
Product Ref: Woodland Heather Twist, Elite.
Tested to: CE Mark Rating Cfl-S1, Hot Metal Nut Test BS4790 Pass
Colour: Travertine

Material: 80% Wool, 10% Polypropylene & 10% Tuftbond

C3025.6

Application: Offices with heavy contract classification carpet.
Manufacturer: Mohawk Carpets Ltd
Product Ref: Broadloom
Tested to: Flammability – ASTM E 648 (USA); Smoke ASTM662
Colour: N/A.
Material: Solution dyed nylon
Notes:

C3025.7

Application: Education, Industrial & Medical
Manufacturer: Vorwerk Ltd.
Product Ref: 'Ecofix 1100'.
Tested to: N/A.
Colour: N/A.
Material: 100% polyamide.
Notes: Tape for carpet fitting.

C3025.8

Application: Education, Industrial & Medical
Manufacturer: Vorwerk Ltd.
Product Ref: Superior 1018.
Tested to: DIN EN ISO 13501-1, Bfl-S1
Colour: N/A.
Material:
Notes: 100% Polyamide, 5.5mm overall, 1380gr/m²

C3026 Bases, Curbs & Trim

Materials

C3026.1

Application: For sheet junctions in all areas.
Manufacturer: Gradus Ltd.
Product Ref: CG/ANT (Alli) Nap Trim/ ANT 35/355 carpet edge trim for all areas.
Use CG type, as a binder bar.
Tested to: Manganese bronze to BSEN12163, BSEN12164, BSEN12167. In Command areas.
Aluminium, BSEN573, BSEN755, BSEN12020
Colour: N/A.
Material: To match nosing & edge trim.
Notes: Non-combustible.

C3027 Access Pedestal Flooring

Materials

C3027.1

Application: Light office grade.
Manufacturer: Kingspan Raised Access Floors
Product Ref: RLG 600 Light Grade Floor.
Tested to: PSA MOB PF2 PS SPU/ Class '0' fire rating.
Colour: N/A.
Material: Galvanised steel. Modular, wrap round steel panel with 30mm thick chip-board core.
Notes: Gravity lay panels; 600mm x 600mm x 31mm thick; 33kg/ sm. Die indents to locate pedestal lugs. 6.7kN/m² uniformly distributed load, subject to individual project requirements.

C3027.2

Application: Medium office grade.
Manufacturer: Kingspan Raised Access Floors
Product Ref: RMG 600 Medium Grade Floor.
Tested to: PSA MOB PF2 PS SPU/ Class '0' fire rating.
Colour: N/A.
Material: Galvanised steel. Zinc plated pedestals; bonded finishes can be added.
Notes: 600mm x 600mm x 31mm thick; 36kg/ sm; Steel base plate fixed to slab. 8kN/m² uniformly distributed load, subject to individual project requirements.

C3027.3

Application: Heavy office grade.
Manufacturer: Kingspan Raised Access Floors
Product Ref: RHG Heavy Grade Floor. For extra heavy grade use stringers.
Tested to: PSA MOB PF2 PS SPU/ Class '0' fire rating.
Colour: N/A.
Material: Galvanised pressed steel.
Notes: 2.4mm max. deflection; 600mm x 600mm x 32mm; 44kg/ sm; Anti-vibration head cap. 12kN/m² uniformly distributed load, subject to individual project requirements.

C3025.4

Application: Raised - Non-slip industrial floors
Manufacturer: Fibreglass Grating Ltd. (Dura Composites Ltd)
Product Ref: N/A.
Tested to: ASTM – E84 fire tested.
Colour: Yellow or grey.
Material: Fibreglass resin.
Notes: Flame-spread Class 1 rating.

C3030 Ceiling Finishes

C3031 Ceiling Finishes

Materials

C3031.1

Application: On plaster-board ceilings where wall to ceiling junctions are poor or susceptible to cracking.
Manufacturer:
Product Ref: Cove 120/ 90.
Tested to: N/A.
Colour: N/A.
Material: Cove adhesive on plasterboard ceilings or room perimeter pelmets.
Notes: To be kept simple and without the addition of extra ceiling strips except in old buildings.

C3031.2

Application: Ceiling bulkheads.
Manufacturer:
Product Ref: Shadow line, corner step profile.
Tested to: N/A.
Colour: N/A.
Material: Aluminium alloy extrusion.
Notes: 69mm x 11mm; 56.5mm x 11mm; 50mm x 11mm etc.; Corrosion resistant high porosity primer; Point loads up to 50kg.

C3032 Suspended Ceilings

Materials
C3032.1

Application: General Use & Offices – Suspended Ceiling Grid.
Manufacturer: Zentia (formally Armstrong UK)
Product Ref: Prelude 24/ Prelude 15.
Tested to: N/A.
Colour: White.
Material: Grid - Aluminium.
Notes: Grid supported from hangers / wires / drop rods suitable for environment and application

C3032.2

Application: Offices & Command Areas.
Manufacturer: Zentia (formally Armstrong UK)
Product Ref: Tegular Square ~~Dune~~ -Plus. Dune range. Perla OP / dB range.
Tested to: N/A.
Colour: White.
Material: Fibre.
Notes: 600mm x 600mm x 17mm minimum thick tiles; Rh >95%; light reflection >85%; wt. minimum 4.5kg/sm.

C3032.3

Application: Rest Rooms & Shower Cubicles - Board.
Manufacturer: Zentia (formally Armstrong UK)
Product Ref: Ceramaguard.

Tested to: N/A.
Colour: White.
Material: N/A.
Notes: 600mm x 600mm x 15mm thick Sound 39dB; light >79%; thermal 0.067W/mK; wt 7.3kg/sm; Tru-lock grid system with exposed tee. Corrosive resistant grid and hangers. Room function to dictate if 600mm centres on main ceiling grid is to be used for high humidity areas

C3032.4

Application: Product removed

C3032.5

Application: General – Acoustic Board.
Manufacturer: Zentia (formally Armstrong UK)
Product Ref: Parafon Hygien; tegular/ sq tile
Tested to: N/A.
Colour: N/A.
Material: N/A.
Notes: Size – 600mm x 600mm x 18mm thick; Tech Spec - Light reflection 82%; Board 1.3 kg/sm

C3033 Other Ceilings

No site specific content.

D – Services

D10 Conveying

D1010 Elevators & Lifts

D1011 Passenger Elevators
No site specific content.

D1012 Freight Elevators
No site specific content.

D1013 Lifts
No site specific content.

D1020 Escalators & Moving Walks

D1021 Escalators
No site specific content.

D1022 Moving Walks
No site specific content.

D1090 Other Conveying Systems

D1091 Dumbwaiters
No site specific content.

D1092 Pneumatic Tube Systems
No site specific content.

D1093 Hoist & Cranes
No site specific content.

D1094 Conveyors
No site specific content.

D1095 Chutes
No site specific content.

D1096 Turntables
No site specific content.

D1097 Baggage Handling & Loading System
No site specific content.

D1098 Transportation System
Unless otherwise indicated site transportation arrangements shall comply with UK Design Standards and good practice guidance. Such areas covered shall include:

- Traffic signs;
- Road markings;
- Zebra crossings - pedestrian;
- Combined Zebra crossings - pedestrians and cycles;
- Tactile paving at crossings.

D20 Plumbing

General Note:
All plumbing must be fully compliant with the UK Water Regulations Advisory Scheme (as per Water Fittings Regulations), and UK Legionella guidance documentation – current version applicable at time of design and/or installation.

D2010 Plumbing Fixtures

Facilities for disabled to meet requirements of UK Building Regulations Part M: Twyfords Doc M Plus Pack with white fittings.

Twyfords Sola 380 ref WB2516WH one taphole left hand with support bracket SR1315XX with Lever Mixer Spray Tap SF5247CP

SANITARY WARE/ SHOWER FITTINGS

MANDATORY or ADVISORY as noted.

Under ADVISORY, this document includes details of acceptable materials. Materials from other manufacturers that meet these requirements can be submitted with evidence of comparability for review and approval.

(MANDATORY) Sanitary ware. Items selected are robust, likely to be readily available in future and simplifies storage of spares.

This specification is for admin office environments only.

Manufacturer; Twyfords, Lawton Rd, Alsager, Stoke on Trent, ST7 2DF Tel: 01270 879777.
http://www.twyfordbathrooms.com. Technical helpline 0870 840 0437. E-Mail:
twyfordtechnical@twyfordbathrooms.com

Colour of all sanitaryware must be white (ref WH) with chrome fittings.

D2011 Water Closets

Bowl 'Galerie HO' (GN1148WH), 6 litre close coupled cistern and fittings (ref GN 2396WH) Heavy duty seat and cover with s/s bottom fix hinges (ref GN 7815WH).

D2012 Urinals

Concealed flush pipes where possible, including urinal dividers, timer control presence detection and Installation of Infrared motion-controlled detection devices S/S sparge pipe and fittings as required.

D2013 Lavatories

No site specific content.

D2014 Sinks

Basin (550mm x 450mm) with one tap hole and wall bolts,
Or
Countertop (560mm x 445mm) with one tap hole,
Or
Semi-recessed' (500mm x 425mm) basin with one tap hole. Or 'Aria' (405mm outer diameter, beneath countertop option)

To Include the installation of a motion-controlled / infrared hot & cold tap / faucet - in areas of commercial, industrial, office & recreational use area's with step down transformers (NO BATTERIES).

Materials

D2014.1

Application: Family Bathroom Accommodation.
Manufacturer: Armitage Shanks Ltd.
Product Ref: 'Tiffany' range of fittings.
Tested to: N/A.
Colour: White
Material: Vitreous china.
Notes: Size: WHB; 610mm x 470mm x 790mm high; Related Items - '*Curzon*' bath, '*Tribune*' shower unit; '*Armastone'* shower tray; SfB 74.23;

D2014.2

Application: Family Bathroom Accommodation.
Manufacturer: Armitage Shanks Ltd
Product Ref: 'Marlow' (recessed) basin.
Colour: White
Material: Vitreous china.
Notes: Vanity basin fully recessed in work-top. Not suitable for separate pillar taps; 560mm x 420mm x 210mm; SfB 74.23

D2014.3

Application: General - Domestic taps, mixers etc.
Manufacturer: Armitage Shanks Ltd
Product Ref: 'Fairline' plumbing fittings.
Tested to: N/A.
Colour: N/A.
Material: Chrome plated; Brass body.
Notes: Type - Single flow mono-bloc with high rise spout; several alternatives available; Accessible Sanitary Ware is a separate item; Hand-wheel taps.

D2014.4

Application: Offices, Education, Industrial Areas
Manufacturer: Armitage Shanks Ltd.
Product Ref: 'Belfast' cleaners sink.
Tested to: N/A.
Colour: White.
Material: Vitreous china.
Notes: Size – 610mm x 455mm x 255mm high; NB, various alternatives sizes available; Related Items - '*Aqualon'* drinking fountain. '*Wansbeck'* Sink; '*Alders*' cleaners sink.

D2014.5

Application: All Areas
Manufacturer: Armitage Shanks Ltd
Product Ref: Accessible fittings.
Tested to: N/A.
Colour: White (depending on colour contrast).
Material: N/A.
Notes: Conforming With - American Disabilities Act Lantac approved configurations.UK Building Regulations; Document 'M'; Cross Reference - Wheelchair W.C.; Ambulant accessible WC/ Shower/ Bath facility.

D2015 Bathtubs

Twyfords steel bath with slip resistant standing area:

'Neptune 1700mm x 700mm or 1500mm x 700mm to fit, 1,8mm wall thickness' (NE9572WH/NE9472WH)
Bath front and side panel: 'Neptune' to suit.

Chain waste and overflow: Twyfords ref WF 5650 CP

D2016 Wash Fountains

No site specific content.

D2017 Showers

Shower trays: 'Calypso 2', 800mm x 800mm fireclay (FC3103WH with WF 4343CP grid waste).

(Mandatory) Shower Fittings: Use thermostatic/ thermoscopic mixer shower with 'hard water shower heads', plumbed into hot and cold water supplies. Model required: Mira Excel with 5 year guarantee.

Manufacturer: Caradon Mira Ltd, Cromwell Rd, Cheltenham, Gloucestershire. GL52 5EP. Tel: 01242 221221.
http://www.mirashowers.co.uk/

D2018 Drinking Fountains & Coolers

No site specific content.

D2019 Bidets & Other Plumbing Fixture

No site specific content.

D2020 Domestic Water Distribution

Hot and cold water cannot be mixed in the body of the tap to meet UK Regulations. Divided flows are required. 'Logics' chrome plated range of bath and basin mixers, taps and pop-up waste fittings.

Washbasins: Logics basin monoblock (LG5191CP) with pop-up waste and Logics handles LG5800CP.

Baths: Logics deck mounted bath filler (LG5250CP) with Logics handles LG5800CP and chain waste to suit.

Manufacturer: Caradon Mira Ltd, Cromwell Rd, Cheltenham, Gloucestershire, GL52 5EP. Tel: 01242 221221.
http://www.mirashowers.co.uk/

Do not use instantaneous water heaters or power showers without prior approval from 48CES.

D2021 Cold Water Services

Basis of Design

Refer to Index of Specifications and Standards.

Description of System

Cold Water Systems

Where deemed necessary cold water storage tanks will be provided they will comprise GRP pre-insulated, sectional panel type with external flanges, conforming to WRC Water Byelaw 30. The merits of either providing water storage or serving fittings directly from the incoming mains supply will be reviewed during the design stage.

Where water storage is deemed necessary a minimum of 24 hours storage will be provided to maintain the buildings

function in the event of interruption of the incoming mains water supply. The requirement for CWS systems to hold a minimum of 24 hrs supply should be tempered with the recommendation in HSG 274 Pt 2 para 2.36 that, in order to prevent stagnation, a maximum of 24 hrs storage is maintained.

Utilise only approved jointing and sealing materials.

Water storage tanks will be provided in designated plant areas within drained bunded areas, thus in the event of tank failure excess water can be contained and disposed of safely. Water storage tanks will be thermally insulated for protection from freezing and also to ensure stored water temperatures do not exceed 20°C.

The cold water system will distribute throughout the building provide water for domestic purposes, note that all fittings requiring a potable water supply will be served directly from the incoming mains water supply. Where possible all cold water systems served from storage tanks will be gravity systems.

All CWS fed systems should be assessed for category of fluid and the appropriate verifiable backflow prevent device should be fitted I.A.W AF standards.

Where the required distribution pressures cannot be achieved via a gravity distribution system the cold water systems in buildings will be pressurised via automatic duty and standby booster pump sets located adjacent the cold water storage tank.

Duty/ standby pump facilities will be provided as separate pumps and monitored by the base BMS system. Pumps will not be twin headed.

The boosted cold water systems will supply cold water for ablutions and provide a pressure balanced cold feed to the hot water systems.

Showers and wash hand basins will be provided with individually adjustable thermostatic mixing valves to ensure temperature is limit to max 43^{0} C, pressure and direction.

Where acceptable to the local Water Authority toilets and urinals will be provided with internal overflows (similar to US design). If it is essential to use external overflows the must be inconspicuous both internally and externally.

The flushing of urinal cisterns will be controlled via either pressure actuated or solenoid/ time clock/presence detection operation valves to prevent water wastage.

Water conservation devices will be provided to minimise water usage and water wastage. Cold water systems will be provided with all necessary main and subsidiary branch isolation, control and drain down valves to facilitate all the requirements of cleansing, testing, commissioning and maintenance.

All necessary backflow prevention devices (including double check valves and vacuum breakers) will be provided on supplies to all fittings where a Class 'A' type air gap cannot be achieved to ensure that contamination of the cold water supply is prevented. All backflow devices will be International Association of Plumbing and Mechanical Officials (IAPMO) approved devices.

Pipework shall be fully insulated to maintain desired system temperature and prevent condensation and heat transference.

Incoming Mains Water (potable)
A new supply will be provided to each building from the external water main.

Each supply will enter the buildings at ground floor level via a below ground sleeve.

The incoming mains water supply will be provided with a meter with pulse facility to enable remote monitoring. Utility meters will be provided on all new and major renovation projects. Meters need to be AF approved type.

The incoming water main will distribute throughout the building provide water for drinking, culinary purposes and where required supply make up water to cold water storage tanks.

Mains water systems will be provided with all necessary main and subsidiary branch isolation, control and drain

down valves to facilitate all the requirements of cleansing, testing, commissioning and maintenance.

Booster pumps will not be directly connected to incoming mains supplies. If there is a necessity to pressurise the incoming mains supply a break tank will be provided between the incoming mains supply and booster pump set.

Buildings will be provided with at least one drinking fountain per floor occupied by ten or more personnel. Drinking fountains will be installed either recessed or semi-recessed pattern. All necessary backflow prevention devices (including double check valves and vacuum breakers) will be provided on supplies to all fittings where a Class 'A' type air gap cannot be achieved to ensure that contamination of the mains water supply is prevented.

Pipework will be fully insulated to maintain desired system temperature and prevent condensation and heat transference. Insulation should be up to point of use. Pipework should have visible cross bonding at each point of use.

Metal pipework running within the ground shall have Cathodic protection provided. Metal pipework should not be permitted in the ground. MDPE/ HDPE should be utilised instead.

Testing & Commissioning

Method statements will submitted for approval relating to all testing and commissioning procedures.

Testing and commissioning will be carried out in accordance with the procedures laid down in the appropriate code of practice.

Testing and commissioning will include all necessary adjustment and re-testing of plant to meet the design duties.

Schedule of Materials

Description	Materials
Cold water pipework	Copper to BS EN 1057/12449, Jointed with lead free capillary fittings conforming to BS EN 1254.
Incoming water main pipework	Copper to BS EN 1057/12449 Jointed with lead free capillary fittings conforming to BS EN 1254.

D2022 Hot Water Services

Basis of Design

Refer to Index of Specifications and Standards.

Description of System

Domestic Hot Water Systems

The merits for provision of either centralised hot water generating plant or local hot water plant will be assessed against the proposed function of the building being designed. Buildings that contain a small demand may benefit from the provision of local electric semi-storage units whereas buildings with a high demand will be better served from centralised gas or oil fired hot water generating plant. Design calculations will be provided to verify the most cost effective and energy efficient solution. Complete with maximum load demand/ histograms.

Centralised hot water generators will be provided in designated plant areas within drained bunded areas, thus in the event of failure excess water can be contained and disposed of safely.

The hot water system will distribute throughout the building to provide water for domestic purposes.

Where the required distribution pressures cannot be achieved via a gravity distribution system the hot water systems cold feed in buildings will be pressurised via automatic duty and standby booster pump sets. Pressurising hot water systems dictates that centralised hot water plant will be unvented system arrangements complete with all necessary expansion and safety devices.

Centralised hot water installations will incorporate secondary circulating pipework, pumps and thermostats to maintain hot water within the system between 65°C – 60^{0}C. Central hot water installations will have the provision to raise the circulated water temperature to 70°C for short periods. Not automatically but by manual procedure.

Centralised hot water installations will be provided vertical pattern and not horizontal. Calorifiers will be provided with the minimum of the following equipment: safety valve, bursting disc, temperature gauge, pressure gauge, de-stratification pump [to be controlled by BMS or fitted with a timer], drain off cock, ancillary control devices, copper or stainless steel lined.

Hot water and heating Calorifiers shall be suitable for use on a pressurised system.

Calorifiers shall be selected to withstand the system design working pressure and fitted with a destratification recirculation pump.

All calorifiers shall have the primary side generated by LTHW/ MPHW/ HTHW to suit the actual location and application. They shall be of the vertical pattern.

A back up immersion heater to give 2 hour recovery shall be installed in each Calorifier. Control of immersion elements to be by pocket control thermostat and high limit manual reset thermostat. Do not use BMS control or sensors to control this back up heat source (BMS can enable & monitor).

No non-storage Calorifiers will be permitted unless authorised by the base Engineer.

Boosted cold water systems will supply cold water for ablutions and provide a pressure balanced cold feed to the hot water systems.

Water conservation devices will be provided to minimise water usage and water wastage. Consideration will be given to the provision of water efficient fittings and appliances.

Hot water systems will be provided with all necessary main and subsidiary branch isolation, control and drain down valves to facilitate all the requirements of cleansing, testing, commissioning and maintenance.

All necessary backflow prevention devices (including double check valves and vacuum breakers) will be provided on supplies to all fittings where a Class 'A' type air gap cannot be achieved to ensure that contamination of the hot water supply is prevented. All backflow devices will be International Association of Plumbing and Mechanical Officials (IAPMO) approved devices.

Local point of use thermostatic blending valves will be provided on wash hand basins to limit hot water temperatures at appliances to between 39-43^{0}C.

The following points will be considered during the design of hot water installations, avoid dead legs in pipework, avoid stratification in storage vessels, provide access to storage vessels, utilise only approved jointing and sealing materials and include provision for fully draining down all parts of the system.

Showers will be provided with individually adjustable thermostatic mixing valves to ensure temperature is limit to maximum 43^{0}C and that pressure and direction is controlled.

Pipework shall be fully insulated to maintain desired system temperature and prevent condensation.
Consideration will be given to the provision of base exchange water softening plant and softened water storage/supplies to areas such as kitchens where equipment that include an evaporative process are installed. This requirement for softened water will be assessed during the design to ensure the installed equipment is afforded adequate protection from the detrimental effects of hard water deposits.

Testing & Commissioning
Method statements will submitted for approval relating to all testing and commissioning procedures.

Testing and commissioning will be carried out in accordance with the procedures laid down in the appropriate code of practice.

Testing and commissioning will include all necessary adjustment and re-testing of plant to meet the design duties.

Schedule of Materials

Description	Materials
Hot water pipework	Copper to BSEN 1057/12449 Jointed with lead free capillary fittings conforming to BSEN 1254

D2023 Domestic Water Supply Equipment

No site specific content.

D2030 Sanitary Waste

D2031 Waste Piping

Above Ground Sanitation System

Basis of Design

Refer to Index of Specifications and Standards.

Description of System

The sanitary pipework system will collect discharge from water closets, wash basins, urinals, cleaners sinks, tea sinks and plantroom gullies plus all other sanitary appliances.

The sanitary pipework system will remain independent to the point of connection with the underground drainage system.

The sanitary pipework system will be a modified single pipe arrangement ventilated to atmosphere.

Soil and waste stacks will pass vertically through the building collecting branch connections from sanitary appliances and equipment.

Soil and waste stacks will connect to the below slab gravity foul water drainage system at ground floor level.

Soil/ waste pipes and associated branch discharge pipes will be provided with rodding access on all stacks above each floor level, at all changes of direction, at the ends of all branch runs and directly above floor level prior to connection to drain.

Large toilet facilities will be provided with trapped open top back inlet gullies to facilitate washing down.

The sanitary pipework system will be ventilated to atmosphere to avoid the accumulation of foul air and minimise pressure fluctuations within the pipework system.

Pipework in ventilated riser shafts and false ceilings will be insulated to avoid the formation of condensation.

UPVC sanitary pipework that penetrate fire barriers will be provided with intumescent fire sleeves to maintain fire separation.

Consideration will be given to the potential treatment and re- use of waste water discharge from buildings.

Testing & Commissioning

Method statements will submitted for approval relating to all testing and commissioning procedures.

Testing and commissioning will be carried out in accordance with the procedures laid down in the appropriate code of practice.

Testing and commissioning will include all necessary adjustment and re-testing of plant to meet the design duties.

D2032 Vent Piping
No site specific content.

D2033 Floor Drains
No site specific content.

D2034 Sanitary Waste Equipment
No site specific content.

D2035 Pipe Insulation
No site specific content.

D2040 Rain Water Drainage

D2041 Pipe & Fittings
No site specific content.

D2042 Roof Drains
No site specific content.

D2043 Rainwater Drainage Equipment
No site specific content.

D2044 Pipe Insulation
No site specific content.

D2090 Other Plumbing Systems

D2091 Gas Distribution Compressed Air & Medical Gases

Basis of Design
Refer to Index of Specifications and Standards.

Description of System
Compressed Air
The installation of Compressed Air systems shall conform to the DE specification "Compressed air pipework instructions up to 30 bar working pressure. Standard Specification M&E No 136".

All work on the Compressed Air system shall be carried in accordance with the Safety rules and procedures for work on boilers and pressure systems.

Safe system of work at RAF Lakenheath is under JSP 375, Volume 3, Chapter 4. (Mechanical Systems) and Chapter 4 (Electrical Services).

Compressed Air Pipework
Piping shall comply with the following standards:

- BS 1387 for steel tube up to 100mm nominal bore, 'Medium' tube up to and including 10 bar, and 'Heavy' tube for pressures above 10 bar.

- BS 806 and BS 3602 for steel tube greater than 100mm nominal bore.
- BS EN 1057 / BS EN 12449 for copper tube up to and including 22mm nominal size and for working pressures not exceeding 4 bar. Copper tube shall not be used for pipes exceeding 22mm size and working pressure over 4 bar.
- ABS pipework shall comply dimensionally with BS 5391 Part 1 – for Imperial pipe and BS 5556 for Metric Pipe.
- Steel tube shall be galvanised both internally and externally.

ABS Pipework

- may be used for working pressures up to 10 bar, where the ambient temperature of the pipe will not exceed 35°C. Temperatures up to 42°C may be tolerated for short periods, e.g. overheating on hot summer days. Ambient temperatures down to -20°C are permissible provided the pipework and fittings are lagged to prevent freezing of the contents;
- shall not be used where exposure to strong acids, strong alkalis or organic solvents is likely, or to oils having a high aromatic value or oxidising properties. The ABS pipework manufacturer must be consulted and his recommendations are to be strictly adhered to;
- shall not be site bent, only factory made bends or fittings shall be used to effect changes or direction. Neither shall ABS be subjected to excessive vibration.
- shall be jointed by using the pipe manufacturers own bends and fittings. Joints shall be cold solvent welded in accordance with the manufacturer's instructions;
- shall not be threaded, connections to metal components being achieved through adapters or composite unions, which can be cold solvent welded onto the ABS pipe and the composite fitting then screwed or bolted etc., to the other component;

Connections

Screwed joints, excluding screwed on flanges, may be used for steel pipes up to and including 80mm nominal bore pipe, providing that the maximum permissible pressure (in practice this shall be taken as the test pressure) does not exceed those specified in BS 806 Table 3. Taper pipe threads shall be used with taper threaded fittings and shall comply with BS 21.

Long screws with back nuts shall not be used for pipe connections.

Welded joints, or flanged joints with the flange welded on, shall be used for steel pipe with maximum permissible pressure in excess of those specified in BS 806 Table 3 and for steel pipe above 80mm nominal bore irrespective of pressure.

Compressed Air Traps, Regulators & Filters

All compressed air traps regulators and filters shall be as manufactured by Spirax Sarco, Cheltenham GL53 8ER

Compressed Air Isolation Valves

All isolation valves shall have provision for mechanical "padlocking"

All compressed air isolation valves shall be Spirax-Monnier ball valve type.
Note requirement for "double isolation".

Written Scheme of Examination

The Mechanical Contractor shall provide a 'Written Scheme of Examination' certified by Base nominated 'Competent Person' all as defined in Pressure System Safety Regulations 2000 (PSSR 2000), in respect of ALL of the gas and compressed air installations. Provision shall also include advice and training the user on the scope of the 'Written Scheme of Examinations' and on necessary maintenance expected from the user to comply with the Written Scheme of Examination and the Regulations including the maintenance of records to comply with the above Regulations.

Medical Gases

Piped medical gases shall be installed by a specialist contractor who is competent and familiar with the installation of such systems and is fully conversant with all current legislation and safety requirements.

Materials

Pipework materials shall be manufactured by a licensee of the BS 5750 Quality Assurance Certification Scheme and all pipe and fittings to be marked with the BSI kitemark and subject to the following requirements:

Pipes Shall:

Be in accordance with BSEN 1057/ BSEN 12449 using solid drawn seamless non-arsenical de-oxidised copper to BAS 6017: Grade C106.

Up to and including 54mm OD be degreased as follows: Be steam cleaned internally, dried, shot blasted and blown through with medical quality air and individually sealed with plastic caps at each end after passing a visual internal examination.

Over 54mm OD be degreased as follows: Be cleaned as above or alternatively, be solvent cleaned with Trichloroethylene or Methyl Chloride leaving no poisonous residues, dried and individually sealed with plastic caps at each end after a visual internal inspection.

Be sealed in bundles with an adhesive tape marked `degreased pipes'.

Be accompanied by manufacturers certification that degreasing and subsequent complete removal of degreasing agent has been carried out.

Materials for pipe jointing fittings shall be phosphorus de-oxidised, non-arsenical copper to BS EN 1254

NOTE: For straight couplings, `expanded' joints may be made instead of using BS EN 1254 Part 2: 1971 fittings.

In Line Regulators

Shall be of a type manufactured to BS 5741 and ISO 2503 quality managed to BS 5750.

Shall be of a brass body with a ¼" NPT male RH inlet connection and a 3/8" BSP male LH or RH outlet connection depending on the gas.

Main Riser Drains

Drain traps shall be positioned at the bottom of each air and vacuum main riser and shall consist of 2 No. valves, (2 No. to be lockable) and a suitable spacing piece between them.

Flashback Arrestors

Flashback arrestors shall be installed at the bench positions and on the manifold position of the gas distribution pipe for argon, hydrogen, oxygen, propane, acetylene and nitrous oxide.

Line Valves

Line valves shall be manufactured of non-ferrous materials. Shall be capable of withdrawal from the pipework.

Shall be of the ball lever type. Open and close with a 90° turn of
the lever, the valve to be closed when the lever lies at right angles to the pipe run.

Shall carry a batch reference number.

Shall have a manufacturer's certificate supplied for each valve or batch of valves stating they have been:

Pneumatically pressure tested to establish their suitability for working at pressures up to 10 bar for all systems.

Cleaned and degreased and that any solvents have been completely removed.

Other Fittings

Other fittings for connection to copper pipes, e.g. valve and control panel fittings, may be of copper, brass, gunmetal or bronze to the appropriate standard.

Cleaning

All pipes shall be cleaned and degreased as for oxygen service and be free of particulate matter and toxic residues. They shall be individually capped at both ends and delivered to site identified as `degreased pipes'.

Note: Pipes shall only be cut with pipe-cutters, not hacksaws to prevent the ingress of particulate matter.

All pipe jointing fittings and sub-assemblies of fittings for connection to pipes shall be cleaned and degreased as for oxygen service and be free of particulate matter and toxic residues. They shall be individually sealed in bags or boxes and delivered to site identified as `degreased fittings'.

Jointing Techniques

Mechanical Joints:

Mechanical flanged joints may be made where pipelines are connected to items such as valves and control equipment, and for vacuum pipelines of 74mm diameter and above.

Brazing copper to brass/ gunmetal/ bronze:

Brazed joints shall be made using a copper-silver-zinc brazing alloy to BS 1845: 1977 and an appropriate flux.

The flux residues and copper oxides created by this process shall be chemically removed and if necessary the complete assembly shall be cleaned and degreased as for oxygen service.

No flux shall be used for making joints on site. Joints made shall be carried out under controlled conditions off-site and sub- assemblies delivered to site in sealed bags or boxes.

Note: Where brass/gunmetal/bronze fittings form part of an installation, they shall be supplied to site individually packed and complete with copper pipe tails brazed to them so that these fittings can be joined to the pipeline installation by fluxless brazing.

Because of this requirement, it will be necessary for a copper to copper brazed joint to be made adjacent to these fittings, e.g. in a wall adjacent to a terminal unit or valve.

Brazing Copper to Copper Joints:

Brazed joints shall be made using a silver-copper-phosphorus brazing alloy to BS 1845: 1977. No flux shall be used.

Brazing shall be carried out using commercial grade carbon dioxide or nitrogen as an internal inert gas shield, to prevent the formation of oxides on the inside of the pipes and fittings.

Use of CO_2 or N^2 Internal Inert Gas Shield

Application

CO_2 or N_2 shall be supplied to the inside of the pre-assembled, unbrazed pipework through a pressure regulator and flow controlling or flow indicating device.

Note: It is recommended that the pipeline to be brazed shall first be flushed to remove the air. This may be followed during the brazing operation by a continuous or intermittent flow as necessary, to prevent the ingress of air. Pipe ends may be capped if desired to direct the flow or purge gas into sections of the pipe or pipes being brazed. Particular attention should be given to the purging of T-joint fittings.

Safety

If working for prolonged periods in very confined spaces, precautions shall be taken to avoid excessive build-up of purge gas, by ventilating the space or by piping the waste purge gas safely out of the space. Precautions shall also be taken to ensure that the purge gas level may be monitored while brazing is taking place in very confined spaces, also before entering any confined space after an overnight break.

RAF Lakenheath operates a permit to work system for entry into all confined spaces. Contractors are required to comply with this safe system of work.

Note: The TLV of carbon dioxide is 0.5% for an 8 hour period. Up to 4% can be tolerated for short periods, but changes in breathing rate may be experienced. If considered necessary, the purge gas level may be monitored while brazing is taking place in very confined spaces, also before entering any confined space after an overnight break.

Note: Nitrogen cannot be detected by an oxygen deficiency monitor can be used in these circumstances.

Other installation processes

As well as during brazing, purge gas shall be used internally on pipework - whenever annealing or hot forming of pipework is carried out.

Inspection of Joints

To demonstrate the competence of the craftsmen in fluxless brazing techniques, test joints shall be requested prior to the installation commencement.

When an installation has reached a stage prior to testing, the Client has the right to request a maximum of 5 joints to be cut out until the extent of the defective joints has been established.

A joint is considered satisfactory when the penetration of brazing alloy is a minimum of 3mm at any point, and the internal surface is clean and free of oxide when wiped with a tissue or cloth.
Some heat burnishing may be apparent and is acceptable.

Capping

Sections of pipeline shall be capped to prevent the ingress of dirt, as soon as they are completed.

Protection of Pipelines

Copper pipelines passing through walls and partitions shall be inserted through copper sleeves which conform to BS EN 1057/ BS EN 12449 Sleeves shall project 200mm beyond finished floor levels and 6mm beyond wall and ceiling finished surface.

Sleeves shall be fitted with wall plates only where exposed.

Pipelines shall be protected individually when passing through floors and fire compartment walls. Surface run pipes shall be protected individually or collectively above finished floor level and up to a height of 1.3 metres.

Pipework in contact with wood shall be wrapped with two layers of PVC adhesive tape half lapped.

Dry wall partitions which form fire sub-compartment walls shall only be penetrated by horizontal pipes passing through normal to the wall.

Where pipes are run in chases in plastered or rendered walls the pipes shall be protected by wrapping with two layers of PVC adhesive tape half lapped.

Where pipes pass through unventilated spaces (in ceiling voids without air movement, i.e. corridors etc.) shall be sleeved and no mechanical joints made as covered by the BCGA Code of Practice.

Identification of Services
Pipelines shall be identified to the following:

Comply with BS1710.

Services shall be identified by means of self-adhesive 2-ply vinyl tapes arranged to overlap so that the tape adheres to itself as well as the pipe.

Identification tape shall be placed at all junctions, at both sides of valves, service appliances, bulkheads, wall partitions, at any change of direction and at 3 metre intervals along the line.

The self-adhesive vinyl tapes shall be not less than 50mm wide and shall include 6mm high BLACK lettering to indicate the name of the service and the installer's logo or name.

Be painted in accordance with the recent B.S. (colour coding).

Testing and Commissioning
Tests and checks during the contract period shall be witnessed and certified by the Engineer or the Responsible Officer.

This will in general be the Clerk of Works (M&E) for a particular project, or for medical gases may be the authorised person for the system.

The Specialist Installer shall provide the Engineer with triplicate test certificates for each of the test specified and shall be witnessed by the Engineer or the Responsible officer.

The following tests and checks shall be carried out during the contract period:

Pressure test for leakage in pipelines only. Valve tightness and correct valve zoning test. Test relief valve operation.
Check for cross connections (sometimes referred to as `anti- confusion test' or `continuity test').

Check satisfactory operation of manifold change-over and operation.

Check performance of alarm signaling system.

Purge the completed system with medical air and test for the presence of particulate matter.

General Conditions
The section to be tested shall be completely installed and fixed securely.

Purge systems to remove all particulate matter. Termination points shall be blanked.
Other devices such as pressure switches shall not be fitted. All connections for such devices will be blanked.

A test unit with gauge will be fitted to the section under test. The gauge must have certification stated.

The installation must fully comply with the current British Standards and BCGA Codes of Practice and meets their safety standards.

Corrosion Control
Refer to Specialist Base Standards.

48 CES Base Corrosion Control Engineer publishes Local Operating Instruction LAKI 32-1054.

D2092 Acid Waste Systems
No site specific content.

D2093 Interceptors
No site specific content.

D2094 Pool Piping & Equipment
No site specific content.

D2095 Decorative Fountain Piping Devices
No site specific content.

D2096 Other Piping System
No site specific content.

D30 HVAC

D3010 Energy Supply

Safety Rules & Procedures

Boiler & Pressure Systems.
All work carried out on Boilers heating and pressure systems shall be carried out in accordance with RAFL Safe system of work for MECHANICAL SYSTEMS is under JSP 375, Volume 3, Chapter 4.

Before any work is undertaken on a boiler or pressure system, a Permit to Work (PTW) or a Standing Instruction (SI) must be obtained from the Authorised Person (AP) Mechanical.

All persons undertaking work on Boilers heating or pressure systems must be appointed & registered mechanical and/ or as necessary electrical skilled persons under MoD JSP 375.

All operatives undertaking welding shall have formal documented qualifications & experience appropriate to the welding operation required. Operative and employing company working on the gas installation shall hold current Gas Safe registration.

These regulations shall apply to work being carried out on the following systems.

- Pressurised heating systems.
- Steam and Condensate systems.
- Pressurised Chilled water systems.
- Pressurised Water systems.
- Refrigeration systems.
- Compressed Air systems.
- Gas systems.

Isolation valves are required at the start of all systems and all main isolation points. These valves shall be fitted in pairs to give double isolation.

Double isolation valves shall be of the quarter turn, full flow ball valve type complete with the facility to be locked in position.

A proving point shall be installed between the two isolation valves and after the second valve to enable testing of the valves to occur. Refer to Double Valve Guidance diagram within D3020.

The proving point shall also have lockable isolation valves installed. Double isolation valves shall also be fitted to all major equipment such as boilers, pumps, unit heaters etc. Radiators will not require this double isolation facility.

Double isolation shall also be provided on steam and condensate installations, this includes steam traps and vents.

Compressed air systems shall also be fitted with double isolation. Pad lockable proving/ vent points also a requirement.

Refrigeration systems shall only require single valve isolation as will pressure gauge connections.

Every plantroom shall have an AI size schematic drawing complete with valve chart to identify all valves. In locations where drains discharge into a common drain point it shall be clearly visible which drain is discharging. If necessary visual indication shall be provided on the pipe line.

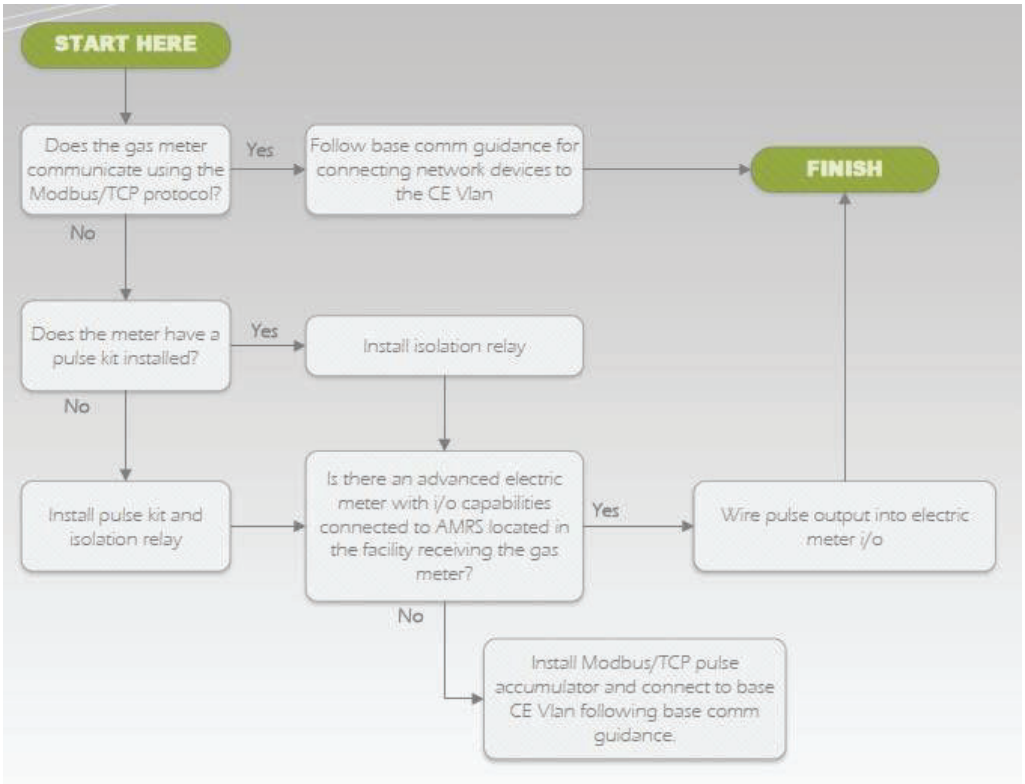
D3011 Oil Supply System

Refer to Specialist Base Standard

D3012 Gas Supply System

[Refer also to D5012 Low Tension Service & Distribution – SMART METERING]

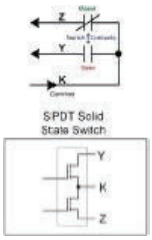
AMRS Compatibility Guide for Gas Meters:



WHAT ARE KYZ PULSES?

KYZ pulses are used to transmit instantaneous gas consumption information from the gas meter to another piece of equipment. The downstream (receiving device) may be a pulse accumulator, an electric meter, a data acquisition server, etc. A KYZ interface (SPDT) includes two switch contacts; Y and Z. The electric current travels/ toggles between K and these two switch contacts (Y and Z) changing from one state to another. A pulse is defined as this change of state, and represents some amount of flow that has gone past the meter, or in other words, consumed by the customer.

When consumption is high the speed of switching from K – Y to K – Z increases, and as consumption declines the switching slows. While the speed of switching increases and decreases with consumption, the duty cycle (time each switch is closed) is always approximately 50/50; meaning that each side s on and off times are the same. This provides a universal way to record and transmit gas usage information.



AMRES COMPATIBLE PULSE ACCUMULATORS & ISOLATION RELAYS

An AMRS compatible pulse accumulator is a device that has been tested thoroughly in the AFCEC AMRS meter lab. Tests include the following: communication protocol compatibility, cyber security testing and configuration baseline development.

MAKE	MODEL
Adams	6051
Acromag	989EN-4016
SSI	PMC-1
E-mon	EIDER

An isolation relay is a device that should accept a form A or C pulse and filter noise to prevent noise from triggering a false output, the isolation relay should also have a fused output to offer protection from lightning or transient voltage damage.

AMRS Compatible Gas Meter Specifications

AMRS compatible gas metering solutions consist of a componential system to achieve the goal of delivering gas consumption data into the AMRS. To accurately scale output pulses the contractor shall obtain building gas usage from base personnel, taking into account peak demand when sizing the components that are necessary as well as determining peak pulse rate as to not saturate the receiving device and risk losing captured pulse data. The various components that may be necessary include but are not limited to the following: Gas Meter, Pulse Kit, High Speed Dividing Pulse Relay, Accumulator, Electric Meter with digital input availability.

- Pulse kit must be able to produce a two-wire (Form A) pulse output.
- Pulse output shall be delivered to a high-speed dividing pulse relay that has the capability of producing a wetting voltage if necessary.
- High speed dividing pulse relay shall provide isolated pulse outputs (Form A) that shall be delivered to an AMRS compatible electric meter.
- In the event a facility does not have a compatible AMRS electric meter a high-speed dividing pulse relay shall provide isolated pulse outputs (Form A) that shall be delivered to an accumulator that speaks the Modbus protocol natively and can communicate to AMRS via the Modbus/ TCP protocol
- Gas Meters that can communicate to AMRS via the Modbus/ TCP protocol may be acceptable if they can pass technical and cybersecurity evaluations directed by the AMRS PMO. At this time there are no tested or approved Modbus/ TCP gas meters.

AMRS Compatible Translation Devices & Accumulators

The following devices are compatible with the AMRS platform, are consistent with the need of the existing site conditions, have been tested and passed cybersecurity requirements:

- Advantech ADAM-6051 I/O Modbus TCP Module with firmware v5.04 B01
- Perle IOLAN SDS1P Serial to Ethernet Device Server with firmware v4.6 F1

The following device was evaluated and is not compatible with the AMRS platform, and is not cyber secure:

- Perle IOLAN DS1 Serial to Ethernet Device Server

Typical Stored Data

Measured Parameter	Meter-Typical	AMRS Namespace
Consumption Interval (15-minutes)	Interval	Calculated (delta value Internal to CEM object)
Demand	Block Average	Calculated (total and peak)

D3013 Coal Supply System

No site specific content.

D3014 Steam Supply System

Steam & Condensate System

The installation of the steam and condensate system shall conform to the DE specification 036. Pipework for steam mains and branches less than 125mm nominal bore shall be either BS 1387 Black Heavy Tube, carbon steel to BS 3601 S410 or BS 3601 ERW410. Pipework 125mm nominal bore or greater than 125mm NB shall be either carbon steel to BS 3601 S410 or BS 3601 ERW410.

Joints in pipelines and fittings shall be welded and comply with BSEN 10253-1.
Steel welding neck or slip-on flanges shall be used for connection to valves and at dismantling points. Flanges shall be raised face to BS 4504. Flange joints shall be made with gaskets inside the bolt circle to BS 3063.

All pipeline equipment including pressure reducing valves, steam separators, traps, Vacuum breakers, sight glasses, check valves, air vents, trap monitors, vent heads etc. shall be as noted on the drawings and shall be as manufactured by Spirax Sarco Ltd. or equal and approved.

Condensate pipework shall be copper to BS EN1057/ BS EN 12449 and have bronze welded fittings or heavy duty silver solder fittings.

Steam Flow Meter

The steam flow meter shall be selected for a minimum duty of 120% of the total steam load required. The system shall have density and dryness compensation and display instantaneous rate of flow, total of flow pressure and temperature (both metric and imperial units).

The steam flow meter shall be as manufactured by Spirax Sarco Ltd, or equal and approved. The information recorded by the steam flow meter shall be recorded on the B.M.S system.

Insulation

All steam and condensate pipework shall be insulated, whether concealed or exposed. The insulation shall be in accordance with DE specification 036.

Written Scheme of Examination

The Mechanical Contractor shall provide a 'Written Scheme of Examination 'certified by nominated 48 CES 'Competent Person' all as defined in the Pressure System Safety Regulations 2000 (PSSR 2000). Provision shall also include advice and training the user on the scope of the 'Written Scheme of Examinations' and on necessary maintenance expected from the user to comply with the Written Scheme of Examination and the Regulations including the maintenance of records to comply with the above Regulations.

D3015 Hot Water Supply System

Hot water systems from centralised HWS cylinders/ calorifiers where incorporating lengthy distribution system runs will use secondary pumped flow & returns.

"Trace heated" HWS pipework will NOT be permitted for legionella control/flow pipework.

D3016 Solar Energy Supply System

No site specific content.

D3017 Wind Energy System

No site specific content.

D3020 Heat Generating Systems

Heating - Basis of Design

Description of Systems

Areas that are used for administrative employment and living areas shall have an internal design temperature for personnel comfort as stated in UFC 3-410-01.

Areas that are used for employment involving physically active work shall have an internal design temperature for personnel comfort as stated in UFC 3-410-01.

Storage areas where there is a requirement to prevent freezing shall have an internal design temperature as stated in UFC 3-410-01. Warehouse facilities for the storage of materials not subject to freezing should not be heated. Warehouse facilities containing materials subject to freezing should be designed to maintain an inside temperature of as stated in UFC 3-410-01. Warehouse areas with active employment should be designed to maintain an inside temperature as stated in UFC 3-410-01. Areas with inactive employment or where administrative functions are performed should be partitioned and maintained at a temperature as stated in UFC 3-410-01.

Heat Pumps to heat (and cool) structures shall be used on a limited basis. This equipment has not proven to be reliable and maintainable. Part L of the Building Regulations may however drive increased use of A.S.H.P "air source heat pump", (may will to be considered in future new builds or refurbishments.

The use of electric resistance heat is prohibited, unless authorised by the Civil Engineer. External design conditions: As current CIBSE Guide A/ASHRAE Handbook standards. Air infiltration: As current CIBSE Guide A/ASHRAE Handbook standard.

Heating Systems

Domestic Heating: Heating of living areas shall be in general L.T.H.W. radiators. All radiators shall be thermostatically controlled by a Drayton TRV 3 or equivalent. No electric kick plate heaters shall be fitted. Where kick plate heaters are used they shall be fed from the LTHW system. Room thermostats and cylinder thermostats to be as Honeywell manufacture.

Commercial Heating: Heating of administrative areas can be by L.T.H.W. radiators, unit heaters, convectors, or warm air systems to suit the application. In accessible facilities, medical or school buildings low surface temperature radiators shall be used.

Radiant Heating: In large workshops/hangars radiant warm air heating systems (example Bldg. 1212) Sonning 2 system are the preferred option. Any proposals for alternative systems are to be accompanied by full cost benefit analysis. In small workshops radiant "wet pipe" systems are preferred.

Thermostats: Adjustable thermostats will not be permitted without BCE/ CEO approval; localised sensors shall be utilised whenever possible.

Definitions

For the purpose of this guide the following definitions apply:

- Low temperature hot-water (LTHW) system. A system which operates at temperatures up to a maximum of 100ºC but is not part of an MTHW or HTHW injection system. Conventionally 82°C/71°C for radiators.

- Medium temperature hot-water (MTHW) system. A pressurised system, either open or closed to the atmosphere, which operates at a temperature above 100°C and up to a maximum of 120°C and at a gauge pressure up to a maximum of 3.4 bar.

- High temperature hot-water (HTHW) system. A pressurised system closed to the atmosphere which operates at a temperature above 120°C and at a gauge pressure up to a maximum of 10.3 bar.

- Steam services. Steam heating and/or distribution systems with working gauge pressure up to a maximum or 10.3 bar.

System Design

Low pressure hot water system design criteria.

Maximum pressure drop 200pa/ metre run on heating water pipework. Maximum velocity 1 metre/ sec. on heating water pipework.

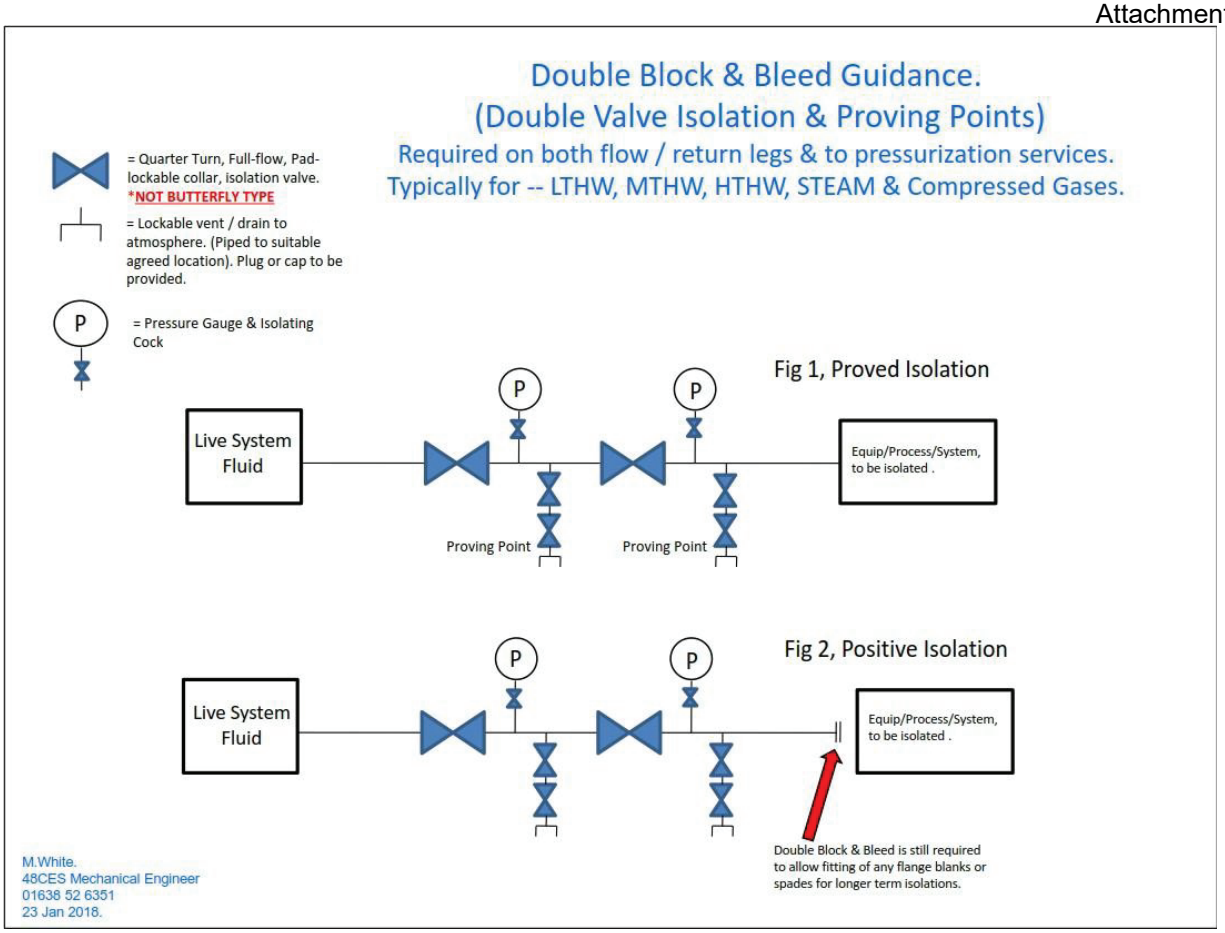
Heating Control Valves & Dampers

All motorised valves/ actuators and dampers shall have the facility for manual operation locally, i.e., if electric motor fails or control system fails, operator can manually disengage or declutch motor from valve and set to desired position.

Heating System Isolation Valves

Where isolation is required on the heating system the valves shall be full bore, quarter turn ball type rated to suit the service temperature and pressure requirements. All isolation valves shall have the facility to be integrally locked in position.

48CES requirement for double block & bleed DBB isolation is to facilitate compliance with JSP 375, Vol 3, Chapter 4 and also as a specific isolation risk reduction measure to As Low as Reasonably Practicable (ALARP) levels.



Identification & Painting

Identification and painting to all items shall be in accordance with the DE Specification 036. All pipework shall be colour coded to BS 1710.

All valves shall be labelled and referenced on the record drawings and on plantroom schematic/valve chart.

All equipment shall be fitted with identification plates.

Pipework Expansion

Pipework shall be supported in such a manner as to permit free movement due to expansion and contraction and arranged so as not to exert undue forces on the structure.

Provision for movement due to expansion and contraction shall be made by either loops or angular bellows.

Adequate supports at such points shall be arranged to ensure that they do not restrict movement. Branch connections at floors and radiators shall be configured to allow movement of the branch without causing undue stress.

The use of axial bellows shall only be allowed subject to demonstration by the Structural Designer that imposed loads can be accommodated.

Flexible Connections

Flexible connections shall be of restrained type as manufactured by Engineering Appliances or equal and manufactured from components suitable for the system temperature, pressure and usage.

Fire Stops

Pipework passing through compartment walls and floors shall be suitable fire stopped with proprietary seals and not oversized sleeves and packing.

Earth Bonding

All parts of the system shall be bonded to earth

Water Treatment

Significant construction, refurbishments & repair;

"Contracts that include Heating, Ventilation & Air-Conditioning systems shall include provisions for the contractor to provide water treatment testing & maintenance for the duration of the construction project warranty period"

Above required by AFI 32-1054, November 2014, Corrosion Control, Specifically Para 4.5.4.

Screw fit durable label(s) at/ adjacent dosing pot positions indicating total system measured volume in Litres and treatment chemical(s) added, i.e. Inhibitors, Biocides, Antifreeze (25%).

Volume detail to be melamine engraved (chemicals added can be by dymo type stick on to melamine backing) – (as treatment regime chemicals could change in the future)

Industrial Water Treatment (IWT)

Provide & install a chemical dosing pot(s) to LTHW, MTHW, HTHW & Chilled Water/Glycol systems. Dosing pots will be appropriately sized & physically matched to the calculated or measured volumes & pressures of the systems concerned.

The dosing pot, unless agreed otherwise in writing with the Base Corrosion Engineer will be connected directly across the system circulating pump(s) suction & discharge points to ensure adequate delivery differential pressure is available to circulate chemical concentrate quickly. Flow & return connections to the dosing pot will be via double valve isolation lockable full flow ball valves. (Additional proving points not required in this particular instance).
LTHW, MTHW, HTHW & STEAM systems will be provided with a dedicated sample cooler. This will be connected to a point in the pressure system that will provide representative samples & cooling via a cold water service connection ensuring suitable local non-return valves are included.

(MANDATORY)
BOSS X-POT of suitable designer assessed size and pressure rating for the system is the approved combined dosing pot and side stream filter. This will satisfy requirements for facilitating safe, controlled introduction of treatment corrosion inhibitors, biocides and small quantities of antifreeze glycol with side stream filtering capability. Include manufacturer fitted thermal insulating jacket at time of install.

Domestic, family housing LTHW only systems are not required to have sample coolers.

The chemicals shall be those used by 48 CES I.W.T Contractors used to provide base-wide industrial water treatment services & chemicals to closed heating & cooling. Chemical should be compatible in all respect with system metals present. 48 CES/ CEO Corrosion Control Officer - Comply with LAKI 32-1054 regarding approvals process for any treatment chemicals proposed.

Industrial Water Treatment will be provided in accordance with British Standards i.e. B.S 8552:2012 and associated standards, UFC 3-240-13FN:2005, AFI & LAKI 32-1054 and BSRIA guidance BG 50/2013.

Schedule of Materials

Description	Material
Heating systems	Heavy weight mild steel BS1387 Pipework Radiators - Steel panel

Materials

D3022.1

Application: Base Wide – Corrosion Control.
Manufacturer: Ondeo Nalco
Product Ref: Ondeo Nalco
Tested to: N/A
Colour: N/A
Material: N/A
Notes: Formulated as a multipurpose treatment to inhibit corrosion, scale, boiler noise and hydrogen gassing in all types of indirect heating systems including those containing aluminium components.

D3022.2

Application: Base Wide – Corrosion Control
Manufacturer: N/A
Product Ref: Sentinel X100.
Tested to: N/A
Colour: N/A
Material: N/A
Notes: Inhibitor - Formulated as a multipurpose treatment to inhibit corrosion, scale, boiler noise and hydrogen gassing in all types of indirect heating systems including those containing aluminium components.

D3022.3

Application: Base Wide – Corrosion Control
Manufacturer: Furnox Product Range.
Product Ref: Furnox.
Tested to: N/A
Colour: N/A
Material: N/A
Notes: -.

D3021 Boilers

General Requirements

All boilers shall be high efficiency with the capability of being stacked to give compact high output if required. They shall be of steel fabrication and have a reverse flame combustion firing pattern, manufactured to BS 855/2790. All boilers shall be oil fired (Automotive diesel fuel) BS EN 590 but capable of a burner change to run on alternative fuel (Natural gas or LPG) if required in the future.

Boilers should be installed to run in both standby and operational mode, e.g.: if two boilers are installed.

- Each should be capable to provide 100% of the load.
- Boiler margin to be 15% of design load.
- Flue economiser shall be incorporated where appropriate.
- The boiler mounted controls should incorporate but not be limited to: flow thermometer, temperature control thermostat, high limit thermostat with manual reset on/off switch, excess temp indicator, hours run meter, flue gas temperature gauge, altitude/pressure gauge and automatic boiler/burner trim control. All boilers are to be Hoval or similar capable of connection to building management system.
- Boilers should be chosen for the highest efficiency, both for firing and insulation. Cost i.e.: “cheapest” shall not be the deciding factor. All boilers to have Low NOX emissions.

- All boilers shall be installed complete with flue gas analyzers for CO, CO_2, O^2 etc. Flue gas analyzer to connect to B.M.S system or be compatible for later connection if B.M.S. is not yet available.
- Each boiler will have a boiler load optimizer to reduce dry cycling, as per Sabien M2G.

Burners.

All burners must be approved by boiler manufacturer and sized to fit/ match boiler. All burners must comply fully with the appropriate part of BS 799/4876. All burners shall have a fully closing air inlet damper to allow for the appliance to maintain a high temperature during shut down periods; capable of single pipe (gravity) or purposes i.e.: removable cover-plate as Nu-way or similar.

A Micro-modulation flue gas analyzer shall also be incorporated on all large plants.

Flues

All flues for industrial applications should comply with the clean air act. However, if disproportionate heights are obtained, a waiver should be sought from 48 CES/ CC and ACE. All details and calculations shall be shown at the 30% design submittal to show flue heights in reference to all surrounding facilities.

Self-supporting stainless steel flues are preferred.

Flues on Domestic MFH boilers shall be thorough wall balanced type where possible.

Plantrooms

- All plantrooms must have a 110v industrial style transformer centre tap for power tool use and BS 4343 industrial socket.
- All fuel line solenoid valves must reset automatically after power outage as per DE Specification 036.
- An emergency knock off button must be installed adjacent to the door to isolate ALL plant, except extract in a fire condition.

D3022 Boiler Room Piping & Specialities

No site specific content.

D3023 Auxiliary Equipment

Pumps

Duty pumps and Standby pumps are required to be installed as two separate pumps on heating systems. Pumps are **not** to be twin headed. Pumps shall have inverter speed control to match system requirements.

Designers to consider/ mitigate risk associated with Legionella and any secondary DHW pump/pipework dead legs which could sit stagnant for periods of time i.e. standby pump.

All pump sets shall be run and standby with fully automatic changeover on loss of flow rate, loss of developed head and electrical failure.

The pumps shall achieve the operating point at mid speed setting. Pump speed settings shall be selected with due regard to the area they are being installed. A minimum increase of 15% in volume flow shall be available in reserve.

Each pump shall be complete with:

- Flexible connections on suction and discharge.
- Anti-vibration protection in accordance with size and duty.
- Isolation and non-return valves.
- Pressure gauges on suction and discharge.
- Strainer on suction.

DHW secondary circulating pumps **ONLY**.

DHW circulation of secondary hot water is generally to be via a single, headed circulating pump with no parallel piped/ pressurised stand by 2nd pump. Contractors will however purchase, provide an identical DHW pump that will be mounted as a facility/ system spare on supporting bracket near to the duty DHW pump (Not connected electrically or piped into the wet system). Immediate spare pump availability will allow prompt replacement by maintainers.
Duty (single) DHW pump is to be monitored for flow failure by local BMS.

Reason behind this recent change is that many instances of DHW pumps fail and are left in circuit for extended periods of time or are overridden away from BMS routine exercise change over and therefore give rise to increased Legionella risk.

Note. “Heating Pumps” not affected by this (still need connected/ pressurised duty & standby pump in commercial/industrial/ boiler house type applications)

The pumps shall be manufactured by one of the following, or equal and approved.

- Grundfos
- Smedegard
- Wilo Salmson

Pressurisation Unit

Where the heating system needs to be pressurised by means of a pressurisation unit. The pressurisation unit shall be fully automatic in operation complete with its own integral controls provided by the Pressurisation Unit Manufacturer.

The pressurisation unit shall be complete with:

- High and low voltage pressure switches.
- Pressure gauge.
- Low water level sensor.
- Audible and visual alarm on abnormal condition.

The “run” and alarm condition status of the pressurisation unit shall be monitored by the Building Management System.

The expansion vessel shall cater for a system volume 15% in excess of the design figure.
Minimum system pressure at the highest point of the system shall provide a 17°C anti-flash margin or be 1.0 bar, whichever is the greatest.

The boiler plant shall automatically shut down in the event of a dangerous condition.

The pressurisation unit shall be manufactured by one of the following, or equal and approved.

- Armstrong Pumps.
- Brefco (UK) Ltd.
- Smedegard.

LTHW Heat Emitters

Radiators shall be of the steel panel variety with TBOE connections. All radiators shall incorporate thermostatic radiator valve which shall be set and locked in position during commissioning and shall be suitable for closing against developed pump pressure. Each radiator shall be provided with a matching LSV.

The steel panel radiators to be used on any specific type of building will be manufactured by one of the following, or equal and approved:

- Stelrad.
- Myson.
- Hudevad.
- Runtal Rad.
- MHS.
- Barlo.

Unit Heaters shall be used where appropriate they shall consist of a 1.6mm casing panel, motor/fan plate and discharge louvre. The unit shall have a removable heating coil constructed from copper tubes expanded into aluminium fins,

Copper headers suitable for the medium being used. If unit heaters are to be used on any specific type of building this shall be specified at the Design Instruction stage. Manufactures of suitable unit heater are as follows, or equal and approved.

- Dunham Bush. Ltd.
- S&P Coil Products. Ltd.

Calorifiers

Hot water and heating Calorifiers shall be suitable for use on a pressurised system. Calorifiers shall be selected to withstand the system design working pressure. All Calorifiers shall have the primary side generated by LTHW / MTHW / HTHW (not pressure) [and in fact some medical group buildings also currently use STEAM as primary heating to calorifiers] to suit the actual location and application.

Hot Water Calorifiers shall be of the vertical pattern and have the following minimum mountings:

- Relief Safety.
- Altitude and pressure gauge.
- Temperature thermometer.
- Thermostatic control.
- Drain cock.
- Bursting disc.
- Clean out access manhole.
- De-stratification pump.
- Secondary and Primary connectors to suit applications.
- Sacrificial Anode – (Of appropriate material and size).

A back up immersion heater to give a 2 hour recovery shall be installed in each Calorifier.
No non-storage Hot Water Calorifiers will be permitted unless authorised by the base Engineer.

Heating Calorifiers shall be of the horizontal pattern and have the following minimum mountings:

- Relief Safety.
- Altitude and pressure gauge.
- Temperature thermometer.
- Thermostatic control.
- Drain cock.
- Bursting disc.
- Secondary and Primary connectors to suit applications.

Pipework, Fittings, Valves, Cocks etc.

All installations shall comply with the DE specification 036. Pipework within floor and ceiling voids shall be welded throughout.

Full bore valved and capped flushing legs shall be provided at the base of each riser.

Drain cocks shall be provided at all system low points and extended where necessary to make accessible. Isolating valves shall be incorporated throughout the system to allow individual circuits and branches to be isolated for maintenance.

Commissioning valves shall be incorporated in all circuits and sub-circuits to allow accurate system balancing and shall be installed fully in accordance with the manufacturer's recommendations.

Strainers shall be fitted to the main LTHW return.

Automatic air vents shall be provided at all high points in the pipework using air bottles. Non-return valves shall be fitted if likely to be under negative pressure.

Pipework running within the ground shall have Cathodic protection I.A.W UFC 3-570-01.

Pipework running at low level within housing/ office areas shall be enclosed within Pendock Profiles where appropriate.

D3024 Insulation

All heating pipework shall be insulated with non-contributable material when tested to BS476. Insulation facings shall have a surface flame spread property of Class 0 when tested to BS 476 Part 7.

All insulation shall be CFC and HCFC free both in composition and manufacturing process.
Insulation finish within the ceiling and floor voids, and ducts shall be aluminium foil with lapped and sealed joints.

Insulation finish within the roof and basement plantrooms shall be Isogenopak or similar. Valves and other fittings shall be insulated with "oversize sections" with removable covers.

All insulation susceptible to mechanical damage shall be hammerclad finish as Dobelshield Stucco embossed aluzink or equal and approved.

Insulation on Valves shall have multi-lag insulating muffs or mattresses held in place with Velco fastenings. The purpose muff shall be used to insulate all valves, strainers etc.

The muffs shall be finished to tone with the Isogenopak and shall be manufactured by Bestobell Engineering Products or Gas force or equal and approved.

D3030 Cooling Generating Systems

As per USAF requirements for single source requirement, Carrier Air Cooled Chiller and Heat Pump Specification (December 2020 - Rev 1) will be the sole guide for Air Cooled Chillers & Heat Pumps.

D3031 Chilled Water Systems

I.A.W. RAF Lakenheath (48th Fighter Wing) - Chiller Specification.

D3032 Direct Expansion Systems

IAW most current UFC 3-410-01.

D3040 Distribution Systems

Fan coils/MHR installed above suspended ceilings to be fully accessible for isolation (electrical & mechanical) and maintenance. Exposed ceiling grids to be labelled as shown below on the grid to indicate fan coil/MHR units above i.e for routine filter changed & tiles to be removed to facilitate the same.

Below ceiling grid printed D.Y.M.O style Labels, (not raised / mechanically-embossed type).

"**Red Bold Text**" on white background tape (arrow directions ↑ to indicate adjacent dropped celling, lay-in removable tile(s) needing to be removed for regular maintainer operational access. Typical text samples below. Tape & font size coordinated for reasonable readability with constraint of exposed Tee-grid physical widths.

Fan/Coil – I.V. ↑	**Fan/Coil – Fuse Spur** ↑	**Fan/Coil – Filter** ↑

Fire Damper / Reset ↑	**Fire Sprinkler Valve** ↑	(i.e. Operational/Zone/Drain/or other item obscured from View)

Mechanical Fan Coils / MHR equipment /AHU's – Items needing more frequent general access for isolation, inspection, operation and test purposes. Labels to adjacent removable tiles also indicates to facility users where positioning of furniture beneath may be inadvisable and restrictive to access with ladders or mobile elevated work platforms (MEWP's) from below.

Ensure the celling grid Tee-Section substrate bar is cleaned/degreased with suitable degreasing wipes to ensure good adhesion of label tape.

**This requirement for labels does not override any current relevant project(s) 100% specifications, including referenced NFPA's, L.P.C, D.I.F.S, UFC, B.S EN, MoD Specification or Design & Maintenance Guides, or to specific fire advisor requirement which may specify with more stringent local labeling & signage requirement.*

Variable Frequency Drive required on all motors 1 Horse Power (HP) and above.

D3041 Air Distribution System
IAW most current UFC 3-410-01.

D3042 Exhaust Ventilation System
IAW most current UFC 3-410-01.

D3043 Steam Distribution System
IAW most current UFC 3-410-01.

D3044 Hot Water Distribution System
IAW most current UFC 3-410-01.

D3045 Chilled Water Distribution
IAW most current UFC 3-410-01.

D3046 Change-over Distribution System
IAW most current UFC 3-410-01.

D3047 Glycol Distribution System
IAW most current UFC 3-410-01.

D3050 Terminal & Package Units

D3051 Terminal Self-Contained Units
IAW most current UFC 3-410-01.

D3052 Package Units

IAW most current UFC 3-410-01.

D3060 Controls & Instrumentation

D3061 Heating Generating Systems
IAW most current UFC 3-410-01.

D3062 Cooling Generation Systems
IAW most current UFC 3-410-01.

D3063 Heating/ Cooling Air Handling Units
IAW most current UFC 3-410-01.

D3064 Exhaust & Ventilating Systems
IAW most current UFC 3-410-01.

D3065 Hoods & Exhaust Systems
IAW most current UFC 3-410-01.

D3066 Terminal Devices
IAW most current UFC 3-410-01.

D3067 Energy Monitoring & Control
Controls - Basis of Design
Refer to Index of Specification and Standards.

Description of Systems

Controls
In new facilities or major renovations, all new utilities must be concealed. Controls shall be Building Management System (BMS) compatible, with Schneider Electric (Andover Controls), or Schneider Electric EcoStruxure.

All controls must comply with RAF Lakenheath's B.M.S. Standards and the details contained in this control section.

The Building Management Control System, supplied directly from the manufacturer, shall be based around an object oriented, microprocessor based network of controllers. It shall control and monitor the building services whilst incorporating central operator facilities. Services shall include but not be limited to a Chilled water plant, Boiler plant, Fan Coils, Air Handling Units, Ventilation, Electrical metering, Gas metering, Water metering, and Generator supplies.

Each item of plant shall be controlled by a network of controllers programmed with text based strategies for Optimised start/ stop, frost control, night setback, time control, sequence calendar, clock and math's functions. Local control for each item of plant shall be via a panel mounted touch screen that shall graphically allow operators to view and alter plants status.

Heating including domestic hot water valves and Chilled water control valves and damper actuators shall have the facility to be manually over ridden locally for emergency use in the event of motor or control system failure. However, where the control is via a BMS system, indication that the valve is in manual control shall still be indicated on the BMS front end if possible.

Product Specification, EcoStruxure AS/ AS-P range of Master Controllers

The EcoStruxure Automation Server (AS/ AS-P) Master Controllers shall be used where possible. Refer to the detailed control section for further details.

Consideration should be given to the surrounding building, present and future that could connect to the above for communication to the base system. Therefore, before installation the Contractor/ Installer MUST contact 48 CES/

CEOIH BMS Administrator for advice on option to be taken.

All Expansion modules may be used. An allowance of 25% space shall be provided in all control panel to allow for future expansion.

A touch screen SmartX Controller 10" Smart Display will be contained in each plant room. The touch screen shall be mounted either on the front of the housing panel or on the front of the panel housing the sub-controllers.

The type of control to be employed on any specific type of building will be decided at the DI Stage (Design Instruction Stage) by 48 CES/ CEOIH BMS Administrator.

Controls shall come into the following general classifications:

- Domestic - Typically MFH (Married Family Housing)
- BMS monitor full control – Typically dormitories
- BMS monitor only – network i.e. for utility monitoring purposes
- Stand-alone control – Compensated, OSC, night set back frost control with facility for future connection to BMS. Typically for smaller industrial style buildings.

Electric Immersion Heaters

Electrical feeds to immersion heaters shall not be via the BMS but the time of use will be monitored. For full details refer to the detailed control section, 10.4.

Enclosures

All enclosures shall meet relevant standard M&E specifications.

Enclosures shall be grey in colour, specification: RAL7035.

Responsibility for the monitoring and archiving of the site network architecture shall be with the 48 CES and the manufacturer. Please speak with 48 CES and/ or the manufacturer when installing all types of networks and controllers.

All panels shall be sized to best suit their placement, environment and contents.

All electrical installation shall meet the Department of the Environment PSA Standard Specification M&E 034 with the following specification not overriding this specification but supplementing specific details.

Fire Signal & Fireman's Switching

Each MCP shall be arranged to de-energise appropriate equipment on receipt of a FDS signal via the Fireman's Override Switching Panel. A fireman's switch shall be hard wired into the extract ventilation system.

Software Commissioning

All software and software commissioning shall be carried out by Schneider Electric Ltd. the software engineer shall have 'ACE' or current equivalent and RAF Lakenheath certification. For full details refer to the specific requirements given in the detailed control section.

The following companies are currently certified systems houses that have attained the approved standard and attended specific training courses with Schneider Electric Ltd.

- TF TULL.
- ECS (Anglia).
- Integrated Control Solutions (Eastern) Ltd.
- Schneider Electric Ltd.

Note that Software Commissioning and Software Programming are not exclusively carried out by Schneider Electric Ltd but can be performed by ECS and T.F Tull.

Schneider Electric Ltd Third party suppliers are NOT acceptable.

Programming Work on the System

NOTE: All work on the "Front End" of the system (meaning the strategies and programming held on the servers) will be carried out by Schneider Electric Ltd and contractors should make provision for this.

Design of Control Systems for Heating, Ventilating and Air Conditioning Systems (HVAC) (UFC 3-410-02)

Mandatory on all projects with HVAC items This Engineering Technical Letter (ETL) provides a methodology for design of HVAC control systems. This policy is mandatory and is to be implemented immediately. The two most common problems are the lack of maintenance access to operating components that require periodic service, and the lack of access ports through which the technicians can measure flow, temperature, pressure, etc. to perform calibration and test procedures. The design and construction efforts must facilitate both efficient operation and effective maintenance.

The design concept will include, but not limited to:

- Use of remote sensors so that controllers can be centrally located in the mechanical room.
- Logical grouping of controllers, adapters, relays and power supplies in an easily accessible controls cabinet mounted away from vibrating machinery.
- Inclusion of electronic-system terminal strips cross- referenced to the control schematic to facilitate troubleshooting and calibration.

Utility/ Consumption Meters

Fuel, heat meters and electric meters must be fitted to allow utilities monitoring/ billing.

For full details refer to the detailed control section.

Full commissioning documentation and installation software shall be available at handover.

Full technical control details are given in the detailed controls section.

Detailed Control Section

Product Specification, EcoStruxure Automation Server Range of Master Controllers

The Automation Server family of Master Controllers shall be used where possible. The Automation Server units shall be used where there is an installed Ethernet connection and the installation of the Automation Server is deemed by the client to be more economic than networking to a neighboring Master Controller. The decision regarding the installation of the controller shall be made by the client during the design stage of the installation.

Install one Automation Server (AS or As-P) master station for all new construction or major renovation. The Automation Server will have direct connectivity to Ethernet on the base wide fibre optic network (IEEE 802.3, TCP/IP) via an RJ45 socket. Where an Automation Server controller is used it shall be fitted in a panel enclosure of the same size and specification as existing enclosures on base. The Master station will require a local means of full control over the sub-network, this can be accomplished by a 10" Advanced Display Touch screen display, which will be mounted on the front of the enclosure.

The input and output points to be connected should be monitored and controlled using I/O modules AS enclosure.

The Ethernet connection from the Automation Server to the patch panel shall be via Cat 5e or Cat 6. This cable shall be segregated in it's own conduit.

Consideration should be given to the surrounding buildings (present and future) that could connect to the above for communication to the base system. In all cases before fundamental design is accomplished the designer/ contractor/ installer **MUST** contact 48 CES/ CEOIH BMS Administrator for advice on options to be taken.

Product Specification - SmartX IP Controllers

Sub-controllers shall be used where there is no automation server (AS/AS-P) in the plant room and an independent Ethernet network (Physically independent to the base area network) has been run from the nearest automation server.

Any of the MP-C or RP-C range maybe used.'

All Expansion modules may be used.

A touch screen with 10” display will be contained in each plant room for maintenance use. Mounting height to bottom edge of screen assembly will be 1.4meters from finished floor level. The touch screen shall be mounted either on the front of the AS/ AS-P housing panel or on the front of the panel housing the Infinet controllers.

The 10” Smart Display shall be used as the operator interface for occupied areas as necessary. The 10” Smart Display shall be mounted in a position deemed by the client to be the most convenient for operator usage. The 10” Smart Display shall be mounted as close as possible to a height of 1.75M. The 10" Smart Display will only be installed in accessible areas. The 10" Smart Display for specific building user occupant use, will be subject to operational requirements and only be included if approved by 48 CES/ CEOIH BMS Administrator.

All controllers shall be contained within a panel enclosure.

Product Specification - Enclosures

All installed enclosures shall meet relevant MOD standard M&E specifications and I.P. ratings. Where a control panel may be accessed internally without disconnection of electrical supply to all component parts within, an appropriate and prominent sign will be fixed to the front of the enclosure warning of the danger. Components or equipment that can be accessed whilst still energized, will individually or as a group be screened/protected to a minimum of I.P 2X. Where use of a Laptop computer/ service tool may be necessary to access the BMS, the panel enclosure will include an internal, twin switched 230volt, 50hz, 13Amp, 30ma RCD protected socket outlet. This socket outlet circuit will be rated and protected by a MCB rated at 10Amps maximum.

Subject to the above strict signage and screening requirements, adequate electrical protection for overload and short circuit etc.

It is preferred that BMS controllers and internal Laptop RCD protected socket outlets derive their electrical supply from the live side of the panel main isolator switch, this usually being “interlocked off” in allowing panel door to open. An additional non-interlocked fused spur or internal isolator and MCB, specific to BMS and associated socket outlet should be provided. Clear labelling to each is essential in this situation. This arrangement will allow necessary and essential work to the BMS to proceed without the inevitable attempts to defeat standard protective panel interlocking.

If the SmartX IP controllers are not to be housed in a nearby MCC panel, which is to be installed with the same project, or is an existing MCC panel, then the controllers (AS or sub-controllers) shall always be enclosed in a standalone housing panel.

Each enclosure shall have a standard identification sticker on the master controller. This sticker shall contain the Identification number of the Automation Server should one be contained within. All ID numbers shall be of the format LAK001. The base wide numbering system for the Automation Server is monitored by the manufacturer of the AS units and these numbers can be obtained from the same manufacturer. Identification stickers can also be obtained F.O.C. from the manufacturer.

Enclosures shall be grey in colour, specification: RAL7035.

Enclosure shall use metal cabinet key locks.

Responsibility for archiving of the revised site network architecture and software shall lie with the installing contract, using the manufacturer; Schneider Electric Ltd as the 48 CES nominated operator. A renovation or new construction project will include for all costs associated with this initial (1 event) requirement. Contact 48 CES/ CEOIH BMS Administrator and/or the manufacturer when installing all types of networks and controllers.

All controllers shall have pockets on the inside of the panel door. These shall contain standard sheets that detail:

- Standard controller sheets that detail network information such as Ethernet ID addresses, listing of which Automation Server units host which sub-controllers, connection details and points listings for the controller including input and output points.
- Control panel wiring diagrams
- Description of operation.

All panels shall be adequately sized. Consideration being given to their placement, environment, contents and subsequent requirements for maintenance access.

Product Specification - Software Standards

The software standards for RAF Lakenheath are and will include the following:

At the time of drafting this document, BMS at RAF Lakenheath and associated sites is employing new hardware and software.

Upon each BMS design, 48 CES/ CEOIH BMS Administrator should be contacted to verify current version in use. The contractor will ensure that full hardware and software compatibility will be maintained between existing and any new, revised or repaired installations.

Graphic Panels: The operator interface will use a pyramid structure allowing the user to travel from one main graphic map and 'zoom' in on areas of the base.

Standard colours are to be maintained throughout based on pastel shades so that operator's eyes are not strained.

Standard animation's and their colours are to be set so that each event has a standard normal, alarm, acknowledged and RTN status of colour and movement.

Standard background colours are to be used.

Upon each BMS graphical interface design, 48CES/CEOER will be contacted to ensure the base-wide standard format is used for the graphic layout & structure, colour schemes and animations. Graphical examples provided in Supplemental Guide "BMS Graphics Brief."

The requirements of BS EN 29241 (parts 1 to 6 where published) will be complied with. This specifies requirements as to PC workstation equipment and environment (replaces BS 7179).

Schedule standards for operation of plant during day and night hours.

Reports standards for maintenance and emergency.

Set point adjustment standards so that for each animated command there is a standard method of issuing that instruction via the head-end workstation.

Groups of values and their display.

Logging frequency at the local stage and at the SX stage, for each type of point.

Alarm annunciation - Colours, Acknowledge and return status, repeat timers, Panels pop up criteria, alarm level definitions. Standard configuration for utility meter graphic readouts, with cumulative and manually resettable unit counters.

ISM's (Infinity Standard Modules) are to be used wherever possible.

Software is to be written in the "Plain English format" as used by all installations at RAF Lakenheath. Shortcuts and

abbreviations to achieve compact software code will not be used.

Additional requirements with regard to programming and software are contained within the General BMS requirements section of this BMS Controls Specification.

Project Completion Documentation
Sample O&M documents are available for viewing at 48 CES/ CEOIH BMS Administrator. All projects that are completed using Schneider Electric Ltd. product shall be documented following the format within the O&M section shown in the sample documents.

Standard chapters and contents shall be used.

The following items will allow the operator to understand the design and operation of the system and must always be provided and or updated upon completion of work to the BMS system:

- Operating and Maintenance Manual
- Software Manual including paper prints of Plain English program
- Points List
- Description of Control Strategy
- Specification of Sensors and Actuators
- "As Installed" Wiring Diagrams showing Cable Routes, Schematics and Locations of Equipment
- Controls Design Specification
- Details of Set Points, Alarm Levels and Time Schedules
- Commissioning Data, Witnessed by Clerk of Works if qualified or approved engineer.
- Electrical Test Results, Witnessed by Clerk of Works.
- Instrument Calibration Certificates.
- "Local" Digital Save of Software to DVD-R

Electrical Installation
The electrical installation shall consist of the following elements:

- Containment
- Primary network cabling (Ethernet)
- Secondary network cabling (Ethernet in topology format; Star, Daisy chain or Rapid Spanning Tree Protocol (RSTP)), (Existing Infinet)
- Input/output control cabling
- Power wiring to plant items
- Uninterruptable Power Supply to BMS controller if required by 48 CES.

As a general rule of thumb, a UPS will always be required on the following: district heating boiler houses, large accommodation blocks, facilities served by a standby diesel generator and where BMS may be subject to frequent loss of commercial power i.e. where testing of fire protection systems shuts off BMS/ HVAC panel power.

All electrical installation shall meet the Department of the Environment P.S.A. Standard Specification M&E No.1, with the following specification not overriding this specification, but supplementing specific details.

Containment
Containment shall be installed for all network, control and power wiring. The containment system installed shall ensure that network and control cabling are segregated from power cabling. Fire Alarm cables will run on a separate containment.

All containment shall either be ladder, perforated galvanized steel tray, trunking or conduit, depending on the application. If control and power wiring are to take the same route, then twin compartment trunking shall be installed or separate tray/conduit systems installed.

Within plant rooms, all field devices shall be connected from the galvanized conduit tube end with a short length of flexible copex.

Plastic conduit is not acceptable for use as containment within plant rooms, electrical rises or main electrical cable routes.

Primary LAN Network Cable (Ethernet, LON or BACNet)
This uses the site-wide Ethernet, which is installed by others. However, if this has to be extended, then the network cable shall be Cat 5e or Cat 6, which shall be run within a separate containment system, of either galvanized steel conduit or trunking. This cable shall be of a different colour to all other cables for identification.

The length of the extended run would be supervised/approved by the RAF Lakenheath Communication Squadron, prior to connection to the site-wide Ethernet. The maximum cable length from the data cabinet will be 90 metres.

Secondary Network Cable (Ethernet Cat5e or Cat6)
As with the primary network, the secondary network cable shall be run separately from power cable and installed in a unique colour.

The cable shall be pairs of twisted copper cables with solid copper conductors with a UTP or STP shielding. But specific details would be specified per project. The cable shall have a nominal impedance of 100 Ohm ± 15% at 1-100Mhz. The Cat5e or Cat6 cable segment length shall not exceed 100m
.
If the Ethernet cable is to be installed externally, in ducts and/or exposure to UV, the cable used shall be duct grade. An amplification module shall be installed as required to maintain the performance of the network.'

Input/ Output Control Cabling

Digital and Analogue Inputs
All Digital and Analogue input cabling shall be run in the controls containment of twin compartment trunking or in a dedicated containment system. All cables shall be screened twisted cables, rated for 250 volt for 1 pair. The conductors shall be fine stranded and insulated with PVC. The screen shall be a tinned copper braid shield. The minimum cross-sectional area shall be 0.75mm^2.

The types shall be as follows:

- 1-Pair- Belden 8760 or equivalent
- 2-Pair- Belden 8723 or equivalent
- 3-Core- Belden 8791 or equivalent

Digital & Analogue Outputs
As with the input cabling, these cables shall be run in separate containment to the power wiring.

All analogue outputs shall be wired using the same specification of screened cables as listed earlier. However, digital outputs may be wired using tri-rated PVC singles cables, instead of screened cables, and shall have a minimum cross-sectional area of 1mm^2.

Metal oxides varistors shall be fitted across the coil of all inductive loads which are to be switched, e.g. relays, contactors, motors and actuators where required. Installation documentation must be checked to confirm the requirement.

Power Wiring to items of Plant

All power wiring to plant devices from motor control panels shall be PVC tri-rated covered stranded single copper conductors. The permissible operating temperature at the conductor shall be 70°C, for a rated voltage of 300 to 500 volts. A conductor size of 2.5mm^2 and above shall be stranded, and all conductors shall be a minimum size of 1.5 mm^2.

The power wiring shall be segregated from all control cabling and housed within the specified containment.

External Communications Cabling

To fibre hubs should be Belden 88102, Teflon coated, 10 base T, 6-pair with a maximum run of a 100m. The cable must be run in a 100m cable duct (buried).

Lightning arrestors are required at each point where an Infinet or other wiring enters or exits a building. The following: two pair combination gas tube/silicon avalanche arrestor # 01-2100-299 is specified by Schneider Electric Ltd.

All cables or cable ducts require a warning tape be placed at a suitable depth above their routes. The tape shall be manufactured from polythene not less than 150mm wide and 0.1mm thick. It shall be yellow in colour and bear the continuously repeated legend “CAUTION ELECTRIC CABLE BELOW”, or similar, in black letters not less than 30mm high.

BMS Points Schedule.

Each new or modified BMS installation will have varying requirements and constraints in terms of specific BMS “points” to be included in the design. The 48 CES/ CEOIH BMS Administrator office will, upon request, provide sample points listing for monitoring and or control. This should **NOT** be taken a full specification as to requirement but a basic template upon which the designer can develop/ modify to suit the particular application.

All BMS detail specifications and subsequent design submissions must provide a full points listing for approval by 48 CES.

Motor/ HVAC/ BMS Control Panels

Introduction

All control panels shall meet the Department of the Environment P.S.A. Standard Specifications M&E No.6 and MOD Specification 037, Section 24, with the following specification not overriding this specification, but supplementing specific details.

All panels shall be sub-divided into separate compartments for ‘Main Incoming Power Section’, ‘Duty Section’, ‘Standby Section’, and ‘Controls Section’.

Each panel shall house all the necessary equipment to control the starting, stopping, interlocking and indication of the various motors and equipment covered by this Specification.

Panel indicators shall be solid state light emitting diode (LED) or multi diode cluster types, NOT incandescent filament lamps. All indicators/ LED’s will have common test facility /button.

All equipment shall comply with the relevant standards.

Each starter/control panel shall be capable as a whole of withstanding the possible electrical and mechanical stresses.

Any item or part within a panel or cubicle remaining live with the main isolator or isolating switches in the off position, or where an isolator can be defeated, shall be fully shrouded and labels provided to warn of the danger.

All floor-standing panels shall be mounted on the floor with easy access for viewing and maintenance. Wall mounted panels shall be mounted such that the top of the panel is no higher than 2m from the floor.

Panels containing BMS controllers which have the facility to connect with a mobile laptop/ service tool will be provided with a lightweight removable podium to hold laptop at height suitable for operator use whilst standing. The support bracketry finish shall match that of the panel, be fixed to the exterior panel door or other location to be agreed with 48 CES/ CEO.

Panel Construction

The method of construction shall be consistent with good and proven practice and be in accordance with the appropriate Standards.

Panel construction shall consist of sheet metal panels built up on a substantial framework or rolled steel or folded sheet metal sections. All edges of panels shall be radiused and when fabricated shall be flat and true.

All necessary stiffeners and supports shall be provided for the framework and panels to provide a rigid unit. Floor mounted panels shall be mounted on U section channel bases suitably drilled to accept the panel and holding down bolts.

Sheet metal for all motor control panels shall not be less than 2mm thick. All sheet metal shall be specially selected flat zinc coated mild steel.

Doors shall be surface fitting steel with folded edges and corners suitable for eliminating distortion and whip and to have a minimum thickness of 2mm.

Adequate access doors shall be provided. All doors shall be of a comparable finish to the panels and provided with dust- excluding gasket of sponge rubber positively retained in a rebate.

After manufacture all steelwork, other than that manufactured from zinc-coated sheet, shall be thoroughly cleaned off and zinc sprayed before any finish is applied.

The cubicle shall be divided internally by sheet metal webs so as to obviate heating up of components. All instruments and equipment shall be securely mounted and all internal wiring runs shall be so positioned as to ensure complete accessibility for servicing purposes.

The panel shall be fitted with removable lifting eyes suitably reinforced to take the total weight of the panel and its components.

Back plates/ component mounting plates shall be manufactured from not less than 3mm thick Zintec sheet and shall be detachable, secured by bolts with shake-proof washers.

Panel construction shall be such that adequate natural ventilation shall be provided for the internal heat dissipation and in no circumstance shall the internal temperature rise 10°C above the scheduled ambient temperature. Should louvered sections be required then they shall be provided.

The cubicle bases shall be provided with internally removable bottom gland/ vermin/ dust plates as appropriate.

Panel Finish

Surfaces shall be smooth and free from burrs, weld marks and sharp edges. After prefabrication the panel sections shall be degreased and chromate etched before being sprayed with two coats of primer.

Final exterior paint finish and colour shall be to BS4800, with the panel back-plate of matt white colour.

The appropriate number of undercoats shall be applied, each being built up and flattened separately. The final coat shall be of sufficient body so that the final appearance is entirely free from blemishes or defects.

Bus-Bars

Where the panel is to be delivered in sections, and the rating is 100 amps or greater the power supply shall be by means of copper bus-bars, the bus-bars short circuit rating shall be compatible with the associated incoming main supply. Joints in bus-bars shall be accessible for inspection and tightening when the panel is in its final position on site.

Full size neutral bars shall be provided.

An externally top mounted earth bar shall be provided to link all panel sections and gland plates. The bar shall be positioned to allow front access for connections and provided with adequate M10 bolt holes, bolts, nuts and washers.

Where bottom entry cabling is required, internal earth bars shall be provided similar to the above.

If the rating is below 100 amps then cable will be acceptable.

Panel Wiring & Terminations

Wiring for mains voltages shall be LSF insulated and coloured in accordance with the relevant Standards

The minimum size of power cables shall be 1.5mm2 and multi- stranded, where such wiring is to be carried across door hinges in looms it shall be in flexible cable 30/0.25.

Flexible cables used for controls and instrumentation shall have suitable crimp on terminations for single screw terminal connections and insulated bootlace ferrules in feed through terminals.

All internal control circuit and instrument cabling shall be wire numbered, numbers being sleeved onto each cable at both ends of each termination and corresponding to the wiring diagram.

Wiring shall be carried on the front surface of the mounting plate either in plastic cable trunking of the ventilated type with clip-on covers and purpose made connecting pieces and accessories or strapped in looms with straps permitting easy access to the looms and clipped to the mounting plate. In either case cable sizes shall be rated taking into account all grouping, bunching and enclosing factors.

Any one loom of cables shall have a maximum of 25 conductors.

Control cables shall be loomed separately from all other cables or segregated in multi-compartment trunking.

Screened cables shall be used for digital input signals.

Where plastic trunking is used the cables shall not occupy more than 45% of the trunking volume.

Wiring outside the trunking or loom shall be neatly set for connection to terminals or equipment.

All wiring to rear mounting terminal strips shall be carried through the mounting plate adjacent to the terminals and suitably protected.

All terminations shall be suitable for the cables to which they are being connected. All cable connections using stranded cable shall be made with the use of crimp lugs or insulated bootlace ferrules.
Outgoing 10mm^2 cables and above shall have bolt type termination.

Connections to all equipment fitted with clamp screws shall be made using compression lugs with overall insulating sleeve. Insulation barriers shall be provided to segregate all lug type terminations and three phase connections.

Terminals shall be of high quality melamine with clamp type terminals suitable for DIN rail mounting and suitably rated and sized to accept the cables specified.

Spare ways on the basis of ten percent of each size of termination terminal shall be provided.

All terminals shall be numbered and arranged in suitable groups. Terminals shall be located suitable for top or bottom cable entry as scheduled.

Panel cable entry and exit shall be via detachable, undrilled gland plates.

Multiple banks of terminals shall include adequate space between banks for wiring and access. “Multi-deck” terminals shall not be used.

Insulated barriers shall be provided in terminal rail systems to segregate and allow easy identification of circuits and systems. Control terminals shall be segregated from main circuit terminals. Extra low voltage terminals shall be segregated from all low voltage terminals.

Flexible bonding cables/ tinned copper braid shall be provided between panel and hinged doors.

Panels which require manufacturing in sections shall be supplied with fully numbered interconnecting terminals on each section and the panel manufacturer shall include for bolting up and connecting the wiring between sections on site after they have been positioned. The manufacturers shall also include for demonstrating the resistance between bus-bar joints using a Ducter tester or equivalent. Low voltage wiring shall be segregated from the mains wiring.

Labelling & Identification

Labels shall be traffolyte engraved with equipment title and operating function.

Unless otherwise specified or agreed with the Design Team, fire equipment labels shall be engraved red on a white background and all other labels black on a white background.

Labels shall be secured with chromium plated raised head screws in tapped holes on the panel fascia or other approved fixing. Self-tapping screws and adhesive fixings are not acceptable.

Internal components (i.e. inside a controller adjacent to override pots or switches) shall be individually labeled to indicate function and drawing reference.

Internal labels shall not be secured to trunking lids. Labels shall be fitted to the back plate adjacent to the trunking and to the equipment.

Working details shall be agreed prior to engraving.

Each plantroom containing BMS control equipment shall be provided with a encapsulated and framed BMS “local architecture” schematic diagram, not less than A3 in size. This will show for example, LAN hub or Master controller, sub-controllers, interconnecting cables, with clear identification numbering and plantroom reference/ descriptor. This schematic would need to show additional building and plantrooms/ controller references, if served by a local infinet network.

Main Switches & Fuse Switches
A triple pole and neutral isolator (or double pole for single phase supplies) mechanically interlocked with the panel access door shall be provided for the power section to a MCP.

Electrical supplies emanating from MCP's to serve equipment other than drive motors shall be provided with an on/ off fuse switch and a pilot indicator to prove supply 'on'.

Main switches and fuse switches shall be capable of opening and closing on-load.

Switches and fuse switches shall be suitable for 50 Hz, three phase, four wiring connections, complying with the relevant Standards and be rated for utilisation category AC3 or to suit the application.

Motor Starters - General
Each starter shall include an incoming switch, protective device, contactors, overloads and auxiliary contacts to achieve the specified operation and switching.

Hand/ Off/ Auto and duty selector switches shall be provided to suit the application starter arrangement.

Starter and relay coils shall operate from a maximum input voltage of 250 volt a.c.

Starters shall be complete with interchangeable thermal overloads with adjustable ranges, set and adjusted to suit the motor drive current as determined during commissioning and be suitable for operating in an ambient temperature of 40°C unless otherwise scheduled. Accessible overload hand reset buttons, back controls on the overload trip switches and overload scales shall be provided.

Contactors shall be single or three phase as necessary fitted with arc shields and have contact ratings not less than 10 Amps of minimum category AC3 or to suit the drive.

Single phasing protection shall be provided. Where motors have variable speed drivers single phasing protection shall be afforded using line voltage monitoring or equivalent.

All starters, contactors and switches shall be provided with a minimum of two auxiliary contacts of the normally open type. Where the design of the panel does not make use of these contacts they shall be wired to terminals on the main terminal rail.

Direct on-line starters shall be used for equipment rated up to and including 5.0 kW.

Star delta starters shall be used for equipment rated above 5.0 kW unless otherwise indicated.

Run pilot indicators shall be established on the delta or final drive mode on assisted start drives.

Single Speed Motor Starter Arrangement
For single motor drives supplied from a MCP the panel shall incorporate the starter together with the following:

Hand/Off/Auto switch to operate as follows:

Hand position - motor runs unless any safety Interlock de-energises the motor or the motor starter trips.

Off position - motor stopped and will not operate under any circumstances.

Auto position - motor is enabled and will run when energised by appropriate remote switching or control system signal.

Run and trip pilot indicator

Multi Speed Motor Starter Arrangement

For multi speed drives supplied from a MCP the panel shall incorporate the starter together with the following:

Hand/ Off/ Auto Switch for each drive motor, the hand position shall include provision to manually select each required running speed. The switch shall operate as follows:

Hand position - motor runs at the selected speed unless any safety interlock de-energises the motor or the motor starter trips.

Off position - motor stopped and will not operate under any circumstances.

Auto position - motor enabled and will start when energised by appropriate remote switching or control system signal. Control signals shall automatically initiate a require motor speed change.

- Run pilot indicator for each speed.
- Common trip pilot indicator

Variable Speed Motors Starter Arrangement

For variable speed drives supplied from a MCP the panel shall incorporate the starter. Drives shall be of the inverter type.

In addition the panel shall incorporate the following:

Hand/ Off/ Auto switch for each drive to operate as follows:

Hand position - motor runs unless any safety interlock de-energises the motor or the motor starter trips.

Off position - motor stopped and will not operate under any circumstances

Auto position - motor enabled and will start when energised by appropriate remote switching or control system signal.

Run and trip pilot indicator.

Duty/ Standby Starter Arrangement

For each motor the panel shall incorporate the starter and facilities specified for the appropriate single motor starter arrangement.

In addition, the panel shall incorporate a single duty/ standby selector switch to select either motor as the duty motor unless this facility is provided by a BMS.

Should the selected duty motor be stopped under a fault condition or its starter tripping the standby motor shall automatically start.

It shall not be possible for both duty and standby motors to run simultaneously.

Relays

Relays shall be of the plug-in type and shall be housed in dust- tight enclosures, with a minimum of 10-amp contact rating. All relays shall have a minimum of 3 change over contacts. Relays shall have a test button to ease fault finding.

Relays with different coil operation voltages shall have bases with unique pin configurations and shall be colour coded into groups.

Instruments

Instruments shall be of the moving coil/iron or electronic pattern as appropriate complying with the relevant Standards for industrial accuracy and be suitable for external zero adjustment. Ammeters used on drives shall have extended ranges to suit the starting current.

All instruments shall have a square dial minimum size 75mm, 120° scale flush pattern and be complete with appropriate selector switches.

Instruments shall have a compatible appearance, size and finish and be mounted on, or as near as possible to the equipment with which they are associated.

Instrument terminals shall be shrouded.

Ammeters

Ammeters shall be provided for starters associated with motors of 5 kW and above.
Direct connected ammeters shall be used for loads up to and including 20A, above this load current transformer operated ammeters shall be used.

The current transformer ratio, scaling and coil ratings shall be stated on the wiring diagrams. Current transformers shall conform to the relevant Standard with accuracy as Class 1.

Groups of current transformers used on three phase systems shall have their secondary connections starred and earthed.

Indicators

Indicators with the exception of fuse failure lamps, shall be of the LED or Multi LED cluster type. Fuse failure lamps shall be of the neon type, with current limiting device, fitted in a similar bezel. All lamps shall be replaceable by removing the front lens bezel.

All lamp lenses shall be polycarbonate or glass. The colours and significance shall be in accordance with BS4099. The colour shall not be an applied coating.

A facility shall be included to test the integrity of all indicators in unison on operation of a common push button switch.

Control Push Buttons

All control push buttons shall be of non-hygroscopic materials and fitted so as to avoid the possibility of sticking. All buttons shall be so arranged that the push button is fully protected to prevent the accidental switching of plant.

Door Mounted Equipment

All equipment mounted on panel access doors shall be fitted with shrouds to cover any exposed terminals. Cable connections shall permit the access doors to be fully opened without disconnecting the cables.

Protection & Control

Unless otherwise agreed with the Design Team, main power protective devices shall be as follows and rated to deal with the motor starting current where appropriate:

Fault Level Amps Protective Device
63A and less:
Miniature Circuit Breaker

Above 63A and less than 800A: Moulded Case Circuit Breaker

800A and above: Air Circuit Breaker

Each starter circuit shall be provided with an individual control circuit MCB.

All 'Driven' control equipment mounted within or external to the panel shall be provided with a separate control circuit MCB. 'Driven' equipment includes temperature control panels, valves and dampers but not control thermostats or other switching functions.

Each control circuit MCB shall have its own separately terminated and identified neutral. The use of fuse carriers with solid links for neutrals will not be permitted.

Wiring arrangements shall permit all motors to be de-energised from remotely mounted lock-off stop buttons or other control devices.

All interlocks and run lamps shall be established on the delta or final drive mode on assisted start drives.

Fire Signal & Fireman's Switching
Each MCP shall be arranged to de-energize appropriate equipment on receipt of a FDS signal via the Fireman's Override Switching Panel.

Additionally, arrangements shall be incorporated to facilitate manual override switching of selected equipment from the Fireman's Override Switching Panel.

Control Section
All DDC programmable BMS controllers shall be mounted in controls sections of the MCP's, include 25% minimum spare terminals, trunking space and expansion space for controllers.

Spare space shall be provided for 1No. MP-C-15A beside a Smart X IP Sub-controller to expand the IO count. The space required for the MP-C-15A. dimensions; Height 70mm, Width 124mm, Length 163mm. Though suited, shall be exceeded where necessary to allow for cable entry to the surrounding cable containment within the control panel

Any interface relays or power transformers shall be mounted in the power section of the MCP.

A main terminal rail shall be mounted along the top of the panel back-plate with the 25% spare space overall shall be provided within these controls. This shall output terminals predominately laid out to the right, and the input terminals to the left. Trunking shall be run underneath the main terminals and down each side of the controls section.

For the installation of Automation Server controllers, trunking shall be installed below them, so that all cables terminated on I/O boards are wired in from below the controller. As with the sub- controllers, output cards shall be installed to the right and input cards to the left, so that predominately all output cables run down the right-hand side of the controls section and input cable down the left hand side. All cables common to a particular AS IOU Module, shall be loomed together from the trunking, to enable ease of removal of the modules.

For all field cables with screens, these screens shall be extended from the terminal rail to a screen bar adjacent to each controller.

The power to the controls section shall be taken from the live side of the isolator via a switched fused spur mounted within the controls section.

LED cabinet light shall be installed in each control section.

To accompany each section will be a door attached pocket containing all of the necessary wiring drawings and a description of operation.

Radio Modems

No radio modems are permitted to be connected to the BMS.

Software Commissioning

All software commissioning shall be independently witnessed by Schneider Electric Ltd or by a competent and impartial engineer, trained upon the Schneider Electric system. The individual shall be familiar with both the design and installed components of the facility/ system concerned. Where a building BMS is “networked” familiarity must also include and extend to RAF Lakenheath BMS site architecture.

The independent witness to the commissioning programme shall be satisfied and certify that **ALL** BMS points, devices and head end reporting have been checked, are fully functional to the requirements of the Contract Specification, Standard Specifications (M&E 047, DMG22) and this document.

Subsequent to successful commissioning the contractor will demonstrate a representative sample of BMS operations selected by 48 CES/ CEOIH BMS Administrator office prior to acceptance.

The software engineer shall have ‘ACE’ Programmer certification or current equivalent. The software programmers shall incorporate the ‘Infinity Standard Modules’ (ISM) wherever possible. The software shall be written according to the standards (Plain English) adopted by Schneider Electric Ltd and agreed with the 48 CES.

The following companies/ systems houses have successfully completed the necessary and specific training courses with Schneider Electric Ltd. They have therefore attained the approved standard for installation or repair to BMS systems at RAF Lakenheath. It should be noted that 3 party contractors are not permitted.

- T F Tull, Watford
Tel 01923 235288.
- E.C.S. (Anglia), Norwich
Tel 01603 890632.
- Integrated Control Solutions (Eastern) Ltd, Reepham
Tel 01603 879510.
- Schneider Electric Ltd. (Buildings Business)
Tel. +44(0)844 994 0317

D3068 Building Automation Systems
Schneider Electric Ltd EcoStruxure Building Operation to be used for these systems.

D3069 Other Controls & Instrumentation
Schneider Electric Ltd EcoStruxure Building Operation to be used for these systems.

D3070 Systems Testing & Balancing

Newly installed equipment will have equipment specific vendor training included as a feature of work.

D3071 Piping System Testing & Balancing
IAW most current UFC 3-410-01.

D3072 Air Systems Testing & Balancing
IAW most current UFC 3-410-01.

D3073 HVAC Commissioning
IAW most current UFC 3-410-01.

D3074 Other Systems Testing & Balancing
IAW most current UFC 3-410-01.

D3090 Other HVAC Systems & Equipment

Ventilation, Basis of Design

Description of Systems

Buildings have three methods of air exchange:

- Forced ventilation/ Mechanical ventilation.
- Natural ventilation.
- Infiltration.

Design Criteria

Mechanical Ventilation

Areas that have a requirement for mechanical ventilation, i.e.to counter odour production, internal room with no operable windows, or where it is required to maintain as acceptable working environment will be provided with a supply and extract system. Mechanical ventilation systems will be constant volume. All mechanical ventilation will have a Variable Frequency Drive (VFD) drive installed on all supply and return motors as applicable. All HVAC Systems will be installed IAW most current UFC 3-410-01 or most stringent standard.

- Office spaces.
- Toilet areas.
- Cleaners store/ storage area.
- Kitchen (cooking) areas.

Ventilation & Fresh Air

General Requirements

Ventilation requirements will be provided in accordance with all Host Nation (British Standards), Ministry of Defence Standard Specifications, Air Force Unified Facility Criteria Codes, Air Force Instructions and all other associated Industry Standards and Good Practices.

Localised Extract

To individual rooms and equipment, to satisfy manufacturers requirements and to maintain environmental conditions, all as CIBSE recommendations (Section B2).

Acoustic
The systems shall be designed and equipment selected to ensure the following noise ratings are not exceeded by mechanical plant.

- Office and ancillary areas NR38.
- Entrance areas NR40.
- Toilets NR40.

External to meet local Environmental Health Officer's requirements.

Structural Vibration
The services installation shall be isolated from the structure to ensure that the frequency and amplitude of structural borne vibration as shown in figure A1.14 of the CIBSE Guide.

Infiltration
The ventilation fans shall be operated from a timed controller or from the BMS, as appropriate.
Toilet cores shall be provided with a twin fan extract unit ducted to the external atmosphere. Individual toilets shall be provided with a twin fan extract unit to the external atmosphere, which shall operate from a P.I.R. sensor and run on timer.

Kitchen (cooking) areas shall have mechanical ventilation installed and comply with the requirements of host nation and UFC's.

Mechanical Ventilation with Cooling
Personal comfort cooling is permitted only where mission essential equipment is installed and backed by T.O, ETL, UFC.
Mechanical ventilation systems with facility for both cooling and heating of spaces shall be included in all areas where it is essential for the maintenance of acceptable internal conditions for environmental or process or similar functions with the space.
(Refrigerant)
The cooling/ refrigeration equipment shall comply with the F Gas regulations.

Area requiring mechanical ventilation with temperature control include:

- Main computer room.
- Instrument and other rooms containing heat producing equipment.
- Large assembly areas, theatres etc. Mechanical ventilation with cooling shall provide a mechanical installation based on the following additional design criteria.

External Conditions Summer 29°c dG, 20°c wB Winter -5.5°c dG, 100% RH **Internal**

Conditions
As current UK CIBSE Guide B standards.

Ventilation & Fresh Air
Standards as mechanical ventilation section.

Humidity

Within range 40-70% (RH).

Refrigerant

The cooling/ refrigeration equipment shall comply with the F Gas regulations.

Natural Ventilation

Rooms that have openable windows and require no specific controlled working environment (with the exception of heating to counter winter heat losses), can be provided by natural ventilation.

Energy Efficient Equipment

Energy efficiency must be considered in the development, design, selection and acquisition of all equipment that affects consumer facility energy or facility energy consumption.

D3091 Special Cooling Systems & Devices

No site specific content.

D3092 Special Humidity Control

IAW most current UFC 3-410-01.

D3093 Dust & Fume Control

IAW most current UFC 3-410-01.

D3094 Air Curtains

IAW most current UFC 3-410-01.

D3095 Air Purifiers

IAW most current UFC 3-410-01.

D3096 Paint Spray Booth Ventilation

IAW most current UFC 3-410-01 and UFC 3-410-04.

D3097 General Construction Items (HVAC)

IAW most current UFC 3-410-01.

D40 Fire Protection

D4010 Sprinklers

Basis of Design
Refer to index of Specifications and Standards.

Description of System
The provision of sprinkler fire suppression systems (or alternative fire suppression systems) will be reviewed for all new and refurbished buildings as part of a 'Fire Risk Analysis' and 'Fire Strategy' study, executed during the design period. A standard approach for the provision of sprinkler installations will be required to ensure a consistent design standard and level of protection in facilities is achieved.

The provision of sprinkler fire suppression systems will not be considered in isolation, but will be reviewed in unison with the overall fire strategy.

During the design period careful consideration will be given to the selection of specific Design Codes, Standards, Base Criteria and Base Fire Officer requirements that will affect the sprinkler systems design and installation.

The provision of sprinkler systems provided will be reviewed against the various criteria indicated in the Index of Specifications and Standards which highlight the relevant UK and USVF fire protection codes.
Note that where standards are different or conflict that the more stringent will apply.

This may result in a combination of sprinkler fire suppression systems being designed/installed utilising both extracts from both UK, US Standards and specific Base requirements.

The provision of sprinkler suppression systems may be required in some sleeping areas.

All new and refurbished buildings will have automatic fire detection and/or fire suppression systems which will be monitored to send signals to Base fire station and/ or central control or monitoring facilities.

Fire alarm panels and fire-man's cut of switches will be located in the primary entrance vestibule of the respective building. Zonal areas of protection and operation will be graphically depicted in a professional manner in keeping with the respective Codes and Standards adopted.

Kitchen and cooking facilities will include:

- Hood and duct systems constructed to National Fire protection association Code (NFPA96) Standards.
- Fire suppression systems for hoods and ducts will comply with NFPA 96, NFPA 17, NFPA17A and AFOSH 27- 59, and EN 16282-7.

The designer will be required to conduct water pressure and flow tests and an overall appraisal of the site fire main characteristics prior to the design of any sprinkler fire suppression systems.

Note the requirement for sprinkler suppression systems in data processing areas to be dry pipe systems with reference to UFC's.

Note the requirement for suppression systems within existing and new air craft hangers are required to confirm to all current UFC's.

Automatic supervised wet pipe sprinkler systems are required to be designed and installed to confirm to BS 5306 (LPC rules) and take into account the more stringent requirements of NFPA13.

D4011 Sprinkler Water Supply

No site specific content.

D4012 Sprinkler Pumping Equipment
No site specific content.

D4013 Dry Sprinkler System
No site specific content.

D4020 Standpipes

D4021 Standpipe Water Supply
No site specific content.

D4022 Pumping Equipment
No site specific content.

D4023 Standpipe Equipment
Hose connections to buildings shall comply with NFPA 14 regarding number of connections, thread diameter and height above ground level etc.

D4024 Fire Hose Equipment
No site specific content.

D4030 Fire Protection Specialities

(THIS SECTION IS MANDATORY)

General Notes

Construction projects on RAFL must comply with both USAF and UK Fire Regulations and Codes. Each building type has specific requirements and both USAF and MOD Fire Prevention Officers must be requested to provide advice on a project by project basis.

The Design Team (Project Managers, Project Sponsors, A/E's, Contractors and Sub-Contractors) are jointly responsible to ensure that UK and USAF Fire Officers are invited to all Pre-Design and Detail Design meetings, become involved in the briefing process and ensure their requirements are incorporated into the design from the initial briefing stage to practical completion of the facility.

Designers must incorporate the most stringent requirements from the current issues of relevant documents:

NFPA Standards (about 290 documents):
are available for purchase from NFPA (National Fire Protection Association, 1 Batterymarch Park, Quicy, MA 02169-7471 USA Tel +1 617 770-3000 (http://www.nfpa.org)

UFC (Unified Facilities Criteria) 3-600 Series for Fire Protection
(http://www.afcesa.af.mil/library/index.asp..Publications)

Any other relevant current UK and US documentation.

The Design Team must ensure that sufficient copies of all relevant documents are available for reference at all meetings.

Note that Fire Dept. approved Fire Extinguishers, Fire Extinguisher Cabinets and Knox Boxes as listed below are to be supplied by the Contractor.

D4031 Fire Extinguishers

Amerex 10lb Multi Purpose Dry Chemical (Ammonium Phosphate Base) Classification 4-A: 60-B:C Amerex model 456. Stock No 4210-00-889-2491.

FlameSkill: Flameskill Unit 7 Hampstead Court, Hampstead Avenue, Mildenhall, Suffolk IP28 7AS; www.flameskill.co.uk; Tel: 01638 781090

Prestige Fire Safety: Unit 7, Meadow View Industrial Estate, Reach Road, Burwell, Cambridgeshire, CB25 0GH, mailto:info@prestigefiresafety.com, tel:0135382015

Cambridge Fire: 11, Hythe Close, Burwell, Cambridge, CB5 OEZ Tel 01638 741894 email sales@camfire.co.uk

Fire Tec: Tel 028 2765 7060 Website http://www.fire-tec.co.uk Email firetecsfp@aol.com Fire Protection Services 01582 413694 (can perform work on site)

D4032 Fire Extinguisher Cabinets

To be recess mounted wherever possible, alternatively surface mounted.

Follow current NFPA 10 guidance on cabinets. For recessed or surface mounted cabinets, they must be sized to suit extinguishers dimensions, have glass vision panel in door and be white, red or stainless steel in colour.

D4033 Rapid Access Systems

Key operated secured rapid access system shall be purchased.
"KNOX" single lock box Model 3200/3261, Black in color
Placed outside main entrance of facility and no more then 5' above ground level.

D4090 Other Fire Protection Systems

D4091 Carbon Dioxide Systems

No site specific content.

D4092 Foam Generating Equipment

No site specific content.

D4093 Clean Agent Systems

No site specific content.

D4094 Dry Chemical System

No site specific content.

D4095 Hood & Duct Fire Protection

No site specific content.

D50 Electrical

D5010 Electrical Service & Distribution

D5011 High Tension Service & Dist.

Requirements shall comply with Supplementary document Tech 008.

D5012 Low Tension Service & Dist.

SMART METERING

Meters

- Metering and sub-metering with meters with interval and remote reading capabilities is to be specified for all new construction and utilities system renovation projects over $200K. Existing buildings 3252 m^2 (35,000 ft^2) and larger will be metered for electricity and water. Existing buildings 4645 m^2 (50,000 ft^2) and larger will be metered for natural gas consumption also (DoD Instruction 4170.11). The metering requirements of UK Building Regulations Part L shall also be considered and complied with. Newly installed metering is to be compatible with the new site wide metering system.

- Advanced metering (smart meters) shall be installed to meet this metering policy, the smart meter implementation shall be met by the following.

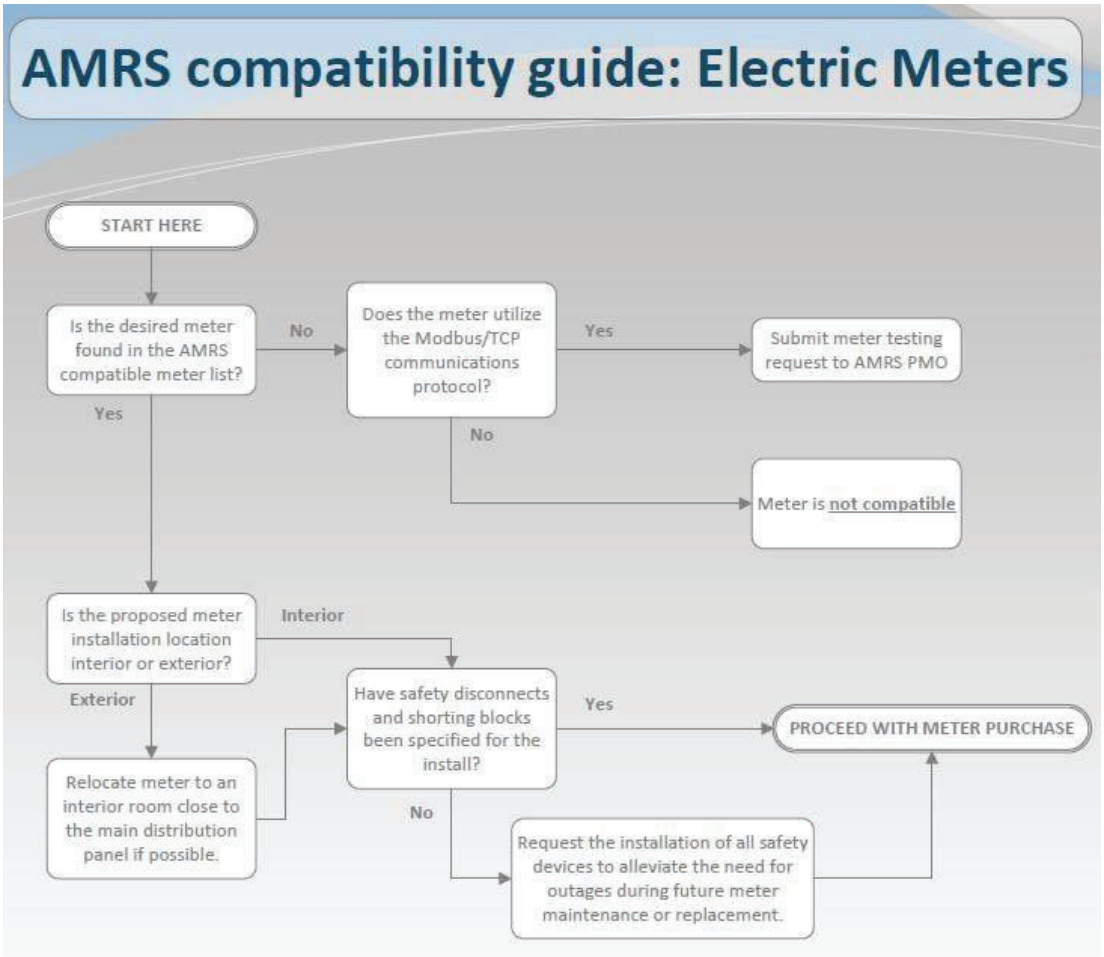
- For electrical metering the meter provides a standard approach for both single phase and three phase applications. A wide variety of smart meters may be utilised providing they provide the same parameters and are OFGEM approved, CoP5 compatible and meet the Measuring Instruments Directive (MID), MI-003: ACTIVE ELECTRICAL ENERGY METERS accuracy standards.

- Where specialist electricity meters are required to carry out analysis of the power supply characteristics, harmonics analysis, etc. this shall be on a case by case basis and shall be pre-approved in all cases. Meter software to be open protocol to allow 3rd party companies to service / carry out additions to the system.

- Where water, oil, gas [Refer also to D3012 Gas Service Systems] and heat metering is to be provided these meters shall provide a suitable pulse output and connect to Iskraemeco P2G Communicator and Data Logger. P2G is an integrated data logger, GSM modem and safety isolation unit in an intrinsically safe device. Other communicator/ data loggers may be utilised providing they provide the same parameters, data storage and communication capabilities as the P2G.

- Meter monitoring and communication shall be via SMS (text) message utilizing pre-installed SIM card to an approved online Meter Management Service. The service currently utilised by RAF Lakenheath is Meter Online Energy Management Service, http://www.meteronline.co.uk, Meter Manager Ltd, 4100 Park Approach, Thorpe Park, Leeds. LS15 8GB. Tel: 08448 733 121

AMRS COMPATIBLE METERING



What is an AMRS compatible meter?

An AMRS compatible meter is a meter that has been tested thoroughly in the AFCEC AMRS meter lab. Tests include the following: communication protocol compatibility, meter data point analysis and data extraction, cyber security testing and configuration baseline development.

Make	Model	Mount
Schneider	PM8000	Surface
EIG	Shark 1500	Surface
Schneider	PM5560	Surface
EIG	Shark 200	Surface
Schneider	ION 8650	9S
EIG	Nexus 1262/1272	9S
EIG	Shark 720	9S

Disconnects & Shorting Blocks

The use of Shorting blocks and Fuse Block Disconnects are required to ensure safety when working with electric meters. The implementation of these devices during installation will alleviate future building power outages due to meter maintenance.

CT Shorting Blades

Fuse Block Disconnect

Form 9S Meters & Surface Mount Installation

The AMRS PMO has determined interior locations for electric meters will lower life cycle sustainment costs and extend meter lift expectancy for various reasons which include: physical security for the electric meters, reducing the need to extend communication outside the building thus eliminating a cyber-security concern, protecting the meter from the elements. In the event that relocation isn't feasible and an existing meter enclosure contains safety disconnects and a shorting block, a Form 9S meter may be specified.

Form 9S base

Surface Mount

What is the Modbus/ TCP Communication Protocol?

The Modbus/ TCP communication protocol is the standard for AMRS due to it being openly published and royalty free as well as having a very broad acceptance in industrial environments. This protocol also enables AMRS and EMCS systems to poll electric meters for data simultaneously.

Approved Meters

Approved meters from Schneider Electric & approved by the AMRS Meter Team as being compatible with the V Lan operating Modbus/ TCPIP over Ethernet:

- Schneider Electric PM5560 (5X is the general meter).
- Schneider Electric PM8000 (8x is the power quality meter for high profile installations waveform captures & ancillary equipment).

AMRS Electric Meter Specifications

AMRS compatible Electric Meters shall meet the following requirements:

Current Inputs:

- Nominal 5A (Class 0.2s).
- Measured Current: 50mA to 10A.
- Withstand: 20A Continuous.
- Poly Phase (3 voltages and 3 currents).
- Internal storage for recording 2 values or channels for 90 days, configurable using manufacturer supplied configuration software. Must support interval consumption (15 minute) and demand (15 minute block average)

- Clear and concise manufacturer's published procedure or method for extracting the internally recorded values, register sets (buffer) or channel data via Modbus and Ethernet.
- Shall support time of use recording.
- On-board Ethernet communications, base 10/100 with RJ45 connector or pigtail with receptacle connector.
- Modbus/TCP communication protocol is required.
- Front display with ability to display all measured values.
- Meter internal real time clock that can be set via the Ethernet network.
- Minimum of two external dry contact inputs that shall count pulses from other devices.
- Minimum of one (1) external RS485 serial port.
- The above requirements are for new, electric meter installations.
- Download capability for Kva, Kwbr & ½ hour data, locally and remote.

New Meter Installations

All new meter installations shall be provided with voltage and current safety disconnect devices or equivalent, so that the meter assembly can be worked on safely over the life of the meter installation and not require utility outages for servicing. All new meter installations shall include the installation of new properly sized split or solid core current transformers (CTs).

AMRS Compatible Meter List

The following list of meters were evaluated, meet the AMRS meter specification and are compatible within the AMRS platform and meet cybersecurity requirements:

- Electro Industries Nexus 1262
- Electro Industries Nexus 1272
- Electro Industries Nexus 1500+
- Schneider Electric PM850SD
- Schneider Electric PM5560
- Schneider Electric PM8000
- Schneider Electric ION 8650

AMRS Non-Compatible Electric Meter List

In general, all meters using ANSI C12 communication are not compatible with the AMRS platform and have exhibited cyber vulnerabilities. Meters using ANSI C12 communication shall not be used on AF installations.
The following meters were evaluated, they are not compatible with the AMRS system and do not meet cybersecurity requirements:

- Elster A3 ALPHA
- Itron CENTRON

AMRS Compatible Translation Devices & Accumulators

The following devices are compatible with the AMRS platform, are consistent with the need of the existing site conditions, have been tested and passed cybersecurity requirements:

- Advantech ADAM-6051 I/O Modbus TCP Module with firmware v5.04 B01
- Perle IOLAN SDS1P Serial to Ethernet Device Server with firmware v4.6 F1

The following device was evaluated and is not compatible with the AMRS platform, and is not cyber secure:

- Perle IOLAN DS1 Serial to Ethernet Device Server

Typical AMRS Electric Meter Profile

Measured Parameter	Meter-Typical	AMRS Namespace
Voltage Phase A-N or A-B, Typical settings	Volts AB	VOLTS_PH_AB
Voltage Phase B-N or B-C, Typical settings	Volts BC	VOLTS_PH_BC
Voltage Phase C-N or C-A, Typical settings	Volts CA	VOLTS_PH_CA
Current Phase A	IA	CUR_PH_A
Current Phase B	IB	CUR_PH_B
Current Phase C	IC	CUR_PH_C
Current Phase N, Neutral, Calculated	INc	CUR_NEUT
Power (Real) or Active, Total	Watts Total	PWR_WATTS_POLY
Power Reactive, Total	VAR Total	PWR_VAR_POLY
Power (Volts Amps) or VA, Total	VA Total	PWR_VA_POLY
Power Factor Total, COS	PF	PF_POLY
Frequency in HZ	Frequency	FREQ
Demand, Block Average (15 Minute) (BWA) (Wright Pat 30 Min)	KW	DEMAND_KW
Energy, KWH (Active or Real)	WH Quadrant 1 or (1+4)	ENERGY_KWH
Pulse Aggregation, Unscaled	Aggregator 1	Pulse_1_raw
Pulse Aggregation, Unscaled	Aggregator 2	Pulse_2_raw
Pulse Aggregation, Unscaled	Aggregator 3	Pulse_3_raw
Pulse Aggregation, Unscaled	Aggregator 4	Pulse_4_raw

Typical Stored Data

Measured Parameter	Meter-Typical	AMRS Namespace
Consumption Interval (15-minutes)	Interval	Calculated (delta value Internal to CEM object)
Demand	Block Average	Calculated (total and peak)

Electrical Distribution

Basis of Design
Refer to Index of Specification and Standards

Description of Systems
The main site distribution at Lakenheath and Feltwell is via an 11kV rings / radial network feeding local step down transformers with Vector group DY11 and local distribution feeder pillars. 48CES shall be consulted in all cases where new distribution infrastructure/ equipment is required.

LV Distribution Feeder Pillars

All distribution feeder pillars are to be of the safe operation type as per Schneider SAIF. They will be complete with any tools or maintenance equipment necessary.

All sub stations are to have a minimum spare load capacity of 20% at the design stage.
Feeder pillars are to have a minimum spare capacity of 20% subject to a minimum of 2 ways.
All transformers feeding local feeder pillars shall be of the low loss, high efficiency type.

Internal Building Transformers

Single or three phase 50/60Hz transformers, will unless otherwise specified, be located within a building and shall be air cooled, where possible with a cast iron resin core.

Voltage taps to give plus and minus 2.5% and 5% shall be provided to cater for any deviation of the supply voltage.

Generally buildings at Lakenheath and Feltwell require, in addition to the standard UK voltages, 208 volts three phase and 120 volt single phase for switched socket outlets. Other transformer primary and secondary voltages and frequencies may be necessary to suit specialist situations or applications.

Power Tools

Transformers used for operating portable tools are to be fully enclosed type and suitably rated for the work to be carried out. The transformers should reduce the voltage from 230 volts 50 Hz to 110 volts 50 Hz and must be centre tapped.

A BS 4343 industrial socket outlet will be required for 110v output tools.

Such transformer to be provided in all mechanical and where indicated, electrical plantrooms.

Switchboard & Switchgear

Basis of Design

Refer to Index of Specification & Standards.

Description of Systems

Switchboards and switchgear are required to both protect and allow circuits to be isolated and “locked off” so that the relevant system can be worked on in a safe manner. Code 4 specification required for all new switchgear.

Distribution Boards

All distribution boards shall be of the lockable type.

MCB’s, RCBO’s etc. should also have provision for individual “locking off” via suitable accessories.

Switchgear

A fireman’s switch (coloured red) shall be connected to the incoming supply and should always be of the latching “on system” type. This means that if external power (EAS) is interrupted to the facility upon restoration all building SVS return to normal unless fireman’s switch or other fire control has operated to off.

The switch should be suitably labelled (traffolite red on white) stating “FIREMANS SWITCH DO NOT TURN OFF”.

DIO/ 48 CES should be consulted for requirements.

Motor Control Panels (MCP's)

Refer also to Controls, for Requirements.

General Power

Basis of Design

Refer to Index of Specification and Standards.

Description of Systems

To enable power and/ or data to be available at specific locations either internal or external to the buildings.

Outlets

120V, small power is not permitted unless required for mission essential equipment.

230V, 50Hz they shall be duplex, 13A twin, switched.

Galvanized conduits and LSF type cables shall be used to supply outlets.

Outlets shall be dado/skirting trunking mounted wherever possible. If this cannot be achieved all outlets shall be flush mounted to the wall with height from the floor compliant with current Building Regulations unless indicated otherwise. Internal utility distribution lines shall be concealed and outlets and switches shall be flush mounted (not surface mounted) in administrative, residential and public use facilities (libraries, clubs etc.) except in plant and utility service areas.

Outlets shall be grouped together consisting of 1 twin 13 amp and 1 twin phone/ data e.g. twin outlet with 1 data and 1 phone.

Outlets for domestic premises, situated externally, shall have a minimum rating of IP54.

Outlets in plantrooms shall conform to BS EN 60309-2/BS 4343, metal clad type and be colour coded for 110V and 230V and shall have a minimum rating of IP44.

Outlet Spacing

Domestic and administrative areas outlets shall be spaced at three metre intervals unless otherwise specified.

Corridors shall have outlets at six metre intervals for cleaning equipment.

External outlets are to be mounted as shown on the relevant drawings and all switches and disconnectors are to have a minimum rating of IP54.

All electrical circuits are to be suitably protected both environmentally and by 30mA RCD's where necessary. Outlets in plantrooms will be metal clad type.

Manufacturers

- MK, Crabtree or MEM

Cabling – Internal Only

Basis of Design

Refer to Index of Specification and Standards.

Description of Systems

To install all necessary cable, containment (ducts, trays, baskets and conduits) and cables for power systems. See section 5.3.1.3, Controls for Cabling requirements for BMS cabling.

All electrical installation shall meet the Department of the Environment PSA Standard Specification034, with the following specification not overriding this specification, but supplementing specific details. Where-ever possible all cabling should be stranded, copper single core LSF run in conduit or trunking. Where armoured cables are used, these shall be multicore, copper conductors, having XLPE insulation, steel wired armour and LSF sheath.

High Voltage (HV) XLPE Steel Wire Armoured (SWA) cables are to conform to BS 6622 with a design rating of 6350/11000(12) (Uo/U/(Um)) Vac. (PVC outer sheath acceptable as minimum standard with MDPE outer sheath being acceptable if PVC not available). HV XLPE cables should be of 185mmsq conductor size as standard for all new installation works unless mitigating factors dictate otherwise. Any deviation from the standard sizing is to be agreed by the Authorising Engineer - Electrical.

Low Voltage (LV) XLPE SWA cables are to conform to BS 6724 with a design rating of 600/1000 (Uo/U) Vac. LSZH sheath (low levels of smoke and non-toxic levels of halogen gas).

Both HV and LV cabling must be certified by the British Approvals Service For Cables (BASEC).

Where FAP200 cable is used it shall have a LSF sheath. Red sheath is reserved for Fire Alarm and shall not be used for other services. Orange sheath is acceptable for power and lighting. White sheath shall be used for emergency lighting.

Containment

Containment shall be installed for all network, control and power wiring. The containment system installed shall ensure that network and control cabling are segregated from power cabling.

All containment shall either be ladder, galvanized perforated steel tray, trunking or conduit, depending on the application. If control and power wiring are to take the same route, then twin compartment trunking shall be installed or separate tray/conduit systems installed.

Within plant rooms, all field devices shall be connected from the galvanized conduit tube end with a short length of flexible kopex.

Plastic conduit shall only be acceptable as containment to single devices mounted within room spaces, **not acceptable for plant rooms, electrical risers or main electrical cable routes.**

Trunking and tray containment system joints, shall be provided with bonding links at each joint to ensure equipotential of the system. Each circuit drawn into conduit and or trunking shall be provided with a separate CPC.

D5020 Lighting & Branch Wiring

Lighting

Basis of Design

Refer to Index of Specification and Standards.

Philosophy

Energy conservation is a primary consideration for all lighting design schemes at RAF Lakenheath. The use of natural daylighting must be used wherever possible. “Roof-lights” or “Light Tubes” may provide acceptable levels of illumination, thus reducing need for artificial sources in some areas.

Description of Systems

Internal Lighting

Maximum use shall be made of P.I.R., microwave or ultrasonic presence/ movement detectors in all internal lighting schemes. These sensors shall provide 100% coverage. Auto dimming of luminaires shall also be incorporated where natural daylighting is available to a significant level. The "Detectors" shall incorporate adjustable sensitivity and duration timers in all applications. The type of detection method selected in each design will need to consider best performance of the installation, any possible detrimental interference between the device and environment or vice-versa (compatibility).

There exists a preference to use 600 x 600mm recessed LED, 4000K colour type, UGR<19 (to avoid glare), Ra>80, SDCM:3, L80/B10>60,000 at Ta+25°C luminaires in lay in grid. These being appropriate in most office and administrative areas, allowing general future flexibility when office layout changes.

Reflectors shall have high reflectance, low iridescent aluminium, with mirrored, satin or white finish.

Manufacturers shall carry out commissioning on all movement sensors due to the specialised nature of the work and be co-ordinated with the relevant furniture layout. Sensors shall give 100% coverage

Per UFC 3-530-01, consistent with industry standard, all LED luminaires require a 5-year warranty.

LED Luminaires shall be recessed into the ceiling where feasible.

Corridors, toilets etc. in non-domestic situations shall make full use of compact recessed LED down-lighters.

Lighting shall be grouped to allow switching by rows in rooms with more than three luminaires. Any proposed switching methodology must meet the requirements of either the current and appropriate UFC or the most stringent alternative guidance at the time of design.

For toilet areas, luminaire switches shall be provided inside and adjacent to the door unless regulations dictate otherwise. Pull cords shall not be accepted as a USAF standard.

Microwave/ ultrasonic detectors shall be used wherever possible except for lighting in domestic/ MFH situation.

LED lighting shall be used to reduce running costs.
Full Life Cycle Cost Analysis is now required for all lighting installs with the consideration of LED's
All luminaires shall be VDU compatible in offices or where VDU's are used.

Roof voids must have suitable luminaires along walkways for ease of access to plant and maintenance item.

Emergency Lighting

Emergency lighting installations shall utilise self-contained, self-testing luminaires. The use of dedicated Uninterpretable Power Supplies (UPS) as a source for emergency lighting is no longer acceptable practice.

Conventional Switching Arrangements

In some situations, traditional/ manual switching or override of luminaries will remain the appropriate choice of the designer. These situations for example, plantrooms & workshops, etc. Where doubt exists on the type of lighting control preferred 48CES will provide further guidance upon request.

Stores & Warehouses

In areas used as warehouses and stores LED energy saving luminaires will be used. Luminaires are to be controlled via PIR detector, which senses movement. Facilities shall be provided to override "off" the detector.

Internal Lighting Levels

The level of internal lighting shall be stated in the particular specification for the project and on the relevant room data sheets.

Hospital Environment

The levels of lighting, types of luminaires and lamps are covered separately in the Life Safety Code 1.1.

External Lighting

Exterior lighting for streets, parking lots, pedestrian routes and service lines shall conform to the Base Standards and shall be of energy conscious design and provide efficient life cycle costs. Post types, styles and heights as well as fixture types, styles, sizes, materials and colours will be co-ordinated with the location and this standard, giving an overall continuity and integrated visual environment. All external luminaires are to be photo-electric cell operated. In low use area on building exteriors PIR to be fitted. All fixtures shall have a minimum rating of IP 55.

Time switches and photocell control shall be provided for external lighting circuits.

Walkway lighting shall be achieved by using illuminated bollards with a minimum rating of IP53. These shall be spaced at an even distance so as to give a minimum lux level of 4 lux (0.4 foot-candles). Please reference G4021, Fixtures & Transformers for suitable equipment selection.

Exterior building lighting and open stairwells shall be achieved using anti-corrosive, vandal resistant, weatherproof luminaries with a minimum rating of IP55 using LED light fittings. The luminaries must be fitted with a form of louver to prevent upward lighting and capable of being wall or corner mounted. Lux level dependent on the usage for the area being lit and controls must be switched, photocell and time-clock.

The diffuser of wall mounted luminaires shall obscure the LED.

Floodlighting is to be achieved using a general purpose, heavy duty luminaire with a minimum rating of IP 65 using integral control gear and energy efficient high intensity discharge lamps or other forms of lighting such as LED's as approved giving optimum photometric performance and maximum versatility. Must be simple to install and maintain and suitable for the usage of the area being lit (see table). Bird spikes to be fitted to top of lamps on all columns.

High mast lighting is to be available in various sizes to a height of 20m and be continuously tapered of polygonal cross section presenting a good visual image. The mast shall be hot dip galvanized internally and externally, and capable of being fixed to the foundation via an on-door plate with mast luminaires via a winch housed in the base of the mast or other systems such as mid and base hinged columns as approved. The mast luminaires are to be lightweight and maintain a good daytime appearance as well as being able to be fixed to a lantern carriage.

All exterior lighting columns, if required, to be painted must be by means of electrostatic coating either prior to or onsite. All exterior luminaires must be controlled by photo-electric cells. The photo-electric cells should be individually mounted on luminaires or banked so one cell switches a group of lights e.g.: exterior luminaires on buildings controlled from one photo-electric cell. Where a single photo electric cell is used to control a group, this shall be located adjacent to the control cabinet. Alternatively low use areas may utilise motion sensors in conjunction with a photo-electric cell. See UFC 3-530-01 for more details on controls.

Description of Internal Luminaires

Surface linear battens LED luminaires. Attachments include prismatic diffusers, white metal reflectors and LG3 Cat 2 and 3 louvres. Emergency versions available.

Recessed linear LED. Attachments include opal, prismatic, LG3 Cat 2 and 3 and general purpose louvres. LIF/ VDT approval. Bodies, white positively located on ceiling grid. Attachments fitted with wishbone springs. Emergency versions available.

IP65/67 GRP corrosion and waterproof LED luminaires and stainless steel toggles. Emergency version available

Surface circular, white aluminium body, opal polycarbonate differs. Emergency versions available

Circular recessed downlights. C/W range of reflectors and attachments. Emergency versions available, fixed and adjustable c/w brass or white finish.

Surface, recessed and semi-recessed low energy c/w range of white, chrome and brass trims. Emergency versions available.

300mm x 300mm recessed and surface mounted. Emergency versions available.

IP65 Die cast aluminium body, vandal resistant polycarbonate visor and stirrup mounting bracket

Base approved Manufacturers

- Crompton
- Thorlux
- Thorn
- Urbis

Any departure from the listed mainstream manufactures, (which meet the required standards of quality), Must be approved before incorporation in any design/project. Approval will be 48 CES.

D5021 Branch Wiring Devices

No site specific content.

D5022 Lighting Equipment

No site specific content.

D5030 Communications & Security

Force Protection

General

The contents of this Appendix are the standards related to force protection within the context of architectural compatibility and include standards for both exterior areas and buildings.

Comprehensive Planning

Many force protection objectives can be achieved through a comprehensive planning process. The least costly and often the most effective protection measures are those incorporated during the comprehensive planning phase. Implementing appropriate force protection measures at the planning stage can preclude the need for piecemeal and costly security enhancements later on. Consideration of force protection at the early planning stages is very important.

This appendix addresses force protection measures related to the following comprehensive planning areas:

- Land Use Planning
- Site Selection
- Area Development Planning
- Vehicular Access and Circulation Utility Systems

When preparing land use plans, locate high-risk land uses in the interior of the installation. High-risk land uses contain high concentrations of personnel, such as administrative, community and housing areas.

Consolidate high-risk land uses to take advantage of opportunities for security efficiency such as minimized control points.

In most cases, integration of force protection measures at the comprehensive planning level will increase the land area needed for individual facilities. Accordingly, when preparing future land use plans, take into account the land areas associated with proposed force protection measures in the calculation of land area requirements. Assess off-base adjacent land use and zoning plans for potential development that would impact security within the installation.

When selecting a site for a facility, consider its location relative to the base perimeter.

Maximize the distance between the perimeter fence and developed areas, providing as much open space as possible inside the fence along the base perimeter. Elevated sites generally enhance surveillance of the surrounding area. However, adjacent high terrain or structures outside the base boundary allow observation of on-base areas by outsiders.

Dense vegetation in proximity to a facility can screen covert activity and should be avoided. Avoiding low-lying topographic areas when siting facilities can mitigate the effects of the possible use of biological and/ or chemical weapons.

Facility site design encompasses site planning for a specific facility and its site, including the arrangement of the facility footprint, relationship of a building to a specific site, internal circulation, access, parking, landscaping, lighting and signage. By comparison, Area Development Plans (ADPs) focus on broader site planning, facility siting and circulation variables.

The following guidelines refer to these broader concerns associated with site planning at an area scale (i.e. multiple facilities) versus site scale (i.e. singular facility). Provide a separation distance between facilities adequate to minimize collateral damage. Site facilities within view of other occupied facilities.

When possible, cluster facilities that are functionally compatible and have similar threat levels. This reduces the perimeter area to be protected, limits access points to serve multiple facilities and provides compact security areas. However, the practical benefits of clustering facilities must be balanced with the survivability benefits of resource dispersal in the event of an attack.

The arrangement of buildings into complexes, with strongly delineated boundaries and buildings oriented to enhance surveillance opportunities, results in the creation of “defensible space” that can be protected more efficiently than scattered buildings. Vehicle parking should be eliminated between clusters of high-risk buildings. Provide pull-over lanes at installation entry gates to check suspect vehicles.

Design entry roads to installations and to individual buildings so that they do not provide direct or straight-line vehicular access to high-risk resources. Locate vehicle parking areas remote from high-risk resources to minimize blast effects from potential vehicle bombs. Whenever possible, commercial, service and delivery vehicles should have a designated entry to the installation preferably distant from high-risk resources.

When planning new roads, route major corridors away from concentrations of high-risk resources.

When selecting sites for high-risk resources, locate them remote from primary roads.

Minimize the number of signs identifying high-risk facilities. Clustering and securing facilities provides opportunities to minimize control points and limit vehicular access to high-risk resources.

Vulnerability assessments should identify all utility service to the installation as well as all utility lines, storm sewers, gas transmission lines, electricity transmission lines and other utilities that may cross the installation perimeter. Detailed knowledge of such service is important for public health and safety considerations as well as installation security concerns.

All utility penetration of the installation’s perimeter, including penetrations in fences, walls or other perimeter structures should be screened, sealed or secured to prevent their use access points for unlawful entry into the installation.

If access is required for maintenance of utilities, secure all penetrations with screening, grating, lattice work or other similar devices so that openings do not allow intruder access. Provide intrusion detection sensors and consider overt or covert visual surveillance systems if warranted by the sensitivity of assets requiring protection. Develop protective measures such as screens, fences or grates to prevent covert access through concrete trenches, storm drains, duct systems, etc. Provide and check locks on manhole covers.

Protect water treatment plants and storage facilities from waterborne contaminants by securing access points, such as manholes. Maintain routine water testing to help detect waterborne contaminants.

Minimize signs identifying critical utility complexes, e.g. power plants and water treatment plants. Provide fencing to prevent unauthorised access and use landscape planting to conceal above-ground systems. When possible, install utilities underground.

Locate petroleum, oil and lubricants (POL)-storage tanks and operations facilities down slope from all other facilities. Site fuel tanks at an elevation lower than operational buildings or utility plants.

Utility systems should be provided with redundant or loop service, particularly in the case of electrical systems. Where more than one source or service is not currently available, provisions should be made for future connections. In the interim, consider “quick connects” at the facility for portable backup systems.

Decentralization of an installation's communications resources and the use of multiple communication networks will strengthen the communications system's ability to withstand the effects of a terrorist attack. Careful consideration should be made in locating, concealing and protecting key network resources such as network control centres

Facility Site Design

Generally

This Appendix addresses force protection issues at the facility site design stage, including orientation of buildings and integration of vehicle access, control points, physical barriers, landscape planting, parking and protection of utilities to mitigate threats. Taking advantage of existing site elements is also a consideration in the facility site design process.

Determining how to provide for the facility's security needs requires an understanding of which site elements are beneficial and which are detrimental. As discussed in this Appendix, conflicts sometimes arise between security site design and conventional site design. For example, open circulation and common spaces, which are desirable for conventional design, are often undesirable for security design. To resolve these and other issues, coordination between design disciplines (e.g. planning, designing and engineering) is critical to the force protection process.

Facility site design works in conjunction with building design. Designers must balance force protection priorities with the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG), Uniform Federal Accessibility Standards (UFAS), National Fire Protection Codes (NFPA) and all applicable local building codes.

Finally, the Installation Security Council should review all force protection measures incorporated into facility site designs to ensure they are beneficial and cost effective.

This Appendix addresses force protection measures related to the following facility site design issues:

- Guidelines for Facility Site Design
- Facility Site Design Tools
- Orientation of Buildings on a Site
- Relationship of Roads to an Asset
- Land Forms and Natural Resources
- Control Points and Physical Barriers
- Landscape Planting
- Parking
- Service Access
- Site Utility Vulnerabilities

While many different measures can be used to provide force protection in facility site design, **distance** is the most effective and desirable tool because other measures vary in effectiveness, are more costly and often have unintended consequences. For example, a blast wall can become the source of fragmentation if an explosion occurs in close proximity to the wall.

The first mode of site protection is to create "keep out"-zones that can insure a minimum guaranteed distance between an explosion, i.e. from a vehicle, and target structure. Facilities should be located on a site as far as possible from points on the site perimeter that are accessible to vehicles. "Keep out"- zones can be achieved with the use of site elements that function as perimeter barriers to vehicles that cannot be compromised by a ramming vehicle. It is also desirable to locate facilities away from other buildings that are not potential targets to minimize damage to them.

Stand-Off Zones

The distance between an asset and a threat is referred to as the **stand-off distance**. There is no ideal stand-off distance; it is determined by the type of and level of threat, the type of construction and desired level of protection.

Energy from a blast decreases over distance. The impact of a blast will decrease as the stand-off distance increases. In general, the cost to provide force protection will decrease as the distance between an asset and a threat increases.

Controlled Access

Within the stand-off distance, levels of protection can be achieved by establishing controlled zones. These zones define minimum distances between assets and potential threats through the installation of barriers (such as bollards, planters and fountains). The barriers should be designed to withstand assaults by terrorist vehicles, however their placement must be planned to allow for access by fire and rescue vehicles in the event of an emergency.

There are two types of stand-off zones. Selection between them is based on operational considerations related to vehicle access and parking. Stand-off zones completely surround a facility. Perimeters are set at distances that consider threat levels, desired level of protection, building construction and land availability. Entry into this controlled area is through an **entry control point**.

An **exclusive stand-off zone** is an area that has a controlled entry with highly restrictive access. It can be used with all threat levels. No vehicles except delivery and service vehicles are allowed into the exclusive stand-off zone. The entry control point provides an opportunity to search delivery and service vehicles.

A **non-exclusive stand-off zone** is an area that has a controlled entry with less restrictive access. Nonexclusive stand-off zones can be used with exclusive stand-off zones for high and very high threat levels to minimize the use of land areas. When a nonexclusive stand-off zone is used, it encloses an exclusive stand-off zone.

Passenger vehicles can be allowed in the area between the exclusive and nonexclusive zone but only under surveillance.

To combat against a moving and stationary vehicle bomb tactic, the perimeter of the exclusive stand-off zone should be set at the stand-off distance necessary to mitigate the effects of a bomb that could be carried in a passenger vehicle up to a medium threat level. Trucks associated with higher threat levels are capable of carrying greater quantities of explosives than automobiles and should not be allowed into the nonexclusive stand-off zone without being searched.

The exclusive stand-off zone around an asset can include other assets. For example, where there are multiple facilities subject to vehicle bomb threats in the same general area, these facilities may be clustered into common stand-off zones to use land and guard manpower more efficiently. If a primary asset is not currently surrounded by an exclusive stand-off zone, consider closing some streets to create an exclusive zone.

Street closures aid in excluding vehicles while continuing to allow access by pedestrians with proper credentials. The possibility of closing streets must be balanced against minimum circulation requirements and fire protection needs.

Barriers used on the perimeter of stand-off zones are *passive barriers.* They are always in place and do not require any action to be employed. Perimeter barriers are selected differently for moving and stationary bomb tactics.

Surveillance

An additional level of protection can be provided for high-risk facilities by creating a *clear zone* within the exclusive stand-off zone. A clear zone is an area immediately adjacent to the asset that is free of all visual obstructions or landscaping that could provide concealment. The clear zone facilitates visual detection of bombs placed near the facility.

Clear zones can be extended if the building construction requires additional stand-off distance to resist the threat explosive. If required, the stand-off zone should be extended if building construction requires additional stand- off distance to resist the threat explosive, if required, extend the stand-off zone to accommodate an expanded clear

zone. Walkways and other circulation features within a clear zone should be located so that buildings do not block view of pedestrians and vehicles.

Orientation of Buildings on a Site

Deny aggressors a clear "line of sight" to the facility from on-or off-base. Protect the facility against visual surveillance by aggressors by locating the protected facility outside of the range or Out of view of vantage points.

Defend against attack by stand-off weapons, antitank weapons, mortars, etc. in selecting perimeter barriers to block sightlines such as obstruction screens or hedges of trees and shrubs. Non-critical structures or other natural or man-made features can be used to block sightlines. Create "defensible space" by positioning facilities to permit building occupants and police to clearly monitor adjacent areas.

If roads are nearby, orient buildings so that there are no sides parallel to vehicle approach routes.

Relationship of Roads to an Asset

If possible, choose a site away from main thoroughfares. Locate facility away from uncontrolled vehicle access. Minimize the number of access roads and entrances into a facility.

Land Forms & Natural Resources

Depending on circumstances, land forms can be either beneficial or detrimental to force protection planning. Avoid siting the facility adjacent to higher surrounding terrain, which provides easy viewing of the facility

- Non Air-Force facilities that are unsecured vegetation, drainage channels, ditches, ridges or culverts, which can provide concealment Maximize opportunities to use natural terrain features to deflect blasts. Consider using bodies of water as a design feature to provide a stand- off zone.

Control Points & Physical Barriers

Select and design barriers based on threat levels. If the limited availability of land precludes the creation of an exclusive zone, the use of screening surrounding the facility can be an alternative. Use a combination of barriers. Some barriers are fixed and obvious (fences and gates), while others are passive (sidewalks far away from buildings, curbs with lawn, etc.).

Where physical barriers are required, consider using landscape materials to create barriers that are soft and naturalistic rather than man-made.

Vehicles can be used as temporary physical barriers by being placed in front of buildings or across access roads.

Maintain as much stand-off distance as possible between Moving Vehicle Bombs (MVBs) and an asset:

- Provide traffic obstacles near entry control points to slow traffic down.
- Consider vehicle barriers at facility entries and drives.
- Offset vehicle entrances from the direction of a vehicle's approach to force a reduction in speed.
- When possible, position gates and perimeter boundary fences outside the blast vulnerability envelope.
- If the threat level warrants, provide a vehicle crash resistance system in the form of a low wall or earth berm.
- Consider checkpoints to screen vehicles entering a facility.
- Provide passive vehicle barriers to keep Stationary Vehicle Bombs (SVBs) at a distance from the asset.
- Use high curbs, low berms, shallow ditches, trees, shrubs and other physical separations to keep stationary bombs at a distance.
- Do not allow vehicles to park next to perimeter walls of the secured area. Consider using bollards or other devices to keep vehicles away.
- Provide adequate lighting to aid in threat detection. Use closed-circuit television (CCTV) to monitor areas that cannot be staffed constantly.

Landscape Planting

Design landscape planting that permits building occupants to see out but does not allow outside monitoring of functions or people inside the building:

- Vegetation in a clear zone should not exceed four inches in height.
- Use landscape planting appropriately to provide screening to protect the facility without creating concealment for covert activity. Vegetation can have both beneficial and detrimental impacts on security. With proper selection, placement and maintenance of landscape planting, appropriate screening and greater field of vision can be accomplished.
- Vegetative groupings and earth sheltering provide inherent blast effect reduction from external blast forces.
- Minimize potential hiding places through placement of landscape materials, site furnishings and screening elements for visually detractive elements, e.g. transformers, trash compactors and condensing units.

Use dense, thorn-bearing plant materials to create natural barriers to deter aggressors. Screen play and outdoor recreation areas from public (off base) view.
Maximize opportunities to use berms to deflect blasts. Minimize signs that identify and locate assets.

Place trash receptacles as far away from the facility as possible. Trash receptacles should not be placed within 30 feet of a facility.

Parking

If possible, do not allow parking beneath the facility. If parking beneath a facility is unavoidable, access to the parking should be limited, secure, well-lighted and free of places of concealment.

Do not authorize vehicles that have not been inspected to park under a building or within the exclusive zone, including at loading docks.

If possible, locate visitor or general public parking near, but not on the site itself. Parking within the secured perimeter of an asset should be restricted to employees.

Parking should be located in areas that provide the fewest security risks to DE personnel. One-way circulation within a parking lot can facilitate monitoring for potential aggressors.

Locate parking within view of occupied facilities. Restrict parking from the interior of a group of buildings. Locate parking and service areas away from high-risk resources.
Restrict parking within the stand-off zone.

When establishing parking areas, provide emergency communication systems (intercom, telephones, etc.) at readily identified, well-lighted CCTV-monitored locations to permit direct contact with security personnel.

Provide parking lots with CCTV cameras and adequate lighting capable of displaying and videotaping lot activity.

Service Access

Provide signage to clearly mark separate entrances for deliveries, visitors and employees. If loading zones or drive-through areas are necessary, monitor them and restrict height to keep out large vehicles.

Avoid having driveways within or under facilities.

Site Utilities

Provide a site-wide public address system that extends from the interior to the exterior of facilities. Where possible, provide underground, concealed and protected utilities. The public address system shall be installed in accordance with UFC 4-021-01.

Provide redundant utility systems (particularly electrical services) to support site security, life safety and rescue functions.

Consider quick connects for portable utility backup systems if redundant sources are not available. Locate fuel storage tanks at least 100 feet (30m) from buildings.

Building Systems Design

After all appropriate force protection measures have been considered at the comprehensive planning and site design level, measures must be considered to protect the ultimate terrorist target: the personnel within the facility. The measures described in this Appendix are designed to minimize vulnerability to attack and loss of life through deterrence and detection and strengthening of the building against a variety of terrorist tactics.

The design team must determine which measures are appropriate and cost effective to incorporate into the design. The designer must balance force protection measures with the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG), Uniform Federal Accessibility Standards (UFAS), National Fire Protection Codes (NFPA) and all applicable local building codes.

The Installation Security Council should review all force protection measures incorporated into building systems design. Since facilities occupied by Air Force personnel are often contained within a DE or other U.S. Government installation, the physical security system for a facility can be structured to take full advantage of security resources already in place. Those facilities located outside a DE or U.S. Government installation require more substantial local physical force protection measures for a given level of terrorist threat than comparable facilities located within a DE or U.S. Government installation.

This Appendix addresses building systems and their components. The force protection measures described are organized in building systems that correlate to design disciplines:

- Architectural
- Interior Design
- Structural
- Mechanical
- Electrical

From a force protection standpoint, the primary goals of building systems design are I) design a safe building that will not fail when attacked and 2) permit rescue teams to evacuate victims during rescue operations. Some force protection measures may conflict with others. The relative risk and benefit of these guidelines vary based upon the asset and threat.

The measures described here are not all-inclusive and additional technical information for implementation can be found in the applicable reference documents.

Building Form

Consider earth-sheltered design to reduce the asset's vulnerability to attack. Orient buildings horizontally rather than vertically to reduce the building's profile and exposure. Place the ground floor elevation of a building at four feet (1.20m) above grade to prevent vehicles from being driven to and into the facility.

Avoid eaves and overhangs, since these can be points of high local pressure and suction during blasts. When these elements are used, they must be designed to withstand blast effects. Orient glazing perpendicular to the primary facade to reduce exposure to blast and projectiles. Avoid having exposed structural elements such as columns on the

exterior of the facility.

Provide pitched roofs to allow launched explosives to roll off of the facility.

Avoid re-entrant corners on the building exterior where blast pressures may build up.

Exterior Envelope

Provide strengthened building elements and systems when stand-off distances cannot be accommodated. Use ductile materials that are capable of very large plastic deformations without complete failure.

Make roof access hatches securable from the interior. Provide blast-resistant walls when a high threat is present. Design facilities with a sacrificial sloping roof that is above a protected ceiling.

Consider use of sacrificial exterior wall panels to absorb blast.

Use earth tone-coloured materials and finishes on exterior surfaces to diminish the prominence of a building. Consider reinforced concrete wall systems in lieu of masonry or curtain walls to minimize flying debris in a blast. Reinforced wall panels can protect columns and assist in preventing progressive collapse, as the wall will assist in carrying the load of a damaged column.

Windows

Eliminate windows adjacent to doors because the windows can be broken, allowing the door to be unlocked. Minimize the number and size of windows in a facade. If possible, limit the amount of glazed area in building facades to15 percent. The amount of blast entering a space is directly proportional to the amount of opening on the facade.

Consider using burglary and ballistic resistant glazing in high threat areas. Consider using laminated glass in place of conventional glass.

Consider window safety laminate (such as Mylar) or another fragment retention film over glazing (properly installed) to reduce fragmentation.

Consider placing guards, such as grills, screens, or meshwork, across window openings to protect against covert entry.

Affix protective window guards firmly to the structure.

Consider curtains, blinds and shades to limit entry of incendiary devices.
Narrow recessed windows with sloped sills are less vulnerable than conventional windows.

Windows with key-operated locks provide a greater level of protection than windows with simple latches. Stationary, non-operating windows are preferred for security.

The operable section of a sliding window should be on the inside of the fixed section and secured with a broomstick, metal rod or similar device placed at the bottom.

Provide horizontal windows six feet above (1.80m) the finished floor to limit entry.
Windows can be hardened by steel window frames securely fastened or grouted to the surrounding structure.

Doors

Provide hollow steel doors or steel-clad doors with steel frames.

Provide blast-resistant doors for high threats and high levels of protection. Permit normal entry/egress through only one door, if possible.

Limit exterior doors to a minimum while accommodating emergency egress. Doors are less attack-resistant than

adjacent walls because of functional requirements, construction and method of attachment.

The weakest part of a door system is the latching component. Replace externally mounted locks and hasps with internally locking devices.

Where practical, doors should present blank, flush surfaces to the outside to reduce their vulnerability to attack. Locate hinges on interior or provide concealed hinges to reduce their vulnerability to attack.

Emergency exit doors should only facilitate exiting movement Equip any outward opening double door with protective hinges and key operated mortise type locks.

Provide solid doors or walls as a back-up for glass doors in foyers.
Strengthen and harden the upright surfaces of a door jamb into which the door fits.

Miscellaneous

Make roof access ladders removable, retractable or lockable. Protect utility openings for a facility from covert entry by installing screens or grates or attaching intrusion detection system (IDS) sensors.

Space Planning

High-risk facilities should not be co-located with lower risk tenants. For example, a post office or supply centre room should not be located in the same building as a child care facility.

Locate assets as far into the interior of a facility as possible.
Place mailrooms on the perimeter of a facility to minimize the damage caused by a mail bomb. Also, consider hardening the walls and ceiling of mailrooms.

Place areas of high visitor activity away from assets.

Locate critical assets in spaces that are occupied 24-hours per day.

Locate assets in areas where they are visible to more than one person. Eliminate hiding places within the building.

Use interior barriers to differentiate levels of security within a facility.

Stagger doors located across from one another in interior hallways to limit the effects of a blast through a structure.
Provide foyers with reinforced concrete walls and offset interior and exterior doors from each other in the foyer.

The innermost layer of protection within a physical security system is the *safe haven.* Safe havens are not intended to withstand a disciplined, paramilitary attack featuring explosives and heavy weapons. The safe haven should be designed such that the time that attackers need to penetrate the protected area is greater than the time that response forces need to reach the protected area.

Detailing

Minimize interior glazing near high-threat areas.

Connect interior non-load bearing walls to structure with non-rigid connections. Interior walls should be painted in light colours to improve illumination.

At windows, consider blast curtains or heavy drapes in high threat areas.

Circulation

Design circulation routes to provide unobstructed views of people approaching controlled access points. Consider the use of access controls, such as a card key locking system, into secured areas of the facility. Pedestrian paths should be planned to concentrate activity to aid in detection.

Consider the use of access controls from one area of the facility to another to slow down intruders. This will provide

more time for security to react. A combination of programmable magnetic swipe cards and personal identification numbers (PINs) is more secure than either a PIN or swipe card used alone.

Signage

Consider using street addresses or building numbers in lieu of detailed descriptive information. Post clear signs to minimize accidental entry by unauthorised personnel into critical asset areas. Eliminate or minimize signage identifying critical facilities to downplay their critical nature.

Structural

Buildings should be designed against progressive collapse.

Structural damage without collapse of the facility is an acceptable and practical design parameter. Consider incorporating internal damping into the structural system to absorb the blast impact.

Symmetric reinforcement can increase the ultimate load capacity of the structure.

Ductile details should be used for structural connections to absorb the energy of a blast (Often the ductile detailing requirements for seismic design can help prevent progressive collapse after a bomb attack.) Redundancy and alternative load paths can help mitigate blasts and reduce the chance of progressive collapse. Strengthening the structural system can help in resisting the effects of a blast.

Consider wire mesh in plaster to reduce the incidence of flying fragments.

Avoid the use of masonry when blast is a threat Masonry walls break up readily and become secondary fragments during blasts.

The use of multiple barrier materials and construction techniques can sometimes accomplish the same goal with less expense than a single material or technique.

Mechanical

The primary goal of a mechanical system after a terrorist attack should be to continue to operate key life safety systems. Mechanical penetrations through exterior walls such as intake louvers should be mounted as high as possible to minimize their vulnerability.

Do not mount plumbing, electrical fixtures or utility lines on the inside of exterior walls. When mounting along exterior walls is unavoidable, mount fixtures on a separate wall at least six inches from the exterior wall. Avoid placing plumbing on the roof slab. Avoid suspending plumbing fixtures and piping from the ceiling. Reduce the number of utility openings, manholes, tunnels, air conditioning ducts, filters and access panels into the structure. Locate utility systems away from likely areas of attack such as loading docks, lobbies and parking areas.

Protect building operational control areas and utility feeders to lessen the negative effects of a blast.

Design operational redundancies to survive all kinds of attack. Use lockable systems for utility openings and man holes where appropriate.

Infrequently used utility covers/ manholes can be tack-welded as an inexpensive alternative to locking tamper resistant covers.

Depending on assessed level of threat, install either a manually activated or a continuously active air filtration system to reduce the risk from airborne contaminants.

Electrical

Use electronic systems for intrusion detection, access control and assessment such as door alarms and CCTV when appropriate.

Illuminate building access points to aid in threat detection.

Self-contained battery lighting should be provided in stairwells and for exit signs. Avoid suspending electrical conduit from the ceiling.

Consider using manually activated duress alarms. An audible alarm can frighten away an intruder. Provide secured dedicated telephone lines between secured areas and security response force.

Provide a manually activated and controlled warning and evacuation system. This can consist of warning systems that can ring in short bursts as a warning to evacuate the building in the event of an impending explosion.

Provide security monitoring through closed-circuit television systems (CCTV).

Provide adequate lighting of perimeters and parking areas to aid in visual surveillance and to support the use of CCTV. Provide an internal public address system.

When risks are high, consider the use of x-ray screening systems in mailrooms and at supply facilities.

Refer to reference documents on Force Protection – Appendix C.

D5031 Public Address & Music Systems

No site specific content.

D5032 Intercommunication & Paging System

No site specific content.

D5033 Telephone System

No site specific content.

D5034 Call Systems

P.A System

Refer to Index of Specification & Standards and Base Communication Squadron Standards (5.7).

Description of Systems

Public address (PA) systems are installed to enable messages to be passed to as many personnel as possible at the same time. This is extremely useful in emergency situations.

Speakers

Large buildings must have speakers, with concealed individual volume control, and amplifier to enable local/building announcements to be made.

The speakers shall be recessed in the suspended ceilings, wherever applicable and connected in parallel not in series.

Amplifier

The amplifier must be sized for the correct output (Watts). It must also be positioned correctly to ensure that when the operator is using the system no additional background noise can be picked up by the microphone.

Cables

Cables for the system should be installed in mini-trunking to avoid damage if office or workshop layouts are amended at future dates.

D5035 Television System

No site specific content.

D5036 Clock & Program Systems

No site specific content.

D5037 Fire Alarm Systems

The exact design of a fire alarm system is determined by the facility space's occupancy classification and the local codes mandated by the Authority Having Jurisdiction (AHJ) for that specific occupancy classification. But regardless of the system design, all fire alarm systems must have a Fire Alarm Control Panel (FACP).

Fire Alarm Panels (FAP) receives information from devices designed to detect and report fires, monitors their operational integrity and provides for automatic control of equipment, and transmission of information necessary to prepare the facility for fire based on a predetermined sequence.

As each building is different, there is no 'one size fits all' FAP. Therefore, the term 'standardisation' means that we use the same type (usually this refers to the same manufacturer) of FAP but not necessarily that all FAP's need to have the same capabilities.

FAP's will be chosen based on the following;

- The purpose and use of the building
- The floor space sizing of the building, plus 25%.
- Must be cost effective

All FAP orders shall include:

- Relevant pictorial zonal maps and their maintenance to be included
- Instruction and training to be provided.

The below is a list of regulations/ standards should be referred to for each system install. Be advised that the design is to include the following for consideration but this list is not exhaustive:

- NFPA 1 (Fire Code)
- NFPA 72 (National Fire Alarm and Signalling code)
- NFPA 101 (Life Safety Code)
- U.F.C 3-600-01 (Fire Protection Engineering for Facilities)

(Auxiliary references are as follows: BS 5839-9:2021; BS 5839-6:2019+A1:2020; BS 5839-6:2019; PD 6531:2018; BS 5839-1:2017; BS 5839-1:2013; BS 5839-3:1988; BS 5839-6:2013; BS 5839-8:2013; BS 5839-9:2011; PD 6531:2010)

D5038 Security & Detection Systems

No site specific content.

D5039 Local Area Network

No site specific content.

D5090 Other Electrical System D5091 Grounding Systems Lightning Protection

Basis of Design

Refer to Index of Specification & Standards.
Inclusive M&E SS 034, BS EN, NFPA 780, UFC 3-575-01.

Description of Systems

Lightning creates excessive "spikes and surges" which can cause extensive damage to both property and the contents of property.

Property Protection

A lightning protection system should be installed to protect the fabric of the building. The design should be carried out by a specialist in the field of lightning protection and must be specific for the building under consideration.

All Lightning conductors shall be copper. Aluminium conductors shall not be used.

All earth test clamp positions shall be labelled with and adjacent screw fixed engraved melamine label. The I.D. number shall correspond to that in the commissioning/test certificates and also the as install drawings.

Contents Protection

Consideration must be given to protection of systems within property. The most vulnerable are those containing micro-

processors and transmission systems.

Uninterruptable Power Suppliers (UPS) must also be considered for protection.

D5092 Emergency Light & Power Systems Emergency Lighting

Emergency lighting for dormitories, hangers, and other major projects should be connected to a suitably sized central battery system. Other installations should be of the self-contained battery type. All emergency systems are to be correctly tested and commissioned to ensure the discharge life is correct. The correct certificate must be signed by the appropriate responsible person. All emergency (external to the luminaire) should be carried out using FAP200 cable with an outer sheath of LSF white.

Emergency lighting to have minimum duration of 3 hours.
Provide lock key test positions and self-test facility on fitting if possible.
Exit signs shall be maintained/ sustained and shall be Chloride "LED" type.
Exit signs legends shall be in accordance with EC Safety Sign Directive.
Escape lighting is required on all designated escape routes to comply with NFPA 101 Life Safety Code, Sections 7.9.1.1, 7.9.2.1, and 7.10 (average 10 lux, minimum 1 lux).

Standby Generator

Basis of Design

Refer to Index of Specifications (Generator Performance Specification 48CES) & Standards (ETL 13-4) and G59 design criteria.

Description of Systems

Standby generators are required for emergency situations only i.e. Loss of normal power. The generator will be selected for a specific project.

Generator Size

The generator should be selected for the particular emergency situation anticipated. If the generator will be required to supply more than one situation care should be taken to ensure the electrical output (kVA) will match that of the highest load required.

Physical size of the generator must also be taken into account for storage purposes. Consideration shall be given to noise levels and exhaust fumes discharge.

Connections

Electrical connections with changeover switches shall be considered for all facilities.

The connections shall be of the quick connect/ disconnect type.

The generator where authorised for installation shall be of the auto-start type to ensure minimum disruption in case of a power loss situation.

All designs shall incorporate suitable means to bypass the generator power and control systems for maintenance purposes. Automatic changeover contactors, bypass or isolating switch/ switch fuse shall incorporate facilities for padlocking in the ON and OFF positions.

Fuel

Standby generators shall be suitable to run on Automotive fuel to BS EN 590.

D5093 Floor Raceway System

No site specific content.

D5094 Other Special Systems & Devices

No site specific content.

D5095 General Construction Items (Elect)

No site specific content.

E – Equipment

E10 Equipment

E1010 Commercial Equipment

E1011 Security & Vault Equipment
No site specific content.

E1012 Teller & Service Equipment
No site specific content.

E1013 Registration Equipment
No site specific content.

E1014 Checkroom Equipment
No site specific content.

E1015 Mercantile Equipment
No site specific content.

E1016 Laundry & Dry Cleaning Equipment
No site specific content.

E1017 Vending Equipment
No site specific content.

E1018 Office Equipment
No site specific content.

Requirements down to user preference agreed during design.

E1020 Institutional Equipment

E1021 Ecclesiastical Equipment
No site specific content.

E1022 Library Equipment
No site specific content.

E1023 Theatre & Stage Equipment
No site specific content.

E1024 Instrumental Equipment
No site specific content.

E1025 Audio-Visual Equipment
No site specific content.

E1026 Detention Equipment
No site specific content.

E1027 Laboratory Equipment
No site specific content.

E1028 Medical Equipment
Refer to Specialist Base Standard.

E1029 Other Vehicular Equipment
No site specific content.

E1030 Vehicular Equipment

E1031 Vehicular Service Equipment
No site specific content.

E1032 Parking Control Equipment
No site specific content.

E1033 Loading Dock Equipment
No site specific content.

E1039 Other Vehicular Equipment
No site specific content.

E1090 Other Equipment

E1091 Maintenance Equipment
No site specific content.

E1092 Solid Waste Handling Equipment
No site specific content.

E1093 Food Service Equipment
No site specific content.

E1094 Residential Equipment
Refer to specialist Base Standard.

E1095 Unit Kitchens
Subject to agreed Performance Specification.

E1097 Window Washing Equipment
No site specific content.

E1099 Other Equipment Materials

E1099.1

Application:	Toilet Facilities - Base Wide.
Manufacturer:	N/A.
Product Ref:	Xlerator Hand Dryer.
Tested to:	N/A.
Colour:	XL-W (White) & XL-C Chrome.
Material:	Alloy
Notes:	Size - 300 x 300mm; Energy Efficient; Hand dry time - 10-15 seconds; Noise Level - 85 DB; Warranty - 3 Year Manufacturers.

E1099.2

Application:	Toilet Facilities - Base Wide.
Manufacturer:	N/A
Product Ref:	Veltia Hand Dryer - GP-100
Tested to:	N/A
Colour:	Snow white/ aluminium/ red/ black/ Atlantic blue/ cherry red/ deep blue/ Bordeaux red/ champagne.
Material:	Alloy.
Notes:	Size - 617 x 300mm;/ Energy Efficient; Warranty - 3 Year Manufacturers; Low noise level – 72db at 1 meter.

E1099.3

Application:	Toilet Facilities - Base Wide.
Manufacturer:	N/A
Product Ref:	Vortex Hand Dryer – SA.
Tested to:	N/A
Colour:	Aluminium.
Material:	Steel case.
Notes:	Size - 350 x 350mm; Energy Efficient; Warranty - 5 years or 1 million cycles; Drying time - typically 15 seconds; Non-contact infrared hand detection.

E20 Furnishings

E2010 Fixed Furnishings

E2011 Fixed Artwork
No site specific content.

E2012 Fixed Casework
No site specific content.

E2013 Blinds & Other Window Treatment
To be determined on a project by project basis.

E2014 Fixed Floor Grilles & Mats
No site specific content.

E2015 Fixed Multiple Seating
No site specific content.

E2016 Fixed Interior Landscape
No site specific content.

E2020 Movable Furnishings

E2021 Movable Artwork
No site specific content.

E2022 Furniture & Accessories
To be determined on a project by project basis.

E2023 Movable Rugs & Mats
No site specific content.

E2024 Movable Interior Landscape
No site specific content.

F – Special Construction & Demolition

F10 Special Construction

F1010 Special Construction

F1011 Air Supported Structures
No site specific content.

F1012 Pre-Engineered Structures
No site specific content.

F1013 Other Special Structures
No site specific content.

F1020 Integrated Construction

F1021 Integrated Assemblies
No site specific content.

F1022 Special Purpose Rooms
No site specific content.

F1023 Other Integrated Structures
No site specific content.

F1030 Special Construction Systems

F1031 Sound, Vibration & Seismic Const.
No site specific content.

F1032 Radiation Protection
No site specific content.

F1033 Special Security Systems
No site specific content.

F1034 Vaults
No site specific content.

F1035 Other Special Construction Systems
No site specific content.

F1040 Special Facilities

F1041 Aquatic Facilities
No site specific content.

F1042 Ice Rinks
No site specific content.

F1043 Site Constructed Incinerators
No site specific content.

F1044 Kennels & Animal Shelters
To comply with appropriate UFC's and ETL's.

F1045 Liquid & Gas Storage Tanks
No site specific content.

F1049 Other Special Facilities
No site specific content.

F1050 Special Controls & Instrumentation

F1051 Recording Instrumentation
No site specific content.

F1052 Building Automation System
No site specific content.

F1059 Other Special Controls & Instrumentation
No site specific content.

F20 Selective Building Demolition

F2010 Building Elements Demolition

F2011 Building Interior Demolition
No site specific content.

F2012 Building Exterior Demolition
No site specific content.

F2020 Hazardous Components Abatement

F2021 Removal of Hazardous Components

Asbestos
Refer to 'Design – General' statement at front of these Standards in respect Asbestos.

Waste Management Engineering Services

Basis of Design
Refer to Index of Specifications and Standards.

Description of System

Waste Provisions
The environmental strategy will be developed during the design incorporating water and waste management proposals in accordance with sustainability tests/ principles and the BREEAM guidelines.

A waste streaming and monitoring policy will be adopted for all developments to maximise the potential for recycling and re- use of all wastes generated. Special consideration will be given to the treatment and disposal of waste streams contributed from kitchen/catering facilities and areas where toxic or harmful chemicals may be present.

Environmental strategies and pollution control measures will not only be adopted for the completed development, but also encompass the preceding construction period, where the following items will be considered:

- Materials used for construction should be sourced from renewable sources and will be selected to maximise the energy efficiency and life of the buildings.

- Where possible materials will be sourced from local suppliers thus minimising transport implications and assist the local economy.

- Waste minimisation principles will be applied to the use of materials for construction. Inert construction waste will be re-used where possible for the landscaping of the site.

- The disposal of construction waste to landfill should be avoided.

  As a means of ensuring that waste management strategies are understood and implemented by staff, a forum for user information and education of staff will be adopted during construction and design period and after the handover of facilities.

- The following strategies will be considered:
    - Resource efficiency, waste minimisation and reduction at source will be central to the waste management strategy.
    - Building and infrastructure designed to promote re-use and recycling of materials at the end of their useful life, including measures to minimise contamination of the recyclate.
    - Segregation and monitoring of waste streams.
    - Storage provision of different types of waste and recyclate will take account of the need for access by the various waste disposal contractors visiting site. Consider the use of compaction plant to reduce the space required for cardboard and paper recyclate.
    - Consider the adoption of a composting facility to promote the recycling of organic waste streams. The resultant compost could be used for landscape maintenance.
    - Consider the separation of kitchen waste water streams containing grease or oils for collection and removal from site.

Guidelines for evaluation of Waste Management Strategy

- Assessment of quantities and composition of waste streams.
- Consideration to appropriate legislation.
- Consultation with relevant authorities.
- Detail design of solutions.

Associated Issues

- Access requirements.
- Storage, collection and separation.
- Transport.
- Equipment i.e.: containers, chutes, pneumatic systems and water borne systems.
- Incineration.
- Volume reduction i.e.: compactors, shredders, crushers and balers.
- Hazardous liquid wastes.
- Health safety and Environmental issues.
- Capital running costs.

F2022 Encapsulation of Hazardous Components

No site specific content.

G – Exteriors

G10 Site Preparation

G1010 Site Clearing

G1011 Clearing & Grubbing
No site specific content.

Note: Clearing of ground and grubbing should have clearance from Environmental to ensure no nesting birds or other animals are disturbed. A check should be made before hand through DIO for any potential archeology that may require further investigation or just a watching brief.

G1012 Tree Removal & Thinning
Environmental must provide approval prior to any trees being removed from site.

G1020 Site Demolition & Relocation

G1021 Building Demolition
No site specific content.

G1022 Demolition of Site Components
No site specific content.

G1023 Relocation of Building & Utilities
No site specific content.

G1024 Utilities Relocation
Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

G1030 Site Earthwork

G1031 Site Grading Excavation
(ADVISORY)
If in SSSI or Functionally Linked Land, salvage topsoil if deemed clean and suitable for reuse after waste testing

G1032 Borrow Fill
Environmental approval required. SSSI requirements may apply.

G1033 Soil Stabilization & Treatment
ADVISORY FOR AIRFIELD AREAS OR NEAR SSSI: Either use natural regeneration from the existing seed bank with bitumen emulsion spray or annual rye grass. Do not use bamboo stakes & turf. Seek approval from 48 CES/CEIE and DIO-Environmental on a case by case basis.

G1034 Site Dewatering
No site specific content.

G1035 Site Shoring
No site specific content.

G1036 Embankments
No site specific content.

G1037 Erosion Control
No site specific content.

G1040 Hazardous Waste Remediation

G1041 Removal of Contaminated Soil

Waste Transfer Regulations apply.

G1042 Soil Restoration & Treatment

Any contractor undertaking works shall ensure an appropriate land quality assessment is undertaken. Further phases of investigation may be required. Historical information is available from 48 CES/CEIE and DIO Environmental, but the contractor shall develop their own risk assessments. All reports are reviewed by DIO Environmental and the appropriate regulator. The project must complete any remediation required per AFI 32-1023 & DODI 4715.08.

G20 Site Improvement

G2010 Roadways

ROADS & PARKING BAYS

(MANDATORY)

Generally
The NFPA Regulations stipulate minimum dimensions for roads, fire lanes, parking lot stalls and parking lot lanes. UFC Criteria to be considered. Design is for American cars. See also base Architectural guide.

(MANDATORY)

Roads
Roads shall have a minimum lane clearance of 12ft (3.7m) for each lane of travel, excluding shoulders and parking.

At least 13ft 6ins (4.4m) vertical clearance shall be provided over the full width of all means of access.

Compliance with current ADA and Equality Acts apply.

Brown signs designating reserved parking spaces to be approved by Traffic Working Safety Group or Security Forces.

(MANDATORY)

Fire Lanes
Fire lane widths adjacent to buildings shall be a minimum of 16ft (4.9m) for one way and 24ft (7.4m) for two-way travel.

Turns in fire lanes shall have a minimum inside curb radius of 25ft (7.6m) and a minimum outside curb radius of 50ft (15.2m).

Fire lanes connecting to roadways shall be provided with curb cuts extending at least 2ft (.61m) beyond the edge of the fire lane.

Clear openings through gates shall be 2ft (.61m) wider than the travelled way.

Fire department personnel shall have ready access to locking mechanisms on any gate restricting access to a fire lane.

Maintain a vertical clearance of 13ft 6ins (4.1m) over the width of a fire lane.

G2011 Base & Sub-Bases

Case by case basis as directed by Pavement Engineer.

Refer to PCASE and UFC for design of the roads and pavements.

Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

G2012 Paving & Surfacing

Materials
G2012.1

Application:	Roads & Car Parks.
Manufacturer:	N/A.
Product Ref:	Bodpave as car parking surfaces. Low volume access routes.
Tested to:	N/A.
Colour:	Black.
Material:	Tarmacadam.
Notes:	6mm top wearing course SMA and 10-25mm base course based on the design criteria.

G2013 Curbs, Gutters & Drains

Materials
G2013.1

Application:	All Areas – Kerbs.
Manufacturer:	Marshalls Mono Ltd.
Product Ref:	Standard, Trieff, Kadet, Eco channel, Mono.
Tested to:	N/A.
Colour:	Light grey.
Material:	Precast concrete.
Notes:	-.

G2014 Guardrails & Barriers

(ADVISORY)

Bollard Types
This document includes details of acceptable materials. Materials from other manufacturers that meet these requirements can be submitted with evidence of comparability for review and approval.

Type 1a: basic bollard (not anti-ram). Type 1b: basic 'anti-ram' rating bollard.

Obtain CE approval in writing in advance to install any of these other bollards:
Type 2a (lit bollard), not anti-ram Type 2b (lit anti-ram bollard), Type 3 (coffin anti-ram bollard),
Type 4 (telescopic anti-ram bollard)

All bollards are to be specified as 'standard' or 'ram-raid', as required. Follow manufacturer's recommendations for suitable concrete footings to provide required resistance to vehicle impact of specified weight, speed and angle of approach. AT/FP must confirm whether resistance to a 30ton vehicle travelling at 30mph is adequate protection from the available angle of approach.

All bollards are to be finished in standard 2 pack epoxy acrylic paint system. This provides 5 – 10 years to first maintenance. Alternative special finishes must be agreed with CE. Bollards must be cleaned and the paint finish touched up on a regular basis to maintain their appearance as required. Coffin bollards must be lifted and lubricated regularly to maintain operating efficiency.

All bollards on roads or in car parks are to be finished in black with white raised rings plus white reflective tape between the top two rings to improve visibility for drivers. This must be fitted during manufacture.

All other bollards must be black with white raised rings without the reflective tape.

Install at maximum 4ft (1220mm) centres to meet AFI 32-1071.

Bollard lifting equipment shall be provided, standardised where possible.

Bollards of equivalent appearance and physical properties from other manufacturers may be submitted for approval by 48 CES.

Materials

To be chosen from the Marshall range for purpose or similar and approved.

G2014.1

Bollard Type: Basic bollard (not anti-ram): 1m high, 140mm o/a diameter.

G2014.2

Bollard Type: Basic anti-ram bollard: 1m high, 140mm o/a diameter.

G2014.3

Bollard Type: Lit bollard (not anti-ram): 1m high, 140mm o/a diameter, Complete with LED internal lamp. See URBIS range for a Lit bollard case by case basis. See lighting standard.

G2014.4

Bollard Type: Telescopic ram-raid bollard: 670mm height above ground, 90mm dia.

G2014.5

Application:	All areas - To be used in limited location to prevent Pedestrian/ Vehicular conflict.
Manufacturer:	Marshalls Ltd.
Product Ref:	'Telford' steel bollard (MSF 616)
Tested to:	N/A.
Colour:	Brown (BS 08B29) with yellow hazard strip.
Material:	Mild Steel.
Notes:	Tech Spec: Fixed below ground or removable using socket flap and padlock; Polyester powder coated; 890mm above ground.

G2015 Painted Lines

Thermoplastic on asphalt unless otherwise specified on roads. Airfield epoxy 2 part. Use primer before painting See ETL 04-02 Painting guide on site specific content.

All signs and road markings shall be laid as per Department of Transport Design guides Chapters 1 to 8. All road markings shall conform to UK Highways unless there is a specify UFC mandate.

Concrete and Airfield see ETL 04-02 Painting guide and also UFC 3-260-01 Heliport and Airfield Design guide. Note use of glass beads type 1 and 3 as case-by-case basis

G2016 Markings & Signage

Markings and Signage for road directions shall be those specified by the Department of Transport. Chapters 1 to 8. In specific instances UFC or AFI may also need to be applied to specific road signs.

Plant, boiler, and similarly used rooms are to be fitted with an external caution sign to appropriately manage & control safe access into these spaces (format attached as PLANT ROOM SIGN V1 in Appendix C). The sign in portrait orientation is to be approx. 215mm wide x 305mm tall on a non-metallic rigid melamine style back approx. 3mm thick. Sign is to be pre-drilled at each corner for galvinised or stainless-steel screw or nyloc-nut & bolt fixing or alternatively pot-riveted **Not fixed using adhesive, tape, self-tapping screw in metal. Mounting can also be on an immediately adjacent wall rawplugged position next to the relevant door(s).

Graphics and text are to be printed in a weatherproof finish with assured U.V. stability. The 48 CES contact TEL# will be the full, current U.K. dialing number for the CES Customer Service desk which auto-transfers to the fire department out of normal working hours. Tape/DYMO style added numbers are to be U.V. stable type. Permanent marker/pen is NOT durable / U.V. stable or easily read.

Mounting at appropriate height on plant room doors themselves is permitted if this, for example, will not compromise/reduce design boiler combustion / ventilation or plant cooling air required via typical louver type doors.

Example of plant room/spaces where this sign will be appropriate and must be posted: boiler rooms or houses, AHU plant rooms, air-compressor rooms, oil-pump plant rooms, converter or UPS rooms, electrical switch rooms, generator rooms, sprinkler pump houses, or plant rooms. Consult with 48 CES/CEOER asset/activity managers (SMEs) if unsure as to provision and instructions above. Provision of this sign does not relieve any project specifications/code requirements fit other regulatory, statutory, or mandated signs & labels appropriate to space and function.

G2017 Vehicular Bridges

No site specific content.

G2020 Parking Lots

(MANDATORY)

Dimensions provided below - refer to UFC.

Parking lot dimensions:

Parking

Angle	Min stall length (one way traffic)	Min aisle width (two way traffic)	Min aisle width
45 degree	27.5ft (8.2m)	16ft (4.9m)	24ft (7.4m)
60 degree	23,7ft (6.6m)	16ft (4.9m)	24ft (7.4m)
75 degree	18.5ft (5.6m)	23ft (7.0m)	24ft (7.4m)
90 degree		26ft (8.0m)	26ft (8.0m)

Parking lot stall width shall be 9ft (2.74m)

G2021 Base & Sub-Bases

6mm top wearing course SMA and 10-25mm base course based on the design criteria.

G2022 Paving & Surfacing

Vehicle parking (where pavers are required instead of asphalt):

Colour Red Buff with Marshall colour White reflective bay dividers.
Colour White reflective inset to pedestrian crossings in paved areas.
Paving to be laid at 90 degree herringbone pattern.

G2023 Curbs, Rails & Barriers

Reference Broxap for lighting column protection see base architecture guide. Case by case basis for security purposes.

Other handrails to be Accessibility and ADA compliant for outside steps. Change in level marked with yellow or white paint or suitable nose edging strip.

G2024 Parking Booths & Equipment

No site specific content.

G2025 Markings & Signage

Markings and Signage for road directions shall be those specified by the Department of Transport. Chapters 1 to 8. In specific instances UFC or AFI may also need to be applied to specific road signs.

G2030 Pedestrian Paving

G2031 Paving & Surfacing

(ADVISORY)

PAVING (CONCRETE BLOCK)

To be from Marshall and Red Buff, cycle ways in Parliament Grey.

Options on a case by case study.

Materials

G2031.1

Application: Footpaths & Pedestrian Areas – Block Paving.
Manufacturer: Marshall Ltd.
Product Ref: Keyblok.
Tested to: General BS 7533.
Colour: 'Brindle'.
Material: Pigmented concrete
Notes: Basket weave bond; Size: 200mm x 100mm x 60mm; 200mm x 100mm x 80mm for vehicular over-used areas.

G2031.2

Application: Housing Areas – Rear Patios – Paving Flags.
Manufacturer: Marshalls Ltd.
Product Ref: 'Perfecta'.
Tested to: BS 7283 (1).
Colour: Natural concrete grey with fine exposed aggregate.
Material: Concrete
Notes: 400mm x 400mm x 50mm thick.

G2031.3

Application: Pedestrian Areas – Slot Drain.
Manufacturer: ACO/ Gatic/ Marshalls Ltd.
Product Ref: 'Birco CG.
Tested to: N/A.
Colour: Brindle.
Material: Pigmented concrete.
Notes: Smooth and dished surface. Concrete drainage channel below.

G2031.4

Application: Ramps & non-slip surfaces.
Manufacturer: Marshalls Ltd.
Product Ref: 'Tactile' slab pavior.
Tested to: DoT guidelines.
Colour: Natural.
Material: Concrete.
Notes: Embossed surface studs; Sand joints & bedding.

G2032 Edging

As Marshalls Ltd. range or similar approved.

G2033 Exterior Steps

ADA and Accessibility Act compliance.

G2034 Pedestrian Bridges

Materials
G2034.1

Application:	RAF Lakenheath - Country Park.
Manufacturer:	C. T. S. Bridges Ltd.
Product Ref:	N/A.
Tested to:	N/A.
Colour:	Stained to natural finish.
Material:	Impregnated softwood.
Notes:	Pre-drilled components arrive on site as a kit of light weight parts.

G2040 Site Development

Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

G2041 Fences & Gates

Fences, Screens & Dumpster Enclosures

(**ADVISORY)**

Fences for visual screening, housing areas & dumpster enclosures.

Fencing provisions to be considered on a case-by-case basis for site location and level of protection.

Comply with the current edition of BS 1722 for close boarded fences. Panel height 1.8m Apply 2No. coats of Base Standard Johnstone's dark Oak water base stain to timber at completion.

Distribution Substations will comply with the requirements of both BS 1722-11 'Fences' and with the specifics and construction methods of the section below.

Construction Notes

Gates require galvanized steel posts with their feet sunk into a concrete base for support. If the gates option is required the steel posts should be included at the initial construction stage, to avoid disturbing post footings at a later date.

Dumpster locations note: UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, requires minimum stand-off between dumpster enclosures and inhabited buildings, primary gathering and billeting buildings. Check

current requirements with ARW/ATO.

Materials

G2041.1

Application:	Rear Gardens, Screening for Storage or Utilities.
Manufacturer:	Killingley Estate Fencing Ltd.
Product Ref:	Timber boards.
Tested to:	N/A.
Colour:	Brown stained.
Material:	Concrete post. Timber panels.
Notes:	Rear Gardens (1.2m); Screening for storage or utilities (2m), with the exception of Distribution Substations (1.8m); limited to low impact areas; Footings anchored in concrete base; vertical close boarding.

G2042 Retaining Walls

No site specific content.

G2043 Terrace & Perimeter Walls

No site specific content.

G2044 Signage

No site specific content.

EXTERNAL

(ADVISORY)

General requirements

This document includes details of acceptable materials. Materials from other manufacturers that meet these requirements can be submitted with evidence of comparability for review and approval.

External signage at RAF Lakenheath must comply with the principles of UFC 3-120-01 Air Force Sign Standard and contributes towards maintaining the highest facility standards. Examples of Base Standard signage at RAF Lakenheath are illustrated in this document. Dimensions of the signs illustrated below must not be exceeded without approval from the BCE.

UFC 3-120-01 is available at http://www.wbdg.org/ccb/DOD/UFC/ufc_3_120_01.pdf

The standardization of organizational and direction signs and building mounted numbers presents a professional image command-wide. Even if they are not standardized, signage for on-base businesses and Services activities must maintain a professional image. Specialist signs can be distinctive but should be in good taste and complement the specific facility and base architectural and sign standards. Purely commercial activities can be integrated into base standard signage, the activity listed on an organizational sign. Vendors may display reasonably sized signage (at their own expense) at their entrances or in windows visible from the exterior of the facility. Where corporate logos such as those of brand-name restaurants etc. are required on Services facilities, they must be unobtrusive and complement the facility: i.e. they must not be too large, too bright in colour or overpower the facility design or locality.

Requests for signage to Services activities, on-base businesses, vendors, or on-base events (including temporary signs) must be submitted for approval to the Base CE with details of the proposed location, detailed description or specification including logos, colours and text, dimensions, fixing method, and the regime and responsibility for cleaning and maintenance. Requests for temporary signs can be sent in email format, but any permanent signs must submit a NexGen Service Request. All requests must go through 48CES Customer Service (details provided below).

Call: DSN: 314-226-4823(48CE) or COMM: 01638-52-4823

NIPR Email: 48CES.CEOXR@us.af.mil
SharePoint: 48 CES/CEOER Facility Manager SharePoint

*AAFES Sign 1:*90x50ins

AAFES Sign 2: 76x26ins

*AAFES Sign 3:*103x54ins

DECA Sign 1: 90x90ins

DECA Sign 2: 230x48ins

Commercial Activity sign: 90x24ins

Commercial Activity Sign

Services Sign: 63x54ins

Services Sign:

66 x 45ins beneath Building Sign.

Framed, Building & Direction Signs:

Building Sign

Direction Sign

Large framed direction signs will be placed along major traffic routes: Finger signs will be used in other areas that are primarily pedestrian.

RAF Lakenheath Frame shop makes up the signs and letters with aluminium sheet boards and applies the adhesive backing sheet and letters on top, made up as required.

Pre-finished colour to frame and brackets: BS 08C37.

Adhesive plastic sheet background colour is available in basic colours: brown (general signage), red (giving warning), or blue (information signs), or others as required, from B840.

INTERNAL

Weather protection for bicycles on a case by case basis.

G2045 Site Furnishings

(ADVISORY)

WASTEBINS

This document includes details of an acceptable item. Items from other manufacturers that meet these requirements can be submitted with evidence of comparability for review and approval by the Base Civil Engineer.

This has been co-ordinated through ARW/ ATO to minimize damage from fragments in the event of an explosion.

Materials

G2045.1

Application:	All Areas – Circular Bin.
Manufacturer:	Marshalls Ltd
Product Ref:	'Boulevard' 700.
Tested to:	N/A.
Colour:	Light grey, exposed aggregate. Bright yellow hood.
Material:	Concrete base & UPVC plastic hood with optional stainless steel ashtray.
Notes:	Base slots for fork lift operations. Capacity: 1000 litres. Larger size near cafes. Tech Spec: Lockable hood with side slot. Wire basket for plastic bin liner. Size: 500mm diameter; 890mm high.

G2046 Fountains, Pools & Watercourses

No site specific content.

G2047 Playing Fields

No site specific content.

G2048 Flagpoles

No site specific content.

G2049 Miscellaneous Structures

G2049.1

Application:	Housing & Community Facility Areas – Play Structures.
Manufacturer:	Lappset Ltd.
Product Ref:	Modular systems.
Tested to:	EN 1176.
Colour:	Stained or painted in bright colours.
Material:	Mainly pressure impregnated Lapp pine.
Notes:	Cross-reference with - Safety surfaces, seats, bins, plants, lighting etc.; Imaginative, sympathetic and varied range; Range covers - 1-4 years, 1-12 years. 3-12 years and 12-+ years.

G2049.2

Application:	**H**ousing & Community Facility Areas – Playground Equipment.
Manufacturer:	Kompan Ltd.
Product Ref:	Modular Systems.
Tested to:	EN 1176.
Colour:	Stained or painted in bright colours.
Material:	High quality steel, wood and plastic.
Notes:	Cross reference - Safety surfaces, seats, bins, plants, lighting etc. Varied range for interaction, creativity and security; Range covers - 2 – 6 years; 4-10 years and 6-12 years.

G2049.3 Electric Vehicle (EV) Charging Points

EV charging points will not be installed except with the expressed permission of the Base Civil Engineer.

G2050 Landscaping

G2051 Fine Grading & Soil Preparation

No site specific content.

G2052 Erosion Control Measures

Follow UFC requirements.

G2053 Top Soil & Planting Beds

No site specific content.

G2054 Seeding & Sodding

LANDSCAPING: GROUND REINSTATEMENT AS TURF OR SEEDED GRASS

(ADVISORY for non-SSSI or not functionally linked land)

Procedure to be adopted:

- Remove all vegetation from area to be cultivated.
- Cultivate area in order to achieve a medium tilth suitable for grading.
- Import good quality top soil (avoid soil with a high peat content) where necessary to marry cultivated areas with existing surrounding levels.
- Spread and level soil in layers not exceeding 100mm deep.
- Consolidate soil to ensure minimal future settlement.
- Grade soil to follow profile of the surrounding landscape.
- Remove all material/ debris with a greater diameter of 25mm.
- Rake soil down to a fine tilth and form seed bed suitable for seed or turf.

(MANDATORY)

If landscaping is occurring in or near SSSI, SAC and/or Functionally Linked Land as defined by host nation regulations, an ecological risk assessment, method statement and consent from the host nation regulator may be required, to be coordinated via DIO-Environmental and 48 CES/CEIE . If landscaping in SSSI, coordinate with 48 CES/CEIE and DIO-Environmental for using SSSI soil stockpiles or equivalent and pre-approved seed banks.

Seed option

- Reference UFC for use of turf on munitions igloos and any restrictions which may apply.
- Use commercial seed mix appropriate to intended use.
- Rake grass seed into soil at a rate of 35g/m^2 ensuring even and uniform distribution within the soil.
- For areas within Habitat of Principle of Importance or near SSSI, consult with 48 CES/CEIE and DIO Environmental for seed mix specification.
- The following is an example of a generic mix of grass seed for reinstating grass areas, cultivars demonstrating similar or equivalent growing characteristics are acceptable:

Typical Grass Seed Mix:

- 50% Strong Creeping Red Fescue
- 45% Perennial Rye grass
- 5% Highland Browntop Bent

Turf Option

Lay turf in stretcher bond style working off boards at all times. During dry weather ensure turf is watered *immediately* after laying.

- Where seeding could be affected by jet blast (near to aircraft movement areas) the seed/ soil mixture shall be sprayed with a 40% cationic bitumen tack coat at a minimum rate of 1litre/m^2.

- Where turf has been laid and could be affected by jet blasts (near to aircraft movement areas) ensure it is adequately secured to the soil by means of a suitable mesh to minimize the effects of jet blast. Ensure that on successful establishment of turf that the securing methods are removed in their entirety.

- Water all turf areas during dry weather when natural rainfall is insufficient to ensure establishment.

G2055 Planting

PLANT LIST

NOTE: All tree planting needs to be pre-approved by DIO-Forester. Submit requests and justifications to 48 CES/CEIE and DIO-Environmental for coordination. Only species listed in the following sections are permitted for planting:

Formal Planting - Trees

- Acer platanoides 'Columnare'
- Aesculus hippocastanum "Baumanii"
- Betula pendula
- Carpinus betulus fastigiata
- Gleditsia tricanthos 'Sunburst'
- Liriodendron tulipifera
- Quercus robur (English oak)
- Pine, Scots (Pinus sylvestris)
- Birch, silver (Betula pendula)
- Black Poplar (Populus nigra)
- White Poplar (Populus alba) Note: Non-native but naturalized
- Grey (Populus canescens) Note: Hybrid

Formal Planting - Shrubs

- Buxus sempervirens
- Choiysia ternate
- Cordyline australis
- Ilex aquifolium “J.C. van Thol”
- Ilex crenata “Convexa”
- Lavendula Hidcote
- Ligustrum ovalifolium
- Lonicera ‘Baggesson’s Gold’
- Lonicera nitida
- Mahonia x ‘Charity’
- Phormium tenax
- Taxus Baccata
- Viburnum tinus.

Formal Planting - Groundcover/ climbers

- Euonymous ‘Emerald n’ Gold’
- Hedera helix
- Hydrangea petiolaris
- Rosmarinus officinalis
- Senecio ‘Sunshine’
- Vinca minor.

Informal Planting - Trees

- Acer campestre
- Alnus cordata
- Amelanchier lamarckii
- Betula utilis jacquemontii
- Carpinus betulus
- Corylus avellana
- Crataegus monogyna
- Fraxinus excelsior
- Populus tremula
- Prunus padus
- Sorbus aucuparia
- Quercus robur (English oak)
- Pine, Scots (Pinus sylvestris)
- Birch, silver (Betula pendula)

Informal Planting - Shrubs

- Euonymous alatus
- Forsythia intermedia
- Hammamelis Intermedia
- Hippophae rhamnoides
- Symphoricarpus chenaultii ‘Hancock’
- Viburnum opulus.

Informal Planting - Groundcovers/ climbers

- Hedera helix hibernica
- Lonicera henryi
- Rubus 'Betty Ashburner'.

Street Tree Planting Primary Streets

- Acer campestre "Streetwise"
- Acer saccharinum
- Fraxinus excelsior
- Gleditsia triacnthos "Sunburst"
- Platanus Acerifolia
- Robina pseudoacacia
- Tilia europea.
- Quercus robur (English oak)
- Pine, Scots (Pinus sylvestris)
- Birch, silver (Betula pendula)

G2056 Planters

No site specific content.

G2057 Irrigation Systems

No site specific content.

G2059 Other Landscape Features

(ADVISORY)

This document includes details of acceptable materials. Materials from other manufacturers that meet these requirements can be submitted with evidence of comparability for review and approval.

Materials

G2059.1

Lamp Post Protectors

Broxap BX14 6539R (PC), 1m high, of mild steel, galvanized and powder coated black. Broxap Limited, Rowhurst Industrial Estate, Chesterton, Newcastle-Under-Lyme, Staffordshire ST5 6BD Tel 01782 564411. Website www.broxap.com

G2059.2

Application:	Public Plazas or Parking Areas – Tree Protection Grill.
Manufacturer:	Marshalls Ltd.
Product Ref:	Ferrocast or equivalent free protection grill
Tested to:	N/A.
Colour:	**-**
Material:	Polyester powder coated, ductile cast iron.
Notes:	Each of the four grille sections sits in an edge frame and inter-locks. Size: Outside dimension, 1.8m x 1.8m x 60mm thick. 230 Kg. Planting hole 600mm diameter. Design: Orthogonal grate with openings for two irrigation covers.

G30 Site Mechanical Utilities

Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

G3010 Water Supply

Water Management Engineering Services

Basis of Design
Refer to Index of Specifications and Standards at the front of these Base Standards.

Description of System
Water resource management strategies will be adopted to minimise mains water consumption and to maximise the potential for recycling and re-use of water.

The following sustainable water management strategies will be considered and merits evaluated for new and existing facilities:

Demand Management

- Water efficient fixtures and fittings.
- Dual water distribution systems will be considered to enable the use of untreated water (borehole water, grey water and rainwater) for irrigation, water features and non-potable domestic purposes i.e.: toilet flushing.
- Rainwater harvesting and re-use.
- Grey water (waste water) recycling and re-use.
- Sub-metering and monitoring of water usage.
- Waste stream monitoring.
- User information and education.
- Optimum use of resources.

Whole Life Costing

- Capital expenditure and payback periods.
- Maintainability.

Sustainable Urban Drainage Management

- Run-off control.
- Retention and treatment.
- Recycling.
- Separation of hydrocarbons.
- Pollution control.
- Irrigation.
- Protection of local water courses and acquifer.

Water Efficiency

- Comparison of water supply costs against capital expenditure and water saving proposals.
- Targets for water conservation and efficiency.
- Evaluate possible use of borehole water supply. Cooling closed loop/open loop.
- Recharge of aquifer.

Landscape Design

- To achieve water efficiencies, environmental protection and enhancement.
- Planting strategy.
- Irrigation.
- Water ecology.
- Water features.
- Pollution protection.

G3011 Portable Water Distribution & Storage
No site specific content.

G3012 Non Portable Water Distribution & Storage
No site specific content.

G3013 Well Systems
No site specific content.

G3014 Fire Protection Distribution & Storage
Mueller Centurion Fire Hydrants with 5 inch Stortz connections and KNOX Company FDC (Fire Department Connection) end caps in hard anodized aluminium.

Caps of hydrants painted to identify the pressure.

Colour: Normally delivered painted red: overpaint Hydrant only in BS 08B29 (dark brown).
Website: www.muellercompany.com

G3015 Pumping Stations
No site specific content.

G3016 Package Water Treatment Plants
No site specific content.

G3020 Sanitary Sewer
Below Ground Foul & Surface Water Drainage System

Basis of Design
Refer to Index of Specifications and Standards.

Description of System
Below ground drainage systems

Drainage outfalls from the building will connect to either new or existing external separate foul and surface water drainage infrastructure.

Separate below slab gravity foul and surface water drainage systems will be provided.

The extent of under slab drainage will be kept to a minimum and connect to the external drainage system beyond the building footprint at the nearest possible location.

Drainage systems will be fully ventilated to atmosphere to avoid the accumulation of foul air and minimise pressure fluctuations.

All below slab drainage systems will be provided with inspection chambers and rodding access points to enable testing, cleaning and maintenance of the entire system.

The installation of internal manholes will be avoided where possible. If unavoidable manholes will be provided in locations such that when access is required that the operation of the building is not unduly affected.

Internal manholes will be provided with air tight double seal access covers of suitable strength to withstand the loadings implied by their location and incorporate recessed covers where required to enable the prevalent floor finishes to be continued in a consistent manner.

Below slab drainage pipework sizes and hydraulic gradients will be arranged so that peak flows can be readily accommodated and that during low flow conditions that the minimum self-cleansing velocities are maintained.

During the design the type of waste effluent to be transported will be evaluated to ensure that the correct detail and specification of materials will be provided. This refers in particular to areas where toxic or harmful waste streams may be present.

Where external rainwater pipes are provided piped connections will be made to the underground drainage system. Rainwater pips will not discharge via shoes above ground level.

Depending on the geographic location and the availability/suitability of nearby surface water storm drains prime consideration will be given to either providing a new underground surface water drainage system or upgrading the existing system to cater with the anticipated inflows. The provision of drainage infrastructure will be included in the program as part of the proposed building works. The utilisation of open ditch or channel systems will be avoided.

Provide all underground drainage systems with all necessary flow control, retention, erosion and pollution control devices. Petrol/oil interceptors will incorporate coalescing filters with remote monitoring and alarm facilities.

The contractor will make a complete survey of the project site recording elevations. Locations of all utilities above and below ground including size and elevation, width of adjacent streets, pavements, ditches and locations of other obstructions such as manholes, utility poles and fire hydrants. If on site borings are required care will be taken not to disturb the surrounding turf, planting beds or pavements. Holes will be refilled within five working days and the area and its surroundings reinstated to its original condition.

Testing and Commissioning
Method statements will submitted for approval relating to all testing and commissioning procedures.

Testing and commissioning will be carried out in accordance with the procedures laid down in the appropriate code of practice.

Testing and commissioning will include all necessary adjustment and re-testing of plant to meet the design duties.

Schedule of Materials

Description Material
Below ground drainage: Cast iron to BS 437 with jointing via mechanical flexible couplings for foul and surface water systems to BS 6087.

Below ground toxic/ chemical waste systems Polypropylene with jointing via seal ring and solvent weld fittings. Conforming to BS 5556, BS 4991 & BS EN 1451.

G3021 Piping
No site specific content.

G3022 Manholes & Cleanouts
Confined space signs to be installed and space registered where they occur from the Regulations.

G3023 Septic Disposal Systems
No site specific content.

G3024 Lift Stations
The following requirements will apply:

- Cannon plug for generator hook up;
- Davit sockets/ arms suited to weight of pump if davit not suitable then a permanent A frame gantry to be installed;
- Audio/ visual (beacon) high level alarm, with battery back up on main lift stations;
- Sign put on of lift station number and emergency contact numbers;
- Pumps to be Duty/standby with auto changeover of duty;
- Pumps to be installed on guide rails;
- Lamp test buttons and reset buttons must be on the front of the electrical panel, so operators do not have to open the panel;
- Control panels must be next to the lift station chamber within a fibre glass lockable kiosk by use of a hasp and staple so a padlock can be put on;
- No controls to be accessible to public;
- Pump switches will be Manual/ Off/ Auto configuration;
- Stainless steel pump chains;
- All valves must be outside of the wet well in their own chamber, with solid lockable hinged lids and will be of a safe weight for single person lifting;
- Over pumping capability with a Bauer connection;
- Control of the pumps will be by ultrasonic with a backup float installed in case of ultrasonic failure;
- Laminated panel drawings shall be placed in all kiosks;
- Level settings of ultrasonic will be printed on a plague and displayed on front of electrical panel;
- Solid lockable hinged lids with safety grids underneath will be fitted on wet well openings and will be of a safe weight for single person lifting;
- Removable safety barriers to go around wet well opening;
- Flygt N - pump series will be installed;
- Floors of wet well will be benched to reduce build-up of solids;
- If the lift station has to be fenced in, access has to be provided for lift station maintenance to include access for Vacuum tanker and utilities vehicles.
- Visual/ Audible alarm and lift station signage would have to be installed on the outside of the fence.

G3025 Packaged Water Waste Treatment Plants
No site specific content.

G3026 Septic Tanks
No site specific content.

G3027 Drain Fields
No site specific content.

G3030 Storm Sewer
Refer to G3020 for combined commentary where applicable.

G3031 Piping
No site specific content.

G3032 Manholes
No site specific content.

G3033 Headwalls & Catch Basins
No site specific content.

G3034 Lift Stations
Confined space signs to be installed and space registered where they occur from the Regulations.

G3035 Retention Ponds
No site specific content.

G3036 Ditches & Culverts
No site specific content.

G3040 Heating Distribution

G3041 Steam Supply
No site specific content.

G3042 Condensate Return
No site specific content.

G3043 Hot Water Supply System
No site specific content.

G3044 Pumping Stations
No site specific content.

G3050 Cooling Distribution

G3051 Chilled Water Piping
No site specific content.

G3052 Wells for Cooling/Heating
No site specific content.

G3053 Pumping Stations
No site specific content.

G3054 Cooling Towers on Site
No site specific content.

G3060 Fuel Distribution

Refer to Specialist Standards.

G3061 Fuel Piping
No site specific content.

G3062 Fuel Equipment
No site specific content.

G3063 Fuel Storage Tanks
Refer to specialist Base Standard.

G3064 Fuel Dispensing Stations
Statutory requirements apply.

G3090 Other Site Mechanical Utilities

G3091 Industrial Waste Systems
No site specific content.

G3092 POL (Petroleum Oil & Lubricants) Distribution Systems
POL reference should be made to the Fuels Squadron on base and to DLA when working around or directly with this system.

G40 Site Electrical Utilities

Newly installed or replacement utility services under or within a paved surface shall be encompassed within a granular in-fill and permeable membrane, separating the surrounding structured ground from the utilities. Refer to appended PDF figure TRENCHING CROSS SECTION v1 for a cross sectional representation.

The membrane shall be Tensar 504b grade or industry specification equivalent.

G4010 Electrical Distribution

G4011 Sub-stations

For both repair/replacement and new build projects, Distribution Sub Station (DSS) design should adhere to Authorising Engineer Instruction (AEI) 107. AEI 107 discusses the USVF Estate requirements for layout, earthing and electrical protection.

G4011.1 - Distribution transformers

Please refer to section G2040 - Site development, sub section G2041 - Fences and gates for substation specific fencing requirements.

As of 1st July 2021, all Distribution transformers procured for new project works or for replacement of existing must conform to the EU Commission Regulation: (EU) 548/20141 and Amendment (EU) 2019/17832 which lays out 'Tier 2' Energy efficiency requirements for transformers with a minimum power rating of 1 kVA, used in 50 Hz electricity transmission and distribution networks or for industrial applications.

Although Tier 1 transformers may still be offered post July 2021, they must not be used in place of the highest efficiency level currently available.

G4012 Overhead Power Distribution

No site specific content.

G4013 Underground Power Distribution

High Voltage (HV) XLPE cables are to conform to BS 6622 with a design rating of 6350/11000(12) (Uo/U/(Um)) Vac. PVC outer sheath acceptable as minimum standard with MDPE outer sheath being acceptable if PVC not available). Steel Wire Armouring (SWA) is required. HV XLPE cables should be of 185mmsq conductor size as standard for all new installation works unless mitigating factors dictate otherwise. Any deviation from the standard sizing is to be agreed by the Authorising Engineer - Electrical.

Low Voltage (LV) XLPE SWA cables are to conform to BS 6724 with a design rating of 600/1000 (Uo/U) Vac. LSZH sheath (low levels of smoke and non-toxic levels of halogen gas).

Both HV and LV cabling must be certified by the British Approvals Service For Cables (BASEC).

G4020 Site Lighting

G4021 Fixtures & Transformers

Materials

G4021.1

Application:	Pedestrian Areas – Light Bollard.
Manufacturer:	URBIS Ltd.
Product Ref:	Quartz LED Bollard.
Tested to:	Compliant with Current UFC'S.
Colour:	BS 08B29.
Material:	Polyester coated steel.
Notes:	900mm above ground; AL9000 series/ ENERGY EFFICIENT; Vandal Resistant, Asymmetric; 90% Light output efficiency (LOR).

G4021.2

Application:	Road, Carpark, Industrial Areas.

Manufacturer: URBIS Ltd.
Product Ref: "SENSO" LED Light.
Tested to: Compliant with Current UFC'S.
Colour: N/A.
Material: Powder coating, die cast Aluminium/ Glass.
Notes: Mounting Height 4 - 10 meters [however this should be assessed on a case by case basis depending on proximity to the airfield];; SENSO/ ENERGY EFFICIENT; Varied LED's to suit application; IP 66; High Photometric Performance LED safe.

G4021.3
Application: Carparks.
Manufacturer: URBIS Ltd.
Product Ref: "ISLA" LED light.
Tested to: Compliant with Current UFC'S.
Colour: N/A.
Material: Powder coating, die cast Aluminium/ Glass.
Notes: Mounting Height 4 - 6 meters [however this should be assessed on a case by case basis depending on proximity to the airfield]; ISLA/ ENERGY EFFICIENT Varied LED's to suit application IP 66 LED safe High Photometric Performance

G4021.4
Application: Pedestrian Crossing.
Manufacturer: URBIS Ltd.
Product Ref: "NEOS" LED Light.
Tested to: Compliant with Current UFC'S.
Colour: N/A.
Material: Powder coating, die cast Aluminium/ Glass.
Notes: Mounting Height 6 meters & Varies; [however this should be assessed on a case by case basis depending on proximity to the airfield]; NEOS/ ENERGY EFFICIENT; IP 66; LED safe; MAINTENANCE FREE; To Suit Application.

G4022 Poles
No site specific content.

G4023 Wiring Conduits & Duct-banks
No site specific content.

G4024 Site Lighting Controls
To provide trimming and dimming.

G4030 Site Communication & Security

G4031 Site Communications Systems
No site specific content.

G4032 Site Security & Alarm Systems
No site specific content.

G4090 Other Site Electrical Utilities

G4091 Cathodic Protection
Refer to Specialist Base Standard.

G4092 Site Emergency Power Generation

Refer to Specialist Base Standard.

G90 Other Site Construction

G9010 Service & Pedestrian Tunnels

G9011 Service Tunnels
No site specific content.

G9012 Trench Boxes
No site specific content.

G9011 Pedestrian Tunnels
No site specific content.

G9090 Other Site Systems

G9091 Snow Melting Systems
Reference should be made to heavy Repair shop and to the UFC for further guidance on what can be used.

APPENDICES: CONTENT

APPENDIX A: ABBREVIATIONS

APPENDIX B: FORMS – (UPDATE & DEROGATION)

APPENDIX C: US STANDARDS

APPENDIX D: UK STANDARDS

APPENDIX A - ABBREVIATIONS

A/E	Architect/Engineer
AAFES	Army and Air Force Exchange Service
AB	Air Base
ADAAG	Americans with Disabilities Act Architectural Guidelines
AFCEE	Air Force Center for Environmental Excellence
AFFF	Aqueous Film Forming Foam
AFH	Air Force Handbook
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFOSH	Air Force Occupational and Environmental Safety, Fire Protection & Health
AFPM	Air Force Pamphlet Manual
AFR	Air Force Requirement
AIC	Alternate Intensity Current
AICUZ	Air Installation Compatible Use Zone
AMDS	Aerospace Medicine Squadron
AMP Manager	Activity Management Plan Manager (responsible for the SMS systems on base)
ANSI	American National Standards Institute
ARR	Appearance Retention Rating
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating & Air -Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
AST	Above ground Storage Tank
ASTM	American Society for Testing and Materials
AT/FP	Antiterrorist/Force Protection
BCE	Base Civil Engineer
BX	Base Exchange
CADD	Computer Aided Design Drafting
CATV	Community Area Television
CCB	Construction Criteria Base
CE	Civil Engineer
CEC	Chief of Engineering
CEF	Base Fire Chief
CEO	Flight Commander Operations Flight
CEOIW	Civil Engineer Operations Infrastructure Water
CES	Civil Engineer Squadron
CEV	Civil Engineer Environmental
CMU	Concrete Masonry Unit
COMM	Communications
CS	Communications Squadron
DIN	Deutsche Industrie Normen (German Industrial Standards)
DoD	Department of Defense
DoDDS	Department of Defense Dependent's Schools
ECP	Entry Control Point
EEC	European Economic Community
EIA	Electronic Industries Association
EIFS	Exterior Insulation Finish System
EMCS	Energy Monitoring Control System
EN	European Norm
EPA	Environmental Protection Agency
ETL	Engineering Technical Letter
FF	Federal Flammability

FFA	Federal Flammability Agency
FFE	Finished Floor Elevation
FGS	Final Governing Standards
FMG	Factory Mutual Global
FOC	Fibre Optic Cable
FSP	Final Sketch Plan
FW	Fighter Wing
GIS	Geographical Information System
GPS	Global Positioning System
HDPE	High Density Polyethylene
HEF	High-Expansion Foam
HQ	Headquarters
HVAC	Heat Ventilation Air Conditioning
HW	Hazardous Waste
IBC	International Building Code
IDS	Intruder Detection System
IP	International Protection
IPC	International Plumbing Code
ISO	International Organization for Standardization
IWW	Industrial Waste Water
LAN	Local Area Network
LPS	Lightning Protection System
LV	Low Voltage
MDOS	Medical Operations Squadron
MIL HDBK	Military Handbook
MSDS	Material Safety Data Sheet
MTF	Medical Treatment Facility
MUTCD	Manual on Uniform Traffic Control Devices
MV	Medium Voltage
MWR	Moral, Welfare, and Recreation
NATO	North Atlantic Treaty Organization
NEC	National Electrical Code
NESC	National Electric Safety Code
NFC	National Fire Code
NFPA	National Fire Protection Association
NIBS	National Institute of Building Sciences
O&M	Operation and Maintenance
ODC	Ozone Depleting Chemicals
OPORD	Operations Order
Ops	Operations
OSHA	Occupational Safety and Health Administration
OWS	Oil/Water Separator
PCI	Personal Computer Industrial
PDM	Pre-Design Meeting
PE	Polyethylene
PIV	Post Indicator Valve
PMO	Project Management Office
POC	Point of Contact
POL	Petroleum, Oil, and Lubricants
POV	Privately Owned Vehicle
PSP	Preliminary Sketch Plan
PVC	Polyvinyl Chloride
PXI	System Functional Test Unit for Electronic Programming Equipment

QOL	Quality of Life
R	Thermal resistance
RAF	Royal Air Force
Rck	Characteristic Strength
RUS	Rural Utilities Service
SATO	Scheduled Airline Traffic Office
SCX	Communications Squadron - Plans and Implementation Flight
SFPE	Society of Fire Protection Engineers
SFS	Security Forces Squadron
SMS	Sustainable Management System.
SPT	Standard Penetration Test
STC	Sound Transmission Coefficient
SUB-AMP	Functional specific works for the AMP Manager
TIA	Telecommunications Industries Association

Associations:

UFC	Unified Facilities Criteria
UL	Underwriters Laboratory

APPENDIX B - UPDATE & DEROGATION FORM

This form is for an: Update ☐ Derogation ☐

NAME OF REQUESTER _____ TEL No. _____
OFFICE/ SHOP OF ORIGIN _____ DATE: _____
SUPERVISOR/ SHOP CHIEF _____ DATE: _____
SIGNATURE OF SUPERVISOR/ SHOP CHIEF _____
BASE STANDARD SECTION, PARAGRAPH, PAGE, APPENDIX REQUIRING CHANGE/ ADDITION/ UPDATE.

SUGGESTED REPLACEMENT WORDING FOR BASE STANDARD: IDENTIFY SPECIFIC REPLACEMENT ELEMENT OR ELEMENTS PROPOSED. USE CONTINUATION SHEET IF REQUIRED.

MANUFACTURER, IF NEW: _____
MODEL/ PART/ CAT No: _____
CONTACT: _____

JUSTIFICATION/ REASON FOR CHANGE/ ADDITION/ UPDATE.

REVIEW/ VALIDATION BY 48CES / CEN
NAME: _____
SIGNATURE: _____ DATE: _____
DATE INCORPORATED INTO BASE STANDARD _____
TEL No: _____
WEBSITE: _____
EMAIL: _____

APPENDIX C - U.S. STANDARDS

Note: This is not an exhaustive list, but is provided for reference only. Users of the Base Standards must refer to the current edition of Statutory Standards& Guidance applicable at the time.

Note: Bazalgette Pavilion, RAF Wyton, Huntingdon, Cambs. PE28 2EA.

Document:	***Location/Contact:***
USAF Installation Force Protection Guide US Building Codes USF Standards	Project Sponsor Lakenheath HMSO Technical Publications Bazalgette Pavilion, RAF Wyton
Air Cooled Chiller & Heat Pump Specification (Dec2020-Rev1)	Toshiba Carrier UK Ltd.; Neil Sims
Air Force Instruction 32-1054, Corrosion Control.	Project Sponsor Lakenheath
A/F Engineering Technical Letter 91-6, Cathodic Protection.	Bazalgette Pavilion, RAF Wyton HMSO Technical Publications Bazalgette Pavilion, RAF Wyton
Relevant NACE Standards, including, RP-0169-92 Corrosion on underground or submerged metallic piping systems. A/F Engineering Technical Letter 86-4 Paints & Protective Coatings	Bazalgette Pavilion, RAF Wyton
Engineering Technical Letter 88-4 Reliability & Maintainability Checklist, Section 14 “Corrosion Prevention & Control.	Bazalgette Pavilion, RAF Wyton
Air Force Handbook 32-1290(I) MIL HDBK 1136/1	HMSO Technical Publications Bazalgette Pavilion, RAF Wyton
Cathodic Protection Field Testing Former PSA Standard Specification (M&E) No 1, Section 20 Cathodic Protection	HMSO Technical Publications Bazalgette Pavilion, RAF Wyton

Related Documents:

Montreal Protocol Substances NFPA Standards (National Fire Protection Association)	HMSO Technical Publications Bazalgette Pavilion, RAF Wyton
ADAAG (The Americans with Disabilities Act Accessibility Guidelines)	Bazalgette Pavilion, RAF Wyton
USAF Engineering Technical Letters (ETL’s); Mechanical and Electrical Items	Bazalgette Pavilion, RAF Wyton
USAF Construction Technical Letters (CTL’s) Project Management Items	Bazalgette Pavilion, RAF Wyton
United States Standards, Base Regulations	Bazalgette Pavilion, RAF Wyton
Construction Criteria Base CD-Rom Library	Bazalgette Pavilion, RAF Wyton
DE (W) & PSA Standards Supplementary Conditions	HMSO Technical Publications Bazalgette Pavilion, RAF Wyton

Generic Safety Plan (for Construction Works)	Bazalgette Pavilion, RAF Wyton
Asbestos Register	Project Sponsor Lakenheath
DE (W) Technical Bulletins and Memoranda	Bazalgette Pavilion, RAF Wyton
DE (W) Functional Standards (FS)	Bazalgette Pavilion, RAF Wyton
DE (W) Safety Warning Notices - Rules and Procedures	Bazalgette Pavilion, RAF Wyton
NRA (EA) Guidance notes Pollution Prevention Guide	NRA Guide
DE/USF Policy on Fuel storage	Bazalgette Pavilion, RAF Wyton
DE/USF Procedural Guides	Bazalgette Pavilion, RAF Wyton
TRENCHING CROSS SECTION v1	RAF Lakenheath/48 CES TNAP AMP (+441638521950)
BMS Graphic Standards	RAF Lakenheath/48 CES BMS Administrator (+441638521950)
PLANT ROOM SIGN V1	RAF Lakenheath/48 CES Mech. Engineer (+441638526351)

US Air Force Publications & Guidance

AFH 10-222, Vol. 3, Guide to Civil Engineer Force Protection, 1 June 1997 (draft)
APH 31-223, The Air Force Resource Protection Program, February 1997
APH 32-1084, Standard Facility Requirements Handbook, July 1994
AFI 3 1-101, Vol. 1, The Air Force Physical Security Program, December 1996
API 31-209, The Air Force Resource Protection Program, 10 November 1994
AFI 31-210, The Air Force Antiterrorism (AT) Program, 1 July 1995
AFT 32-1021, Planning and Programming of Facility Construction Projects, May 1994
AFI 32-1024, Standard Facility Requirements, 31 May 1994
AFT 32-1032, Planning and Programming Real Property Maintenance Projects Using Appropriated Funds (APF), May 1994
AFT 32-7062, Air Force Comprehensive Planning, April 1994
AFJMAN 32-1055, Design and Analysis of Hardened Structures to Conventional Weapons Effect, April 1997 (draft)
AFJMAN 32-1071, Vol. 1, Security Engineering Project Development, 12 May 1994
AFJMAN 32-1071, Vol. 2, Security Engineering Concept Design, 12 May 1994
AFJMAN 32-1071, Vol. 3, Security Engineering Final Design, 12 May 1994
AMC Flight-Line Security Standards, April 1996
AMC Passenger Terminal Design Guide (draft)
Air Force Office of the Civil Engineer memo, Antiterrorism (AT) Protective Features for Facilities and Installations, 2 December 1996
Area Development Planning Bulletin, October 1991
Base Comprehensive Planning Handbook, Planning Air Bases for Combat Effectiveness, December 1993
ETL 86-10, Antiterrorism Planning and Design Guidance
ETL 90-3, TEMPEST Protection for Facilities
ETL 91-2, High Altitude Electromagnetic Pulse

AFM 8843, Installations Design, March 1981
AFP 32-1097 Sign Standards Pamphlet, November 1997
APP 86-10, Landscape Planning and Design, April 1996

US Federal Guidance

GSA, Security Criteria, 17 June 1997 (Final Working Version; limited official use only) US Department of State, Bureau of Diplomatic Security,
Structural Engineering Guidelines for New Embassy Office Buildings, August 1995 (limited official use only) US Department of State, Bureau of Diplomatic Security,
Physical Security Standards handbook, 7 January 1988 (limited official use only)
AFI 32-1024, Standard Facility Requirements, 31 May 1994
AFT 32-1032, Planning and Programming Real Property Maintenance Projects Using Appropriated Funds (APF), May 1994
AFT 32-7062, Air Force Comprehensive Planning, April 1994
AFJMAN 32-1055, Design and Analysis of Hardened Structures to Conventional Weapons Effect, April 1997 (draft)
AFJMAN 32-1071, Vol. 1, Security Engineering Project Development, 12 May 1994
AFJMAN 32-1071, Vol. 2, Security Engineering Concept Design, 12 May 1994
AFJMAN 32-1071, Vol. 3, Security Engineering Final Design, 12 May 1994
AMC Flight-Line Security Standards, April 1996
AMC Passenger Terminal Design Guide (draft)
Air Force Office of the Civil Engineer memo, Antiterrorism (AT) Protective Features for Facilities and Installations, 2 December 1996
Area Development Planning Bulletin, October 1991
Base Comprehensive Planning Handbook, Planning Air Bases for Combat Effectiveness, December 1993
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US Department of State, Bureau of Diplomatic Security, Structural Engineering Guidelines for New Embassy Office Buildings, August 1995 (limited official use only)
US Department of State, Bureau of Diplomatic Security, Physical Security Standards handbook, 7 January 1988 (limited official use only)

NOTE: Check the following web site to verify current applicable ETL.
https://www.wbdg.org/ffc/af-afcec/engineering-technical-letters-afetl

APPENDIX D - U.K. STANDARDS

Note: This is not an exhaustive list, but is provided for reference only. Users of the Base Standards must refer to the current edition of Statutory Standards & Guidance applicable at the time.

Note: Bazalgette Pavilion, RAF Wyton, Huntingdon, Cambs. PE28 2EA.

Document:	***Location/Contact:***
Construction (Design Management) Regulations (CDM)	HMSO Technical Publications
Asbestos Regulations	HMSO Technical Publications
Legionella Regulations	HMSO Technical Publications
UK Building Regulations	HMSO Technical Publications
CIBSE Design Guides	CIBSE
ASHRAE Handbooks	ASHRAE
British Standards and Codes of Practice	HMSO Technical Publications
Standard Specification M&E DE	HMSO Technical Publications
BISRA	https://www.bsria.co.uk
DIO(MoD) Multiple Practitioner Guides https://www.gov.uk/government/publications/practitioner-guides-2017	
Spec 036	
M&E No 037	
M&E No 0136	
M&E No 165	
Relevant NACE Standards, including,	
SP 0169-2013: Standard for achieving effective control of external corrosion on buried or submerged metallic piping systems or other buried metallic structures.	HMSO Technical Publications
Engineering Technical Letter 88-4 Reliability & Maintainability	(USF),
Checklist, Section 14 “Corrosion Prevention & Control.	Bazalgette Pavilion, RAF Wyton
Former PSA Standard Specification (M&E) No 1, Section 20 Cathodic Protection	HMSO Technical Publications
Pressure System Safety Regulations	HMSO Technical Publications

Related Documents:

National Building Specification (NBS)	HMSO Technical Publications
NFPA Standards (National Fire Protection Association)	(USF), Bazalgette Pavilion, RAF Wyton
DE (W) & PSA Standards	HMSO Technical Publications
Water Regulations	Anglian Water
IEE Wiring Regulations	I.E.E.